# 2017 HMSC REU Summer Intern Marine Research Symposium

Thursday, August 24th, 2017 • 9:00am – 12:30 pm
Hennings Auditorium in the HMSC Visitor Center

**9:00 Welcome**

**9:15 Naomi Jainarine** **Rider University**
Mentor: Scott Heppell, OSU Fisheries & Wildlife
*Assessing potential changes in reproductive life histories of female Sebastes melanops during changing climates in Newport, Oregon*

Abstract: As natural systems in the North Pacific change due to anthropogenic induced anomalies, such as the marine heat wave from recent El Nino events, economically important fisheries must monitor how stocks are adapting in terms of reproductive success. Specifically, *Sebastes melanops* (Black Rockfish), a long-lived rockfish species are being evaluated in order to understand the understudied reproductive life histories of female black rockfish in changing environmental conditions (in terms of temporal and latitudinal variability). Black Rockfish consist of over 50% percent of the landings in the bottom fishing industry and contribute a great deal to the local environments and economies. Biological samples were taken by extracting otoliths, for age determination, and gonads, for maturation state, from the carcasses of recreationally landed fish. Length-Age data from 2015 and 2016 did not individually fit the von Bertalanffy model when generating a growth curve. A better fit could only be obtained by combining the 2015 and 2016 growth data. These yielded the following parameters, $L_{inf}$=439.6, K=0.3141, $t_0$=-2.932. In order to compare the age-length relationship between these years, an alternate model needs to be determined. Maturity state will be used to investigate at what age/length females are becoming mature and be compared to past and future data sets in order to investigate possible correlations with differing environmental conditions.

**9:30 Makayla Kelso** **Texas A&M University at Galveston**
Mentor: Scott Heppell, OSU Fisheries & Wildlife
*Identifying and Quantifying Common Prey Items in Pacific Staghorn Sculpin (Leptocottus armatus) Diets in Three Oregon Estuaries*

Estuaries are among the most productive and most vulnerable ecosystems in the world. Understanding the community structure and predator-prey relationships of the species residing within them is an essential step towards preserving these critical habitats. As ocean conditions continue to change and anthropogenic activities increase along coastlines, it is important to determine the effects these changes have on estuarine communities. While often home to many economically and ecologically important species, less well known species residing in estuaries, such as Pacific Staghorn Sculpin (*Leptocottus armatus*), remain understudied, and the understanding of the roles they play in these systems remains incomplete. Pacific Staghorn Sculpin (PSS) were sampled from January to December 2016, in three Oregon estuaries; Yaquina, Alsea, and Nehalem. The contents of their stomachers were counted and organized into major categories for analysis in an attempt to identify and quantify their prey types in different locations. Differences were found in prey species presence and absence between estuaries, specifically between Alsea and Yaquina, as well as between months sampled specifically in April, May, June, August, and September. Major prey groups driving differences across the board included Gammaridean amphipods, Corophiidae, crustaceans, *Crangon* spp., and polychaetes. Due to it's abundance in West

Coast estuaries, this data could aid in determining any possible competition for prey resources between PSS and other commercially important species residing in Oregon estuarine communities as well as act as a baseline for future studies on how availability of certain prey resources may change over time within Oregon estuaries.

**9:45 Madeline Musante** **Flagler College**

Mentor: Su Sponaugle, OSU Integrative Biology

*Recruitment and Size of Settled Juvenile Rockfish along the Oregon Coast*

Variable survival during the early life history of rockfishes off the Pacific Northwestern coast of Oregon plays a fundamental role in interannual recruitment variability. Larval predation and starvation fluctuate from year to year depending on oceanographic conditions, which leads to interannual variability in recruitment. Additionally, oceanographic conditions influence the size of individuals and thus mediates predation and starvation of larvae and settled juveniles. Assessing the influence of ocean temperature on recruitment rate of rockfishes is essential to understanding future fluctuations in population size. I examined patterns of rockfish recruitment and length distribution during OSU, OCA and ODFW's 2017 marine reserve monitoring program and determined the average day of recruitment across 2013-2017. Settlement stage rockfishes were collected in Standard Monitoring Units for the Recruitment of Fishes (SMURFs) from Otter Rock Marine Reserve and Redfish Rocks Marine Reserve and Cape Foulweather and Humbug Mountain were the non-reserve comparisons. In 2017 the recruitment rate varied between the OYTB and QGBC complexes, which was likely due to differences in the timing of recruitment and pelagic duration. There was a significant increase in the standard length of OYTB recruits over time in the 2017 sampling season. Across all sampling years the annual average day of recruitment for the OYTB complex varied by up to two weeks from the overall mean day of recruitment for 2013-2017, which was likely due to temperature and as well as other variable oceanographic conditions.

