Seaweed (Macroalgae) Monitoring in Rehoboth Bay and Indian River Bay Delaware: May to September 2009

Presented by: Robin M. Tyler
March 26, 2009
Meeting of the Delaware Inland Bays STAC

Photo: Buzz Henifin
ACKNOWLEDGEMENTS

Funding: Center for the Inland Bays
DNREC

Project Team: Robin Tyler * DNREC, Water Resources
Chris Bason Center for the Inland Bays
Tom Greco Volunteer
Cathy Greco Volunteer
Jay Headman Volunteer
Buzz Henifin Volunteer
George Junkin Volunteer

* Principal Investigator
1) Why monitor seaweed?

2) Don’t we monitor enough factors already to determine how the Inland Bays are doing?
1) Seaweed can be a prominent factor influencing ecological character and health, and it is not accounted for in water testing.

2) Omitting seaweed from environmental monitoring may lead to a false interpretation of ecological character and health.
The Two Sides of Seaweed


Nuisance Ulva washed onshore in Rehoboth Bay, Delaware, Late 1990’s

Photo: Robin Tyler

Photo: Unknown
Objectives

1) Refine a **practical** seaweed sampling approach for the Inland Bays and similar shallow waters that can be used routinely over the long-term to track changes in type, distribution and abundance.

2) Compare current dominant seaweed types, distribution and abundance with previous studies.

3) Reset the baseline for seaweed dominant type, distribution and abundance at the onset of Pollution Control Strategy implementation.
Three dominant genera of seaweed in Indian River Bay and Rehoboth Bay, Delaware

- Ulva
- Agardhiella
- Gracilaria

Photo: Robin Tyler
Ceramium – The Black Algae

Photo: Chris Bason
## General Taxonomy Terms

<table>
<thead>
<tr>
<th>Type</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finely Bushy Red Seaweeds</td>
<td>Ceramium</td>
</tr>
<tr>
<td>Coarsely Bush Red Seaweeds</td>
<td>Agardhiella</td>
</tr>
<tr>
<td></td>
<td>Gracilaria</td>
</tr>
<tr>
<td>Green Seaweeds</td>
<td>Ulva</td>
</tr>
</tbody>
</table>

Methods

Seaweed collected using a small grappling hook

Total wet volume measured in sieve bucket, sorted and % composition estimated visually

Photos: Robin Tyler
Seaweed sampling method for density. Comparison of grappling hook vs. square meter quadrat.

Photos: Carisa Larson
Macroalgae Sampling Method for Density
Comparison of Hook vs. Quadrat

<table>
<thead>
<tr>
<th>Light – Moderate</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – &lt;8 L m⁻²</td>
<td>&gt;3 - &lt;8 L m⁻²</td>
<td>&gt;8 L m⁻²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hook</th>
<th>Quadrat</th>
<th>Hook</th>
<th>Quadrat</th>
<th>Hook</th>
<th>Quadrat</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>1.5</td>
<td>6</td>
<td>5</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

P = 0.394

P = 0.143

P = 0.001
Random generation of potential sampling sites.
Results
Main Findings

1) The dominant seaweed was Ceramium in 2009 as compared to a dominant mix of Agardhiella, Gracilaria and Ulva in 1999.

2) Overall, there appeared to be less seaweed in both bays in 2009 as compared to 1999.

3) In 2009 seaweed was light to absent over the entire summer in areas of both bays, whereas in 1999 it was heavy at some time during the summer.
113 total samples, 66 samples (58%) had < 1 liter of algae.
Distribution for all seaweed samples collected during 2009. N = 113
Analysis includes samples with algal volume ≥ 1 liter
N = 47 samples

Dominant seaweed type in sample
Sites 8 and 9
Site 3
Discussion
Main Findings

1) The dominant seaweed in 2009 was Ceramium as compared to a dominant mix of Agardhiella, Gracilaria and Ulva in 1999.

2) Overall, there appeared to be less seaweed in both bays in 2009 as compared to 1999.

3) In 2009 seaweed was light to absent over the entire summer in some areas of both bays, where in 1999 it was heavy there at some time during the summer.
Worldwide Issue

Delaware - Inland Bays

China - Qingdao

France - Brittany Coast
France - SAINT-MICHEL-EN-GREVE, Brittany Coast

Source: Google Search – Seaweed Brittany Coast
Almost 100 places in Brittany have toxic seaweed

More beaches could be shut in northwestern France due to health fears over toxic seaweed, conservationists warned on Monday, after it emerged that algae have spread to almost 100 sites in Brittany.

The places under threat include some of the area's most popular resorts.

French Prime Minister Francois Fillon has announced his government will pay for cleaning French beaches polluted by a toxic seaweed.

Seaweed suspected in French death …driver died in July after carrying three truckloads of sea lettuce away from the beaches where it has been decaying, releasing poisonous gas.

……a horse-rider was rendered unconscious and his mount died after slipping on the algae late last month, apparently after inhaling toxic gas released by the rotting seaweed.
Meanwhile

Behind the scenes at the 2008 Summer Olympics

Source: Google Search of China and seaweed
Source: Google Search of China and seaweed
Algae encroaches on Chinese waters ahead of Olympics

China's efforts to offer a "greener" Summer Olympics in Beijing has taken on a whole new meaning, as the sea where the Games' sailing events will be held has been overrun by algae.

About 10,000 volunteers are scooping up the green goo by hand in Qingdao, a port town on China's east coast, while the army has deployed hundreds of soldiers to do the same. More than 1,000 fishing and other vessels are collecting the thick algae with nets, in hopes of clearing the area of algae by July 15.

Already, 155 tonnes have been hauled away

Some Chinese officials and experts have blamed warmer seas, winds from the south and an "exotic" strain of algae from farther down the coast for the algae. Others suggest it is a result of pollution, which deposits excessive nutrients in the water and causes algae to grow at abnormal rates.

It was first detected in May and is so thick and ropey that one member of the U.S. sailing team said she and her teammates think of it as land.

Source: Google Search – Seaweed China
Red Algae Crisis - - What Do We Do Now?

City of Sanibel, Florida
Rhode Island – Newport

Turning the tide on seaweed
Newport hopes 9-ton vehicle can clean up beach, bring crowds back

It has long been an unsightly red stain on this world-renowned headland of exclusive yacht clubs, oceanfront mansions, and immaculate tennis lawns.

For decades, Newport has mulled ways to get rid of the seaweed.

The red stuff is actually several kinds of algae, including Ceramium, Polysiphonia, and Chondrus Crispus,

“Over the course of the season it just gets horrible,” said the city manager
Questions Going Forward

1) Can the Citizen Monitoring Program add the “hook” method of seaweed sampling to its' current group of monitoring activities. This type of sampling is not a good fit for the existing State water monitoring program.

2) Is the apparent shift in seaweed dominance from a mix of Agardhiella, Gracilaria and Ulva in 1999 to Ceramium in 2009 real, or an anomaly that will reverse itself in the near future?

3) If Ceramium is to be the dominant alga of the future how does it rate as habitat and nuisance versus previous dominants.

4) Is the apparent reduction in overall seaweed abundance real and if so what are the reasons for the decline?

5) Why has all seaweed declined so much in northern Rehoboth Bay and western Indian River Bay.
Recommendation

Monitor seaweed (type and volume) at selected sites multiple times per year between May and September. This may prove to be an essential indicator of system response to ongoing pollution abatement efforts.

Photo: Robin Tyler