



**JNCC Report
No. 712A**

**Mapping the flow of data from monitoring programmes into
UK Marine Strategy indicators for benthic habitats
Technical notes: Dataflow descriptions & recommendations**

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Summary

Under the UK Marine Strategy (UK MS) the UK is required to determine and measure the status of the health of its seas. For this, specific indicators are used for different ecosystem components to measure and assess progress. Data used for the calculation of benthic habitat indicator assessments originate from a series of monitoring programmes carried out by a number of organisations. Most of these programmes operate on a localised basis and contribute towards multiple local and national assessment obligations. The data landscape underpinning the UK MS indicator assessments is therefore complex and the risk of duplication of effort and underutilisation of data resources great. This piece of work aims to follow and depict the flow of data from monitoring programmes to the indicator assessments, with the goal of highlighting areas where the flow of data could be streamlined, improved or, in the case of missing data links, created. This report was created by JNCC in close collaboration with the UK statutory environmental bodies and showcases a momentary snapshot of the current statutory UK benthic data landscape. We have outlined issues that could impact the efficiency and quality of the indicator assessments and made recommendations on how to address them.

This report forms part of a series of three reports describing the flow of data into each of the UK MS biodiversity indicators. Collectively these reports will provide the initial step in improving the efficiency of data flowing into indicators and achieving a more inclusive, accessible, and robust marine biodiversity evidence base.

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1 Introduction

The health of our seas is vital for our food and energy security, our economy and social well-being; over half of the UK population lives within 15 km of the sea. The seas have an integral role in regulating our climate by storing excess carbon dioxide and heat created by human activities and providing over 50% of the oxygen we need. As well as being enjoyed for recreational activities, the seas are crucial to the UK economy, providing oil and gas, maritime transport, and renewable energy (Defra 2019).

To determine the state of and changes in the health of the UK's wide variety of marine ecosystems, specific indicators have been developed under the [UK Marine Strategy](#) (HM Government 2012). The UK Marine Strategy (UK MS) benthic biodiversity indicators are primarily reliant on data from monitoring programmes undertaken by the individual statutory environmental bodies situated within Wales, England, Scotland, and Northern Ireland. These discrete programmes collect data to fulfil multiple legislative obligations and were not originally designed with the aim of fulfilling the requirements of UK MS indicators. As such, many of these programmes collect data at localised or Marine Protected Area (MPA) scales. These disparate datasets are pieced together to provide an overview of the health of the UK seabed.

The flow of data into the indicator assessment is therefore reliant on localised monitoring efforts, resources and prioritisation. This means that currently the pathways of data feeding into the indicator assessments are not standardised or streamlined and it is unclear whether indicators capture all available data.

In 2008 the Marine Environmental Data and Information Network (MEDIN) was established, to improve access to, and management of, UK marine environmental data and information. MEDIN aims to achieve this primarily through a coordinated framework for managing marine data and information (see Figure 1). Ideally, general monitoring activities carried out by the statutory environmental bodies or other organisations should be registered at the UK Directory of Marine Observing Systems ([UKDMOS](#)). Specific datasets produced by monitoring activities should be made accessible and archived at one of the MEDIN Data Archive Centres where they can be assigned a persistent identifier (PID) in form of a Digital Object Identifier (DOI). Metadata describing the datasets should be published via the [MEDIN](#) Discovery Portal to ensure optimal discoverability. The datasets DOIs can then be linked to UKDMOS under the overarching monitoring survey. Dataset products (combinations of individual datasets) produced as part of the indicator assessments should be archived in the same manner (see Figure 1) but original sources of raw data from which these data products are derived can be traced back easily using PIDs. Ideally, the Marine Online Assessment Tool ([MOAT](#)) would contain metadata (information about the dataset) on the datasets collated for indicator assessments (e.g. raw data, compiled dataset, data snapshot) and link them back to the data archiving centre where they have been deposited. The infrastructure behind the MEDIN framework requires further development to function optimally and consistent usage among the statutory bodies and other organisations is needed.

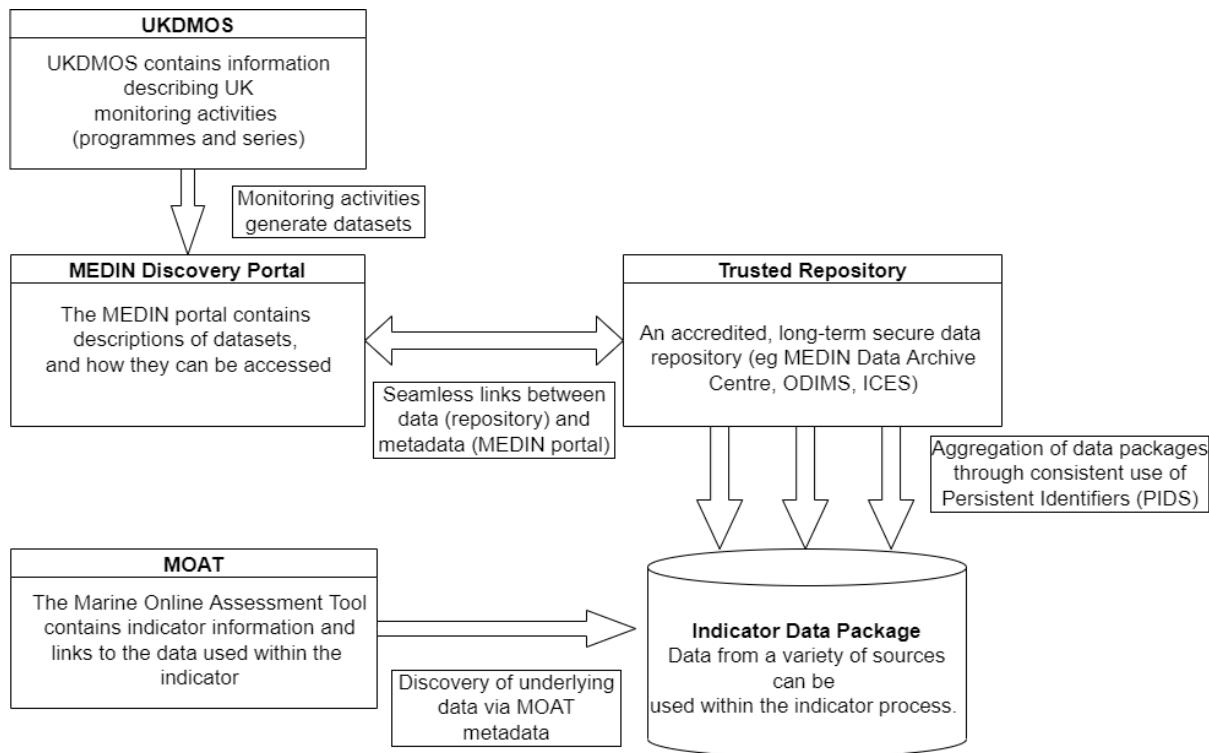


Figure 1. Idealised flow for UK monitoring programmes. It should be possible to access indicator data packages either from data collection information (UKDMOS) to datasets (MEDIN) or directly via indicator assessments (MOAT) with links maintained to support traceable and transparent reporting of assessment results.

This report describes the pathway of data from UK statutory environmental body monitoring programmes into two benthic indicators used for UK MS assessments:

- BH3 – extent of physical damage to predominant and special habitats
- Potential physical loss of predicted seafloor habitats

Two additional UK MS benthic indicators were considered for this paper: 'BH2b – Condition of benthic communities: subtidal habitats of the southern North Sea' and 'BH1 – Typical species composition'. However, as these indicators were not fully operational during the 2019 UK MS assessments, they have not been included in this report. Further information on these indicators is provided in Sections 4.3 and 4.4.

Missing, dysfunctional, and duplicated links impacting the flow of data from collection to the indicators are identified, and key issues and recommendations highlighted. Diagrams providing graphical representation of the dataflows are provided in the accompanying Annex; these diagrams should be viewed alongside the technical notes in Sections 4 and 5.

This report forms part of a series of reports describing the flow of data into each of the UK MS biodiversity indicators. Collectively these reports will provide the initial step in improving the efficiency of data flowing into indicators and achieving a more inclusive, accessible, and robust marine biodiversity evidence base.

A summary of the assumptions and limitations of this report is provided in Section 6.

2 Key dataflow issues

Collecting, analysing, archiving, and publishing of statutory benthic monitoring data in the UK is undertaken primarily by the individual statutory environmental bodies. This report focuses on the issues surrounding data availability and flow into indicator assessments once data have been made accessible by the statutory bodies. It is acknowledged that there is a wealth of data being collected outside of public monitoring, including by industry, research institutes and Non-Government Organisations (NGOs). However, this report is concerned with the flow of data from statutory monitoring programmes (or external organisations which already have an established pathway into the UK MS indicator assessments).

Problems that are universal in data handling and usage which have not been individually addressed as part of this report involve comparability and standardisation of data across different monitoring surveys and regions. Data processing within each organisation differs depending on resources and internal data infrastructure, which can often cause a significant time-lag between the collection of data and publishing of data (several years in some instances). Although not the focus of this report, these are issues that could hamper the outcome of the indicator assessments which rely on a wide range of timely and high-quality (quantitative and comparable) data.

2.1 General marine biodiversity dataflow issues

2.1.1 Discoverability of data

Many organisations are battling a backlog of data to be made available on their database and/or stores. This carries the risk that most recent data are not available for indicator assessments. Some of this backlog is caused by an individual organisations internal lack of resources and manpower, others are caused by inefficiencies and limited engagement in the UK-wide data infrastructure such as MEDIN.

2.1.2 Resource-intensive dissemination to UK-wide databases

Data upload to UK portals and online GIS applications can be a complex process requiring several steps and specialist knowledge. These include creation and upload of metadata associated with the dataset to a metadata directory; choice of data portal (often dictated by regional policy driver); making datasets compliant with UK data standards and the specific requirements of the individual data portal, and upload of the dataset. For example, the Marine Environment Monitoring and Assessment National ([MERMAN](#)) database does not always accept the newest taxonomic nomenclature conforming with the World Register of Marine Species ([WoRMS](#)). Whilst currently resource intensive, these processes are required to ensure availability and discoverability of datasets, compliant with the FAIR data principles (Findable, Accessible, Interoperable and Reusable) to provide a consistent, transparent and UK-wide coverage of data for the inclusion in the indicator assessments.

