



An Australian Government Initiative
National Collaborative Research
Infrastructure Strategy



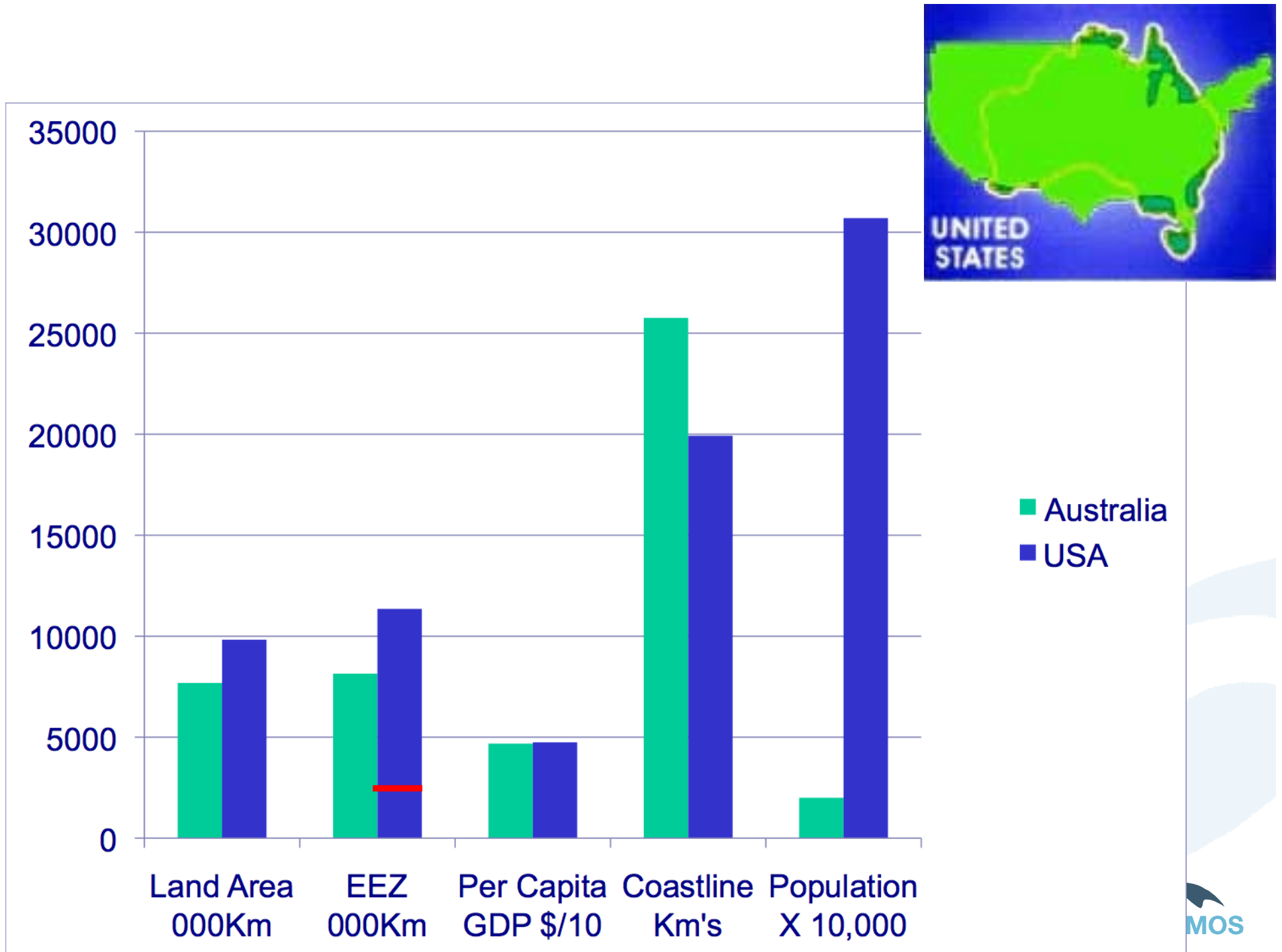
The Australian Integrated Marine Observing System (IMOS)

An Overview

Simon Allen

Technical Director, IMOS

SeaHARRE Workshop, 15th April 2010, Hobart, Tasmania



Pop Density

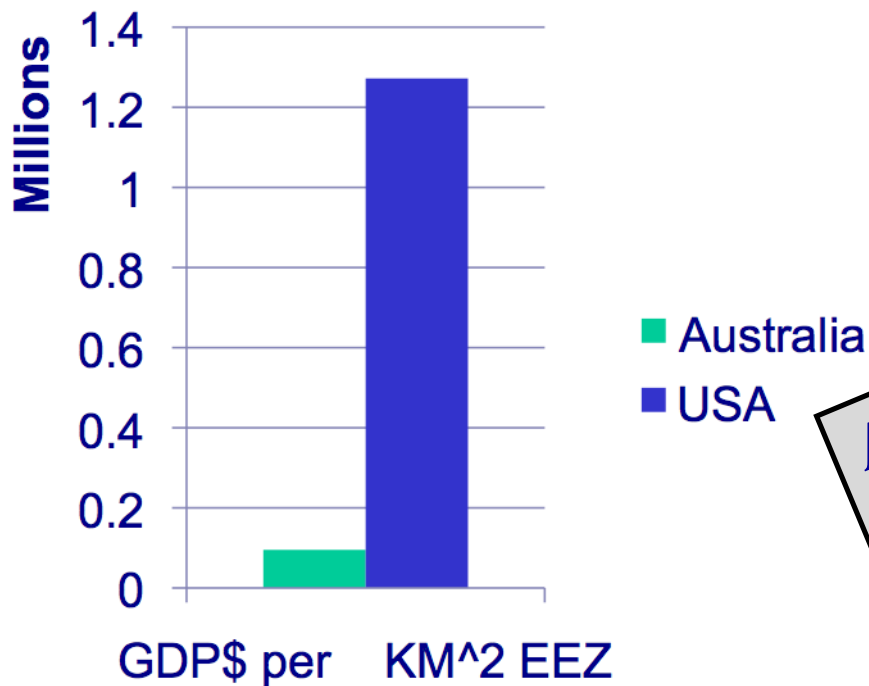
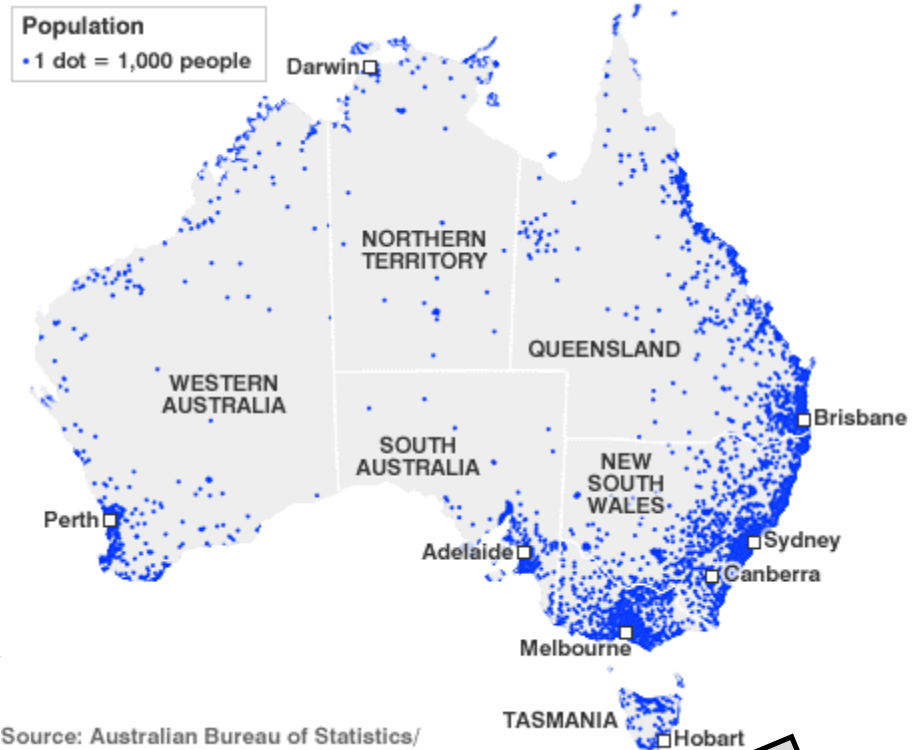
Aus = 3 / km²

