Molts reveal life-history patterns of American horseshoe crabs in fringe habitats

- Ruth H. Carmichael
  - Dauphin Island Sea Lab
  - University of South Alabama
- Maury G. Estes, Jr.
  - Universities Space Research Assoc.
- Angela J. Brady
  - University of Maine-Machias
CROSS SYSTEM COMPARISON

Sandy & cobble beaches (near apex)

CAPE COD, MA
CROSS SYSTEM COMPARISON

Vast rocky mud flats (fringe northeast)

Taunton Bay, ME
Sandy dynamic beaches (fringe southwest)

Petit Bois Island, MS
Life history & habitat

Horseshoe crabs are generalists & flexible

• Do the details differ with habitat?
  • Population dynamics (growth, mortality, size distributions)
  • Timing of life history events
  • Links to habitat change & other species (phenologies)
Life history & habitat

*Horseshoe crabs are generalists & flexible*

- Can fringe populations provide answers?
  - First affected by change (pulse v. long-term)
  - Adaptability
  - Apex populations
- Fringe areas less studied
  - Sparse populations
  - Less interest (not harvested)
  - Hard to study (weather, turbidity, depth, access)
Purpose

- Test molt characteristics as an alternative method to obtain population data
- Collect baseline data on two fringe populations for comparison
**Methods**

- *Limulus polyphemus* molts were collected from spawning beaches in fringe habitats:
  - **Taunton Bay** - Gulf of Maine (northeast)
  - **Petit Bois Island** - northern Gulf of Mexico (southwest)

- Populations are small & poorly studied

- Every 2–4 wks, corresponding to full & new moons
- Transect from high tide ~3 m to water
- Molts were measured (PW) & sexed (M:F)
Population data

Maine:
246 molts
19-165 mm

nGOM:
793 molts
2-152 mm

- > 40
- M:F ~ 2
- Cohorts
- Annual pattern
Molt number

Molt frequency

Patterns?

Maine:
d 230 - 255  
(Aug-Sep)

nGOM:
d 140 - 160  
(May-Jun)

• M & Fe same
• Pre & post spawn peaks?
Molt size

Size frequency

Patterns?

• Males & females similar
• Smaller crabs molt near spawn
• > 40 mm
Conclusions

- Molts provided information on population dynamics in fringe habitats, as a proxy for number & size of living individuals.
- M:F of molts ~ 2.0 in North & South regions
- Males & females had similar molt characteristics.
- Peak molting periods may occur at different times among regions (need more data); but occurred at roughly same temperatures (13-17 °C).
- Molt size varied through time, but suggested smaller crabs molted closer to peak spawning.
Implications

- If collected diligently, molt data could be used to define cohorts, estimate growth rates, other life history traits.

- This method is useful in *fringe habitats* like Maine & nGOM, where populations are difficult to study because of sparse numbers, few background data, or difficult access due to water depth, turbidity, & temperature/weather extremes.
Deepwater Horizon & nGOM

Horseshoe crabs

- Changes in population dynamics
- Contaminants in tissues & feces
Acknowledgments

- This work was funded in part by:
  - Maine Sea Grant
  - Dauphin Island Sea Lab (DISL) through the undergraduate summer program

- We also thank many volunteers:
  - Biology Department at the University of Maine, Machias
  - DISL Technicians C. Pabody, N. Taylor, REU C. Kovacs