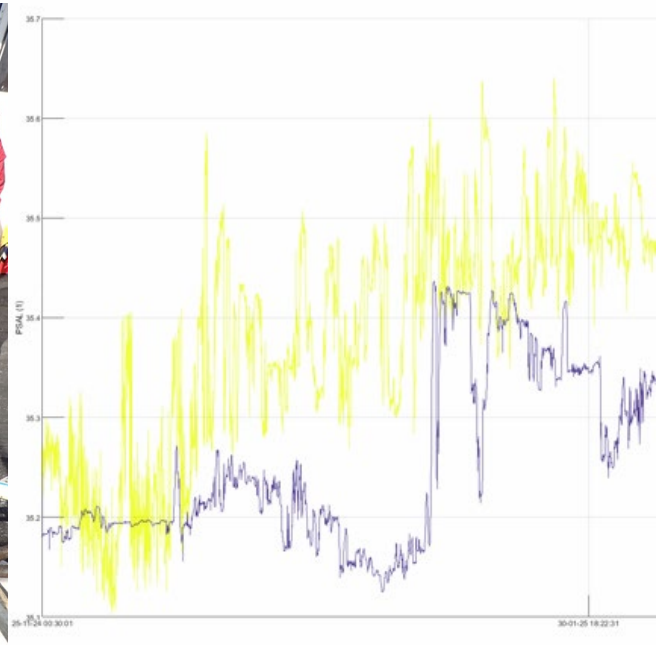
CELEBRATING 20 YEARS
OF SUSTAINED MARINE OBSERVING

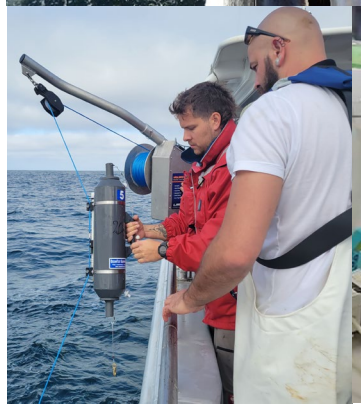
IMOS
Integrated Marine Observing System

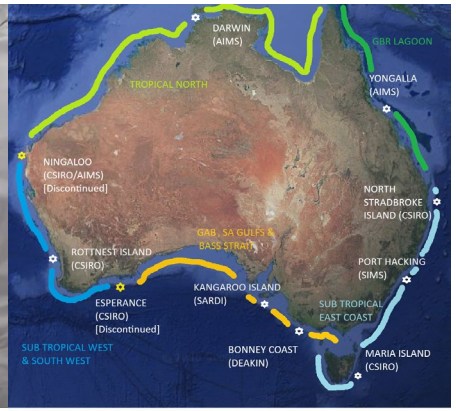
National Reference Stations

A Twenty-Year Retrospective

David Hughes & Claire Davies & many more



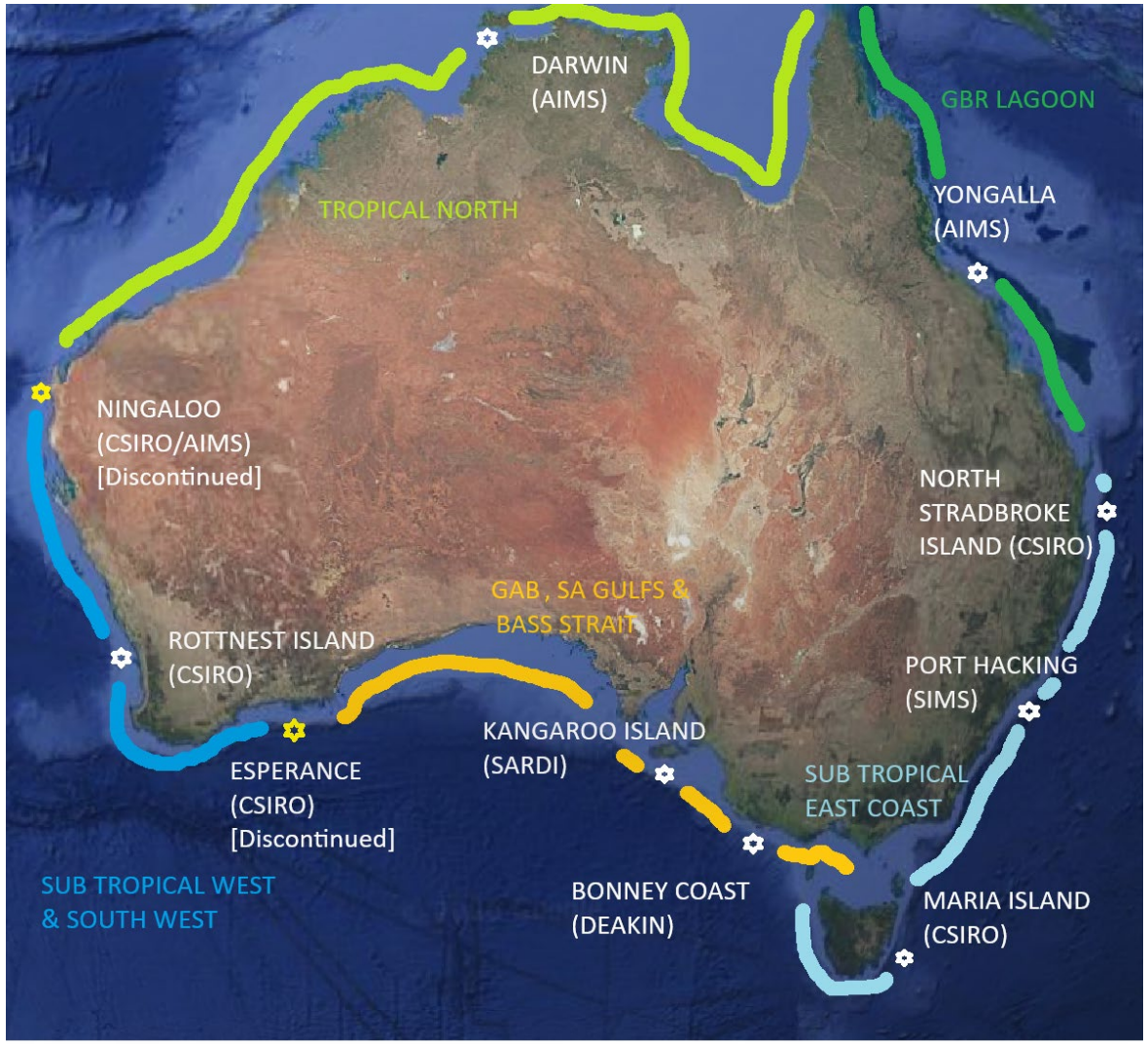




IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe, and recognise them as Australia's first marine scientists and carers of sea Country. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.

