Marine and Coastal

National Environmental Science Program

FINAL REPORT

PROJECT 1.2

National areas of interest for seabed mapping, characterisation and biodiversity assessment: scoping study

November 2022

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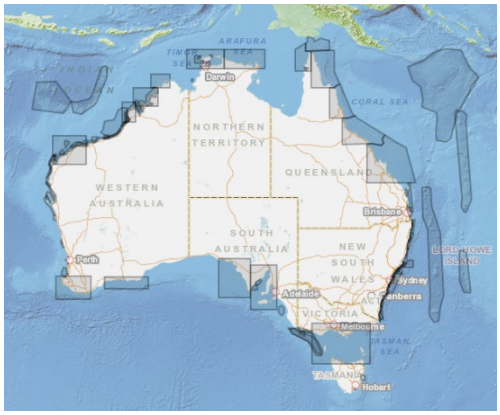
AUS SEABED

Survey Coordination Tool
PRIORITIES, REQUESTS AND PLANNING



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NESP Marine and Coastal Hub partners

The Australian Institute of Marine Science, Bioplatforms Australia, Bureau of Meteorology, Charles Darwin University, Central Queensland University, CSIRO, Deakin University, Edith Cowan University, Flinders University, Geoscience Australia, Griffith University, Integrated Marine Observing System, James Cook University, Macquarie University, Murdoch University, Museums Victoria, NSW Department of Planning and Environment (Environment, Energy and Science Group), NSW Department of Primary Industries, South Australian Research and Development Institute, The University of Adelaide, University of Melbourne, The University of Queensland, University of New South Wales, University of Tasmania, University of Technology Sydney, The University of Sydney, University of Western Australia, The University of Wollongong

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Executive summary

The National Areas of Interest for Seabed Mapping, Characterisation and Biodiversity Assessment project was a scoping study designed to assist the planning and prioritisation of marine surveys that undertake physical and biological seabed data collection. Through a process of workshops and targeted engagement with stakeholders from the seabed mapping community, the project created a set of standard metadata to allow users define spatial Areas of Interest (AOI) within Australia's marine jurisdiction. The project also developed a submission and publication service for these areas as part of the open access web application, the AusSeabed Survey Coordination Tool. In addition, the project team used the metadata to design and prototype a prioritisation framework that allows users to transparently and consistently establish a rank and priorities for survey work or data delivery processes. The prioritisation is based on rankings established by three sets of criteria: (1) the organisation's purpose driving the data need, the type of data being collected, the ecosystem, management conditions and zoning, pressures, and the availability of existing data; (2) logistics, time-sensitivity of collection, and whether there is a relative organisational priority that can be applied, and; (3) user interest in prioritising an area based on other Areas of Interest that either intersect or are in close proximity and represent opportunities for collaboration and cost sharing.

The engagement campaign associated with the launch of the AOI functionality in the AusSeabed survey coordination tool has led to solid uptake. The period from March-July 2022 saw 134 users register, of which 17 new users from 11 different organisations submitted 85 new AOI, and existing users from the previous version of the tool reviewed, edited and resubmitted 101 AOI to bring them up-to-date with the standard metadata. In total, there are now approximately 370 AOI being published from the tool to the AusSeabed Marine Portal. The prototype prioritisation framework was developed to complement the Australian Marine Park Management Effectiveness system. The prototype currently awaits the Areas of Interest from Parks Australia before it can be used to inform future research plans that might focus on Protected Places, including Australian Marine Parks.

This project sets a strong foundation for understanding the value of data collection and delivery within the Australian marine estate. For the first time, the Australian marine science community is able to see in-depth the data needs across disciplines and sectors presented through a single portal. This aims to encourage a greater number of multidisciplinary surveys with a higher degree of collaboration and cost sharing. Continued engagement is needed to ensure proper coverage and representation of the different sectors, including working with national data collection programs to maximise the benefit of data collection opportunities. Both the AOI functionality of the Survey Coordination Tool, and the AusSeabed Marine Portal will be maintained by Geoscience Australia who will also continue working to raise the profile and uptake of the service among government, private, academic and community sectors.

1. Introduction

Seabed and marine biodiversity data are time-consuming and costly to collect, so it is important that acquisition is focused on geographic and thematic areas that align with end user priorities. Understanding the value that different stakeholders place on seabed and marine biodiversity data is currently difficult to determine, with the risk that survey planning and prioritisation may not always be based on the most comprehensive information available. The National Areas of Interest project was designed to facilitate the planning process by establishing a community-endorsed value framework and set of metadata attributes that can be used to identify areas of common interest. Here we define marine surveys to encompass activities that map and characterise the seabed and associated biological communities. This includes the physical properties of the seabed (depth, morphology, substrate type), as well as benthic and demersal biota. As such, the project seeks to support the planning requirements for baseline mapping and biodiversity assessment and monitoring surveys.

With the development of the value framework and metadata for defining future survey areas, stakeholders are now able to update their areas of interest through the AusSeabed Survey Coordination tool (https://coordination.ausseabed.gov.au/). Maintained as an ongoing function within the AusSeabed portal, the Survey Coordination Tool allows the marine community to identify common areas of interest where the greatest need for data is, and where collaborative opportunities may exist. It also presents an opportunity to build the capacity for the MaC Hub to link to other funded programs, including the Marine National Facility (MNF) and HydroScheme Industry Partnership Program (HIPP).

The task of guiding future benthic biodiversity surveys and ongoing monitoring priorities is somewhat more complex than guiding mapping priorities. There are a wide range of stakeholders with an equally wide range of information needs, and it is important that the MaC Hub determines the main drivers of survey priorities over the life of the program to ensure core stakeholder needs are adequately addressed. Such guidance is also needed by the wider research community and the major infrastructure providers that underpin this process, including the Integrated Marine Observing System (IMOS) and the research institutions with mapping interests and capabilities. Within Government, these interests include those of Parks Australia which are guided by the Australian Marine Park Science Strategy and Science Plans currently under development. Equally, there are wider needs to understand biodiversity values outside of the Australian Marine Park network to underpin conservation and extractive industry values and needs, and these now can be represented by the value framework developed by this project and implemented through the AusSeabed Survey Coordination Tool.

2. Methods – Planned approach

The project was completed through a process of desktop research and stakeholder workshops, as follows:

Desktop research: This provided a review of existing value prioritisation frameworks and associated metadata used to classify and prioritise “areas of interest” for seabed physical

and biodiversity data collection (including the earlier NESP Marine Biodiversity Hub survey prioritisation framework).

Workshop 1: A cross-sector activity-based workshop held on 3 November 2021 involving key marine data users and collectors across government, industry and academia to develop a prototype value framework and establish standardised metadata for spatial representation, taking into account existing solutions.

Repurposing of the AusSeabed Survey Coordination Tool: The existing National Priority Areas web service was repurposed to capture metadata from the value framework and ingest spatial data to represent the physical and biodiversity mapping areas of interest as map layers.

Socialising the tool and soliciting submission: Contacting stakeholder groups to introduce the updated tool and to encourage submissions into the new tool. This included training sessions with the wider community to teach them how to deliver areas of interest through the AusSeabed Survey Coordination Tool.

Workshop 2: A prototype prioritisation framework was designed, to establish comparative ranking of AOIs, using the metadata collected in the tool. A workshop was held on 15 December 2021 to introduce and refine the prototype prioritisation framework. In addition, the project team consulted with Parks Australia to refine the prioritisation framework to ensure it aligned with their interests and can complement the Management Effectiveness system.

3. Results

3.3 Desktop study

A desktop study to identify existing frameworks and processes for survey prioritisation found that most existing frameworks descriptions were either too generic or high-level, or referred to internal processes that are not described in publicly accessible documents. Apx Table 1 - Appendix A identifies links to framework references identified as part of the desktop study and gives a short description of the context of the linked documents and mentions any potentially useful figures or content. This finding was reinforced during the first workshop where the majority of respondents suggested that most of their organisations did not have a formal framework for prioritising seabed surveys.

However, it was clear that most of these high-level documents were underpinned from existing frameworks that focussed on ‘values’, commonly divided into social, cultural, economic, and environmental/ecological themes. These broad purposes were identified and broken down to form the basis for discussion during Workshop 1.

3.4 Workshop 1: Prioritisation Framework

The first workshop was held online on November 3, 2021 with an attendance of 68 participants from across a wide range of Government, industry and university organisations that either undertake seabed mapping or use the data (Figure 1). The reach of the workshop

included representatives from all States/Territories, including some international representation (Figure 1). Around a third of these participants identified as researchers, followed by marine surveyors (Figure 1).

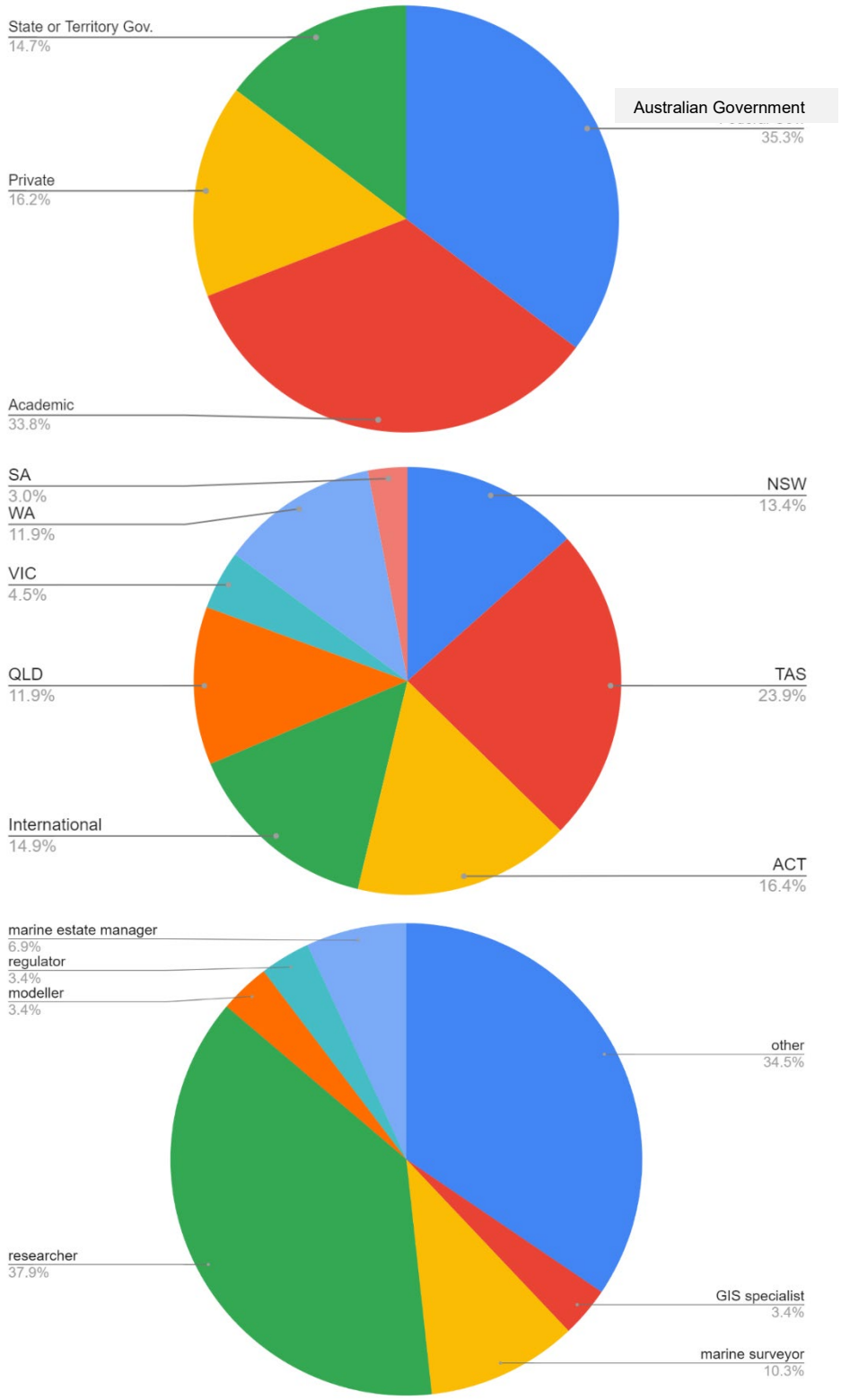


Figure 1 Participant reach of workshop by Sector (top), State/Territory (middle) and position (bottom)