2.1.3 Inconsistencies in data sharing between organisations

Data sharing between organisations often relies on communication between individuals of the different organisations. This carries the risk that data sharing is patchy, infrequent and might be lost if individuals move roles. This could also cause confusion around permissions to share and re-use datasets for other purposes. In addition, the responsibilities for data management and the collation of data to support indicator development often sits within different teams or departments within organisations requiring ongoing cross-departmental liaison and engagement.

2.1.4 Inconsistencies in response to data calls

Contributions of data to UK assessments or data products relevant for assessments are often based on ad-hoc provision of data in response to data calls. Such calls require specific and varying data formats and are regularly responded to by individuals and rely on availability and good will of specific personnel. This can result in data calls that are infrequently responded to and carry the risk of not utilising recent data in the indicator assessments.

2.1.5 Duplication of data upload effort

Submission of data to one UK database/portal does not automatically guarantee data are made available on other UK portals. Until recently, for example, data submitted to [Marine Recorder](#) were not routinely uploaded to and disseminated through [DASSH](#). This causes duplication of effort by some organisations. Some of the duplication will be removed by the re-development of Marine Recorder. Yet, clarifying and increasing linkages, and wider adoption of existing data standards between the different UK data portals might be a useful next step.

2.1.6 Underutilisation of available resources

Within UK statutory monitoring, global/European or even UK-based data portals are only interacted with at the end of the data publishing chain. Data deposited in these portals are from a wide range of monitoring activities (including academic) and over a greater regional scale. Thus, data that are available from portals such as [OBIS](#), [GBIF](#), and [DASSH](#) could prove very valuable for the indicator assessment. As a rule, these portals are currently not used as the start point for data acquisition for indicator assessments.

2.2 Benthic indicator dataflow issues

The benthic indicators rely heavily on composite data products (e.g. EUSeaMap/UKSeaMap) and monitoring databases (e.g. Marine Recorder) compiled or hosted by JNCC and supported by the statutory environmental bodies. Many of the processes required to create data products or publish contents of databases are based on manual, non-automated processes which are time-consuming and often under-resourced. Generally, data are being collected by a statutory body and uploaded to their organisation-level database before being disseminated to a UK-wide data repository and consequently made available to more global data portals (e.g. OBIS or GBIF). There are several areas where this report has identified inefficiencies in this process:

2.2.1 Underutilisation of available sources

Currently, data for the biology components of both indicators are extracted from Marine Recorder as a default, in combination with specific data calls. This report has shown that:

- Marine Recorder does not contain all relevant biological data that are currently available.
- The response to data calls is variable across organisations.

2.2.2 Inaccessibility of recent data

Most statutory bodies have a backlog of data awaiting quality control (QC), finalisation and/or publication on internal and external databases. Therefore, the most recent data are not available for assessments, unless provided during specific data calls.

2.2.3 Transparency of datasets

The publishing of the dataset assembled for the purpose of the 2018 indicator assessment in DASSH had been delayed up to 2022 owing to internal problems. Additionally, the linking of its metadata to MOAT has not been realised yet.

2.2.4 Missing data on Marine Recorder

Marine Recorder is currently the starting point for species data extraction. However, several organisations collecting inshore data, do not upload these directly to Marine Recorder (or DASSH). Additionally, Marine Recorder is currently inflexible in the type of data that it can hold. For example, currently biomass data cannot be submitted to Marine Recorder. However, there are plans for this issue to be addressed with the re-development of Marine Recorder.

3 Key recommendations

3.1 Use of a wider breadth of data

To include a greater breadth of monitoring data (outside of statutory programmes), data need to be acquired from wider sources. Currently, none of the global, European or UK-wide data portals (e.g. ODIMS, OBIS, UKDMOS, DASSH) have been used as a source of data for assessments. It is acknowledged that using downstream data aggregators does potentially increase the risk of dataset duplication without a consistent and careful use of Persistent Identifiers (PIDs). Therefore, a short project could be set-up to understand the risks of duplication of datasets and to identify ideal access points for sourcing the most complete dataset for the indicator assessments. Ideally DASSH, as the MEDIN biodiversity Data Archiving Centre (DAC) and UK node of OBIS, should provide the most complete marine biodiversity picture at the UK scale.

3.2 Streamline dataflow for indicator assessments

There should be a standardised, transparent and auditable flow of data feeding into the indicator assessments. Useable data for assessments should be identified using UKDMOS (for monitoring programmes) and the MEDIN Discovery Portal (for datasets) and ideally sourced from DASSH (or from the ideal access point along the DASSH data pipeline (e.g. Marine Recorder)). To function optimally, statutory bodies need to actively engage with UKDMOS and DASSH to support improvements to the system and interface. All UK marine biodiversity data collectors should be encouraged to upload their data and information to DASSH and UKDMOS.

3.3 Improve uptake of UKDMOS by statutory bodies

UKDMOS should be a first port of call to check what monitoring programmes are collecting data which could be included in the indicator assessment. Currently, UKDMOS is underutilised as a tool to search for data but also by the individual data producers for registering their monitoring programmes. It would be useful to generate greater buy-in to UKDMOS by the different statutory bodies and other monitoring organisations.

3.4 Improve user-friendliness of MEDIN and MEDIN data archiving centres (DACs)

Accessibility of datasets is dependent on data publication to open data portals and DACs such as DASSH. At present, the process for data ingestion by the DACs creates bottlenecks due to the set data format requirements (which differ between data portals/databases). A simplified more user-friendly pathway for data ingestion and creation of metadata as part of an update of the MEDIN network could improve user uptake amongst the statutory bodies.

3.5 Automate data-sharing processes

Currently data have to be uploaded manually to statutory body internal databases. From there, the process to make these data publicly available also requires manual interaction. It would be more cost-efficient and less resource intensive to establish better interconnection between internal and external databases, as well as between external databases which automate the process of sharing data to external databases such as DASSH or Marine Recorder.

3.6 Establish single point of contact for data calls

Often requests for data to be used within assessments are submitted to individuals within an organisation. This could lead to data not being made available when individuals are unavailable or move roles. Organisations should consider setting-up a single point of contact for data calls which is serviced by all members of a department rather than specific individuals. Ideally reliance on data calls will be reduced as data ingestions bottlenecks are resolved.

3.7 Provide data standards and guidelines

The UK Marine Monitoring and Assessment Strategy are in the process of updating data standards and guidelines for UK monitoring. Providers of public data should be mandated to adhere to these guidelines and standards and adopt them into their organisation.

3.8 Futureproof new projects

The current problems exist because monitoring programmes were set-up prior to the existence of a data strategy. All new projects and monitoring programmes supported by public funds should require a detailed data management plan which follows the UK Marine Monitoring and Assessment Strategy (UKMMAS) Data Strategy.

4 Technical notes on indicator dataflows

4.1 Indicator: Extent of physical damage to predominant and special habitats (BH3)

4.1.1 Technical summary

The dataflow diagram for this indicator, is displayed in the accompanying Annex (Figure 1).

The [indicator](#) is designed to assess the impacts on habitat sensitivity from physical damage pressure caused by human activities. It has been focused on bottom fishing on all subtidal habitat types for the first round of assessment, with additional activities being incorporated in future assessments. The indicator is used to assess progress against the qualitative target set for seafloor habitats in the Marine Strategy Part One in respect of the exposure to pressure. At present, the Marine Strategy Framework Directive requires sub-regions not to exceed moderate impact/vulnerability of the seafloor habitat ([HM Government 2012](#)). Impact of fishing gear is classified as either sub-surface or surface abrasion alongside intensity and variation. This is combined with the sensitivity of the different benthic communities to these impacts to produce an assessment on the extent and distribution of physical damage per subregion and across time.

The existing BH3 indicator under the UK Marine Strategy draws primarily from four different data sources (captured by the brackets on the dataflow diagram): A habitat map derived from the OSPAR EUNIS level 3 Combined Map and the OSPAR threatened and/or declining (T&D) habitats layer to represent habitat types; species presence/absence data to represent vulnerable species, a combination of different reports to provide sensitivity scoring evidence and the ICES demersal trawling records to represent surface and subsurface abrasion on the seafloor.

4.1.1.1 Habitat types

The Combined Map is created by merging the latest EUNIS maps submitted to JNCC from Nature Scot, Natural Resources Wales, DAERA, Natural England and any countries who responded to the latest OSPAR data calls, as well as with the latest EUNIS maps for the OSPAR area and the newest broad-scale habitat map (EUSeaMap), both extracted from EMODnet. Finally, the EUNIS map is merged with the latest OSPAR T&D habitats polygon layer.

4.1.1.2 Vulnerable Species

Species presence/absence data are extracted from Marine Recorder (for more detail see Section 5.1) and combined with responses from member states to the latest OSPAR data call and with responses from statutory bodies to a UK-wide data call.

4.1.1.3 Pressure data

For the fishing effort data, VMS data, e-log books and information on gear types from UK and foreign vessels are submitted to ICES which creates a set of pressure layers that can be downloaded from the ICES data platform to create abrasion rasters.

4.1.1.4 Sensitivity scoring

JNCC scores the sensitivity of the habitat and species. For habitats, the final habitat map is scored based on [MarESA](#) (Tyler-Walters *et al.* 2018). Areas not covered by MarESA are

completed with extracts from the report by Tillin *et al.* (2010) and information extracted from the OSPAR threatened and/or declining species and habitats list. For species data, sensitivity scoring is based on work from Tillin and Tyler-Walters (2014) and Maher and Alexander (2016). Sensitivity scoring of habitat maps and species presence/absence data are combined to create the sensitivity maps. The sensitivity map in turn is combined with the pressure raster to form the following two main end products of the BH3 indicator:

- A disturbance map, which showcases likelihood of sensitivity of areas to disturbance calculated from amount of fishing pressure and sensitivity scoring of individual species and habitats to these pressures.
- An area statistics table assigning confidence in data sources and sensitivity scoring.

Outcomes of the indicator assessment also includes trend analysis to measures changes in disturbance values over time.

