



Site selection for Florida's Coral Reef Restoration & Recovery (FCR3) Initiative

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Background: Governor DeSantis directed the establishment of Florida's Coral Reef Restoration and Recovery (FCR3) Initiative in 2023 with Executive Order 23-06. The FCR3 Initiative aims to develop the infrastructure, technology, skilled workforce, and logistics necessary by 2050 to support the long-term recovery of no less than 25% of FCR.

FCR3 site selection aim: In a multi-step process, identify 5-10 priority reefs to conduct restoration activities for the FCR3 Initiative.

Tier 1 planning aim: Prioritize criteria that are relevant at the FCR scale and could be overlooked at the local scale.

Restoration goals:

- 1) Enhance coral population and coral community resilience
- 2) Enhance habitat quality in support of coral recruitment
- 3) Increase coral survivorship

Exclusion areas

Remove areas deeper than 60 feet and those likely to be impacted by human uses.

Coral demographics

Use long-term data sets to predict where corals are likely to survive to sexual maturity.

- Persistence over time (2014-2022; DRM, NCRMP)
- Size frequency distribution (2020-2022; DRM, NCRMP)

Larval Connectivity

Overlay cutting-edge larval connectivity modeling to prioritize areas that serve as a source of larvae.

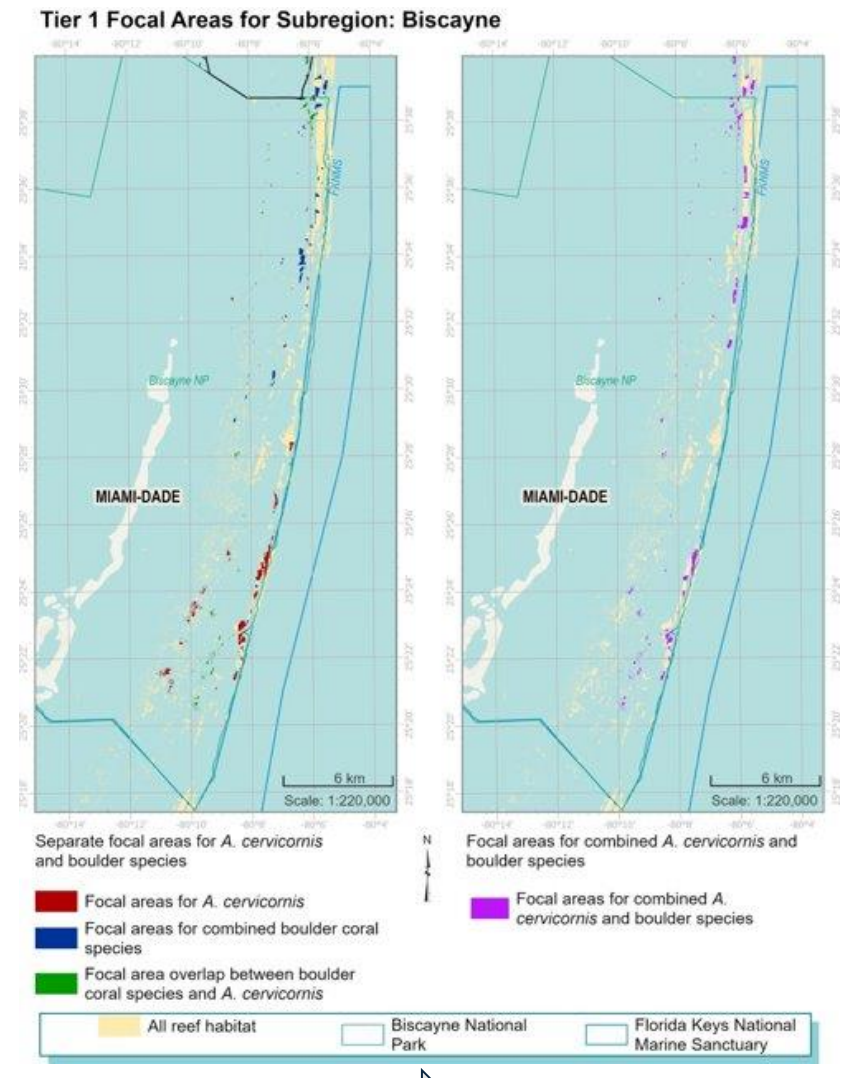


Figure 1 (left). Focal areas identified in tier 1 process.

Left panel: Focal areas for boulder coral restoration identified in blue, for *A. cervicornis* in red, and for all four species in green.

