

# RIMReP Data Management System

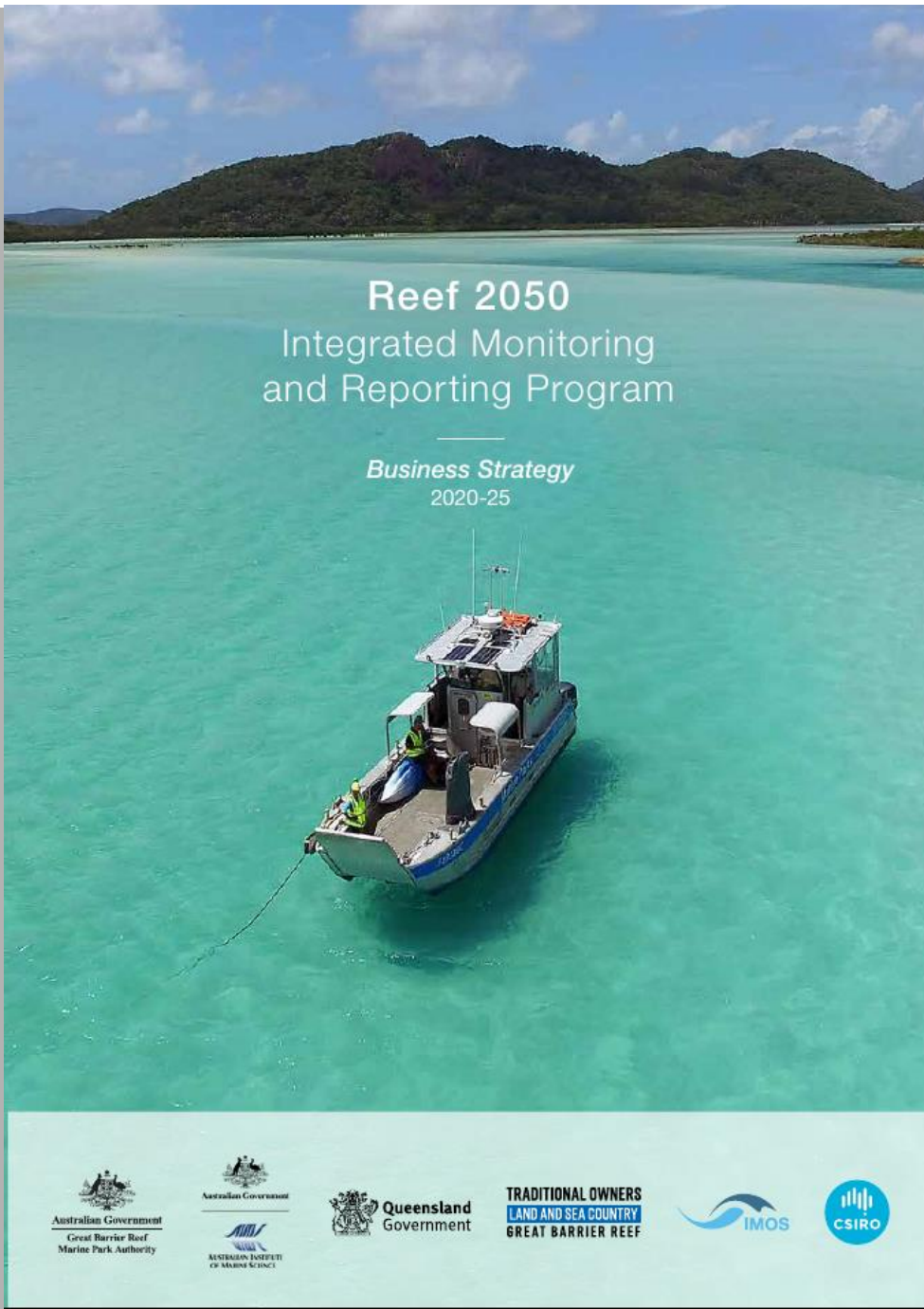
## A Cloud Native Framework for Efficient Data Management in the Great Barrier Reef Conservation

RIMReP-DMS Team  
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*IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.*





# Access Information

## 6.1 Objectives

- A Data Management System, where required information is easily located and accessed [AI1 and AI2].
- Responsive and sustainable information platform, supporting knowledge systems needs [AI4 and AI5].
- A platform where 'big data' can be analysed for management information and systems, including the Reef Knowledge System [AI5].
- Negotiate and manage data sharing agreements, protecting ownership rights and privacy [AI1 and AI2].
- Improved efficiency of access to information through automation of repetitive tasks [AI1, AI2 and AI3].

