Final report of the 2025 discovery process to explore the requirements for an online directory of marine monitoring

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Executive Summary

The Marine Environmental Data and Information Network (MEDIN) undertook this discovery project to determine whether there is a business case for providing an online database of UK marine monitoring activities and, if so, how such a tool should function to meet the needs of the marine community. This work supports MEDIN's strategic objective to record and provide access to information on UK marine monitoring and to support the UK Marine Monitoring and Assessment Strategy (UKMMAS) community.

Clear evidence of need

Engagement with the marine community was extensive, comprising 156 questionnaire responses (0.8 % response rate), 23 one-to-one interviews and five discovery workshops, generating 246 user stories from at least 46 organisations.

There was near-unanimous agreement that a central, authoritative, online directory of UK marine monitoring information is needed.

Users require reliable, up-to-date monitoring programme information, access to the data generated by monitoring activities, and interoperability with existing marine data systems. There is also a clear expectation that such a directory should support the identif gaps in monitoring and avoid duplication of effort. Users require flexibility when updating content.

Assessment of existing platforms

MEDIN currently supports two relevant discovery tools: the MEDIN Portal, which provides access to marine dataset metadata and the UK Directory of Marine Observing Systems (UKDMOS), which describes monitoring programmes and associated stations and sites. UKDMOS is the only existing system specifically designed to describe marine monitoring programmes past and present but has not been technically updated since 2017 and is perceived as being difficult to update. In contrast, the MEDIN Portal benefits from more recent investment, higher usage and stronger interoperability, but it is not currently designed to describe monitoring programmes.

User stories were analysed to determine whether needs could be met by minor enhancement of the MEDIN portal, minor enhancement of UKDMOS or could only be achieved through a new bespoke tool. The analysis found that:

- UKDMOS already meets over 50% of the identified user needs,
- Around 30% could be met through enhancement of the MEDIN portal and
- Approximately 16% would require a new, bespoke solution.

While a new system would offer a comprehensive solution, it would be costly and risk duplicating existing capability. Enhancing either UKDMOS or the MEDIN Portal presents more proportionate options, but each involves strategic trade-offs. Enhancing UKDMOS would build on an established monitoring-focused database but would require modernisation and improved mechanisms for user updates. Enhancing the MEDIN portal would align with its role as the central UK marine data discovery service but would require significant changes to the MEDIN Discovery Metadata Standard and supporting tools. Maintaining two separate directories would continue to fragment marine data discovery for users.

Key conclusion

There is strong, evidence-based demand for a central, authoritative, and interoperable directory of UK marine monitoring. Much of the required functionality already exists across UKDMOS and the MEDIN Portal, but neither fully meets user needs without further development. A new bespoke system would provide the most complete solution but would carry higher cost and risk.

Next steps

This discovery work provides a robust, prioritised evidence base to support development of a business case. MEDIN now requires direction from the Sponsors Board and Executive Team on the preferred strategic option - enhancing UKDMOS, enhancing the MEDIN Portal, or developing a new solution - and on governance, resourcing and stakeholder incentives to ensure long-term sustainability and uptake.

The content of the Executive Summary was AI assisted

Introduction

MEDIN were tasked with investigating whether there is an underlying business case for providing an online database of marine monitoring undertaken by UK organisations. And if there is, how this should function to meet the needs of the marine community. This work aligns with MEDIN's High Level Objective 'Record and provide access to information on monitoring activities in the UK and support the UK Marine Monitoring and Assessment Strategy (UKMMAS) community with expert advice' (MEDIN Business Plan 2024-2029).

Since 2008, MEDIN has supported and updated the UK Directory of Marine Observing Systems (UKDMOS) which is a directory of marine monitoring programmes and was intended to fulfil the "basic requirement to know where, when and what is being monitored by the UK in the marine environment" (extracted from the tender document of January 2007). Although a very detailed and useful tool, it has been criticised for not being kept up to date, which is partly the result of there being no editing interface for owners of programmes to directly make updates themselves. UKDMOS however remains the most comprehensive online directory of UK marine monitoring in the UK currently, providing information about 275 different monitoring programmes and over 15K associated monitoring stations, cruises and sites (see more information in Table 2).

The UKDMOS online catalogue is driven by the same database as the European Directory of Ocean Observing Systems (EDIOS) with a filter in place to enable searching on UK metadata only. EDIOS is one of the core metadata catalogues of the European SeaDataNet infrastructure and the database and content is governed by the MEDIN Data Archive Centre (DAC) for oceanographic data, British Oceanographic Data Centre (BODC). Both the EDIOS and UKDMOS online discovery interfaces are hosted by another SeaDataNet partner, MARIS. With the current co-dependence of UK and European databases of marine observing systems, we intend to share the findings from this discovery work to allow our European colleagues to benefit from the evidence and analysis we have collected. Nationally, we will share the outputs and results with other data and monitoring initiatives, particularly the UK Marine Monitoring and Assessment Strategy (UKMMAS) community and the UK Centre for Seabed Mapping.

MEDIN has also developed the MEDIN metadata discovery portal, which is a widely used MEDIN asset allowing users access to over 18.5K records of marine datasets that are owned or managed by more than 600 organisations. UKDMOS provides access to metadata about marine monitoring programmes and the MEDIN portal provides access to metadata about marine datasets. MARIS also hosts this online tool, the database and the software for harvesting metadata records from MEDIN partners (see more information about the MEDIN portal in Table 2). Since its build in 2010, the portal has seen many iterations and is currently at Version 1.3, released in April 2024.

The Discovery Phase of this work was launched at the beginning of 2025 with the release of a questionnaire which was followed up by four online discovery sessions and twenty-three one-to-one interviews. This phase was completed by the end of March 2025.

Initial findings were presented to the MEDIN Sponsors Board (May 2025), the Marine Assessment and Reporting Group (MARG May 2025) and the MEDIN Executive Team (July 2025). MARG is the umbrella group for the UK Marine Monitoring and Assessment Strategy community and is a key stakeholder in this work.

This report will be submitted to the MEDIN Executive Team and MEDIN Sponsors Board for their consideration and recommendation for next steps.

Method

The project adopted the Agile practice of using user stories to gather and clarify software requirements. User stories are high level informal descriptions of what a user would like to be able to do with a tool and why. They emphasise the user's perspective and the value they would derive from a piece of software. The format for a user story is

'**As a** [user role], **I need** [the software to be able to do so-and-so] **so that** [I can do this]'

The methods employed here were focused on gathering user stories (via the discovery questionnaire and one-to-one interviews) and gaining insight into how these user stories should be prioritised (through discussion at group discovery sessions).

User stories supplied by the community were also used to inform where a future online database of marine monitoring could be hosted.

Method for discovery questionnaire

The discovery questionnaire was disseminated in January 2025 and closed at the end of March 2025 (refer to Appendix 1 for the ten questions posed). The questionnaire was open to anyone with an interest in marine monitoring and was advertised to the marine community using the Bob Earll (CMS) mailing list, NERC listserver, Challenger Society, National Oceanography Centre mailing lists, the Marine Alliance for the Science and Technology for Scotland, the Marine Assessment Reporting Group (MARG) and associated evidence groups, MEDIN mailing lists and MEDIN social media. MEDIN Sponsors, the MEDIN Executive Team and all MEDIN working groups were asked to share the questionnaire across their organisations. A webpage was created to provide context and information on the project, share the questionnaire and allow volunteers to sign up to discovery workshop sessions.

The discovery questionnaire was deliberately short to encourage participation and uptake. It was designed to gather 'user stories', asking for respondents to submit information on whether they needed an online database for UK marine monitoring data and information, and if so, what their priorities for functionality of such a database should be.

The starting question was 'Would the creation and/or enhancement of an online directory of marine monitoring programmes be a useful asset in your opinion?'. To which the respondent was asked to give their reasoning.

Method for one-to-one interviews

The final question in the questionnaire asked the respondent whether they were willing to discuss their answers further with a member of the MEDIN Executive Team. Details of the individuals who agreed to be contacted for further information were collected and a diverse sample of these were chosen to represent users from across the community.

An hour-long informal interview took place with each person individually online using Microsoft Teams. Refer to Appendix 2 for details of the interview questions and the spreadsheet template that was filled in for each interviewee. Questions were laid out in the user story format and then followed up with additional questions to put these user stories into context. Each interviewee generated several user stories each.

Method for discovery sessions

Four discovery sessions took place over a two-month period providing opportunity for questionnaire respondents and those who had not contributed to the questionnaire a forum to discuss the challenges they face around accessing and using UK marine monitoring data. Each discovery session included an introduction to UK marine monitoring, to set the context and to ensure that all attendees understood the purpose of the session. The bulk of each session was for attendees to prioritise their needs for a marine monitoring database. The ‘I need’ part from questionnaire user stories (see Figure 1) were displayed on a Miro board and each attendee spent time prioritising the list of needs (each attendee was given the same list) using the MoSCoW method. The MoSCoW method was developed by Dai Clegg at Oracle in 1994 and is widely used in Agile project management. The ‘I need’ requirements were prioritised into “must-have”, “should-have", “could-have” and “won’t have”.

