tested for the presence of ciguatoxins to compare the frequency of occurrence of ciguatoxin in fish caught in west versus east Hawaii to determine if leeward fish are differentially exposed to ciguatoxins versus windward fish. Dinoflagellate distribution data will be compared with fish toxicity and dissolved nutrient data to examine the potential role that water quality may play in ciguatera outbreaks on the Big Island.

OS22A-165 1330h POSTER

A Treatice on the Abundance and Turnover of Transparent Exopolymer Particles (TEP) in Puget Sound, Washington

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The objectives of this study were to determine the relationship between phytoplankton productivity and TEP production in the Main Basin and Hood Canal of Puget Sound. Chlorophyll and TEP samples were taken at three depths, including the chlorophyll maximum, and four day long incubations were constructed with seawater from the chlorophyll maximum at one Hood Canal and one Main Basin station. TEP concentrations were determined spectrophotometrically using an alcian blue stain. Phytoplankton productivity was measured using 14C incubations to quantify TEP production with respect to phytoplankton productivity. A positive correlation between TEP concentration and productivity was observed in Main Basin incubations where the dominant plankton were diatoms. However, in Hood Canal incubations no correlation between TEP and phytoplankton productivity was observed. TEP concentrations measured in the Main Basin were significantly lower then expected ranging from 21.8 g xanthan equivalents per liter to 76.4 g xanthan equivalents per liter. Single cells of Phaeocystis were dominant in Hood Canal and are known to produce larger amounts of carbohydrates. Higher TEP concentrations were therefore measured in Hood Canal incubations, up to 1579 g xanthan equivalents per liter. Relating TEP production and abundance to productivity, chlorophyll a, and phytoplankton abundances will increase our understanding of the timing and mechanisms involved in TEP interactions, aggregation, and sedimentation.

URL: http://students.washington.edu/jsatterb

OS22A-166 1330h POSTER

Phototactic Behavior of Marine and Freshwater Copepods as Influenced by Habitat and Light Quality

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Marine and freshwater zooplankton exhibit similar phototactic behaviors despite fundamental physical differences between their respective habitats. These behaviors stem from a common physiology as well as analogous challenges regarding predator avoidance and foraging. This study examines the phototactic behavior of the freshwater copepod *Diaptomus* and the marine copepod *Acartia* across a range of specific light wavelengths of equal intensity. Organisms were placed into small vessels, through which a light beam of specific wavelength was projected. Using a high-resolution video system, we then observed and recorded the position and activity of the copepods in response to each light treatment. Data were analyzed to compare the interspecific behavioral responses to different wavelengths, and to identify overarching intraspecific variation. Results show variations in phototaxis within each species in response to different light treatments, and marked differences in activity levels between *Diaptomus* and *Acartia*. In addition, our results suggest that species specific responses may also be influenced by the light regime that characterize its habitat.

OS22A-167 1330h POSTER

Investigations Into the Phototactic Behaviors of Marine and Freshwater Mysids.

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The phototactic behaviors of zooplankton can have far-reaching effects with respect to the trophic dynamics of both freshwater and marine aquatic systems. The light regimes in freshwater and marine systems also differ due to differences in the physical characteristics of each locale, potentially influencing the way organisms react to stimuli. The purpose of this project was to investigate the effect that varying light regimes have on the behavioral responses of mysid shrimp. For our study, we observed *Mysidopsis bahia*, a marine mysid found in most coral reefs in the Caribbean Sea, and *Mysis relicta*, a freshwater mysid characteristic of many lakes in the northern United States and southern Canada. Specimens were placed in an observation vessel and exposed to a beam of light of a specific wavelength and intensity. Behavioral responses of the mysids were monitored using a high-resolution camera and a high-resolution monitor, and were recorded on a VCR for subsequent analysis. There were distinct differences in type of response to the various wavelengths tested within each species, and those responses differed when compared to the other species. Our results suggest that the natural light regime in each species' respective habitats may influence phototactic behavioral patterns.

