11th Biennial

S.Y. Feng Colloquium

May 12, 2016

Department of Marine Sciences

University of Connecticut

ORGANIZING COMMITTEE
Chris Murray
Steven Schmidt
Emily Seelen

FACULTY ADVISORS
Hans Dam
Julie Granger
Hannes Baumann

COLLOQUIUM LOGISTICS
Debra Schuler

This colloquium honors the memory of Professor S. Y. Feng, Director of the former Marine Sciences Institute, and founding Head of the Department of Marine Sciences, University of Connecticut. The Colloquium is funded by the Department of Marine Sciences and the S. Y. Feng Scholarship Fund. Donations to this fund are accepted through the University of Connecticut Foundation, and are tax deductible. All donations are greatly appreciated.

The Department of Marine Sciences wishes to thank Mrs. Jean Feng for her continued support of Marine Sciences and the growth of its students.

8:45-9:15 **Breakfast**

9:15-9:30 **Opening Remarks** – Hans Dam

Session I

9:30-9:45 Consequences of long-term exposure to elevated CO_2 in a coastal forage fish
Chris Murray

9:45-10:00 Impact of sea surface temperature on the evolution of squall lines
Tristan Kading

10:00-10:15 Contextualizing CO_2 flux into a salt marsh using tidal inundation and surface heat flux time series
Michelle Fogarty

10:15-10:30 Evidence for increased carbon storage in the deep South Atlantic during the last deglaciation
Matthew Lacerra

10:30-10:45 **Coffee Break**

Session II

10:45-11:00 Methylmercury at the sediment-water interface: Insights from a unique sampling regime
Emily Seelen

11:00-11:15 Improving the representation of estuarine processes in earth system models
Qiang Sun

11:15-11:30 The interactive effects of UV radiation and titanium dioxide nanoparticles on marine snow-associated microbes
Vena Haynes

11:30-11:45 Tracking the sorption, degradation and mineralization of explosive-trinitrotriazine (RDX) in coastal marine ecosystems using stable isotopic tracers
Thivanka Ariyarathna

11:45-12:00 A novel approach to measure a grazer-induced trade-off between cell growth and toxin production in the marine dinoflagellate *Alexandrium fundyense*
Gihong Park

12:00-1:15 **Lunch**

Session III

1:15-1:30 Investigating island influences on river water pathways and mixing in western Long Island Sound
Steven Schmidt

1:30-1:45 The role of the biological pump in producing the carbon isotopic minima during Heinrich Stadial 1
Melissa Cote

1:45-2:00 Seasonal cycle of the Connecticut River water pathways and its water age
Yan Jia

2:00-2:15 The influence of genetic divergence and developmental phenotypic plasticity on local adaptation to temperature in a widespread copepod
Matthew Sasaki

2:15-4:00 **Poster Session**

POSTERS

Isotope dynamics of freshwater nitrification
Danielle Boshers

Photochemical degradation of methylmercury from coastal waters to the open ocean
Brian DiMento

Analysis of a decade-long time series of momentum and heat fluxes
Raymond Graham

The fate of diatoms in microbial mats
Almariet Palm

Glacial-interglacial changes in sea-level influence mid-ocean ridge magmatism on the East Pacific Rise
Emily Seeley

A comparative analysis of two congeneric tintinnids: An integrated approach to protist discrimination
Susan Smith

Lifted from the dust: Digitizing and analyzing the ~40 year data set collected by Project Oceanology
Jacob Snyder

Phytate as a growth substrate for dinoflagellates
Brittany Sprecher

Establishing timescales to detect trends in sea surface temperature and dissolved oxygen in Long Island Sound
Allison Staniec

ABSTRACTS

Tracking the sorption, degradation and mineralization of explosive-trinitrotriazine (RDX) in coastal marine ecosystems using stable isotopic tracers

Ariyarathna, Thivanka[1], Penny Vlahos[1], Mark Ballentine[1], Richard Smith[1,2], Christopher Cooper[1], John Böhlke[3], Stephen Fallis[4], Thomas Groshens[4] and Craig Tobias[1]

