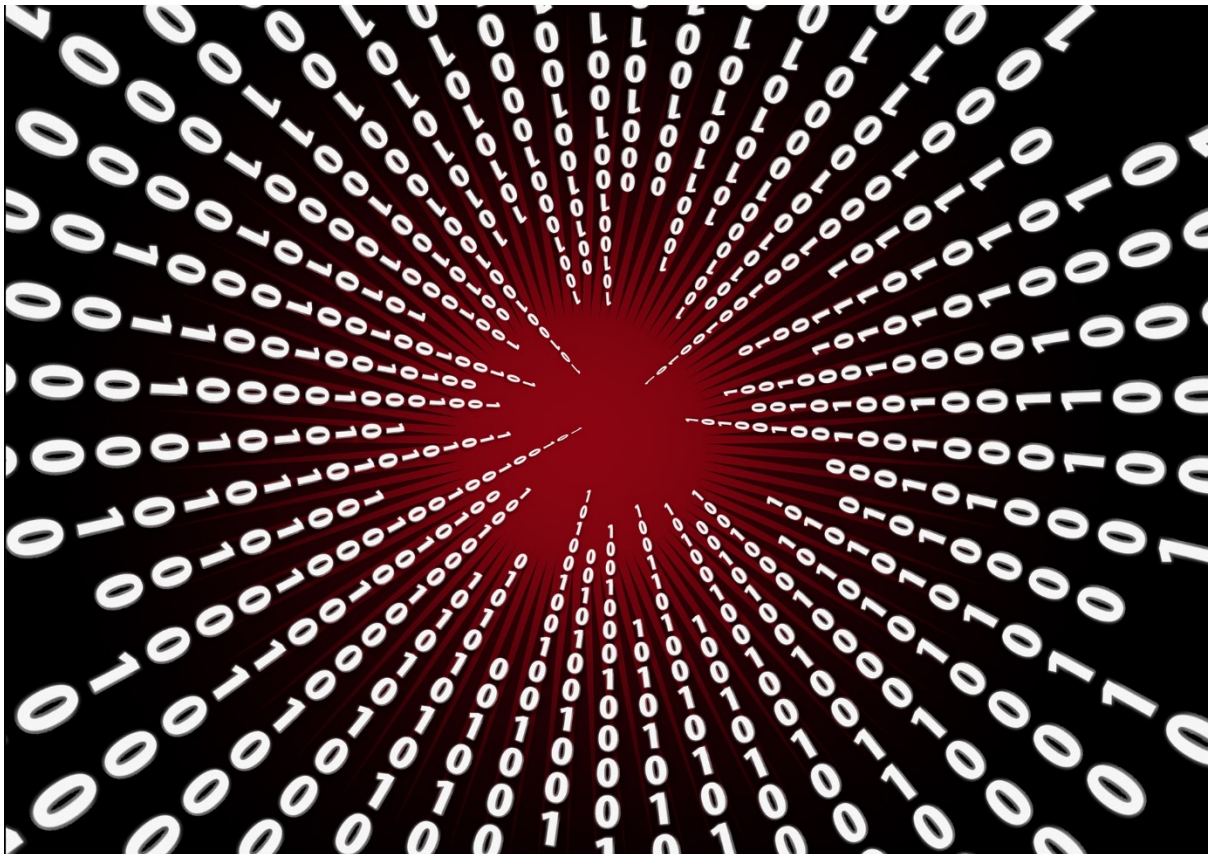




National Environmental Science Programme

Data Management Framework



Version 1.2



Version control table

Prepared by:	Emma Flukes, Hub Data Manager emma.flukes@utas.edu.au
Version:	1.2
Status:	Final
Last Updated:	05 December 2016
Approval:	

VERSION CONTROL REVISION HISTORY			
Version	Date revised	Reviewed by (Name, Position)	Comment (review/amendment type)
V1.0	15/06/16	Emma Flukes	Includes content from Annabel Ozimec
V1.1	01/08/16	Emma Flukes	Revisions following comments from Paul Hedge
V1.1	25/08/16	Emma Flukes	Minor revisions following comments from Paul Hedge
V1.2	05/12/16	Emma Flukes	Completing Table 1 (data contacts), minor revisions following comments from AODN (Roger Proctor)

Cover image:

<https://pixabay.com/en/binary-one-null-binary-code-1536589/>

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1. Overview

It is imperative that Marine Biodiversity Hub research outputs are made freely available to Government, the science community, and to the public. Providing easy access to the Hub's research outputs (data sets, reports, journal articles, maps etc.) is an important step on the pathway to impact and achieving outcomes. The Hub is also contractually obligated to make its information outputs available to the public. The administrator of the NESP, the Department of the Environment, has also published the [NESP Data and Accessibility Guidelines](#) to clarify its expectations and provide guidance for meeting contractual obligations.

The Hub has two separate mechanisms to provide access to its research outputs. The first mechanism is the Hub's website, which is used to provide access to reports, papers, and other written information. The second is the Australian Ocean Data Network (AODN), which is the aggregation point for all spatial and non-spatial Hub data which can include maps, video, images, and models. Hub data must be accompanied by a descriptive metadata record which links to the data access (download) point, and is published in a catalogue harvested by the AODN. The Hub has appointed a Data Manager role to assist with making Hub research data outputs available to the public. The Data Manager is responsible for implementing and refining this framework document, supporting researchers to publish their data, and overseeing quality control of published Hub data outputs.

