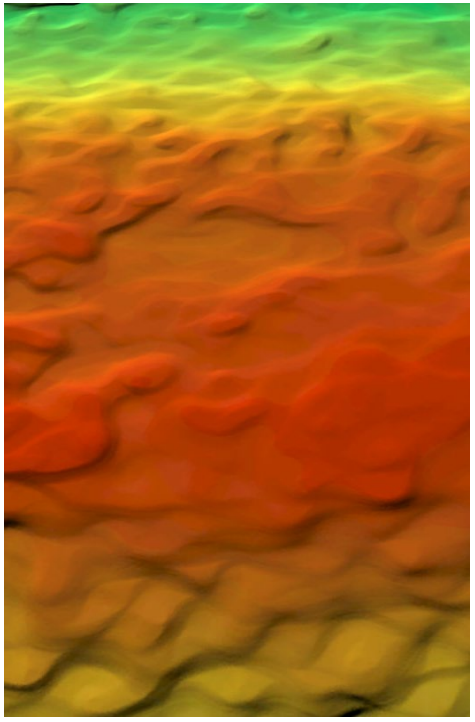
Assessment of drone-based indicators of intertidal oyster reef resilience



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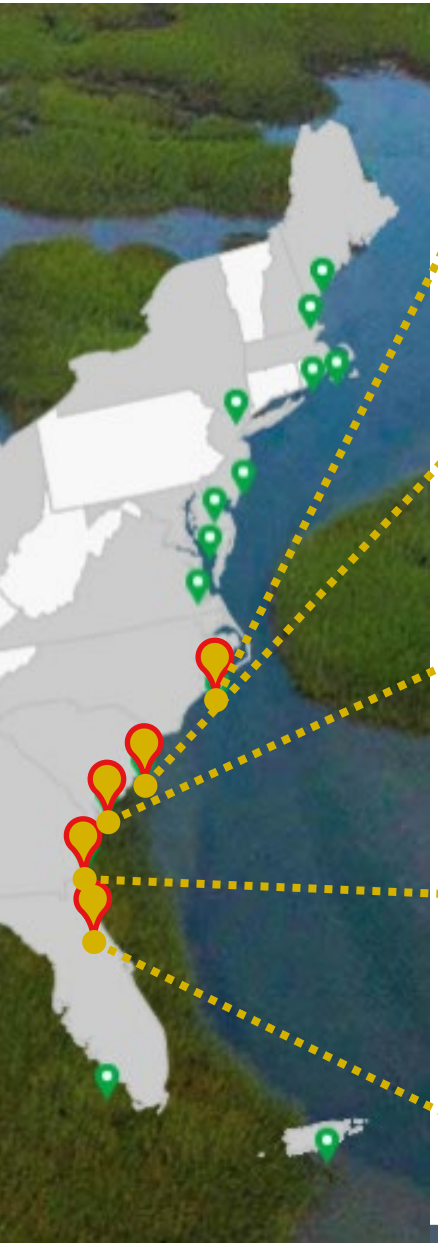
NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

National Estuarine Research Reserve System Science Collaborative

Project team



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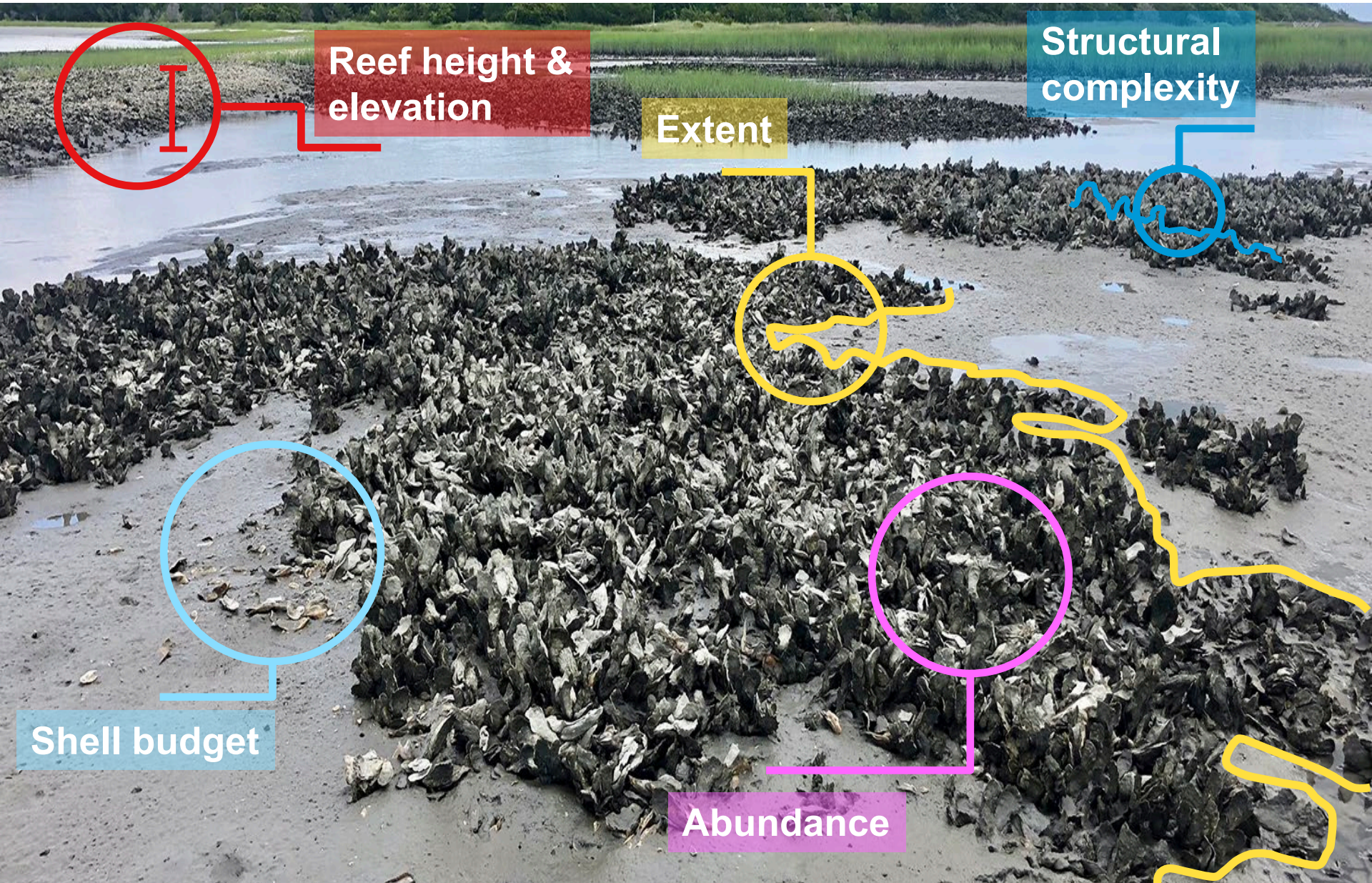
Reef resilience, persistence, and function



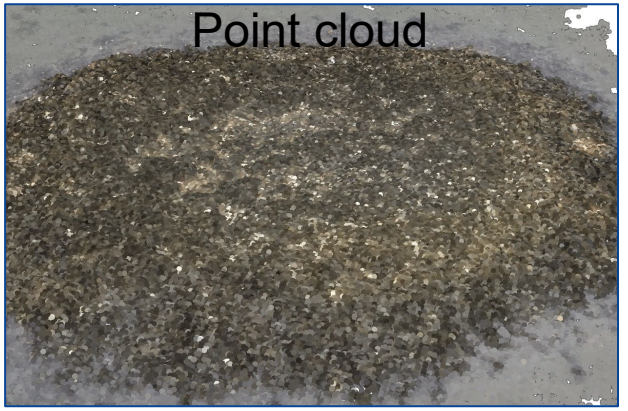
Objectives

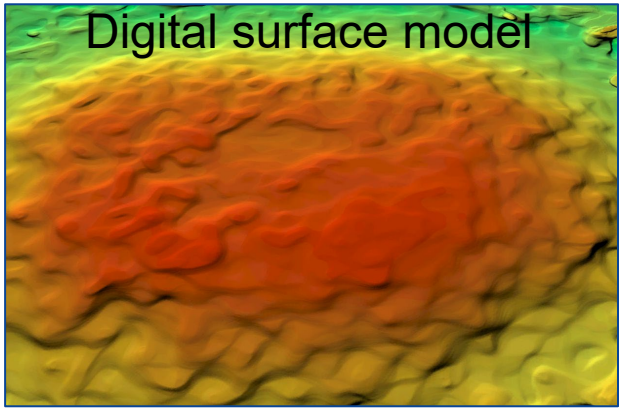
Objective 1: Use drone-derived products to quantify reef extent, elevation, rugosity, shell volume, and oyster density and size structure.

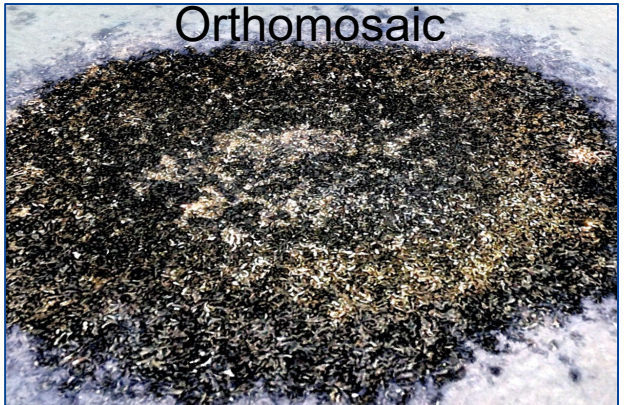
Objective 2: Compare drone-derived and *in-situ* measurements of same reef metrics to assess the accuracy of drone-based estimates.

Objective 3: Assess the ability of drone-derived products to detect and quantify change in reef metrics.

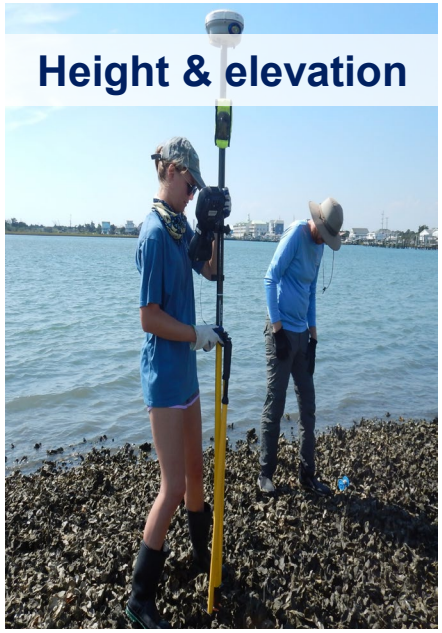
Objective 4: Compare *in situ* and drone methods in terms of time and effort.

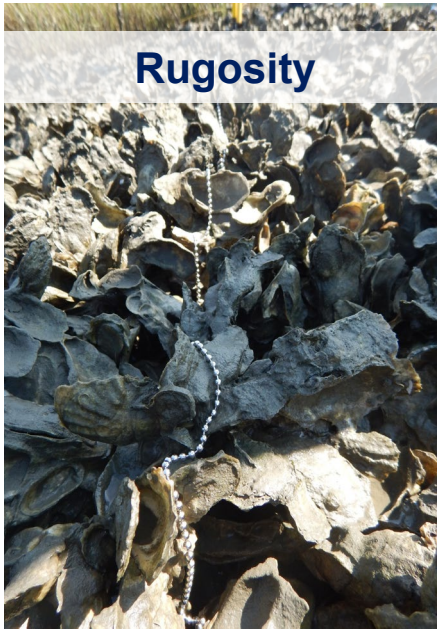






Methods: in-situ sampling and lab processing

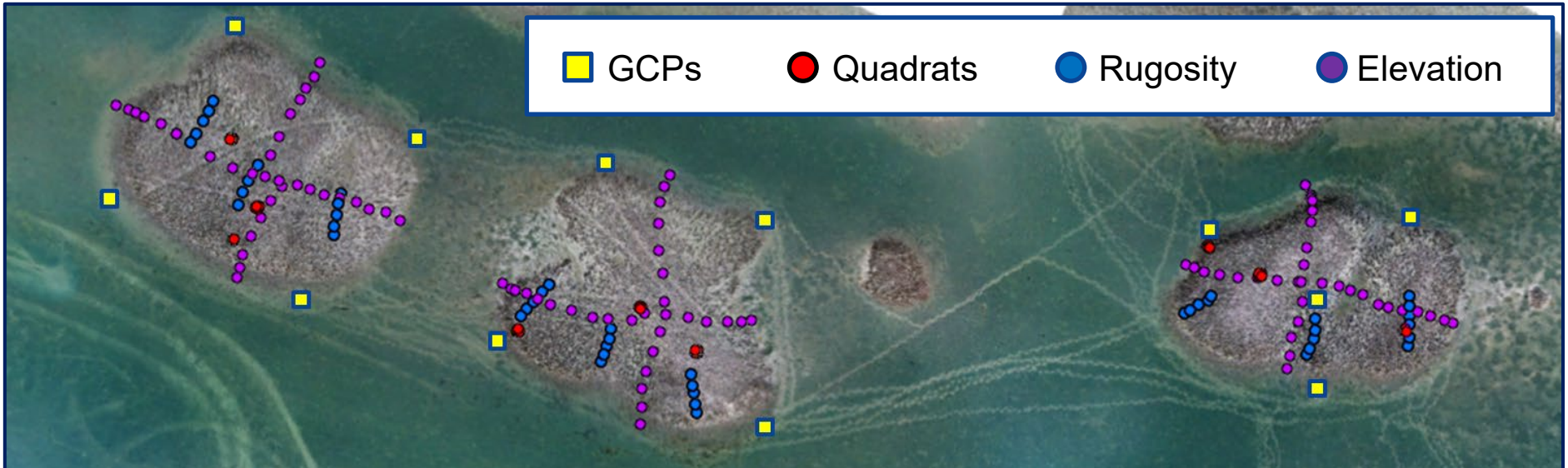




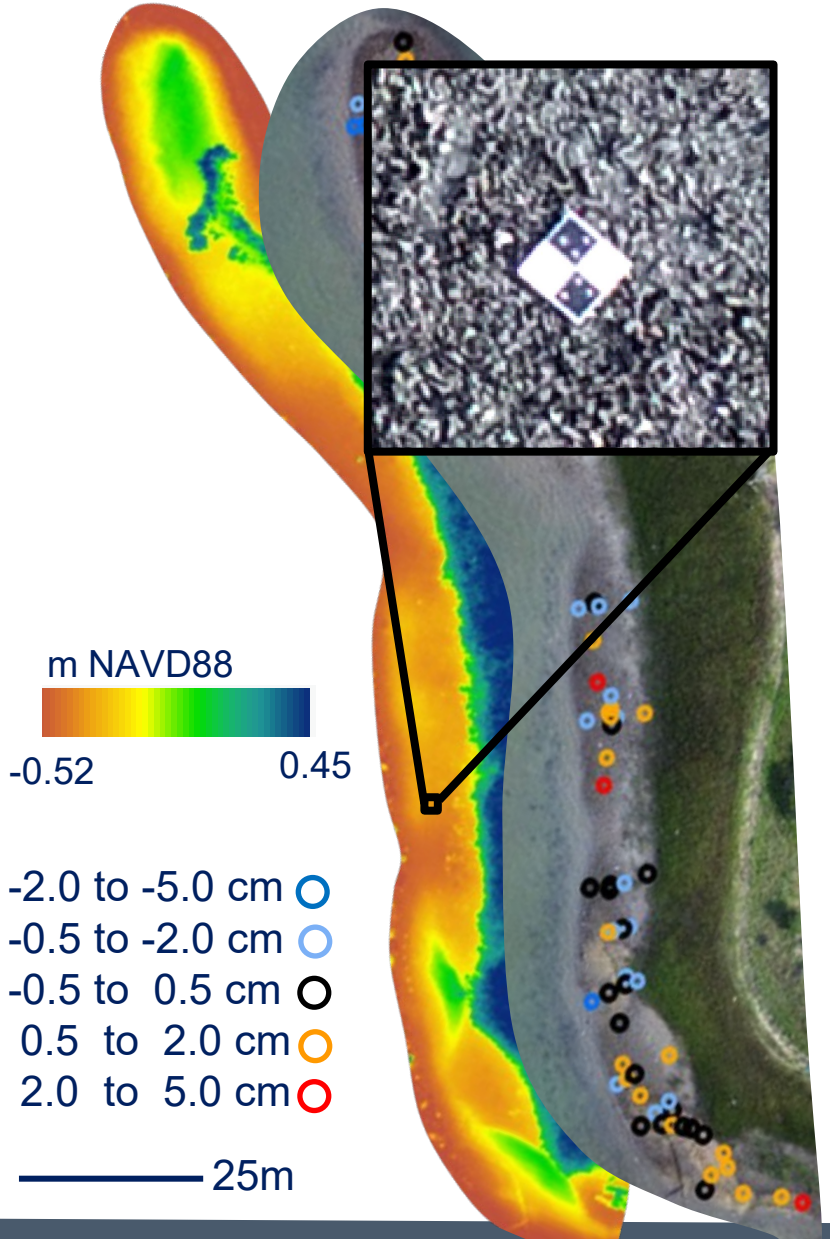
- Sampled 13 reef sites in a 2x2 factorial design
  - Patch-Harvest reefs (x4) and Patch-Closed reefs (x3)
  - Fringing-Harvest reefs (x3) and Fringing-Closed reefs (x3)
- 4-6 rugosity measurements per site
- 6 quadrats per site
  - Counted and measured live oysters
  - Measured volume of shell excavated via water displacement

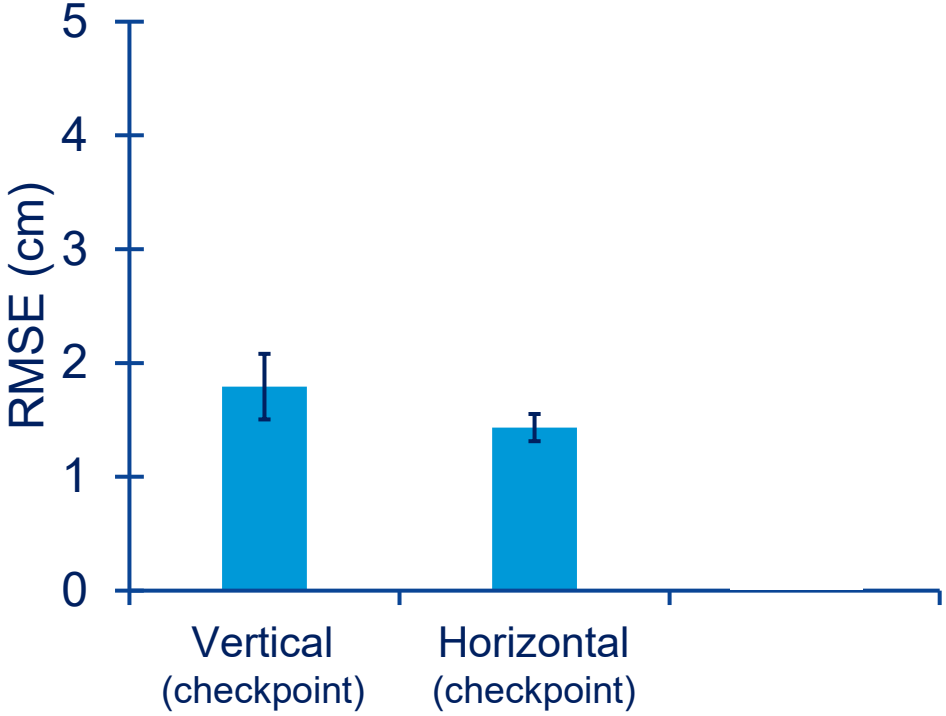
Methods: UAS sampling

- Phantom 4 Pro (20 MP RGB sensor)
- Flights at low tide ~ solar noon, 1-5 ha
- Ground sampling distance = 1cm/px
  - GSD at a subset of sites = 0.5cm/px, 1cm/px, 2cm/px
- 12 GCPs per site, 6 checkpoints
- Flights before and after quadrat excavations at each site
- SfM photogrammetry in Agisoft Metashape and analyzed in ArcGIS Pro
  - Orthomosaics, Point Clouds, and Digital Elevation Models



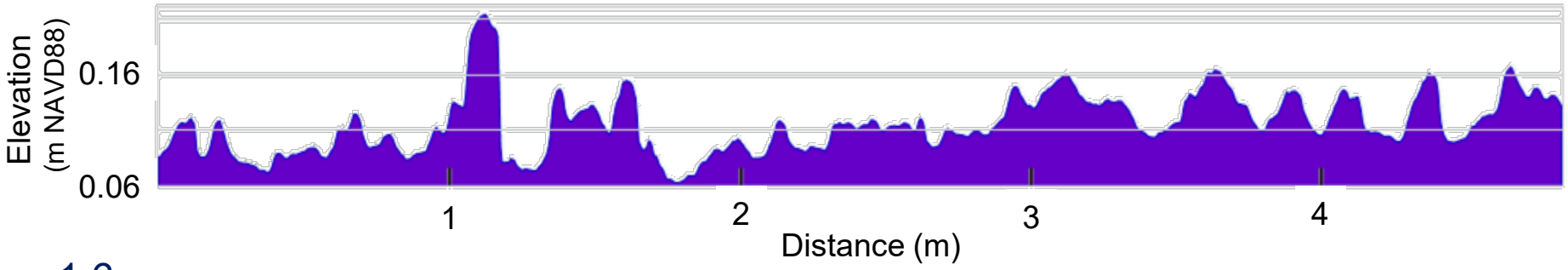
1) Reef height and elevation

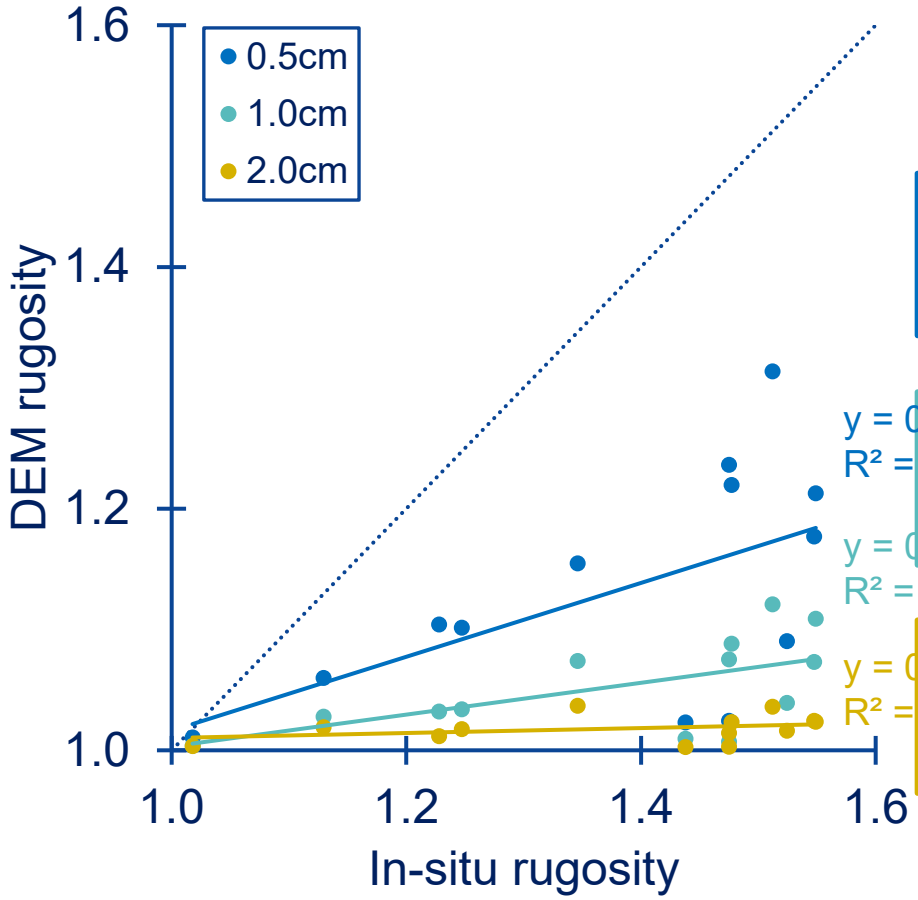


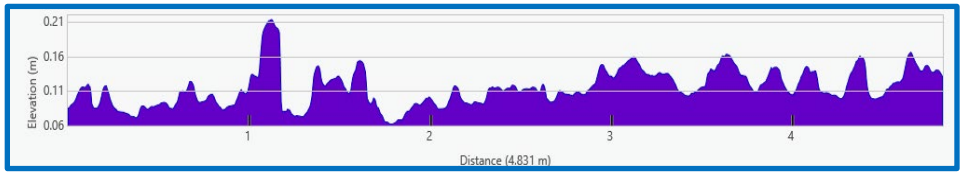


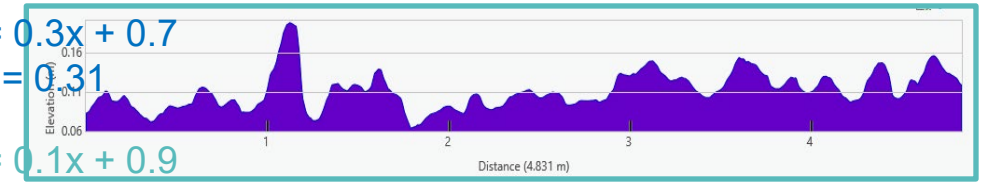
- Potential accuracy ~ 2cm
- Realized accuracy ~ 4cm

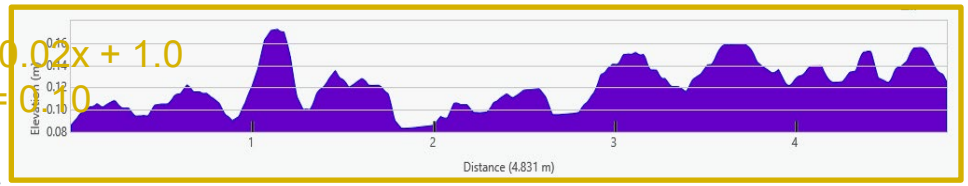
2) Structural complexity: rugosity



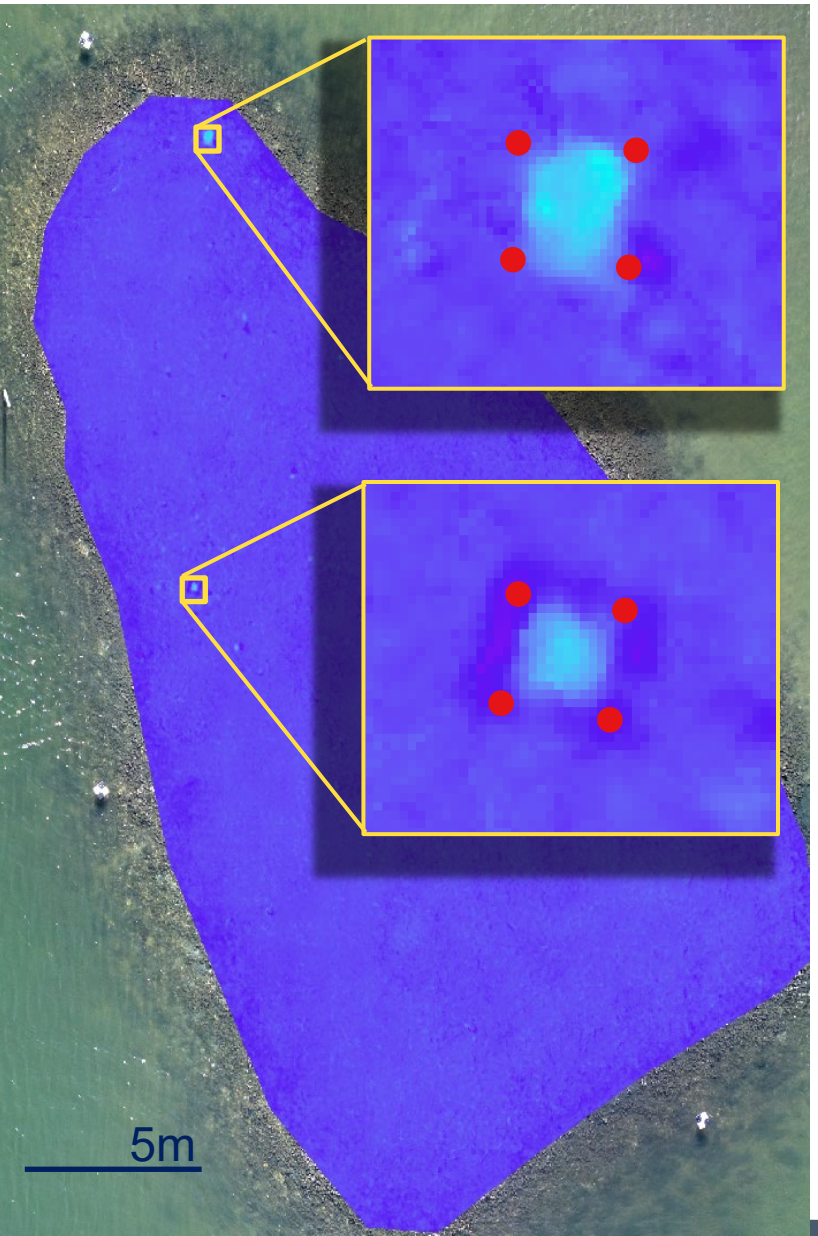


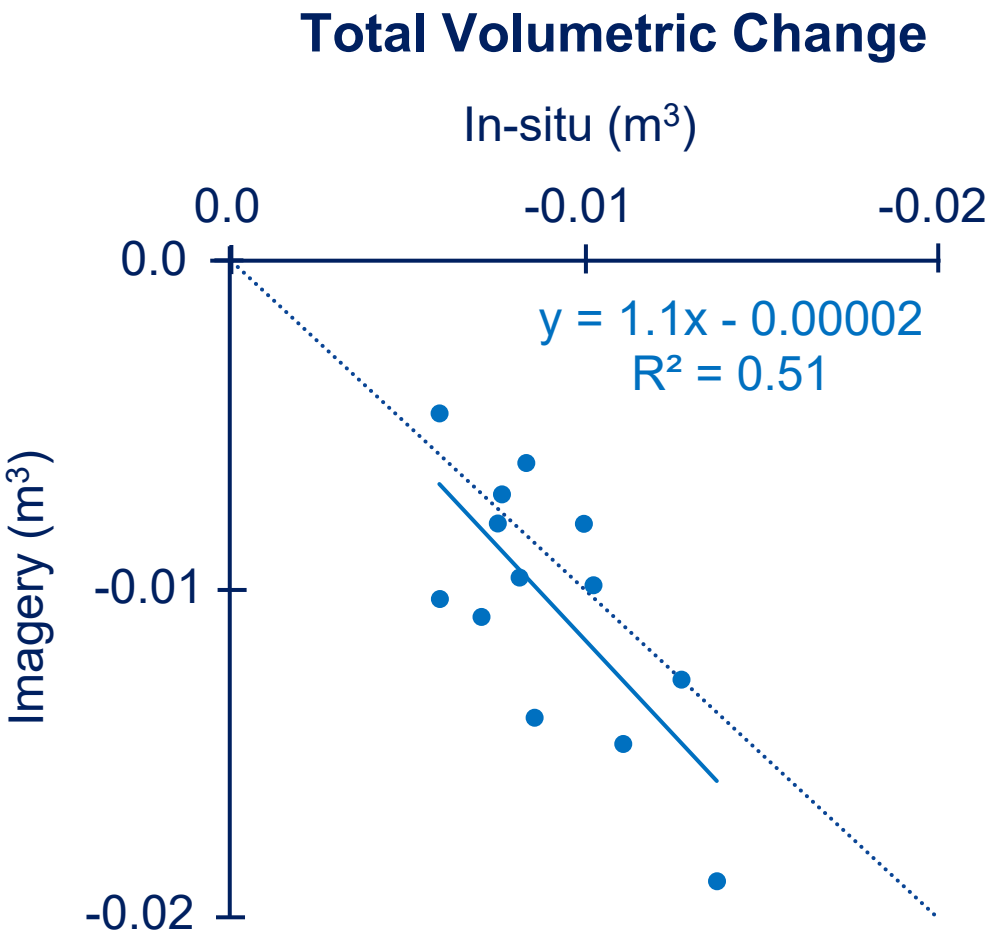




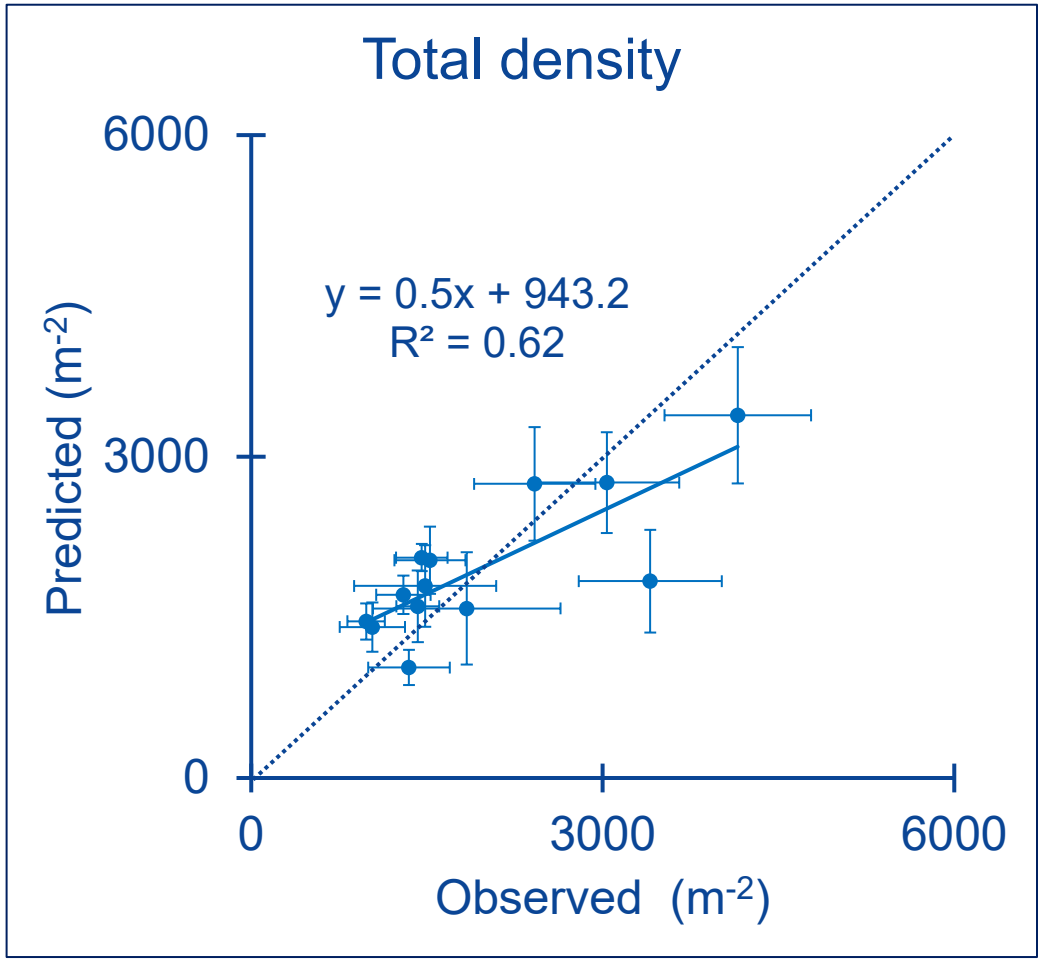


3) Shell budget: volumetric change

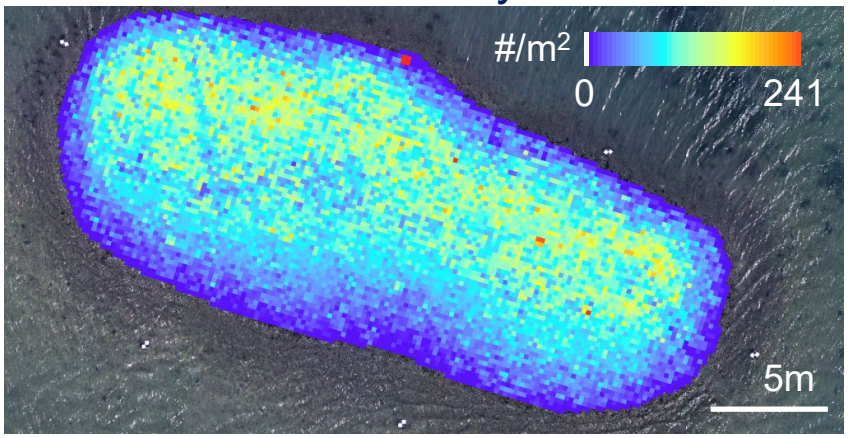




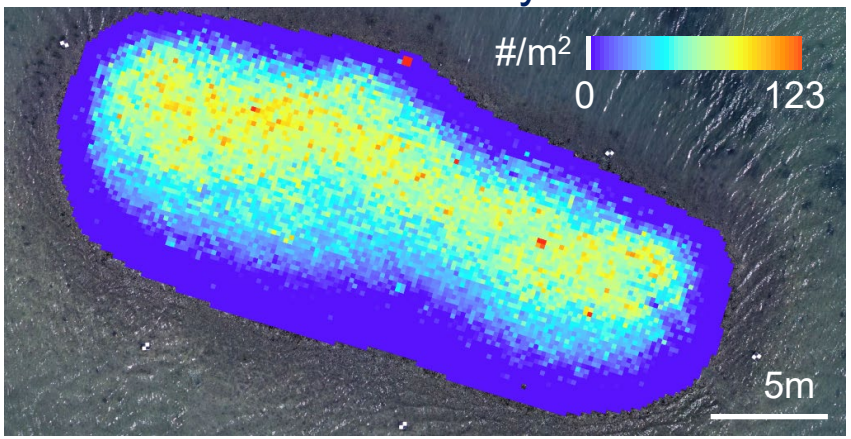
4) Abundance: density & size structure



Total density

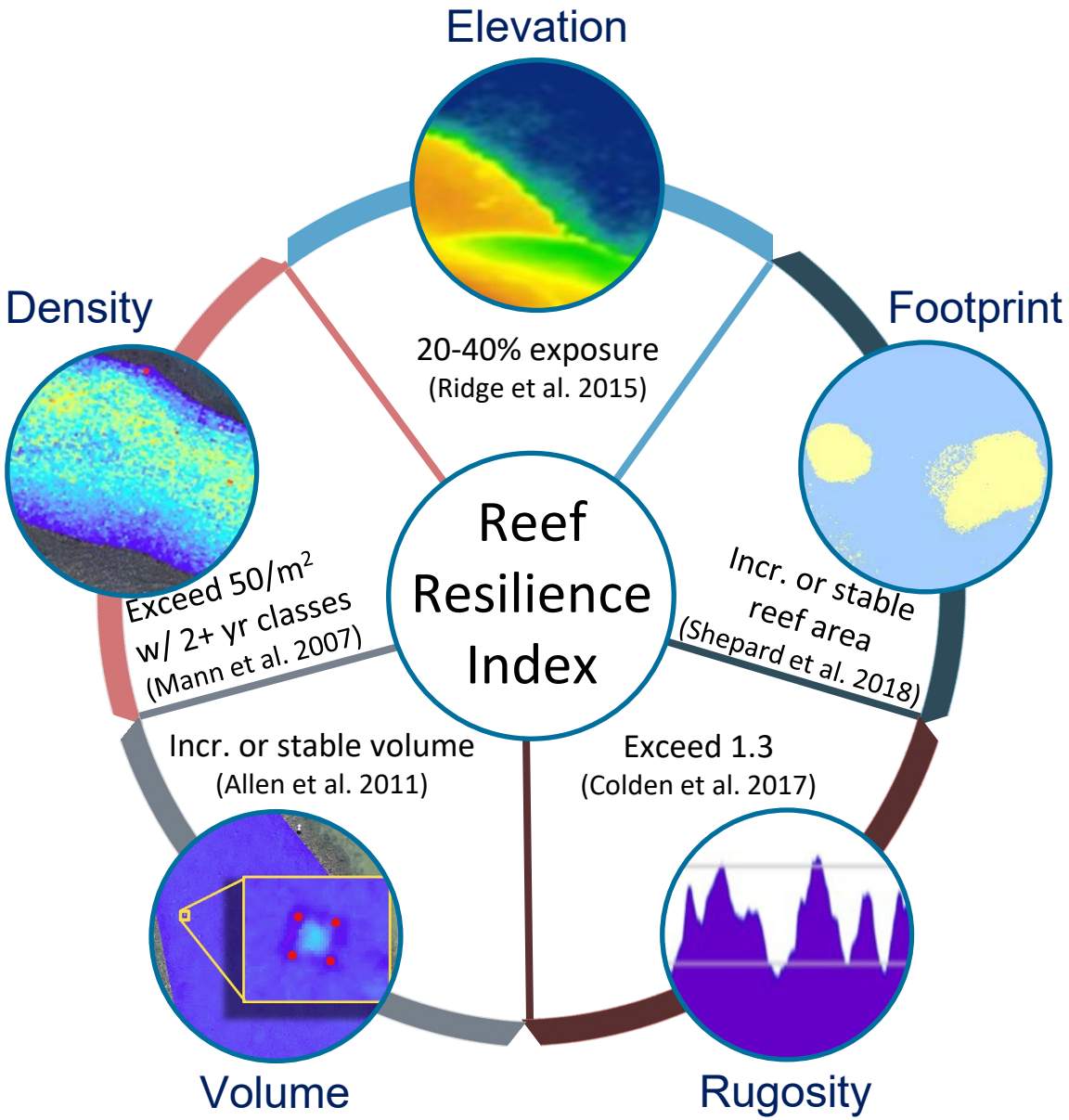


Recruit density



Next steps

- Refine workflows → apply to SC, GA, FL
- Conduct a coordinated experiment
  - Remove shell to mimic harvest
  - Add shell to mimic restoration
- Develop a multi-metric index of reef resilience



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