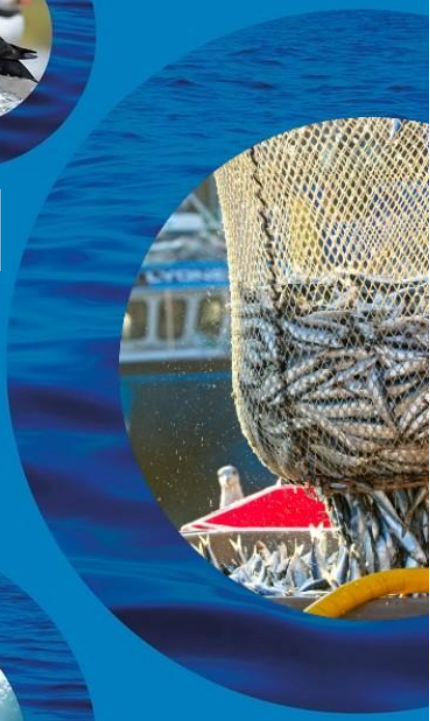
Marine Management Organisation



Standardisation of Post-Consent Environmental Monitoring for Wind Farms in English Waters

Guidance

...ambitious for our seas and coasts

Contents

Acronym Used

COWRIE	Collaborative Offshore Wind Research into the Environment
eDNA	Environmental deoxyribonucleic acid
ESAS	European Seabirds At Sea
EUNIS	European Nature Information System
ICES	International Centre of the Exploration of the Sea
IHO	International Hydrographic Organisation
ISO	International Organization For Standardization
JCDP	Joint Cetacean Data Programme
JNCC	Joint Nature Conservation Committee
LiDAR	Light Detection and Ranging
MBES	Multibeam Echosounder
MarLIN	The Marine Life Information Network
MEDIN	Marine Environmental Data and Information Network
MESH	Mapping European Seabed Habitats
MMO	Marine Management Organisation
MMOb	Marine Mammal Observer
MNCR	Marine Nature Conservation Review
NE	Natural England
NMBAQC	Northeast Atlantic Marine Biological Analytical Quality Control
NPL	National Physical Laboratory
OMP	Ornithological Monitoring Plan
QAF	Quality Assurance Framework
ReSCUE	Reducing Seabird Collisions Using Evidence
RSMP	Regional Seabed Monitoring Programme
SNCBs	Statutory Nature Conservation Bodies
SRU	Strategic Renewables Unit
SSS	Side Scan Sonar
UXO	Unexploded Ordnance
WoRMS	World Register of Marine Species

Introduction

This guidance summarises the outcomes and conclusions from the Marine Management Organisation's (MMO) Strategic Renewables Unit's (SRU) project to implement post-consent monitoring standards for offshore wind in English waters, for receptors where agreed standards already exist and where standardisation would be appropriate. The project team have worked with other government departments, Statutory Nature Conservation Bodies (SNCBs) and the offshore wind industry to standardise the monitoring of offshore wind farms, aiming to make post-consent monitoring requirements clear and enable monitoring data to be more easily discovered, shared and re-used by stakeholders.

Monitoring carried out by developers during the development and operational lifetime of an offshore wind farm is crucial to understanding and managing the environmental impacts of development and plays an important role in reducing the level of uncertainty in future impact assessments. Generally, monitoring aims to validate predictions made in statutory environmental assessments, detect any unforeseen impacts, and ensure compliance with measures used to mitigate significant impacts.

In recent years there have been many publications which identify best practice in collecting and reporting offshore wind monitoring data. By standardising this best practice, MMO aim to deliver multiple benefits. Firstly, it will be easier to compare monitoring data between projects. This will make it easier to draw robust conclusions about cumulative impacts and could allow the conclusions from one monitoring programme to be used in assessing the impacts of another project. Over time this should reduce the uncertainty in assessments by supporting a stronger feedback loop between data, evidence and decision-making. Standardised approaches to monitoring would also enable data to be more easily discovered, shared, analysed and re-used by stakeholders including industry, SNCBs, regulators and academics, by ensuring that data is presented in an accessible and widely understood format.

