which is consistent with growing evidences of enhanced El Nino activities after 1976/77. During cooling phase of PDO, the equatorial system shows reversed patterns. As a consequence, the primary production tends to have stronger positive anomalies during La Nina before 1976/77 and stronger negative anomalies during El Ninos after 1976/77. Therefore, the mean primary production in the equatorial Pacific during cooling phase of PDO is higher than during the warm phase. Another manifestation of PDO in the equatorial Pacific is that during the cooling phase of PDO, the modeled SST and nutrient anomalies in eastern equatorial Pacific tend to lead its anomalies in the central equatorial Pacific by 4-5 months before the peak of El Nino, whereas no significant difference in timing of anomalies can be observed during the warm phase of PDO.

OS51H-08 1035h

1990's Ecosystem Change in the Eastern Tropical Pacific Ocean?

Paul C. Fiedler[1] (858-546-7016; pfiedler@ucsd.edu)

Valerie A. Philbrick[1] (Valerie.Philbrick@noaa.gov)

Lisa T. Ballance[1] (Lisa.Ballance@noaa.gov)

Robert L. Pitman[1] (Robert.Pitman@noaa.gov)

[1] NOAA/National Marine Fisheries Service/Southwest Fisheries Science Center, 8604 La Jolla Shores Dr., La Jolla, CA 92037, United States

Interdecadal variability of the environment and marine ecosystem responses are well-known in the North Pacific, where long time series of oceanographic data and fish catch are available, but not in the tropical Pacific. The eastern tropical Pacific supports a large, but poorly observed, ecosystem that is subject to substantial variability at periods of 2-6 years. Yearly surveys of the eastern tropical Pacific Ocean in 1986-1990 and 1998-2000 show physical and biological variability between years related to the El Niño/Southern Oscillation. Time series of surface temperature and thermocline depth show little or no change corresponding to the 1988-89 regime shift in the North Pacific, although large interdecadal changes occurred in this region earlier in the century. Plankton, seabird, and flyingfish data are examined for changes in abundance, diversity, and distribution that might indicate an ecosystem response to longer-term climate change.

OS51H-09 1050h

Climate-Related Ocean Ecological Responses - Forecasting for Proactive Resource Management

Gary D Sharp[1] (831-449-9212; gsharp@montereybay.com)

Leonid Klyashtorin[2] (Klyashtorin@mtu-net.ru)

James D Goodridge[3] (jdg@mcn.org)

[1] Center for Climate/Ocean Resources Study, PO Box 2223, Monterey, CA 93907, United States

[2] Federal Institute for Fisheries and Oceanography (VNIRO), Leninsky pr. 69, cor. 2., 351,, Moscow, RUS 11729

[3] California State Climatologist, retired,, PO Box 750, Mendocino, CA 95460, United States

Among the principal forces affecting marine ecosystems are surface winds - driven by pressure disparities, the results of various sources of lagged seasonal temperature gradients - over longer-term patterned forces. Equatorial ocean-atmosphere energetics captured many researchers attention over the recent decades. Others have stepped back to larger time and space scales in order to understand these dynamics - and their upstream forcings. A.A. Girs monitored and defined specific Atmospheric Circulation Indices (ACI) for the Asian-Pacific region (as well as Wangengeim's Atlantic-Eurasian ACI classifications) that appear to reflect general trends and processes that affect regional climate, and in turn, regional ecosystems measured via regional species responses - are of general ecosystem and economic interests to many societal sectors. Marcel Leroux's 1998 "Dynamic Analysis of Climate and Weather" focused on observations of the consequences of Mobile Polar Highs (MPH) on terrain/ocean surface temperatures and surface winds that control upper ocean heating and cooling. With this in mind, we returned to early 1990s studies of ocean ENSO Warm Event surface heat content reflected at both sides of the Pacific Ocean, as planetary waves progress over years from the equator to higher latitudes - west, then east, then back west again - until they are dissipated near the poles. All of these processes are linked, and over decades, result in the 45-60 year or so ecosystem response cycle(s) evidenced in paleosediments beneath the world's more productive coastal fisheries.

