


Deeper, faster, cheaper: technology revolutionises
21st century Marine Biology

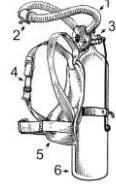
Prof. Andy Davis



Better understanding our south coast Marine Parks
Point Perpendicular, Jervis Bay Marine Park


University of Wollongong

Cousteau & the Aqualung



Aqua-Lung SCUBA



1. Hose
2. Mouthpiece
3. Valve
4. Harness
5. Backplate
6. Tank



Jacques Cousteau

Cameron & the Deepsea Challenger

Mariana Trench (>11km)

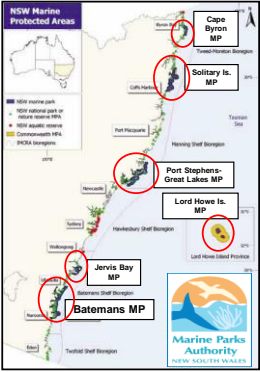



James Cameron



NSW Marine Protected Areas

- 6 MPA in NSW
- protect biodiversity
- maintain ecological processes & systems

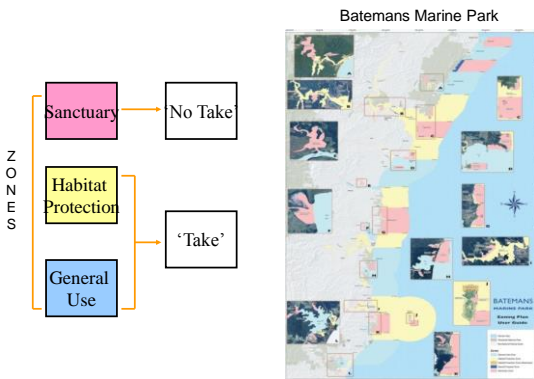


South Coast Marine Parks



- Three questions:
- Are they in the right place?
 - Are they effective?
 - Do they protect motile organisms eg fish?

Bowen Island, Jervis Bay Marine Park



Background

Rising threat of substantial marine biodiversity loss

Marine Protected Areas (MPAs) – effective conservation strategy

Location and configuration not often based upon ecological data

MPAs may not be achieving conservation objectives

Biological data = time consuming and expensive



Technological Solutions in 3 parts

(i) Are they in the right place? – Habitat Mapping as a surrogate for Biodiversity

(ii) Are they effective? - Monitoring change with Baited Remote Underwater Video (BRUV).

(iii) Do they protect motile organisms eg fish? Using Acoustic Tags to reveal patterns of fish movement



1. Habitat mapping as a surrogate for reef Biodiversity



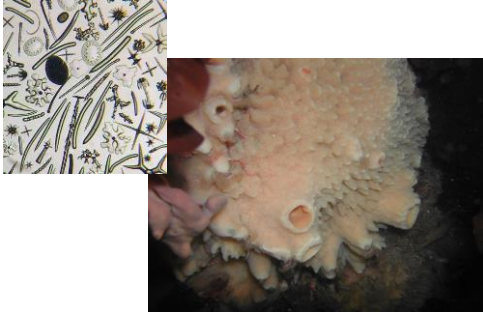
A well characterised fauna?



Some taxa are poorly known



Sponges – difficult to identify



Significant unknowns

- Sponges in Estuarine Systems
 - 18 species - 2 described by Science
 - 90% undescribed!
- Deep water sponges (30-50m)
 - 50 species
 - 60% undescribed

Courtesy of DLWC

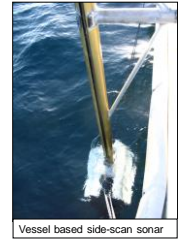
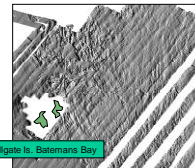
Side scan sonar to assess reef Heterogeneity

Can we use remotely-sensed abiotic measures to predict temperate reef biodiversity?