SNCB's who consult on monitoring reports strongly support collaborative approaches to marine monitoring as having data collected in standardised formats will facilitate this better in the future allowing external bodies and researchers to access a wider data set and hopefully work towards answering evidence gaps. It is still important that monitoring reports state a clear hypothesis in any post-consent monitoring to ensure that monitoring is set up to answer questions to focus any study. Therefore, standardisation of monitoring, along with a more strategic approach to monitoring, is understood to be a key opportunity for enabling the sustainable deployment of offshore wind.

How this guidance should be used

This guidance does not aim to standardise *what* must be monitored, but rather *how* surveys must be completed. Monitoring programmes should still be agreed for each project on a case-by-case basis, following discussions between developers, the relevant SNCB and MMO's Marine Licensing Team to deem what is applicable for the project. Once a monitoring programme has been agreed, this guidance provides a list of standards which specify how that monitoring should be carried out, what data should be captured, and how that data should be stored.

All recommendations will be implemented through MMO's Marine Licensing Team who are the marine licensing authority for England and consult on post-consent monitoring with SNCBs. Monitoring reports will be checked once obtained by case teams and will determine whether monitoring reports are to proceed to the next stage, which is SNCB consultation. The project team acknowledge that the published standards are an expectation for Applicants. Therefore, where an Applicant has stated why specific standards have not been followed, this may be accepted under specific circumstances.

From stakeholder input, the project team acknowledge that these recommendations may need to be revisited at timely intervals to update to newer standards and methodologies, as well as to encompass new technologies in monitoring. The first review is expected to be 12-24 months after initial publication. Following publication of the recommendations, the project team anticipate there may be further feedback from stakeholders who have not previously engaged with the project. To facilitate this, a survey has been created for interested parties to record their thoughts and compile responses into one database. Once the recommendations have reached review, these responses can also be acknowledged in any future updates to the project.

Lastly, these standards are for post-consent monitoring only, however, the MMO anticipate these being adopted for monitoring at earlier stages of development in the future.

Marine Mammals

Recommended standards:

If marine mammal monitoring is required, then the following standard approach is recommended:

MM1: JCDP data guideline to be used for boat based and aerial surveys, and data to be uploaded to the ICES Data Portal within 6 months after the monitoring report has been discharged.
MM2: Reporting of marine mammal mitigation used during UXO clearance should follow section 3 of the JNCC Guidance (2025).
MM3: Reporting of marine mammal monitoring during piling to follow section 3.1 of JNCC Guidance (2010).

Further Information:

- The **Joint Cetacean Data Programme (JCDP)**[1] data guideline for effort-related survey cetacean data to be used for transect-based surveys (boat based and aerial) and upload this to the **International Centre of the Exploration of the Sea (ICES) Data Portal**[2]. The MMO understand The Crown Estate are exploring closer integration of the **Marine Data Exchange**[3] and the ICES data portal. If the two platforms do become integrated, then a separate submission to the ICES portal may no longer be necessary. It is suggested that data should be uploaded to the ICES Data Portal within 6 months after the monitoring report has been discharged.
- At the start of **2025, JNCC**[4] released new guidance for minimising the risk of injury to marine mammals from unexploded ordnance (UXO) clearance in the marine environment.
- In addition to the **JNCC 2025** guidelines, a standardised marine mammal recording form is also available within this package, to record mitigation effort for Marine Mammal Observers (MMObs) use. MMObs are to record periods of marine mammal observations, details of environmental conditions (sea state, weather, visibility, etc.) and sightings of marine mammals. The data collected by observers is reviewed by JNCC to check compliance with licence conditions and evaluate the effectiveness of deterrents. By standardising this data, it is easier for these checks to occur. It is the responsibility of the developer to share this information with JNCC.
- **JNCC guidance 2010**[5] is the statutory nature conservation agency protocol for minimising the risk of disturbance and injury to marine mammals from piling noise. Reporting of marine mammal monitoring during piling to follow section 3.1 of the guidance document.