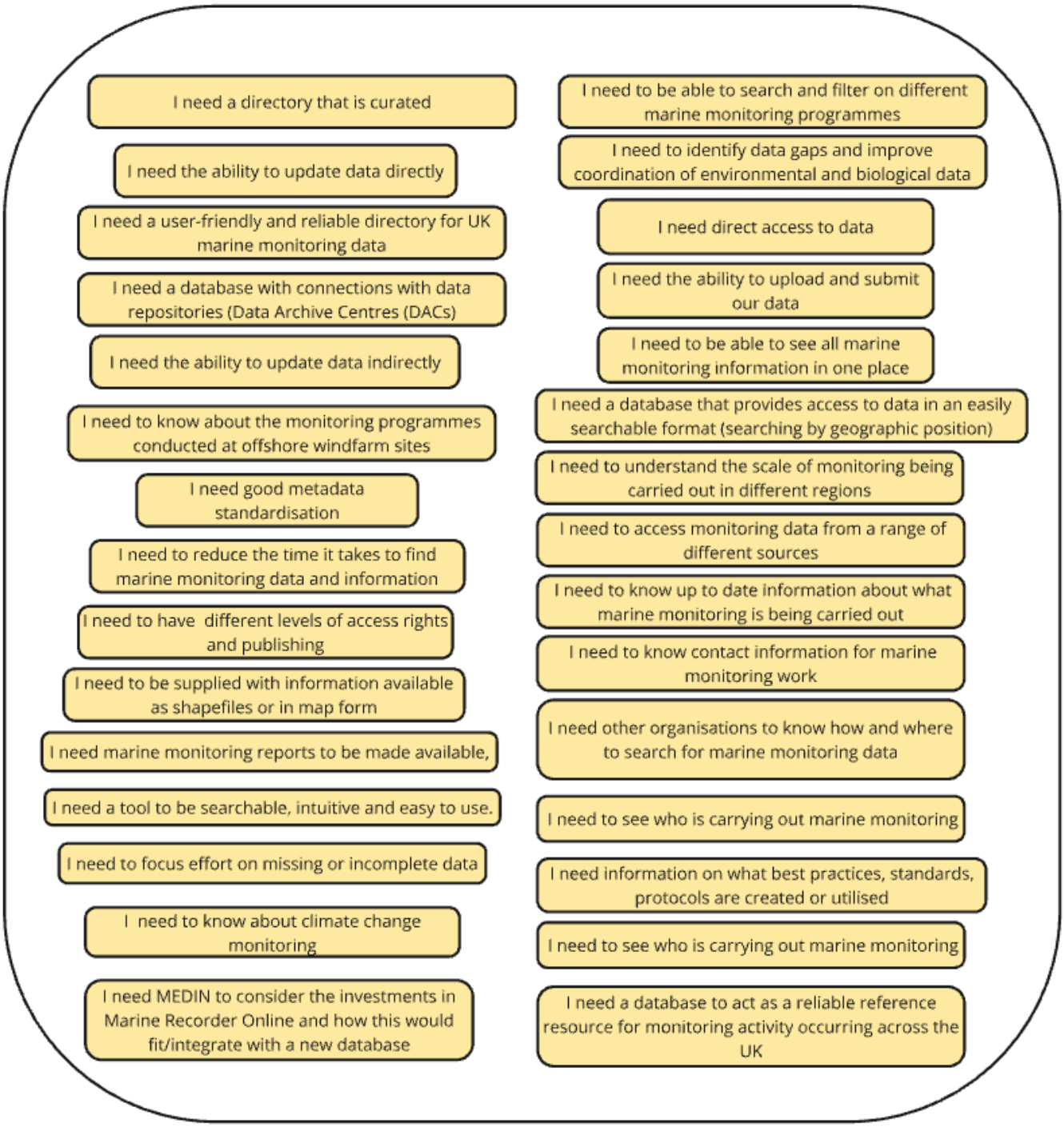


Figure 1. List of needs from user stories analysed in discovery sessions using MoSCoW

Additional questions were also asked during the discovery sessions which were similar to those additional questions asked in the one-to-one interviews. These provided a more personal perspective and a context for understanding their viewpoint (see Appendix 3).

An additional mini discovery session was conducted with the Monitoring Coordination Group (MonCoG). The group prioritised needs as a whole to give a MonCoG consensus result. This was combined with the other discovery session results.

Method for analysis of user stories

As previously noted, responses from both the online questionnaire and one-to-one interviews generated a series of user stories. The total number of user stories created was 246 and these were visually displayed on a board using open-source software Miro. These boards act as a visual tool to document the journey from high-level user stories to the final product. This approach allows the building of software whilst keeping the users' needs and perspectives as central to the process as possible.

The 246 user stories were grouped according to ten user role categories (also referred to as the persona). Respondents and interviewees frequently identified themselves as having more than one role in their organisations hence the multiple terms in some of the user role categories (Figure 2).

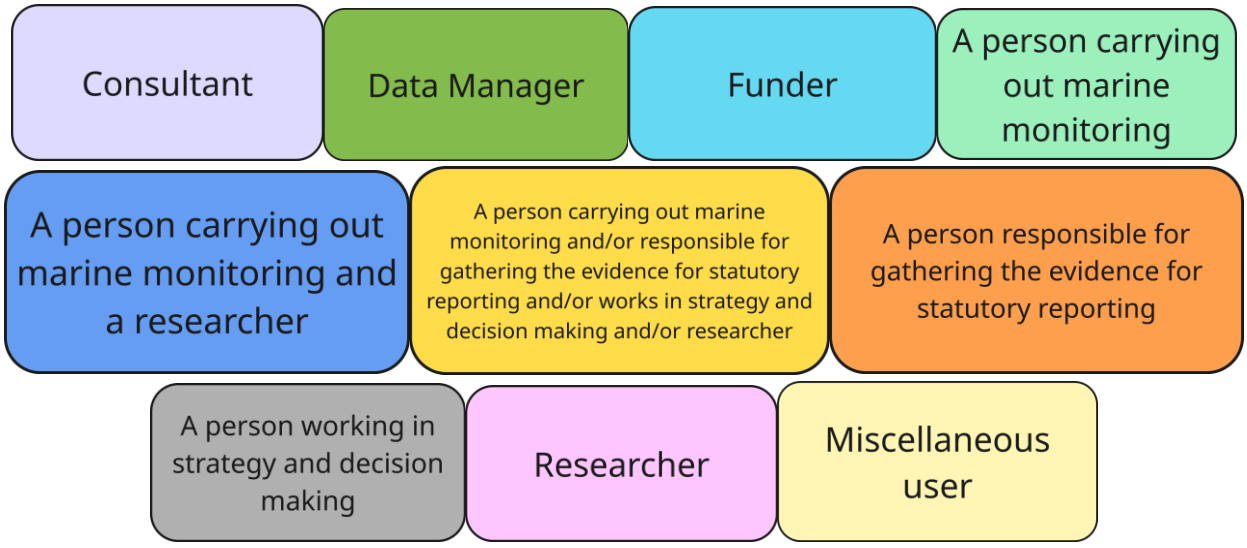


Figure 2. User role categories or personas

The 'Miscellaneous user' is detailed in Appendix 4. User stories were added to a Miro Board and grouped according to user type. Here the user story is still represented in the '**As**

a [user role], **I want** [the software to be able to do so-and-so] **so that** [I can do this]' just with the 'I want' in the first sticky note and the 'so that' in the second sticky note. Some of the respondents and interviewees did not supply the 'so that' part of their feedback so in that instance the sticky note is left blank to capture this.

User stories were also grouped according to broadly similar 'needs' under each user role. These 'user story' categories are detailed in green boxes below (Table 1) with a statement to clarify their meaning. The number of user stories per category was assessed and the higher number of user stories used as a measure of a user roles' priority for requiring that collection of user stories. The highest, second highest and third highest collections of user stories allocated to the different category needs were given 1st Priority, 2nd Priority and 3rd Priority. The boxes surrounding the user stories were highlighted in green, orange and red respectively to indicate this on the Miro board. Where more than one category box had the same number of sticky note user stories then there are multiple boxes highlighted in the same colour.

Table 1. User story categories

authoritative one stop	I need an authoritative, single place to find UK monitoring programmes metadata and data
baseline data required	I need to gather baseline data for an area to contextualise data already collected and plan future data collection
direct access to data	I need direct, easy access to the data collected from monitoring activities (with use of an API including interoperability with other databases)
functional attributes of a tool	I need the tool to provide me with specific functionality

identify gaps in monitoring	I need to identify gaps in monitoring, improve coordination of monitoring and avoid duplication of effort
what monitoring is happening	I need to know what monitoring is happening, when and where (high level/generic need)
what monitoring is happening – specific metadata information required	I need to know what monitoring is happening, when and where and require specific metadata

User stories were used to analyse how the community would like a marine monitoring tool to function for them. The grouped user stories were also used to analyse whether any existing platforms provide infrastructure that delivers these requirements. In particular, the current functionality of two platforms, UKDMOS and the MEDIN portal, was assessed to establish whether these platforms can already meet the user needs or whether a new, purpose-built online application is required.

The groupings of user stories on the Miro board were individually assessed and the catalogue label 'Portal' and 'UKDMOS' tagged onto the box if it could meet the stated user needs with minor development (equating to less than 5 days of developer time). A 'new tool' label implies that the requested functionality may only be possible with the creation of a new application.

Results

Stakeholder participants

The questionnaire was sent to approximately 19,580 people that we know of, with the possibility that people received it multiple times. The total number of questionnaire respondents was 156 (a response rate of 0.8%). We actively engaged and noted conversations with 57 people, with 34 of those attending discovery sessions and the remainder participating in 23 one-to-one interviews (there were multiple people present in some interviews). Of everyone we spoke to, nobody voiced the opinion that there should not be a single online directory for marine monitoring data and information. The 246 User Stories generated from the questionnaire and interviews originated from at least 46 organisations (see Figure 3 below). It should be noted that there were two interviews with Defra from different departments. Similarly, there were two interviews with the MMO from different departments. Some respondents remained anonymous in their answers to the questionnaire.

Figure 3. Logos of all the known organisations involved in this work (other respondents took part anonymously)

The distribution of User Stories generated by interviewees and questionnaire respondents across different marine roles is shown in Figure 4. Broadly speaking, 25% were people carrying out marine monitoring, 20% were marine researchers, 10% were those who are decision makers, 10% were those responsible for evidence gathering, 5% were in marine consultancy (anecdotally this was offshore wind farm companies for the most part), 5% were funders and 10% were defined here as Miscellaneous user (refer to Appendix 4). There was a group of individuals with self-defined multiple roles, and these were included in a grouping 'A person carrying out marine monitoring and/or responsible for gathering the evidence for statutory reporting and/or works in strategy and decision making and/or researcher' and these included 15% of respondents.