3.4.1 Workshop background

The previous iteration of the AusSeabed Survey Coordination tool was limited in that it was designed around the priority needs of State and Australian Government seabed mapping programs. By expanding the Area of Interest (AOI) functionality to include other mapping data types such as benthic habitats and biodiversity while expanding the target user base to include the academic, community and private sectors, the application had a much greater potential to service the needs of Australia's marine data community. Redesigning and redeveloping the tool also offered the opportunity to develop metadata that would be interoperable with an informed prioritisation framework. To do this, more detail about the proposed areas needed to be collected from the community. Prioritisation frameworks commonly focus on the purpose and value of proposed data acquisition or research (see previous section). Location and extent contribute to the assessment of feasibility, while data type and method inform decisions about compatibility and comparability between potential collaborators. As such, the first workshop was crucial in guiding the design specifications and metadata standards for this range of criteria in the software development work.

3.4.2 Workshop focus

The workshop focussed on **five primary questions**:

1. Who? — Organisation submitting the priority areas for consideration and contact details.

2. Where? — Geographic location and overlap with existing boundaries.
    a. Which part of the ecosystem, using the Australian Marine Park defined common language to define what 'natural value(s)', i.e. part and components of the ecosystem should be targeted for mapping in the AOI.

3. Why? — Rationale/ Purpose & Value: What is the reason for the proposed AOI and what is the overarching value the requested mapping is going be focussed on.

4. What? — What type of data are required.
    a. How? — What methods should/could be used to collect the data.
    b. How detailed? — What spatial resolution is necessary for the data to fulfill the purpose. (Including survey standards for bathymetry mapping)
    c. How often? — Cadence for time series data

5. When? — Indication of the preferred time frame for the data collection and if seasonality is of importance

Additional information

6. A 'Due Diligence' question was added to ensure submitters had considered existing data in the area and had checked relevant data portals and sources.

7. Perceived impact and organisational priority

8. Pressures – existing anthropogenic pressures if known

To be able to include in a database and analyse areas submitted by a wide variety of stakeholders, details regarding the submitted area needed to be captured in a standardised format, using defined terminology. Under each of these primary questions we identified broad groupings or themes and populated each of these into a schematic of the data fields and standard terms that we presented at the first workshop as a starting point for discussion (Figure 2).

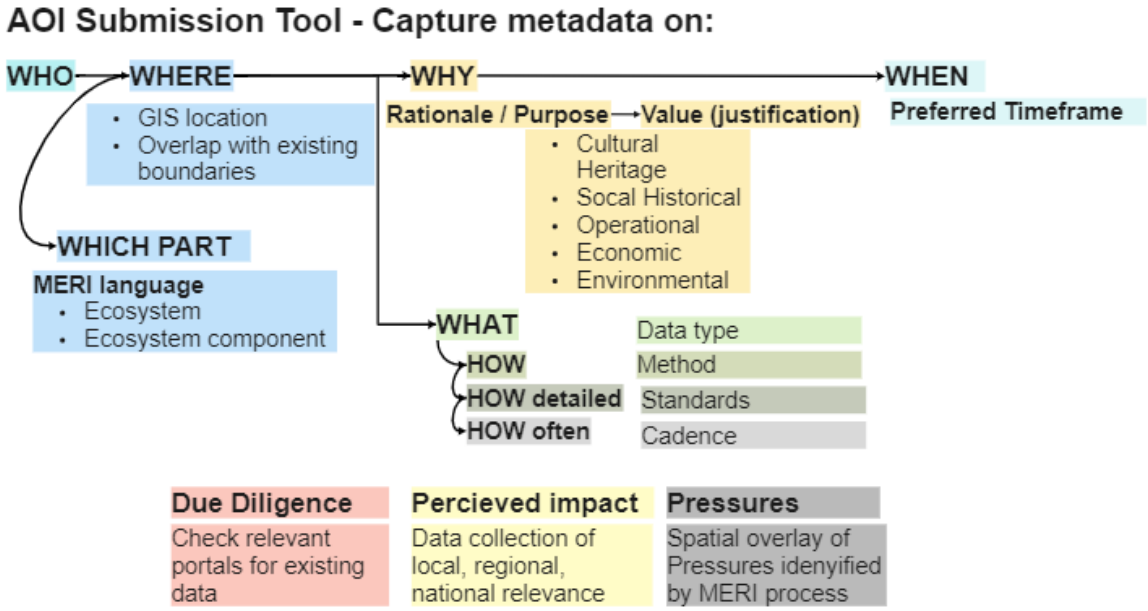


Figure 2 Schema of data metadata fields identified for capturing essential descriptions of area of Interest submissions schematic based on this outline was considered and developed on Miro board during the 1st workshop.

3.4.3 Key outcomes

The workshop refined the metadata conventions under the 'WHY' theme (Figure 2) to clearly capture the variety of reasons for data collection (PURPOSE) and the values of or justification for the purpose. These were grouped into broader activities that align with social, cultural, economic, and environmental/ecological values for an AOI, with the addition of operational to separate general shipping and safety purposes. Table 1 and Table 2 show the final terminology implemented in the Survey Coordination Tool to capture AOI submissions.

It was also agreed in the workshop that adopting the vocabularies and naming conventions for ecosystems, values and pressures associated with Parks Australia's Australian Marine Parks common language would better align the complimentary approaches to high value areas for monitoring (in the case of the Management Effectiveness system) and seabed surveys (in the case of the NAI tool and framework).

Following the workshop, an additional session was held with First Nations representatives to refine and expand on metadata that describes broad sea country needs and to ensure that terminology was appropriate and respectful.

Table 1 The terminology to capture the **PURPOSE** of an AOI submission under broad themes agreed on during the 1st workshop and for subsequent out of session engagement with Traditional Owners for the Cultural heritage section.

Cultural Heritage	
Tangible	Preservation of cultural sites
	Management of traditional resources
	Protection of totems
	Preservation of language
Intangible	Conduction ceremony
	Preservation of Songlines/creation stories
	Preservation of Language
Social Historical	known/likely
Managing historical heritage	Archaeology
	Wrecks
Enabling recreation	
Operational	prospective/existing
Charting / shipping	Ship routing
	Port approaches
	Anchoring management
Defence	
Natural disaster management	
Anthropogenic disaster management	
Georegulation (boundaries / boarders)	
Economic	prospective/existing
Extractive	Fisheries
	Oil & gas
	Seabed mining / Bioprospecting / biodiscovery
	Dredging
Infrastructure (includes wind, oil, gas, tidal, etc)	Decommissioning
	Disposal
	Tourism
	Coastal / urban development
	Environmental economic accounting
Environmental	sci. knowledge/intervention
Characterisation / inventory	e.g. AMP inventory, env. Assessment for regulatory purpose
Fundamental research	
Monitoring	
Restoration	
Rehabilitation	

Table 2 The terminology to capture the **VALUES** associated with the **PURPOSE** of an AOI submission agreed on during the 1st workshop and for subsequent out of session engagement with Traditional Owners for the Cultural heritage section.

Cultural Heritage
Access to traditional resource areas
Maintaining and protect culture
Cultural wellbeing
Connection to culture / Country
Cultural awareness
Intergenerational transfer of knowledge
Responsibility to Country / cultural obligation
Practice and continuation of Language
Education
Outstanding universal value
Social Historical
Effective management of heritage sites
Memorial value
Increase awareness and understanding heritage
Identify new recreational assets
Increase personal satisfaction
Operational
Decrease operational risk
Reduce cost
Increase human safety
Inform infrastructure planning
Increased economic efficiency/tonnage
Freedom of manoeuvre
Pollution mitigation
Wildlife interaction mitigation
Economic
Increase productivity
Decrease risk
Create jobs
Generate investment
Sustainable infrastructure
Environmental offsets
Environmental
Knowledge gap / discovery
Foraging / Nesting grounds TEPs
Status/trends or TEPS/ecosystem
Ecosystem function
New management areas

The terminology for data capture of Questions 1, 2, 4 and 5 are shown in the screen captures from the re-designed area submission tool shown in Appendix B (Appendix Figure 1 to

Figure 8). During Workshop 1 participants were asked to gauge their interest in seeing other organisation areas of interest, with 28 of the 29 responses expressing a desire to see others submitted areas while the remaining respondent replied that they were unsure. Participants we also asked to rank their perceived importance of the various purposes and values (Figure 3, Figure 4). Using the environmental purpose as an example, a clear bias toward purposes that target Inventory Characterisation and Environmental Baseline was recorded, relative to surveys for the purpose of Ecosystems Services and Environmental Intervention (Figure 3). Importantly, the responses also highlighted mixed priorities between participants with both the environmental purposes and values showing a mixture of rankings. Similar variation was found across the other purposes and values (available on request).