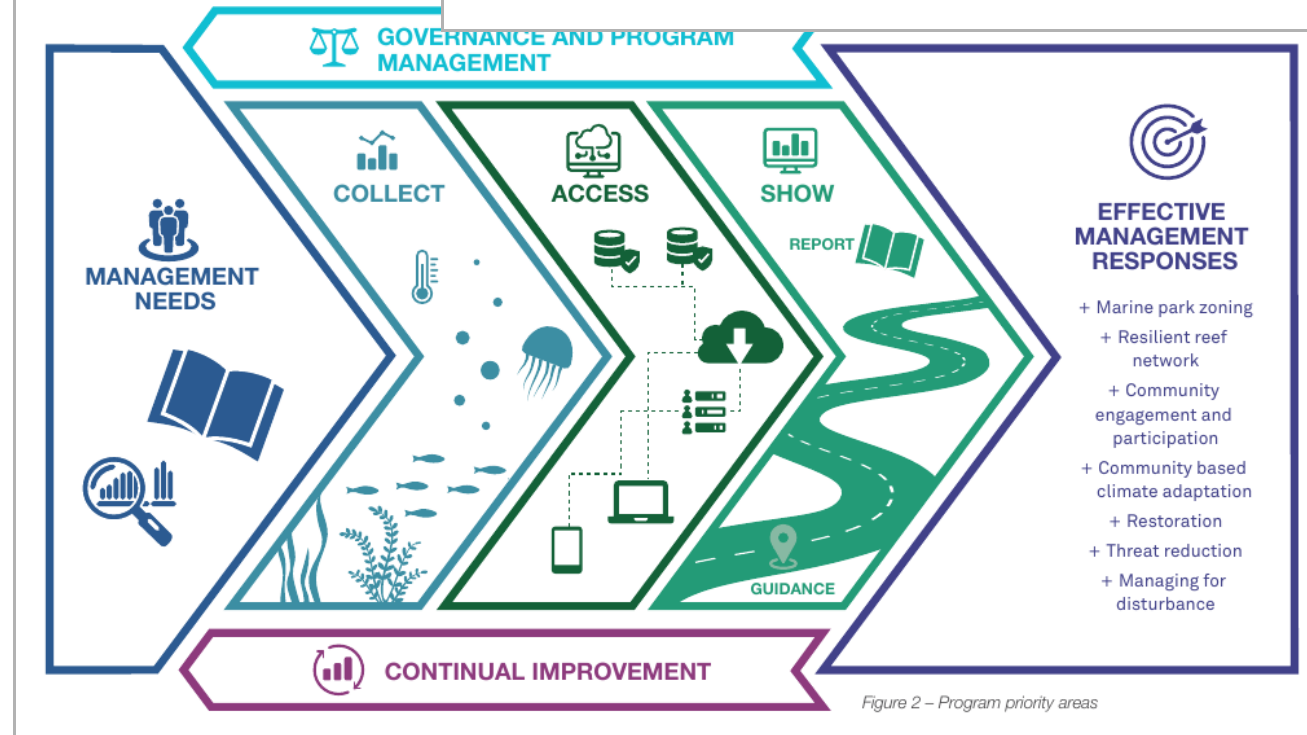


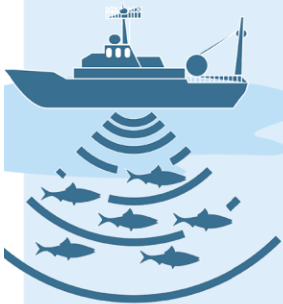
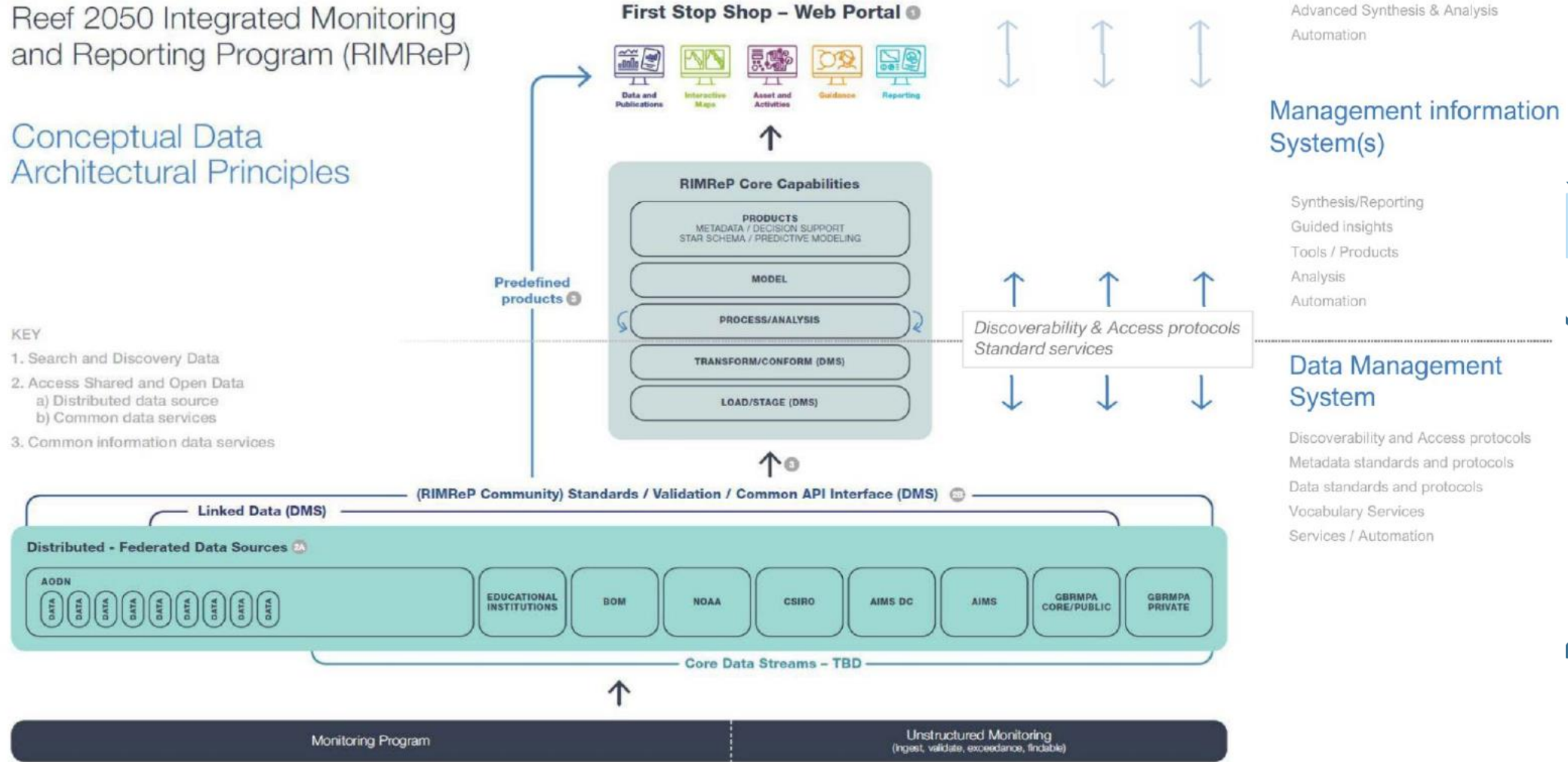
Figure 2 – Program priority areas

# RIMReP Data Architecture

Reef 2050 Integrated Monitoring and Reporting Program (RIMReP)

Conceptual Data Architectural Principles

- KEY
1. Search and Discovery Data
  2. Access Shared and Open Data
    - a) Distributed data source
    - b) Common data services
  3. Common information data services



# Data Sources

+160 datasets identified (+300 historic biodiversity DS from OBIS)

- 83 audited in terms of data maturity (IMOS/AODN 2017)
- 121 prioritised by GBRMPA (**G**reat **B**arrier **R**ef **M**arine **P**ark **A**uthority) according to their use in agency's reporting
- High diversity of data systems, data types, access protocols

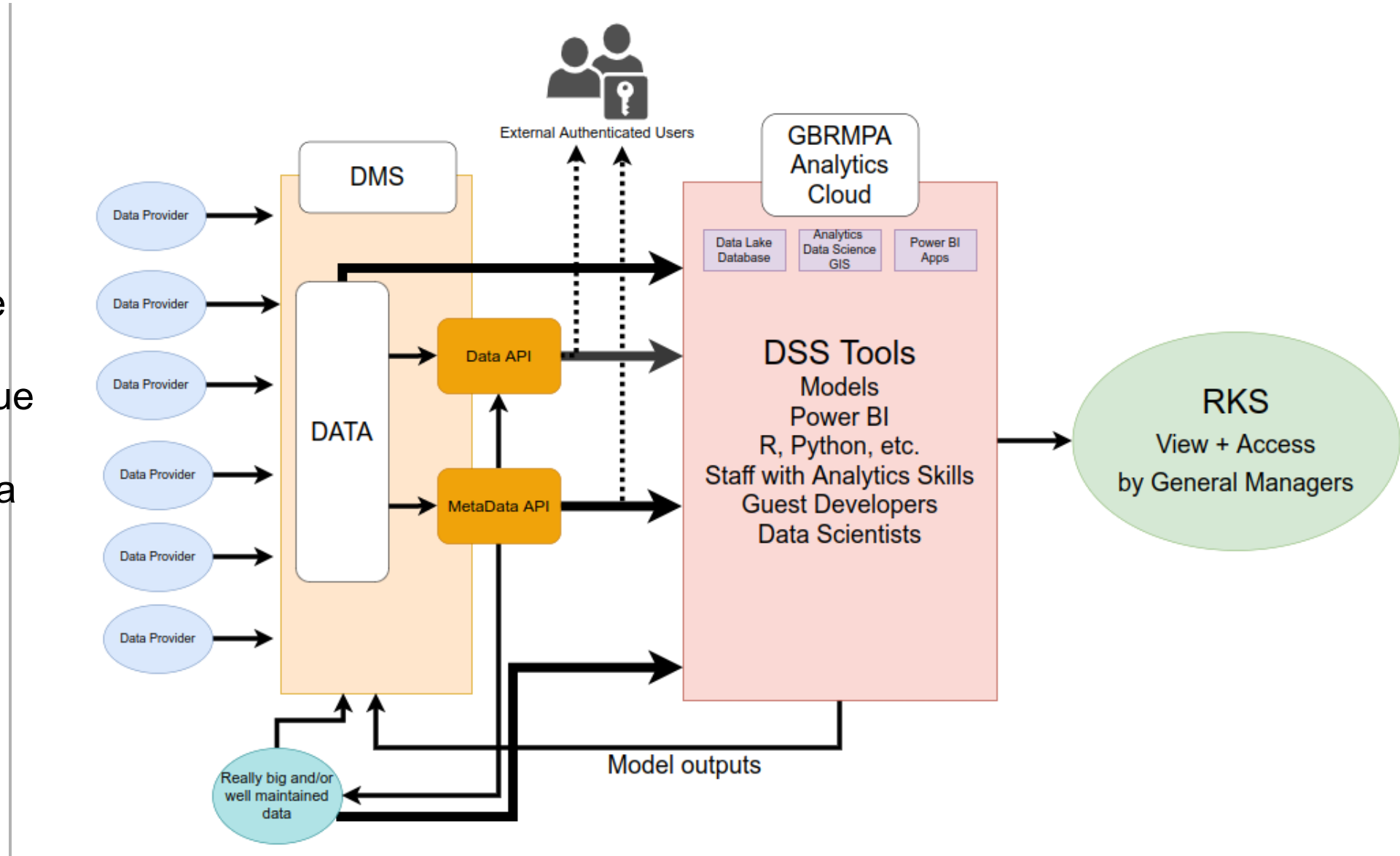
Program	dataset_ID	Organisation	has_Contact	Critical	Survey_ID	GBR_Priority	DA_Priority	DA_Maturity
Great Barrier Reef Ocean Observing System	DS-049	QIMOS	TRUE		40	HIGH	HIGH	1
eReefs	DS-029	CSIRO   AIMS   BOM	TRUE	CM1-NA		HIGH	HIGH	1
AIMS Weather Observing System	DS-005	AIMS	TRUE		42	HIGH	HIGH	1
Great Barrier Reef and Coral Sea bathymetry	DS-047	JCU	FALSE			HIGH		1
GBR Habitat Mapping layers and bathymetry	DS-039	GBRMPA	FALSE			HIGH		1
ReefTemp	DS-088	CSIRO   GBRMPA   BoM	TRUE			HIGH	HIGH	1
Australian National Accounts: State Accounts, census data	DS-008	ABS	FALSE			HIGH		2
Qld wetland extent change mapping	DS-077	QLD Herbarium   DSITI	TRUE			HIGH	HIGH	2
GBR MMP- Inshore Water Quality Monitoring – Remote Sensing	DS-045	CSIRO	TRUE			HIGH	HIGH	2
Socio-Economic Long-Term Monitoring Program (SELTMP)	DS-096	CSIRO	TRUE	CM1-NA	35	HIGH	MED	2
Coral Reef Watch Satellite Monitoring	DS-016	NOAA	TRUE		37	HIGH	HIGH	2
FRS (Field Reporting System)	DS-037	GBRMPA	FALSE			HIGH		2
GBR MMP - Inshore Water Quality Monitoring – Ambient Water Quality Sampling	DS-043	AIMS	TRUE		53	HIGH	HIGH	2
GBR MMP - Inshore Water Quality Monitoring – Ambient Water Quality Sampling; (RRM)	DS-044	JCU	FALSE		55	HIGH	HIGH	2
Sea Temperature Monitoring Program	DS-091	AIMS   GBRMPA	TRUE		41	HIGH	HIGH	2
AIMS Long-Term Monitoring Program	DS-004	AIMS	TRUE		4	HIGH	HIGH	3
Coastal Bird Monitoring	DS-013	GBRMPA   QPWS	TRUE		25	HIGH	HIGH	3
Old State-wide Monitoring of Recreational fishing (OFish)	DS-076	DAF	TRUE		11	HIGH		3
	DS-027	JCU	TRUE		49	HIGH	HIGH	3
	DS-078	DAF	TRUE			HIGH	MED	3
	DS-079	DAF	TRUE		12	HIGH	MED	3
	DS-014	QPWS   GBRMPA	TRUE			HIGH	HIGH	4
	DS-041	JCU	TRUE		32	HIGH	HIGH	4
	DS-040	AIMS	TRUE		3	HIGH	HIGH	4
	DS-020	RRRC   GBRMPA	TRUE		46	HIGH	MED	4
	DS-042	Entox   UQ	TRUE		28	HIGH	HIGH	4
	DS-075	DAF	TRUE			HIGH	HIGH	5
	DS-024	JCU   Giringun Aboriginal Corporation	TRUE			HIGH	MED	5
	DS-025	JCU   Lama Lama Aboriginal Corporation	TRUE			HIGH	MED	5
Dolphin and dugong monitoring - Mandubarra Sea Country	DS-026	Mandubarra Land and Sea Inc.	TRUE			HIGH	MED	5

75% of high priority datasets are provided by 9 organisations (from +68)



# DMS

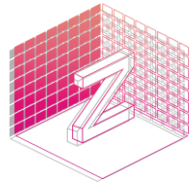
- Harvesting engine
- Data API
- Metadata catalogue and API
- Authenticated data services



# DATA

## ARCO formats (Analysis-Ready Cloud-Optimised)

**Gridded Datasets**  
e.g. Satellite derived data

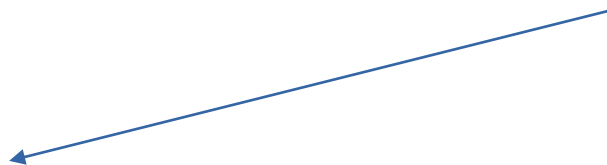
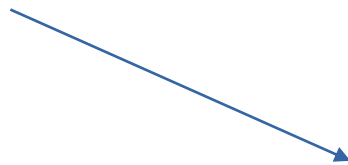


Zarr

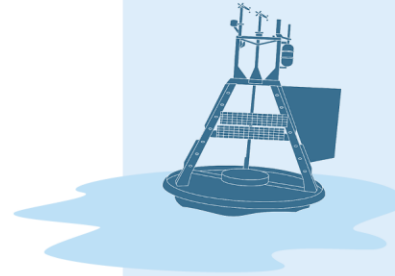
**Tabular Datasets**  
e.g. Long Term Monitoring Program (AIMS)



**Geometries (shapefiles)**  
e.g. GBR Features



**Frictionless Data**



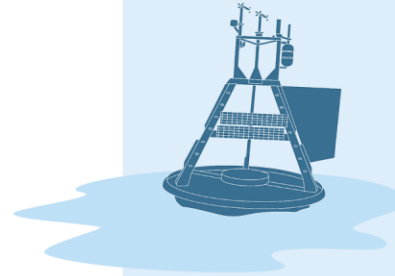
# HOW TO USE RIMReP-DMS



1. **Discover** the data collections of interests → STAC

1. **Get** the data:

- a. From the **original provider** → See metadata link in STAC
- b. By directly **connecting to the AWS S3 bucket** → get the URL from STAC
- c. By making **pygeoapi API calls** → get the link from STAC



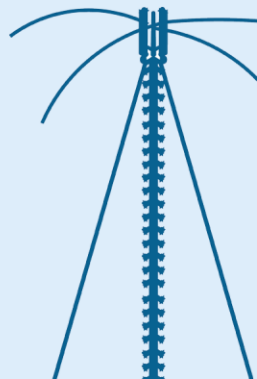
# STAC Catalogue



## METADATA STAC Catalogue Spatio-Temporal Asset Catalogs

- INTERNAL catalogue
- Refers to the original point-of-truth
- Light & Highly configurable
- Searchable
- Browser / API

A screenshot of the stac-fastapi web interface. The page title is "stac-fastapi". It features a navigation bar with "Browse" and "Search" buttons. Below the navigation bar is a "Description" section with the text "stac-fastapi". To the right of the description is an "Additional Resources" section with two links: "OpenAPI service description" and "OpenAPI service documentation". Below the description is a "Catalogs" section with a count of 9, a "Tiles" button, a "List" button, and sorting options for "Ascending" and "Descending". A search bar is present with the text "Filter catalogs by title". The main content area displays a grid of catalog cards. Each card includes a title, a brief description, and a date range. The visible cards are: "NOAA Coral Reef Watch Version 3.1 Daily Global 5km Satellite Coral Bleaching Heat Stress Monitoring Product Suite" (1/1/1985, 12:00:00 AM UTC until present), "GBRMPA Administrative Regions" (7/1/2004, 12:00:00 AM UTC until present), "AMSA Vessel Tracking" (1/1/2022, 1:00:00 AM UTC until present), "AIMS Oceanography" (11/12/1991, 12:00:00 AM UTC until present), "ABS Census" (1/1/2011, 12:00:00 AM UTC - 12/31/2022, 12:00:00 AM UTC), "ABS Spatial Geographies" (10/6/2021, 12:00:00 AM UTC - 7/21/2022, 12:00:00 AM UTC), "QLD Transport and Main Roads Vessels", and "GBR Biogeographic Areas".



# METADATA

## METADATA STAC Catalogue

### Spatio-Temporal Asset Catalogs

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The screenshot displays the 'stac-fastapi' web interface. At the top, there are 'Browse' and 'Search' buttons. Below this is a 'Description' section for 'stac-fastapi'. A 'Catalogs' section shows 9 items, with options for 'Tiles' and 'List' views, and sorting options for 'Ascending' and 'Descending'. A search bar is present with the text 'Filter catalogs by title'. The main content area is a grid of catalog cards, each with a title, description, and temporal range. The cards include:

- NOAA Coral Reef Watch Version 3.1 Daily Global 5km Satellite Coral Bleaching Heat Stress Monitoring Product Suite**: The NOAA Coral Reef Watch (CRW) daily global 5km (0.05 degree spatial resolution exactly) satellite coral bleaching heat stress monitoring product suite present... 1/1/1985, 12:00:00 AM UTC until present
- GBRMPA Administrative Regions**: The Great Barrier Reef Marine Park Authority (GBRMPA) is the custodian to a large range of data relevant to the Great Barrier Reef. On the Geoportal,... 7/1/2004, 12:00:00 AM UTC until present
- AMS A Vessel Tracking**: The Australian Maritime Safety Authority provides multiple sources of vessel traffic Craft Tracking System (CTS). Included w... 1/1/2022, 1:00:00 AM UTC until present
- AIMS Oceanography**: The Australian Institute of Marine Science (AIMS) has been collecting in situ oceanographic data since 1980 with the deployment of automatic weather observing... 11/12/1991, 12:00:00 AM UTC until present
- ABS Census**: The Australian Bureau of Statistics (ABS) provides a range of statistical outputs. Included within this collection are ABS datasets related to census and demographic... 1/1/2011, 12:00:00 AM UTC - 12/31/2022, 12:00:00 AM UTC
- ABS Spatial Geographi**: The Australian Bureau of Statistics (ABS) range of non-ABS structure digital bounda... Block boundaries were created using vari... 10/6/2021, 12:00:00 AM UTC - 7/21/2022, 12:00:00 AM UTC
- QLD Transport and Main Roads Vessels**: The QLD Department of Transport and Main Roads maintains data related to marine vessels in the state of
- GBR Biogeographic Are**: The Great Barrier Reef Marine Park Auth... (GBRMPA) is the custodian to a large ran...

# STAC Catalogue

## AIMS Oceanography

in stac-fastapi [↑ Up](#) [🗺 Browse](#) [🔍 Search](#)

### Description

The Australian Institute of Marine Science (AIMS) has been collecting in situ oceanographic data since 1980 with the deployment of automatic weather observing stations and since 1991 with the sea temperature monitoring program. Both datasets provide hourly data related to sea temperature at a range of depths, atmospheric pressure, air temperature, relative humidity, solar radiation (light as PAR), wind direction and wind speed, spanning the entirety of the Great Barrier Reef.

**License** CC-BY-3.0-AU  
**Temporal Extent** 11/12/1991, 12:00:00 AM UTC until present



### Provider

> AIMS [LICENSOR](#) [PRODUCER](#)

### Metadata

General

## AIMS Sea Surface Temperature Monitoring Program

[🔗 Source](#) [🔗 Share](#) [🗺 Language: English ▾](#)

in stac-fastapi [↑ Up](#) [🗺 Collection](#) [🗺 Browse](#) [🔍 Search](#)



### Asset

✓ AIMS Sea Water Temperature Observing System (AIMS Temperature Logger Program) [DATA](#) [PARQUET](#)

#### Parquet

[📄 Copy URL for Amazon S3](#)

S3 address of the AIMS Sea Water Temperature Observing System (AIMS Temperature Logger Program) in GeoParquet format

### Additional Resources

#### Description of the resource

- [Link to data API](#)
- [Link to original metadata](#)

### Description

The data provided here are from a number of sea water temperature monitoring programs conducted in tropical and subtropical coral reefs environments around Australia. Data are available from approximately 80 GBR sites, 16 Coral Sea sites, 7 sites in North West Western Australia (WA), 8 Queensland regional ports, 13 sites in the Solitary Islands, 4 sites in PNG and 10 sites in the Cocos (Keeling) Islands. Data are obtained from in-situ data loggers deployed on the reef. Temperature instruments sample water temperatures every 5-10 minutes (typically) and are exchanged and downloaded approximately every 12 months. Temperature loggers on the reef-flat are generally placed just below Lowest Astronomical Tide level. Reef-slope (or where specified as Upper reef-slope) generally refers to depths 5 - 9 m while Deep reef-slope refers to depths of ~20 m.

### Collection

#### AIMS Oceanography

11/12/1991, 12:00:00 AM UTC until present

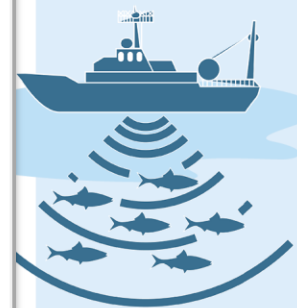
The Australian Institute of Marine Science (AIMS) has been collecting in situ oceanographic data since 1980 with the deployment of automatic weather...

### General

**Themes** **Scheme:** [https://wiki.esipfed.org/ISO\\_19115-3\\_Codelists#MD\\_TopicCategoryCode](https://wiki.esipfed.org/ISO_19115-3_Codelists#MD_TopicCategoryCode)  
**Concepts:**  
**Id:** oceans  
**Title:** Oceans

**Time of Data begins** 11/20/1991, 2:00:00 PM UTC

**Time of Data ends** 5/6/2022, 1:56:45 PM UTC



## AIMS Sea Surface Temperature Monitoring Program

in stac-fastapi [Up](#) [Collection](#) [Browse](#) [Search](#)



### Description

The data provided here are from a number of sea water temperature

Name	Description
f string (query)	The optional f parameter indicates the output format which the server shall provide as part of format is GeoJSON.  Available values : json, html, jsonld, csv  Default value : json  [ json ]
lang string (query)	The optional lang parameter instructs the server return a response in a certain language, if s available values, the Accept-Language header language will be used if it is supported. If the language is used. Note that providers may only support a single language (or often no language server language. Language strings can be written in a complex (e.g. "fr-CA,fr;q=0.9,en-US;q=0.8,de-CH" or "fr_BE") fashion.  Available values : en-US  Default value : en-US  [ en-US ]
bbox array(number) (query)	Only features that have a geometry that intersects the bounding box are selected. The bounding box depending on whether the coordinate reference system includes a vertical axis (height or depth). <ul style="list-style-type: none"><li>• Lower left corner, coordinate axis 1</li><li>• Lower left corner, coordinate axis 2</li><li>• Minimum value, coordinate axis 3 (optional)</li><li>• Upper right corner, coordinate axis 1</li><li>• Upper right corner, coordinate axis 2</li><li>• Maximum value, coordinate axis 3 (optional)</li></ul> If the value consists of four numbers, the coordinate reference system is WGS 84 longitude/latitude (http://www.opengis.net/def/crs/OGC/0/CRS84) unless a different coordinate reference system is specified in the parameter.  If the value consists of six numbers, the coordinate reference system is WGS 84 longitude/latitude/height (http://www.opengis.net/def/crs/OGC/0/CRS84h) unless a different coordinate reference system is specified in the parameter.  The query parameter <a href="#">bbox-crs</a> is specified in OGC API - Features - Part 2: Coordinate Reference System.  For WGS 84 longitude/latitude the values are in most cases the sequence of minimum longitude and maximum longitude. However, in cases where the box spans the antimeridian the first and third values (east-most box edge).  If the vertical axis is included, the third and the sixth number are the bottom and the top of the vertical axis.  If a feature has multiple spatial geometry properties, it is the decision of the server whether to use to determine the extent or all relevant geometries.
limit integer	The optional limit parameter limits the number of items that are presented in the response.

### Asset

> AIMS Sea Water Temperature Observing System (AIMS Temperature Logger Program)

### Additional Resources

#### Description of the resource

- [Link to data API](#)
- [Link to original metadata](#)

geoJSON, CSV

```
JSON Raw Data Headers
Save Copy Collapse All Expand All Filter JSON
type: "FeatureCollection"
features:
  0:
    id: "149486624"
    type: "Feature"
    properties:
      deployment_id: 3603
      site: "Nth West Solitary Is-Manta Moor"
      site_id: 971
      subsite: "NWMA"
      subsite_id: 2989
      from_date: "2000-12-13T00:00:00"
      thru_date: "2001-02-24T00:00:00"
      depth: 7
      parameter: "Water Temperature"
      instrument_type: "Odyssey"
      serial_num: "SST-372810"
      lat: -30.0185
      lon: 153.2666
      gbrmpa_reef_id: null
      metadata_uuid: "ef29d61c-2917-4e43-a1e6-fac161cf3bba"
      sites_with_climatology_available: null
      time: "2001-01-08T19:30:01+00:00"
      cal_val: 21.83
      qc_val: 21.83
      qc_flag: 1
    geometry:
      type: "Point"
      coordinates:
        0: 153.2666
        1: -30.0185
      bbox:
        0: 153.2666
        1: -30.0185
        2: 153.2666
        3: -30.0185
  1:
    id: "149486625"
    type: "Feature"
    properties:
      deployment_id: 3603
      site: "Nth West Solitary Is-Manta Moor"
```

# DATA API



<https://pygeoapi.staging.reefdata.io/collections/noaa-crw-dhw/coverage?datetime=2023-02-01>

pygeoapi [Contact](#)

Home / Collections / NOAA Coral Reef Watch... [json](#) [jsonld](#)

## NOAA Coral Reef Watch - Degree Heating Week

NOAA Coral Reef Watch Daily Global 5km Satellite Coral Bleaching Degree Heating Week

Links

- [Information \(text/html\)](#)
- [The landing page of this server as JSON \(application/json\)](#)
- [The landing page of this server as HTML \(text/html\)](#)
- [This document as JSON \(application/json\)](#)
- [This document as RDF \(JSON-LD\) \(application/ld+json\)](#)

```
{  
  "type": "Coverage",  
  "domain": {  
    "type": "Domain",  
    "domainType": "Grid",  
    "axes": {  
      "x": {  
        "start": 133.02499389648438,  
        "stop": 168.97500610351562,  
        "num": 720  
      },  
      "y": {  
        "start": -8.024999618530273,  
        "stop": -25.975000381469727,  
        "num": 360  
      },  
      "time": {  
        "start": "2023-02-01T12:00:00.000000000",  
        "stop": "2023-02-01T12:00:00.000000000",  
        "num": 1  
      }  
    }  
  },  
  "values": [
```

```
    ],  
    "shape": [ 360, 720, 1 ],  
    "values": [ 4.5, 4.690000057220459, 5.029999732971191, 5.230000019073486, 5.489999771118164, 5.690000057220459, 5.739999771118164, 5.819999694824219, 5.900000095367432, 5.960000038146973, 6.039999961853027, 6.049999713897705, 6.099999904632568, 6.089999675750732, 5.769999980926514, 5.87999963760376, 5.549999713897705, 5.5, 5.449999809265137, 4.96999979019165, 4.759999752044678, 4.529999732971191, 4.279999732971191, 4.069999694824219, 3.68999981880188, 3.369999885559082, 3.4499998092651367, 3.419999837875366, 3.25, 3.1999998092651367, 3.319999933242798, 3.1599998474121094, 3.5799999237060547, 3.5799999237060547 ]  
  ]  
}
```

coverageJSON, netCDF, GeoTIFF

# USING DMS

<https://github.com/aodn/rimrep-examples>

The image displays four overlapping screenshots from the GitHub repository 'aodn/rimrep-examples'. The top-left screenshot shows the repository's file structure, including folders for 'Python\_based\_scripts', 'R\_based\_scripts', and 'images', and files like '.gitignore', 'LICENSE', 'README.md', and 'rimrep-examples.Rproj'. The top-right screenshot shows a pull request by user 'lidef87' titled 'correcting rendering of list in markdown'. The bottom-left screenshot shows a notebook titled 'Extracting temporal data' with a table of contents including 'Goal of this notebook', 'Loading libraries', 'Connecting to RIMReP collection', 'Extracting variables of our interest', 'Plotting map of sampled sites', 'Extracting data for sites of interest', and 'Saving data summaries and maps'. The bottom-right screenshot shows a notebook titled 'Geoparquet direct access example' with authors 'Leo Ghignone, Denisse Fierro Arcos'. It includes a 'Goal of this notebook' section, a 'Workflow to be followed' section, and a 'Loading libraries' section with code for accessing an S3 bucket and loading data.



<https://github.com/aodn/rimrep-examples>

<https://stac.staging.reefdata.io/browser/>



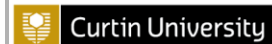
Australia's Integrated Marine Observing System (IMOS) is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent. [www.imos.org.au](http://www.imos.org.au)

#### PRINCIPAL PARTICIPANTS



SIMS is a partnership involving four universities.

#### ASSOCIATE PARTICIPANTS



IMOS thanks the many other organisations who partner with us, providing co-investment, funding and operational support, including investment from the Tasmanian, Western Australian and Queensland State Governments.

IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.

[info-rimrep@utas.edu.au](mailto:info-rimrep@utas.edu.au)

