
ENGINEERED FRINGING REEFS
ENGINEERING WITH NATURE SOLUTIONS FOR COASTAL EROSION CONTROL
PIANC
APAC
2022
MMA
OFFSHORE

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UNDP
Mon Choisy UNDP Video

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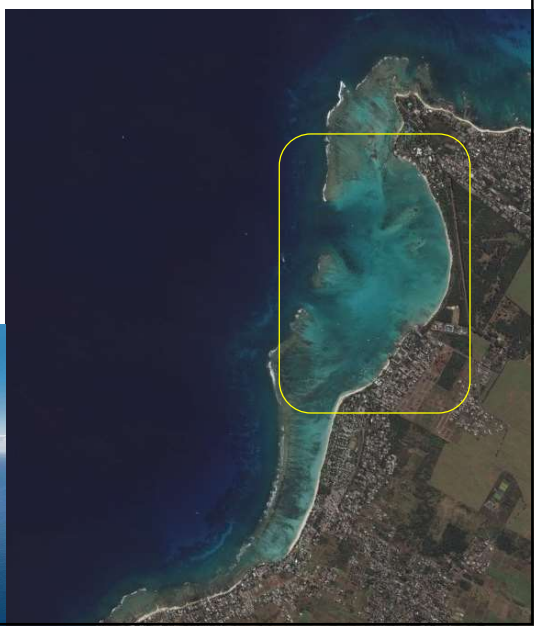
MON CHOISY BEACH, MAURITIUS

- Beach largely protected by natural fringing reef
- Gaps in the reef led to wave transmission and mobile sediments resulting in severe erosion at the south end of the bay



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MON CHOISY BEACH EROSION

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MON CHOISY BEACH FRINGING REEF

- 1000 modules
- 3300Te reef
- Outer Reef ~350m
- 2 x 75m Patch Reefs

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MON CHOISY BEACH RESTORED

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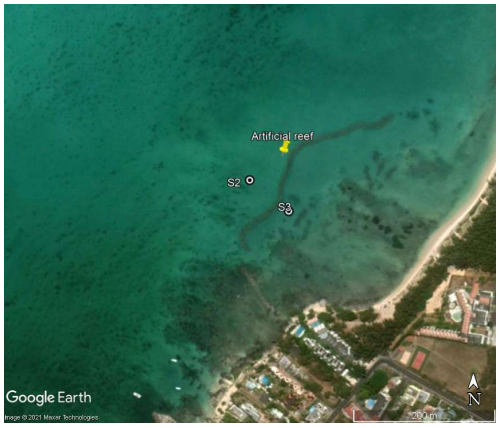
MON CHOISY BEACH, FIELD OBSERVATIONS

- Deployment period: 5 December 2020 – 15 January 2021
- Pressure sensor / wave gauges: S2 (offshore of reef), S3 (onshore of reef)



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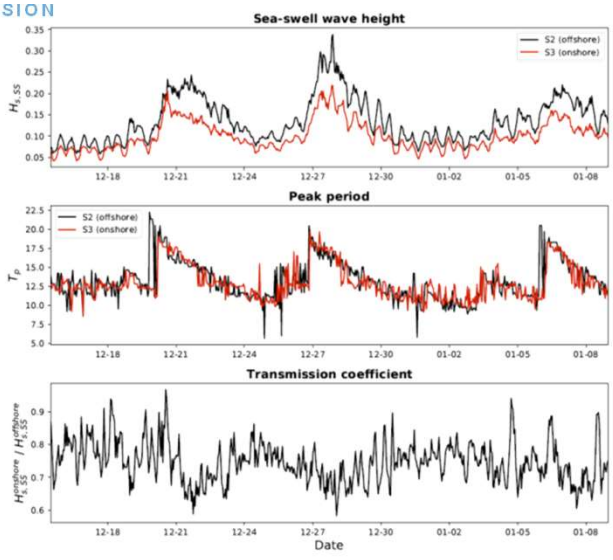
MON CHOISY BEACH, FIELD OBSERVATIONS