Use remotely sensed habitat info as surrogates to indirectly measure biodiversity and guide MPA boundaries

Advantages:

Easy to obtain
Affordable and time efficient



Vessel based side-scan sonar



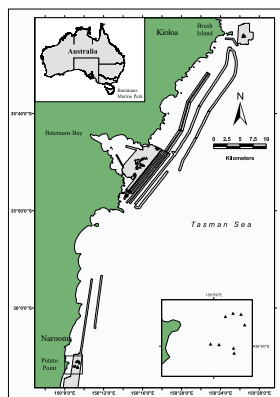
Swath Mapping

Batemans Marine Park

40 sites

Each site was:

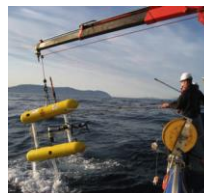
- 1) Swath mapped
- 2) Filmed using BRUV
- 3) 32 of the sites were photographed



Automated Underwater Vehicle - AUV

- Raft of instruments;

- high resolution stereo camera pair & strobes
- multibeam sonar
- depth and conductivity/temperature sensors
- Ultra Short Baseline Acoustic Positioning System (USBL)
- Forward looking obstacle avoidance sonar.





Results

2206 fish were observed which comprised of 58 species represented by 33 families

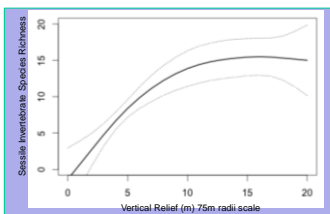
61 species of sessile invertebrates were observed including:

- 51 sponge species
- 8 ascidian species
- 1 hydroid and bryozoan species



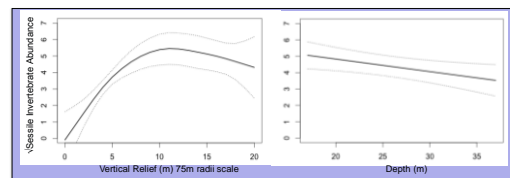
Sessile Invertebrate Species Richness

Model and Terms	F	P	r ²
SI Species Richness			0.683
s(Vertical Relief 75m)	17.62	<0.001	



Sessile Invertebrate Relative Abundance

Model and Terms	Estimate	F	SE	t	P	r ²
SI Abundance						0.636
s(Vertical Relief 75m)		13.76			<0.001	
Depth	-0.07		0.03	-2.37	0.026	

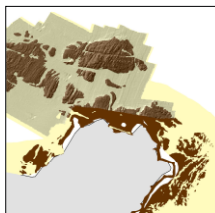


Conclusions

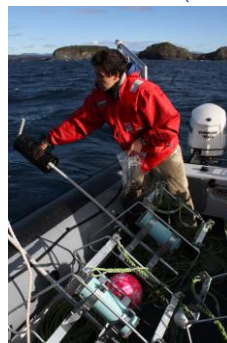
Sidescan sonar derived abiotic variables are potential surrogates for invertebrate assemblages

Can determine areas of high conservation value on temperate reefs

Incorporated into new MPA zoning and examine current MPA zoning

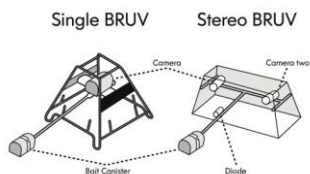


2. Monitoring change with Baited Remote Underwater Video (BRUV)



Baited Remote Underwater Video (BRUV)

- Unobtrusive means of sampling fish assemblages
- Cryptic and shy fish
- >1000 metres depth
- Permanent records
- Stereo BRUV allows length calculation



Deploying BRUV



Pic: Ian Osterloh

Deployed for 35 mins ~ 5 min settlement period and a 30 min sample

Baited Remote Underwater Videos (BRUVs)



Measures

1. MaxN
 2. Total MaxN
 3. Species Richness
- MaxN
Onespot Pullers = 14
Painted Basslet = 2
Gunthers Butterflyfish = 1
Spotted Sawtail = 1

Total MaxN = 18; Species Richness = 4

Baited Remote Underwater Videos (BRUVs)

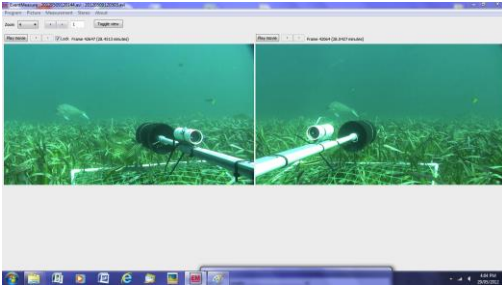


Measures

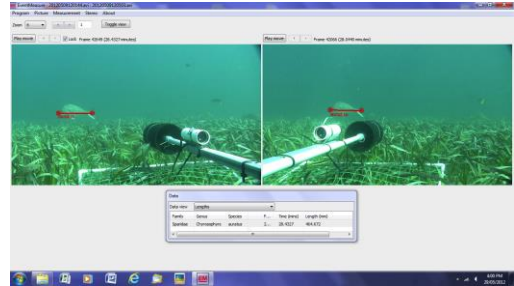
1. MaxN
 2. Total MaxN
 3. Species Richness
- MaxN
Snapper = 8
Grunter = 6
Maori Wrasse = 4
Tarwhine = 1
Longfin Pike = 1
Shovelnose Ray = 1

Total MaxN = 21; Species Richness = 6

Length Calculation



Length Calculation



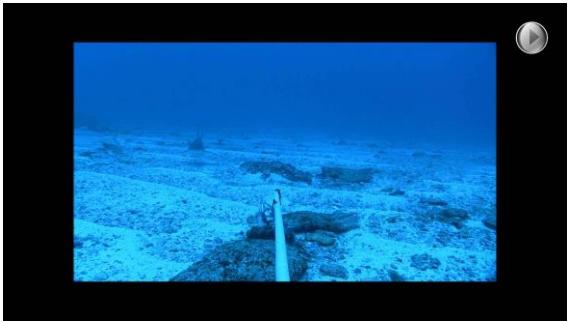
'MiniBRUVs': Cryptic fishes in seagrass



Small BRUVs: Species Sampled

- Blue Weed Whiting
- Rough Leather Jacket
- Little Weed Whiting
- Six-Spine Leatherjacket
- Bluestriped Goatfish
- Pygmy Leather Jacket
- Blue-nose Whiting
- Krefft's Frillgoby
- Common Weedfish
- Australian Mado
- Senator Wrasse
- Old Wife
- Southern Eagle Ray
- Common Silverbiddy
- Smooth Stingray
- Snapper
- Eastern Australian Salmon
- Common Stingaree
- Banded Toadfish
- Yelloweye Mullet
- Long-finned Pike
- Sea Mullet
- White Trevally
- Eastern Striped Grunter
- Chinamen Leatherjacket
- Onestripe Seapike
- Fiddler Ray
- Luderick
- Yellow Fin Bream
- Yellow Tail Scad

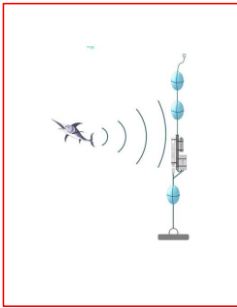
Key
 Unique to small BRUV design
• Cryptic species



3. The movement of fish on sand: Implications for the management of marine protected areas



Acoustic tracking



Acoustic tags

- Acoustic tags transmit ultrasonic signals to a submerged receiver (hydrophone).
- Internal battery powers transmitter, size of the battery dictates the size of the tag.
- Tag life depends on the battery size, transmitter size, signal power and rate



IMOS Integrated Marine Observing System

Introducing IMOS > Facilities > Animal Tagging and Monitoring

Home

AATAMS

Southern Tails as Ocean Samplers

AATAMS publications

AATAMS workshop

Data Base

AATAMS Receiver Locations 2013

Instrumentation

The AATAMS Mobile Receiver Pool

Contact details

AATAMS Forms

Links

Chilton

Australian Animal Tagging and Monitoring System (AATAMS)

The Australian Animal Tagging and Monitoring System (AATAMS) is one of ten facilities of the Integrated Marine Observing System (IMOS). AATAMS represents the higher biological monitoring of the marine environment for the IMOS program.

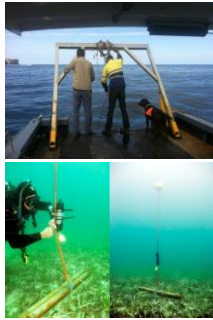
Currently AATAMS uses acoustic technology, CTD, satellite trackery and loggers to monitor coastal and oceanic movements of marine animals from the Australian mainland to the sub-Antarctic island and as far south as the Antarctic continent.

AATAMS is set up to collect data over a long period of time. This sustained approach will enable researchers to assess the effects of climate change, ocean acidification and other physical changes that affect animals within the marine environment.

Currently a large range of fish, sharks and mammals are collecting a wide range of data. This includes behavioural and physical data such as the depth, temperature, salinity and movement effort of individual marine animals.

This data is freely available via the IMOS Ocean Portal and can be overlaid with data from the other IMOS facilities.

Tracking Array



Gone fishing!



Soft sediment fish assemblage

- 50 + species of fish
- Dominant species below



Implanting tags

- Surgery
- Tracking for 700 days +
- 25+ of each species



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Tagging so far...

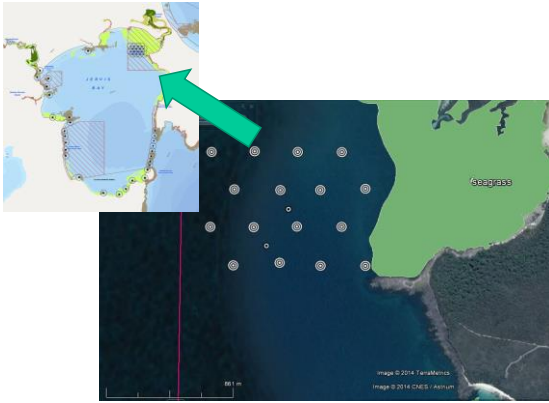
- 50 Blue-spotted flathead
- 12 Fiddler Rays



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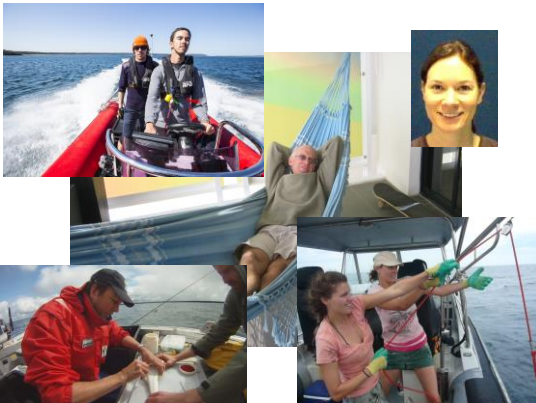


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SEA SERPENT

SOUTH EAST ASIA
SCIENTIFIC AND ENVIRONMENTAL ROV
PARTNERSHIP USING EXISTING INDUSTRIAL
TECHNOLOGY



UNIVERSITY OF WOLLONGONG

FISH_THINKERS

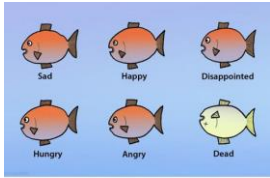


NSW GOVERNMENT | Department of Primary Industries

The Nature Conservancy
Protecting nature. Preserving life.



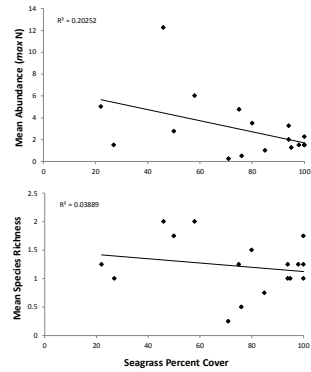
Questions.....



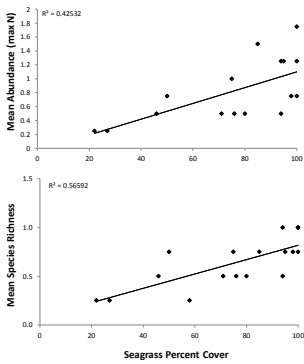
Understand your fish



Results (Non-cryptic Fish)



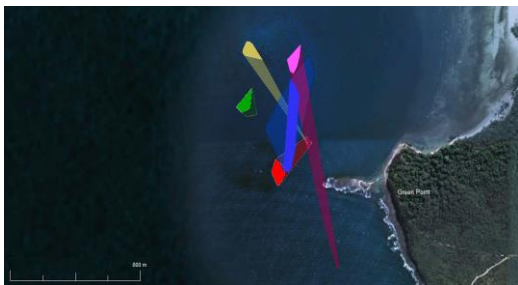
Results (Cryptic Fish)



Release locations



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Fish one Fish two Fish three Fish four Fish five

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To examine MPA effectiveness we compare a number of fish parameters between no-take and take zones.

- **Species Richness**
- No. of species
- **Relative Abundance**
- max no. of a particular species
- **Total Abundance**
- all species

