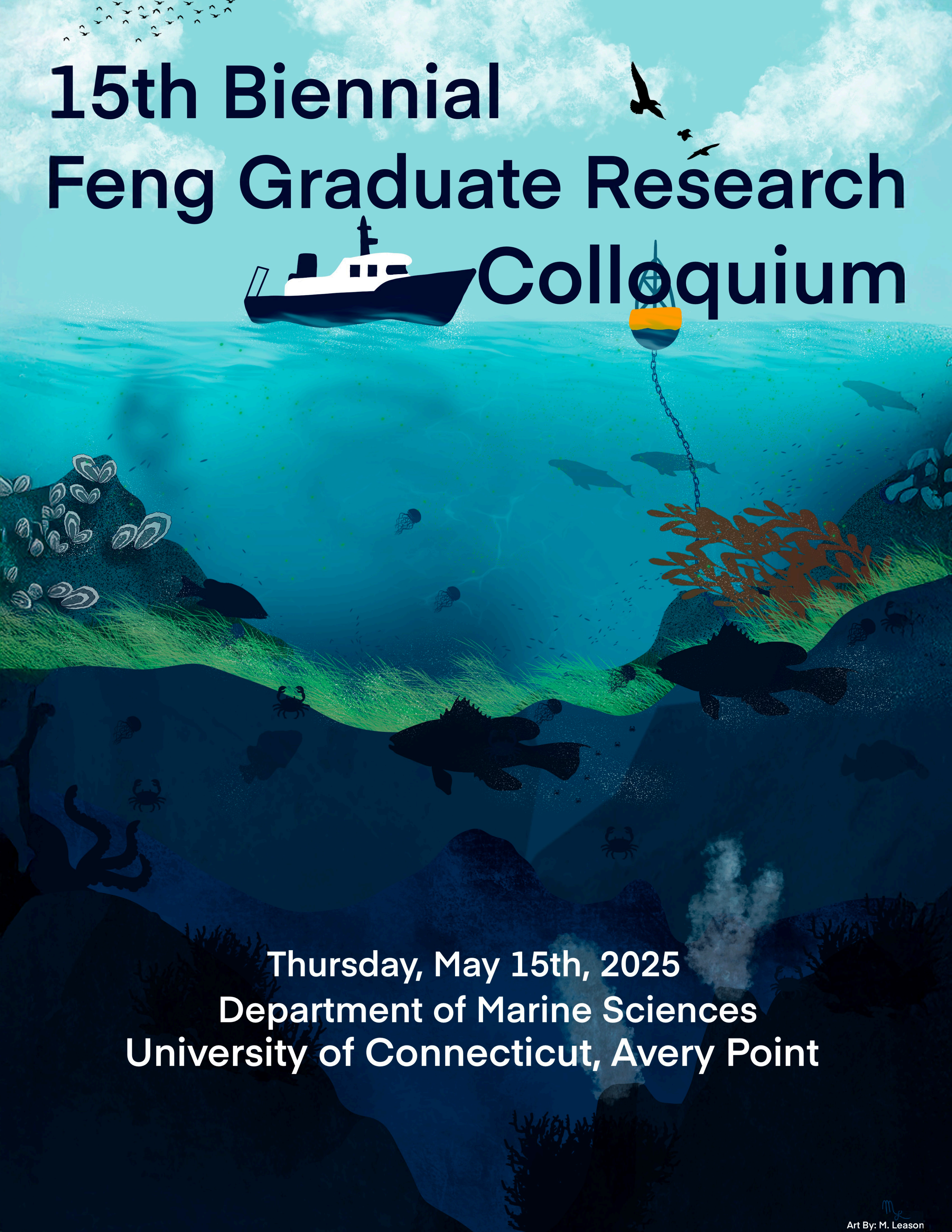
15th Biennial Feng Graduate Research Colloquium



Thursday, May 15th, 2025

Department of Marine Sciences

University of Connecticut, Avery Point

Art By: M. Leason

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 support of Marine Sciences and the growth of its students.

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Yifan Zhu
Emily Watling
Anne Gilewski

Faculty Coordinator
Julie Granger

Logistical Support
Debra Schuler
Todd Fake

Artwork
Matthew Leason

LWB 103 *Coffee/Tea/Water available throughout the Symposium*

8:00 - 8:30 am: **Breakfast (Bagels/Cream Cheese/Fruit) and Coffee/Tea**
8:45 am: **Opening Remarks by Julie Granger**

SESSION I: Oral Presentations & Lightning Talks Group 1 **9:00 -10:30 am**
Moderator: Anne Gilewski
LWB 103

TIME	PRESENTER	TITLE
9:00 - 9:15 am	Samantha Rush	Organic alkalinity in Arctic sea ice brine: The dominant role in carbonate speciation
9:15 - 9:30 am	Hannah Collins	Tissue-specific resident and transient microbial communities of the freshwater Unionid *Elliptio complanata*
9:30 - 9:45 am	Rowan Batts	Thermal plasticity rather than adaptation to warming dominates reproduction and CTmax of a common copepod
9:45 - 9:50 am	Olivia Patrinicola	Carbonate system dynamics in the oxygen minimum zones of the Sargasso Sea (*Lightning Talk*)
9:50 - 9:55 am	Kelsey Ward	Quantifying rates of denitrification and nitrogen fixation in *Zostera marina* beds using noble gas tracers (*Lightning Talk*)
9:55 - 10:00 am	Monica Garity	Progressively greater biological carbon storage in the deep Atlantic during glacial inception (*Lightning Talk*)
10:00 -10:15 am	Anagha Payyambally	Nitrous oxide dynamics and fluxes in the Southern Benguela Upwelling System (SBUS) in August 2023
10:15 -10:30 am	Halle Berger	Modeling the spatiotemporal effects of ocean acidification and warming on Atlantic sea scallop growth to guide adaptive fisheries management

SESSION II: Posters Group 1 **10:30 - 12:00 pm**
LWB 3rd Floor

PRESENTER	TITLE
Anne Gilewski	The long and winding road: Tire wear particles in Connecticut estuaries and their interactions with bivalve shellfish
Quin Zabel	Machine-learning driven non-targeted mass spectrometry approach for pesticide screening in Sri Lankan drinking water samples
Erin Leathrum	The oxygen isotope ratio of benthic foraminifera as a conservative tracer of deep ocean circulation during the Last Glacial Maximum
Julia Lara Navarrete	Will there be crab for Christmas? Forecasting Dungeness crab (*Metacarcinus magister*) meat quality.
Vicki You	Identifying sand lance species and their distributions in the Northwest Atlantic using real-time PCR (qPCR)
Jessica Vorse	Planktonic diversity in the Revolution Wind project area
Meg Shah	Surface currents and coastal connectivity: Insights from seasonal drifter deployments in offshore Rhode Island Sound

SESSION II: Posters Group 1 (continued) **10:30 - 12:00 pm**

LWB 3rd Floor

PRESENTER	TITLE
Alexander Francoeur	Potential genetic underpinning of differential response to turbulence in diatoms and dinoflagellates
Erich Nitchke	Monthly measurements of carbonate system parameters in Long Island Sound reveal hypercapnia as an additional stressor to the Western Sound
Matthew Leason	Assessing dock-based deployments as a proxy for light and temperature in nearby seagrass beds
Paxton Tomko	Uncovering the role of methanogens in $CaCO_3$ precipitation in microbial mats

12:00 - 1:00 pm: **Lunch (Paul's Pasta); LWB 3rd Floor**

SESSION III: Oral Presentations Group 2 **1:00 - 2:00 pm**

Moderator: Yifan Zhu

LWB 103

TIME	PRESENTER	TITLE
1:00 -1:15 pm	Lisa Piastuch	Does adaptation to warming benefit the copepod, *Acartia tonsa*, during future marine heatwaves?
1:15 - 1:30 pm	Lucas Jones	Is there a genomic basis to CO_2 sensitivity in the Northern sand lance?
1:30 -1:45 pm	Paban Bhuyan	Submesoscale frontogenesis observed using an array of saildrones

SESSION IV: Posters Group 2 **2:00 - 3:30 pm**

LWB 3rd Floor, Snacks provided

PRESENTER	TITLE
Emma Siegfried	Temperature effects on the time to hatch in American sand lance (*Ammodytes americanus*)
Yifan Gu	Plankton community in Long Island Sound: Temporal and spatial dynamics
Eva Scrivner	Characterizing unique phytoplankton bio-optics to enhance estimates of pigments and productivity in Antarctic coastal waters
Sunnidae Gallien	Determining *Acartia* spp. nauplii abundance and phenology in Long Island Sound using mtCOI gene
Madison Sobol	Extending the record of carbon variables in the Northwest Atlantic Shelf utilizing the Regional Ocean Model System
Emily Watling	Oyster aquaculture associated with eelgrass (*Zostera marina*) Habitat – Maybe we can get along after all
Melissa Sanchez	Examining the uptake of methylmercury by the mixotroph *Ochromonas* sp. during heterotrophic or autotrophic growth