SEA-SWELL (2-25 S) WAVE CONDITIONS & TRANSMISSION

- Wave heights at reef site behind the reef flat are small -> up to 0.35 m
- But very similar to eCoast observations (up to 0.5 m during a passing tropical cyclone)
- Sea-swell wave transmission coefficient as low as ~0.6 during the larger wave conditions



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MON CHOISY BEACH, FIELD OBSERVATIONS

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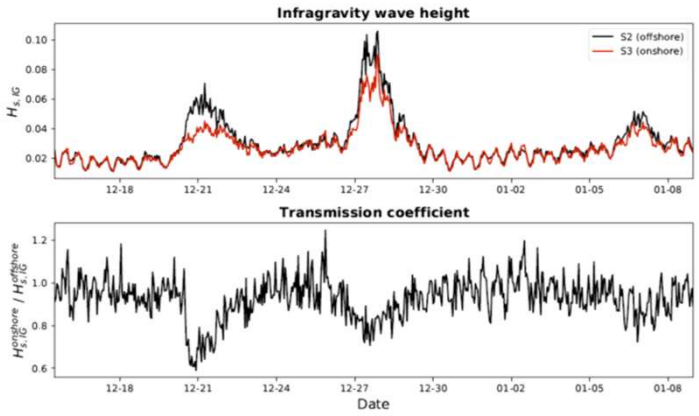
INFRAGRAVITY (25-250 S) WAVE CONDITIONS AND TRANSMISSION

- Infragravity (IG) wave heights up to ~0.1 m (~30% of sea-swell-height)
- Large IG waves typical shoreward of coral reef crests where breaking occurs
- Transmission coefficients for IG waves appear similar (reaching as low as ~0.6 during the study)



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MON CHOISY BEACH, FIELD OBSERVATIONS

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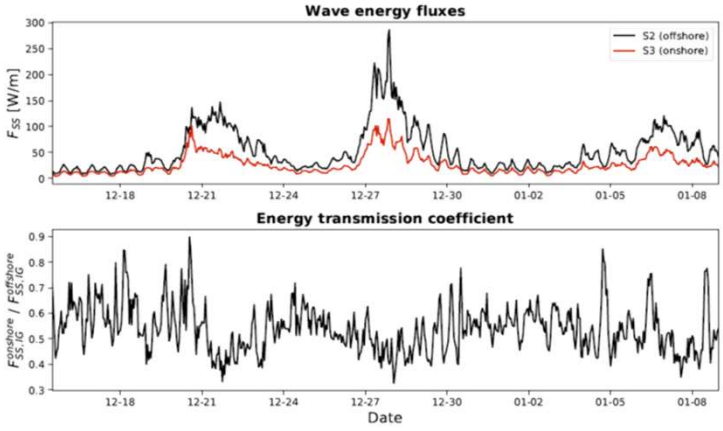
WAVE ENERGY FLUXES (SEA-SWELL) & ENERGY TRANSMISSION

- Results can also be expressed in terms of wave energy fluxes
- Wave energy transmission coefficients (ratio of fluxes onshore and offshore of the structure reach values down to ~0.4)



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MON CHOISY BEACH, FIELD OBSERVATIONS

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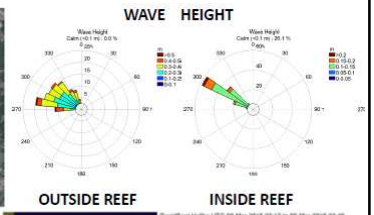
WAVE CONDITIONS AT THE SITE DURING THE ECOAST

- Field observations from the eCoast study included wave measurements offshore and at a nearshore (proposed artificial reef) site for ~1 month
- Wave conditions at their nearshore site are consistent with those observed at S2 offshore of the artificial reef -> wave heights <0.2 m but reaching ~0.5 m during a passing tropical cyclone.

