UNIVERSITY OF NEW ENGLAND

INNOVATION FOR A HEALTHIER PLANET

Summer Undergraduate Research Experience Symposium

October 1, 2016
University of New England
Biddeford Campus

Research at UNE

On behalf of the College of Arts and Sciences, it is my pleasure to welcome you to the 2016 Summer Undergraduate Research Experience (SURE) Symposium. This event features posters and talks by more than 40 students that have performed research at our home campus in Biddeford and regions throughout the Northeast United States. During this summer, our students have worked closely with our faculty to build on the knowledge they have acquired through their coursework to explore more advanced realms of understanding and to prepare for more continued study in their fields.

Students from all sorts of disciplines have tackled projects ranging from an analysis of community sustainability on the islands of Maine, to the examination of experiential learning in the Marine Science labs, to the use of biological mosquito control methods around UNE. These projects are the basis for future scholarly articles, presentations, and manuscripts.

Please join us in celebrating the hard work done by our summer undergraduate research students. I invite you to learn more about the fascinating work of our students and celebrate their accomplishments.

Sincerely,

Charles Tilburg
Associate Dean and Professor of Marine Sciences
College of Arts and Sciences

Summer Undergraduate Research Experience Symposium

9:00 a.m.
Poster Presentations
Multi-Purpose Rooms
Campus Center

10:30 a.m.
Welcome
Jeanne A.K. Hey, Ph.D.
Dean of the College of Arts and Sciences
The Hang, Campus Center

10:45 a.m. – 12:00 p.m.
Oral Presentations
Multi-Purpose Rooms
Campus Center

12:00 p.m.
Closing Remarks
Edward Bilsky, Ph.D.
Vice President for Research and Scholarship
Professor of Pharmacology, College of Osteopathic Medicine
Multi-Purpose Rooms
Campus Center

Poster 1

Development of a histological protocol for the age determination of monkfish, Lophius americanus

Presenter: Kayla Burgess '18
Major: Marine Science (Biology)
Minor: Applied Mathematics
Advisor: James Sulikowski

Description of research/abstract:
Monkfish (Lophius americanus) is a commercially important benthic species of anglerfish that generates the highest revenue of any finfish fishery in New England. Given the economic importance of this species, it is crucial that accurate and up-to-date scientific information is available that informs management agencies about the size of the population, the life history characteristics of the species, as well as other information that aids in the creation of stock management policies. Information about age within a fishery population is crucial for understanding aspects of life history such as growth and mortality rates, making it one of the most critical pieces of information for the conservation of a fishery. Because the traditional monkfish aging technique produces imprecise age estimates, monkfish stocks are most likely being overestimated, placing them at risk for overfishing. To investigate ways in which to improve monkfish age estimates, modified histological methods were evaluated. For this technique, vertebrae were decalcified, embedded in wax, sectioned, and stained using histological techniques that have proven successful on other hard-to-age species. When histologically processed vertebrae were compared to those that were traditionally processed, the histological sections provided clearer images of the age banding patterns. Due to this preliminary success, histological techniques will continue to be used experimentally as a new protocol for aging this highly important species is established for use in future monkfish research and stock assessments.

Student, faculty, or staff contributors: James Sulikowski, David Koester

Poster 2

Postoperative Treatment of Adolescent Colon Cancer: A Case Study of Chronic and Cancer-related Pain

Presenter: Samantha Shepard '17
Major: Medical Biology
Advisor: Edward Bilsky PhD

Description of research/abstract:
Instances of colorectal cancer are extremely rare in adolescence, occurring in less than 1% of Americans diagnosed. Of the colorectal cancer cases diagnosed nationally, 90% of patient diagnosis occur over the age of 50, and typically require surgical intervention, or removal of the cancerous tissue, due to late diagnosis and progression of disease. Surgical intervention is a preferred treatment option in progressive cases, and more aggressive surgeries improved resectability rates and survivorship. Surgically induced fibrous adhesions, or bands of fibrous tissues, often thought of as scar tissue, form between abdominal tissues and organs through the healing process, and are the most common abdominal surgery complication. Postsurgical treatment and intervention for fibrous adhesions is an important part of care that is often overlooked by clinicians. It is critical that fibrous adhesions be treated early in children as the negative implications, signs and symptoms of iatrogenic fibrous adhesions often are amplified with onset of rapid pubescent growth or 'growth spurts. Various noninvasive interventions are available to reduce complications associated with fibrous adhesions such as myofascial and visceral release. This case study focuses on a cancer induced chronic pain patient, T.L., the genetic predisposition for recurrent cancer, and provides further investigation into postsurgical abdominal pain, a sensation that has become debilitating and chronic for many. It will provide insight into non-surgical interventions that will allow us to better serve our patients in order to provide the highest quality of healthcare.

Poster 3

Characterization of Currents in the Biddeford Pool: A Lagrangian Study

Presenter: Kristen Falcinelli '18
Major: Marine Science
Second Major: Applied Math
Minor: Biophysics
Advisor: Charles Tillburg

Description of research/abstract:
This project investigates currents in the Biddeford Pool, a semi-enclosed body of water just south of the mouth of the Saco River in Maine. The Biddeford Pool is a unique area, as it fills with water during flood tide and almost completely empties during ebb tide, exposing a large mud flat area. Since the Pool fills and empties with each tidal cycle, it is important to understand the currents responsible for this water movement in order to understand both the human effects on intertidal and oceanic ecosystems and to understand the movement of invasive organisms that may alter the ecosystem in the Biddeford Pool and surrounding area.

Student, faculty, or staff contributors: Markus Frederich, Mike Esty

Poster 4

The Phyto Games: Interspecific Competition between Flagellate Phytoplankton Dunaliella tertiolecta and Isochrysis galbana affinis Tahiti in Nutrient-Limited and Nutrient-Rich Environments

Presenter: Emily Vollmer '18
Major: Marine Science
Advisor: Dr Carrie Byron

Description of research/abstract:
The phytoplankton species Dunaliella tertiolecta and Isochrysis galbana affinis Tahiti can be cultured as an in-house feedstock for various shellfish species. Many reports summarize the individual growth patterns of phytoplankton species, but fewer look at specific relationships. This research aims to determine the impact of nutrient concentration on interspecific competition between Dunaliella tertiolecta and Isochrysis galbana affinis Tahiti, so that they may be grown in tandem to create a high nutrient bio feed. Mono- and di-species cultures were grown at varying f/2 media concentrations ((0.066µL f/2 media)/(1mL 0.22µm filtered seawater), (0.266µL f/2 media)/(1mL 0.22µm filtered seawater), and (1.066µL f/2 media)/(1mL 0.22µm filtered seawater)) for 2 weeks while monitoring cell density. Dominance-based data analysis shows that D. tertiolecta was the dominant species (composing ≥95% of total cell composition) in the low-nutrient culture, while neither displayed dominance in the medium- and high-nutrient culture. Three null hypothesis were referenced during ANOVA statistical analysis: H01: Cell density in all three nutrient concentrations will be equal, H02: Cell density in both one and two species cultures will be equal, H03: Nutrient concentration and number of species present are independent factors. Statistical analysis disproved all three hypotheses. These findings can be applied to future competition experiments and aquaculture techniques.

Student, faculty, or staff contributors: Jeri Fox, Zachary Miller-Hope

Poster 5

Analysis of Estrogen Effects on Norepinephrine, Serotonin, and Dopamine Transporters in the Rat Brain as it Relates to Attention

Presenter: Jacklyn O'Brien '17
Major: Medical Biology
Minor: Philosophy
Advisor: David Mokler

Description of research/abstract:
This project was done to study the effects estrogen has on norepinephrine, serotonin, and dopamine transporters in the rat brain as it relates to attention. Attention was measured previously using attention set shifting tasks. Transporter density will be measured using immunohistochemistry and immunocytochemistry. We hypothesized that a transporter density decrease due to estrogen will result in higher extracellular neurotransmitter levels, and lead to optimal attention. Protocol was successfully developed to measure each transporter, which was supported through positive staining, but data collection is still ongoing. These results, paired with micro-dialysis results will lead to the overall results of this project.