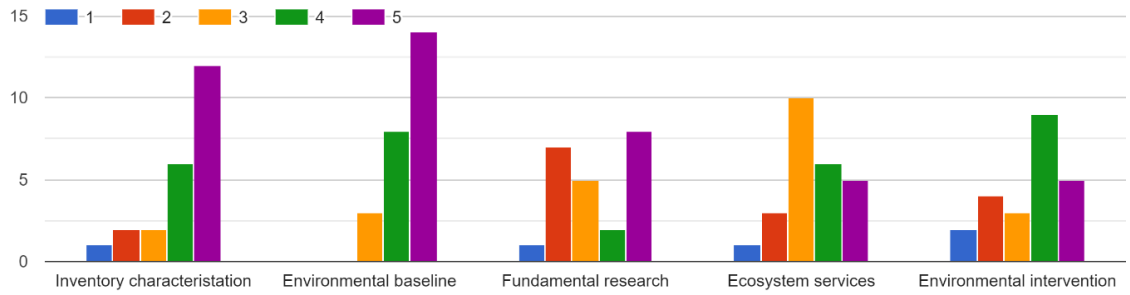


Figure 3. An example of variation in the perceived importance of “environmental purposes” to workshop participants, plotted by number of responses. 1 (blue) – denotes lowest priority, 5 (purple) – denotes highest priority.

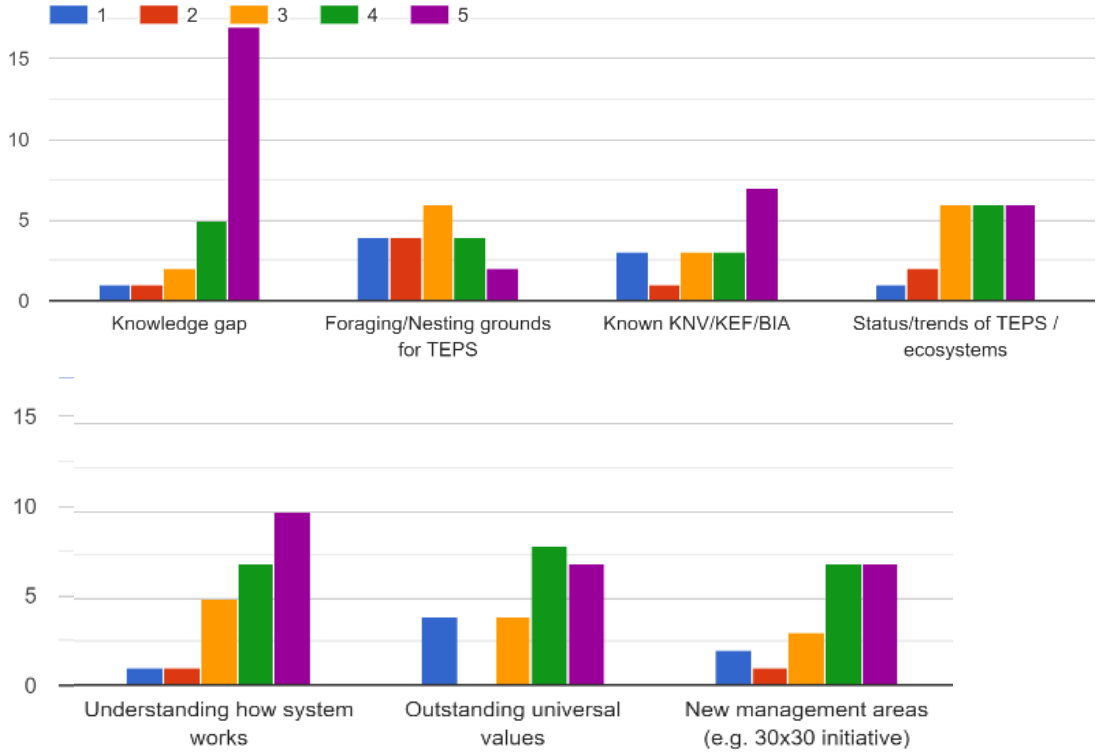


Figure 4. An example of variation in the perceived importance of “environmental values” associated with “environmental purposes” to workshop participants, plotted by number of responses. 1 (blue) – denotes lowest priority, 5 (purple) – denotes highest priority.

3.5 Survey Coordination Tool

Development of the Survey Coordination Tool to incorporate the metadata capture identified during the workshop was critical to the submission of Areas of Interest for developing prioritisation methods. Outputs from Workshop 1 were used to develop software design requirements and specifications (available on request) for the Survey Coordination Tool re-development. During development, extensive testing was undertaken by the project partners to ensure the tool functioned as expected and was user friendly (the code repository is open-source and can be accessed here). Version 2 of the tool, with the updated AOI functionality was launched on the 2nd of March 2022. With the launch of the tool, the Web Map Service and Web Feature Services that the tool creates were also brought online. These services allow users to create an API to the live data that is published by the tool, the WFS server also supports gml and zipped shapefile download and filtering.

As part of Workshop 1, Questions 3-8 (identified in the previous section) were captured as the **AOI Profile** with the agreed terminology bundled under 8 Tabs [Metadata Groups - MG] in the re-designed tool as shown in Figure 5.

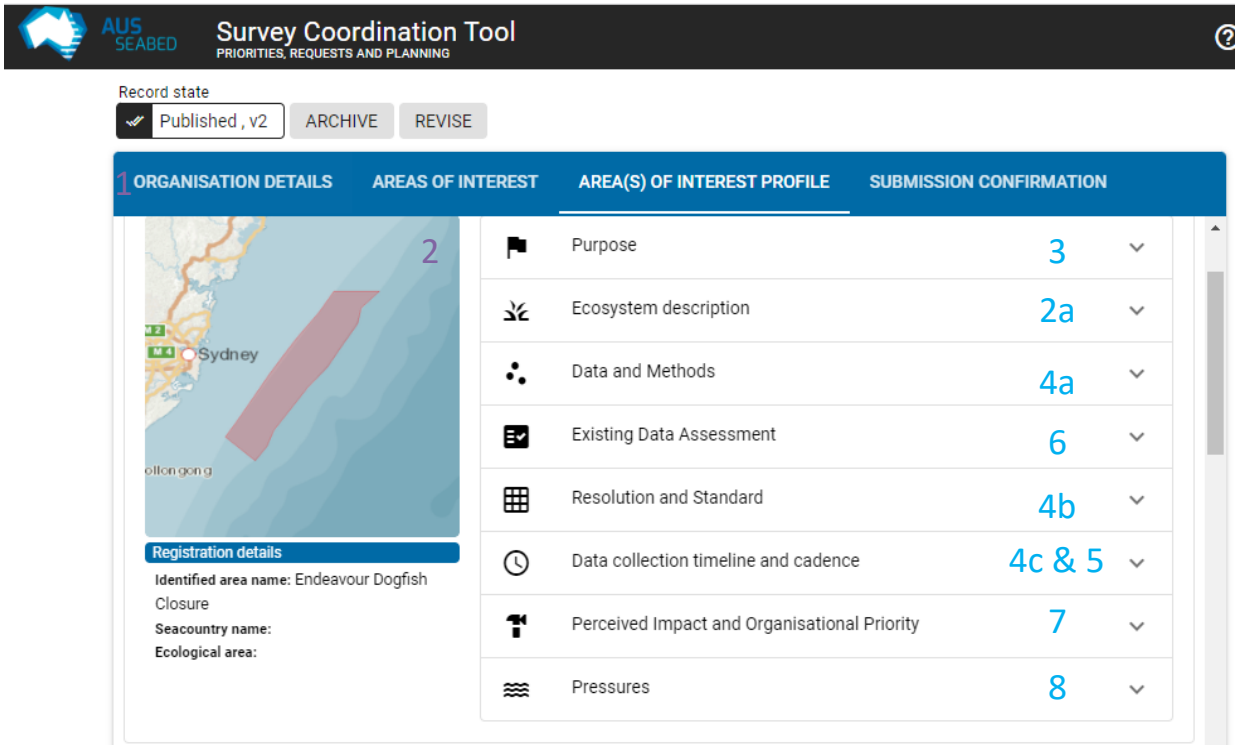


Figure 5 Screen capture of the AOI submission tool AOI Profile Tab showing the relation of each Metadata Group Tab to the question numbers above. Screen shots of each of the Metadata Group Tabs showing the detailed data fields/terminology are shown in Appendix B (Figure 1-8).

3.6 AOI submissions

Once the re-designed tool was live, an engagement campaign was run to increase awareness of the AOI functionality of the Survey Coordination Tool as well as generate use registrations and facilitate submissions. An overview is provided in the following subsections.

3.6.1 Social media and newsletter outputs

A LinkedIn article and Twitter tweet were both published from Geoscience Australia accounts encouraging organisations and individuals to sign up and submit AOIs. The links to these posts were distributed to project co-contributors with instructions on liking and sharing to boost exposure. Cumulative impact of the posts can be summarised by looking at the impressions (the number of times a post appears in user feeds) and engagements (collective term for the number of interactions: likes, shares, comments, retweets, tags etc.). The LinkedIn article generated 2,518 impressions and 84 engagements while the tweet generated 6,552 impressions and 95 engagements. Segments were also published in the AusSeabed newsletter outlining project progress and opening the call for registrations and submissions. The AusSeabed newsletter is circulated to a managed list of over 500 individuals.

3.6.2 State-based engagement

A list of 390 target contacts from 103 different organisations (Table 3) was collated from project co-contributors' networks and the AusSeabed email distribution list. This list was segregated by state and sector and appropriate project co-contributors were delegated as state-based contacts to lead engagement:

- **Tim Ingleton (NSW DPIE)** – New South Wales.
- **Dan Ierodiaconou/Mary Young (Deakin Uni)** – Victoria.
- **Mark Doubell/Gretchen Grammar (SARDI)** – South Australia.
- **Franzis Althaus/Piers Dunstan (CSIRO) & Jacquomo Monk/Neville Barrett (UTAS)** – Tasmania.
- **Tim Langlois (UWA) / Ralph Talbot-Smith (WADoT)** -- Western Australia.
- **Claire Streten (AIMS)** – Queensland.
- **Claire Streten (AIMS)** – Northern Territory
- **Aero Leplastrier (GA)** – Australian Capital Territory/Commonwealth

Project Co-contributors were also provided with presentation materials and talking points for in-person engagement where opportunities arose. Each coordinator emailed their target group and was prompted to follow-up and engage as appropriate.

