Centre for Environment Fisheries & Aquaculture Science

Cefas

Strategic Monitoring: Developing a Definition

Interim Report

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1.0	SG, JL, AG	04/02/2022	First Draft
1.1	SG, JL, AG	11/03/2022	Revised Draft
1.3	SG, JL AG	18/03/2022	Revised final draft

Contents

1. Background

The Centre for Environment, Fisheries and Aquaculture Science (Cefas) have been funded by the Department for Environment, Food & Rural Affairs (Defra) to undertake a review of what is meant by ‘strategic monitoring’ in the context of assessing the impacts of human activities on the UK marine and coastal environments. The main driver for this project was understanding to develop and an approach for implementing strategic monitoring of offshore wind and associated infrastructure development and their interactions, effects and trade-offs within the marine and coastal environment and the ecosystem services they provide within English (and Welsh) waters. This report provides the output of the first step of the review by providing a proposed definition of ‘strategic monitoring’, informed by literature, expert semi-structured interviews and expert and stakeholder engagement. This first output will be used as the basis of a proposed strategic monitoring approach, informed by a review of existing approaches both in the UK and internationally. For more details on the wider project, see Appendix I.

2. Methods

2.1. Literature review

A non-comprehensive review of the primary and secondary literature was undertaken, including literature recommended during expert reviews and expert and stakeholder workshops. The aim of this review was to find existing definitions of ‘strategic monitoring’ and to better understand and incorporate into this report the main concepts emerging from expert and stakeholder engagement. Literature was searched using Clarivate™ Web of Science and Google Scholar™.

2.2. Expert semi-structured interviews

To arrive at the general concepts that should be included in a definition of strategic monitoring, semi-structured interviews were carried out with experts in a range of relevant fields. For more details, including a list of Cefas interviewees, see Appendix II. The same interview questions were shared with the experts ahead of the interview, but the responses varied from emailed responses through to topical discussions and associated notes. Appended to the interview questions was a request to share or direct us to any relevant literature, which we consulted along with any other related literature that was deemed relevant.

2.3. Expert and stakeholder engagement workshops

In collaboration with Defra, two workshops were organised to obtain feedback on proposed draft and updated definitions of “strategic monitoring”. For more details of the workshops, including a list of participants, see Appendix III.

3. Defining “strategic monitoring”

3.1. First draft definition

Based on a review of the literature and interviews with Cefas experts, a first draft definition of “strategic monitoring” was proposed:

> *strategic monitoring assesses changes in the socio-economic and environmental status of the spatial and temporal domain potentially impacted, positively or negatively, by human activity to allow effective adaptation to, and mitigation of, any undesirable impacts.*

This proposed definition incorporated the main concepts encountered during project research that are suggested to underpin *monitoring*, and how it is done *strategically* (Figure 1).

This first draft definition was supported by the literature review and was shared with Defra and representatives from its Arm’s Length Bodies (ALBs) and then with a wider project Steering Group for their consideration and comment. See Appendix III for group members and dates. After each meeting, the definition was revised to address the comments received, as too was the associated literature review, presented in section 4.

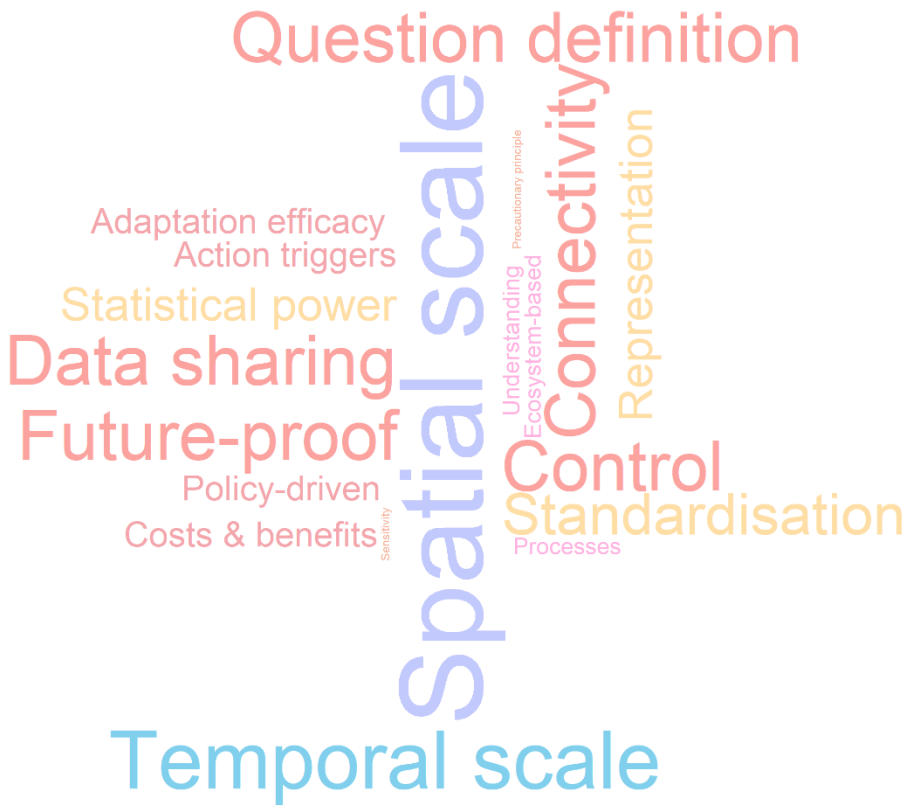

Figure 1 A word cloud showing concepts encountered during interviews with experts towards a proposed definition of strategic monitoring.

3.2. Revised strategic monitoring definition

Following both project workshops, the draft definition was revised to address the following salient comments:

- The definition should include concepts that make it more strategic, including:
  - presenting it as a principle;
  - promoting collaborative working; and
  - making allowances to fill knowledge gaps.
- Cumulative impacts should be considered with negative and positive impacts.
- Decision-making should be proportionate.

The updated strategic monitoring definition is given in Figure 2.

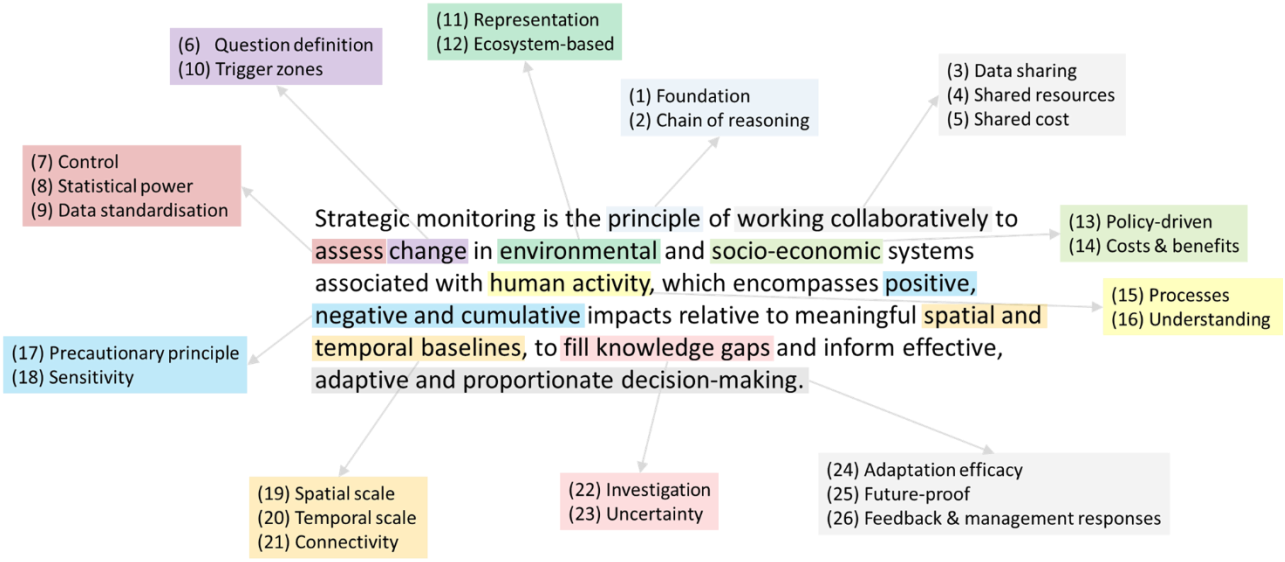

Figure 2 Revised strategic monitoring definition incorporating comments from expert and stakeholder engagements. The colour-coded boxes link concepts to specific terms used in the definition. The numbers link the concepts to the summary text below.

The following section summarises – with reference to the primary and secondary literature – why these concepts are important to the revised definition of strategic monitoring with reference to specific terms within the definition (see Figure 2).