SESSION IV: Posters Group 2 (continued) **2:00 - 3:30 pm**
LWB 3rd Floor

PRESENTER	TITLE
Jackson Sanders	Molecular techniques for understanding harmful algal blooms: A review
Hayden Holcomb	Modeling larval transport and oyster reef connectivity in the Long Island Sound
Mehrnoosh Abbasian	Evaluating turbulence closure schemes under wave breaking conditions using the General Ocean Turbulence Model (GOTM)
Xavier Warren	Validation of atmospheric correction approaches of PACE imagery using ship-based radiometry across the coastal and open ocean Atlantic

SESSION V: Oral Presentations & Lightning Talks Group 2 **3:30 - 5:00 pm**
Moderator: Emily Watling
LWB 103

TIME	PRESENTER	TITLE
3:30 - 3:45 pm	Lucy Hendrickson	Sea spray: The missing ocean feedback
3:45 - 4:00 pm	Hung Nguyen	Temporal trends and causes of deoxygenation in the northwest Atlantic Shelf
4:00 - 4:15 pm	Hannah Roby	Digesting the evidence: Black sea bass and trophic impacts in Long Island Sound
4:15 - 4:20 pm	Catherine Crowley	Phytoplankton nitrate assimilation and response to coastal upwelling in the California Current (*Lightning Talk*)
4:20 - 4:25 pm	Gavin Jackson	Contribution of Long Island Sound light profile data to updated Eelgrass Habitat Suitability Index Model (*Lightning Talk*)
4:25 - 4:40 pm	Luke Glass	Tide and beach geomorphology impacts on a small-scale plume at Rocky Neck Beach, Connecticut
4:40 - 4:55 pm	Riley Pena	Maintenance of top-down control at a Predator’s Range Edge

4:55 - 5:00 pm: **Closing Remarks by Evan Ward**

5:00 - 7:00 pm: **Please join us for a post-Symposium Happy Hour at Par 4**

Thank you to students, faculty, and staff for a successful 2025 Feng Symposium!

ABSTRACTS

Oral Session Group I

Organic alkalinity in Arctic Sea ice brine: The dominant role in carbonate speciation

Samantha Rush[1*], Chang-Ho Lee[2,], Kitack Lee[2], Seog-Hyeon Yoon[2], Penny Vlahos[1]

[1]Department of Marine Sciences, University of Connecticut, 1080 Shennecossett Rd, Groton, CT 06340

[2] Division of Environmental Science and Engineering, Pohang University of Science and Technology, Pohang, Republic of Korea

* samantha.rush@uconn.edu

While total alkalinity (AT) is traditionally attributed to dissolved inorganic constituents, dissolved organic matter (DOM) can significantly contribute to AT, introducing errors in carbonate parameter calculations such as $CaCO_3$ saturation state (Ω) and partial pressure of CO_2 (pCO_2). Accurately quantifying organic alkalinity (OrgAlk) is particularly crucial in the rapidly changing Arctic. This study presents measurements of OrgAlk in the Arctic Ocean and assesses its influence on carbonate speciation, with OrgAlk contributing 0.1 – 1.0% to AT. Sea ice brine exhibited elevated DOM and OrgAlk, with an OrgAlk/DOC ratio of 0.13 ± 0.06 $\mu mol\ kg^{-1}\ \mu M^{-1}$, consistent with global ocean values. Correcting AT for OrgAlk increased computed pCO_2 (derived from AT and dissolved inorganic carbon, CT) upwards of 84 µatm and decreased $\Omega \leq 0.2$ for aragonite and ≤ 0.3 for calcite compared to uncorrected values. Elevated brine pCO_2 suggests that conventional estimates of Arctic sea ice CO_2 absorption capacity may be significantly overestimated, particularly in the spring, as OrgAlk is released from brines. OrgAlk contributed greater errors to carbon speciation than boron uncertainties, highlighting the necessity of accounting for even minor OrgAlk levels to refine predictions of surface pCO_2, net air-sea CO_2 flux, and the fate of $CaCO_3$ minerals.

Tissue-specific resident and transient microbial communities of the freshwater Unionid *Elliptio complanata*

Hannah I. Collins[1*], Tyler W. Griffin[1,2], and J. Evan Ward[1]

[1]University of Connecticut, Department of Marine Sciences, 1080 Shennecossett Road, Groton, CT 06340

[2]Bowdoin College, Department of Biology, 225 Maine Street, Brunswick, ME 04011

* hannah.i.collins@uconn.edu

Research into bivalve microbiomes has identified distinct microbial communities across tissue types. Some microbes to which these animals are exposed may become resident in host animals, whereas others are transiently associated. Most microbiome research has focused on marine bivalves, with little focus on freshwater species. The purpose of this study was to characterize the resident and transient gill and gut microbiomes of the freshwater eastern elliptio, *Elliptio complanata*. Mussels were collected from populations in the Delaware River. One subset of mussels was dissected immediately to isolate resident and transient microbes associated with gill and gut tissues. A second subset of mussels was depurated for 24 hours to allow animals to egest feces and transient microbes. Egested feces were collected, and gill and gut tissues isolated to characterize resident microbial communities. Water samples were taken to examine the pool of microbes from the Delaware River. All samples underwent 16S rRNA sequencing to identify the associated microbial communities. Data indicate that gill and gut microbial communities appear similar to each other, but distinct from source water and fecal communities. Depuration of these tissues induces shifts in the microbiomes, providing evidence of resident and transient fractions of tissue-associated microbial communities in freshwater mussels. and the fate of $CaCO_3$ minerals.

Thermal plasticity rather than adaptation to warming dominates reproduction and CTmax of a common copepod

Rowan Batts[1]*, Eidan Sanchez[2], Hans G. Dam[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT, 06340, USA
[2]MiraCosta College, Oceanside, CA, 92056
* rowan.batts@uconn.edu

Rising global temperatures and thermal variability in coastal marine ecosystems will cause many organisms to exceed their thermal optimum. Adaptation can help mitigate the effects of warming but often comes at the cost of reduced thermal plasticity, which may limit the ability of biota to respond to thermal extremes. Here, we use Acartia tonsa, a widespread coastal copepod, to investigate the effects of adaptation to warming on thermal plasticity in reproductive success and Critical Thermal maximum (CTmax), an acute measurement of the upper thermal limit. We used individuals from an existing long-term experimental evolution study with lineages exposed to ambient (18°C) and warm (22°C) temperatures for over 200 generations. To determine reproductive success, we measured egg production rates and egg hatching success at 10, 14, 20, 24, 28, 30, and 32 °C. Hatching success was unaffected by thermal adaptation. Egg production, however, decreased in the warm adapted population at the optimal temperature and increased above it compared to the ambient adapted population. We examined the plasticity in CTmax by testing individuals raised at 14, 20, and 28°C. CTmax exhibited a strong, but non-linear increase with increasing developmental temperature but was not affected by warming adaptation.

Carbonate system dynamics in the oxygen minima of the Sargasso Sea

Olivia Patrinicola[1]*, Penny Vlahos[1], Robert Mason[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
* olivia.patrinicola@uconn.edu

The Sargasso Sea is an oligotrophic region of the North Atlantic where local oxygen minimum profiles (OM) have been expanding. Minimum DO in the thermocline has decreased by 0.29 $\mu mol\ kg^{-1}$ per year from 1990-2015. As oligotrophic open ocean regions are representative of 60% of ocean surfaces, and with the expansion of these local OM, monitoring biogeochemical cycles changes over time is of utmost importance. The goal of this research is to establish a comprehensive understanding of the Sargasso Sea's carbonate system, with an emphasis on its local OM, through the analysis of biogeochemical parameters (dissolved oxygen, total alkalinity, dissolved inorganic and organic carbon, pH, nutrients, and particulate organic carbon). Three research cruises from Bermuda scheduled for 2024-2025 will visit 5-10 sampling stations and collect seawater samples to a depth of 1000 meters with a focus on OM in vertical profiles. Samples are analyzed to generate detailed carbonate system profiles and the impact on local pCO_2. Preliminary data from September 2024 followed distinct carbonate chemistry in OM. These cruises will provide exciting spatial and temporal information on local OM carbonate chemistry and carbon cycling.