Data snapshots for the OSPAR intermediate assessment in 2017 have been submitted to ODIMS and snapshots for the UK Marine Strategy 2018 assessment should be made available through DASSH and linked to MOAT.

4.1.2 Future development

- The reports scoring sensitivity of species are being updated to incorporate the latest evidence. Testing is currently ongoing to use other species sensitivity tools, such as the BH1 indicator on typical species composition based on biological trait analysis alongside other biotope sensitivity assessments. These are currently being developed.
- Additionally, the [OSPAR CEMP](#) guidelines for this indicator are currently being updated to reflect the recent addition of the development of a physical damage pressure layers for non-fishing activities.
- The Quality Status Report 2023 will already include the assessment of the impacts of aggregate extractions. These have been derived from a data call to OSPAR contracting parties on aggregate extraction pressure hosted by the Environmental Impacts of Human Activities Committee (EIHA).
- JNCC has developed a more streamlined process to update the EUNIS habitats combined map in UK waters. This streamlined process can be applied to the north-east Atlantic and will make the next update of the NE Atlantic Combined habitat map less resource intensive and produce a more user-friendly final product.

4.1.3 Missing, duplicated and dysfunctional links

- Generally, the quality and rate of response to different data calls is variable. Sometimes datasets are submitted but are not compatible with the data requirements, sometimes response is low.
- Marine Recorder is the primary source of data for the indicators as it currently holds a more extensive archive of species data from statutory monitoring. There is also a relative ease of access to Marine Recorder by JNCC compared with other data portals. As such, other data sources that hold UK species data such as OBIS, DASSH or NBN are not currently included in the indicator assessments. However, the redevelopment of Marine Recorder will include an automated link with DASSH.
- Fishing data for vessels below 12 m in length are not available, which is causing an underestimation of physical damage from inshore fisheries.
- Data on aggregate extraction are not openly available from industries, therefore data are currently obtained through data calls from the OSPAR EIHA Committee.

- Historically, there has been a delay in the publication of the final data snapshot of the indicator assessment owing to bottlenecks at JNCC and DASSH. There is a need for more timely publication through DASSH.

4.2 Indicator: Potential physical loss of predicted seafloor habitats

4.2.1 Technical summary

The dataflow diagram for this indicator, is displayed in the accompanying Annex (Figures 2 and 3).

The [indicator](#) for potential physical loss of predicted seafloor habitat is used to assess progress against the target set for biogenic seafloor habitats in the Marine Strategy Part One ([HM Government 2012](#)) which requires the area of selected habitat to be stable or increasing and not smaller than the baseline value. It was developed using three key sources of information: potential distribution of a selection of habitats; information on habitat sensitivities to pressure; and the likely pressures impacting these habitats

4.2.1.1 Benthic species and habitat distribution

The habitats that are assessed in this indicator are those for subtidal seagrass beds (*Zostera marina*) and horse mussel reefs (*Modiolus modiolus*). Species distribution modelling is used to establish the potential extent and distribution of these habitats in the absence of human pressures. The habitat distribution models take as input in-situ observations on habitat presence or absence as well as rasters of environmental variables that affect their distribution.

Data products on in-situ observations feeding into the habitats distribution model are supplied by JNCC and involve the OSPAR threatened and/or declining habitats list (for more detail see Section 5.1), data extracted from Marine Recorder, and the Annex 1 Reef Habitat database (for more detail see Section 5.2).

Environmental raster datasets are derived from data extracted from EMODnet's portals as well as outputs from the Atlantic European North West Shelf Ocean Physical and Biogeochemistry model hosted on the [Copernicus](#) portal and the [ICES](#) data portal. [EMODnet seabed habitats](#), provide access to several data products used in the models, including:

- substrate type information,
- data on wave and currents climatology published on EMODnet Seabed Habitats,
- the amount of light at the seabed.

Substrate types are extracted from the EUNIS Level 3 combined habitat map and the full coverage broad-scale habitat maps (UKSeaMap or EUSeaMap, see section 5.3 (Dataflow: UK benthic monitoring)). These habitat products are updated regularly, and which one is used depends on which provides the best evidence for the UK at the time of modelling. Modelling outputs from a Cefas project provide further detail on substratum type (Stephens & Diesing 2015). EMODnet Bathymetry provides a digital terrain model which, together with Defra's marine Digital Elevation Model, forms the model input for seabed slope and bathymetry. The ICES data centre and the World Ocean Data Centre feed into the Ocean Climatology of the North-West European Shelf dataset hosted by the ICES data centre. This provides average near sea-bed temperature to the model. Lastly modelling outputs from the [POLCOM](#) model which are downloadable from the [Copernicus](#) portal provide salinity data.

4.2.1.2 Sensitivity scoring

The Marine Evidence-based Sensitivity Assessment of the Marine Life Information Network ([MarESA](#)) is used to score sensitivities of habitats to pressures. JNCC's [Pressures-Activities Database](#) is then used to link pressures to human activities.

4.2.1.3 Human activities and pressures

The human activities assumed to cause impacts to *Z. marina* and *M. modiolus* habitats included aquaculture activities, oil and gas extractions, coastal development, renewable energy, fishing, dredging, and spoil disposal for navigation and other purposes as well as aggregate extraction. Fishing pressure was accessed from the [ICES](#) data portal, while The Crown Estate holds data on renewable energy and aggregate extraction. Data on hydrocarbon extraction and pipelines are being held by the [Oil & Gas Authority](#) Data Centre, and data on coastal development such as structures, communication cables and recreation were extracted from the Hydrospatial One data layer. Data on navigational dredging were collected from data.gov.uk, Marine Scotland, NRW and DAERA. The Marine Management Organisation (MMO) fed information on navigational dredging into data.gov.uk. Cefas is collecting data on dredge and spoil disposal, from the Marine Case Management Systems (MCMS) Licencing database, the devolved administrations (Scottish Government, NRW and DAERA) and paper records. These data were forwarded to JNCC where they were included in the indicator assessment. Data summarising pressures from aquaculture were collected from NMPI and environment.data.gov.uk where Marine Scotland and the Environment Agency respectively deposit data. Defra submitted data on aquaculture, finfish and shellfish directly to JNCC where the data were merged and analysed. Pressures and sensitivity of habitats were scored and calculated by JNCC which created a dataset of the potential overlap between pressures and marine habitats. This dataset was subsequently submitted to DASSH.

4.2.2 Future development

- 'Hydrospatial one' is a spatial data layer which was previously only freely available to academia. It was used in the UK Marine Strategy Part I 2018 assessment because it could be accessed by those developing and running the indicator. This spatial layer does not exist anymore and has been replaced by [Marine Themes Vector](#) by OceanWise. However, JNCC has access to the Defra UKHO data layer which is comprised of the same data.
- Modelling methods are currently being updated to improve predictions of habitats, but this will not change the dataflow.
- Legislation is due to come into force in 2022 which will make it a legal requirement for all vessels under 12 m in length to have an inshore vessel monitoring system (I-VMS) installed and transmitting data when they are at sea in English waters ([HM Government 2022](#)). These data will enable a more accurate estimation of potential physical loss from inshore fisheries for future assessments. However, as the seabed abrasion data product which is incorporated in this indicator assessment requires a full year of UK data, it is unlikely that this iVMS data will be utilised in the next (2024) UK MS assessments.

4.2.3 Missing, duplicated and dysfunctional links

- Fishing data for vessels below 12 m in length across the UK are not currently available, causing an underestimation of potential physical loss from inshore fisheries. No data are available on submarine infrastructures deposited for contingency measures such as rock dumps to protect pipelines or stabilise drilling platforms.

- Aquaculture pressure has been extracted from Hydrospatial one. In England several different authorities, such as [Defra](#), the Environment Agency, Cefas, MMO, The Crown Estate, regional IFCAs (Inshore Fishery Conservation Agencies) and other local authorities hold data on aquaculture. For Scotland, data on aquaculture are freely available from [NMPi](#) and for Northern Ireland from [DAERA's map viewer](#), while data for Wales might be available from [NRW](#) upon request. It is not clear whether information from all these organisations is represented as part of the Hydrospatial one layer.
- The open version of the dataset used for the indicator assessment in the UK MS 2018 has been submitted but not yet uploaded to DASSH owing to bottlenecks at DASSH and JNCC.
- Upload of inshore data to MR is less consistent across the statutory environmental bodies than upload of offshore data, potentially causing patchy data across coastal areas for this indicator.

4.3 Indicator: Conditions of benthic communities: subtidal habitats of the Southern North Sea (BH2b)

4.3.1 Technical summary

The BH2b [indicator](#) detects and quantifies the impact of a pressure compared to baseline conditions per habitat type. The current focus of BH2b is on fishing pressure. For the UK Marine Strategy Part I 2018 assessments a pilot was conducted in the Southern North Sea. This means that some of the data used for the calculations of BH2b in the 2018 UK Marine Strategy assessment stemmed from other European Nations and not the UK. Mapping the UK dataflow for BH2b, thus, is currently not feasible.

4.4 Indicator: Typical species composition (BH1)

4.4.1 Technical summary

This indicator looks at changes in the proportion of sentinel species within the benthic community across a pressure gradient (e.g. trawling or pollution). Sentinel species are defined as species that are characteristic of the benthic community and particularly sensitive to a pressure. The sensitivity of species to trawling pressure is calculated using the “Benthic Sensitivity Index to Trawling Operations (BESITO), (González-Irusta *et al.* 2018) using information on a selection of biological traits. The sensitivity of species to pollution is calculated using the AZTI Marine Biotic Index (AMBI) (Borja *et al.* 2000). The indicator is currently used for the OSPAR Quality Status Report assessment but whether it will be included in the next round of the UK Marine Strategy Part I assessments is still being discussed. There are also uncertainties around the methodology that have not been clarified yet. Therefore, no dataflow for BH1 have been mapped yet.

4.4.2 Future development

- The name of this indicator has changed to “Sentinels of the Seabed” – SoS.

5 Technical notes on supplementary dataflows

Supporting dataflows and technical notes have been created on some of the composite data products regularly used in the previously discussed indicator assessment, these diagrams are displayed in the accompanying Annex (Section 2, Figures 4, 5 and 6). This is not a finite list which encompasses all indicators and is likely to be extended as the number of indicators described and mapped is increased. One exception is the UK benthic monitoring dataflow which is aiming to capture the complete UK benthic monitoring data landscape and, although likely to be subject to change, is applicable to all benthic indicator assessments.