4. General concepts

4.1. Monitoring

Monitoring is centred around a few main *concepts* and is "to *watch* something *over a period of time* in order to see *how it develops*, so that you can *make any necessary changes*"[1]. These main concepts are captured in most definitions of monitoring used to detect changes in our natural world. For example, a recent report of the International Union for Conservation of Nature (IUCN) Species Survival Commission Species Monitoring Specialist Group and the IUCN Global Business and Biodiversity Programme defines monitoring as "the periodic collection and evaluation of data relative to stated project goals and objectives" and in accordance with a monitoring plan that "includes information needs, indicators, methods, timeframe and roles and responsibilities for

[1] Oxford Learner's Dictionary of Academic English

collecting data" (Stephenson & Carbone, 2021). Similarly, a definition of monitoring of monitoring in the marine environment adopted by OSPAR is "the repeated measurement of: (a) the quality of the marine environment and each of its compartments, that is, water, sediments and biota; (b) activities or natural and anthropogenic inputs which may affect the quality of the marine environment; (c) the effects of such activities and inputs" (OSPAR Commission, 1998).

4.2. Strategic

For something to be considered as strategic it should "*be done as part of a plan* that is meant to *achieve a particular purpose* or to *gain an advantage*"[2]. Faced with questions over what, how, where, and when to monitor, while considering that people's priorities differ, knowledge is incomplete, and resources limiting, it would seem sensible that monitoring plans are based on strategies to maximise their effectiveness, i.e., strategic.

4.3. Combining outputs to define strategic monitoring

In the following text, points relating to concepts and terms highlighted in the colour-coded boxes in Figure 2 are referenced by their corresponding number in parentheses, e.g., (25) future-proof.

Based on the literature review and consultation with the Defra/ALB and project Steering Group, it was agreed that "strategic monitoring" should be considered a principle. Accordingly, it should be considered a (1) foundation with an associated (2) chain of reasoning that those wishing to do strategic monitoring must follow to ensure all concepts in the definition are considered. By treating "strategic monitoring" as a principle to which practitioners should adhere, the concept of working collaboratively can be more easily achieved. Specifically, following a prescribed principle would allow promotion of ideas underpinning collaborative working, such as (3) data sharing, (4) shared resources (e.g., survey vessels and equipment), and ultimately (5) shared costs (Cooper et al., 2019).

Careful (6) question definition was widely recognised as a critical consideration when designing a monitoring programme to detect change (Allan et al., 2006). Detecting change is challenging when that change happens within an environment that is also changing, whether naturally (van Meyel, 1979) or because of human activity (Wilding et al., 2017). Related – largely statistical – concepts were also encountered, including the need for (7) control and (8) statistical power in order to assess the magnitude and relevance of any detected changes (Sutherland, 2006). For example, a 10% change in abundance of a population that varies in abundance naturally by 10% each year would be difficult to detect

[2] Oxford Learner's Dictionary of Academic English

over a few years and could be more difficult if the abundance was also declining (Lande et al., 2003). When change is detected relative to some agreed baseline(s), it was recognised that action(s) should be considered when approaching or within predefined (10) trigger zones. These are needed to ensure that action(s) are initiated in time to respond to any change, whether it be a negative impact that should trigger remedial action(s), such as mitigation or compensation, but also a positive impact that might trigger opportunities.

An oft-quoted axiom is that 'the only constant is change', i.e., variability is inherent in all systems, from those of the natural environment, such as ecosystems, to human concepts, such as societies and economies. Each of these systems has myriad complexities. For example, a single ecosystem can encompass millions of organisms, their interactions and feedbacks with one another and their environment, and any emergent effects (Brook et al., 2008). Rather than try to monitor even one of the complex systems, we tend to monitor agreed indicators to represent them (McQuatters-Gollop et al., 2019). Several respondents highlighted the need to ensure indicators were a good (11) representation of these complex systems and that taking an (12) ecosystem-based approach to monitoring is important to allow for interactions among multiple indicators.

It was agreed that strategic monitoring should be (13) policy driven. Specifically, it was suggested that strategic monitoring should be implemented to meet policy requirements, which are set by governing bodies and assumed to reflect the people's priorities. It was also raised that any strategy would have to account for possible (14) costs and benefits to different systems, including socio-economic systems, but also environmental and ecological systems that might gain from some human activities, such as no-fishing zones within and around offshore wind farms (Gill et al., 2020).

Experts and stakeholders emphasised the need to consider how human activities might affect the system (15) processes, rather than just the patterns of change, and these should reflect prevailing (16) understanding of these systems. Where there are knowledge gaps or understanding is lacking, it was suggested that provision for additional, more focused monitoring would be beneficial and with consideration of the statistical basis for the monitoring (Wilding et al., 2017).

A few respondents raised issues around dealing with uncertainty in assessment of change. It was suggested that it would be prudent to adopt the (17) precautionary principle and trigger mitigation unless no impact could be proven beyond reasonable doubt. Another suggestion was that the (18) sensitivity of the assessment outcome could be explored by varying the inputs to the assessment, a so-called sensitivity analysis.

The ability to assess change due to a single human activity is complicated because they rarely occur in isolation, whether it be multiple instances of the same activity or other additional activities (Borja et al., 2010; Wilding et al., 2017). Assessing changes due to

multiple developments requires a cumulative effects assessment that is “a systematic procedure for identifying and evaluating the significance of impacts from individual or multiple sources and/or activities” (Lonsdale et al., 2020). Understanding of the need to look beyond the (19) spatial scale and (20) temporal scale of the domain potentially impacted by a human activity was widely recognised in the review (Wilding et al., 2017). Associated ideas were also recognised, such as (21) connectivity, whether in space use by indicator species or between proposed activities to improve collaborative working (Stephenson & Stengel, 2020).

While one can monitor aspects of the environmental and socio-economic systems that are known about, there always exists the possibility that there are aspects of those systems that are unknown but that become apparent during the monitoring. In cases such as these, and where they are deemed to be important, it was agreed that strategic monitoring should aim to fill knowledge gaps by making allowances for additional (22) investigation to learn more or to reduce (23) uncertainty in our understanding of systems and their processes or our characterisation of them.

Notwithstanding issues around assessing change in representative indicators, its effect on these complex systems and when action should be taken to limit their impact, it is important to consider whether any remedial action(s) will be effective now and in the future (Lindeboom et al., 2015). These concepts were recognised among respondents, especially the need to monitor the systems response to action(s) to maximise (24) adaptation efficacy and ensure that monitoring programmes and their attendant actions are (25) future-proof. This would also include potential for (26) feedback & management responses to ensure actions and decisions are effective for all.

5. Advantages of strategic monitoring

Overall, the research outputs – taken together with the prevailing opinions of experts and stakeholders – conclude that adopting strategic monitoring (or a strategic approach to monitoring) would have advantages compared to the variety of somewhat disparate approaches currently undertaken. Among the most important perceived advantages to adopting strategic monitoring were the potential to reduce activities that result in a “data rich information poor” situation (Wilding et al., 2017), and the possibility to move away from individual plan/site assessments and towards a programme of coordinated and collaborative regional monitoring with its perceived improved efficiencies.

6. References

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Appendix I – project brief

Project background

The UK has world-leading ambitions for expanding the offshore and marine renewable energy sector, with a clear commitment to both fixed and floating offshore wind, and the associated subsea cabling, and future hydrogen production and storage, across much of the UK territorial waters. However, the knowledge gained from the past two decades of offshore wind development, and the ongoing monitoring and research to meet current licensing requirements, has relied on the collection of site or project level data (Willsteed, Jude, et al., 2018) for a small number of specific variables on a few specific receptors. Such data are required to assess and monitor potential impacts identified during the mandatory environmental impact assessment process. These data are, however, limited in their ability to provide the understanding of what the physical and abiotic changes that are occurring mean in terms of the scale of change (i.e., whether the changes actually represent significant impacts) to cause ecological consequences, which lead to changes in the ecosystem services that we obtain from our aquatic environment (Gill et al., 2020; Wilding et al., 2017). The types of changes, and the how they affect the ecosystem components, are important to monitor over the most appropriate spatial scales and temporal scales. This is essential for understanding and predicting the changes that will occur in relation to the future scale of offshore wind development and the rate of planning and installation to support the UK's 2030 renewable energy and wider Net Zero targets and sustainability aspirations.

A strategic approach is therefore necessary. Such an approach requires an agreed set of elements covering a wide, holistic scope, which can be applied at a local scale and be extended to a regional scale (Willsteed et al., 2017; Willsteed, Birchenough, et al., 2018). Furthermore, to understand cumulative effects of multiple turbines and wind farms, in terms of how they may impact ecosystem components, also requires the appropriate temporal scales to be factored in (Gill et al., 2020; Willsteed et al., 2017; Willsteed, Birchenough, et al., 2018).

