

Data management strategy

National Environmental Science Program
Marine and Coastal Hub



© University of Tasmania and Reef and Rainforest Research Centre, 2021

Unless otherwise noted, Copyright (and any other intellectual property rights) in this publication is owned by the University of Tasmania and the Reef and Rainforest Research Centre.

Creative Commons licence

All material in this publication is licensed under a [Creative Commons Attribution 4.0 International Licence](https://creativecommons.org/licenses/by/4.0/) except content supplied by third parties, logos and Commonwealth Coat of Arms.

Inquiries about the licence and any use of this document should be emailed to enquires@nespmarine.edu.au or enquires@rrrc.org.au



Cataloguing data

This publication (and any material sourced from it) should be attributed as: Data management Strategy, National Environmental Science Program, Marine and Coastal Hub (2021).

This publication is available at www.nespmarinecoastal.edu.au

The NESP Marine and Coastal Hub advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, the NESP Marine and Coastal Hub (including its host organisation, employees, partners and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Contents

Acknowledgement of Country	1
Approvals	Error! Bookmark not defined.
Background	2
Strategy aims	6
Data and information management approach	7
Hub roles and responsibilities	9
Types of research products and data	12
Ownership and intellectual property rights	13
Data licencing	15
Data management and storage	16
Exceptions to the open data policy	19
Accessibility	20
Acknowledgment of NESP	21
Project-level data management	22
Budget and risks	25
Key contact information	Error! Bookmark not defined.
Related materials	Error! Bookmark not defined.

Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and their continuing connection to land, sea and community.

We pay our respects to them and their cultures and to their elders past, present and emerging.

Our Indigenous research partnerships are a valued and respected component of National Environmental Science Program (NESP) research.

Background

The National Environmental Science Program (NESP) is a long-term commitment by the Australian Government to environment and climate research. The program is committed to promoting open access to public sector and publicly funded information, including optimising the use and reuse of data. Hence, open access to government-funded information is the default position with exception only for sensitivity reasons. The program works collaboratively with the private and research sectors to extend the value of public data for the benefit of the Australian public.

Open data follows the FAIR principles of being findable, accessible, interoperable and reusable under licences that allow reuse. When working with Indigenous data these guidelines require the complementary use of the Global Indigenous Data Alliance's CARE principles for Indigenous data governance of collective benefit, authority to control, responsibility and ethics. This will increase the capacity of the program to support a more collaborative, informed approach to managing Australia's environment.

In accordance with the funding agreement, the Marine and Coastal Hub is required to create a data management strategy that is compliant with the *NESP Data and information guidelines*. Application of this Strategy enables the Hub to take a systematic and standards-based approach to identifying, cataloguing, packaging, and presenting its research outputs to stakeholders and the public.

The Strategy is supported by resources and infrastructure, such as:

- Hub Data Wranglers, who have a role to work with the Hub researchers, the Department and other stakeholders, to translate data and information into relevant outputs that align with these guidelines.
- allocation of resources to support data management, from the initial data capture through to ongoing delivery and curation.
- information technology infrastructure: hardware, software and other facilities that underpin data-related activities.
- support services: resources allocated to support implementation of metadata management so that data records can be used for both internal and external purposes.

For the NESP Marine and Coastal Hub, marine science data management is heavily influenced by several existing programs and platforms, including the Australian Ocean Data Network (AODN) and the National Marine Science Plan (NMSP). The AODN, originally established as a partnership between Commonwealth agencies, now includes a broad representation across the Government and University sectors. Organisationally, the AODN is also the data management facility of the Integrated Marine Observing System (IMOS). Both the partnership and facility provide data management standards, infrastructure and guidance for the Australian marine science community through the evolution of the Australian Marine Data Landscape. The IMOS AODN facility is also the centralised aggregation point for all Australian marine science datasets described by metadata.

The NESP Marine and Coastal Hub, through its origins in the previous NESP Marine Biodiversity and Tropical Water Quality Hubs, brings a broad and knowledgeable data management team to establish and build on existing principles, strategies, guidelines and infrastructure for both the Hub and as a key participant in the broader marine science community. Additional resources from the AODN brings standards, infrastructure knowledge and economies of scale.

Marine and Coastal Hub

Australia is responsible for managing and protecting the third largest marine estate in the world. Our oceans provide tremendous environmental, cultural, social and economic benefits. These are subject

to cumulative pressures including coastal development, unsustainable natural resource extraction, climate variability and change, and marine plastics and pollution.

The Marine and Coastal Hub will deliver high quality research that improves environmental, cultural, social, and economic outcomes for marine and coastal Australia. We deliver applied scientific knowledge and methods to support decision-making and practical management relating to Australia's national and international laws and obligations in this arena. Our approach is stakeholder-driven, co-designed, and highly collaborative, building on 15 years of achievement in previous national funding programs.

Vision

The Marine and Coastal Hub will build on the experience of its partners to deliver a national marine research program to ensure:

- Australia's coastal and marine assets are managed and conserved such that Australians derive maximum social, cultural and economic benefit; and leading coastal communities and industries to view effective marine and coastal management and the relationship with their catchments as a positive pathway to sustained economic growth and recovery.
- The environmental information and solutions requested by the Australian Government and the community are delivered by a responsive, flexible and highly skilled national coastal and marine research capability that is transdisciplinary, solution-focused, respectful of tradition and local knowledge and capable of equipping the nation to better respond to challenge and change.

Research themes

Informing Policy and Decision Making

This overarching research will develop methods for assessing the cumulative impacts of activities in the marine environment, enabling decision-makers to balance development and protection in the context of climate change. It will draw together information generated by the other five hub themes, on environmental values and processes and cultural sensitivities. Complementary research may develop tools for deriving benefit from environmental offsets, and methodologies for evaluating the economic, social and cultural value of ecosystems.