OS22A-168 1330h POSTER

Status and Biogeochemical Impact of the Aimakapa Hawaiian Fishpond

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Aimakapa fishponds is of several large coastal ponds in the Koloko-Honokohau National Historical Park on the west side, or "Kona", coast of the island of Hawaii. This pond is part of an extensive anchialine system of ponds, usually having no direct connection to coastal waters, but showing measurable salinity and tidal rhythms. Aimakapa fishpond has served as a useful fish-producing system up until the 1960s but has fallen into disuse, and may be becoming increasingly eutrophic. Aimakapa currently has no opening ('auwau kai) to the sea, and has become heavily silted and infilled. The Aimakapa system, however, does provide a relatively-protected habitat for many endangered waterbirds, such as the Hawaiian stilt and the Hawaiian coot. In cooperation with the National Park Service we have begun an examination of the biogeochemistry of the waters and sediments of this ecosystem, to understand the current- and projected-impacts this system may have on local coastal coral reef ecosystems, should it be restored to full use. We are also assessing the overall inorganic nutrient levels, their fluxes, and their sources, in order to assess the relative impact of planned and existing industrial developments near the Park, as well as to understand the biogeochemical function of this ancient ecosystem. The sediments within Aimakapa are anoxic and may harbor harmful anaerobic microorganisms such as Clostridium botulinum. We have examined Aimakapa in a series of inland-shore (mauka-to-makai) sampling transects for pond water and sediment. Our preliminary data indicates the system has lower salinity (approximately 11 ppt.) on the bottom of the ponds than that of the surface waters (approximately 13 ppt.), consistent with the anchialine flow component. We will present our cross-pond interstitial water inorganic nutrient profiles and estimates both of diffusive and advective fluxes of inorganic nutrients.

OS22A-169 1330h POSTER

Optical estimation of Phytoplankton and Sediment Transport in Morro Bay Estuary

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Morro Bay National Estuary, California has experienced an increase in sediment deposition resulting from land use changes in the surrounding watershed. An increase in suspended particles in the water and the resultant loss of the estuarys aerial extent has had a detrimental effect on the survival of benthic filter feeders and other invertebrates. Two possible explanations for sedimentation events are increased erosion from fresh water sources into the bay, and the transport of sediment from adjacent coastal waters. To assess sediment loading and primary production over an extended period of time under a variety of environmental conditions, moored instruments (HydroScat-6, CTD) took physical and optical measurements at forty-five minute intervals between October 2000 and May 2001. Discrete measurements were taken during optical sampling intervals and correlated with instrument data. Through observation and statistical validation between the differences of incoming and outgoing tidal components, this data set provides evidence for Morro Bay estuary as a net source for sedimentation (t-test, p=0.003) and a net sink for phytoplankton production (t-test, p=0.000). Despite Morro Bays national recognition, little work has been done to assess the loss of aerial extent of the estuary. Based on these results, assumptions can be made about possible terrestrial sources of sediment load and appropriate management practices.

OS22B HC: Hall III Tuesday 1330h

Interactions Between Macro- and Microorganisms in Aquatic Sediments III

Presiding: **R Haese,** Utrecht University**; E Kristensen,** Odense University**; J Kostka,** Florida State University

OS22B-170 1330h POSTER

Fluorescence of Pore Water Dissolved Organic Matter in Shallow Water Marine Carbonate Sediments as a Function of Seagrass Density

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Pore waters from shallow water carbonate sediments in the Bahamas were collected over a period of three years on a seasonal basis (winter and early summer) to examine the factors controlling sediment organic matter remineralization. Sediments at these sites range from bare ooitic sands to sediments underlying dense seagrass meadows (*Thalassia testudim*). In this study, pore water samples were analyzed for their fluorescence properties using EEMS (excitation - emission matrix spectroscopy) focusing on humic-like and protein-like peaks observed in such fluorescence spectra. Dissolved organic matter (DOM) fluorescence in shallow water carbonate pore waters showed an overall increase with depth over the upper 20 cm of sediment. This is similar to that seen in siliciclastic estuarine and shelf/slope break sediments. However, in the interval from the sediment-water interface to approximately 2 cm depth, only minor depth changes were observed in the shallow water carbonate pore waters relative to gradients deeper in the sediment. This may indicate the possible occurrence of advective mixing of pore waters and bottom waters in these surface sediments.

DOM fluorescence was observed to be a function of seagrass density at these sites. Sites with high seagrass density showed the largest fluorescence values, while sites with no seagrass (ooitic sands) showed the smallest fluorescence values. Furthermore, dense seagrass sites showed seasonal trends in DOM fluorescence, with winter samples having lower fluorescence values than summer samples. The fluorescence/DOC ratio was also lower in shallow water carbonate sediments as compared to siliciclastic estuarine and shelf/slope break sediments. Further examination of the data will involve using it in an attempt to differentiate between types of DOM present in the sediment pore waters (terrestrial versus marine) and examine the degradation and remineralization mechanisms affecting both DOM and total organic matter. We will also use the data to specifically examine the role of seagrasses in the cycling of DOM in these shallow water carbonate sediments.

OS22B-171 1330h POSTER

The Effect of the Mud Shrimp *Callianassa* on Sediment Permeability as measured by a Whole-tank Permeameter

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The mud shrimp *Callianassa* creates a deep burrow system (up to 40 cm) and is known for high excavation activity and sediment turnover. In order to quantify the effect of *Callianassa* bioturbation on nearshore sediment permeability, a laboratory mesocosm experiment was conducted with an aquarium functioning as the permeameter. The tank bottom, measuring .54m x .54m, was drilled with a one-half inch hole and connected to a calibrated reservoir by tubing. A drilled piece of plexiglas covered by a fine mesh was set above the tank bottom. The tank was filled with ∼30cm of muddy sand collected from Waveland Beach, Mississippi and an additional 30cm of water with a salinity of 6ppt. The substrate was allowed to settle and permeability measurements stabilized to average 6.68 x 10^{-4} cm/s. The tank was populated with shrimp collected from the same location at a density of 31 ind/m^2 26 days after the substrate was introduced. Three days after shrimp introduction permeability increased to 2.03 x 10^{-3} cm/s before peaking at 4.20 x 10^{-3} cm/s 14 days later, and subsequently stabilizing to an average permeability of 3.12 x 10^{-3} after 54 days. Bioturbation by the shrimp *Callianassa* has an almost immediate effect on sediment permeability, increasing measurements nearly an order of magnitude. Subsequent slight decreases in permeability is attributed to the degrading health of the shrimp colony after several weeks in the tank.

OS22B-172 1330h POSTER

Microscale Effects of Light on Redox Zonation in Seagrass Sediments

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Seagrass meadows are a primary structuring feature in many estuaries because of their ability to provide refuge for resident and transient fauna, trap and stabilize sediments, and mediate/regulate diagenetic reactions in sediments. This study focuses on the dynamic interactions between seagrasses and associated sediments and their impact on porewater chemistry. Microelectrode vertical profiling using a non-stripping, gold-mercury amalgam electrode made possible the observation of fine-scale (<1 mm) chemical changes, both spatial and temporal, for the major redox reactive elements O_2, Mn^{2+}, Fe^{2+}, and H_2S in sediments. Sediments vegetated with *Zostera marina* and nearby (<1 m) unvegetated sediments in Yaquina Bay, OR were analyzed to quantify differences in the vertical and horizontal distributions of the concentrations of these redox elements. Overall, profiles showed a distinct decrease in concentrations of sulfide and iron relative to dark conditions with exposure to light (200 μE/m^2/s). Conversely, concentrations of sulfide and iron increased under dark conditions.

The use of microelectrodes to produce approximately an order of magnitude better spatial resolution revealed differences in the chemical composition of porewater at this finer vertical scale. Furthermore, frequent differences in porewater chemistry of similar magnitude to vertical variability occurred between different profiles on the order of only a few centimeters apart and demonstrated that small-scale lateral heterogeneity also exists.

This study highlights the advantages in using data capable of such higher spatial and temporal variability when compared to the classical view that both are largely insignificant in a one-dimensional steady-state diagenetic model. A multi-dimensional model will be necessary for accurately describing processes occurring in sediments hosting seagrasses at the relevant spatial scale for biogeochemical processes.

OS22B-173 1330h POSTER

Burrow Ventilation by Thalassinid Shrimp From the Northern Gulf of Mexico: Mechanics of Effluent Plumes and Effects on Benthic Communities.

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Thalassinid shrimp are common members of soft-sediment intertidal habitats along the Northern Gulf of Mexico where burrow densities can reach 700 per m^2. Water contained within the burrow is enriched in inorganic nutrients (e.g. nitrogen, phosphorous, and silicate), and these nutrients may play an important role in benthic production if delivered to the surface sediment or overlying water column. However, very little is known about the temporal patterns of burrow ventilation or the fate of nutrients as they are pumped into the surface water.

To address these issues, we are examining the biomechanics of burrow ventilation and effluent plume formation for several coastal species in the lab and field. Castings of *Callichirus major* burrows reveal long (>10 cm) and narrow (approx. 0.4 cm) chimneys through which effluent must pass. This constriction represents a 25 to 50% reduction in burrow diameter, and may act as a nozzle to accelerate effluent away from the burrow opening. Preliminary lab measurements with the same species show highly variable pumping patterns, and effluent exit velocities of up to 10 cm/s. Investigations of effluent plume dynamics are planned for the near future, in addition to examinations of seasonal trends in ventilation and the effects of burrow effluent on benthic primary production.

OS22B-174 1330h POSTER

In Situ Two-Dimensional High-Resolution Profiling of Sulfide in Sediment Interstitial Waters

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Sulfide is a key constituent of most sediment interstitial waters. It is a toxicant to all aerobic organisms and is one of the major factors affecting the distribution of both aerobic and anaerobic organisms. Sulfide is also one of the major controls of the cycling, speciation, bioavailability, and toxicity of many trace elements. The distribution of sulfide in the sediment interstitial water thus provides important insights into a wide array of biogeochemical and biological processes in the sediments. Using an in situ profiling technique based on the diffusive-gradients-in-thin-films (DGT) methodology, we obtained two-dimensional microprofiles of sulfide in the sediment interstitial water in Delta Marsh (Manitoba, Canada), one of the largest lacustrine wetlands in North America. At a vertical and lateral resolution of 0.2 mm, the profiles revealed unprecedented two-dimensional heterogeneity of sulfide concentrations in the sediment interstitial waters. The mosaic distribution of oxic and sulfidic microenvironments suggests not only the significance of bioturbation and bioirrigation in controlling the biogeochemistry of a variety of elements in the sediments, but also the capability of aquatic organisms for coping with the sulfidic environment.

OS22B-175 1330h POSTER

Ammonia Assimilation in the Lucinid Clam *Codakia orbicularis*

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The family Lucinidae is one of the oldest and most common bivalve families, including 11 genera and almost 1,000 species. All adult Lucinids examined have an established nutritional symbiosis with intracellular chemoautotrophic, sulfur-oxidizing bacteria. This symbiotic relationship has enabled Lucinids to inhabit environments where other bivalve families are rare or non-existent due to low or unavailable particulate organic matter (i.e. seagrass detritus). Stable isotope and metabolic studies have shown that the symbiont provides the host clam with a substantial portion (up to 75%) of its carbon requirements through carbon fixation via the Calvin-Benson Cycle. Metabolic studies done on Lucinids have focused on how carbon requirements are met in the near absence of feeding, but have neglected how other essential elements such as nitrogen are acquired. To better understand how Lucinids meet their nitrogen requirements, wild *Codakia orbicularis* juveniles were exposed to porewater concentrations (30 μM) of ^{15}N-enriched ammonia or ^{15}N-enriched nitrate for either 28 hours or 92 hours. The animals were sacrificed and the gills were dissected from the remaining tissue. Using LC/MS, the incorporation of ^{15}N was examined in the amino acids glutamine, L-glutamate, D-glutamate, taurine, L-alanine, and D-alanine. The ^{15}N-labeling patterns show that ammonia is assimilated into the amino acids L-glutamate and glutamine, whereas nitrogen from nitrate is not incorporated. The high incorporation into glutamine and the presence of glutamine synthetase activity in both gill and body tissue suggest that both the animal and symbiont are capable of nitrogen acquisition via the assimilation of ammonia.

TUE

OS22B-176 1330h POSTER

Host-Symbiont Dynamics Affect Community Structure in Vibrio Populations.

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Understanding the evolution of animal and bacterial associations has been an underlying theme in establishing the development and specificity of symbiotic relationships. There is a need to develop better systems to resolve interactions among symbiotic species where population dynamics and environmental processes clearly play an important role in the evolution of the association. These model systems should promote integrated approaches that take into account the response within as well as between various symbiotic populations and their host partners.

The mutualistic association between sepiolid squids (Mollusca: Cephalopoda) and their Vibrio symbionts provides a versatile and experimentally tractable model system to study the population dynamics and evolution of bacterial speciation and diversity. Since the symbiotic bacteria are environmentally transmitted to new hosts with every generation, this system has been ideal for the study of specificity amongst the wide variety of bacteria that reside in the water column. Moreover, it provides a model to resolve whether the ecology of the free-living symbiont is as important as the ecology of the mutualism in the architecture of bacterial-host interactions. We have examined some of the abiotic mechanisms that drive host-symbiont recognition, and assessed whether environmental factors or inherent genetic characters affect speciation and diversity among Vibrio bacteria. We will present preliminary data that has characterized the distribution of Vibrio species that dominate the bacterioplankton community near sepiolid squid populations, and correlated this with both the community structure of sepiolid hosts in the same area. We have also measured how abioic factors (such as temperature) affects the gradient of Vibrio species that are available in the water column. The investigations promise to reveal new experimental paradigms for studying bacterioplankton/eukaryote dynamics, and the ecological and evolutionary mechanisms responsible for bacterial speciation and diversity.