[1] (JNCC JCDP, 2024) Joint Cetacean Data Programme: Data submission and data use resources: https://hub.jncc.gov.uk/assets/1b35ddf6-c469-4bf8-8300-86ec21da1c2d#jcdp-data-standard-v1-1.pdf
[2] ICES Cetaceans Data Portal: https://www.ices.dk/data/data-portals/Pages/Cetaceans.aspx
[3] Marine Data Exchange: https://www.marinedataexchange.co.uk/search?site%2Fname=Pre-Consents%20Surveys&sortBy=Relevance&lat=55&lon=-7&zoom=5&view=series
[4] (JNCC, 2025) Guidelines for minimising the risk of injury to marine mammals from unexploded ordnance (UXO) clearance in the marine environment: https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/jncc-guidelines-marine-mammals-and-explosive-use.pdf
[5] (JNCC, 2010) Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise: https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

Underwater Noise

Recommended standards:

If underwater noise monitoring is required, then the following standard approach is recommended:

UWN1: NPL Good Practice Guidance Note no. 133 for monitoring of underwater noise levels generated by wind turbines using hydrophones, pre-, during and post-construction.

UWN2: The MEDIN standard for noise surveys is the MEDIN data guideline for underwater noise data, as requested through the NPL Guidance.

Further Information:

- Monitoring of underwater noise levels at various distances from the noise source should follow the **National Physical Laboratory (NPL) Good Practice Guidance Note no. 133**[6] using hydrophones as well as recording noise levels before and after construction. Furthermore, Sound Exposure Level measures should be recorded in accordance with the NPL good practice guidance. The NPL states that "Although not intended as a standard, these guidelines address the need for a common approach, and the desire to promote best practice", however, we found this approach was being followed by most of the monitoring reports reviewed in this project, and stakeholders agreed it was appropriate to use as a standard.
- The Marine Environmental Data and Information Network (MEDIN) standard for noise surveys is the **MEDIN**[7] data guideline for underwater noise data, as noted by the NPL Guidance. If the standard is being used, then this should explicitly be stated.
- The International Organization for Standardisation (ISO) have also produced both **ISO 8405**[8] **(2017)** & **ISO 18406**[9] **(2017)**, which describes the terminology, methodologies, procedures, and measurement systems to be used to measure the radiated underwater acoustic sound generated during pile driving using percussive blows with a hammer. The MMO do not currently have enough information about the benefits of the ISO standards to suggest a move away from the most currently used methods from NPL. These standards can still be included by applicants if it is deemed the most appropriate standard, however they do not form part of the recommendation.

[6] (Robinson et al. 2014) NPL Good Practice Guidance for Underwater Noise Measurement: https://www.npl.co.uk/gpgs/underwater-noise-measurement

[7] (MEDIN Guidelines) Marine Environmental Data & Information Network Standards: https://medin.org.uk/data-standards/medin-data-guidelines

[8] (ISO, 2017) 18405 - Underwater acoustics — Terminology: https://www.iso.org/standard/62406.html

[9] (ISO, 2017) 18406 - Underwater acoustics — Measurement of radiated underwater sound from percussive pile driving: https://www.iso.org/standard/62407.html

Seabirds

Recommendations:

If an Ornithological Monitoring Plan (OMP) is required, then the following standard approach is recommended:

SB1: The development of each wind farm OMP includes engagement with Natural England.

SB2: OMP's to consider NE's best practice guidance for post-consent monitoring relating to seabirds (Parker et al., 2022) which provides advice in relation to common monitoring solutions and key considerations for implementation.

