Mid-Atlantic Chapter
of the
American Fisheries Society

2014
Annual Meeting

Cape Henlopen State Park
Lewes, Delaware

Welcome to the 2014 MAC Annual Meeting

We are looking forward to a great meeting. We have a really strong lineup of presentations Thursday and Friday, as well as posters Thursday night, so make sure to attend. Also, don't forget to take advantage of Cape Henlopen State Park; there are wonderful hiking and walking trails, historical sites, as well as an amazing coastline to explore.

Thank you for your support!

Thanks to these businesses and individuals that have supported the Mid-Atlantic Chapter and donated items to make this a better meeting.

Dogfish Head Craft Brewed Ales

Irish Eyes Pub & Restaurant

L Town and Earth

Lewes Harbour Marina Fishing & Boating Outfitters

Jay Fleming Photography

DSF Delaware Surf Fishing

KEVIN FLEMING PHOTOGRAPHY

Daphne Monroe
John Clark

Backyard Jams and Jellies

Fordham and Old Dominion Brewing

Shorebreak Lodge

DUH Delmarva United Homebrewers

Lori Brown, Jimmy Kroon, and Terry Daleiden

Meeting Schedule ***(* indicates student presenter)***

Thursday		
Time	Presenter	Title
7:30	**Breakfast and Registration**	
8:30	Dewayne Fox	Welcome to the Annual Meeting
8:40	Matthew Stone*	Nekton Abundance and Diversity Relative to Marsh Grasses in Blackbird Creek, Delaware
9:00	Christopher Free*	Illegal fishing for the endangered endemic Hovsgol grayling
9:20	Jenny Paterno*	Assessment of Fish Utilization on a Sub-tidal Oyster Restoration Area in a Mid-Atlantic Estuary
9:40	Kris Roeske*	Impacts of Phragmites australis on Callinectes sapidus and Resident Fish Population in Blackbird Creek, Delaware
10:00	**Break**	
10:20	Nivette M Perez-Perez*	Effects of diet and temperature on the survival of larval red deepsea crab Chaceon quinquedens in laboratory conditions
10:40	Paola Lopez-Duarte	Habitat use by horseshoe crabs in Great Bay, NJ: new insights from a small estuary
11:00	Molly Ellwood*	Progress Report on the Subtidal Movements of Atlantic Horseshoe Crabs (*Limulus polyphemus*) in Delaware Bay During Summer 2014
11:20	Max Davidson*	Diel-Cycling Hypoxia and pH Impacts on Juvenile Summer Flounder Growth: Nothing Good Happens After Midnight
11:40	Kaycee Coleman*	Response in the distribution of the southernmost winter flounder subpopulation to warming bottom water temperatures
12:00	**Lunch**	
1:00	Symone Johnson*	Taking the Initiative to Conserve Sand Tigers (*Carcharias taurus*) in Delaware Bay

1:20	Danielle Haulsee*	Social Sharks: Long-term Internal Acoustic Transceivers Reveal Species Associations and Large-scale Movements of a Coastal Apex Predator
1:40	Thomas Marcellin Grothues	Acoustic Telemetry of Pelagic Thresher Sharks (*Alopias pelagicus*)
2:00	Matthew J Oliver	A Satellite Driven Dynamic Biome Product to Assist in Fisheries Management and Marine Spatial Planning
2:20	Matthew Breece*	Identifying Marine Habitat Preferences for Atlantic Sturgeon Using AUVs, Satellites, and Telemetry
2:40	Alex DiJohnson*	Assessing Atlantic Sturgeon behavior in the presence of vessel traffic within the Delaware River
3:00	**Break**	
3:20	Lathadevi Karuna Chintapenta	Assessment of Water Pollution in Blackbird Creek, Delaware using Diatoms as Water Quality Indicators
3:40	Johnny Moore	Monitoring American shad (*Alosa sapidissima*) in the Nanticoke and Delaware Rivers
4:00		Business Meeting
6:00	**Dinner/Poster Social**	
	Andrew Kluge*	Determining the Population Density of the Freshwater Mussel (Elliptio complanata) in the Brandywine Creek
	Sean Martin*	An Electronic Vessel Trip Reporting Program For New Jersey's Commercial Fishermen
	Collin Dobson*	Waved Whelk (Buccinum undatum) in the Mid-Atlantic Bight: Biology of Commercial Catch and Population Distribution
	Thomas Marcellin Grothues	Telemetry Infrastructure in the Mullica River/Great Bay Estuary as a Service of the Jacques Cousteau National Estuarine Research Reserve

	Katie Ommanney*	Investigation of Nekton Richness in Relation to Salt Marsh Grasses in Blackbird Creek, Delaware
	Tyler O'Neal*	A Comparison of Bottom and Hanging Gear for Growing Eastern Oysters (Crassostrea virginica) in Broadkill Creek, Delaware
	Foudan Salem	HYPERSPECTRAL REMOTE SENSING FOR MONITORING INTERACTIONS BETWEEN TURBIDITY AND NUTRIENTS DYNAMICS IN THE BLACKBIRD CREEK, DELAWARE

Friday		
Time	Author	Title
8:00	**Breakfast**	
9:00	Paul Robert Jivoff	Potential impact of hurricane Sandy on blue crabs, *Callinectes sapidus*, in Barnegat Bay, NJ: Did the Sedge Island Marine Conservation Zone offer protection?
9:20	Jordan Zimmerman	Management and Monitoring of American Eel (*Anguilla rostrata*) in Delaware Waters
9:40	Ian Park	Use of Hydrologic Curve Data to Calculate Desired American Eel Stocking Densities in the Susquehanna River Watershed
10:00	Sunny Jardine	Fishermen, Markets, and Population Diversity
10:20	**Break**	
10:40	Gulnihal Ozbay	Are the Aquaculture Practices Sustaining Our Goal to Restore Oysters (*Crassostrea virginica*)?
11:00	Richard Wong	A Modern Day Fisheries Classic - The Rise and Fall of a Massive New Fishery in Delaware. The Knobbed Whelk,its Biology, and Management
11:20	Mike Steiger	Size Does Matter: A Histological Examination of Delaware Bay Knobbed Whelk (*Busycon carica*)
11:40	**See You Next Year!**	

Oral Presentations

Alexander M. DiJohnson
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE and
Delaware Department of Natural Resources and Environmental Control: Division of Fish and Wildlife

Lori M. Brown, Delaware State University, Dover DE
Dewayne A. Fox, Delaware State University, Dover DE
Matthew T. Fisher, Virginia Commonwealth University, VCU Life Sciences, Richmond, VA

