Ecology and Conservation of Horseshoe Crabs: New Challenges and Recent Progress

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So, why study horseshoe crabs?
I usually get two reactions....
Eeeeyyyewww!
What (the %$%$#&!) good are these things?
Living Fossils

Photo credit: Rudkin & Young (2009)
Economic Importance

Biomedical (LAL)

Bait fishery
Ecological Importance

- Delaware Bay shorebirds depend on horseshoe crab eggs to fuel their non-stop flights to the Arctic for breeding.
- The decline in shorebird populations and the declining abundance of crab eggs has been the primary driver in the movement to conserve horseshoe crabs.
Horseshoe crabs: A multiple use fishery

HSC Value (million $ per year)
Source: Manion et al. (2000)

- Bait ($17.10)
- Ecotourism ($10.30)
- Biomedical ($96.00)
Since I began my research in 1977, I’ve had the opportunity to study HSC’s in diverse environments (& to have witnessed many changes)

• Delaware Bay and Middle Atlantic Continental Shelf
  – Feeding ecology
  – Mating behavior and habitat selection
  – Population status and trends
  – Conservation biology

• Urban estuaries including:
  – Jamaica Bay (Brooklyn & Queens)
  – New Haven Harbor (Long Island Sound)

• Coastal Japan
Delaware Bay has the largest known population of horseshoe crabs in the world.
We’re located in an urban estuary, where horseshoe crabs and other organisms are impacted by man’s activities, including shoreline development and pollution.
How does the reproduction of horseshoe crabs differ between Jamaica Bay and Delaware Bay?

- Embryos collected from JB were cultured in water from Jamaica Bay and Delaware Bay
- Total Number of Embryos Examined: JB (2,428); DB (1,466)
- Percent Normal Embryos: JB (99.05%); DB (98.84%)
What limits the abundance of horseshoe crabs in an urban estuary?

► The low frequency of occurrence of abnormal embryos suggests that water quality in Jamaica Bay is suitable for horseshoe crabs.

► Horseshoe crabs in Jamaica Bay are probably limited by the scarcity of sandy beach habitat for egg-laying.

► A proposed restoration plan for Jamaica Bay (U.S. Army Corps of Engineers) may increase good spawning areas).
The problem of habitat availability is even more acute in Japan.

The coastline of Japan has been extensively altered.

This is a “preserved” beach in Kyushu.
Japanese horseshoe crabs are highly endangered because of the loss of spawning habitat and pollution.
We found that malformed embryos were much more common from polluted Japanese bays than from Jamaica Bay or Delaware Bay. Are Japan’s urban estuaries even more impacted than ours?

Botton & Itow (2009)
Recent Conservation Activities

• Implementation of coast-wide fishery management plan under the authority of the Atlantic States Marine Fisheries Commission that places strict state-by-state quotas on the bait harvest.

• Establishment of a 1,500 square mile no-take zone in Federal waters off the mouth of Delaware Bay.
International Cooperation on HSC Conservation

• In June 2007, over 150 scientists and conservationists from 10 different countries met at Dowling College to discuss the common problems confronting HSC’s in North America and SE Asia.

• Symposium proceedings have been recently published by Springer (2009).

• Plans are underway for a second International Workshop to be held in Hong Kong in 2011.
Editing of this book was greatly facilitated by a Faculty Fellowship during the Fall 2007 semester.
Horseshoe Crabs and Undergraduate Education
• General Biology labs
  – *heart rate studies*

• Undergraduate research
  – *Toxic/sublethal effects of pollutants*
  – *Mechanisms of coping with environmental stresses (e.g. temperature, osmotic shock, pollution)*
Many students present their research at professional conferences

MLB with Morgan Greene (FCLC '10) at the 2009 Benthic Ecology Meetings in Corpus Christi, Texas.
Recent presentations by Fordham students

• Posters or oral presentations:
  – Eastern Colleges Sciences Conference
  – Atlantic Estuarine Research Federation
  – Benthic Ecology Meetings
Research articles on horseshoe crabs coauthored with Fordham students have been published in:

- *Archives of Environmental Contamination & Toxicology*
- *Marine Ecology Progress Series*
- *Journal of Ethology*
- *Journal of Experimental Marine Biology and Ecology*
- *Biology & Conservation of Horseshoe Crabs (Springer Publ.)*
Thanks to the Fordham students on “Team Limulus”

Pollution Studies:
Kristy Johnson, Melanie Hodge, Leticia Helleby, Tino Gonzalez, Christine Santesteban, Kevin Mai, Irene Paraskevakis

Field Studies:
Erin Duffy

Physiological Stress Studies:
Laura Smoral, Monika Pogorzelska, Amy Shehata, Marie Reilly, Alicia Worden, Chris Fiorese, S-L. Yang, Morgan Greene, Lucas Cusumano
Thanks for listening!