Further Information:

- It is recommended that if an OMP is deemed appropriate for an offshore wind farm, this must include engagement with **Natural England (NE).**
- Post-consent monitoring requirements for seabirds depend upon a variety of factors such as impact pathway, scale of impacts, species impacted, and sources of uncertainty, therefore, the monitoring objectives must be tailored accordingly. As a result, the specific post-consent monitoring requirements, and the most appropriate monitoring methods and applications, are likely to vary between projects.
- Due to the complexity of post-consent monitoring for seabirds, we suggest that the development of each OMP should consider **NE's best practice guidance for post-consent monitoring relating to seabirds (Parker et al., 2022)**[10]. The best practice is comprehensive, setting out key consideration relating to post-consent monitoring for seabirds, and key monitoring requirements for seabirds relating to specific pressures (i.e., displacement/disturbance and collision mortality) and sources of uncertainty in the impact assessment process. This guidance will also be updated periodically with new evidence and associated advice as it becomes available.
- NE will also continue to consider whether there is anything else to be done to improve standardisation of post-consent monitoring outputs and would welcome the opportunity to work with the MMO and other stakeholders to this end.
- The initial view was that OMP's should be conducted following the guidance of the **Collaborative Offshore Wind Research into the Environment (COWRIE) report (Camphuysen et al., 2004)**[11]. This comes under the **European Seabirds At Sea (ESAS)**[12] standards and methodology, endorsed by NE. However, stakeholder workshop attendees thought them to be outdated and focused on boat-based surveys.

[10] (Parker et al., 2022) Phase IV Best Practice Advice for Post-Consent Monitoring: https://naturalengland.blog.gov.uk/2022/04/13/offshore-wind-best-practice-advice-to-facilitate-sustainable-development/

[11](Camphuysen et al., 2004) Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK: https://tethys.pnnl.gov/sites/default/files/publications/Camphuysen-et-al-2004-COWRIE.pdf

[12]European Seabirds At Sea (ESAS) https://www.ices.dk/data/data-portals/Pages/European-Seabirds-at-sea.aspx

- The **ReSCUE (Reducing Seabird Collisions Using Evidence)**[13] project has an aim to produce standards for the use of 'Light Detection and Ranging' (LiDAR). Outputs will be available in the next 12 – 24 months and will be incorporated into NE Best Practice Advice. We recommend that the possibility of standardisation for this receptor is reviewed in 12-24 months once these steps have been finalised.

[13] ReSCUE (Reducing Seabird Collisions Using Evidence): https://naturalengland.blog.gov.uk/2024/10/24/to-the-rescue-understanding-flight-heights-for-seabird-conservation-and-offshore-wind-expansion/

Fish & Shellfish

Recommendations:

If fish & shellfish monitoring is required, then the following standard approach is recommended:

FS1: Species to be recorded using the WoRMS list of accepted scientific names.
FS2: Fish & shellfish surveys to use the MEDIN standard. These are the MEDIN data guideline for species and benthos data by trawl or dredge, video surveys of species and benthos and shellfish stock assessment data.
FS3: The JNCC Marine Monitoring Handbook to be used for sampling benthic and demersal fish populations on sediments.
FS4: If eDNA-based methods are used then this should follow NE's Monitoring methods for assessing inshore fish communities (Franco et al. 2020a).

Further Information:

- Fish species should be recorded using the **World Register of Marine Species**[14] (WoRMS) list of accepted scientific names. From feedback, it was suggested the consultants have a preference to use this database.
- Our workshop attendees stated that **MEDIN**[15] is widely used and recommended by SNCBs. The MEDIN standard for fish & shellfish surveys are the MEDIN data guideline for species and benthos data by trawl or dredge, video surveys of species and benthos and shellfish stock assessment data. However, feedback has suggested that this database needs to be simplified, and consultants would be more inclined to use the system if it was more user-friendly. The MMO are aware that MEDIN are currently working to improve their services.
- The **JNCC Marine Monitoring Handbook** [16], which states the method for sampling benthic and demersal fish populations on sediments, is recommended. However, monitoring must remain species and site specific, meaning that data for each species should be provided separately.
- Fish species and assemblages are particularly suitable to environmental DNA (eDNA) monitoring and DNA-based methods are already widely and successfully deployed for fish monitoring programmes **(Franco et al. 2020a)**[17]. eDNA methods have been shown to outperform conventional methods in terms of detection probability, costs and feasibility. Particularly for fish, eDNA methods are a well-suited sampling approach which can replace expensive and potentially harmful methods such as gill-netting, trawling or electrofishing. There remain some limitations of the method, for example, the influence of hydrodynamics needs to be carefully considered to determine where eDNA within a sample has come from. For further assistance on whether eDNA methods are applicable, this should be discussed with NE.
- Many types of surveys are used for fish sampling, such as otter trawling, potting surveys, gill nets, and beam trawling. These should be completed on a timely