Protected Places

Working with other NESP hubs, this research will build and enhance the science that underlies the socio-ecological management of Australia's protected places (such as Australian Marine Parks, Ramsar sites, World Heritage Areas, the National Reserve System and Indigenous Protected Areas). It will synthesise existing knowledge, establish baseline understanding of biodiversity, ecosystems and ocean processes, and identify best-practice management approaches that bridge land and sea. We aim to support Indigenous leadership and participation in science and management, and embrace the importance and value of traditional knowledge and cultural values. The Hub is also the cross-Hub Initiative leader for protected places under the NESP.

Threatened and migratory species and ecological communities

This research, in association with the Resilient Landscapes Hub as the cross-Hub Initiative leader for threatened species under the NESP, will provide knowledge on the status, trends and pressures on threatened and migratory species and ecological communities, in response to management needs. This includes exploring threats to threatened and migratory species, such as interactions with fishing and shipping, port developments and oil and gas operations/infrastructure. Many of these species are of concern for Indigenous peoples, and we support their engagement in protection activities through research engagement, training and employment.

People and Sustainable Use

This theme is focused on the human dimensions of sustainable people-environment interactions. Research will examine how regional, remote and Indigenous communities and industries interact with their environment – including specific adaptations to climate change – and ways to minimise environmental impact. It supports ecosystem services or restoration programs that support the economic and social revival of coastal communities. Partnerships will be forged with industry sectors including fisheries, aquaculture, ports, energy, tourism and coastal development, through deriving economic benefit from conservation and protection. We will explore innovative risk reduction actions such as protection and reinstatement of coastal defences (shellfish reefs, wetlands, salt marshes) to prevent harm and reduce major economic loss. With the Sustainable Communities and Waste Hub we will research practical approaches to reduce plastic waste impacts.

Ecosystem Restoration and Protection

This research aims to improve the coordination, scalability and evaluation of wetland rehabilitation, shellfish reef restoration, beach restoration, mangrove and seagrass recovery, kelp and coral restoration and marine pest control. It will explore novel approaches to infrastructure design in partnership with industry, for example habitat engineering to achieve 'living-shorelines', and maximising blue-carbon sequestration. We will also apply research to control species, and deliver on projects that protect habitats in association with Indigenous communities.

Knowledge Systems

This research will lead and support the marine science community as it augments and improves national marine monitoring to support environmental and cross-sectoral reporting and decision making at regional and national scale. A cost-effective marine and coastal monitoring system will incorporate existing methods and technologies in a national toolbox of standard monitoring approaches. This includes smart monitoring technologies and novel indicators; aligning existing monitoring programs; mining existing data and data aggregation, industry information, citizen science and traditional ecological knowledge, and modelling. By working with industries, indigenous communities, and related marine organisations, we will foster a shared understanding of socio-ecological systems.

Integration of Hub strategies

The Marine and Coastal Hub has developed four strategies to guide development and implementation of its annual research plans. Collectively, these strategies outline the Marine and Coastal Hub's pathway to impact (see diagram below).

- *Communication Strategy*: provides direction communicating the Marine and Coastal Hub's interests, products and outcomes to researchers, research end-users and interested parties.
- *Knowledge Brokering Strategy*: provides direction for facilitating the exchange of information between researchers, policy makers, managers and Indigenous organisations to generate shared understanding and to capture and transfer knowledge.
- *Indigenous Partnerships Strategy*: provides direction for encouraging collaborative input and guidance from indigenous communities, the appropriate communication of Indigenous knowledge and respect for millennia of experience.
- *Data Management Strategy*: provides direction for enabling pathways for how the Hub and its researchers will achieve findable, accessible, interoperable and reusable NESP research products.

Marine and Coastal Hub Data Management Strategy



Strategy aims

This document provides a framework for how the Hub and its researchers will achieve findable, accessible, interoperable and reusable NESP research products. It is recognised that discipline-specific standards of data management exist, and the Department encourages NESP researchers to apply these standards wherever possible.

The Marine and Coastal Hub Data Management Strategy aims to:

1. manage all data collected through Hub activities in accordance with the [FAIR data principles](#) in a sustainable manner for the long term.
2. make all Hub data and research outputs freely and openly available unless specific restrictions apply (indefinitely or for a limited time) for reasons of privacy, ethics, sensitivity, or commercial confidence.
3. ensure research outputs are presented in an accessible form that encourages reuse and maximises impact on management and policy decision making.
4. ensure published data and research outputs acknowledge the Hub and associated researchers, and support appropriate acknowledgement when reused by implementing licensing, persistent identifiers, and acknowledgment guidelines.
5. apply existing established research data management policies, standards and guidelines; and support and engage in the development of evolving standards guiding the direction of the national marine data network, including Baselines and Monitoring and the Australian Marine Data Landscape.
6. promote collaboration and support the work of management agencies, researchers, Traditional Owners, marine based and coastal industries, and community groups, through its data management approach.

Data and information management approach

This strategy provides guidance on the objectives, key steps and resources to ensure that Hub research outputs meet the requirements of the *NESP Program Guidelines* and the *NESP Data and Information Guidelines*. It outlines how hub researchers will manage their data and other research outputs before, during, and after a research project; and the role of the Data Wrangler to support researchers to manage their data in alignment with NESP guidelines. The strategy will be updated periodically throughout the life of the program, to capture emerging trends in data management, and changing or new stakeholder requirements, and as the specifics of data outputs become clearer.

Fundamental to all data management will be adherence to Indigenous cultural and intellectual property (ICIP) guidelines and principles. This requirement will be monitored by the Hub's Indigenous Facilitator.

This strategy is a living document that describes:

- who will be responsible for data management related activities
- data management practices used
- who owns and can access and use the Hub's data and products
- metadata standards used
- products and data storage, security, privacy and unique identifiers
- product legacy planning
- facilities and equipment used or required.

The [Australian Research Data Commons](#) (ARDC) provides an overview of data management plans and the FAIR data principles. Many Australian Universities have [data management policies and tools](#) available for use by researchers to create a data management plan at the start of a research project.

As outlined in the [Australian Code for the Responsible Conduct of Research](#), researchers will have primary responsibility for managing their research data. The Hub will provide a Data Management Framework (document in progress) for Hub researchers outlining requirements and processes required to effectively manage and publish their data and provide resources to assist them in doing so. The Framework will provide detailed guidelines to achieve practical implementation of the objectives articulated in this strategy, and to ensure Hub research outputs meet the requirements of the *NESP Data and Information Guidelines*.