Assessing Atlantic Sturgeon behavior in the presence of vessel traffic within the Delaware River

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) populations along the entirety of the eastern United Stated declined in the late 1800s due to overfishing and habitat degradation. Despite recovery efforts, Atlantic Sturgeon were listed as endangered under the Endangered Species Act in 2012. In the final ruling determination, NOAA-NMFS listed vessel strikes, which increase during the period of likely spawning, as a threat to Atlantic Sturgeon in the Delaware River. We monitored a 5.2km reach of probable spawning habitat near Chester, PA from mid-April to July, 2013 with a two dimensional acoustic VEMCO positioning system that provided location estimates of telemetered Atlantic Sturgeon. Shipping activity was assessed through the global Automatic Identification System, providing vessel type, position, course and speed. Throughout our study, five telemetered adult Atlantic Sturgeon were positioned 11,468 times for an average of 4.7 days (range 3-7) within the study area. During periods of Atlantic Sturgeon occupancy we identified 102 vessels. We queried both datasets by time and have identified likely interaction zones. Through our efforts we hope to conserve this imperiled species by providing managers with information that can minimize the risks associated with sturgeon/vessel interactions while simultaneously balancing economic importance of the region's shipping industry.

Christopher Free
Institute of Marine and Coastal Sciences, Rutgers University
New Brunswick, NJ cfree@marine.rutgers.edu 610-999-4732

Olaf P. Jensen - Institute of Marine and Coastal Sciences, Rutgers University; New Brunswick, NJ
Bud Mendsaikhan - Institute of Geoecology, Mongolian Academy of Science; Ulaanbaatar, Mongolia

Illegal fishing for the endangered endemic Hovsgol grayling

Although fishing and fish consumption are historically uncommon in Mongolian culture, they may be gaining prevalence as new sources of food, income, or recreation. However, knowledge of fishing is largely anecdotal; little is known about the motivations for fishing, the frequency and methods of fishing, and the potential impact of fishing on Mongolian fish species, especially globally unique salmonids like the endangered endemic Hovsgol grayling (*Thymallus nigrescens*) and endangered taimen (*Hucho taimen*), the largest trout species in the world. The purpose of this study is to: (1) gain a better understanding of the motivations for fishing and the frequency and methods of fishing through interviews with herding families and national park rangers and (2) validate responses from these interviews using surveys for derelict fishing gear as an indirect indicator of illegal fishing activity. Interview responses suggest that gillnet fishing for grayling is widespread in Lake Hovsgol National Park and occurs primarily in river mouths during the spring spawn. Interviewees report decreases in the size and abundance of Hovsgol grayling as a result of fishing. Surveys for derelict fishing gear validate these responses: fishing gear, predominantly gillnet material, was found in every transect along the lakeshore and was concentrated on accessible shorelines near river mouths. Furthermore, the most frequently observed gillnet mesh size in surveys for derelict fishing gear is also the most efficient mesh size at capturing Hovsgol grayling in our long-term monitoring study. These preliminary results suggest that illegal gillnet fishing could have an impact on the endemic Hovsgol grayling population.

Danielle Haulsee
University of Delaware, (717)451-7636, dhaulsee@udel.edu

Matthew Breece, University of Delaware
Lori Brown, Delaware State University
Bradley Wetherbee, University of Rhode Island
Dewayne Fox, Delaware State University
Matthew Oliver, University of Delaware

Social Sharks: Long-term Internal Acoustic Transceivers Reveal Species Associations and Large-scale Movements of a Coastal Apex Predator

Sand tigers (*Carcharias taurus*) are large apex predators common in the coastal ocean along the Eastern US Coast. Although Delaware Bay and surrounding coastal waters are known summer hot-spots for Sand Tigers, our understanding of where this population travels throughout the year is less well known. Since 2007, we have implanted more than 300 VEMCO acoustic transmitters in Sand Tigers providing detections from Cape Canaveral, Florida to Long Island, New York by collaborators in the Atlantic Cooperative Telemetry (ACT) Network. During the summer of 2012, 20 Sand Tigers were implanted with VEMCO Mobile Transceivers (VMTs), which are capable of both transmitting and receiving coded acoustic pings. To date, two of the 20 sharks have been recaptured, and their VMTs recovered. VMTs recorded detections of 350 individuals (216 Sand Tigers), from 7 species telemetered by ACT Network researchers. This represents the species assemblages associated with Sand Tigers throughout the year. Detections of species by transceivers also created a network allowing us to piece together the locations of Sand Tigers throughout the year. This project is a unique look at the social network of an apex predator and is a useful model for studies quantifying the social structures of marine animals.

Gulnihal Ozbay
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE 19901 gozbay@desu.edu

Brian Reckenbeil
Frank Marenghi
Patrick Erbland

Are the Aquaculture Practices Sustaining Our Goal to Restore Oysters (*Crassostrea virginica*)?

Decline of eastern oyster stocks along the east coast of the United States, particularly in the Mid-Atlantic area, have prompted the implementation of many types of restoration efforts. Delaware's oyster gardening program cooperates with volunteer growers in the three coastal bays of the Delaware Inland Bays. Research efforts in the DIB have focused on monitoring oyster growth and survival, water quality conditions, species diversity and abundance in and around oyster aquaculture and riprap habitats. Riprap is designated as the final destination of oysters cultured by the volunteer oyster gardeners. Our research effort provides baseline information on the ecological value of oyster aquaculture in Delaware's Inland Bays. We found newly settled juvenile oysters for the first time within floating oyster gear in man-made, residential canal systems, and on riprap shorelines around the DIB. Many species of economic and ecological importance are considered habitat-limited in the Inland Bays, particularly regarding juvenile refugia and forage areas. Oyster aquaculture gear can provide habitat for these native estuarine fauna at small scales, while supplementing oyster spawning stocks and enhancing natural recruitment, without difficult and costly types of habitat modifications. Although aquaculture sites or gears are clearly not structurally or functionally equivalent to natural reefs, research conducted over eight years in Delaware Inland Bays revealed the diversity of species found in and around oyster culture sites to be quite encouraging. As enhancement and restoration efforts of oysters move forward, it is important to understand the impacts of oyster aquaculture on the surrounding habitat and biological community.

Ian Park
Delaware Division of Fish and Wildlife
ian.park@state.de.us

Use of Hydrologic Curve Data to Calculate Desired American Eel Stocking Densities in the Susquehanna River Watershed.