[14] World Register of Marine Species (WoRMS): https://www.marinespecies.org/aphia.php?p=search
[15] (MEDIN Guidelines) Marine Environmental Data & Information Network Standards: https://medin.org.uk/data-standards/medin-data-guidelines
[16] (Davies et al., 2001) JNCC Marine Monitoring Handbook: https://data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/marine-monitoring-handbook.pdf
[17] (Franco et al.,2020a) A review of methods for the monitoring of inshore fish biodiversity: https://publications.naturalengland.org.uk/publication/4755646568464384

basis depending on factors such as species and life history stage, through designated sampling stations.

- Some workshop attendees stated they preferred the use of **European Nature Information System (EUNIS)[18],** and The **Marine Life Information Network (MarLIN)**[19] database instead of the WoRMS list of accepted scientific names.
- Many fish surveys are for demersal/benthic species and involve benthic sampling so not all species are captured. Due to the infrequent use of telemetry surveys for pelagic fish in post consent monitoring, there are no known current standards on their monitoring.
- The MMO recognise that monitoring will be tailored to different species, as highlighted in NE's post consent monitoring best practice **(Parker et al., 2022)**[20], which was agreed by the stakeholder workshop participants. Stakeholders stated they want to make sure these different methods are included in monitoring standards where the standards are species/group specific.
- ICES hosts **DATRAS**[21] as an online database of trawl surveys with access to standard data products, as well as the ICES Acoustic data portal which also hosts information on fisheries observations collected from various pelagic surveys. These data portals require specific quality standards, that are different to MEDIN standards but have been suggested to be useful for storing long term data series and feeding into the European database. The recommendation is that data is submitted in line with MEDIN standards, however, the use of ICES data portals is highly encouraged as a long-term repository for data.

[18] (European Environment Agency, 2019) EUNIS Habitat Classification System: https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification-1/folder_contents
[19] The Marine Life Information Network: https://www.marlin.ac.uk/
[20] (Parker et al., 2022) Phase IV Best Practice Advice for Post-Consent Monitoring: https://naturalengland.blog.gov.uk/2022/04/13/offshore-wind-best-practice-advice-to-facilitate-sustainable-development/
[21] ICES Data Portals: https://www.ices.dk/data/data-portals/pages/datras.aspx

Benthic

Recommendations:

If a benthic monitoring is required, then the following standard approach is recommended:

BE1: Standards in the NMBAQC Scheme to be followed for benthic sample analysis, including the use of MEDIN standard for benthic data recording.

BE2: The JNCC Marine Monitoring Handbook, including Guidelines No. 3-9 and the Procedural Guidance 4-3 should be followed for benthic sample collection.

Further Information:

The **Northeast Atlantic Marine Biological Analytical Quality Control (NMBAQC)**[22] is endorsed by NE and provides quality control and assurance to the macrobenthic invertebrate elements of the Clean Seas Environmental Monitoring Programme. However, it was suggested that some of the older methodologies in this scheme may need updating. Due to the large volume of standards within NMBAQC, Table 1 is provided to summarise some of the most used methodologies.

Table 1:

Methodology	Purpose
Mason, 2016[23]	Methods for Particle Size Analysis (PSA).
Turner et al. 2016[24]	Guidelines for epibiota remote monitoring from digital imagery.
JNCC Epibiota Quality Assurance Framework (QAF) [25]	Standardise the analysis of epifaunal imagery data through Epibiota proformas, QAF form checks and a Comparison tool.
Worsfold et al., 2010[26]	NMBAQC Processing Requirements Protocol for Marine Macrobenthic Samples.
World Register of Marine Species[27] (WoRMS)	List of accepted scientific names.
Mapping European Seabed Habitats (MESH) standards [28]	Recommended Operating Guidelines for habitat mapping.