Metadata and data collected or collated by the Hub will be published in publicly accessible data repositories complying with FAIR data principles. Some data may be subject to restricted access based on its classification under privacy legislation or for ethical, commercial or sensitivity reasons (see [Exceptions to the open data policy](#)).

In order to ensure its sustainability for the long term, the Hub will take advantage of, and contribute to, existing institutional and national data management infrastructure. This will function as a distributed data network to make Hub information publicly and freely accessible via automated workflows. Figure 1 shows an overview of this data network. All data (via metadata records) will be aggregated to the [AODN](#) and [Research Data Australia](#) (RDA) national information repositories to maximise discoverability and access. Linked Hub- and Project-level metadata records will be created to facilitate organisation of Hub content, and will follow ARDC's best-practice for linking publications and grants. Where appropriate, some metadata and data may be additionally aggregated to other national or global information repositories (e.g. the Ocean Biodiversity Information System, OBIS).

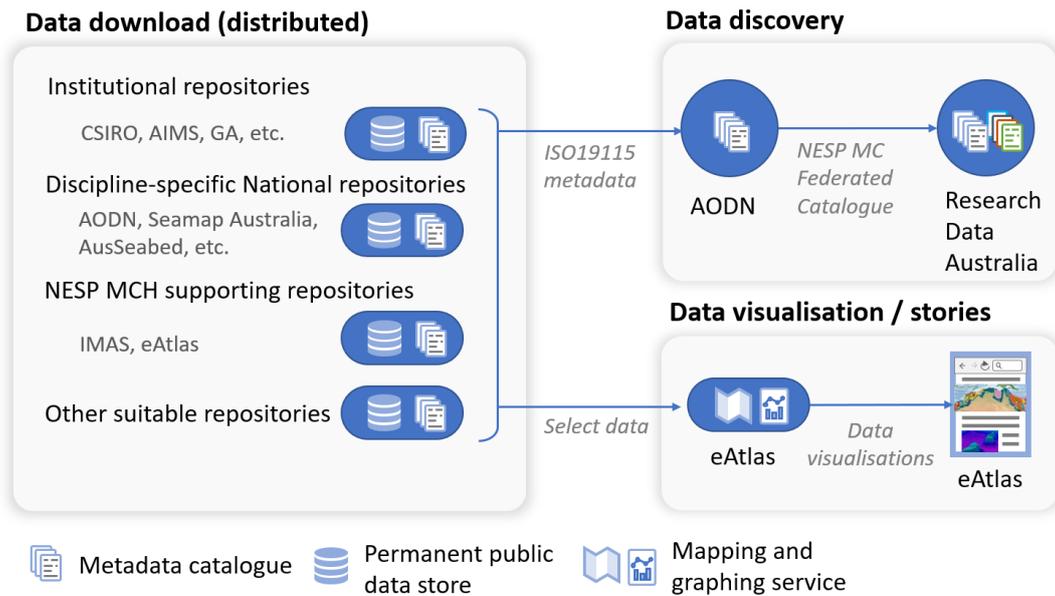


Figure 1. Overview of the approach to the Marine and Coastal Hub’s distributed data management infrastructure and services. Project data can be hosted on institutional, national discipline-specific or other repositories meeting agreed requirements outlined in the NESP MCH Hub Data Management Framework. IMAS and eAtlas will provide storage for all datasets that do not have a more suitable host. Metadata will be collated through the AODN, providing a central access point for all Hub data. The eAtlas will create visualisations and data stories of select datasets.

Hub data will be published using partner repositories or discipline-specific repositories, where available. Selection of data repository will generally follow project leadership affiliations or can be otherwise guided by the Hub Data Wrangler. Where no appropriate partner repository exists, Hub data will be published through the University of Tasmania (using the Institute for Marine and Antarctic Studies, IMAS, [data repository](#)), which relies on the IMOS information infrastructure, or the eAtlas [data repository](#) (managed by the Australian Institute of Marine Science). IMAS and eAtlas will provide tools and workflows to support publication of Hub data. Practical guidelines will be provided in the Data Management Framework (document in development).

Hub partners managing data repositories will work with the Data Wrangler to ensure minimum requirements regarding access and sustainability (to be formulated) are met. Figure 1 shows example institutional repositories. Partners intending to act in this capacity will provide researchers with working storage and adequate resources and infrastructure to ensure appropriate access and backup security.

In some instances, data may be derived by or stored in a discipline-specific data portal. For example:

- processed bathymetry data will be stored in AusSeabed
- benthic habitat data will be aggregated or stored in Seamap Australia
- AUV and other imagery will be aggregated, and annotation data will be derived, in UMI (Understanding Marine Imagery)
- Baited Remote Underwater Video (BRUVs) and other sources of underwater survey video data will be aggregated, and annotation data will be derived, in GlobalArchive.

A full list of recommended data portals and their function will be maintained as part of the Hub’s Data Management Framework (document in progress). Data portals in use by the Hub will additionally be listed on the ‘data’ page of the Hub website. The Hub recognises the importance of contributing to the open data landscape and will actively investigate processes to liberate data from collaborating state and federal monitoring programs, local agencies and other sources to fill information gaps, be used in decision-making processes, and for the collective benefit of the marine science community.

Hub roles and responsibilities

The following provides a brief description of each of the Hub's key roles in data and information management. Additional detail on specific roles and responsibilities is contained within the Hub's Data Management Framework (document in progress).

Hub Data Wrangler role

The Data Wrangler's activities include working with the Hub, researchers, the Department and other stakeholders, to translate data and information into relevant data products and tools; and to help integrate research outputs into national information repositories, digital systems and decision support tools. This includes ensuring data management aligns with the FAIR data principles and the *NESP Data and Information Guidelines* to maximise the use and reuse of public data. The Data Wrangler is responsible for coordinating and conducting data discussions with research projects, providing guidance to projects on best practice data management, reviewing project data management plans, tracking data management milestones, and the review of final datasets (see [Project-level data management](#)).