The Susquehanna River is 444 miles long and creates a watershed of over 27,000 square miles. Conowingo Dam is the lower most dam on the Susquehanna River and was constructed about ten miles from the mouth of the river. Upon completion in 1928, the dam has been a blockage to juvenile American Eels attempting to migrate into the Susquehanna watershed. In the years following the remaining eels emigrated out of the river, and except for sporadic stockings in the 1970's and 80's there has not been any large scale stockings of eels. In 2008 the Fish and Wildlife Service began a trap and transport program of juvenile eels collected at the base of Conowingo Dam and released into the Susquehanna watershed, since then over 750,000 eels have been stocked into the watershed. The project goal was to return eels to their native range, but it has also allowed for several studies and hypotheses to be tested. This presentation will focus on the watershed being void of American Eels allowing the project to evaluate the hypothesis that the sex of an American Eel is determined by the overall density of eels in a distinct population.

Jenny Paterno
Rutgers University - Haskin Shellfish Research Laboratory
856-498-9003, jenny1390@gmail.com

David Bushek and Lisa Calvo, Rutgers University, Haskin Shellfish Research Laboratory
Thomas Grothues, Rutgers University, Marine Field Station

Assessment of Fish Utilization on a Sub-tidal Oyster Restoration Area in a Mid-Atlantic Estuary

The Gandy's Beach Oyster Restoration Enhancement Area is a sub-tidal ten-acre plot located in the upper Delaware Bay established by Rutgers' program, Project PORTS (Promoting Oyster Restoration Through Schools). Project PORTS is an educational outreach program that engages local school children in building shell bags, which serve as cultch for oyster larvae settlement. Since 2007, the program has worked to establish a low relief oyster reef. This study compared the diversity and abundance of resident fishes, transient fishes and benthic macroinvertebrates on the enhancement area with nearby natural oyster habitats.

Each month from July through November 2013, trawl and benthic habitat tray samples were collected from seven sites in the Bay. Overall, a similar fish and macroinvertebrate community was found across all sites. However, the enhancement site exhibited the greatest cumulative diversity of fish species. The enhancement area appears to represent a transitional stage between degraded oyster habitat and high oyster density habitat. Project PORTS, a small-scale community based restoration program created valuable habitat comparable to natural oyster reefs.

Johnny Moore
Delaware Division of Fish & Wildlife
302-735-2962, johnny.moore@state.de.us

Edward A. Hale, Ph.D, Delaware Division of Fish and Wildlife

Monitoring American shad (*Alosa sapidissima*) in the Nanticoke and Delaware Rivers

American shad (*Alosa sapidissima*) are the largest of the anadromous alosines and have historically represented a significant commercial and recreational fishery in the Delaware and Nanticoke Rivers, DE. American shad are density-dependent, batch spawners with males maturing within 3-5 years and females maturing within 4-6 years of age. On the Nanticoke River there is a moratorium for American shad prohibiting commercial and recreational harvest. The Delaware River has a commercial season with a landings quota based on the number of licensed gill netters while recreational fishers have a 10 fish daily limit that extends throughout the year. These regulations were put in place due to the decreased commercial landings of American shad on the Nanticoke and Delaware Rivers. The Delaware Division of Fish and Wildlife operates an American shad hatchery and since its inception in 2005, has stocked an estimated average of over 500,000 shad fry marked with oxytetracycline (OTC) per year in the Nanticoke River. Juvenile shad are sampled every year using a haul seine from July-October on the Nanticoke River and August-October on the Delaware River at multiple locations. The Juvenile Abundance Index (JAI) has risen in the Nanticoke River since monitoring began in 1999. The percent of hatchery reared fish recaptured during sampling ranges from 0-35 % of the total number caught. Similarly, the JAI in the Delaware River has risen since monitoring began in 1980. However, more inter-annual variability in CPUE has been observed in the Delaware River, respective to the Nanticoke River. We have identified two of the four sampling locations in the Delaware River as largely responsible for driving the annual JAI. Further, we have found that available data on mean flow, water temperature, air temperature and dissolved oxygen are not correlated with geometric mean CPUE at each location except between mean annual flow rate and CPUE at the Trenton sampling site ($\rho = 0.376$, $p < 0.001$).

Jordan Zimmerman
Delaware Division of Fish & Wildlife
(302) 739-4782, jordan.zimmerman@state.de.us

Management and Monitoring of American Eel (*Anguilla rostrata*) in Delaware Waters

The American eel (*Anguilla rostrata*) supports a large commercial fishery in the mid-Atlantic region of the United States. Perceived population declines in parts of the American eel's range have led to more intensive management of the species over the last 15 years culminating most recently with a USFWS evaluation of population status to ascertain if Endangered Species Act (ESA) listing is warranted. American eels are managed by the Atlantic States Marine Fisheries Commission (ASMFC) which recently implemented two addenda to the interstate fishery management plan for American eel. As a member state, Delaware is required to monitor commercial landings and young-of-the-year (YOY) abundance. Commercial landings in Delaware remained relatively stable, until bait shortages resulted in an involuntary landings reduction. However, record high glass eel abundance has been documented in two of the last three years (Total Catch > 400,000). Similar trends in peak ingress of glass eels have been previously documented at Roosevelt Inlet, DE. Relative to other survey locations along the Mid-Atlantic, my findings demonstrate that Delaware is an important juvenile nursery for American eels.

Kaycee Coleman
Graduate Program in Oceanography
Rutgers University Marine Field Station
908-642-6893, coleman@marine.rutgers.edu

Thomas M. Grothues and Kenneth W. Able
Rutgers University Marine Field Station

Response in the distribution of the southernmost winter flounder subpopulation to warming bottom water temperatures

The Southern New England / Mid-Atlantic (SNE/MA) stock of winter flounder (*Pseudopleuronectes americanus*) has failed to recover from being overfished despite management efforts. This may be due to variable environmental conditions at the southern extent of their range. This study aims to resolve changes in the spatial distribution of winter flounder below the Hudson Shelf Valley using bottom trawl survey data from the Northeast Fisheries Science Center (NEFSC), the New Jersey Department of Environmental Protection (DEP), and the Northeast Area Monitoring and Assessment Program (NEAMAP). Average weight per fish increased in all three surveys, which could be in response to decreased fishing pressure. The DEP and NEFSC surveys revealed significant distributional shifts in the subpopulation shifting deeper and receding northward at the southern edge. While NEFSC data showed a northward shift in the Mid-Atlantic population, DEP data showed a range contraction with the southern edge receding northward as well as contracting at both edges longitudinally. Bottom water temperature on the northeast continental shelf warmed during the study period seen in the DEP and NEFSC surveys. Including bottom water temperature as a response variable when modeling catch per tow for all three surveys provided a better fit than excluding temperature. Mean survey bottom water temperatures further affected catch per tow with a negative relationship on geometric mean catch per tow as temperatures increased for the DEP data. Significant differences found between survey variables for both seasonally and yearly averages, could imply inshore and offshore subpopulations adapting differently over time to warming temperatures.

