Adding Texture and Relief to Seattle's New Seawall, an Application of Ecological Engineering

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Habitat Enhancements in Seattle’s Seawall—Ecological Engineering and Adaptive Management

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Seattle Seawall

- Seawall was built in 1930’s to create a deep-water port.
- This transformed a sloping beach to a vertical wall
- Few shallow areas remain within the Seattle waterfront area
- 2001 Nisqually earthquake caused a 100-foot section of the seawall to settle, and inspections showed that it was in disrepair and needed to be rebuilt
Shoreline Salmon

- Migratory corridor & rearing habitat for juvenile salmon
- Green River and Duwamish populations
  - Pink, Chum, and ESA listed Chinook salmon outmigrate along Seattle’s waterfront
  - City of Seattle sponsored UW research found:
    - Juvenile salmon were abundant very close to the seawall
    - Their diets were linked to intertidal
Habitat Enhancement

- New seawall
- Intertidal corridor
- Lighting
- Riparian vegetation
- Textured wall
- Substrate enhancement
- Cobble reefs
Olympic Sculpture Park habitat enhancement: replaced shoreline armoring with a beach and a habitat bench

- Habitat bench resulted in enhanced juvenile salmon densities, increased chum salmon feeding rates, increased invertebrates
- Pocket Beach resulted in increased larval fish, Chinook feeding rates, some invertebrate taxa

Textured Seawalls

3 Sites

3 panel designs, each with 2 surface treatments; plus Reference and Control

Clay St.

Vine St.

Aquarium
Mussels
- Early high recruitment of mussels on cobble surfaces
- After four years, mussel populations had increased greatly on most of the panel types as compared to the pre-existing seawall surface.

Rockweed
- Rockweed favored the higher relief of the finned and stepped panels, regardless of whether or not they had the cobble texture.

Epibenthic Invertebrates
- Small invertebrates favored by juvenile salmon had higher species diversity on the stepped and finned panels.
Outcome

Engineered habitat enhancements—addition of habitat benches, beaches and textured walls—are being added to Seattle’s seawall to improve ecology of the intertidal zone.

- **Desired Results:**
  - Increased diversity and abundances
    - Epibenthic organisms (harpacticoid copepods)
    - Sessile Organisms
  - Benefits for juvenile salmon
    - Outmigration corridor
    - Feeding opportunities
Adaptation of Habitat Plan—Addition of Light

• The seawall rebuild will pull the seawall back 10-15 feet, but the sidewalk will stay where it is, shading the habitat.
• Juvenile salmon do not like to cross shadow lines, and are uncommon in shaded habitat under piers.*
• Salmon do not feed under piers, and little is known about how much light they require to feed.*
• Shaded habitats do not produce algae and invertebrates that comprise the food web.

Juvenile Chinook salmon feeding
Light Penetrating Surfaces

Metal Grating

Glass Panels

Solar Tube
Light Penetration Under Glass Panels

The graph illustrates the photosynthetically active radiation (PAIR) as a function of water depth for different conditions: Ambient, Glass Blocks, and Glass Blocks Control. As the water depth increases, the PAIR decreases significantly, indicating reduced light penetration under glass panels.
Recommendations

• Post construction monitoring, as per the 10-year monitoring and adaptive management plan
• Prolonged salmon observations under piers using cameras
• Quantifying light levels under & adjacent to piers under a variety of weather conditions and throughout salmon presence window
• Effects of LPS on invertebrate communities