**10:00 Lianne Blodgett** **University of Chicago**

Mentor: Chris Langdon and Matt Hawkyard, OSU Fisheries & Wildlife

*Evaluation of Liposomes for the Delivery of Oxytetracycline to Oyster Larvae (Crassostrea gigas) and Subsequent Effects on Resistance to Vibrio coralliilyticus*

Despite ongoing research, improved and innovative methods for preventing and treating bacterial infections in aquaculture are needed. Present bacterial treatments often require the use of large quantities of antibiotics dissolved in culture water, a method that is wasteful and may promote antibiotic-resistant bacteria. In this research, we investigated the use of microparticles (liposomes) for direct delivery of antibiotics to the Pacific oyster (*Crassostrea gigas*) and evaluated subsequent effects on larval resistance to *Vibrio coralliilyticus*. By feeding larval oysters fluorescently-tagged liposomes, we determined that 2-day old and 9-day old larvae readily ingest and at least partially digest liposomes, releasing water-soluble antibiotics into their guts. In addition, oxytetracycline (OTC), a water-soluble antibiotic, was shown to be highly effective against *V. coralliilyticus* at low concentrations, and OTC was successfully encapsulated within liposomes. However, when oyster larvae were fed liposomes containing OTC and exposed to *V. coralliilyticus,* larval survival did not increase. Moreover, while larvae were shown to take up dissolved OTC from culture water, pretreated culture water with dissolved OTC did not increase larval survival or resistance to *V.*

*coralliilyticus,* suggesting that more research is needed to evaluate if oral ingestion of antibiotics is an effective treatment at all for oyster larvae. Despite the inability of the dissolved OTC and antibiotic liposome treatments to increase larval survival, this research suggests that liposomes may be used to efficiently deliver other water-soluble compounds, such as dietary supplements, to young oyster larvae.

**10:15 Sawyer Finley** **Colorado College**
Mentor: Jessica Miller, OSU Fisheries & Wildlife
*Stable Isotope Analysis to Assess Tissue Specific Fractionation in Juvenile Chinook Salmon*

Stable isotope analysis use allows for the quantification of habitat impact in highly migratory species such as Chinook salmon (*O. tshawytscha*). To provide baseline stable isotope (SI) values and discrimination factors for Snake River spring Chinook, we investigated the caudal fin, dorsal muscle, liver, plasma, and red blood cell tissue of hatchery reared spring/summer juveniles from the McCall Hatchery in Idaho. Understanding tissue specific SI values and fractionation factors, as well as variation in a diet-controlled study, will help future researchers choose tissue types appropriately. Baseline SI will allow for comparison to future field studies to provide insight into the role of different habitats and available prey in the migration of Snake River yearlings. The tissue types listed above, as well as hatchery feed, were analyzed for baseline $\delta^{13}C$ and $\delta^{15}N$. These values provided $\delta^{13}C$ and $\delta^{15}N$ values in different tissue types, so that fractionation and SI values may be compared with further field study. We found that tissue types often had high variation in both $\delta^{13}C$ and $\delta^{15}N$ SI values, were statistically different for both $\delta^{13}C$ and $\delta^{15}N$, and were overall poorly correlated between tissue types. Physical factors, such as fork length (FL), weight, fish condition, and C:N ratio also poorly described the variation within tissue types. Further laboratory study with more variables controlled (growth, temperature, size) could provide a more accurate depiction of SI interactions.