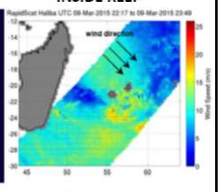


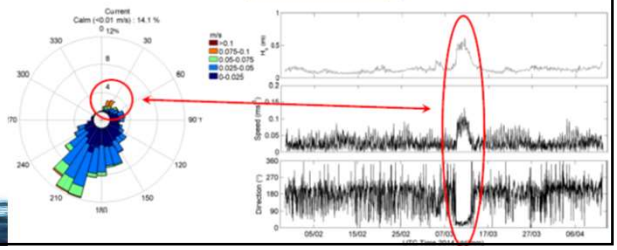
OUTSIDE REEF

INSIDE REEF

TROPICAL CYCLONE HALIBA

A second instrument was deployed at the inshore location in early 2015. This instrument recorded the effects of Tropical Cyclone Haliba. Although this was not a major storm, it did produce several days of strong northwesterly winds with offshore wave heights in excess of 4 m. Inside the lagoon, measured wave heights exceeded 0.5 m for a period of 3 days. During this time measured currents were in excess of 0.1 m/s flowing towards the northeast.





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C.Y. O'CONNOR BEACH EROSION

- $650 reef project
- $700 research project

Department of Transport

City of Cockburn

THE UNIVERSITY OF WESTERN AUSTRALIA

THE UNIVERSITY OF MELBOURNE

Australian Government
Australian Research Council

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C.Y. O'CONNOR BEACH

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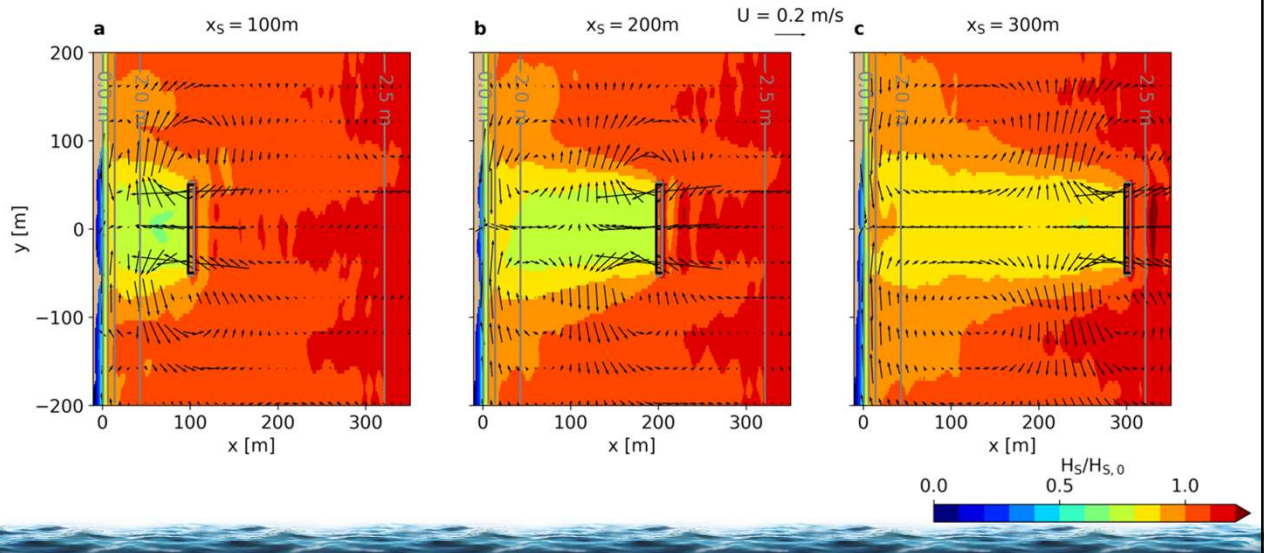
MODELLING

COUPLED WAVE-CIRCULATION MODELLING OF REEFS LOCATED AT TWO DISTANCES FROM SHORE.