Aims and Objectives

(1) This project aims to develop a new strategic approach, built around the key elements of assessing change at relevant and meaningful spatial and temporal scales. In this context, 'meaningful' relates to ecological changes that will have consequences to the status of the ecosystem and, therefore, affect the ecosystem services obtained from the marine and coastal environment. This strategic approach will address how to monitor and understand what may be gained or lost by using the UK's waters for offshore wind development, which will address the 'so what' questions that have to be

addressed to achieve effective sustainable management and preserve future opportunities.

(2) The outputs will assist in filling evidence gaps associated with determining the ecological status of the marine and coastal waters and will feed into considerations such as marine spatial planning, the UK Marine Strategy and other related policies and legislation.

Appendix II – expert semi-structured interviews

Questions emailed ahead of semi-structured interviews

- How would you define strategic monitoring?
- In your area of expertise, what specific considerations should strategic monitoring account for? Think definition…
    - And in relation to offshore wind farms?
- In your area of expertise, how would you ideally do strategic monitoring? Think approach…
    - And in relation to offshore wind farms?
- Can you recommend any reports/papers about strategic monitoring for your area?

Table 1 Details of Cefas experts interviewed as part of the research for this project.

Topic area	Specialism	Interviewee	interviewer
Benthic ecology	Offshore renewables	Jackie Eggleton	SG
Benthic ecology	Aggregates	Keith Cooper	SG
Fisheries	Migratory fish	Alan Walker	SG
Fisheries	Offshore renewables	Louise Cox	JL
Underwater noise	Underwater noise	Rebecca Faulkner	SG
Marine mammals	Marine mammals	Simone de Winter	JL
Physical	Substrate	Jon Barry	SG
Physical	Oceanography	Jon Rees	JL
Biogeochemistry	Biogeochemistry	Ruth Parker	JL
Strategic assessment	Fisheries Modelling	Will le Quesne	SG
Strategic assessment	Biogeochemistry/ Water quality	Michelle Devlin	SG
Strategic assessment	Physical Modelling	Stephen Dye	JL
Strategic assessment	Offshore renewables	Daniel Wood	SG
Modeller	Ocean Modelling	Liam Ferdinand	JL

Appendix III – workshop details

Defra/ALB group meeting

- Date: 15 February 2022
- Location: Microsoft Teams™
- Attendees: Joshua Parker (Natural England); Karen Webb (JNCC); Nik Perepelov (Defra); Rosanne Gaulton (Defra); Yessica Griffiths (JNCC); Natasha Hill (Defra)
- Hosts: William Hutchinson (Defra); James Lawson (MMO); Andrew Gill (Cefas); Rachel Mulholland (Cefas); Jemma Lonsdale (Cefas); Stephen Gregory (Cefas); Stephanie Close (Cefas)

Project Steering Group (including experts and stakeholders) meeting

- Date 1 March 2022
- Location: Microsoft Teams™
- Attendees: Joshua Parker (Natural England); Rebecca Walker (Renewable Electricity); Nik Perepelov (Defra); Rachael Mills (SSE contractor); Emma Ahart (Ørsted); Colin McAllister (RWE); Adam Payne (Flotation Energy); Christina Platt (Wildlife Trusts); Sion Roberts (Crown Estate); Lucy Fosbraey (Defra); David Price (Planning Inspectorate); Karen Webb (JNCC); Rosanne Gaulton (Defra); Jennifer Godwin (JKG Consultancy); Darren Jameson (Scottish Power); Katherine Wood (Vattenfall); Juliette Webb (Renewable UK); Gero Vella (Res-Group)
- Hosts: William Hutchinson (Defra); James Lawson (MMO); Andrew Gill (Cefas); Rachel Mulholland (Cefas); Jemma Lonsdale (Cefas); Stephen Gregory (Cefas); Stephanie Close (Cefas)

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We are the government's marine and freshwater science experts. We help keep our seas, oceans and rivers healthy and productive and our seafood safe and sustainable by providing data and advice to the UK Government and our overseas partners. We are passionate about what we do because our work helps tackle the serious global problems of climate change, marine litter, over-fishing and pollution in support of the UK's commitments to a better future (for example the UN Sustainable Development Goals and Defra's 25 year Environment Plan).

We work in partnership with our colleagues in Defra and across UK government, and with international governments, business, maritime and fishing industry, non-governmental organisations, research institutes, universities, civil society and schools to collate and share knowledge. Together we can understand and value our seas to secure a sustainable blue future for us all, and help create a greater place for living.

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