Right panel: Focal areas for multi-species restoration identified in purple.

Expert and stakeholder engagement

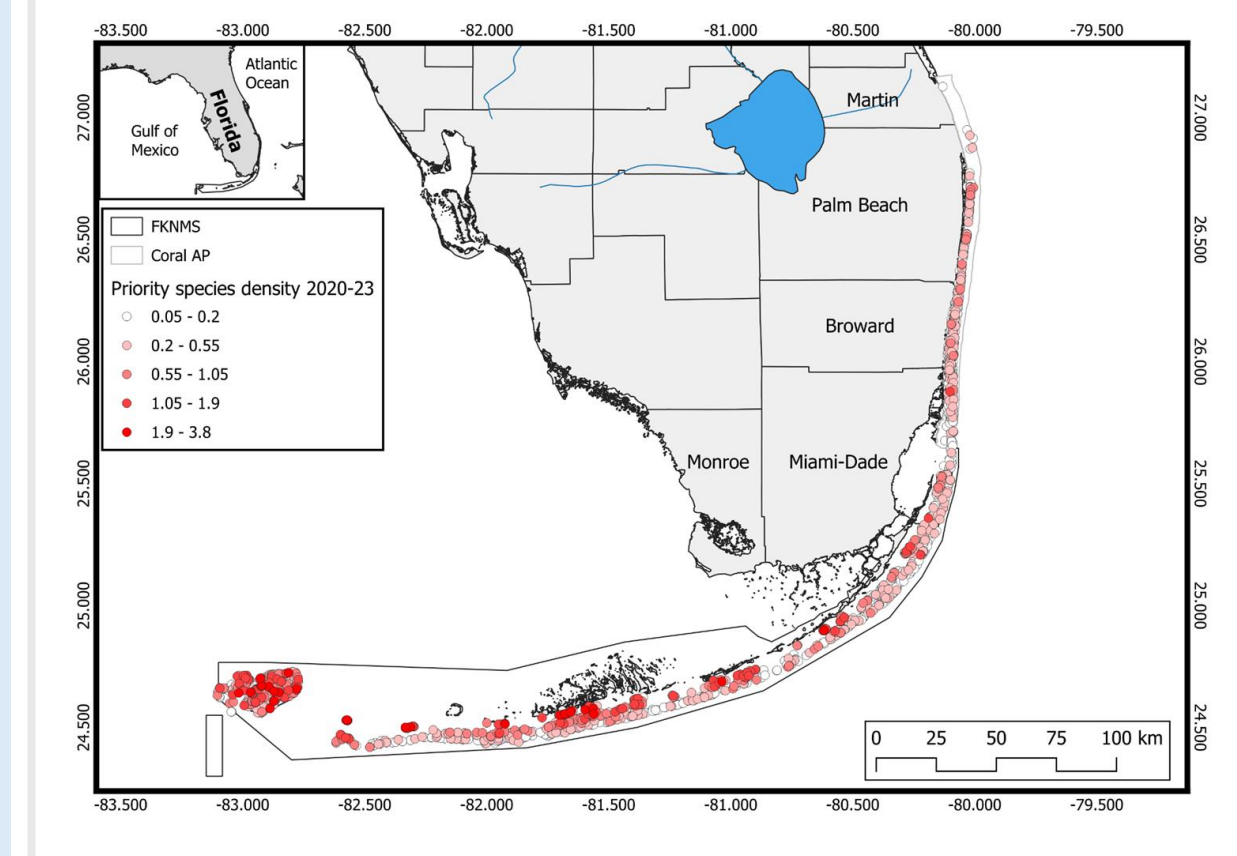
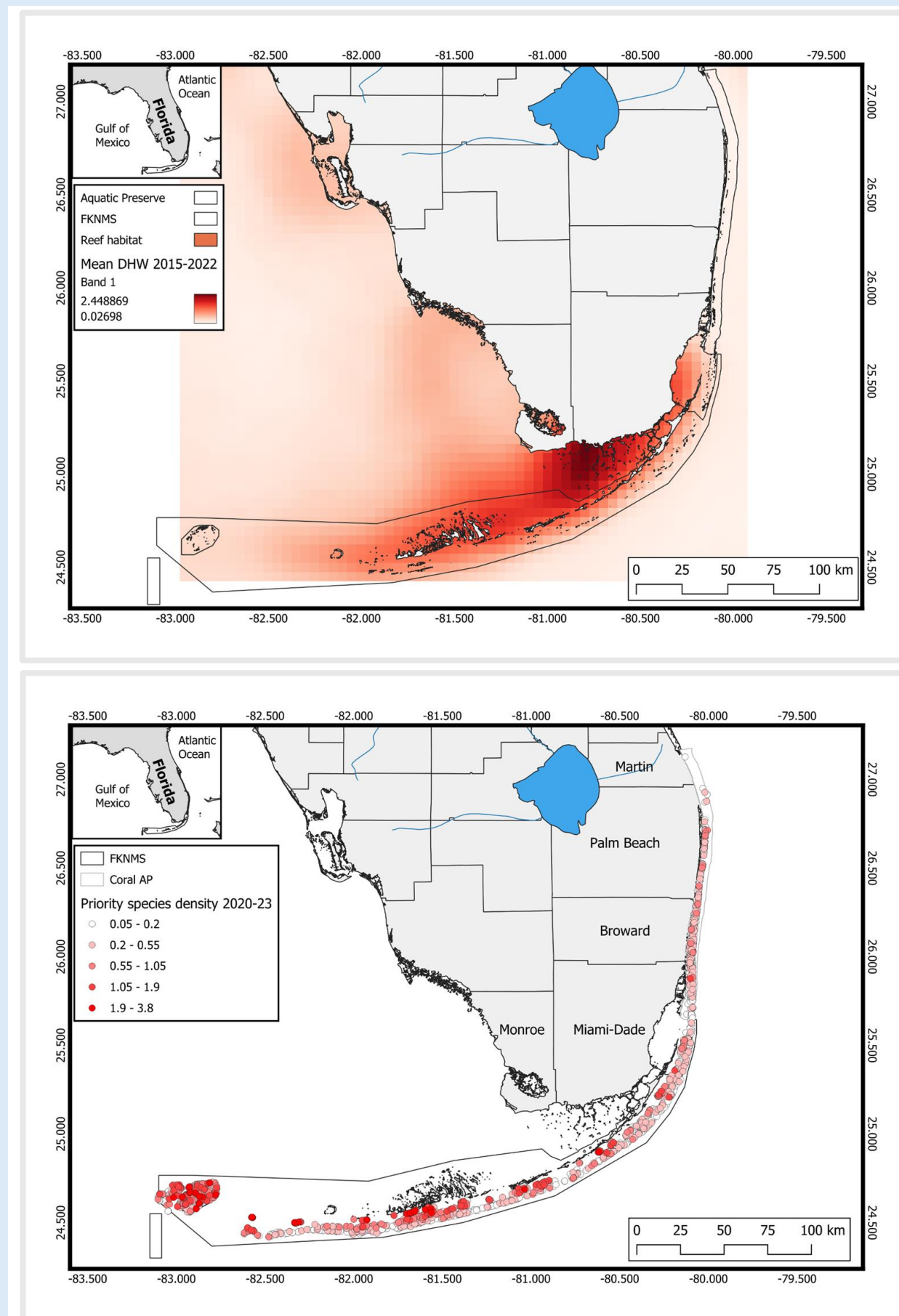
NSU: Geographic focus area determination

RQ: In which focal areas is restoration most likely to be successful?

Goal: Use expert knowledge, ecological and environmental data to refine Tier 1 focal areas to select 25% of total focal area per county to ground-truth.

Methods (I): Calculate metrics predicted to enhance restoration success from in situ, satellite and modeled data.

1. **Temperature** (NOAA coral reef watch)
 - a. Sea Surface Temperature trend (1986-2024)
 - b. Maximum Degree Heating Weeks (2015-2024)
 - c. Mean Degree Heating Weeks (2015-2022) (Fig 2. Right top)
2. **Bleaching history** (DRM) and **disease probability** (modeled)
 - a. Bleaching score (2005-2023): bleaching record, weighted by species composition
 - b. SCTLDS susceptibility model
3. **Water quality** (Coral AP Water Quality Assessment Project (2020-2024); Southeast Environmental Research Center (2020-2022))
 - a. Maximum mean ammonium, dissolved inorganic nitrogen, silicate concentration
4. **Coral demographics** (NCRMP, DRM, CREMP, SECREMP)
 - a. Change in priority species density (2013-2022)
 - b. Priority species density (2020-2023) (Fig 3. Right bottom)
 - c. Species richness (2020-2023)
 - d. Size structure: mean colony length, skew, kurtosis (2020-2023)



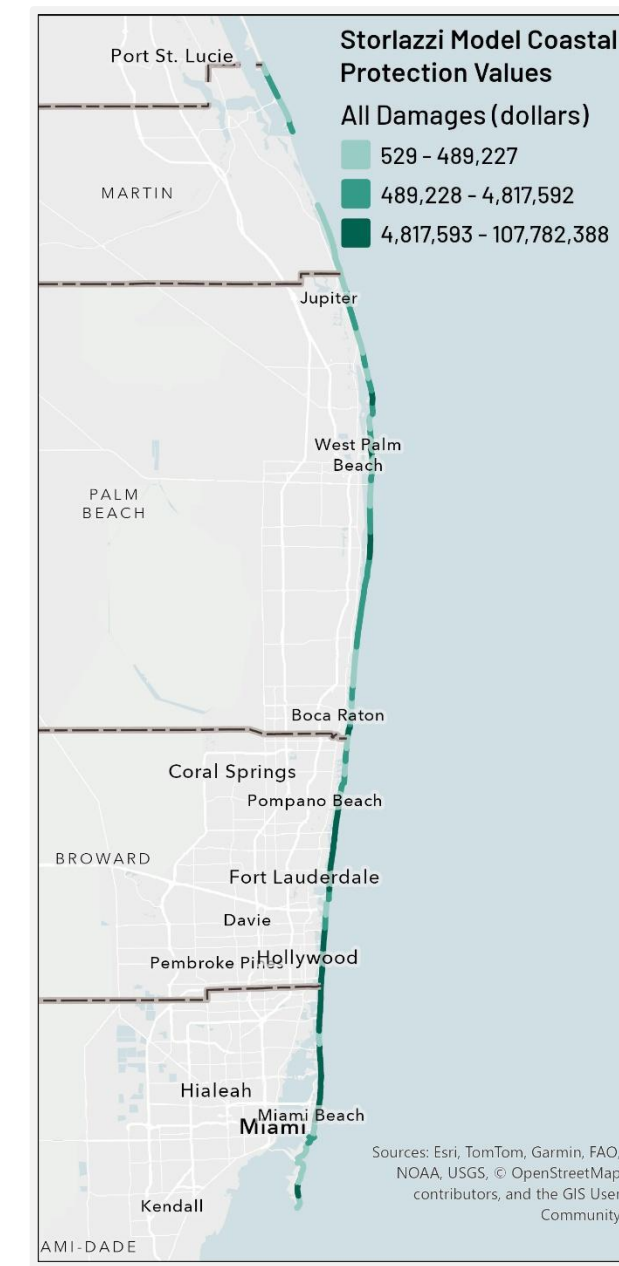
Tier 2 Restoration Plan: Kristin Jacobs Coral Aquatic Preserve

RQ: Where will restoration provide the most benefit to ecosystem services?

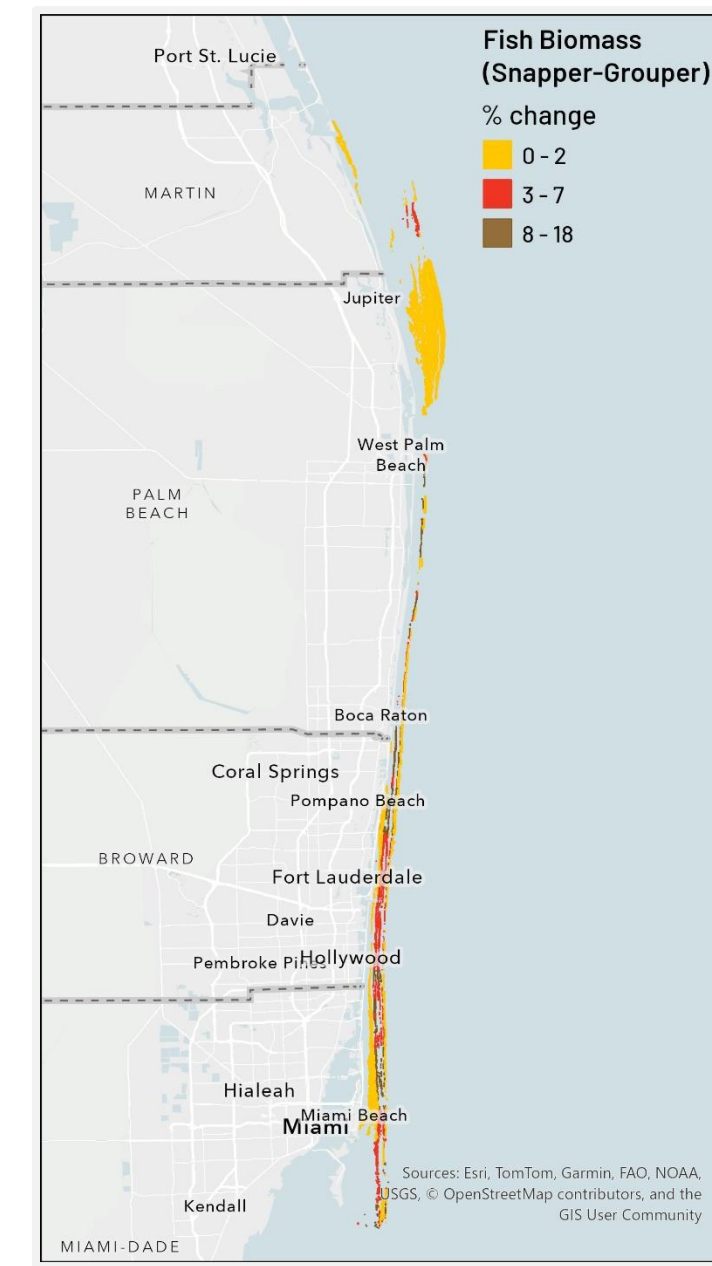
Restoration goals:

1. Establish resilient and self-sustaining reefs by implementing the Tier 1 restoration goals.
2. Conduct restoration activities at reefs that provide ecosystem services such as a) coastal protection (Fig 4. Below left), b) habitat for reef fish populations (Fig 5. Below middle), and c) quality reef-based tourism and recreation (Fig 6. Below right).

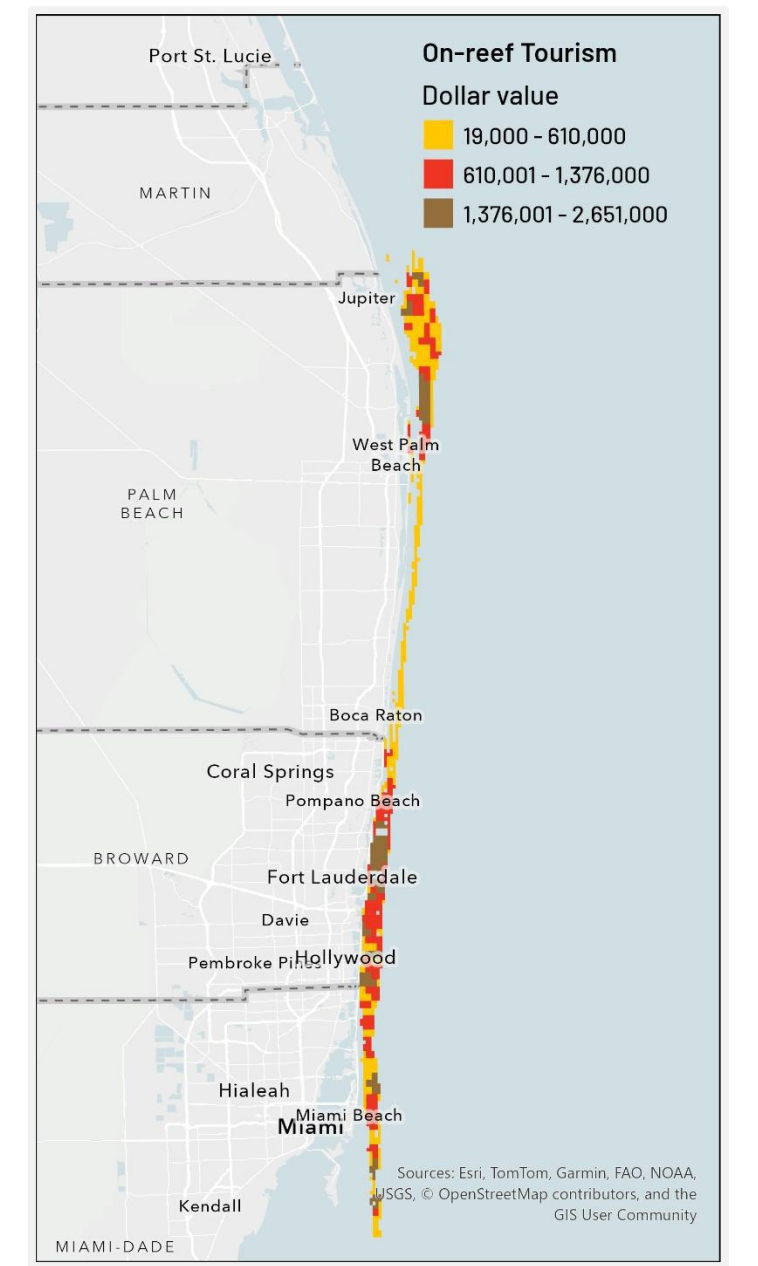
Methods: Assign each tier 1 focal area values for fish production and tourism based on area of largest overlap; evaluate coastal protection values along adjacent shoreline; choose focal areas with highest ecosystem service values.



Storlazzi et al., 2021



Zuercher et al., 2023



Spalding et al., 2017

Methods (II) Focal area evaluation and ranking

1. Spatially join and summarize metrics for each tier 1 focal area
2. Normalize metrics to scale values
3. Assign weight and direction of metric
 - a. Priority species density, species richness, mean colony length were double weighted
 - b. Temperature, water quality and other coral demographics were single weighted
 - c. Disease probability was half weighted
4. Calculate ranking score for each focal area
5. Identify priority focal areas as top ranking 25% of area within state waters per county
6. Identify high-ranking areas bordering or outside state waters

Figure 7 (right): Focal areas to ground-truth. Locations where NSU geographic focus area determination results suggest restoration of priority species will be most successful in Florida and/or Tier 2 Restoration Plan results suggest provide the most benefit to ecosystem services.

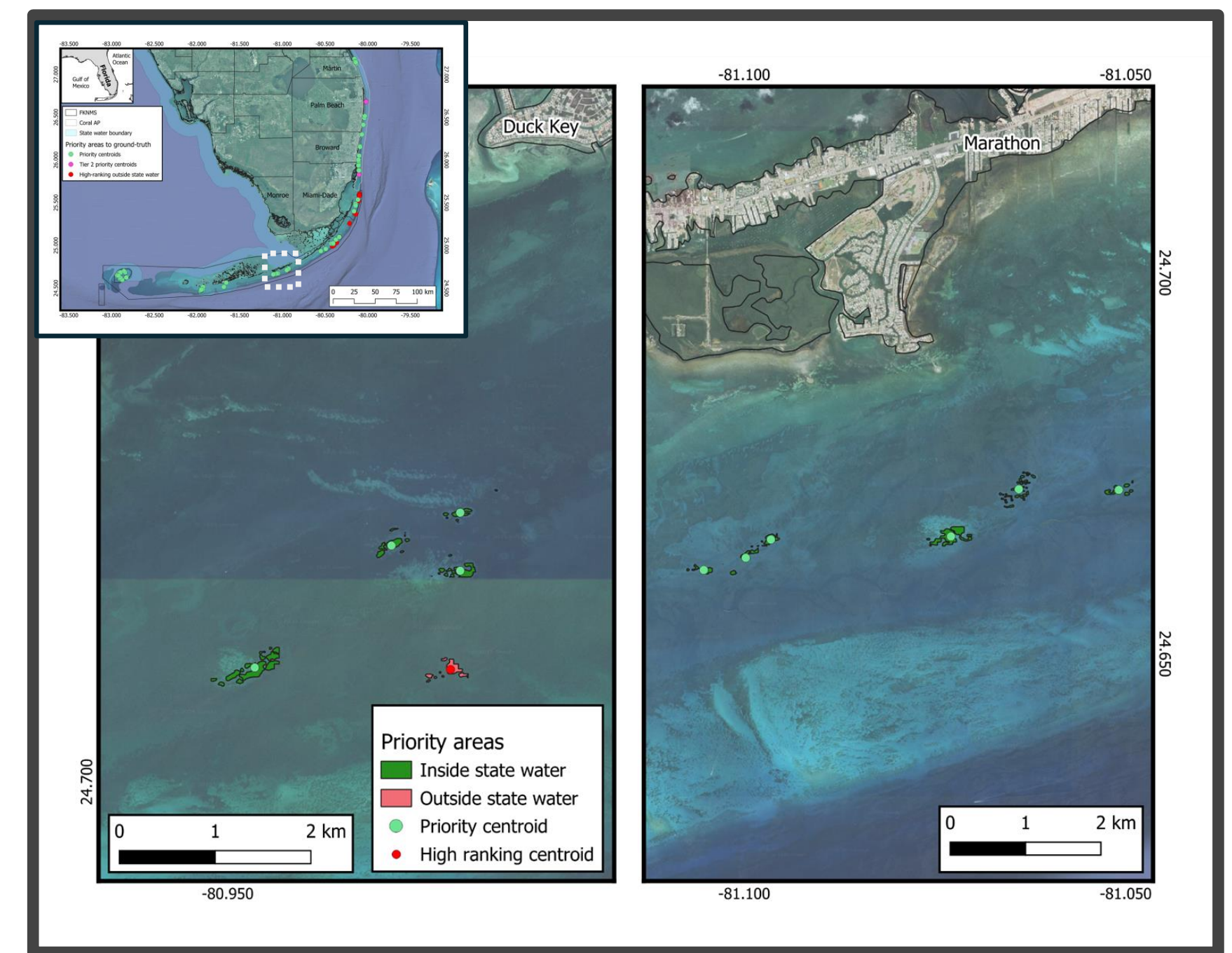
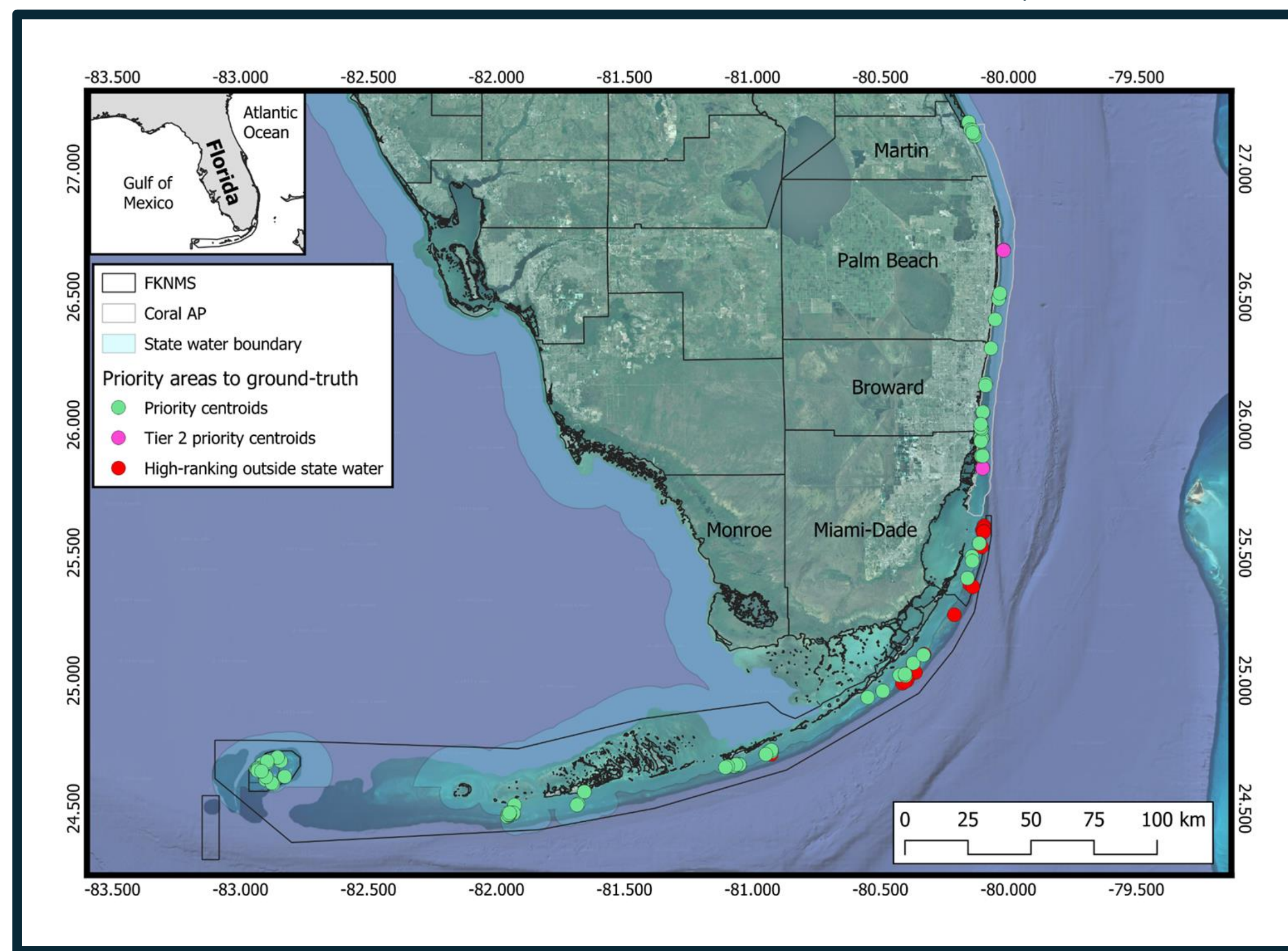


Figure 8 (above): Priority focal areas to ground-truth in the Middle Keys including the focal area polygon and the centroid position.

Ground-truthing

Goal: Determine best 1-2 focal areas within each county to recommend for FCR3 restoration activities.

Methods: Conduct ground-truthing surveys in each priority focal area.

- **Benthic transect surveys** (30 m point intercept transect and 10 m x 1 m belt transect)
 - Line point intercept (LPI): Conduct 30 m survey, recording benthic taxa every 0.25 cm.
 - Turf algae height: Measure turf algae height at the first 10 turf algae LPI points.
 - Relief survey: Collect 15 relief measurements within alternating 1 m² subplots along benthic transect.
 - Belt transect survey: Coral demographic survey. Record and measure all species ≥ 4 cm and tally to species juvenile corals < 4 cm.
- **Roving diver surveys** (45-minute timed swim around focal area)
 - Priority coral species survey: Tally by size class priority species and tally colonies with disease, bleaching and/or predation
 - *Diadema antillarum* survey: Tally abundance
 - Overall site assessment: Record defining site features and note if there is excessive damage to biota or fishing gear.

Conduct each type of benthic transect survey along the same transect. If a focal area is < 5 ha conduct 3 benthic transect surveys and 1 roving diver. If a focal area is ≥ 5 ha conduct 6 benthic transect surveys and 2 roving diver surveys.

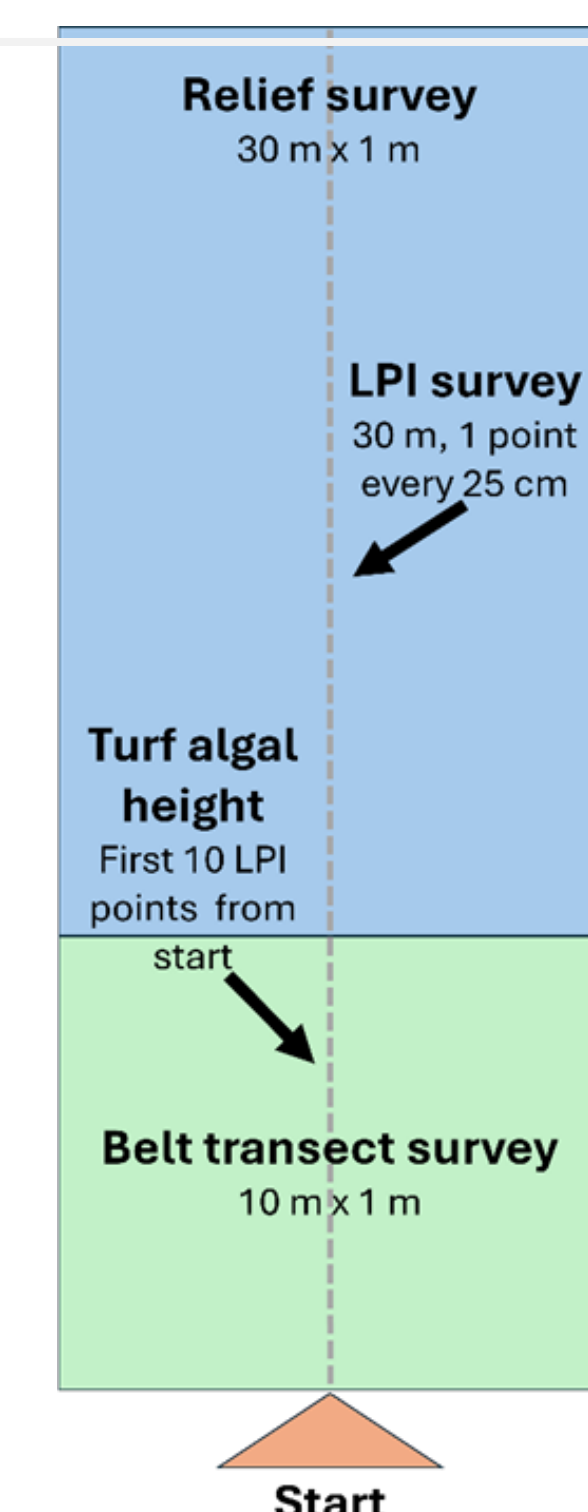


Figure 9 (above): Benthic transect survey layout

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