Kris Roeske
Delaware State University, Dover, DE 19901

Paul Jivoff, Rider University, Department of Biology, Lawrenceville, NJ 08648
Mike Mensinger and Robert Scarborough, Delaware Department of Natural Resources and Environmental Control, Dover, DE 19901
Gulnihal Ozbay, Delaware State University, Dover, DE 19901

Impacts of *Phragmites australis* on *Callinectes sapidus* and Resident Fish Population in Blackbird Creek, Delaware

Blue crabs (*Callinectes sapidus*), as well as various other species, flourish in the salt marsh environments where the leaves, roots, and stems of native plants provide much needed sources of food and shelter from a number of predators. Blackbird Creek, along with much of Delaware's other coastal wetlands, has been subject to a loss of biodiversity over the past several decades due largely to the invasion of the common reed (*Phragmites australis*). This study aims to evaluate the impact *P. australis* has on native invertebrates using the blue crab as an indicator species. Sites for blue crab sampling are selected based on five treatments: *S. alterniflora* dominated (control), *P. australis* dominated, previously *P. australis* dominated (Phragmites has been removed), intermediate Phragmites invasion, and known oyster beds near the mouth of Blackbird Creek. An otter trawl and crab traps are utilized in the sampling at all locations on a weekly basis from June through November and the sex, carapace width including tips of the lateral spines (mm), maturity stage (recruits, juveniles, adults), and molt stage are all being measured. Along with the blue crabs, species caught in the trawls and crab traps are identified, measured and released. Average carapace width from Spartina, Phragmites, and intermediate Phragmites invasion sites are 111, 111.53 and 125cm, respectively. The total number of crabs caught at Spartina, Phragmites, and mixed sites are 38, 66, and 16 individuals respectively. 58%, 65%, and 43% of the crabs from Spartina, Phragmites, and intermediate Phragmites invasion sites were female. Ultimately this research will provide enhanced insight into the importance of marsh surface vegetation in relation to the way blue crabs and resident fish utilize such habitats. This will further advance the management and restoration efforts that have been, and are currently in place in regards to the elimination of the common reed.

Lathadevi Karuna Chintapenta
College of Agriculture & Related Sciences, Delaware State University, 3028576405, kchintapenta@desu.edu

Deidre L Carter, Department of Biological Sciences, Delaware State University
Venu Kalavacharla, Center for Integrated and Biotechnology Research, Delaware State University, Dover
Gulnihal Ozbay, College of Agriculture & Related Sciences, Delaware State University

Assessment of Water Pollution in Blackbird Creek, Delaware using Diatoms as Water Quality Indicators

Blackbird Creek is considered as one of the most pristine marsh ecosystems in Delaware but it is being exposed to various point and non-point pollution sources because of increased human activity. Water quality monitoring performed by the Department of Natural Resources and Environmental Control (DNREC) has shown that the waters of Blackbird Creek and most of its tributaries are impaired by elevated levels of the nutrients, nitrogen and phosphorous. These nutrient loadings have a drastic impact on aquatic organisms. In this study diatoms are used as biological indicators to assess the environmental conditions of Blackbird Creek. As environmental conditions change over space and time the presence of these indicator species also change. Nitrogen and phosphorous levels of the soil at study sites is being studied by extracting the pore water, also the chemical water quality is being monitored. The nutrient quality of soil and water will further be correlated to diatom diversity and the health of Blackbird Creek will be assessed. The sampling sites include native marsh grass site, invasive marsh grass site, diverse marsh grass site and agriculture sites. *Navicula phyllepta* is the dominant diatom in the native marsh grass site and diverse marsh site where nitrate nitrogen and total nitrogen are found in high concentrations. *Thalassiosira aestivalis* was found in areas near to the agricultural sites where the nutrients are high. Further research includes monitoring of diatoms from the resident fish gut to have a better understanding of habitat utilization and feeding pattern of fish in Blackbird Creek.

Matthew Breece
University of Delaware
727-735-2472, mwbreece@udel.edu

Dewayne A. Fox, Delaware State University
Keith J. Dunton, Stony Brook University
Matthew J. Oliver, University of Delaware

Identifying Marine Habitat Preferences for Atlantic Sturgeon Using AUVs, Satellites, and Telemetry

The 2012 Endangered Species Act listing emphasized the need for improved understanding of Atlantic Sturgeon marine habitat requirements. To aid in this understanding and facilitate management, we developed a spatial prediction for occurrence by linking detections of 395 telemetered adult and sub-adult Atlantic Sturgeon with water classes assignments derived from satellite ocean color observations (specifically remote sensing reflectance at 443 and 555 nm, and daytime sea surface temperature were used to classify water classes). Using a modified SLOCUM glider equipped with telemetry receivers we conducted a 79-day stratified sampling mission to test these predictions across the Lagrangian framework of water classes. Sampling continuously along the Delmarva Peninsula from April 10 to June 28, 2013, our glider detected 62 Atlantic Sturgeon in coastal waters at depths of 10-23 m, within 18 km of the coast, which were associated with specific water classes. In situ data from the glider indicate the preferred habitats for Atlantic Sturgeon are likely characterized by chlorophyll, CDOM, and temperature. Spatial predictions, derived from integrated observing technologies should facilitate management of Atlantic Sturgeon by identifying potential areas of increased bycatch and enhancing spatial planning for projects including power generation, ultimately enhancing the conservation and recovery of this imperiled species.

Matthew J Oliver
University of Delaware
302-645-4079, moliver@udel.edu

Dewayne A. Fox, Delaware State University,302-857-6436,
dfox@udel.edu
Josh Kohut, Rutgers University, 848-932-3496,
kohut@marine.rutgers.edu
John Manderson, Ecosystems Processes Division, NEFSC/NMFS/NOAA

A Satellite Driven Dynamic Biome Product to Assist in Fisheries Management and Marine Spatial Planning

Fisheries managers balance resource extraction and the protection of dynamic marine systems that often display a high degree of spatial and temporal variability. The fluid nature of seascapes do not lend themselves to static boundaries often used in management practices. Static partitioning of marine systems may lead to poorly resolved marine biome locations and lead either to excessively large spatial management zones, or local partitions and boundaries that do not match regional dynamics. Here we propose a satellite derived, dynamic biome approach which accounts for both the fluid nature and state changes in seascapes. The goal of this approach is to provide simple, dynamic, yet seasonally predictable framework that reflects the complexity of seascapes, and provide the ability to manage marine seascapes that reflect their spatial and temporal dynamics. We will show how dynamic biomes can be derived from standard satellite observations, how they are verified with in-situ data, how they reflect well known local and climate processes, and how they can be used for ecosystem hypothesis testing. We propose that these dynamic biomes can be used to control for the high degree of spatial and temporal variability in marine ecosystems.

