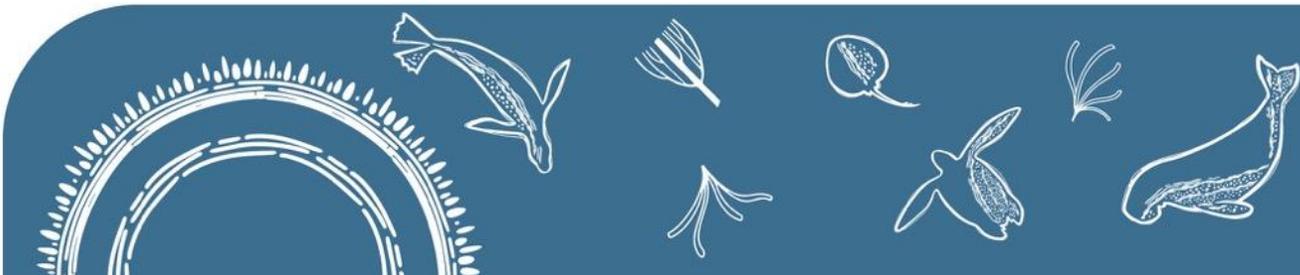
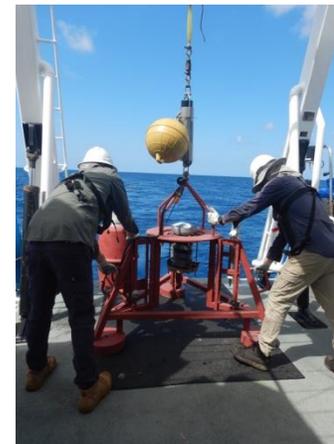
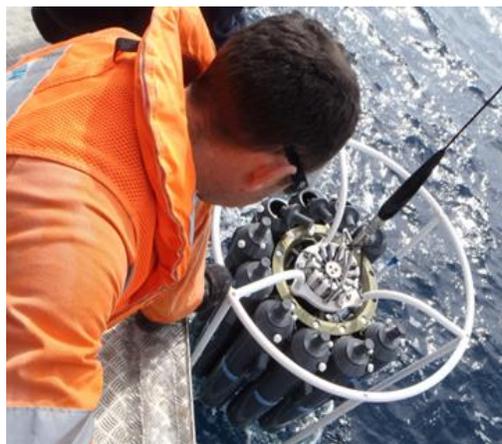




Retrospective: Australian National Mooring Network

Discoveries and impacts from sustained ocean observations



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 Australian National Mooring Network

- Foundational Facility (est. 2008)
- Network of NRS & regional moored sensor arrays that monitor Australia's coastal and continental shelf
- Developed based on GOOS principles and Regional Node Science Plans
- Collaborative national observing system

NRS - CSIRO (David Hughes)

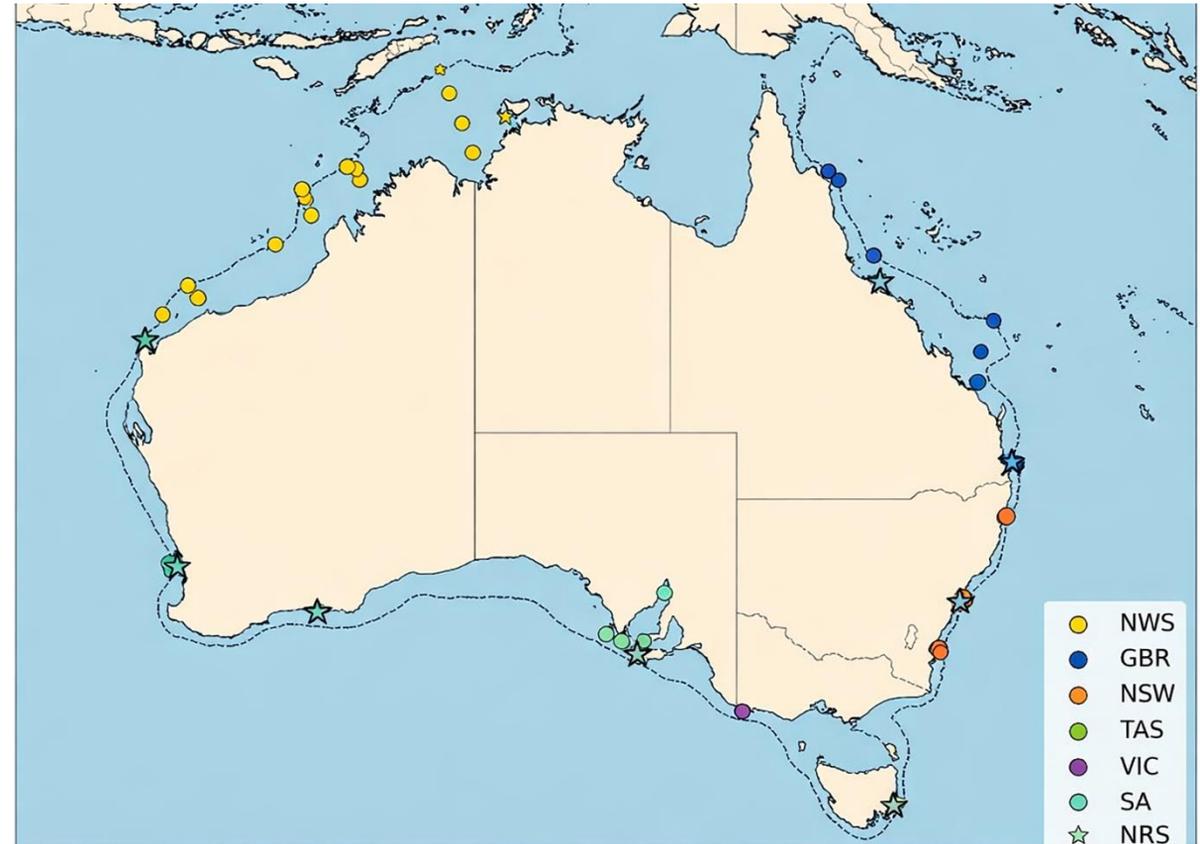
NSW - UNSW (Moninya Roughan)

WA - CSIRO (Ming Feng)

QLD & Northern Australia - AIMS (Simon Spagnol)

SA - SARDI (Mark Doubell)

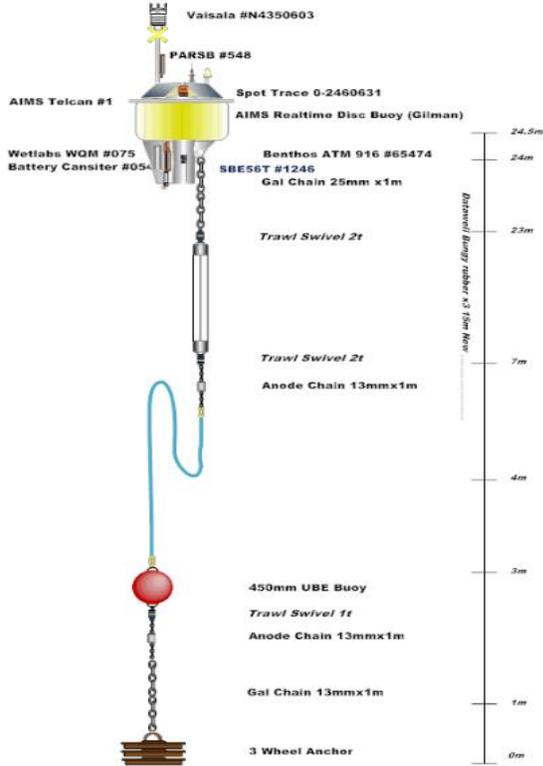
VIC – Deakin Uni & SARDI (Daniel Ierodiaconou)