Compliance with this data management framework 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.

1.1 Purpose and objectives

The purpose of this framework is to provide researchers with clear directions for making NESP Marine Biodiversity Hub research outputs openly and freely available to the public. Four specific objectives are identified:

1. To define the Hub research outputs that will be made available to the public;
2. To provide direction for publishing written outputs on the Hub's website using agreed standards and requirements;
3. To provide direction for publishing research data outputs to the Australian Ocean Data Network using agreed standards and requirements;
4. To clarify the roles and responsibilities for planning, quality control, uploading research products and associated metadata, and ensuring persistent access to Hub data products.

2. Hub research outputs available to the public

2.1 *Scope and definitions*

This framework applies to all research outputs generated by the NESP Marine Biodiversity Hub throughout the lifetime of the program. These products can be broadly categorised as (1) written outputs; or (2) research data. While the majority of written outputs will take the form of peer-reviewed journal articles, this framework also extends to other valuable products such as reports and fact sheets (grey literature). For research data, this management framework encompasses all data products that have contributed to or are derived from a dataset including analysis imagery and videos, computer models and software products. All data products should be accompanied by metadata which describes the name, content, format, context, structure, purpose, spatial and temporal extent of the data. In the context of this document, **metadata records** refer to metadata items lodged in a GeoNetwork catalogue.

2.2 *Identifying the Hub's research outputs*

Written outputs

A list of the anticipated written outputs for each Hub project will be assembled in a **Product Delivery Schedule**. This will be compiled by the Hub's Communications Support Officer (Annabel Ozimec) from details provided in Project Plans.

Data outputs

A list of anticipated research data outputs will be collected in a **Data Delivery Schedule** that is to be completed by each Project Leader. The schedule should be populated by data milestones identified in Project Plans, with the addition of specific product information such as links to metadata, data storage information/requirements, and expected dates for data publication. The schedule should be generated within the first 3 months of project commencement (for current projects, as soon as is practical following distribution of the Data Delivery Schedule template). Completed Data Delivery Schedules can be returned to the Hub Data Manager (Emma Flukes).

The Hub strongly encourages metadata records to be created and published before data collection has been completed. Publishing metadata records early flags the existence of a dataset and facilitates promotion of the Hub's research activities. Early creation of metadata is valuable for Theme Leaders and the Hub's Data Manager to facilitate tracking of project milestones, and helps to identify in advance any additional IT infrastructure or support required to publish data. Published metadata can be modified and updated at any time.

3. Publishing written outputs

3.1 *WHAT written outputs need to be published?*

NESP funding agreements require all research outputs to be made publicly available under the latest [Creative Commons framework](#) (Creative Commons Version 4.0 International as at the date of this publication) using a Creative Commons by Attribution licence ([CC BY 4.0](#) at the date of publication).

The Hub produces a broad range of written outputs that must be made easily discoverable and accessible to the public. The most common types of written outputs that the Hub will make publicly accessible are peer-reviewed journal articles, reports (e.g. technical reports, synthesis reports, voyage reports, etc.), brochures, facts sheets and posters. An electronic copy of all NESP peer-reviewed journal articles and reports published by specific Hub partners (e.g. Geoscience Australia, James Cook University, CSIRO) must also be published on the Hub website. The Hub is required to provide an electronic copy of all journal articles (as accepted for publication after peer review) within 12 months of publication. See [Appendix A](#) for more information on choosing an open access journal and making post-print versions of articles available.

3.2 *WHERE to publish written outputs?*

All written outputs are to be submitted to the Marine Biodiversity Hub website as drafts for approval by the Hub's Director. Submission of a draft output instigates the Hub's approval and publishing processes. The website provides a searchable index of written outputs that can be browsed or filtered by theme/project, document type, and author.

3.3 *HOW to publish written outputs?*

1. Go to the [document submission tool](#) on the Hub's website (via Quick Link on home page).
[User must have a website profile and be logged in to access the tool]
2. Complete document submission form by providing a title, selecting a project from the available list, add any comments (e.g. target journal) and upload the document.
3. Before submitting your draft written output for approval check the following:
 - ☐ [NESP style guide/template](#) has been used (scroll down to 'templates')
 - ☐ [NESP and Marine Biodiversity Hub logos](#) have been used
 - ☐ [Acknowledgement of NESP/NERP funding](#) has been included
 - ☐ All Project Leader / Theme Leader comments have been addressed
4. An email will be automatically sent to Nic Bax as Principal Investigator/Hub Director who will approve the publication and advise the researcher by email.

4. Publishing research data

4.1 WHAT research data needs to be published?

Marine Biodiversity Hub research data can be broadly considered as any information collected or generated in the course of Hub research not classified as “written output” ([defined previously](#)). This includes (but is not limited to) the following:

- raw data (spatial or non-spatial) including BRUV/AUV and other video and imagery data
- analysis and data products including GIS maps and derived video/imagery products
- models, tools and software created during the research process

Hub data must be accompanied by a descriptive metadata record which links to the data access (download) point. All geospatial Hub data should, wherever possible, be deployed via Web Map Services (WMS) and Web Feature Services (see [how to publish research data](#) section below).

4.2 WHERE to publish research data?

All Hub data must be made discoverable through the [Australian Ocean Data Network \(AODN\) GeoNetwork Catalogue](#). The AODN Catalogue aggregates marine metadata into a central repository and is the index for all NESP Marine Biodiversity Hub data products. Geospatial datasets deployed as Web Map Services (WMS) and Web Feature Services (WFS) can additionally be showcased in the interactive [AODN Portal](#) (see [Figure 1](#) for portal components). All Hub data published to the AODN is also automatically harvested to [Research Data Australia](#) (RDA).

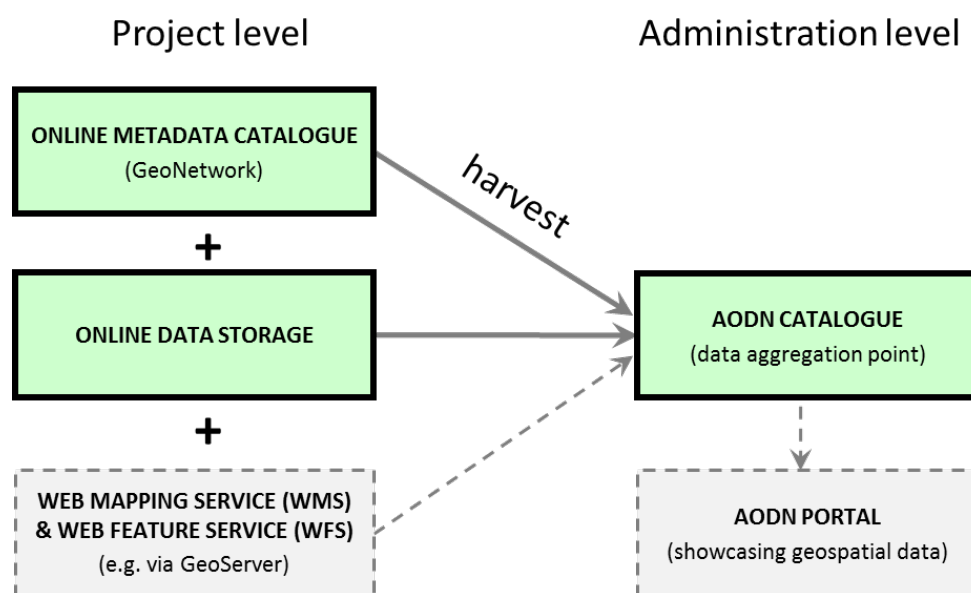


Figure 1. Publishing Hub data to the AODN works on the basis of a three-part “stack” where data, metadata, and Web Services (for geospatial data) can be contributed from different sources. Green boxes indicate mandatory components for publishing to the [AODN Catalogue](#), and grey boxes indicate additional components required to showcase geospatial data in the [AODN Portal](#).

4.3 HOW to publish research data?

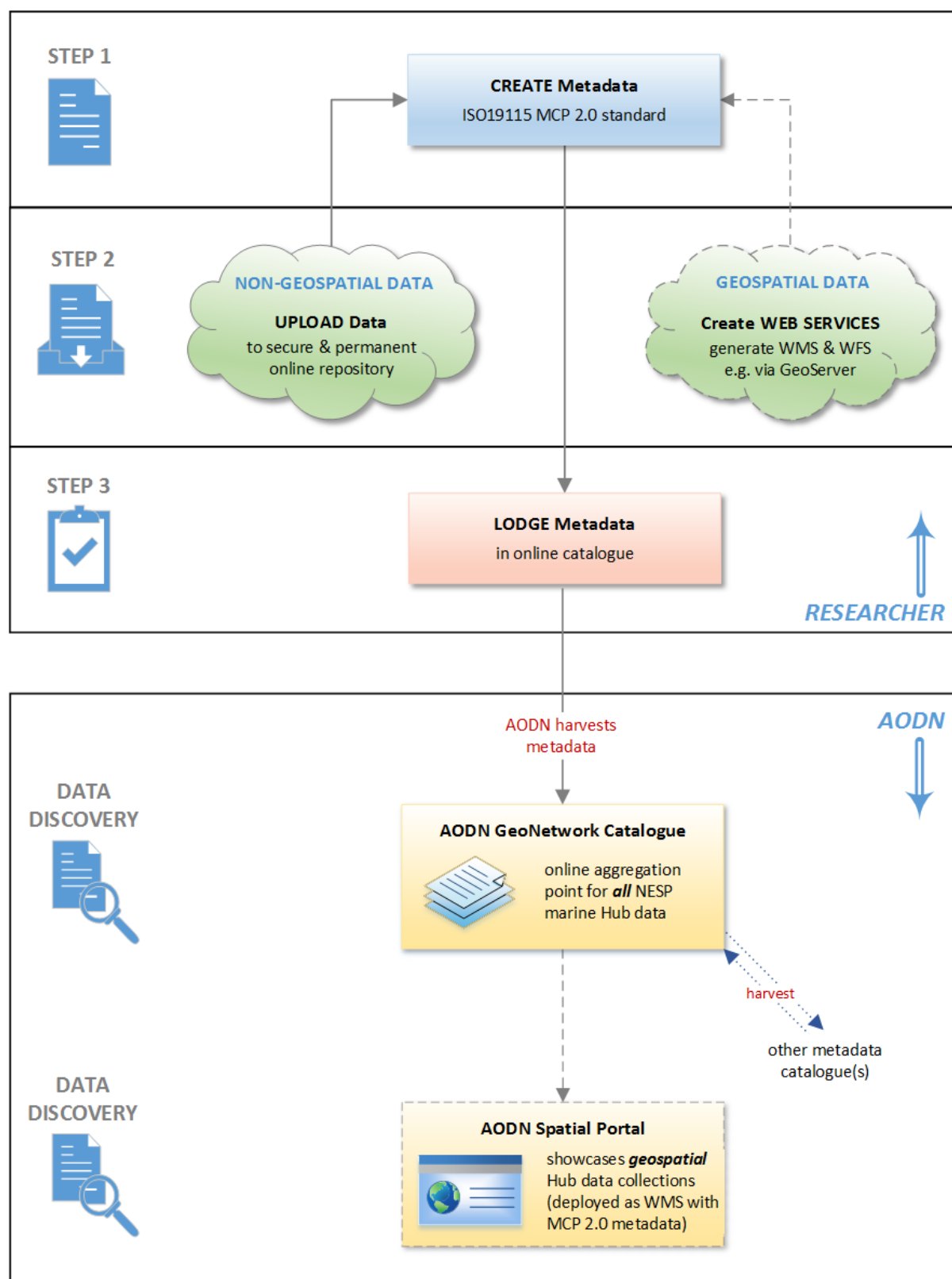
There are 3 main steps required to publish Hub data to the AODN: (1) create metadata; (2) upload data and (for geospatial data) create mapping layers; (3) lodge metadata in a repository harvested by the AODN. The precise process will vary between Hub partners depending on their 'in-house' (agency-level) data management infrastructure. However, the same basic workflow for publishing data to the AODN applies to all Hub data contributors (see [Figure 2](#) below).