The Data Wrangler will also work with other Hub staff, including the Knowledge Broker and Communications Officer, researchers, the Department and other stakeholders; to maximise the utility of Hub outputs. Key to this strategy will be delivering data and data products through advanced communication tools (e.g. eAtlas) designed tailor information to the specific needs of stakeholders and increase the accessibility of data to decision and policymakers.

The Data Wrangler role will be achieved via a collaboration between staff in the northern (RRRC - with data management carried out by eAtlas, administered by AIMS) and southern (UTAS) Hub nodes, to ensure there is sufficient capacity to engage with all Hub projects in data management activities. The allocation of data management of individual projects to UTAS or eAtlas staff (in filling the collaborative Data Wrangler role) will be guided predominantly by contracts with the administering Hub node (north or south), but will be flexibly adjusted based spatially, by topic, or by prior relationships with research partners, to achieve the most efficient and effective data management outcomes. The UTAS and eAtlas teams will work closely as a single virtual team in this role, and will provide consolidated advice and guidance to the Hub leadership team.

Researcher role

It is the researcher's role to develop a project-specific data management plan in conjunction with project team members and the Hub Data Wrangler, and in accordance with the Hub's Data Management Strategy and the *NESP Data and Information Guidelines*.

Researchers will have primary responsibility for managing their research data and must comply with agreed data management and publication milestones as outlined in their project plan.

Researchers are responsible for ensuring Intellectual Property requirements in the use of third party data are appropriately managed so as to not restrict access to NESP funded research outputs.

Hub Leader role

It is the Hub Leader's responsibility to provide oversight of data management activities and access to related infrastructure for the Hub, and collate instances of exceptions to these guidelines. The Hub Leader will work with the Data Wrangler to collated exceptions at the project level, and will include basic information on the data generated or collected and the justification for its non-release.

Partner Data Specialists

Where partners provide access to data management infrastructure or other specialised data management roles, they must comply with the relevant sections in this document, the NESP Marine and Coastal Hub Data Management Framework (document in progress), and the *NESP Data and Information Guidelines*. Partner data specialists will work with the Hub Data Wrangler to ensure these standards are adequately met for Hub data.

AODN

The AODN is an interoperable online network of marine and climate data resources and a nationally recognised data repository for IMOS facilities. The AODN Portal is an access point for marine data which incorporates a catalogue of metadata, a search interface and a map interface to aid interaction with and downloading of data collections produced and maintained by Hub partners. It is recognised the AODN provide a powerful and necessary service for aggregating and collating Hub information and access to Hub research data.

The recent AODN review found that a national strategy for agreeing standards for managing marine biological data, and for providing an effective (biological) data service is needed. The NESP Marine and Coastal Hub, as one of the largest generators of marine biological and ecosystem data nationally, will need to collaborate closely with the AODN and together provide strong leadership managing nationally relevant and continent scale marine biological data. Maintaining a presence within the AODN will give the Hub focus and support for the establishment of standards and infrastructure optimising biological data services in line with the broader research community.

The AODN provide a number of services relevant to the NESP Marine and Coastal Hub, including:

- provide support to the Data Wrangler to identify appropriate data management standards, policies and guidelines;
- a facility for aggregating all marine science metadata generated by Australian research agencies in a single discovery and access catalogue, providing discoverability and access for both Hub-generated datasets, and relevant third party datasets for use by Hub researchers (providing support for reporting Hub research data outputs across partners);
- provision of IMOS data streams for use in Hub research;
- host the AODN Technical Advisory Group (TAG), the peak national body for technical advice and standards related to marine data management reporting to the National Marine Science Committee (NMSC);
- participate in Hub workshops and meetings to provide advice on data management standards, processes; and
- work with the Marine and Coastal Hub to provide advice on interoperability between portals and platforms operated by the AODN and in use by Hub researchers to meet Hub needs.

eAtlas

The eAtlas has historically been the data repository for the Marine and Tropical Sciences Research Facility (MTRSF), NERP Tropical Ecosystems Hub and the NESP Tropical Water Quality Hub. The Marine and Coastal Hub will use eAtlas as a platform for advanced communication of selected Hub datasets. eAtlas will present environmental research data in a synthesised or derived form, enhancing accessibility to data through tailored information products (Figure 1). eAtlas additionally operates as an enduring repository for publishing data in accordance with FAIR data principles, in the same manner as AODN, the IMAS (UTAS) data repository, and other Hub-approved institutional or

discipline-specific repositories (see Data Management Framework for a comprehensive list of supported repositories; document in progress).

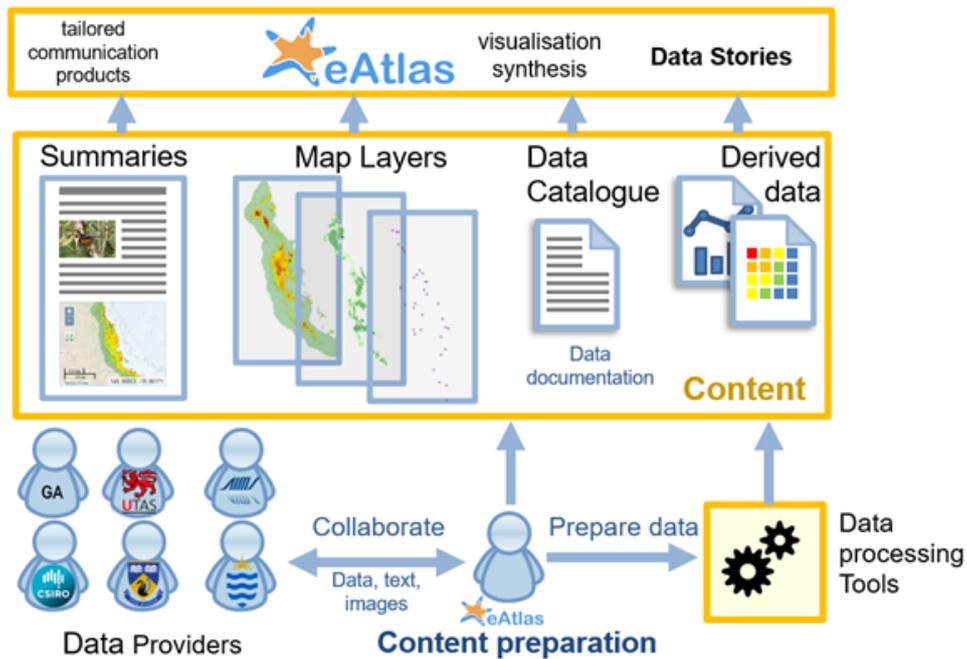


Figure 2. Creation of data communication products ('data stories') by eAtlas.

