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Submitted to **Updated UK Marine Strategy Part Two: marine monitoring**
Submitted on **2020-11-12 10:44:45**

Introduction

1 What is your name?

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3 What is your organisation?

Organisation:
National Oceanography Centre

Updated UK Marine Strategy Part Two:consultation questions

4 Would you like your response to be confidential?

No

5 If you answered 'yes' with regards to wishing for your response to be confidential, please give your reason.

6 1) Are the proposed monitoring programmes sufficient to meet the requirements of the Marine Strategy Regulations 2010, bearing in mind our current knowledge base?

Question 1:
While the proposed monitoring goes some way to meeting requirements, we do not believe that this is sufficient to meet all the requirements of the Marine Strategy Regulations 2010 as they do not fill all the gaps identified in the Marine Strategy Part 1. Our current knowledge is based mainly around Good Environmental Status (GES) so further details are provided in response to Question 2. It is worth noting however, that the Integrated Marine Observing Network (IMON) is listed as an active monitoring programme that contributes to monitoring of prevailing conditions. It should be noted that IMON does not provide monitoring services directly but acts to help coordinate UK marine observing (inc. monitoring) efforts.

7 2) Are the proposed monitoring programmes sufficient to provide the necessary data to assess progress towards the achievement of GES, and the related targets, as set out in the updated UK Marine Strategy Part One?

Question 2:
No, we do not believe that the proposed monitoring presented in Part 2 is sufficient to meet the requirements of the Marine Strategy Regulations 2010 as they do not address all data gaps identified in the Marine Strategy Part 1. Part 1 notes that there is insufficient information to assess GES for food webs, marine mammals, pelagic fish, seals, pelagic habitats, benthic habitats, underwater noise. Our assessment is that Part 2 fails to suitably address these monitoring gaps. Some examples are presented here, but the principle applies to all indicators where there was insufficient information to assess GES in Part 1.

Benthic Habitats (D1, D6) – comments based on NOC expertise in benthic habitats

A key concern is that the monitoring programme for inshore and offshore benthic habitats is largely based on Marine Protected Area (MPA) monitoring programmes. While the UK has made very good progress in the designation of protected areas, (at 25 September 2020, 36% of UK waters are protected) this leaves over 60% with only scarce assessment of its status and changes.

Marine Litter (D10) – comments based on NOC expertise relating to Seafloor (Macro-)Litter:

The Seafloor Litter Monitoring Programme is based on trawl surveys. This results in litter quantifications being biased towards larger and heavier items. Trawling also offers only limited spatial accuracy in recording where the litter is collected i.e. the position of collected litter might be anywhere along the length of the trawl. A further limitation is that trawl surveys are only possible on smooth seabeds, while a lot of marine litter (particularly lost & discarded fishing gear) is found in complex habitats with rocky substrata, cold-water reefs and vertical cliffs. These litter occurrences will not be accounted for or form part of ongoing assessments under the currently proposed monitoring programme.

Hydrographical conditions (D7) – comments based on relevant NOC expertise

As stated in Part 2, no monitoring programme has been put forward specifically for Descriptor 7 because there are ‘currently no significant broad scale alterations of hydrographical conditions affecting ecosystems in UK marine waters’. This does not fit with current scientific understanding however as climate cycle indices (notably the Atlantic Multidecadal Oscillation; AMO) have been shown to impact marine ecosystems within the UK EEZ and in the adjoining NE Atlantic. Further, ‘Issues and Opportunities’ outlined in each of the D7 conditions, however, highlight a lack of confidence in knowledge of local or long-term changes due to a lack

of historical or current observations. We suggest that a lack of further monitoring of D7 conditions will continue to broaden this knowledge gap. Further, the impact of climate change on GES Descriptors remains a critical point of underlying uncertainty. Without a comprehensive monitoring programme for hydrographical conditions this uncertainty is likely to increase in future years. Some solutions to meeting gaps have been proposed, including the use of autonomous platforms and sensors to meet pH, Ocean Acidification (OA), salinity, and better integration of in situ with remote sensing data has been proposed e.g. to improve turbidity assessments. With no clear roadmap to the integration of new technologies into this framework however, it is hard to see where suitable advance will be made to address current gaps. An urgent review is recommended.

Cetaceans (D1, 4) – comments based on review of Parts 1&2

MS Part 1 states that the extent to which GES has been achieved for cetaceans is uncertain because there is not enough information. MS Part 2 proposes that this can be improved by running the Small Cetaceans in European Atlantic waters (SCANS) monitoring more frequently. However, these only run every 10 years, and there is no confirmation within MS Part 2 that this monitoring will be run more frequently or if it will suffice. A risk, therefore, remains that there will be insufficient information to assess GES for D1 and D4 in future assessments, which the current actions do little to address.

8 3) Are any additional monitoring programmes needed in order to assess progress towards achieving GES and the related targets?

