NORTH WEST SHOALS TO SHORE RESEARCH PROGRAM

Monitoring of fishes exposed to a marine seismic survey source

- *BRUVS and acoustic tagging*

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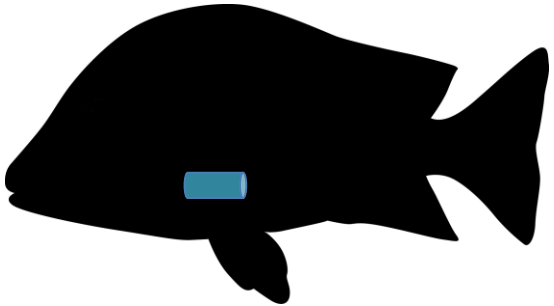
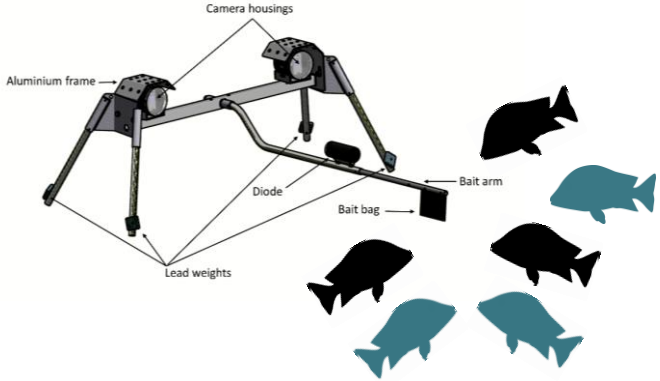
Collaborating Agencies include:
- Santos;
- Woodside;
- RV Solander crew;
- AIMS & DPIRD staff conducting field work and reading BRUVS videos;
- V. Udyawer and K. Lee for assistance with ATT and interpretation of data; and
- H. Pederson of Vemco.

Tagging and BRUVS recap

1. Use tagged fish to infer potential impacts of seismic activity on behaviour;

2. Use BRUVS to infer potential impacts of seismic activity on fish abundance and community structure.

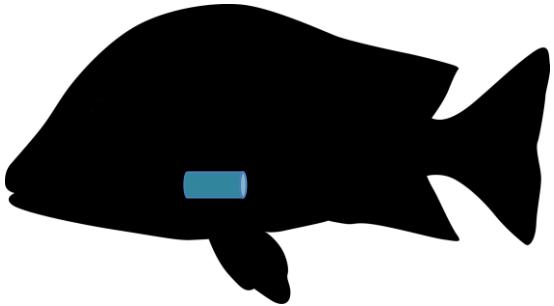




Tagging overview

Fish tagging

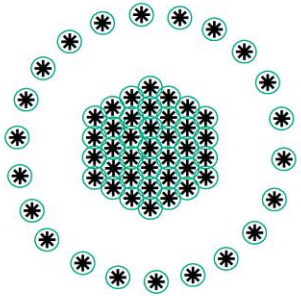
- Two tagging trips Jun and Aug 2018;
- 387 red emperor tagged;
- Downloads completed Dec 2018; and
- > 3.8 million detections.



Acoustic array design

* Receiver locations
Approximate range - 500m

High exposure site



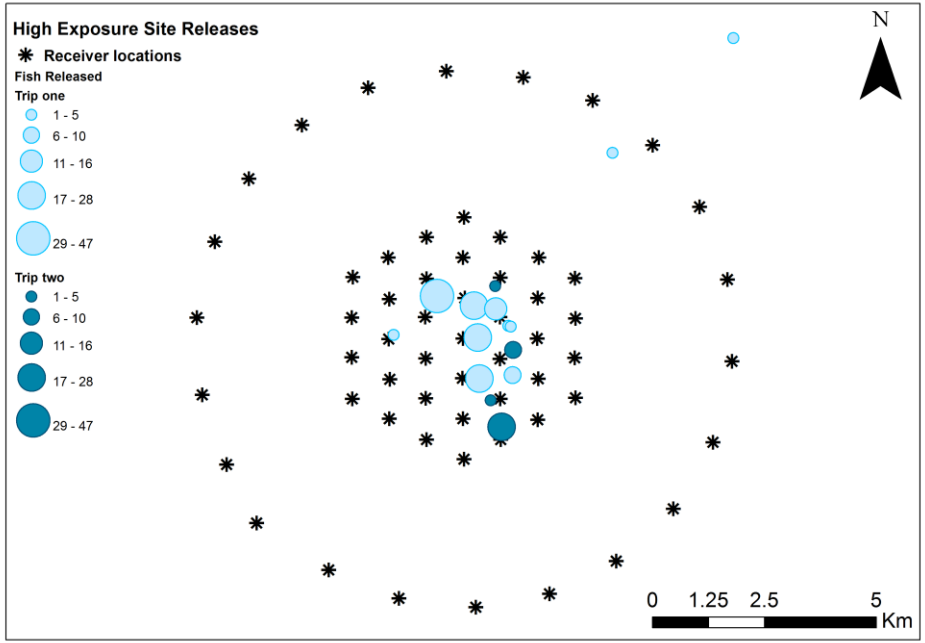
N

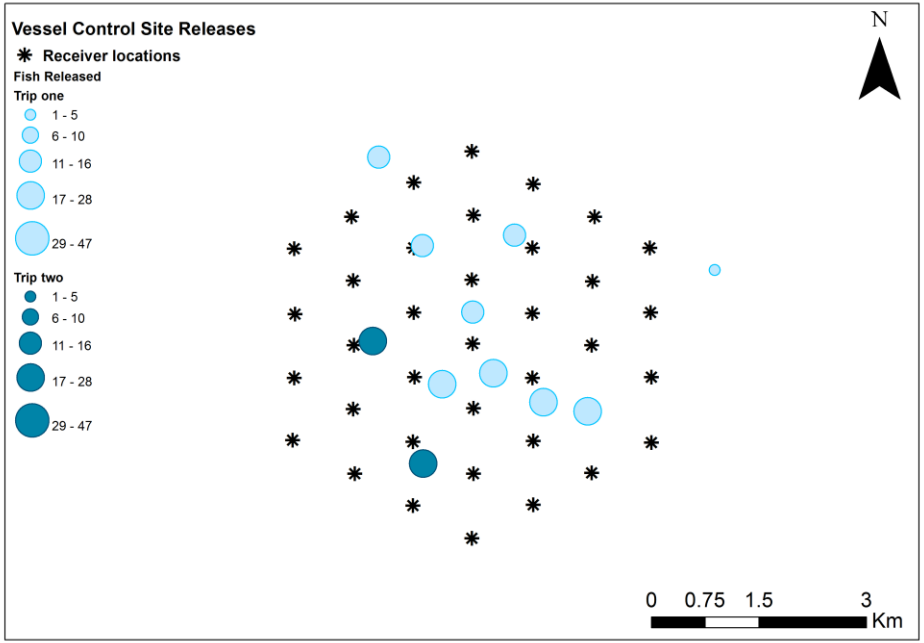
Vessel control site

0 5 10 20
Km

Fish release locations

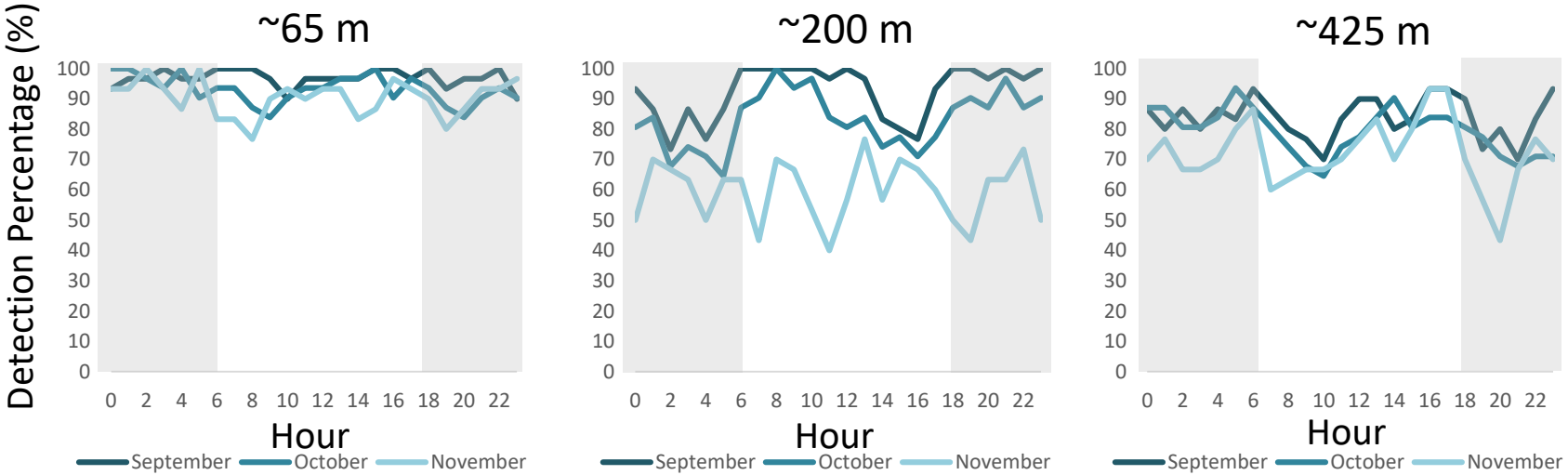
- Changed release locations each trip.





Receiver range

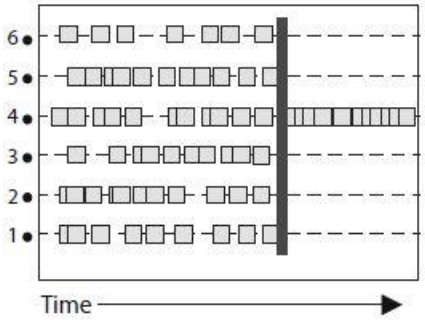
- Range testing;
- Sentinel tags;
- Range greater than expected



Fish tagging summary

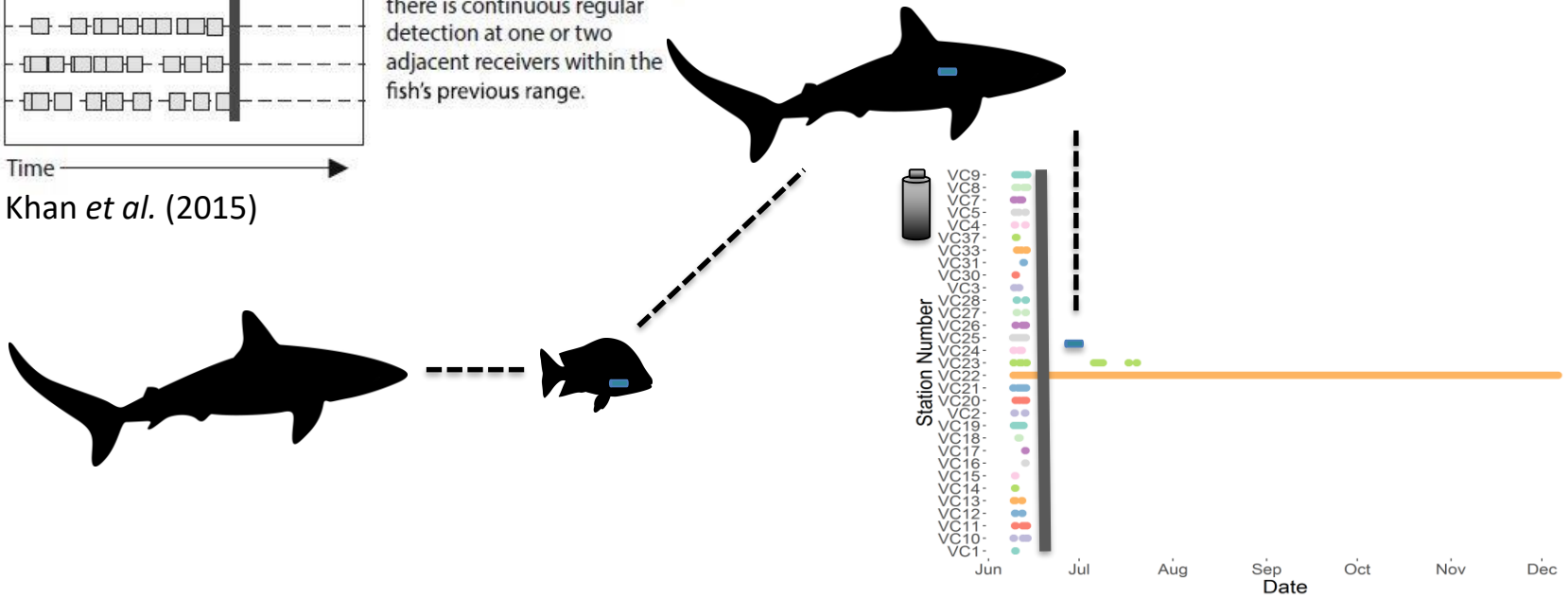
Site	Tagged (n)	Detected (n)	Suspected predated (n)	Transmitting tags
High Exposure	196	123 (63%)	54 (44%)	67
Vessel Control	191	103 (54%)	30 (29%)	62

Potential predation events

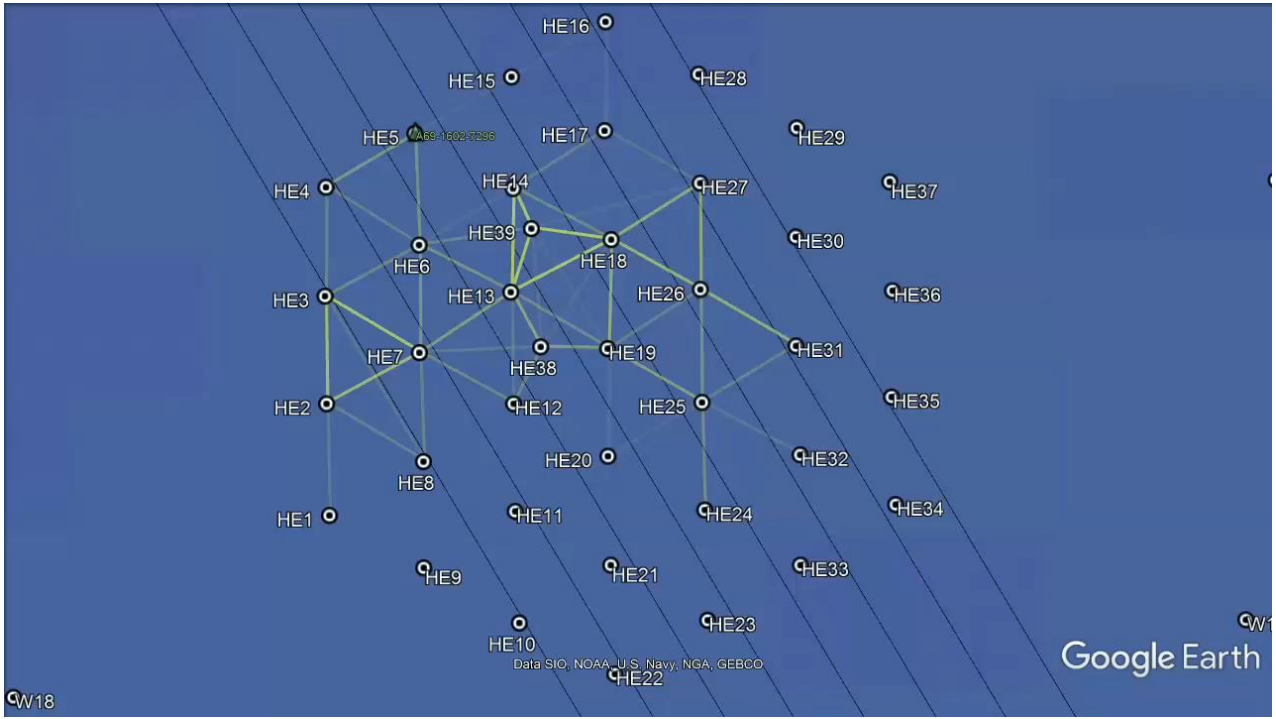


Stationary. A sudden stop in previously consistent detections, as with Abrupt PMEs. However, following this event, there is continuous regular detection at one or two adjacent receivers within the fish's previous range.

Khan *et al.* (2015)



Potential predator track



Shark detections

Species	Number (n)	High Exposure	Vessel Control	Detections
Tiger	2	☒	☑	9 & 28
Dusky	1	☑	☒	8
Lemon	1	☑	☑	56

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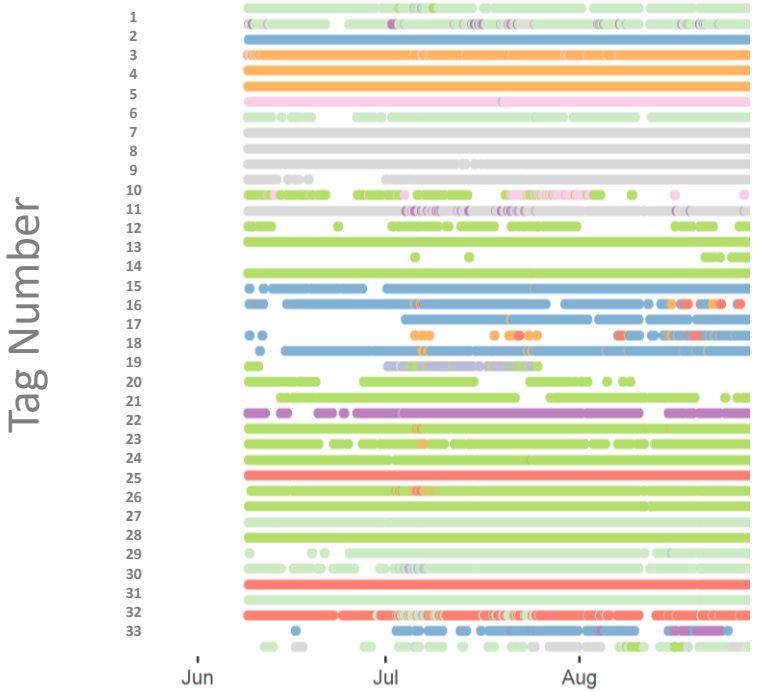
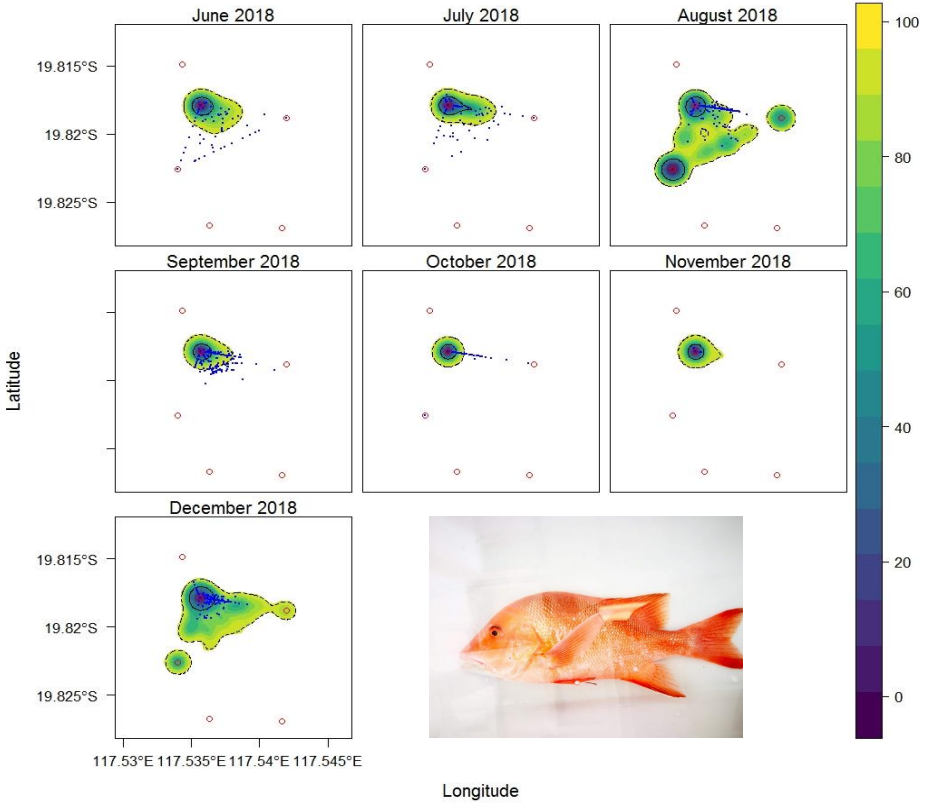
Temporal patterns

- Change in temporal patterns (Residency index);
- Environmental conditions;
- Biological drivers.



Spatial patterns

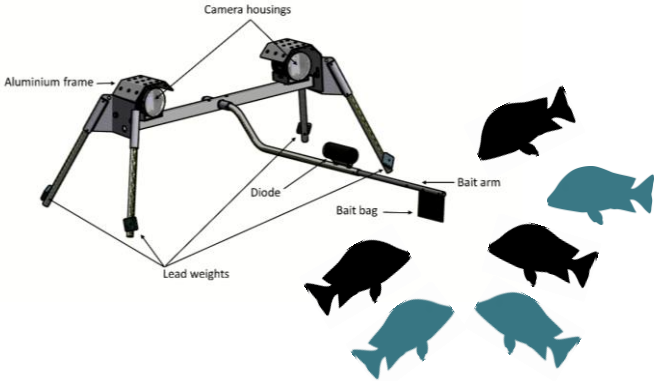
- Calculate areas of use;
- 50% & 95% KUD;
- Assess changes pre & post experiment;
- Mixed models
  - non-independence
  - fixed & random effects
  - include explanatory variables

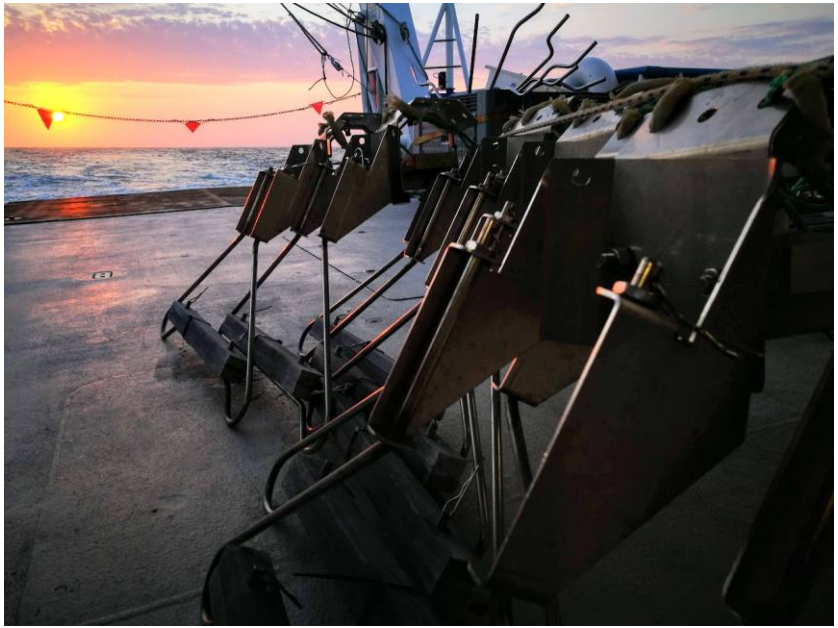


BRUVS overview

Baited Remote Underwater Video Stations

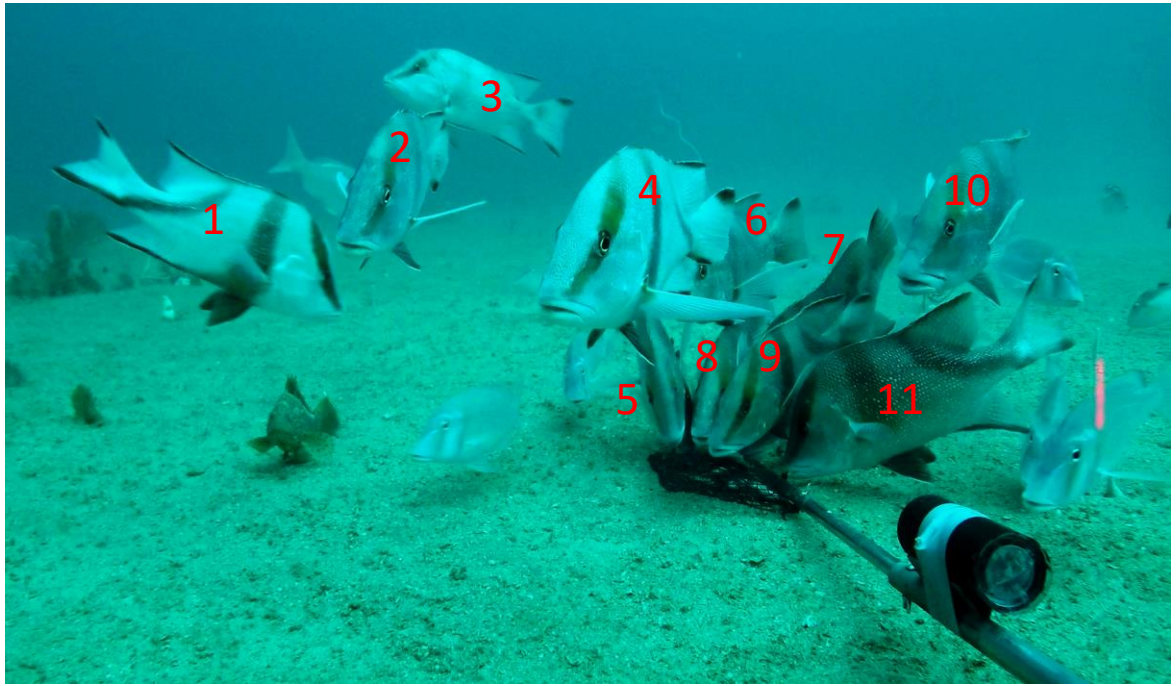
- Five samples (3 x pre and 2 x post);
- Total BRUVS deployed 584;
- Total BRUVS analysed 322 (55%).





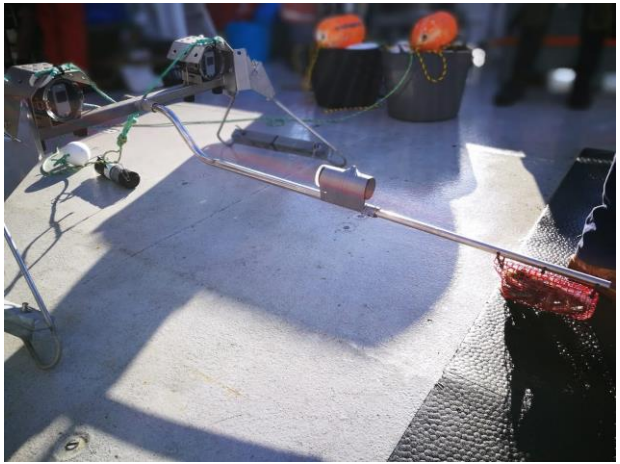
Relative abundance

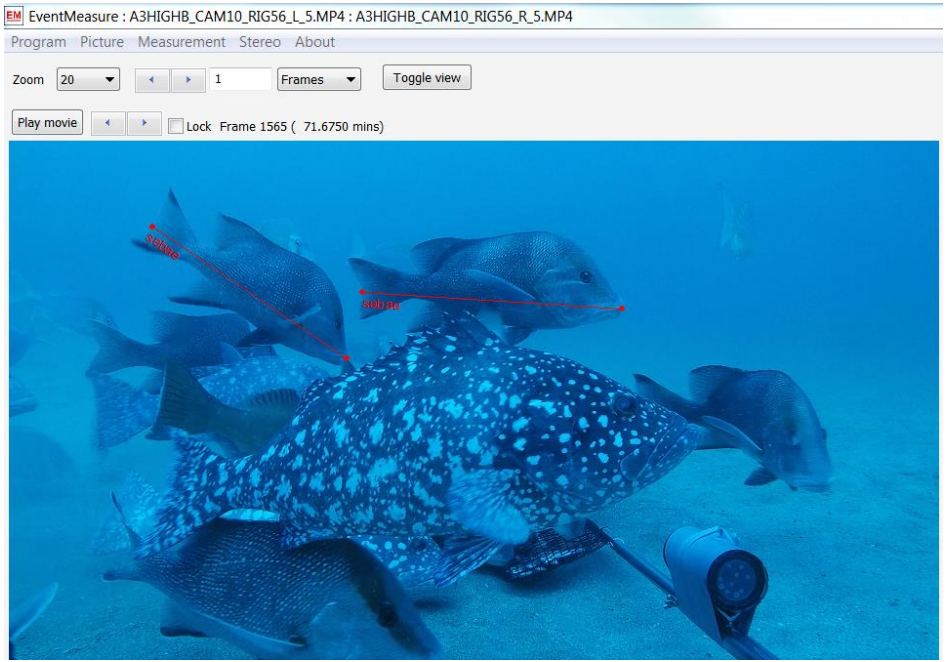
- MaxN – the maximum number of fish counted in one frame from each video.



Size distribution

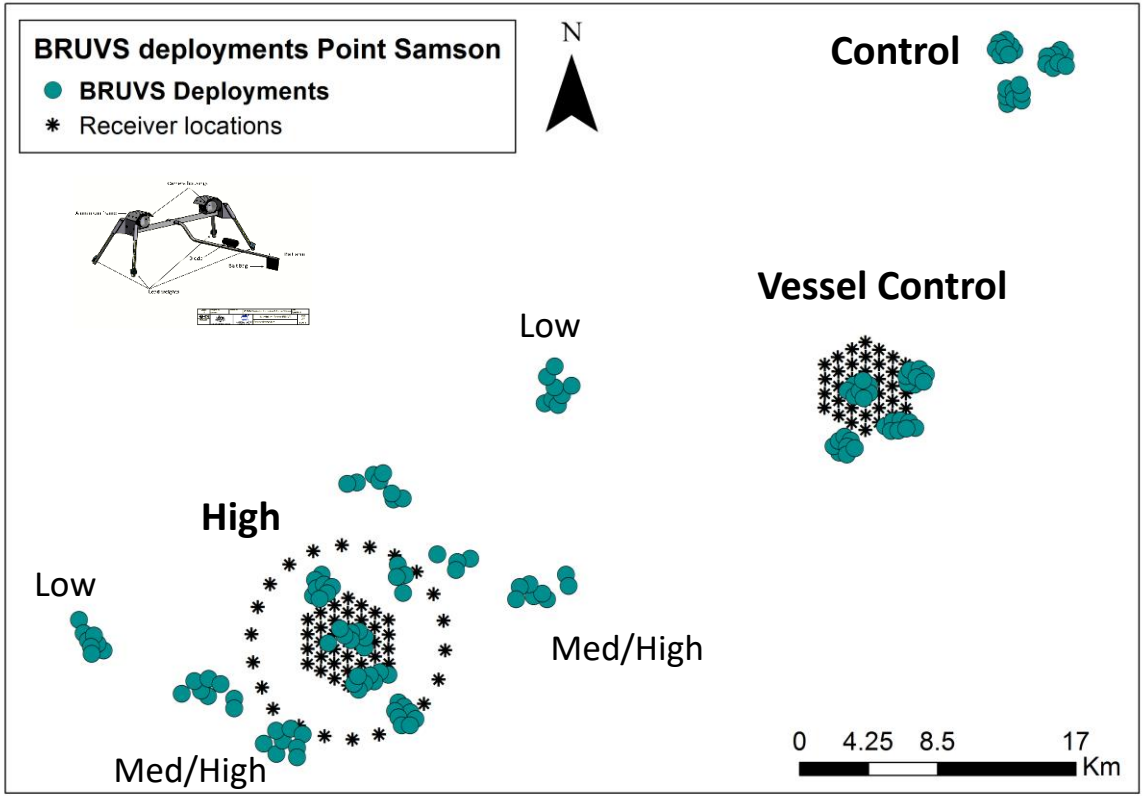
- Measure length of individuals (EventMeasure);
- Create size distribution; &
- Include in models.





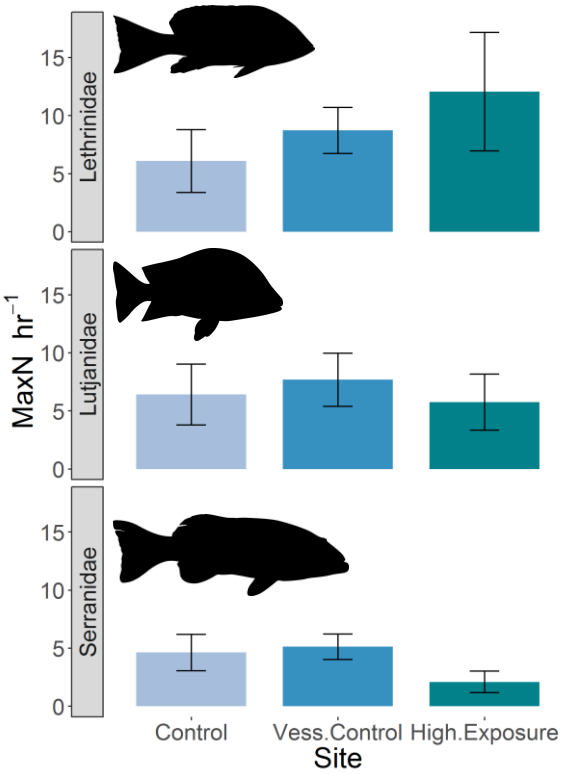
BRUVS deployments

- Prioritised HE, VC & C;
- Pre surveys – samples 1 & 2;
- MaxN used for relative abundance;
- MBACI.



Relative abundance of common families

- Relative abundance per hour (MaxN hr^{-1});
- BRUVS favour carnivores;
- Commercially important species.

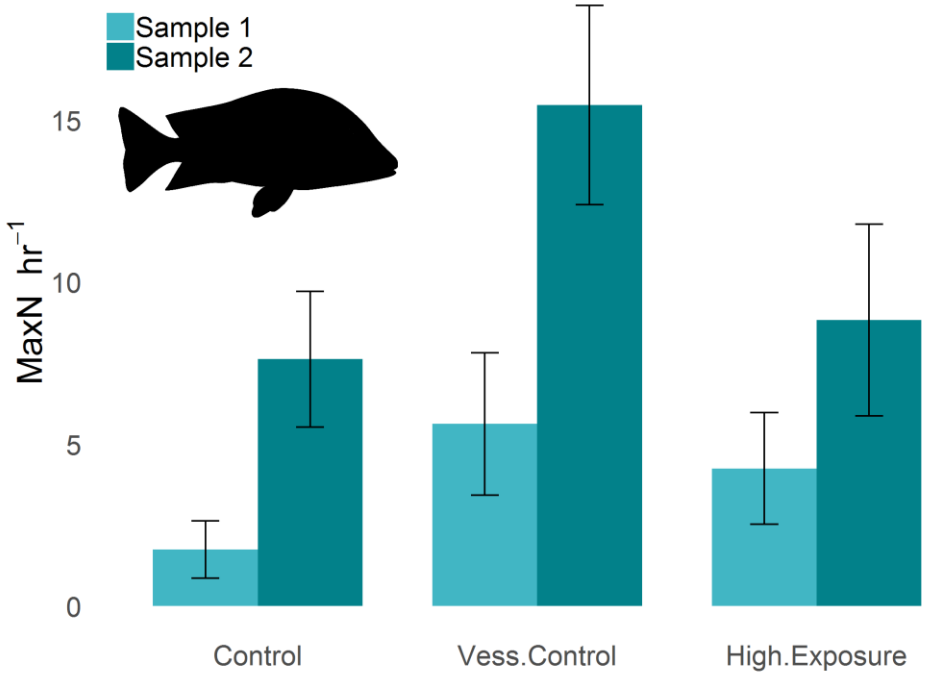


Commercial species summary

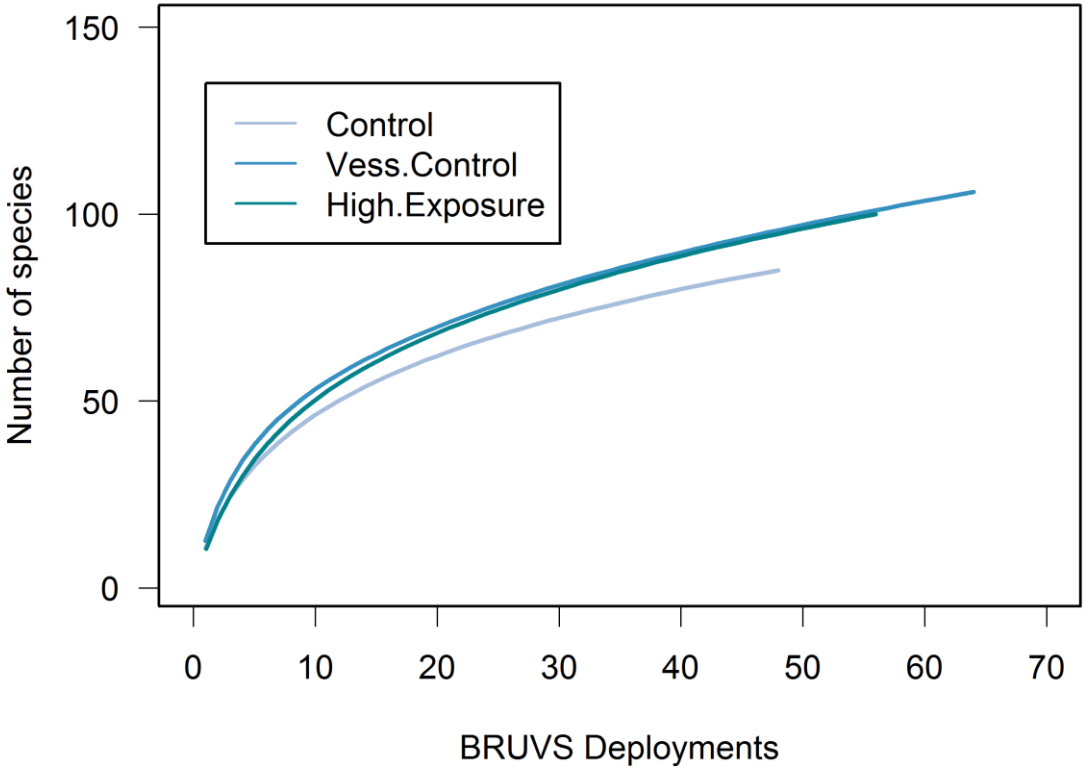
Species	Common name	High Exposure	Vessel Control	Control
Lutjanus sebae	Red emperor	☑	☑	☑
Lutjanus vitta	Flagfish	☑	☑	☑
Lethrinus punctulatus	Blue spotted emperor	☑	☑	☑
Epinephelus areolatus	Yellow spotted rockcod	☑	☑	☑

Red emperor relative abundance

- Differences in pre experiment samples 1 & 2;
- Biological or environmental;
- Assess changes across treatments through samples 1-5 (pre & post experiment).
- Mixed models
  - spatial & temporal variance
  - non-independence
- Dose-response curve



Species accumulation curve



Where to from here?

- Complete BRUVS video processing;
- Conduct fish community analyses from BRUVS;
- Collate environmental and habitat information; and
- Assess red emperor behaviour pre- and post-seismic survey.