Assessment of nutrient, metal, and organic contaminant concentrations in eelgrass (Zostera marina L.) in Puget Sound, WA (USA)

Jeff Gaeckle
Washington State Department of Natural Resources, jeff.gaeckle@dnr.wa.gov

Follow this and additional works at: https://cedar.wwu.edu/ssec

Part of the Fresh Water Studies Commons, Marine Biology Commons, and the Natural Resources and Conservation Commons


This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Salish Sea Ecosystem Conference by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.
Assessment of nutrient, metal, and organic contaminant concentrations in eelgrass (Zostera marina L.) in Puget Sound, WA

Jeffrey Gaeckle
Nearshore Habitat Program
Washington State Department of Natural Resources

Salish Sea Ecosystem Conference
13 April 2016
• DNR manages land and resources throughout the state

• Eelgrass is an embedded resource that has important ecosystem values
Toxicity Pathways in Seagrass Meadows

CONTAMINANT TROPHIC TRANSFER (GRAZING)
- Planktonic Herbivores
- Epibenthic Meio-Macrofauna
- Infaunal Meio-Macrofauna

MODIFYING FACTORS
- Temperature
- Irradiance
- Nutrients
- Salinity

DRIFT and EXPORT

CONTAMINANT TOXICITY and BIOACCUMULATION (Blades, Epiphytes, and Grazers)

MODIFYING FACTORS
- Dissolved Oxygen
- Sulphide Concentrations
- Total Organic Carbon

SEDIMENT TOXICITY and CONTAMINANT BIOACCUMULATION (Rhizome, Roots, Epibenthic and Infaunal Species)

LITTER DECOMPOSITION

(Lewis & Devereux 2009)
Trace elements and oil related contaminants (1988)

- Document background levels in sediment, bivalves and eelgrass in the event of an oil spill

- Higher PAH levels in eelgrass were observed at sites closest to the oil refinery infrastructure
  - PAHs: 0.05 – 0.17 µg gww⁻¹

- Higher arsenic levels associated with the March Point Landfill
  - Arsenic: 2-8 µg gdw⁻¹
Project Objectives

• Baseline assessment of nutrients, metals, and organic contaminants in eelgrass (Zostera marina) throughout Puget Sound
  – Spatial distribution
  – Proximity to outfalls
  – Co-locate with Mussel Watch sites
Site Selection

- Spatially distributed
- Impacted and pristine areas
- Access (safety at night)
- Permission
- Assistance
- Co-location with other research
  - eelgrass (USFW 1994)
  - mussels (Lanksbury et al. 2012)
Methods

- %C, %N, δ^{13}C, δ^{15}N
- As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, V, Zn,
- PAHs, PCBs, PBDE, DDT
- %N = 4% (1-5%)
- %C = 37% (28-43%)

- Relatively low C:N ratios (< 20, median for global seagrass) suggest high nutrient availability
Arсеній

- найвищий в гідросфірі біомасі в Падилла Бей
- найвищий в грунтовій біомасі в Томпсон Спіт
Copper

- highest in above- and belowground biomass at 4-Mile Rock
Nickel

- highest in above- and belowground biomass Cypress Island
PAHs

- highest PAHs measured in the aboveground biomass at 4-Mile Rock.
PCBs and PBDEs

- Total PCBs
- Total PBDEs

Concentration (ng gww⁻¹ ±SE)

LIPIDS

Percent Lipids (%)

Map of Washington state with locations marked.

Source: Washington State Department of Natural Resources

www.dnr.wa.gov
• Research threshold effect of concentrations under environmental conditions similar to Puget Sound
  – evidence that concentrations of certain metals affect physiological process
  – mesocosm study
  – field component along a gradient

• Explore the potential of nutrient, metal, and organic contaminant cycling (aboveground tissue) and storage (belowground tissue)
Partners and Volunteers

Nearshore Habitat Program
• Helen Berry
• Lisa Ferrier
• Kate Sherman
• Fred Short
• Andrew Ryan
• Jessica Demetro-Stowe
• Kiri Kreamer

Aquatic Reserves Program
• Kyle Murphy
• Mike Grilliot

WDFW
• Jennifer Lanksbury
• Laurie Niewolny
• Jim West

Laboratories
• Gina Ylitalo (NOAA-Montlake Lab)
• Katherine Bourbonais (KCEL)
• Connie Harrington (USFS)
• Ben Harlow (WSU)

Site Contacts and Assistance
• Puget Sound Corps (WCC team, Birch Bay, Cypress Island, Anderson Island)
• Port of Orcas Island Airport (Orcas Island)
• FHL, Pema Kitaeff and divers (Orcas Island)
• Padilla Bay NERR (D. Bulthuis & H. Bohlmann, Padilla Bay)
• Megan Black (Thompson Spit)
• Al Bahl (Big Gulch Wastewater Treatment Facility, Big Gulch)
• Lincoln Lohr (Big Gulch)
• Seattle Parks and Recreation (Barbara DeCaro, 4-Mile Rock)
• Arlene Bac and Holly White (Holly)
• Cathy Short (Holly)
• Archdiocese of Seattle (Dumas Bay)
• Neifert Family (Anderson Island)

Funding provided by WDFW-DNR Puget Sound Marine and Nearshore Protection and Restoration Program. This project received funding from the EPA under an agreement with WDFW. The contents do not necessarily reflect the views and policies of the EPA. Mention of trade names or commercial products does not reflect endorsement.