1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
2. Global Aquatic Research LLC, Sodus, NY 14551.
3. U.S. Geological Survey, Reston, VA 20192.
4. Naval Air Warfare Center Weapons Division, Chemistry Division, China Lake, CA 93555.

thivanka.ariyarathna@uconn.edu

Although hundreds of coastal zones sites are contaminated with explosives, we know little about the fate of these explosives. The goal of this study is to understand the fate of the explosive trinitrotriazine (RDX) in coastal ecosystems using stable nitrogen isotopes. Mesocosm experiments representing subtidal vegetated, subtidal unvegetated and intertidal marsh ecosystems were conducted. Steady state concentration of RDX was maintained throughout a two-week period and sediment, porewater and overlying water samples were analyzed for RDX, degradation products and ^{15}N inventories of inorganic nitrogen pools including ammonium, nitrate, nitrite, nitrous oxide and nitrogen gas. An initial rising inventory followed by decay in ^{15}N of bulk sediment illustrates the role of sediments on sorption and degradation of RDX, respectively. RDX is mineralized through several intermediates leaving nitrous oxide as the prominent product of RDX. Different ecosystems, based on sediment characteristics and redox conditions, show significant differences in RDX degradation and transformation. Fine grained, organic-carbon-rich sediments show notably higher mineralization rates of RDX. This information will be useful for elucidating the mineralization pathways of RDX and constructing mass balances of RDX.

Isotope dynamics of freshwater nitrification

Boshers, Danielle[1]

1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340

danielle.boshers@uconn.edu

Measurements of the naturally occurring nitrogen (N) and oxygen (O) stable isotope ratios of nitrate (NO_3^-) in the environment, $^{15}N/^{14}N$ and $^{18}O/^{16}O$, can be used to determine the source, dispersal, and fate of natural and contaminant NO_3^- in aquatic environments. To this end, it is necessary to know the extent to which NO_3^- isotopologues are modified by biological reactions, as heavy and light isotopes have different reaction rates. The project presented here aims to determine the influence of the $^{18}O/^{16}O$ ratio of ambient water on the isotope composition of NO_3^- produced during nitrification, the biological oxidation of ammonium (NH_4^+) to nitrite (NO_2^-) and then NO_3^-, which is poorly constrained in freshwater systems. To determine the $^{18}O/^{16}O$ of nitrate produced by nitrification in freshwater systems, we collected water from a stream in New England, which we amended with NH_4^+ and ^{18}O-enriched H_2O, to monitor the isotope composition of NO_3^- produced by a natural consortium of nitrifiers. Preliminary results show a relatively rapid accumulation of NO_3^- from added NH_4^+, and an influence of the $^{18}O/^{16}O$ of water on NO_2^- and NO_3^-. This experiment will be repeated, and compared to parallel experiments with pure culture of a nitrite oxidizing bacteria, *Nitrobacter Winogradskyi.*

The role of the biological pump in producing the carbon isotopic minima during Heinrich Stadial 1

Cote, Melissa C.[1], David C. Lund[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
melissa.cote@uconn.edu

The period Heinrich Stadial 1 (HS1; 14.5-17.5kyr) occurred at the onset of the last deglaciation. During HS1 paleo-records show an anomalous decrease in surface ocean $\delta^{13}C$ of ~0.5‰. Currently, there are two leading hypotheses explaining the carbon isotopic anomalies. The Southern Ocean hypothesis states that enhanced ventilation of ^{13}C-depleted abyssal water in the Southern Ocean transported the low $\delta^{13}C$ signal to lower latitudes via intermediate waters. Conversely, the biological pump hypothesis states that a reduction in the Atlantic Meridional Overturning Circulation reduced the efficiency of the ocean's biological pump, thus increasing ^{12}C in the surface oceans and decreasing $\delta^{13}C$. In order to disentangle these two explanations a compilation of sea surface $\delta^{13}C$ records from published planktonic foraminifera datasets encompassing HS1 was assembled. Anomalies were calculated and placed on a map of global sea-surface phosphate in order to spatially compare the magnitude of each anomaly with upwelling zones. We find that anomalies within an ocean basin, regardless of proximity to upwelling zones, are of similar magnitude. This supports the biological pump hypothesis as we would expect to find larger anomalies in upwelling regions influenced by intermediate waters from the Southern Ocean if the light carbon signal originated from the abyssal ocean.