Table 3 Organisations from which individuals were contacted about registering to the Survey Coordination Tool and submitting Areas of Interest to represent their data needs

Contacted Organisations		
ACFR	Fugro	Pilbara Ports Authority
Acoustic imaging	GA	Precision Hydrographic Survey
AECOM	GBRMPA	QLD Department of Environment and Science
AFMA	GHD	Queensland University of Technology
AIMS	Guardian Geomatics	RBR-Global
Amentum Aerospace	Hydrobiology	Rottnest Island Authority
AMSA	Hydrographic Survey	Royal HaskoningDHV
ANU	INPEX Corporation	RPS Group
APPEA	iXblue	SANTOS
ARENA	James Cook University	Science into action
Atteris	Kongsberg	Seaskip
Australian Hydrographic Office	Macquarie University	SkadiNu
Australian Hydrographic Society	Marine Solutions	South Australia Department of Environment and Water
Australian National Maritime Museum	Maritime Safety Queensland, Department of Transport and Main Roads	Star of the South
Australian Antarctic Division	Meridian Subsea Consulting	State Growth
Baird & Associates	Mid-West Ports	Stegg Civil
BMT Global	MMA Offshore	Thermofisher Scientific
BOM	Monash	Unique Group
City of Newcastle	Mondo	University of Adelaide
CSIRO Data 61 & O&A	Mosaic Environmental	University of New South Wales
CSIRO MNF	Murdoch University	University of Queensland
Curtin University	Nautilus Environmental and Engineering	University of Sydney
DAWE	Neptune Marine Services	University of the Sunshine Coast
DAWE (Parks Australia, Underwater Cultural Heritage)	Newcastle University	University of Western Australia
Deakin University	NOPSEMA	University of Wollongong
Department of Environment and Natural Resources	NSW DPI	UTAS/IMAS
DISER	NSW DPIE	Veris
EcoCoast consulting	NSW Government Manly Hydraulic Laboratory	VIC DEWLP
EGS Survey	NSW Transport	WA Department of Biodiversity Conservation and Attractions
Elgin Associates	NT Fisheries	WA Department of Primary Industries and Regional Development
EOMAP	O2 Marine	WADoT
EPA	OneTemp	WAMSI
EVOCOAST	Parks Victoria	Westnet
Exodus Hydrographic	Pawsey	WWF
FRDC	Perth NRM	

3.6.3 AOI submission demonstrations

Online video demonstrations were held during March 2022 and given to 31 different people. These sessions covered user registration, navigation, submission and revision of AOIs to boost familiarity and new user

3.6.4 Survey Coordination Tool Areas of Interest submission outcomes

Since the launch of the new AOI functionality in the Survey Coordination tool on the 2nd of March 2022 we have seen:

- 134 new users have registered
- 85 new AOIs added since 2nd of March
- 101 AOIs resubmitted with updated metadata
- The number of submitting organisations increase from 10 to 21 (Figure 6)
- The number of different users submitting areas of interest increase from 15 to 32.

Figure 6 shows a snapshot of the AOI submissions by submitting organisation as per June 2022. These submissions include legacy AOIs (dating to 2018/19) with limited metadata and new submissions with updated metadata standards developed for this project. Engagement with the tool is set to continue as part of the AusSeabed program, so these numbers are expected to continue increasing alongside community awareness. The AOIs can be viewed and interacted with as a layer on the AusSeabed Data Portal. The data set can also be downloaded as a standalone shapefile on the AusSeabed portal by going to Layers > AusSeabed Coordination > Areas of Interest > About then at the bottom of the abstract there is a download button that gives users a range of options for packaging the data. This data layer is fed live from the Survey Coordination Tool so changes to the public portal and downloadable layer are updated almost immediately after submission.

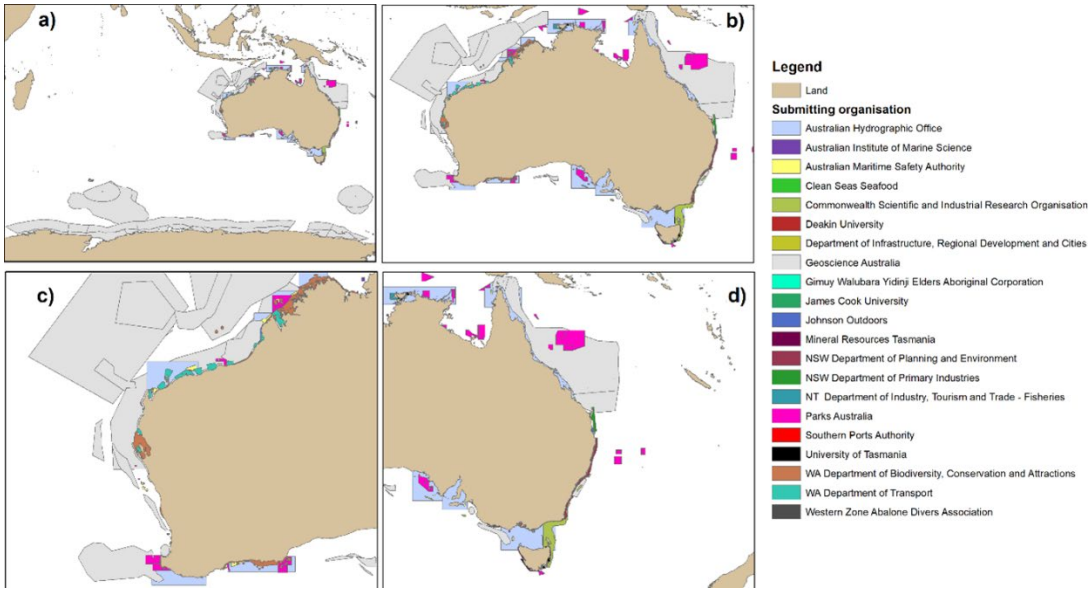


Figure 6. Distribution of areas of interest submitted by the 21 organisations. a) overall coverage and zooms for b) mainland Australia, c) west coast and d) east coast. Note – Parks Australia AOIs are legacy submissions from 2018 and will be updated as new information is provided following the conclusion of their current science prioritisation process.

3.7 Prototype prioritisation framework

3.7.1 Framework development

Assigning priorities to AOIs in the tool was set up as a three-step process, utilising the metadata provided for each AOI submission:

1. Priority from Priority profile based on data and science information in AOI profile under: Purpose, Data types & methods, Ecosystem, Management boundaries, Pressures, and Existing data

2. Priority from other factors – Perceived priority, Time scales, Logistics

3. Others AOI – Considerations include:

    - Closeness to own AOI – Neighbouring, Intersecting

    - Priority profile based on data and science information (possibly using different profile to own, depending on who submitted it, etc.)

Each of these steps is expanded on below.

1. Priority from Priority profile

A decision framework was set up on how to establish a prioritisation profile for an organisation (current prioritisation purpose) based on the information captured in the AOI submission tool. The priority profile is created by selecting and ranking the metadata-terms captured under 6 of the Metadata Groups (MG): Purpose, Data types & methods,

Ecosystem, Management boundaries, Pressures, and Existing data (Figure 7). The ranks are normalised to a rank between 0 and 1 by the size of the data selection in each MG. These are then normalised across all selected MGs (here differential weighting can be applied to the MGs) into a single combined priority rank between 0 and 1 for the AOI (Figure 8).

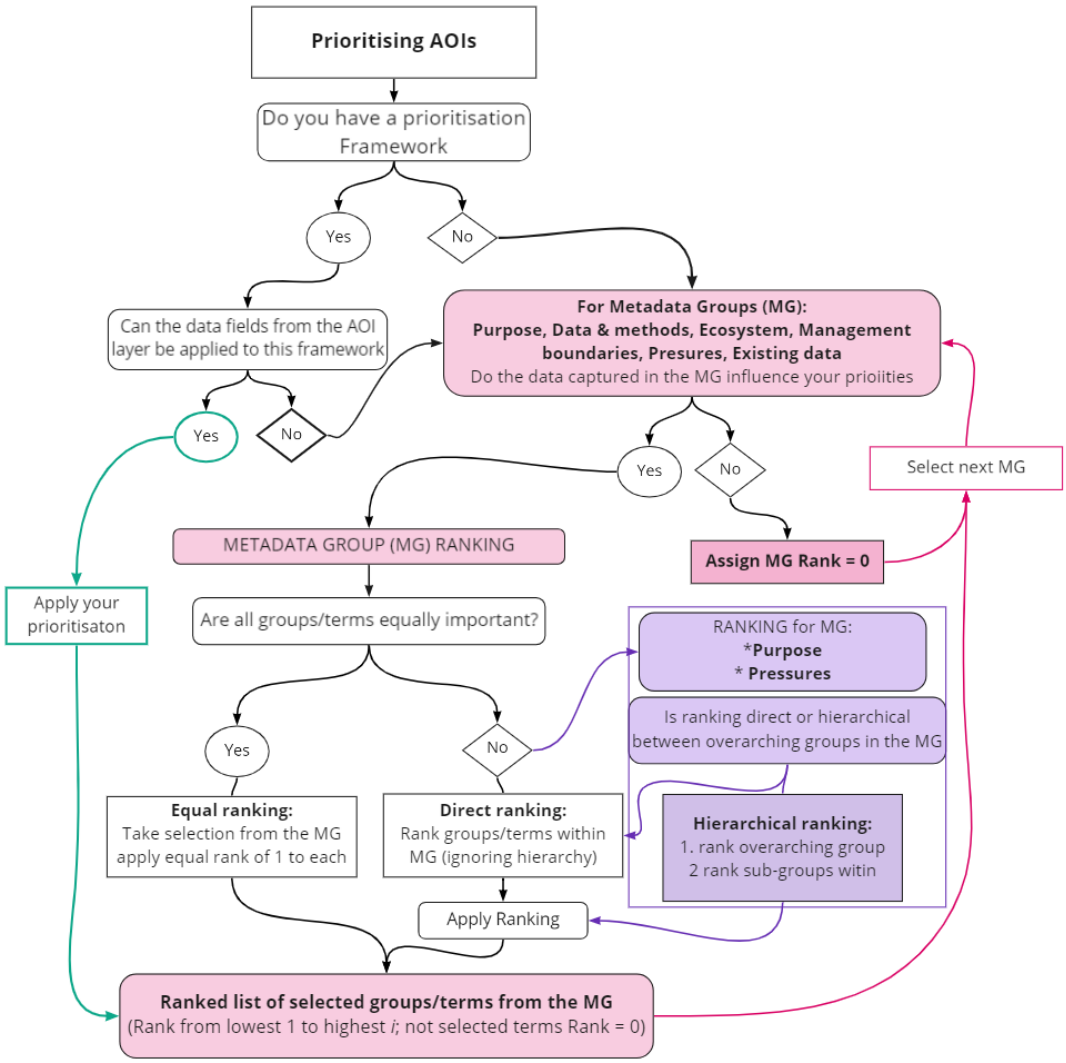


Figure 7 Decision framework to establish a priority profile for ranking metadata fields.

Once the profile is established a normalised numerical priority rank can be calculated for each AOI, according to the data supplied in the AOI submission (Figure 10). AOIs can then be consistently ranked and compared based on their data and science information.