5.1 Dataflow: OSPAR threatened and/or declining habitats data product

5.1.1 Technical summary

The dataflow diagram for the OSPAR threatened and/or declining habitats product, is displayed in the accompanying Annex (Figure 4).

The OSPAR threatened and/or declining species and habitats list is compiled to identify species and habitats in need of protection. It is based on nominations by Contracting Parties and Observers to the OSPAR Commission. JNCC uses this list to create an extent (polygon) and presence (point) layer of threatened and declining habitats in the UK approximately every 2 years before the start of an assessment round. This dataset is used as the basis for status assessments for the listed habitats but is also included in calculating sensitivity of habitats to pressures for the UK MS indicators.

To build the data product, JNCC extracts data snapshots from Marine Recorder, GeMS (Geodatabase of Marine features adjacent to Scotland), NRW Section 7 Habitats database and the Natural England Evidence base to which the Environment Agency provides specific relevant habitat data on an *ad-hoc* basis. Inshore data on Northern Irish OSPAR T&D habitats are extracted from the Northern Irish [Marine Map viewer](#) which is kept up-to-date with Northern Ireland (NI) Priority Marine Habitats data by DAERA. AFBI provides data from their Nephrops monitoring in the wider Irish Sea and Marine Scotland Science from Scottish Nephrops surveys. Individual habitat maps for offshore England and NI are also added to the dataset by JNCC. Data are either provided directly by the specific SNCBs or via download from their respective datportal (e.g. [Lle Geo Portal](#) – NRW, [data.gov.uk](#) – NE, [NMPi](#)– MSS & NatureScot, NI [Marine Map viewer](#)– DAERA). Data are updated with responses from OSPAR data calls before duplication and spatial overlap are removed from all layers to create the UK OSPAR T&D habitats data product. This is then merged with other T&D Habitat data from other OSPAR contracting Parties to form the NE Atlantic OSPAR T&D habitats data product.

5.1.2 Missing, duplicated and dysfunctional links

- Focusing on the four named databases to create the OSPAR T&D layer could mean several statutory as well as other data sources are being missed. Any data collected from SEPA and Marine Scotland Science that is not part of statutory MPA monitoring with NatureScot for example is not included in any of these databases.
- Seagrass and saltmarsh data collected by the Environment Agency are submitted to the Natural England evidence database sporadically on an *ad-hoc* basis. This does not guarantee availability of newest and complete Environment Agency datasets.
- No data from DASSH are currently being included in the OSPAR T&D habitats data product, which means there is a risk of missing potential data from statutory

monitoring, as well as a wide variety of data collected by other stakeholders such as academia.

5.2 Dataflow: Annex 1 Reef Habitat

5.2.1 Technical summary

The dataflow diagram for the Annex 1 Reef Habitat product is displayed in the accompanying Annex (Figure 5).

The [Annex 1 Reef Habitat](#) database is a composite data product showing the best-available data for the extent and distribution of all Annex 1 Reefs in the UK, to help assess the conservation status of the reef feature. The offshore and habitat regulations (as amended) require the UK to designate SACs based on habitats listed on Annex I of the Habitats Directive. A data layer is created each for polygon and point data derived from some shared and some unique sources.

For the polygon layer, previous versions of Annex 1 Reef maps and ‘not reef’ layers provide the starting point. Relevant data are also extracted from:

- EUNIS level 3 combined habitat map;
- Polygon data for Welsh Waters derived from SAC surveys and submitted by NRW as the NRW Annex 1 dataset;
- SAC monitoring surveys within England and Northern Ireland, contributed to by JNCC, Cefas, Natural England and DAERA.

Additional data are gained from:

- Previous surveys on iceberg ploughmarks (AFEN/DTI Tobi Sidescan survey) held by the National Oceanographic centre (NOC);
- Previous survey by the British Geological Survey on Stanton banks between 1969 and 1970;
- A model which semi automates the mapping of rock in the UK called ‘Predictions of outcrops or subcrops of rock in UK shelf seabed’ (Brown *et al.* 2017; Diesing *et al.* 2015; Downie *et al.* 2016; Lillis *et al.* 2018).

Other biogenic reef data, which might change, are extracted from:

- Natural England’s Core reef data product on *Sabellaria* distribution in the Wash;
- The Eastern IFCA Report;
- The East Coast Regional Environmental Characterisation (REC) survey; and
- Industry data on the Inner Dowsing Race Bank North Ridge SAC.

The polygon layer and the point layer share several different data sources, namely: the UK Offshore habitat features of conservation importance list hosted by JNCC; the OSPAR threatened and/or declining habitats list (for more detail see Section 5.1); the Natural England Evidence base; and the Scottish Geodatabase of Marine features (GeMS). Once spatial overlap between the different data products is resolved, four polygon layers are produced (“High confidence reef”, “high confidence not reef”, “potential reef” and “potential not reef”). These are merged and after topological corrections and a final external review by relevant statutory bodies form the GIS polygon layer.

For the point layer, additional data besides the shared data sources with the polygon data, are added. These additional sources consist of an ‘other biogenic reef point data’ dataset

and Marine Recorder, which in its current format can hold only point data of species and biotopes relevant to the Annex 1 Reef layer but does not directly hold determinations of records as Annex I features. Other biogenic reef data currently contain data provided by SEA7 ([Strategic Environmental Assessment Area 7](#)) and SEA/SAC survey data along the Wyville Thomson Ridge as well as East coast Regional Environmental Characterisation (REC) surveys. Data from these data sources were standardised before being merged to produce the GIS point layer output.

5.2.2 Future development

- An additional data product has been produced to show additional area to be considered as potential reef, focusing on *Sabellaria spinulosa* reefs that occur within the three offshore SACs beyond 12 nm from the UK coast: Haisborough, Hammond and Winterton; Inner Dowsing, Race Bank and North Ridge; and North Norfolk Sandbanks and Saturn Reef. This is a supplementary layer to the main reef layer to provide evidence for additional areas to be managed as reef.

5.2.3 Missing, duplicated and dysfunctional links

- Because reef abundance data are not available throughout all of UK waters, habitat models are being used to predict presence of reef habitats. This could mean some reef habitats are being missed or might be predicted to be present when they are not.

5.3 Dataflow: UK benthic monitoring

The dataflow diagram for UK benthic monitoring programmes, is displayed in the accompanying Annex (Figure 6).

In the UK, statutory marine monitoring efforts are distributed across a wide range of stakeholders. In some countries, such as Wales, all statutory monitoring is carried out by one organisation, Natural Resources Wales (NRW). In other countries, such as England, statutory monitoring is carried out via several different organisations, including Natural England and the Environment Agency for inshore monitoring, and JNCC for offshore monitoring with overlap in their statutory monitoring remit between them. Some organisations have a statutory remit on certain monitoring efforts but contract them to other organisations. Certain data from NGOs and citizen science, although not derived from statutory monitoring, are still included in databases which are regularly used for indicator assessment. Based on policy drivers of specific regions, all monitoring data derived from one overarching monitoring framework (e.g. Water Environment (Water Framework Directive) (England and Wales) Regulations 2017) is not necessarily submitted to the same data-portal but often to country-specific data portals.

The resultant data landscape is therefore complex; discrete programmes are governed independently with organisation-level processes and databases for managing and archiving datasets. This presents challenges for not only compiling datasets for UK MS assessments but also for wider collaboration across the UK and globally.

This section provides a comprehensive overview of the flow of benthic data from public sector monitoring activities into databases and portals. This monitoring provides the data source which not only feeds into and underpins both the previously discussed UK MS benthic indicators but also supports assessment activities at multiple scales and for multiple reporting obligations (e.g. OSPAR, WFR (Water Environment (Water Framework Directive) (England and Wales) Regulations 2017), Habitats Directive, Marine & Coastal Access Act).

Where an individual organisation collects different types of benthic data, if these datasets follow the same pathway, then they have been grouped under the same overarching monitoring programme and represented as one entity in the dataflow diagram. Where different data types follow different pathways, these have been split into constituent components and represented individually in the dataflow diagram.

5.3.1 DAERA

5.3.1.1 Technical summary

DAERA carries out a number of statutory monitoring programmes which are handled and submitted along two separate pathways. Subtidal and intertidal (carried out in collaboration with AFBI) MPA benthic monitoring programmes, WFR (Water Environment (Water Framework Directive) (England and Wales) Regulations 2017) macroalgae and estuarine fish surveys as well as marine invasive/non-native species monitoring, are being submitted to CEDaR. At CEDaR this information is collated with other Northern Irish data (e.g. academic) and submitted to Marine Recorder. Data from CEDaR are also being submitted to NBN and MERMAN. Outcomes of WFR classification data submitted to CEDaR will also be forwarded to WISE (Water Information System for Europe) every 6 years. Seabed data derived from subtidal monitoring programmes are submitted to EMODnet Seabed Habitats on an ad-hoc basis by an individual without formal process. Data from CSSEP (Clean and Save Seas Environment Programme) sediment (carried out in collaboration with AFBI) and benthic infauna monitoring as well as from WFR benthic monitoring and disposal site monitoring are submitted to DAERA's own database – the Marine Data Management System (MDMS). From there, results from IQI (Infaunal Quality Index) assessments (no raw data) and WFR assessments are submitted to WISE. CSSEP data are also submitted to MERMAN. Data from the Northern Ireland *Nucella* imposex triannual survey are submitted to MERMAN and the outcome of the imposex assessment is submitted to WISE. MERMAN will manually forward CSSEP sediment and imposex data to the ICES database and from there via a web-link to OSPAR's ODIMS (OSPAR Data & Information Management System). Any data held in MERMAN will be uploaded to BODC (the British Oceanographic Data Centre) automatically. In parallel, CSSEP sediment data held in MERMAN is also being forwarded to EMODnet Chemistry in a semi-automated fashion.