Student, faculty, or staff contributors: *Tim Newell, *Sandi Chen, Peter Caradonna, Robert Lenox

*Student

Poster 6

Analysis of Community Sustainability in the Year Round Islands of Maine: The Role of Public Health and Food Security

Presenter: Melissa Klemt '17
Major: Psychology
Second Major: Sociology
Advisor: Samuel McReynolds

Description of research/abstract:
This research draws on a article published in 2014 by Dr. Samuel McReynolds about community sustainability in the year-round of islands of Maine. He focused on components of community sustainability such as food prices, affordable housing, population changes, school systems, economic development, and industries. In this project the previous data collected on food prices was updated, and a new area of concern was added. Through our investigation of this issue by using interviews, survey responses, and other forms of anecdotal data, we concluded that access, affordability, and quality of health care on the islands were all important factors in sustainability of the communities. This project highlights the challenges these communities are facing in regards to sustainability, and explains the innovative solutions island communities are utilizing to combat these challenges.

Student, faculty, or staff contributors: Emily Potter, *Jacklyn O'Brien, *Varun Thakkar

*Student

Poster 7

Changes in nutritional value of Alaria esculenta during degradation with potential for shellfish production

Presenter: Erynn Mills '19
Major: Marine Science
Minor: Mathematics
Advisor: Carrie Byron

Description of research/abstract:
The motivation behind this work was to establish a baseline data of δ13C, δ15N, and lipid fatty acid profile for Alaria esculenta during the degradation process to detritus in order to identify potential nutrition for bivalves, with better farm placement in mind. This was done by keeping Alaria esculenta in tumble cultures for five weeks while it degraded into detritus. Once a week, the water in these cultures was filtered and stable isotope and lipid fatty acid analyses were performed on these filters. The significance of these findings is that if Alaria detritus is nutritious for commercially important bivalves, it can be found in the environment through field work. By knowing where the best detritus can be found, shellfish farmers could have a better idea of where to place shellfish farms which greatly enhances shellfish aquaculture in Maine.

Student, faculty, or staff contributors: Carrie Byron

Poster 8

Self-expansion in the context of romantic relationship initiation, maintenance, and dissolution

Presenter: Allison Symonds '18
Major: Psychology
Advisor: Julie Peterson

Description of research/abstract:
The current research is interested in the way people incorporate close others into the self-concept and how the inclusion of others (e.g., friends, family) in the self-concept might shift in response to romantic relationship initiation or break-up. Three studies were designed to explore this phenomenon. Study 1 was designed to examine the inclusion of existing close others in the self-concept when faced with the potential for a new romantic relationship. We expect to find that people may decrease the amount of self-other overlap in existing close relationships in anticipation of self-expansion with a new romantic partner. Study 2 was designed to examine the effect of relationship length on self-expansion as well as the effect of relationship threat on self-expansion. We expect to find that in new romantic relationships people "bump" close others (e.g., family, friends) out of their self-space to prepare for the type of self-expansion that normally accompanies a budding romantic bond. Additionally, we expect that people in the break-up threat condition will report greater inclusion of others into the self-concept to protect against the pain of romantic threat. Study 3 was designed to measure the amount of self-space individuals devote to close others before and after a romantic breakup. We expect to find that participants who have recently broken up will increase self-other overlap with family and friends as to combat the feelings of loss. This poster presentation will highlight hypotheses and expected results regarding self-expansion in the context of relationship initiation and relationship dissolution.

Poster 9

Observing the effects of 17 -ethinylestradiol on the behavior of three-spined stickleback and mummichogs

Presenter: Alyssa Kaufold '18
Major: Animal Behavior
Minor: Marine Science
Advisor: Carrie Byron, Teresa Dzieweczynski

Description of research/abstract:
Estrogen is the main ingredient in birth control and gets into the ocean due to a lack of proper filtration through wastewater treatment plants. The endocrine disrupting chemical then gets into the ocean and could possibly have an effect on the marine life. This experiment was done to see of 17 -ethinylestradiol (EE2) has an effect on the behavior of three-spined stickleback and mummichogs. Antipredator, conspecific, heterospecific and foraging behavior were all examined using different treatment tanks. Three groups of five subjects in each were exposed to different concentrations of EE2, put through the five different treatments, and video taped. The results showed a possible effect on fish at low concentrations of EE2, but any effects seen could also be by chance due to the very small sample size. For research like this to be used to make an impact on how wastewater is treated, a much larger sample size would be needed.

Poster 10

How Neonatal Pain and Stress Effects the Distribution of Corticosterone Releasing Factor and the Regulation of CRF Receptors One and Two in Infant Rats

Presenter: Victoria Eaton '18
Major: Neuroscience
Minor: Philosophy
Advisor: Michael Burman

Description of research/abstract:
Anxiety is a prevalent mental disorder that can occur throughout the lifespan. Anxiety is extensively studied and well understood in the adult brain, however, the neurobiology development underlying anxiety remains understudied. One source of early-life pain and stress can be found in Neonatal Intensive Care Unit (NICU) procedures conducted on pre-mature infants. Interestingly, it has been shown that infants that have spent time in the NICU have a higher risk of developing anxiety-disorders later in life. In order to fully understand anxiety, it is important to understand the possible life-long effects these procedures may have. Therefore, this project set out to determine any immediate effects early-life pain has on the neonatal brain including changes in early brain development, chemistry, and circuitry. Neonatal rat pups were given painful heal pricks or control procedures. We then assessed corticotropic-releasing-factor (CRF), a neurotransmitter/hormone commonly implicated in stress responding, to determine if there were any differences in CRF mRNA in the amygdala and hypothalamus across treatment groups. Pilot data collected through immunohistochemistry and PCR has suggested that early-life pain and stress causes an increase in CRF expression in both brain regions as well as a down-regulation of CRF receptors. Effects of these changes in the brain may lead to anxiety disorders and altered pain thresholds later in life. This project helps to advance the scientific community's understanding of anxiety and how events that occur early in life may give rise to this disorder. Understanding the development of anxiety is the key to discovering effective treatments.

Poster 11

Recent Developments in the Chemistry of Dicopper(I)-Naphthyridinediimine "Crescent" Complexes

Presenter: Ryan Conger '18
Major: Chemistry
Advisor: Stephen Fox

Description of research/abstract:
Dicopper(I) units with short metal-metal distances, supported by chelating ligand, bridging halides and mercaptides, are presented as enzyme reaction center model compounds.

Student, faculty, or staff contributors: Stephen Fox

Poster 12

Currents and Contraceptives: 17α-ethinylestradiol turns the tide on

Presenter: Nicole Greaney '17
Major: Ocean Studies and Marine Affairs
Advisor: Teresa Dzieweczynski

Description of research/abstract:
Endocrine disrupting chemicals, such as the estrogen mimic 17α-ethinylestradiol (EE2), are released into the aquatic environment from various sources and are prevalent and persistent worldwide. A variety of species exposed to these chemicals experience morphological and behavioral changes, yet the effects of exposure on behaviors beyond courtship and aggression are understudied. To address this, mummichogs (Fundulus heteroclitus) were exposed to different amounts of EE2 (control, 10 ng/L, and 100 ng/L) and their boldness was examined in four different assays (Empty Tank, Novel Environment, Shoaling, Foraging) once a week for four weeks (pre-, 1, 2, and 3 weeks of exposure). Chronic exposure to EE2 caused changes in activity level in the Empty Tank and Shoaling assays. The higher dose had the greatest effects on behavior, such as increasing the amount of time individuals took to find food in the Foraging assay. The results show that exposure alters behavior differently depending on the exposure level, length of exposure, and the assay. Exposure impacted behaviors that are related to fitness, and, as such, may cause evolutionary consequences. Because dose and duration of exposure, as well as the specific assay in which behavior was measured, interacted to cause different behavioral changes, the study stresses how important it is to examine the behavioral effects of unintentional pharmaceuticals exposure in multiple contexts and at multiple exposure levels.

Student, faculty, or staff contributors: Sydney Farrin*, Erika Ackerman*, Teresa Dzieweczynski

*Student

Poster 13

Effects of tidal cycle, river discharge, and wind velocity on the salinity of the Saco River, Maine

Presenter: Cassandra Elmer '17
Major: Marine Science: Oceanography
Minor: Applied Mathematics
Advisor: Charles Tilburg

Description of research/abstract:
Estuaries such as the Saco River, which is partially mixed, are essential to the organisms of the plume area just outside the river mouth. Physical processes such as river discharge, wind velocity and direction, and tidal cycle affect the salinity profile of both the estuary and the plume. Using data collected by Conductivity-Temperature-Depth (CTD) cruises, we constructed the salinity field of the river near the mouth. River discharge was found to have a linear relationship with the downstream location of the leading edge of the low salinity portion of the river and tidal phase was found to have a cyclical relationship with the location of a specific salinity and depth. Wind velocity and direction, however, appear to have a very small effect on the location of a specific salinity and depth. The effects of physical processes on the river are slightly different than the effects on the plume: river discharge and tidal phase have similar effects, while wind velocity and direction have the opposite effect on the plume. The results indicate that river discharge, tidal phase, and wind velocity and direction affect the salinity profile of the Saco River, which leads to the conclusion that these processes also affect the organisms of the Gulf of Maine.

Poster 14

The role of CRF in neonatal pain-induced anxiety and stress disorders

Presenter: Erik Holmqvist '17
Major: Medical Biology
Advisor: Michael Burman

Description of research/abstract:
Painful procedures performed on newborns without the use of analgesics is a common occurrence. The arguments deeming it unnecessary are based on factors like infantile amnesia, underdevelopment of the nervous system, and the perceived dangers of analgesic use in infants. However, studies have correlated time spent in the Neonatal Care Unit (NICU) with subsequent stress disorder development, which suggest that the dismissal of analgesics during painful procedures on infants may be a factor in later-life anxiety and mood disorders. Our lab believes these stress-induced disorders are the result of morphological changes driven by hypersecretion of amygdalar and hypothalamic CRF during traumatic early-life experiences. It was hypothesized that CRF1 receptor antagonism during early-life manipulations would reduce subsequent stress disorder development. To test this, the CRF1 antagonist antalarmin hydrochloride (20mg/kg) was injected s.c. in male and female Sprague Dawley rat pups. Rats were assigned to one of six groups: handle-vehicle, handle-antalarmin, no-handle vehicle, no-handle antalarmin, no-injection-no-handle, or no-injection-handle. Groups received respective early-life experience and treatment between postnatal days (PD) 1-7. On PDs 24-26, the rats went through a fear conditioning procedure in which a 70 db tone was paired with a mild foot shock. Percent freezing was measured to assess stress behavior. On PD 27, rats underwent sensory testing (von Frey, and Hargreaves) to assess pain threshold between groups. Current results indicate that antalarmin may reverse the effects of early-life stress. This is reflected in a stress behavior of handled-antalarmin rats similar to that of no-handle groups, rather than vehicle-handled rats.

Student, faculty, or staff contributors: Seth Davis

Poster 15

Survivorship rates of commercially important species, soft shell clams (Mya arenaria), in the presence of invasive species, European green crabs (Carcinus maenus)

Presenter: Andrew Davidsohn '18
Major: Marine Biology
Minor: Aquaculture and Aquarium Science
Advisor: Dr. Carrie Byron

Description of research/abstract:
This project aimed to determine the effects of predation by green crabs (Carcinus maenus) upon soft shell clams (Mya arenaria) in Biddeford Pool, ME. By using an experimental design for field-based manipulation of predator exclusion, the actual results of green crab predation on soft shell clams were quantified through survivorship rates between several different experimental scenarios. There were three different scenarios: complete predator exclusion, crab-only exclusion, and no predator exclusion (the control). Utilizing these methods, we expected to find there was a higher clam mortality rate in the presence of predators compared to no predators, and that crabs will be held responsible for a majority of the clam mortalities in the tests being performed. The results supported both hypotheses, with a 75.9% difference in mortality rate between the control (92.5%) and complete predator exclusion (16.6%), and the finding that 25% of all predation during the project was from green crabs.

Poster 16

The Relationship Between Childhood Sexual Abuse and Psychopathology: The Role of Socialization of Emotions and Experiential Avoidance

Presenter: Benjamin Katz '17
Major: Psychology
Advisor: Patricia Long, Ph.D.

Description of research/abstract:
Research examining the effects of child sexual abuse (CSA) has long suggested that the experience is associated with both immediate and long-term mental health difficulties (Briere & Elliott, 1994; Polusny & Follette, 1995). While research indicates a relationship between CSA and adult psychological adjustment, not all individuals who experience CSA develop difficulties in adulthood (Lynskey & Fergusson, 1997). This summer 2016 SURE project built upon a previously funded SURE project investigating the long-term impacts of CSA, specifically examining two constructs that are hypothesized to mediate the relationship between CSA and adult psychopathology, experiential avoidance (EA) and socialization of emotions. EA is characterized by an unwillingness to remain in contact with undesirable private experiences such as emotions, bodily sensations, memories and thoughts (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996) and a continuance to prevent these events from occurring, as well as the contexts in which the private experiences were originated. Emotion socialization practices by either parents or friends can be broadly conceptualized as parents'/friends' reactions and/or behaviors which aim to either facilitate or impede the emotional expressions of their children/friends (Garside & Klimes-Dougan, 2002; Miller-Slough & Dunsmore, 2016). This summer involved selecting appropriate research methods to investigate the topics of interest and developing the online survey used to collect participant responses (with data collection to begin this fall). Implications will be discussed.

Poster 17

The role of genetic diversity in competitive fitness of invasive Phragmites australis in a salt marsh ecosystem

Presenter: Jillian Henrichon '19
Major: Environmental Science
Advisor: Dr. Greg Zogg

Description of research/abstract:
Salt marsh ecosystems are primarily dominated by a grass species called Spartina alterniflora. Recently however, an invasive species of reed, Phragmites australis, has been competing with S. alterniflora and has become a threat to the overall health of the salt marshes in which it resides. Both species exhibit relatively low genetic diversity because of their tendency to reproduce clonally from extensive rhizomes. The purpose of this study is to outline the role of genetic diversity in P. australis in its competition against S. alterniflora. Ten P. australis stems from ten patches of varying genetic richness were collected and maintained in mesocosms. They are currently being outcrossed with one another to enhance genetic diversity as anthesis continues throughout early fall, and competition experiments against S. alterniflora will occur next summer. A small field study was additionally carried out to determine differences in P. australis vigor (measured in P. australis height, density, and dead matter weight) according to the patches genotypic richness.

Student, faculty, or staff contributors: Dr. Steven Travis, Sarah Raymond

Poster 18

Metabolic efficiency and nutritional profiles in commercially grown bivalves

Presenter: Katherine Perry '18
Major: Marine Biology
Minor: Applied Mathematics
Advisor: Carrie Byron

Description of research/abstract:
Oysters and mussels are the two most prominent shellfish industries in Maine, making them very important to the growth and successfulness of the aquaculture industry as a whole. These organisms both reside in the same trophic level, therefore, their tissue composition and metabolic processes are comparable. Both organisms were fed the same diet of phytoplankton, then stable isotope analysis was done to get a comprehensive history of each organism tissue composition, specifically the δ13C and δ15N. These markers are insightful on energy distribution across trophic levels and where organisms get their nutrients from, known as sourcing. Lipid analysis was used to gain an understanding of the fatty acids and more specifically the omega 3's that compose these organism's tissues. With this knowledge, we will gain an understanding of how they obtain and use nutrients and therefore can establish what parameters are needed to make the most nutrient dense shellfish for human consumption.

Poster 19

Making Connections: Integrating lecture, the local environment, and current marine research through the restructuring and development of new experiential learning opportunities in the marine science teaching labs

Presenter: Abigail Hayne '19
Major: Marine Science
Minor: Applied Mathematics
Advisor: Angela Cicia

Description of research/abstract:
Ample literature exists demonstrating the benefits that experiential learning opportunities have on the success of both the student and academic program. As the University of New England's marine science program grows and acquires new teaching platforms (i.e. Ocean Clusters, Ram Island, TURBO), the ability to offer practical, hands-on learning opportunities to our students, particularly within our undergraduate teaching labs, also expands. To take advantage of and utilize these expanding opportunities, we collaborated with UNE lecturers and professors to accomplish the goals of this study, which are to restructure and develop new teaching labs that expose students to relevant, place-based and experiential learning activities. More specifically, we restructured one novel lab in MAR106, and worked collaboratively with Dr. Carrie Byron to redesign the majority of MAR250 labs to better fit a zoological standpoint, rather than the previous ecological standpoint.

Poster 20

Lactic acid bacteria reduce the cytotoxic and inflammatory effects of Salmonella Javiana and decrease pathogen virulence gene expression

Presenter: Arnold Kandolo
Major: Biology (at SMCC)
Advisor: Kristin Burkholder

Description of research/abstract:
Salmonella enterica Javiana is an emerging foodborne pathogen that causes severe gastrointestinal infections. Little is known of how S. Javiana interacts with intestinal epithelial cells, or of potential methods for ameliorating the bacterial-host interaction. Using the HT29-MTX human intestinal epithelial cell line and lactate dehydrogenase release assays, we observed a strong cytotoxic effect of S. Javiana on the host cells. We also evaluated the potential inhibitory effect of probiotic lactic acid bacteria (LAB) on S. Javiana infection, and found that the cytotoxic effect of S. Javiana was reduced when host cells were exposed to Lactobacillus acidophilus, Lactobacillus rhamnosus or Lactobacillus casei prior to infection. Adhesion assays showed no reduction in S. Javiana binding to host cells in the presence of LAB, but qRT-PCR analysis revealed that LAB exposure decreased S. Javiana expression of genes encoding for toxins and a toxin secretion system. Host cells exposed to LAB prior to S. Javiana infection also exhibited decreased production of inflammatory cytokines. Data suggest that LAB might be useful if taken as prophylactics to reduce incidence or severity of S. Javiana infection, and that probiotics may work by preventing S. Javiana from producing key toxins that would otherwise damage host cells.

Student, faculty, or staff contributors: Arnold Kandolo*, Dylan Fletcher*, Lauren P. Gileau*, Kristin M. Burkholder

*Student

Poster 21

Creating an OWHL: Monitoring Our Coasts to Understand Waves

Presenter: Ethan Wester '17
Major: Oceanography
Second Major: Mathermatics
Advisor: Charles Tilburg

Description of research/abstract:
Aquaculture is significant in coastal ecology and as a food supply for the human population. To fully understand aquaculture and its effects, the environment that it is built in must be understood. Waves play a key role in determining how fisheries are impacted by their environment, which leads to an understanding of the local wave field. Researching the wave field is important in such an aquaculture active location. A major factor in preventing wave monitoring is the high price of the equipment. Our goal is to build and deploy inexpensive wave height sensors in the Saco Bay. Once they are deployed, we can compare the custom sensors to the current wave monitoring equipment and determine if there is a future in relying on inexpensive wave monitors that can easily be spread along a coastline or basin.

Poster 22

An examination of "Unstoppable Global Warming Every 1,500 Years": Is it an accurate depiction of the current scientific thought?

Presenter: Harley Neubauer '16
Major: Marine Science
Minor: Environmental Studies
Advisor: Charles Tilburg

Description of research/abstract:
Fred Singer and Dennis Avery are coauthors of the book "Unstoppable Global Warming Every 1,500 Years". Both Singer and Avery assert that the present climate change is a natural occurring cycle that happens roughly every 1,500 years and has been doing so long before humans were around. In their book "Unstoppable Global Warming Every 1,500 Years" Singer and Avery describe the 1,500 year climate cycle, provide evidence that it is a natural occurring cycle and discuss how humans have hardly had an effect on it. There are 499 sources that Singer and Avery have cited in this book to bolster their claim that the 1,500 year cycle has happened before and the climate change humans are seeing now is just part of the natural cycle. The 499 sources will be read through, analyzed and then compared for accuracy to what Singer and Avery had to say.

Poster 23

The Impact of Single Base Deletions on DNA Microarray Hybridization

Presenter: Carolyn Lucy '19
Major: Biochemistry
Minor: Mathematics
Advisor: John Stubbs

Description of research/abstract:
Microarray technology is becoming more prevalent in analysis of DNA sequences. Microarrays consist of a DNA probe strand, made up of the (reverse) complement of a sequence being tested for,which is attached to a surface, which will ideally hybridize with its complementary target strand, which is in a solution. Through computer simulation, this project looks at the potential impacts single base deletions will have on the hybridization of DNA microarrays, as well as DNA duplexes in solution. Since the ideal hybridization temperature of specific DNA strands has not yet been determined, three temperatures were used during this work. Microarray systems have promising future applications such as the use for diagnosis of predisposition to genetic diseases and detection of viral and bacterial pathogens.

Poster 24

GIS and Remote Sensing of Monthly Primary Production Measuring Carbon Levels in the Indonesian Throughflow Region

Presenter: Jennifer Lutes '18
Major: Marine Science Oceanography
Minor: Applied Mathematics
Advisor: Stephan Zeeman

Description of research/abstract:
The euphotic zone in every ocean have significant primary productivity, which is the major resource that disseminates the sun-dependent energy throughout most of the water column. The purpose of this study is to statistically analyze primary production in the Indonesian Throughflow (ITF) Region from the years 2002 to 2014. The Indonesian seas contain the shallow-water basins that connect the Indian and Pacific Oceans. The data analysis performed by utilizing a database of satellite images that have measured global primary productivity on a monthly basis in various chlorophyll and carbon scales. The most accurate means of measuring productivity is through an alternative algorithm comparing carbon to chlorophyll ratios that measure carbon biomass and rate of production, or carbon-based production models (CbPM). Since the Indonesian seas undergo current, heat, and wind shifts periodically, we will be collecting statistics over a few different time frames. The interannual data compares individual monthly differences. The El Niño and Southern Oscillation (ENSO) climate patterns compare El Niño, La Niña, and neutral months according to Southern Oscillation Index (SOI). Since there is seasonal wind and ocean current shifts between the Indian and Pacific Ocean, monsoonal seasons called southeastern and northwestern monsoons are also accounted in the statistical analysis. Each of these time frames show that there is variable significant differences in primary production in the ITF. This region is directly impacted by ENSO and monsoonal weather pattern changes. The ITF provides the answers to many unknown future predictions and questions about the state of the heating planet.

Poster 25

Atlantic sharpnose shark (Rhizoprionodon terraenovae) age and growth in the Gulf of Mexico

Presenter: Alicia Brown '17
Major: Marine Biology
Advisor: James Sulikowski

Description of research/abstract:
Life history information is essential for establishing and improving conservation and management policies for commercially and recreationally important marine species. Life history data provides the fundamental information about a species population dynamics such as age, growth, and reproduction biology. However, these parameters can be altered due to both natural and anthropogenic stressors over time. An example of an anthropogenic stressor that can alter life history parameters is an increase in fishing pressure. Increased fishing pressure can, among other things, create shifts in length compositions to smaller sizes and lower reproduction rates. The Atlantic sharpnose (Rhizoprionodon terraenovae) is a small Carcharhinid shark that inhabits southern coastal waters and is a common bycatch species of commercial and recreational fisheries. Although previous studies have evaluated life history characteristics for the sharpnose, the results between studies are conflicting, outdated, and all have used small sample sizes. In collaboration with the National Oceanic and Atmospheric Administration and Gulf Coast Research Laboratory, my study is aiming to reevaluate the age and growth of the Atlantic sharpnose using gross vertebrae counts. 500 vertebrae samples collected from 2008 to 2015 have been sagittally cut using a Jemsaw, and a second method of histological cutting and staining of the vertebrae is now being done. For each specimen, two vertebrae centra are processed. Currently, 55 samples have been completely processed using histological techniques. A total of about 100 samples will be completed ranging in fork length size 24.9 to 88.5 cm. Once they are all processed, ages will be estimated and growth rates of the species will be determined using the age data.

Student, faculty, or staff contributors: David Koester

Poster 26

Optimization of supercritical carbon dioxide/water extraction of organic compounds towards planetary exploration using Monte Carlo simulations

Presenter: Kenneth Mei '17
Major: Chemistry
Advisor: John Stubbs

Description of research/abstract:
Super critical carbon dioxide has vast amounts of untapped potential in the field of chemistry. Among the potential uses, is the extraction of organic molecules for the purpose of space exploration. Organic molecules are of interest due to their crucial role in terrestrial biology, essential for the processes and mechanisms of life. The purpose of this experiment is to determine the feasibility of utilizing super critical carbon dioxide as a method for extracting organic molecules from a planetary exploration perspective. Specifically, the organic compounds we are interested in consist of 1-octanol, phthalic acid, octanoic acid, glycine, and alanine. These were chosen because of either their presence in extraterrestrial environments or represent structures of compounds in extraterrestrial environments. The physical property of study is the solubility of these organic compounds in super critical carbon dioxide and water at differing compositions, temperatures, and pressures using Monte Carlo simulations. Compounds were modeled using TraPPE-UA, OPLS-AA, and TIP4P/2005 force fields. The parameters researched were temperatures of 373 K and 453K, pressures of 4, 10, and 20 MPa, and super critical fluid compositions of 0%, 0.5%, 1%, and 4% water. Preliminary results indicate a positive correlation between temperature/pressure with composition of solute. The simulations also supported the hypothesis that the presence of water in super critical fluid increases solubility of organic compounds by a significant amount.

Poster 27

Laboratory induction of sorus tissue formation in vegetative sporophytes of sugar kelp (Saccharina latissima) through photoperiod adjustment & histological categorization of sporangia development

Presenter: Michelle Dufault '18
Major: Marine Biology
Minor: Environmental Studies
Advisor: Adam St. Gelais

Description of research/abstract:
Saccharina latissima is an important kelp species in Maine, farmed for many products, such as chemicals, fertilizers, soaps, biofuels, and food. Kelp aquaculture is a growing industry in the United States, as kelp is a valuable crop, but its biomass output can potentially be increased with variable lab techniques. To reduce the dependency on harvesting healthy reproductive kelp from the wild, thus decreasing risk and increasing farm efficiency, this study tested the prospective to induce sorus, or reproductive, tissue formation in a controlled laboratory setting. This was done by imitating normal sporogenesis environmental conditions in the lab via shortened photoperiod (8 hours light) and analyzing the production and development of sorus tissue by measurements photos, and histological analysis. Lab conditions to assess optimal sorus growth that can be applied to the local environment include four growing tanks, two with full salinity seawater from Saco Bay and two with half strength salinity seawater. Histological analysis was used to qualitatively compare sorus tissue between field and lab samples, assessing the overall health and development of the tissue. Results show rapid deterioration of samples in half strength seawater. However, samples in full strength seawater began to grow sorus after seven weeks with a growth rate of sorus tissue length of about 17.5 cm/day. Overall, the experiment was successful in growing sorus tissue under a controlled setting, making it a viable option for kelp farmers over collecting wild reproductive kelp blades for sporing.

Poster 28

Impact of DNA single strand length on duplex stability in solution and in a microarray environment

Presenter: Brea Rivard '19
Major: Chemistry
Second Major: Applied Mathematics
Advisor: John Stubbs

Description of research/abstract:
25-base DNA strands were analyzed using Monte Carlo molecular simulations with varied complementary strand lengths. They were looked at for a range of temperatures, strand lengths, and both bound to a surface and free in solution. Their respective hydrogen bonding energies and structural properties were looked at to understand the relative stability of each duplex. It was found that when the target strand undergoes over fragmentation, the duplex is most stable when the shortened target strand binds to the side of the probe strand furthest away from the surface.

Poster 29

The Bonds of Algae: Inducing Flocculation

Presenter: Alanna Sachse '17
Major: Ocean Studies and Marine Affairs
Minor: English
Advisor: Zach Miller-Hope

Description of research/abstract:
Flocculation is used as a harvesting method by removing dense coagulated cells from water medium. Changes in pH and addition of chemicals are used to stimulate coagulation in cell cultures. Flocculation tests were carried out with pH buffers and the three chemicals chitosan, calcium carbonate, CaCO3, and sodium hydroxide, NaOH were used in the experiment to see what is the most effective at inducing full flocculation in Tetraselmis suecica. Spontaneous auto-flocculation and chemical flocculation in microalgae was explored through pH and the addition of chemicals respectively. My motivation for this work was to see if there was a viable way to harvest and store phytoplankton. In terms of aquaculture, flocculation can be used to harvest algae out of a water medium to be used more readily as feed and other needs. Effects of chitosan, CaCO3, and NaOH on T. suecica flocculation in different doses are explored. This study showed that NaOH can be an effective and clean way to induce partial floccu-lation.

Poster 30

Antimicrobial compounds in local algae species

Presenter: Andrea Call '19
Major: Biological sciences
Minor: Mathematics
Advisor: Dr. Ursula Roese

Description of research/abstract:
The antimicrobial capacity of Fucus vesiculosus, brown algae, was explored for potential use against pathogens. In order to harness the potential antimicrobial compounds produced by F. vesiculosus one group was exposed to a chemical stress, methyl jasmonate a plant hormone known to induce a defensive response in plants. A second group was exposed to a physical stress in the form of an incision every centimeter along the algae thallus. Six days were allowed for products to build up, then extracts were prepared using a solvent. Solvents used include water, methanol, and dichloromethane. The product was used in an antimicrobial assay to determine if there was any inhibition of the bacterial growth in a variety of Staphylococcus and non-Staph species. Dichloromethane samples failed to inhibit growth, however, both methanol and water showed potential as solvents for the extraction process. In addition, the sex ratio of locally available F. vesiculosus was investigated microscopically. The sex ratio was found to be around 50:50 for this algae, which is consistent with previous literature. This 50:50 sex ratio is important for culturing these algae in the lab. Preliminary experiments were performed on Chondrus crispus, a red algae, to determine the effect of methyl jasmonate and mechanical injury on antimicrobial properties and growth. The mass was recorded both before and ten days after treatment and the difference in percent mass change between the groups was analyzed to determine the effect on growth. Although further testing is necessary, preliminary tests showed the control experienced the most growth while algae exposed to methyl jasmonate experienced the smallest growth. This indicates that the production of antimicrobial compounds may occur at the expense of primary metabolism.

Student, faculty, or staff contributors: Cameron Russell*, Dr. Kristin Burkholder

Poster 31

The Impact of Wavelength and Light Intensity on Concentration of Coral Pigments

Presenter: Dylan Turner '17
Major: Marine Biology
Second Major: Aquaculture and Aquarium Science
Advisor: Jeri Fox, Zach Miller-Hope

Description of research/abstract:
Coral pigmentation is highly variable, even between members of the same species color morphs exist. It is thought that coral pigmentation is dependent on the individual's position in relation to the light and how much light of certain wavelengths they are experiencing. Coral utilizes its pigment to block out or let in these light waves to benefit their algae symbionts, depending on what light they are exposed to will determine the concentration of those pigments. To study this corals will be housed in separate aquariums under constant conditions but with variable lighting conditions, ie different wavelengths of light, and later examined histologically to determine pigment concentrations in the coral tissue. This study aims to look at what wavelength can be used to change the pigmentation in the corals for the purpose of the ornamental aquarium trade as well as further investigate a way to evaluate the health of corals.

Poster 32

Seasonal Variation H. grypus Diet Composition Through Fecal Analysis

Presenter: Halli Bair '18
Major: Marine Biology
Advisor: Kathryn Ono

Description of research/abstract:
The grey seal (Halichoerus grypus) population has increased exponentially since the near species extirpation in the 1960's. The drastic increase leaves marine mammal researchers and fisherman questioning the grey seal's ecological role in the marine environment. Fishery-pinniped interactions are of great interest in New England waters, as H. grypus are thought to be consuming commercially important fish stocks such as Atlantic cod (Gadus morhua) and Striped bass (Morone saxatilis). Grey seal diet composition is obtained through fecal analysis and prey consumption is determined through identification of hard remains. To further investigate H. grypus diet a comparison between winter breeding samples and spring non-breeding samples was completed. The difference in seasonal diet variation was greatly apparent. The 27 winter breeding samples from January 2016 were processed showing clear trends of primarily plant material and parasitic worms present in the scat. The plant filled scats accounted for 85.19% (n=23) of the samples lacking hard remains while the remaining 14.81% (n=4) accounted for hard parts found in scat samples. The 2007 spring non-breeding season samples (n=22) support the generalist feeding behavior for this species, and all samples contained proof of prey via hard parts. These hard parts include shrimp, blue mussel (Mytilus edulis), skate denticles, and miscellaneous fish parts. The spring diet was composed of various fish species; 92.9% American sandlance (Ammoydyte americanus), 4.26% Silver hake (Merluccius bilinearis), and 2.86% White hake (Urophycis tenius) suggesting that the H. grypus has a inter-seasonal variation of diet and may not be causing depletion of commercially valuable fish stocks.

Poster 33

Establishing a new invasive species monitoring site as part of the MIMIC network

Presenter: Jessica Stumper '18
Major: Ocean Studies and Marine Affairs
Advisor: Markus Frederich

Description of research/abstract:
Invasive species have a significant detrimental impact on ecosystems around the world by changing ecosystem structure and food webs, and often negatively affect fisheries and even human health. Removing an established invasive species from an ecosystem is nearly impossible. Therefore, several programs and processes were established to track and monitor invasive species, to either remove the very first invaders or to understand the dynamics of the respective invasions. In New England the Marine Invasive Monitoring & Information Collaborative (MIMIC) monitors monthly more than 60 sentinel sites for a specific set of 16 invasive species. We established a new MIMIC monitoring site at the coast of Biddeford pool and assessed it for invasive species from May to September 2016. We found eight invasive species (Botrylloides violaceus, Botryllus schlosseri, Carcinus maenas, Codium fragile, Didemnum vexillum, Hemigrapsus sanguineus, Membranipora sp., Ostrea edulis). The abundance of these species varied throughout the summer, with seasonal trends for some species, but not for others. So far, no new, presently unknown invasive species was detected in our MIMIC site. We will continue to monitor this MIMIC site monthly for the next several years to evaluate trends in abundance of present invaders, and to find potential new invaders. All data will be included in the MIMIC database and help manage and monitor invasive species in New England.

Student, faculty, or staff contributors: Amber Jenkins*, Jessica Stumper*, Markus Frederich

*Student

Poster 34

Design of a Mutant Form of Src Homology 3 Domain to Study its Protein-Protein Interactions Using Atomic Force Microscopy

Presenter: Aleeza Barkas '18
Major: Biochemistry
Minor: Applied Mathematics
Advisor: Eva Rose Balog

Description of research/abstract:
The Src homology 3 (SH3) is a modular protein interaction domain that is found in a wide range of proteins. SH3 is commonly seen as an adaptor protein, making it an attractive building block for protein-based nanomaterials with defined structures, functions, and mechanical properties. However, the unbinding forces between SH3 and its protein interaction partners have yet to be measured. We are designing experiments to quantify the rupture force between SH3 and engineered protein polymers with variable affinity for SH3 using an Atomic Force Microscope (AFM). We have produced a genetically engineered SH3 domain with a substitution that permits attachment to an AFM tip. We used site-directed mutagenesis to introduce a single amino acid substitution (Serine to Cysteine), which will allow a number of chemical attachment strategies. Furthermore, our results represent an efficient protocol for mutating, expressing, and purifying SH3 proteins.

Student, faculty, or staff contributors: Eva Rose Balog, Michael Carbone*, Robert Elliott*

*Student

Poster 35

Natal Dispersal of Migratory Grassland Songbirds Breeding in Vermont

Presenter: Emily Filiberti '17
Major: Environmental Science
Advisor: Noah Perlut

Description of research/abstract:
The bobolink (Dolichonyx oryzivorus) and Savannah sparrow (Passerculus sandwichensis) are two species of songbirds that breed in grassland habitats (typically agricultural fields that are maintained for the production of hay) throughout New England. Farmers commonly cut their fields around the same time that these songbirds nest, leading to nest destruction in both species. However, neighboring fields frequently differ in timing of hay-harvest, where some nestlings successfully fledge from fields hayed later in the season. In previous work we identified that many of these birds migrate and return to the study fields as breeders in subsequent years. In an attempt to understand more about their habitat selection, I studied breeding bobolinks and Savannah sparrows in Shelburne, Vermont. Throughout a 10-week study period, I collected location data from 12 bobolinks and 7 Savannah sparrows that were banded as nestlings in previous years. Using this information, I measured the distance between where all of the individuals were born and where they were found in subsequent years (known as natal dispersal). Of the 19 individuals, only one Savannah sparrow returned to its natal field. The average (±SD) natal dispersal distance for bobolinks was 1,522 ± 799.9 m, and the average natal dispersal distance for Savannah sparrows was 1,587 ± 675.8 m. Both of these species rarely dispersed > 2 km, which could be problematic if farming practices continue to intensify, decreasing the number of local fields that produce offspring.

Poster 36

Generating seedlings to test the effects of genetic diversity of Spartina alterniflora on its competitive interactions with invasive Phragmites australis

Presenter: Sarah Raymond '17
Major: Animal Bahavior
Minor: Environmental Science and Education
Advisor: Steven Travis

Description of research/abstract:
An important fixture of New England salt marshes, which provide crucial habitat for native plants and animals and protect human infrastructure from the sea, is the marsh grass Spartina alterniflora. This species tends to grow clonally, producing large swaths of marsh with minimal clonal diversity. Threatening this foundational grass is Phragmites australis, or common reed, which originates in Europe. As it spreads into a marsh habitat, it competes with S. alterniflora for space. The aim of our study was to find the perfect distance at which to breed individuals of S. alterniflora to create optimally diverse clones for successfully competing with P. australis. Previous studies showed that S. alterniflora may be safely bred with individuals from up to 200 km away and still produce viable offspring. Starting in Scarborough, ME, our reference site, we collected 12 samples of S. alterniflora every 15 km southward from eight more sites, with an added outlier ~350 km away in Connecticut. The samples from these 10 sites were brought back to UNE, where they continue to flower and be bred with pollen collected from the reference site. We will overwinter the seeds in half-strength seawater and use them in competitive experiments next growing season. We also conducted fieldwork to study the habitats where S. alterniflora and P. australis grow in contact. These data should bring us a better understanding of the conditions under which these species compete in the wild.

Student, faculty, or staff contributors: Greg Zogg, Jill Henrichon*

*Student

Poster 37

Synthesis of an engineered VEGF-SH3 fusion protein for an artificial extracellular matrix biomaterial

Presenter: Robert Elliott '18
Major: Biochemistry
Minor: Mathematics
Advisor: Eva Rose Balog

Description of research/abstract:
During development, stem cells differentiate into every kind of cell that you will ever need. This process is triggered and guided by proteins called growth factors. Growth factors coordinate the development of stem cells into the complex structures needed for continued life function. For blood vessels, this process is triggered by Vascular Endothelial Growth Factor (VEGF) acting upon endothelial cells. Though a great deal is now known about the importance and basics of VEGF signaling, blood vessel growth and development still remains a complex and incompletely understood process.

Here we show continued work towards developing a novel artificial extracellular matrix (aECM) for the study and control of angiogenesis signaling. Our aECM system will include a fusion protein composed of two domains: VEGF and SRC homology 3 Domain (SH3), a protein that binds with tunable affinity to proline-rich peptides. Towards the production of this fusion protein, we created a plasmid containing the genetic sequence of a VEGF isoform characterized by a lack of extracellular matrix attachment. From here we can further modify the plasmid to contain the sequence for the SH3 domain such that when the full-length fusion protein is expressed in bacteria it will contain a functional VEGF domain connected to a functional SH3 domain. This novel protein will bind to engineered protein polymer aECM materials via its SH3 domain, leaving the VEGF domain fully functional. Ultimately, using various SH3-binding proline-rich peptides, we plan to expose endothelial cells to precisely controlled spatial and temporal localization of VEGF and study the resulting biochemical events.

Poster 38

An Assessment of stress and post release mortality in Atlantic cod captured in the commercial lobster fishery

Presenter: Riley Austin '18
Major: Marine Biology
Minor: Applied Mathematics
Advisor: James Sulikowski

Description of research/abstract:
Atlantic cod (Gadus morhua) populations, once one of the most important commercial species in the Gulf of Maine (GOM), have been decimated by overfishing in our recent history and now the fishery has collapsed. In order to restore these populations we must consider all the ecological, environmental, and anthropogenic influences that have an impact on their populations. This study focuses on the stress associated with capture in lobster gear and how it relates to subsequent mortality of cod. Sampling trips with a commercial lobster fisherman from Cape Porpoise, ME were taken beginning in the summer of 2016. One mL of blood was drawn from each of the 11 cod that were captured in lobster gear. The secondary blood stress parameters glucose, hemoglobin, lactate, and hematocrit were tested on board the fishing vessel. Mean values for these parameters were 42.8 ±20.9 mg dL-1, 1.265 ± 0.41 mmol l-1, 6.145 ± 0.53 g/dL, and 30% ± 4.15% respectively. When compared to baseline values from other studies, results herein revealed that cod were relatively non-stressed. Throughout this semester I will also be using blood radioimmunoassay to determine concentrations of cortisol, a primary indicator of stress, which will then be compared to secondary blood parameters to establish relationships between stress and mortality. Sampling will continue throughout this fall and next year to increase sample size to further quantify the effects of capture in lobster trap gear.

Poster 39

Assessment and characterization of anti-Staphylococcal compounds produced by the marine macroalgae Saccharina latissima and Ulva lactuca

Presenter: Cameron Russell '18
Major: Biological Science
Advisor: Kristin Burkholder

Description of research/abstract:
Methicillin-resistant Staphylococcus aureus (MRSA) is a bacterial pathogen that causes serious skin and soft tissue infections. Because of MRSA's increasing drug resistance, there is great need for new anti-Staphyloccocal therapeutics. Attention has focused on potential utility of marine macroalgae as a source of novel antimicrobial compounds. We recently reported that crude extracts of the green macroalgae Ulva lactuca inhibit growth of a range of clinically-important S. aureus strains, but the chemical properties and identity of the antimicrobial compounds present in the crude extracts remains unknown. It is also unclear whether additional species of macroalgae share U. lactuca's anti-Staphylococcal properties. In this study, antimicrobial disk diffusion assays and minimum inhibitory concentration (MIC) assays were used to examine the antibacterial properties of crude extracts of Saccharina latissima (sugar kelp). We found that S. latissima crude extracts inhibited the growth of a variety of MRSA strains, indicating that S. latissima produces anti-Staphylococcal compounds. We also used HPLC to separate crude U. lactuca extracts by polarity and then used disk diffusion assays to assess the anti-Staphylococcal activity of individual U. lactuca fractions. One of the three fractions tested exhibited bacterial inhibition at levels similar to that of the crude extract, indicating successful partitioning of the U. lactuca antimicrobial compounds into a single fraction. This work will serve as the basis of further fractionation and antimicrobial testing of extracts from S. latissima and U. lactuca, in our ongoing efforts to identify the anti-Staphylococcal compounds produced by marine macroalgae.

Student, faculty, or staff contributors: Jessica Woolf*, Zachary Millier-Hope*, Amy Deveau, Kristin M. Burkholder

*Student

Poster 40

Scavenging decisions by vertebrates: testing visual and olfactory cues to risks associated with carcasses

Presenter: Cameron Russell '18
Major: Biological Science
Advisor: Kristin Burkholder

Description of research/abstract:
Ecological relationships among organisms are recognized and categorized based on the relative costs and benefits of the relationship to each participant, but organisms also experience risks associated with such relationships. Risks associated with scavenging behavior, an ecological relationship where an animal feeds on a dead animal it did not kill, are not well defined. We hypothesize three risks associated with scavenging: pathogens, nearby predators, and nearly-dead animals that fight back. To test if scavengers perceive these scenarios of risk, we deployed mouse (Mus musculus) carcasses in a factorial design with two manipulations and monitored scavenging activity using remote cameras. Manipulations included: 1) a visual cue to carcass risk that used carcasses deployed singly (normal) or in groups of seven to simulate disease risk, and 2) an olfactory cue to carcass risk that used carcasses with intact microbiota (normal) or depleted microbiota to simulate freshly dead carcasses that might have nearby predators or might be nearly-dead and fight back. The visual cue caused scavengers to pass on a meal, whereas the olfactory cue did not, with the visual cue to risk creating longer latencies from detection to carcass removal (mean +/- variance; 0.89 +/- 1.30 days) than the olfactory cue (0.02 +/- 0.003 days). These preliminary results suggest that pathogen risk may be more important in the foraging decisions of scavengers than the possibility of nearby predators or of nearly-dead animals.

Student, faculty, or staff contributors: Cameron M. Russell*, Sara R. Deangelo*, Carolyn A. Wawrzynowski*, Kristin M. Burkholder, and Zachary H. Olson

*Student

Poster 41

Assessing reproductive steroid hormone concentrations in shark species captured off the coast of Southern Florida

Presenter: Nora Wells '18
Major: Marine Biology
Minor: Applied mathematics
Advisor: James Sulikowski

Description of research/abstract:
An understanding of important life history characteristics is crucial to conservation and management of a species. Unfortunately, little is known about the life history of elasmobranchs including reproductive characteristics. This research is in collaboration with the RJ Dunlap Marine Conservation Program of the University of Miami to analyze lemon sharks (Negaprion brevirostris) and sandbar sharks (Carcharhinus plumbeus) captured off the coast of Southern Florida. This study is unique in its multiple year effort to track and analyze the individual sharks' reproductive events. The non-lethal radioimmunoassay method was used to analyze the steroid hormone, progesterone (P4), present in lemon sharks and sandbar sharks. Preliminary analysis of results for 2013 and 2014 so far has been conducted. The P4 level for the one mature female lemon shark captured in 2013 was 12.42pg/ml while in 2014 the concentration for 2 mature females was 2901.45pg/ml±3367.17pg/ml. These dissimilarities suggest that sharks captured in 2014 were in a different reproductive stage than those in 2013. Conversely, the average P4 value in 3 mature female sandbar sharks captured in 2013 was 25.19pg/ml ±15.44pg/ml while the average value for the 8 mature female sandbar sharks captured in 2014 was below 15.625pg/ml. This decrease in P4 concentration could indicate that these female sandbar sharks were also in a different reproductive stage in 2014 when compared to those captured 2013. While both species appear to exhibit a biennial cycle, the preliminary results suggest an alternative reproductive cycle between the two species, which is a unique finding for these shark species.

Poster 42

Stability and Chemical Analysis of Maine Ulva lactuca Extracts that Have Antimicrobial Properties

Presenter: Jessica Woolf '17
Major: Biochemistry
Minor: Applied Mathematics
Advisor: Amy Deveau, Zachary Miller-Hope

Description of research/abstract:
U. lactuca is indigenous to Maine waters. Due to the rising mean water temperatures in the Gulf of Maine, it is hypothesized that U. lactuca will proliferate in biomass. If commercial uses of this increased Ulva biomass could be identified, then favorable environmental impact with value-added from both scientific and economic perspectives could be achieved. With this global goal in mind, we propose to continue studies exploring the chemical and antimicrobial properties of U. lactuca harvested from Biddeford Pool. Specifically, we will compare the chemical composition and stability of dried, ground U. lactuca to the liquid U. lactuca extracts in reference to antimicrobial effects. The chemical and antimicrobial effects will also be correlated to the Gulf of Maine water temperatures at the time of harvest.

Student, faculty, or staff contributors: Kristin Burkholder, Lisa Harding

Poster 43

Can crabs feel pain?

Presenter: Amber Jenkins '19
Major: Marine Biology
Advisor: Markus Frederich

Description of research/abstract:
It is generally accepted that invertebrate animals can not feel pain because they lack the respective neurological structures. Their respective responses to pain are considered to be only reflexes. However, some recent studies challenge this paradigm. The study "Electric shock causes physiological stress responses in shore crabs, consistent with prediction of pain" by Elwood and Adams (2015) claims that the Green crab Carcinus maenas feels pain because of increased hemolymph lactate levels when shocked by an electrical stimulus. However, we interpret these results as muscle contractions caused by electrical muscle stimulation. To test this alternate explanation we repeated the published experiments as closely as possible: Crabs were shocked with 10 V at 180 Hz for 200 ms with 10 s intervals for 2 min. We measured lactate accumulation in hemolymph, claw muscle, liver and heart tissue after 2, 4 and 10 minutes. The results show an increase in hemolymph lactate from 0.3±0.3mM under control conditions, to 44.7±9.6mM 4 minutes after applying the electrical stimulus, and to 97.7±24.8mM after 10 minutes. In a next step will repeat these experiments in isolated legs and hearts to exclude central pain mechanisms. Understanding whether invertebrates experience pain can have significant implications in regulations and practices for experimenting with invertebrates.

Student, faculty, or staff contributors: Amber Jenkins, Kisten Glennie, Markus Frederich

Poster 44

The role of corneal nerves and secondary cold allodynia following lacrimal gland excision

Presenter: Tori Denis '17
Major: Medical Biology
Minor: Creative Arts
Advisor: Lei Lei

Description of research/abstract:
The cornea is the most densely innervated tissue in the body. Proper corneal function requires tears produced by the lacrimal glands. The absence of adequate aqueous tears results in a subtype of dry eye disease (DED), marked by reduced tear volume. Resulting dryness causes damage to the corneal epithelium. Sensory nerve fibers of the trigeminal nerve innervate the cornea. Sensory projections of the trigeminal nerve also innervate the head and neck. The first aim of this study was to investigate the morphology of the sub-basal corneal nerves as well as corneal nerve terminals two weeks following lacrimal gland excision (LGE), with a focus on sex differences. Immunohistochemistry with β-III tubulin was performed to label the sub-basal corneal nerves and nerve terminals. The second aim was to study if secondary cold allodynia was present during aqueous deficient dry eye in male and female mice two weeks after LGE surgery. Fifteen microliters of acetone was applied to the center of the forehead of the mouse to produce a cool stimulus. The duration of time the mice spent swiping with their forepaws at the site of acetone application, an indication of pain, as well as the number of swipes was recorded.
It was found that nerve density was decreased two weeks following LGE and that secondary cold allodynia was increased following LGE. No sex difference for nerve density or acetone swiping has been determined at this time.

Student, faculty, or staff contributors: Ian Meng, Danielle Demers*, Neal Mecum, William Bushey

*Student

Poster 45

Effects of Polybrominated Diphenyl Ether on Adipose Tissue

Presenter: Nikita Naumowicz '17
Major: Medical Biology
Minor: Art
Advisor: Dr. Deena Small

Description of research/abstract:
For this research project I have tested the hypothesis that the presence of PBDEs in a cell will compete with thyroid hormone for thyroid hormone receptors and cause irregularities in the cell cycle that may increase adipogenesis. During this research I have cultured several aggregations of fat cells from two different cell lines - primary preadipocytes from dissections preformed on the white adipose from the visceral depot of mice sacrificed by Dr. Small under her IACUC protocol and from the 3T3L1 precultured preadipocytes- and then exposed them to varying levels of decaPBDEs. I began my research testing with a high dosage of decaPBDE exposure of 1.0 uM through a DMSO vehicle control, and throughout the project transitioned to testing both high and low dosage exposures (0.1 uM). Cells were then analyzed for their ability to proceed through the cell cycle and proliferate and for their ability to undergo adipogenesis.

Student, faculty, or staff contributors: Dr. Deena Small

Oral Presentation 1

Importance of the Saco River Estuary to winter flounder (Pseudopleuronectes americanus) life stages

Presenter: Lars Hammer '18
Major: Marine Biology
Minor: Mathematics
Advisor: James Sulikowski

Description of research/abstract:
Due to the effects of overfishing and habitat loss, winter flounder stocks have drastically declined since the 1980's. Although strict fishing regulations have stabilized populations, they are still below sustainable harvesting levels. In order to better manage and further promote the rebuilding of winter flounder stocks, essential fish habitat (EFH), such as nursery grounds and spawning areas, need to be identified. While previous EFH have been documented in the southern most US range of the species, very little information has been gathered in their northern most US range. Previous studies have suggested the Saco River estuary system (SRES), in southern Maine, has the potential to serve as a nursery ground for winter flounder based on the presence of YOY and juvenile individuals. However, the extent to which winter flounder utilize the SRES needs to be addressed. In order to assess the importance of this Northern estuary to winter flounder, a multifaceted study was initiated in 2016. Thus far, a total of 61 beach seines and 17 otter trawls have been conducted between May and August. Fish captured ranged in size from 25mm-400mm TL. Flounder captured in seine nets had an average total length of 53.3mm+-25mm, while flounder captured by otter trawling averaged 156.8mm+-80mm. These methods yielded CPUE's of 0.3115 (fish/seine) and 0.15044 (fish/minute towed) respectively. Based on the wide size distribution range of sampled specimens, it would appear that this estuary not only has value as a nursery ground, but for other life history stages as well.

Student, faculty, or staff contributors: James Sulikowski

Oral Presentation 2

Correlation of Stress Tolerance and Molt Stage in the European Green Crab, Carcinus maenas

Presenter: Gwendolyn Pelletier '17
Major: Marine Science
Minor: Chemistry, Applied Mathematics
Advisor: Markus Frederich

Description of research/abstract:
The European green crab, Carcinus maenas, is variable in ventral sternite coloration, green after molting and often dark red after prolonged intermolt. Earlier studies reported that red morphs are less stress tolerant than green morphs. Previously we exposed crabs of both colors to 2h anoxia and assessed their subsequent motor activity as righting time. Green morphs maintained constantly fast responses while red morphs slowed down with corresponding differences in lactate accumulation, AMPK activity, and HSP70 protein expression. To test how stress tolerance changes through the molt cycle, juvenile animals were collected after molting and assessed for stress tolerance through a complete molt cycle. Coloration was assessed using standardized photographs. Animals were assessed for stress tolerance by righting response in normoxic conditions, and hypoxic conditions. Righting response was consistent through the molt cycle in both normoxia (1.5±0.2s), and hypoxia (5.7±0.4s). Hemolymph samples were taken to assess lactate accumulation. Data show lactate concentrations rising steadily through the molt cycle (0.25±0.15mM after the first molt, to 2.83±0.34mM before the second molt) and dropping off sharply after the second molt (1.03±0.51mM). Oxygen consumption decreased from (0.17±0.06 μmol O2 min-1g-1) in the first week to (0.11±0.03 μmol O2 min-1g-1) in the eleventh week. Overall, we observed a gradual decrease in hypoxia tolerance during the molt cycle, which might be associated with an increasingly thicker cuticle on the gills, leading to decreased O2 uptake and decreased scope for aerobic activity. Understanding stress tolerance through the molt cycle will help control damage caused by this invasive species.

Oral Presentation 3

Shortnose Sturgeon in the Saco River Estuary: An Assessment of Critical Habitat

Presenter: Cameron Hodgdon '17
Major: Marine Science
Second Major: Applied Mathematics
Advisor: James Sulikowski

Description of research/abstract:
The shortnose sturgeon (Acipenser brevirostrum) is an endangered fish species that inhabits river systems along the east coast. Being anadromous, they have the ability to migrate from river to river, using the ocean as an intermediary. In 2010, the first sighting of shortnose sturgeon occurred in the Saco River, Maine. Data suggests that these fish migrate to and from this river every summer. Understanding habitat usage is crucial for proper management of endangered species and critical habitats must be determined to ensure their future survival. Critical habitats (areas necessary for the conservation of a species) have never before been designated for the shortnose sturgeon, and thus there is an ever more pressing need to discover them. To learn more about importance of the Saco to shortnose sturgeon, an acoustic tagging study was initiated in 2011. From this ongoing study, movement data within the Saco River for 27 individuals has been catalogued. Preliminary movement data suggests that the shortnose sturgeon appear to prefer areas between river kilometer (rkm) 7 and rkm 9. In an effort to understand why the shortnose sturgeon prefer this area, temporal and spatial variances of temperature, salinity, dissolved oxygen, acidity, substrate type, and depth have been monitored within the river since June 2016. In November, these 6 parameters will be ranked by significance they have upon shortnose sturgeon movements within the river by way of multivariable regression analysis.

Oral Presentation 4

Biological Mosquito Control Methods at UNE

Presenter: Kady Winsor '19
Major: Environmental Science
Advisor: Noah Perlut

Description of research/abstract:
Since 2013, the University of New England's Health and Safety department has been working with the Department of Environmental Studies and Facilities to promote biological control of mosquito populations on the Biddeford campus through the use of bat and bird species that prey on mosquitos, as well as species of plants which repel them. The project aims to reduce human exposure to mosquito-borne diseases. This inter-departmental endeavor has consisted of 25 bat and 24 bird boxes installed in 2013 intended to increase populations of bird and bat species. Planters of mosquito repellent plant species were added in 2015, concentrated in high-traffic areas around campus. Two species of birds inhabited the bird boxes in 2016, fledging a total of 101 chicks between them, up from only 68 chicks in 2015.

Student, faculty, or staff contributors: Noah Perlut

Directory of Presenters

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