All Project Leaders should familiarise themselves with this workflow and identify the most appropriate options for publishing their Hub Project's data (consultation with their organisation's data manager may be required, see [Table 1](#)). Once Steps 1-3 of the workflow are completed, metadata (with associated data links) will be harvested into the AODN Catalogue where it will be available for discovery, searching, and download. Geospatial data served by WMS/WFS and accompanied by MCP 2.0 metadata can additionally be showcased in the AODN Portal (i.e. data will be available for discovery and download through *both* the [AODN Catalogue](#) and [AODN Portal](#)).

Table 1. Suggested data management contacts for each Hub partner.

Hub Partner	Data Contact	Email
Australian Institute of Marine Science (AIMS)	Mark Rehbein	m.rehbein@aims.gov.au
Charles Darwin University (CDU)	Neil Godfrey	Neil.Godfrey@cdu.edu.au
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Tara Martin	T.Martin@csiro.au
Geoscience Australia (GA)	Johnathan Kool	Johnathan.Kool@ga.gov.au
Integrated Marine Observing System (IMOS)	Sebastien Mancini	Sebastien.Mancini@utas.edu.au
Museum Victoria (MV)	Ursula Smith (specimen data and images), Tim O'Hara (all other data)	usmith@museum.vic.gov.au tohara@museum.vic.gov.au
NSW Department of Primary Industries (DPI)	Alan Jordan	Alan.Jordan@dpi.nsw.gov.au
NSW Office of Environment and Heritage (OEH)	Tim Ingleton	Tim.Ingleton@environment.nsw.gov.au
University of Tasmania (UTAS)	Emma Flukes	Emma.Flukes@utas.edu.au
University of Western Australia (UWA)	Jessica Meeuwig	Jessica.Meeuwig@uwa.edu.au

Figure 2. Workflow for publishing Marine Biodiversity Hub data to the AODN. Each workflow step is hyperlinked to additional information, including solutions for researchers requiring assistance to create metadata or host data.



STEP 1: CREATE metadata

- ☒ Create an ISO 19115 metadata record using the Marine Community Profile (version 2.0) describing the scope, contents, methodology, and responsible parties for the data collection.
 - **Option 1 (preferred):** create MCP 2.0 metadata using your organisation's 'in-house' metadata creation systems (e.g. ANZMET Lite, direct GeoNetwork entry)
 - **Option 2:** create MCP 2.0 metadata records using the online [IMAS Data Submission Tool](#)
- ☒ Add an acknowledgement statement of the National Environmental Science Program as the funding source for the Hub ([Appendix B](#)).
- ☒ Add a statement instructing users of the data on how to acknowledge NESP ([Appendix B](#)).
- ☒ Identify the Hub project to which the data belongs ([Appendix B](#)).

HELP & ADDITIONAL INFORMATION: see [Appendix B](#) for specific requirements of MCP 2.0 metadata, NESP acknowledgement statements, and identifiers for Hub projects.

STEP 2: UPLOAD data

- ☒ Upload cleaned, quality checked data to a public, permanent online location.
 - **Option 1:** upload data to the Project Leader's agency repository (e.g. CSIRO Data Centre, AIMS Data Centre) or other specific disciplinary domain (e.g. Genbank, ATF).
 - **Option 2:** if you require assistance locating a secure online data repository, contact the Hub Data Manager to arrange for data hosting.
- ☒ Add data download link(s) to the metadata record (*note that metadata records without data access links **do not** meet NESP open data requirements*).
- ☒ **[for geospatial data only]** Create Web Map Services (WMS) and Web Feature Services (WFS) for data and add WMS and WFS information to the metadata record as per the [instructions provided by AODN](#).

HELP & ADDITIONAL INFORMATION: see [Appendix C](#) for recommended file types for storing data, and information on creating Web Services (for geospatial data).

STEP 3: LODGE metadata

- ☒ Lodge metadata record in an online metadata repository that is harvested to the AODN.
 - **Option 1:** lodge metadata in your agency's metadata system or that of another Hub partner (e.g. CSIRO Marlin, AIMS GeoNetwork, GA Metadata Gateway)
 - **Option 2:** use the [IMAS Data Submission Tool](#) to create and lodge metadata records (metadata will be hosted in the [IMAS GeoNetwork Catalogue](#))
- ☒ Inform the Hub Data Manager of new published metadata to ensure that all Hub records are harvested correctly to the AODN.

4.4 *Exceptions to the Open Access policy*

NESP funding agreements require that all Hub data outputs be made publically available. Exceptions to the open access policy may only be made in special cases where information is culturally, environmentally or socially sensitive (e.g. location information for rare species, social data restricted by privacy considerations, heritage or indigenous matters). A case for restricted access to Hub data should be made to Nic Bax (Hub Director) and must be *approved in writing* by the Department. Even in the case of restricted data, a fully descriptive metadata record (including explanation of why the data has not been released) must still be created and lodged as previously described. Published metadata records flagging the existence of restricted data is vital to ensure the Hub's research outputs are comprehensively catalogued in the public domain.

5. Roles and responsibilities

5.1 Planning, quality control, publishing outputs, progress reporting

There are a number of roles to be performed to ensure that all Hub written and data outputs are made available via the Hub's website (written outputs) and AODN Catalogue (data outputs). The key roles are that of identifying research outputs, publishing outputs to the appropriate locations, quality control of published content and links to data access, and meeting and reporting on publication milestones. [Table 2](#) identifies the responsibilities for these roles.

Table 2: Roles and responsibilities for planning, quality control, publishing, and milestone progress reporting of Hub research outputs.

Role	Responsibility
Compile list of anticipated written outputs	Project Leaders to complete <i>Product Delivery Schedule</i> and return to Annabel Ozimec - Communications Support Officer
Compile list of anticipated data outputs	Project Leaders to complete <i>Data Delivery Schedule</i> and return to Emma Flukes - Hub Data Manager, within 3 months of Project commencement.
Create Project metadata records in AODN	Hub Data Manager to create Project metadata records (populated with information from Project Plans) and publish to the AODN catalogue within 3 months of Project Plan submission.
Quality control of written and data outputs	The Responsible Party cited in the product metadata (typically the Project Leader) is responsible for both the information contained in metadata records, and the content of written and data outputs.
Publish written outputs to Marine Hub website	Project Leaders to complete online document submission form and upload written outputs to Hub website.
Support researchers to publish data outputs to the AODN	Hub Data Manager to develop <i>Data Management Framework</i> and provide support to Hub partners for publishing research data outputs to the AODN.
Publish research data outputs to the AODN catalogue	Project Leaders to lodge data in secure online storage repository, create MCP 2.0 metadata and publish in catalogue harvested to AODN, and notify Hub Data Manager of new data submissions.
Quality control checks (verification) of metadata and data access	Hub Data Manager to conduct random audits of published Hub data, conduct QA/QC checks of metadata (e.g. completeness, verify data access links), report on performance of partners.
Report on milestone progress for publishing written and data outputs	Deputy Director to report on achievement of publication milestones for written and data outputs. Project Leaders to notify Hub Data Manager of any issues preventing data publication milestones from being met.

Appendix A – Excerpt from NESP Data and Accessibility Guidelines – Peer-reviewed publications

Peer-reviewed publications

Publications include peer reviewed scientific papers, books, and other peer-reviewed published material. An electronic copy of all peer-reviewed articles (as accepted for publication after peer-review) must be made openly and freely available on the internet, if not immediately, then within 12 months of publication. Researchers are not permitted to grant a licence for NESP funded articles to publishers if that licence does not allow the hub to place a complete copy of the article (not just an abstract or citation) on its website within twelve months of publication.

Understanding pre-print, post-print and re-prints: Which should be made publicly available?

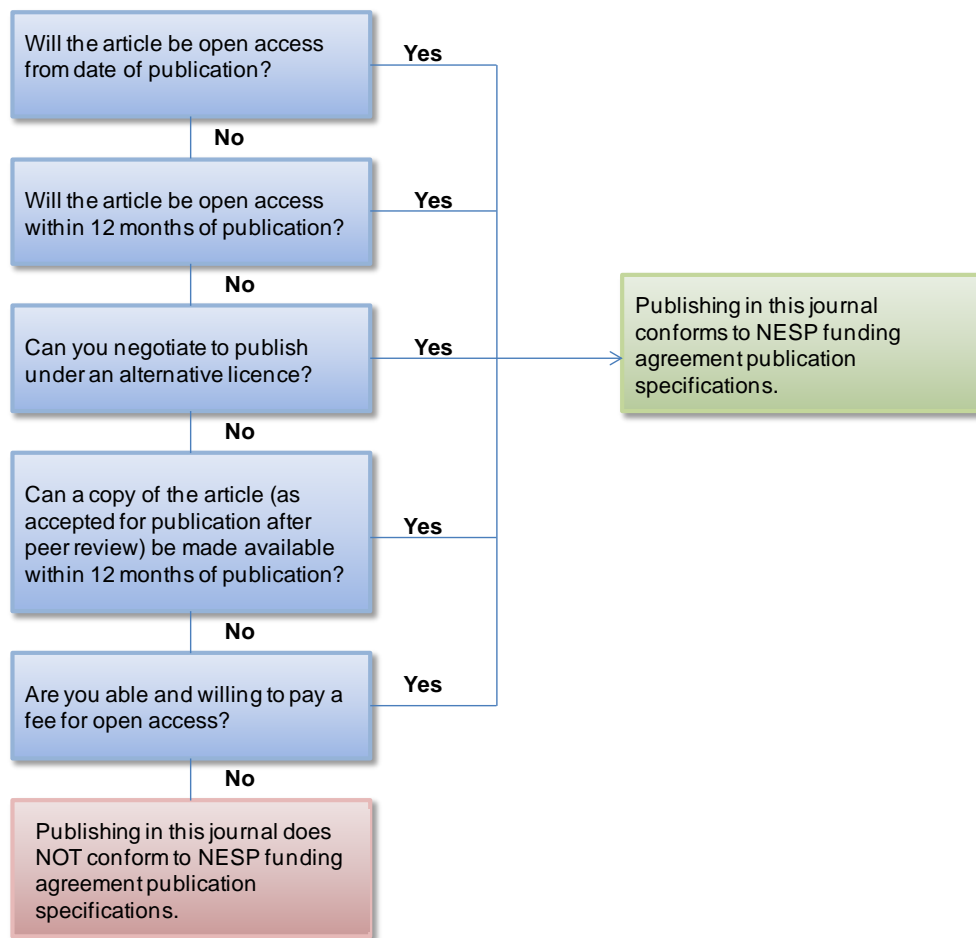
Journal copyright arrangements often distinguish between three versions of a published peer-reviewed article - pre-print, post-print and re-print. A pre-print refers to a paper that has been submitted for publication but which has not yet undergone peer-review. The manuscript is termed a post-print after the author has re-written the manuscript based on the comments of reviewers or editors. The re-print refers to the publisher's final PDF version of the paper encompassing the journal-specific formatting and which contains the same figures and text exactly as the post-print.

Tools for understanding journal copyright arrangements

It is the responsibility of the research hubs to understand the copyright and associated licensing arrangements being entered into when signing agreements with publication houses. Internet tools such as SHERPA/RoMEO can be used to determine the default position of the publication house. Where the default position of a publication house does not conform to the NESP requirements for open access, hubs may be in a position to negotiate licensing arrangements by stipulating that their funding body has a requirement for all research products to be open access. Many journals will negotiate the license conditions applying to individual journal articles in cases where research funding organisation has an open access policy. Some publications allow researchers to pay a fee to make the article open access. Payment of open access fees is the responsibility of the research hub. The Department's preference is for research funding to be used for research, in preference to publication fees.

Alternatively, it is often possible to negotiate with the publisher to publish under an alternative licence scheme that meets the Australian Government's open access policy. AusGOAL provides licences for a range of information access situations that are designed to manage legal risks associated with making information available for reuse and are endorsed by the Office of the Australian Information Commissioner. These include a non-commercial licence which may be acceptable to the publisher. Figure A1 is a flow diagram which may aid in determining whether publishing in a specific journal conforms to the NESP funding agreement specifications.

Figure A1. Choosing a journal that conforms to the NESP funding agreement publication specifications.



Appendix B – Specific requirements for Marine Community Profile 2.0 Hub metadata

Required structure for Hub metadata

All Marine Biodiversity Hub metadata records must be created using the Australian Marine Community Profile (MCP) version 2.0 of ISO 19115 (see [AODN guide to MCP 2.0 required fields](#)). While other metadata profiles (e.g. ANZLIC, MCP 1.4) can be harvested into the AODN Catalogue, metadata records must use the Marine Community Profile v2.0 in order to populate the AODN geospatial Portal, which includes a search and discovery interface driven by controlled vocabulary facets derived from the metadata (see AODN help links below for further information).

Additional useful AODN resources
What is a metadata record?
ISO 19115 metadata - Marine Community Profile
Required MCP 2.0 metadata fields
Vocabularies and faceted searching (geospatial data only)

Specific required elements for Hub metadata

In addition to the standard required content fields for metadata (see above), all Hub metadata must contain the following 3 key elements:

- 1. AN ACKNOWLEDGEMENT STATEMENT** of the National Environmental Science Program as the funding source for the Hub (see [NESP Branding and Acknowledgement Guidelines](#)), e.g.

This project is supported through funding from the Australian Government's National Environmental Science Programme (NESP).

- 2. AN ATTRIBUTION CONSTRAINTS** statement instructing users of the data on how to acknowledge the data source, e.g.:

Any users of NESP Marine Biodiversity Hub data are required to clearly acknowledge the source of the material in the format: "Data was sourced from the NESP Marine Biodiversity Hub – the Marine Biodiversity Hub is supported through funding from the Australian Government's National Environmental Science Program (NESP)."

- 3. IDENTIFICATION OF THE PROJECT** to which the data belongs by including:

- a text statement (e.g. "NESP Marine Biodiversity Hub Project X - <insert project title>");

AND

- a specific XML snippet containing the unique identifier of the project record added within the <mcp:MD_Metadata> (or <gmd:MD_Metadata> for ANZLIC) tag as follows (replace **highlighted** identifier with corresponding Hub project UUID in [Table B1](#)):

```
<gmd:parentIdentifier>
  <gco:CharacterString>5b155a2d-bd36-413c-896e-74f7cbc0a2df</gco:CharacterString>
</gmd:parentIdentifier>
```


The inclusion of each of these elements (1-3 above) is essential to ensure Hub data is discovered, cited, and categorised appropriately. While the purpose of elements 1, 2, and 3a is evident, the XML identifier (element 3b above) is a critical metadata component used to create hierarchical linkages between all Hub data products published to the AODN. The Hub Data Manager has created a [metadata record for each Hub project](#) in the AODN. Project records are populated with information provided in the Project Plans and provide a brief overview of each of the Hub's research activities. Project records also act as an aggregation point for all metadata records describing specific data products generated by a Project, and provide a structured overview of all published Hub metadata linking to the data access points ([Figure B1](#)).

Figure B1. Hierarchical structure describing Hub data products and project records. This structure is generated in the AODN Catalogue by including the parentIdentifier XML snip (detailed above) in metadata records. Note this schematic is for illustrative purposes only and does not include all Hub project records. To view the full collection of Hub projects, visit the [NESP Marine Biodiversity Hub data collection](#) in the AODN Catalogue.

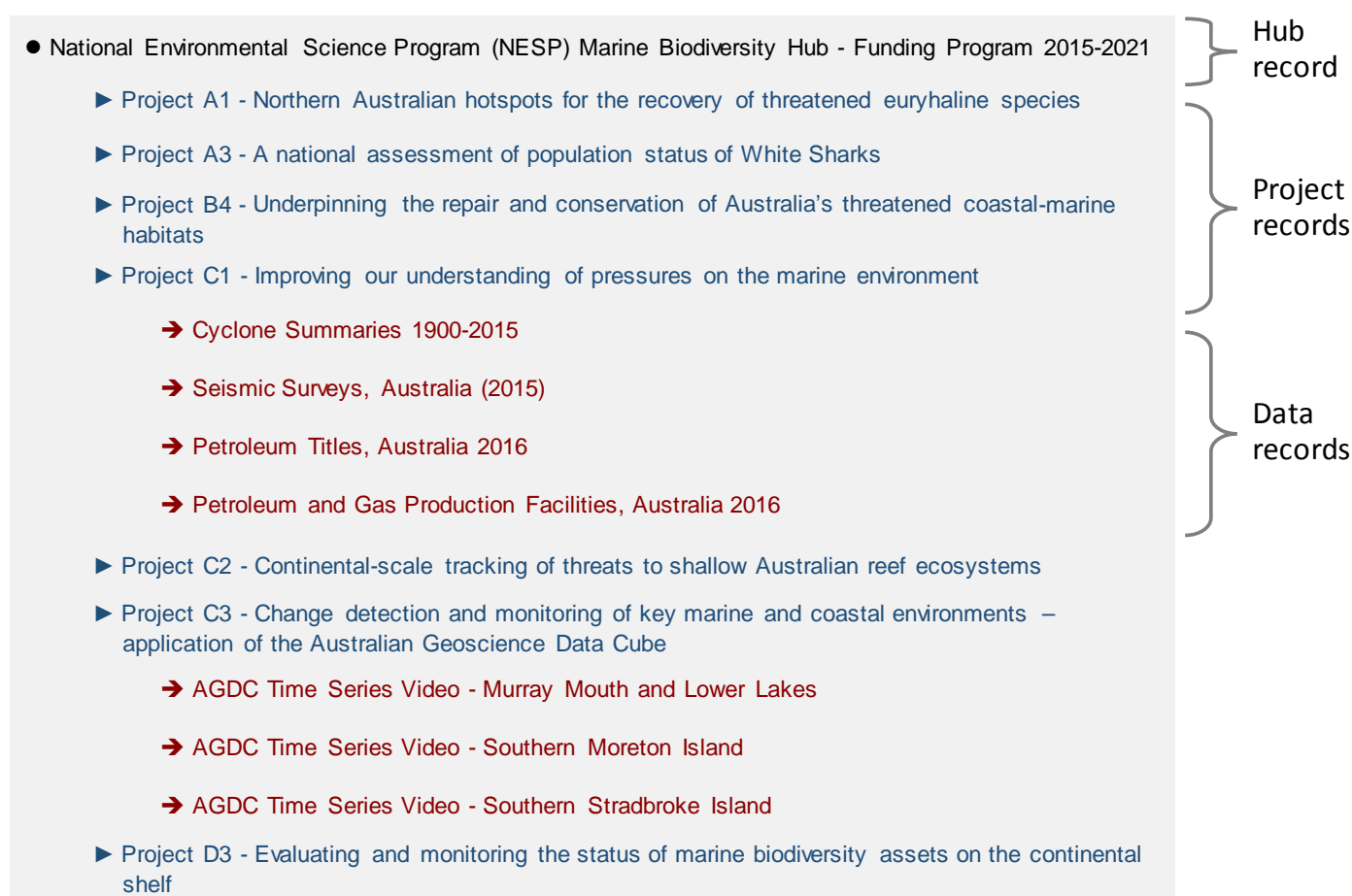


Table B1. Project-level Hub metadata records and their corresponding unique identifiers (UUIDs). Project UUIDs are to be inserted into the XML of all metadata records within the tag <gmd:parentIdentifier> (as detailed above) to create nested project – data hierarchies in the AODN (see [Figure B1](#) above)

NESP Hub Project	Unique Identifier (UUID)
Project A1	e42486aa-40d8-4fb0-96fd-f3c0cc246fd9
Project A3	8a41de4e-b649-45bd-b496-28250b627f77
Project A4	4bede4d1-29ad-45ee-b84f-1460804c5f46
Project A5	2bc9e6be-ed27-43fa-aa05-1f2332df7125
Project A7	298ada9a-b326-48f9-8e0a-2dba0b315b53
Project A8	7be029e5-afbd-431e-975a-2c03987b367c
Project A9	9a130a40-15e3-4e0f-b25f-bf0b743fb066
Project A10	948d7fac-7dfa-43d0-9969-aa66a765852d
Project B1	0a3a2761-9a4f-411f-9503-3cd661005ab1
Project B3	88898d65-6581-4746-b432-d6fa7c62cc5c
Project B4	4fde31ee-7a51-4029-8e32-c020dfce56f8
Project C1	9130534d-34d1-4b18-a255-668d4b04b1a1
Project C2	4db9bf7f-9469-4fc2-8746-3824427512d0
Project C3	3ad255f9-64f0-496d-8b75-703a637162da
Project C4	fa9f43ef-5327-4fb7-bf13-ec4454468ff3
Project C5	5fb8766b-b3cb-4fd0-aad7-7dfcda6582a9
Project D1	d150240e-3cb7-437f-90ca-b9afe700a19
Project D2	43716bdf-68d8-497a-8871-c25c848d39b9
Project D3	6fc86902-d98d-4ae4-b7f2-00e5b831bb88
Project D4	27a2ecfb-0d7d-4333-af4a-4fb0049be6b6

Appendix C – Recommended file types for storing data and deployment via Web Services (WMS & WFS)

Recommended file types for storing research data

While there are no mandatory file type standards for archiving Hub data, storage in an open (non-proprietary) format facilitates reuse and value-adds. The Hub recommends the following formats (more information on open formats available [here](#)):

- For tabular data, comma separated variable (.csv) format is preferred.
- For relational data (database tables), any database management system permitting public connections is acceptable. e.g. MS Access, MS SQL, PostgreSQL
- For gridded data (e.g. model output), NetCDF is the most commonly-used format (NetCDF metadata should conform to the [CF 1.6 convention](#)).
- For video, Motion JPEG 2000 (.mj2), AVI (.avi) or QuickTime Movie (.mov) are all acceptable formats. Windows Media Video (.wmv) or proprietary camera codecs should be avoided.
- For raster images, JPEG (uncompressed), TIFF and PNG are all acceptable.
- For maps/charts, PDF or the above image formats are acceptable.
- All geospatial data should, wherever possible, be deployed via OGC Web Services (see more below). Any geospatial data *not* deployed via Web Services must still be supplied in a format that enables visual representation of the data, e.g. Shapefile, GeoJSON, KML

GEOSPATIAL data – configuring WMS and WFS

All geospatial Hub data should be deployed via [Open Geospatial Consortium](#) (OGC) compliant Web Services. This enables the data to be showcased in the interactive [AODN Portal](#) – an interactive access point for geospatial marine data published to the AODN.

- A geospatial data server such as [GeoServer](#) is required to create Web Map Services (WMS) and Web Feature Services (WFS).
- WMS and WFS information must be configured in metadata records as per the [instructions provided by AODN](#) in order to populate the AODN Portal.
- Wherever possible, partners should seek to create WMS and WFS using the infrastructure of their own research agency or that of another collaborating Hub partner (at the time of writing, AIMS, CSIRO, GA, IMOS & UTAS all have their own GeoServers)
- For Hub partners generating geospatial data but without access to a GeoServer within their organisation (i.e. no means to generate Web Services), contact the [Hub Data Manager](#) to discuss options for deploying geospatial data.

Additional useful AODN resources
‘ABC’ of contributing data
Required WMS & WFS metadata (geospatial data only)
WMS & WFS GeoServer example (geospatial data only)



www.nespmarine.edu.au

Contact:

Emma Flukes

Institute for Marine and Antarctic Studies
University of Tasmania

University of Tasmania, Private Bag 129, HOBART TAS 7001
emma.flukes@utas.edu.au | Tel +61 408 901 952