Response of fish communities to eco-engineered seawalls in Sydney Harbour

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Seawalls

- Cover 50% of Sydney Harbour shoreline [1]
- Reduce biodiversity and abundances of intertidal organisms [1, 2]
- Remove complexity/niches from intertidal environments [3]
- Retrofitted or replaced to mitigate effects – "Eco-engineering" [4]

[1] Chapman 2003, [2] Goodsell et al. 2007, [3] Bulleri and Chapman 2010, [4] Morris et al. 2018

Photo from: Heritage Victoria

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2022 Banksia Sustainability Award for Biodiversity
2021 Earthshot Prize Finalist
Living SEAWALLS
REEF DESIGN LAB
sims
sydney institute of marine science
Installed November 2018
Photo from: Maria Vozzo

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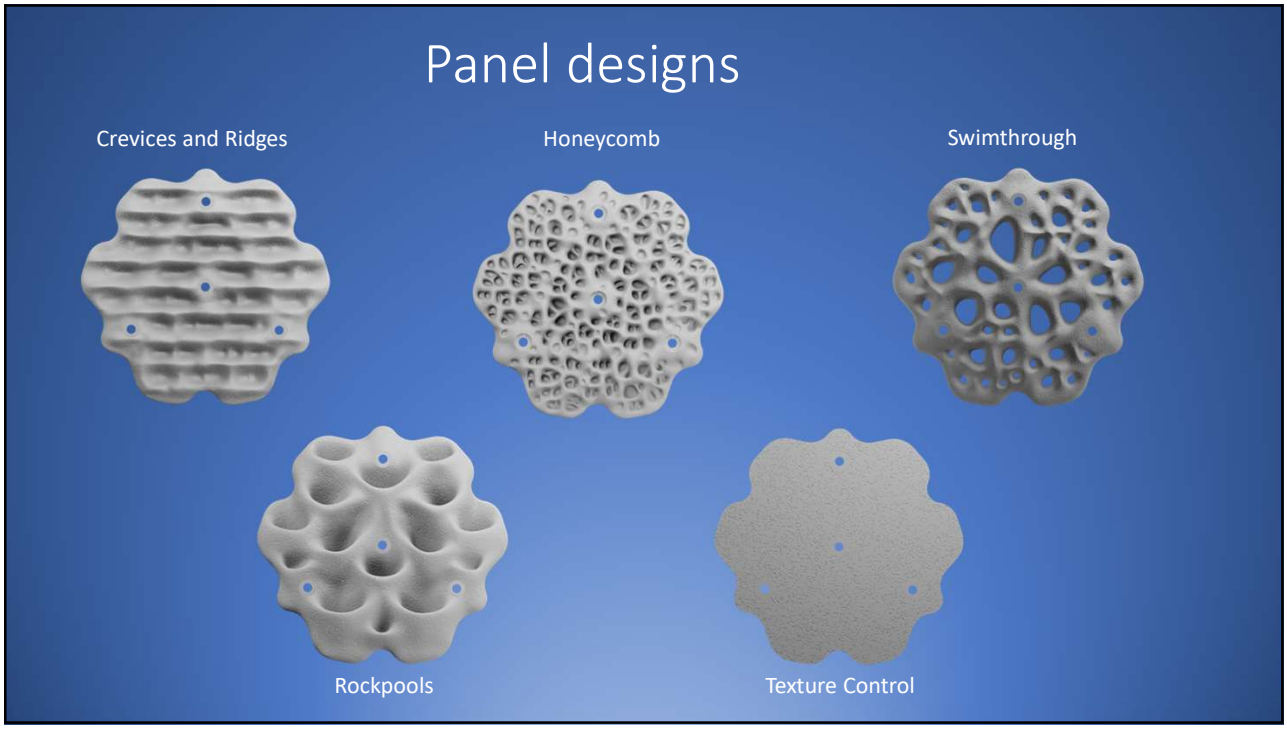
Panel designs
Crevices and Ridges
Honeycomb
Swimthrough
Rockpools
Texture Control