USA = 31 / km²

Water Frontage

Aus = 1.2m pp

USA = 6.5 cm (2.5in) pp



Australia coastal living at risk!
Australians may have to leave coastal areas as rising sea levels threaten homes, according to a new report. About 80% of Australians live in coastal areas, and the report recommends new laws banning further development in coastal regions
BBC News 27 October 2009

IMOS

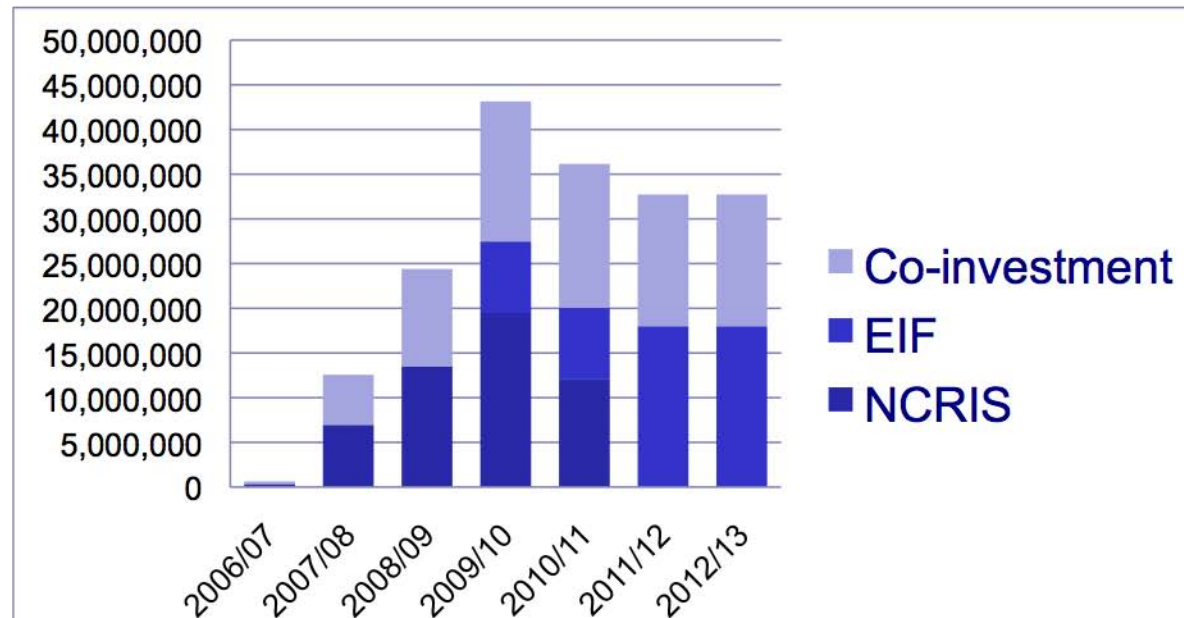
Australia's Integrated Marine Observing System
Twenty Seven Australian Institutions and Agencies
working together to deliver:

- Free open and timely access to sustained data streams focused on:
 - The role of the ocean in the climate system
 - The biophysical impacts of Australia's currents and their future change, particularly on the continental shelf.

From physics to fish....

How does it work?

- Core funding from the Australian Government
 - \$102M over ~six years (\$50M 'NCRIS' and \$52M 'EIF')
- Co-investment by Partners
 - Operators, other Australian Govt. Programs, State Govt's
 - ~\$78M cash and in-kind (40+%)
- Ramp up to 2009-10, then levelling out at ~\$35M pa



Biological Parameters?

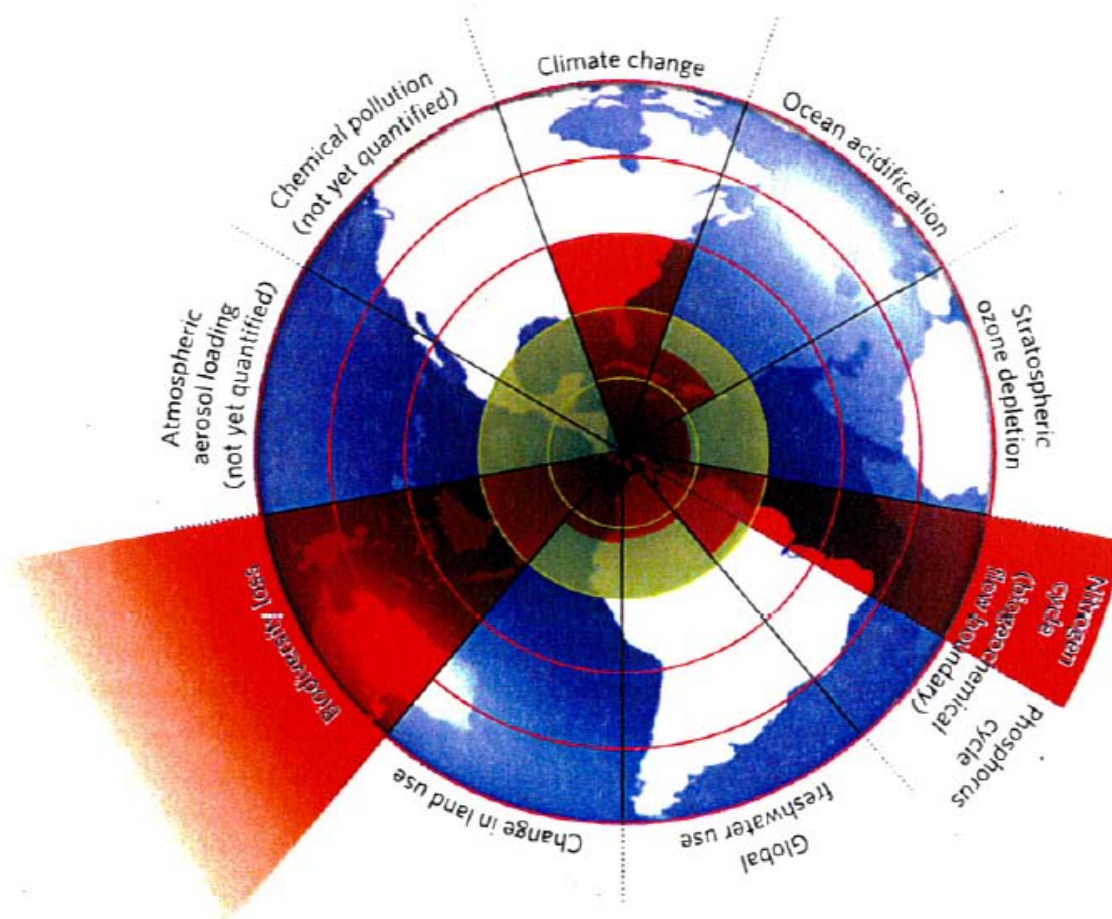


Figure 1 | Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.

Johann Rockstrom et al, Nature 26 September 2009

Photo: AP



The IMOS Elements

Operations delivered through 11 Facilities + Office

- **Argo Australia**
- **Enhanced Measurements from Ships of Opportunity** (SOOP)
- **Deep Ocean Moorings**
- **Australian National Facility for Ocean Gliders** (ANFOG)
- **Autonomous Underwater Vehicle Facility** (AUV)
- Australian Coastal Ocean Radar Network (ACORN)
- **Australian Acoustic Tagging and Monitoring System** (AATAMS)
- **Australian National Mooring Network**
- Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS)
- **Satellite Remote Sensing** (SRS)
- eMarine Information Infrastructure (eMII)

Bio-Optics Working Group

- To provide coherent practices across facilities for the collection of bio-optical data.

Australian National Facility for Ocean Gliders

Initial Fleet

- 4 x Slocums (1 lost)
- 5 x Seagliders

Additions

- 6 x Seagliders (in transit)

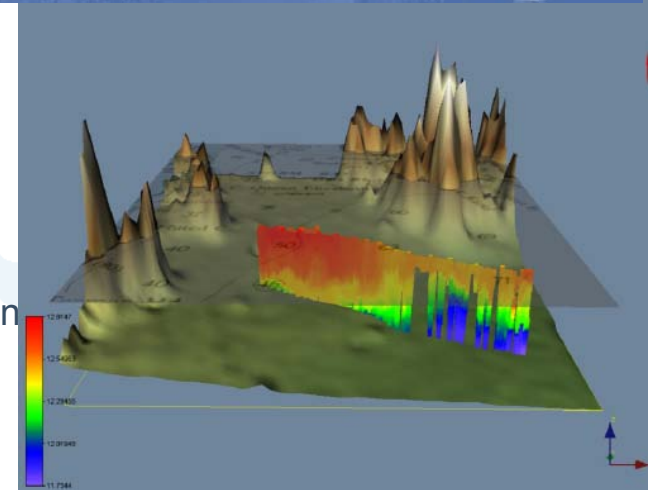
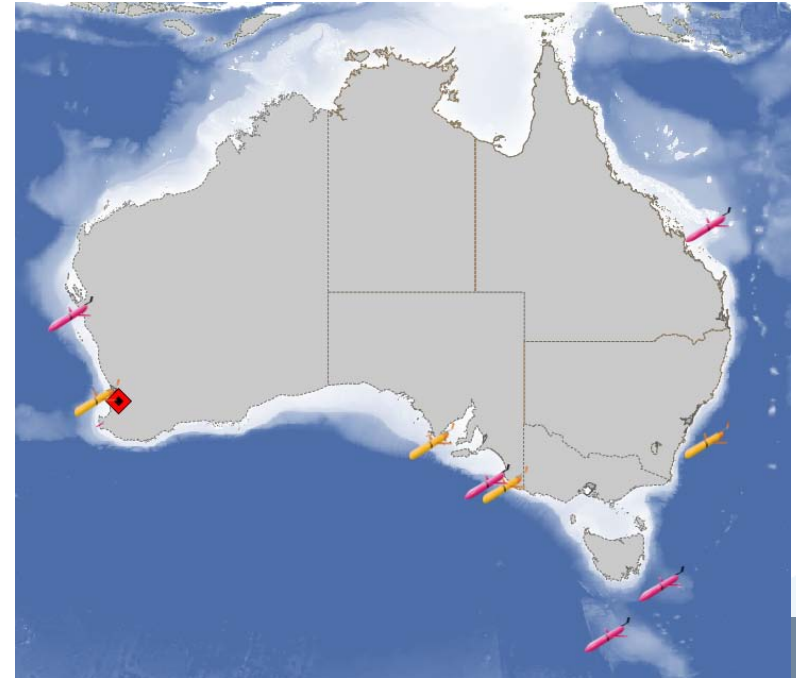
Next steps

- Expand operational bases

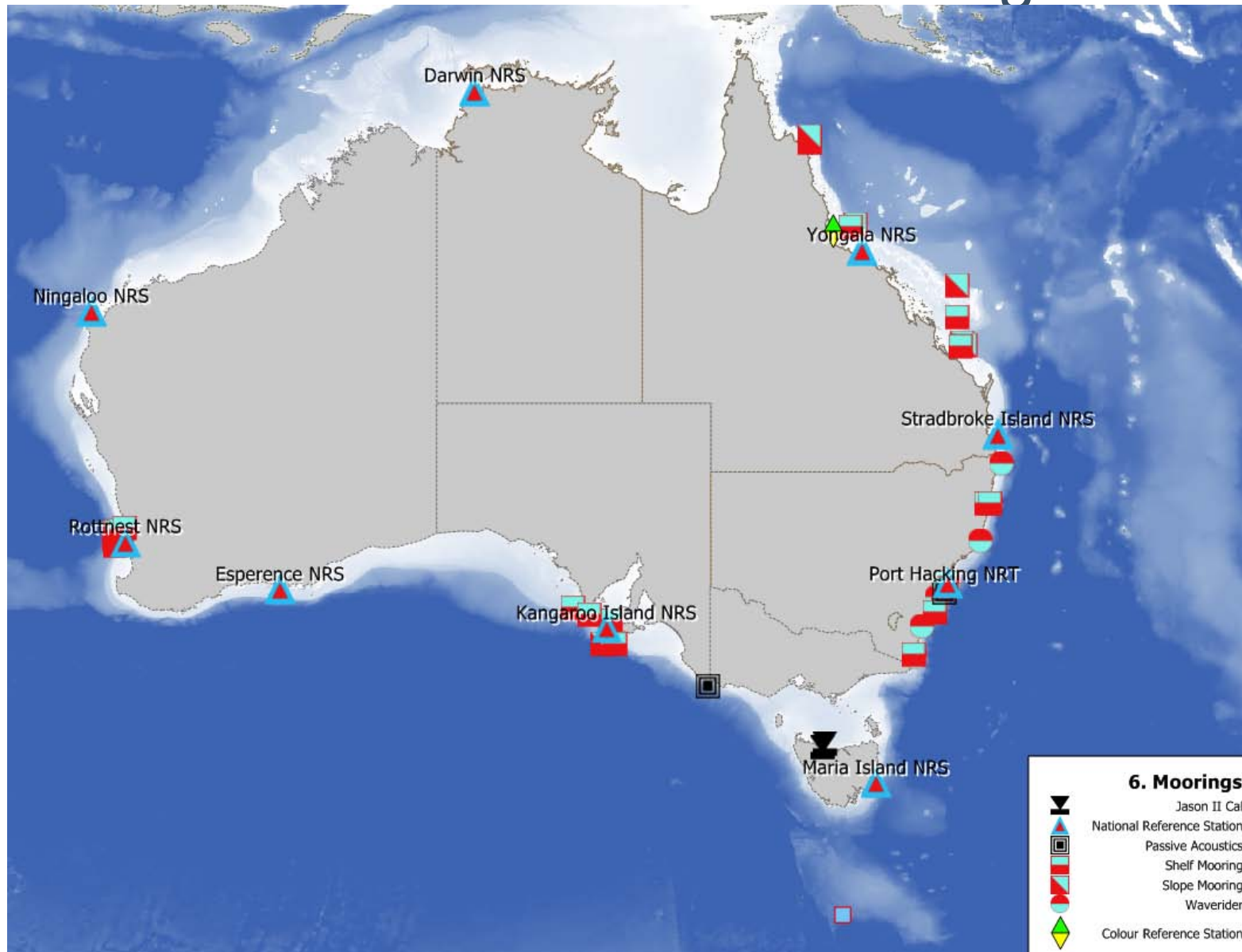
Instruments

SLOCUM Seabird-CTD, WETLabs BBFL2SLO (Chlorophyll-a, CDOM & 660nm Backscatter), Aanderaa Oxygen optode.

SEAGLIDER Seabird-CTD, WETLabs BBFL2VMT (measuring Chlorophyll-a, CDOM & 660nm Backscatter), Seabird Oxygen sensor.



Australian National Mooring Network



Australian National Mooring Network

Initial Design

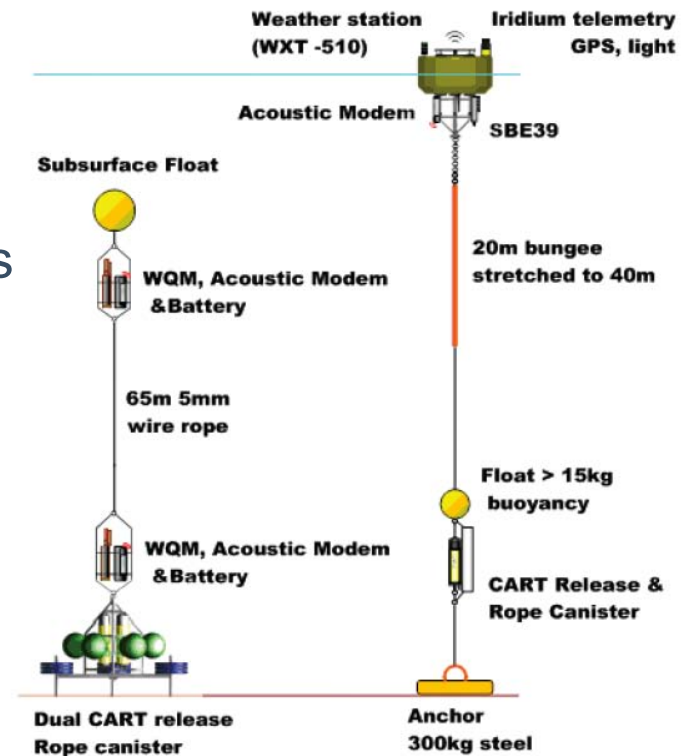
- 35 Mooring sites of which
 - 9 National Reference Stations

Lessons

- Capability building takes time
- Use local infrastructure

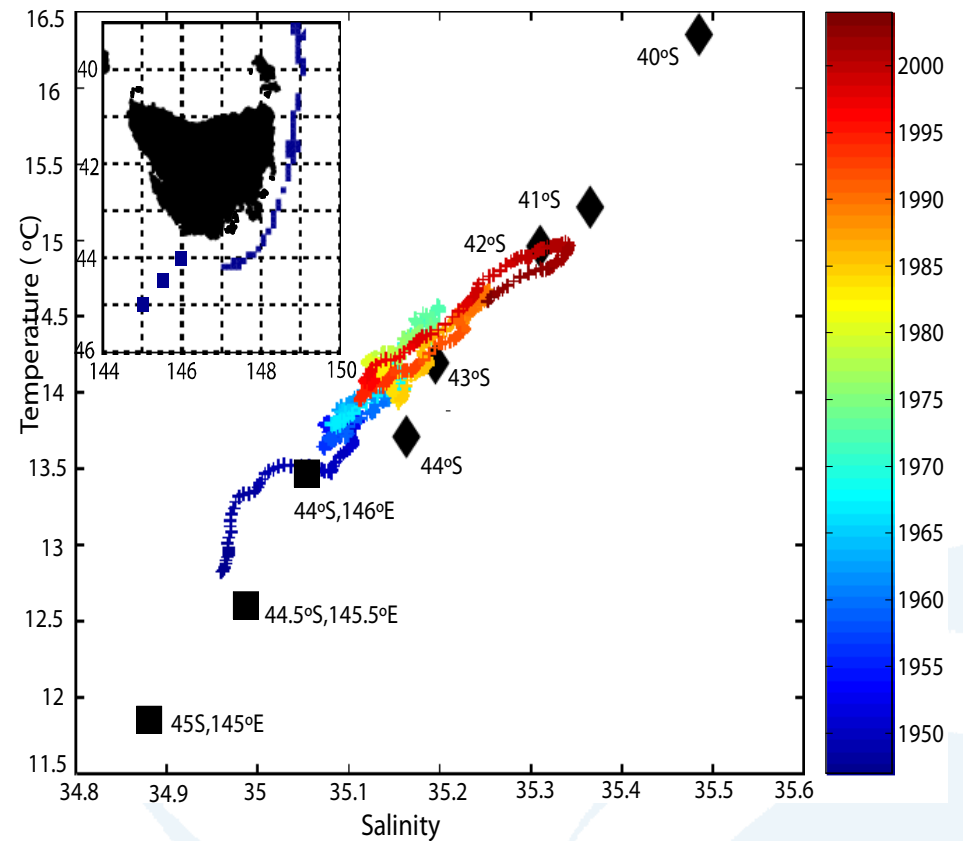
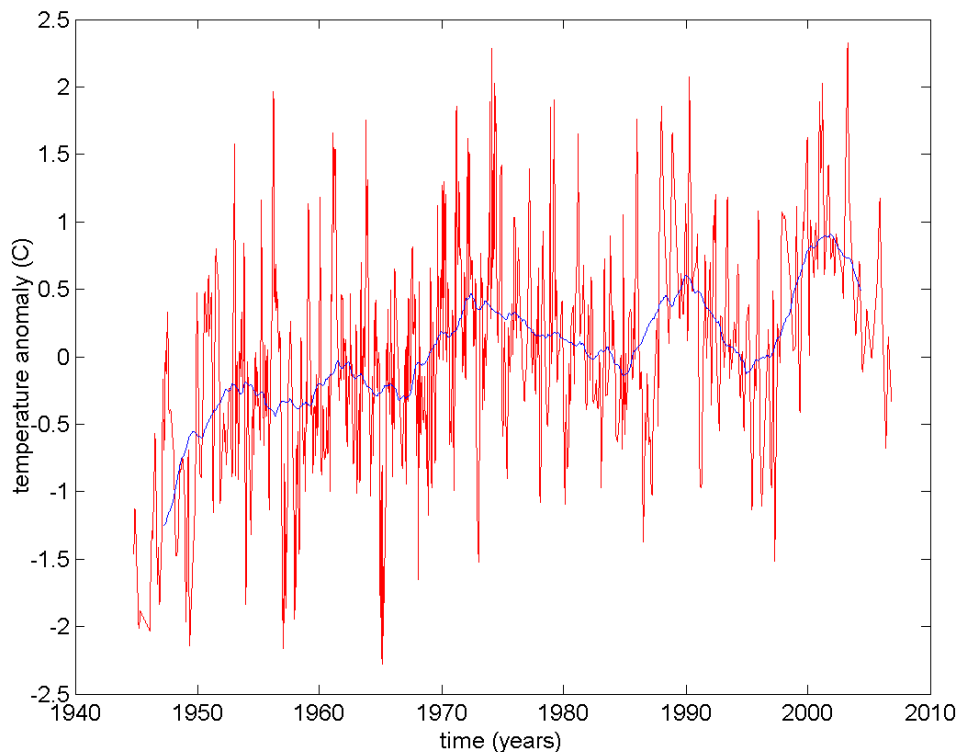
Next steps

- Consolidate observations at NRS
- Design observing System for Northern Australia



Supporting established time series: Maria Island Coast Station (now one of 9 National Reference Stations)

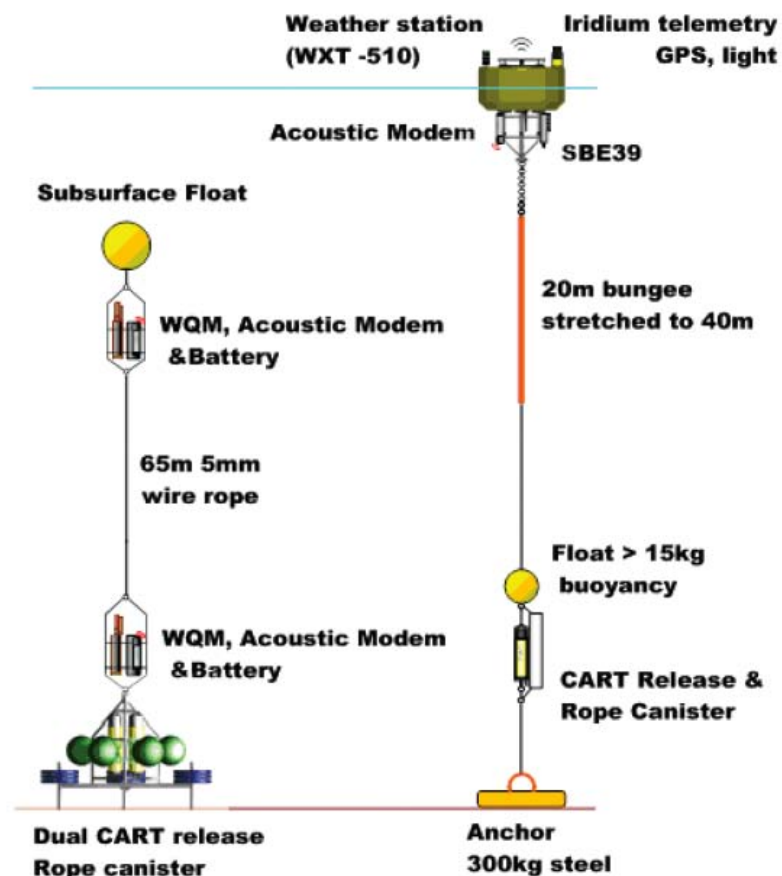
- Trend 2.28°C and 0.34psu per century
- 2-3 x global mean SST rate of warming (Casey & Cornillon 2001 Smith & Reynolds 2003)



Hill et al, GRL 2008



Use Local Infrastructure



National Reference Stations

Add EcoTriplet to 4 NRS
Self logging, Self powered

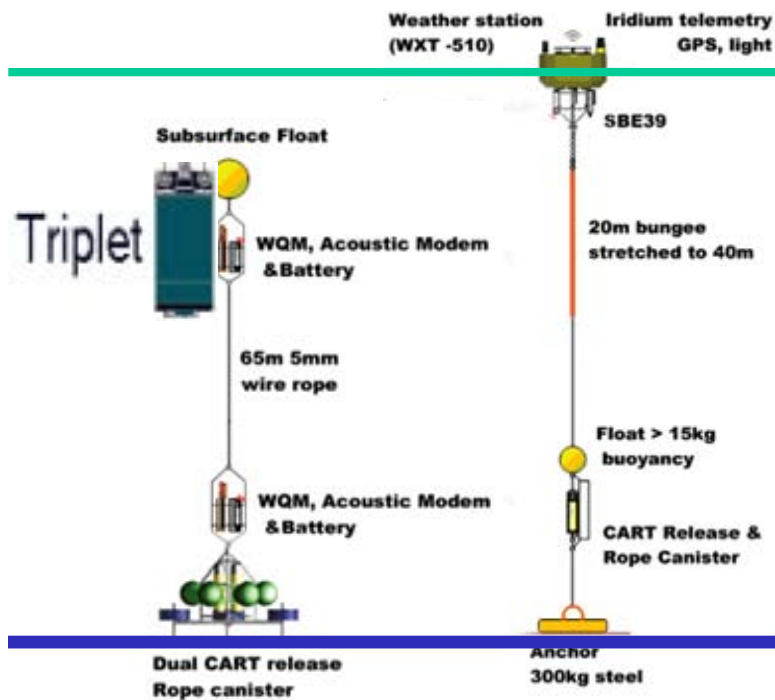
Subsurface NRS
Implemented:
6 of 9 sites

Real-time NRS
Implemented:
1 of 9 sites

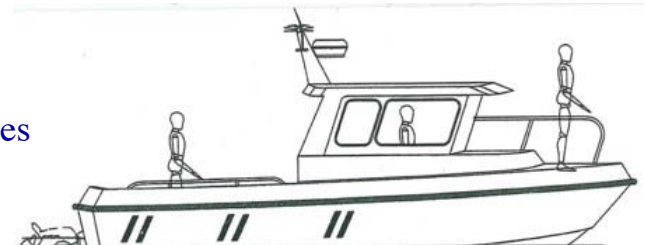
ADCP
EIF 2009/10
Implemented
1 of 9 sites

PCO2
EIF 2009/10
Implemented
0 of 2 (+?) sites

Physical Sampling
Implemented 5 ½ of 9 sites
Regional variations.
Molecular sampling @ 3? Sites
AUV's?



ADCP



Variable	Sensor	Sample
Temperature	X	X
Salinity (conductivity)	X	X
dO2	X	limited
Turbidity	X	X
Flourescence	X	X
Meteorology	surface	
Secchi depth		X
Alkanlinity		X
Phyto community		X
Phyto pigments		X
Zoo community		X
Zoo size / total weight		X
Nutrients		X
TO/TI susp. Matter		X
PCO2	proposed	X
Microbial Genetics		proposed
Current Profile	proposed	
Multiwavelength BS	proposed	



National Reference Sites and Sampling Depths

Site	Station code	Sonic Depth	Officer Responsible	Biogeochemistry sampling depths (excluding Carbon) – First Cast
With WQM's				
Maria Island	MAI	90 m	Tim Lynch	Surface, 10, 20 , 30, 40, 50
Kangaroo Is	KAI	110m	Charles James	Surface, 10, 20 , 30, 40, 50
Esperance	ESP	50m	Tim Lynch	Surface, 10, 20, 30, 40, 50
Rottnest Is	ROT	50m	Tim Lynch	Surface, 10, 20, 30, 40, 50,
Ningaloo	NIN	50m	Tim Lynch	Surface, 10, 20, 30, 40, 50,
Darwin	DAR	25m	Craig Steinberg	Surface, 10, 20 , bottom + 2.5 (2) *
Yongala	YON	28.9	Craig Steinberg	Surface, 10, 20 , bottom + 2.5 (2) *
Port Hacking 100	PHB	100m	Tim Pritchard	Surface, 10, 20 , 25 , 30, 40, 50 **
Soon to fit with WQM's				
North Stradbroke Island	NSI	60m	Anthony Richardson	Surface, 10, 20, 30, 40, 50, 60 *** (Single bottles – no WQM's yet)

Carbon samples

Site	Station code	Sonic Depth	Officer Responsible	Listing of all Carbon sampling depths	number/total Carbon sampling depths per site
With WQM's					
Maria Island	MAI	90 m	Tim Lynch	Surface, 10, , 30, , 50, 75, bottom + 2.5	6
Kangaroo Is	KAI	110m	Charles James	Surface, 10, , 30, , 50, 75, 90, bottom + 2.5	7
Esperance	ESP	50m	Tim Lynch	Surface, , 20, , 40, bottom + 2.5	4
Rottne Is	ROT	50m	Tim Lynch	Surface, 10, , 30, , 50, bottom + 2.5	5
Ningaloo	NIN	50m	Tim Lynch	Surface, 10, , 30, , 50, bottom + 2.5	5
Darwin	DAR	25m	Craig Steinberg	Surface, 10, 20, bottom + 2.5	4
Yongala	YON	28.9	Craig Steinberg	Surface, 10, 20 , bottom + 2.5	4
Port Hacking	PHB	100m	Tim Pritchard	Surface, , 20 , , 40, , 60, 80, 100, bottom + 2.5	7
Soon to fit with WQM's					
North Stradbroke Island	NSI	60m	Anthony Richardson	Surface, 10, , 30, , 50, bottom + 2.5	5

Physical Sampling and analysis

1. Carbon Parameters:

Total Dissolved Inorganic Carbon (TCO₂)

Total Alkalinity (TALK)

2. Hydrochemical parameters:

Dissolved Oxygen (chemical) – only conducted at
2 stations

salinity

Nitrate/nitrite

silicate

phosphate

ammonia

total, organic and inorganic suspended matter

3. Biological parameters:

Phytoplankton

pigment composition

phytoplankton microscopy (species composition)

flow cytometry

Zooplankton

dry weights

community composition

average size of the zooplankton community

4. Physical/profiling instrument measurements

Secchi disk – black and white

CTD with profiling capabilities for:

temperature

pressure (depths)

conductivity

fluorescence

turbidity

Dissolved Oxygen (to be retrofitted)

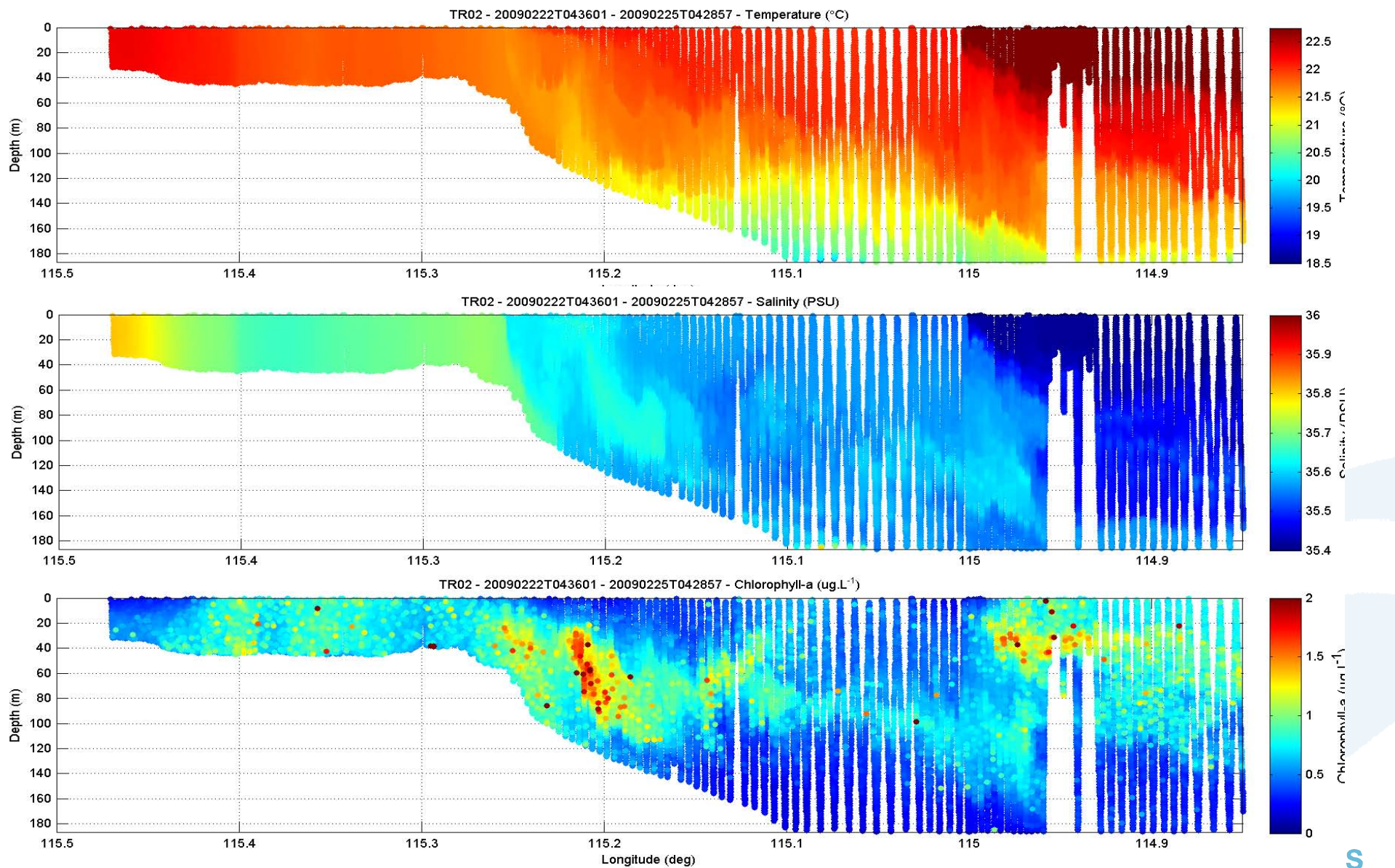
5. Sampling for Genomic analysis

Zooplankton

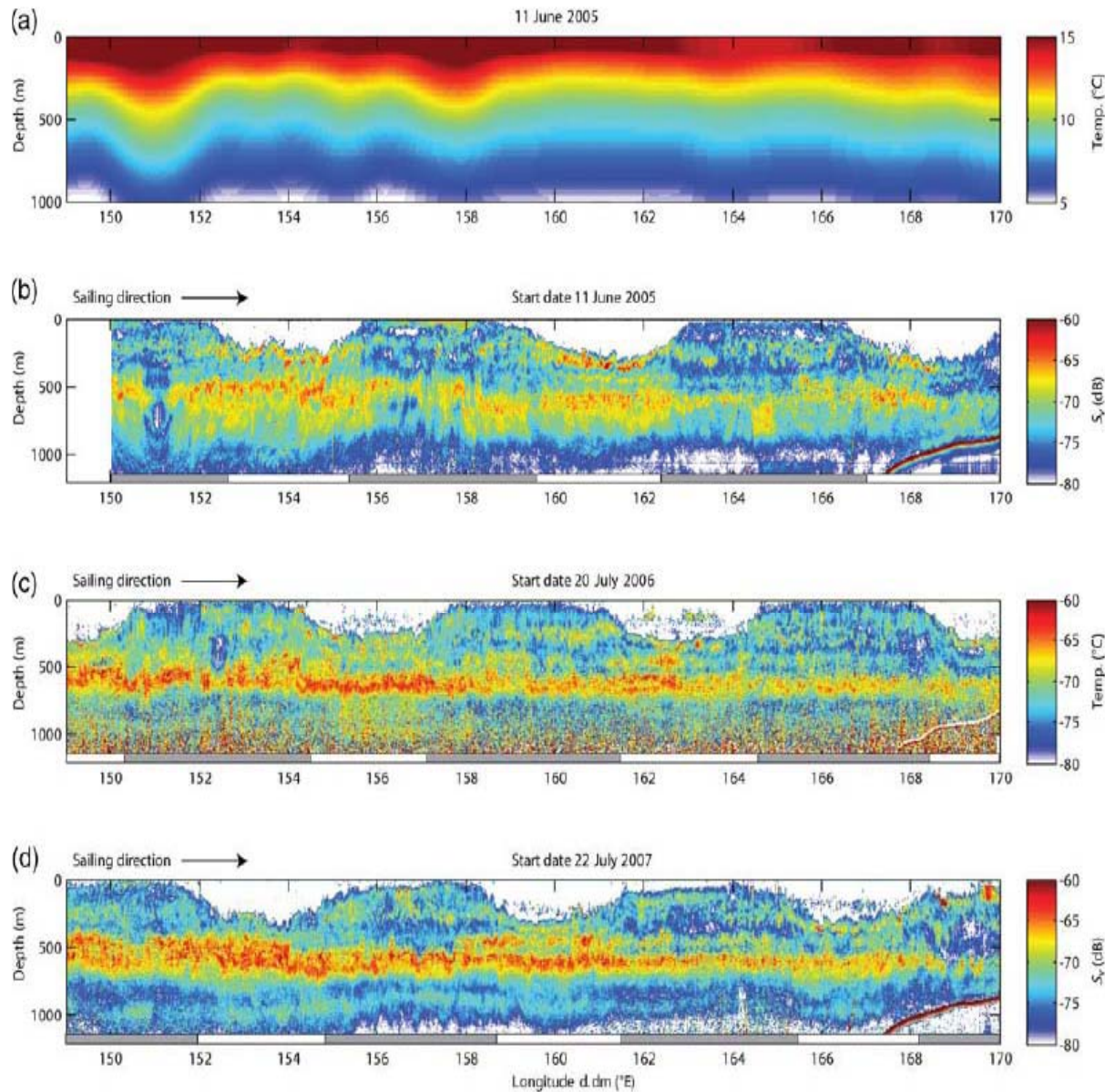
Phytoplankton

Microbial

TR2: 22 Feb 2009



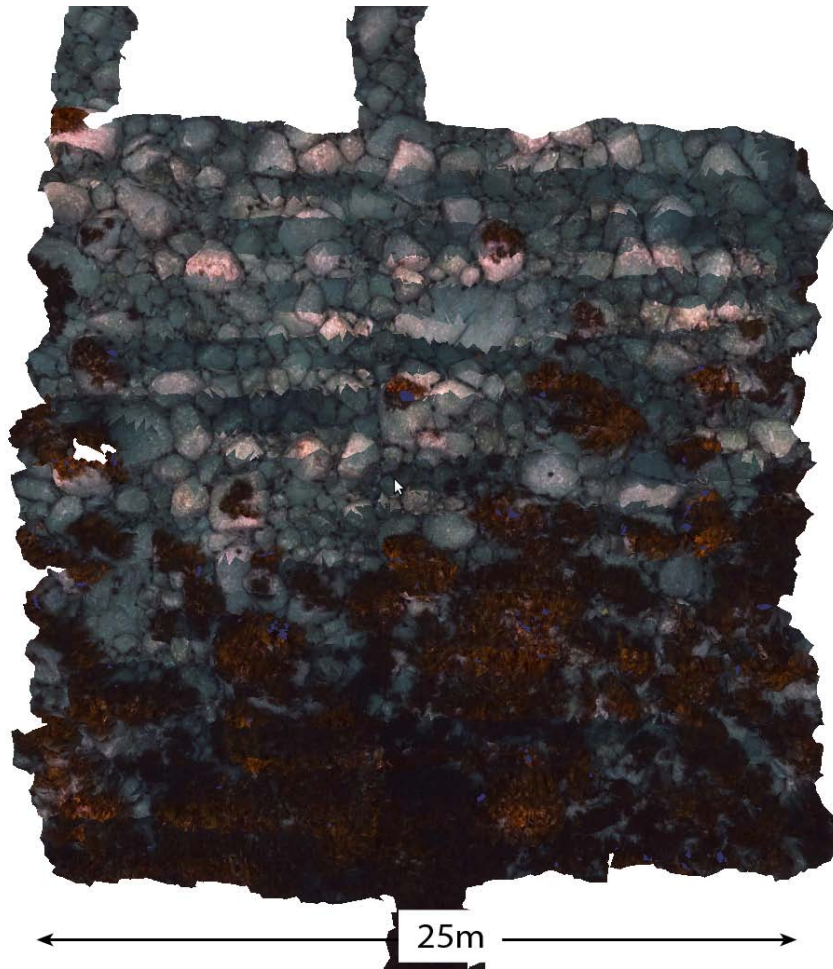
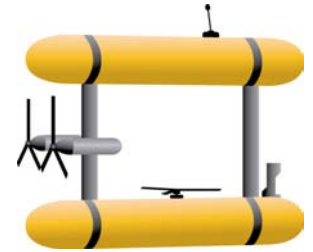
Mid Trophic levels



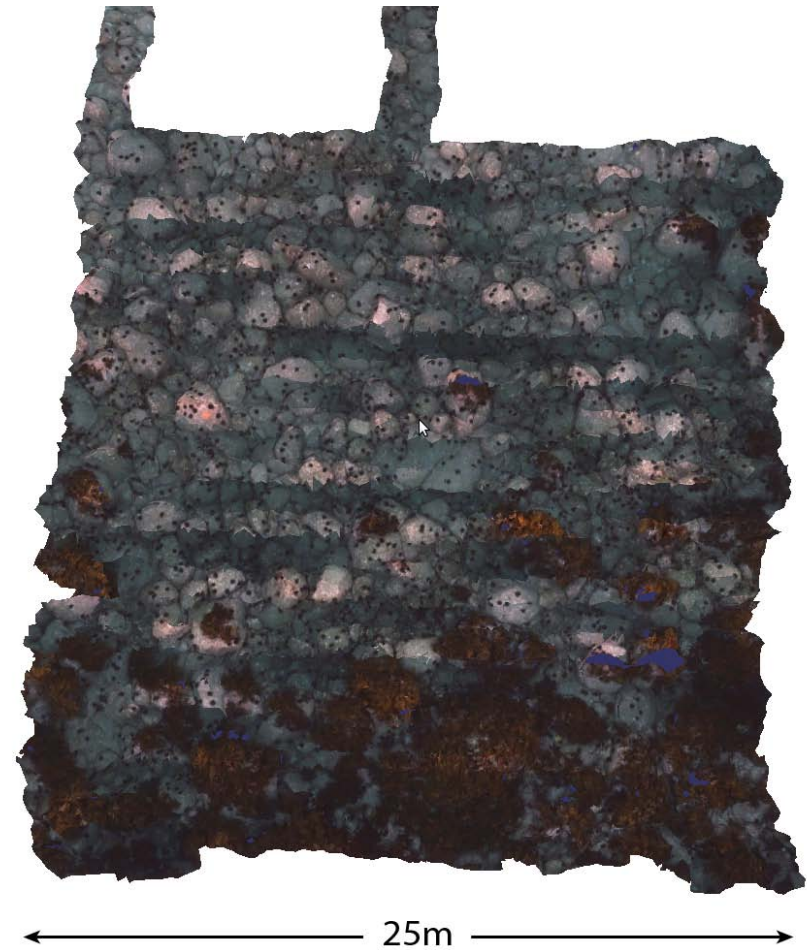
- Basin scale distribution & abundance of mid-trophic organisms from calibrated SOOP vessel.
- Will be integrated with CPR measurements on Trans Tasman (fig) and Southern Ocean (l'Astrolabe) lines.

From Rudy Klosser (CSIRO)

Monitoring benthic changes: Dense, repeated Surveys of urchin barrens



Day



Night

From Stefan Williams (USYD)

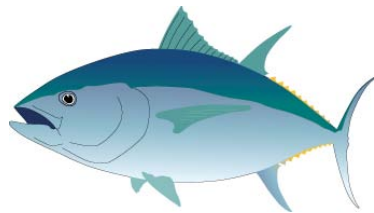


Connectivity in a reef system

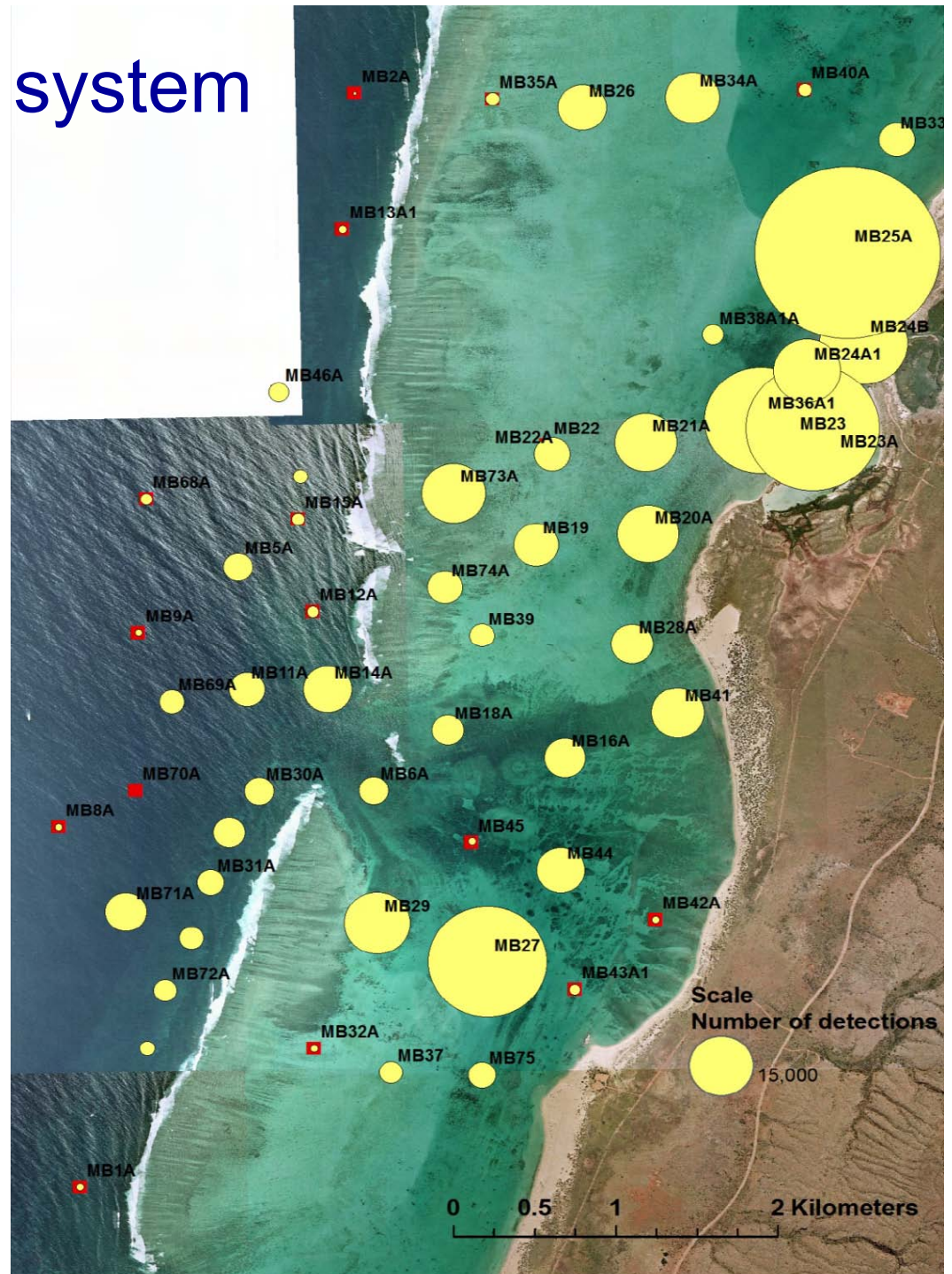
Ningaloo (NRETA)

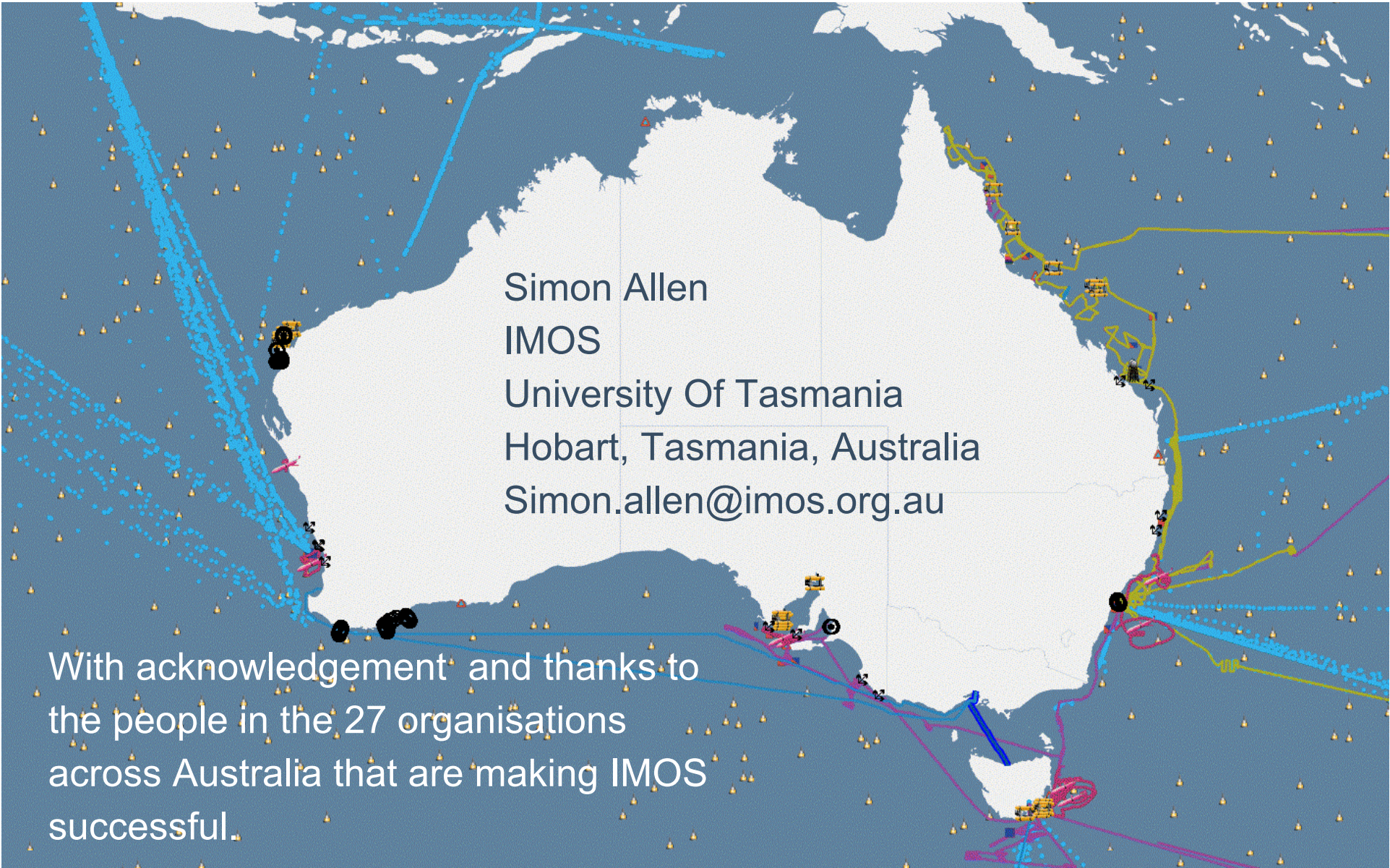
Number of detections recorded by each receiver throughout the array from Dec 2007–Oct 2008.

- The scale of yellow bubbles (number of detections per receiver) ranges from 58-158297.



From Andrew Boomer (SIMS)





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The background of the slide is a map of Australia. Overlaid on the map are numerous colored lines (blue, yellow, pink, purple) representing marine observing tracks. These tracks are densely packed in the southern and eastern coastal waters, particularly around Tasmania and the southern coast of New South Wales. Small icons of ships and buoys are scattered across the map, indicating specific observation points or stations.

With acknowledgement and thanks to
the people in the 27 organisations
across Australia that are making IMOS
successful.

<http://sites.google.com/site/coastaltasmania/>

- <http://emii3.its.utas.edu.au/dt/maria1?service=jnlp&channels=NRSMAI/0m/Sea%20Surface%20Temperature>