The specific role of eAtlas in the NESP Marine and Coastal Hub will be to highlight select aspects of Hub research through generating 'data stories' - visual summaries and representations, analytics and other derived information for enriched communication. eAtlas will also provide a gateway to other data portals and products in use, or produced by, the Hub.

Data Stories are a method for communicating information, tailored to a specific audience, with a compelling narrative. It is the last ten feet of your data analysis, and arguably the most important aspect.

Types of research products and data

A broad range of research products are expected to be generated throughout the life of the program by the Marine and Coastal Hub. These products can be broadly categorised as written outputs or data outputs and may include the following:

Written outputs

- publications including scientific papers, reviews, books, book chapters
- grey literature including fact sheets, project profiles, manuals, and technical reports

Data outputs

- raw data sets including spatial data
- analysis and data products such as geographic information system-derived maps
- images, maps, photos, videos, animations
- computer models and code
- software and other tools, such as decision support tools or software
- websites, mobile or tablet apps
- unspecified emerging technology.

Ownership and intellectual property rights

At the commencement of each project, a clear understanding of the ownership of the rights, including any intellectual property rights associated with each acquired or generated research dataset and any contractual constraints, must be documented in accordance with *NESP data and information guidelines*.

The Marine and Coastal Hub Leader will ensure, through standard contractual arrangements at the commencement of each project, that the ownership of rights invested in the Project, including any intellectual property rights associated with each acquired or generated research dataset and any contractual constraints, will be in accordance with *NESP data and information guidelines*.

This document does not seek to alter existing intellectual property ownership rights defined or assigned under agreement, including the NESP Marine and Coastal Hub Agreement and agreements between staff or students and their research organisations or educational institutions.

In general:

- Intellectual Property ownership of data collected in the execution of Hub-funded projects will remain with the party or partner carrying out the project, and may be governed by employment conditions or other agreements binding individuals, or additionally guided by principles such as the GIDA CARE principles (see below).
- Owners of Intellectual Property vested in data and research products generated in the execution of Hub funded projects will be required to make their data and products freely and openly available in such a way that complies with the FAIR data principles and *NESP data and information guidelines* (unless it meets the [Exceptions to the open data policy](#))
- Researchers will be required to prepare a data management plan for all Hub funded projects which will include details of Intellectual Property ownership and licensing for data generated as part of a project or introduced as background Intellectual Property.

Indigenous cultural and intellectual property (ICIP)

NESP adheres to the objectives of the [Global Indigenous Data Alliance](#) (GIDA) with respect to Indigenous data, especially in relation to access of data by non-Indigenous users. Although the *NESP data and information guidelines* follow the FAIR data principles, when working with Indigenous data these guidelines require the complementary use of GIDA's [CARE principles](#) for data governance, which consider both people and purpose as part of open data and information.

Knowledge held by Indigenous peoples will be recognised, valued, and protected throughout any partnerships struck with Traditional Owners throughout the operations of the Marine and Coastal Hub. This will be guided by the CARE principles for Indigenous data governance: Collective benefit, Authority to control, Responsibility, and Ethics.

The Hub and its researchers will ensure all legal obligations are understood before collecting information (including free and prior informed consent) and be guided by the overarching GIDA objectives.

Just as NESP acknowledges the rights of Indigenous peoples to their Indigenous cultural and intellectual property (ICIP) the obligation to recognise, value and protect any ICIP rights will be incorporated into all the Marine and Coastal Hub project agreements as condition of contract, as mandated in the NESP funding agreement with the Hub.

Marine and Coastal Hub Data Management Strategy

The Hub acknowledges that all research that is undertaken, irrespective of its nature, will have impact on Indigenous people. Projects will apply the NESP [3-Category Approach to Indigenous Engagement](#) and be guided by these recommendations for planning, designing, collaborating, sharing, and communicating with Indigenous partners. CARE principles will be applied at all stages from initial project planning through to final data curation. For Categories 2 and 3 projects, all decisions regarding the curation and publication of data will be made in consultation with Indigenous partners. While the Hub's Data Management Strategy aims to apply FAIR data principles alongside CARE principles, if conflict occurs, CARE principles will take precedence.

Data licencing

All Hub research data are required to be made available through an appropriate data repository under an appropriate [Creative Commons](#) or [Open Source Initiative approved](#) (software) license to enable flexible public reuse, unless specifically exempt under the [Exceptions to the open data policy](#). Third Party material collated by, or supplied for use in Hub research activities, is also subject to these guidelines, unless data use agreements between Third Party data providers and Hub researchers (or organisations) explicitly prohibit this.

Specific guidelines and procedures on data repositories, licensing and access restrictions will be provided in the NESP Marine and Coastal Hub Data Management Framework (document in progress).

Data management and storage

Metadata

Hub researchers will take all reasonable steps to create high-quality metadata records for all data resulting from NESP funding. This provides the contextual information needed to enable the end-user to use the data appropriately and consistently. High-quality metadata can facilitate findability of data, allow for more successful data integration and increase data value.

All metadata created for NESP Marine and Coastal Hub datasets will conform to the ISO19115-3 standard and be published in a supported metadata repository that can be harvested by, and aggregated to, the [AODN Metadata Catalogue](#) and the Australian Research Data Commons (ARDC) data discovery portal, [Research Data Australia](#). Metadata should contain a link to any related publications, to the NESP website, and to the Project website on the Hub website.