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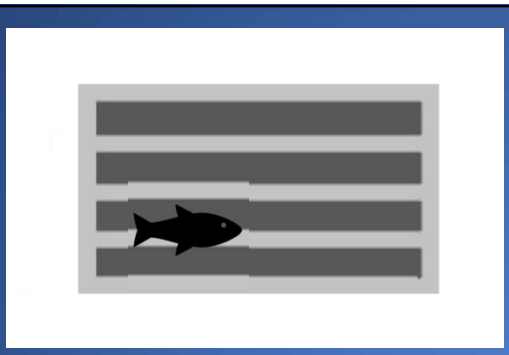
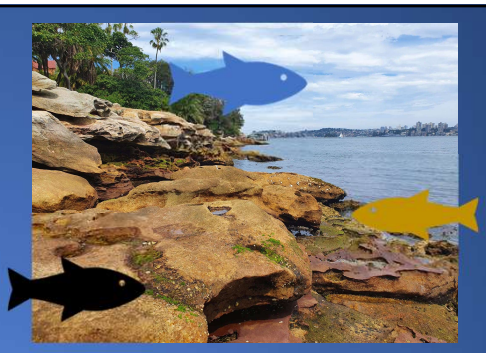
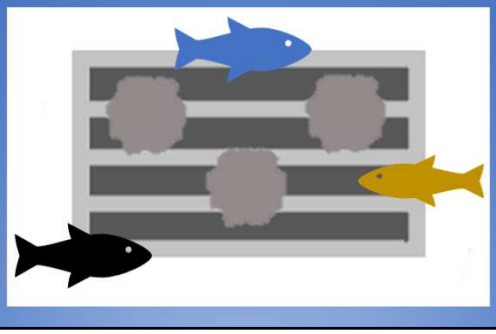




Less microhabitats =

Less refuge

Less prey



More microhabitats =

More refuge

More prey

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Hypotheses:

1. Fish communities at Reference rocky shore sites will differ from those at Control seawall sites

2. “Living Seawalls” installations will bring fish community structure closer to those at Reference rocky shore sites

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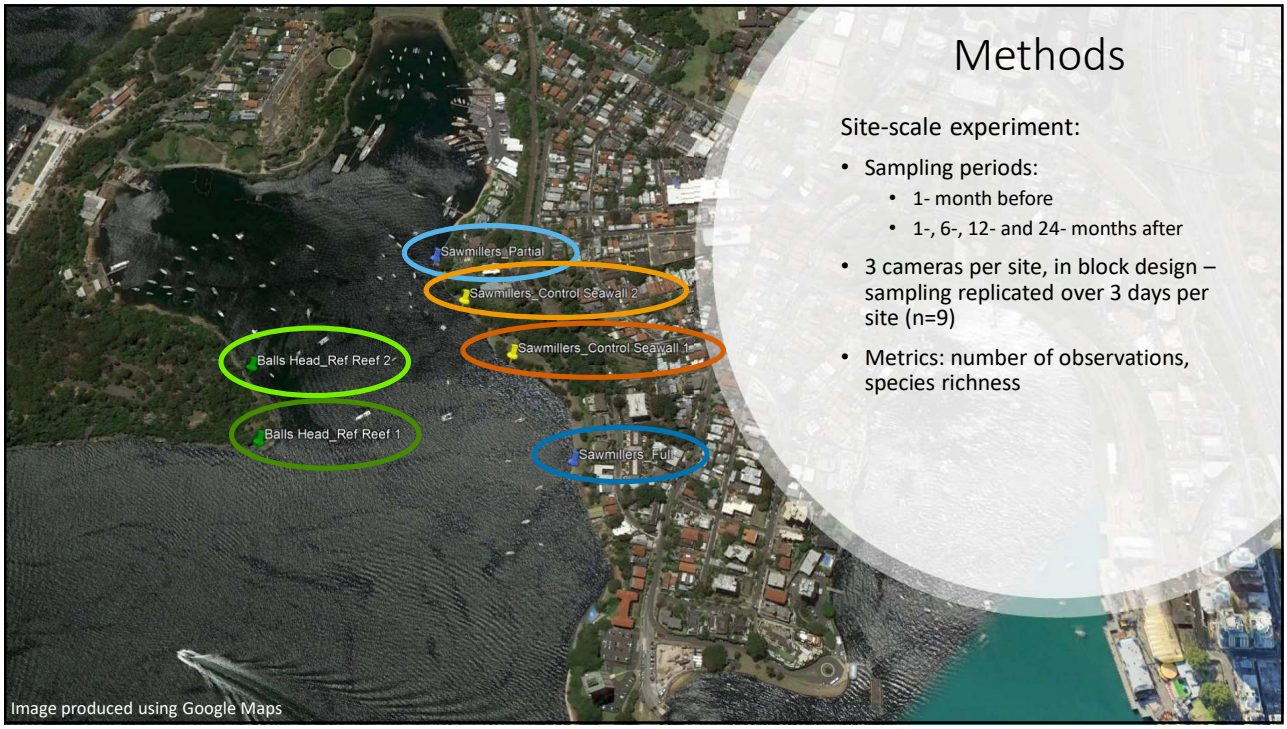

Methods

Site-scale experiment:

- Sampling periods:
  - 1- month before
  - 1-, 6-, 12- and 24- months after
- 3 cameras per site, in block design – sampling replicated over 3 days per site (n=9)
- Metrics: number of observations, species richness