The NRS System

- Australia's mainland including Tasmania has a coastline of ~36,000km
- It's a huge challenge to fully capture coastal regions in a manageable and affordable number of stations.
- These need to be regularly sampled and their moorings rotated while managing availability of staff, suitable vessels, weather, tech reliability, budgets and other logistics.
- To decide on locations, 5 distinct coastal regions were identified [ref fig and IMOS NRS Rationale, Design and implementation Plan August 2011]. Lynch et Al 2014 PLoS One].
- The system initially commenced with 7 stations including those that had been historically sampled since the 1940's at MAI, PH, ROT .
- Ningaloo and Esperance were added soon after but were later discontinued due to the cost and logistics involved in their operation.
- Bonney Coast was recently welcomed as an eighth station capturing a significant coastal upwelling.
- Oke PR, Sakov P. 2012. Assessing the footprint of a regional ocean observing system. Journal of Marine Systems.



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Collaboration

- AIMS, CSIRO, SARDI, SIMS and now Deakin University
- Individually managed mooring and sampling operations, but (mostly) centrally processed samples
- Coordination across all partner organisations
- Fine-tuning methodology and application for most effective sampling
- Value adding where appropriate, and possible, such as eDNA
- Cross skilling and swapping knowledge
- Knowledge gained across organisations leading to constant improvements in QA procedure for moorings, instrument management, and in situ sampling best practice
- E.g. peer reviewed BGC sampling manual and Eriksen *et al.* 2019 – Frontiers methods, plankton sampling methods and Hood *et al.* 2010 – GO-SHIP Hydrochemistry manual

CSIRO

AUSTRALIAN INSTITUTE OF MARINE SCIENCE

SARDI RESEARCH AND DEVELOPMENT

sims sydney institute of marine science

DEAKIN UNIVERSITY

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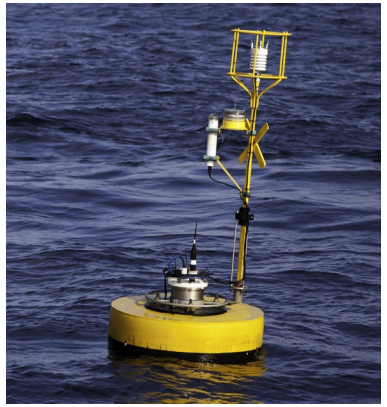
Tech Changes

The instrumentation suite on the NRS moorings has changed and evolved over time.

Initially the Wetlabs WQM was widely used.

This was replaced with either a Seabird SBE37SMP CTD or SBE16+V2

MAI and NSI initially had a weather station, SBE39 surface temp sensor and telemetry but were removed in concert with the WQM -> SBE37 changeout in 2017. DAR and YON have telemetry.



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Tech Changes

Sites primarily have used the RDI Workhorse Sentinel 300 ADCP to capture currents however many sites are now moving to the Nortek Signature series such as the Signature 250

CTD profiles during BGC insitu sampling voyages have used the SBE19+V2 and earlier variants.

With the new NRT system coming online, bottom water DO will again become available with the use of an SBE37ODO CTD, and surface temperature and salinity will be provided by an SBE37SMP

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Near Real Time (NRT) Uplift

- NRT provides a continuous data stream, not staggered, discrete downloads.
- NRT provides the ability to incorporate forcing into predictive modelling, assisting in predictions of events such as Marine Heat Waves and Harmful Algal Blooms.
- Transmitted data is collected data. It is not at risk from weather, delays in boat charters to recover moorings, or mooring failure.
- NRT assists in quality control –it allows rapid identification of instrument failure or sensor drift.
- NRT can assist in timing the co-location of assets such as Sea Gliders.

The NRT system has been rolled out to Maria Island NRS after overcoming a number of technical challenges.

It is expected that NRT systems will be provided to the Kangaroo Island and Rott Nest Island NRS sites in time for their next mooring rotations in May 2026.

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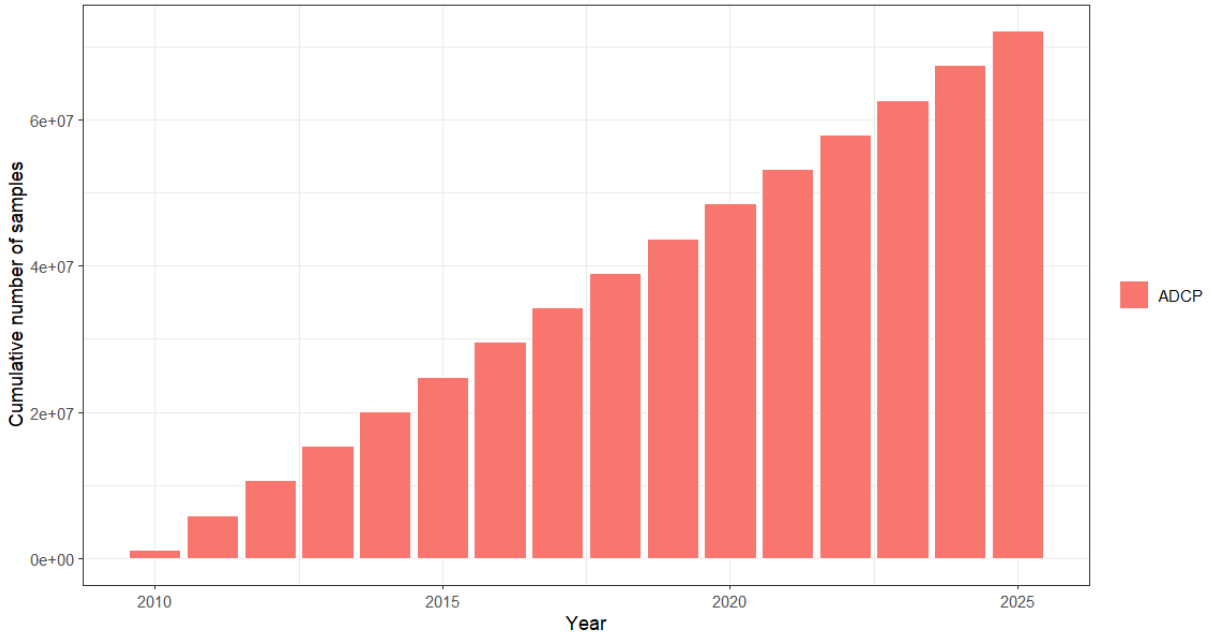
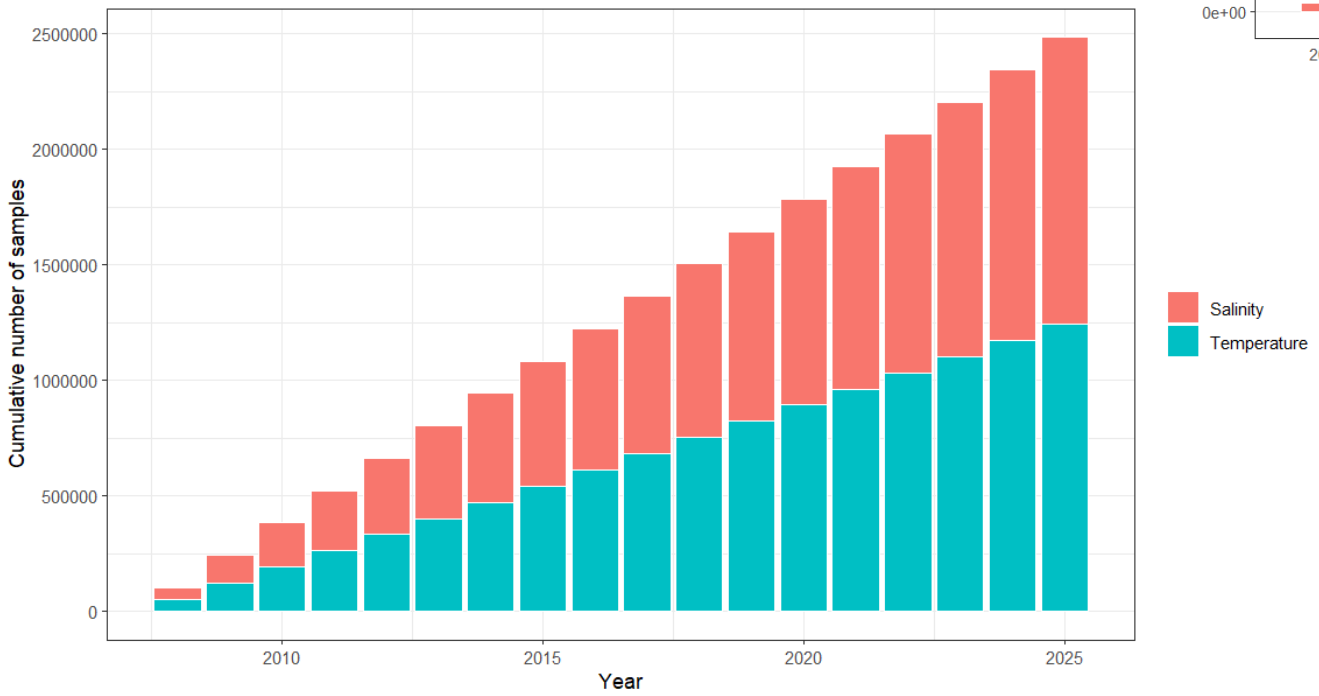
Datasets