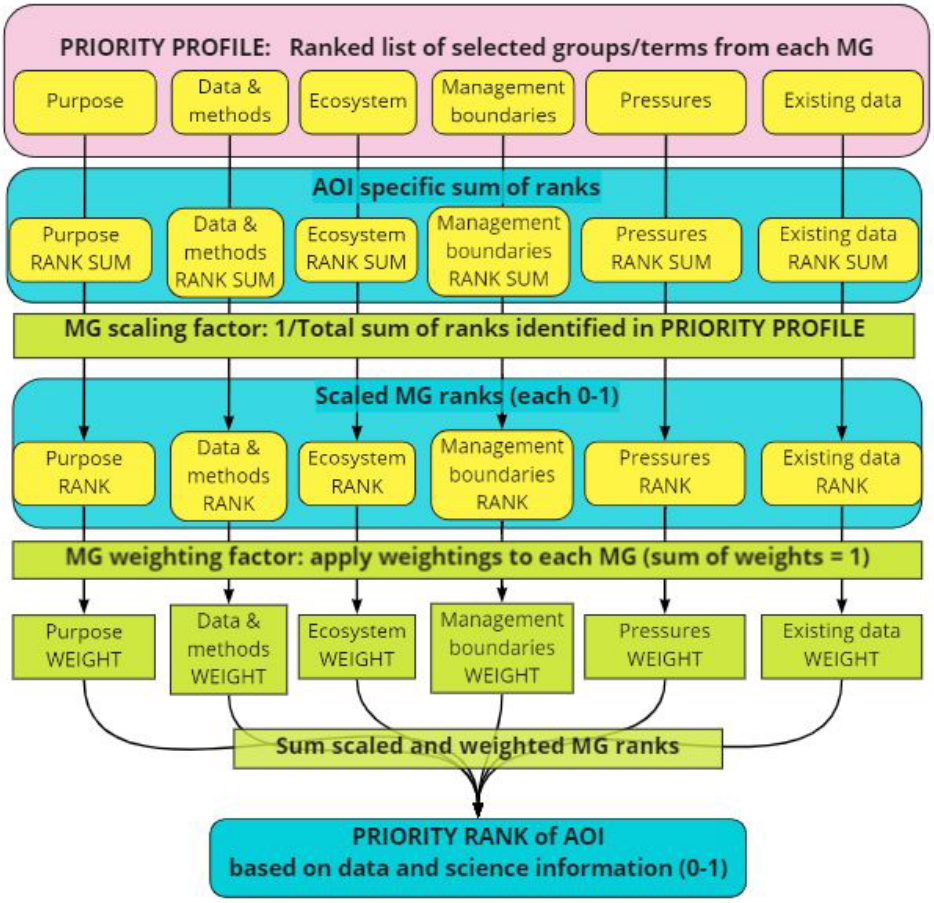


Figure 8 Using the priority profile to assign an overall priority rank to an AOI based on data and science information in AOI profile. (MG = Metadata Group).

2. Priority from other factors

Two Metadata Groups (perceived impact and timeline) and a remoteness / logistics factor were identified for assigning a second priority rank that is not directly related to the science underpinning AOI submissions. Both Metadata Groups are submitted as a rank in the submission tool, that can be assigned numbers 0 (=NA) to 3 for calculating a scaled priority. The remoteness/ logistic factor is calculated in GIS based on distance of the AOI from a suitable port. Ranking is assigned according to Table 4.

Table 4 Ranking for remoteness/ logistic factor [higher rank = higher priority]

Remoteness ranking key	Distance from suitable port	Rank
Coastal survey	<50 km	4
Minor survey	50-100 km	3
Major survey	100-1000 km	2
Remote area survey	>1000 km	1

This second priority rank can be combined with the first or used separately as ‘additional information’ when comparing AOIs.

3. **Consideration of others' AOIs**

There are various reasons for considering AOIs submitted by others. It may be to identify regions of high, wide-ranging interest, overlapping or complementary interests with collaboration potential, or potential of conflicting interests.

It may be sufficient to be aware of the number and variety of AOIs in the vicinity of your own AOIs. This can be identified using GIS spatial tools that identify intersecting or neighbouring AOIs (for the latter a buffer of inclusion around your AOIs can be chosen). Once identified, others' AOIs can be prioritised using the tools described above. Separate priority profiles may also be used, depending on the focus applied to intersecting/ neighbouring AOIs.

The information of the number and priority ranking of intersecting/ neighbouring AOIs adds a third, objectively defined layer to the comparison between AOIs.

3.7.2 Workshop 2: Prototype Prioritisation

The second workshop was held on 15th of December 2021, with an attendance of 16 participants from 10 organisations. This workshop was deliberately smaller, focusing on project partners, co-contributors and a few key stakeholders that had a vested interest in prioritisation work (NESP, Parks Australia, AHO and CSIRO). The concept of the prioritisation decision framework to assign three levels of ranking to AOIs was socialised and discussed with the core stakeholders and project collaborators during Workshop 2. However, the details of the implementation are dependent on having a priority profile specific to the organisation's interests. Following the workshop, the team engaged with representatives from Parks Australia examining what a priority profile of Parks Australia might look like; but this process is anticipated to take a few iterations to identify a profile that yields a ranking that is expected for a set of the organisations' AOIs. For this to be achieved, all the AOIs need to be identified and described in the Survey Coordination Tool.

Once the profile is set up, it can be used to transparently and objectively compare AOIs, including considerations based on timelines, and level of interest for data in a region by other stakeholders.

4. Next Steps & Recommendations

This project has set the foundation for an improved understanding of data needs from different users and collectors of seabed mapping and biodiversity characterisation data across the government, private, academic and community sectors. Delivering an open-access service to ingest and publish AOI that depict the value of and purpose behind data needs will create opportunities for collaboration and increased efficiencies with marine surveys. We also hope to see an increase in the number of multidisciplinary studies due to better awareness of overlapping data needs across fields. In addition, the AOI layer has the potential to inform high-impact data collection and legacy data release from national collection and data management organisations when coupled with the preliminary prioritisation work.

4.3 Uptake and implementation

While initial uptake has been successful, there will be a need to continue monitoring and driving engagement to ensure awareness of the tool and capability using its functions spread through the marine science community. Geoscience Australia, through the AusSeabed program will continue engagement on this front, and the project and co-contributors of NESP project 1.2 will continue using the tool and spreading awareness among their networks. The WMS and WFS links have been provided to the CSIRO Marine National Facility (MNF) for integration to the MAPS voyage planning tool. Discussions have been had on the value of these services and how integration with the MNF MAPS tool could improve the quality of multidisciplinary surveys and increase awareness of national data needs that could in turn lead to targeted opportunistic data collection during transits and survey down-time. The NESP Marine and Coastal Hub has also indicated the intention to establish the registration of upcoming surveys and submission of areas of interest within the Survey Coordination Tool as components of NESP survey planning standard operating procedures.

Next steps:

- Publicise the tool and advocate its usage through AusSeabed platforms (ongoing)
- Ensure that AOI submissions are maintained and updated as needed by users (ongoing)
- Report on tool uptake and use annually through the annual AusSeabed Highlights report and utilise information to identify knowledge gaps and guide engagement (ongoing)
- Broaden the stakeholder base within Government to raise awareness of the tool and potentially capture additional areas that require seabed data (acknowledging that the ability to share information may have sensitivities)
- Present information captured by the AOI functionality at the AMSA conference in August 2022.
- Deliver a session on using the Survey Coordination Tool and AOI functionality as part of the AMSA AusSeabed workshop in August 2022.
- Work with CSIRO to facilitate the integration of AOI WFS service with the MAPS portal and encourage use of the tool as part of CSIRO MAPS application standard procedures.
- Work with NESP Marine and Coastal Hub partners to facilitate the incorporation of the Survey Coordination Tool Areas of Interest functionality and upcoming survey register in the NESP survey planning standard procedures.

4.4 Further improvement - Areas of Interest functionality

The responsibility for maintenance, and service uptime will reside with Geoscience Australia to ensure continuity of service. However, it is important to differentiate this from potential improvements and tool updates, of which Geoscience Australia will establish a watching brief to ensure that suggestions and appetite for improvement from key users (e.g. NESP, AHO, CSIRO) are recorded and considered in line with opportunities to fund further development.

Ongoing use and feedback since launch has provided a more nuanced understanding on the function and performance of the AOI functionality within the Survey Coordination Tool which in turn has allowed the team to identify additional opportunities for future technical improvements. These include:

- Add 'Protection' as an environmental purpose
- Enable Map widget resizing so that AOIs can be drawn at an appropriate scale
- Investigate the potential for managing sensitive AOI from organisations, or allowing user specified 'limited access' areas to the tool
- Update list of AOI submissions so that archived, draft and published submissions are differentiable by colour, or they are segmented
- Improve the handling (export) of the metadata database and shapefiles (attributes)
- Provide administration functionality that allows backend edits to user and organisation details and removal of inactive accounts
- Facilitate reporting through better administrative user lookup functionality
- Increase the size of the SCT instance to handle more complex geometry checks
- Add automated email notifications for when submissions approach their nominated data collection deadlines, or other submissions overlap a user's AOIs

4.5 Future Opportunities – extension and integration

The prototype prioritisation framework developed as part of this project has the potential to enable faster, more transparent and repeatable decision making when it comes to establishing survey, research and data release priorities. However, the application of this framework as a strategic planning and management toolbox is currently limited due to a moderately complex user driven excel spreadsheet workflow. An extension of this project could look at developing an automated multi-criteria analysis tool that integrates with the Survey Coordination Tool Areas of Interest functionality. This may be worth considering as a future endeavour if a strong business case can be built based on continued growth and uptake of the AOI service. This stream of work may also be feasible if one of the major organisations or research programs wants to realise the benefits of automation to meet their own business needs and is able to fund development. In the first instance, working through the prototype framework with Parks Australia's AOIs will be a good test for utility. This

outcome was not possible during the project due to dependencies beyond the project's control, but will be undertaken as soon as circumstances and resources allow. The application of the prioritisation framework to Parks Australia's AOIs will give an indication on whether further research and engagement should be pursued in extending the priority profiles (collected as part of the workshop 1 survey) to the prototype prioritisation framework with relevant stakeholders and give a better understanding on the appetite for a more advanced and semi-automated iteration.

