

Atlantic Horseshoe Crab (*Limulus polyphemus*) population structure within southern New England



Natalie Ameral
November 30th, 2020



How are Horseshoe Crabs Used?

Bait

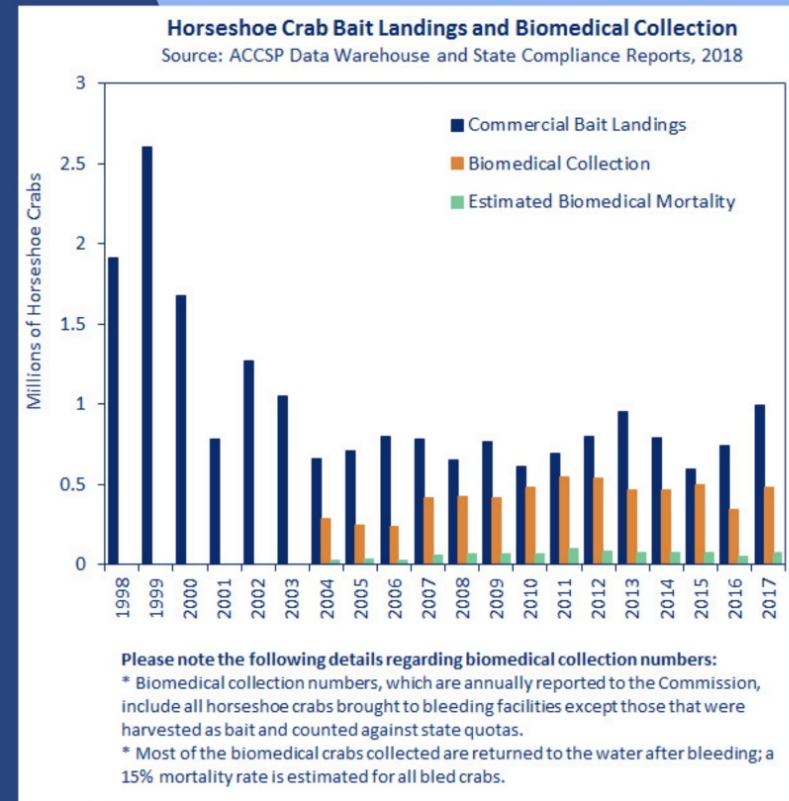
Biomedical

How are Horseshoe Crabs Doing?

Stock Status

Why are
we doing
this
research?

Bait for Commercial Fishing



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Biomedical

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Biomedical Use



Blood is harvested to create *Limulus* amebocyte lysate

In the news!

[https://
www.nationalgeographic.com/
animals/2020/07/covid-vaccine-
needs-horseshoe-crab-blood/](https://www.nationalgeographic.com/animals/2020/07/covid-vaccine-needs-horseshoe-crab-blood/)

[https://www.smithsonianmag.com/smart-
news/race-coronavirus-vaccine-runs-
horseshoe-crab-blood-180975048/](https://www.smithsonianmag.com/smart-news/race-coronavirus-vaccine-runs-horseshoe-crab-blood-180975048/)

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ASMFC Assessment - 2019

Number of Surveys Below the Index-based 1998 Reference Point
in the Terminal (Final) Year of ARIMA Model

| Region | 2009 Benchmark | 2013 Update | 2019 Benchmark | 2019 Stock Status |
|--------------|-------------------|----------------|-------------------|----------------------|
| Northeast | 2 out of 3 | 5 out of 6 | 1 out of 2 | Neutral |
| New York | 1 out of 5 | 3 out of 5 | 4 out of 4 | Poor |
| Delaware Bay | 5 out of 11 | 4 out of 11 | 2 out of 5 | Neutral |
| Southeast | 0 out of 5 | 0 out of 2 | 0 out of 2 | Good |
| Coastwide | 7 out of 24 | 12 out of 24 | 7 out of 13 | Neutral |

RIDEM Assessment 2013

- Population is "overfished"
- "Overfishing" is occurring
- 8 year closure necessary to reestablish BMSY

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Research Objectives

- Define management unit(s)
- Identify discrete populations
- Describe horseshoe crab behavior

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Research Approach

- 10 sampling locations
- 30 specimens per location
- 50/50 split male/female

Field

Lab

Analysis

Three Major Data Pools

1. Environmental/Phenotype

- water temperature, tide, sex, size, weight

2. Tagging

- USFWS disc tag

3. Genetic

- leg tissue for DNA/RNA extraction



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Analysis

Laboratory Processing

- DNA extraction
- Genotype individuals
- Expressed Exome Capture Sequencing
(new technique)

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Analysis

Environmental, Phenotypic, Tagging

- Non-metric multidimensional scaling
- ANOVA - tagging data

Population Genomic Analyses

- Mechanisms of selection
- Genetic diversity and connectivity
- Population graph trees

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2020 Sampling Update

Field

Lab

Credits

Field Metrics

- 288 crabs tagged
- All locations represented except CT
- 272 tissue samples collected



2020 Sampling Update

Field

Lab

Credits

Lab Status

- All tissue samples frozen
- DNA extractions done for 90% of samples!



2020 Sampling Update

Field

Lab

Credits

Acknowledgments:

Dr. Jon Puritz, Anna Sorgie (URI)

Scott Olszewski, Dr. Conor McManus, Katherine Rodrigue (RIDEM)

The Nature Conservancy on Block Island

MA DMF, CT DEEP, USFWS

Photo Credits

<https://www.nj.gov/dep/fgw/artbeachtreasure.htm>

<https://www.baltimoresun.com/news/environment/bs-gr-eels-20131104-story.html>

<https://www.cnn.com/2014/09/04/health/this-crabs-blood-could-save-your-life/index.html>

<http://www.asafc.org/species/horseshoe-crab>

2020 Sampling Update

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