Datasets are growing through the years, producing an incredible timeseries across many parameters, providing an invaluable resource.





Measurements for just Maria Island NRS:

Over 72 Million ADCP data points (3-axis velocity) Since 2010

~2.5 Million Temperature and Salinity Insitu Measurements Since 2008

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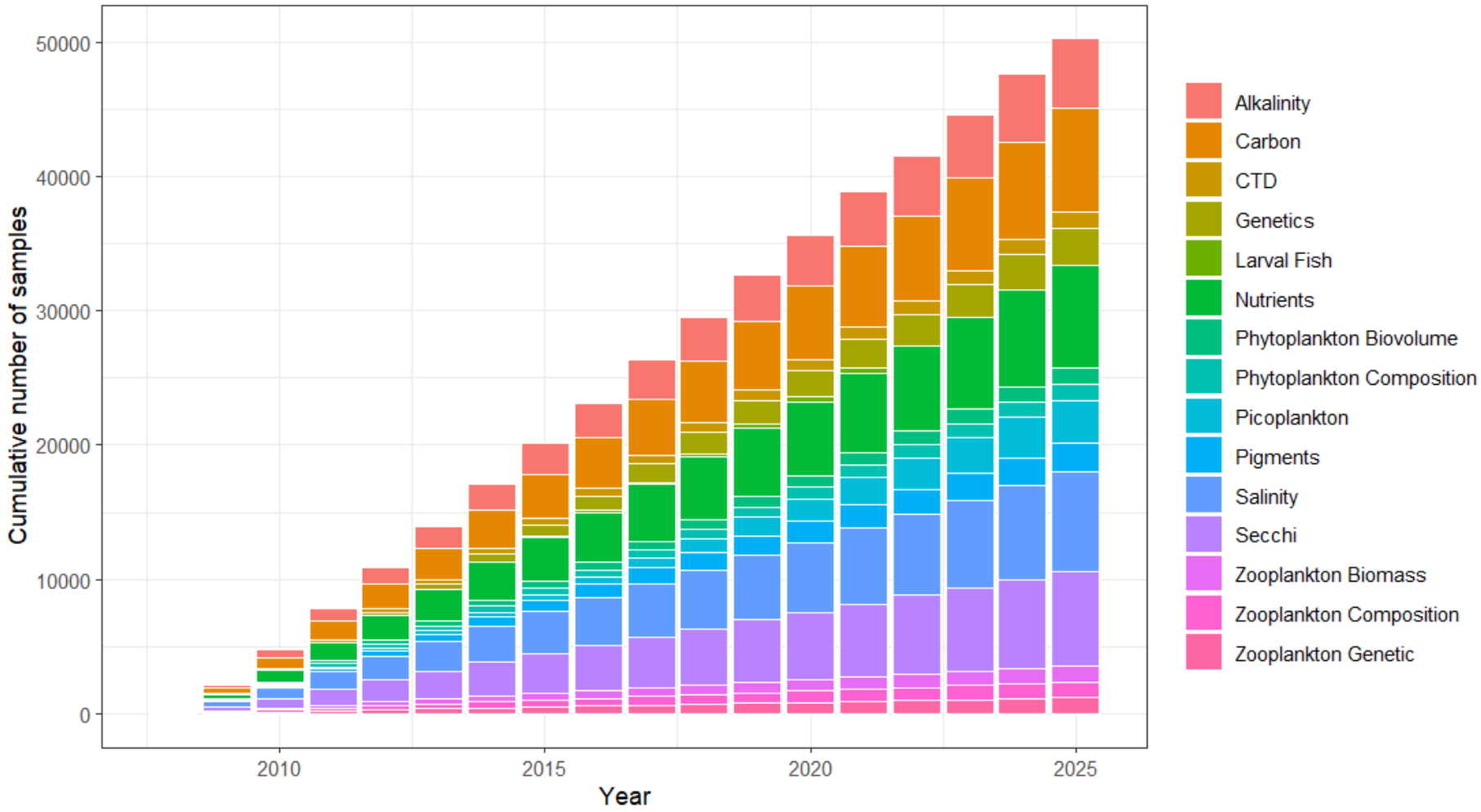
Datasets