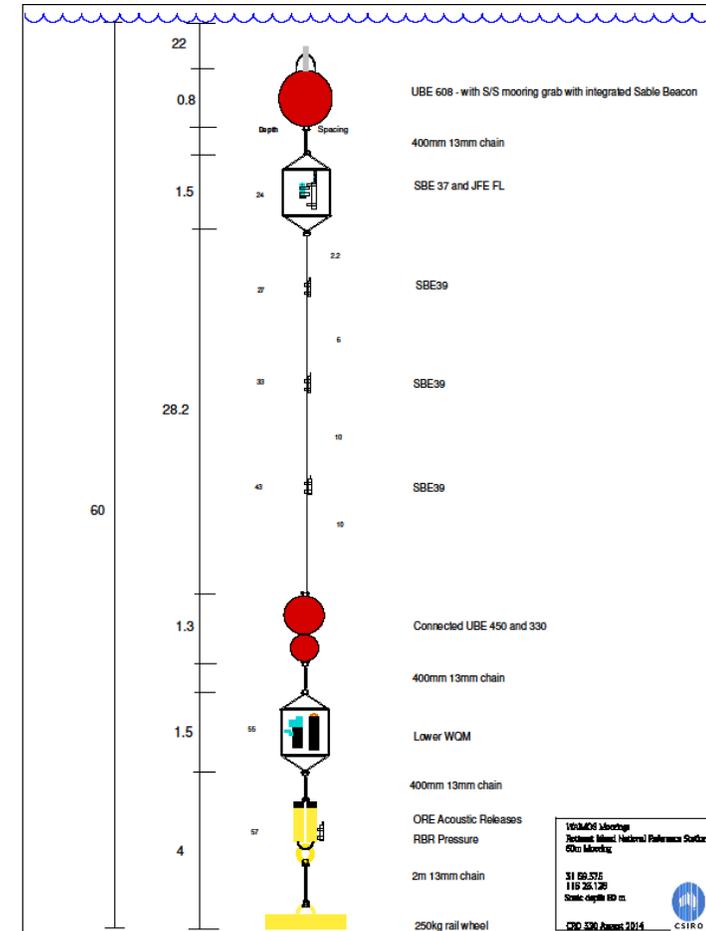
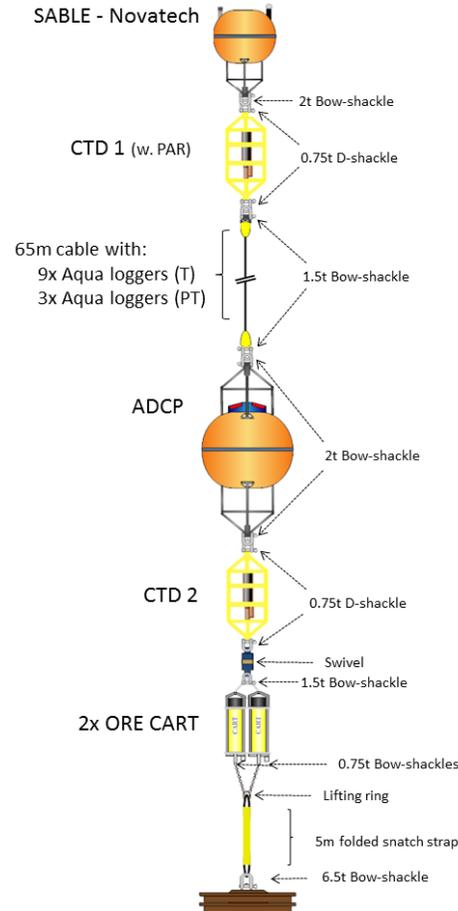
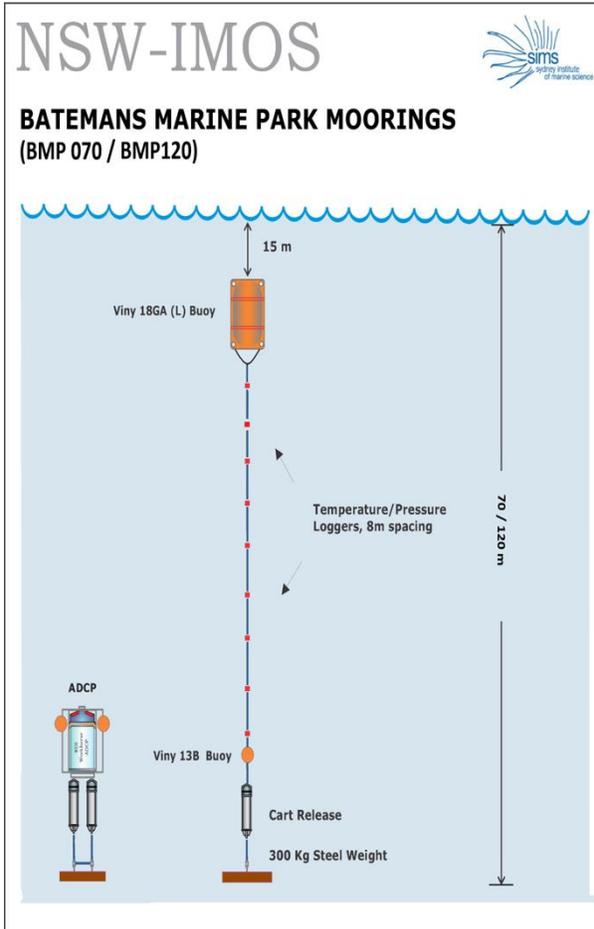
Observing Infrastructure

Yongala NRS Real-time Surface 1811

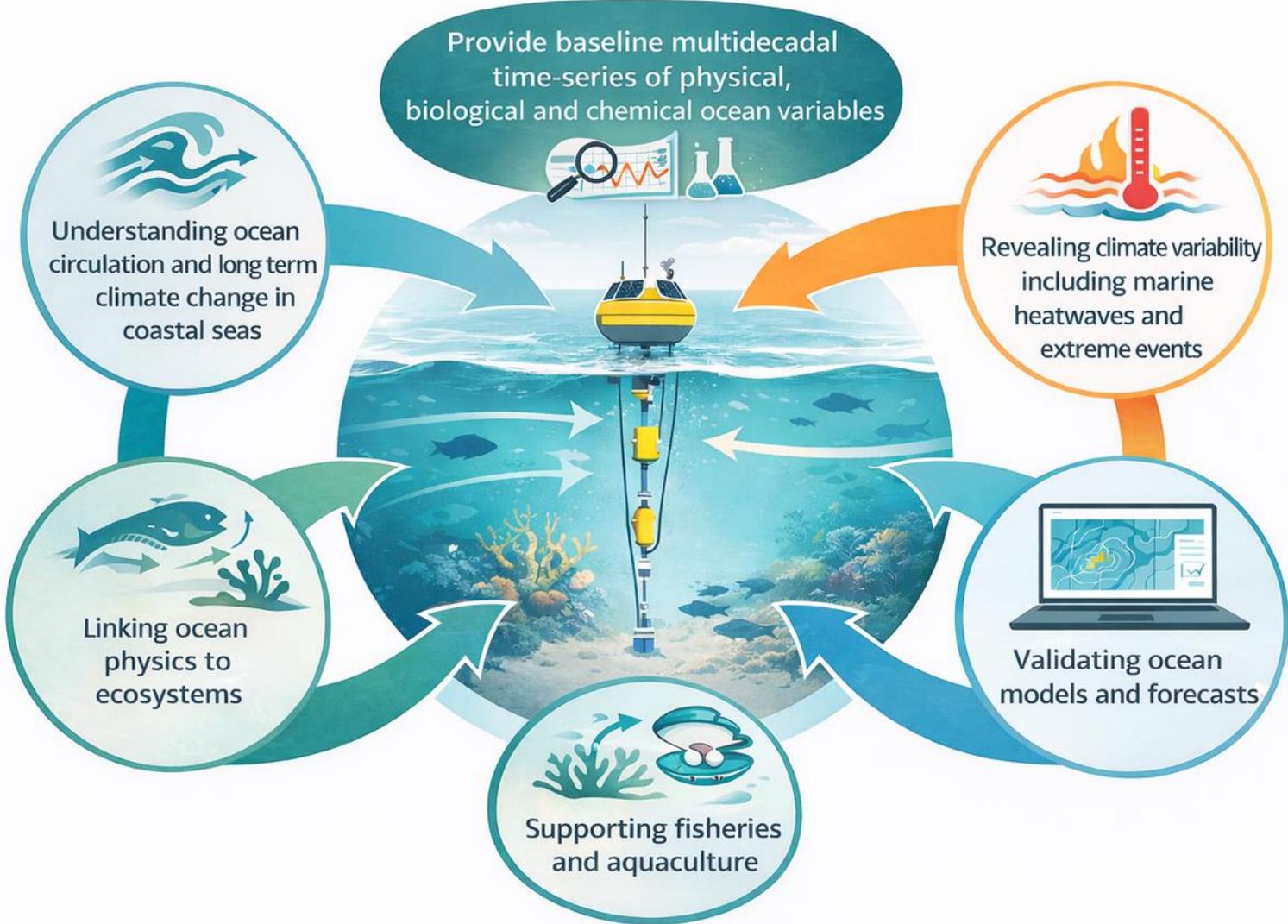
Depth: 30.5m (total at deployment)
 Deployed: 0000 09/11/2018 (UTC)
 Position: 5 19° 18.046 ' S
 E 147° 37.229' (WGS84)



© Copyright AIMS 2016



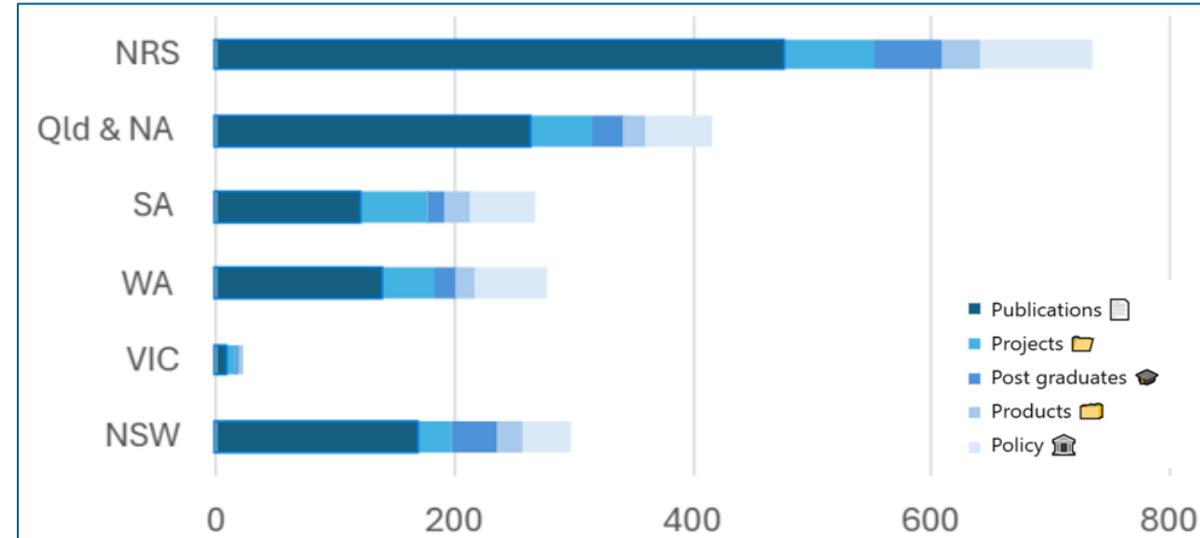
Why sustained moorings matter?



