Rising abundance of largemouth bass in the littoral zone of Sacramento – San Joaquin Delta: the role of *Egeria densa*

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IEP Workshop, California State University: May 26, 2010
...On the rise

- **HOW** is the population changing?
  - Size structure?

- **WHAT** favors abundance?
  - Increased submerged aquatic vegetation (SAV)?

- **DIET??**
Size distributions between years: April of ‘95, ‘02, ‘09

Average CPUE +/- SE

Size Class (FL in mm):
- 50-100
- 101-150
- 151-200
- 201-250
- 251-300
- 301-350
- 351-400
- 401-450
- 451-500
- >500

Graph showing size distributions for years 1995, 2002, and 2009.
Bimonthly fish & vegetation surveys at 33 sites since October 2008

- SAV biomass by species
- Water quality

Each Point:

>175mm FL
Submerged Aquatic Vegetation (SAV)

- *Egeria densa*
- *Potamogeton crispus*
- *Ceratophyllum demersum*
- *Myriophyllum spicatum*

Graph showing the average biomass of *Egeria densa* and other spp. from October to April.
Does SAV biomass help explain largemouth abundance?

- Small bass (≤ 125mm) vs. Larger bass (> 125mm)

- Generalized linear mixed models (GLMMs)

- Variables:
  - Average SAV biomass
  - Conductivity
  - Temperature
  - Distance to shore
  - Secchi depth

- Compare AIC between models
# Linear Models

<table>
<thead>
<tr>
<th></th>
<th>Juveniles (≤ 125mm)</th>
<th>Adults (&gt;125 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Δ AIC</td>
<td>Effect</td>
</tr>
<tr>
<td>1</td>
<td>-12.3</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>-1.5</td>
<td>ns</td>
</tr>
<tr>
<td>3</td>
<td>-5.6</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>-0.8</td>
<td>ns</td>
</tr>
<tr>
<td>5</td>
<td>-1.0</td>
<td>+</td>
</tr>
</tbody>
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**Δ AIC** = Reduction in AIC from previous model

**Effect** = Direction of effect in **best model**.
1. Both life stages have strong INITIAL response to SAV
2. Adults need a lot LESS SAV before their density reaches a plateau
From the field to the lab:

1. Does *Egeria* biomass density affect WHERE adults feed?
   – Prey choice?

2. Additional effects of turbidity?

<table>
<thead>
<tr>
<th>12 Replicates Each Combination:</th>
<th><em>Egeria</em> Biomass Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>Low</td>
</tr>
<tr>
<td>Clear</td>
<td></td>
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<tr>
<td>Turbid</td>
<td></td>
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Diet Composition in the Field: October 2008 – August 2009

Index of Relative Importance

- ≤ 125 mm (n = 648)
- > 125 mm (n = 676)
Conclusions and Upcoming Work

• *Egeria densa* promotes bass abundance
  – Juveniles exhibit a stronger response than adults
  – Mescosom studies: turbidity more important to feeding success than *Egeria* density when vegetation is patchy

• Diet sample analyses indicate that nearly all prey come from nearshore habitats

• Continue surveys through October 2010
  – Add new sites in the North Delta

• Conceptual model for the nearshore
The big picture: the full nearshore assemblage

Catfish
Alien Cyprinids
Native Residents

Average CPUE +/ - SE

1980-1983
1995, 97, 99
2001-2003
2008-2010
Future Work: Building a conceptual model for the nearshore

Abiotic Factors
- Temperature
- Turbidity
- Conductivity
- Distance to Shore
- Outflow

SAV Biomass

Inverts

Juvenile Fish (including Juvenile LMB)

Adult LMB
Thanks to...

Project Sponsor: Interagency Ecological Program

Electrofishing Vessel: California Department of Fish & Game
Marty Gingras, Curtis Hagen

Diet Sample Analysis
Talene Baghdassarian
Andrew Bibian
Bryn Evans

Modeling: Richard McElreath, UCD

Mesocosms
Lynn Ranaker
Joan Lindberg, FCCL
Luke Ellison, FCCL
Paul Lutes, CABA
Erik Hallen, CABA