Quantifying rates of denitrification and nitrogen fixation in *Zostera marina* beds using noble gas tracers

Kelsey Ward[1]*, Craig Tobias[1], Cara Manning[1]

[1] Department of Marine Sciences, University of Connecticut, Groton, CT 06340
* kelsey.ward@uconn.edu

Understanding which coastal ecosystems are sources or sinks of nitrogen is important for coastal eutrophication management. Currently, there are conflicting results on whether the presence of *Zostera marina* facilitates net nitrogen addition or removal in sediments. This uncertainty is largely due to inconsistent and imprecise methods. We aim to resolve this discrepancy by improving the N_2/Ar method, in which measurements of Ar, an inert noble gas, are used to quantify physically driven changes in gas saturation. This method relies on the assumption that physical processes affect N_2 and Ar identical, but solubility differences between the two gases can yield incorrect conclusions. We are refining this method by modifying a membrane inlet mass spectrometer (MIMS), which currently measures N_2 and Ar, to also measure the noble gases Kr and Ne. This will allow us to more precisely separate biological N_2 fluxes from physical fluxes driven by temperature and ebullition effects. We plan to then test the method on *Z. marina* mesocosms. Additionally, we will employ this method in the field to study local *Z. marina* beds throughout CT and RI. This method could help inform coastal management practices and eelgrass restoration efforts, as well as improve understanding of coastal biogeochemical processes.

Progressively greater biological carbon storage in the deep Atlantic during glacial inception

Monica Garity[1]*, David Lund[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
* monica.garity@uconn.edu

The last million years of Earth's climate has been dominated by the Ice Ages, the cyclic variation between cold glacial conditions with low atmospheric CO_2 (pCO_2) and warm interglacial conditions with high pCO_2. Lower pCO_2 may be due to enhanced carbon storage in the deep ocean, but reconstructions of oceanic carbon storage are sparse for key intervals of pCO_2 decline during the last glacial cycle (0-150 ka). Here we present reconstructions of $[CO_3^{2-}]$ and the $d^{13}C$ of dissolved inorganic carbon from the Brazil Margin spanning 1800 m to 3600 m water depth. The $[CO_3^{2-}]$ record from 3600 m indicates that carbon sequestration occurred in Antarctic Bottom Water (AABW) during the first major decline in pCO_2 at ~115 ka. During the second pCO_2 decline at ~70 ka, the $[CO_3^{2-}]$ records show greater carbon storage from 2300 m to 3600 m, likely due to expansion of poorly ventilated AABW. In each case, parallel changes in $d^{13}C$ imply the $[CO_3^{2-}]$ signals were due to accumulation of respired biological carbon. Importantly, shoaling of the $[CO_3^{2-}]$ saturation horizon during the second pCO_2 decline caused seafloor $CaCO_3$ dissolution, increasing alkalinity and further amplifying the ocean's capacity to store carbon.

Nitrous oxide dynamics and fluxes in the Southern Benguela Upwelling System (SBUS) in August 2023

Anagha Payyambally[1*], Julie Granger[1], Sina Wallschus[2], Samantha Siedlecki [1], Annie Bourbonnais[3], Fawcett, Sarah[2], Josie Mottram[1], Cara Manning[1]

[1]University of Connecticut, [2]University of Cape Town, [3]University of South Carolina
* anagha.payyambally@uconn.edu

Nitrous oxide (N_2O) is a potent greenhouse gas with a global warming potential 300 times greater than that of CO_2 over a 100-year time scale. The ocean is estimated to contribute a third of all natural N_2O emissions to the atmosphere. There are limited data on N_2O distributions in the Southern Benguela Upwelling System (SBUS), despite eastern boundary upwelling systems being potential hotspots of N_2O production. To address this gap, we measured N_2O concentrations and quantified sea-air fluxes within the SBUS in August 2023. Water samples were analyzed using gas chromatography. N_2O concentrations ranged from 8–27 nmol kg^{-1} (87–261% saturation). The bottom water near St Helena Bay showed the highest N_2O concentration and lowest O_2 concentration (32 μmol kg^{-1}) in our study. Correlations between N_2O, O_2, and nutrients suggest that the primary source of N_2O in most of our study region was nitrification, whereas in the bottom water near St Helena Bay, nitrification and denitrification could have both been significant sources. The sea-air flux of N_2O from SBUS was 1.2 [0.7, 2.2] μmol m^{-2} d^{-1} (median [Q1, Q3]). Our results indicate that N_2O emissions from the SBUS in August are similar to global average oceanic N_2O emissions.

Modeling the spatiotemporal effects of ocean acidification and warming on Atlantic sea scallop growth to guide adaptive fisheries management

Halle Berger[1*], Samantha Siedlecki[1], Shannon Meseck[2], Emilien Pousse[3], Dvora Hart[4], Felipe Soares[1], Antonie Chute[4], Catherine Matassa[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340,[2]NOAA Northeast Fisheries Science Center Milford Laboratory, Milford, CT, 06460,[3]Océanopolis, Brest, France, [4]NOAA Northeast Fisheries Science Center Woods Hole Laboratory, Woods Hole, MA, 02543
* halle.berger@uconn.edu

The Atlantic sea scallop (*Placopecten magellanicus*) fishery is one of the most valuable in the U.S. However, changing conditions driven by climate change and ocean acidification (OA) may reduce scallop availability and harvest. Scallop habitats already experience suboptimal temperature and carbonate chemistry conditions episodically, and regional models predict these conditions will worsen in the future. Here, we project the effects of OA and warming on scallop growth historically and over the next century using a dynamic energy budget (DEB) model spatially coupled to a regional ocean model. The model successfully simulated observed patterns in scallop growth based on temperature, food, and pCO2 conditions. Under combined end-of-century OA and warming, scallops grew slightly faster but reached smaller sizes in most areas, with mortality confined to the southern Mid-Atlantic. While OA contributed to uniform sublethal growth effects across the region, warming effects varied from positive in the north to lethal in the south. Notably, the cold pool area and deep Gulf of Maine emerged as thermal refugia, counteracting OA's negative energetic effects and making these areas potential candidates for rotational management. Altogether, our findings demonstrate the utility of the spatially coupled DEB model as a tool to inform adaptive fisheries management.

The long and winding road: tire wear particles in Connecticut estuaries and their interactions with bivalve shellfish

Anne L. Gilewski[1]*, Bridget Holohan[1], Sandra E. Shumway[1], J. Evan Ward[1]

[1]University of Connecticut, Department of Marine Sciences, 1084 Shennecossett Rd, Groton, CT 06340
* anne.gilewski@uconn.edu

Tire wear particles (TWP) are produced when car tires abrade on roadways. Resultant particles are washed away during rain events, directly entering waterways or via culverts that drain the road surface. These TWP contain a cocktail of polycyclic aromatic hydrocarbons, including pyrene, and are composed of natural, styrenebutadiene, and butadiene rubber, along with reinforcing and vulcanizing agents. These particles are recognized as significant anthropogenic contaminants in estuaries adjacent to human-built environments. Data are limited, however, on the abundance and distribution of TWP in estuaries near urban and suburban coastline locations in Connecticut (CT). Moreover, few studies have examined the interactions of TWP with estuarine animals. In this regard, bivalves perform essential ecosystem services, and their potential impairment by TWP could affect commercial and aquaculture ventures. Bivalves may further transfer TWP to higher trophic levels. We propose to examine the abundance of TWP within oyster (Crassotrea virginica) shellfish communities along the CT coastline to assess the degree of ingestion, rejection, and egestion of TWP by bivalves, and to assess the potential transfer of TWP to upper trophic levels. This science-based information will help guide management strategies and mitigate fears of shellfish consumption.

The oxygen isotope ratio of benthic foraminifera as a conservative tracer of deep ocean circulation during the Last Glacial Maximum

Erin Leathrum[1]*, David Lund[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT, USA
* erin.leathrum@uconn.edu

The Last Glacial Maximum (LGM; 19 – 23 ka) was marked by expanded Northern Hemisphere ice sheets, lower atmospheric pCO_2, and cooler mean sea surface temperatures. Traditional reconstructions based on the stable carbon isotope ratio ($\delta^{13}C$) of benthic foraminifera suggest expansion of poorly ventilated southern-sourced waters (SSW) in the deep Atlantic promoted oceanic carbon storage during the LGM. However, newer results from sedimentary neodymium isotopes (εNd) suggest there was little change in SSW geometry. Both $\delta^{13}C$ and εNd are non-conservative tracers, affected by organic matter remineralization or changes in deep water residence time. Therefore, a conservative tracer like the oxygen isotope ratio ($\delta^{18}O$) of foraminifera, which reflects temperature and the $\delta^{18}O$ of seawater, is needed. We propose creating an LGM Atlantic $\delta^{18}O$ section based on ~80 sediment cores from 30°S to 60°N and 1000 m to 5000 m water depth. Because spatial differences in $\delta^{18}O$ are similar in magnitude to interlaboratory $\delta^{18}O$ offsets – complicating the mapping of SSW – cores will be sampled for *Cibicidoides wuellerstorfi* and analyzed on one mass spectrometer, thus avoiding interlaboratory offsets. Using ^{14}C for chronological control, we will compare our results with $\delta^{13}C$ and εNd reconstructions to better constrain SSW extent and carbon storage during the LGM.

Machine-learning driven non-targeted mass spectrometry approach for pesticide screening in Sri Lankan drinking water samples

Quin Zabel*, Adam Graichen, Ishara Athauda, Dhananjalee Mahalekam, Nishad Jayasundra, Shuchi Anand, Penny Vlahos

University of Connecticut, University of Peradeniya, Duke University, Stanford University
* fiona.zabel@uconn.edu

Incidence rates of kidney disease of unknown etiology (CKDu) are a growing concern within global tropical agricultural areas, including the Wilgamuwa division of Sri Lanka. The wide diversity of pesticides used in the region may be a contributing factor. However, current targeted approaches collect only limited assessments of the environmental hazards to which people are exposed. Additionally, modern-day pesticides breakdown quickly by design, leading to the introduction of potentially toxic metabolites. We conducted comprehensive organic contaminants screening of drinking water samples in CKDu endemic and non-endemic regions using non-targeted mass spectrometry and machine learning-based library matching. We exploited community molecular networks to draw connections between related compound hits within non-targeted spectra, allowing for further identification of pesticide breakdown products. Non-targeted analysis yielded hits for Tebuconazole, Terbutryn, Kinoprene, Diazinon, Azoxystrobin, Orbencarb, Metalaxyl, Boscalid, Tebufenozide, Buprofezin, and Prometryne within drinking water samples. Several of these compounds have been linked with preliminary findings of increased risk of kidney disease. High regional variability was observed with the highest concentration pesticide being Kinoprene in the endemic and Terbutryn in the non-endemic region. Use of non-targeted techniques streamlines the process of environmental forensics and by rapidly investigating many organic contaminants simultaneously as potential drivers of CKDu.

Identifying sand lance species and their distributions in the Northwest Atlantic using real-time PCR (qPCR)

Vicki Y. You[1]*, Hannes Baumann[1], Paola G. Batta-Lona[1], Tim O'Donnell[2]

[1]University of Connecticut, Avery Point, USA
[2]Gloucester Marine Genomics Institute Inc., Gloucester, USA, tim.odonnell@gmgi.org
* vicki.you@uconn.edu

Sand lance are crucially important forage fishes in north-temperate to polar ecosystems and are key prey to more than seventy species of squid, fish, seabirds, and marine mammals. Due to their life history traits and slender build, they are often under- sampled by standard trawl surveys, resulting in a lack of knowledge concerning the biogeographic distribution of the different species, population dynamics, connectivity, and basic ecology. This study focused on two sand lance species in the Northwest Atlantic: the American sand lance (*Ammodytes americanus*), reported to be residing in nearshore habitats, and the Northern sand lance (*Ammodytes dubius*), reported to inhabit offshore sand banks. Due to the lack of distinguishing features between the two species, using standard morphology to differentiate A. americanus from A. dubius has been unsuccessful and resulted in misidentifications that have cast doubt on the efficacy of molecular techniques like COI mtDNA barcoding to discriminate the sand lance species. Our work used a custom real-time PCR assay to amplify a fragment of the mtDNA ATP6 gene, for the effective discrimination of the two Ammodytes species. Samples collected from nearshore Gulf of Maine and offshore New England waters were analyzed for species identification and distribution. Our findings give first insights into the species composition and biogeography of the Northwest Atlantic sand lance species to aid in more targeted management and conservation recommendations.

Will there be crab for Christmas? Forecasting Dungeness crab (Metacarcinus magister) meat quality

J. Lara Navarrete[1*], S. Siedlecki[1], IC. Kaplan[2], EL. Norton[3], C. King[4], O. Yazzie[5], F. Soares[1], K. Corbet[6], D. Ayres[7], M. George[7], CR. Biggs[7], J. Schumacker[8]

[1]Department of Marine Sciences, University of Connecticut, Storrs, CT, USA; [2]Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, USA; [3]Cooperative Institute for Climate, Ocean, and Ecosystem Studies, University of Washington, Seattle, WA, USA, [4]Fairfield University, Fairfield, CT, USA; [5]Arizona State University, Tempe, AZ, USA; [6]Oregon Department of Fish and Wildlife, Newport, OR, USA; [7]Washington Department of Fish and Wildlife, Montesano, WA, USA; [8]Quinault Department of Fisheries, Taholah, WA, USA
* Rqw24002@uconn.edu

Dungeness crab (*Metacarcinus magister*), a native species of the Pacific coast, is one of the West Coast's most valuable fisheries with harvests value ranging from $10M to $50M. In Washington and Oregon, the harvesting season typically starts before Christmas, when the test fishery confirms that the threshold in meat to total crab weight ratio, i.e., meat quality, is surpassed. Recently, the fishery has been opening later presenting challenges to the current management process. Regional ocean conditions that influence the meat quality of crabs have been changing as well. Managers and end users are thus interested in having a prognostic tool to forecast when the season will open. Seasonal forecasts of ocean conditions exist in the region which can be used to inform this fishery. Using two different statistical models, beta regression and General Additive Model (GAM), observed meat quality was related to oceanographic forecast conditions. Both models provide a forecast of the day of the year that the meat quality threshold was surpassed at each sampling station for the entire forecast period (1999-2024). Forecast skill was evaluated outside the calibration period and was found to be skillful. The forecasting products that emerge will be co-designed with managers.

Planktonic diversity in the Revolution Wind project area

Jessica Vorse[1*], Vicki You[1], Bridget Holohan[1], Evan Ward[1], Paola Batta-Lona[1]

[1]University of Connecticut, Department of Marine Sciences
* jessica.vorse@uconn.edu

Revolution Wind, an offshore wind (OSW) farm servicing Connecticut and Rhode Island, is under construction in New England's shelf seas. Initial OSW impact investigations neglected planktonic organisms in the pelagic zone. Zooplankton are a vital part of the marine carbon cycle and pelagic food web, transporting organic carbon from the euphotic zone to deep waters during diel vertical migration and mediating energy transfer from the lowest to highest trophic levels. During six research cruises from September 2024 – October 2025 our research group will investigate zooplankton abundance and distribution within and around Revolution Wind. We are employing three sampling methods for cross validation: Bongo net tows, environmental DNA (eDNA), and FlowCam visualization. Bongo net and eDNA samples will be analyzed for zooplankton diversity using COI and 18S primers. FlowCam data will be analyzed using trained artificial intelligence software. We aim to (1) identify a core subset of taxonomic groups making up the zooplankton community of the OSW study area, (2) investigate how zooplankton diversity changes seasonally, and (3) determine whether zooplankton diversity and distribution are impacted by the development of Revolution Wind. This work will inform best management of a complex marine ecosystem shared by wind energy, fisherman and recreationists, alike.

Surface currents and coastal connectivity: Drifter-base insights for a Mid-Atlantic Bight offshore wind project

Meg Shah*, Michael M. Whitney

University of Connecticut
* meg.shah@uconn.edu

The Vineyard Wind project encountered 2 turbine blade failures in July 2024. Within days, blade debris washed up on nearby beaches in Martha's Vineyard, Nantucket, and coastal Massachusetts. These materials are potentially hazardous to coastal communities and wildlife and can impair beach use and coastal access. Assessing surface flow pathways within and surrounding Offshore Wind (OFW) construction zones is essential in emergency tracking and material recovery after turbine breakage. OFW turbine installation is currently underway in the Cox Ledge leased area in the Rhode Island Sound region of the Mid-Atlantic Bight. Four to six custom-built, biodegradable surface drifters with SPOT Trace GPS tracking devices were deployed throughout the project area in September, October, February, and May (2024-2025) to characterize surface flow pathways, drifter dispersion, and residence times. Drifter tracks exhibit seasonal and/or event-based differences in path velocities, directions, and extent. In September, drifters predominantly traveled along shore southwestward, reaching as far as Delaware. In October, drifters exhibited greater tidal ellipses and residence time, travelling northeastward but remaining within the offshore region. In February, drifters beached onto Martha's Vineyard and Nantucket's south shore days after deployment. Results highlight varied surface flow pathways connecting the leased area to both local and distant coastlines. These observations can validate and refine debris retrieval models, such as NOAA Office of Response and Restoration spill model utilized in the Vineyard Wind incident.

Potential genetic underpinning of differential response to turbulence in diatoms and dinoflagellates

Alexander Francoeur*, Senjie Lin

University of Connecticut, Avery Point
* alexander.francoeur@uconn.edu

Diatoms and dinoflagellates are generally known to flourish under different oceanographic conditions. In the classic framework, diatoms thrive in the high nutrient waters of turbulent well mixed seas whereas dinoflagellates prefer calmer waters. Dinoflagellates can be conspicuously sensitive to water movement in species with bioluminescence. A better understanding of this latter dynamic could explain ecological differences between these groups and add context to help model bloom dynamics. The genomic basis of this preference is especially underexplored. Here, we investigated genes used in sensing turbulence in these two important groups of phytoplankton. We mined existing genome and transcriptomic data, including TARA Oceans metatranscriptomic database, to examine the distribution and expression patterns in shear stress sensing genes. A diversity of mechanosensitive receptors (MsR) was identified. Overall, their sequences are not conserved, and diatoms and dinoflagellates possess distinct sets of MsRs, although some functional domains are shared. Mechanosensitive channel beta domain was found in both algal groups, but a phylogenetic analysis showed their diverse sequences, with evidence of multiple independent acquisition from bacteria. Additionally, the number of genes containing this mechanosensitive channel beta domain are markedly expanded in dinoflagellates. This may suggest dinoflagellates have evolved increased adaptive responses to respond to turbulence.

Monthly measurements of carbonate system parameters in western Long Island Sound reveal hypercapnia as an additional stressor

Erich Nitchke[1*], Penny Vlahos[1], Samantha Rush[1], Katie O'Brien-Clayton[2]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
[2]Connecticut Department of Energy and Environmental Protection
* erich.nitchke@uconn.edu

Estuaries are complex transition zones where freshwater, typically from rivers, mixes with saline oceanic water, and biological productivity is high, which impacts carbonate system parameters. Estuaries undergo two types of acidification. The first is the long-term influx of carbon dioxide gas (CO_2) from rising atmospheric CO_2 levels, which is also seen with the open ocean. The second results from seasonal eutrophication wherein excess respiration generates elevated CO_2 levels in the waters. This seasonal hypercapnia represents an additional stressor to the Long Island Sound (LIS) ecosystem that is important to constrain for improving LIS ecosystem integrity. In 2023, the Connecticut Department of Energy and Environmental Protection integrated measurements of total dissolved inorganic carbon (DIC), total alkalinity (TA), and spectrophotometric pH to their monthly sampling effort, allowing for the establishment of a time-series of LIS carbonate system measurements. We present the data from 2023 and 2024 to identify the trends and provide insights in LIS's carbonate system parameters. Furthermore, we utilize CO_2SYS to derive aragonite saturation utilizing different combinations of carbonate parameters and compare the differences between the values obtained from each across the region. This work will inform and contribute to the long-term remediation and sustainability of LIS.

Investigating temperature trends in Long Island Sound and dock-based monitoring for seagrass conservation

Matthew Leason[1,2*], Jamie Vaudrey[1,2]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
[2]Connecticut National Estuarine Research Reserve, Groton, CT 06340
* matthew.leason@uconn.edu

Understanding light availability and temperature variation in Long Island Sound is critical to studying ecosystem stressors on eelgrass (*Zostera marina*). However, methods used to deploy sensors (e.g., mounting on screw anchors) are labor intensive to maintain as sensors must be cleaned of fouling organisms every 7-10 days. Additionally, sensors deployed in the dense meadows are easily lost. Mounting sensors to nearby docks simplifies sensor maintenance and retrieval, though research is lacking on how well this represents conditions in nearby eelgrass beds. Since July 2024, we have deployed temperature/light loggers on docks adjacent to eelgrass beds in seven locations in eastern Long Island Sound. These data inform our understanding of temperature and light patterns over time. Deployment of sensors in nearby eelgrass beds will occur in 2025 and allow for a comparison assessing whether dock-based sensors can act as a practical and accurate alternative to traditional in-bed measurements. Additionally, different types of light sensors will be compared at the dock, to assess the need for more expensive sensors capable of measuring photosynthetically active radiation versus luminosity. Results will inform large-scale, ongoing environmental monitoring in support of eelgrass conservation efforts in Long Island Sound and beyond.

Uncovering the role of methanogens in $CaCO_3$ precipitation in microbial mats

Paxton Tomko[1]*, Pieter T. Visscher[1]

[1]University of Connecticut, Department of Marine Science
* paxton.tomko@uconn.edu

Methanogenic archaea (MA) are well-known for their contribution to methane production in the global carbon cycle, producing ~70% of this greenhouse gas annually. Less well studied is their contribution to the carbon cycle through the precipitation of $CaCO_3$ mediated by their metabolism and exopolymeric substance (EPS) production. MA likely contribute to $CaCO_3$ precipitation in sediments, including microbial mats. I investigated MA in (freshwater) microbialites from Fayetteville Green Lakes, NY (FGL), a Proterozoic Ocean analog, and marine non-lithifying microbial mats from Barn Island, CT (BI) to reveal their role in carbon cycling, notably their contribution to $CaCO_3$ precipitation in these systems. In situ measurements of net CH_4 fluxes are combined with observations in MA enrichments of CH_4 production and calcium binding, and the role of EPS in $CaCO_3$ precipitation. I isolated methylotrophic MA from both systems through enrichments, performed CH_4 measurements, and obtained molecular diversity data. SEM observations of MA revealed ~1 µm coccoidal cells that produce EPS. The strains were fast growing, with some reaching stationary phase in less than a week. Next steps include measurements of calcium binding to MA EPS, assessment of carbonate mineral production, and linking CH_4 production in cultures and in the field.

ABSTRACTS

Oral Session Group 2

Does adaptation to warming benefit the copepod, *Acartia tonsa*, during future marine heatwaves?

Lisa A. Piastuch[1]*, Hans G. Dam[1], Michael Finiguerra[2], Catherine M Matassa.[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
[2]Department of Ecology and Evolutionary Biology, University of Connecticut, Groton, CT 06442
* lisa.piastuch@uconn.edu

Marine heatwaves (MHW), thermal events persisting for more than five consecutive days at temperatures above the 90th percentile of 30-year historical mean, are increasing in frequency and intensity. MHW can have adverse effects on ectotherms as increased temperatures results in higher metabolic activity and energy expenditure. However, long-term adaptation to ocean warming (OW) may be advantageous to surviving MHW. Studies have revealed increased thermal tolerance after multi-generations of exposure to higher temperatures. We exposed the copepod *Acartia tonsa*, a dominant estuarine species, adapted to OW for over 150 generations and ambient-adapted lineage acclimated to OW conditions to future MHW temperatures of 27.5 °C and 30.8 °C for 7.5 days. Survival, egg production rate (EPR) and hatching success (HS) were measured. Initial results suggest warming adaptation has no effect on survival during MHW at 27.5 °C but at 30.8°C is detrimental. At 27.5 °C, there was no observable difference in EPR, whereas HS was significantly lower in the OW-adapted lineage. EPR and HF at 30.8 °C were not assessed due to few surviving adults. These preliminary results suggest, paradoxically, that warming adaptation does not confer benefits during MHW, but contrarily is costly to the population, potentially exacerbating deleterious effects of MHW.

Is there a genomic basis to CO_2 sensitivity in the Northern sand lance?

Lucas F. Jones*, Christopher S. Murray, Max Zavell, Emma Siegfried, Nina Overgaard Therkildsen, Hannes Baumann

* lucas.jones@uconn.edu

Previous experimental work has produced strong empirical evidence that Northern sand lance (*Ammodytes dubius*) embryos are unusually sensitive to future ocean CO_2 levels, showing reductions in hatching success of up to 60% in response to 2000 µatm CO_2. However, the mechanisms behind this severe reduction in hatching success in sand lance under acidified conditions are unresolved. We used experimentation and molecular tools to inform if there are genomic signatures associated with samples that survive through the embryo phase at high CO_2. We used control pH (400 µatm) and acidified (2,000 µatm) treatments at two different temperatures (10 -> 7 °C, 10 -> 5 °C), and collected successful and unsuccessful hatchlings. We used low-coverage, whole genome sequencing on all samples (n = 687) to elucidate any genomic regions of differentiation between successful vs unsuccessful hatch groups. Our initial findings will be a first glimpse into the genomic makeup between sand lance that survive through the embryonic stage and sand lance that are not able to survive in acidified treatments. Importantly, determining if there is a genomic basis to CO_2 sensitivity will allow us to estimate the heritability of the sensitivity and allow for forecasting the potential of the species to evolve.

Submesoscale frontogenesis observed using an array of saildrones

Paban Bhuyan[1]*, Leonel Romero[1], Cesar Rocha[2], J. Thomas Farrar[3]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT
[2]Oceanographic Institute of the University of São Paulo, São Paulo, Brazil
[3]Woods Hole Oceanographic Institution, Woods Hole, MA
* paban.bhuyan@uconn.edu

Fronts are not immutable; they undergo a life cycle. The terms frontogenesis and frontolysis describe the formation and decay of fronts. For nearly a century, frontogenesis has been explained using two-dimensional dynamics, where mesoscale strain intensifies fronts through deformation flows. However, model-based studies over the past decade suggest that frontogenesis at smaller scales (0.1–10 km, ~1 hour)—referred to as submesoscale frontogenesis—intensifies fronts through convergent flows following three-dimensional Turbulent Thermal Wind (TTW) dynamics. From an energy transfer perspective, mesoscale strain has been associated with an inverse energy cascade, transferring energy to larger scales. In contrast, divergence-driven submesoscale turbulence is linked to a forward cascade, transferring energy to smaller scales. Recent airborne remote sensing observations at the ocean surface have shown evidence of both cascades attributing the energy transfer to either strain rate or divergence alone. Here we present the first in situ observational evidence of submesoscale frontogenesis using a coordinated Saildrone array. We show that both forward and inverse cascades arise from the combined effects of strain and divergence. We also use multi-depth observations to compute vertical profiles of kinetic energy flux and show how energy transfer mechanisms vary with depth—an aspect not resolved in prior studies.

Temperature effects on the time to hatch in American sand lance (*Ammodytes americanus*)

Emma Siegfried[1]*, Lucas Jones[1], Zofia Baumann[1], Hannes Baumann[1]

[1]Department of Marine Sciences, University of Connecticut, Groton CT 06340
* emma.siegfried@uconn.edu

Sand lances (*Ammodytidae*) are important forage fishes in temperate to polar shelf seas across the northern hemisphere. One species, the Northern sand lance (*Ammodytes dubius*) is sensitive to ocean warming and acidification, but whether the same is true for congeneric species is yet to be seen. American sand lance (*A. americanus*) live inshore, is the most closely related species to *A. dubius*, and have not been adequately studied. If sensitivity to ocean warming or acidification is found in *A. americanus*, this could be an evolutionarily conserved trait with broad implications for the entire genus. Our first objectives were to identify a wild source population of *A. americanus* for repeated sampling, establish a brood stock, and conduct an experiment quantifying temperature-dependent hatch time and hatching. Adult *A. americanus* were encountered and collected via beach seine in the harbor of Wells, Maine (US) and transported to the Rankin laboratory. Adults became flowing ripe when temperatures decreased below 7˚C. Strip-spawned embryos were reared at 5˚C or 8˚C and hatching timing and size were recorded. Hatching was delayed in the 5˚C treatment in comparison to the 8˚C treatment. Future work will expand experiments to quantify responses to ocean warming and acidification in *A. americanus*.

Plankton community in Long Island Sound: Temporal and spatial dynamics

Yifan Gu[1]*, Huan Zhang[1], Senjie Lin[1]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340, USA
* tvx24001@uconn.edu

Long Island Sound (LIS) is an estuary surrounded by urbanized regions, therefore understanding the dynamics of plankton communities in LIS is vital for monitoring ecosystem changes and anthropogenic impacts such as eutrophication and climate change. Here, we investigated the spatial and temporal variations of phytoplankton communities in LIS from 2023 to 2024. Water samples were collected monthly at ten stations across LIS, and phytoplankton communities were characterized by microscopy based on established taxonomic protocols. A total of 261 surface and bottom water samples were processed. Over 100 taxa were identified, with diatoms being the most abundant and diverse group. Major seasonal blooms were observed, including a winter bloom dominated by *Skeletonema* spp., and minor blooms in spring and summer involving other diatoms and dinoflagellates. In addition to traditional microscopy, DNA was extracted from selected bloom samples for high-throughput sequencing (HTS) of the 18S rRNA gene (rDNA) V4 region. The integration of HTS resolves taxonomic ambiguities, enhancing our understanding of microbial diversity and ecological dynamics in coastal systems. This comprehensive sampling provides critical insights into seasonal patterns, bloom dynamics, and the ecological significance of plankton in LIS.

Characterizing unique phytoplankton bio-optics to enhance estimates of pigments and productivity in Antarctic coastal waters

Eva Scrivner[1]*, Jessie Turner[1], Oscar Schoffield[2], Michael Cappola[3], Heidi Dierssen[1]

[1]Department of Marine Science, University of Connecticut, Groton, CT, USA
[2]Department of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ, USA
[3]School of Marine Science and Policy, University of Delaware, Newark, DE, USA
* mel24002@uconn.edu

The Southern Ocean is a critical regime for air-sea carbon exchange, yet drastic uncertainties persist in the region's carbon budget. Phytoplankton absorb less blue light in the Southern Ocean than the global ocean; as such, global remote sensing retrievals underestimate Chlorophyll-a, a key metric of primary productivity, by a factor of 2 – 2.5. Using a suite of radiometric, pigment, and imaging data, here we characterize the unique bio-optics of the Western Antarctic Peninsula to refine algorithmic retrievals of regional chlorophyll, primary productivity, and phytoplankton community composition. Data was collected onboard three cruises through the NSF Palmer Station Long Term Ecological Research Site (PalLTER) in November 2021 and January 2023 and 2024. Reflectance measurements were conducted using a bow-mounted, solar tracking hyperspectral radiometer from 350 – 800 nm (HyperSAS). Additional measurements include phytoplankton absorption using an integrating cavity absorption meter (QFT-ICAM), phytoplankton taxonomic composition via High Performance Liquid Chromatography, and particle imaging using an Imaging Flow Cytobot. Radiometry measurements were compared to reflectance products from the MODIS and Sentinel 3 – OLCI sensors, validating calibration and atmospheric correction in this region. While ongoing, the refined retrievals produced in this study can improve understandings of Southern Ocean carbon dynamics amid continued global climate change.

Determining *Acartia* spp. nauplii abundance and phenology in Long Island Sound using mtCOI gene

Sunnidae Gallien*, Gihong Park, and Hans G. Dam

Department of Marine Sciences, University of Connecticut, Groton, Avery Point, Connecticut 06340, USA
* guu24004@uconn.edu

The abundance and phenology of dominant copepod species, *Acartia hudsonica* in winter-spring and *Acartia tonsa* in summer-fall in Long Island Sound (LIS), have been characterized since 2002 by the CT-DEEP sponsored Zooplankton Monitoring Program. The adult and copepodid stages of these species, respectively, are identified by microscopy. The naupliar stages of copepods are not identified to species because of their morphological similarity, which makes it cost prohibitive. However, molecular identification is a useful method that allows one to quantify species-specific nauplii. Species-specific TaqMan probes were designed and labeled with 2 distinct fluorescent dyes (duplexing qPCR) targeting mitochondrial cytochrome c oxidase subunit I (mtCOI) gene. We hypothesize that there will be a linear relationship between mtCOI copy number and naupliar body carbon, suggesting that qPCR data can estimate the abundance of each species even during co-occurring periods. Because the specimens were preserved in DNA-damaging formaldehyde, we need to optimize a protocol with subsequent tests for: 1. probe sensitivity and specificity; 2. comparison of living/preserved nauplii specimen with different periods; 3. applying to the decadal DEEP nauplii samples. In combination with continued tests, this approach may provide insight into the seasonal and long-term changes of the dominant *Acartia* spp. in the LIS.

Extending the record of carbon variables in the Northwest Atlantic shelf utilizing the regional ocean model system

Madison M. Sobol*, Samantha A. Siedlecki, Hung Q. Nguyen

University of Connecticut
* Madison.sobol@uconn.edu

A global increase in atmospheric carbon dioxide (CO_2) has resulted in intensified ocean warming and acidification globally, but regionally their trends are modified by coastal processes. These climate stressors are especially detrimental to sensitive coastal regions, emphasizing the need to study their long-term impact. Currently, the carbon observational record on the Northwest Atlantic shelf extends only to 2006, posing challenges for models that work to quantify the historical trends and biogeochemical processes under climate stress. Here we apply an empirical algorithm, as detailed in McGarry et al. (2021), to the Regional Ocean Model (ROMS) and World Ocean Database (WOD) observations to reconstruct carbon variables and compute trends on the Northwest Atlantic Shelf. By focusing on the subsurface environment, we can better understand how carbon is transferred to depth on the shelf through historical reconstructions, including carbon sequestration potential. Analyzing metrics relevant to mCDR can provide insights into how the potential for CO_2 uptake has changed over time already and can help identify regions where mCDR would be most successful or harmful.

Oyster aquaculture associated with Eelgrass (*Zostera marina*) habitat – Maybe we can get along after all

E.A. Watling[1,2*], J.M. Vaudrey[1,2], C. R. Tobias[1,2], A. Hamilton[2]

[1]University of Connecticut Department of Marine Sciences, 1084 Shennecossett Rd, Groton, CT 06340
[2]Connecticut National Estuarine Research Reserve
* emily.watling@uconn.edu

Oyster aquaculture thrives under environmental conditions like those required by the marine plant eelgrass (*Zostera marina*). Over the past century, eelgrass worldwide has declined due to poor water quality. As efforts to improve water quality advance, eelgrass has the potential to recolonize areas like Long Island Sound, which may lead to increased overlap with aquaculture. Due to perceived incompatibility, current regulations prohibit aquaculture within 25 feet of existing eelgrass beds; however, low-density, transient cages utilized in eastern Connecticut may pose less of an impact than permanent methods. We hypothesize that aquaculture and eelgrass may have mutually beneficial interactions, particularly related to water chemistry changes and flow dynamics. Here we present initial results from a before-after-control-impact (BACI) study deploying aquaculture cages within eelgrass in Beebe Cove, Connecticut. Oyster and eelgrass growth metrics, as well as water condition parameters, were evaluated across four treatments: oysters in bottom cages within eelgrass, oysters in bare sediment, and two adjacent cage-free reference sites. Results were evaluated to assess the impacts of aquaculture and eelgrass interactions from the perspectives of both species. Early findings indicate a relationship between oyster growth and treatment. This study will inform the management community to optimize economic benefit and environmental stewardship.

Examining the uptake of methylmercury by the mixotroph *Ochromonas* sp. during heterotrophic or autotrophic growth

M. Sanchez[1*], R. Mason[1], C. Koerting[1], C. Chen[2]

[1]University of Connecticut | Department of Marine Science
[2]Dartmouth College | Department of Biological Sciences
* melissa.sanchez@uconn.edu

Photosynthetic plankton, both algae and bacteria, constitute the foundation of the marine food web. Recent studies looking at mixotrophs, distinguished by their ability to use photosynthetic and heterotrophic nutrition, have revealed that they constitute the majority of single-celled and multicellular plankton. The impact of these organisms within marine food chains is being recognized and advanced, but there is an urgent need for understanding the role of mixotrophs in trophic transfer of contaminants. The bioaccumulation of methylmercury (MeHg) by microbes has been recognized as the key entry point into aquatic food webs as the bioconcentration of MeHg into marine phytoplankton is recognized as the largest bioconcentration step in the marine food chains. Incorporating mixotrophic variation in nutrition may account for differences among MeHg algal uptake between species and therefore most likely impacts marine mercury cycling. Therefore, developing biogeochemical models that focus on incorporating mixotrophs into oceanic food web structures and their impact on MeHg bioaccumulation is the next step toward understanding the role of these important organisms. To understand how different feeding modes drive changes in MeHg uptake a feeding/light experiment was conducted. The uptake of MeHg by the mixotrophic *Ochromonas*, characterized as a facultative mixotrop

Molecular techniques for understanding harmful algal blooms: A review

Jackson Sanders[1*], Senjie Lin[1]

[1]University of Connecticut, Department of Marine Sciences, Groton, CT
* lgp24001@uconn.edu

Harmful algal blooms (HABs) are ecological events caused by diverse algal species and are influenced by a myriad of biotic and abiotic factors. The urgently needed development of effective prevention and control techniques face two primary challenges. The first being technical shortfalls in rapidly identifying and monitoring the causative species. The second is the absence of research frameworks/technologies for accurately diagnosing the primary bloom drivers. Molecular techniques offer promising solutions to these issues, and research in this field has seen significant growth over the past two decades. Previous reviews have predominantly focused on species identification and monitoring, leaving the status of bloom driver studies less clear. This review provides a comprehensive overview of molecular techniques for HAB identification and driver analysis. HAB-specific use cases of techniques and comparison are provided. Nucleic acid-based techniques presently dominate over antibody-based techniques due to their tunable taxon-specificity and ease to prepare probes. In-situ applications and monitoring platforms still have room for improvement. The omics approach is the most promising choice for unraveling HAB drivers but requires a framework and a quantitative model for estimating the contribution of potential responsible factors. Future prospects relating to particular needs in HAB research and emerging technologies are discussed.

Validation of atmospheric correction approaches of PACE imagery using ship-based radiometry across the coastal and open ocean Atlantic

Xavier Warren*, Gavin Tilstone[2], Tom Jordan[2], Heidi Dierssen[1], Michael Cappola[3]

[1]University of Connecticut
[2]PML - Plymouth Marine Laboratory
[3]University of Delaware
* rxm24002@uconn.edu

Eastern oysters (*Crassostrea virginica*) provide numerous ecosystem services to coastal communities along the US east coast, including shoreline stabilization, water filtration, habitat for diverse fish and invertebrate assemblages, and support for valuable fisheries. In Connecticut, commercial shellfish harvests are currently valued at $25M USD per year, and recreational shell fishing drives local economies. However, these ecosystem services, provided by benthic adults, rely on successful recruitment of pelagic larvae that may originate from other reefs. Thus, the degree of connectivity and gene flow among reefs depends on the ecological and hydrodynamic conditions experienced by larvae. Understanding how oyster reefs reproduce, repopulate, and recruit new oysters is imperative for continuing aquaculture operations. We plan on employing a coupled biophysical larval transport model to assess net larval transport and connectivity among oyster beds along the central CT coast, using quantitative field surveys of intertidal oyster beds at focus areas to validate model outputs and analyze potential reef sources and sinks. This work aims to determine which reefs are particularly important for oyster recruitment in the Long Island Sound, and which reefs are most vulnerable to changing environmental conditions and overharvesting.

Evaluating turbulence closure schemes under wave breaking conditions using the General Ocean Turbulence Model (GOTM)

Abbasian Mehrnoosh*, James O'Donnell, Alejandro Cifuentes-Lorenzen, Craig Tobias

Department of Marine Sciences,University of Connecticut
* mehrnoosh.abbasian@uconn.edu

Ocean dynamics are significantly influenced by near surface turbulence, which modulates vertical mixing, the mixed layer depth, air-sea fluxes and therefore key biogeochemical cycles on the planet. We present preliminary results from the implementation and validation of GOTM to study subsurface turbulence using three turbulence closure schemes (i.e., k-ε, GLS, and k-ω) in the presence of breaking waves, exploring mixing with varying detail and accuracy. Results are compared to observations from the ASIT TKE 2019 experiment focused on wave-induced perturbations at the air-sea interface. The k-ε and GLS accurately capture the temporal evolution of depth-integrated shear production and vertical structure of the Reynolds stresses, closely mirroring observations in the dataset. Although both closures slightly underestimate the shear production based on default parameters, they still provide a robust representation of shear-driven turbulence. This is consistent with the shear frequency squared (SS) aligning well with observations. While SS is slightly underestimated at certain depths, the shear's vertical structure is well captured. Evaluation of k-ε and GLS models against observed TKE dissipation rate shows that both perform similarly, underestimating TKE enhancement despite capturing the vertical structure. We focus on testing boundary conditions to assess the k-ε scheme's ability to capture subsurface TKE enhancement from breaking waves.

Modeling larval transport and oyster reef connectivity in the Long Island Sound

Hayden Holcomb[1]*, Michael Whitney[1], Catherine Matassa[1]

[1]University of Connecticut
* bsv24005@uconn.edu

Eastern oysters (*Crassostrea virginica*) provide numerous ecosystem services to coastal communities along the US east coast, including shoreline stabilization, water filtration, habitat for diverse fish and invertebrate assemblages, and support for valuable fisheries. In Connecticut, commercial shellfish harvests are currently valued at $25M USD per year, and recreational shell fishing drives local economies. However, these ecosystem services, provided by benthic adults, rely on successful recruitment of pelagic larvae that may originate from other reefs. Thus, the degree of connectivity and gene flow among reefs depends on the ecological and hydrodynamic conditions experienced by larvae. Understanding how oyster reefs reproduce, repopulate, and recruit new oysters is imperative for continuing aquaculture operations. We plan on employing a coupled biophysical larval transport model to assess net larval transport and connectivity among oyster beds along the central CT coast, using quantitative field surveys of intertidal oyster beds at focus areas to validate model outputs and analyze potential reef sources and sinks. This work aims to determine which reefs are particularly important for oyster recruitment in the Long Island Sound, and which reefs are most vulnerable to changing environmental conditions and overharvesting.

Sea spray: The missing ocean feedback

Lucy Hendrickson*, Penny Vlahos, Leonel Romero

* lucy.hendrickson@uconn.edu

The air-sea interface is a major climate control for our planet by regulating the balance of CO_2 free in the atmosphere and stored in the ocean. At high winds, this boundary layer becomes turbulent and challenging to parameterize in gas exchange models. Sea spray is only now emerging as an important but unaccounted-for parameter in air-sea exchange models. Here we apply state-of-the-art air-sea surface sea spray generation models coupled to a carbonate system model to predict the spray-driven flux of carbon dioxide (CO_2) gas between the atmosphere and ocean at various wind speeds and sea states. When spray droplets are injected into air, they are known to experience gas exchange by both temperature equilibration and evaporation. Our results suggest that the latter process leads to a super-saline and acidic droplet that removes dissolved inorganic carbonate and bicarbonate, chemically converting them to additional CO_2 and thereby evading more CO_2 than predicted by traditional models that do not consider this process. At 40% evaporation, our results suggest that the droplet evicts all of its dissolved inorganic carbon, which is a 10-fold increase in potential CO_2 evasion. We estimate that gas flux driven by spray can be on the same order of magnitude as interfacial fluxes at winds of 20 m/s or higher, and can counter the direction of interfacial fluxes. Relative humidity and the temperatures of the air and the surface seawater are also found to be determining factors in the direction and magnitude of spray-driven flux. We conclude that evaporating sea spray is a significant feedback to ocean CO_2 uptake and could serve important roles in episodic storm events and over longer planetary timescales.

Digesting the evidence: Black sea bass and trophic impacts in Long Island Sound

Hannah Roby[1]*, Hannes Baumann[1]

[1]Department of Marine Science, University of Connecticut, Groton, CT 06340
* hannah.roby@uconn.edu

The rapid range expansion of black sea bass (*Centropristis striata*) in the Northeast Atlantic has attracted attention from ecologists and fisheries stakeholders. The species is a known mesopredator on crustaceans and fish, including several commercially and recreationally valuable species. However, the ecological impacts of their increased abundance within coastal ecosystems like Long Island Sound (LIS) remain unclear. This study will provide the first comprehensive diet analysis of black sea bass to assess its trophic impacts in LIS. Fish across the entire size spectrum and LIS regions were collected during the 2024 spring and fall LIS trawl surveys. Morphological stomach content analysis was performed using numeric and gravimetric methods, with prey identified to the lowest taxonomic level. Preliminary results from spring-collected specimens (n = 330) reveal a diverse diet, encompassing at least 37 species from five major phyla. The most frequently consumed prey included mysid shrimp (*Mysidae*), sand shrimp (*C. septemspinosa*), Atlantic rock crabs (*C. irroratus*), Atlantic mud crabs (*P. herbsteii*), coastal mud shrimp (*U. affinis*), and gammarid amphipods (*Aoridae and Ampeliscidae*). The rarity of fish prey, limited to just three species, suggests that black sea bass will primarily affect the benthic crustacean community.

Temporal trends and causes of deoxygenation in the northwest Atlantic Shelf

Hung Nguyen[1]*, Samantha Siedlecki[1], Enrique Curchitser[2], Charles Stock[3], Zhuomin Chen[1], Felipe Soares[1], Andrew Ross[3], Laure Resplandy[4], Mathieu Poupon[4], Sam Ditkovsky[4], Fan Yang[4]

[1]Department of Marine Sciences, University of Connecticut, Groton, CT 06340
[2]Department of Environmental Sciences, Rutgers University, New Brunswick, NJ 08901
[3]Geophysical Fluid Dynamics Laboratory, Princeton University, Princeton, NJ 08540
[4]Department of Geosciences, Princeton University, Princeton, NJ 6649
* hung.nguyen@uconn.edu

The air-sea interface is a major climate control for our planet by regulating the balance of CO_2 free in the atmosphere and stored in the ocean. At high winds, this boundary layer becomes turbulent and challenging to parameterize in gas exchange models. Sea spray is only now emerging as an important but unaccounted-for parameter in air-sea exchange models. Here we apply state-of-the-art air-sea surface sea spray generation models coupled to a carbonate system model to predict the spray-driven flux of carbon dioxide (CO_2) gas between the atmosphere and ocean at various wind speeds and sea states. When spray droplets are injected into air, they are known to experience gas exchange by both temperature equilibration and evaporation. Our results suggest that the latter process leads to a super-saline and acidic droplet that removes dissolved inorganic carbonate and bicarbonate, chemically converting them to additional CO_2 and thereby evading more CO_2 than predicted by traditional models that do not consider this process. At 40% evaporation, our results suggest that the droplet evicts all of its dissolved inorganic carbon, which is a 10-fold increase in potential CO_2 evasion. We estimate that gas flux driven by spray can be on the same order of magnitude as interfacial fluxes at winds of 20 m/s or higher, and can counter the direction of interfacial fluxes. Relative humidity and the temperatures of the air and the surface seawater are also found to be determining factors in the direction and magnitude of spray-driven flux. We conclude that evaporating sea spray is a significant feedback to ocean CO_2 uptake and could serve important roles in episodic storm events and over longer planetary timescales.

Contributions of Long Island Sound light profile data to the Eelgrass Habitat Suitability Index Model

Gavin Jackson, Jamie Vaudrey

University of Connecticut Department of Marine Sciences, Vaudrey Lab
* gavin.jackson@uconn.edu

The Long Island Sound Eelgrass Restoration & Management Strategy developed in 2022 called for an update to the existing Eelgrass Habitat Suitability Index (EHSI) model as it is a vital tool used to aid in eelgrass restoration goals within Long Island Sound (LIS). Updates to the current EHSI model would bridge gaps highlighted in the previous iteration. These updates would enhance ideal site selection for eelgrass restoration projects whether it may include direct planting or seed placements. Since the last iteration of the EHSI model in 2013, there has been an increase in information and data available to create other parameters that can serve as model inputs. These new parameters will be added to fill the acknowledged data gaps from the previous model which included limited bathymetry, temperature and light data. This update will incorporate new parameters with additional data such as LIS Light Profile Data obtained through CTDEEP LIS water quality monitoring program. Manipulation and analysis of this light profile data will provide an updated perspective for related area projects like updating the EHSI but through method creation for assessing water clarity metrics for LIS using the most reliable parameters available.

Phytoplankton nitrate assimilation and response to coastal upwelling in the California Current

Catherine A. Crowley[1*], Raquel Flynn[2], Adrian Marchetti[2], Yeongjun Ryu[3], Daniel Sigman[3], and Julie Granger[1]

[1]Department of Marine Sciences, University of Connecticut, USA
[2]Earth, Marine and Environmental Sciences Department, University of North Carolina at Chapel Hill, USA
[3]Department of Geosciences, Princeton University, USA
* Catherine.Crowley@uconn.edu

The California Current Upwelling System experiences seasonal upwelling from April to September. Summertime upwelling events stimulate phytoplankton blooms by supplying nitrate to the euphotic zone, which subsequently enhances carbon export. Phytoplankton rely on new (nitrate) and recycled (ammonium) nitrogen sources for growth; but their nutrient preferences, particularly as a bloom progresses, are not well understood. In this study, we conducted a semi-lagrangian experiment whereby we sampled newly upwelled water mass composed of nutrient-rich recently upwelled water and aged, more nutrient-deplete surface waters to elucidate the variability in the nitrogen preference of various phytoplankton groups as the bloom progressed. To assess populations' nutrient preferences, we measured the stable nitrogen isotope ratio (d^{15}N) of four eukaryotic phytoplankton populations and one cyanobacterial population from the California Current during spring. Our preliminary data includes d^{15}N measurements of the bulk particulate organic nitrogen (PON) pool and flow-sorted phytoplankton populations. Our goal is to compare the d^{15}N of various phytoplankton populations to the bulk PON to determine the N preference of each population and the bulk community. Our findings seek to enhance the understanding of phytoplankton nutrient dynamics during periods of nutrient upwelling and drawdown, and how these dynamics change with the progression of the bloom.

Tide and beach geomorphology impacts on a small-scale plume at Rocky Neck Beach, Connecticut

Luke C. Glass*, Michael M. Whitney, Parker Sallum

University of Connecticut, Department of Marine Sciences, Groton, CT, 06340
* Luke.glass@uconn.edu

Rocky Neck Beach in Connecticut regularly suffers from high enterococci concentrations, impeding beach access. A small freshwater brook on the eastern side of the beach delivers a small plume of fresh, bacteria-laden water directly onto the beachfront. Although long-term monitoring indicates spatially varying alongshore freshwater distribution, temporal changes in plume structure and mixing over a tidal cycle here remain unclear. A high-resolution hydrodynamic model, validated by high-frequency CTD transect sampling over the 2024 summer season, was used to understand bathymetric and tidal effects on the Rocky Neck plume, the freshwater retention mechanisms, and across-shore plume extent. Initial results imply sand bar morphology plays a key role in the retention of plume water close to the shoreline. Additionally, the nearfield plume is much fresher prior to offshore advection during a spring tide as opposed to neap. In all cases, western Rocky Neck beach remains largely unaffected by the local outflow. These results provide greater insight into small-scale river plume behavior under different forcing conditions. Plume evolution also highlights the importance of tidal sampling to capture daily variability, particularly at beaches under the influence of localized freshwater sources.

Maintenance of top-down control at a Predator's Range Edge

Riley Pena*, Catherine Matassa

University of Connecticut
* riley.pena@uconn.edu

As climate change continues to alter species distribution and performance, communities are likely to change in species composition and functional diversity. Such changes can lead to novel overlaps of functionally similar but historically segregated species. Understanding how resulting competition impacts the performance of these species will be key to understanding mechanisms for coexistence and how ecological communities might function under climate change. Here we examine competitive interactions between two functionally similar predators (dogwhelks, *Nucella lapillus*, and oyster drills, *Urosalpinx cinerea*) and their net trophic impact by measuring behavior, feeding, and growth of individuals in one- or two-species assemblages along a resource gradient. We found that growth rates of *Nucella* declined when foraging alongside *Urosalpinx*, regardless of prey availability. Despite this asymmetric competition, all assemblages (*Nucella*, *Urosalpinx*, and *N+U*) had similar net impacts on prey. *Nucella* population declines have been observed throughout the Gulf of Maine, attributed to direct and indirect effects of climate change. Although more work is needed to determine how these two species interact under different environmental contexts, our results suggest that the presence of *Urosalpinx* may buffer against community-level changes on rocky shores in southern New England caused by *Nucella* declines.