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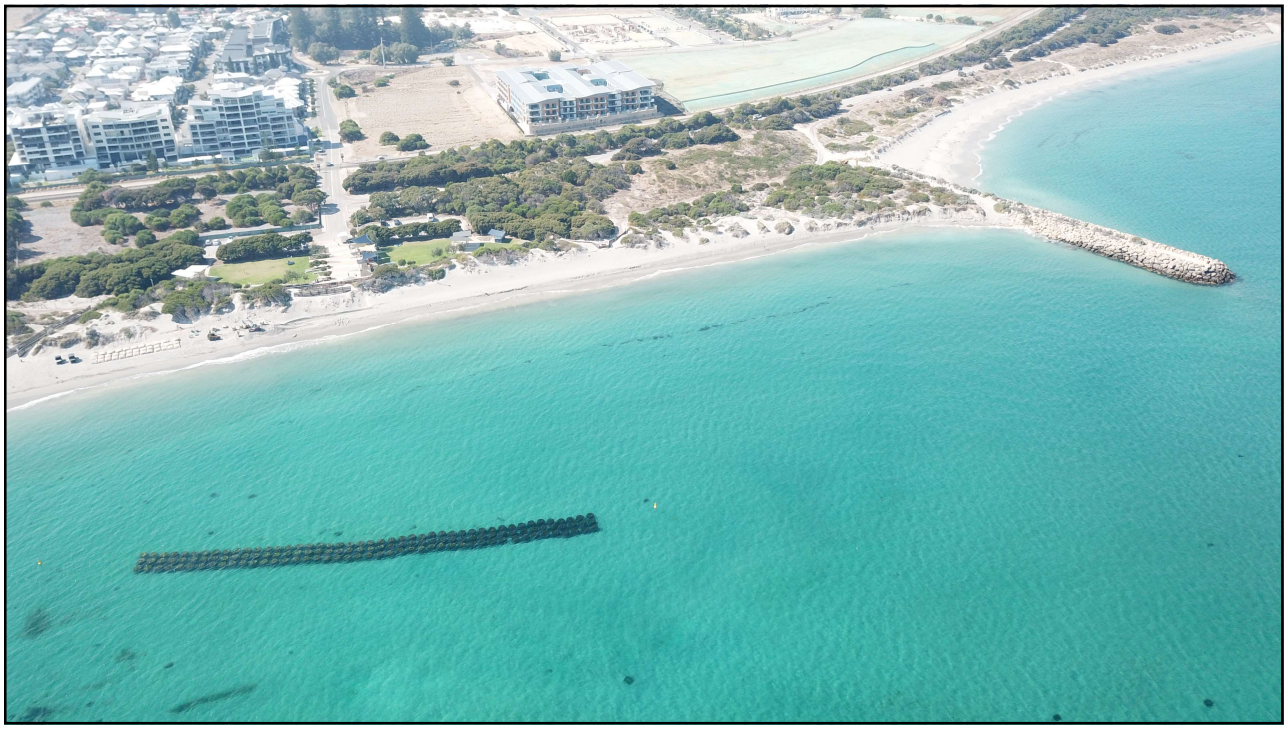

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RESEARCH

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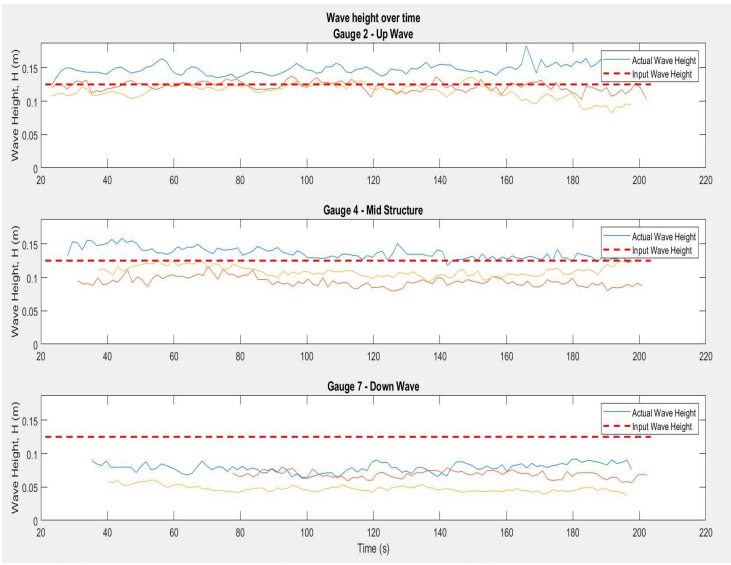