**10:30 Break and Special Poster Presentation**

**Lincoln County Community Services Consortium**
**Summer Natural Resources Conservation Crew**
Mentor: John Chapman

**11:00 Ryan Case** **University of Oregon and the Robert D. Clark Honors College**
Mentor: Daniel Palacios, OSU Marine Mammal Institute
*Do Ocean Currents Impact the Navigation of Migrating Humpback Whales?*

It has long been known that humpback whales (*Megaptera novaengliae*) migrate over long distances, however there are still large gaps in our understanding of how humpbacks navigate during these migratory journeys. We analyzed data from satellite telemetry tracked humpback whales in the Hawaiian subpopulation to assess the impact of ocean currents on navigation during the whales' open ocean migrations. To do this we created a method to automatically identify segments of tracks displaying highly directed migratory movements, and found the mean bearing of these segments. Among both southbound and northbound whales, there is a statistically significant correlation between the whale's track velocity perpendicular to the segment's mean bearing, and the ocean current's velocity perpendicular to the mean bearing, evidence that the humpbacks drifted due to the currents. A similar

correlation did not exist between the whale's perpendicular heading velocity, and the ocean current's perpendicular velocity, so no evidence of compensation for the ocean currents was found. Further study of humpback migratory navigation should take these current drift effects into account to accurately assess the intended orientation of the whale before drift.

**11:15 Angelina Zuelow** **Humboldt State University**

Mentor: Sarah Henkel, OSU Integrative Biology

*Changes in the caloric density of the shrimp (Crangon alaskensis) associated with the North Pacific marine heatwave*

*Crangon alaskensis* are an abundant shrimp species found in soft bottom habitats that are an important prey for many predators. *Crangon* spp. act as both prey and predators of flatfish depending on the fishes' current life stage, giving the shrimp a unique and influential ecological role. Additionally, *Crangon* spp. have been captured and used as a food source for commercial fisheries for centuries. A marine heatwave initially hit the North Pacific during the winter of 2013-2014, altering the ocean conditions along the central Oregon Coast starting in September 2014. The marine heatwave led to a decline in cold-water upwelling, and the associated low nutrient availability can lead to changes in food availability, resulting in slower-growing shrimp. We measured caloric content in *Crangon alaskensis* from samples collected every other month when possible, beginning in June 2010 and ending in August 2015, from the central Oregon coast before and during the marine heatwave. We hypothesized that the marine heatwave would lower the caloric density of *C. alaskensis*. Caloric density was found to be lower in August 2015 than any other previous years in August. August 2015 was found to be statistically different from August 2013. However, few strong correlations were found between Joules per gram and most possible correlated factors (biomass, CTD data, and ocean climate indices). What was significantly correlated was upwelling, with the previous month of upwelling having overall higher correlation to Joules per gram than the current month of upwelling.

**11:30 Megan Hazlett** **Allegheny College**

Mentor: Tom Hurst, NOAA Alaska Fisheries Science Center

*Effects of Elevated $CO_2$ on the Behavioral Responses of Speckled Sanddab (Citharichthys stigmaeus) to a Visual Predator Cue*

Over the next century, the pH of the ocean is expected to decrease as the level of $CO_2$ in the atmosphere continues to increase, a process known as ocean acidification. Increased $CO_2$ levels in the ocean have been shown to cause behavioral and physiological changes in marine organisms including effects on behavior, survival, growth, and reproduction in marine fishes. Behavioral studies have examined the effects of elevated $CO_2$ on responses to visual, olfactory, and auditory cues. In this study, we examined the effects of elevated $CO_2$ on the behavioral responses of the speckled sanddab (*Citharichthys stigmaeus*), a Pacific coast flatfish, in response to a visual predator cue. Juvenile sanddab posture, activity, number of feeding strikes, and feeding latency were examined at high $CO_2$ and low $CO_2$ treatments. Although there was no significant difference in behavior between $CO_2$ treatments, there was a trend towards higher posture in the high $CO_2$ treatment. We conclude that speckled sanddab behavior appears resilient to possible near-future oceanic conditions. On-going trials will supplement those observations and clarify any trends seen in the data. Future work should

examine the behavioral responses of other marine fishes living in upwelling regions to determine any pattern in behavior between species in this ecosystem.

**11:45 Alexis Morris** **Flagler College**

Mentor: Fiona Tomas Nash, OSU Fisheries & Wildlife

*Investigating the interactions of non-native eelgrass Zostera japonica with native grazers*

Invasive species are one of the world's largest threats to biodiversity, and continue to become more common as a result of increasing globalization. To effectively manage the expansion of invasive species, it is important to understand the role of food web relationships (e.g., herbivory or competition) in either mediating or exacerbating the spread of an invasion. In temperate seagrass systems, herbivore-seagrass relationships are vital for the survival of ecologically and economically valuable seagrass beds. *Zostera japonica* is a non-native seagrass that has spread across estuarine systems of the western United States coast. Little is understood about the potential value *of Z. japonica* as a food source for small invertebrate herbivores, such as gastropods and crustaceans, that serve as a key trophic link in native Pacific Northwest (PNW) eelgrass communities, or the potential threat it poses to native eelgrass (*Zostera marina*) communities in PNW estuaries. In this study, we aim to understand 1) the role of common seagrass grazers in contributing to biotic resistance, or the ability to defend against invasion, and 2) how non-native *Zostera japonica* affects grazer fitnessIn order to examine the feeding preference of herbivores, and the impact of the different seagrass species on grazer fitness, I will conduct a series of no-choice and feeding preference trials with four different native grazers (*Idotea resecata, Eogammarus confervicolus*, *Pugettia producta*). We found significant evidence that local grazers may preferentially consume *Z. japonica* in our local eelgrass beds and potentially contribute to biotic resistance. Our results show that *Z. japonica* is a healthier diet for grazers than native *Z. marina*. These findings suggest that rather than posing a threat to local ecosystems, *Z. japonica* is actually beneficial in the context of eelgrass beds as it expands available habitat for native grazers. These implications regarding the relationship between the native grazers and non-native eelgrass could help environmental managers make decisions regarding the management of the non-native eelgrass *Z. japonica*.

**12:00 Christina (Nina) Mauney** **University of Virginia**

Mentor: Fiona Tomas Nash, OSU Fisheries & Wildlife

*Assessing the interaction between native Zostera marina and non-native Zostera japonica eelgrass under eutrophic conditions*

Oregon's *Zostera marina* eelgrass, a foundation species for local estuarine ecosystems, is threatened by several anthropogenic factors, such as sediment pollution, climate change, eutrophication, and the introduction of non-native species. In Oregon and the Pacific Northwest specifically, where seasonal upwelling brings about nutrient enrichment, anthropogenic and natural nutrient enhancement is especially prevalent. The introduction of non-native *Zostera japonica* in the early 20$^{th}$ century signaled a shift in seagrass communities. Due to the importance of seagrass ecosystems, it is crucial to understand the interaction of these two species under eutrophic conditions and the potential role of grazers in modifying this interaction. Therefore, this study examined seagrass health and growth under nutrient and grazer treatments in a mesocosm experiment of a mixed seagrass bed. Significant effects of a mesograzer treatment were found in plant aboveground biomass,

epiphyte load, and leaf area responses. There was also a significant nutrient effect in epiphyte load. Overall, *Z. japonica* was more responsive to treatment than *Z. marina*, and the grazer treatment appeared to favor *Z. marina*.

**12:15 Gabby Kalbach** **California State University Monterey Bay**
Mentor: Joe Haxel, OSU College of Earth, Ocean, and Atmospheric Sciences
*Analyzing the Continental Shelf Soundscape: Application of a Glider for Passive Acoustic Monitoring*

A NOAA/PMEL glider, equipped with a hydrophone, was sent on a three-week journey along the continental shelf of the Pacific Northwest to continuously collect passive acoustic data. Gliders are a relatively unexplored platform for performing acoustic monitoring, and this operation provides an opportunity to assess their advantages and disadvantages. The most significant advantage to using gliders for acoustic studies is their flexibility as a data collection instrument. The ability of gliders to record data throughout their sawtooth dive profiles is ideal for sampling sound which varies by range and depth, allowing sampling to be completed in a 2-dimensional (north-south and depth) environment. In order to accurately analyze these recordings, noise generated by the glider's buoyancy and navigation systems must be removed. To correct the raw data for analysis, a detection algorithm was used to identify the instances of glider generated system noise. Each of these detections were then visually annotated from time series and spectrogram displays to confirm the origin of the automated detected signal. Smoothing the areas of system noise leads to an overall lower true ambient sound level measurement. Obtaining acoustic data on a wide spatial and temporal scale is critical to determining the health of the oceans, and there is a lack of large datasets for the continental shelf region of the Pacific Northwest. These recordings will provide baseline ambient levels that give insight into spatiotemporal variability of anthropogenic noise, weather, and presence of marine mammals.

12:30 Closing Remarks

**Dimitri Diagne –** *unable to present* **Yale University**
Mentor: John Chapman, OSU Fisheries & Wildlife and Brett Dumbauld, USDA ARS

*Using growth rate and parasite brood production to determine the energetics of a Mud Shrimp-Isopod Host-Parasite relationship*