[22] (NMBAQC Scheme 2024): NE Atlantic Marine Biological Analytical Quality Control (NMBAQC) Scheme: https://www.nmbaqcs.org/

[23] (Mason, 2016) Particle Size Analysis (PSA) for Supporting Biological Analysis: https://www.nmbaqcs.org/media/qiybf5sd/best-practice-guidance.pdf

[24] (Turner et al. 2016) Epibiota Remote Monitoring from Digital Imagery: Interpretation Guidelines: Epibiota Remote Monitoring from Digital Imagery: Interpretation Guidelines (infomar.ie)

[25] (JNCC) Epibiota Quality Assurance Framework: https://www.nmbaqcs.org/scheme-components/epibiota/epibiota-quality-assurance-framework-and-documents/#:~:text=The%20Quality%20Assurance%20Framework%20project,and%20sharing%20in%20the%20future.

[26](Worsfold et al., 2010) NMBAQC Processing Requirements Protocol for Marine Macrobenthic Samples: https://www.nmbaqcs.org/media/440n1nus/guide-for-processing-marine-macrobenthic-invertebrate-samples.pdf

[27] World Register of Marine Species (WoRMS): https://www.marinespecies.org/aphia.php?p=search

[28] (Mapping European Seabed Habitats (MESH) standards): https://maritime-spatial-planning.ec.europa.eu/projects/development-framework-mapping-european-seabed-habitats

Hitchin et al. (2015)[29]	Drop-down video survey methodology forms part of the epibiota component of the NMBAQC scheme.
The MEDIN[30] standard for benthic surveys	This includes guidelines for data by grab or core, species and benthos data by trawl or dredge, video surveys of species and benthos and transect survey data.

Further discussions included -

- **The JNCC Marine Monitoring Handbook** [31] for littoral sediment habitats provides high level guidance for monitoring intertidal sediments. The Handbook includes Guidelines (No. 3-9, Thomas 2001) to define the methods of quantitative sampling of sublittoral sediment biotopes and species using remote-operated grabs and the Procedural Guidance 4-3 which states the sampling of benthic and demersal fish populations on sediments for epibenthic beam trawl surveys.
- All workshop participants agreed the use of multibeam echo sounders (MBES) and side scan sonar (SSS) techniques on their own are not sufficient for benthic monitoring, therefore benthic sampling should always be used in monitoring. The method of sampling used will depend on the environment.
- Where biotope assignments are to be made, the NMBAQC Scheme states that these must be analysed and assigned to the appropriate level of the **Marine Habitat Classification (Connor et al., 2004)**[32] and/or the **EUNIS Classification System**[33] hierarchy.
- The Marine Habitat Classification developed by JNCC's Marine Nature Conservation Review (MNCR) provides a tool to aid the management and conservation of marine habitats and is stated to be fully compatible with the European EUNIS habitat classification system. As well as this, the **SACFOR Abundance Scale**[34] (JNCC, 1990) comes under the MNCR methods.
- The NMBAQC Scheme states that the guidelines for marine monitoring methods are provided by JNCC's Mapping European Seabed Habitats (MESH) which is the recommended operating guidelines for underwater video and photographic imaging techniques **(Coggan et al. 2007)**[35], as well as epifaunal trawls and dredges.
- **OneBenthic**[36] has been designed for aggregates monitoring, however, they are trying to standardise across sectors, and the join up between the Marine Data