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RESEARCH

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ENGINEERING GUIDELINES

CRITICAL TO UPTAKE OF NATURE BASED SOLUTIONS

Australasian Coasts & Ports 2021 Conference – Christchurch, 30 November – 3 December 2021
Performance of Engineered Wave Attenuating Reef Structures
Geldard et al. 2021

Performance of Engineered Wave Attenuating Reef Structures

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Abstract
Natural reef structures (coral or rocky) protect large portions of the world's coastline from coastal flooding and erosion. Multi-function artificial reef structures can perform similarly as a nature-based solution to coastal protection while also offering many additional benefits over conventional engineering structures. Subcon and the University of Western Australia Coastal and Offshore Engineering Laboratory have physically modelled different layouts of 1:5.8 scaled porous Subcon Bombora reef modules in a 54 m long and 1.5 m wide wave flume. Wave induced heights and velocities were measured over a range of offshore wave conditions to quantify wave transmission across different reef configurations (varying water depths over the reef, reef widths, number of modules and module row spacing). From these results, non-dimensional ratios are used to quantify the performance of a given reef layout. These demonstrate a performance that is generally comparable to submerged rubble mound breakwaters. Finally, the spacing between module rows within artificial reefs is found to significantly influence the overall wave transmission.

Keywords: Artificial Reefs, Working with Nature, Wave Transformation, Coastal Structures, Coastal Protection.

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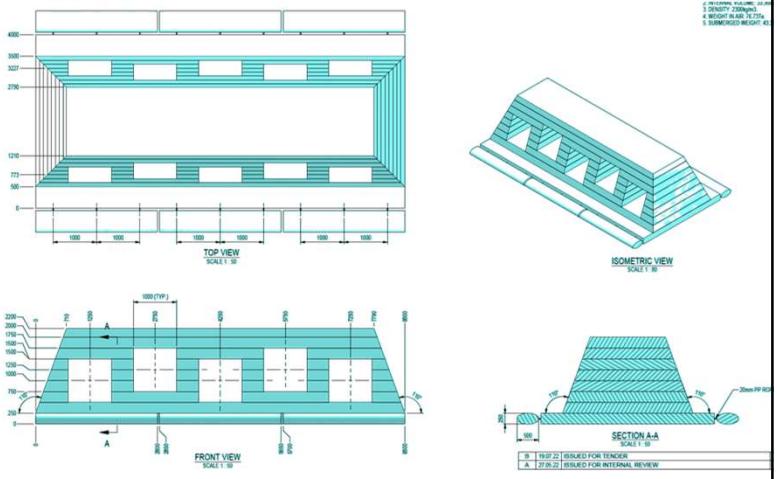
INNOVATION

PATENTED REEF MODULES

- Locally Installed
- Cost Effective
- Natural and Local Materials
- **Builds Coastal Resilience - *Enabling Ocean Communities to Thrive***



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INNOVATION

SEAGRASS FOR EROSION CONTROL

- Three Step Proces:
  1. December Harvest of Sea Grass Fruits from *Cockburn Sound*;
  2. Germinate in Tanks onshore;
  3. Replant at C.Y. O'Connor;
- Community Engagement; and
- Staff Volunteer Days