Cumulative number of BGC samples collected across NRS stations until end of 2025

1257 sampling trips

Total BGC samples collected to 2025 = 50,253



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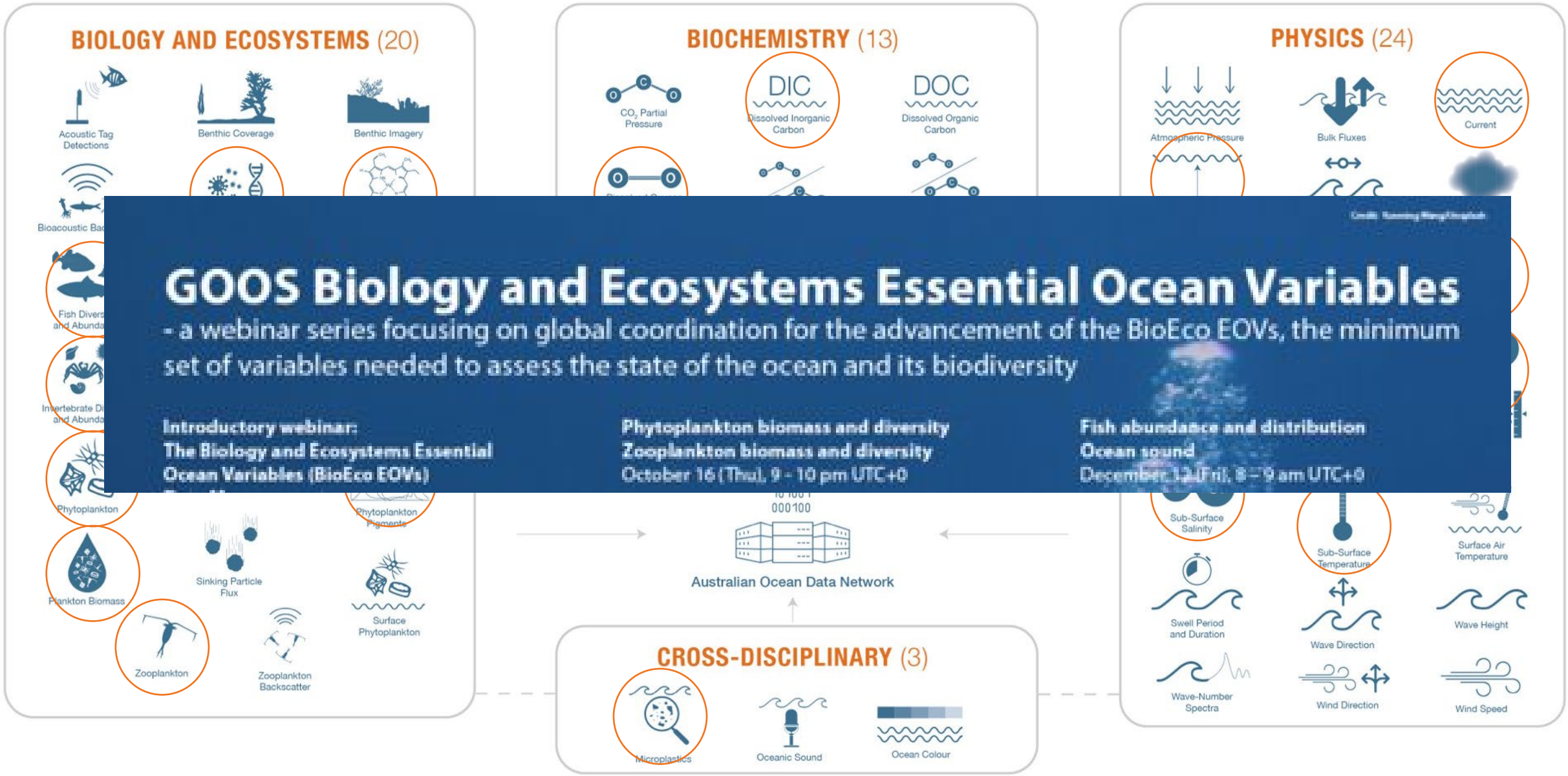
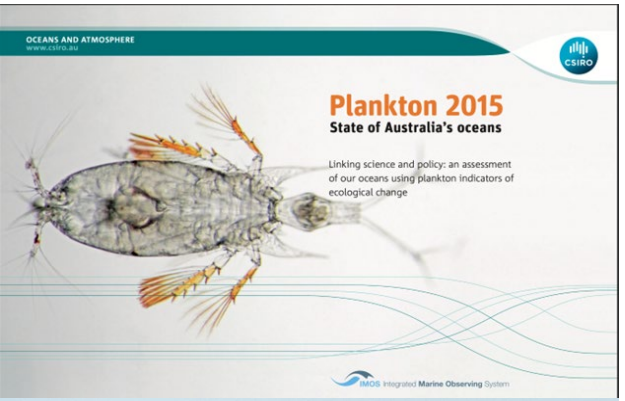
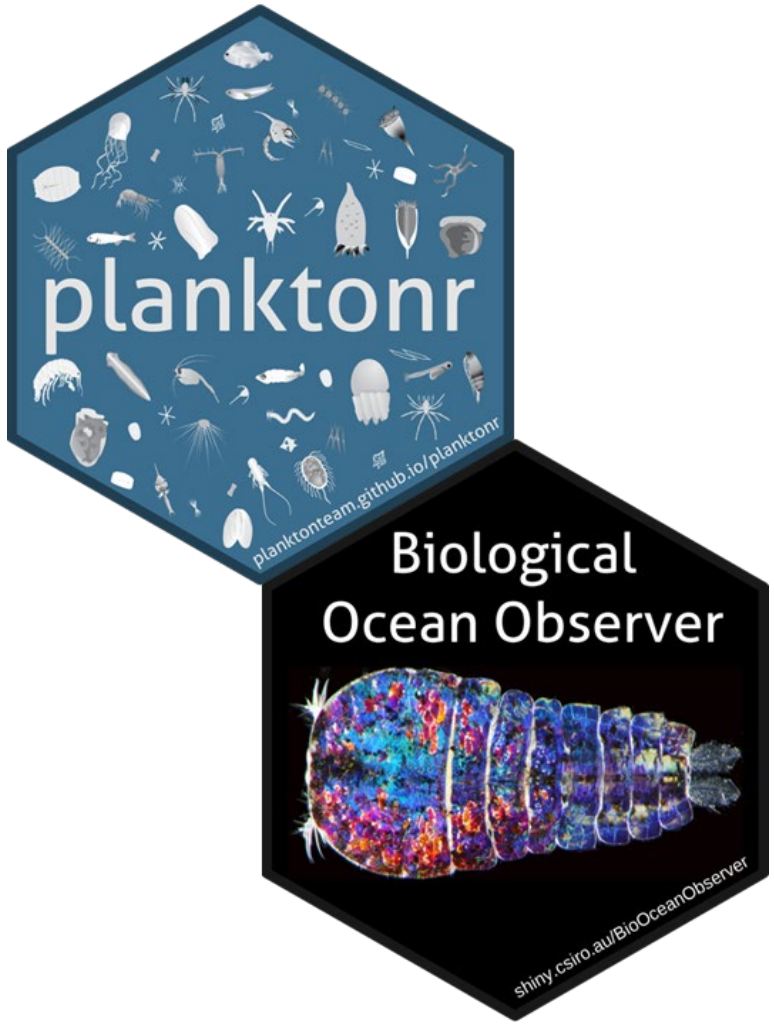
IMOS delivers over 60 data streams contributing to 27 Essential Ocean Variables and 21 Essential Climate Variables

BGC delivers over 18 data streams contributing to 15 Essential Ocean Variables and 11 Essential Climate Variables



Essential Ocean Variables and Reporting





NSW GOVERNMENT
Department of Climate Change, Energy, Environment and Water

Changing Oceans: Science and Synthesis – A regional analysis of the state of NSW coastal waters 2025.

