Molecular Markers and Stable Isotopes as Indicators of the Paleo-Occurrence of Eelgrass (Z. marina) in Westcott Bay, San Juan Islands, WA

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INTRODUCTION and STUDY AREA

Z. marina (eelgrass) is valuable marine resource that provides critical habitat for a number of marine and invertebrate animals, including juvenile salmon (Oncorhynchus spp.), Dungeness crab (Cancer productus) and various fish. A recent (2003) widespread loss of juvenile salmon, Pacific herring, and Dungeness crab in the Puget Sound system indicated a significant loss of habitat for a number of marine and estuarine animals, including eelgrass (Z. marina). Molecular markers and stable isotopes were used to develop and apply a multi-index technique for the paleo-detection of Z. marina in Westcott Bay, San Juan Islands, WA.

APPROACH AND STRATEGY

The goal was to develop a diagnostic chemical signature for Z. marina to measure the spatial and temporal occurrence of eelgrass in sediment cores. We developed and applied a multi-index technique using molecular biomarkers and stable isotopes. We found that specific sediment core location in Westcott Bay.

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3. n-ALKANES IN EELGRASS

n-alkanes in pure eelgrass with an odd predominance in the carbon number preference and a peak at C29, being 50% derived from eelgrass.

4. TYPICAL n-ALKANE DISTRIBUTIONS

Strong terrestrial component, marked by strong odd over even predominance in the range C27 - C40. Strong macrophtye input, marked by no odd over even predominance in the range C21 - C27. Strong algal input, marked by bell shaped pattern centered within the range C19 - C21 and a strong terrestrial input as well.

5. PLANT STEROLS

Sterols are not necessary but diagnostic component of eelgrass except in the absence of terrestrial material.

6. LIGNIN PHENOLS IN EELGRASS

Lignin phenol ratios (S/V, CV) provide information on sources of lignin to the sediments. Lignin from eelgrass contains very low levels of syringyl phenols (S/V < 0.02). The p-hydroxy/Vanillyl (P/V) ratio provides information on algal versus vascular plant contributions to the sedimentary organic matter.

7. LIGNIN PHENOLS IN WESTCOTT BAY SEDIMENT

Lignin phenol ratios (S/V, CV) as proxies for eelgrass abundance the higher-plant sterols: campesterol, in combination with the lignin phenols are good indicators of eelgrass.

8. ELEMENTAL & ISOTOPIC CONTENT OF WESTCOTT BAY SEDIMENT

Elemental Ratio of Organic Matter

The relationship between the C/N ratio of the sediments and the Redfield ratio (N/C3 plants) for C3 plants is strong, indicating that the C/N is derived from a mixture of eelgrass and algae. Using the lower end of the algal range, the C/N for Padilla Bay is ~40% derived from eelgrass whereas the C/N from Westcott Bay is ~30% derived from algae.

CONCLUSIONS

CIRMS can be utilized to de-convolute confounding concentrations of LMW n-alkanes possibly derived from an algal source because Z. marina is a C3 type plant with some C4 characteristics such as 13C-enriched n-alkanes.