5.3.1.2 Future development

- Defra is currently reviewing the possibility of a re-development of MERMAN to make it more functional. Likewise talks are ongoing between BODC and DASSH to organise an automatic link between MERMAN and DASSH for long-term archiving within the MEDIN framework.
- DAERA is currently setting up a Northern Ireland MarClim project similar to the MarClim project in England and Scotland which is aiming to establish a time series on the impact of climate change on coastal species across the UK. It is expected that the outcome of the Northern Ireland MarClim project will feed directly into Marine Recorder.

5.3.1.3 Missing, duplicated and dysfunctional links

- The Marine Data Management System (MDMS) has been developed to hold benthic data, however currently there is no link between the MDMS and Marine Recorder or an accredited MEDIN Data Archive Centre, which means raw data collected for IQI assessments (from WFR benthic monitoring and disposal site monitoring) and held in MDMS is not available for any of the discussed indicator assessments. Resolving this issue will become even more important once data from intertidal and subtidal

MPA/MCZ monitoring programmes are being submitted to MDMS instead of CEDaR as originally intended.

- Data submission from subtidal MPA/MCZ monitoring to EMODnet Seabed Habitats are carried out by individuals on an ad-hoc basis when data are collected. This is not an automated and standardised procedure and relies on the goodwill of the post holder, thus could hold a risk for the future.
- MERMAN's data protocol has not been updated with WoRMS (World Register of Marine Species) conforming taxonomic nomenclature. Thus, species data which conform with WoRMS often will have to be changed to old and no longer accepted terminology to be able to be uploaded. This can cause confusion and duplication of effort.

5.3.2 Marine Biological Association (MBA)

5.3.2.1 Technical summary

Data collected for the MarClim project are collated at the Marine Biological Association (MBA). From here data that have been collected between 1997 and 2019 are uploaded to DASSH and passed onto the NBN. Previously, these data were then uploaded from DASSH to Marine Recorder after a two-year embargo. This, however, is currently not the case. Other data from monitoring projects carried out by or with the MBA as partner are submitted to Marine Recorder on a six-monthly basis.

5.3.2.2 Missing, duplicated and dysfunctional links

- Ownership of historic data collected prior to 1997 has been difficult to establish. Thus, these data are currently not openly available from DASSH and have not been uploaded to Marine Recorder but are available upon request.
- Forwarding of the MarClim data from DASSH to Marine Recorder has been suspended, pending the new Marine Recorder developments.

5.3.3 Natural Resources Wales (NRW)

5.3.3.1 Technical summary

Natural Resources Wales carries out two main statutory monitoring programmes: Welsh WFR benthic monitoring and Welsh SAC/SSSI/MCZ benthic monitoring. WFR data are held in the internal NRW database. Outcomes of the WFR assessments are published on the [Water Watch Wales Portal](#). Data relevant for Wales Section 7 Biodiversity lists of habitats and organisms of key significance to sustain and improve biodiversity in Wales and OSPAR GIS layers are periodically extracted from Welsh benthic WFR monitoring data and submitted to NRW's internal Section 7 Habitats database where it is collated into an updated GIS layer. This is a manual process undertaken by Section 7 Habitat specialists at NRW. Data contained in the Section 7 Habitats database and open data from SAC/SSSI/MCZ monitoring are published openly through Lle Geo Portal Wales. EUNIS habitat data derived from Section 7 data and the OSPAR threatened and/or declining habitats layer are generally extracted by JNCC from the Lle Geo Portal Wales on an ad-hoc basis. JNCC publishes data products derived from NRW data such as UKSeaMap or EUSeaMap on EMODNet Seabed Habitats and the OSPAR ODIMS portal. Species and habitat data from Welsh SAC/SSSI/MCZ surveys are submitted to Marine Recorder and the NBN atlas. The Lle Geo Portal Wales is periodically updated and collated with a Marine Recorder snapshot.

5.3.3.2 Future development

- Lle Geo Portal Wales is being rebranded as DataMapWales Geo Portal.
- NRW is planning to publish any raw data derived from WFR monitoring contained in internal databases through the NBN atlas or if data are not suitable for NBN through Lle Geo Portal Wales/DataMapWales Geo Portal.

5.3.3.3 Missing, duplicated and dysfunctional links

- Data collected from WFR monitoring programmes are not forwarded onto Marine Recorder and thus might be missed in any assessments relying on Marine Recorder.
- NRW contributes to EMODnet Seabed Habitats and the combined EUNIS map rely on requests from JNCC. There is no automated process to continuously submit new data products to EMODnet Seabed Habitats.

5.3.4 Environment Agency

5.3.4.1 Technical summary

The Environment Agency carries out WFR intertidal and subtidal monitoring, flood and coastal risk management projects and incident response monitoring. Estuarine and coastal water quality and ecology data from these programmes are uploaded to one of several Environmental Agency databases where they are available upon request. Most datasets, including WFR classifications, held at these EA databases are uploaded to gov.uk. WFR monitoring data are also uploaded to NBN. Habitat datasets and derived data products from specific monitoring programmes are transferred to the Natural England Evidence Base on an ad-hoc basis:

- Intertidal seagrass
- Subtidal seagrass (monitoring data and GIS extent layer)
- Saltmarsh extent, zonation and change
- Benthic invertebrates
- Particle size analysis
- Sediment chemistry

The Environment Agency contributes to the National Network of Regional Coastal Monitoring Programmes (NNRCMP) of England led by councils involved in the project with specific outcomes of monitoring surveys (Aerial imagery data capture, Coastal LIDAR, Bathymetry, Mapping and data AQC and reporting). These data are submitted to the platform of the [Channel Coastal Observatory](#) from where the Environment Agency extracts relevant derived data products such as maps of benthic habitats which are included in the ad-hoc transfer to the Natural England Evidence database.

5.3.4.2 Missing, duplicated and dysfunctional links

- None of the data derived from Environment Agency statutory monitoring programmes are being uploaded to databases generally used for indicator assessments such as Marine Recorder. There are, however, several pathways in which data collected by the Environment Agency could still find its way into the assessments in future.
- Data from WFR monitoring is uploaded to NBN and shared with Natural England. Although NBN exchanges data with DASSH on an ad-hoc basis, these data portals are currently not utilised for the indicator assessment but could be in the future.

- Data shared with Natural England is stored on the Natural England Evidence database but is not currently uploaded to Marine Recorder as this would require additional resources.
- Environment Agency data that are shared with Natural England might, however, be included in assessment via data products such as the EUNIS habitat map. However, this process depends on links between individuals in Natural England and the Environment Agency.

5.3.5 Joint Nature Conservation Committee (JNCC)

5.3.5.1 Technical summary

As part of its statutory monitoring remit JNCC carries out offshore benthic habitat MPA monitoring programmes in partnership with Marine Scotland Science (in Scottish waters) and with Cefas and Natural England (in English waters). For surveys carried out with Marine Scotland Science, JNCC remains the data custodian. For surveys in English waters custodianship is agreed upon before the survey by the different participants. JNCC uploads habitat polygons from MPA monitoring programmes to EMODnet Seabed Habitats. JNCC also uploads any species and habitat data to Marine Recorder as well as DASSH. When Cefas is the main data holder, Cefas will upload the data to DASSH and Cefas' [OneBenthic](#) analysis toolkit, but the responsibility to upload it to Marine Recorder remains with JNCC. From November 2021 onwards, species and habitat data from the open Marine Recorder snapshot are being uploaded to DASSH. From December 2021 onwards the complete Marine Recorder archive is being uploaded to EurOBIS through the EMODnet Biology portal and through EMODnet to OBIS and GBIF.

5.3.5.2 Future development

- Marine Recorder online is currently in initial development under the guidance of the Marine Recorder steering group and undergoing continuous testing, feedback and adaptation by core representative users from the steering organisations. Initial release of the 'minimal viable product' is slated for FY22/23, with ongoing improvements, functionality increase, and development planned for future financial years, funding dependent. This will help to broaden the capacity of the database in holding different data types and streamline and automate some of the data archiving processes for organisations uploading data.
- Work is underway to automate data exchange between Marine Recorder and DASSH, thus the current manual upload of monitoring data to DASSH might not be required in the future.

5.3.5.3 Missing, duplicated and dysfunctional links

- JNCC is currently experiencing a backlog of data to be uploaded to Marine Recorder and DASSH. A lack of resources means recent monitoring data might not be available for assessments as part of the Marine Recorder snapshot or within DASSH.

5.3.6 Marine Scotland Science (MSS)

5.3.6.1 Technical summary

In addition to the offshore monitoring with JNCC, Marine Scotland carries out a number of statutory monitoring programmes. Similar to Northern Ireland, the imposex in marine gastropods survey is also carried out in Scotland and the data derived are submitted to MERMAN and forwarded to the ICES database and from there to ODIMS. Submissions from MERMAN to ICES are based on a manual upload facilitated by BODC. Spatial data from this

survey is also submitted to Marine Scotland's NMPI. Data from other environmental monitoring programmes such as the Clean and Save Seas Environmental Monitoring Programmes (CSSEP), the Reference Mussel Monitoring for Hazardous Substances and the Dangerous Substances Monitoring Programme are also uploaded to MERMAN. Data from CSSEP monitoring uploaded to MERMAN are also being forwarded to EMODnet Chemistry and ICES. Data from the Seabed Disturbance and Regulated Activities Monitoring is part of a licensing procedure and not published regularly. Data from Historic Benthic Monitoring is currently part of a physical archive and awaiting digitisation. Data from the Scottish Coastal Observatory is published on marine.scot.gov. Benthic monitoring at Beryl and Buzzard Oilfield is no longer carried out and data are not readily available online.

5.3.6.2 Missing, duplicated and dysfunctional links

- Much of the benthic and environmental data Marine Scotland gathers are not fed into data platforms contributing to indicator calculations. Marine Scotland has gathered over 90 years (Historic Benthic Monitoring) of benthic data which are currently awaiting digitisation and are not utilised based on resource limitation. These data could be extremely useful in assessing change in benthic communities.
- Data from the Scottish Coastal Observatory are also only published on the marine.gov.scot website and are not part of any of the database snapshots feeding into indicator calculation such as GeMS or Marine Recorder.
- The Seabed Disturbance and regulated Activities Monitoring data could provide useful insights for the calculation of pressures for the potential physical loss of predicted seafloor habitats and BH3 but are also not published publicly.

