Oyster Updates and Shellfishery Needs

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Rutgers

Measurable Goals for the Delaware Estuary

Goal Statement: Healthy Habitats supporting healthy waters and communities.

<table>
<thead>
<tr>
<th>Healthy Habitats =</th>
<th>10 Year CCMP Goal</th>
<th>Measure – short term</th>
<th>Measure – long term</th>
<th>Responsible Agencies</th>
<th>Assumptions/Needs</th>
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<tbody>
<tr>
<td>Healthy fish and shellfish habitats</td>
<td>By 2037...</td>
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<tr>
<td>Measure and improve freshwater mussel abundance and habitat</td>
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<td>Measure and improve vegetated nursery habitat for fish/nest</td>
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<tr>
<td>Measure and improve abundance of and habitat for crustaceans including shrimp and crabs</td>
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<tr>
<td>Measure and improve spawning horseshoe crab abundance and habitat</td>
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<td>Protect fish passage with 1-3 projects per year</td>
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<tr>
<td>Critical species habitats</td>
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<tr>
<td>Mussel habitat (fresh and marine)</td>
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<tr>
<td>Vegetated nursery habitat for fish &amp; crustaceans, particularly in shallow estuarine areas</td>
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<tr>
<td>Beach habitat for horseshoe crabs</td>
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<tr>
<td>Critical system habitat for sturgeon, and other fish</td>
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<td>Facilitate 5 fish passage projects per year</td>
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<td>Measure the increase in abundance and habitat by year and amount TMD</td>
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<tr>
<td>Increase fish passage</td>
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PDE, States, DRA, LUDD, UMD, USDA, DMRC, AQUAC

- EPA cannot participate in utilization of funding - Subject to completion of NDU with NI Heritage Program in support mussel habitat - Collaboration with partners in the area of sturgeon recovery, fish passage, and oyster recovery
Competing Interests

- Fishing Interests
- Farming Interests
- Conservation Interests

Overlapping Interests

- Fishing
- Farming
- More Oysters in the Bay
- Conservation
What are we doing?

- Oyster Fishery management
  - Annual Stock Assessment
- Oyster Habitat enhancement
  - Shell planting programs
  - Living shorelines
- Outreach Programs
  - Project PORTS (Promoting Oyster Restoration Through Schools)
  - Living shorelines
- Oyster Aquaculture
  - Regulatory issues
  - Threatened species conflicts (red knot)
Delaware Bay direct market fishery has stabilized at an average of ~76,000 bushels.
Oysters build habitat

Fishery harvests habitat

Ecosystem health depends upon healthy reefs
Local economy depends on healthy oyster fishery
Managers must balance these needs

Shell planting is primary restoration tool.

Presently, entirely industry funded by self-imposed bushel tax

Plant ~150,000 bu/yr

Estimated economic impact is 25:1 on average

Limitations: Funding, shell, regulations, labor
Oysters and erosion: What do they have in common?

A free informational session on the Gandy’s Beach & Money Island Living Shoreline Project

Please join us for a chicken and crab barbeque and a discussion on shoreline projects that benefit your community

- **Date:** Saturday, June 11th, 2016
- **Location:** Money Island Marina
- **Address:** 192 Bayview Rd, Newport, NJ 08345
- **Time:** 2:00 – 5:00pm

Partners funded through the grant from the US Fish and Wildlife Service include:
- The Haskin Shellfish Research Laboratory at Rutgers
- Partnership for the Delaware Estuary
- The Nature Conservancy of New Jersey

For additional information, please contact:
Moses Katkowski, Coastal Projects Manager
The Nature Conservancy in New Jersey
(609) 861-0800
mkatkowski@tnc.org

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**PORTS**

Promoting Oyster Restoration Through Schools

- Provides students with **authentic** research and restoration experience in the Delaware Bay
  - Community-based oyster restoration
  - In-school enrichment
  - Field trips
  - Curriculum Guides
  - Teacher workshops
  - Stewardship opportunities for all ages

In the 2015-16 school year,
> 3,600 children participated
> 15,500 shell bags
Intensive Oyster Aquaculture

Small, but large potential, many challenges:
- Regulatory
- User conflicts
- Endangered species
Migratory Pathway of Red Knots

7000+ mile route

Delaware Bay is a critical stopover (others include barrier islands of GA & SC, Delmarva, Cape Cod)

birds are present for a 3-7 week window in May and June

overexploitation of horseshoe crabs is associated with steep declines in the red knot population
CAPE SHORE OYSTER CULTURE

INTERTIDAL SHELLFISH PRODUCTION
ON THE CAPE MAY SHORES OF
DELAWARE BAY, NEW JERSEY

Compiled by W J Canzonier
Maurice River Oyster Culture Foundation
31 August 2008

http://hsrl.rutgers.edu/HSRL_documents
Oysters in large trays at Cape Shore - TCN photo 1930s

Amos Pepper/WPA. Oyster Tray RR on Cape Shore, TCN phbt. 1930s.

Cape Shore Oyster Tray RR by Pepper; after 1952, note studio wing; TCN phbt
To ensure that aquaculture structures do not impede the nearshore horseshoe crab activity...

...prohibit installation of new equipment between April 15 and June 15

...300 and 500 ft buffers off beach and from creek mouth shoals

...limit access to no more than once per week in high red knot use leases, and... twice per week in moderate red knot use leases

...limit access to the 2 hrs before and 2 hrs after low tide

...ensure that all personnel enter and exit the lease area together and minimize the time spent constructing the protected area
Regional Approach

Two segments at North South Border

Very restrictive conditions during Red Knot season to the north, less so to the south

Incentives to relocate operations in the northern segment to the southern segment

Blue is North
Brown is private leases in southern segment, Green could be potential ADZ expansion areas to obtain clustering.

Any southward expansion is wholly dependent on the State being able to obtain riparian permissions.
Access is a large issue.

Preliminary Results from the First Year of Research Aimed at Identifying the Potential Impacts of Intertidal Oyster Aquaculture on Foraging Red Knots

Brooke Maslo1,2,*, Julie L. Lockwood1, David Bushek3 and Joanna Burger1

1Ecology, Evolution and Natural Resources, Rutgers, The State University of New Jersey
2Rutgers Cooperative Extension
3Haskin Shellfish Research Laboratory
Acknowledgements

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Craig Tomlin
Lisa Calvo
NJ Oyster Growers Forum

Project Objectives/Study Questions

GENERAL OBJECTIVE:
Provide a baseline understanding of how intertidal oyster culture is affecting red knot foraging

1. What is the effect of aquaculture racks (structures only) and tending activities on red knot presence?

2. What is the effect of aquaculture racks (structures only) and tending activities on red knot foraging rate?
Census Counts – Red Knot Abundance

- census count at 2-hr intervals:
  - # and location of red knots
  - total shorebirds present

- environmental variables:
  - tide
  - wind speed
  - air temperature

- oysterculture variables:
  - presence of racks
  - presence of tending
  - # of growers present

- behavioral variables:
  - # of non-oyster growers
  - # of dogs
  - # of planes
  - # of raptors

Habitat Considerations – Shoreline Characterization

- shoreline types encountered:
  - dune
  - Phragmites
  - salt marsh
  - creek
  - woodland
  - bulkhead
Y<sub>i</sub>: Number of Red Knots per Segment

\[ Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \]

Beta<sub>j</sub>: Variables that we think may have an influence on number of red knots per segment

<table>
<thead>
<tr>
<th>Tide Level, Segment, Wind</th>
<th># REKN in flock</th>
<th>Planes (pres/abs)</th>
</tr>
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<tbody>
<tr>
<td>Racks (pres/abs)</td>
<td>Shoreline Type</td>
<td>Tending (pres/abs)</td>
</tr>
<tr>
<td>Total Shorebirds (around knots)</td>
<td>Total Gulls (around knots)</td>
<td>Other Activities (dogs, raptors, non-oystermen)</td>
</tr>
</tbody>
</table>

We can build as many linear models from this as we want, for example:

\[ Y_i = \text{Tide} + \text{Wind} \]
\[ Y_i = \text{Tide} + \text{Wind} + \text{Planes} \]
\[ Y_i = \text{Tide} + \text{Wind} + \text{Shoreline} + \text{Gulls} \]
\[ Y_i = \text{Tide} + \text{Wind} + \text{Tending} + \text{Racks} \]

Tending, Planes, Activities, and Gulls Explain REKN Abundance

<table>
<thead>
<tr>
<th>Model</th>
<th>DIC</th>
<th>ADIC</th>
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<tbody>
<tr>
<td>Base</td>
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<tr>
<td>tide+wind+segment</td>
<td>2465</td>
<td>-25</td>
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<tr>
<td>Univariate</td>
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<td>base+tending</td>
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<tr>
<td>base+activities</td>
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<td>-15</td>
</tr>
<tr>
<td>base+shoreline</td>
<td>2455</td>
<td>-15</td>
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<tr>
<td>base+racks</td>
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<td>base+shorebirds</td>
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<tr>
<td>Multivariate</td>
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<td>base+planes+activities+gulls</td>
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<td>base+tending+racks</td>
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<tr>
<td>global model (all variables)</td>
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<td>base+shorebirds+planes</td>
<td>2502</td>
<td>-62</td>
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<tr>
<td>base+shorebirds+gulls</td>
<td>2502</td>
<td>-62</td>
</tr>
<tr>
<td>base+shorebirds+racks</td>
<td>2506</td>
<td>-66</td>
</tr>
<tr>
<td>base+racks+shoreline</td>
<td>2518</td>
<td>-78</td>
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</table>
Clear impacts of tide and tending on REKN abundance

*Note: gulls also had a credible interval straddling zero

Model: Base + tending + planes + activities

Effect Size

-14 -12 -10 -8 -6 -4 -2 0 2 4 6 8

High Tide Rising Tide Low Tide Falling tide Presence of activities Presence of planes Presence of tending Wind

Summary of Year 1 Results

RED KNOT FORAGING RATE: No clear results after 1 year

RED KNOT ABUNDANCE:

- clear influence of tidal stage and oyster tending
  - rising tide attracts more birds, disperse on falling tide
  - tending has a negative effect – associated with falling tide

- tide appears to have a more significant influence, relative to tending activities

- banner planes appear to negatively affect red knot abundance (measureable uncertainty)

- no detectable trends regarding the influence of untended racks

FUTURE STEPS

- collect an additional 2 years of data
- modify protocols to target the influence of racks

*
How are the knots doing?

Red knots seem to thrive during Delaware Bay stopover

New evidence suggests Delaware Bay may be one of many coastal stopping points for the red knot, a Robin-sized shorebird that has made the lower estuary a seasonal tourist destination.

But researchers still maintain that Delaware Bay is the critical link in the spring migration and horseshoe crab eggs -- the preferred diet along the Delaware Bay -- are vital to the health of the population.

"Delaware Bay is the epicenter of red knots now but a lot of us think they used to spread out up and down the coast," said Barry Troutt, retired chief conservation scientist at the Virginia Coast Reserve of the Nature Conservancy. Troutt studied the birds as they migrated through the barrier islands along the eastern shore of Virginia for more than a decade.

The birds, listed in January as a threatened species, seemed to thrive on their Delaware Bay stopover this spring with 74 percent weighing in at 180 grams or more prior to their migration to Arctic breeding grounds, said Gregory Breese, Supervisory Fish and Wildlife Biologist with the Delaware Bay Estuary Project. The 180-gram weight is the benchmark for peak breeding success.

"It seemed like a great year," he said.
Moving Forward

• Fishery management
  o Annually funded in NJ and DE

• Habitat Enhancement
  o Continuing to pursue shell planting options
  o Shell recycling programs building – PDE and TNC leaders
  o Living shoreline work continuing with partners

• Outreach
  o PORTS and LS work continues to reach many people

• Aquaculture development and conflicts
  o Delaware seems to have stalled due to user conflicts – focused on inland bays
  o NJ red knot research continues with Sea Grant support
    - Yr 1 follow up monitoring to prelim study just completed. 3rd yr funded
  o Received NOAA S-K funding to help develop deep water oyster aquaculture methods to revitalize production on leases
  o Planning technical workshop on status of HSC and Shore Birds in Delaware Bay, including interaction with oyster aquaculture
    - Could be useful to have a STAC brief that goes beyond single species, single interest needs for system as a whole