Matthew Stone
Delaware State University
(510) 846-7438, mstone14@students.desu.edu

Katharine Ommanney - Delaware State University
Laurieann Phalen - Delaware State University
Karuna Chintapenta - Delaware State University
Venu Kalavacharla - Delaware State University
Gulnihal Ozbay - Delaware State University

Nekton Abundance and Diversity Relative to Marsh Grasses in Blackbird Creek, Delaware

Blackbird Creek drains 31 square miles of central Delaware into the Delaware River. In this intertidal creek, the invasive Common reed, *Phragmites australis*, is the dominant grass closest to the mouth of the creek, whereas the native Smooth cordgrass, *Spartina alterniflora*, is dominant further upstream. In order to determine possible effects that these different grasses have on resident nekton, fish and crabs were captured via otter trawl during the spring through fall months of 2012 through 2014 and identified in the field at three sites: one dominated by the native grass, one dominated by the invasive, and one characterized as a mixed site. Fewer individual organisms were present at the mixed site relative to the other sites. Half as many species were collected at the Spartina site relative to the other sites. However, biodiversity was statistically equivalent between all sites when normalized to biomass and effective number or species. Research is ongoing and more data will help determine potential impacts that the different marsh grasses may have on the overall ecology of the creek.

Max Davidson
University of Delaware, 2019197473, Davidsom@udel.edu

Timothy E. Targett, University of Delaware
Paul A. Grecay, University of Salisbury

Diel-Cycling Hypoxia and pH Impacts on Juvenile Summer Flounder Growth: Nothing Good Happens After Midnight

Laboratory experiments were conducted to determine the impact of diel-cycling dissolved oxygen (DO) and pH on young-of-the-year summer flounder (*Paralichthys dentatus*). Flounder were exposed to two cycling DO levels (extreme = 1-11 mg O2 l-1; moderate = 3-9 mg O2 l-1), two cycling pH levels (extreme = 6.8-8.1; moderate = 7.2-7.8), and a constant normoxia (7.5 mg O2 l-1) & pH (7.5) control treatment in a fully crossed 3X3 experimental design at 25°C. DO and pH levels were chosen to reflect summertime conditions in shallow eutrophic estuarine nursery areas. Growth Curve Analysis and Dunnett's tests were used to analyze all data. Growth rate (change in mass) was significantly reduced in fish exposed to the most extreme diel-cycling DO across all pH treatments over the course of 20 d experiments. No consistent growth detriment was observed in the other treatments, indicating a) that moderate DO cycles have little or no impact on growth and b) that pH has neither an independent nor interactive effect on growth rate. Experiments to examine growth rate recovery and acclimation showed an initial growth rate detriment when subjected to extreme diel-cycling DO and pH for 10 days, but then growth returned to control levels under control conditions for the following 20 days. Flounder did not exhibit growth rate acclimation, as growth rate detriment persisted over the 20 d exposure to extreme diel-cycling DO and pH. In fact, flounder exhibited mortality after two to three weeks of exposure to these conditions. Thus, young summer flounder exhibit growth rate detriment, and ultimately mortality after prolonged exposure, under extreme diel-cycling DO and pH conditions present in shallow, highly eutrophied, nursery habitat.

Mike Steiger
Delaware Division of Fish & Wildlife
302-735-2980, Michael.Steiger@state.de.us

Richard Wong Delaware Division of Fish & Wildlife
302-735-2975, Richard.Wong@state.de.us

Size Does Matter: A Histological Examination of Delaware Bay Knobbed Whelk (*Busycon carica*)

Knobbed whelks (*Busycon carica*) are marine snails that have only recently become a prominent commercial species in Delaware. From 2001 to 2004, whelks represented the second largest commercial fishery in Delaware. Currently, whelks rank as the fourth largest fishery. Research into age, growth, and reproduction began in earnest in 2005. Slow growth to maturity and low reproductive potential, along with a sharply deteriorating fishery led to an increase in the minimum size regulation from 5" in 2007 to 6" in 2010. Understanding knobbed whelk reproductive development and maturity was central to determining proper size limits for the fishery. We developed formal criteria for staging oocyte development through histology, in order to accurately describe maturity. Maturity (L50%) occurs at 4.75 inches in a very steep, knife-edge rate. We also fully describe stages of ovary development based on macroscopic examinations. Incorrect assumptions about oocyte development and maturity can occur without histological validation. Mature females can be mistakenly identified as immature based on macroscopic-only evaluations. Macroscopic staging can be used effectively when looking at coarse descriptions of development such as seasonality of gravid individuals. A histological examination is necessary however, when validating initial finding as well as when describing ovary development on a fine scale.

Molly Ellwood
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE

Dewayne A. Fox
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE
Lyndie Hice-Dunton
Delaware National Estuarine Research Reserve, Dover, DE

Progress Report on the Subtidal Movements of Atlantic Horseshoe Crabs (*Limulus polyphemus*) in Delaware Bay During Summer 2014

The Delaware River Estuary supports the world's largest population of the Atlantic Horseshoe Crab (*Limulus polyphemus*) which plays major roles in our region's economic and ecological well-being. Their designation as a multiple use resource is reflected in their Fisheries Management Plan (FMP) whose primary goal is focused on their continued utilization by humans, shorebirds, and other dependent fish and wildlife species, including federally listed sea turtles. Although Delaware Bay has been a focal point for the study of Horseshoe Crabs for decades, most research has focused on spawning activities while limited information exists about the migratory patterns and sub-tidal habitat requirements. The objective of this study is to refine our regional understanding of the subtidal movements by adult Horseshoe Crabs in the Delaware Bay. Movements of adults are being tracked by affixing 65 terminal phase adults with VEMCO V16-4H acoustic transmitters and monitoring their movements through the use of a large scale passive acoustic receiver (VEMCO VR2W) network in the Delaware Bay.