Metadata must include certain minimum attributes to ensure discoverability and effectiveness for re-use. Specifically:

- is available online, provides links to the data (unless legitimately restricted), and is accessible by web search engines and metadata harvesting web services (eg. OAI-PMH)
- describes the nature and purpose of the data along with contextual background information
- describes the methods used in the dataset creation and all data attributes, and highlights the quality and limitations of the dataset
- defines or links to online (or otherwise published) definitions of all terms used in the data
- provides links to key reports and papers that provide additional context and data details
- provides contact information, and access locations, for the data
- provides licensing information and any use restrictions for the data
- includes provenance information for any data that has been used to generate the data described by the record.

Projects generating Hub dataset selected to be highlighted through eAtlas Data Stories may be required to contribute additional metadata to comply with specific eAtlas needs. The Data Wrangler and eAtlas team will work directly with the Project Leader or their nominated project representative to extract and document any additional metadata required.

Persistent identifiers

Persistent identifiers are globally unique numeric and/or character strings that reference a digital object and are guaranteed to be managed and kept up to date over a defined time (intended for the long term). A persistent identifier will be assigned to all NESP data and, where possible, research outputs, to allow trusted, uninterrupted access.

Persistent identifiers will vary depending on the type of research output and may include an International Standard Book Number (ISBN), International Standard Serial Number (ISSN), a Digital Object Identifier (DOI) or a web URL

A DOI is a type of persistent identifier that indicates a research product is static in nature (allowing replication of research analysis) and permanently accessible. Assigning a DOI to finalised data and other research outputs facilitates citation and is considered best practice for immutable outputs. It is now routine for publishers to assign DOIs to journal articles, and for authors to include them in article citations.

Partners who have DOI minting capabilities (through the [ARDC DOI Minting Service](#) or similar) should create DOIs for NESP research outputs, where appropriate. DOIs may also be arranged by contacting the Hub's Data Wrangler.

DOIs are associated with a product's metadata and can typically be created only if minimum metadata requirements are met. See ARDC's [DOI System for Research Data](#), or the Hub Data Management Framework, for more information.

Research output submission process

Different processes apply for the publication of (1) written and (2) data outputs generated through Hub research activities. The following section broadly details the approach Hub researchers should follow for publishing both output types. More specific direction is provided in the Hub's Data Management Framework (document in progress).

(1) Written outputs

The *NESP knowledge brokering and communications strategy* outlines that the Department and the Hub will adopt a collaborative approach to communicating about NESP and the Hub. A 'no-surprises' approach is central to this collaboration. This allows the Department and other Australian Government agencies the opportunity to prepare, where necessary and appropriate, a response to the research prior to its release. It also allows the Science Partnerships team to manage all incoming outputs and have a timely copy on hand.

Appropriate members of the Department and its portfolio agencies should be engaged throughout research and be provided with a timely opportunity to consider and, where appropriate, provide comments on draft (written) outputs prior to public release.

Written outputs are to be submitted to the Hub website as drafts for approval by a Hub Director. Submission of a draft output instigates the Hub's approval and publishing processes. This will include assignment of an ISBN and (once approved) submission to national digital libraries for public access. Additional guidance will be provided in the Hub's Data Management Framework (document in progress).

The Hub is required to email the Science Partnerships team at least 10 working days prior to the release or final publication of any written output, and include the following information:

- an electronic copy of the output
- completed research output submission template

All NESP or Hub communication and media products must comply with the *Australian Government style manual* and the *NESP brand standards* (refer to the NESP brand standards for correct acknowledgement of funding sources).

(2) Data outputs

The Hub will take a distributed approach to publishing data outputs, as detailed in the section [Data and information management approach](#). Partners are encouraged to generate and publish metadata records in advance of project completion, where appropriate. Early publication of metadata facilitates promotion of Hub research activities, encourages collaboration, and reduces duplication of research effort. Where possible, data outputs (linked or otherwise attached to metadata records) should be published iteratively throughout the duration a project.

While some data repositories incorporate basic quality control checks as part of the standard submission process, data and metadata quality control is the ultimate responsibility of the nominated person submitting this information. The Data Wrangler will work closely with Projects and researchers

through scheduled data discussions, and additional ad-hoc communications as required, to support a consistently high standard for published Hub data outputs (and associated metadata).

A checklist for (meta)data quality control, including appropriate NESP funding acknowledgement, will be provided in the Data Management Framework (document in progress). This document will also provide additional data publication procedural guidance.

All metadata published by the Hub will be aggregated to AODN, RDA and other relevant national or global research information aggregators. Additionally, the Data Wrangler will ensure data outputs are harvested by, or published to, appropriate discipline-specific data aggregation facilities recognised as contributors to the Australian Marine Data Landscape, and as identified in the Hub's Data Management Framework (document in progress).

Open-access outputs

Providing open access to the data and information, and products developed under NESP provides up-to-date, high-quality data and information to decision-makers, environmental managers, other scientists and the community. The Hub will, wherever possible, follow Open Access principles and make its research outputs available at no charge, using best-practice approaches specific to the research output type.

In the case of scientific publications, researchers should make reasonably practicable efforts to either publish via Creative Commons license or make scientific publications otherwise publicly accessible within 12 months of publication.

The Hub will apply FAIR principles to all data outputs. Hub data will be accompanied by descriptive metadata records published using a standardised, interoperable schema (see section [Metadata](#)) allowing outputs to be discovered and harvested by national data aggregation services (e.g. AODN, RDA). Research outputs may additionally be incorporated into end user tools, such as the [Synthesis](#) tool previously developed under the NESP Tropical Water Quality Hub, and other emerging decision support tools.

Open access to information may not be suitable in cases where that information is culturally, environmentally, commercially or socially sensitive, or could contravene privacy laws (see sections [Indigenous cultural and intellectual property](#) and [Exceptions to the open data policy](#)). Decisions to restrict access to sensitive research outputs must be justified. Please refer to the *NESP data and information guidelines* for more information.

Approach to legacy systems

Ongoing access to NESP research outputs will provide an enduring legacy of quality-assured data and information that will assist both decision-makers and the wider research community.