Appendix A – Desktop Study

Appendix Table 1. List of relevant documents found during the desktop study to identify existing frameworks and processes for prioritisation

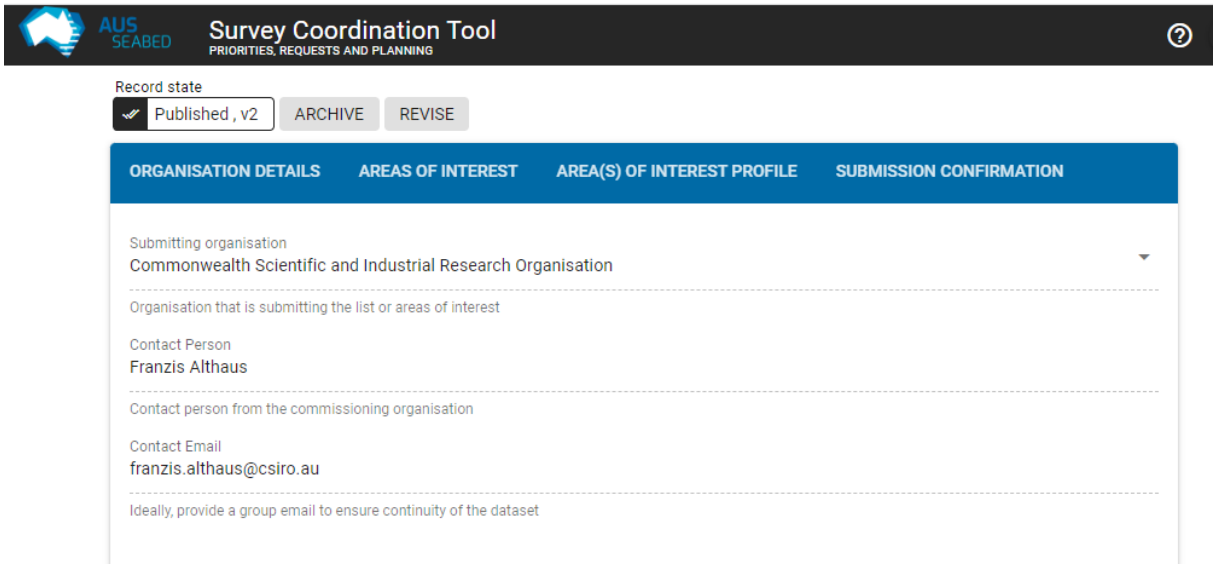
Description	Link
Marine planning framework of South Australia	https://cdn.environment.sa.gov.au/environment/docs/mp_framework.pdf
Integrated water management collaborative tool (Victoria DELWP)	http://mapshare.maps.vic.gov.au/gvh270hydra/
National marine science plan	https://www.marinescience.net.au/nationalmarinescienceplan/
Victoria marine spatial planning tool	https://www.marineandcoasts.vic.gov.au/coastal-programs/marine-and-coastal-knowledge-framework
Victorian Coastal Act	https://www.legislation.vic.gov.au/in-force/acts/marine-and-coastal-act-2018/003
Marine research priorities for New Zealand	https://www.sciencedirect.com/science/article/pii/S0308597X18309059?via%3Dihub
Marine Science plan (Western Australia)	https://wamsi.org.au/project/west-coast-metropolitan-science-plan/
Research agenda (AIMS)	https://www.aims.gov.au/docs/research/research.html
Great Barrier Reef	https://www.environment.gov.au/marine/gbr/publications/summary-report-cost-effectiveness-reef-trust
South Australia Fisheries	https://digital.library.adelaide.edu.au/dspace/handle/2440/116467
Tasmania Marine Atlas (Current FRDC funded project)	https://www.imas.utas.edu.au/__data/assets/pdf_file/0005/1295555/IMAS-Spatial-Assessment-Tool-Web.pdf
Marine Spatial Plan (Victoria)	https://www.marineandcoasts.vic.gov.au/marine/marine-spatial-planning
Coastal spatial planning (Western Australia)	https://www.wa.gov.au/organisation/department-of-planning-lands-and-heritage/coastal-planning-and-management
North Devon Marine Nature Capital Framework	https://www.researchgate.net/figure/NEA-FO-framework-applied-to-coastal-and-marine-ecosystem-services-from-Turner-et-al_fig4_333144626

Description	Link
Europe research prioritisation	https://prioritisation.eda.europa.eu/
Special issue in Frontiers in Marine Science on research prioritisation	frontiersin.org/research-topics/3604/ocean-research-priorities-and-prioritizing-ocean-research
Marine spatial planning (has GBR as an example)	https://www.oecd.org/greengrowth/GGSD_2017_Issue%20Paper_Marine%20Spatial%20Planning.pdf
Paper on the need and practice of monitoring, evaluating and adapting marine planning and management—lessons from the Great Barrier Reef	https://www.sciencedirect.com/science/article/pii/S0308597X08000717
Paper that has a good commentary on decision tools used in GBR	https://www.sprep.org/attachments/VirLib/Australia/aust-marine-zoning-revisited-spatial-planning-marine-ecosystem-based-management.pdf
Fact sheet on values from Vic Forests/DELWP	https://www.delwp.vic.gov.au/__data/assets/pdf_file/0023/415544/15-DSS-fact-sheet-FINAL.pdf
Thesis on spatial prioritisation	https://espace.library.uq.edu.au/data/UQ_6e4f05b/s4335866_final_thesis.pdf?Expires=1656310366&Key-Pair-Id=APKAJKNBJ4MJBJNC6NLQ&Signature=XVHb5ra4Znh-WWSytUgouZufQGPAhy~1XYlhNstnNO1HNDqji8kugvUeeHHj1yAIJJOhQeW2bxpvRBuUgq1JJAJX~1tK~YIItKMZ5Puvk0ogMo2Yue408~mSAKhxWqgXu41HnSBoZRcVaHpP3EmkfTDxmDTRdez3ge~Xte3mUW3Skvz4erFDxc9cIyt9r4j8FPi1rJ5P-UfjYjADOnO6-wMCOtmb6m6ViP2jPaTO9hdQZaJRG5BInqbfkSTrLsi4YIE762IUWM3-9wNdGU9HcdlRTrlAni0fl93kVX8wMNp8gi~AxNK4jUBds-E1mQK7HdMxFHvikBO6OcdYPuprdA__
Paper on perceived need and value of decision-support tools for joint mitigation of air pollution and climate change	https://online.ucpress.edu/elementa/article/doi/10.1525/elementa.126/112401/A-survey-on-the-perceived-need-and-value-of
Values for bushfire risk (nice ideas around values)	https://www.ffm.vic.gov.au/__data/assets/pdf_file/0012/413220/IFER-Fact-Sheet-SocioEco_Final.pdf

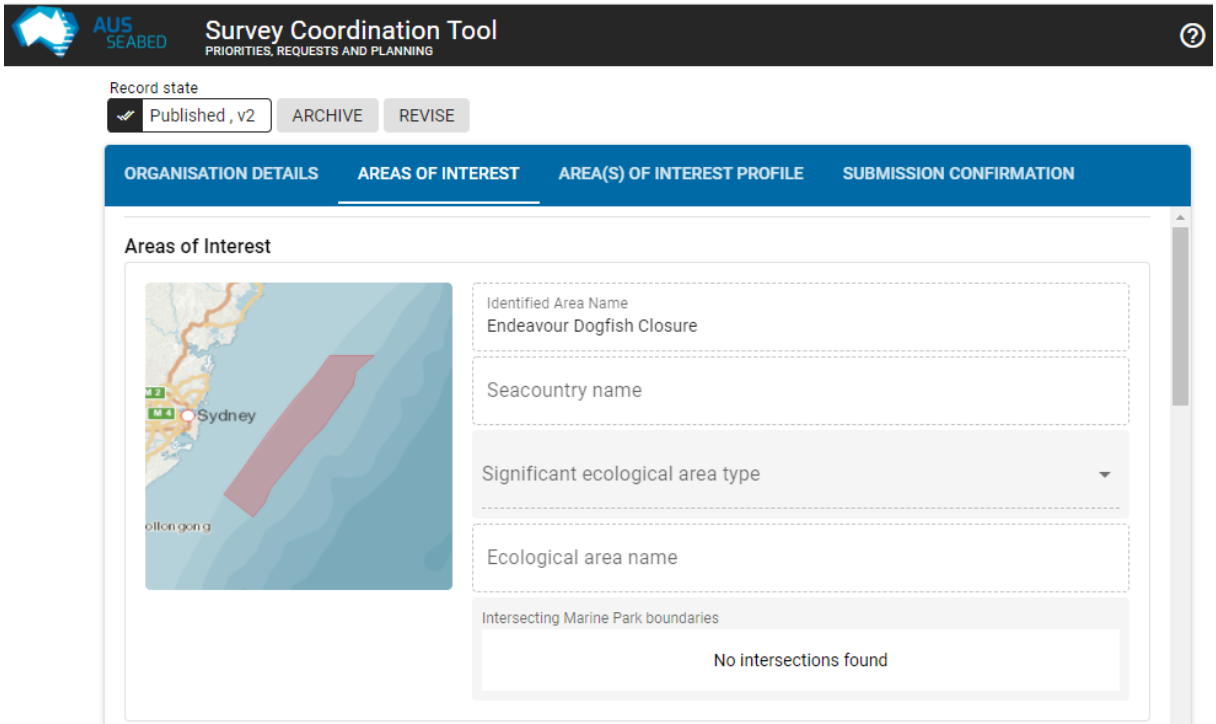
Description	Link
Seamap Australia (has assets and a pressures from SS2 and more) Also currently developing report cards for each park to summarise coverage of sampling	www.seamapaustralia.org
Systematic literature review and meta-analysis on how researchers and decision-makers include ecological processes in coastal and marine conservation planning.	https://link.springer.com/article/10.1007/s10452-021-09896-9
Comparison of social values of MPAs USA vs Australia	https://doi.org/10.1016/j.ecoser.2019.100919
NESP MBH report on decision support tools	https://www.nespmarine.edu.au/document/review-decision-support-tools-and-their-potential-application-management-australian-marine
Meta-analysis example on collaborative research prioritisation	http://dx.doi.org/10.1098/rspb.2020.0012
Prioritisation for remote marine regions - biodiversity and development trade off	https://www.nature.com/articles/srep32029
Valuing biodiversity in management	http://dx.doi.org/10.1016/j.ecolind.2015.02.034
National conservation values atlas (DAWE)	http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf
Biodiversity values map (NSW)	https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/about-the-biodiversity-offsets-scheme/when-does-bos-apply/biodiversity-values-map
Mapping conservation values (has nice figure in it)	https://eco-intelligent.com/2019/06/25/high-conservation-value-areas-all-you-need-to-know/
FRDC RD plan 2020-2025	http://rdplan.frdc.com.au/ Includes a system map: http://frdc.com.au/map-fishing-and-aquaculture

Description	Link
Conservation Action Plans (Parks Victoria)	https://www.parks.vic.gov.au/get-into-nature/conservation-and-science/conserving-our-parks/conservation-action-plans
EPA - EPBC strategic assessment: terminology - adverse impacts; flow-diagram: adaptive management	A Guide To Undertaking Strategic Assessments (environment.gov.au)
EPA - EPBC strategic assessment (approval)	Environment assessment and approval process under the EPBC Act
EPA - EPBC assessment - federal and states	Environment Assessments: How State and Federal Governments work together | Department of Agriculture, Water and the Environment
UK - Mapping European Seabed Habitats project (MESH) confidence scores: assign confidence scores to existing data (habitat mapping)	https://webarchive.nationalarchives.gov.uk/ukgwa/20101014083419/http:/www.searchmesh.net/Default.aspx?page=1635
UK - graphic and terminology 'Ecosystem service classification' (fig 4.5) - divided into supporting, provisioning, regulating and cultural	http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=IJEp3mJSVBw%3d&tabid=82
Oil and Gas- NOPSEMA: Marine Seismic surveys	Marine seismic surveys | NOPSEMA
Marine Spatial Planning review	https://www.frontiersin.org/articles/10.3389/fmars.2021.713980/full
Tsunami risk framework	https://knowledge.aidr.org.au/media/5640/tsunami-planning-guidelines.pdf
Interactive tool for considering areas - with data overlays	https://www.seasketch.org/projects/

