Effects of Sediment Grain Size on Settlement of Juvenile Horseshoe Crabs

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Life Cycle
- Atlantic Horseshoe crab (Limulus polyphemus) populations have decreased due to harvest by fisheries, the biomedical Industry, as well as loss of habitat.
- Spawning occurs from late spring to summer, when female horseshoe crabs deposit eggs in the high intertidal zone.
- Recently-hatched larvae (Fig 1, left) emerge one month later and planktonic larval duration lasts 1 to 3 weeks according to previous studies.
- Competency occurs when larvae are physiologically ready to molt into the first stage juvenile (Fig 1, right).
- Following the first molt, horseshoe crabs become benthic.
- The effect of grain size on habitat choice by horseshoe crab larvae is unknown.

Larval Competency
At 15 days old, 50% of larvae molt.

Figure 2. Percentage of larvae that molted into the juvenile stage over a monitoring period of 20 days at 25°C.

Experimental Design
- Sediment choices were based on grain size categories described by Wentworth (1922) (Table 1).
- Sediments were heated in a muffle furnace to remove chemical cues, then rinsed of any residue.
- 15 day old larvae were introduced to experimental chambers containing two sediment sizes (see Figure 3, top panel).
- The number and location of larvae that molted into juvenile was recorded after 48 hrs.

Table 1.
<table>
<thead>
<tr>
<th>Size Terms</th>
<th>Grain Length (μm)</th>
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</thead>
<tbody>
<tr>
<td>Pebbles</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>Very Coarse Sand</td>
<td>1000 – 2000</td>
</tr>
<tr>
<td>Coarse Sand</td>
<td>500 – 1000</td>
</tr>
<tr>
<td>Medium Sand</td>
<td>250 – 500</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>125 – 250</td>
</tr>
</tbody>
</table>

Conclusions
1) Larvae in this study were not competent to settle before day 8, but 90% molted by day 18. Therefore, day 15 larvae were used to maximize molting during experiments.
2) In general, larvae avoided molting in sediments with larger grain size.
3) Additional experiments are underway to determine whether the smallest grain sizes are preferred.
4) A lack of preference between course vs. medium sand may indicate larvae do not differentiate between these two size classes.
5) Sediment preference can help us identify juvenile habitats and target these areas for conservation.

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Sediment Choice Results

Fig 3. Preference for smaller grain sizes was observed in treatments 1 and 2, and no preference was observed in treatment 3.

Fig. 1 Larvae (left) molt into first stage juveniles (right).

Objectives
1) To determine when larvae are competent to molt into first stage juveniles.
2) To examine whether grain size has an effect on sediment choice.