Valuing Ecosystem Services of Shellfish Aquaculture—What’s Next For the NW

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Ecosystem services related to shellfish
Estimating monetary values
Why value ecosystem services?
Current NOAA project finding
What’s next for the NW?
Shellfish Ecosystem Services

- Water filtration
- Reduced eutrophication
- Biosequestration
- Habitat for other organisms
Shellfish & Carbon Uptake

\[ \text{CO}_2 \rightarrow \text{HCO}_3^- + \text{H}^+ \rightarrow \text{CaCO}_3 \]

Shell formation

12% C (in shell)
~8% C (total weight)
Shellfish & Nitrogen Cycling

- Phytoplankton, other microbiota, and detritus
- Excretion and resuspension
- Filter feeding
- Excretion and burial in sediments
- Removal through harvest

Diagram shows the cycling of nitrogen through shellfish and the ecological processes involved.
Why value these services?

- Demonstrate the positive environmental impacts of shellfish production
- Better understand the benefits of shellfish restoration
- Eventual payments for
  - Nutrient trading credits
  - Carbon offset credits
N concentrations in tissue were analyzed by EXOVA (Portland, OR) using the Kjeldahl Method

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Mean % nitrogen concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific oyster C. gigas</td>
<td>Henderson Inlet</td>
<td>0.95%</td>
</tr>
<tr>
<td>Manila clam V. philippinarum</td>
<td>Oakland Bay</td>
<td>0.95%</td>
</tr>
</tbody>
</table>

n=80 animals per spp, per location
Std dev= 0.08
Consistent with Rice 2001, Ojea et al. 2004, Linehan et al. 1999
Shellfish harvest records (2000-2008) average 2,578,700 lbs/yr shellfish harvested in Oakland Bay

\[ 2,578,700 \times 1\% = 25,787 \text{ lbs N/yr removed} \]

= 19\% of Oakland Bay’s annual DIN load from sewage
Based on the City of Shelton WWTP 2010 upgrade of N removal technology (NRT) to 10.0 mg/L:

- $25,787 \text{ lbs N/yr} \times \$2.99/\text{lb life cycle cost of NRT}
  
  \textit{capital costs only}

= $77,100 \text{ annual water quality benefit}
Based LOTT’s (Lacey Olympia Tumwater Thurston County) 2017 upgrade of N removal technology (NRT) from 4.0 to 2.25 mg/L:

\[
25,787 \text{ lbs N/yr} \\
\times \\
$25.24/\text{lb life cycle cost of NRT} \\
\text{capital costs only} \\
= \\
$650,863 \text{ annual water quality benefit}
\]
Nitrogen removal capacity is substantial

Just one bay in south Puget Sound provides a $77K to $650K annual benefit from shellfish harvest alone
There is tremendous potential to demonstrate ecosystem services provided by shellfish \textit{but}.

Basic production data for shellfish aquaculture is still lacking, esp. in Washington State.
There is tremendous potential to demonstrate the economic impacts of shellfish aquaculture but again.

Basic production data and economic data for shellfish aquaculture is needed.
What’s Next?

- PSI, partnered with Northern Economics, received funding to expand research
- Survey existing aquaculture operations in WA, OR and CA
  - Revenue and expenditures
  - Shellfish production
  - Barriers to entry for the West Coast industry
Develop a production function and related Input-Output model (I/O) for WA, OR & CA shellfish industries

I/O models depicts inter-industry relations of a regional economy (output of one industry inputs to another)
Information gathered through these NOAA funded research projects will provide tools to support the continuation of sustainable shellfish aquaculture.

Findings could also inform marine spatial planning on the West Coast.
Thank you!

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