Eelgrass Preservation and Restoration in Ship Traffic Areas

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Purpose

- Review potential vessel impacts to eelgrass
- Present some examples of ways to avoid, minimize and compensate for damage
Potential Impacts from Vessels

- Direct vessel prop and hull scour
  - Jet skis, small and large vessels in Florida
- Propeller wash
  - Ferry boats in Puget Sound
- Vessel wakes
  - Fast ferries in Puget Sound
  - Large container vessels
Eelgrass (Zostera marina) Biology and Ecology

- One of about 60 species of seagrass (rooted angiosperms that grow in the sea)
- Z. marina is most widespread species
- Grows in dense meadows in shallow water in protected marine and estuarine areas

Functions:
- Primary productivity
- Directly eaten
- Detritus export
- Refuge from predation
- Reproduction habitat
- Prey production
- Shoreline stabilization
Mechanisms of Impacts

- Fragmentation of plants
- Erosion on surface fine material (organic and inorganic material on plants and on sediment)
- Erosion of sediments, and exposure of rhizomes and roots
- Erosion of plants
- Deposition and burial
- Reduction in light
Eelgrass Conceptual Model

Controlling Factors → Structure → Functions

- Light
  (3M PAR/day)
- Temperature
  (7-13 deg C)
- Salinity
  (10-30 ppt)
- Substrata
  (sand-mud)
- Nutrients
  (mod. soil; low water col.)
- Water Motion
  (3m/sec tidal; 80 cm/sec. burst)

Eelgrass Biomass and Associated Community

- Carbon Export
- Fisheries Resources
- Shoreline Stabilization
Erosion/Deposition Zone
Large Vessel Wake

Scalloped edge

Exposed Rhizomes
Role of Light

- **Controls growth**
- **Controls distribution**
- **Frequent reduction can affect eelgrass**
Eelgrass Flume Studies

(A) Plants Lost or Exposed (%)

(B) Velocity (cm s⁻¹)

y = 131.890\log(x) - 247.693

r = 0.974
18m from propellers

41m from propellers
Field Studies of Propeller Wash

Mean Bottom Current Velocity (cm/s) vs Distance (m) from Tyee

Propeller speed:
- 0 rpm
- 550 rpm
- 750 rpm
- 1000 rpm

Distance (m) from Tyee

Mean Bottom Current Velocity (cm/s)
Bottom Velocity, Turbidity and PAR
Mechanisms for Minimization and Recovery

- Remove or reduce source of disturbance below a threshold expected to cause problem
  - Set back zone
  - Reorient slips
  - Reroute ships
  - Establish and enforce best management practices

- Natural Recovery Processes
  - Flowering and seed deposition
  - Rhizome spread
  - Drift fragments

- Restoration
  - Adult plantings
  - Seed plantings
Oakland Middle Harbor Mudflat/Eelgrass Restoration

Adaptive Measures

• Incremental fill-settlement cycle

• Test planting of eelgrass

• Adjustable openings to maintain water quality

~185 acres
Eelgrass Restoration

- Mean shoot density over all plots close to performance criterion by 2002.
- Highly variable reference density tracked generally by planting plot density.
- Large increase over time in reference density an issue.

Performance Criterion (PC)

(77.0% of Ref.; 94.4% of PC)
Contact Information

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