5.3.7 Scottish Environment Protection Agency (SEPA)

5.3.7.1 Technical summary

SEPA historically carried out or participated in several monitoring programmes including WFR monitoring, Monitoring for Nitrates, Clean and Safe Seas Environment Programme, Controlled Activity Regulation Monitoring and Imposex in marine gastropods (Scotland). Data from the Clean and Safe Seas Environment Programme have been forwarded to MERMAN. Data from benthic monitoring are forwarded on to DASSH and data derived from subtidal remote sensing are shared with the British Geological Survey and UKHO. These data originated from a number of monitoring programmes including Controlled Activity Regulation and the majority of these programmes are partnerships working either at a Scottish or a UK-level.

During the 2020 Lockdown SEPA suspended all monitoring activities and then was subject to a cyber-attack in late December 2020, which suspended SEPA's ability to work. The initial work that was restarted in 2020 was in relation to COVID assessments (Scottish Environment Protection Agency 2021) and the seasonal Scottish Bathing Water programme. Thereafter a limited programme of Controlled Activity Regulatory monitoring in relation to marine aquaculture was resumed in the summer of 2021. SEPA is now planning to focus future monitoring programmes around the health of marine biodiversity in relation to pen fish farms, as well as a continuation of the seasonal Scottish bathing water programme and COVID status assessments. SEPA is not planning to actively support WFR or MS assessments in the future. However, there are still plans to submit any relevant benthic data to DASSH.

5.3.8 NatureScot

5.3.8.1 Technical summary

NatureScot carries out MPA/MCZ monitoring, often in collaboration with Marine Scotland Science and SEPA. Data from these surveys are being uploaded to Marine Recorder as well as to NBN (species data collected between 1993 and 2018). Scottish Priority Marine Feature and MPA search feature data, as well as a snapshot of Marine Recorder, are periodically uploaded to GeMS and collated with data held there. The same process is carried out with a snapshot from NBN to GeMS. Through GeMS these data are then forwarded and made available on NMPi and NatureScot's Natural Spaces web portal as well as EMODnet seabed habitat. NatureScot contracted the Scottish Association for Marine Science (SAMS) to carry out their MarClim survey. Data derived from these surveys are submitted to DASSH and from there to NBN.

5.3.8.2 Future development

- NatureScot is aiming to mobilise more seabed survey species data into DASSH, however, this is recognised as a resource intensive exercise.
- The redevelopment of Marine Recorder will alter NatureScot's dataflow. Data will still be submitted to Marine Recorder but should then be automatically uploaded to DASSH which will exchange data with NBN, EMODnet and EurOBIS.
- NatureScot is considering submitting MarClim data to Marine Recorder pending redevelopment of Marine Recorder.

5.3.8.3 Missing, duplicated and dysfunctional links

- Data are being uploaded to DASSH and NBN. Between NBN and DASSH exists a two-way exchange. However, NBN only accepts marine species data not habitat data, which means a submission to DASSH is vital if data are meant to contribute to EMODnet and EurOBIS. This is a duplication of effort.
- Similar to English MarClim data, data from the Scottish programme is also uploaded to DASSH and not Marine Recorder, which means there is a risk that these data are not utilised in all UK MS assessments using these particular indicators (BH3 and Potential physical loss of seafloor habitats).

5.3.9 Natural England (NE)

5.3.9.1 Technical summary

Natural England carries out SAC/SSSI/MCZ benthic habitat monitoring, where applicable in cooperation with the Environment Agency. Data from these surveys are being submitted to the Natural England Evidence Base and Marine Recorder on a six-monthly update cycle. An open version of the NE evidence base (points and polygons) is made available on gov.uk and designated habitat and species of conservation importance within marine protected areas are uploaded to Defra's Multi-Agency Geographic Information for the Countryside (MAGIC) portal. Habitat data are being submitted to EMODnet seabed habitats. Data from Marine Recorder are downloaded to the Natural England Evidence Base during the regular update process and added to the data held there.

5.3.9.2 Future development

- The redevelopment of Marine Recorder should improve workflows for point data and make the process of updating records easier for Natural England. It may also help to find a solution for the current stalemate with EA point data being in a different format.

- Work on dataflows within NE should in time naturally expand out to cover dataflows with other organisations that NE works closely with, such as JNCC.

5.3.9.3 Missing, duplicated and dysfunctional links

- Natural England has a backlog of habitat survey datasets to be sorted through, archived and made available in either EMODnet or DASSH. This will be tackled slowly when resources permit.
- Species data are not being made available in DASSH, NBN or OBIS, although this might change with the redevelopment of Marine Recorder. This poses a low risk for UK MS indicator assessments but could affect international assessments and research which are based on extracts of internationally known data portals.

5.3.10 Additional monitoring sources

5.3.10.1 Technical summary

There are several organisations which submit data to Marine Recorder and whose monitoring programmes are often reliant on citizen scientists. The Kent and Sussex Wildlife Trust submit biotope point data from their Shoresearch programme to Marine Recorder. Further Wildlife Trust monitoring programmes are also submitted to Marine Recorder by the Wildlife Trust. Polygon data from relevant Wildlife Trust monitoring programmes (such as seagrass surveys) are also incorporated into the Natural England Evidence Base, however this data exchange relies on linkages between individuals within these organisations. The Marine Conservation Society submit biotope point data from their Seasearch programme. The Porcupine Marine History Society is submitting biotope point data from their annual field surveys to Marine Recorder every 6 months.

5.3.10.2 Future development

- JNCC is currently in the process of evaluating whether other web-based tools such as OneBenthic could be useful for the testing of indicators.

5.3.10.3 Missing, duplicated and dysfunctional links

- Another programme that has been identified as harbouring potentially useful data for the indicator assessment is [MarPAMM](#). MarPAMM is a project carried out in collaboration with AFBI and the Marine Institute (Ireland) to develop tools for monitoring and managing coastal protected areas in Ireland, Northern Ireland and Western Scotland. Data from this project are available upon request but are not submitted to any assessment streams.

5.3.11 Inshore Fisheries and Conservation Authorities (IFCA)

5.3.11.1 Technical summary

The regional IFCA organisations carry out a suite of benthic and environmental monitoring programmes, some of which are linked with other organisations such as CEFAS and Natural England. So far, it is unclear whether data from these programmes are submitted to any of the data portals utilised for indicator assessment and whether they meet the required data standards. However, IFCA is currently in the process of determining which data would be useful for indicator assessment, where these data are stored, whether they are accessible and what would be required to make the data accessible.

6 Assumptions and limitations of this paper

The dataflows described in this report are based on those used for the 2018 UK MS indicator assessments ([HM Government 2019](#)). However, where changes in the pathways have been implemented or where changes are expected for the next round of assessments, this has been described in the Future Development sections. Where possible, detail relating to specific assessment rounds has been removed from the dataflow diagrams to maximise their future applicability.

These benthic indicators are also used for the NE Atlantic OSPAR assessments, with the outputs reworked and scaled for the UK MS assessments. The dataflows for these assessments are intertwined and therefore represented graphically as one flow diagram with both outputs. However, the focus of this report is on describing the flow into the UK MS assessments.

It is acknowledged that there is a wealth of benthic monitoring ongoing throughout the UK, which is conducted outside of the statutory bodies, for example, the monitoring conducted by research institutes, Non-Government Organisations (NGOs) and various industries. It is also noted that there is ongoing work (e.g. between MEDIN, The Crown Estate, OneBenthic, DASSH) to ensure more industry data are captured and accessible in a standard way within the UK data infrastructure. However, this report is focused on those monitoring programmes conducted by statutory bodies or those external programmes which already have an established pathway into UK MS indicator assessments. The mapping of external data pathways and the exploration needed to determine the compatibility of individual external datasets with the benthic indicators, is outside the scope of this paper.

This report focuses on the flow of data into the indicator assessments and not the indicator assessments themselves. Where missing links are identified, this could provide additional data for assessments. However, further exploration of data quality and compatibility would be required. The confidence, quality and coverage of data feeding into assessments is not included in the scope of this report.

This report and accompanying dataflow diagrams (see accompanying Annex) depict the flow of monitoring datasets and not the flow of associated metadata which may follow separate pathways.

References

- Borja, A., Franco, J. & Perez, V. 2000. A marine Biotic Index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. *Marine Pollution Bulletin*, **40**, 1100–1114.
- Brown, L.S., Green, S.L., Stewart, H.A., Diesing, M., Downie, A.L., Cooper, R. & Lillis, H. 2017. Semi-automated mapping of rock in the Irish Sea, Minches, western Scotland and Scottish continental shelf. JNCC Report No. 609. JNCC, Peterborough, ISSN 0963-8091.
- Diesing, M., Green, S.L., Stephens, D., Cooper, R. & Mellett, C.L. 2015. Semi-automated mapping of rock in the English Channel and Celtic Sea. JNCC Report No. 569. JNCC, Peterborough, ISSN 0963-8091.
- Downie, A.L., Dove, D., Westhead, R.K., Diesing, M., Green, S.L. & Cooper, R. 2016. Semi-automated mapping of rock in the North Sea. JNCC Report No. 592. JNCC, Peterborough, ISSN 0963-8091.
- González-Irusta, J.M., De la Torriente, A., Punzón, A., Blanco, M. & Serrano, A. 2018. Determining and mapping species sensitivity to trawling impacts: the Benthos Sensitivity Index to Trawling Operations (BESITO). *ICES Journal of Marine Science*, **75**, 1710–1721. <https://doi.org/10.1093/icesjms/fsy030>
- HM Government. 2012. Marine Strategy Part One: UK Initial Assessment and Good Environmental Status.
- HM Government. 2019: Marine Strategy Part One: UK updated assessment and Good Environmental Status.
- Lillis, H., Manca, E., Brown, L.S., Cooper, R., Diesing, M., Dove, D., Downie, A., Green, S.L., Mellett, C.L., Stephens, D., Stewart, H.A. & Westhead, R.K. 2018. Prediction of outcrops or subcrops of rock in UK shelf seabed.
- Maher, E. & Alexander, D. 2016. Marine Rocky Habitat Ecological Groups and their Sensitivity to Pressures Associated with Human Activities. JNCC Report No. 589A. JNCC, Peterborough, ISSN 0963-8091
- Sinclair, R. 2022. A review of the Scottish marine biodiversity data infrastructure in Scotland by NatureScot. An adjunct to the Scottish Biodiversity Information Forum Review. NatureScot.
- Stephens, D. & Diesing, M. 2015. Towards quantitative spatial models of seabed sediment composition. *PLoS ONE*, **10**, e0142502.
- Tillin, H.M., Hull, S.C. & Tyler-Walters, H. 2010. Development of a Sensitivity Matrix (pressures-MCZ/MPA features) (Report to the Department of Environment, Food and Rural Affairs from ABPMer, Southampton and the Marine Life Information Network (MarLIN) Plymouth: Marine Biological Association of the UK No. 22), Defra Contract No. MB0102 Task 3A. ABPMer, Marine Biological Association of the UK, Southampton and Plymouth, UK.
- Tillin, H.M. & Tyler-Walters, H. 2014. Assessing the sensitivity of subtidal sedimentary habitats to pressures associated with marine activities: Phase 2 Report – Literature review and sensitivity assessments for ecological groups for circalittoral and offshore Level 5 biotopes. JNCC Report No. 512B. JNCC, Peterborough, ISSN 0963-8091.

Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F. & Stamp, T. 2018. Marine evidence-based sensitivity assessment (MarESA) - A guide (Marine Life Information Network (MarLIN)). The Marine Life Information Network, Marine Biological Association of the United Kingdom., Plymouth, UK.

Appendix 1: Acronym list

Acronym	Definition
AFBI	Agri-Food and Bioscience Institute
AMBI	AZTI Marine Biotic Index
BODC	British Ocean Data Centre
CEDaR	Centre for Environmental Data and Recording
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Coordinated Environmental Monitoring Programme
CSSEP	Clean and Save Seas Environmental Monitoring Programme
DAC	Data archive centre
DAERA	Department of Agriculture, Environment and Rural Affairs (NI)
DASSH	Archive for Marine Species and Habitats Data
Defra	Department for Environment, Food & Rural Affairs
EIHA	Environmental Impacts of Human Activities Committee
EMODnet	European Marine Observation and Data Network
EUNIS	European Nature Information Systems
EUROBIS	European Ocean Biodiversity Information System
FOCI	Features of Conservation Importance
GeMS	Geodatabase for Marine habitats and Species adjacent to Scotland
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authorities
IQI	Infaunal Quality Index
JNCC	Joint Nature Conservation Committee
MAGIC	Multi-Agency Geographic Information for the Countryside
MarClim	Marine Biodiversity and Climate Change
MarESA	Marine Evidence based Sensitivity Assessment
MBA	Marine Biological Association
MCMS	Marine Case Management System
MCS	Marine Conservation Society
MCZ	Marine Conservation Zone
MDMS	Marine Data Management System (DAERA)
MERMAN	Marine Environment Monitoring and Assessment National Database
MMO	Marine Management Organisation
MPA	Marine Protected Area
MS	Marine Strategy

Acronym	Definition
NBN	National Biodiversity Network
NE	Natural England
NERC	Natural Environment Research Council
NMPi	National Marine Plan Interactive
NRW	Natural Resources Wales
OBIS	Ocean Biodiversity Information System
OSPAR	Oslo-Paris Convention
POLCOM	Proudman Oceanographic Laboratory Coastal Ocean Modelling System
PMF	Priority Marine Feature
SAC	Special Area of Conservation
SAMS	Scottish Association of Marine Science
SEA/SAC	Strategic Environmental Assessment / Special Area of Conservation
SSSI	Sites of Special Scientific Interest
UKHO	UK Hydrographic Office
WFR	Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
WISE	Water Information System for Europe
WoRMS	World Register of Marine Species

Appendix 2: Summary of data portals

Table 1. Amended from (Sinclair 2022). Description of existing public database or portal that receives seabed species and/or habitat records from key sector (public, charity, industry and academia) organisations and individual data recorders in the UK data landscape.

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
BODC	<p>Purpose: The British Oceanographic Data Centre (BODC) is hosted by the National Oceanography Centre. Its focus is on oceanographic data. On a national level BODC hosts data of physical parameters describing the marine environment based on data submitted from UK research establishments as well as the UK Tide Gauge Network. It is a designated data centre for NERC environmental data as well as a data archive centre (DAC) within MEDIN (Marine Environmental Data and Information Network) for which it holds water column and oceanographic data. BODC is part of several international and European efforts coordinate visualisation and storage and make available of oceanographic data.</p> <p>How it differs from other systems: In contrast to other data platform, BODC stores mostly oceanographic data and is one of the main datastores for academically generated data in the UK.</p>	Academic Public sector through MERMAN
CEDaR NI Portal/website	<p>Purpose: The Centre for Environmental Data and Recording (CEDaR) collects, stores, manages and releases data on the wildlife and habitats of Northern Ireland and it's coastal waters. The main objective of CEDaR is to support the supply of environmental data needed to implement the Northern Ireland Biodiversity Strategy and support good land, freshwater and marine management and planning. CEDaR contains and manages spatial datasets and makes them available through existing and new web products, but also provides access to data for various audiences.</p> <p>How it differs from other systems: CEDaR is focused on spatial datasets from Northern Ireland. It does not include offshore data.</p>	NI Public Sector

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
<p>DASSH (Archive for marine species and habitats data)</p> <p>UK Data Archive Centre</p>	<p>Purpose: DASSH operates as the archive for marine biodiversity data. It provides tools and services for the long-term curation, management and publication of marine species and habitats data, within the UK and internationally (e.g. EurOBIS, EMODNet). DASSH is a key provider of marine data to the NBN, and the UK node for OBIS.</p> <p>How it differs from other systems: DASSH has well established links between UK and International marine data systems, which other UK databases and portals, such as NBN, do not have. DASSH archives fully attributed data, while only summary data is available through the NBN. DASSH supports both marine species and habitat data. DASSH, as a DAC, has a very flexible database structure and is able to receive data from many different sources and in multiple formats, whereas Marine Recorder has a strict database structure and can only accept data in that format. DASSH fulfils the niche well as a data archive and data disseminator, Marine Recorder fulfils the niche as a data management system.</p>	All sectors
<p>DataMapWales Welsh Portal/website</p>	<p>Purpose: DataMapWales previously lle.gov.wales is a web-based interface fed by public sector data in Wales and providing a shared data platform to members of the public and public authorities. It provides marine and terrestrial spatial data based on different monitoring programmes.</p> <p>How it differs from other systems: The platform only contains public sector spatial data from within Wales.</p>	Welsh Public Sector
<p>EMODnet Biology/EurOBIS European Portal</p>	<p>Purpose: The EMODnet Biology portal provides free access to data on temporal and spatial distribution of marine species and species traits from all European regional seas. It is built upon the World Register of Marine Species and EurOBIS. In fact, EurOBIS is the data system that underpins EMODnet Biology. EMODnet Biology is part of the European Marine Observation and Data Network (EMODnet) with the aim to improve access to high-quality marine data on a European scale.</p> <p>How it differs from other systems: EMODnet Biology focuses on marine species data across Europe.</p>	All sectors

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
EMODnet Chemistry European Portal	<p>Purpose: EMODnet Chemistry is the node of the European Marine Observation and Data Network (EMODnet) that provides a data archive centre and making available of data on marine water quality issues. Data it contains primarily focuses on eutrophication, ocean acidification, contamination and marine litter issues within European waters.</p> <p>How it differs from other systems: One of the only databases specifically designed to hold and provide data on marine water quality inshore and offshore.</p>	All sectors
EMODnet Seabed Habitat European Portal	<p>Purpose: EMODnet Seabed Habitats provides access to seabed habitat data across Europe. This includes EMODnet broad-scale seabed habitat map for Europe (EUSeaMap). It is part of the European Marine Observation and Data Network (EMODnet) and continues the work started by MESH and MESH Atlantic projects in collating and making available European seabed habitat maps from surveys through the map viewer.</p> <p>How it differs from other systems: As the name suggests, EMODnet Seabed Habitats focuses solely on modelling and categorizing seabed habitats in European waters.</p>	All sectors
EurOBIS European Node of Global Portal OBIS	<p>Purpose: The European Node of the international Ocean Biodiversity Information System (OBIS). EurOBIS and EMODnet Biology act as one portal. EurOBIS aims to centralise biogeographic data on marine species collected by European Institutions inside or outside Europe. Data published through EurOBIS are freely available through EurOBIS, EMODnet Biology, OBIS, GBIF.</p> <p>How it differs from other systems: EurOBIS acts as a node within the OBIS system which allows data to be managed and stored at a regional scale. EurOBIS focuses on taxonomy and occurrence records in space and time. When data is added to the EurOBIS data system, the data is immediately available through the EuroBIS and EMODnet Biology Portal. All the EurOBIS data is sent to OBIS on a regular basis, which in turn sends its data to GBIF. EurOBIS can also act as 'back flow' from GBIF. When data in GBIF is identified and not included in EurOBIS's database, a request is sent to GBIF to make the data available through EurOBIS.</p>	All sectors

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
GBIF Global Portal	<p>Purpose: The Global Biodiversity Information Facility (GBIF) is an international network and data infrastructure funded by the world's governments. Each participant of the network (which can be countries, economies or international organisation) are designated a node of the network. All biodiversity data (terrestrial and marine) can be uploaded and freely downloaded to and from GBIF in several formats such as metadata, checklist data, occurrence data and sampling event data.</p> <p>How it differs from other systems: Combines terrestrial and marine species data but does not contain any physical parameters associated with the different species.</p>	All sectors
GeMS Scottish Database	<p>Purpose: The Geodatabase of Marine features adjacent to Scotland (GeMS) holds species polygon records which are attributed as to their qualification as a protected feature of protected areas within the Scottish MPA network. Record details will include Scottish PMF or Annex II Species, scientific name, abundance details, date, temporal range, year, status, accuracy, determiner and ownership of records. Datasets are available for download from the gov.scot website.</p> <p>How it differs from other systems: Similar to Marine Recorder this database holds a collation of species records which a in this case specific to Scotland. GeMS does not provide a web-based user-interface, instead data layers can be downloaded as a 'snapshot' from the gov.scot website.</p>	Scottish public sector
ICES Global Portal	<p>Purpose: The ICES data portal is separated into several thematic portals focused on the marine environment including benthic and pelagic biota as well as oceanographic and pressure data. Data in the ICES data portal are collected for the purpose of aiding assessments of expert groups and regional sea conventions. The ICES data portal has a web-based user-interface which provides a suite of tools which help visualise and calculate data products. Data held in the ICES data portal contribute to OSPAR CEMP, ICES stock assessments and AMAP contamination assessments.</p> <p>How it differs from other systems: The ICES data portal focuses on the ICES regions and providing data for specific assessments.</p>	All sectors