Photochemical degradation of methylmercury from coastal waters to the open ocean

DiMento, Brian[1]; Robert Mason[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
brian.dimento@uconn.edu

Many studies have identified and quantified sources of methylmercury (MeHg) to aquatic systems, although relatively little research has been conducted on its fate and stability in coastal and oceanic waters. Abiotic photochemical degradation is a potentially important sink for MeHg in surface waters, but the rate-controlling factors are poorly understood. The overall objective of this study was to improve our understanding of the relative importance of photochemical reactions in the degradation of MeHg across a variety of marine ecosystems. Experiments were conducted using surface water collected from coastal sites in Delaware, Connecticut, and Maine, as well as from the New England continental shelf break and equatorial Pacific Ocean. The water was filtered and amended with additional MeHg before being exposed to natural sunlight. Water quality parameters – salinity, dissolved organic carbon, and nitrate – were measured, and specific UV absorbance was calculated as a proxy for dissolved aromatic carbon content. Degradation rate constants were very similar (~1-2 day^{-1}) across all water types tested despite varying characteristics, and did not depend on initial MeHg concentrations. Overall, this study helps to better constrain the degree to which photochemical degradation impacts the net transport of MeHg from coastal waters to the open ocean.

Contextualizing CO_2 flux into a salt marsh using tidal inundation and surface heat flux time series

Fogarty, Michelle C.[1], James B. Edson[1], Melanie R. Fewings[1], Craig R. Tobias[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
michelle.fogarty@uconn.edu

Salt marshes may play an important role in the sequestration of atmospheric carbon dioxide. Current estimates of salt marsh carbon budgets extrapolate CO_2 flux data collected at low tide and do not capture temporal variability in CO_2 flux. Temperature, intensity of sunlight, and whether the marsh is inundated affect photosynthesis and respiration and therefore the CO_2 flux. We hypothesize that the direction and magnitude of the CO_2 flux will be affected by the timing of tides in relation to solar noon. Instruments were deployed in the salt marsh adjacent to Freeman Creek in Jacksonville, North Carolina from October to December, 2015 to create a time series of CO_2 flux, surface heat flux, sediment temperature, and water depth. We review the surface heat flux at the marsh, highlighting when the heat flux and water level data clearly correspond to changes in the CO_2 flux. Of particular interest is the damping of the CO_2 signal when high tide inundates the sun-warmed sediment. Our results demonstrate that high-resolution time series of heat flux and water level are necessary to correctly interpret the CO_2 flux over a salt marsh. Data sets like these will help quantify the ability of salt marshes to sequester carbon.

Analysis of a decade-long time series of momentum and heat fluxes

Graham, Raymond T.[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
raymond.graham_jr@uconn.edu

This study investigates the exchange of momentum and heat between the atmosphere and ocean by using 10 years of historical data from the Martha's Vineyard Coastal Observatory (MVCO). Meteorological data, including direct covariance estimates of momentum fluxes were collected from the MVCO mast and matched to oceanographic data from the MVCO off-shore node. The purpose of this study is to improve the parameterization of the drag coefficient (C_D) and transfer coefficient for heat (C_H) used to estimate the surface stress and sensible heat flux from bulk formulas. The motivation for this study is that the direct covariance (DC) approach provides direct measurements of the surface fluxes where, e.g., the stress is given by $\tau_o = -\rho\overline{u'w'}$. However, the DC approach is difficult to implement on a moving platform as it requires motion correction. Therefore, oceanographers and meteorologists often rely on the bulk method to estimate the flux, where $\tau_o = C_D * U^2$, and U is the mean wind speed. This work will use the 10 year time series to provide information that can be used to improve the estimate of surface stress and heat fluxes using bulk formulation, which is important for open ocean research and numerical modeling studies.