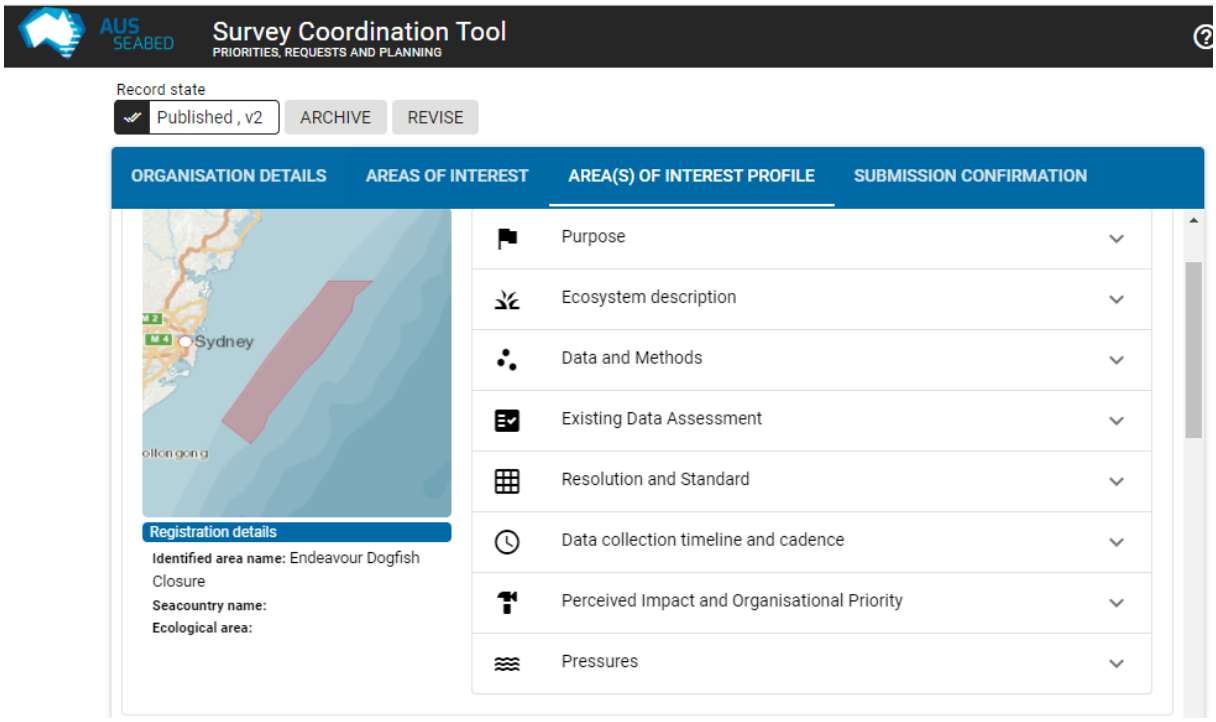
Appendix B Meta-data fields and standard terminology



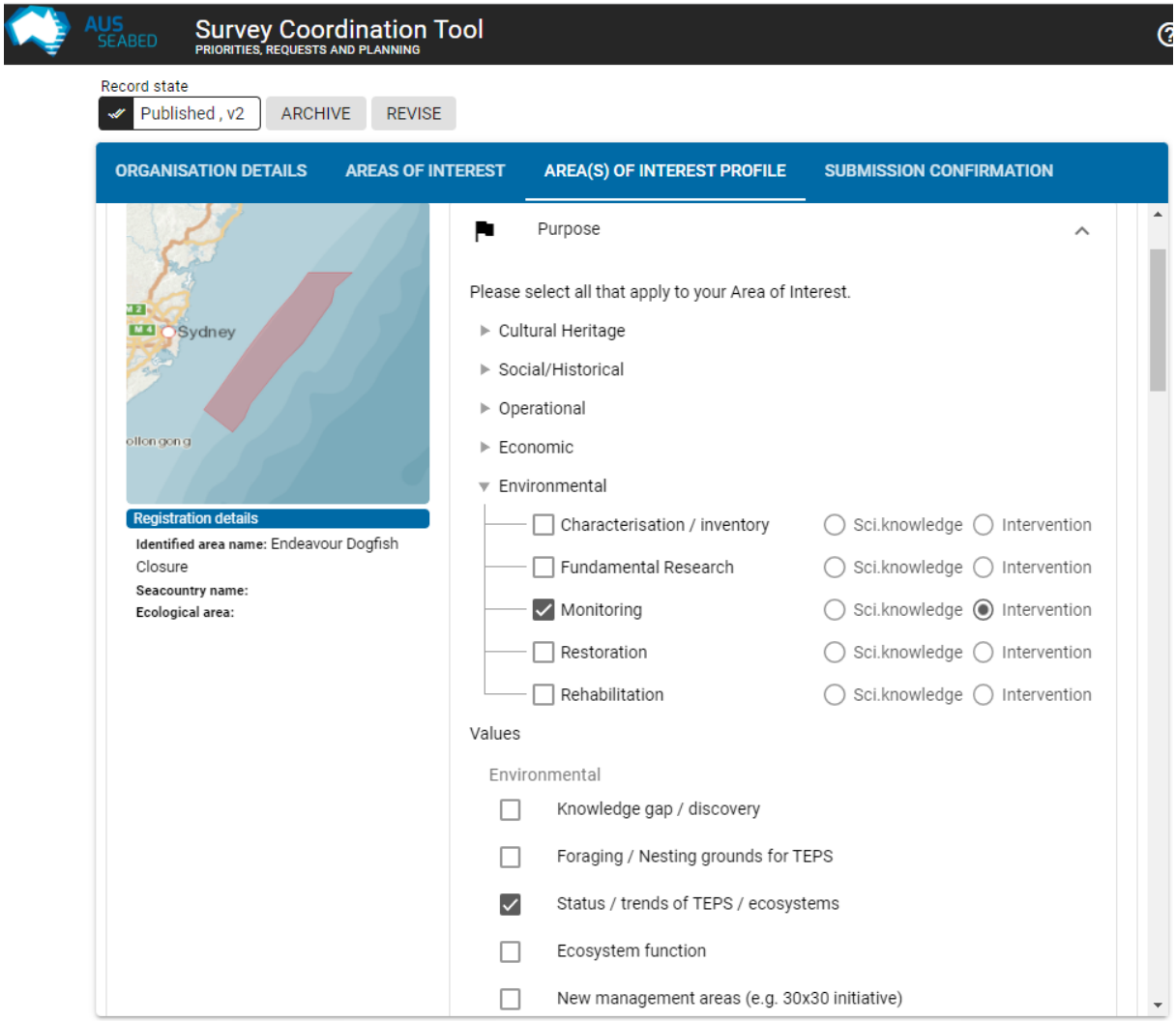
Appendix Figure 1 Areas of interest Capture Tool — Organisation Details: who is submitting the Area



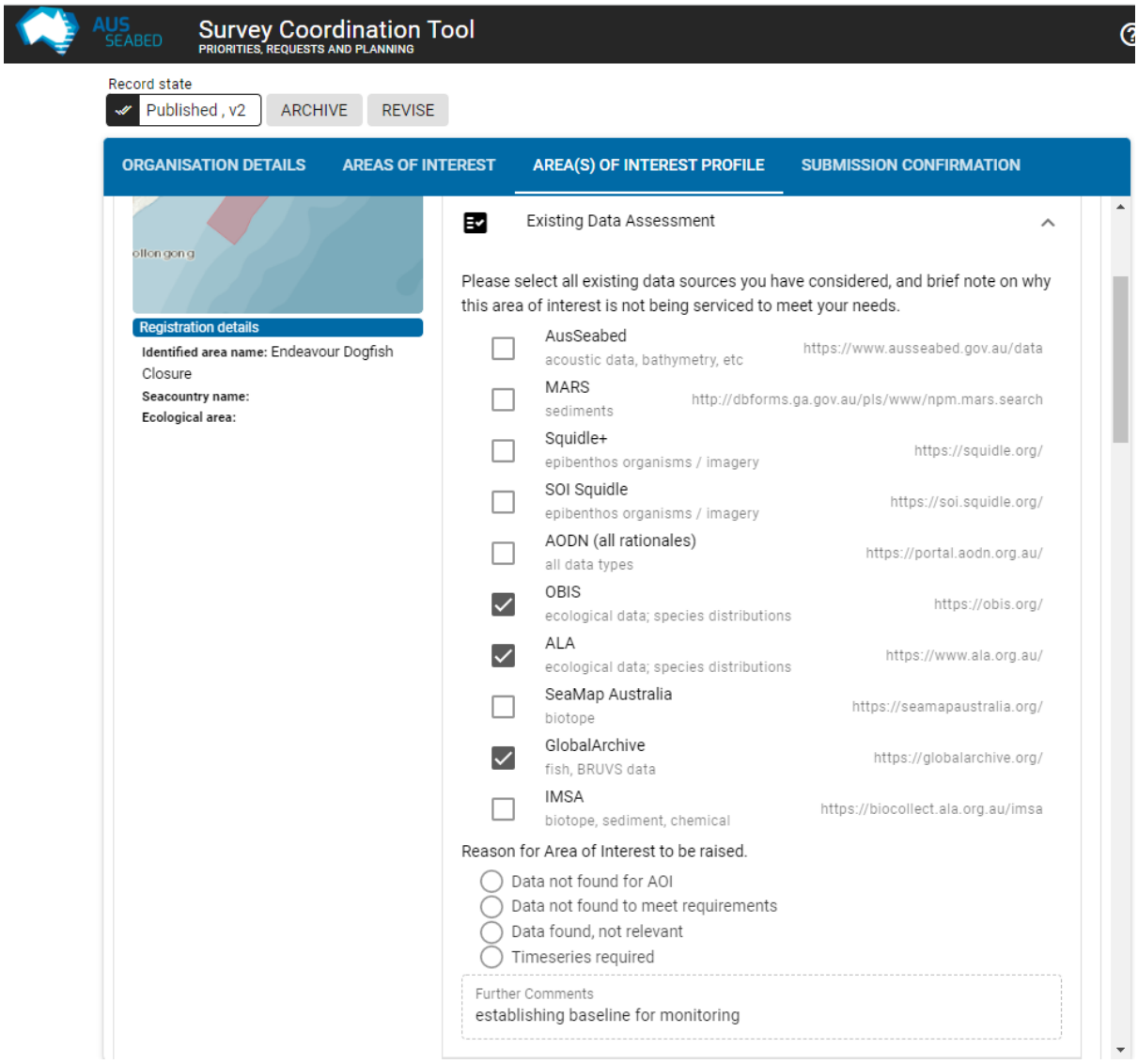
Appendix Figure 2 Areas of interest Capture Tool — Area details: capturing the mapping coordinates, name and overlap with existing management zones or identified areas of significance.