The NESP Marine and Coastal hub will build on the legacy work already in place and overseen by the Reef and Rainforest Research Centre (RRRC) and the University of Tasmania (UTAS). All research outputs will be published via the most relevant institutional, Government, publication or domain specific services that demonstrate sustainable support for the long term. Where necessary, contribution to the development, configuration or sustainability planning to meet Hub requirements may be made, but the Hub will not directly operate or own infrastructure used to publish and/or archive research outputs.

Exceptions to the open data policy

There may be instances that open access to information may not be suitable when information is culturally, environmentally, commercially or socially sensitive, or could contravene privacy laws. Decisions to restrict access to sensitive research products must be justified and made by those closest to the source (for example, the researcher). In cases where restricted access applies, an enduring copy of the unaltered data must be kept, and metadata record(s) made publicly available that describe the data and why it has not been released. Publishing metadata that flags the existence of restricted data ensures the Hub's research outputs are comprehensively catalogued in the public domain.

Sensitive data may include, but is not limited to:

- location information for highly desirable or collectable species
- location information for rare species
- data derived from commercial activities, e.g. commercial fishing
- culturally significant site data
- social data restricted by privacy law or considerations
- other heritage or sensitive Indigenous matters
- commercially sensitive information

Hub Project Plans and Data Management Plans will be required to identify potentially sensitive data and information that will be generated during the project, and should trigger discussions in that regard (e.g. PhD theses and publications). These plans must also contain strategies for how exceptions to the open data policy will be managed to ensure adequate security of the information and meet any legislative or other requirements (e.g. GIDA's CARE principals). Scheduled data management discussions between research projects and the Data Wrangler (to be included in project milestone deliverables) will provide additional opportunities to identify and document potential exceptions to these guidelines.

It is the researcher's responsibility to communicate and justify requests for exceptions to the open data policy to the Data Wrangler. The Data Wrangler will collate instances of requested exceptions and provide them to the Hub Knowledge Broker. Exceptions to the open data policy must be approved by the Hub Leader. The Knowledge Broker, in conjunction with the Project Leader, will be responsible for reporting these to the Department and in Annual Progress Reports.

The Data Wrangler will work with Project Leaders to seek strategies that enable publication of reduced or less sensitive portions of the data wherever possible, with particular consideration to assisting decision-making by the Department.

The *NESP data and information guidelines* will be provided to all Project teams to enable determination of both open access requirements, and exceptions to and conditions around this policy.

Accessibility

The Web Content Accessibility Guidelines (WCAG) is an internationally recognised standard created by the World Wide Web Consortium (W3C).

- [Web Content Accessibility Guidelines \(WCAG\) 2.0](#)
- [Web Content Accessibility Guidelines \(WCAG\) 2.1](#)
- [WCAG 2.1 checklist](#).

All online systems used by the Hub will comply with the Web Content Accessibility Guidelines in accordance with Australian Government requirements under the Disability Discrimination Act 1992 to ensure that online information and services are accessible by people with disabilities.

Acknowledgment of NESP

Support from the Australian Government must be acknowledged in all research outputs, including data, publications, presentations, promotional and advertising material etc. See the *NESP brand standards* and *NESP knowledge and communication strategy* for more details.

The below is an excerpt from the *NESP brand standards*.

To acknowledge Australian Government funding, hubs must use one of the following funding acknowledgement statements:

- The Marine and Coastal Hub is funded by the Australian Government under the National Environmental Science Program.
- This project is supported with funding from the Australian Government under the National Environmental Science Program.
- This project is jointly funded by *[insert organisation/program name]* and the Australian Government under the National Environmental Science Program.

Project-level data management

Every NESP project must have a project-specific research plan that includes an outline of the approach to data management. The project-level data management approach will be outlined in the designated subsection of the *NESP research project plan template*.

Data generated by the Hub will be managed through the project funding agreement conditions, and the oversight of the Hub Data Wrangler, in consultation with the Hub researcher. Data management and submission activities will be included in the Project milestone deliverables. Project data milestones will be scheduled at 6-month intervals (although also guided by project timelines), and will include the following:

- Photo submissions (highlighting project activities)
- Data discussions to cover Hub expectations, identification of potential outputs for data stories, identification of potential dataset issues
- Formulation of a data management plan, including follow-up discussions with the Data Wrangler team
- Dataset declarations (outline expected datasets to be delivered by the project, and anticipated milestones for delivery)
- Dataset delivery (periodically where possible, and at conclusion of project)

Projects with specialised data management requirements or collecting large volumes of data may require additional advice, services or infrastructure from other organisations (such as the AODN) and must include corresponding planning and budget as required.

Additional ad-hoc communication between Project leaders (or nominated project representatives) and the Data Wrangler will occur throughout the life of the project as required by the project, and/or as requested by the Data Wrangler. It is the project leader's responsibility to ensure their project's compliance with the NESP Data and Information Guidelines, and the Hub's Data Management Strategy and Data Management Framework (document in progress). Project leaders are expected to liaise with the Data Wrangler to ensure this is achieved.

Figure 3 shows an overview of the workflow associated with project-level data management. The Data Wrangler and the research project will engage in regular discussions to address project data milestones, and to identify with the eAtlas team datasets that will be suitable for generating data stories. Once datasets are ready for publication, the Data Wrangler will review the dataset and documentation (metadata and grey literature) to ensure that they are suitable for reuse. Project leaders (or nominated project representatives) are expected to work with the Data Wrangler team to address any data issues and questions arising during this review process.