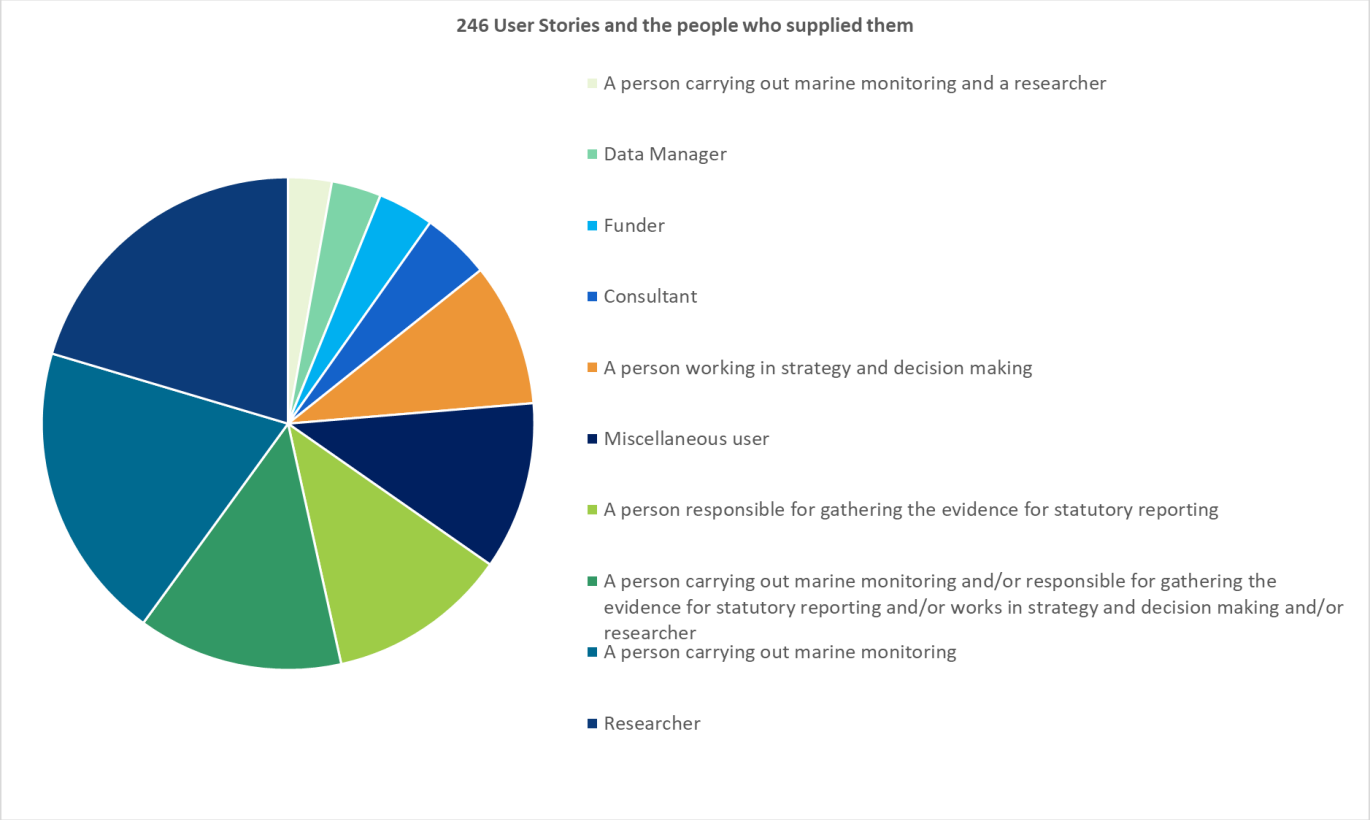


Figure 4. User story personas from 156 respondents who completed the discovery questionnaire (Miscellaneous users are detailed in Appendix 3)

Results from the questionnaire

Only four of the 156 questionnaire respondents said that an online directory of UK marine monitoring is **not** needed. The reasons given were to do with concerns about the treatment of citizen science data; a perception that UKDMOS was not beneficial in the past but recognition that an enhanced version could be now; a reluctance to use an additional portal when data are already being uploaded to The Crown Estate's Marine Data Exchange but appreciation for a single site for industry and research data; a reflection that it would be impossible to keep up to date because of resource constraints and a preference for allocating resources to high quality data and tools or product development.

Appendix 5 details the questionnaire results that can be shared.

User stories

The user stories were collated and grouped into seven broad themes (see Figure 5 below). By far the largest category of user stories linked to the need-to-know what monitoring is happening, when and where, with specific metadata. Roughly 20% of the user stories related to needing direct access to monitoring data. Only 2% of the user stories related to needing an authoritative single place to find UK monitoring programme metadata and data.

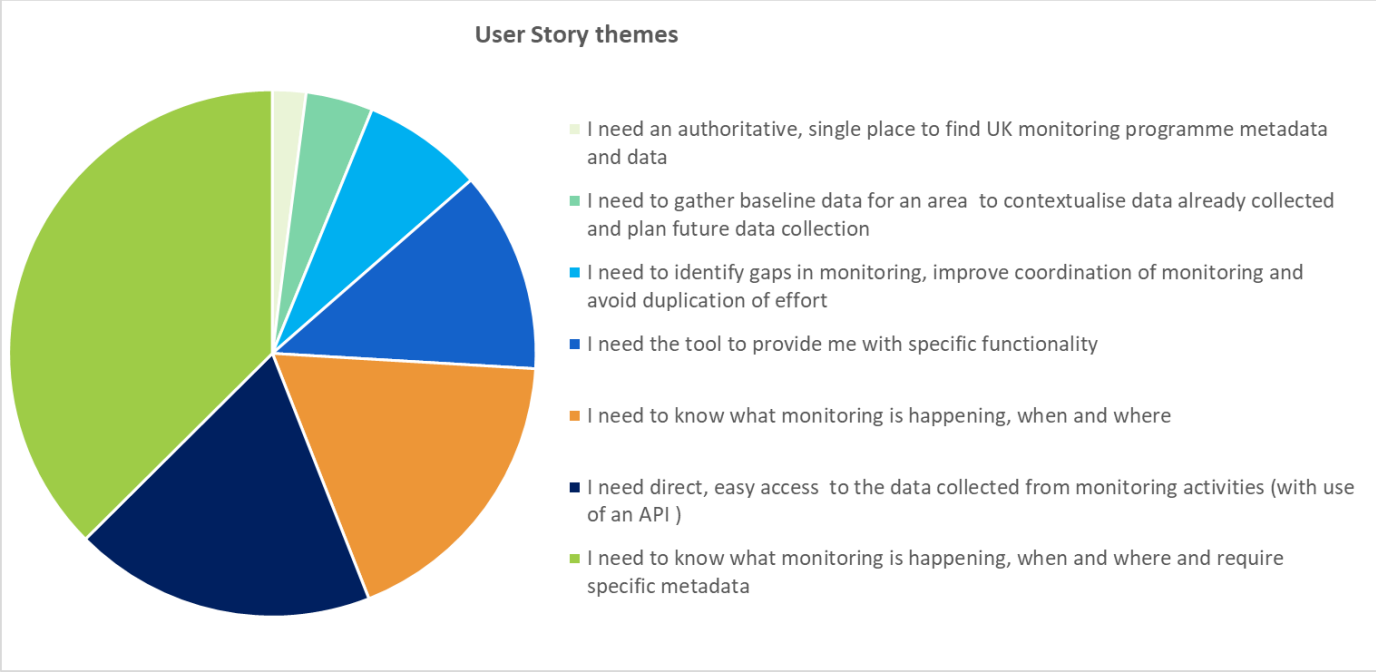


Figure 5. Pie chart showing the user story themes from the discovery questionnaire results

In the online questionnaire, we included three questions where we asked respondents to rank options in terms of importance: what they need a UK marine monitoring directory to do (Figure 6), their interest in marine data or metadata (Figure 7) and their preferred mechanism to update an online database of marine monitoring (Figure 8). These questions complement the MoSCoW analysis carried out during the Discovery Sessions.
Gaining access to marine monitoring data was the highest priority for most respondents (Figure 6). However, nearly 80% of the questionnaire respondents need access to both monitoring programme metadata and the data from these programmes (Figure 7). Supplementary, contextual information was least likely to be the primary priority of respondents (Figure 6). There was a marginal preference for having summary metadata over detailed metadata.

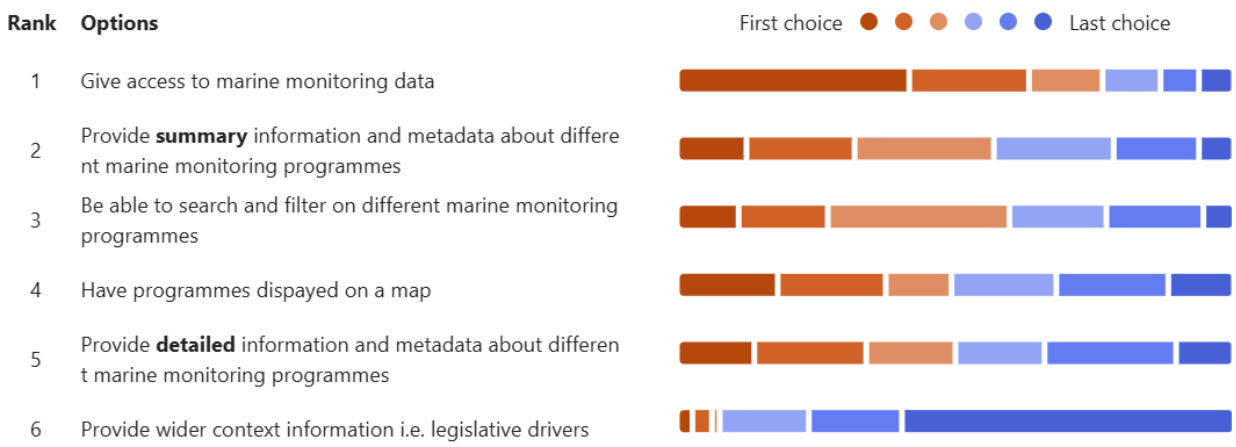


Figure 6. Bar chart showing the responses to question 7 of the discovery questionnaire 'What do you need a UK marine monitoring directory to do for you?'

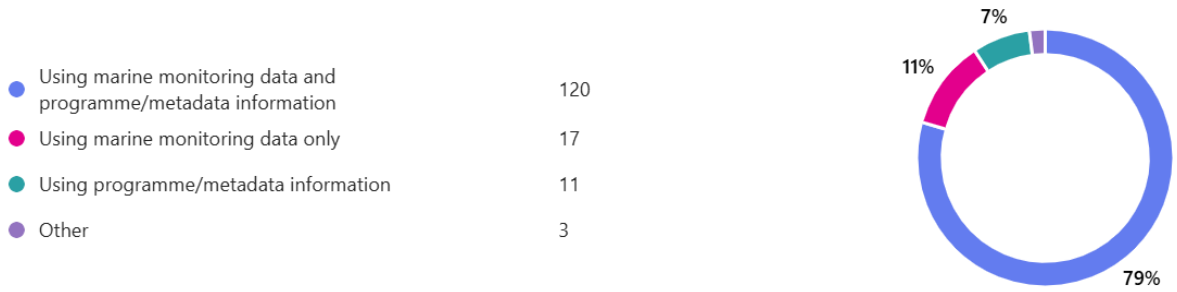


Figure 7. Pie chart showing the responses to question 8 of the discovery questionnaire 'Which of the following are of most interest to you? Are you interested in monitoring programme information (metadata) or the data collected by a monitoring programme.'

Respondents were more split in their preferences for how to update information within a directory of UK marine monitoring, with 45% preferring to update a directory directly (e.g. using an Application Programming Interface or similar) and 29% preferring an indirect approach (e.g. content updated centrally by a support team) (Figure 8). This highlights the need to provide users with more than one option for updating their monitoring metadata.

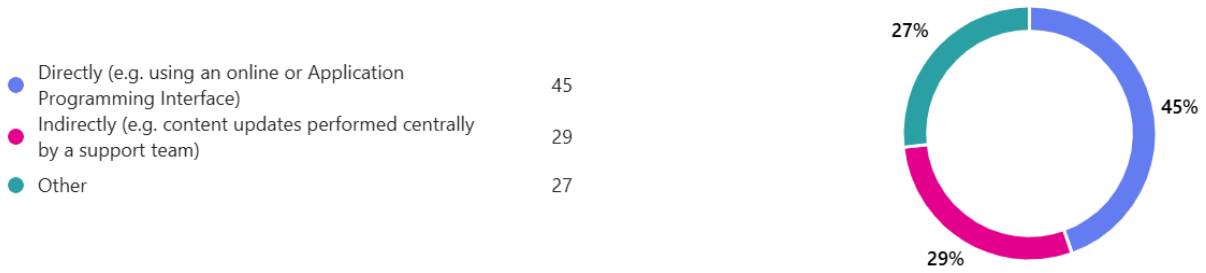


Figure 8. Pie chart showing the responses to question 9 of the discovery questionnaire 'If you are responsible for a UK marine monitoring programme, how would you prefer to update information within a directory of UK marine monitoring?'

Results from one-to-one interviews

The questionnaire answers that the interviewees had submitted were used as a basis to explore their answers to a) generate additional user stories and b) expand upon and clarify the user stories we had extracted from their questionnaire submissions. The template filled out per interviewee also included extra questions besides the user stories. These questions were more open-ended in nature and provided a useful means to capture more insight into the needs and current practices of the interviewee. These questions corresponded to the ones used in the Discovery Session Workshops.

During the interviews, as well as gathering user story information, additional questions (see orange column headers in table Appendix 2) were asked around the subject area of UK marine monitoring to gather more understanding of current knowledge of resources and ideas for incentivising maintenance of such a database. The results of these questions are in Appendix 6. The pie chart (Figure 9) shows the proportion of people we spoke to that are already aware of the UK Directory of Marine Observing Systems (UKDMOS) and the proportion of people who had not heard of it before. The graph is split into interviewees and discovery sessions attendees' knowledge. Overall, 75% of people we spoke to during this discovery work were unaware that UKDMOS exists. This is particularly interesting as it indicates that we reached a much wider audience with this discovery work than existing UKDMOS stakeholders.

For those interviewees that had engaged with UKDMOS, we asked "What are your current issues with UKDMOS?". The answers ranged and included opinions that UKDMOS is not easy to use and not kept up to date. See Appendix 6 for more details.

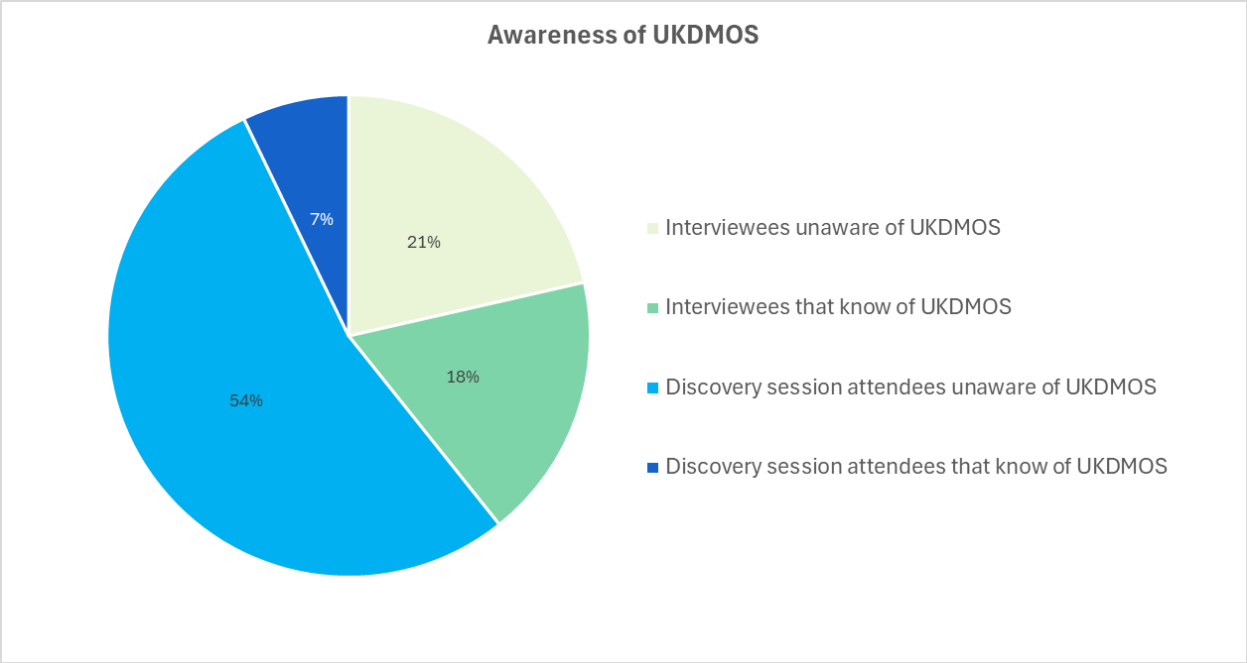


Figure 9. Pie chart showing the proportion of interviewees and attendees of discovery sessions that were aware of the UK Directory of Marine Observing Systems (UKDMOS)

We asked the interviewees "How can we incentivise maintaining an online database for UK marine monitoring?". The responses show it is clear that the value of maintaining and carefully archiving marine monitoring data and information needs to be shown to funders and policy decision makers (Appendix 6). It is imperative that there is buy-in from the appropriate stakeholders from the beginning of any sort of development of an online database. There needs to be a wider incentive for people to keep the database updated, be it legislative requirements or funding conditions. Promoting the benefits of having a central place to find this information will become an incentive of its own. Some examples of suggestions are:

"Make sharing marine monitoring data and information a legal requirement..."

"Organise an annual conference where everyone reports their marine monitoring highlights"

"Have a reporting body for marine monitoring with governance"

Of key interest to this work is where stakeholders currently go to access marine monitoring data. Figure 10 shows where interviewees and discovery session attendees currently access marine monitoring data and information. There were a broad range of answers and

some interviewees reported only using data from their own organisation. The most frequently reported source of monitoring data and information was the Marine Management Organisation (MMO), which may reflect the number of individuals from MMO that contributed to the process. However, it should be noted that it was not just MMO colleagues that we spoke to that are using MMO data.

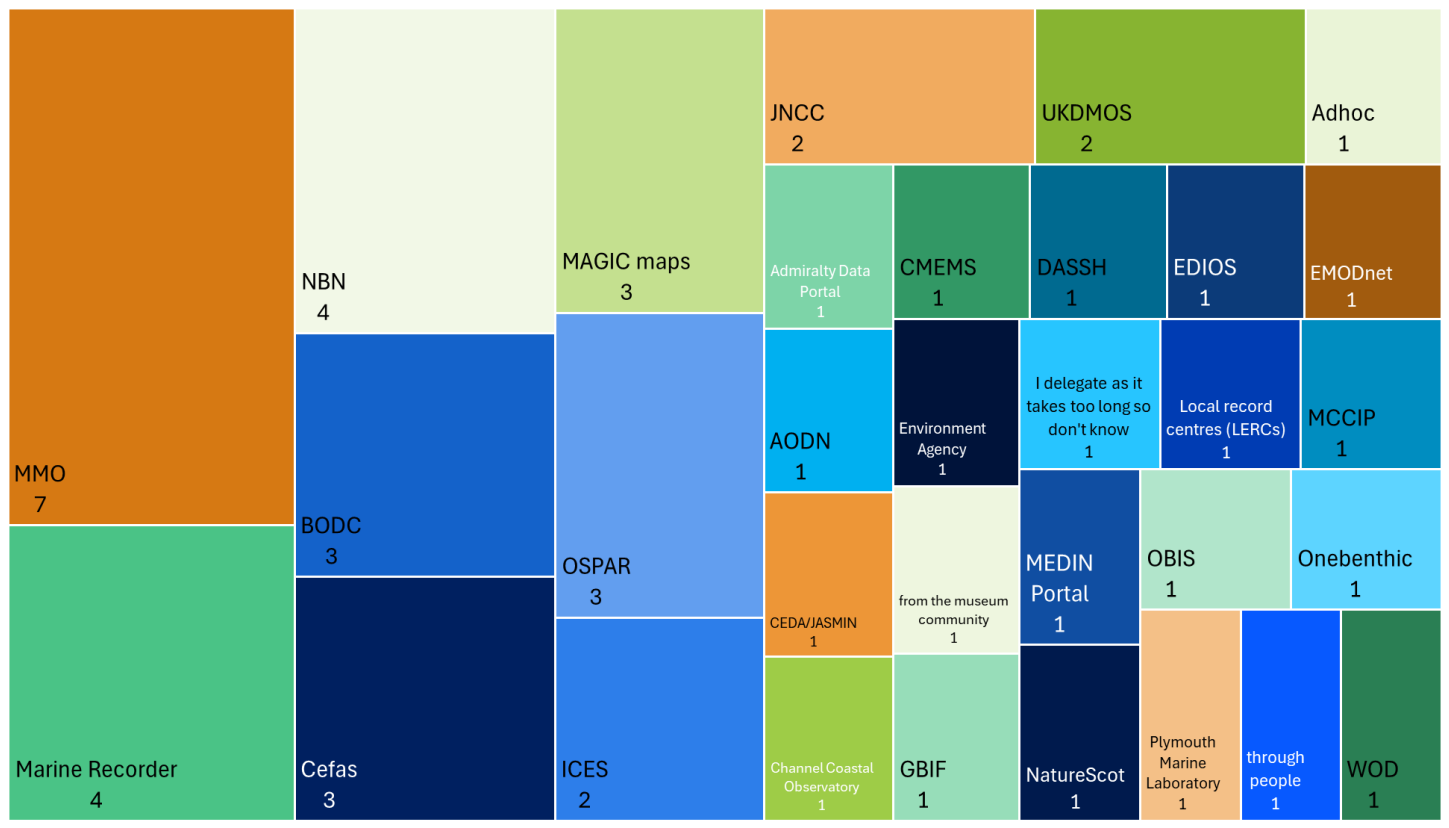


Figure 10. Marine monitoring data and information sources that interviewees currently use. The larger the box, the more people use them (values are numbers of people)

We asked interviewees "If money were no object, what would you like a database to do for you?" As expected with such a wide range of stakeholders, the suggestions varied and included having full certainty that everything in the database is up to date; incorporating machine learning in metadata generation; having only one place to go to download data and not having to contact anyone to get the data and information that the user needs. The details can be read in full in Appendix 6.

