Effects of fertilization and herbivory on seagrass community structure in Florida Bay

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Interactive effects of fertility & grazing on plant communities

- **Fertilization in the absence of grazing increases biomass and decreases species density** (Gough and Grace 1998)

- **Rates of competitive exclusion and the recovery after grazing determined by fertility** (Lubchenco 1978, Huston 1979, Kondoh 2001)

- **Fertilization increases the dominance of few species** (Lubchenco 1978, Proulx and Mazumder 1998) whereas grazers counteracted these effects by removing dominant species (Worm et al. 1999, Hillebrand 2003)
• Net primary production similar in aquatic & terrestrial systems but aquatic systems experience greater biomass loss to herbivores (Cyr and Pace 1993, Cebrian and Lartigue 2004)

• Herbivores play greater role in carbon and nutrient recycling and accumulation of producer biomass in aquatic systems (Cebrian 2004)

• Aquatic ecosystems are dominated by and dependent on one or a few key plant species
Questions

1. What is the effect of nutrient addition and simulated grazing on the competitive performance of primary producers in a seagrass bed in South Florida.

1.1. What is the effect of grazing on plant competition at different levels of fertility?

1.2. Will grazing influence the response of the seagrass community to fertilization?
Thalassia
Thalassia
Testudinum
Testudinum
(SF)

Syringodium
Filiforme
(N2451.041)

Halodule
Wrightii
(W80 53.190)

Thalassia
Testudinum
(TT)
Effects of fertility and grazing on species composition

<table>
<thead>
<tr>
<th>Fertility</th>
<th>high</th>
<th>intermediate</th>
<th>low</th>
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</thead>
<tbody>
<tr>
<td>grazing</td>
<td>Fast and slow-growing</td>
<td>Fast-growing</td>
<td>Fast-growing</td>
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<tr>
<td>high</td>
<td>Slow-growing</td>
<td>Fast and slow-growing</td>
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<td>low</td>
<td>Slow-growing</td>
<td>Slow-growing</td>
<td>Slow-growing</td>
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</tbody>
</table>

Slow-growing – low nutrient requirement, *Thalassia*

Fast-growing – high nutrient requirement, *Halodule*
### Methods

<table>
<thead>
<tr>
<th>C</th>
<th>1NP</th>
<th>2NP</th>
<th>1G</th>
<th>2G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1NP1G</td>
<td>1NP2G</td>
<td>2NP2G</td>
<td>2NP2G</td>
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</tbody>
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- **N and P loading rates**
  - Med NP: 2.4 mg N d\(^{-1}\) and 80 μg P d\(^{-1}\)
  - High NP: 4.8 mg N d\(^{-1}\) and 160 μg P d\(^{-1}\)

- 3 replicates
- 45 plots
- Simulated herbivory (SH)

25 and 50% aboveground biomass removal every 2 months
• Bi-monthly sampling

• Seagrass shoots were collected, dried, weighed & analyzed for elemental content (%C, %N, %P), and elemental ratios (C:N, C:P, N:P)

• Percent cover of primary producers (macroalgae and seagrasses) measured using a modified Braun-Blanquet method (Fourquarean et al. 2001)

Braun Blanquet Scoring
0  absent
0.1 solitary, <5%
0.5 sparse, <5%
1 many, <5%
2  5-25%
3  25-50%
4  50-75%
5  75-100%
• Nutrient addition and grazing decreased Syringodium N:P

• No effect of nutrient addition and grazing on Thalassia N:P
Nutrient addition and grazing had no effect on relative abundance of *Thalassia*

Nutrient addition increased relative abundance of *Syringodium*

Grazing decreased relative abundance of *Syringodium*

Nutrient addition and grazing had positive effect on relative abundance of *Halodule*
Syringodium filiforme

- NP addition increased Syringodium leaf length

Thalassia testudinum

- NP addition and grazing no effect on Thalassia leaf length
2 months after grazing
2NP1G

2NP2G

2 months after grazing
Summary

• No seagrass response to N addition

• P addition enhanced the relative abundance of *Syringodium filiforme*

• Grazing prevented competitive exclusion in NP enriched plots

• NP enrichment allowed seagrasses to recover from grazing
Significance of the study

• Understand the interactive effects of nutrient enrichment and grazing on plant competition

• Predict responses of ecosystems to environmental changes for the development of effective management and conservation strategies in Florida Bay
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