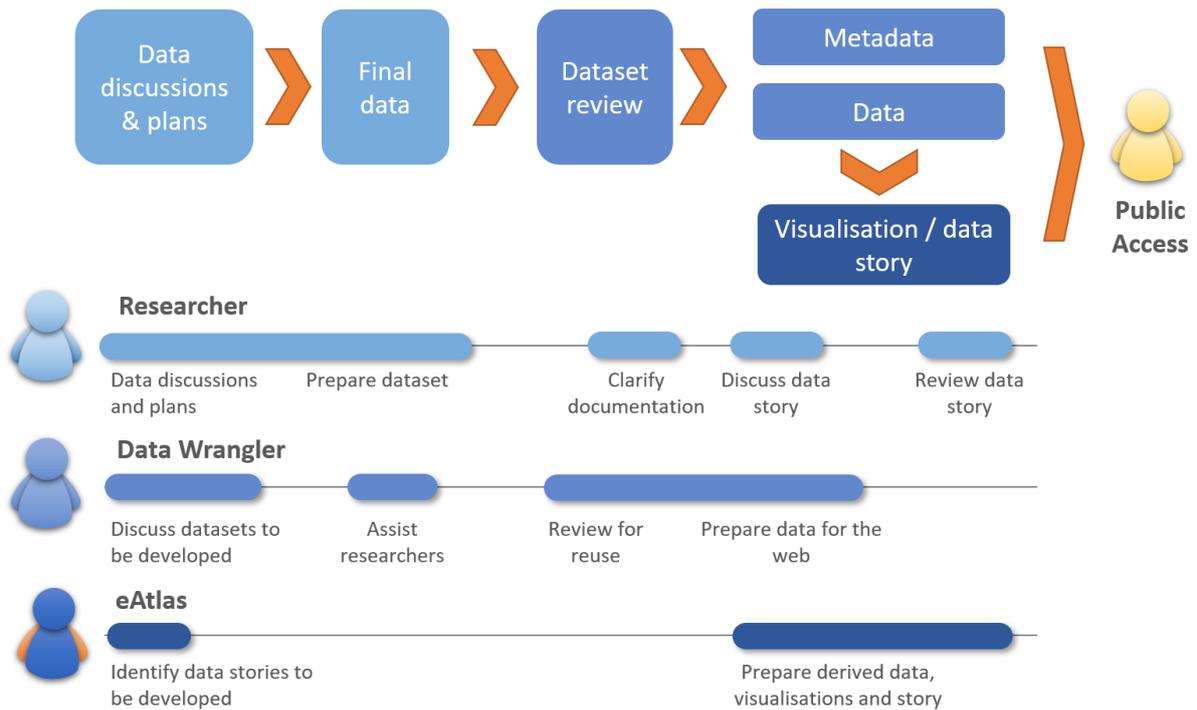


Figure 2. Overview of the project level data management workflow.

The data review process will be further developed in the Data Management Framework (document in progress) and may vary depending on the data repository. If the data is published via the IMAS or eAtlas data facilities, the review process will be completed as part of the submission process. Data published via institutional, discipline-specific or other repositories will be reviewed prior or shortly after publication, depending on the repository’s support for pre-publication review.

In the case of datasets that are suitable for data stories, once published, the eAtlas team will work with the research projects to develop visualisations and associated enriched data explanations.

Monitoring and Evaluation

Data management will be evaluated at the program level in accordance with the *NESP monitoring and evaluation plan*. Hub data management activities should be evaluated at the commencement of Research Plan V2, and subsequently every 12 months as required, using the most appropriate method.

Evaluation will include reviewing strategy and operational activities and adjustment to best meet the needs of the Hub, including budget as required. External participation may be sought from relevant organisations such as the AODN, Australian Research Data Commons (ARDC) or peer organisations (including Marine and Coastal Hub partners and other NESP Hubs).

The Hub will assess the performance of its strategy annually using the following monitoring and evaluation framework.

Table 1: Hub Data Management performance monitoring and evaluation project.

Measure	Primary alignment with objectives	Performance metric
Liberation of data through NESP activities for the benefit of the greater marine community	5, 6	Number of data sets made publicly available to the Hub, or made publicly available, by third parties for the purpose of informing NESP research
Apply Open Data principles;	1, 2, 3, 4, 5	Percentage of datasets made publicly available under Open Licence by the Hub
Apply FAIR data principles	1, 2, 4, 5	Percentage of NESP research outputs (including data and metadata) meeting the access requirements of the NESP Data and Information Guidelines
Apply CARE principles; right to Indigenous Cultural and Intellectual Property (ICIP)	6	Proportion of Indigenous co-designed and -led projects (Tiers 1 & 2, per the NESP Three-Category Approach) for which discussions regarding data custodianship and access have taken place with relevant Indigenous groups.
Maximise research impact for stakeholders	3	Number of 'data stories' published by eAtlas for the purposes of advanced data communication

Budget and risks

Table 2 shows the estimate % budget allocation at the time of writing this document. This budget may need to be adjusted through the life of the program to meet evolving needs of the Hub, the Department and other stakeholders.

Table 2: Budget

Item	Hub Contribution	Partner Contribution (in-kind)
Data Wrangler x 2 FTE Hub Leaders (5%) AODN Infrastructure Support eAtlas IT infrastructure contribution Indigenous (TEK) Travel/ workshop/ operations Other data activities/ data mining	The Hub contribution will represent ~6.0% of the total Hub budget for the life of the program. Additional investment is expected to occur within specific projects that deliver on aspects of the Strategy.	Matching in-kind contribution will be provided to support the Hub budget allocation.

Table 3. Key Risks, Treatments and Mitigation

RISK	EXISTING CONTROLS	MITIGATION
Personnel unaware of data collection and management process	Data collection guidelines training (refer Related Materials this document)	Initial and Annual refresher training
	Data Wrangler management of data process in consultation with Hub Knowledge Broker	Data Wrangler referred to by and involved with potential Project Leader from inception of and in design of project. Scheduled reviews Relationship development
Intellectual property transgressions and possible legal action	Training in Global Indigenous Data Alliance's CARE principles for Indigenous data governance	Satisfaction feedback mechanism with project participants Data Wrangler referred to by and involved with potential Project Leader from inception of and in design of project.
	Data collection guidelines training	Scheduled reviews Relationship development
Data unusable/un-interoperable	Project proposal review and data collection guidance by hub Data Wrangler and Knowledge Broker	Projects to follow Standard Operating Procedures with regards to experimental design and data collection, where appropriate.
Loss of data	Hub Data Wrangler to establish and enforce requirements for supported Hub data repositories including minimum storage and backup requirements	Establish data transfer pathways and ensure scheduled data transfers