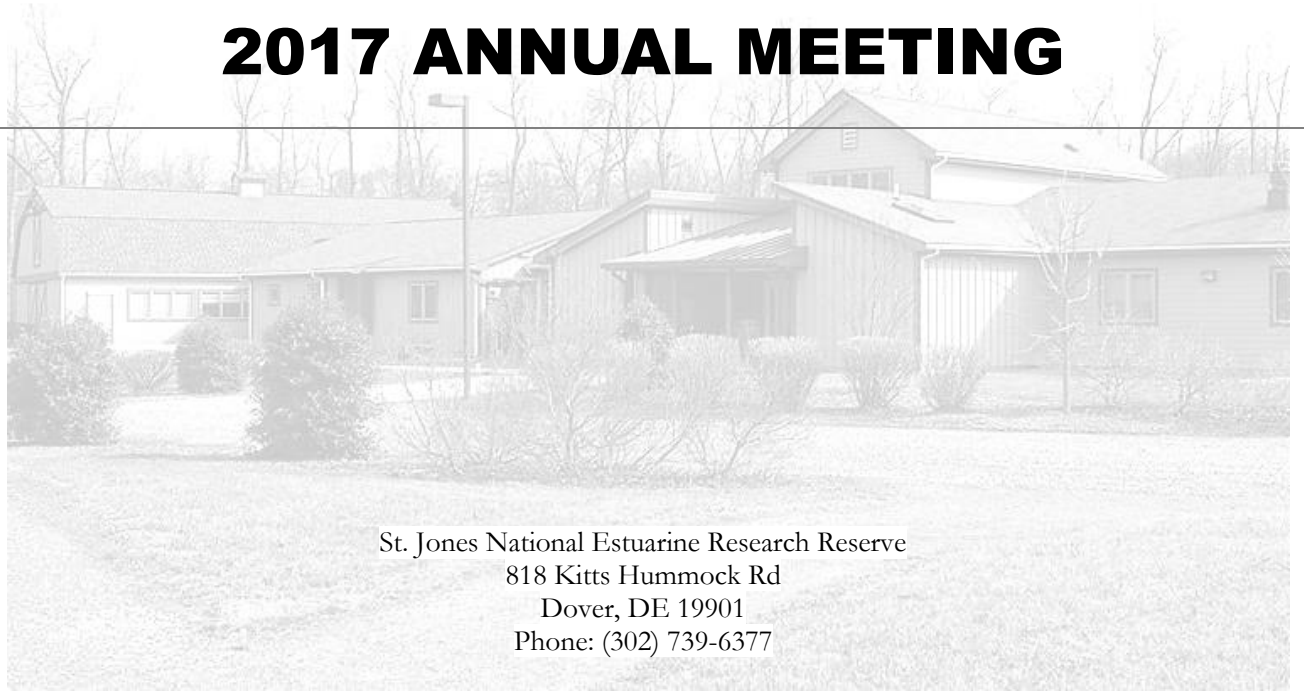
2017 ANNUAL MEETING

MID-ATLANTIC CHAPTER OF THE AMERICAN FISHERIES SOCIETY

2017 ANNUAL MEETING



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Schedule

Thursday, October 26, 2017

8:30	9:00	Breakfast
9:00	9:45	Plenary by Dr. Olaf Jensen – Rutgers University
10:00	12:00	Oral Presentations
12:00	13:20	Lunch
13:20	15:00	Oral Presentations
15:00	15:20	Break
15:20	16:20	Oral Presentations
16:20	18:00	Business Meeting
18:00	21:30	Networking Event/Poster Judging

Friday, October 27, 2017

8:30	9:00	Breakfast
9:00	10:00	Oral Presentations
10:00	10:20	Break
10:20	12:00	Oral Presentations
12:00	13:20	Lunch
13:20	15:00	Oral Presentations
15:00	15:20	Break
15:20	15:40	Oral Presentation
15:40	16:00	Presentation of Student Awards
16:00		Adjourn

Oral Presentations

An asterisk (*) after the author's name denotes a student presenter.

October 26, 2017

10:00-10:20

Is There Evidence of Phenological Shifts in the Recruitment of Fishes from a Long-Term Time Series in the Mullica River-Great Bay Estuary in Southern New Jersey?

Thomas Grothues, Jason Morson, and Kenneth W. Able
Rutgers University

The Mullica River-Great Bay estuary in New Jersey serves as habitat to recruits from resident, oceanic, northern and southern-spawning estuarine/coastal species. The mean bay temperature has increased 3 °C over the last 16 years. We examined trends in phenology and their potential response to warming for the most common species in a 25-year-long weekly ichthyoplankton collection series, as well as in a similarly timed wire mesh trap sampling series for juveniles. Latent trend analysis regressed the date at which 10%, 25% and 50% of the total annual standardized catch of common fish species was reached for each sampling series separately and also examined catch-per-unit-effort (CPUE) trends against time. The landmark dates, as phenological amplitudes, were also regressed against annual mean temperature. There was no evidence of phenological shift for most of the examined species, but a seven species have been arriving/persisting significantly earlier (e.g. *Anchoa hepsetus*, *Menidia menidia*) or later (e.g. *Anguilla rostrata*, *Brevoortia tyrannus*). Landmark amplitude for only three species were significantly related to temperature at alpha = 0.05 and this was sensitive to which landmark was tested. Trends were similar in slope sign and sometimes strength among date landmarks for a given species, but not necessarily relative to CPUE. Differences in the trends may relate to life history traits. The lack of a strong general tendency in phenology may be because the common species utilizing this centrally-located estuary already experiences wide intra-annual temperature gradients over their nursery range, and may differ from that of recently-appearing southern species.

10:20-10:40

Direct Aging of Crustaceans with Application to Red Deep-Sea and Jonah Crabs

Bradley Stevens and Justin Wilson
University of Maryland Eastern Shore

The difficulty of estimating age for crustaceans has long been an impediment to modern scientific management of their populations, due to the perceived lack of hard body structures, such as scales, otoliths, or bones. A recent advancement within the field of crustacean aging is the discovery of growth rings or bands in the eyestalk or gastric mill. This method has been validated for a number of species including snow and Tanner crabs, American and European lobster, crayfish, swimming crabs, and king crabs, among others. We have used this technique to estimate age of the red deep-sea crab *Chaceon quinquedens*, and Jonah crab, *Cancer borealis*, with mixed results. Estimated ages ranged from 3 to 14 for deep-sea crab, and from 2 to 5 for Jonah crab. Agreement between multiple viewers was poor for RDSC at low and high ages but it is unclear whether this is due to inherent variability, or the relatively constant environment in which they live. Other challenges include lack of known-age crabs for validation. Major questions about this technique still remain, however, and recent publications raise some doubts about whether age bands in gastric ossicles are true annuli. Nonetheless, the method shows great promise and may lead to improvements in management of crustacean populations.

10:40-11:00

Influence of SST on the Productivity and Recruitment of Marine Fisheries Globally

Christopher Free*[1], James Thorson[2], Malin Pinsky[1], and Olaf Jensen[1]
[1]Rutgers University and [2] NOAA-NWFSC

Marine fish and invertebrates are experiencing distribution shifts, changing phenology, altered food availability, and increasingly oxygen-depleted and acidic waters as a result of climate change, but the net effect of these changes on fisheries productivity remains unclear. In this study, we estimate the influence of sea surface temperature (SST), an index of environmental change, on the productivity of marine fisheries globally by fitting surplus production and stock-recruit models with dome-shaped temperature dependence to >200 populations from each of two global databases of stock assessment output. We examine the role of taxonomy, life history, position within the thermal niche, and geographical location in structuring the response of populations to changing ocean temperatures. We also forecast the effect of continued ocean warming on net productivity and discuss the implications for both livelihoods and fisheries management. This study offers several advantages over similar global scale studies in that it (1) is the first to use actual stock boundaries, rather than large marine ecoregions, to attribute SST experiences; (2) evaluates the influence of SST on surplus production and recruitment within the same analytic framework allowing for direct comparisons of the influence of SST on both measures of productivity; and (3) focuses on the specific stocks that contribute to the majority of global catch rather than broader species groups.

11:00-11:20

Krill Patches are More Frequent in Convergent Features Defined by Lagrangian Coherent Structures

Cordielyn Goodrich*[1], Josh T Kohut[2], Megan A Cimino[3], Travis N Miles[2], Laura J Nazzaro[2], Peter Winsor[4], Hank Statscewich[5], Erick Fredj[6], Kim Sarah Bernard[7], Donna Patterson-Fraser[8], William Fraser[9], and Matthew J Oliver[1]
[1]University of Delaware, [2]Rutgers University, [3]Scripps Institution of Oceanography, [4]Univ of AK-Fairbanks, [5]University of Alaska Fairbanks, [6]The Jerusalem College of Technology, [7]COAS, [8]Polar Oceans Research Group and [9]Polar Ocean Research Group

Antarctic ecosystems are highly patchy and trophically short, suggesting that physical convergence zones might play an important role in sustaining their top predators, especially in biological hotspots. An acoustic Doppler current profiler (ADCP) mounted on an autonomous underwater vehicle (AUV) was used to sample one of these hotspots along the Western Antarctic Peninsula, Palmer Canyon. Relative acoustic backscatter was used as a proxy to identify presence-absence of krill. Simultaneously, a High Frequency Radar (HFR) field measured sea surface currents in the Canyon. Using a Lagrangian coherent structure analysis, we show that krill are more likely to be found in higher zones of convergence, which are targeted by top predators. In Palmer Canyon, the spatial distribution of these convergent areas vary based on tidal regimes. Integrated krill biomass increases significantly during diurnal tides (Bernard and Steinberg, 2013). This is supported by changes seen in Adélie penguin foraging location also in response to tidal cycle, during semidiurnal tides the penguins travelled further from the colony to forage than during diurnal tides where they remained nearshore (Oliver et al., 2013). We also found strong differences between diurnal and semi-diurnal tidal regimes and krill availability over Palmer Canyon. We suggest that these convergent zones are predictable and ecologically stable, thus help to maintain this biological hotspot.

11:20-11:40

Nitrogen Source Tracking and Measuring Macrobenthos Biodiversity at Oyster Aquaculture Sites in the Delaware Inland Bays

Melanie Fuoco*[1], Deb P. Jaisi[2], and Gulnihal Ozbay[1]
[1]Delaware State University and [2]University of Delaware

The Delaware Inland Bays consist of three shallow coastal bays located in southern Delaware. These bays have low flushing rates and are surrounded by highly developed areas, leading to anthropogenic activities degrading water quality. Consequences include loss of biodiversity and abundance of organisms within the bays. Ongoing degradation of the bays since the late 1800s has resulted in dramatic decline of local *Crassostrea virginica* populations. As keystone species, oysters provide habitats for organisms, help to improve water quality and act as

bioindicators for ecosystem health. The aims of this research are two folds: i) identify if the introduction of oyster aquaculture improves local biodiversity and abundance of macrobenthos and ii) determine the sources of nitrogen pollution in the bays using oysters as a bioindicators. To realize these aims, field study was conducted in the Rehoboth, Indian River, and Little Assawoman Bays. Aquaculture gear was placed at one location in each bay and 24 sediment cores were retrieved once a month. Worms in sediment cores were fixed and stained in a 10% formalin rose Bengal solution and preserved in 70% ethanol for later identification. Preliminary results indicate that Little Assawoman has highest abundance of worms and Rehoboth has the lowest. Stable isotope ratios of carbon and nitrogen of oyster tissues are being analyzed to identify sources of pollution and to assess the health of the bays. This research is expected to help better understand the role of oyster aquaculture in restoring the viability in natural habitats of the Delaware Inland Bays.

11:40-12:00

Diversifying the New Jersey Aquaculture Sector by Developing Culture Techniques for the Atlantic Surfclam (*Spisula solidissima*)

Michael Acquafredda*[1], Daphne Munroe[1], Lisa Calvo[1], and Michael DeLuca[2]
[1]Haskin Shellfish Research Laboratory, Rutgers University and [2]Aquaculture Innovation Center, Rutgers University

Throughout much of the Northeast region, shellfish aquaculture is dominated by only two species: the hard clam (*Mercenaria mercenaria*) and the Eastern oyster (*Crassostrea virginica*). However, local shellfish farmers are eager to diversify and have expressed interest in culturing new species. The Atlantic surfclam (*Spisula solidissima*) represents an ideal target species because it is native, grows rapidly, and fits into the established farming framework. To optimize surfclam culture for the Northeast region, we have conducted a series of experiments related to surfclam husbandry, specifically how various nursery and grow-out phase techniques and local environmental conditions impact surfclam performance (i.e. survival and growth) throughout its developmental stages. We have assessed early juvenile rearing temperature, nursery phase gear types, grow-out phase locations, and other core components of surfclam production. Moreover, we are working closely with shellfish farmers and other stakeholders interested in farm-raised surfclams in order to streamline plans to bring this species to the seafood marketplace within the next few years. Ultimately, we will develop a surfclam culture handbook that will be distributed to interested aquaculturists in New Jersey and other Northeastern states.

12:00-13:20

Lunch

13:20-13:40

Monitoring of Vibrio Species in Oysters *Crassostrea virginica* and Seawater of Delaware Bay and Molecular Characterization of *Vibrio parahaemolyticus*

Esam Almuhaideb*, Lathadevi. K. Chintapenta, Amanda Abbott, and Gulnihal Ozbay
Delaware State University

Vibrios are marine pathogenic bacteria, which have ecosystem-wide impacts on humans and marine species. Vibriosis, caused by the genus *Vibrio*, is a fatal disease that causes mortality of fish and other aquaculture organisms. Among *Vibrio* spp., *Vibrio parahaemolyticus* is the leading cause of gastroenteritis, and accounts for 80% of *Penaeus monodon* (Tiger prawn shrimp) mortality associated with the red disease. This study is aimed to identify and differentiate *Vibrio* spp. in oysters and seawater samples collected from the Delaware Bay using CHROMagar™ differential medium. Total and pathogenic *Vibrio parahaemolyticus* were further characterized by screening the species-specific tlh gene, the toxic tdh/trh genes, and the virulence-related toxR/vpm genes. *V. parahaemolyticus*, *V. vulnificus*/*V. cholerae*, and *V. alginolyticus* colonies were identified based on color development (mauve, green/blue, and colorless, respectively). The increase in water temperature significantly increases total Vibrio spp. and specifically *V. parahaemolyticus* ($p < 0.05$). Only (19%) of *Vibrio parahaemolyticus* isolates were tdh+ and (24%) were trh+ while 83%, 65.5%, and 67% of the isolates were tlh+, toxR+, and vpm+, respectively. Screening for tdh and trh genes is not sufficient for the surveillance of pathogenic or potentially pathogenic *V. parahaemolyticus* as the reliability of toxR and vpm as gene markers is notably higher. This study provided informative data to better understand dynamics of infections associated with consumption of oysters and contaminated waters caused by pathogenic *Vibrio* species. Furthermore, research directed at coastal environmental and public health issues is need for crucial management decisions.

13:40-14:00

Maternal Effects on Blue Crab (*Callinectes sapidus*) Larval Morphology

Joseph Caracappa* and Daphne Munroe
Haskin Shellfish Research Laboratory, Rutgers University

Adult blue crab (*Callinectes sapidus*) population abundance is highly variable, and may be related to variability in larval success and recruitment. Larval success depends in part on morphology, as it affects predation risk, feeding and swimming ability, and ultimately dispersal capability. Despite the importance of larval morphological variability, there is a lack of studies documenting the scale of variation and investigating drivers of that variability. The purpose of this experiment was to (1) evaluate the degree of inter- and intra-brood morphological variability in blue crab larvae, and (2) determine the influence of maternal effects on larval morphology. To test for maternal effects, larvae from 19 gravid adult female crabs from Delaware Bay were reared in laboratory cultures in the summers of 2016 and 2017. Maternal and egg mass

characteristics were measured upon capture including size, weight, brood size, and egg diameter. Additionally, larvae were sampled at hatching, and their morphology was measured microscopically. Larval measurements included size, shape, spine, and swimming appendage dimensions. Larval morphology varied significantly among mothers (broods); therefore, maternal effects should be controlled for in studies addressing blue crab larval morphology. Differences between broods were inconsistent across all metrics, where larval morphology was highly variable both within and between broods. Larger crabs produce larger egg masses, yet few other correlations exist between maternal and larval characteristics. It is possible that a combination of genetics, nutrition, and maternal environment may explain morphological differences between broods. Individual blue crabs produce morphologically different larvae from one another, which may result in differences in overall larval survival and dispersal ability.

14:00-14:20

Insights Into Community Composition and Reef Development from a Pilot Trap Survey of New Jersey Artificial Reefs

Mattea Berglund[1], Douglas Zemeckis[1], Olaf Jensen[1], and Peter Clarke[2]
[1]Rutgers University and [2]New Jersey Department of Environmental Protection, Division of Fish and Wildlife

The New Jersey Department of Environmental Protection has constructed 17 offshore artificial reefs to create habitat and improved fishing and scuba diving opportunities. Commercial fish traps provide a promising method for surveying the structure-associated species that utilize these reefs, which are habitats not typically accessible by mobile bottom trawls. In 2016 and 2017, we conducted a pilot trap survey of three artificial reefs off New Jersey (Sea Girt, Manasquan Inlet, and Little Egg Inlet Reefs) in order to investigate spatial and temporal trends in community composition and relative abundance, and evaluate the efficacy of traps for surveying reef habitats in the Mid-Atlantic. The relative abundance of several species, including black sea bass, tautog, scup, and American lobster, varied between seasons and locations. Variation in the diversity of trap catch on metal, concrete, and sand substrates provided evidence of habitat preferences that can inform future reef design. Field experiments indicated that the presence of certain species in the trap impacts observed catch rates, therefore trap catch may not be linearly related to abundance. Results from our pilot trap survey will continue to be useful for informing artificial reef program activities, survey design for complex habitats, and both stock assessments and fishery management of structure-associated species.

14:20-14:40

Investigating the Utility of Inshore Trawl Surveys for Developing Black Sea Bass Abundance Indices

Jeff Brust[1], Mike Bednarski[2], and Jason McNamee[3]
[1]NJ DFW, [2]MA DMF and [3]RI DEM

Fishery independent trawl survey data are used regularly in stock assessments of U.S. Mid Atlantic species to provide scientifically based estimates of trends in population abundance and size composition. One principal constraint of trawl surveys, however, is their limited ability to sample in areas of structure or high relief. The utility of trawl surveys is therefore greatly diminished when developing abundance indices for structure oriented species. Black sea bass are known to inhabit areas of structure, and the use of trawl survey indices has been raised as a concern during several peer reviews of black sea bass stock assessments. A growing body of evidence, however, suggests that black sea bass are not structure-obligate species, and may in fact be relatively vulnerable to trawl gear. In this study we evaluate black sea bass catch characteristics from different gears and different habitat types to determine whether trawl surveys are a reliable source of black sea bass abundance information.

14:40-15:00

Black Sea Bass Reproduction and First-Year Growth in New England: Northward Expansion of Spawning and Nursery Grounds in a Warming Gulf Of Maine

Richard McBride[1], Matthew K. Tweedie, and Kenneth Oliveira[2]
[1]NOAA Fisheries, Northeast Fisheries Science Center and [2]University of Massachusetts Dartmouth

Little is known about black sea bass spawning and nursery habits and habitats, particularly at their northern distributional limit. To investigate this, age-0 sea bass were collected from coastal waters of southeastern Massachusetts (Buzzards Bay and Nantucket Sound) during 2006 and 2007 and aged using otolith microincrements. This daily age method was validated with captive age-0 fish, and repeated age estimates of wild-caught fish were unbiased and precise. Wild-caught age-0 fish ranged in size from 32 to 88 mm total length (53 [mean] + 11 [SD] mm), and in age from 50 to 129 days (d) old (84 + 16 d). They grew at linear rates from 0.32 to 1.22 mm/d (0.65 + 0.15 mm/d), and they had hatched from May 2 to July 21 (June 6 + 14 d) (n = 381). Supplemental collections from trawl surveys, since the 1980s, demonstrated that adults have consistently spawned in Buzzards Bay and Nantucket Sound – and in the last 15 years – increasingly in the southern Gulf of Maine. Age-0 sea bass have been evident during fall of some years in the southern Gulf of Maine since the 1980s, but over the last 30 years, the occupancy of age-0 fish has increased about 1°N latitude in association with warming sea temperatures in this region. This new information should help predict this population's success in relation to this extension northward in the Gulf of Maine.

15:00-15:20

Break

15:20-15:40

Factors Affecting Detection Efficiency of Mobile Telemetry Slocum Gliders

Matthew Oliver[1], Matthew Breece[1], Danielle Haulsee[1], Megan Cimino[2], Josh Kohut[3], Dave Aragorn[3], and Dewayne Fox[4]
[1]University of Delaware, [2]Scripps Institution of Oceanography, [3]Rutgers University and [4]Delaware State University

Acoustic biotelemetry sensors have been fully integrated into a broad range of mobile autonomous platforms; however, estimates of detection efficiency in different environmental conditions are rare. Here, we examined the role of environmental and vehicle factors influencing detection range for two common acoustic receivers, the VEMCO mobile transceiver (VMT) and a VEMCO cabled receiver (VR2c) aboard a Teledyne Slocum glider. We used two gliders, one as a mobile transmitting glider and one as a mobile receiving glider during the fall in the mid-Atlantic coastal region. We found distance between gliders, water depth, and wind speed were the most important factors influencing the detection efficiency of the VMT and the VR2c receivers. Vehicle attitude and orientation had minimal impacts on detection efficiency for both the VMT and VR2c receivers, suggesting that the flight characteristics of the Slocum glider do not inhibit the detection efficiency of these systems. The distance for 20% detection efficiency was approximately 0.4 and 0.6 km for the VMT and VR2c, respectively. The VR2c receivers had significantly lower detection efficiencies than the VMT receiver at distances <0.1 km, but higher detection efficiencies than the VMT at distances >0.1 km. Slocum gliders are effective biotelemetry assets that serve as sentinels along important animal migration corridors. These gliders can help elucidate the relationships between telemetered organisms and in situ habitat. Therefore, estimating the detection ranges of these common telemetry instruments provides an important metric for understanding the spatial scales appropriate for habitat selection inferences.

15:40-16:00

Plasticity of Responses of an Estuarine Forage Fish, Atlantic Silverside (*Menidia menidia*), to Elevated CO_2 Regimes

Christopher Chambers[1], Delan Boyce[1], Ehren Habeck[1], Kristin Habeck[1], Matthew Poach[1], and Melissa Drown[2]
[1]Howard Marine Sciences Laboratory, Northeast Fisheries Science Center, National Marine Fisheries Service, NOAA and [2]University of Minnesota-Twin Cities

Elevated levels of atmospheric CO_2, due largely to hydrocarbon combustion, acidify coastal and ocean waters. Effects of CO_2 on the ocean's biota may range from minimal and subtle to strong and pervasive with outcomes either net negative or positive. Marine scientists largely lack a predictive understanding of the patterns of responses and the consequences of these effects. Poor predictive capability may be due to prior experimental assessments of CO_2 effects

on marine fauna use a small number of different CO_2 environments to test experimental subjects. While this design may be appropriate for determining whether CO_2 has effects in the responses measured, it often reveals little about the scope and shape of the biological responses, the resilience of the organism, and its adaptive potential. We describe experimental studies that achieved large numbers of different CO_2 environments among experimental tanks at one time, and report effects of these multiple environments on early life-stages of Atlantic silverside (Menidia menidia), a common forage fish of coastal habitats throughout the Atlantic Coast of North America. We have also compared outcomes between constant and highly variable CO_2 regimes, estimated the interactions between CO_2 and dissolved oxygen, and assessed the potential for adaptive responses of this species to future CO_2 conditions. Overall, these high-frequency treatment systems reveal the organismal responses to CO_2 variations in a uniquely useful way. Such data are needed for establishing a quantitative understanding of CO_2 effects on our living marine resources in future CO_2-impacted environments.

16:00-16:20

Using Controlled Laboratory Experiments to Improve Fisheries Management in Response to Climate Change

Beth Phelan[1], Vince Saba[1], Dan Wieczorek[1], John Rosendale[1], Emily Slesinger[2], Grace Saba[2], Rachel Young[2], Alyssa Andres[3], and Brad Siebel[3]
[1]Howard Marine Sciences Laboratory, Northeast Fisheries Science Center, National Marine Fisheries Service, NOAA, [2]Rutgers University and [3]University of South Florida

Over the past 20 years, ocean surface temperature in the United States northeast Shelf (U.S. NES) has warmed at a substantially higher rate than the global average. The productivity and/or distributions of many living marine resources (LMRs) within the U.S. Northeast Shelf have been changing in concert with warming ocean temperatures. Examples of ongoing experimental studies at the NOAA James J. Howard Lab will be presented that investigate the impacts of increasing temperatures on the physiology and ecology of different fish species. Understanding these impacts helps improve fisheries management by contributing to modelling efforts utilized to predict future habitat conditions.

16:20-18:00

Business Meeting

18:00-21:30

Networking Event-Poster Viewing

October 27, 2017

9:00-9:20

Survival and Development of Overwintering Horseshoe Crab Eggs

Molly Ashur* and Danielle Dixson
University of Delaware

Horseshoe crabs are vital contributors to coastal ecosystems at all life stages. Spawning in the early summer, adult horseshoe crabs deposit eggs, which develop into the first larval stage within the sand. Most of these "trilobites" vacate the sand after several weeks to continue development in shallow waters. A smaller portion of the eggs and trilobites remain buried in the sand through the winter and emerge the following spring. It has been hypothesized that this division of emergence times between the summer and the subsequent spring acts as mortality insurance and contributes to the persistence of horseshoe crabs throughout geological time. However, little is known about this overwintering phenomenon. We sought to understand the impact colder temperatures have on the survival and development of horseshoe crab eggs. Eggs collected in the summer were housed in a refrigerator, and a subset was moved into a flow-through seawater system biweekly to assess viability. Egg hatch rate decreased the longer the eggs were kept in cold temperatures, but all larvae that hatched reached the juvenile stage with no size discrepancies. We conclude that while overwintering is within the physiological capabilities of trilobites, this process is damaging to the egg stage. Further research into the physiological constraints and impetus for overwintering would lead to a better understanding of the ecological importance of this process.

9:20-9:40

Effects of Ocean Acidification on Tropical Elasmobranch Behavioral Responses to Sensory Stimuli

Lane N. Johnston* and Danielle Dixson
University of Delaware

Rapidly increasing atmospheric carbon dioxide (CO_2) emissions have resulted in the acidification of shallow oceans globally, which act as a sink for excess CO_2. Recent studies in teleost fishes have demonstrated impairment to sensory function and behavioral abnormalities when treated with future predicted elevated levels of ocean acidification. An explanation for behavioral changes may result from regulation of ion concentrations within the animal. Elasmobranchs rely heavily on chemoreception to locate prey, find mates, avoid predators, and navigate through their environment. Their electrosensory system, made of electroreceptor organs called ampullae of Lorenzini, is also important for prey tracking as it allows individuals to detect weak electrical stimuli in the environment. This on-going project investigates the impact

that projected future CO_2 levels have on two tropical elasmobranch species: the epaulette shark (Hemiscyllium ocellatum) and the black-banded bamboo cat shark (Chiloscyllium punctatum). Here we identify the impact of lower pH conditions on the chemical and electrical tracking behavior of juveniles held in different diel fluctuating pCO_2 conditions. Juvenile sharks were exposed to two different pCO_2 treatments consisting of 1) end of century "business as usual" CO_2 (mean 7.74 pH), and 2) present day CO_2 (mean 8.15 pH). Following treatment exposure, both shark chemosensory and electrosensory systems were tested using behavioral trials, as well as their blood sampled for osmolality and chloride ion concentration. Understanding the effects of ocean acidification on critical behaviors, such as prey tracking in large predators, can help determine the potential impacts of future ocean acidification on ecosystem function.

9:40-10:00

The Role of Larval Sources and Population Connectivity in Rotating Closures in the Atlantic Sea Scallop (*Placopecten magellanicus*) Fishery

Daphne Munroe[1], Dvora Hart[2], Burton Shank[2], Dale Haidvogel[3], Joseph Caracappa[1], Eric N. Powell[4]
[1]Haskin Shellfish Research Laboratory, Rutgers University, [2]NMFS Northeast Fisheries Science Center, [3]Rutgers University and [4]University of Southern Mississippi

The Atlantic sea scallop (*Placopecten magellanicus*) fishery is among the most valuable fisheries in the U.S., and has shown remarkable recovery from a severely overfished state in the early 1990s. One probable contributor to the recovery is the system of rotational fishery closures that have enhanced broodstock biomass and may have led to elevated downstream recruitment. Additionally, enhanced fertilization success due to high density of broodstock in closed areas may be contributing even more to larval production than would be inferred by simply increases in biomass. We examined the linkage between increased broodstock abundance and potential for amplified recruitment downstream using a circulation model (ROMS) along with to an individual-based scallop larval tracking model to simulate larval dispersal dynamics and connectivity among the stock. Simulations focus on the trajectories of larval dispersal within the overall stock, and from areas of increased scallop biomass, allowing examination of whether broodstock in closed areas are likely to supply high recruitment events elsewhere in the stock following closures. Estimates of dispersal encompass years 2006 through 2012 inclusive, and cover multiple spawn timing scenarios. In general, patterns of larval connectivity are 'downcoast', with interannual and seasonal variation in these general patterns. The understanding of sea scallop connectivity in the Mid-Atlantic will greatly assist developing metapopulation stock-recruit models, rather than a simple whole stock dynamic pool relationship.

10:00-10:20

Break

10:20-10:40

Age and Growth of Sheepshead in South Texas

Samantha Vanderhoof*[1], Brad Erisman[2], and Derek Bolser[2]
[1]Stockton University and [2]University of Texas Marine Science Institute

Sheepshead (*Archosargus probatocephalus*) are a popular recreationally fished species in many regions, especially in Texas. Despite them being very popular in South Texas little is known about their growth patterns in this region. The objectives of this study were to fit the von Bertalanffy growth model to length at age data, and compare South Texas Sheepshead growth with Sheepshead growth in different states. We hypothesize that the t0 and L∞ parameters would be different, while k value will be like that of other Sheepshead studies. Differences in growth parameters can be explained by regional differences in nutrient availability, exploitation status, and temperature. To determine the age of each fish otoliths were extracted, sectioned, and then aged by counting annuli under a camera equipped microscope. Von Bertalanffy growth parameters were estimated by nonlinear squares regression in R Studio. Our growth parameters came to $L\infty=400.11$, $k=0.38$, and $t_0= -2.54$. Our estimates of t_0 and L∞ are substantially lower than values reported in previous Sheepshead age and growth studies. Specifically, t_0 was biologically implausible, suggesting a sampling deficiency. Data was simulated using mean length at age calculated using growth parameters from Dutka-Gianelli and Murie (2001), and standard deviation for ages one to three. Combining our data with our simulated data showed that our parameter estimation for t0 and L∞ will improve when more samples are collected. Therefore, this work is an important foundation for describing Sheepshead age and growth in South Texas, but more sampling must be done to accurately characterize this relationship.

10:40-11:00

Tidal Largemouth Bass Program-Managing Delaware's Most Sought-After Freshwater Gamefish in the Nanticoke River System

Edna Stetzar
DNREC-Division of Fish and Wildlife

Many of Delaware's tidal rivers include freshwater habitat that supports fishable populations of Largemouth Bass *Micropterus salmoides*, a popular freshwater gamefish. The Nanticoke River bass population is the most heavily fished in the state and active management is necessary for maintaining a viable recreational fishery. A monitoring program, initiated in the early 1990s, provides a long term data set that is used to determine if management actions are necessary. The program includes a mark-recapture survey to estimate population abundance and to evaluate condition and size structure. Compared to historical catch data, abundance has been declining while the size structure is trending towards a greater proportion of legal size fish (≥ 305 mm). This trend may influence angler satisfaction. Evaluation of tournament

catch data and of angler behavior through periodic tagging studies has been an important component of the program. In addition to fishing related pressure, the bass population is also subject to high turbidity levels, tidal fluctuation, heavy nutrient loads, shoreline development and invasive species. The limited availability of suitable spawning habitat, coupled with these factors, contributes to variable recruitment. To supplement poor reproduction, up to 8,000 advanced fingerlings are stocked each year. The fingerlings are the progeny of brood stock collected from the river system in the spring. Research has shown that stocked fingerlings constitute up to 20% of the Nanticoke River bass population.

11:00-11:20

Seasonal Occurrence of Atlantic Sturgeon and Winter Skate in the Delaware Wind Energy Area

Danielle Haulsee[1], Matthew Breece[1], Dewayne Fox[2], and Matthew Oliver[1]
1University of Delaware, 2Delawere State University

The mid-Atlantic continental shelf has been identified by the National Renewable Energy Laboratory as the coastal region with the greatest offshore wind resource potential in waters less than 60m deep and therefore is very well suited for near-term offshore wind energy technology. Federally endangered Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) and the commercially important Winter Skate (*Leucoraja ocellata*), are two species that occur in the Delaware Wind Energy Area (WEA), although there is little information on their patterns of residency and habitat. . Acoustic receivers were deployed around the perimeter of the DE WEA in February 2017 to monitor the seasonal occupancy and movement of telemetered individuals. In April 2017, VEMCO acoustic transmitters were implanted in 50 Atlantic Sturgeon, and 50 Winter Skate in the Delaware coastal ocean. In addition to Atlantic Sturgeon and Winter Skate, the acoustic receivers record the presence of species tagged with compatible transmitters, which are identified through the collaboration with the Atlantic Cooperative Tagging Network. To date, 13 species have transited through the array, showing slight preference for the receivers further offshore, in deeper water (~25-30m). As anticipated, our initial results suggest a strong seasonality in species occurrence. This acoustic array extends further offshore than previously deployed receivers in the Delaware coastal ocean, and will expand our understanding of telemetered species use of these coastal waters further offshore in addition to informing the feasibility of potential offshore wind development in this region.

11:20-11:40

Assessing an Endangered Species in a Fisheries Framework

Katie Drew[1], Laura Lee[2], Kristen Anstead[1], Max Appelman[1], Michael Celestino[3], Kiersten Curti[4], Jared Flowers[2], Dewayne Fox[5], Edward Hale[6], Amanda Higgs[7], David Kazyak[8], Michael Loeffler[2], Bill Post[9], Eric Schneider[10], David Secor[11]
[1]ASMFC, [2]NC DMF, [3]NJ DFW, [4]NEFSC, [5]Delawere State University, [6]DE DFW, [7]NY DEC, [8]USGS, [9]SC DNR, [10]RI DEM and [11]UM CES

Atlantic sturgeon once supported one of the largest fisheries by weight on the east coast of the US. Nearly two centuries later, the stock was placed under a complete moratorium, and fourteen years after that, NOAA Fisheries had listed Atlantic sturgeon as endangered or threatened throughout its US range. In 2017, ASMFC completed the first stock assessment of the species since the moratorium was implemented. As a long-lived, rare-event species rarely encountered by surveys and no longer subject to commercial monitoring, Atlantic sturgeon present unique challenges to the traditional assessment framework. ASMFC applied a suite of approaches, including trend analysis, data limited methods, a Bayesian tagging model, and a stochastic EPR model to assess the status of the stock. The assessment found that Atlantic sturgeon are showing signs of slow recovery from a depleted state, with total mortality at the coastwide level likely below the mortality threshold.

11:40-12:00

Perceptions of EBFM Among State Natural Resource Agency Personnel in the Northeast

Alexandrea Safiq*[1], Olaf P. Jensen[1], Joesph Caracappa[1], Chris Free[1], Jessica Valenti[1] and Alexis Kleinbeck[2]
[1]Rutgers University and [2]King County Watershed and Ecological Assessment Team

Ecosystem based fisheries management (EBFM) is a specific application of ecosystem-based management (EBM) whereby, abiotic, biotic, and socio-economic interactions among components of the ecosystem are taken into account when developing a management plan for fisheries. While there exists a federal demand for the implementation of EBFM, few studies have attempted to examine the working definition of EBFM and its implementation at the state level. Eight key components of EBFM were defined in this study: (i) protecting/enhancing habitat, (ii) incorporating geographically specific management needs, (iii) adapting to changing biological and social conditions, (iv) engaging stakeholders, (v) considering the interactions between the physical, biological, and human factors that affect the health of fisheries, (vi) considering the social, economic, and cultural impacts on industries and communities that depend on fisheries, (vii) accounting for uncertainty in ecosystems, (viii) including flexibility in management strategies. The primary objectives of this study are: (1) to understand the definition of EBFM by state

managers; (2) to identify potential barriers in implementing EBFM; (3) to rank the importance of inclusion and implementation of our eight-part component definition of EBFM. Interviews were conducted via phone surveys. The survey was composed of Likert scale questions and open-ended questions. Both the Likert scale questions and open-ended questions focused on identifying a common core definition of EBFM, if one existed, and ranking the importance and implementation of EBFM.

12:00-13:20

Lunch

13:20-13:40

Characterization of Microplastics by Using a Novel Method of Pyrolysis GC-MS

Ashok Deshpande
NOAA-NMFS-NEFSC Sandy Hook Laboratory

Plastics are contaminants of emerging concern that are accumulating at increasing rates in the marine and freshwater ecosystems. Some scientists refer to plastics as the next predator of wildlife. Because of sun and wave energy, the plastics tend to break down into smaller particles, called the microplastics of grain size lower than 5 mm. Microplastics also enter the aquatic environments directly from a variety of sources, including cosmetics, clothing, and industrial processes. Microplastics are a cause for concern because their size range overlaps with the preferred particle size ingested by the animals at the base of the aquatic food webs. We seek to characterize microplastics polymer types by using a novel method of pyrolysis gas chromatography-mass spectrometry (GC-MS). In this method, a small piece of microplastic sample, less than 1 milligram in weight, is placed in a narrow quartz tube which is then placed in a platinum coil and heated to 750 degrees C. The intense heat breaks down the large plastic polymer chain into smaller fragments. The pyrolytic fragmentation patterns are reproducible and unique to a given polymer type. These fragments are then transferred to and separated on a gas chromatographic column and identified using a mass spectrometer. We have created a pyrolysis GC-MS library of some of the most commonly used plastics polymers. The next step in this effort is the characterization of the weathered field samples. Understanding the nature of microplastics is critical to the identification and possibly regulation and mitigation of sources of plastics that can impact the quality of bivalve and fish habitats as well as that of the aquaculture facilities. As different types of plastics exert different toxicities by themselves, and as in addition they adsorb different levels of chemical contaminants, the knowledge of polymer composition is important in the understanding of fisheries risk assessment.

13:40-14:00

Perceptions of Recreational Fisheries Conservation Among New Jersey Striped Bass Anglers

John Tiedemann
Monmouth University

Striped bass (*Morone saxatilis*) are among the most important marine recreational fisheries along the east coast of the United States with an estimated annual economic value in excess of $300 million. However, while the current status of striped bass stocks generally represents a positive trend thanks to the conservation efforts of government agencies and dedicated fishermen, as more anglers target stripers, added pressure is being placed on the fishery and there is a distinct possibility that this could have a negative impact on the population. Using a survey instrument consisting of 10 questions, striped bass surf fishermen were surveyed at two major annual surf fishing in New Jersey - Surf Day, sponsored by the Jersey Shore Surfcasters and the Berkeley Striper Club Fisherman's Flea Market, sponsored by the Berkeley Striper Club – and at meetings of these two clubs. The survey was implemented by convenience with willing participants as we circulated through exhibits at the shows or by request at the club meetings. In total, 99 completed surveys were collected. The purpose of this project was to collect information on their opinions of avid striped bass anglers regarding catch-and-release practices, current striped bass regulations in New Jersey, and solicit their views on the state of marine recreational fisheries conservation and management. The results of this survey will help guide our future education and outreach efforts in promoting conservation and management of this important recreational fishery.

14:00-14:20

Utilizing Collaborative Scientist-Industry Partnerships to Estimate and Reduce Discard Mortality in Recreational Fisheries

Douglas Zemeckis[1], Connor Capizzano[2], John Mandelman[2], Emily Jones[2], Hugues Benoît[3], Micah Dean[4], William Hoffman[4], Jeffrey Kneebone[2], Eleanor Bochenek[1], and Olaf P. Jensen[1]
[1]Rutgers University, [2]New England Aquarium, UMass Boston, [3]Canada Department of Fisheries and Oceans and [4]MA Division of Marine Fisheries

Recreational fishery removals can represent a significant proportion of total fishing mortality for some stocks. Discard rates are often high in recreational fisheries due to management measures or catch-and-release conservation ethics. However, reliable discard mortality rate estimates and best practice capture and handling guidelines for reducing discard mortality are not typically available for recreational fisheries. Our team has collaborated with recreational fishing

industry stakeholders and volunteer anglers to address discard mortality data gaps for informing stock assessments, fishery management, and best practice capture and handling guidelines for Atlantic cod, haddock, cusk, and black sea bass. Results for Atlantic cod and haddock have provided fishery-scale discard mortality rate estimates that have been included in stock assessments and fishery management. Best practices have been identified for reducing the discard mortality of both species, including tackle and handling recommendations. Barotrauma can significantly influence the discard mortality of some species, including cusk and black sea bass. Therefore, the efficacy of weighted release devices and swim bladder venting for mitigating the effects of barotrauma and reducing discard mortality are being examined for these species. These case studies have inspired the development of specifically-adapted parametric survival analysis methods, which provide a robust analytical approach for analyzing discard mortality data in recreational and commercial fisheries. The successful science-industry partnerships that were executed serve as valuable models for conducting studies which are representative of typical fishing conditions and provide results that can be used to educate anglers on best practices and incorporated into stock assessments and fishery management.

14:20-14:40

The Taming of the Data-Shrew: the Importance of Data Management

Sarah Rains and Joseph Myers
Atlantic Coastal Cooperative Statistics Program

The Atlantic Coastal Cooperative Statistics Program (ACCSP) is a cooperative state-federal program including 23 agency partners that designs, implements, and conducts marine fisheries statistics data collection programs and integrates those data into a single data management system to meet the needs of fishery managers, scientists, and fishermen. The ACCSP creates data collection standards and maintains an online data warehouse for commercial and recreational data from 1950 to the present. Data management, the process of managing data as a useful resource, is used in various parts of fisheries science and management. As there are more and more data available for fisheries, understanding and properly implementing data management techniques is very important. This presentation will give a general overview of what data management is, how it is used in fisheries, what kinds of organizations deal with fisheries data, and the various ways fisheries professionals look at data.

14:40-15:00

Taming of the Data-Shrew: The Data Life Cycle

Joe Myers and Sarah Rains
Atlantic Coastal Cooperative Statistics Program

"I now have a mountain of data… but what do I do with it all!!?!" A general understanding of the data life cycle model can help to provide a best practices approach towards the successful management and long-term preservation of fisheries data beyond the lifespan of the project under which it was collected. In the same way that the scientific method can provide a roadmap for proper project design, the data life cycle should play an essential role throughout the development and implementation of any new project. The data life cycle teaches us that a 'Plan' must first be formulated to define how data are to be 'Collected' and managed. Next, steps must be taken to 'Assure' the quality of your data. By clearly 'Describing' your data and methodology, you can help to avoid the headaches from colleagues/advisors who misinterpret how your data should be used. Proper 'Storage' will ensure that your data are protected against dropped laptops or faulty hard drives, and that the data will be accessible to 'Share' for many years after the project ends. Finally, by fully embracing the data life cycle model, your data will be in the best possible condition when the time comes to 'Analyze' and publish your data.

15:00-15:20

Break

15:20-15:40

Evaluating Trophic Relationships in a Saltmarsh Food Web using Stable Isotopes and Fatty Acids

Paola C. Lopez-Duarte[1], Kenneth W. Able[1], F. Joel Fodrie[2], Linda M. Hooper-Bui[3], Olaf P. Jensen[1], Jill A. Olin[4], Charles M. Martin[5], Jennifer Pincin[1], Michael J. Polito[3], Brian J. Roberts[6], Philip C. Stouffer[3], Sabrina S. Taylor[3], and Stefan Woltmann[7]
[1]Rutgers University, [2]University of North Carolina at Chapel Hill, [3]Louisiana State University, [4]Stony Brook University, [5]University of Florida, [6]Louisiana Universities Marine Consortium and [7]Austin Peay State University

Saltmarsh ecosystems will undoubtedly continue to face unprecedented change in the coming decades. The identification of food web structures that confer stability to these systems is, therefore, a priority. Here, we use bulk stable isotopes ($\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$) and fatty acid profiles to resolve the food web structure and the terrestrial vs. aquatic energetic contribution to consumers from two different saltmarshes located in Barataria Bay, Louisiana. One saltmarsh was directly impacted by the 2010 Macondo Oil Spill and the other was not. Because oil pollution has the potential to significantly alter food webs and energy flow pathways and reduce food web resilience, our hypothesis was that oiling has resulted in simpler and less resilient food webs. Tissue samples from terrestrial and aquatic primary producers and higher-level consumers (e.g., insects, mollusks, crustaceans, fishes and birds) were collected during the spring and fall of 2015. We show that the food webs are structured such that upper trophic levels couple separate energy channels (based on detrital, phytoplankton or marsh grasses), regardless of season or saltmarsh. For example, predatory fishes appear to derive their energy from phytoplankton and detrital

sources. Although many consumers have a high degree of feeding plasticity, as the nature and availability of food can vary considerably both spatially and temporally, few species exhibited significant shifts in resource use.

15:40-16:00

Presentation of Student Awards

16:00

Adjourn

Poster Presentations

An asterisk (*) after the author's name denotes a student presenter.

A 25-Year Time Series Analysis of Juvenile Blue Crabs in Southern New Jersey

Alexandra Schneider*[1], Paola C. Lopez-Duarte[2], and Kenneth W. Able[2]
[1]Villanova University and [2]Rutgers University

Blue crabs (*Callinectes sapidus*) utilize multiple habitats throughout their life cycle. Females carry developing embryos to high salinity areas near the mouths of estuaries to spawn. Larvae undergo a series of molts in coastal waters, molt into megalopae, and migrating back to estuaries where they molt into juveniles. To better understand the factors that may influence the recruitment of blue crab juveniles, we evaluated two long-term data sets collected from 1991 to 2015 in the Mullica River-Great Bay (MRGB) estuary, NJ. Data from wire mesh traps and plankton nets were analyzed to (1) describe the seasonality and abundance of juvenile blue crabs in the system, (2) determine any temporal shifts in seasonality and size classes over time, and (3) assess the relationship between environmental factors and juvenile abundance. Most (97%) blue crab juveniles collected with plankton net were small (<30mm CW) and most (78%) juveniles in the wire mesh traps were medium-sized (20-60mm CW). Most juveniles were collected in the fall, with peaks in October and November. Medium juveniles were prevalent throughout the year, but peaked in June and July. The number of small juveniles in the fall was positively associated with the number of storm days with northeastern winds in the New Jersey coast. The number of medium-size juveniles in the summer was positively associated with warmer than average winters. These results have important implications in regards to climate change because the frequency and strength of storms, as well as the incidence of warmer winters, are expected to increase.

Reestablishing a Seafood Favorite: How do Water Currents Affect the Spat of the Eastern Oyster (*Crassostrea virginica*)?

Angelica Anglero*, Anna Pfeiffer-Herbert, and Christine Thompson
Stockton University

Historically, New Jersey had a thriving Eastern Oyster (*Crassostrea virginica*) population across the state, but human settlement and harvest had greatly reduced their numbers. Restoring the wild Eastern Oyster population would help to improve local water quality, while also providing other organisms with oyster reef habitat. In this study, tilt current meters (TCM) and HOBOs were placed at 2 separate locations in the Mullica River Great Bay Estuary, known as Fitney Bit and Swan Point. Bags of clean shell were placed at 4 different sites (see figure 1), then retrieved 2-4 weeks later with 20 shells (per site) brought back to the lab for spat counts (process repeated 4 more times). The average amount of spat per shell was calculated for each site per time period, then compared against the TCM and HOBO datasets. The Mullica Lump and Collin's Point locations both showed a higher average of spat per shell than Fitney Bit or Swan

Point. Swan point had very strong flood tides with a possible eddy circulating over the area; this site also had the lowest average spat per shell out of all the test sites. While some of these sites are often close in terms of geography and water quality, subtle changes in current velocity may be a factor in the survival of oyster spat. Conducting this project on a larger scale in the future could help identify how currents affect mortality, recruitment, and growth of Eastern Oyster spat.

Effect of Salinity on Eastern Oyster (*Crassostrea virginica)* Reproduction

Angelina Watts*[1], Dewayne Fox[1], and Bob Carey[2]
[1]Delaware State University and [2]University of Maryland Center for Environmental Science

At present, large scale restoration and enhancement programs for the Chesapeake Bay's Eastern Oyster (*Crassostrea virginica*) population are underway, however several impediments are slowing recovery. Potential changes in salinity regimes due to climate change underscore the need to study salinity effects on female fecundity. To better understand the role of salinity in mediating Eastern Oyster reproduction, we conducted experimental trials at the Sandy Hill Oyster Sanctuary which is located near the mouth of the Choptank River, MD. Our objective was to determine salinity's influence on female fecundity and initiation of spawning. Five trials were conducted between July 18 and August 19, 2017 and consisted of two standard spawning trays (112x 15x 106 cm) containing 70 randomly selected Eastern Oysters. During each trial we randomly assigned a salinity regime (low 11.0-11.5 ppt; high 15.0-15.5 ppt) and we monitored for the onset of spawning and total spawning success (female fecundity). A water sample was collected from each tray to determine female fecundity. Our preliminary findings suggest that the salinity regimes we examined did not substantially influence the initiation of spawning. Although, salinity had a positive impact on spawning with increased female fecundity in the high salinity treatment (mean 14.5 million eggs/female; range 3.9-38.3) vs. the low salinity treatment (mean 12.4 million eggs/female; range 16.6) our results were inconclusive. Our findings suggest that understanding the role of salinity on Eastern Oyster reproduction is important to optimize yearly spat output and recovery in the Chesapeake Bay.

Evaluating Passage Performance of Spawning American Shad and River Herring at the Island Farm Weir on the Raritan River

Anthony Vastano, Orion Weldon, Mario Hernandez, Stephanie Melara,
Andrew Lahr, Shawn Hazlett, and Olaf P. Jensen
RutgersUniversity

Populations of American shad (*Alosa sapidissima*) and river herring (*A. pseudoharengus* and *A. aestivalis*) in the Mid-Atlantic have undergone striking declines in recent decades. The recovery of these anadromous species is hindered by dams along spawning routes. With the recent removal of dams along the Raritan River, the Island Farm Weir (IFW) in Bound Brook, NJ is the first obstacle shad and river herring face in their spawning migration. The IFW is equipped with a fish ladder, but its efficiency was not previously evaluated. Each spring from 2012-2017, we

conducted weekly sampling for American shad and river herring by angling and seining. All captured American shad and river herring were tagged with Passive Integrated Transponder (PIT) tags. Four antennas were deployed at the IFW fish ladder to determine passage duration and efficiency. Additionally, we deployed a camera system to count and identify all fish species passing through the fish ladder. Across all years, 50 American shad and 116 river herring were tagged. American shad that successfully located the fish ladder entrance were significantly larger. Attraction and staging periods were highly variable among individuals, but transit times were relatively short for most fish, with a median transit time of 14 minutes. Thirty-eight percent of tagged American Shad and 1.72% of tagged river herring successfully passed through the IFW fish ladder. Video data show that passage of American shad and river herring begins in the latter part of March and peaks during the first half of May.

Understanding the Effects of Short or Long Term Sunscreen Exposure on The Survivorship and Movement Behavior of the Juvenile Atlantic Horseshoe Crab, *Limulus polyphemus*

Ashley Barnett*, Megan Cain, Alex Matacchieri, Bethany Vanderloo, Kameron Wong, and Danielle L. Dixson
University of Delaware

As the human population increases, anthropogenic impacts on the marine environment are intensifying. The Atlantic horseshoe crab, *Limulus polyphemus*, is a keystone species found within the Northeast United States ecosystem. During the tourist months of May through July, adult horseshoe crabs engage in a mass spawning aggregation on the shoreline, with the highest concentration of crabs occurring in the Delaware Bay. The overlapping timing of the tourist season with horseshoe crab spawning aggregations leaves the shallow sand-buried egg clutches exposed to a variety of anthropogenic pollutants. We tested the effect of Equate Sport sunscreen [oxybenzone based, 2 mg/L], on *L. polyphemus* juveniles. Specifically, we investigated the impact that sunscreen dissolved in artificial seawater had on the movement behavior, assessed through video tracking software, and survivorship after different exposure durations. Individuals exposed to the long-term sunscreen treatment were maintained in seawater with sunscreen for eight weeks, beginning immediately after egg clutches were laid and ending when developing larvae had progressed to the crawling second instar stage (juvenile stage). Juveniles exposed to the short-term sunscreen treatment were maintained in the seawater with sunscreen for five days followed by exposure to untreated seawater for sixteen days. Our experimental aim was to determine if both short and long-term sunscreen exposure impact early life stage horseshoe crabs and if short-term exposure occurs, what behavioral impacts remain after the sunscreen pollutant is removed. This study highlights the anthropogenic impacts of sunscreen, a commonly used and overlooked pollutant, on a vital species to the Delaware Bay ecosystem.

Stable Isotope Analysis of Juvenile Weakfish (*Cynoscion regalis*) from the Delaware Bay

Brian Galvez*[1], *D.* Oliver[1], B. Neilan[2], M. Grecco[3], G. Ozbay[1], and S. Smith[1]
[1]Delware State University, [2]NJDEP and [3]DNREC

Weakfish (*Cynoscion regalis*) is a high demand fish species of the sciaenid family that occurs on the Atlantic coast of North America from Florida to Nova Scotia. The main population makes a northwestern migration in the spring from offshore wintering grounds in North Carolina up to bays and estuaries. The stock has been depleted since 2002, with recent studies and assessments indicating natural mortality to be the cause for the stock's inability to rebound despite fishing mortality decreases since 2011. To determine if food availability contributed to weakfish natural mortality in the Delaware Bay, we are using 13C and 15N stable isotopes of weakfish and its prey items such as mysid shrimp, bay anchovy, and isopods to study current food web dynamics. We collected weakfish from 12 trawl stations in the western Delaware Bay (Summer 2017) and 4 stations from the eastern Delaware Bay (Summer 2016/2017) using an otter trawl. The bay was separated into three parts (upper, middle, & lower). Weakfish muscle and liver tissues were collected, dried in an oven at 60°C for 24-48 hours, ground to a powder, and sent to the Central Appalachians Stable Isotope Facility for analysis. Potential prey items were collected and processed for stable isotope analysis. Weight and standard length (SL) were collected for all fish, and weakfish stomachs collected from a subsample per station. There were statistically significant differences in δ13C and δ15N values between the upper and middle bay for fish <100 mm SL and fish >100 mm SL.

Long Term Exposure of Juvenile Hatchery Reared Lobsters to Ocean Acidification Conditions

Daniel Wieczorek and Beth Phelan
NOAA-NMFS

The American lobster *Homarus americanus* is a commercially important species in the northeastern United States and Atlantic Canada. In 2014, American lobster landings were nearly 147.8 million pounds valued at $566.6 million. Together, Maine and Massachusetts produced more than 94 percent of the total national landings (National Marine Fisheries Service; 2015). Anthropogenic carbon input into the atmosphere has caused the ocean to acidify but the current and predicted levels of CO2 and acidity of seawater for nearshore, estuarine, and higher-latitude habitats are expected to be even greater and substantially more variable than those for the open ocean (Duarte et al., 2013; Johnson et al., 2013). These increases could put the American lobster at risk during the early benthic juvenile stages.

Analysis of Juvenile Striped Bass Spawning Sites Using Otolith Microchemistry

Dawn Parry[1], Paola C. Lopez-Duarte[2], Jessica Valenti[2], Kenneth W. Able[2], and Olaf P. Jensen[2]
[1]University of Rhode Island and [2]Rutgers University

Recruitment of striped bass from the mid-Atlantic Bight northward is generally thought to result from spawning in a few large estuaries: Chesapeake Bay, Delaware River, and the Hudson River. However, juvenile striped bass are also found in small estuaries such in New Jersey. Possible spawning sites may be distinguishable by studying the microchemical signatures of small-juvenile striped bass otoliths because trace elements that reflect local environments are incorporated into the structure. By analyzing the rings near the otolith edge, where the most recent growth occurred, it is possible to establish a signature for the most recent "environment" experienced by the fish. Similarly, areas of the otolith closest to the core should reflect signatures associated with the spawning site. The objective of this project was to compare the microchemical signatures of small striped bass otolith collected in the Hudson, Raritan, Mullica, and Delaware Rivers, in different years, to determine whether the signatures were distinct across space and time. Trace element levels of early (spawning site) and late (collection site) otolith growth were measured using Laser Ablation Inductively Coupled Mass Spectrometry. Principal component analysis was used to determine which elements drove variation among collection sites and potential spawning sites. Strontium was the most important driver of variation. Otoliths from the Hudson, Mullica, and Delaware rivers had more distinct signatures, while the Raritan River otoliths split into two groups, indicating that fish collected there may have originated elsewhere. However, the signatures did not vary greatly over multiple years for the same river.

First Year Results From a Hook and Line Survey to Understand Spatial Population Dynamics of Black Sea Bass

Eleanor Bochenek[1], Jason Morson[2], Olaf Jensen[1], Thomas J. Miller[3], Reed Brodnik[3], Joel F. Fodrie[4], and Reed Brodnik[3]
1Rutgers University, 2Haskin Shellfish Research Laboratory, Rutgers University, 3University of Maryland Center for Environmental Science, 4University of North Carolina at Chapel Hill

In 2016, a black sea bass (BSB) hook and line survey was conducted on five charter boats to understand spatial and temporal trends in catch of BSB from Rhode Island to North Carolina We are presenting a small analysis from the larger project on j and circle hook catch rates and composition. Up to seven reefs per day were fished by recreational anglers with standardized gear using drifting and anchoring. Anchoring and drifting were used at the reef sites except for North Carolina that only used drifting. Four anglers used identical rod and reel combos with a high/low bottom rig, surf clam as bait, and either 2/0 circle octopus or 2/0 J hooks. Five drops were made by each angler at each reef site. Fishing time was also standardized. Rods with circle hooks were left in the rod holder during a drop (dead sticked). All BSB caught were measured and sexed. Preliminary results are from 30 trips taken from May-August. 764 drops (4 lines/drop) were

conducted consisting of 6,112 standardized hook trials (circle and J hooks combined). Overall, 21% of all J hooks and 21% of all circle hooks caught BSB. Both hook types caught similar sizes of BSB.

The Effects of Climate Change of Harmful Algal Growth and Toxicity

Erin Papke*, Nayani Vidyarathna, and Mark Warner,
University of Delaware

As the seawater temperatures continue to increase, there is concern that distributions of harmful algal species may change and/or the frequency of harmful algal blooms (HABs) in the Delaware Inland Bays (DIBs) may increase. Some HABs produce toxins that can potentially harm humans, while also harming marine animals, including fish. The cause of such HABs can include changes in water circulation, increase in nutrients, and changes in light and temperature. The effects of temperature were tested on three harmful algal species found in the DIB: the toxic dinoflagellate *Karlodinium veneficum*, and the raphidophytes *Heterosigma akashiwo* and *Chattonella subsalsa*. Batch growth rate, chlorophyll *a*, and cellular toxicity (as measured by a hemolytic assay) were evaluated at 25, 28 and 30°C. Cell specific growth (μ, d-1) of *K. veneficum* was significantly lower at 30°C when compared to 25°C. The cell specific growth for *H.akashiwo* was a significantly lower at 28°C when compared to 25°C and also at 30°C when compared to 25°C. The cell specific growth rate for *C. subsalsa* was significantly lower at 30°C when compared to 25°C as well. This showed that as the water temperature increases, the growth rate for these species of algae decrease, creating an inverse relationship. Cellular toxicity analyses were only available for samples collected between 25 and 28°C for *K. veneficum*, and only at 25°C for the raphidophytes species and will be presented as well. Future growth and toxin analyses are planned and will include a broader range of temperatures.

Trends in the Abundance and Spatial-Temporal variation of Sharks and Rays in New Jersey Coastal Waters

Gina Badlowski* and Keith Dunton
Monmouth University

Worldwide, numerous coastal shark and ray species have shown drastic declines in populations. Many of these species are of great conservation need because of their currently low population levels as well as k-selected life history traits making the understanding of their abundance and distribution patterns essential for both conservation and management issues. The coast of New Jersey has been shown to have abundance of shark and ray species, but patterns and distributions of species are relatively unstudied. In 1988, the New Jersey Department of Environmental Protection (NJDEP) initiated an Ocean Trawl Survey to evaluate the states fishery resources. This survey, is conducted 5 times throughout the year encompassing the entire coast of NJ inshore of 30 m, representing one of the longest running and comprehensive fishery surveys conducted along the east coast allowing long-term patterns of species to be identified. Utilizing the NJDEP survey from (1988-2016) we identified spatial and

temporal patterns of abundance (CPUE) and habitat of 4 species of commonly captured sharks; Atlantic Angel Shark, Sand Tiger Shark, Dusky Shark, Thresher Shark, and 3 species of rays; Roughtail Stingray, Southern Stingray, and Spiny Butterfly Ray. All of these species showed strong patterns in spatial and temporal variation with all species being most abundant from June-October and within the southernmost portion of the survey. This identification of spatial and temporal patterns of these species allows for better insight of their populations, distributions, and migratory habits, which is necessary for conservation and appropriate management actions for these species.

Evaluating the Potential for a Sex-Balanced Harvest Approach in the Recreational Summer Flounder Fishery

Jason Morson*, Daphne Munroe, Ryan Harner, and Rachel Marshall
Rutgers University

Management efforts to constrain harvest below the maximum allowable catch in the recreational sector of the summer flounder fishery have typically involved increasing the minimum landing size; however, females grow faster than males. Thus, reliance on increased minimum size limits as a management strategy has resulted in approximately 90% of the recreational landings being large, female fish. We evaluated the potential for slot limits to produce a sex-balanced harvest in the recreational fishery. We sampled the landed and discarded fish (n = 3,290) caught by anglers on party boats from New Jersey to Rhode Island during the 2016 fishing season. We then examined a wide array of slot limits to estimate which would have promoted a more sex-balanced harvest given the observed catch composition. We demonstrate that slot limits applied to the recreational fishery have the potential to simultaneously meet multiple management objectives, including the conservation of female biomass while maintaining a fixed fishing mortality; however, no single slot limit performed best at all sampling locations. Results should therefore be viewed as optimal given the observed catch composition for the year, fishing mode, and locations that we observed, and further evaluation of interannual, spatial, and fishing mode variability is warranted.

Fishes and Crabs of a Temperate Estuary: Diel Influence on Species Composition and Abundance

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A comprehensive, daytime otter trawl survey of the fishes and crabs inhabiting Barnegat Bay, a lagoonal estuary in New Jersey, occurred during 2012-2014. In order to supplement this survey, paired daytime and nighttime otter trawl sampling occurred over three years (2014-2016) in August, September, and October at one open bay station and one submerged aquatic vegetation station. Throughout the sampling duration, 107 trawls were performed and 5,877 fishes and 582 crabs representing 36 species were collected. Four species were unique to daytime samples and 12 species were unique to nighttime samples. Overall, fishes, and especially Atlantic silverside (*Menidia menidia*), were more abundant in the daytime samples; however, certain

species were more abundant in the nighttime samples (e.g. silver perch, *Bairdiella chrysoura*). All species of crabs were more abundant in the nighttime samples. Richness increased for both fishes and crabs at night. Overall, fishes were more abundant at the submerged aquatic vegetation station and crabs were more abundant at the open bay station regardless of whether the stations were sampled during daytime or nighttime. This study illustrates the importance of diel influence on measures of species composition and abundance for various fishes and crabs within the Barnegat Bay estuary system.

Assessing the Sustainability and Performance of Caged and Tray Aquaculture Gear for the Eastern Oyster (*Crossostrea virginica*)

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The objective of this study is to assess the sustainability of aquaculture gears and their performance to optimize the growth and survival of the Eastern oyster (*Crassostrea virginica*). Off-bottom caged and tray aquaculture gear were deployed in 3 watershed areas within the Inland Bays. Rehoboth Bay, Indian River Bay, and Little Assawoman were selected because of potential ideal oyster garden conditions. The caged gear consists of galvanized metal, and is placed directly on the floor of the selected site, with an anchor to keep in place. The tray gear consists of two trays stacked, held in place by 4 poles on each end, as well as an anchor attached to keep in place. To assess these two types of gear, one-hundred and eighty oysters ranging from 37-71 mm in shell length were randomly selected. Three bags, each containing 10 randomly selected oysters, were tagged and placed in the caged and tray aquaculture gear at each of the Inland Bay sites. Over the past 3 years, we have found no significant difference in the performance of the two gears; and that more preparation was involved in the setup of the trays than the caged gear. This year's study is based on our preliminary results and will allow us to further confirm our findings earlier. This study will provide information to oyster farmers with culture methods that will suite each of the 3 watershed areas.

Monitoring Heavy Metal Levels from the Marshes located in Coastal Delaware

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Delaware State University

Coastal wetlands are productive habitats for fish and wild life, and provide key services such as flood protection, erosion control, maintaining the water quality and many others. But human activities like agriculture, urban and rural development and other land use changes result in loss of these coastal wetlands. Delaware's coastlines contain marsh grasses that are known to be used as efficient and inexpensive tools for phytoremediation. The current study is focused to determine and compare the concentrations of cadmium, arsenic, and lead within marsh soils and marsh grasses from Blackbird Creek (BBC), Delaware. BBC is largely tidally fed from the Delaware Bay and is managed by the Division of Natural Resources and Environmental Control (DNREC) and the Delaware National Estuarine Research Reserve (DNERR) program. The most

common anthropogenic activities in the BBC estuary are agricultural, recreational, and residential. Study results observed significant differences in the concentrations of heavy metals at study sites with varying marsh vegetation types and in soils containing no vegetation. Interestingly, metal concentrations in soil and Phragmites leaves were inversely correlated while it was contrary with Spartina soils and leaves. Furthermore, the levels of heavy metals within this region of the Delaware marsh lie within the ranges for aquatic systems. But in comparison heavy metals were high in areas without marsh vegetation.

Examples of Active Learning Techniques in a Fisheries Classroom

Lauren Jescovitch
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Evidence-based teaching is growing within Science, Technology, Engineering, and Mathematics (STEM) classrooms. One approach of evidence-based teaching that can be used to improve the teaching-learning experience in the classroom is using active learning techniques. While labs can be thought of as the active learning portion of the class, information used during lectures could also be transformed into kinesthetic activities that provide a fun, hands-on experience in the classroom. This poster will discuss methods of techniques called "changing charts", "cross the line", and "comic strips" that were used in fisheries classes. Learning outcomes were linked with each activity, and outcomes of student involvement will be shown. The average human attention span is half your age in minutes – thus, these examples give great opportunities to integrate between mini-lectures to break up class time to keep students attentive and engaged with fisheries topics in a classroom.

Seasonal Diet and Prey Selectivity of Atlantic Sturgeon in a Coastal Marine Aggregation

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[1]Monmouth University and [2]Stony Brook University

To understand potential reasons why sturgeon aggregate, seasonal changes in diet as well as prey selectivity were examined from sub-adult fish within an aggregation off the coast of New York. The prey of the Atlantic Sturgeon was determined through stomach contents, collected through non-lethal gastric lavage in both the Spring (n=28) and Fall (n=39) of 2013. In both seasons Gammarid Amphipod species, *Ampelisca verrili*, proved to be the most important prey item, indicated by the Index of relative importance (IRI) accounting for the weight, frequency and abundance of all prey taxa. In addition to gammarids, the sturgeon ingested considerable numbers of *Glycera* spp., *Nepthys* spp., *Squilla empusa* and other various polychaete and crustacean species. The Atlantic sturgeon show an opportunistic feeding behavior due to slight variations in diet seasonally with macroinvertebrate prey availability as seen in the increase of importance of polychaete species from fall to spring. Comparison was done between the diversity of organisms found in the gut content of the sturgeon as well as sediment samples taken from the aggregation site. The spring sediments showed a greater diversity than the fall supporting the higher diversity

in spring diet. Low diversity of benthic invertebrates in the gut content support the idea of diet selectivity. Sturgeon are actively selecting amphipod species, especially *Ampelisca verrili* while opportunistically feeding on most polychaetes in this aggregation. Concurrent studies indicate that this area is important for migrating Atlantic Sturgeon, and the high abundance of prey resources indicates an important feeding habitat.

Assessing Nekton Biodiversity at the Delaware National Estuarine Research Reserve

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DNREC-Delaware Coastal Programs

Estuaries serve as important nursery areas for many economically important fish and crab species. However, many pressures, such as climate and land-use change, have the potential to affect nekton community assemblages over time. For this reason, continuous monitoring of nekton through monthly trawl surveys are necessary to better understand both short-and long-term biological responses to a changing climate. The Delaware National Estuarine Research Reserve (DNERR) participates in the System-Wide Monitoring Program (SWMP), a NERRS program that tracks both long and short-term changes in estuarine conditions. While SWMP initially focused on abiotic factors, the establishment of biological monitoring programs was recognized as a need in the 2016 DNERR Climate Adaptation Plan. In response, a nekton monitoring program was piloted in 2016 and fully implemented in 2017 in Blackbird Creek, a tidal freshwater tributary which could be vulnerable changing salinities. Blackbird creek was stratified into 7 salinity zones and a 300 meter subset was randomly sampled within each from April to October 2017. Individuals are measured, identified to species level, and counted in order to assess nekton biodiversity within the Blackbird Creek. Preliminary data suggests that blue crab, white perch, and American eel are among the most common species present and that native grass shrimp populations could be stressed by the non-native oriental shrimp. The DNERR's newly instituted nekton monitoring program will serve as a sentinel program to assess trends and patterns in the spatiotemporal biodiversity of nekton within a Delaware tributary and will identify the appearance or disappearance of species long-term.

Isolation and Identification of Lead and Cadmium Tolerant Bacteria from Blackbird Creek Marsh in an Effort to Reduce Heavy Metal Pollution in Marine

Petrina McKenzie-Reynolds*, Lathadevi K. Chintapenta, and Gulnihal Ozbay
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Environmental pollution caused by toxic heavy metals has become a growing concern worldwide. Efficient and effective bioaccumulation of soluble and particulate forms of metals by microorganisms can be implemented. The United States Environmental Protection Agency (USEPA) and United States Geological Survey (USGS) have been using microorganisms as an alternative or addition to conventional methods to remove environmental pollutants from contaminated areas. Heavy metals are usually found at high concentrations in industrial areas, residential areas and ground waters adjacent to these locations and in agricultural

run-offs. Marsh ecosystems are known as environmental engineers, and naturally harbor microorganisms that can remove these toxic metals from soils and water. The pollution caused by these heavy metals can cause severe degradation in marine ecosystems. These impacts are detrimental to fish and other marine lives either directly or indirectly. The present study focuses on isolation, identification, and characterization of lead and cadmium resistant bacteria from marsh soils. These bacteria were isolated from the soils collected from the Blackbird Creek saltmarsh, located in Townsend, Delaware. For the isolation of lead and cadmium tolerant bacteria, soil samples were inoculated in Luria Broth (LB) and enriched with various concentrations of lead nitrate and cadmium chloride. Heavy metal tolerant bacterial colonies were enumerated and genomic DNA was isolated using phenol: chloroform method. The DNA was amplified using universal bacterial primers (27F/ 1492R) and the PCR amplicon was identified by Sanger sequencing. Preliminary results showed the growth of bacteria with increased tolerance to lead up to 2500ppm and cadmium up to 500ppm. The long-term goal of this study is to isolate lead and cadmium absorption bacteria that can be implemented for the bioremediation of contaminated ecosystems.

Using Statoliths to Estimate the Age-Length Relationship of Waved Whelk (*Buccinum Undatum*) in the Mid-Atlantic Bight

Sarah Borsetti*, Daphne Munroe, and Eleanor Bochenek
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Recent expansion of the unmanaged waved whelk (*Buccinum undatum*) fishery on the Mid-Atlantic continental shelf region of the United States has prompted investigation into local life history parameters of this species. Substantial fisheries exist in several countries around the globe that are economically important, and demand for this species continues to increase. As commercial demand and interest in this fishery continues to grow in the United States it is critical that the important life history data is obtained to enable successful management and sustainability of this fishery. Until recently, a main problem in studying this species was the inability to accurately age *B. undatum*, which demonstrates highly variable sizes-at-age depending on their location and sex. An existing aging technique has been modified and validated for whelk stocks in the UK. This method, which involves identifying and counting statolith growth rings, will be described. Age-length growth curves for the whelk from the New Jersey region have been calculated and show that males tend to grow more slowly than females, and males and females reach maturity between 4 and 6 years of age. This novel aging technique and age-length relationship can be incorporated into future stock assessments of this species to allow improved assessment modeling.

Baseline Population Density and Distribution of the Eastern Oyster, *Crassostrea virginica*, in Delaware Inland Bay's

Scott Borsum*, Melanie Fuoco, and Gulnihal Ozbay
Delaware State University

Delaware is currently the only state on the Northeast Atlantic seaboard without commercial shellfish aquaculture. Legislation has passed and the leasing process is currently underway. The three inland bays in Southern Delaware offer promising future locations, due to protection from open waters, ease of access for workers, and a developed tourism industry. Oyster aquaculture has been suggested to help restore depleted local wild populations of oysters while filtering the water, providing structural habitat, and creating a new sources of jobs. There is a unique opportunity to study directly how aquaculture effects populations by developing baseline information prior to the onset of commercial aquaculture. This research aims to further understand the current oyster population by developing baseline population locations and density using standardized survey methods for further use as management tool to measure changes over time. Oyster survey locations were by prioritizing habitat for hard substrate where oysters are more likely to settle and occur naturally, in this system hardened shorelines. Standardized swaths were run along a permanent transect line in order to determine a population density at each location. Results allowed for the production of the first map of native oysters locations within the Delaware Inland Bays.

Age Composition of Male and Female Summer Flounder *Paralichthys dentatus* in The New Jersey Recreational Fishery

SeungWhan Lee*, Daphne Munroe, and Jason Morson
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Summer flounder (*Paralichthys dentatus*) support valuable commercial and recreational fisheries in the Northeast and Mid-Atlantic regions. Length, age, and sex composition data collected from the recreational and commercial catch provide valuable information that helps stock assessment scientists estimate the status of the population and helps managers make informed decisions about fishery regulations. This project collected, for the first time, a full set of age composition data from a sector of the recreational fishery. Summer flounder (n=1,414) were sampled biweekly on participating party boats in Cape May, NJ and Atlantic Highlands, NJ during the entire 2016 recreational fishing season. A representative subset of sampled fish (n=538) were aged by identifying and counting annuli under a microfiche. A blind re-aging test with the Northeast Fisheries Science Center aging lab resulted in 87% agreement. Sex- and port-specific age-length keys were developed from these data and applied to the full catch. Results agree with previous reports that female summer flounder grow significantly faster than males and that growth rates vary by region. In addition, under the 2016 recreational fishery regulations, female summer flounder reached the minimum landing size of 18 inches approximately 2-3 years earlier than males.

Understanding Larval Recruitment and Settlement of Delaware's Important Recreational and Commercial Fish Species

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University of Delaware

The health of Delaware's estuaries and inland bays has been of growing concern in recent years. Anthropogenic stressors such as nutrient pollution and marsh degradation have led to an increase in the frequency of harmful algal blooms, bacterial outbreaks, and fish kills. These areas function as key nursery habitat for many species of teleost fish that are commercially and recreationally important for not just Delaware's fisheries but the Mid-Atlantic's as well. Until the late 1990s, it was assumed that marine larvae dispersal was a physical process and larvae were thus regarded as passive plankton. However, recent studies have challenged this, and demonstrate fish larvae have well-developed behavioral and sensory abilities that are used to alter dispersal and recruitment patterns. Research suggests that larval fish use innate preferences for specific chemical cues during settlement, and can differentiate between healthy and degraded habitats. Here, we investigate the settlement preferences of a variety of coastal species important to the ecosystem and economy of Delaware. Model species used for this research include weakfish (*Cynoscion regalis*), striped bass (*Morone saxatilis*), and summer flounder (*Paralichthys dentatus*). A two-channel choice flume will be used to assess the ability of larval and juvenile estuary fish to discriminate between cues from different settlement habitats. Understanding the innate habitat preferences of settlement stage larvae is vital to our management of the nursery habitats and local fisheries. If estuaries face recruitment decline stemming from habitat degradation, the effects will be compounded and reflected in the standing stock of the various populations.

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