Results from discovery sessions

Attendees in the discovery sessions were asked to choose a top priority from the 'must-have' box on the Moscow board. As highest priority, some chose needs that were not on the initial list of needs we had asked them to prioritise (Figure 1). For example, "I need quality metadata" was not in our suggested list of needs, but an attendee chose it as their top priority need for an online directory of marine monitoring data and information. "I need a user-friendly and reliable directory for UK marine monitoring data" was a need we asked attendees to prioritise and this is the most common top priority from the 'must-have' boxes. Figure 11 shows the top priorities attendees chose from their 'must-have' MoSCoW boards. As an absolute minimum, these stakeholders need a directory of UK marine monitoring to be a reliable resource that is user-friendly and provides links to the individual responsible for the monitoring.

These priorities are also clear when we consider the full list of 'must-have' user needs from all the discovery sessions (Figure 12). The most common user need is that a database be user-friendly and reliable. This exercise produced a large list of 'must have' user needs, which is an excellent resource upon which to build a specification for a UK directory of marine monitoring. It is reassuring that the 'must-have' user needs identified during the discovery sessions are similar to the results from the questionnaire and interviews.

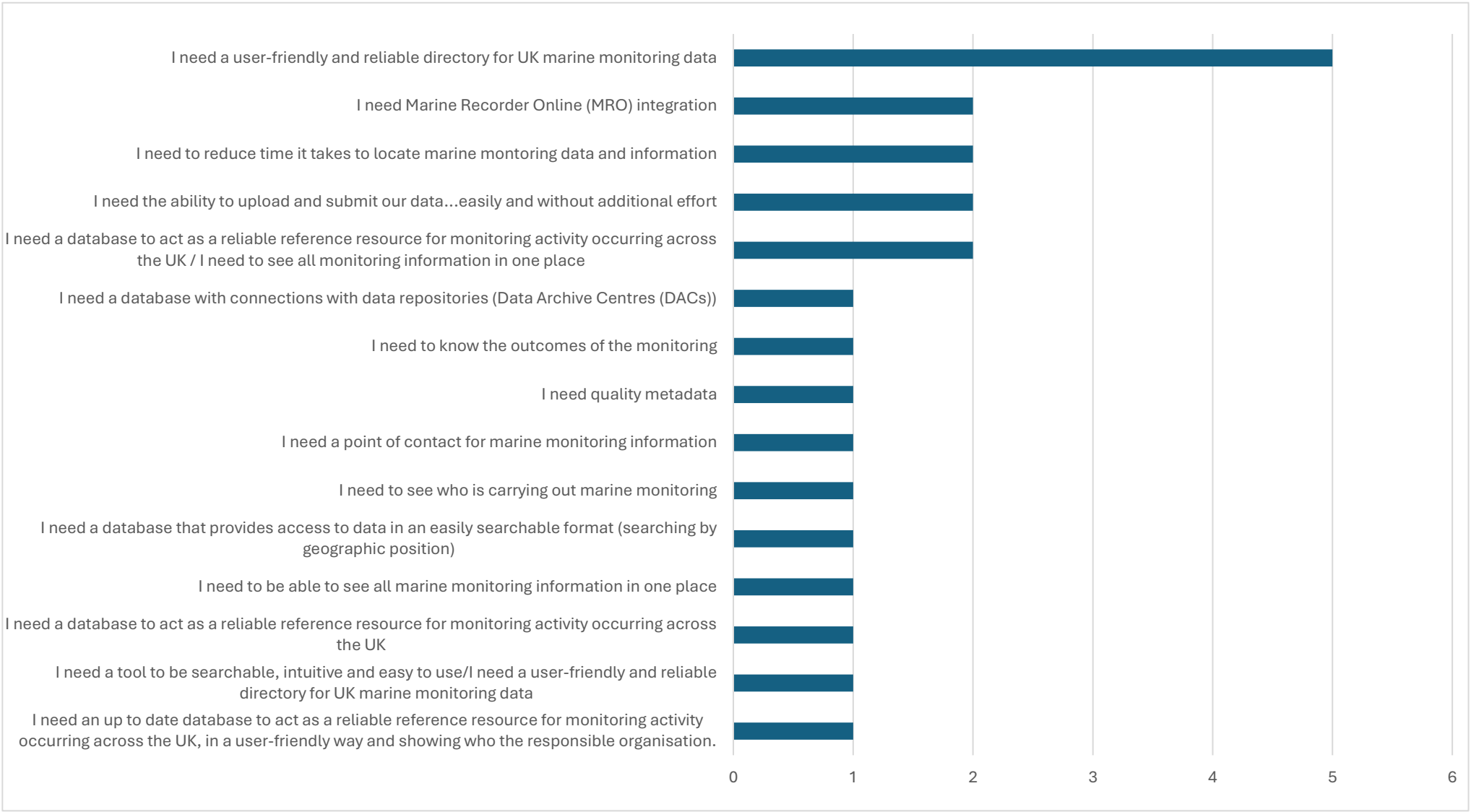


Figure 11. Graph to show the top priority user needs from all the discovery sessions (units are numbers of attendees)

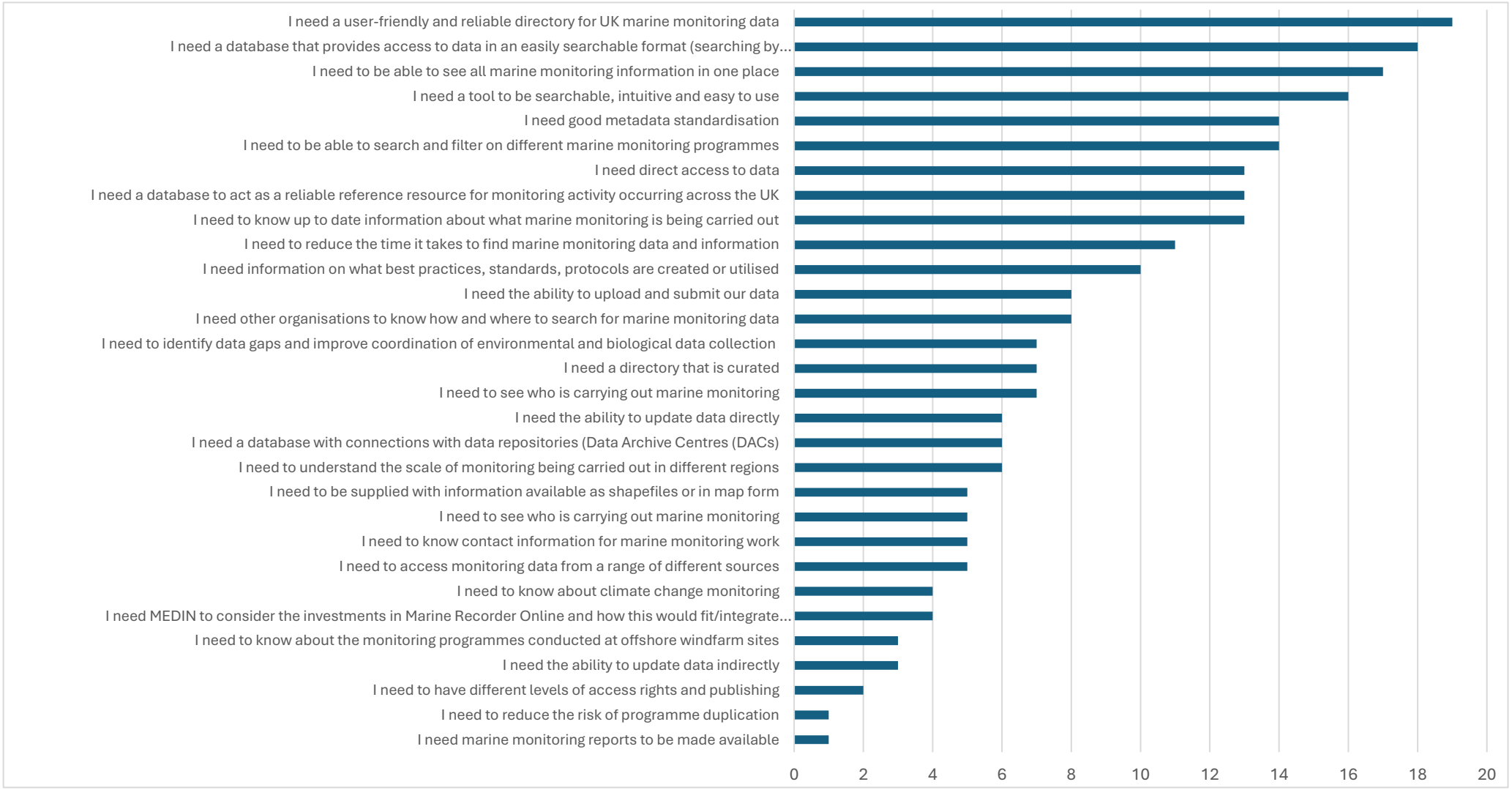


Figure 12. Graph to show all the "must have" user needs from all the discovery sessions (units are numbers of attendees)

Results of the analysis of user stories

All user stories were captured on sticky notes in Miro Board A (all the content of Miro Board A can be found in Appendix 7). The original user stories were constructed in the form: '**As a** [user role], **I need** [the software to be able to do so-and-so] **so that** [I can do this]'. Here the user stories have been split down by user role ('Consultant', 'Funder' etc.) (Figure 2) and the **I need** and **so that** are captured on two separate sticky notes of the same colour as the user role box. User stories were then further divided into boxes of similar user story category (refer to Table 1). Finally, labels are tagged onto each of these boxes denoting whether an existing catalogue (with minor development which means less than 5 days developer time) could meet the stated user needs or whether a new software build would be needed.

Each of the user story categories under each of the user roles were assessed and tagged on Miro board A with label 'Portal', 'UKDMOS' and/or 'new tool'. The criteria for adding these labels were whether all user needs in a user story category could be supported by the current version of the Portal or current version of UKDMOS (or with minor development meaning less than five days development time) or whether it seemed more likely that a new software build would be needed to fully meet all the user needs in the user stories.