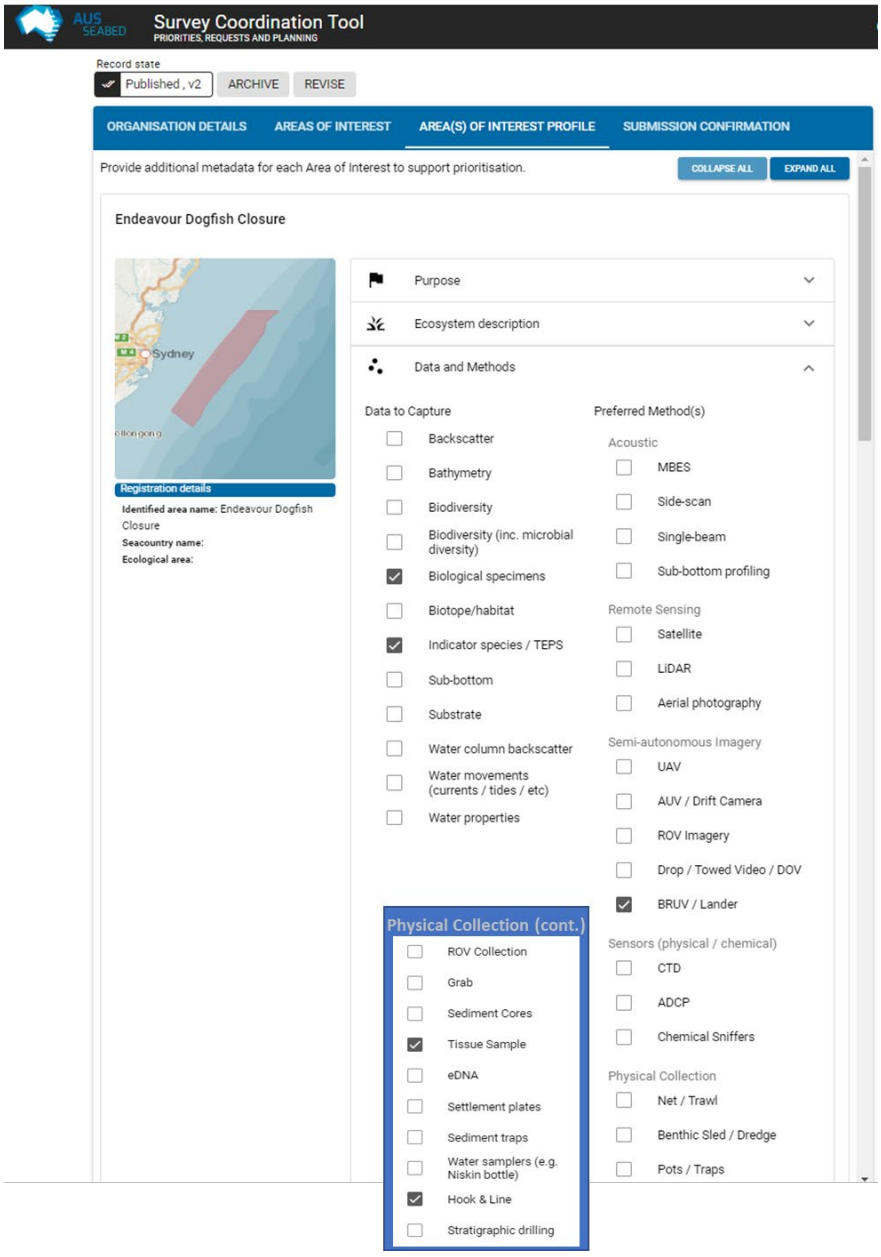
Appendix Figure 3 Areas of interest Capture Tool — Profile Tab: This tab captures details regarding the area submission. For expanded views of the Tabs see Figures below



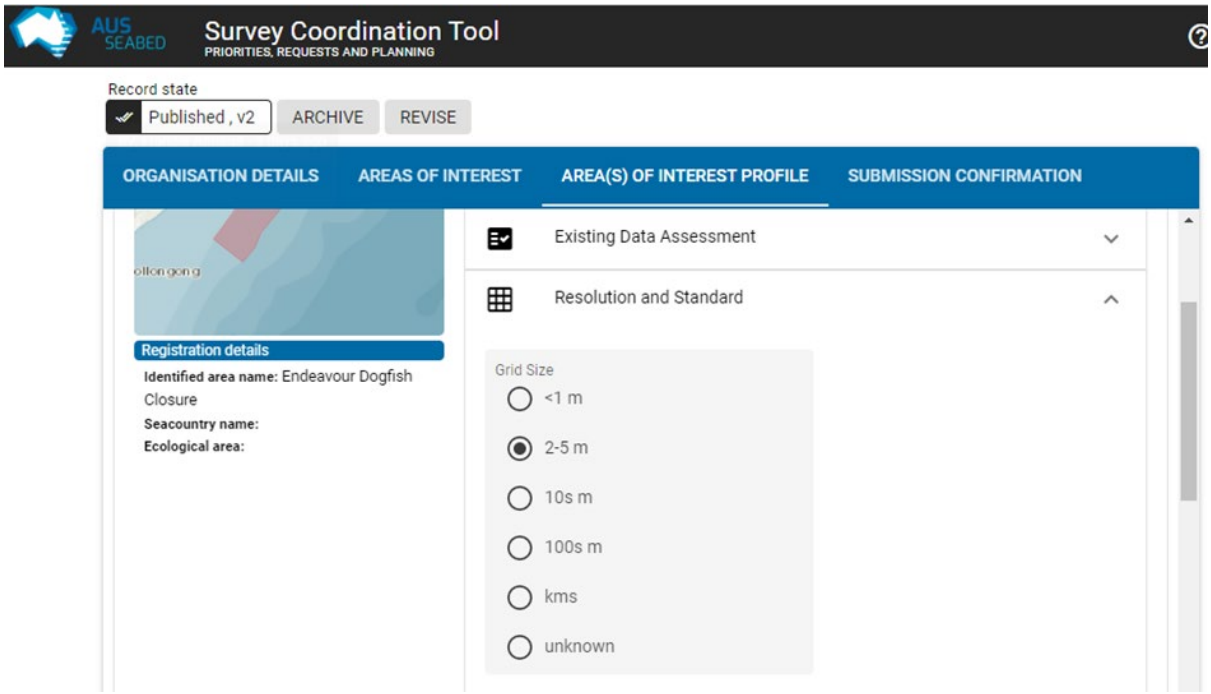
Appendix Figure 4 Areas of interest Capture Tool: MG - Purpose and Values: Environmental. Note the data fields and terminology for this tab are shown in Table 1 and Table 2.



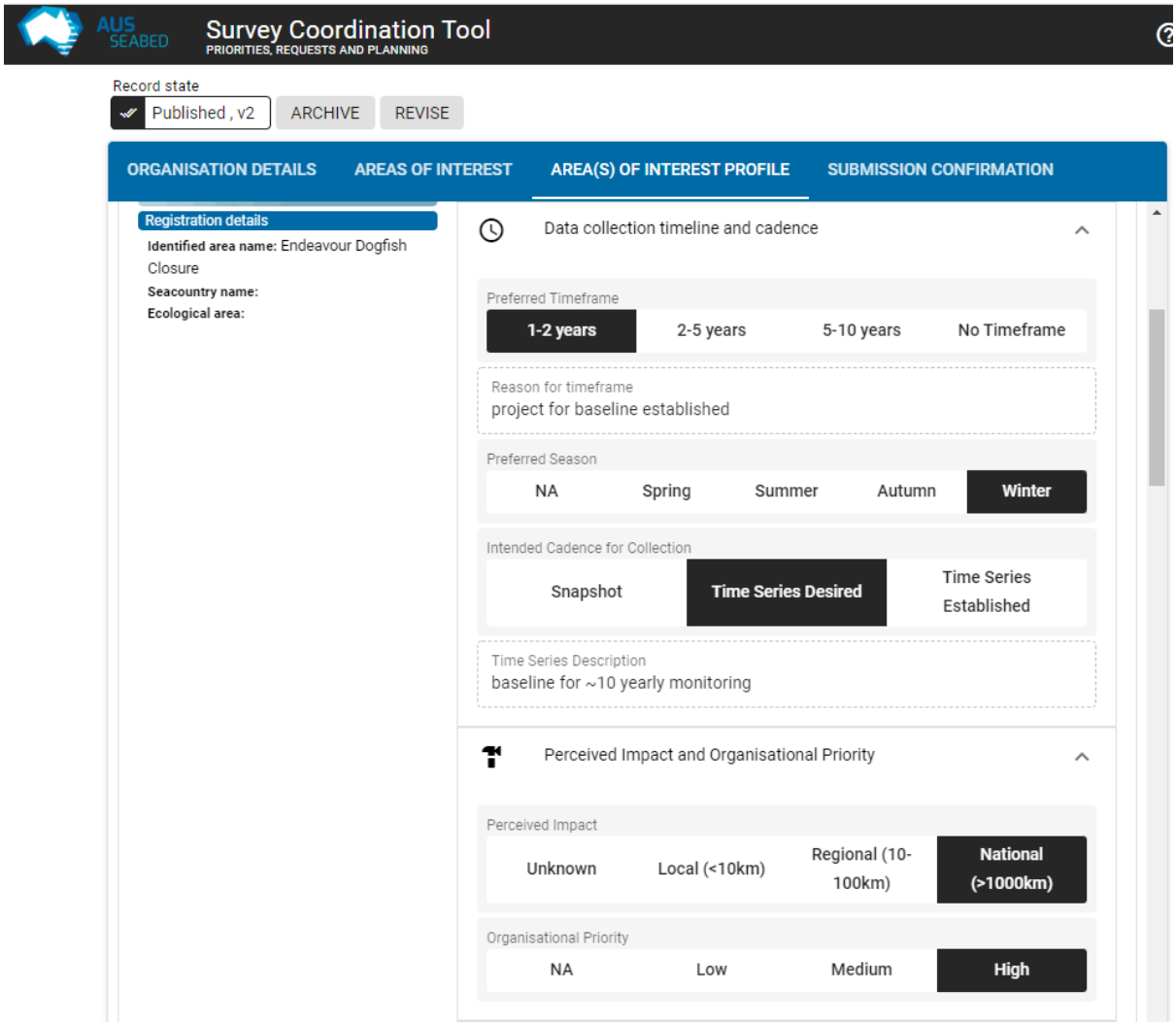
Appendix Figure 5 Areas of interest Capture Tool: - Existing Data Assessment Tab



Appendix Figure 6 Areas of interest Capture Tool: MG - Data and Methods



Appendix Figure 7 Areas of interest Capture Tool: MG - Resolution and Standard



Appendix Figure 8 Areas of interest Capture Tool: MG - Data collection Timeline and Cadence and MG - Perceived Impact and Organisational Priority

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