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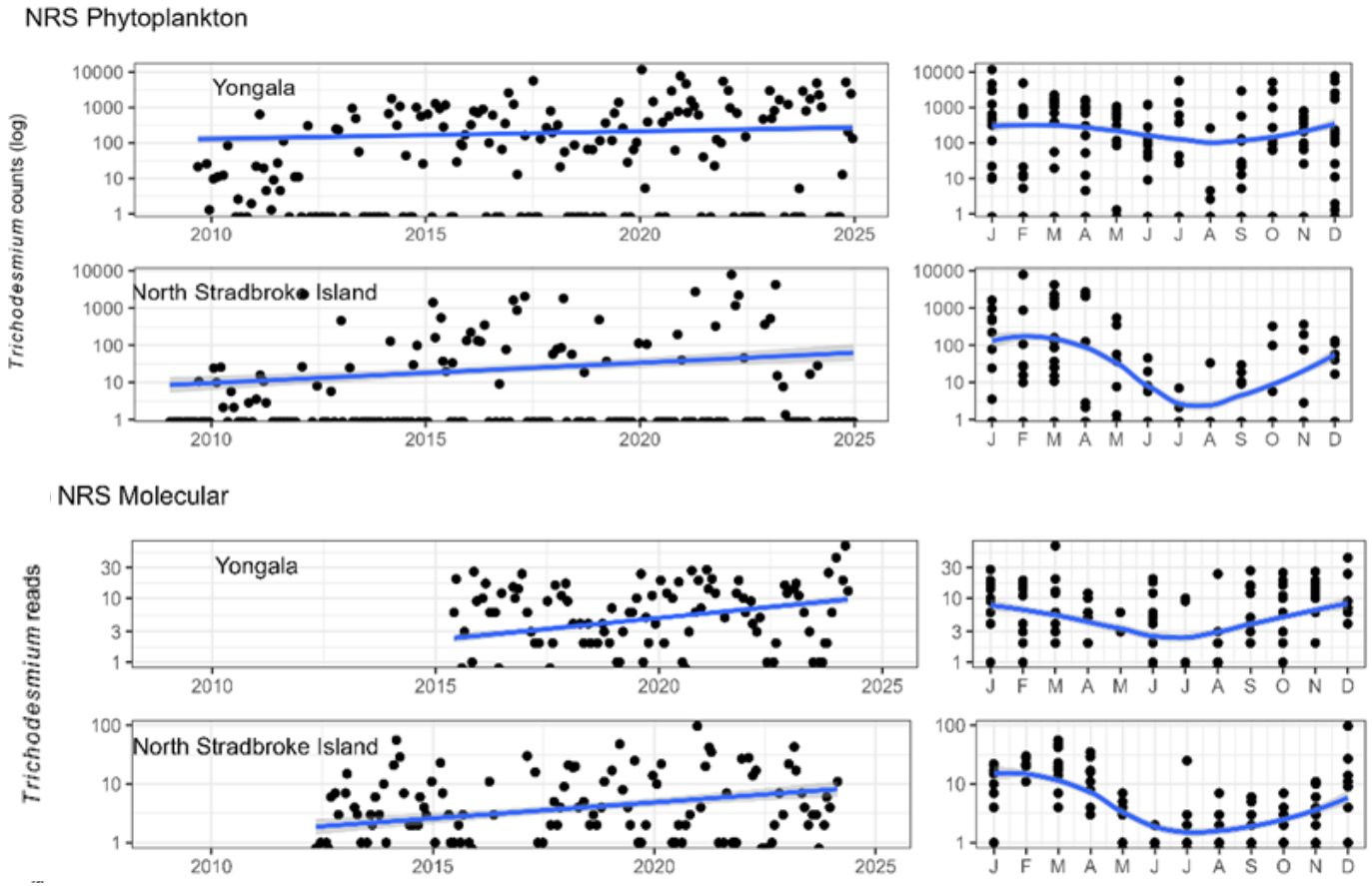
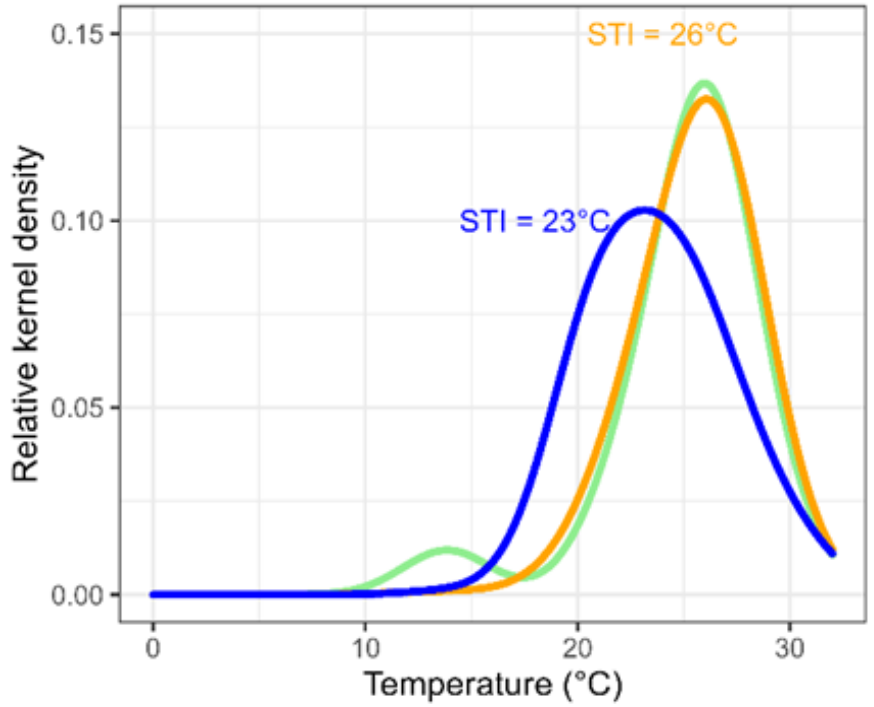
Trichodesmium increasing in Australia

Using multiple time series to confirm increasing abundances of a diazotroph and implications for ecosystems.