Nivette M Perez-Perez
Delaware State University
(787) 412-2747, nivette2p@gmail.com

Matthew Poach, NEFSC James J. Howard Marine Sciences Laboratory;
Bradley Stevens, University of Maryland Eastern Shore;
Stacy Smith, and Gulnihal Ozbay, Delaware State University

Effects of diet and temperature on the survival of larval red deepsea crab *Chaceon quinquedens* in laboratory conditions

The red deepsea crab *Chaceon quinquedens* supports a commercially valuable fishery on the North Atlantic coast of the United States. Early life history of the red crab is poorly known, especially conditions required for larval development. In July 2014, ovigerous females were obtained from commercial traps owned by the Atlantic Red Crab Company and transported to the NOAA James J. Howard Laboratory in Sandy Hook, NJ. Crabs were placed in individual flow through containers that allowed collection of newly hatched larvae. First stage zoea larvae were obtained from one female that hatched in captivity. Larvae were transferred to an experimental diet system consisting of two temperature baths at 9°C and 15°C, with 10 buckets each. Each bucket held 3 containers with 10 larvae for a total of 60 larvae per diet. Three diets were administered daily: rotifers, algae (T-Iso), and unfed control. Temperature, survival, and number of molts in each container were recorded daily. Larvae raised at 15°C exhibited faster development but lower survival than those held at 9°C. The rotifer diet produced higher survival and development rates at both temperatures. Understanding developmental requirements will facilitate further research on red crab biology and impacts of climate change.

Paola Lopez-Duarte
Rutgers University Marine Field Station
609-296-5260 (x280), lopez-duarte@rutgers.edu

Thomas Grothues, RUMFS
Rose Petrecca, RUMFS
Ken Able, RUMFS

Habitat use by horseshoe crabs in Great Bay, NJ: new insights from a small estuary

Horseshoe crabs (*Limulus polyphemus*) have a wide distribution along the Atlantic and Gulf coasts of North America. Once considered an abundant resource, reports of their decline are widespread. Their uses in the biomedical industry, the fishing industry, and habitat loss have been cited as contributing factors for this decline. Much of what we know about horseshoe crabs comes from research conducted in Delaware Bay, where the highest concentrations of mating adults migrate each spring. Research has focused extensively on the adults, but also their eggs, an important food source for migrating birds. Less is known about the larval and juvenile stages. As a result, we have a limited understanding of the role of habitats in other, smaller estuaries to the population status of this species, and the temporal and spatial distribution of early life history stages. The objective of this study was to summarize multiple years of data on the occurrence, abundance, and habitat use of horseshoe crab larvae, juveniles, and adults in Great Bay, a smaller estuary in New Jersey. In this presentation, we describe the seasonality of larval supply in Great Bay based on plankton samples from a 10-year time series, the seasonal distribution of horseshoe crabs on the NJ shelf based on trawl surveys, and the sampling effort in the estuary based on a variety of gear types. In addition, we describe the results of laboratory experiments on burial behaviors of juvenile horseshoe crabs, a potential mechanism by which they can avoid the sampling gear.

Paul Robert Jivoff
Rider University
609-895-5421, pjivoff@rider.edu

Laura Moritzen, Amber Barton, Jade Kels, Julie McCarthy, Amanda Young, Pilar Ferdinando, Frank Pandolfo, Chelsea Tighe...all Rider University

Potential impact of hurricane Sandy on blue crabs, *Callinectes sapidus*, in Barnegat Bay, NJ: Did the Sedge Island Marine Conservation Zone offer protection?

Currently, estimates of hurricane Sandy's impact on ecologically or economically important species are rare. Using three data sets, all occurring in 2012 (pre-Sandy) and 2013 (post-Sandy), we investigated the potential impact of Sandy on blue crabs by comparing annual variation in abundance of different life history stages. Trap sampling showed the abundance of adults was similar between years. However, in sampling with trawls, 52% fewer juveniles were captured post-Sandy versus pre-Sandy, particularly 10-30mm sized crabs in June. Reductions were essentially bay-wide, occurring in all but one sampling area and habitat. This suggests that Sandy had a negative impact on blue crabs that recruited to the estuary in the late summer-early fall of 2012 (before Sandy). Results from sampling inside versus outside the Sedge Island Marine Conservation Zone (SIMCZ) indicate: reduced abundance post-Sandy but only outside the SIMCZ, and a reversed pattern of abundance at the locations between years with greater abundance inside the SIMCZ after Sandy, thus the SIMCZ may have buffered the effect of Sandy. Sandy may not be the sole explanation of the annual variation we observed but the consistency between data sets and the bay-wide nature of the results, suggest that Sandy had a negative impact on blue crabs in Barnegat Bay.

Richard Wong
Delaware Division of Fish and Wildlife
302-735-2975, Richard.Wong@state.de.us

Michael Steiger Delaware Division of Fish and Wildlife
302-735-2980 Michael.Steiger@state.de.us

A modern day fisheries classic – The rise and fall of a major new fishery in Delaware. The knobbed whelk, its biology, and management

A rarity occurred at the start of the new millennium, as a massive, new fishery suddenly emerged in Delaware. In 2001, knobbed whelk dredge landings rose sixty-fold in one year to 1.8 million pounds. Together with channeled whelks, landings averaged 2.4 million pounds until reaching the rank as Delaware's largest fishery in 2003. A sharp, steady decline in landings and fishery catch-per-unit-effort ensued until conservation measures went into effect in 2007.

Extensive study of the age, growth, and reproductive biology of knobbed whelk has been undertaken since 2004. New findings are incorporated into the management of the fishery. Advances in aging methodologies have occurred, transitioning from operculum structures to microscopic statoliths. It takes five years to reach maturity (females) and seven years to recruit into the fishery.

Oocyte development and reproductive maturity were initially described by macroscopic staging and later verified by histology. Oocyte development is synchronous, with first spawning (L50%) of females occurring at 5 inches. There is little evidence of spawning seasonality. Spawning frequency may be intermittent, given a lengthy and costly reproductive cycle.

Symone Johnson
Department of Agriculture and Natural Resources, Delaware State University, Dover, DE

Dewayne A. Fox
Department of Agriculture and Natural Resources, Delaware State University, Dover, DE
Bradley M. Wetherbee
Department of Biological Sciences, University of Rhode Island, Kingston, RI

Taking the Initiative to Conserve Sand Tigers (*Carcharias taurus*) in Delaware Bay

Sand Tigers (*Carcharias taurus*), although seldom encountered in most of North America, inhabit Delaware Bay in large concentrations during summer months playing a key role as apex predators. Unfortunately, overexploitation and life history traits have contributed to the species being listed as a Species of Concern. As a result, we are developing a conservation plan to assist in recovery of Sand Tigers in the mid-Atlantic, our focus being on Delaware Bay, to levels that would prevent a future listing under the Endangered Species Act. We work in partnership with local and national governments, partner organizations, and local communities to scale conservation results. A major component of the plan includes an angler survey developed with the assistance of Delaware Department of Natural Resources and Environmental Control. The goal of our survey is to gauge marine anglers' attitudes toward shark fishing in Delaware waters with an emphasis on prohibited species. This program takes a multi-perspective approach for building a conservation plan for sand tigers incorporating research, application of research findings, and education.