[29] (Hitchin et al. 2015) Epibiota Remote Monitoring from Digital Imagery- Operational Guidelines: https://www.nmbaqcs.org/media/mirhlqmu/epibiota_operational_guidelines_final.pdf
[30] (MEDIN Guidelines) Marine Environmental Data & Information Network Standards: https://medin.org.uk/data-standards/medin-data-guidelines
[31] (Davies et al., 2001) JNCC Marine Monitoring Handbook: https://data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/marine-monitoring-handbook.pdf
[32] (Connor et al., 2004) The Marine Habitat Classification for Britain and Ireland: https://mhc.jncc.gov.uk/media/1027/04_05_introduction.pdf
[33] (European Environment Agency, 2022) EUNIS Habitat Classification System: https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification-1/folder_contents
[34](JNCC, 1990) SACFOR abundance scale used for both littoral and sublittoral taxa: https://mhc.jncc.gov.uk/media/1009/sacfor.pdf
[35] (Coggan et al. 2007) MESH Review of standards and protocols for seabed habitat mapping: https://www.researchgate.net/publication/269630850_Review_of_standards_and_protocols_for_seabed_habitat_mapping
[36] OneBenthic: https://rconnect.cefas.co.uk/onebenthic_portal/

Exchange (MDE)[37] from The Crown Estate and OneBenthic is relatively easy and could be improved even more through automation in the future. The main aim for OneBenthic is to understand the connection between Particle Size Analysis (PSA) and response. Workshop participants stated they use OneBenthic and that it relies on individuals using the **NMBAQC's Guidelines for PSA**[38]. Despite the initial positivity, workshop participants also stated they had concerns with losing quality in their data by putting it into OneBenthic. Furthermore, OneBenthic uses the **Regional Seabed Monitoring Plan (RSMP)**[39] as a protocol which is only a programme for PSA (meaning it does not give guidance on the use of underwater imagery) and has led to issues with EIA data.

[37] Marine Data Exchange: https://www.marinedataexchange.co.uk/search?site%2Fname=Pre-Consents%20Surveys&sortBy=Relevance&lat=55&lon=-7&zoom=5&view=series

[38] (Mason et al., 2016) PSA for Supporting Biological Analysis: https://www.nmbaqcs.org/media/qiybf5sd/best-practice-guidance.pdf

[39] Regional Seabed Monitoring Programme: https://rconnect.cefas.co.uk/RSMP/RSMPstoryboardv1.html

Geophysical

Recommendations:

If a geophysical survey monitoring is required, then the following standard approach is recommended:

GE1: IHO standards S44 and S57, for hydrographic surveys. If completed alongside a side-scan sonar survey, bathymetric coverage should comply with Order 1a or Order 1b. If not accompanied by side scan sonar surveys, hydrographic surveys should provide 200% coverage (Exclusive Order).

GE2: Side-scan sonar & multi-beam echosounder surveys should follow MESH Remote Operating Guidelines and MESH Remote Operating Guidelines for swath Bathymetry, respectively.

GE3: Geophysical surveys to use the MEDIN standard. These are the MEDIN data guideline for seismic data, bathymetry data, sampling sediment and rock characteristics and for side scan sonar data.

Further Information:

- Geophysical surveys should adhere to the **International Hydrographic Organisation (IHO) standards for hydrographic surveys** (**S44**[40] and **S57**[41]). From S44, Order 1a or 1b is acceptable bathymetric coverage, if used in combination with a SSS survey. Without this, hydrographic surveys should provide complete seabed coverage for detailed feature or habitat mapping, equating to 200% coverage (Exclusive Order). Our workshop participants stated that as it is normal practice it is sometimes not mentioned in monitoring reports. However, we would recommend that, for clarity, adherence to these standards is noted in monitoring plans and reports.
- Side-scan sonar surveys should follow the **MESH Recommended Operating Guidelines**[42], whilst MBES should follow the **MESH Recommended operating guidelines for swath bathymetry**[43].
- The MMO understand that standard industry practise for geophysical surveys to be completed are usually during year 1, between years 2 and 3 and between year 5 and 8.
- **MEDIN**[44] -compliant discovery metadata, which also conforms to The Crown Estate's **Marine Data Exchange**[45] standard, should be adhered to. For geophysical surveys, these are the MEDIN data guideline for seismic data, bathymetry data, sampling sediment & rock characteristics and for SSS data.