Davies et al. (submitted) IMOS special issue

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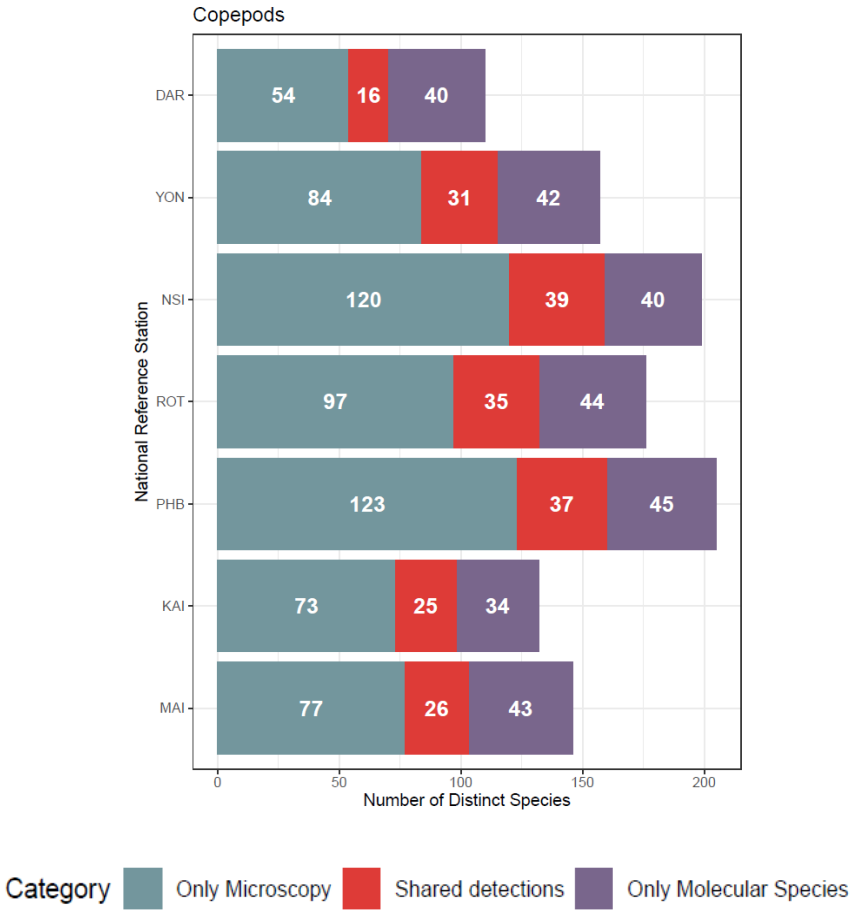
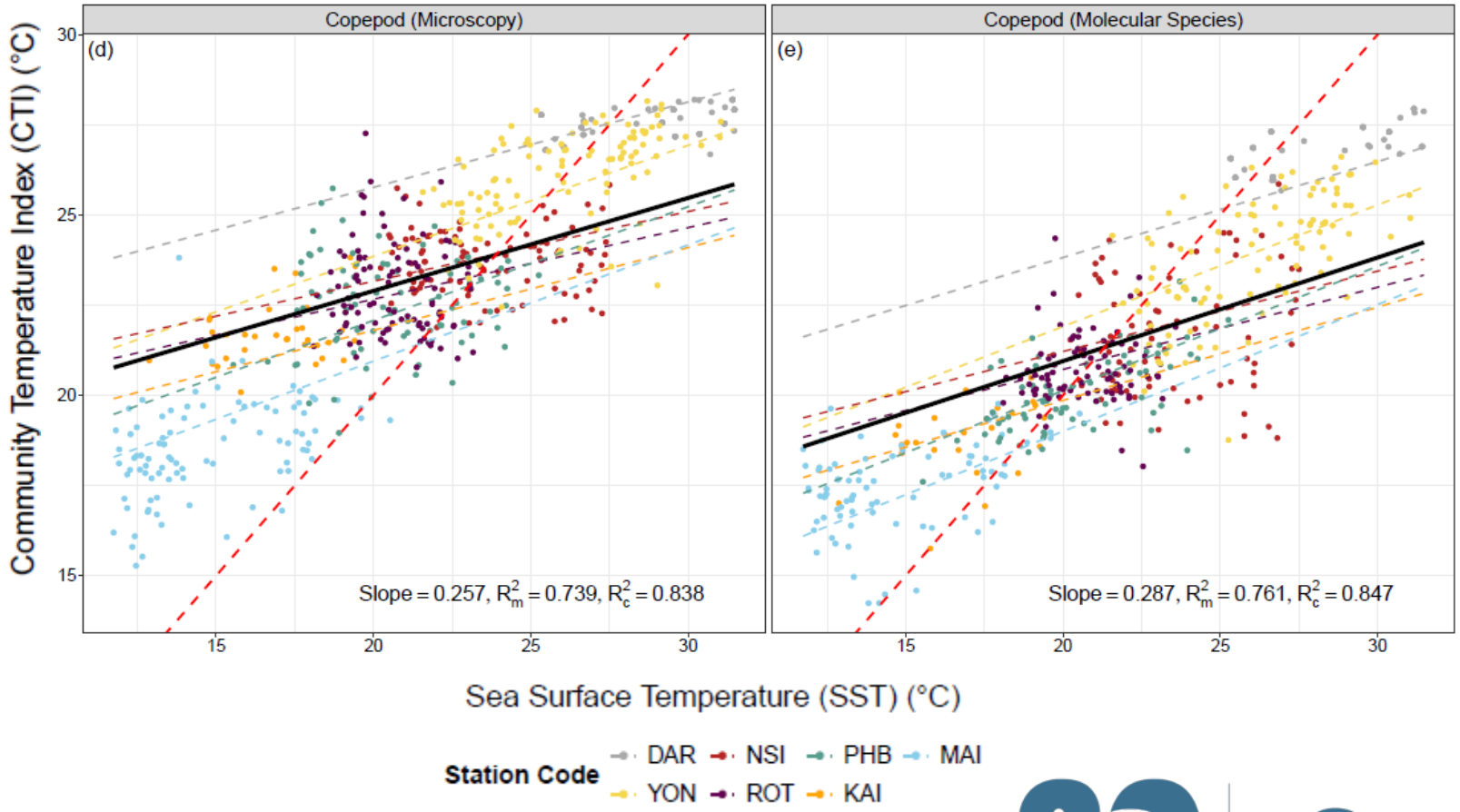
Sensitive climate indices from time series data

Using multiple time series to produce sensitive climate ecological indicators – Community Temperature Index





Brown et al. 2024.
Jayasinghe et al. (submitted) IMOS special issue

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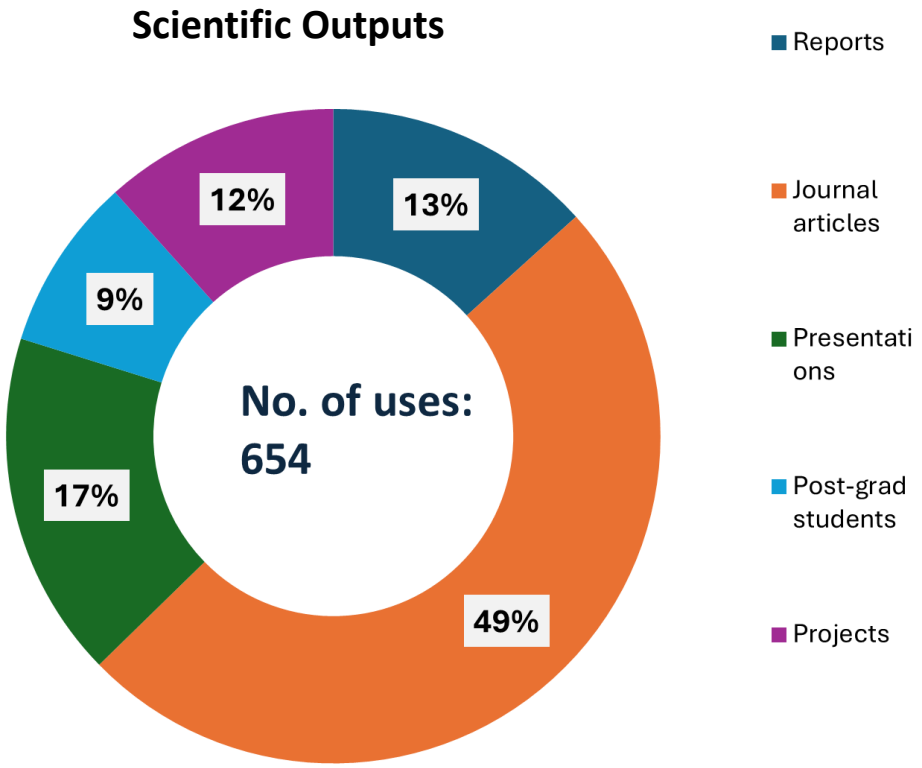
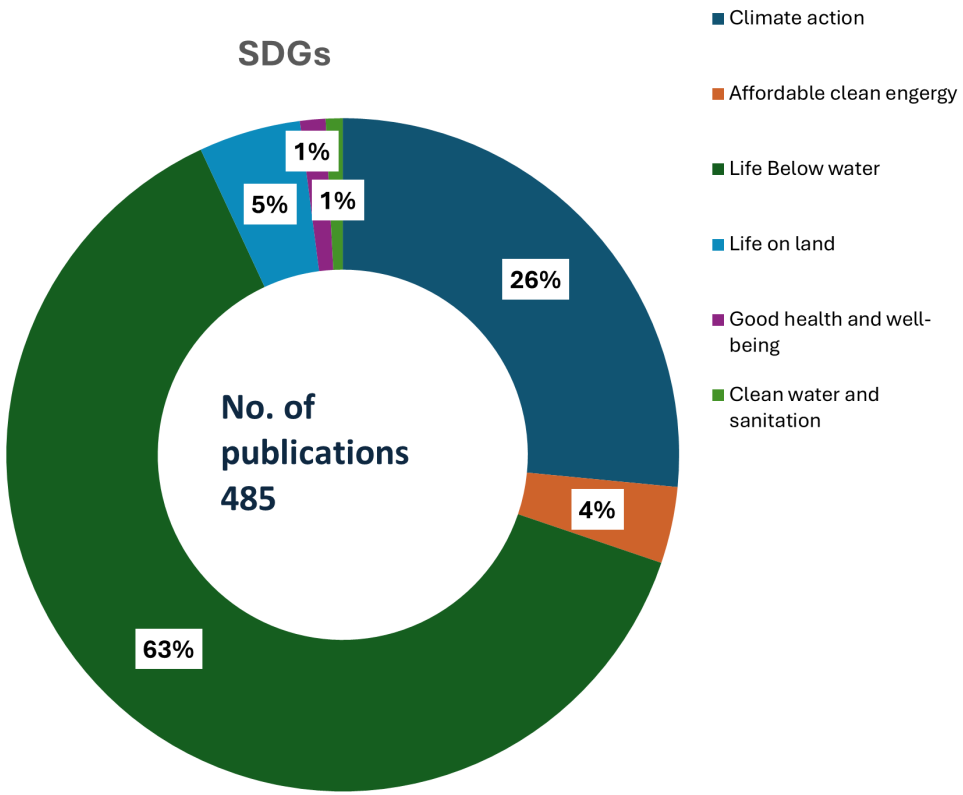
Data Usage Metrics





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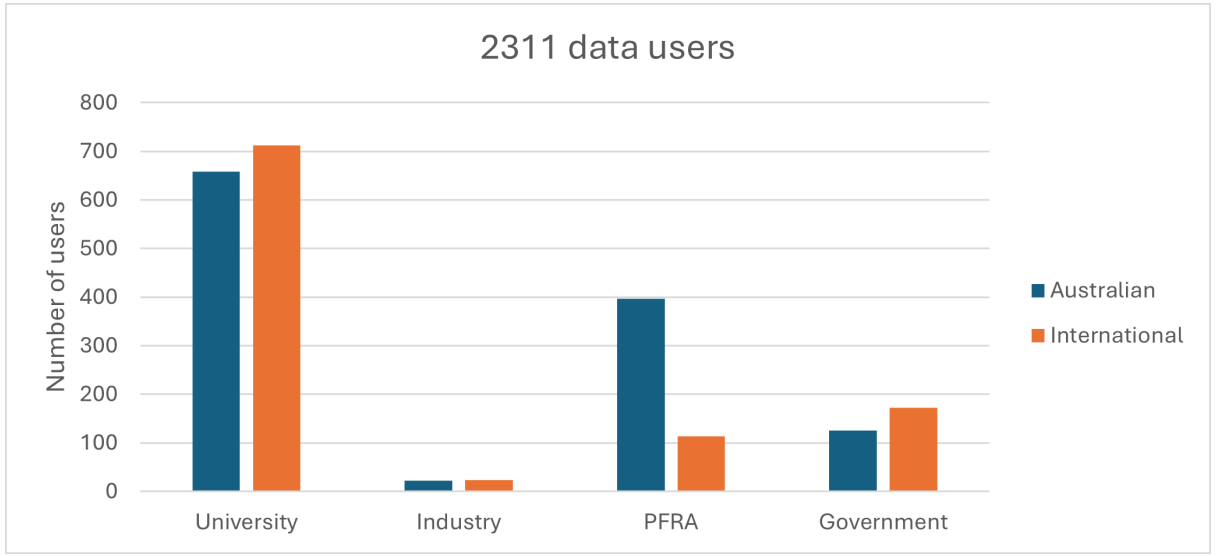

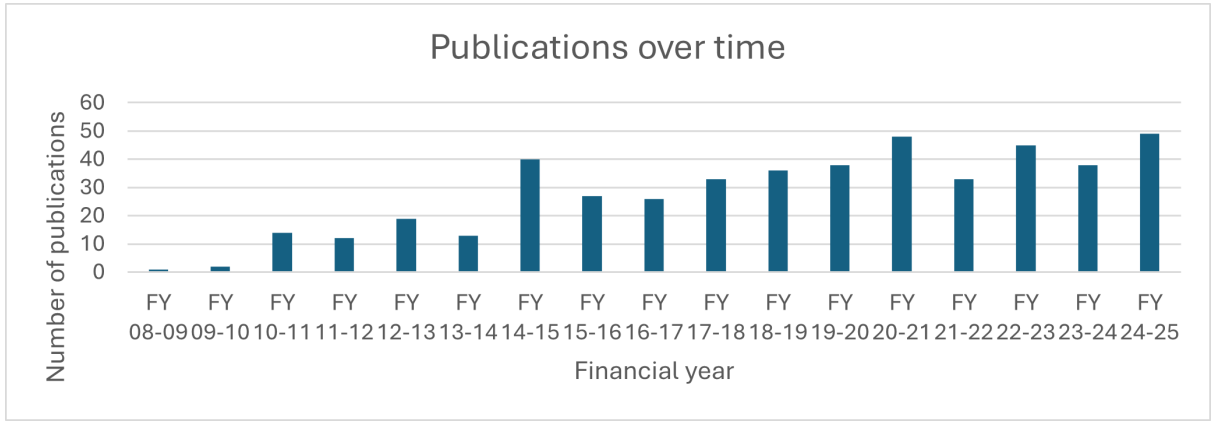

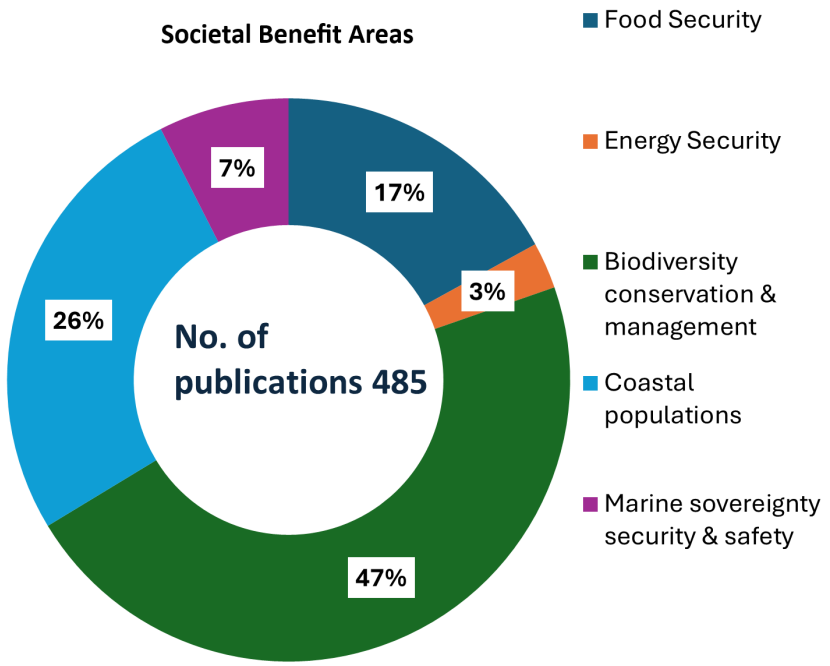

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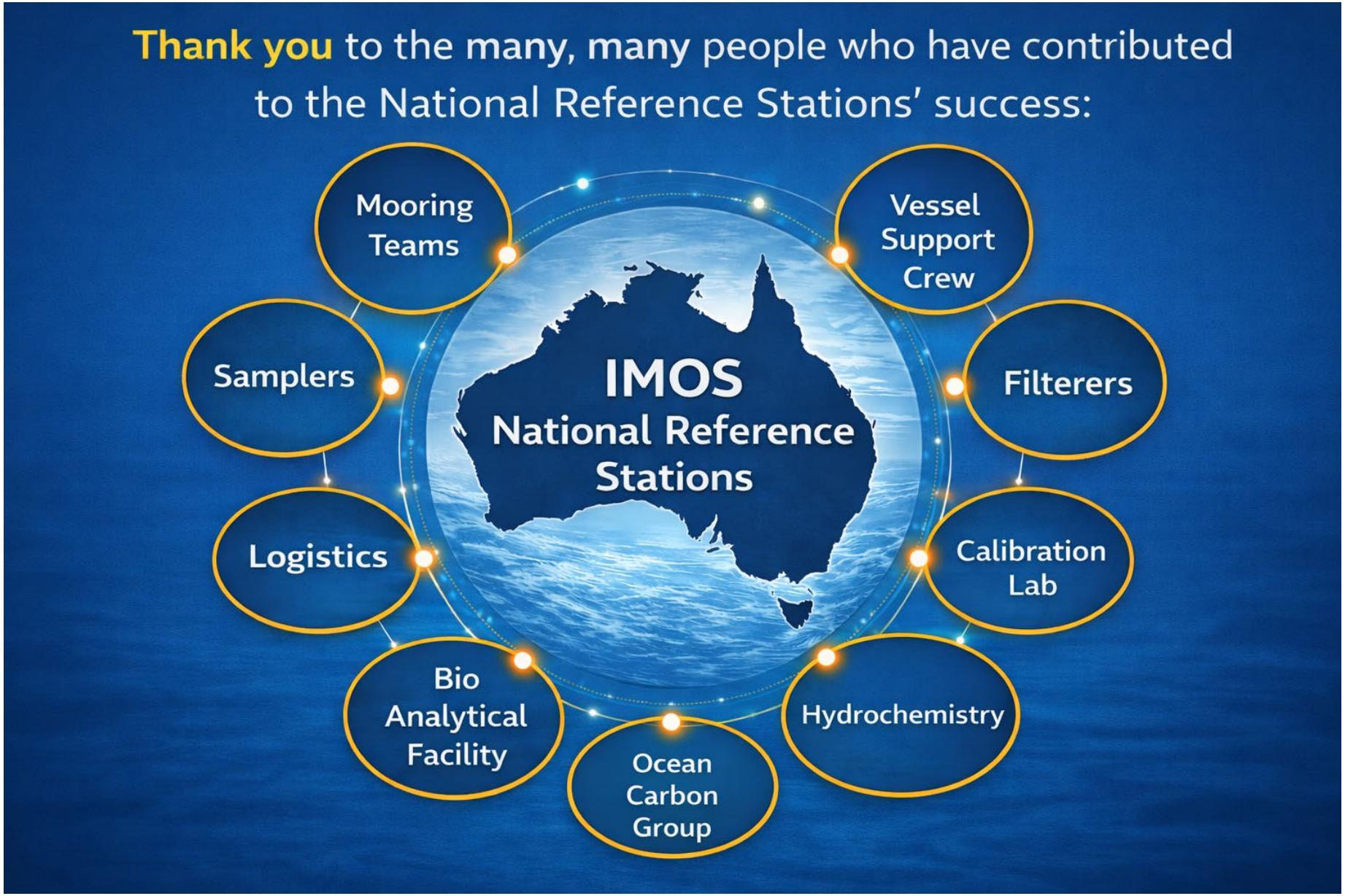

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NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Australia's Integrated Marine Observing System 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.

PRINCIPAL PARTICIPANTS

University of Tasmania (Lead Agent)

Australian Government

Australian Institute of Marine Science

Australian Government Bureau of Meteorology

CSIRO

Government of South Australia

SARDI South Australian Research and Development Institute

The University of Western Australia

sims sydney institute of marine science

UTS

The University of Sydney

Macquarie University

UNSW Sydney

SIMS is a partnership involving four universities

ASSOCIATE PARTICIPANTS

Curtin University

Australian Government
Department of Climate Change, Energy, the Environment and Water
Australian Antarctic Division

Australian Antarctic Program

Deakin University

The University of Melbourne

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