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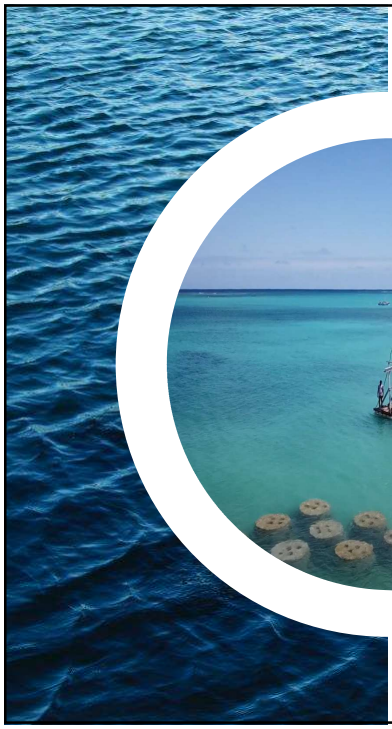

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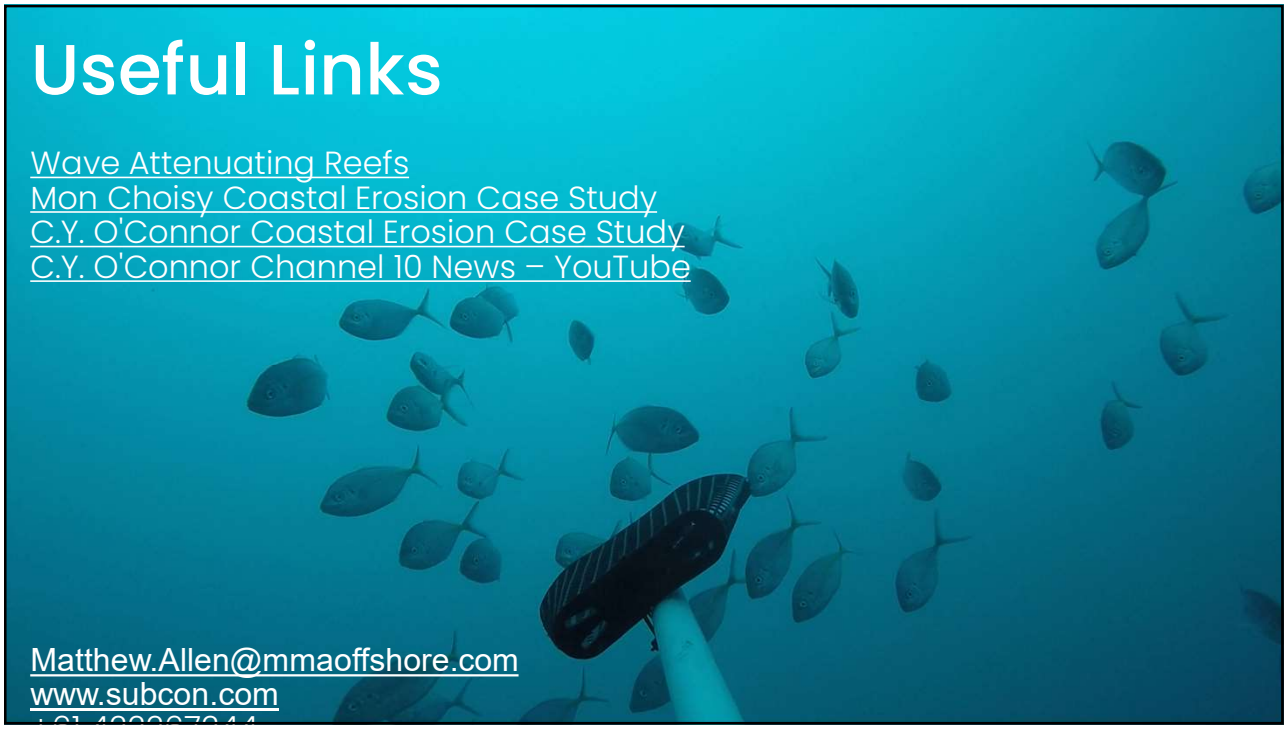
Useful Links

Wave Attenuating Reefs
Mon Choisy Coastal Erosion Case Study
C.Y. O'Connor Coastal Erosion Case Study
C.Y. O'Connor Channel 10 News – YouTube



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