[40] International Hydrographic Organisation Standards for Hydrographic Surveys S-44: https://iho.int/uploads/user/pubs/standards/s-44/S-44_Edition_6.1.0.pdf
[41] International Hydrographic Organisation Standards for Digital Hydrographic Data S-57: https://iho.int/uploads/user/pubs/standards/s-57/31Main.pdf
[42] (Henriques et al., 2013) MeshAtlantic ROG for side-scan sonars - https://emodnet.ec.europa.eu/sites/emodnet.ec.europa.eu/files/public/mesha_rog_sidescan_sonar_v40.pdf
[43] (Henriques et al., 2013) MeshAtlantic ROG for side-scan sonars - https://emodnet.ec.europa.eu/sites/emodnet.ec.europa.eu/files/public/mesha_rog_sidescan_sonar_v40.pdf
[44] (MEDIN Guidelines) Marine Environmental Data & Information Network Standards: https://medin.org.uk/data-standards/medin-data-guidelines
[45] The Crown Estate's Marine Data Exchange: https://www.marinedataexchange.co.uk/

- The Crown Estate has provided a **Scope of Work and Specification for geophysical Pre-Consent Surveys**[46]. This includes full coverage high-resolution bathymetric data, SSS of the seabed and identification of anthropogenic and natural items above and below seabed, seismic information down to at least 50 m below seafloor; identification of geo-hazards, geological information on geological structures to 50 m, and geological conditions in the upper 10 m and magnetometer survey data.
- NE state that **Lurton & Lamarche** (2015)[47] provide additional guidelines and recommendations for backscatter measurements for geophysical surveys.
- Other standards that were mentioned were **The JNCC Marine Monitoring Handbook** [48], **Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites**[49] and **JNCC's Marine Habitat Classification of Britain and Ireland**[50]. All these standards were found to be used in many of the monitoring reports; however, they weren't mentioned in the NE Best Practice guidance.

[46] The Crown Estate, Pre-Consent Surveys, Geophysics Survey Scope and Specification (2023): https://www.marinedataexchange.co.uk/details/TCE-3880/2023-the-crown-estate-pre-consent-surveys-geophysics-survey-scope-and-specification
[47] (Lurton & Lamarche 2015) Backscatter measurements by seafloor-mapping sonars, Guidelines and Recommendations: https://webstatic.niwa.co.nz/static/BWSG_REPORT_MAY2015_web.pdf
[48] (Davies et al., 2001) JNCC Marine Monitoring Handbook: https://data.jncc.gov.uk/data/ed51e7cc-3ef2-4d4f-bd3c-3d82ba87ad95/marine-monitoring-handbook.pdf
[49] (Ware & Kenny, 2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-001376-%C3%98rsted%20Hornsea%20Project%20Three%20(UK)%20Ltd%20-%20Appendix%208%20-Ware,%20S.J.%20&%20Kenny,%20A.J.%202011.pdf
[50] (Connor et al., 2004) The Marine Habitat Classification for Britain and Ireland: https://mhc.jncc.gov.uk/media/1027/04_05_introduction.pdf

All Receptors

Recommendations:

AR1: Monitoring plans and reports to include clear signposting of monitoring/data standards.

Further Information:

- Monitoring plans and reports to include clear signposting of monitoring/data standards so that MMO's Marine Licensing Team and SNCBs can efficiently see what form the monitoring will take.
- As covered by the agreements of the seabed lease with The Crown Estate, all data should be uploaded to the **Marine Data Exchange**[51]. This aims to make data and evidence publicly available, with survey data collected throughout the lifecycle of UK offshore projects as well as new research that addresses evidence gaps.
- Lastly, all post-consent monitoring reports should consist of general good scientific monitoring report writing standards. These include:
  - A clearly defined and testable hypothesis,
  - Clear survey methodology,
  - Analysis of the data; including sufficient information about how the data has been analysed and explanation on the choice of test,
  - Results,
  - Discussion of the results in addition to discussions of limitations of the data,
  - Raw data (where appropriate).

[51] Marine Data Exchange: https://www.marinedataexchange.co.uk/search?site%2Fname=Pre-Consents%20Surveys&sortBy=Relevance&lat=55&lon=-7&zoom=5&view=series