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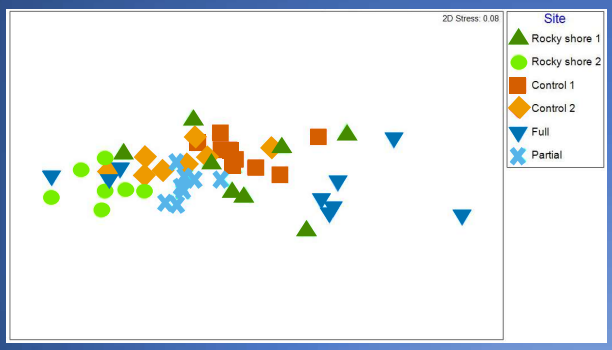
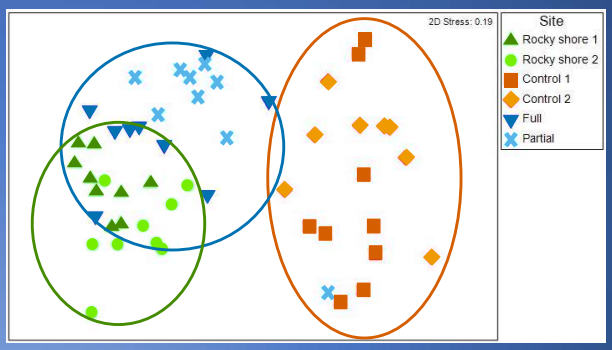
Results:

Multivariate analyses *(Site-scale experiment, n=9)*



12 months

Total no. fish = 7,940



24 months

Total no. fish = 4,709

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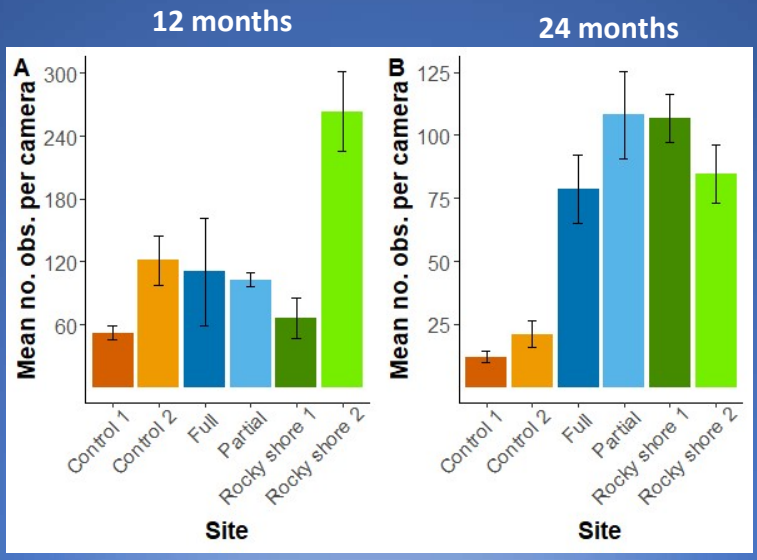
Total observations



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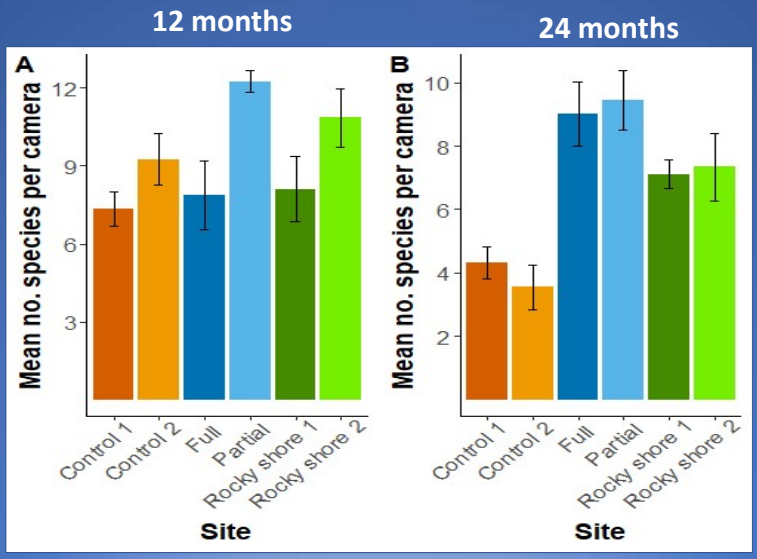
Total species richness



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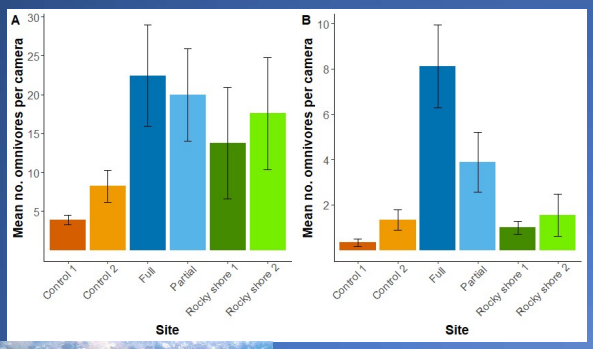
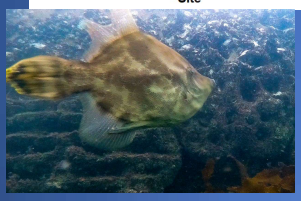
12 months
24 months
12 months
24 months