'Traditional' fisheries stock assessment logic presumes that there is a somewhat stable 'mean' state (a single target) that can be managed toward. The reality is that there are at least four (4) obvious states, within these decadal scale coming-and-going fugues in response to these atmospheric changes within each double peaked fishery production cycle. Optimal fishing practices will produce the greatest yields from each of the two major (so-called Warm/Cold) periods only if there is considerable restraint in the second and fourth stages when Neither populations/species group is in good shape - as both are vulnerable to over-exploitation, and the growth of the incoming species complex can be compromised. Understanding these transition periods is critical to resource management. Recent history provides excellent examples.

Patterns of ACI and Length of Day are now tracked, and used in forecasts of each phase of these ocean ecosystem processes, particularly the all-important transitions - useful not only in fisheries management, but also in regional rainfall forecasting for agricultural planning purposes. Linkages will be made and processes followed from initial polar Subsidence Events, to the equator, and back - and subsequent ecosystem responses related.

URL: http://www.john-daly.com/sharp.htm

OS51H-10 1105h

Effects of Climate and Stock Size on Recruitment and Growth of Pacific Halibut

Steven R Hare[1] (206-634-1838 x220; hare@iphc.washington.edu)

William G Clark[1] (206-634-1838 x219; bill@iphc.washington.edu)

[1] International Pacific Halibut Commission, P.O. Box 95009, Seattle, WA 98145-2009, United States

This paper compares long-term changes in Pacific halibut Hippoglossus stenolepis recruitment and growth with long-term changes in climate and stock size. It appears that environmental variability?both interdecadal and interannual?is responsible for most of the observed variation in Pacific halibut recruitment. The large changes in growth rates that occurred during the twentieth century appear to have been density dependent responses to changes in stock size, with virtually no environmental influence.

URL: http://www.iphc.washington.edu/Staff/hare/html/papers/hist-hal/abst-najfm.html

OS51H-11 1120h

Tracking Environmental Bottlenecks in the Coastal Zone: What are the Mechanisms Linking Climate Variability to Oregon Coho (Oncorhynchus kisutch) Marine Survival?

Elizabeth Ann Logerwell[1] (206-526-4231; Libby.Logerwell@noaa.gov)

Nathan J Mantua[2] (206-616-5347; mantua@atmos.washington.edu)

Peter W Lawson[3] (541-867-0430; peter.w.lawson@noaa.gov)

Robert C Francis[1] (206-543-7345; bfrancis@u.washington.edu)

Vera N Agostini[1] (206-329-9663; vagostin@u.washington.edu)

[1] School of Aquatic and Fisheries Science, University of Washington Box 355020, Seattle, WA 98195, United States

[2] School of Marine Affairs/Joint Institute for the Study of the Atmosphere and Oceans Climate Impacts Group, University of Washington Box 354235, Seattle, WA 98195, United States

[3] National Marine Fisheries Service Northwest Fisheries Science Center, 2030 S. Marine Science Dr., Newport, OR 97365, United States

To better understand the mechanisms driving variability in Oregon coho (Oncorhynchus kisutch) marine survival, we developed a conceptual model of four environmental bottlenecks through which coho must pass during early marine life: 1) winter climate prior to smolt migration from freshwater to ocean, 2) the date of the spring transition from winter downwelling to spring/summer upwelling, 3) the spring upwelling season and 4) winter ocean conditions near the end of the maturing coho's first year at sea. We then parameterized a General Additive Model (GAM) with Oregon Production Index (OPI) coho smolt-to-adult survival estimates from 1969 to 1998 and environmental data representing each bottleneck (pre-smolt winter SST, spring transition date, spring upwelling wind indices, and post-smolt winter SST). The model explained a high and significant proportion of the variation in coho survival during the period of record (R^2=0.73). To examine linkages with climate variability, we evaluate the relationships between our local environmental indices and indices tracking hemispheric scale climate patterns, specifically indices for the Aleutian Low, the El Nino-Southern Oscillation, and the Pacific Decadal Oscillation. This approach allows for an assessment of the potential predictability of ocean conditions for OPI coho.

OS51H-12 1135h

Will the coral reef survive global climate change ?