Sunny Jardine
University of Delaware

Fishermen, Markets, and Population Diversity

Fishing impacts biodiversity on multiple levels, potentially resulting in unintended feedbacks to economic performance of the fishery over time. For example, targeting observable traits within a population can impact genetic diversity, targeting populations within a species can impact population diversity, and targeting valuable species can impact biodiversity at the ecosystem level. The natural science and economics literatures, however, have given little attention to the impact of fishing on population diversity, even though population diversity is directly linked to readily measurable values from ecosystem services and estimates of population extinction rates are three orders of magnitude higher than species extinction rates. Here we develop a bioeconomic model that links the harvest of multiple salmon populations by a single commercial fishery to the trajectory of salmon population diversity. We parameterize our model with biological and economic data from the Copper River Chinook salmon fishery. We show that markets can incentivize the degradation of population diversity, reducing infra-marginal fishery rents. Factors impacting the magnitude of our results include the level and distribution of harvesting efficiency and market conditions. We also show that second-best management can conserve population diversity and improve welfare. Furthermore, depending fishermen's time preferences, this management strategy is potentially self-financing.

Simon. P. Oliver University of Chester, Chester, UK

*Thomas M. Grothues (Presenter), Rutgers University Marine Field Station, New Jersey, USA
Amie L. Williams, The Scottish Association of Marine Science, Oban UK
Veep C. Cerna, Thresher Shark Research and Conservation Project, Malapascua, PI

Acoustic Telemetry of Pelagic Thresher Sharks (*Alopias pelagicus*)

The Pelagic Thresher Shark (*Alopias pelagicus*) has a pelagic Indo-Pacific tropical/subtropical distribution and is the least well studied of three congeners. However, some individuals are predictably observed when they visit the top of a protected seamount, Monad Shoal, in the Visayan Sea, Philippines, for grooming by cleaner wrasse. A dive tourism economy has developed on the nearby island of Malapascua dependent largely on this unique opportunity. The stability/ vulnerability of this economy depends on the frequency with which individual sharks utilize the cleaner sites in conjunction with the total number of sharks that use them, the vulnerability of that population, and the fidelity of sharks to individual cleaner stations. Additionally, the value of grooming as an ecological driver is interesting but largely unquantified. To address these questions, divers attached individually-coded acoustic transmitters with temperature and pressure sensors to 14 Pelagic Thresher Sharks in June 2014 and followed them by boat from departure until as far as their return to the seamount. Additionally, 4 moored hydrophones logged return visits to cleaner stations over a 3 month period. Sharks often used a common route to move northeast of the seamount before dispersing along Leyte Island's western coast and returning to the seamount within one to 3 days. During this time they made frequent steep dives from 60 to 250 m encountering temperatures between 13 and 34 oC. Future work will seek to fit these data to a population estimate that includes seasonal variation and connectivity with the wider exploited population.

Poster Presentations

Andrew Kluge
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE 302-857-6476, galapaghost@yahoo.com

John Jackson, Stroud Water Research Center, Avondale, PA
Gulnihal Ozbay, Department of Agriculture and Natural Resources, Delaware State University, Dover, DE

Determining the Population Density of the Freshwater Mussel (*Elliptio complanata*) in the Brandywine Creek

The freshwater mussel is considered to be the most imperiled group of plants or animals in the United States. Out the approximately 300 species that were formerly common locally, 30-40 are now extinct and over 100 others are seriously declining. The Population density, age distribution of mussels from the Brandywine Creek is being investigated. Mussels are being measured, weighed, and their shells sliced to count the annual growth rings on the shell to determine if the population is reproducing. Although a population may seem healthy due to numbers, it may not produce offspring. Reasons for non-production may be due to an invasive Asian clam (*Corbicula fluminea*) whose entire populations die off in waves, adding ammonia to the stream and substrate. We are trying to link the age of the mussels to the date in which the Corbicula were first found in the stream. Ultimately, data collected during this study brings new information and knowledge to help with the management decisions of this near imperiled freshwater mussel species (*Elliptio complanata*) in local watersheds.

Collin Dobson
Haskin Shellfish Research Laboratory Rutgers University
609-501-4437, Cdobs09@gmail.com

Sarah Borsetti, Sean Martin, Eleanor Bochenek, and Daphne Munroe,
Haskin Shellfish Research Laboratory Rutgers University

Waved Whelk (*Buccinum undatum*) in the Mid-Atlantic Bight: Biology of Commercial Catch and Population Distribution

A fishery is developing in the Mid Atlantic Bight for Waved Whelk, *Buccinum undatum*. The life history characteristics of this species, including the lack of a planktonic larval stage, may make this species susceptible to localized overfishing. Lack of planktonic larvae and limited dispersal could create spatially distinct populations with unique biological characteristics. This project aims to provide data concerning the biology of the commercial catch and to determine the population distribution of whelk in the Mid-Atlantic Bight. Whelk samples from the fishery were collected from five locations off of New Jersey aboard a commercial fishing vessel. Biological measurements, including shell morphometry and biomass, were made on the whelk in these samples. Significant differences in whelk phenotype were evident among fishing locations. Whelk fished from two sites were found to be significantly larger than those from the other locations. Female whelk from all sites were significantly larger than males, and mature males were significantly larger than immature males. These significant differences in phenotype may suggest limited population connectivity which could contribute to localized species vulnerability. Limited dispersal poses a significant challenge to management because localized populations could quickly become overfished. The distribution of *B. undatum* in the Mid-Atlantic Bight was assessed using images of the seafloor taken with the habitat camera mapping system (HabCam). These images were analyzed to determine the number and location of whelk on the shelf. High abundances were noted near Hudson Canyon South and Elephant Trunk, which are both currently popular commercial fishing areas.

Foudan Salem
Delaware State University, Department of Agriculture & Natural Resources
302-857-7137, fsalem@desu.edu

Gulnihal Ozbay
Delaware State University

HYPERSPECTRAL REMOTE SENSING FOR MONITORING INTERACTIONS BETWEEN TURBIDITY AND NUTRIENTS DYNAMICS IN THE BLACKBIRD CREEK, DELAWARE

Estuaries receive continuous inputs of nutrients from their fresh water sources. But the fate of the inputs is poorly known. Hyperspectral remote sensing with high spectral and spatial resolution was used for monitoring environmental changes in optically complex turbid environments. Nutrients can be measured by monitoring water quality with estimating distributions of biogeochemical activity. Image classification of biogeochemical constituents can be used to develop models to map water quality characteristics of the estuarine and freshwater tidal wetlands in the Blackbird Creek (BBC). Environmentally sensitive sites such as BBC can be quickly and accurately mapped, measured, and characterized. The upland land use in the creek basin is primarily agriculture and forested. The amount of direct physical alteration can be estimated by monitoring the distribution of turbidity, sediments and phytoplankton, which are coupled with physical processes. Specifically, our objective is to develop new technique using spectral analysis for monitoring water constituents to determine high productivity zones and actual field measurements in the BBC. The Spectral analysis can determine the level of suspended sediments concentration areas and identifying shoreline features. Hyperspectral image analysis for (AISA) data shows longitudinal gradients in turbidity in the creek that mirror the distribution of suspended sediments and tidal waters. Physical processes include tidal water; turbidity and sediments movements in the bay can be detected, and gives detailed understanding of the interaction between turbidity and estuarine nutrients dynamics. The study can help to understand the physical processes relationships with water nutrients and productivity.

Katie Ommanney
Delaware State University, 1200 North DuPont Highway, Dover, DE 19901
302-857-6476, kommanney88@gmail.com

Matthew Stone, Kris Roeske, Laurieann Phalen, and Gulnihal Ozbay
Delaware State University

Investigation of Nekton Richness in Relation to Salt Marsh Grasses in Blackbird Creek, Delaware

Blackbird Creek is located in New Castle County, Delaware and flows into the Delaware River and is considered one of the most pristine salt marshes in the state. However, the invasive grass species *Phragmites australis* appears to be more capable of adapting to changing climate then native grasses, has become the more prevalent vegetation, and is changing the landscape of Blackbird Creek. The objective of this project was to identify if the grasses themselves could force shifts in aquatic biodiversity based on bottom-up trophic dynamics. Sample sites were chosen based on the dominance of particular marsh grass species; one dominated by native *Spartina sp.*, a second dominated by *P. australis*, and third which contained a mix of the two grass types. Otter trawling was conducted during the summer months of 2012 through 2014 in order to identify local aquatic nekton at these sites. While there was a greater number of species found in the Spartina site, there was no significant difference in species richness between the sites. Research is ongoing and more data is required to determine potential impacts of the grasses on food web dynamics and, thus, aquatic diversity in the creek.

Sean Martin
Rutgers University
862-266-3013, martinsean89@gmail.com

Dr. Eleanor A. Bochenek, Rutgers University

An Electronic Vessel Trip Reporting Program For New Jersey's Commercial Fishermen

The electronic vessel trip reporting program is a partnership with the Garden State Seafood Association, Lunds Fisheries, Atlantic Capes Fisheries, Viking Village, North Atlantic Clam Association, Coonamesett Farm Foundation, Rutgers University's Cooperative Fisheries Program, and National Marine Fisheries Service NEFSC Cooperative Fisheries Program. The goal of this project is to help facilitate and demonstrate the effectiveness of electronic vessel trip reports (eVTR) using FLDRS (Fisheries Logbook and Data Recording Software). FLDRS was developed by NMFS to provide commercial fishermen a method to electronically report their catch and bycatch on a tow-by-tow basis, which will greatly increase the amount and quality of data utilized by fishery managers. The vessel will send the eVTR to NMFS by email after the trip is completed. Catch per unit effort will be far more accurate because FLDRS permits managers to see how long and where they were fishing, what gear was used, and even how many fishermen were on the vessel. Improved fishing data will allow more accurate fishery management plans by species and hopefully create more successful and long-lived fisheries. A total of 25 New Jersey commercial fishing vessels (primarily scallopers and draggers) are using FLDRS. Rutgers Fisheries Cooperative Center helps train the fishermen in the use of the software and trouble shoots issues as they arise at the dock and on the fishing vessel. Future plans are to expand the program to about fifty surfclam/ocean quahog vessels from Massachusetts to New Jersey.

Thomas Marcellin Grothues
Rutgers University Marine Field Station
800 c/o 132 Great Bay Blvd.
Tuckerton, NJ 08087

Gregg Sakowicz
Jacques Cousteau Coastal Center
130 Great Bay Blvd.
Tuckerton NJ 08087

Telemetry Infrastructure in the Mullica River/Great Bay Estuary as a Service of the Jacques Cousteau National Estuarine Research Reserve

A series of 4 Vemco VR2W hydrophones are being deployed in the Mullica River Great/Bay Estuary to detect transmitter-tagged marine fauna as a service of the Jacques Cousteau National Estuarine Research Reserve (JCNERR). The infrastructure is intended to facilitate research both inside and outside of the JCNERR. Through colocation, the hydrophones will extend the utility of 4 water quality (temperature, conductivity, pressure [water level], pH, dissolved oxygen, and nutrient) monitoring stations across the estuary's salinity gradient. While the water quality data is available to the public through a central portal of the national System Wide Monitoring Program (SWMP) and can be mapped to tag detections through time stamps by the investigators, management of the hydrophone data recognizes tag deployers as the primary owners of detection data. Therefore, tag identification numbers and data will not be publicly available unless made so by the tagger. Instead, the JCNERR will utilize the existing Atlantic Cooperative Telemetry (ACT) Network to facilitate notification of trackers whose tags are detected. Metadata (total number of detections, total ids, timeline distribution, hydrophone deployment dates and location) will be posted to track performance and value of the array and the cooperation of taggers in reporting system value is encouraged for its continued existence.

Tyler O'Neal
Delaware State University, Department of Agriculture and Natural Resources, Dover, DE
302-857-6476, tponeal11@students.desu.edu

Laurieann R. Phalen, Katherine Ommanney, Matthew L. Stone, and Gulnihal Ozbay, Delaware State University

A Comparison of Bottom and Hanging Gear for Growing Eastern Oysters (*Crassostrea virginica*) in Broadkill Creek, Delaware "Tyler P. O'Neal

The use of bottom and hanging gear for growing hatchery raised American oysters (*Crassostrea virginica*) and deployed near the mouth of the Broadkill River in Lewes, Delaware was compared. Oysters ranging from 37-92mm shell height were placed in either grow-out bags and hung from a dock, or in weighted grow-out trays (bottom gear) placed in the intertidal benthic area. Oysters were randomly selected and their shell height and live weights measured to the nearest 0.1mm with digital calipers and 0.001g with a digital balance, respectively. Physical water quality parameters including temperature, dissolved oxygen, salinity, conductivity, pH, and total suspended solids, and chemical parameters (hardness and alkalinity) were also measured and compared. This study will provide information on the culture method that may be better suited for commercial aquaculture practices in Delaware.

NOTES: