2020 Annual Meeting
Abstracts

2020 Full Presentations

Breeding Farmed Atlantic Surfclams (*Spisula solidissima*) for Greater Heat Tolerance

Michael Acquafredda, Student
Rutgers University
Co-authors: Ximing Guo, Daphne Munroe

The Atlantic surfclam (*Spisula solidissima*) is emerging as an attractive alternate species grown by aquaculturists across the Northeast, USA. This species is native, grows rapidly, and complements the region's established farming framework. However, the surfclam is vulnerable to high temperature conditions, an issue that will be exacerbated by rising ocean temperatures and one that will be problematic on shallow coastal farms. This study explored the feasibility of selectively breeding farmed Atlantic surfclams for greater heat tolerance. We evaluated the phenotypic and transcriptomic responses of adult farmed surfclams to heat stress after juvenile exposure as well as the ability for heat tolerance to be passed to subsequent generations. We found that when juvenile surfclams were exposed to prolonged lethal temperatures, the adult survivors withstood subsequent heat stress for significantly longer than individuals not exposed to lethal temperatures as juveniles. However, the naïve surfclams had a more intense transcriptomic response to the heat shock, differentially expressing about 3x more genes than the clams that had previously survived prolonged lethal temperatures. We also found that selective breeding enhanced heat tolerance in first-generation surfclam progeny. Moreover, growth of the heat-selected progeny was not significantly different from that of control clams when they were reared under ambient conditions. Together, this work suggests that selective breeding may be a viable strategy for enhancing summer survival of farmed surfclams.

Contemporary Size Truncation in the Weakfish Population in New Jersey and Delaware Bay, U.S.A.

Linda Barry
New Jersey Department of Environmental Protection

Anecdotal accounts of the loss of large Weakfish *Cynoscion regalis* have been widespread throughout Delaware Bay and coastal New Jersey, U.S.A., for the last two decades. Stock assessments conducted by the Atlantic States Marine Fisheries Commission showed the stock to be in a depleted state leading to stringent management measures in 2010, which relegated Weakfish into a bycatch fishery only. The most recent update assessment in 2019 did not show any signs of a meaningful recovery for this stock. To assess the occurrence of loss of larger Weakfish, as well as the timing of any size truncation, three fishery-independent trawl surveys from Delaware Bay and New Jersey with multidecadal length frequencies for Age-1+ Weakfish were analyzed, including the New Jersey Department of Environmental Protection (NJ-DEP) ocean trawl survey (1989-2018), the Delaware Department of Natural Resources and Environmental Control (DE-DNREC) adult trawl survey (1967-2018), and the DE-DNREC juvenile trawl survey (1980-2018). For the size frequency analyses, lengths were grouped into 3-year time periods with each of the earlier time periods compared to the most recent time periods between 2010-2018. Significant differences were found in these length comparisons for all time periods through 2006, with decreases in mean lengths and overall truncations in size ranges extending into the most recent years. Correlations were also explored between annual mean lengths of Weakfish and mean water temperatures and salinities from positive Weakfish tows. Correlation analyses yielded no significant relationships between mean lengths and mean salinities. However, moderate negative correlations were seen with mean water temperatures and mean lengths of Weakfish, but only for the years after 1989 when the Weakfish size ranges had begun significant truncation. Water temperatures had begun to increase several years earlier, however, so these findings suggest that a size-truncated and size-range contracted Weakfish stock may be more sensitive to the effects of water temperatures. With water temperatures continuing to rise globally, this negative correlation may be another factor hampering efforts at stock recovery.

"Slackwater" - Sustain Music and Nature Songscape: Forsythe National Wildlife Refuge

Roland Hagan
Rutgers University
Co-authors: Ben Sollee, Mallory Cunningham, Betsy Mortensen, Harrison Goodale, Ken Able, Virginia Rettig, Vinnie Turner, Keena Graham, Bob Neuweiler

Tying together efforts by many, Sustain Music and Nature set the stage for American Composer and Cellist Ben Sollee to visit the Forsythe National Wildlife Refuge with support from the Rutgers University Marine Field Station and videography by Mallory Cunningham to create a songscape. Ben and his family were able to visit New Jersey coast for the first time and explore the natural beauty of the Forsythe National Wildlife Refuge. After being struck by the dynamics and diversity of the Mullica River - Great Bay Estuary, a moment of Slackwater was found that inspired the writing of a song when the push of the flood tide meets the pull of the ebb and all goes still. Captivated by this time of transition an effort is made to invest in natural spaces and protect Wildlife Refuges to provide increased biodiversity and shelter against increased storm waters ahead.

Trawl and eDNA Assessment of Marine Fish Diversity, Seasonality, and Relative Abundance in Coastal New Jersey

Greg Hinks
New Jersey Department of Environmental Protection
Co-authors: Mark Y. Stoeckle (lead author), Jason Adolf, Zachary Charlop-Powers, Keith J. Dunton, Stacy M. VanMorter

Environmental DNA (eDNA) obtained from seawater may provide an opportunity to supplement fisheries monitoring programs. To better understand the potential benefits of this technology, we sought to understand the relationships between fish presence and abundance through side-by-side comparisons of eDNA and data from a fishery-independent bottom-trawl survey in coastal New Jersey. One-liter water samples were collected prior to conducting a subset of trawls performed throughout 2019. The average diversity of fish species detected by eDNA per water sample was at least that of the recovered per trawl samples. Similarly, most species sampled by the trawl were detected by eDNA and vice versa. Trawl and eDNA peak seasonal abundance and relative monthly abundance were largely concordant for most species. This is the largest known trawl-eDNA comparison to date and results suggest eDNA monitoring may help better census marine fish species and support further investigation to establish the benefits and limits of this technology.

Insuring That Stock Assessment Is a Scientific Enterprise

Desmond Kahn
Delaware Department of Natural Resources and Environmental Control, Retired
Fishery Investigations

Like other mathematical models in biology, a stock assessment should be seen as a hypothesis (Ricklefs 2008). As Karl Popper emphasized, hypotheses can and should be tested against the available data, which are our connection to the real world. Butterworth (2006), following Heisenberg (1925), suggested that fisheries management should be based on the "observables" of catch and indices of abundance. I suggest also combining these two to calculate relative fishing mortality, defined as (catch per year)/(mean index per year). The latter is a relative version of Baranov's catch equation (F = catch/(mean stock size). Like relative abundance, relative fishing mortality indicates the trend in fishing mortality. One great advantage of relative F is that it does not require an estimate of natural mortality. None of these three variables are subject to retrospective bias. I will present two examples, employing these variables to test two assessments: weakfish and George's Bank yellowtail flounder. In these examples, the assessment estimates of fishing mortality, was falsified by the available data. In the latter case, the assessment estimate of trends in abundance was also falsified.

Exploring Trends in Abundance of Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), Spot (*Leiostomus xanthurus*) and Weakfish (*Cynoscion regalis*) in Relation to Large Scale Climatic Signals in a Mid-Atlantic Estuary

Jake Mathews
Delaware Department of Natural Resources and Environmental Control
Co-authors: Edward A. Hale, John H. Clark, Ian A. Park, Michael J. Greco, Christopher J. Petrone, Haley Oleynik

Atlantic Croaker (*Micropogonias undulatus*), Black Drum (*Pogonias cromis*), Spot (*Leiostomus xanthurus*) and Weakfish (*Cynoscion regalis*) have shown species specific varying trends in abundance, despite general declines in commercial landings throughout the Delaware River Estuary. A linear mixed effects model was used to aggregate two state monitoring surveys into a composite index using standardized indices for each of the four species. Species-specific indices were compared with two environmental phenomena, the Atlantic Multidecadal Oscillation (AMO) and the North Atlantic Oscillation (NAO) to explore their potential relationships. We found that the relative abundance of each species varied annually with

significant, detectable trends observed through time. Further, our results demonstrate that the AMO was significantly cross-correlated with abundance measures of three species at varying time lags, while the NAO was significantly cross-correlated with two species suggesting that juvenile production varies concurrently with changes in dominant environmental signals. We found Weakfish abundance was most significantly cross-correlated with the AMO at a lag = -4 years, while Atlantic Croaker abundance was significantly cross-correlated at a lag = 0 years and Spot abundance at a lag = 0 years. We also found significant cross-correlations between bottom temperature and the abundance of Atlantic Croaker at a lag = -2 years and Weakfish at a lag = 0 years. Permutational analyses of variance revealed that AMO is the most important driver of Weakfish and Spot abundance, while NAO is the most important driver of Atlantic Croaker abundance.

Cooperative Shark Tagging Program: Citizen Science Detecting Changes in Fish Populations

Camilla McCandless
NOAA Fisheries
Co-author: Richard McBride

The Cooperative Shark Tagging Program is a collaborative effort between recreational anglers, the commercial fishing industry, and NOAA Fisheries to learn more about the life history of Atlantic sharks. Since launching in 1962, program participants have tagged more than 300,000 sharks of over 50 species and there have been more than 18,000 recaptures of these sharks, providing movement data on over 30 shark species. It is the longest running shark tagging program in the world and one of NOAA's oldest citizen science programs. The original objective of this program was to document the distribution and movements of Atlantic sharks, while promoting conservation through catch and release. However, given the long-term, continuous time series, this mark-recapture program has not only been instrumental in shaping what we know about shark migration and distribution, but has also been used to define stock structure, document longevity, and validate age and growth in several species, information essential for stock assessment and effective management. Additionally, Cooperative Shark Tagging Program data—combined with long-term environmental, fishery-independent survey, and/or satellite telemetry data—are revealing migratory cues, detailed migratory routes, and, in some cases, decadal shifts in seasonal distribution related to changes in population abundance and/or ocean warming.

Can Cutting Bar Modifications Reduce Bycatch and Increase Catch Efficiency in the Atlantic Sea Scallop Dredge Fishery?

Jason Morson
Rutgers University
Co-authors: Eleanor Bochenek, Douglas Zemeckis, Jennifer Gius

The current dredge configurations used to harvest Atlantic sea scallops (*Placopecten magellanicus*) in the northeast United States allow some bycatch to escape, but some non-target animals are still retained. The cutting bar of the current legal dredge is in a fixed position and forms a flat (0 degree) angle with the seafloor. Our industry partner designed a modified dredge with an adjustable cutting bar to alter the hydrodynamics in front of the dredge and reduce bycatch. The objective of this study was to evaluate if adjustments to the angle of the cutting bar would reduce the bycatch of small sea scallops or other species. We conducted paired tows (n=58) with this modified dredge and a standard, legal commercial dredge in the U.S. Mid-Atlantic during the summer of 2019 to evaluate how the bar modification impacts bycatch and catch efficiency. We tested four angles (15, 30, 45, and 60 degrees) on the cutting bar. Preliminary results suggest that the modified cutting bar significantly reduced bycatch of sand dollars, smaller sea scallops, and some finfish. Exploratory testing of angles >60 degrees resulted in larger reductions in unwanted bycatch. Side-by-side video comparison shows higher turbulence behind the cutting bar on the modified dredge relative to the standard dredge at all tested angles. This turbulence appears to be ejecting small sea scallops, sand dollars, and finfish through the roof of the twine top before reaching the chain bag. While the results are preliminary, they suggest this modification to the scallop dredge could significantly reduce bycatch and increase catch efficiency.

Changes in a Mid Atlantic Estuary: Trends and Drivers of the Fish and Macroinvertebrate Community in the Delaware Bay

Haley Oleynik
University of Delaware
Co-author: Aaron Carlisle

The Delaware Bay, the third largest estuary in the United States, is a unique habitat with a diversity of fish and invertebrate species. The University of Delaware and the Delaware Department of Natural Resources Division of Fish and Wildlife have conducted a trawl survey in the Delaware Bay, dating back to 1966, which takes place once a month at nine stations. The survey collects data on environmental conditions, species composition, number, weight, length, and sex of fishes and macroinvertebrates. Using the data from this trawl survey, we

characterized the Delaware Bay marine community, both spatially and temporally, and explored long-term changes and associated environmental drivers of the fish and macroinvertebrate community in the Delaware Bay. We identified three distinct biogeographic regions in the Bay described by environmental conditions and species assemblages. We also found that community composition and abundance is driven by localized temperature and salinity. In addition, we saw a significant increase in temperature, decrease in dissolved oxygen, and increase in species richness over the course of the past three decades in the Delaware Bay. The increase in species richness is largely due to community-wide reorganization likely driven by ocean warming. Understanding how the marine community of Delaware Bay has changed through time, and how environmental conditions drive these changes, provides important insight into how climate change has impacted, and will continue to impact, the Delaware Bay ecosystem and similar estuarine ecosystems around the world. Our findings provide important baseline information necessary for effective implementation of ecosystem-based management.

Spawning Phenology of a Rapidly Shifting Marine Fish Species Throughout its Range

Emily Slesinger
Student
Rutgers University
Co-authors: Olaf Jensen, Grace Saba

Ocean warming is leading to poleward range shifts for many fish species, and while well described, potential life history phenology differences within fish populations along a gradient from their historic to current range have not been studied. We investigated the intraspecific differences in a rapidly shifting species, black sea bass (*Centropristis striata*), spawning phenology and output throughout their spawning season and across the U.S. Northeast Shelf to comprise locations in their historic and more recently occupied range near their northern range boundary. Spawning started earliest in the Northern and Southern extremes of our study but ended earliest in the northern regions leading to decreased spawning duration from South to North. Spawning phenology was mostly driven by Julian day followed by temperature and latitude. Reproductive output was lowest in the northern region, indicating black sea bass did not compensate for the shorter spawning season there. Hepatosomatic index was lowest in the northern regions indicating lower pre-spawning liver energy reserves, potentially leading to lower reproductive output. These results suggest a potential for lower recruitment in the recently occupied range and should be further investigated to predict impacts of ocean warming and for proactive fisheries management as black sea bass range expands poleward.

Optimizing Remote Setting on Different Cultch Types for Small-Scale Oyster Restoration in Barnegat Bay, NJ

Christine Thompson
Stockton University
Co-authors: Dale Parsons, Steve Evert, David Ambrose

Restoration efforts for the eastern oyster, *Crassostrea virginica*, are often limited by sources and availability of cultch for remote setting. In Southern New Jersey, a shell recycling program has been created to provide shell for restoration purposes, but the types and availability of shell can vary. Additionally, the growth of oysters on these shell types once planted can potentially affect restoration success if set ratios are too high or low. This study evaluated the average settlement of eyed oyster larvae in tanks with mixtures of three shell types: eastern oyster (*C. virginica*), surfclam (*Spisula solidissima*) and knobbed whelk shell (*Busycon carica*). Spat settlement was assessed 24 days after settlement and again after being deployed on the restoration site for four months. Initial settlement numbers (# oysters per shell) were highest for surfclam shell and lowest for whelk shell, with all three means being statistically significant ($p<0.001$). Oysters were assessed during reef surveys in October 2019 to determine growth survivorship on all three shell types. This study is important for optimizing aquaculture techniques for small-scale remote setting that can be restricted by both the availability of shell types and permitting requirements for use of certain cultch types in shallow-water bays.

Crabbing Responsibly at Barnegat Bay, NJ: The Need for More Education for a Sustainable Blue Crab (*Callinectes sapidus*) Population

Alessandro Barlotta, Molly Lada, John Philip Ostapovich, Lexi Pereira,
Students
Marine Academy of Technology and Environmental Science
Co-author: John Wnek

We used to be able to catch and keep more (blue) crabs in the past" is a comment that we received when discussing recreational crabbing practices at Barnegat Bay, New Jersey. As a result of comments like this one, a team of 11 students at the Marine Academy of Technology and Environmental Science (MATES), Manahawkin, NJ in 2018 developed and implemented a survey to examine crabbing practices. The initiative Crabbing Responsibly at Barnegat Bay (CRABB) studied the knowledge of local recreational crabbers through a series of questions focusing on crab size regulations, locations, and economic aspects of crabbing. There was also a component of the project that focused on the perception of crabbing currently and future predictions. Of the approximately 1000 respondents, results were analyzed by gender, age, and

municipality. Overall, there were a high percentage of individuals (~700) who did not know recreational crab size regulations and identification of crab sex (~300). In fact, the survey also showed that recreational crabbing is important both economically and culturally at Barnegat Bay, NJ, but we need to conduct more education and outreach to ensure the viability of blue crabs. This study could provide managers with areas to focus on when implementing conservation initiatives.

2020 Larval Presentations

Sex Specific Energetics of Spawning of Black Sea Bass in New Jersey

Kiernan Bates
Student
Rutgers University

The northern stock of black sea bass annually migrate inshore from offshore waters along the Middle Atlantic Bight to spawn from May – November. Energy accumulation is essential for successful migration and subsequent reproduction. The concentration of lipids in specific tissues can be used to approximate energy available between body and reproductive energy stores. In 2018, black sea bass were collected off coastal New Jersey waters throughout their spawning season. The sex and maturity stage were determined for each fish. Muscle, liver, and gonadal tissues were collected for lipid extractions on a subset of fish (N = 81) that represented the entire sample size (N = 319). Fifty-one female (263.49±5.92 mm) and thirty male (287.07±13.68 mm) fish were analyzed. Female fish generally had higher lipid concentrations than male fish. Muscle lipid concentration was not correlated to sex or maturity stage, but liver and gonad lipid concentrations both varied with sex and maturity stage. Gonadosomatic index (GSI) and gonad lipid concentration were positively related up until a GSI of ~6 for female fish, whereas there was no increase in lipid concentration with increasing GSI for male fish. Liver lipid concentration in female fish was positively correlated to hepatosomatic index for pre-spawning and spawning fish. There was no relationship between hepatosomatic index and lipid concentration for male fish. These results indicate energy storage occurs primarily in the liver and that female fish have higher energy usage for spawning. Sex-specific differences in energy usage and relation to spawning can provide useful insight for management.

Using Volunteered Geographic Information to Track Invasive Fish in Delaware

Lori Brown
Delaware Department of Natural Resources and Environmental Control

Invasive species are a daunting issue world-wide and it is challenging to conduct the needed surveys to truly capture their extent and spread, even in a small state like Delaware. To enhance efforts, I have developed a web application using Survey123 Connect to collect volunteered geographic information (VGI) from private citizens. We are currently collecting information for three invasive fish species (Northern Snakehead, Blue Catfish, and Flathead Catfish) and the application is available in English and Spanish. I have also developed web applications to verify submissions and visualize the data. VGI is a simple way to enhance reporting efforts. Prior to development, information has been collected from phone reports, emails, and surveys completed by scientists in Delaware's Division of Fish and Wildlife. We hope that these easy-to-use tools will encourage public reporting and enhance the understanding of the importance of reporting invasive species.

Insights into New Jersey Land Based Recreational Shark Fishery

Danielle Dyson
Student
Stockton University
Co-authors: Michael Nguyen, Charlie Vasas, Jeff Kneebone, Keith J. Dunton

Worldwide, shark species are drastically declining due to negative interactions with recreational and commercial fishing. Along the coast of New Jersey, the recreational land-based shark fishery has been relatively undocumented although it is believed to capture prohibited species. While rapidly growing in popularity, uncertainties within this fishery such as species, capture stress, post-release behavior, and survivorship need to be identified. Working with volunteer anglers, we focused to fill critical data gaps by examining specific aspects of the unknown recreational land-based shark fishery in NJ. From 2017-2020 we observed the landing of 292 Sandbar sharks (*Carcharhinus plumbeus*), 98 Sand tigers (*Carcharias taurus*), 16 Dusky (*Carcharhinus obscurus*), 2 Spinners (*Carcharhinus brevipinna*) and 1 Blacktip (*Carcharhinus limbatus*). In 2020, to observe post-release behavior and survival, a sub-set of sharks were tagged with Wildlife Computers survival pop-off archival satellite tags (13 Sandbars and 2 Sand tigers) or surgically implanted with Vemco V16-6 acoustic transmitters (39 Sandbar, 5 Dusky, 4 Sand tiger) which are still being analyzed. Additionally, fight time, total time out of water, and release practices were recorded to see if these variables correlated to certain post-release

behavioral responses. Fight time showed that most sharks were landed on average within 4 minutes and remained landed for an average of 8 minutes before being released back into the ocean. With additional tagging efforts in 2021, we can evaluate the post-release responses and mortality from these sharks and hopefully link it to certain practices observed and aid in conservation and management of these species involved.

Habitat Selection Has Implications for Post-Settlement Growth of Oysters in Different Salinities

Emily Manuel
Student
Rutgers University
Co-authors: Daphne Munroe, Joseph O'Brien, Teresa Lin

As the interface between the saline ocean and freshwater rivers, estuaries provide valuable habitat for the Eastern oyster (*Crassostrea virginica*). While salinity at a given location fluctuates regularly with the tide, there are stark differences upbay and downbay controlled by the salinity gradient. The downbay region supports higher oyster growth, while upbay is a refuge from predation and disease. The brief larval phase is the only time oysters travel within the bay; habitat selection at the time of larval settlement has long term implications for growth and survival. Oyster spat were collected from 3 different beds in 2 distinct Delaware Bay salinity regions, then each was held in 3 different salinities in the laboratory (19, 13, 7 ppt). Spat growth was monitored weekly for 7 weeks. The lowest salinity treatment showed a marked decrease in percent growth after about 2 weeks in the laboratory; the intermediate and high salinity treatments experienced similar growth throughout the experiment. The spat collected from one of the higher salinity beds exhibited greatest percent growth in all treatments compared to the other two beds. These results suggest environmental conditions at the time of settlement can impact subsequent growth of oysters, despite changes in salinity. As conditions in Delaware Bay are expected to experience increased freshwater events due to climate change, these characteristics of early growth and habitat selection can be important to the resilience of the oyster stock.

Coastal Movements of Sandbar Sharks (*Carcharinus plumbius*) Tagged in New Jersey

Kerry McFeeters
Student
Monmouth University
Co-author: Keith J. Dunton

The sandbar shark (*Carcharinus plumbius*) is a large coastal shark and is widely distributed along the East Coast of the United States. Sandbar sharks are known to undergo large seasonal annual migrations, North during the spring and South during the fall. While previous information on their movements within nursery grounds is well known, fine-scale information on their coastal migratory patterns is lacking. We examined coastal movements of Sandbar sharks in New Jersey using acoustic telemetry. Sandbar sharks were captured and tagged using volunteer anglers in the recreational land-based shark fishery. During 2016-2019, a total of 40 females and 10 male sandbar sharks were surgically implanted with V16 Vemco acoustic transmitters with sharks ranging in size from 114.3-226 cm total length. Overall, post-release movements showed that during the months of June-August, sharks tend to stay local to New Jersey with 96% of the tagged individuals being detected in or around Delaware Bay, which is a major nursing ground and is close proximity to the tagging location. During, November-April, sharks migrated south mainly to North Carolina, but as far as Florida This project gives insight on their coastal movements of Sandbar sharks captured in NJ. With long-term transmitters and continued tagging efforts we hope to gain insight on site fidelity and sex based migratory movements as well as provide information for conservation and management of these populations.

Identification of Potential Drivers in the Decline of Delaware Bay Weakfish

Stephanie Merhoff
Delaware Department of Natural Resources and Environmental Control
Co-author: Jason Boucher

The weakfish (*Cynoscion regalis*) population of Delaware Bay has been in decline since the fishery peaked in the early 1980s with a subsequent population crash beginning in the late 1990s. Overharvesting, largescale environmental cycles (e.g. North Atlantic Multidecadal Oscillation), increased natural mortality due to predation and competition pressure, and a collapse in the age-structure have been implicated as reasons for the decline and ensuing recovery failure of the stock. We investigate factors potentially affecting Delaware's weakfish recovery using Delaware Division of Fish and Wildlife's trawl survey data (1980-2019). Preliminary analyses show limited change in the environmental parameters of Delaware Bay, with a slight increase in

water temperature over the time series. Examining the phenology of weakfish across decades indicates minimal temporal shifts in the YOY, while mature weakfish are entering the bay earlier in spring. Competition may be a driving factor limiting weakfish recovery, with Atlantic croaker exhibiting substantial population increases over the time period. Analysis of predation pressure is complicated due to limited encounters of large predators with the trawl gear. Next steps include investigating a potential shift in peak spawning activity, analyzing size-at-age variation, and assessing trends in predator abundance from external data sources.

Oyster Microbiome Dynamics Driven by Salinity and Seasonality in the Delaware Bay

Heidi Yeh
Student
Rutgers University
Co-author: David Bushek

To examine microbiome changes driven by season, salinity, and disease in wild oysters, the bacterial dynamics of the digestive gland were studied in wild oysters from the Delaware Bay. The digestive gland is the organ with the highest abundance and diversity of both resident and transient microbiota within the oyster. Bacteria hosted in these tissues can be involved in digestion, and also play a role in the nitrogen cycle of water bodies as the carbon-rich and hypoxic conditions can foster denitrification processes. Digestive gland samples were collected from low (~11 ppt) and high (~18 ppt) salinity sites July – October 2019 and were sequenced via Illumina MiSeq using the 16S rRNA V3-V4 hypervariable region. Samples were dominated by groups associated with digestive systems (Mycoplasma, Rickettsiales, Cyanobacteria, Lachnospiraceae, Chlamydialese, Bifidobacteriaceae, Spirochaetes, Campylobacteria), as well as bacteria with narrow chemical niches such as obligate anaerobes from Bacteroides, the nitrite-oxidizing bacteria Nitrospira, and the annamox-performing Planctomycetes. Bacterial abundances were significantly higher at the low-salinity site. Alpha diversity of bacteria composition increased during the study period, and was higher as well as more variable at the higher salinity site. Seasonality, likely driven by temperature, had the greatest influence on changes in bacterial composition. Additional experiments to quantify the presence and activity of denitrifying bacteria in these tissues are currently underway. Continuing to study the oyster microbiome will contribute to our understanding of the oyster's place in nutrient cycles as well as the dynamics underpinning the presence of bacteria that are potentially harmful to human consumers.