Omnivores
e.g. leatherjackets

Invertivores
e.g. bream

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Results suggest:

1. Unmodified seawalls have lower abundances and biodiversity than natural rocky shores

2. The addition of microhabitat panels to seawalls is increasing abundances and biodiversity to match that of natural rocky shores

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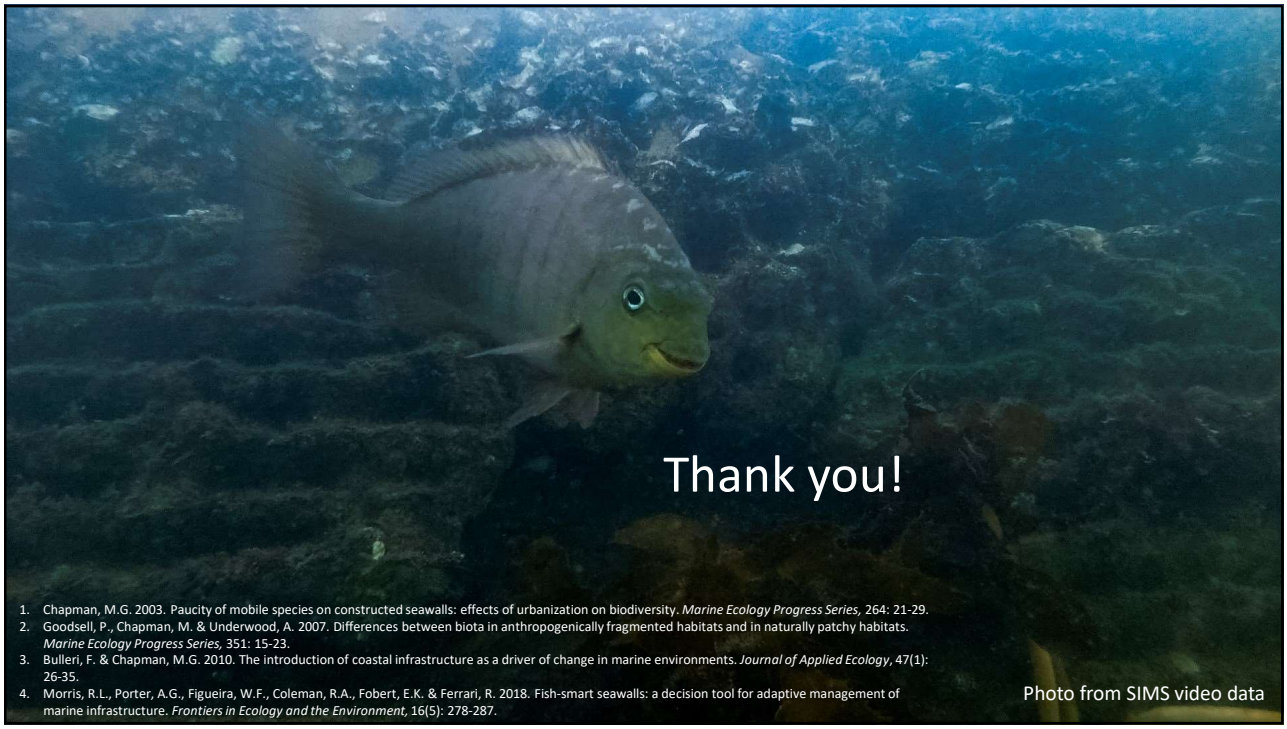

1. Chapman, M.G. 2003. Paucity of mobile species on constructed seawalls: effects of urbanization on biodiversity. *Marine Ecology Progress Series*, 264: 21-29.
2. Goodsell, P., Chapman, M. & Underwood, A. 2007. Differences between biota in anthropogenically fragmented habitats and in naturally patchy habitats. *Marine Ecology Progress Series,* 351: 15-23.
3. Bulleri, F. & Chapman, M.G. 2010. The introduction of coastal infrastructure as a driver of change in marine environments. *Journal of Applied Ecology*, 47(1): 26-35.
4. Morris, R.L., Porter, A.G., Figueira, W.F., Coleman, R.A., Fobert, E.K. & Ferrari, R. 2018. Fish-smart seawalls: a decision tool for adaptive management of marine infrastructure. *Frontiers in Ecology and the Environment*, 16(5): 278-287.

Photo from SIMS video data

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