Bessat Frederic[1] (0033144321436; frederic.bessat@paris4.sorbonne.fr)

Juillet-Leclerc Anne[2] (0033169824348; Anne.Juillet@lsce.cnrs-gif.fr)

Le Bec Nolwenn[2] (00169824348)

Buigues Daniele[1] (00169267800; daniele.buigues@cea.fr)

[1] CNRS/UMR 8586 an CEA/DAM/DIF/CDEI, 191 rue Saint-Jacques, PARIS 75005, France

[2] CNRS/LSCE, Domaine de la Terrasse, GIF/YVETTE 91000, France

Certain reef-building corals have the potential to provide information about coral growth and climate over the past several centuries. Proxy records from corals may provide informations about long-term variability in the performance of coral reefs, allowing unnatural change to be distinguished from natural variability. Measuring how fast corals grow is in this way a fundamental problem in coral reef research, particularly relationships with the global change. In this paper, we have generated several centuries-long time series of change in corals growth of Porites corals heads in order to investigate environmental controls on growth of the massives corals in the tropical South Central and Western Pacific region. Measurements of corals growth has led to a refined record of skeletal extension, density and calcification on material from Moorea Island (French Polynesia) and Yasawa island (Fiji island). Correlations of coral growth characteristics with instrumental records indicates a link between variations in average annual calcification variations and air temperature. Linear regression of temperature versus calcification data shows a trend in which a rise in temperature would increase the calcification rate. These data suggest that calcification has increased over recent decades, which differs notable from the 6-14% decline in calcification over the past 100 years predicted by certain researchers. Furthermore, the study relies coupled analysis of different proxies: oxygen and carbon isotopic compositions, Sr/Ca ratios Long-lived massive corals can contribute to the monitoring of coral reefs environments through the growth records measurable in the annual density patterns ; these can provide a historical perspective against which to assess environmental changes and help to establish limits of coral growth.

OS51I HC: 319 A Friday 0830h

Chemical Oceanography: Biologically Important Compounds

Presiding: **R Turner,** Coastal Ecology Institute**; M R Anderson,** Science Oceans and Environment Branch Fisheries and Oceans Canada

OS51I-01 0830h

A Paleo-Reconstruction of Water Quality in the Charlotte Harbor Estuary (Florida)

R. Eugene Turner[1] (225 578 6454; euturne@lsu.edu); Nancy N. Rabalais[2] (985 851 2836; nrabalais@lumcon.edu); Nazan Atilla[2]; Claire Normandeau[2]; Brian Fry[1]; James M. Lee[1]; Charles Milan[1]; Tom Oswald[1]; Erick Swenson[1]

[1] Coastal Ecology Institute, Stadium Road Louisiana State University , Baton Rouge, LA 70803, United States

[2] LUMCON , 8124 Hwy. 56, Chauvin, LA 70344, United States

A suite of proxies for water quality were examined to use as indicators of water quality change in the shallow subtropical estuary Charlotte Harbor, Florida (USA). Sediment cores were collected in the region of mid-summer hypoxic zone and also upstream from a Juncus sp. marsh. Dating with 210Pb was sufficient to establish chronologies back to before major watershed changes (circa 1900). Trace metal analyses helped define transitions unrelated to water quality changes before 1900 in the marsh core and support the use cores from open water as suitable source material for other analyses. Sedimentary biogenic silica (BSi), carbon, nitrogen and phosphorus concentrations all increased concurrently with known or inferred changes in nutrient loadings. The behavior of trace metals and the distribution down-core of 12/13C, 15N and 34S isotope signatures suggests an estuarine system that is responsive to the increased carbon loading from the nitrogen-limited phytoplankton community. These indicators include a direct relationships between phytoplankton pigments and BSi, variations in the quality of these pigments, heavier 34S with increased carbon loading, and sequestration of P, Al and Fe as carbon loading (hence more reduced conditions) increased. Present nutrient loading is about three times above that before the 1800s, suggesting that the present hypoxic conditions are not natural, but are the result of cultural eutrophication.

OS51I-02 0845h

Photochemical Effects on Arsenic Speciation in Surface Waters

Katherine C Filippino[1] (757-683-4941; kfilippi@odu.edu)

Gregory A Cutter[1] (757-683-4929; gcutter@odu.edu)

[1] Old Dominion University, Dept. of Ocean, Earth, and Atmospheric Sciences, Norfollk, VA 23529-0276, United States

The geochemical reactivity and toxicity of dissolved arsenic in seawater are highly dependent upon its chemical speciation. For example, arsenate (As V) is toxic to phytoplankton, causing them to detoxify it by producing methylated As species and arsenite (As III). However, arsenite is toxic to higher trophic levels such as zooplankton, fish, and humans. Although considerable attention has been paid to biological and strictly chemical redox changes for arsenic in marine systems, relatively little has been done on photochemical redox transformations. Thus, experiments were conducted to examine whether sunlight could mediate redox changes to dissolved arsenic at nanomolar concentrations in coastal and open ocean seawater.