Question 3:
Rather than proposing additional monitoring programmes within the current framework we would encourage an urgent review of the suitability of this framework to meet the UK Marine Strategy requirements. The UK-IMON appears to offer a sensible step towards improved coordination and governance of UK monitoring and observing programmes. Investment in such initiatives is urgently needed however if they are to propose new solutions or monitoring effort within a timely manner. Under the current framework, we propose that existing monitoring programmes must be improved if they are to fill the gaps identified in Marine Strategy Part 1, wherever a lack of information makes GES uncertain. Some examples are provided below.

Regarding Benthic Habitats (D1, D6)

The UK seabed area is extensive and benthic monitoring is expensive, but to achieve the aims set out in the Marine Strategy, a sufficient level of monitoring has to be planned. Improvements are further hampered by a lack of agreed or well-defined metrics of status and change. Solutions require a higher funding level and an increased use of new technologies (e.g. autonomous survey vehicles, computer-assisted data analysis, machine learning and artificial intelligence), underpinned by expert data analysis. Aspects relating to autonomy and AI are being tackled under UKRI efforts in the AESA, STEMM-CCS, and CLASS (Haig Fras MCZ and Darwin Mounds SAC) projects. Future strategies should look to lessons learned from these programmes.

Regarding Marine Litter (D10)

Part 2 does not propose the inclusion of new and emerging methods with imagery that might provide significant improvements on current practice despite OSPAR litter monitoring guidelines including litter quantifications from imagery data (including video and photography data). As with benthic habitats, autonomous and AI aspects are being tackled by UKRI funded efforts in the AESA, STEMM-CCS, and CLASS (Haig Fras MCZ and Darwin Mounds SAC), and these programmes offer some lessons for future monitoring solutions. We also recommend investigating the possible inclusion of available video & photography data in the monitoring programme and future assessments.

Hydrographical conditions (D7)

A range of potential solutions to filling knowledge gaps are proposed. We would encourage increased efforts to engage with the research sector to assist with the integration of new and emerging technologies to meet these requirements.
pH and OA: Part 2 recognises the need for extending OA measurements beyond the surface. Autonomous gliders and floats are being widely used in research for this purpose and have been shown to be effective in providing the spatial and temporal coverage required. Emerging technologies, such as lab-on-chip sensors offer potential solutions for sustained observing of pH and OA.

Temperature: The proposed combination of historical time series and models future assessments requires a dedicated R&D programme. No details are provided but community consultation is recommended to identify best practice. Utilising the IMON-NPOP (National Partnership for Ocean Prediction) partnership would seem a sensible way forward to help achieve such aspirations under expert guidance.

Salinity: Autonomous platforms are again highlighted as a potential solution to fill otherwise sparse data sets. However, no sustained observing programme is currently underway in UK waters that includes autonomous platforms. If this is an aspiration then a Roadmap is required to identify how such technologies can contribute to UK marine monitoring. Lessons learned from recent sustained shelf sea programmes (e.g. AlterEco, SSB) should be included in any review.

Turbidity: It appears that only satellite data was used for this assessment, despite the reported contribution from in situ observatories. Sea surface turbidity alone is not sufficient to assess the impact of turbidity on ecosystems in UK waters, particularly during summer months when much of the biological activity in UK seas occurs at depths beyond the reach of remote sensing methods. A clear action plan on the integration of in situ and remote sensing monitoring is required but currently missing.

Waves: Despite extensive wave measurements and monitoring around the UK and similarly extensive efforts towards modelling waves there appears to be no UK wide assessment and the impact of wave conditions on GES Descriptors remains unresolved. An urgent review is recommended.

Seals (D1, D4):

Part 1 reports the status of harbour seals (part of D1 D4 Seals) in parts of the Celtic Sea as uncertain. MS part 2 does not indicate any additional monitoring of seals in the Celtic Sea and does not address how this knowledge gap will be filled. There is a risk, therefore, that there will still not be enough information to determine GES in all of the Celtic Sea.

Introduction of energy, including underwater noise (D11):

We recommend rolling out ocean-basin scale fibre-optic cable sensor networks, static or portable seafloor/water column arrays, plus similar mounted on autonomous vehicles in key locations. These would take advantage of technological and big data analytical (AI, ML) advances in fibre-optic distributed acoustic sensing. Sensor networks could also take advantage of existing and future trans-ocean seafloor telecommunications cable networks for such a purpose. Such systems could provide a near-real time, ocean-scale monitoring capability for e.g. ambient and man-made acoustic noise environment.

9 4) Are you aware of any additional marine monitoring currently being carried out that we have not covered which could contribute to our assessments and make them more effective?

Question 4:
Available data:

While the Marine Strategy relates to UK waters, assessment is also dependent on understanding the impact of prevailing conditions that are largely driven by open ocean and climate conditions. Open ocean monitoring from UKRI funded National Capability programmes (e.g. CLASS) provide sustained observations and outputs that feed into this broader system understanding, but are poorly evaluated in terms of their contribution to UK marine monitoring efforts. We would encourage development of a coherent strategy that better enables UK marine monitoring and marine research communities to work together to meet common objectives for the benefit of future assessments.

There are additional sustained marine observations that could be included and that would be of value to UK marine assessments. The UK Directory of Marine Observing Systems (UKDMOS) provides a comprehensive list of sustained observing and monitoring programmes. UKDMOS also provides access to metadata and data that could support monitoring described and proposed in Part 2. Moreover, there are standalone datasets that could provide additional contextual evidence catalogued in and accessible from the Marine Environmental Data and Information Network (MEDIN) portal.