A UKDMOS label was removed as an option where:

- an API is mentioned as a requirement. It would take major development for UKDMOS to support an API whereas the Portal already has one in operation. Where the term 'direct access to data' is used, the UKDMOS label remains, as data are accessible via the current metadata fields.
- a GIS-based webmap of data is requested. UKDMOS is excluded here as it would take more than minor work to allow the uploading of external GIS layers. The addition of reference layers is currently enabled in the Portal.
- there is a need to have 'datasets all in one place' as this is not supported currently by UKDMOS

The Portal label was removed as an option where:

- there is a specific requirement for monitoring metadata or marine monitoring portal or monitoring programmes or monitoring database. It would take major development (>5 days) to expand the Portal metadata standard to include and then serve up complete monitoring programme information. The Portal as an option

remains if monitoring data is specified as this is available via the current metadata standard under resource locator.

A new tool label was added as a viable option where:

- neither UKDMOS nor the MEDIN Portal could support all grouped user needs.
- there are UKDMOS plus new tool labels or MEDIN Portal plus new tool labels; the named tool can support some of the needs but not all of the needs whereas a new tool would satisfy all requirements. Here it is not clear if over 5 days of development work to either the MEDIN Portal or UKDMOS would enable the functionality.
- there is the need to access marine monitoring data and be able to update the database directly. This is currently not enabled in UKDMOS or the MEDIN Portal.

Figure 13 and Appendix 7 show 81 collections of user stories grouped by user story category. 53% of those collections of user stories can be met by the current functionality of (or minor upgrade to) UKDMOS, 31% by the MEDIN portal and 16% would require a new bespoke tool to achieve.

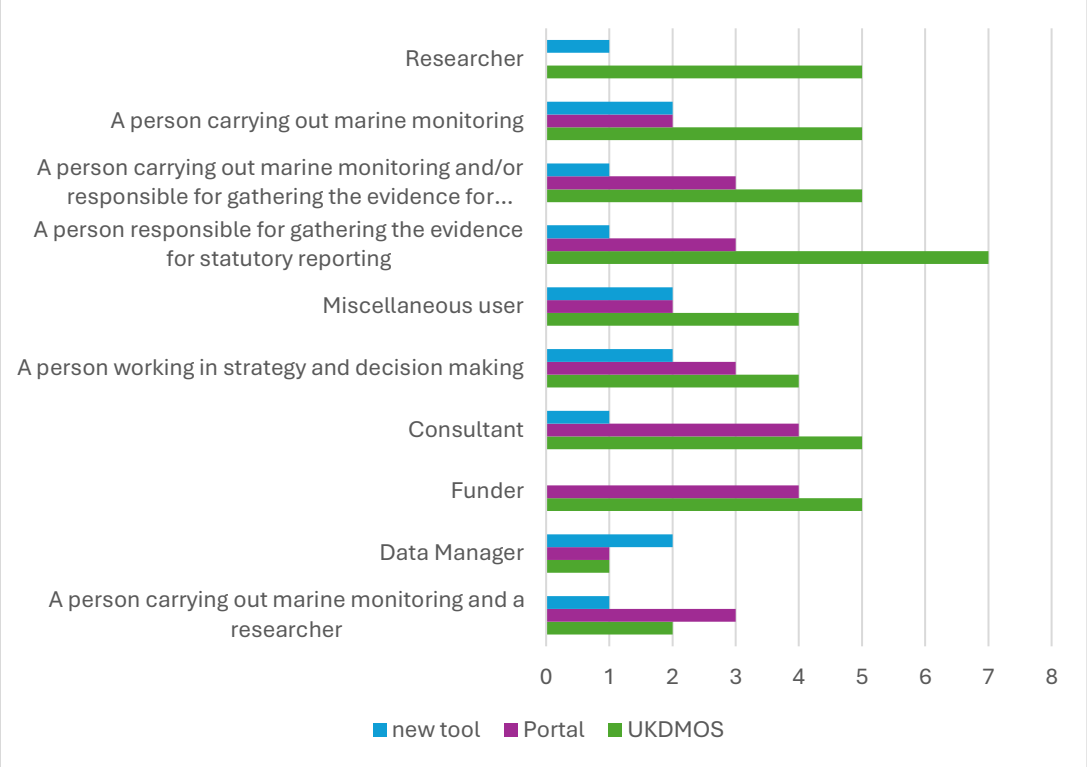


Figure 12. Bar chart showing the number of collections of user stories that can already be met by the functionality of UKDMOS or MEDIN Portal versus those that would require a bespoke tool

Summary of findings

MEDIN have engaged with the marine community to discover whether a directory of marine monitoring in the UK is a tool that should be available and if so, how it should function based on the feedback from the would-be user community. The discovery questionnaire started out by asking the basic question of whether there is an actual need for an online database of marine monitoring programmes. The respondents clearly expressed that there is a need.

Feedback on how this tool should function to meet user needs was gathered via user stories, and a total of 246 were drawn from the discovery questionnaire and interviews. This information was used to build a specification list of user needs that can hereafter be used to generate a business case. The prioritisation exercises during the discovery workshops were used to rank these needs.

Besides providing information on 'how' a marine monitoring tool should function, user stories were analysed to address potentially 'what' sort of platform/software could be used to support the catalogue based on what it would need to provide for users. In groups of similar users' stories, an assessment was made on whether the user requests for functionality and information could be met by minor enhancement of the MEDIN portal, minor enhancement of UKDMOS or could only be achieved through a new software build.

A new software build would be an all-encompassing solution and meet priority user needs but would be an addition to the plethora of pre-existing online digital solutions. The adaptation of an existing tool would be the better solution if this is practicable.

The user story assessment exercise indicated that UKDMOS already meets over 50% of the user stories compared to 30% for the MEDIN portal. However, there are other factors (summarised in Table 2 below) to consider to place this exercises' findings into context.

UKDMOS and the MEDIN portal are quite dissimilar in the metadata they provide and the way metadata are harvested and exposed for discovery. The database entity for these two tools is not the same; one describing datasets, series and services and the other describing monitoring programmes and sampling sites. Naturally it would be easier to add monitoring programme metadata with associated station and cruise spatial data to the database already delivering this, UKDMOS. On the other hand, where users wish to have all marine metadata and data in one place, then the MEDIN portal would be the more intuitive starting point.

The MEDIN portal has a well-established, community supported discovery metadata standard, which UKDMOS does not have. However, the MEDIN discovery metadata standard is specifically for datasets, series and services and is not currently set up to describe monitoring programmes. We should not underestimate the work required to amend the MEDIN standard, metadata tools and portal to enable delivery of monitoring programmes.

UKDMOS has not benefited from the continual software development that the MEDIN portal has undergone being last updated in 2017. MEDIN has four times the web traffic and has gained traction as a central, authoritative source of marine data as the MEDIN partnership has expanded its national reach over the last decade.

In terms of governance, the MEDIN portal is solely owned and operated by MEDIN. Whilst MEDIN are responsible for updating and managing UKDMOS, the database underpinning UKDMOS is operated by a MEDIN DAC, BODC, on behalf of SeaDataNet (a pan-European project) and modification of this tool would create opportunities for collaboration with our European Partners.

Both UKDMOS and the MEDIN portal would need development work for the addition of an online system to allow users to add/edit monitoring programme records. The feedback that came back from the discovery work was that users would like to have the ability to both update the catalogue manually and be able to provide updates to a third party. Any system would of course need oversight and governance by the MEDIN Core Team and crucially be kept up to date. Not providing up to date, current metadata has been recurring criticism of UKDMOS. Update has been difficult to implement for two reasons; 1. community engagement dwindled over the years 2. the mechanism for updating the catalogue is a lengthy, manual process. These challenges were addressed during the interviews (see Appendix 8), and we received constructive suggestions to tackle these going forward.

Throughout user stories and questionnaire responses, there were multiple suggestions that any new or improved database must be interoperable with existing databases (for example, The Marine Data Exchange, Marine Recorder and other portals as they emerge). Support for API's and technology that enables interoperability is imperative for maintaining up to date database content.

Results from this discovery work show that MEDIN has been given evidence from the marine community that a central place to discover marine monitoring information is strongly desired, and we are grateful for the considerable amount of valuable feedback we

have received. MEDIN now requires guidance from the MEDIN Sponsors Board and the Executive Team on how we take this discovery work forwards.

Table 2. Key information on the MEDIN Portal and UKDMOS

	MEDIN Portal	UKDMOS
Governance	MEDIN created and has owned this data discovery portal since 2010.	BODC (a MEDIN DAC) governs EDIOS for SeaDataNet. The underpinning database feeding both EDIOS and UKDMOS catalogues is also hosted by BODC.
Information provided	The portal supplies dataset metadata from over 18.5K marine datasets from over 600 UK organisations.	UKDMOS supplies information about 275 monitoring programmes and over 15K associated monitoring stations, cruises and sites.
Database entity	Marine datasets, series and services Reference GIS layers as Web Map Services are searchable via a function in the portal.	Marine monitoring programmes In 2010 the UKMMAS protocols database was integrated into UKDMOS making use of existing fields.
Metadata schema	The MEDIN Discovery Metadata Standard defines and constrains the fields in the MEDIN portal. The metadata described includes datasets, series and services. Non-spatial datasets (for example DNA sequences) were added to the metadata schema in October 2024. The portal is supported by the NERC Vocab Server	The metadata format for EDIOS and UKDMOS is based upon ISO 19115 with UKDMOS having additional fields to satisfy national reporting requirements. The NERC Vocab Server supports vocabulary usage.
Technical structure	The MEDIN portal uses a bespoke user interface and database (both hosted at MARIS). GeoNetwork is used for metadata harvesting of	Metadata are kept in an ORACLE Database at BODC and exported as .xml files to the production database at MARIS when new content is

	XML files and for supplying metadata to other portals. The XML files are produced using MEDIN tools and bespoke software at MEDIN DACs. GeoNetwork is open-source software and implements open standards and specifications from the Open Geospatial Consortium (OGC)	added. Content is added and updated manually via SQL by the MEDIN Core Team. The bespoke user interface is hosted at MARIS.
Metadata standard	The MEDIN Discovery Metadata Standard is a marine profile of the UK government Standard UK GEMINI (GEo-spatial Metadata Interoperability iNItiative) and complies with EU INSPIRE Directive and ISO19115.	UKDMOS has monitoring programme level information that is compliant with ISO19115. Series information (i.e. sampling sites, transects and cruises) and Platform information (ship, mooring, coastal structure) are not compliant with ISO19115.
Interoperability	The portal uses GeoNetwork to harvest metadata from MEDIN suppliers of metadata which is also used as an API to expose all metadata as machine readable for use by other portals (for example, Ocean InfoHub, Google dataset search). MEDIN metadata are marked up with JSON-LD (JavaScript Object Notation for Linked Data) which is a lightweight, machine-readable format for encoding structured data on the web. JSON-LD is a format of RDF (Resource Description Framework)	UKDMOS does not have an API function. The SeaDataCloud project has applied the Linked Data standard to metadata to enable improved interoperability on a global scale. This could possibly be extended to UKDMOS. EDIOS has a SPARQL endpoint (SPARQL is an RDF query language and the RDF language used is RDF XML).
Mechanism of content update	XML files containing metadata content are harvested from 9 MEDIN partners daily. Creation of MEDIN metadata can be done with the MEDIN Discovery Metadata Editor, Metadata Maestro (a standalone application) and by	EDIOS has a 'Content Management System' called MIKADO which allows registered individuals to add and change details of monitoring programmes remotely and is supported by SeaDataNet. This tool can also

	integrating the MEDIN Schematron and Xml Schema Definition (XSD) into internal systems.	be used for updating UKDMOS metadata. However, it is effectively a tool for use by data managers only and is not considered sufficiently user-friendly tool for the non-data manager.
Last technical software investment	Last update in April 2024	Not technically updated since 2017
Usage metrics	Average monthly visits to the portal 4,601 (Apr 2020 to March 2025)	Average monthly visits to UKDMOS 1,083 (Apr 2020 to March 2025)

APPENDICES

Appendix 1 Discovery Questionnaire released January to March 2025

Discovery Survey for an online Directory of Marine Monitoring Programmes

MEDIN have been tasked with finding out whether there is an underlying business case for providing an online database of marine monitoring undertaken by UK organisations. And, if there is, how this should function to meet the needs of the marine community and the level of information it should provide.

Since 2008, MEDIN have supported and updated UK Directory of Marine Observing Systems (UKDMOS) which is a tool for users to find out about the marine monitoring programmes that operate in the UK. The results of this questionnaire will influence the future of UKDMOS and whether MEDIN will continue to support it.

Please complete this survey so that we can gather initial community thoughts and opinions of those whose work involves regular monitoring of the marine environment in any way, including funders, decision makers, those who carry out monitoring and those who use information about monitoring. It should take no longer than 15 minutes to complete.

This questionnaire is anonymous, with an option to leave your contact details at the end if you wish.

1. About you - what best describes what you do: *

- [ ] I carry out marine monitoring
- [ ] I am a funder
- [ ] I work in strategy and decision making
- [ ] I am a researcher
- [ ] I am responsible for gathering the evidence for statutory reporting
- [ ] Other

2. About you - what best describes your type of organisation: *

- ( ) Government Department and Agency
- ( ) Commercial Organisation
- ( ) Academia/Research Council/Blue skies research
- ( ) Charity and Non-Governmental Organisation (NGO)
- ( ) General Public
- ( ) Other

3. Would the creation and/or enhancement of an online directory of UK marine monitoring programmes be a useful asset in your opinion? *

- ◯ Yes
- ◯ No

4. You answered 'no', that the creation and/or enhancement of an online UK directory of marine monitoring would not be useful to you. Before you go, please could you explain your decision?

Enter your answer

5. You answered 'yes', a UK directory of marine monitoring would be useful to you. Please can you tell us your reasoning?

Enter your answer

6. What would a directory of UK marine monitoring need to do for you and why?
(e.g. be interoperable through the use of APIs, provide direct access to data/metadata etc)

Enter your answer

7. Please rank in terms of importance, what you need a UK marine monitoring directory to do for you?

- Give access to marine monitoring data
- Provide **detailed** information and metadata about different marine monitoring programmes
- Provide **summary** information and metadata about different marine monitoring programmes
- Be able to search and filter on different marine monitoring programmes
- Have programmes dispayed on a map
- Provide wider context information i.e. legislative drivers

8. Which of the following are of most interest to you? Are you interested in monitoring programme information (metadata such as location, parameters measured, rationale for monitoring etc) or the data collected by a monitoring programme?

- ◯ Using marine monitoring data and programme/metadata information
- ◯ Using marine monitoring data only
- ◯ Using programme/metadata information
- ◯ Other

9. If you are responsible for a UK marine monitoring programme, how would you prefer to update information within a directory of UK marine monitoring?

- ◯ Directly (e.g. using an online or Application Programming Interface)
- ◯ Indirectly (e.g. content updates performed centrally by a support team)
- ◯ Other

10. Would you be willing to share further details with us about your user story? If so, please enter your name and email address below (your details will only be used for the purposes of informing this work). The information you provide will be crucial for the discovery sessions where we will discuss if there is a need for a database for marine monitoring and how it should function.

Enter your answer

Appendix 2 Question template for 1-to-1 interviews

Interviewee Name	Organisation	MEDIN User Type	As a	I need to	So that	Clarification questions

Interviewee Name	Organisation	MEDIN User Type	Are you familiar with UKDMOS?	Did you have any issues with UKDMOS?	How do you currently get the monitoring information you need?	What frustrations currently exist with how you do this?	What is marine monitoring ?

What does reliable mean to you?	Do you have any access to marine monitoring data at the moment?	Any requirement for international interoperability?	Any use of TCE data?	Thoughts on incentivising maintenance of such a database?	If money were no object....	Part of a steering group?	Any other relevant observations made by the interviewee?

Appendix 3 Additional questions asked during the Discovery Sessions

Q1. What does marine monitoring mean to you?

Q2. Do you have a go-to resource for marine monitoring information?

Q3. What issues have you had in the past that prevented access to marine monitoring data and metadata?

Q4. What percentage of your work requires access to UK marine monitoring information?

Q5. What do you want to be able to do with a marine monitoring database?

Q6. to update indirectly - what is your preferred communication method for updates?

Q7. to update directly - what software are you most comfortable using for this?

Appendix 4 ‘Miscellaneous user’ is a user type or persona category used in Figure 3 and on the Miro board and groups together the following users (self-defined)

As a charity working with the UK fishing industry

As a citizen science marine mammal monitoring programme lead

As a facilitator between stakeholders in a partnership

As a GIS data manager for offshore wind development

As a lecturer

As a local government funded project

As a local marine authority planner

As a marine ecologist

As a marine environmental data analyst

As a member of the public

As a person who works for an NGO

As a person working in a government department and agency

As a retired marine ecologist

As a retired marine monitorer

As a sensor provider

As a student

As an editor

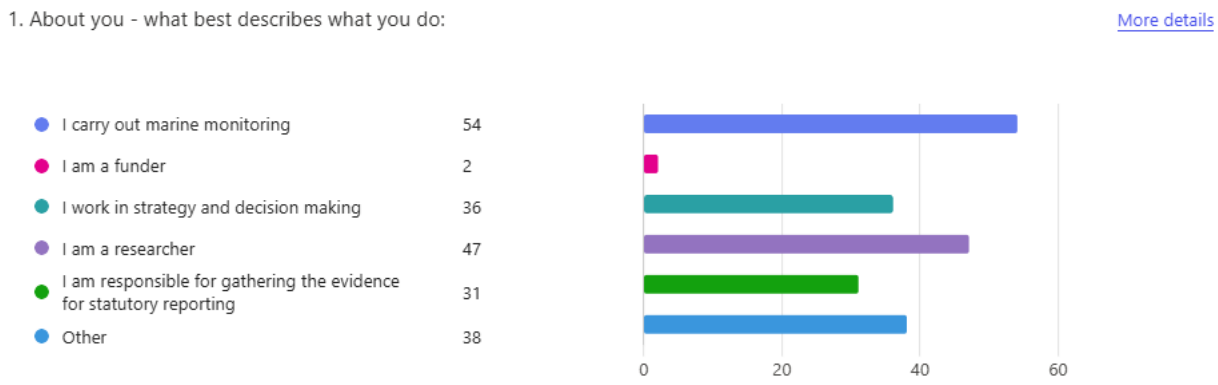
As an employee of Ocean Best Practices

As an independent stakeholder involved with assess management effectiveness of MPA's globally

Protocol: To reduce the number of personas down to a manageable number, some shoehorning was applied and ‘similar’ personas grouped together i.e. 'as a person working in consultancy' became 'as a consultant', 'as a marine database manager' became 'as a data manager', 'as a researcher in estuarine science' became 'as a researcher', 'as an Environmental Consultant - Advising Offshore Wind Clients on Monitoring/Surveys' became 'as a consultant’, 'as a researcher carrying out marine monitoring' became 'as a researcher', 'As a 'Head of Department' responsible for gathering the evidence for statutory reporting' became 'As a person responsible for gathering evidence for statutory reporting', 'As an offshore wind developer' became 'As a consultant'; 'As a person carrying out marine monitoring and a freediver' became 'As a person carrying out marine monitoring'

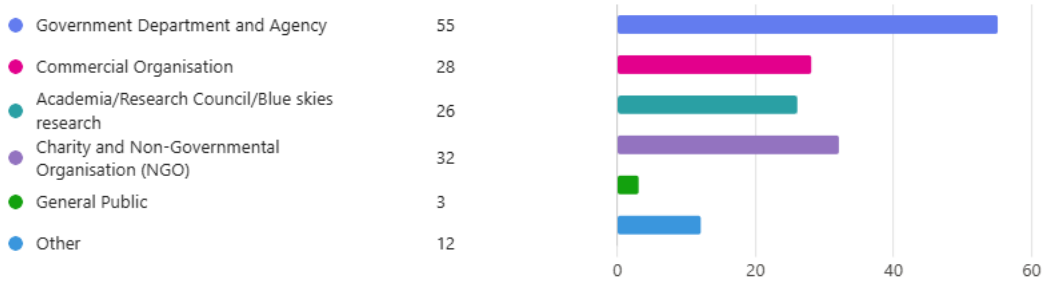
Appendix 5 Questionnaire questions and results

Questionnaire results available to share which do not breach GDPR requirements are as follows:



2. About you - what best describes your type of organisation:

More details



3. Would the creation and/or enhancement of an online directory of UK marine monitoring programmes be a useful asset in your opinion?

More details

5. You answered 'yes', a UK directory of marine monitoring would be useful to you. Please can you tell us your reasoning?

More details

143
Responses

Latest Responses

"Provide transparency onto marine monitoring activities that allows user insi... "

"clearly there are benefits to increasing visibility of other work, to share exper... "

"It would be useful to see in one place what programmes other statutory bod... "

...

62 respondents (43%) answered data for this question.