Measuring Impact

A diverse range of impact across a range different sectors & stakeholders including:

- Research (fundamental & applied)
- Industry (e.g. fisheries, aquaculture, energy)
- Education
- Government (state & national)
- Defence



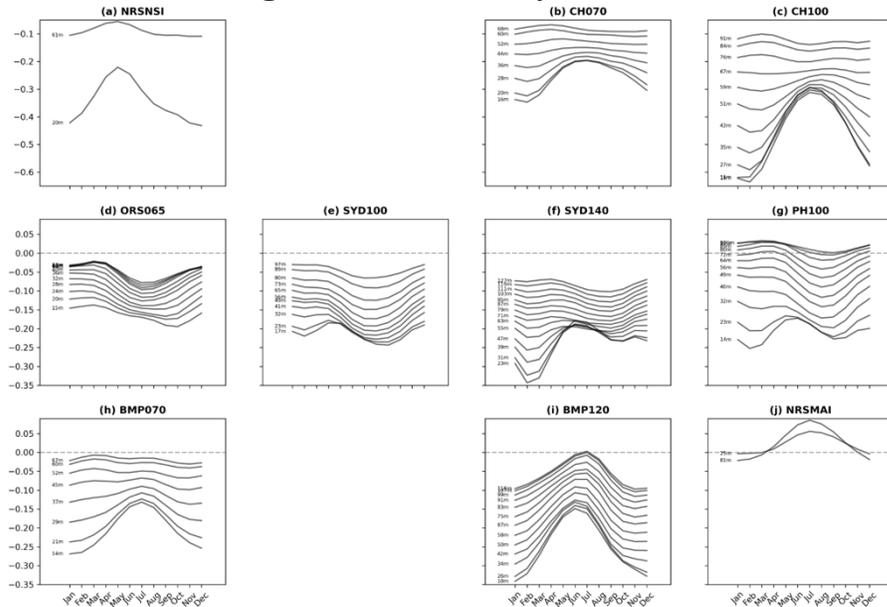
Sub-Facility	Publications	Projects	Post graduates	Products	Policy
NSW	170	27	39	23	40
VIC	9	9	1	4	2
WA	140	43	19	16	60
SA	122	56	13	22	56
Qld & NA	264	52	27	17	57
NRS	477	76	56	33	93



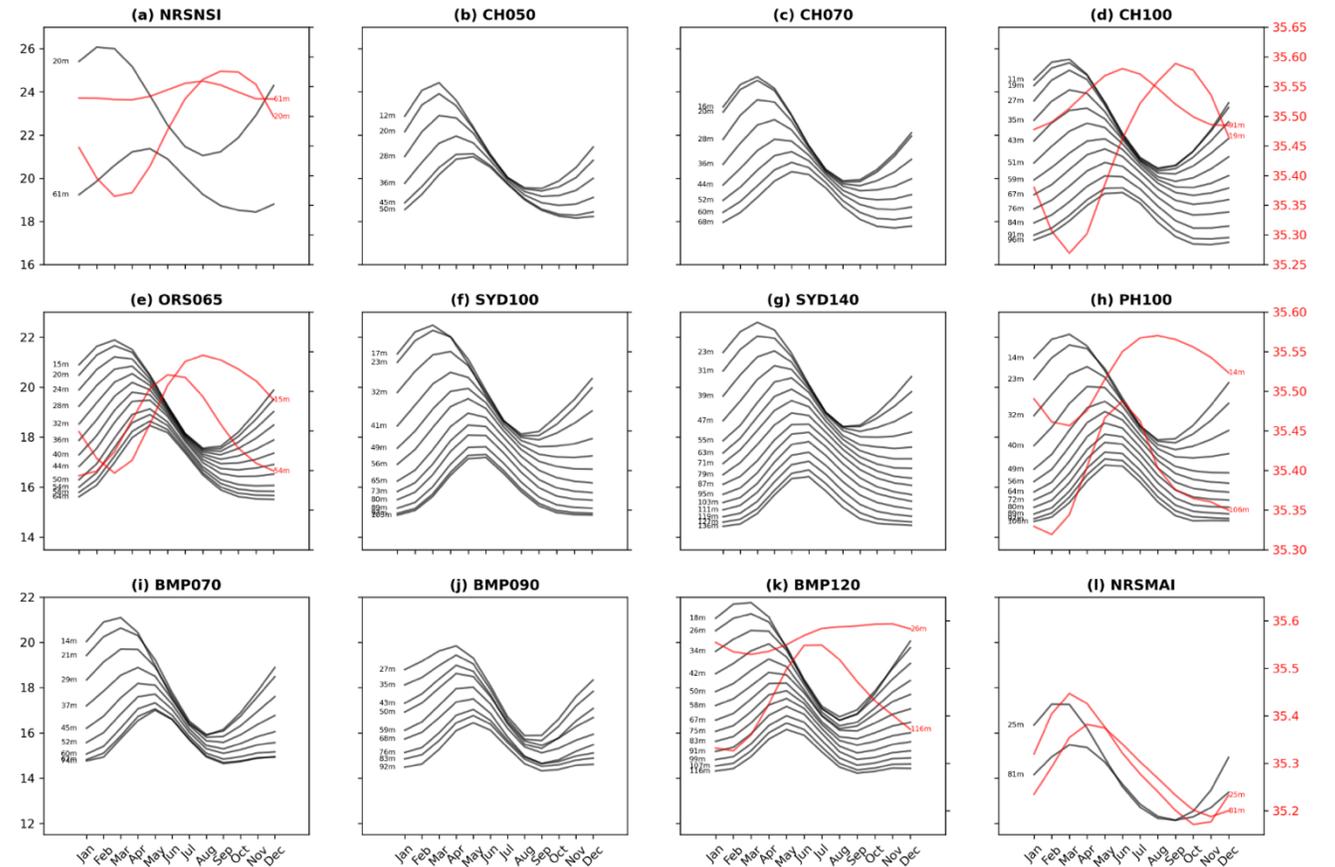
New South Wales

- Long term (mooring) data underpins development of climatologies
- essential for identifying trends, extremes & observational gaps

Alongshore Velocity

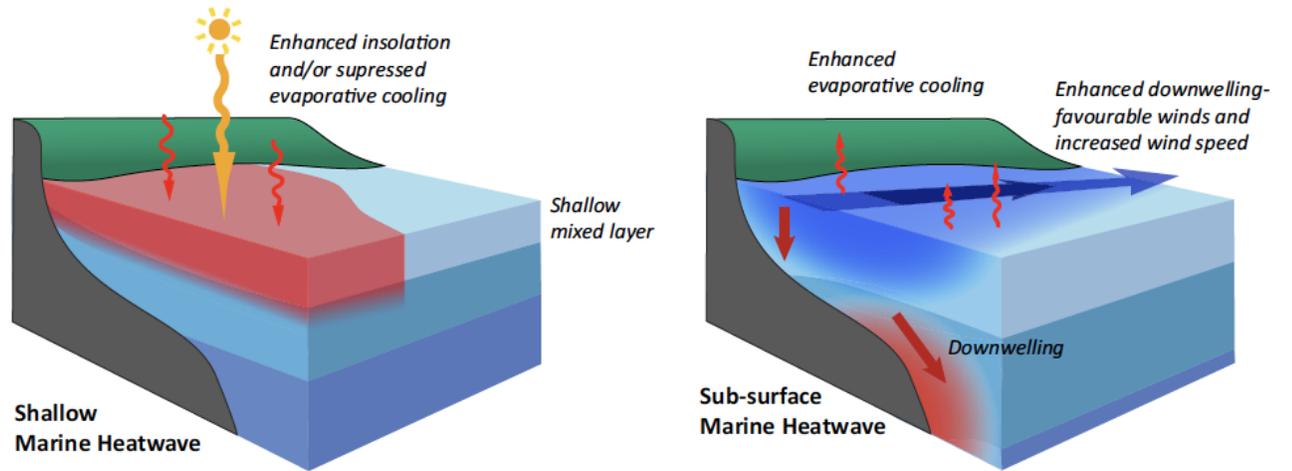


Temperature (°C)

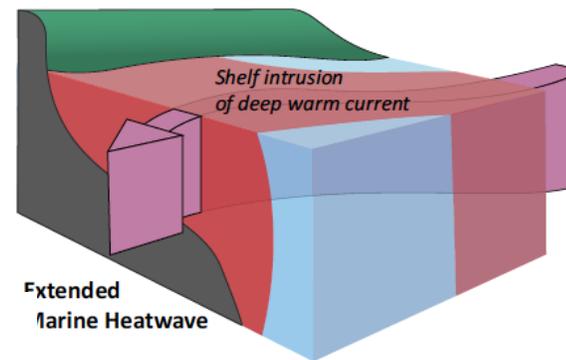


Salinity

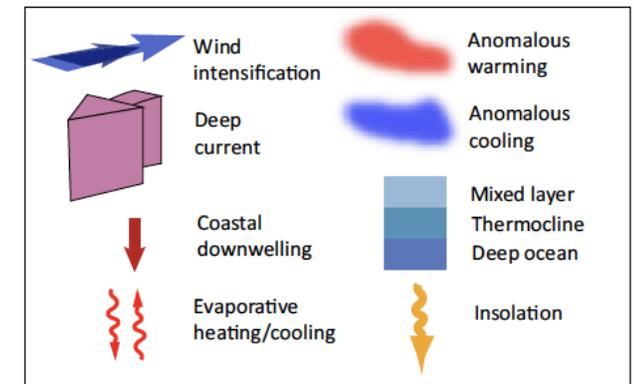
- Multi-decadal timeseries sub-surface temperature data (Port Hacking since 1940s)
- Accurate climatologies through the water column underpinned the first papers on sub-surface MHW's



STRONGLY STRATIFIED PERIODS



WEAKLY STRATIFIED PERIODS



AGU PUBLICATIONS



Geophysical Research Letters

RESEARCH LETTER
10.1002/2017GL073714

Subsurface intensification of marine heatwaves off southeastern Australia: The role of stratification and local winds

Special Section:
Midlatitude Marine Heatwaves:
Forcing and Impacts

A. Schaeffer¹ and M. Roughan¹

communications
earth & environment

ARTICLE

<https://doi.org/10.1038/s43247-023-00966-4> OPEN

Seasonal stratification and complex local dynamics control the sub-surface structure of marine heatwaves in Eastern Australian coastal waters

Amandine Schaeffer^{1,2,5}, Alex Sen Gupta^{2,3} & Moninya Roughan^{2,4}

Check for updates

Geophysical Research Letters

RESEARCH LETTER
10.1029/2021GL094785

Key Points:

- Advection-driven marine heatwaves (MHWs) are more than three times

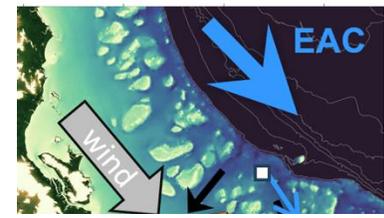
Oceanic Circulation Drives the Deepest and Longest Marine Heatwaves in the East Australian Current System

Youstina Elzahaby^{1,2}, Amandine Schaeffer^{1,2}, Moninya Roughan^{1,2}, and Sébastien Delaux³

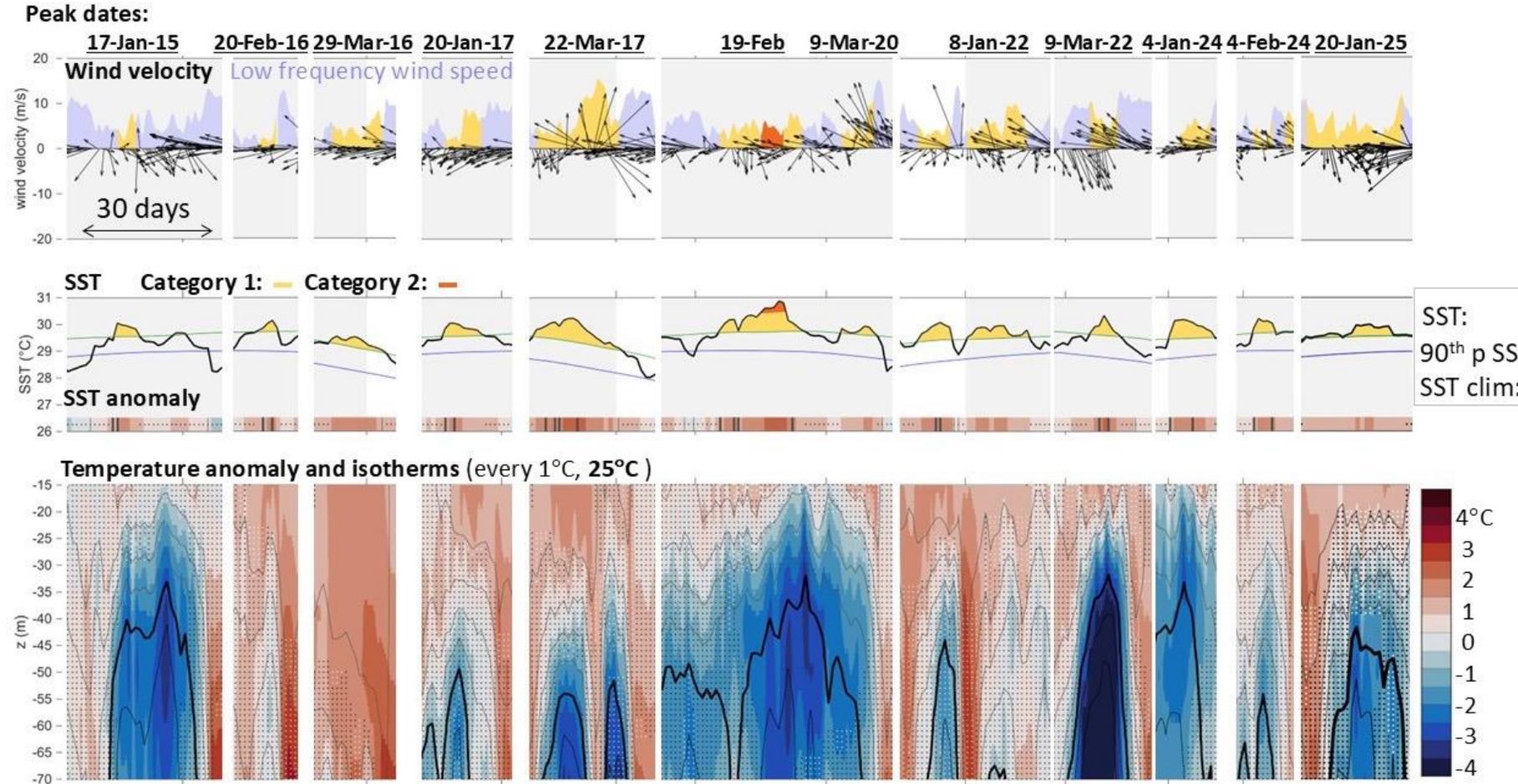
AGU ADVANCING EARTH AND SPACE SCIENCE



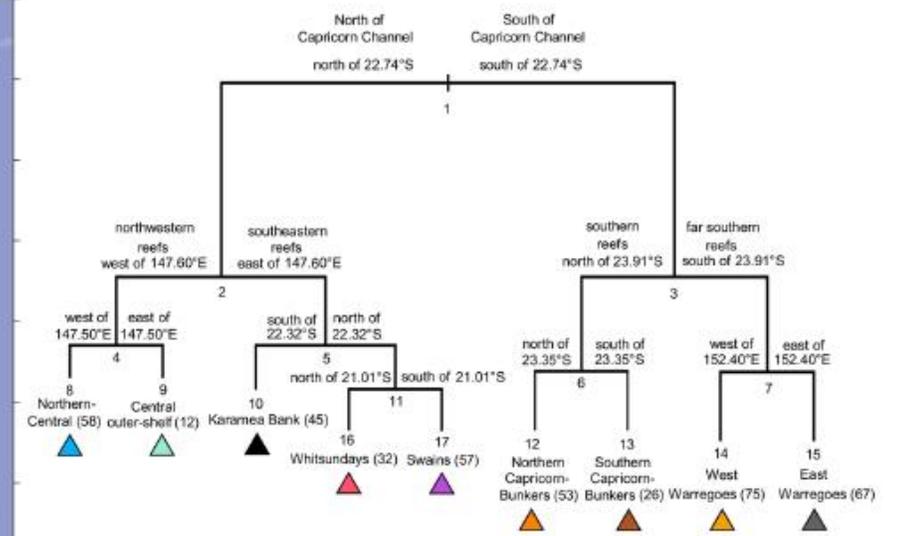
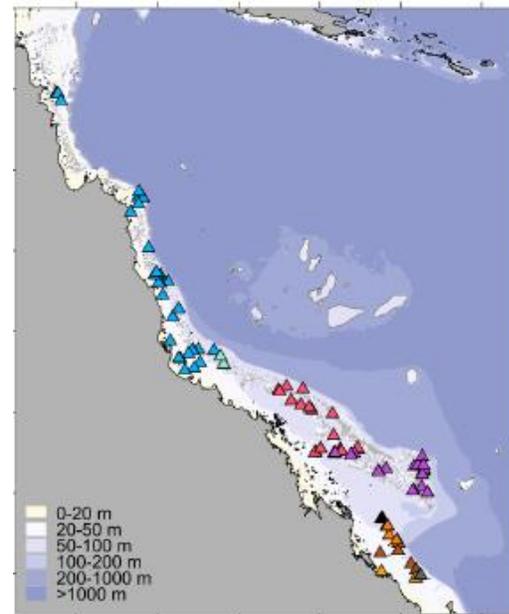
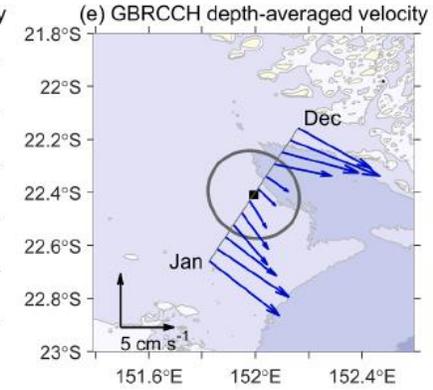
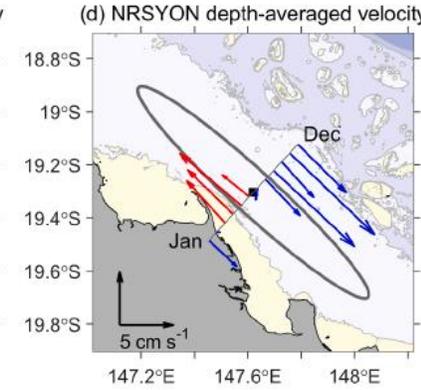
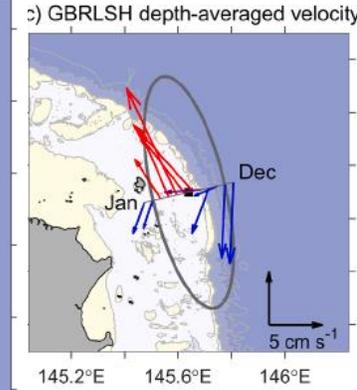
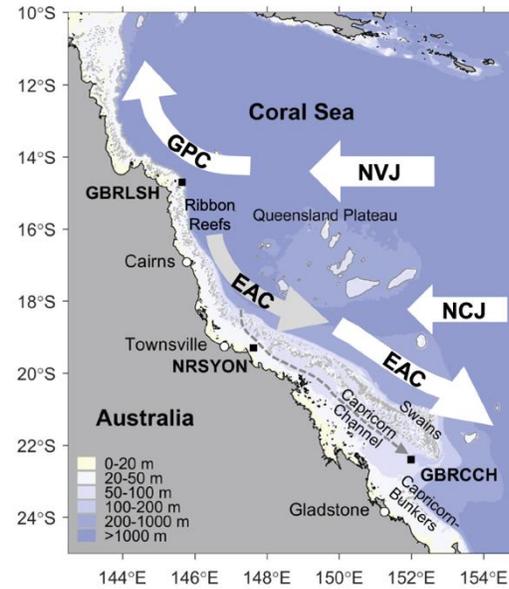
QLD and Northern Australia



- Climatologies revealing the internal structure of MHW's
- During weak, or poleward winds, surface MHW's coincide with subsurface cooling



- Ocean currents influence larval dispersal, acting as barriers or facilitators
- Contribute to maintaining distinct reef fish communities along the Great Barrier Reef defined by distinct latitudinal splits



Progress in Oceanography 208 (2022) 102901

Contents lists available at ScienceDirect

Progress in Oceanography

journal homepage: www.elsevier.com/locate/pocean



ELSEVIER



Oceanographic influences on reef fish assemblages along the Great Barrier Reef

Jessica A. Benthuyzen*, Michael J. Emslie, Leanne M. Currey-Randall, Alistair J. Cheal, Michelle R. Heupel

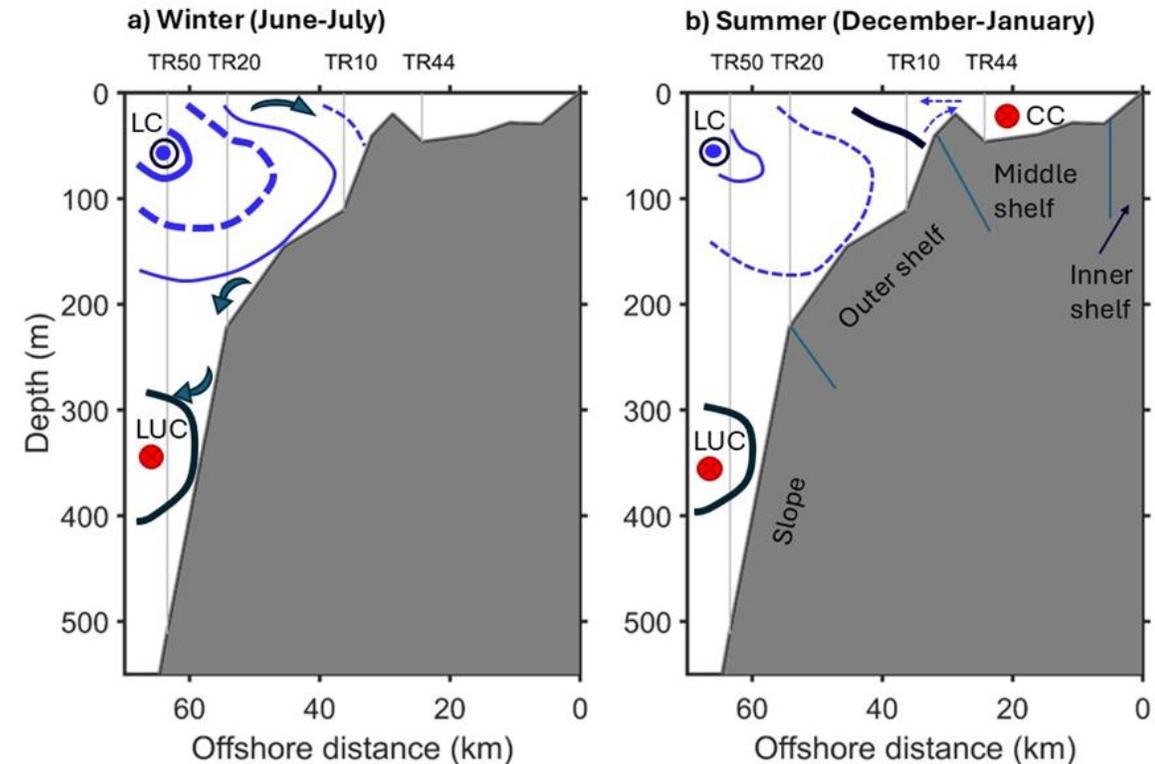
Western Australia

- Long timeseries -> temperature and current velocity data products
- Described the structure and seasonal variations of major currents in southwest WA (Leeuwin, Ninagaloo, coastal & Capes Currents)
- Demonstrated the currents influence regional biogeochemical processes and fisheries recruitment

Daily and monthly gridded mooring data 2011-2025

Major current definitions currently being used to determine transport indices under a WA State Government-funded IMOS project on "key oceanography indices".

Sustained Current observations



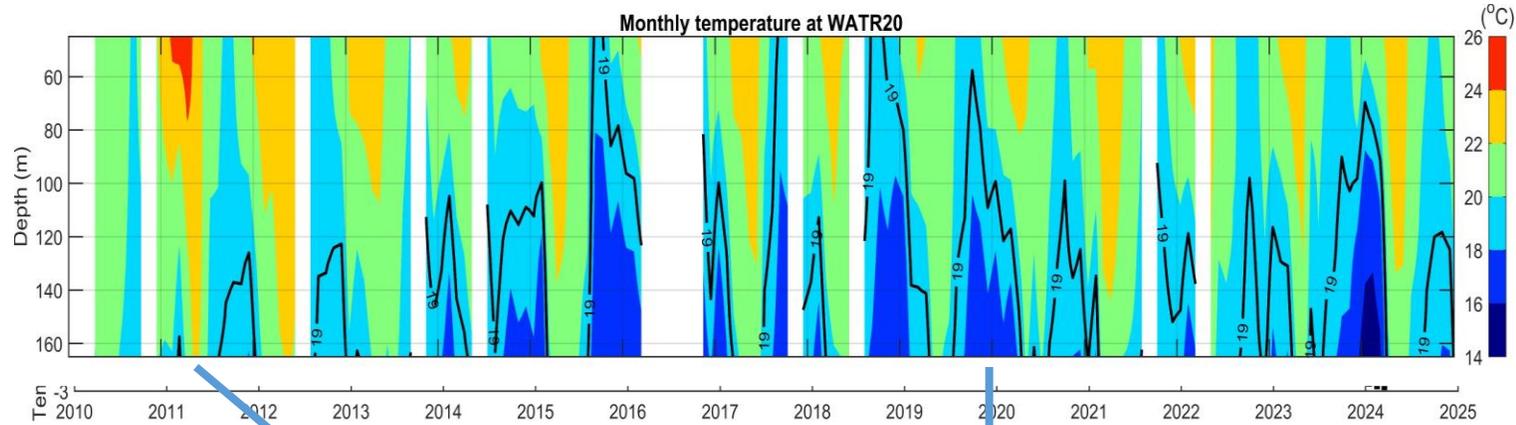
JGR Oceans

Research Article | [Open Access](#) | [CC](#) [BY](#) [NC](#) [ND](#)

Seasonal Climatology of the Leeuwin Current-Capes Current System Off Southwest Australia From Long-Term Moored Observations

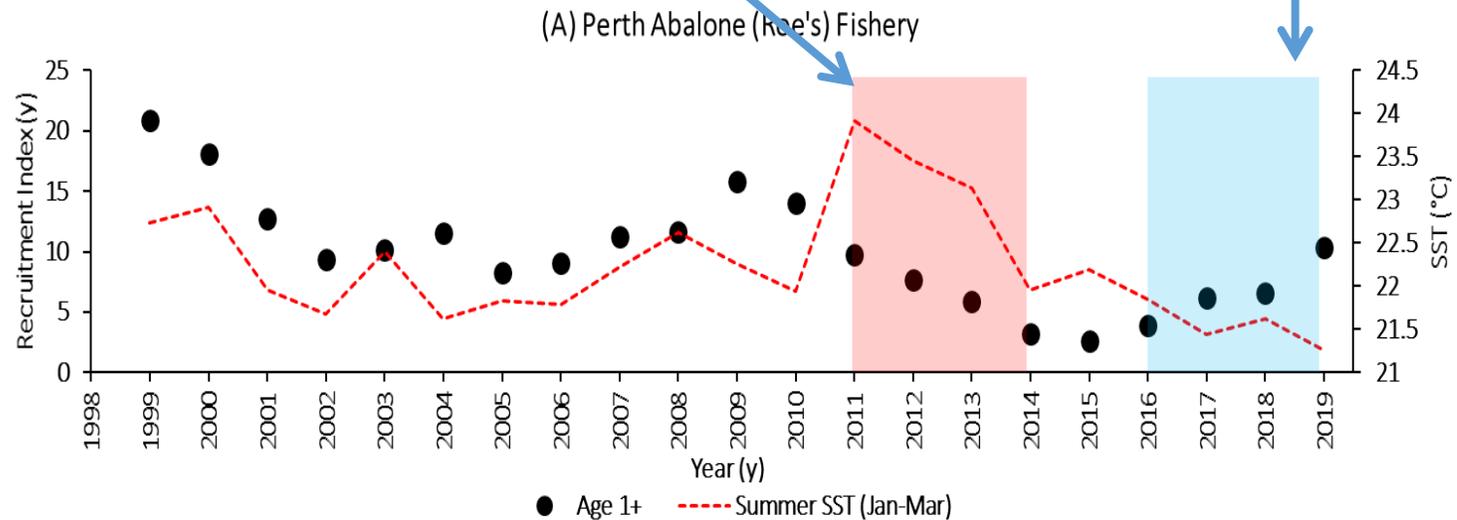
[Ming Feng](#) [✉](#) [Toan Bui](#), [Jessica A. Benthuisen](#)

- Moorings used to assess the impacts of marine heatwaves and cold-spells on fisheries recruitment
- Reduction in invertebrate recruitments during MHW's and slow recovery during cold-spells



2011-2013 MHWs

2016-19 cold spells

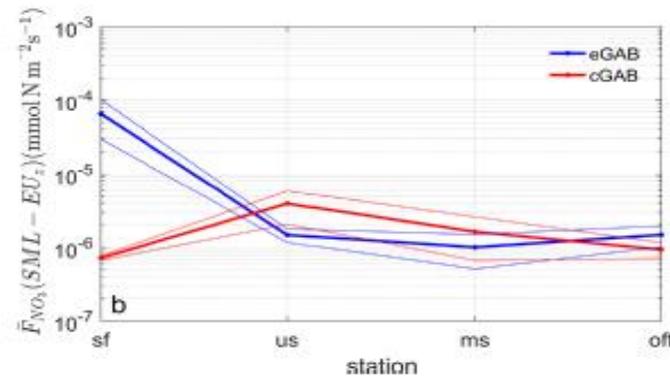
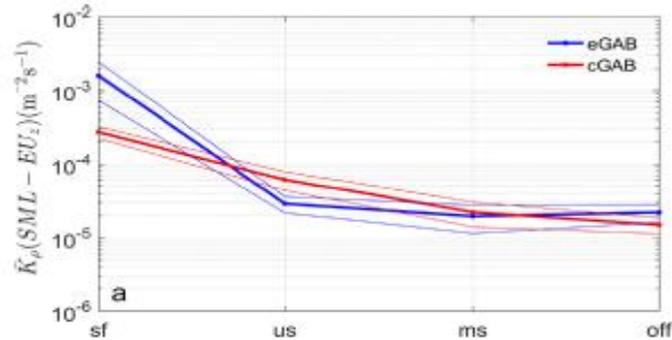


South Australia

- Underpinned research providing new insights into marine ecosystems including:
 - upwelling dynamics
 - ecosystem productivity
 - climate change impacts on fisheries

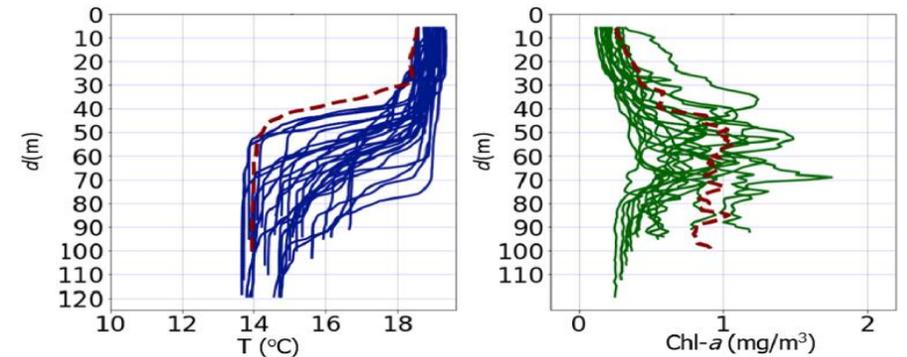


Observations of vertical turbulent nitrate flux during summer in the Great Australian Bight
 M.J. Doubell^{a,*}, D. Spencer^{a,b}, P.D. van Ruth^a, C. Lemckert^c, J.F. Middleton^a



Variability of surface and subsurface phytoplankton blooms in a seasonal coastal upwelling system

Alex Shute^a, Jochen Kämpf^{a,*}, Mark Doubell^b, Ana Redondo Rodriguez^b, Luciana Möller^a, Ryan Baring^a, Michelle Newman^a



TEMPORAL VARIATION OF A SOUTHERN ROCK LOBSTER (*JASUS*) POPULATION: A LIKELY RESPONSE TO CLIMATE CHANGE

, Mark J. Doubell^a, Adrian J. Linnane^a

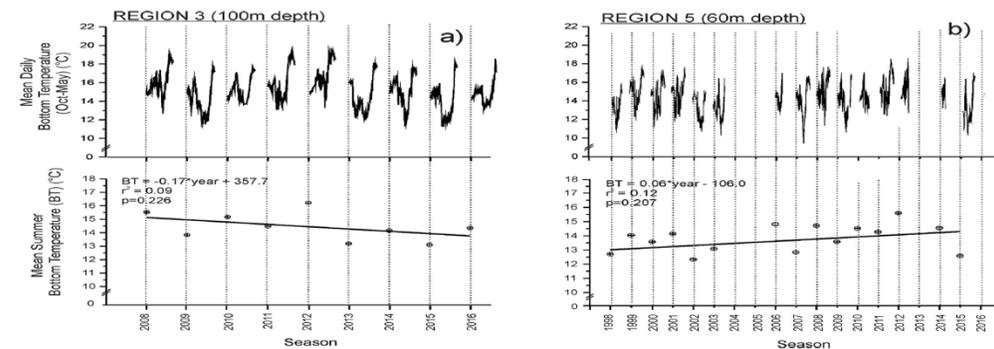


Fig 7. Temporal trends in bottom temperature measured from the IMOS mooring deployed at 100 m depth in region 3 between December 2008 and February 2017, and from on-site StowAway® TidbiT® bottom loggers deployed at 60 m depth in Region 5 between December 1998 and February 2016. Mean daily bottom temperature is presented for data available from October to May. Mean summer bottom temperature are presented for data averaged from December, January and February. Mean summer bottom temperatures are presented \pm standard error (SE).

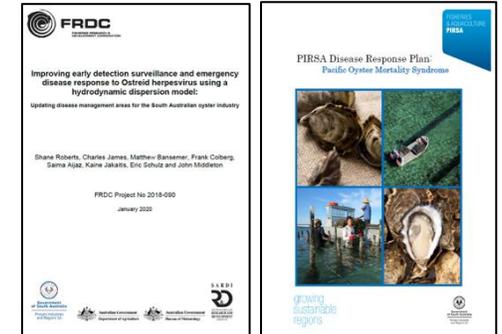
- Validation of ocean models (hindcast, nowcast and forecast)
- Used to assist incident responses & support the sustainable growth and development of aquaculture & fisheries

Aquaculture Carrying Capacity

Time (days) to flush an aquaculture lease

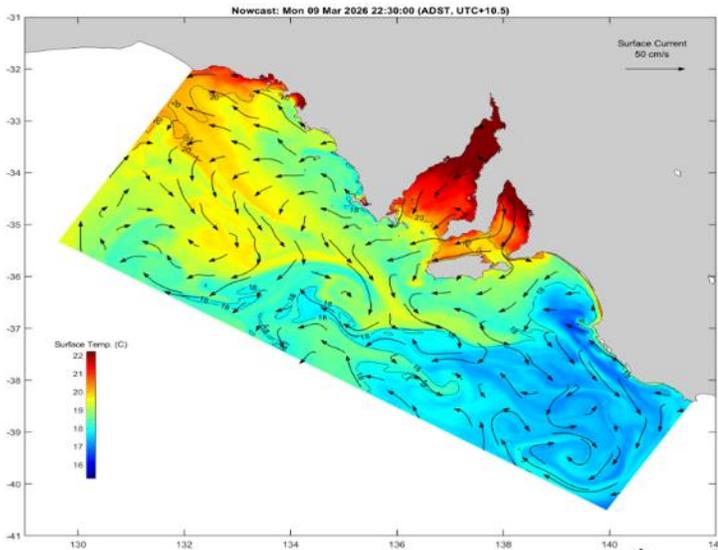


Disease Management Areas & Response Plans



eSA-Marine system

The eSA-Marine system maps past 'hind-cast', present 'now-cast' and future 'forecast' ocean conditions in South Australia (SA).



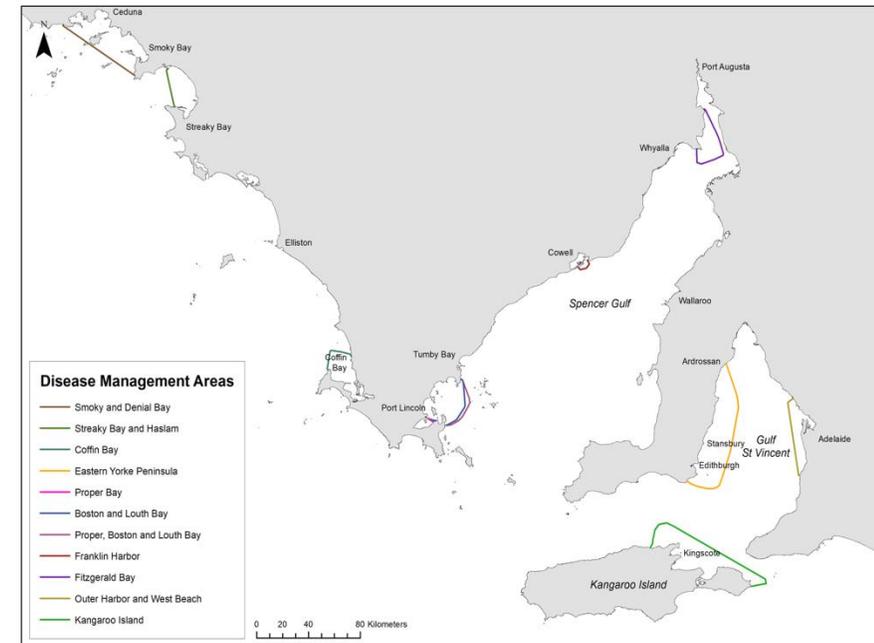
Carrying capacity for finfish aquaculture, Part I—Near-field semi-analytic solutions

John F. Middleton^{a,b,*}, Mark Doubell^a



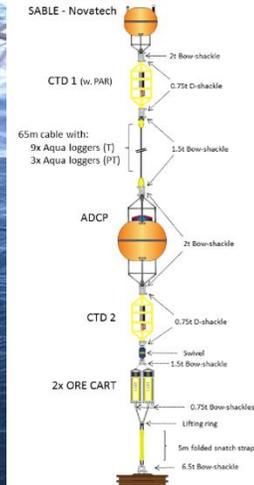
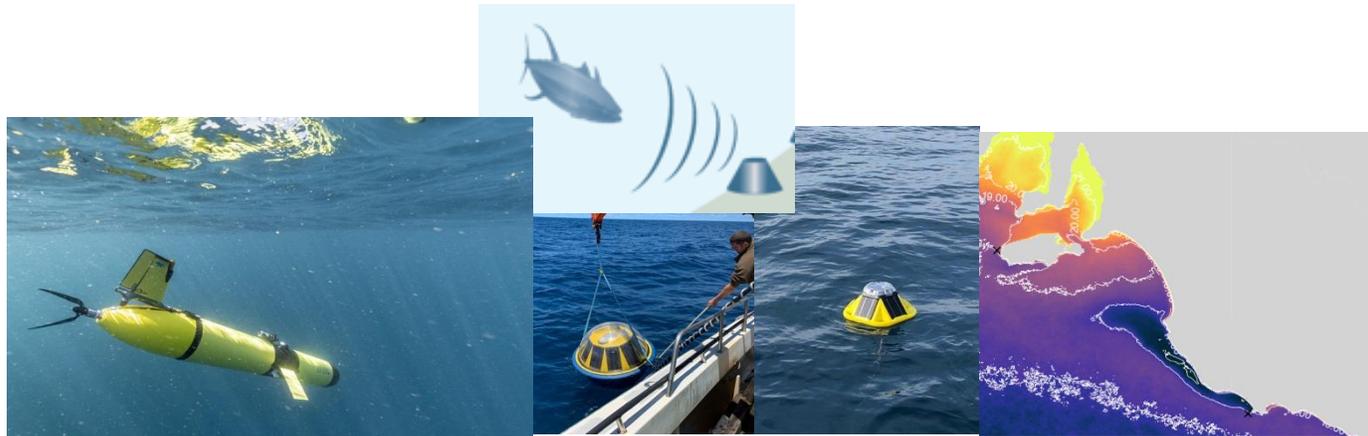
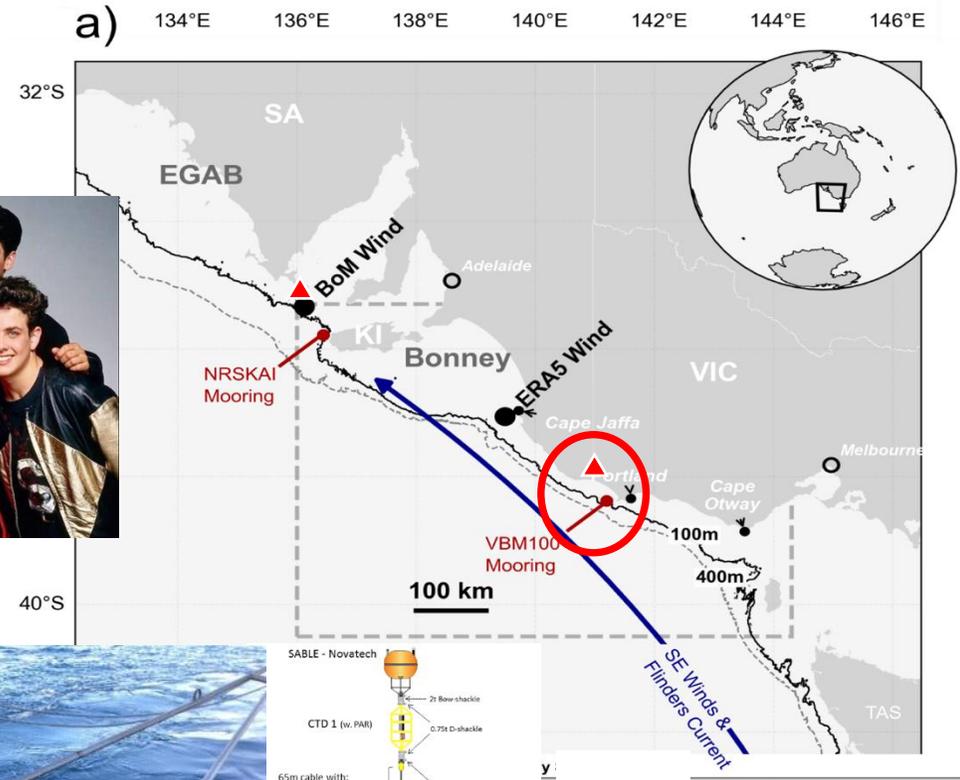
Carrying capacity for finfish aquaculture, Part II – Rapid assessment using hydrodynamic and semi-analytic solutions

John F. Middleton^{a,b,*}, John Luick^a, Charles James^a



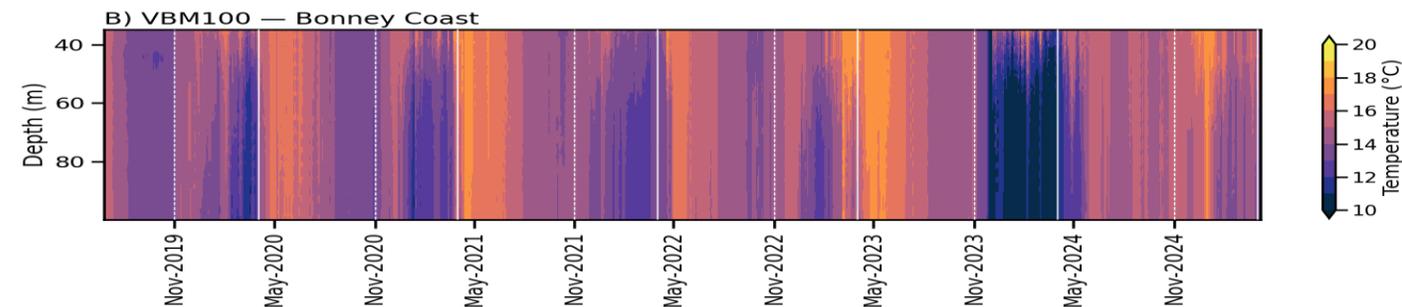
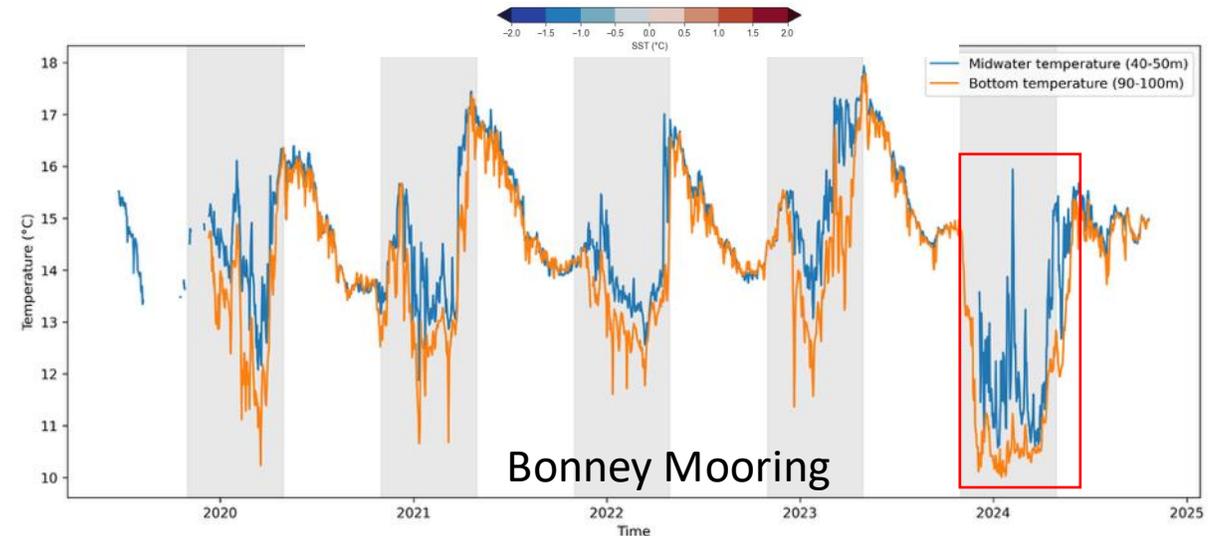
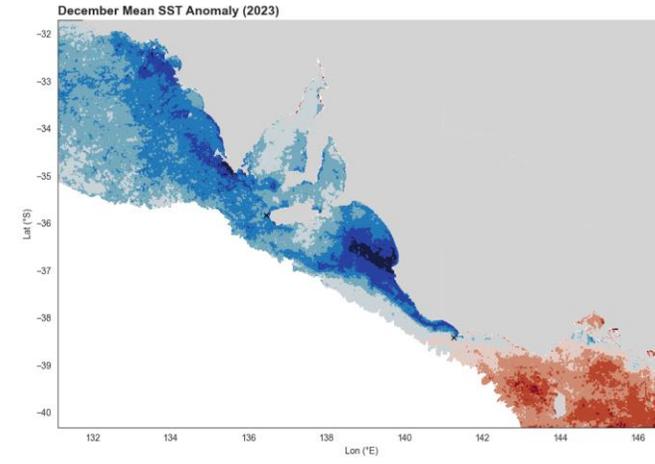
Victoria

- Newest addition to the mooring network
- Established mooring in 2019 by Deakin University/ SARDI collaboration. 2024 conversion to NRS
- Combined effort with other facilities: Satellite Remote Sensing, Ocean Gliders, ATF acoustic curtain, IMOS wave buoys



Summer Mean SST Anomaly: (November – April) 2019-2025

- Monitoring of Australia's largest upwelling system hotspot
- Consistently stronger upwelling signals compared to Kangaroo Island
- Moorings reveal subsurface structure
- Summer 2023/24 upwelling ~3 °C colder than past events (and prolonged)

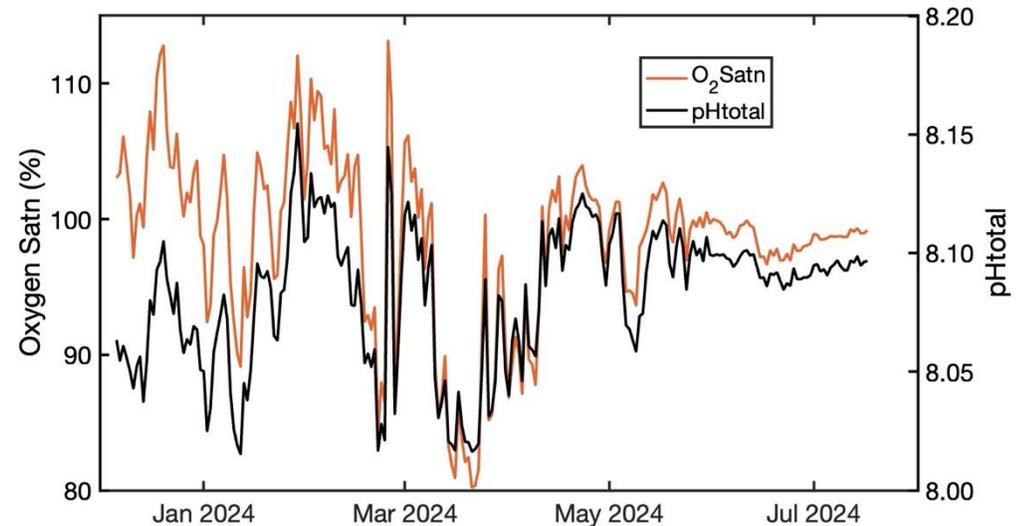
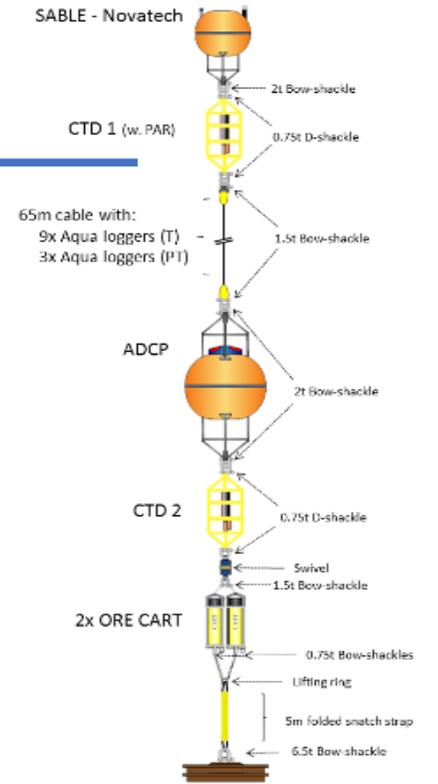


Providing environmental context to fisheries

- Population of Victorian pipis in Discovery Bay collapsed in summer 2023/2024 (96% of Vic fishery)
- Subsurface measurements start of upwelling season shows a cold waters not visible at the surface.
- Conditions with 80% O₂ saturation and pH of 8 are low for Australian shelf waters -> impact marine life.
- Followed by a rapid increase in O₂, pH & chl with algal blooms observed along the coast

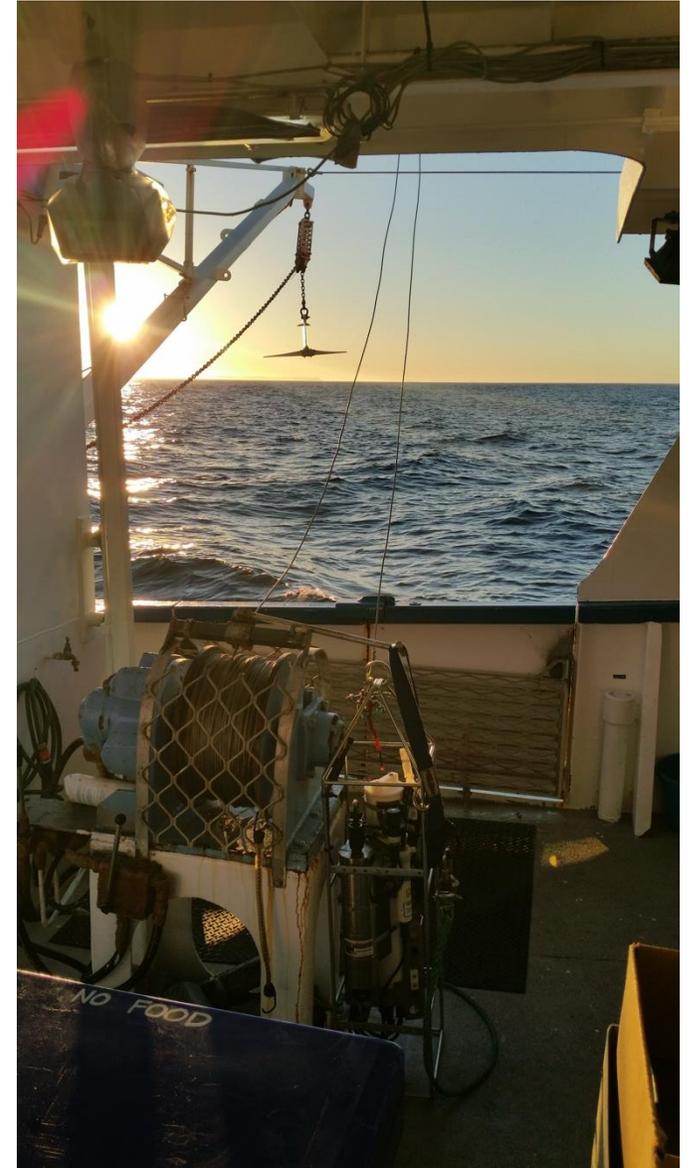


SeapHOx (DO, pH) in 25m of water



Future Vision & Opportunities

- Continued improvement and standardisation of mooring configurations (vertical structure) and best practices (QAQC)
- Integration of new sensors/parameters/observations (e.g. BGC)
- Near-real time data delivery (support operational decision making)
- Improve linkages with Bluewater, Estuarine & Coastal Moorings & other Facilities
- Integration with state & national ocean modelling/forecasting systems (ANCOMS)



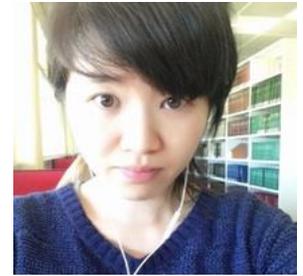
New South Wales



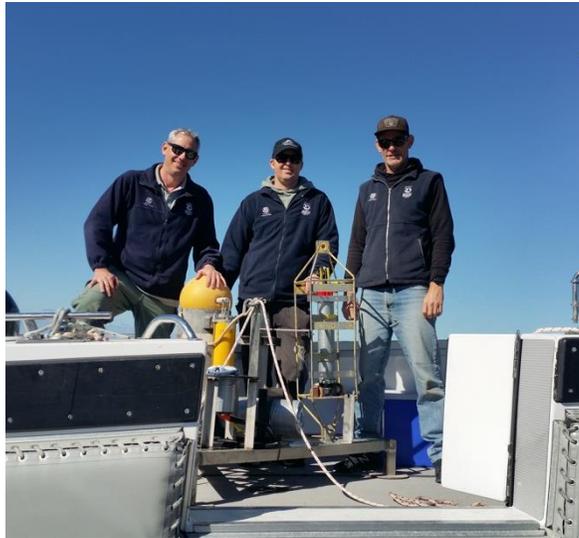
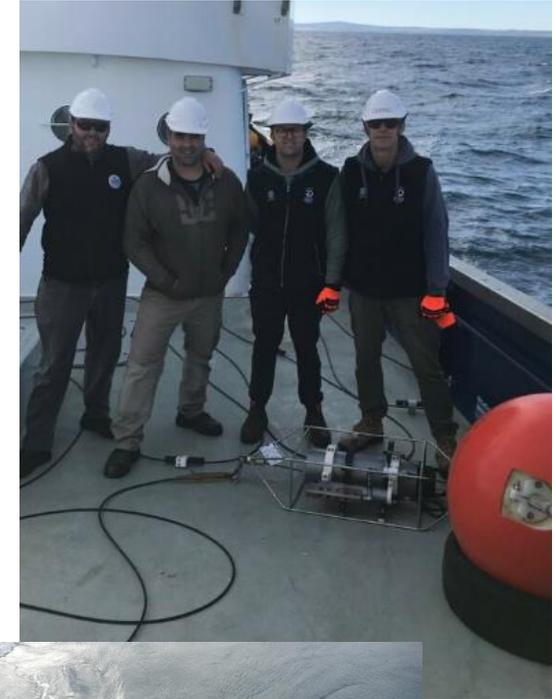
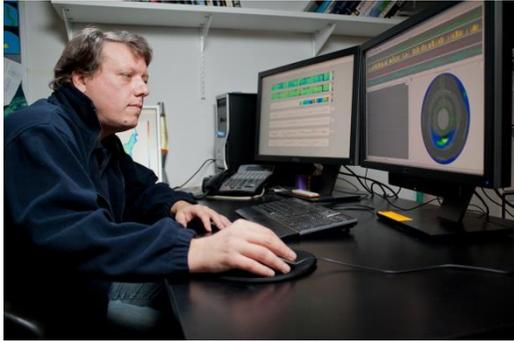
QLD and Northern Australia



Western Australia



South Australia & Victoria





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



SIMS is a partnership involving four universities

ASSOCIATE PARTICIPANTS



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.