By example, the United Kingdom Directory of Marine Observing Systems (UKDMOS) has identified some Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI) monitoring programmes run by Scottish Natural Heritage (now NatureScot) and Natural England that may be relevant or adaptable for monitoring seal populations (D1 D4 Seals). It is not clear from Part 2 whether these already form part of the monitoring for D1 and D4.

A quick search of the Marine Environmental Data and Information Network (MEDIN) portal pulled out 192 datasets relevant to seals, with a significant proportion of these originating from the offshore renewable industry, and available from The Crown Estate. Whilst we acknowledge that it can be time consuming to extract data from other sources, for the most part, it likely remains cheaper than conducting a survey. Data sets are now easy to find using the MEDIN portal, and we urge the monitoring community to make maximum use of the wider data available to them.

Increased collaboration with the UK academic sector

While international collaboration is prominent in delivery of UK marine monitoring, we also suggest that increasing efforts to promote sustained collaborations with the UK academic sector would improve the monitoring programme considerably through encouraging co-design of research programmes and recognition of the added value to UK monitoring efforts. Examples include,

Benthic Habitats (D1, D6)

Repeated surveys at several MPAs as part of the National Capability programme Climate Linked Atlantic Sector Science (CLASS) (e.g. at Greater Haig Fras MCZ, The Canyons MCZ and Darwin Mounds SAC) already provide input to this process, and provide scope for a longer-term, scientifically underpinned monitoring programme.

The MS Part 2 documents the ambition for increased use of innovative technology, in order to reduce costs while expanding monitoring capability. Research carried out in the UKRI CLASS programme can act as an example of the potential of these technologies in mapping of benthic habitats.

NOC is currently engaging with a broad consortium of seabed visual imaging practitioners and data users in a large project lead by JNCC (“The Big Picture”) that aims to establish best practise and standards for seabed image-generated data on habitats, biotopes, and biodiversity. Outputs from this and other recent programmes should be considered in future design of UK benthic habitat monitoring programmes e.g. Horton, T., L. Marsh, B. J. Bett, A. R. Gates, D. O. B. Jones, N. M. A. Benoist, S. Pfeifer, E. Simon-Lledó, J. M. Durden, L. Vandepitte & W. Appeltans, Submitted (Oct 2020). Recommendations for the standardisation of open taxonomic nomenclature for image-based identifications. Frontiers in Marine Science.

Attention is also directed to the paper by Wynn, R. B., et al (2012). Investigating the feasibility of utilizing AUV and Glider technology for mapping and monitoring of the UK MPA network., Final report for Defra project MB0118. National Oceanography Centre, Southampton. 244pp. and its subsequent open publication: Wynn, R. B., (et al) (2014). Autonomous Underwater Vehicles (AUVs): Their past, present and future contributions to the advancement of marine geoscience. Marine Geology 352:451-468 doi:10.1016/j.margeo.2014.03.012.

Marine Litter (D10)

Academic research into benthic habitats is routinely based on imagery data, and many of those data sets are also analysed for litter. While a certain amount of standardisation would be necessary, those data sets could form an additional source of information, that could improve the baseline, and assessment of the presence of macro-litter on the seabed. For example, as part of the UKRI programme 'CLASS', several offshore locations and MPAs are surveyed on recurrent time scales from one to eight years. The benthic imagery data of those, collected in a standardised, repeatable way, could provide additional information to be included in these assessments.

Eutrophication (D5) and Hydrographical Conditions (D7)

The potential for autonomy and emerging technologies to assist or improve UK marine monitoring is mentioned numerous times but no strategy for implementation of such technologies is provided. Defra has invested in the use of marine autonomous vehicles and sensors, notably through joint strategic funding programmes such as Shelf Sea Biogeochemistry and more recently, Marine Integrated Autonomous Observing Systems (MIAOS, including AlterEco and CAMPUS) to measure parameters largely within D5 and D7.

The overarching objective of MIAOS was to 'accelerate the use of autonomous measurements and combined observational-model outputs in meeting long- term science need and statutory policy requirements.' We recommend an expert review of the outcomes from these and other sustained observing or monitoring programmes using autonomous methods to help guide future strategic planning of UK marine monitoring and to improve the identification and adoption of best practice across research and monitoring activity.

10 Please add any general comments here.

General comments:
Good morning,

The National Oceanography Centre is pleased to contribute to this consultation. I was not able to include hyperlinks, however, if you would like a pdf version of our response that will include these, please kindly let me know.

This response is submitted on behalf of Professor Ed Hill, Chief Executive, National Oceanography Centre and was coordinated by Dr Matthew Palmer, IMON Chair with contributions from:

Dr Clare Postlethwaite - MEDIN Coordinator
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Kind regards,

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Consultee Feedback on the Online Survey

11 Overall, how satisfied are you with our online consultation tool?

Very satisfied

12 Please give us any comments you have on the tool, including suggestions on how we could improve it.

Survey feedback comments: