Investigation of herbivorous sea urchins in *Thalassia testudinum* beds in the Florida Keys National Marine Sanctuary using data from a long-term seagrass monitoring program

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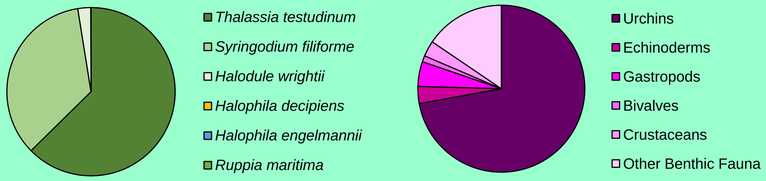
Introduction

Seagrass Importance
- Carbon storage
- Support biodiversity and fisheries
- Nursery habitat and feeding grounds

Monitoring Program and Water Quality
- FKNMS contains one of largest documented seagrass beds
- Seagrasses are indicators of local nutrient regimes

Other Factors Affecting Seagrass Beds
- Herbivorous animals, over-grazing



Goals and Hypotheses

Goals

•Investigate the spatial and temporal trends of *Thalassia testudinum* and sea urchin densities in the FKNMS.

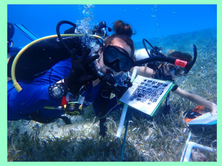
•Evaluate optimal *T. testudinum* densities for sea urchin populations.

•Determine if there is a correlation between urchin density and *T. testudinum* tissue nutrients.

Hypotheses
- There is a positive correlation between *T. testudinum* density and sea urchin density. We expect that both may be declining.
- There is no correlation between *T. testudinum* tissue nutrients and sea urchin density.

Methods

Invertebrate Composition
- At each site (n=40), divers survey a 1m x 50m transect to quantify invertebrates within the area

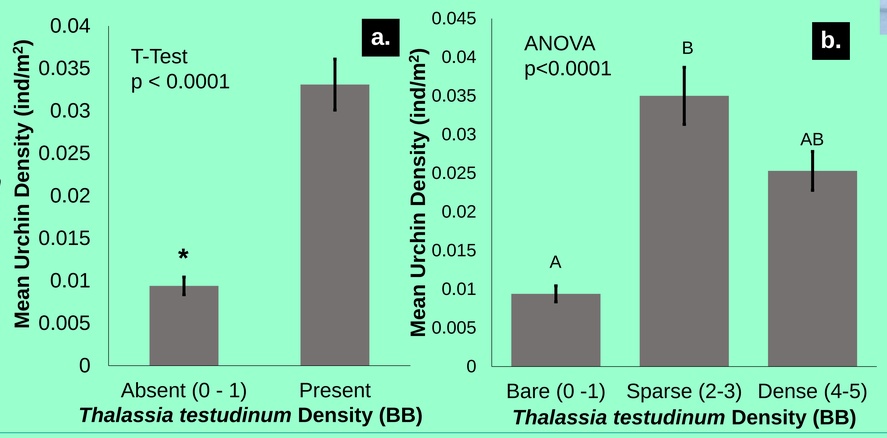


Seagrass Density
- Braun-Blanquet survey along transect
- 10 quadrats (0.5m x 0.5m)
- Score assigned based on cover

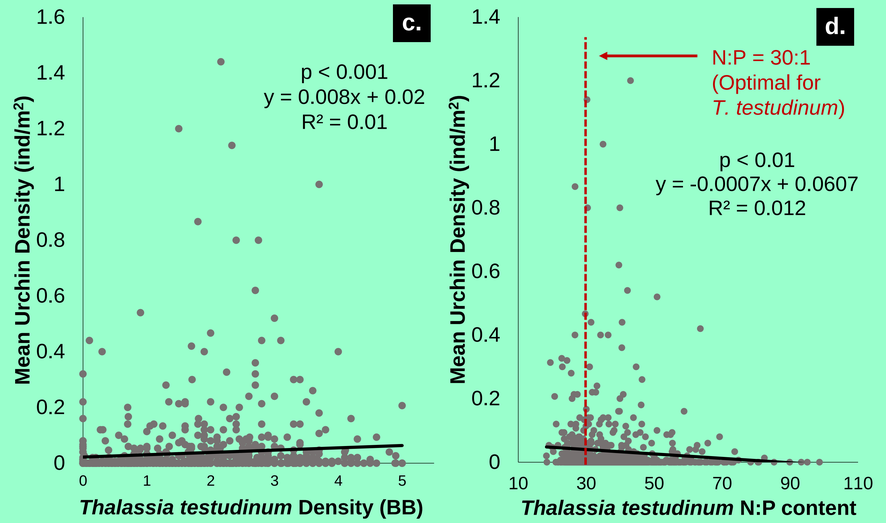
Score	Cover
0	Taxa absent from quadrat
0.1	Taxa represented by a solitary shoot, <5% cover
0.5	Taxa represented by a few (<5) shoots, >5% cover
1	Taxa represented by many (>5) shoots, <5% cover
2	Taxa represented by many (>5) shoots, 5 - 25% cover
3	Taxa represented by many (>5) shoots, 25 - 50% cover
4	Taxa represented by many (>5) shoots, 50 - 75% cover
5	Taxa represented by many (>5) shoots, 75 - 100% cover

Nutrient Analysis/ Lab Work
- Homogenize dried samples
- Measure N content with elemental analyzer
- Analyze P content spectrophotometrically

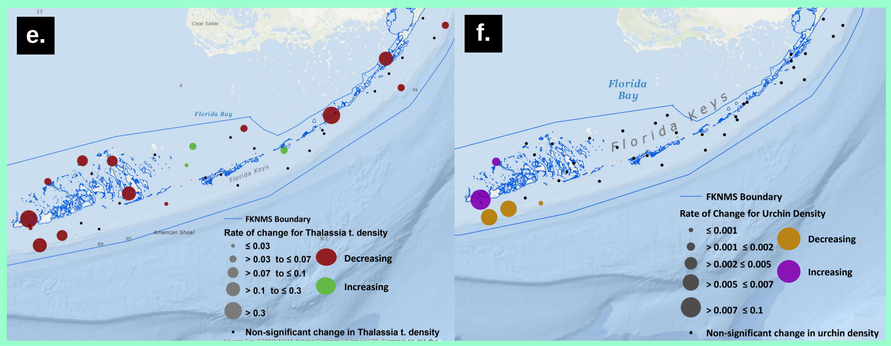
Results



Results continued



(a) Higher sea urchin densities in areas with seagrass present. **(b)** Highest sea urchin densities in locations with 5-50% seagrass coverage. **(c)** There is a positive correlation between *T. testudinum* density and sea urchin density. **(d)** There are larger concentrations of sea urchins where *T. testudinum* N:P ratios approach 30:1 (higher tissue P).



Rate of change in *T. testudinum* **(e)** and sea urchin **(f)** density from 1996 to 2018.

Discussion and Future Studies

- First analysis of SERL benthic invertebrate survey data
- Researchers can leverage long-term habitat monitoring programs to investigate other ecological questions (e.g. invertebrates, decomp.)
- Since *T. testudinum* tissue nutrients exert control over sea urchin densities, this could suggest a bottom-up system

Future Studies
- Compare Dry Tortugas National Park to current study
- More inclusive herbivore surveys to better understand all interactions in this complex system

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