SHORELINE ARMORING

Erosion control practices using hard structures (e.g., concrete or wood walls, or rock riprap) that stabilize the shore and the bank or bluff behind it.

Juvenile Salmon
Chinook emphasis
(Oncorhynchus tshawytscha)
Monitor:
• Densities
• Feeding
• Invertebrate prey
Improving habitat within human-use constrains

CHAPTER 21

Benches, Beaches, and Bumps
How Habitat Monitoring and Experimental Science Can Inform Urban Seawall Design

Jeffery R. Cordell, Jason D. Toft, Stuart H. Munsch, and Maureen Goff

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21.1 BACKGROUND

On February 8, 2001, Washington State experienced one of its largest recorded earthquakes, measuring 6.8 on the moment magnitude scale and lasting approximately 45 s. In Washington’s largest city, Seattle, a 100-ft-long by 10-ft-wide section of a surface street adjacent to the shoreline settled, raising concerns about the condition of the city’s seawall. Further assessment of the 71-year-old structure showed it to be in worse shape than expected; in addition to the effects of aging, the wooden foundation of the seawall was deteriorating because of the activities of wood-boring invertebrates. Over the next 10 years, the seawall continued to deteriorate despite regular maintenance, and it became evident that it needed to be replaced. Replacement of the seawall presented an opportunity to explore designs for improving the habitat conditions of the structure and its surroundings, and the city formed an interdepartmental team to focus on habitat enhancements that could be incorporated into the seawall design. A series of meetings were conducted, which included scientists from the University of Washington, local environmental consultants, and city engineers and environmental planners. These meetings resulted in habitat enhancement concepts developed and employed in Seattle’s new seawall. In this chapter, we review habitat impacts of seawalls and how these impacts can be mitigated and present a case study of Seattle’s seawall habitat improvements.
Restoration Trajectories

Things take time - meta-analysis of pre-post restoration data of 5 biotic measures at 6 sites in Puget Sound

Research & management opportunity: Reconstruction of a highly modified shoreline

1934 2014

- 2001 Nisqually Earthquake damaged the Elliott Bay seawall
- Waterfront needed reconstruction
  - Do armoring and overwater structures impair fish habitat?
  - Can we improve habitat along a highly modified waterfront?
- Elliott Bay has become a focal system for research examining effects of shoreline modifications on fish ecology
Monitoring of the New Seattle Seawall

Initiated this March 2018, post-construction of Phase 1 seawall rebuild (~1km):

- Fish – snorkel, SCUBA, DIDSON hydroacoustic camera
- Mobile invertebrates – epibenthic pump
- Sessile invertebrates and algae - quadrats
- Light – Photosynthetically Active Radiation

May 18, 2017

Seattle seawall’s novel fish features are a potential model for the world

Michelle Ma
UW News

A segment of the new Seattle seawall. The sidewalk’s light-penetrating glass panels let light through to the water below to encourage young salmon to migrate along the engineered shoreline. SDOT/Flickr
Juvenile Chum – feeding along new seawall, underneath a pier with light panels
Preliminary results – encouraging!

• Improvements in juvenile salmon presence and feeding than before habitat enhancements.

• Fish predators on juvenile salmon extremely rare.

• Lots of bull kelp on areas with extended habitat bench – fringe benefits.

* More to come – 1\textsuperscript{st} of 2 year funding with graduate students. Proposed 10-yr monitoring plan.

<table>
<thead>
<tr>
<th>Strata</th>
<th>Feeding %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Seawall</td>
<td>28%</td>
</tr>
<tr>
<td>Under Pier</td>
<td>24%</td>
</tr>
<tr>
<td>OSP Pocket Beach</td>
<td>29%</td>
</tr>
<tr>
<td>OSP Habitat Bench</td>
<td>32%</td>
</tr>
</tbody>
</table>
The 1-slide summary

• Gradual slope better than steep slopes

• Minimize artificial shading

• Increase aquatic-terrestrial connections (armoring cuts-off)

• Monitor new ideas to measure how they work (before-after, other sites)
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Dara Yiu, Alex Sawyer,
Arielle Tonus Ellis

Further info on seawall design and construction:
https://waterfrontseattle.org/seawall

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