6. What would a directory of UK marine monitoring need to do for you and why?
(e.g. be interoperable through the use of APIs, provide direct access to data/metadata etc)

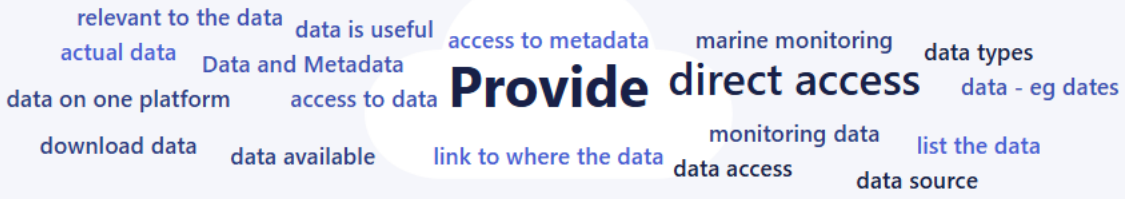
More details

138
Responses

Latest Responses

"Provide links to monitoring data (e.g. in Marine Recorder Online); provide lin..."
"direct access to data would be helpful, ideally wouldn't rely on direct upload... "
"Would be useful to link to future monitoring programmes with data that is e... "
...

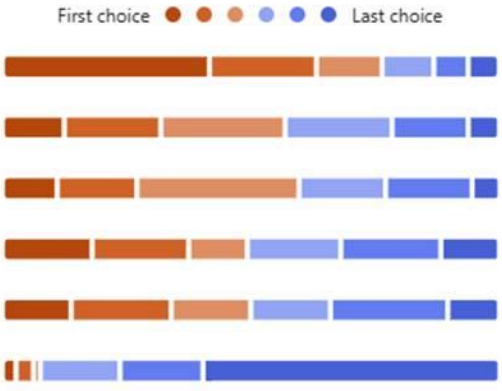
63 respondents (46%) answered Provide for this question.



7. Please rank in terms of importance, what you need a UK marine monitoring directory to do for you?

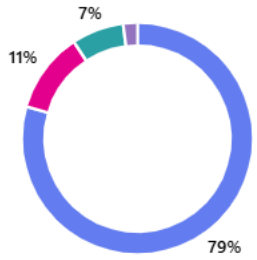
144 Responses

Rank	Options
1	Give access to marine monitoring data
2	Provide **summary** information and metadata about different marine monitoring programmes
3	Be able to search and filter on different marine monitoring programmes
4	Have programmes dispayed on a map
5	Provide **detailed** information and metadata about different marine monitoring programmes
6	Provide wider context information i.e. legislative drivers



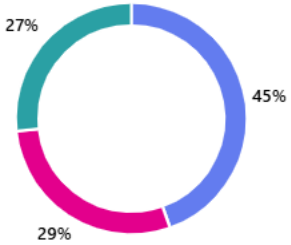
8. Which of the following are of most interest to you? Are you interested in monitoring programme information (metadata such as location, parameters measured, rationale for monitoring etc) or the data collected by a monitoring programme? More details

Using marine monitoring data and programme/metadata information	120
Using marine monitoring data only	17
Using programme/metadata information	11
Other	3



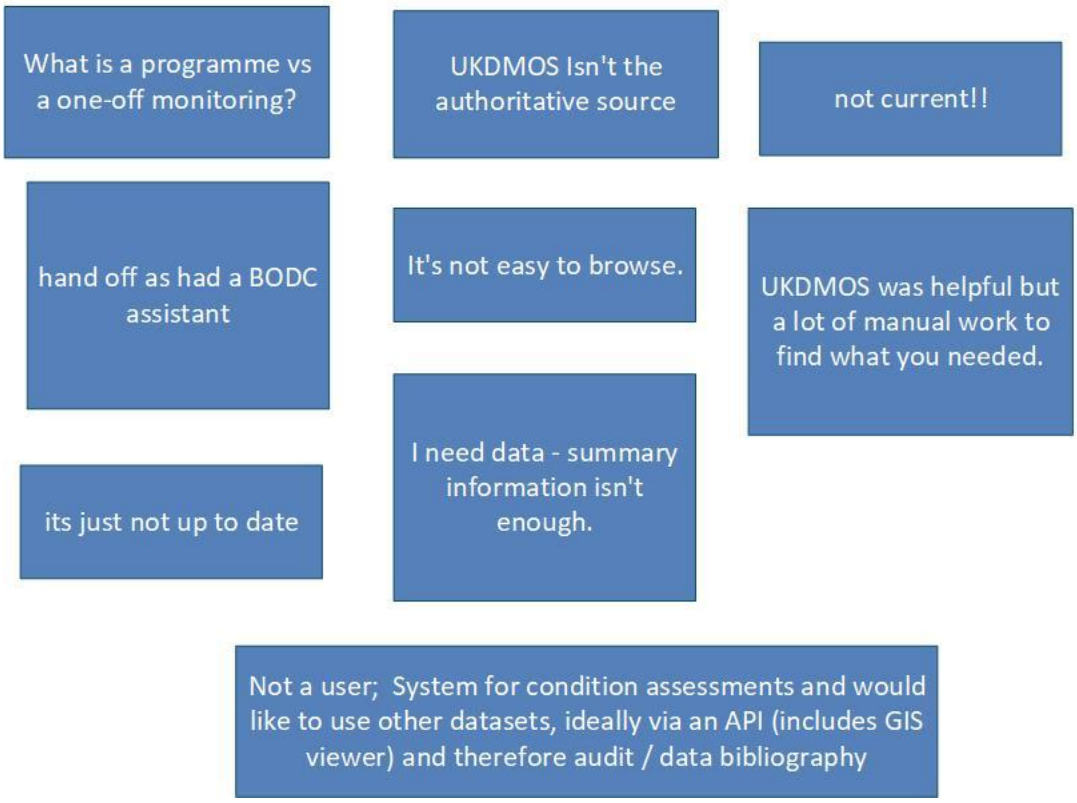
9. If you are responsible for a UK marine monitoring programme, how would you prefer to update information within a directory of UK marine monitoring? More details

Directly (e.g. using an online or Application Programming Interface)	45
Indirectly (e.g. content updates performed centrally by a support team)	29
Other	27



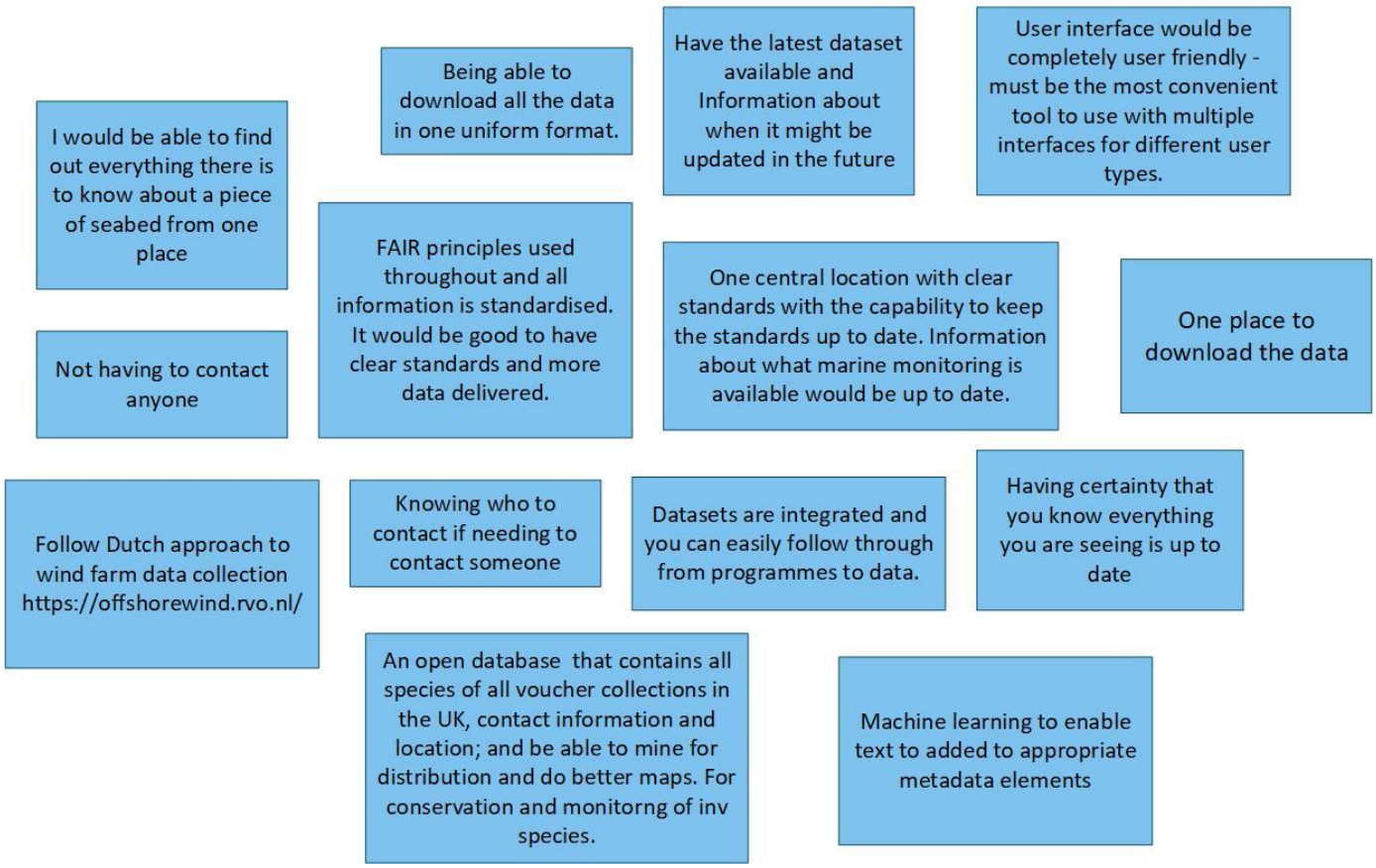
Appendix 6 Additional answers from interviewees

Interviewee answers to “What are your current issues with UKDMOS?”.



Interviewee answers to "How can we incentivise maintaining such an online database for UK marine monitoring?".

Interviewee answers to “If money were no object, what would you like a database to do for you?”.



Appendix 7 User story personas, stories and themes on Miro Board A

All .pdf files of user stories can be found here.

A read_me file provides details of the directory.

A person carrying out marine monitoring

A person carrying out marine monitoring and a researcher

A person carrying out marine monitoring and/or responsible for gathering the evidence for statutory reporting and/or works in strategy and decision making and/or researcher

A consultant

A data manager

A funder

A person responsible for gathering the evidence for statutory reporting

A miscellaneous user

A researcher

A person working in strategy and decision making