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
MAGIC English Portal/website	<p>Purpose: Amongst others, the Multi-Agency Geographic Information for the Countryside (MAGIC) holds data from Defra, Natural England, the Environment Agency and the Marine Management Organisation. It is an end-user web-based user-interface, that helps users to produce maps of information relevant to them. Data held are available for download but the database itself is there to aid users in the visual representation of it.</p> <p>How it differs from other systems: Data provided here focuses on the representation of different environments (rural, urban, marine, coastal) in England. It includes some links to marine benthic biodiversity data held by Natural England.</p>	Public sector across England
Marine Recorder UK Database	<p>Purpose: Marine Recorder is a holistic data (holds ecological and physical / environmental records) management system for storing and querying benthic sample data. The re-developed system will facilitate flow of data automatically into the UK MEDIN DAC network and dissemination to established UK and international Portals.</p> <p>How it differs from other systems: Marine Recorder is a relational database system for managing marine benthic occurrence data. It provides a means for data suppliers to submit and actively manage and maintain their own data as the data custodian, as part of the UK picture. Marine Recorder provides the means for a single master version of the data to be maintained. The system's primary purpose is for managing data, not for public browsing or statistical analyses.</p>	Public sector (SNCBs); National Recording Scheme (Seasearch) Potentially industry data in redeveloped system

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
Marine Scotland's National Marine Plan Interactive (NMPi) Scottish Portal	<p>Purpose: NMPi is an interactive tool that enables user access to spatial information relating to the marine environment and activities, and has been designed to assist in the development of Scotland's national and regional marine planning and to support work of the regional Marine Planning Partnerships. NMPi allows users to view different types of information and, where appropriate, links are provided to the related parts of Scotland's Marine Atlas and to the National Marine Plan.</p> <p>How it differs from other systems: Marine and coastal (qualifying PMF and Annex 1 habitats) specific datasets (non-terrestrial). Layers include biological datasets, physical data, industry development data, and administrative and boundary data. Data are fed by WMS feed, layers are served up by organisations such as NatureScot on a routine basis in line with UK Marine Recorder snapshot provision and GeMS collation. Users gain public access to a Scottish picture of records tagged with conservation status used in policy and management advice by Government, NatureScot and SEPA. The data uploaded to NMPi are for the purposes of supporting marine planning.</p>	All sectors
MERMAN UK database	<p>Purpose: The Marine Environment Monitoring and Assessment National Database (MERMAN) holds data collected to fulfil the UK's mandatory monitoring requirement under the OSPAR joint assessment and monitoring Programmes (JAMP). These data are also used to support European Commission Directives and national assessments such as Charting Progress 2. The main data hosted on MERMAN are derived from the Clean Seas Environment Monitoring Programme (CSEMP). MERMAN is funded by Defra, DAERA, AFBI, MSS and is hosted by BODC. MERMAN submits quality assured data of the monitoring programme to ICES on an annual basis. Data from MERMAN are being made available through the EMODnet chemistry portal.</p> <p>How it differs from other systems: This database specifically holds data from one main environmental monitoring programme (CSEMP) with the purpose of supporting international, European and national assessments of the sea. The data from this monitoring programme are focused on documenting the contamination and pollution of UK seabeds.</p>	Public sector

<p>MSODN (Marine Scotland's Open Data Network) Scottish Portal/Website</p>	<p>Purpose: The Marine Scotland Open Network includes MSI, MS Maps NMPi, MS Data and MS Assessment – the new home for Scotland's Marine Assessments, including Scotland's Marine Assessment 2020. The MSODN is the marine part of the Scotland's environment (SEWeb). MSI is a web portal that provides access to descriptions and information about the Scottish marine environment while providing links to datasets and map resources that are made available by Marine Scotland and Partners. The web portal brings together datasets and maps from across the MSODN as well as links to other sources to provide context and information.</p> <p>How it differs from other systems: Marine focussed. MSODN is an integrated suite of platforms, rather than solely being interactive spatial mapping portal (i.e. NMPi), containing links to datasets and information made publicly available through Marine Scotland. It also signposts users to the wide range of additional, supporting resources that are available online from Marine Scotland and other organisations. Datasets and maps are grouped together by topic/theme and the content is categorised in to three types: Information, Maps and Data.</p> <p><u>Marine Scotland Information:</u> A web portal that provides detailed information and data about the Scottish marine environment. It has been designed to bring together: the information pages that support the spatial layers in Marine Scotland MAPS NMPi, providing metadata and links to related resources; contextual information and descriptions for data resources provided through the Marine Scotland Data Portal; the content previously held on the Marine Scotland interactive (MSi) web pages.</p> <p><u>Marine Scotland Data:</u> A dedicated portal that will allow you to search Marine Scotland's published datasets and reports. Citation information for these datasets is provided through the use of DOIs. The portal: provides a single point of access to Marine Scotland's published data, and allows everyone to explore, download, share and cite those data; provides a user interface for searching datasets as well as machine readable services to locate and retrieve data; describes each dataset with standardised metadata, and downloadable resources are described in detail in terms of units, use of vocabularies, etc; groups datasets into broader topics to help exploration, but all content is also searchable right across the portal; publishes datasets consisting of one or more downloadable resources. Downloadable data are made available as 3-4 star open data and are released</p>	<p>Public sector / Scottish Government</p>
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Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
	<p>under the UK Open Government Licence, where possible; uses persistent identifiers to allow accurate citation and location of datasets.</p> <p><u>Marine Scotland Maps NMPi</u>: [see above re: NMPi] An online, interactive GIS-based tool allowing you to view different types of information (as layers) at a scale of your choice and undertake a number of functions with the maps' layers including creating maps for printing.</p>	
<p>NatureScot's Natural Spaces Scottish Portal</p>	<p>Purpose: NatureScot's portal for mobilising marine and terrestrial natural heritage spatial data held by the organisation (marine species and habitats' records (i.e. the GeMS collation of marine records); protected area boundaries; land forms and geology). Users can browse through the available Scottish datasets on the webpage and access the data in several different GIS formats or via WMS consumption.</p> <p>How it differs from other systems: Covers a wider user base than just marine (also covers terrestrial and freshwater datasets). Natural Spaces contains all mobilised publicly available data held by NatureScot; NMPi on the other hand is focussed on marine data and has an interactive map with hundreds of data layers from government and partner organisation that users can browse and overlay. Natural Spaces contains full spatial datasets that users can download as a zipped file of consume via WMS and import to their own GIS systems for their own purposes, providing a resource more tailored to individual analyses rather than for planning, development purposes or general public viewing.</p>	<p>Public sector / NatureScot</p>

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
NBN Atlas UK Portal	<p>Purpose: The NBN Atlas collates records from various organisations and LERCs into a national picture on a free online web portal for users to browse and download. The NBN combines multiple sources of information about species and habitats, with the ability to interrogate, combine, and analyse these data in a single location.</p> <p>How it differs from other systems: provides a UK picture of both marine, terrestrial and freshwater species data together. It is not a data management system, but rather a discovery point for users to find datasets; it allows users to view species records together with other environmental information such as habitat information and geographical boundaries and to download and export maps and reports or summaries for their own use. The NBN is a node of GBIF and so it also provides a mechanism for disseminating species data internationally.</p>	All sectors
OBIS Global Portal	<p>Purpose: The Ocean Biodiversity Information System (OBIS) is a data platform that integrates, quality controls and provides access to records of marine species on a global scale. Data are gathered through different national, regional and thematic nodes (see EurOBIS for Europe and DASSH for the UK) that are hosted by specific institutes. The OBIS portal provides a web GIS based system to visualise distribution of marine biodiversity as well as singular species. OBIS integrates species abundance data as well as physical parameters describing the marine environment in which these species have been found.</p> <p>How it differs from other systems: OBIS constitutes a global network of regional dataportals (nodes – see EurOBIS) on marine biodiversity.</p>	All sectors
OneBenthic	<p>Purpose: OneBenthic is an open database and interactive science tool hosted by Cefas. Cefas provides abundance data of benthic species derived from statutory offshore monitoring but also from industry outlets on this database.</p> <p>How it differs from other systems: The database holds a limited dataset and associated metadata for statutory monitoring data and does not contain any biomass data. It focuses on providing web-based tools for the analysis and reporting of data in R.</p>	Cefas (Industry)

Scottish / UK database or portal	Description of system purpose and niche	Sector contribution
OSPAR ODIMS Global Portal	<p>Purpose: The OSPAR Data and Information System (ODIMS) is an online tool providing a single point of access to all the data and information gathered through OSPAR's Joint Assessment and Monitoring Programme across the different thematic work areas of the Convention. It will help ensure that data is readily accessible for OSPAR assessments, but also help a broad range of users to find data held by OSPAR, to facilitate access to it and make use of it.</p> <p>How it differs from other systems: ODIMS is focused on the OSPAR regions and includes data from different aspects related to Ocean health which include information on benthic species but also on offshore industry, hazardous Substances, environmental impact of human activity, etc. It is specifically designed to hold data for OSPAR assessments.</p>	All Sectors
WISE European Portal	<p>Purpose: The Marine Water Information System for Europe is a portal for sharing information with the marine community on the state of Europe's seas. This includes the pressures affecting them and the steps taken to protect and conserve the marine environment. This information is collected through implementation and reporting for the EU Marine Strategy Framework Directive as well as other European legislation and initiatives. WISE reports and visualises the outcome of recent European assessments on the state of Europe's seas and provides links to metadata for data used in the different assessments.</p> <p>How it differs from other systems: WISE is not a data portal as such but a way to report on the state of European marine environment to a wider audience. Data are not available for download on the web-interface, however metadata linking to data on the different assessments and regions is available.</p>	Europe Public Sector