The interactive effects of UV radiation and titanium dioxide nanoparticles on marine snow-associated microbes

Haynes, Vena[1], J. Evan Ward[1] and Brandon Russell[1]
1. University of Connecticut Department of Marine Sciences, Groton, CT 06340
vena.haynes@uconn.edu

Titanium dioxide nanoparticles (TiO_2 NP) are used in consumer goods including paints and sunscreens. TiO_2 NP are photocatalysts, able to produce reactive oxygen species that can cause deleterious effects in some aquatic organisms. As with other suspended particulate matter, NP can be incorporated into natural agglomerations through association with other particles (e.g., marine snow). This study investigated the effects of commercially available TiO_2 NP on marine snow-associated microorganisms. Natural seawater was spiked with NP and marine snow was generated by means of a roller table. During the 3-day rolling period, samples were exposed to three different light regimes (15-, 9- and 0-hr light) at two different light intensities. An oceanographic optical model, Hydrolight, was used to determine the appropriate environmental light levels for experiments and light was supplied by solar lamps that mimic natural light in the visible and UVA/B regions. Marine snow was collected and bacterial abundance and functional diversity were analyzed. At the lowest light intensity there were no "nano" effects observed. At the highest light intensity, a shift in functional diversity occurred for 15-hr light treatment compared to no NP controls. This study suggests that NP can affect marine snow-associated organisms under environmentally relevant light regimes.

Seasonal cycle of the Connecticut River water pathways and its water age

Jia, Yan[1] and Michael M. Whitney[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
yan.jia@uconn.edu

As the largest freshwater source to the Long Island Sound (LIS), the Connecticut River (CR) delivers water near the sound's mouth. The river water pathways are impacted by river discharge, tides, winds, and topography. Using the Regional Ocean Modeling System (ROMS), with passive dyes and age tracers, the main routes of CR water are determined with their corresponding time scales. The results show that during late summer, CR water enters central LIS by flowing underneath the previous spring water, and half of these waters stay until next spring flood. Most winter CR water stays in eastern LIS because of influence by the prevailing westerly winds. Spring floods run into central LIS along the coast, and freshen the sound again. CR water leaves the sound along the southern coast. Neap tides allow more CR water to quickly escape to the open shelf through Block Island Sound; spring tides allow more CR water back into the central LIS at depth. The CR mean water age is twice the CR residence time because only half of the water circulates in the sound. These results suggest there is an annual cycle of CR water pathways and quantify the corresponding time scales inside the LIS.

Impact of sea surface temperature on the evolution of squall lines

Kading, Tristan J.[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
tristan.kading@uconn.edu

New England squall lines are a potentially deadly hazard that produce strong winds, hail, tornadoes and flash flooding. One challenge in forecasting these systems is that little is known about the mechanisms governing the strengthening and weakening of squall lines as they move from overland to oversea. We hypothesize that sea surface temperature (SST) contributes to the success or failure of the squall line to survive crossing the land-sea boundary. To begin testing this hypothesis, we used an idealized physical model to simulate a convective system approaching and crossing over the coast. Initial atmospheric conditions for temperature, humidity, and wind shear known to favor convection were used in all runs, while the SST was varied to simulate seasonal changes. The model surface fluxes generated a marine atmospheric boundary layer (MABL) that varied in strength with the SST. Convection persisted over the ocean during winter, early summer, and late summer SST simulations, though storm structure, intensity, convective lifting mechanism and the source region of air the storm ingested varied with the MABL strength. These differences determined squall line propagation characteristics and potentially the associated severe weather. Thus, increased understanding of storm-MABL interaction may improve our ability to forecast these storms.

Evidence for increased carbon storage in the deep South Atlantic during the last deglaciation

Lacerra, Matthew[1] and David Lund[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
matthew.lacerra@uconn.edu (undergraduate researcher)

Model results and paleoceonographic data show that the AMOC (Atlantic Meridional Overturning Circulation) has fluctuated between two steady states over time. Today, the AMOC is characterized by rapid overturning. However, as recently as HS1 (Heinrich Stadial 1: 14-5 -17.5 kyr BP), it appears that the AMOC was significantly weaker. Models consistently show that weakening of the AMOC has a range of climate impacts, such as cooling of the North Atlantic, and southward migration of tropical rain-belts. Considering potential changes in AMOC strength in the future, understanding the drivers and consequences of past changes in the AMOC is critically important to future climate predictions. Recent model results suggest that weakening of the AMOC increases the residence time of deep waters in the Atlantic, allowing for accumulation of respired carbon. Here we test this hypothesis by estimating $[CO_3^{2-}]$ in the deep South Atlantic during HS1 using the B/Ca ratio of benthic foraminifera. We find that $[CO_3^{2-}]$ decreased, reflecting an increase in $\sum CO_2$. In combination with published results from the North Atlantic, our data imply that carbon storage increases in the deep Atlantic when the AMOC weakens, consistent with model predictions. This suggests the AMOC was a key driver for observed $\delta^{13}C$ anomalies during HS1.

Consequences of long-term exposure to elevated CO_2 in a coastal forage fish

Murray, Christopher S.[1], Lee A. Fuiman[2], Hannes Baumann[1]
1. University of Connecticut, Department of Marine Sciences, Groton, CT 06340
2. Marine Science Institute, The University of Texas at Austin, Port Aransas, TX 78373
Christopher.Murray@uconn.edu

Increasing recognition that ocean acidification may impact the fitness of marine fish has led to a rapid expansion of experimental research. Studies have reported neutral to moderate effects from mostly short-term exposures to elevated CO_2, but studies on whole life cycles are still lacking. Here, we present findings of a long-term, large scale CO_2 exposure experiment in which Atlantic silverside *Menidia menidia* offspring (n>2,200) were reared under ambient (500 µatm) and high CO_2 (2300 µatm) from fertilization to 135 days post-fertilization. While survival was high across treatments, subtle but significant differences in length, weight, condition factor, and fatty acid composition were observed. On average, fish from the acidified treatment were 4% shorter and weighed 6% less, but expressed a significantly higher condition factor (k) than control juveniles. These differences were most distinct in samples >35 mm, where high CO_2 fish were significantly heavier per-unit of length. Additionally, 5 of 27 fatty acids were significantly different between treatments. Our results demonstrate that high CO_2 can alter long-term growth in *M. menidia,* particularly when food is not provided in excess. However, it has yet to be demonstrated how these differences will impact wild fish facing size-selective predation and seasonally varying prey abundance.

The fate of diatoms in microbial mats

Palm, Almariet[1] and Pieter T. Visscher[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
Almariet.palm@uconn.edu

Diatoms are ubiquitous at the surface of microbial mats, but their frustules are not observed at depth. This puzzling phenomenon is not well understood. The question remains whether the absence of diatoms within mats in the fossil record is because they were not present, or because they were not preserved. The goal of this study is to test the latter explanation. The disappearance of frustules may be due to their dissolution, which increases with elevated pH. Microbial metabolic reactions within the mat, such as intense photosynthesis by cyanobacteria, create alkaline conditions, which increases pH, thereby facilitating dissolution of biogenic silica. Using the benthic diatom *Nitzschia closterium* as a model for this study, I will explore the dissolution of diatom frustules in three experiments 1) abiotically at elevated pH in a buffered solution 2) With cyanobacterial cultures seeded with diatom frustules and 3) in natural mats. The pH and dissolved silica will be monitored. Light microscopy and SEM will be used to investigate evidence of pitting and etching of the frustules. Increased understanding of the fate of diatoms in extant systems can be used as a proxy for paleoreconstruction of extinct mats, diagenesis and preservation mechanisms.

A novel approach to measure a grazer-induced trade-off between cell growth and toxin production in the marine dinoflagellate *Alexandrium fundyense*

Park, Gihong[1] and Hans G. Dam[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
gihong.park@uconn.edu

The dinoflagellate *Alexandrium fundyense* always bears saxitoxin (STX), but a portion is constitutive (always present) and another is inducible (increased in the presence of grazers). Because resources allocated to toxin production are at the expense of cell growth, grazer-induced toxin production entails a trade-off (cost). The goal of this study is to understand changes in grazer-induced transcripts related to toxin production and cell growth in the dinoflagellate *Alexandrium fundyense*. We quantified, in a series of experiments with and without grazers, STX- and cell-growth gene expression using reverse transcription-qPCR. Our work indicates: 1) There is a negative relationship between STX transcripts and abundance of the gene related to cell growth in *A. fundyense*; 2) In the absence of grazers, this relationship represents the constitutive cost of toxin production; 3) STX transcript abundance in *A. fundyense* increases for the first 48 hours in the presence of grazers. The change of transcript abundance represents the real-time cost of induced toxin production. These results can help us gain insights into the co-evolutionary arms race between prey and grazer by understanding the constraints on anti-grazing defenses. The work will also produce a novel, fast, and cost-effective means of quantifying the potential for STX production.

The influence of genetic divergence and developmental phenotypic plasticity on local adaptation to temperature in a widespread copepod

Sasaki, Matthew[1]; Ricardo Pereira[2]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
2. Centre for GeoGenetics, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark
matthew.sasaki@uconn.edu

Genetic divergence and phenotypic plasticity both constitute mechanisms of thermal adaptation, and will play a role in organismal response to climate change. However, it is unclear if both mechanisms contribute equally to local adaptation, particularly in species with broad latitudinal distribution. Here, we examine thermal adaptation in 11 populations of the inter-tidal copepod *Tigriopus californicus*, ranging from Southern Baja California (latitude 27.18°N) to British Columbia (latitude 50.58°N). Previous studies have shown clear genetic local adaptation to thermal stress. Our common garden experiments show that survivorship to acute heat stress differs between populations, confirming this strong genetic effect on thermal adaptation. Using split-brood experiments, we also show that developmental phenotypic plasticity affects thermal survivorship, and that the effect varies between populations. In addition, we observed a strong latitudinal correlation of genetic effect on thermal survivorship, but no corresponding correlation of plastic response with latitude, suggesting that selection for thermal tolerance and selection for thermal plasticity are uncoupled. In the context of climate warming, our results imply that low latitude populations of *T. californicus* are most susceptible to local extinction because, while they have similar adaptive plastic capabilities to high latitude populations, their thermal maxima may already be near physiological limits.

Investigating island influences on river water pathways and mixing in western Long Island Sound

Schmidt, Steven[1] and Michael Whitney[1]
1. University of Connecticut, Department of Marine Sciences, Groton, CT 06340
steven.r.schmidt@uconn.edu

There is an island chain offshore of where the Saugatuck, Norwalk, and Five Mile Rivers enter western Long Island Sound (LIS). Prior research using a LIS-wide Regional Ocean Modeling System (ROMS) model that did not include this island chain found these and other small coastal rivers increase stratification along the southwestern Connecticut shoreline. Recent observations, however, suggest that these unresolved islands can enhance mixing in some areas and reduce near-shore stratification. A high resolution nested grid in ROMS is used in addition to observations collected during the summer of 2015 low discharge season to isolate the effect of these islands and their influence on the flow pathways and mixing of coastal river waters. The islands changed the tidal average and range of surface salinities between shore and the islands. Mixing power and flow perpendicular to the mainland's shoreline are enhanced in some of the island passes. River plumes appear to be split by the presence of the islands as they sweep by during the tidal cycle, enhancing their mixing with ambient water. Furthermore, water from the Saugatuck River mouth moves westward into the Norwalk River, acting as a potential source of nutrients that would fuel summer hypoxia in its channel.

Methylmercury at the sediment-water interface: Insights from a unique sampling regime

Seelen, Emily A.[1], Robert P. Mason[1], and Grace M. Cartwright[2]
1. Univerisity of Connecticut, Department of Marine Sciences, Groton, CT 06340
2. Virginia Institute of Marine Science, Gloucester Point, VA
Emily.seelen@uconn.edu

Sediments are the largest repository for mercury in estuarine systems, but their role as a source of methylmercury (MeHg) to the coastal water column is under debate. We used a unique resuspension approach to better couple the sediments to the water column and compared the results to traditional bulk sediment sampling techniques. The resuspended fraction was collected using a Gust Microcosm Erosion System, which induces step-wise increasing shear stresses to undisturbed sediment cores. The cores were collected at four sites in the Delaware Bay; two organic poor and two organic rich. Particles were collected from the erosion effluent and analyzed for MeHg, total Hg, chlorophyll a, and C, N, S composition. The results suggest that easily eroded particles have a different Hg composition than the bulk sediment sample (0-4 cm homogenized) for both organic carbon conditions. The water-column MeHg concentrations did not reflect the resuspended nor the bulk-sediment MeHg fractions, but the differences can be partially explained through the ancillary data (CNS) set. This suggests that the MeHg dynamics at the sediment-water interface are distinct from the bulk sediment, and that near-surface particulate MeHg should be considered when relating sediment-MeHg contributions to estuarine water columns.

Glacial-interglacial changes in sea-level influence mid-ocean ridge magmatism on the East Pacific Rise

Seeley, Emily I.[1] and David C. Lund[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
emily.seeley@uconn.edu

Melting glaciers may have indirectly affected submarine volcanism via changes in sea level. As sea level quickly drops, the rate of pressure change increases, resulting in decompression melting in the upper mantle, increasing magmatic flux. Given that hydrothermal activity at mid-ocean ridges is driven by near-axis magmatic heat, the concentration of hydrothermal proxies in ridge crest sediments (Fe, Mn, and As) can be used to infer long-term changes in hydrothermal plume activity. Using a series of well-dated sediment cores from the East Pacific Rise (EPR), we find glacial-interglacial variations in the concentrations of Fe, Mn, and As at multiple locations, with peak concentrations occurring during glacial terminations. These results are similar to those from sites further north along the EPR, suggesting widespread changes in hydrothermal activity along the EPR. A basaltic ash layer in Core OC170-026-159 aligns with Glacial Termination II, suggesting a volatile, submarine eruption. Diagenetic overprinting, sediment focusing, and dilution with nonhydrothermal components are proven as unlikely complicating factors for the interpretation of hydrothermal proxies. The release of carbon and geothermal heat during increased hydrothermal activity would promote deglaciations, but the exact mechanism remains unclear.

A comparative analysis of two congeneric tintinnids: An integrated approach to protist discrimination

Smith, Susan[1], Luciana Santoferrara[1], and George McManus[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
susan.smith@uconn.edu

Among the ciliated protists, the tintinnids possess some of the most detailed literature in historical and modern collections. However, species discrimination between these diverse microplankton is still subject to the inconsistent codes of nomenclature inherent in protist taxonomy. *Favella* is a common tintinnid genus that has been amenable to cultivation and has thus become a "model" organism for microzooplankton studies. In recent years, more detailed studies have separated several different species into a new genus, *Schmidingerella*. Two *Schmidingerella* isolates from the west and east coasts were examined through DNA sequencing, morphological comparisons and physiological experiments. Results thus far reveal minor genetic and morphological differences, yet significant differences in physiological responses, which could imply different ecological niches. Ongoing work includes experiments on environmental extremes, toxic prey, and gene expression. These results present broader implications for the way model organism studies are used to understand natural microzooplankton assemblages, and for the application of the species concept to single-celled organisms that are capable of both sexual recombination and binary fission.

Lifted from the dust: Digitizing and analyzing the ~40 year data set collected by Project Oceanology

Snyder, Jacob[1], Hannes Baumann[1], and Lauren Rader[2]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
2. Project Oceanology, Groton, CT, 06340
jacob.snyder@uconn.edu

Long-term time series are scarce but highly valuable, and are essential to understanding ecological and biological temporal trends that occur in dynamic estuarine locations like Long Island Sound (LIS). LIS is an ideal model for climate change studies, given its connection to the Atlantic Ocean and the rapid rate at which it has been warming. We are currently assembling a dataset of near-shore environmental observations from LIS collected over the past 40 years by Project Oceanology, an educational facility for students and the public; data include pH, oxygen, benthic invertebrates, near-shore fish catches and other important abiotic and biotic factors. The goal of this project is to digitize, analyze, and develop this information into a resource for marine educators. In our first step, a web-based data entry form has been developed, with data being entered into the Long Island Sound Integrated Coastal Observing System (LISICOS). In our second step, we will explore the dataset for evidence of long-term warming, acidification, and shifts in near-shore species assemblages. Our third and final step will be to formulate this database into a web-based tool to visualize long-term trends, and make it available to educators, researchers, and students.

Phytate as a growth substrate for dinoflagellates

Sprecher, Brittany N.[1] and Senjie Lin[1]
1. Marine Sciences Department, University of Connecticut, Groton, CT, 06340, U.S.A.
brittany.sprecher@uconn.edu

Dinoflagellates are an important class of primary producers. In many environments their productivity is limited by phosphorous (P). While P is bioavailable in both dissolved inorganic (DIP) and organic (DOP) forms, dinoflagellates prefer DIP, which is low in many marine systems. However, even under undetectable DIP concentrations, dinoflagellates can sustain large populations. This has been attributed to the utilization of DOP. The plant product phytate is released via feces into aquatic ecosystems, and is a potential source of DOP pollution. Yet, dinoflagellate utilization of this DOP reservoir has heretofore been understudied. Preliminary data indicates the presence of coding genes for phytase, the enzyme responsible for the hydrolysis of phytate, in several dinoflagellate genomes. We propose to apply molecular and biochemical techniques to determine if, under DIP-limited conditions, dinoflagellates will hydrolyze and exploit phytate as a source of P. This study will measure growth rate and phytate gene expression levels in axenic dinoflagellate cultures under different DIP and DOP conditions. Key findings will provide a novel perspective on P utilization in dinoflagellates. If phytate utilization is found, phytate could be used as a molecular marker for future studies to survey the phytate-utilizing ability in global phytoplankton communities.

Establishing timescales to detect trends in sea surface temperature and dissolved oxygen in Long Island Sound

Staniec, Allison[1] and Penny Vlahos[1]
1. Department of Marine Sciences, University of Connecticut, Groton, CT 06340
allison.staniec@uconn.edu

Long term time series represent a critical part of the oceanographic community's efforts to discern both natural and anthropogenically forced variations in the environment. In using these time series, it is essential to isolate trends from natural variability. Numeric methods exist to calculate the minimum length of time required to detect a trend in an observed parameter. Herein we apply the statistical n* method to water quality parameters in the Long Island Sound (LIS) to ascertain the utility of this approach in coastal waters. Analysis shows that the CT DEEP LIS time series is approaching the needed amount of time to detect long term trends in temperature (SST) and dissolved oxygen (DO), which is, on average, less than 20 years. The observational times required for SST average 14, 9 and 16 years from west to east. Surface DO ranges from 10 to 13 to 37 years. Analyses also show that LIS temperatures have increased an average of 0.06°C yr^{-1} while DO has dropped an average of 0.02 $mgL^{-1}yr^{-1}$ since 1994. N* values calculated here are consistent with open ocean values indicating that the n* method is applicable for both open ocean and coastal time series.

Improving the Representation of Estuarine Processes in Earth System Models

Sun, Qiang[1]
1. Marine Sciences Department, University of Connecticut, Groton, CT, 06340, U.S.A.
qiang.sun@uconn.edu

The riverine discharges of freshwater have much larger impacts on oceanic dynamics than would be guessed based on their total volume flux alone. Model studies have shown that stronger stratification due to increasing riverine discharge could substantially slow and even shut down meridional overturning in the North Atlantic. In most earth system models, the riverine discharge is imported into the ocean model with zero salinity. This method omits important natural physical processes in estuaries and on continental shelves that pre-mix the riverine water with oceanic water and can change the location and timing of freshwater delivery to the ocean. However, computational time constraints limit global ocean models to coarse horizontal resolution (e.g. 1 degree latitude), so the estuarine and shelf processes cannot be resolved. An Estuary Box Model (EBM) with two-layer is developed to represent the mixing processes driven by tides and bottom friction in the estuaries and creates an exchange flow that introduces saltier lower-layer water into the fresher surface layer. The EBM is globally implemented within the ocean model of the Community Earth System Model (CESM). The impacts of the estuaries on global ocean surface salinity will be presented.