Filtered (0.4 μm) surface waters from the Virginia coast, Chesapeake Bay, and Sargasso Sea were irradiated in submerged quartz flasks under full sunlight, and actinometry and spectral measurements were also made; dark controls were used. Arsenate and arsenite were determined by hydride generation GC/PID at time zero and at six intervals throughout the irradiation. A rapid decrease of arsenite occurred, with a half-life on the order of two to three hours depending on water type, and apparent first order kinetics were observed. Equivalent increases in arsenate were found, demonstrating photooxidation rather than reduction. These results show that photochemical oxidation of arsenite must be considered in the biogeochemical cycling of arsenic. Moreover, mass balances for dissolved arsenic have likely underestimated the biotic production of arsenite (i.e., an additional loss requires greater production).

OS51I-03 0900h

Melting of Marine Methane Hydrates in Geologic History: What do Molecular Biomarkers Tell Us?

Laura Hmelo[1] (507-646-4000; hmelol@carleton.edu)

Kai Hinrichs[2] (khinrichs@whoi.edu)

[1] Carleton College, Department of Chemistry, Northfield, MN 55057, United States

[2] Woods Hole Oceanographic Institution, 360 Woods Hole Road, Woods Hole, MA 02543, United States

Stable carbon isotopic compositions of carbonates of fossil foraminifera suggest that the release of methane from sedimentary hydrates was a widespread phenomenon in different geologic episodes. An example from the very recent geologic past is provided by the late Quaternary sediment record from the Santa Barbara Basin (SBB), ODP Site 893, which features strong 13C-depletions in both benthic and planktic foraminifera coinciding with evidence for warming of bottom waters [Kennett et al., Science 288, 128-133, 2000]. The authors speculated that during the Late Quaternary methane release occurred not only in the SBB but widespread along continental margins and contributed to elevated atmospheric methane concentrations during warmer periods. Based on the premise that high concentrations of methane would have resulted in elevated growth of methanotrophic microorganisms, which can be identified in paleoenvironments by specific molecular biomarkers with distinct isotopic composition, we tested the hypothesis by Kennett and co-workers. Our results provide clear-cut evidence that methane was in fact causing the suspicious isotopic signals in fossil foraminifers. The evidence that compounds from methanotrophic microorganisms accumulated only in periods marked by distinctly light isotopic compositions in fossil foraminifers fully supports the hypothesis by Kennett and co-workers. The abundance of isotopically depleted diplopterol (?13C = ?70 to ?56), a hopanol found in methanotrophic bacteria, correlates with the abundance of isotopically depleted benthic foraminifera and is likely derived from methanotrophic bacteria that oxidized methane in the basin's bottom water. In contrast, the most extreme isotopic excursion in the record of planktic foraminifera preceding Interstadial 11 is associated with methane oxidation by anaerobic microorganisms (i.e., consortia of methanotrophic archaea and sulfate-reducing bacteria) as evidenced by the presence of isotopically depleted archaeal and bacterial dialkyl glycerol ethers. Several lines of evidence suggest that these consortia thrived in the SBB water column. This requires that portions of the water column became temporarily anoxic due to depletion of oxygen by methanotrophy. Moreover, relative concentrations and isotopic compositions of molecular biomarkers derived from marine phytoplankton suggest a complex response of surface-water communities to the major outgassing events over a period of decades to centuries following the initial abundance of methanotrophic signals.

OS51I-04 0915h

EVALUATION OF HYDRATE METHANE SOURCES AND COMPOSITION

Richard B Coffin[1] (202-767-0065; rcoffin@ccf.nrl.navy.mil)

John W Pohlman[2] (804-684-7153; jp@vims.edu)

Kenneth S Grabowski[1] (202-767-5738; grabowski@nrl.navy.mil)

David Knies[1] (knies@nrl.navy.mil)

Luis A Cifuentes[3] (979-845-3380; cifuentes@ocean.tamu.edu)

[1] Naval Research Laboratory, 4555 Overlook Avenue, SW, Washington, DC 20375, United States

[2] Geo-Centers, Inc , 4555 Overlook Avenue, SW, Washington, DC 20375, United States

[3] Texas AM University, Department of Oceanography, College Station, TX 77843, United States

Work has been conducted in the Norwegian-Greenland Sea and Texas-Louisiana Shelf to understand the relative input of biogenic and geothermal methane to the methane hydrates. Carbon isotope analysis of organic sediment, bacterial biomarkers and methane shows a wide range of sources between the two sites. This work is coupled with the analysis of methane hydrate composition and structure. In the Norwegian-Greenland Sea biogenic signatures, averaging -63.5 ppt, were measured in methane from the hydrates. Data from the Texas-Louisiana Shelf suggests that there is mixture between the sources of methane. Methane stable carbon isotope ratios range from - 48.5 to -33.0 ppt, with the lower values suggesting that methane is in part from bacterial activity. The presentation will provide data on stable and radio carbon isotope analysis, through key carbon pools, to compare the factors that influence the methane hydrate formation and content.

OS51I-05 0930h

Radiocarbon in Pore Water Carbon Pools in Sediments of the Eastern Equatorial Atlantic Ocean.

William R Martin[1] (1-508-289-2836; wmartin@whoi.edu)

Daniel C McCorkle[2]

Ann P McNichol[2]

Fred L Sayles[1]

[1] Woods Hole Oceanographic Inst. , Dept. of Marine Chemistry and Geochemistry, Woods Hole, MA 02543

[2] Woods Hole Oceanographic Inst., Dept. of Geology and Geophysics, Woods Hole, MA 02540

We analyzed the radiocarbon content of pore water dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) at 5 sites on the Sierra Leone Rise and Cape Verde Plateau in the Eastern Equatorial Atlantic. 3 of these sites lie above the calcite saturation horizon, 2 below. At all but one site, pore water DIC has radiocarbon content equal to or greater than that of bottom water DIC, to depths ranging from 2 to 7 cm below the sediment-water interface. The pore water DIC is substantially enriched in radiocarbon relative to sedimentary CaCO3 and organic carbon, indicating that radiocarbon-rich material is released preferentially from one or both of these carbon pools during early diagenesis.

We do not have a direct measure of the radiocarbon content of DIC produced by organic matter oxidation, but we do know, from measurements of radiocarbon in pore water DOC, that "young" organic matter is released into pore waters during organic matter diagenesis. At all sites, pore water DOC was greatly enriched in radiocarbon relative to bottom water DOC to depths up to 8.5 cm below the interface (the maximum depth at which we made measurements); DOC in the upper 1 cm had a modern radiocarbon signature. It is likely that the organic carbon that is oxidized to DIC also is rich in radiocarbon relative to the sedimentary organic carbon pool.

In situ pore water alkalinity and DIC profiles from these and other sites in the region clearly show that sedimentary CaCO3 is dissolving, both above and below the calcite saturation horizon. Thus, CaCO3 dissolution, as well as organic carbon oxidation, contributes to pore water DIC. The radiocarbon age of the CaCO3 that is dissolving can be calculated from a mass balance using pore water radiocarbon data and organic matter oxidation and CaCO3 dissolution rates derived from other pore water data. The results of these mass balance calculations will be presented.

OS51I-06 0945h

Role of acid polysaccharides on the Th-234 scavenging

Peter H. Santschi[1] (409-740-4476; santschi@tamug.tamu.edu); Chin-Chang Hung[1] (409-740-4772; hungc@tamug.tamu.edu); Laodong Guo[2] (guol@iarc.uaf.edu); Gary Schultz[1] (schultzg@tamug.tamu.edu); Nicolas G. Alvarado-Quiroz[1] (alvarado@tamug.tamu.edu); Jennifer Haye[1] (jmarcellefh@hotmail.com); James L. Pinckney[3] (pinckney@ocean.tamu.edu)

[1] Department of Oceanography, Texas AM University,, 5007 Ave. U, Galveston, TX 77550

[2] International Arctic Research Center, University of Alaska, 930 Koyukuk Dr., Fairbanks, AK 99775

[3] Department of Oceanography, Texas AM University, 3146 TAMU Department of Oceanography, College Station, TX 77843

To study the role of polysaccharides in marine organic carbon cycling and in the scavenging of trace metals and radionuclides, the concentrations of carbohydrates (CHO), uronic acids (URA), total acid polysaccharides (APS) and Th-234 in various particulate size fractions were measured in seawater from the Gulf of Mexico, across a cold core and a warm core ring, during May, 2001 aboard the R/V Gyre. The concentrations of particulate acid polysaccharides (p-APS) in different size fractions (0.4-10, 10-53, and greater than 53 um) ranged from 0.5 to 1.8, 0.02 to 1.0, and 0.003 to 0.3 ug-C/L, respectively, indicating that small particles (0.4-10 um) are the major carriers of acid polysaccharides, as well as of CHO and URA. Within the total particulate (greater than 1 m) Th-234 pool, the greater than 53 um particle size fraction had the largest share of Th-234 (18-88%), followed by the 10-53 um fraction (6-58%), while the 1-10 m size fraction generally contained the lowest amount of Th-234 (6-63%). Total particulate Th-234 and acid polysaccharide (APS) contents, both normalized to particulate organic carbon, strongly correlated, suggesting that fibrillar APS, the main surface active substances in seawater, are the effective organic compounds for the scavenging of Th(IV) in the water column. Most importantly, Th-234 activity correlated significantly and positively to phytoplankton in the water column suggesting that APS from phytoplankton and/or attached bacteria may play a significant role in Th(IV) scavenging. These results are in agreement with those of Quigley et al. (L&O, in press), who not only showed that the phase partition coefficient of Th(IV) strongly correlates to polysaccharide content, but also that there was an APS of 12.5 kDa molecular weight which most strongly complexed Th(IV).

OS51I-07 1020h

The Contribution of Water-Soluble Free and Combined Amino Acids in Atmospheric Particles to the Marine DON Budget

Nadia M Greger[1] (441517945986; ngreger@liverpool.ac.uk)

Martin R Preston[1] (441517944093; preston@liverpool.ac.uk)

[1] University of Liverpool, Oceanography Laboratories University of Liverpool, Liverpool L69 7ZL, United Kingdom

Until now approximately 70-90% of the dissolved organic nitrogen (DON) fraction of aerosols has remained uncharacterised, that is about to change.

While several studies have presented a timely insight into the magnitude of atmospheric nitrogen fluxes, they have provided little information about the specific chemical characteristics of the DON fraction. Other studies of atmospheric organic nitrogen deposition have focused on determining the concentrations of particular organic nitrogen compound groups, such as amines, amino acids and azaarenes. In addition, urea has been identified and established as a small contributor, accounting for <10% of the dissolved fraction of aerosol organic nitrogen. Leaving a sizeable fraction of the DON, approximately 90% uncharacterised.

This study, therefore, focuses not only on the total dissolved organic nitrogen and urea content of aerosols but also on the amino acid and proteinaceous contributions. These free and combined hydrolysable amino acids, although previously identified, in precipitation samples have not been extensively studied in relation to the water-soluble fraction of aerosols.

Aerosol samples were collected in the Pacific (Hawaii) and United Kingdom (Liverpool). Initial results show the presence of a number of free amino acids but again are insufficient to account for the observed DON concentrations. The results from the combined hydrolysable amino acid analysis revealed, that not only could this fraction account for a substantial part of the total DON (approximately 50-70% on average), but that in the case of the coarse aerosol fraction, was contributing up to nearly three times the measured DON. This paradox can only be explained through analytical problems associated with the DON measurement, conducted using UV oxidation, followed by ion chromatographic quantification of the liberated nitrate.

OS51I-08 1035h

Estimating Production and Loss Rates of Nitrous Oxide in Seawater Using ^{15}N Tracers

Stephen Punshon[1] (902 494 3671; spunshon@is2.dal.ca)

Robert Moore[1] (902 494 3871; Robert.Moore@dal.ca)

[1] Department of Oceanography, Dalhousie University, Halifax, NS B3H 4J1, Canada

Nitrous oxide (N_2O) is a biogenic greenhouse gas that makes significant contributions to both radiative forcing of the Earth's climate and stratospheric ozone destruction. The ocean provides a substantial yet patchy source of atmospheric N_2O, with high supersaturations observed in areas of upwelling and in coastal waters subjected to fertiliser run-off and eutrophication. Nitrification and denitrification have been identified as the most important bacterial pathways leading to N_2O production in the ocean, and degradation of N_2O is known to occur in anoxic environments. The distribution of dissolved oxygen in particular appears to exert a control on rates of N_2O production, with high levels of nitrous oxide often found in sub-oxic zones. An improved understanding of N_2O production and loss kinetics is required to better predict the response of the ocean /atmosphere N_2O flux to continuing anthropogenic perturbation of the marine nitrogen cycle, and the effects of climate change. Until now there have been few direct measurements of nitrous oxide production or loss rates in the water column. We have developed a sensitive yet relatively practical method to measure marine production and consumption rates of N_2O using ^{15}N. Seawater samples are collected in 100 mL glass syringes, amended with ^{15}N-labelled ammonium, nitrate or N_2O and incubated under *in situ* conditions. Subsamples are periodically analysed for ^{15}N-labelled N_2O using purge-and-trap gas-chromatography mass-spectrometry (PT GC-MS). An investigation of the relative importance of nitrification and denitrification to N_2O production and of the factors controlling production rates is currently under way. Results from a series of studies are presented.

OS51I-09 1050h

Effect of Salinity on the Release of Humic-Bound Ammonium

Jason H See[1] (804-684-7149; jsee@vims.edu)

Deborah A Bronk[1] (804-684-7779; bronk@vims.edu)

[1] Virginia Institute of Marine Science, Department of Physical Sciences P.O. Box 1346, Gloucester Point, VA 23692-1346, United States

Humic substances are common organic compounds which can represent 30-60% of the dissolved organic matter (DOM) in riverine and estuarine environments. These substances give some river waters their characteristic tea color. Recent studies have suggested that nitrogen bound to humic substances can be utilized by phytoplankton, though the mechanism is unknown. We provide evidence that humic substances are capable of adsorbing ammonium (NH_4^+) from surrounding waters to cation binding sites on the humic structure, which then desorbs as the humic substances move downriver and encounter an increasingly saline environment. The salt ions bump off the loosely bound NH_4^+ ions on the humic structure, releasing them into the environment. The adsorption of NH_4^+ to humic substances makes them an important shuttle for nitrogen produced upriver to the estuary and coastal ocean. Studies in three east coast estuaries (York, Satilla, and Altamaha Rivers) suggest that this "humic shuttle" is capable of releasing $77*10^6$ g of NH_4^+ nitrogen into the estuary annually, or approximately 1 μmol of nitrogen per liter of water passing through the estuary. The release of NH_4^+ from aquatic humics along a salinity gradient is a previously unrecognized source of nitrogen to the mid-saline bloom regions and has the potential to be an important source of NH_4^+ for organisms living in the higher salinity regions of estuaries or the coastal ocean. This work also suggests that humic extraction, via the traditional XAD-8 method, likely overestimates the C:N ratio of humic substances in the environment by removing loosely bound NH_4^+ from the humic structure during isolation.

OS51I-10 1105h

Abundance and origin of acid polysaccharides in the marine environment

Chin-Chang Hung[1] (409-740-4772; hungc@tamug.tamu.edu); Laodong Guo[2] (guol@iarc.uaf.edu); Gary Schultz[1] (schultzg@tamug.tamu.edu); Nicolas Alvarado-Quiroz[1] (alvarado@tamug.tamu.edu); Jennifer Haye[1] (jmarcellefh@hotmail.com); Peter Santschi[1] (santschi@tamug.tamu.edu); James Pinckney[3] (pinckney@ocean.tamu.edu)

[1] Department of Oceanography, Texas AM University, 5007 Ave. U, Galveston, TX 77551

[2] International Arctic Research Center, University of Alaska, 930 Koyukuk Dr, Fairbanks, AK 99775

[3] Department of Oceanography, Texas AM University, 3146 TAMU, College Station, TX 77843

Acid polysaccharides (APS), excreted by both phytoplankton and bacteria, play an important roles in cell adhesion, trace metal complexation and toxicity, particle coagulation, colloid scavenging, immobilization of toxic substances in natural waters, as well as protection against various types of viruses and tumors within animals. However, little is known about quantitative abundance and origin of APS in the marine environment. We have recently developed an improved method to determine APS concentrations of different size marine particles (i.e. 0.7-10, 10-53, and greater than 53 um) from the Gulf of Mexico during July 2000 and May 2001. Results showed that APS in small particles (0.7-10 um) accounted for 85-97 % of APS in samples from 2000 while APS in large particles (greater than 10 um) accounted for 49-97 % in year 2001. The difference of APS in small particles between two years could be due to the presence of different phytoplankton and bacteria species. APS only accounted for 1-3 % of particulate organic carbon in both years, suggesting that previously published APS data might have been significantly overestimated this compound class. Most importantly, APS concentrations correlated significantly and positively with several phytoplankton species such as cyanobactera, prochlorophytes, prasinophytes, dinoflagellates, prymnesiophytes, and pelagophytes present in the water column during one or the other year. Moreover, bacterial productivity (BP) also correlated significantly with APS. These results imply that APS in suspended particles are produced in situ by pico, nano and micro phytoplankton or particle-attached bacteria.

OS51I-11 1120h

Mercury and Methyl Mercury in Marine Biota - a Universal Baseline

M. Robin Anderson (709-772-0460; andersonro@dfo-mpo.gc.ca)

Science Oceans and Environment Branch Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre PO Box 5667, St. John's, NF A1C 5X1, Canada

There is increasing concern worldwide for the risk of mercury exposure to fish-eating populations. This concern is balanced with the recognition that seafood represents a high quality food source that is readily available for many coastal populations. The dominant pathway of mercury uptake in aquatic systems is through food and the contaminant is biomagnified up through the food chain. The highest levels of mercury in fish are generally found in the piscivores, particularly in lakes with long food chains. In marine systems where food chains are usually much longer than terrestrial or freshwater systems mercury has been shown to be elevated in the top level predators. There have however been few systematic studies of biomagnification of mercury in marine foodwebs. Based on analysis of a dataset comprising over 1700 measurements of mercury in the flesh of marine biota from around the world, mercury levels of marine biota can be predicted from either body-size or the trophic status of the organisms. Methyl mercury (MeHg) content is also significantly related to trophic status as is the proportion of total mercury found as MeHg which increases more rapidly than total mercury. These relationships can thus serve as a universal baseline for testing for mercury contamination and for testing hypotheses relating to Hg distributions in marine biota.

OS51I-12 1135h

Impact of Biological Activity on the Size-Fractionation of Trace Metals

William Kentrup[1] (852-6290-5161; sharkkid1@ecxite.com)

Sergio A Sanudo-Wilhelmy[1] (1-631-632-8615; ssanudo@notes.cc.sunysb.edu)

Christopher J Gobler[2] (cgobler@southampton.liu.edu)

[1] Marine Sciences Research Center, SUNY at Stony Brook, Stony Brook, NY 11794-5000, United States

[2] Natural Science Division, Southampton College of Long Island University, Southampton, NY 11968, United States

The partitioning of Cu and Fe between particulate, colloidal and dissolved pools was measured in the water column of West Neck Bay, Long Island over the course of a phytoplankton bloom followed by a bacterial bloom. Samples were collected on ~5 day intervals from a depth of 1 meter below the surface between April 9 and October 5, 1998. Particulate metal fractions were separated into labile and refractory pools by acid digestion and dissolved fractions were separated into colloidal (1000 NMW to < 0.2 um) and truly dissolved (< 1000 NMW) fractions by cross-flow ultrafiltration. Fluctuations in these pools were compared to changes in chlorophyll a, particulate and dissolved nutrients, and suspended particulate matter concentrations. The net affect of the bloom on total metal concentration was a significant buildup of Cu associated with DOM accumulation and a removal of Fe via particle stripping. During the phytoplankton bloom, total Cu concentrations increase from 22 nM to 37 nM and total Fe concentrations decrease from 4841 nM to 2523 nM. Decreased levels for both metals appear to be associated with bacterial activity. Colloidal Cu and particulate Fe represented most of their total concentrations (from 61% to 80% and 79% to 99% respectively). Changes in fraction-specific concentrations, production and removal rates as well as log Kd, Kp and Kc values were found to be significantly correlated with chl a concentrations, % POM and with bloom products (especially DON). Fractionation changes led to decreases in all Cu log K values over the course of the bloom, log Kc values being both highest and least affected. For Fe, log Kc values showed the largest drop during the bloom, while log Kp values were most stable. Our preliminary results show how Cu, with a high affinity for dissolved constituents and Fe, a highly particle reactive metal, can exhibit differential fractionation during biological events that are typical of coastal regions. It points out that the biological condition of an aquatic environment should be considered when applying management policies that make use of models containing log K values.