33RD ANNUAL MEETING OF THE AMERICAN FISHERIES SOCIETY

TIDEWATER CHAPTER

February 7-9, 2019

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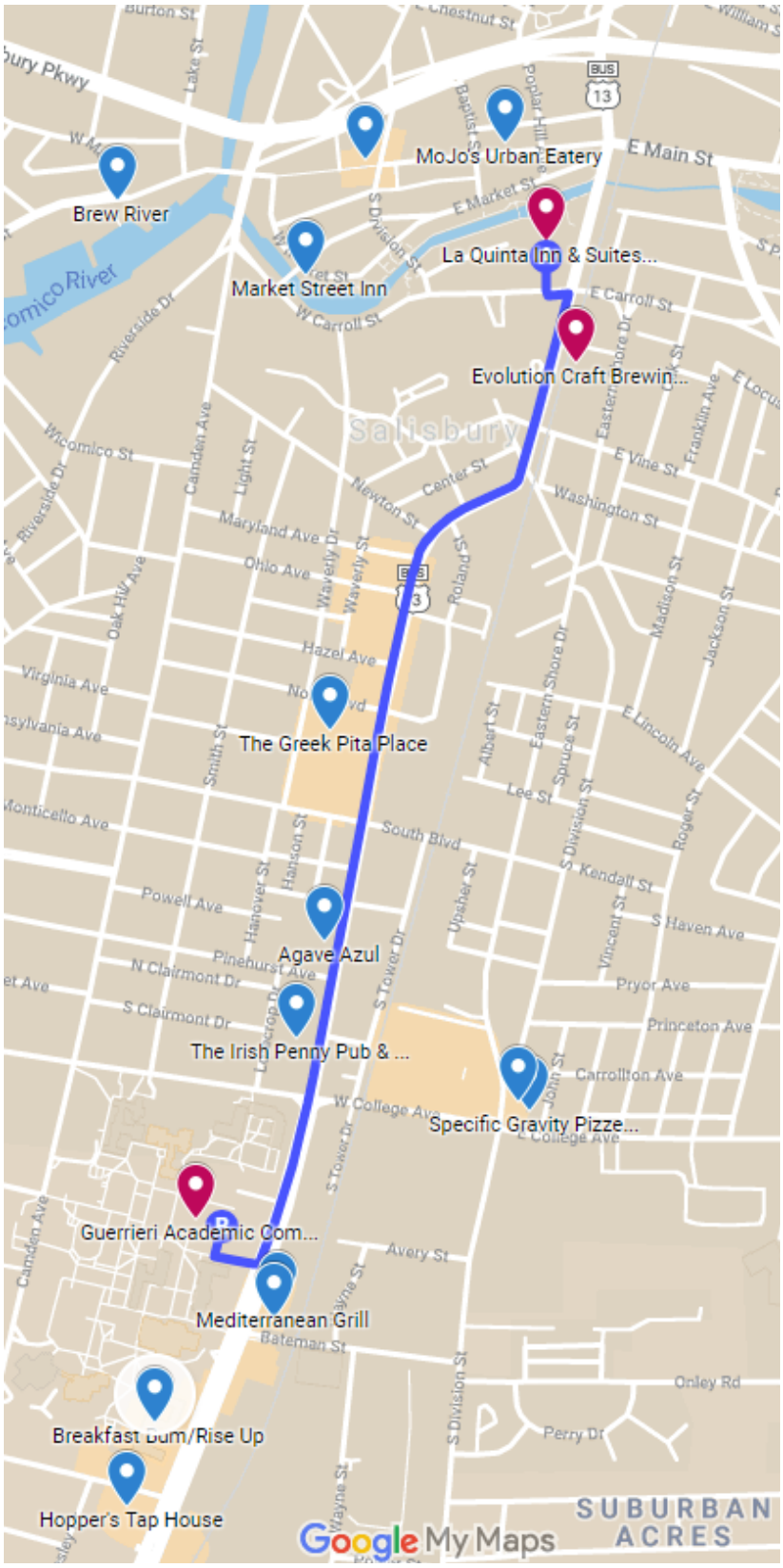

From La Quinta Inn to Guerrieri Academic Commons, Salisbury University:

- Turn left onto E Carroll Street.
- At the intersection, turn right onto US-13 BUS S/S Salisbury Blvd for 226 feet.
- Turn right into large parking lot in front of Guerrieri Commons building. It is the first parking lot on your right once you pass College Avenue.
- If you reach Bateman Street (on the left) you have gone too far.
- Visitors may park in the Visitor lot in front of Holloway Hall or any legal space designated for red, green, blue or gold permits.

Conference Venue: Guerrieri Commons, Salisbury University

Visitor & Off Campus Parking Information

- Visitors MUST DISPLAY a Visitor Parking Pass. The pass may be obtained free of charge from the Parking Services Office or online. If applying online, please submit your request **at least 48 hours** in advance of your visit at:

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- Visitors are responsible for all parking violations on campus.

Modified from: https://www.salisbury.edu/

AFS Tidewater Meeting Schedule Overview

February 7-9, 2019

Thursday, February 7, 2019:

Time	Event	Location
2:00 PM – 5:00 PM	Service Event - Trail Maintenance	Pemberton Park*
5:00 PM – 7:00 PM	EXCOM Meeting	La Quinta Inn & Suites
4:00 PM – 6:00 PM	Poster Set-up and On-site registration	Guerrieri Commons, Salisbury University**
6:00 PM – 9:00 PM	Poster Session and On-site registration	

*Service Event Venue: Pemberton Park - 5561 Plantation Ln, Salisbury, MD 21801

**Meeting and Poster Social Venue: Guerrieri Academic Commons, 4th floor - 1134 S Salisbury Blvd, Salisbury, MD 21801

Friday, February 8, 2019:

Time	Event	Location
7:30 AM	Registration Opens	Guerrieri Commons, Salisbury University
8:00 AM – 8:15 AM	Coffee and snacks	
8:15 AM – 8:20 AM	Welcome Remarks *Brad Stevens and Paul Rudershausen*	
8:20 AM – 8:30 AM	Welcome Remarks *Salisbury University Provost*	
8:30 AM – 9:10 AM	Plenary Talk *Tom Miller, Chesapeake Biological Laboratory*	

9:15 AM – 10:00 AM	Student Lightning Talks	
10:00 AM – 10:30 AM	Coffee Break	
10:30 AM – 12:00 PM	Student Oral Presentations	
12:00 PM – 1:30 PM	Lunch on your own (including student/mentor lunch)	Downtown Salisbury (see program for options)
1:30 PM – 3:00 PM	Student Oral Presentations	Guerrieri Commons, Salisbury University
3:00 PM - 3:15 PM	Break	
3:15 PM – 4:00 PM	Student Oral Presentations	
4:00 PM – 5:00 PM	Business Meeting	
6:00 PM – 7:00 PM	Social Hour	Evolution Craft Brewing Company*
7:00 PM – 8:30 PM	Dinner	
8:30 PM – 9:30 PM	Awards, Auction and Raffle	

*Social / Banquet Venue: Evolution Craft Brewing Company - 201 E Vine St, Salisbury, MD 21801

Saturday, February 9, 2019:

Time	Event	Location
8:00 AM – 8:30 AM	Coffee and snacks	Guerrieri Commons, Salisbury University
8:30 AM – 10:00 AM	Professional Oral Presentations	
10:00 AM – 10:15 AM	Break	
10:15 AM – 12:00 PM	Professional Oral Presentations	
12:00 PM	Meeting Adjourned	

Recommended Food Options

Restaurant Name	Address	Comments
Pat's Pizza	1151 S Salisbury Blvd	Within walking distance from campus.
Mediterranean Grill	1151 S Salisbury Blvd	Within walking distance from campus. Wraps, kabobs, falafel, hummus, fish, lamb, chicken, salads.
Agave Azul	934 S Salisbury Blvd	Latin American cuisine.
Specific Gravity Pizzeria & Beer Joint	105 E College Ave	Great spot for wings, tots, and pizza!
1 Fish 2 Fish Crabs & Seafood	1019 Eastern Shore Dr	
The Irish Penny Pub & Grill	1014 S. Salisbury Blvd	
Hopper's Tap House	1400 S Salisbury Blvd	Several eateries inside: BBQ, pizza, sushi, and more. Greenhouse, cornhole game, within walking distance.
Rise Up Coffee and Mad Eggs	105 E College Ave	Great locally ground and brewed coffee, egg sandwiches and specialties
Fratelli's Italian Restaurant	925 Snow Hill Rd	
The Greek Pita Place	800 S Salisbury Blvd	
Brew River	502 W Main St	Waterfront view seafood-heavy American menu & craft brews
Market Street Inn	130 W Market St	Waterfront view, American fare and local seafood, live music.

Plenary Talk

Climate change and Chesapeake Bay Fisheries

Tom Miller

The mid-Atlantic region and the Chesapeake Bay is expected to be particularly influenced by changes in climate. It is anticipated that these changes will involve changes in the species distributions, phenology and life histories that, in combination, have the potential to dramatic alter the socio-ecological systems that rely on the natural resources in the Bay. The nature and magnitude of these climate impacts arise from increases in water temperature which affect a broad suite of physiological and ecological processes, changes in the carbonate system (acidification) which will have both direct and indirect effects on many species, and sea level rise which may alter the distribution of habitat. Focusing on the effects of temperature and acidification in particular, this talk will explore examples of how Chesapeake Bay species are and will change in distribution, life history and productivity and how these changes are affecting the ecology and fisheries of the Chesapeake Bay ecosystem.

Poster Session Overview

(6:00-9:00 PM), Thursday February 7, 2019

Presenters will be at their posters from 6:30 to 7:30 PM

Easel #	Presenter (S = Student)	Poster Title
1	Arai, K. (S)	Sub-annual cohort representation in young-of-the-year juvenile recruits of the western Atlantic bluefin tuna population
2	Gallagher, R. (S)	Estimating stock structure of cobia (*Rachycentron canadum*) using acoustic telemetry
3	Nelson, L. (S)	The Skatey Bunch: Examining the relationships of clearnose and roundel skates using the ND2 mitochondrial gene
4	Cooper, J.	Eastern pearlshell (*Margaritifera margaritifera*) dominates the unionid mussel population in Scriba Creek, NY
5	Czarnecki, J. (S)	Bioaccumulation of selected pharmaceuticals and personal care products between primary producers and consumers in the tidal freshwater Potomac River
6	Drzewicki, M. (S)	Integrative assessment of the quality of shallow tributary forage habitats for striped bass in the Chesapeake Bay
7	Goldberg, D. (S)	Gone with the Wind?: Environmental and demographic factors contributing to large year classes of juvenile red drum in North Carolina
8	Aguilar, R.	Chesapeake Bay Barcode Initiative (CBBI): The first comprehensive genetic library for fish of the Mid-Atlantic US
9	Lee, T. (S)	Using digenean trematode diversity to inform status of estuarine fisheries
10	Lyon, R. (S)	Mortality and migration of hatchery-reared bay scallops *Argopecten irradians* in North Carolina seagrass beds
11	Marens, M. (S)	Movement and habitat use of female sand tiger sharks (*Carcharias taurus*) in North Carolina coastal waters
12	Biesack, E.	Population structure of *Rachycentron canadum* in the southeastern U.S.

13	Baldwin, A. (S)	Preliminary diet analysis of juvenile bull sharks (*Carcharhinus leucas*) in Pamlico Sound, North Carolina
14	Prescott, J. (S)	Hierarchical cluster analysis elucidates unique patterns of pre-migratory behavior of an endemic riverine population of striped bass (*Morone saxatilis*)
15	Fowler, A.	Field surveys and comparative parasitology of freshwater native and invasive snails in Virginia
16	Ropp, A. (S)	Genetic diversity of the hard clam, *M. mercenaria*, along the US East Coast
17	Stark, S. (S)	Variation in isotopic signatures at multiple spatial scales may reveal differences in suitability of settlement habitats for juvenile red drum
18	Lankford, T.	The UNCW fish collection: A resource of ichthyology research and education
19	Sherman II, J. (S)	Early ontogeny of *Alosa mediocris*
20	Gardner, S. (S)	The contribution of ontogenetic diet and habitat shifts to variable first-year growth in southern flounder (*Paralichthys lethostigma*)
21	Richie, K.	Building a database for the Mid-Atlantic acoustic telemetry community
22	Bialek, J. (S)	Abundances and seasonality of surf zone fishes: Implications for beach renourishment
23	Pereira, V. (S)	Exploring the Parasitic Dinoflagellate *Hematodinium perezi* and *Vibrio* Bacteria Coinfection in the Hemolymph of *Callinectes sapidus* from the Maryland Coastal Bays
24	Valenza, A. (S)	The ecophysiological response of juvenile southern flounder (*Paralichthys lethostigma*) growth to settlement habitat

Poster Abstracts

(presenting author listed in bold)

E1. **Authors: Kohma Arai** , John E. Graves , David H. Secor
Presenter Affiliation: U. of Maryland Center for Environmental Science - Chesapeake Biological Laboratory

Sub-annual cohort representation in young-of-the-year juvenile recruits of the western Atlantic bluefin tuna population

The western North Atlantic bluefin tuna fishery relies on individuals recruited principally from Gulf of Mexico spawning grounds although recruits also originate from the Mediterranean Sea. Recent discovery of bluefin tuna larvae in the western North Atlantic Slope Sea calls into question whether there is yet another source of recruits to the US bluefin tuna fishery. The period of larval production is 2 months later in the Slope Sea (late June to early August) than in the Gulf of Mexico (early April to mid-June). We tested whether age-0 juveniles occurring in the Mid-Atlantic Bight might originate from Slope Sea spawning by estimating the hatch date distribution based on otolith microstructural analysis. Hatch dates were estimated using whole otoliths of age-0 Atlantic bluefin tuna collected off Virginia in 2010 (n = 25). Each otolith was examined three times by an experienced principal reader, and the third count was used as the final age estimate. An additional three counts were conducted by a second reader to evaluate between-reader variation. Estimated age ranged from 92 to 146 (days post hatch) for fish that ranged from 23.2 to 36.3 cm (FL). Estimated hatch dates ranged from 18 April to 30 May, with majority of hatch dates occurring in mid-May 2010. This hatch date distribution corresponded to the spawning and larval production period for the Gulf of Mexico, known from decades of ichthyoplankton surveys to occur from early April through mid-June.

E2. **Authors: R.M. Gallagher,** J.R. Krause, J. A. Buckel
Presenter Affiliation: North Carolina State University Center for Marine Sciences and Technology

Estimating stock structure of cobia (*Rachycentron canadum*) using acoustic telemetry

Cobia (Rachycentron canadum) is a large pelagic fish whose landings have increased in recent years due to its popularity with recreational anglers. The South Atlantic Fisheries Management Council recently transferred Cobia management to the Atlantic States Marine Fisheries Commission, largely in response to a contentious federal closure of the Cobia fishery in 2016.

Management transitions have led to a call for more research on (1) subpopulations of cobia within the southeastern US (SEUS; e.g. inshore-offshore migrations vs north-south migrations) and (2) the geographic boundary for SEUS and Gulf of Mexico Cobia stocks. As part of a coast-wide initiative among multiple investigators, we are using telemetry tagging in North Carolina (NC) and Virginia (VA) and receiver arrays (ours in NC and other PIs in other states) to address questions about stock structure and boundary. In 2018, NC State University tagging crews telemetry tagged 54 Cobia and have detected 34 of the tagged individuals on receiver arrays between Florida and Maryland. Our findings will be important for future SEUS Cobia stock assessments and management.

E3. **Authors: Lindsey N. Nelson** and Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

The Skatey Bunch: Examining the relationships of clearnose and roundel skates using the ND2 mitochondrial gene

Clearnose skates, *Rostroraja eglanteria*, are flat bodied, benthic elasmobranchs distributed from Massachusetts to Florida and in the Gulf of Mexico. They are often incidentally caught in bottom trawl fisheries and discarded at sea. Unlike their more charismatic relatives, they have been afforded little attention by fisheries managers and conservation groups. Clearnose skates are managed as part of a Skate Complex in the Northern Atlantic and not managed at all in the Southern Atlantic or Gulf of Mexico. Before policies can be implemented or improved, more life history research is needed. In particular, population structure throughout their entire range must be examined before attempting to delimit stocks and monitor harvests. To assess the population structure of clearnose skates, specimens were collected from New York, South Carolina, and western Florida. The mitochondrial nicotinamide adenine dinucleotide subunit 2 (ND2) region was amplified and sequenced from 44 *R. eglanteria* (16 from NY, 14 from SC, 14 from FL). Additionally, 9 *Raja texana* specimens were included as an outgroup. Phylogenetic relationships among the resulting sequences are being examined for evidence of spatially structured clearnose skate populations.

E4. **Author: John E. Cooper**
Presenter Affiliation: Cooper Environmental Research

Eastern pearlshell (*Margaritifera margaritifera*) dominates the unionid mussel population in Scriba Creek, NY

Eleven species of freshwater mussels (Unionidae) were extirpated from Oneida Lake, NY, after the introduction of invasive zebra mussels in 1995 and quagga mussels in 2003. Scriba Creek flows into Oneida Lake on the northern shore near the village of Constantia. Adult mussels were

surveyed in Scriba Creek at nine sites located from 0.1 km to 13 km from Oneida Lake using visual and tactile search methods. Transects were parallel to stream flow covering an average search area of 9 m^2. Three species of mussels were collected: Eastern pearlshell, Eastern elliptio (*Elliptio complanata*), and Creeper (*Strophitus undulatus*). Eastern pearlshell was most abundant at six sites (85% of living mussels collected), Eastern elliptio was most abundant at one site (83%), and two sites had no mussels. Mussel density declined in a downstream direction from an average of 4 mussels/m^2 at the upper seven sites to 0.2 mussels/m^2 at the lower two sites. Four muskrat middens were found but only in one year and at only one site. Predation was primarily on Eastern pearlshell (99 %) with a size distribution (65 to 107 mm SL) similar to that of living Eastern pearlshell (73 to 108 mm SL). Unionid mussels survive in the tributaries of Oneida Lake because zebra and quagga mussels cannot persist in a unidirectional flow without recruitment from upstream, which is lacking in Scriba Creek.

E5. **Authors: Julia Czarnecki**, Thomas Huff, Greg Foster, Duane Hugget, Amy Fowler
Presenter Affiliation: George Mason University

Bioaccumulation of selected pharmaceuticals and personal care products between primary producers and consumers in the tidal freshwater Potomac River

Increased concentrations of contaminants flow into our waters ways every year and pose a threat to the aquatic ecosystems. Pharmaceuticals and personal-care products (PPCPs) are amongst these contaminants that enter our lakes, rivers, and streams (Snyder 2009). Medicines and other constituents found in household products like creams, shampoos, or cleaning products, enter the environment from municipal wastewater, septic systems and runoff (Harvard Health 2011). Although there is little knowledge about impacts on the environment (Foster and Huff personal communication 2017), we are aware that PPCPs can lead to sex change in fish and occur in our drinking water (Snyder 2010). It also results in a health risk to those who continue to consume aquatic species infected with PPCP bioconcentrations. This project will strengthen ecotoxicologists' knowledge to detect and respond effectively to new and existing PPCP concentrations. Specifically, this research will confirm the identities of the toxic PPCP contaminants found in the upper Potomac River and improve our knowledge on current distributions. Outcomes that should be expected from this project include a dataset of the presence and abundance of PPCPs, new and current, in the upper Potomac River, enabling surveyors and scientists to update database record and distribution maps. This includes a broad range of audiences, including statewide fishing organizations, Chesapeake Bay alliances, George Mason science department's current dataset, and USGS records just to name a few. Data and analysis collected will provide transformative, integrated education and communication, and assist policymakers on state or federal levels.

E6. **Authors: Maya R. Drzewicki**, Keira Heggie, Katrina M. P. Lohan, Matthew B. Ogburn , Anson

H. Hines
Presenter Affiliation: Smithsonian Environmental Research Center

Integrative assessment of the quality of shallow tributary forage habitats for striped bass in the Chesapeake Bay

Striped Bass (Morone saxatilis) support an important commercial and recreational fishery with a substantial fraction of the coastal stock concentrated in the Chesapeake Bay watershed. As an important predator of forage species (Menhaden and Blue Crabs), Striped Bass may be indicative of the relative quality of tributary forage habitats. The overarching goals of this study are to identify key prey species in shallow tributary habitats and evaluate the relative quality of tributaries as foraging habitat. Young of the year (YOY), juvenile (aged 1-4), and adult Striped Bass were collected from tributaries of the upper Chesapeake Bay during 2018. Fish were measured for total length and fork length, weighed, and dissected to obtain tissue and liver samples for stable isotope analysis; gut contents for a morphological and genetic barcoding examination of prey species; and otoliths for age and growth determination. Fish samples were also analyzed for parasite prevalence. Ultimately, we hope to link diet to body condition across various life stages, seasons, and tributaries as well as to identify key prey species. In this preliminary report, we compare size, body condition, and body cavity parasite prevalence of age 1-4 and adult fish. Taking an integrated approach to understanding linkages between habitat and fisheries is vital in the transition to ecosystem-based fisheries management.

E7. **Authors: Danielle A. Goldberg** and Frederick S. Scharf
Presenter Affiliation: University of North Carolina–Wilmington

Gone with the Wind?: Environmental and demographic factors contributing to large year classes of juvenile red drum in North Carolina

The identification of factors contributing to strong year classes of marine fishes has been a constant goal to improve the understanding of recruitment variability. In 1991, the North Carolina Division of Marine Fisheries initiated a yearly survey to estimate the relative abundance of juvenile red drum to serve as a recruitment index. Here, we hypothesize that several hydrological and atmospheric variables may contribute to reproductive success and larval transport, and at least partially explain the periodic occurrence of large year classes. Specifically, we plan to examine late summer and fall coastal water temperatures, chlorophyll-a concentrations, and nearshore wind stress for their influence on year class strength, based on the potential for these factors to affect egg and larval survival and transport. We plan to examine interannual variation of catch and body size distributions to identify possible associations between year class strength, larval delivery, and growth rates. We will apply generalized linear models to quantify the variance in year class strength explained by environmental forcing variables and identify the functional relationships with arrival timing and

growth. This project will build upon previous efforts to understand important processes shaping recruitment in red drum near the northern edge of the species range.

E8. **Authors: Robert Aguilar**, Matthew B. Ogburn, Amy C. Driskell , Kenneth S. MacDonald III, Lee A. Weigt, Anson H. Hines
Presenter Affiliation: Smithsonian Environmental Research Center

Chesapeake Bay Barcode Initiative (CBBI): The first comprehensive genetic library for fish of the Mid-Atlantic US

DNA barcoding is a powerful tool to investigate biodiversity, food webs, wildlife forensics, and ecosystem services. The ecological utility of reference libraries are greatly improved when they are validated, possess vouchers and detailed metadata, and are regionally based. Although the Chesapeake Bay (CB) is the largest estuary in the United States and a major focus of early fisheries research, there has been minimal genetic sequencing effort and a paucity of museum collections in the last century. We provide the first comprehensive *COI* barcode library for fish of the greater CB/mid-Atlantic region. Associated with each sequence are photographic, tissue, DNA, and museum vouchers and detailed metadata. All vouchers are housed in the Smithsonian National Museum of Natural History's collections and sequences and metadata will be publicly available via GenBank and BOLD. To date, we have sequenced the majority of the bay's fish fauna (>220 species). Neighbor-joining analysis based on K2P genetic distances formed non-overlapping clusters for most species, but we found evidence of divergent lineages, incomplete separation, and cryptic hybridization in several important species, as well as possible non-native introductions.

E9. **Authors: Timothy S. Lee** and April M.H. Blakeslee
Presenter Affiliation: East Carolina University

Using digenean trematode diversity to inform status of estuarine fisheries

Digenean trematodes have life histories that require three host organisms to complete their life cycles. In the U.S. east coast's estuaries there are nine identified species of trematodes which infect eastern mudsnail *Tritia obsoleta* (T.O.) as its first intermediate host and infects a second intermediate host (polychaetes, crustaceans, fish, or mollusks) followed by infecting a final definitive host (often seabirds or fish). These estuaries have also been colonized by non-indigenous red seaweed *Gracilaria vermiculophylla* (G.V.), a macroalga that provides shelter and nursery grounds for variety of invertebrates, including T.O. We predicted that habitats with G.V. have higher prevalence of T.O. infected with trematode species that use birds or fish as definitive hosts, because larger biomasses of G.V. can host ample abundance of macroinvertebrates prey for migratory fish and birds alike. We sampled T.O. in four estuarine sites of eastern shore, Virginia in fall 2018 and found 10.58% infection rate of all T.O. dissected

(n = 567). Of the infected T.O., 35% and 38.33% were infected with trematodes requiring seabirds and fish as definitive hosts respectively. We found that prevalence of T.O. infected with trematodes using fish as definitive host was 38% in sites with low to no G.V. presence while it was 45% in sites with high G.V. biomass. Trematode diversity of infected T.O. in habitats colonized by G.V. can be a useful indicator of predicting varying abundances of migratory fish and birds in the region. Furthermore, trematodes can be a tool to inform fisheries status locally and regionally.

E10. **Authors: R. Patrick Lyon**, David B. Eggleston, Gabriel J. Hopkins, Charles R. Weirich, Ami Wilbur, David Cerino
Presenter Affiliation: North Carolina State University

Mortality and migration of hatchery-reared bay scallops *Argopecten irradians* in North Carolina seagrass beds

With oyster aquaculture rapidly developing in North Carolina, shellfish crop diversification may allow for more resilience against loss due to disease or water quality issues. The bay scallop, *Argopecten irradians*, is a significant component of shellfish fisheries in the eastern United States and has historically contributed much to North Carolina's commercial fisheries. However, due to red tides, habitat loss, and increased numbers of predators, the bay scallop fishery in North Carolina has been non-existent since the late 1980s. Introducing cultured bay scallops to habitats where native populations once thrived could provide another option for shellfish fisheries in North Carolina, as well as potentially restore wild stocks that could support future harvesting. We conducted a mark-recapture experiment with hatchery-reared bay scallops in estuarine seagrass beds starting in late June 2018 and terminating in late August 2018. Scallops were deployed in three density treatments: (i) low (2 per m^2), (ii) medium (4 per m^2), and (iii) high (8 per m^2) in a square-within-a-square design to quantify mortality and migration over time. Preliminary results indicate that initial scallop mortality is very high (> ~50%), and that scallop mortality decreases with increasing seagrass density. Additionally, the mean cumulative mortality of hatchery-reared bay scallops may be less for those in medium densities, which better represent natural abundances, than low or high densities. Based on the amount of broken shell present at the sites, we believe that the major influence on scallop mortality was predation. Using mesh to exclude predators like crabs and rays could potentially result in lower initial scallop mortality after deployment.

E11. **Authors: Madeline M. Marens,** Dewayne A. Fox, Bradley M. Wetherbee, Amanda S. Williard and Frederick S. Scharf
Presenter Affiliation: University of North Carolina - Wilmington

Movement and habitat use of female sand tiger sharks (*Carcharias taurus*) in North Carolina

coastal waters

In the western north Atlantic, sand tiger sharks (*Carcharias taurus*) are distributed from the Gulf of Maine to the Gulf of Mexico. The seasonal reproductive cycle of C. taurus includes extensive (100's km) seasonal migrations. Coastal waters off North Carolina serve as a migratory corridor, but the degree of residency in these waters is unknown. Aggregations of C. taurus have been observed near previously hypothesized birthing areas along the southern US Atlantic coast and are presumed to be associated with seasonal reproductive movements. However, patterns of seasonal residency, habitat use, and migration patterns at finer spatial scales are lacking. From 2016-2018, 32 mature female sand tiger sharks were equipped with internal acoustic transmitters to identify habitat use and movement patterns along the NC coast (between Cape Fear and Cape Lookout). Residence time was quantified to identify essential reproductive habitats using passive tracking techniques. On-board ultrasound imaging confirmed 14 pregnant female sharks at the time of tagging in various early-mid term stages. Preliminary findings of seasonal residency have been found for 9 individuals in North Carolina surrounding Cape Lookout from November 2017 to May 2018. 4 sharks showed patterns of residency in North Carolina over 7 days (CRT= 9-124 days) during this period. More extensive movements of 12 individuals were also observed throughout the western North Atlantic. Additional tagging and tracking will take place in 2019 to refine our understanding of habitat use patterns of the North Carolina coast as well as compare habitat use between active and resting mature female sharks.

E12. **Author: Ellen E. Biesack**
Presenter Affiliation: Virginia Institute of Marine Science

Population structure of *Rachycentron canadum* in the southeastern U.S.

Cobia (*Rachycentron canadum*) is a coastal pelagic species that supports a robust recreational hook-and-line fishery in the western central Atlantic and Gulf of Mexico. Cobia are known to be migratory, with some individuals traversing much of the southeastern United States coastline annually. Though study of migration patterns and spawning behaviors have been supported by large efforts in mark-recapture programs, not much is known about the population genetic structure of these harvested fish. Tissue samples were collected for genetic analysis from 14 locations from Louisiana to Virginia, including both the Gulf and Atlantic coasts of Florida and several sites in the Chesapeake Bay. When possible, analyses were restricted to samples collected during the known spawning period of cobia (late spring and summer) and from mature adults (>36 inches). Twenty-six microsatellite markers were tested, multiplexed, and amplified for a final dataset of >650 samples. This wide-scale (Gulf vs. Atlantic) and local (Chesapeake Bay) characterization of genetic structure in cobia populations will provide important data to managers of this growing fishery.

E13. **Authors: Ariana A. Baldwin,** Charles W. Bangley, Robert Aguilar, Matthew B. Ogburn
Presenter Affiliation: Smithsonian Environmental Research Center

Preliminary diet analysis of juvenile bull sharks (*Carcharhinus leucas*) in Pamlico Sound, North Carolina

A recent expansion in the nursery range of an apex predator has been observed in Pamlico Sound, North Carolina. Prior to 2011, juvenile Bull Sharks (Carcharhinus leucas) were rarely captured in the North Carolina Division of Marine Fisheries (NCDMF) fishery-independent gillnet survey, but have been captured at an increasing rate from 2011-2018. The presence of juvenile Bull Sharks in this estuary will likely have significant ecological impacts; however, these impacts are currently unknown. Stomach contents were collected from 10 juvenile Bull Sharks that were mortalities in the NCDMF survey. The percent weight (%W), percent number (%N), and percent occurrence (%O) were calculated and used to calculate the percent Index of Relative Abundance (%IRI) for each prey species or group. Results indicated a broad generalist diet, with unidentified teleost fishes as the most important component, making up 74% of the diet by weight. Crustaceans may also be an important prey group, occurring in 60% of the individuals. Fishing gear was found in 20% of Bull Shark stomachs, which may be indicative of interactions with recreational fisherman. Further genetic analysis will identify prey to species. This study is a first step in evaluating how juvenile Bull Sharks will alter the ecology of Pamlico Sound.

E14. **Authors: James C. Prescott**, Joseph F. Facendola , and Frederick S. Scharf
Presenter Affiliation: University of North Carolina - Wilmington

Hierarchical cluster analysis elucidates unique patterns of pre-migratory behavior of an endemic riverine population of striped bass (*Morone saxatilis*)

Understanding the movement ecology of fishes can aid in conservation and management. For anadromous species, identifying patterns and pathways of migration can considerably enhance the effectiveness of spatial and temporal management approaches. During 2012-2015 we examined the movements and residency patterns of acoustically-tagged striped bass (n = 225) endemic to the lower Cape Fear River, NC. We applied hierarchical cluster analysis to daily location data specific to four seasonal periods each year. Clusters were based on aggregated similarity scores weighted by distance traveled from a core habitat area used throughout the year. As expected, the analysis identified three primary behavioral clusters during the spring migratory season each year. However, the analysis was also able to reveal behavioral clustering outside of the spring migratory season, and also interannual variation in the extent of migration

during the spring migratory season. Unique pre-migratory behaviors were linked to future participation in migration, and behavioral clusters often displayed temporal stability over seasons and years. Overall, the hierarchical approach revealed differing degrees of intra-seasonal migratory behavior and temporal plasticity with respect to migratory behavior that would not have been observable with more traditional approaches.

E15. **Authors: Amy E. Fowler** and April MH Blakeslee
Presenter Affiliation: George Mason University

Field surveys and comparative parasitology of freshwater native and invasive snails in Virginia

Invasive species are often detrimental to native flora and fauna and can also carry parasites that may be of human concern. Differences in infection susceptibilities between native and invasive hosts have been shown to modulate aquatic invasions and contribute to the success of invasive species in areas where native snails are more heavily parasitized. We surveyed native and invasive freshwater snails at six sites in Northern Virginia in summer 2018, targeting invasive mystery snail populations. Native and invasive snail populations were hand and visually surveyed for 1 hour along a ~30m transect for abundance and diversity at a maximum water depth of 1m. At least 100 individuals of each invasive and native snail species along a size gradient were brought back to the laboratory, dissected and examined for parasite abundance and diversity. In addition to the invasive species, the following five native snail species were collected: *Campeloma decisum*, *Pleurocera virginica*, *Lymnaea* sp., *Physa* sp., and *Helisoma anceps*. Across all sites, mystery snails had lower average trematode prevalence (3.9%) than native snails (5.6%), but this was highly variable at the site level. The exact species identifications for the trematodes are undergoing genetic confirmations, but we suspect that there are at least five different species. Additional parasites found during dissections include ciliates and the symbiotic oligochaete of many molluscs, *Chaetogaster limnaei limnaei*. Knowing whether these invasive species have higher or lower parasite loads than native snails may be helpful in predicting future ecosystem-level impacts, if the snails continue to spread.

E16. **Authors: Ann J. Ropp**, Jan McDowell, and Kimberly Reece
Presenter Affiliation: Virginia Institute of Marine Science

Genetic diversity of the hard clam, *M. mercenaria*, along the US East Coast

The hard clam, *Mercenaria mercenaria* (Linnaeus, 1758) is distributed from the Gulf of St. Lawrence to the northern Gulf of Mexico and is an economically important aquaculture species along the US East Coast. Nationally, the estimated farm gate value for aquacultured hard clams was $112 million in 2015 with Virginia being the leading aquaculture producer. Despite

the economic value, there are very few genomic resources available to support hard clam aquaculture. Development of genomic resources will promote the hard clam industry by providing tools to monitor genetic variation in hatchery stocks, ensure the genetic integrity of hatchery lines, address the contribution of adults during spawning events, and differentiate among wild populations and hatchery lines. The initial focus of this study is the discovery of molecular genetic markers for the hard clam. Wild samples were collected at sites along the US East Coast including Harbor Cove (MA), Assateague (MD), Wachapreague Channel (VA), Mobjack Bay (VA), York River (VA), James River (VA), Bogue Sound (NC), and North Inlet (SC). Following DNA isolation, 144,575 single nucleotide polymorphisms (SNPs) were identified via high throughput genotyping by sequencing. SNP data was analyzed to delineate population structure and quantify the levels of genetic differentiation among populations. SNP data will be analyzed to identify a subset of loci capable of geographic discrimination and population assignment for inclusion in assay panels that will be available to growers and other researchers.

E17. **Authors: Sydney K. Stark**, Danielle A. Goldberg, Frederick S. Scharf
Presenter Affiliation: University of North Carolina - Wilmington

Variation in isotopic signatures at multiple spatial scales may reveal differences in suitability of settlement habitats for juvenile red drum

The choice of settlement habitat for newly recruiting fishes can impact patterns of post-settlement growth, primarily manifested through variable foraging environments. Stable isotopes present in multiple tissue depots can provide information on the primary source of carbon in different food webs and also quantify trophic levels of foragers. Juvenile red drum settle in a variety of estuarine habitats during the first month of life and likely encounter foraging environments that differ appreciably in space. We took advantage of a spatially extensive survey to collect juveniles from several systems and locations within those systems to examine patterns in isotopic signatures. We measured both δ^{13} C and δ^{15} N present in muscle and liver tissues of juvenile red drum collected in three different estuarine systems that each included habitats positioned along a salinity gradient. We found differences among the three systems, primarily in the δ^{15} N signatures, that suggested slight differences in the trophic levels of red drum. More striking were patterns of both δ^{13} C and δ^{15} N along the salinity gradient in both the New and Neuse River estuaries, with tissues being more enriched in C in the lower estuary (high salinity) and more enriched in N in the upper estuary (low salinity). We expected the observed gradient in δ^{13} C, which has been observed often in previous studies. The higher levels of δ^{15} N detected in the upper estuary, especially in the Neuse River, indicated that red drum which settled in low salinity habitats experienced a foraging environment that yielded a higher mean trophic level. On average liver tissues showed higher levels of δ^{13} C and lower levels of δ^{15} N relative to muscle tissue. We had limited contrast in red drum body size, but did observe some size-dependent trends in δ^{15} N. Further analyses are planned for specific habitat types within each of the estuarine systems.

E18. **Author: Tom Lankford**
Presenter Affiliation: University of North Carolina - Wilmington

The UNCW Fish Collection: A resource of ichthyology research and education

The University of North Carolina Wilmington's Fish Collection, established by the late Dr. David G. Lindquist, is maintained by the Department of Biology and Marine Biology and provides extensive material in support of ichthyological research and education. The research collection consists primarily of alcohol-fixed specimens and includes >32,000 catalogued and >20,000 uncatalogued specimens representing >340 genera and >700 species. Entries (>1,500 lots) span the period 1975-present, providing coverage of 1) marine fishes of the Carolinian province, 2) freshwater fishes of the lower coastal plain of the Cape Fear River drainage, 3) larval fishes of the Onslow Bay mid/outer continental shelf and adjacent Gulf Stream, 4) juvenile fishes from estuarine and ocean surf habitats in southeastern North Carolina, and 5) freshwater endemics of Lake Waccamaw. Geographic coverage includes limited material from Ecuador, California, Mexico, Bahamas, Florida Keys, and southern Appalachia. Also included is an undergraduate teaching collection of isopropyl-fixed juvenile and adult specimens representing >275 species common to the marine, estuarine, and freshwater habitats of coastal North Carolina, along with skeletal preparations, cleared and stained specimens, digital photographs and otolith voucher specimens. The UNCW collections are now digitized and we are working towards producing an online, searchable database. Housed within the UNCW vertebrate museum, the collections have reoccupied renovated facilities in Friday Hall. Ichthyologists interested in accessing the collection are encouraged to contact Dr. Tom Lankford, Curator of Fishes, at lankfordt@uncw.edu.

E19. **Authors: Jon H. Sherman II** and Roger A. Rulifson
Presenter Affiliation: East Carolina University

Early ontogeny of *Alosa mediocris*

During the spring of 2017 the developing eggs of hatchery-spawned Hickory Shad were photographed periodically through ontogeny (development) to the post-yolk sac stage. Those photographs have been enhanced for visual inspection. The goal of this project was to fully describe these various stages of development from fertilization of the egg through post yolk-sac. For each hour of observation, photos were selected depicting the range of characteristics developed, or forming, at that time. Characteristics were noted, measured, and annotated for verbal description. Representative photographs were selected and displayed serially to provide up-to-date representations of the developing stages.

E20. **Authors: Spencer T. Gardner**, Apria N. Valenza, and Frederick S. Scharf
Presenter Affiliation: University of North Carolina - Wilmington

The contribution of ontogenetic diet and habitat shifts to variable first-year growth in southern flounder (*Paralichthys lethostigma*)

Ontogenetic shifts in diet and habitat during the early life history of fishes can have large influences on growth and subsequent survival. Considerable variation in body size at the end of the first year of life is evident for southern flounder in North Carolina estuaries. Previous research suggests that age and settlement timing only contribute marginally to ~2-fold differences in length at age 1. We hypothesize that the timing or lack of ontogenetic shifts in diet and habitat may be largely responsible for observed growth variation in southern flounder. Our specific goals are to quantify the effects of diet and trophic level on recent patterns of growth, and to identify ontogenetic habitat shifts that may advance/delay dietary shifts. Beginning in January, we sampled the 2018 southern flounder cohort each month until fall. Stomach contents were analyzed to quantify the occurrence of piscine prey. Muscle and liver tissue samples were extracted for analysis of δ^{13} C and δ^{15} N to document habitat shifts and flounder trophic levels integrated over weeks to months. Otoliths were removed, sectioned, and are being examined to estimate growth rates in the most recent 30-45 d period. Stomach contents revealed an ontogenetic shift to piscivorous feeding which occurred at smaller body sizes within higher salinity (mesohaline) habitats relative to fish found in lower salinity (oligohaline) habitats. Analysis of δ^{15} N supported the stomach contents findings, with flounder occupying higher salinity habitats able to feed at higher trophic levels at smaller body sizes compared to flounder occupying low salinity habitats. Muscle and liver tissues produced δ^{13} C signatures that largely differed between low and high salinity habitats, with only moderate overlap. Differences in δ^{13} C between muscle and liver tissues were indicative of recent transitions from oligohaline to mesohaline habitats. When completed, patterns in otolith microstructural growth will be used to quantify the growth consequences of these diet and habitat shifts.

E21. **Authors: Kimberly D. Richie** and Matthew B. Ogburn
Presenter Affiliation: Smithsonian Environmental Research Center

Building a database for the Mid-Atlantic acoustic telemetry community

Acoustic telemetry is a common tool for fisheries research in the US Mid-Atlantic that is increasingly providing valuable data for fisheries management. Traditionally, acoustic tag detection data have been shared by email through the Atlantic Cooperative Telemetry Network (ACT). As ACT transitions into a new phase in 2019, we are working to bring the Mid-Atlantic Acoustic Telemetry Observation System (MATOS) online as a new tool facilitating data sharing for the ACT community. Supported by the US Animal Telemetry Network (ATN) as a regional

database node of the ATN Data Assembly Center, MATOS has the added advantages of storing transmitter and receiver metadata and managing tag detection data. MATOS also has a web-based user interface that highlights research projects, allows users to set permissions for data access, enables data upload and download, can display data using a mapping function, and can serve as a public repository for data to meet grant requirements. Anticipated updates will enable data integration with other telemetry networks including the Florida Atlantic Coast Telemetry Network (FACT) and Ocean Tracking Network (OTN), facilitating efficient data sharing and strengthening the animal tracking community.

E22. **Author: Jackson Bialek**
Presenter Affiliation: University of North Carolina - Wilmington

Abundances and seasonality of surf zone fishes: Implications for beach renourishment

The surf zone is a highly dynamic environment that hosts a large and diverse community of marine fishes, and frequently serves as important nursery habitat for commercially and recreationally important fish species. Sampling effort is often limited due to the high energy conditions that define this system, and as a result, fish assemblages in the surf zone are not well understood. A thorough understanding of fish communities will allow for the development of management policies that more effectively safeguard this ecologically important system and preserve its habitat function. We describe the fish assemblage inhabiting the surf zone of Wrightsville Beach, NC, as well as the seasonal variation exhibited by ten species of fish found in this habitat from 2004 to 2014. We also discuss the implications of these seasonal abundances with regards to regular beach renourishment projects, such as the Wrightsville Beach Renourishment Project. Recommendations of practices that might least impact these fish communities during nourishment projects are offered based on these data.

E23. **Authors: Veronica Pereira** and Joseph Pitula
Presenter Affiliation: University of Maryland Eastern Shore

Exploring the Parasitic Dinoflagellate *Hematodinium perezi* and *Vibrio* Bacteria Coinfection in the Hemolymph of *Callinectes sapidus* from the Maryland Coastal Bays

The blue crab, *Callinectes sapidus*, is a commercially important fishery in the Chesapeake Bay region and was worth approximately 82 million in 2015 (NOAA Commercial Fisheries statistics). Pathogens are issues of emerging concern for fishery managers as they can cause significant mortality, economic losses, and have human health implications. The blue crab is known to harbor infections from the parasitic dinoflagellate, *Hematodium perezi*, and the reo-like virus, but little is known about the occurrence of potentially pathogenic bacteria. This study is examining the role of *Vibrio* bacteria in healthy and infected blue crabs, as well as the

relationship between macrophytes, in the coastal bays and disease prevalence. Crabs are collected monthly (April-October) from 7 sites throughout the Maryland Coastal Bays (MCBs). Hemolymph is analyzed to quantify pathogen abundance using previously established quantitative real-time PCR (qPCR) protocols. For qPCR detection of *Vibrio* genus-specific primers directed to the 16S rDNA gene will be used, while *H. perezi* detection will occur by targeting the ITS2 region of the 18S rRNA gene. After two years of data collection, statistical significance will be tested using matched pair t-tests and multiple linear regressions. Future conditions associated with climate change (i.e. increased temperature and salinity) may further influence the distribution and abundance of marine organisms, and could tilt environmental conditions to favor disease transmission. Therefore, understanding the microbial and pathogen dynamics of this important fishery and exploring potential sources of disease mitigation could provide valuable information to better assist in stock management.

E24. **Authors: Apria N. Valenza**, Spencer T. Gardner and Frederick S. Scharf
Presenter Affiliation: University of North Carolina - Wilmington

The ecophysiological response of juvenile southern flounder (*Paralichthys lethostigma*) growth to settlement habitat

The attributes of post-settlement nursery habitats can strongly influence vital rates of fishes during early life stages. The physiological response of fishes to abiotic and biotic factors can alter individual growth trajectories, with lasting impacts on cohort demographics. In North Carolina estuaries, southern flounder (*Paralichthys lethostigma*) settle primarily in headwaters as post-metamorphic juveniles during late winter and spring. Near the end of the first year of life, > 2-fold variation in body size is observed in most years. As part of a broader project to assess the influence of salinity on southern flounder distribution and productivity, we specifically addressed whether southern flounder that remain in oligohaline settlement habitats throughout the juvenile life stage experience diminished growth relative to individuals that either settle or transition to mesohaline habitats. We collected fish from the 2018 cohort in the Cape Fear River estuary from Feb – Aug within habitats that extended from the lower estuary to nearly freshwater. Fish condition was quantified for recent post-settlement fish using Fulton's K to assess whether condition varied upon arrival to distinct settlement habitats. Flounder stomach contents were examined to document foraging ecology and possible habitat-specific patterns in prey availability. Analysis of δ^{15} N among habitats enabled comparison of flounder trophic levels. While the condition of settling southern flounder was similar across habitats, our findings point to three distinct nursery habitats based on trophic differences along the salinity gradient (upper estuary ~ 0-2 ppt, transitional zone ~ 0-9 ppt depending on tidal stage, and lower estuary ~ 10-19 ppt). The foraging strategies of southern flounder differed markedly among nursery habitats. Individuals occupying the upper estuary (oligohaline waters) consumed large amounts (> 76%) of insect prey and only small amounts (6%) of piscine prey, while individuals in the lower estuary included much higher amounts of fish prey (58% piscine prey vs. 5% insect prey). Flounder in the lower estuary also demonstrated

tissues that were more enriched in $\delta^{15}N$, indicating higher trophic levels. Our findings imply that prey fish availability may be greater within higher salinity habitats, contributing to faster growth in juvenile flounder.

Student Lightning Presentation Overview

Friday, February 8, 2019. 3 minutes each, 2 minutes Q&A.

Time	Presenter	Title of Presentation
9:15 AM	Meyer, S.	Identifying stocks of hickory shad using geometric morphometric analysis
9:20 AM	Martinez, J.	Genetic assignment tests to identify stock composition of striped marlin, *Kajikia audax*, in the Central North Pacific Ocean
9:25 AM	Frey, B.	Monkfish age validation using hardpart analysis of known-age cohorts
9:30 AM	Wenker, R.	Sea whip coral (*Leptogorgia virgulata*) in the Mid-Atlantic Bight: Age, colony complexity, and growth
9:35 AM	Bailey, J.	A potential mismatch? Changes in the seasonality of larval fishes and their zooplankton prey in Beaufort Inlet, North Carolina
9:40 AM	Fitzenreiter, K.	Uncovering patterns of circulation and bay-ocean exchange in Maryland's coastal waters
9:45 AM	Bartlett, B.	Projections of changes in the distribution of nassau grouper spawning habitat using an ensemble of earth system models
9:50 AM	Hobbs, T.	Effects of body size and temperature on fast start performance in *Fundulus heteroclitus*

Student Lightning Talk Abstracts

LT1. **Student:** Steven D. Meyer
Affiliation: East Carolina University

Identifying stocks of hickory shad using geometric morphometric analysis

Identifying stocks can be difficult, especially when the species you're studying has an extensive range or complicated life history. Hickory Shad happen to have both. Hickory Shad are an anadromous species native to the East Cost of the U.S. from the St. Johns River in Florida up to the Bay of Fundy in Canada. We hypothesize that Hickory Shad home to natal rivers. If Hickory Shad do home to natal rivers, we believe that the unique environmental conditions and gene pools present in each river will result in stocks that we can identify using genetics, merisitcs and morphometrics, otolith shape and chemistry, and body shape. We will look at the differences in body shapes using geometric morphometric analysis. Analyses will be run on our sample population of 757 Hickory Shad from 21 watersheds across the East Coast. Results of geometric morphometrics using Discriminate Function Analyses and ANOVA found statistically significant differences in body shapes of males and females. A principle component analyses revealed that the majority of the variation between males and females was in the y axis of landmarks around the dorsal and pelvic fin, indicating body depth is the main difference between sexes. After discovering this sexual dimorphism, all analyses ran thereafter were done on males and females separately. Discriminate function analyses found differences in the body shapes of fish from different states, different rivers within state, and even some tributaries within rivers.

LT2. **Student:** Jackson L. Martinez
Affiliation: Virginia Institute of Marine Science

Genetic assignment tests to identify stock composition of striped marlin, *Kajikia audax*, in the Central North Pacific Ocean

The striped marlin, *Kajikia audax*, is an istiophorid billfish found throughout the Pacific and Indian oceans at latitudes between 45°N and 45°S. In contrast to other billfishes, striped marlin exhibit a relatively high degree of genetic population structuring throughout their distribution. Previous studies have supported the presence of 3-4 populations within the Pacific Ocean but conflict on whether individuals within the central North Pacific comprise a distinct stock or a mixed-stock aggregation. One study indicated genetic differences between juveniles and adults in the central North Pacific and spawning is known to occur in the region. The goal of this research will be to

elucidate the stock composition of striped marlin in the central North Pacific Ocean. Striped marlin of different size classes, caught by the Hawaii-based pelagic longline fishery, will be sampled throughout the year. Individuals will be genotyped using a recently developed SNP panel and stock composition will be evaluated using genetic assignment testing. The results of this study will further characterize the movement and stock structure of striped marlin within the central Pacific Ocean, providing information necessary for proper assessment and management of the stocks.

LT3. **Student:** Benjamin Frey
Affiliation: U. of Maryland Center for Environmental Science - Chesapeake Biological Laboratory

Monkfish age validation using hardpart analysis of known-age cohorts

Monkfish (*Lophius americanus*) are one of the most economically valuable species of the Mid-Atlantic fisheries. Conservative fishing quotas were recently imposed owing to refutation of a traditional ageing method that resulted in unreliable stock assessments. This study employs a novel approach to monkfish ageing using trace element microconstituent analysis of hardparts of a cohort of "known-age" monkfish arising from an exceptionally strong year-class from 2015. Monthly sampling of this year class, conducted by the NMFS Northeast Fisheries Science Center, will provide samples of ilicia and vertebrae hardparts. Hardparts will be processed, annuli identified, and seasonal changes in the hardpart microconstituents (Ca, P, Sr) analyzed to test whether seasonal cycles in these trace elements correspond with annulus formation. Chemical validation of the optical interpretations of annuli would support age-structured assessments and allow fisheries managers to make well informed assessments of stock status on which to build sound management practise.

LT4. **Student:** Rebecca Wenker
Affiliation: University of Maryland Eastern Shore

Sea whip coral (*Leptogorgia virgulata*) in the Mid-Atlantic Bight: Age, colony complexity, and growth

Sea whip coral (*Leptogorgia virgulata)* are a common structural component of benthic habitats found in the Mid-Atlantic region and may serve as essential fish habitat for commercially valuable species like black sea bass (*Centropristis striata)*, tautog (*Tautoga onitis)*, and American lobster (*Homarus americanus)*. However, they are slow-growing, easily damaged, and especially vulnerable to damage by passive fishing gear. Despite their potential importance and fragility, sea whips are relatively unstudied in this region. No standard for comparison exists if there were to be major changes to this habitat, whether human or naturally caused. To reconcile this lack of

knowledge, we are examining the age and colony complexity of sea whips from 4 sites in the Mid-Atlantic region, and using these data to construct age-length keys and von-Bertalanffy growth models to gain a better understanding of reef ecology in the area. Preliminary results show corals ranging from 2-15 years in age, with an average bifurcation ratio of 3. This project will provide much needed information on an understudied species vital to Mid-Atlantic fisheries.

LT5. **Student:** Javan Bailey
Affiliation: East Carolina University

A potential mismatch? Changes in the seasonality of larval fishes and their zooplankton prey in Beaufort Inlet, North Carolina

As the primary prey item for larval fishes, variations in mesozooplankton abundance can have a large influence on the growth and survival of fish larvae, ultimately resulting in impacts on the productivity of fisheries. Changing climate regimes introduce the increased possibility of mismatches in the seasonal abundance of larval fishes and their zooplankton prey. By pairing a long-term dataset on larval fish ingress into an estuary with zooplankton abundance analyses, along with studies of larval fish diet and morphometric condition, we aim to determine if the phenology, species composition, and abundance of mesozooplankton communities are changing over time and how that might impact the larval fish community. In addition to the 30+ years of data on larval fish taxa collected by the NOAA Beaufort Inlet Ichthyoplankton Sampling Program (BIISP), we have been collecting weekly data on mesozooplankton abundance at Beaufort Inlet, NC over the last two years. These weekly samples are currently being analyzed with a Zooscan, an instrument that uses machine learning techniques to perform partially automated identification of zooplankton taxa. Additionally, weekly measurements of oceanic variables, such as temperature, salinity, dissolved oxygen, and chlorophyll concentration, are recorded concurrently with zooplankton samples to identify any potential correlations between changing zooplankton communities and these variables. We have identified long-term, climate-related trends in ichthyoplankton phenology using the BIISP time series and now aim to investigate potential mismatches between trophic levels based on Zooscan analysis of the mesozooplankton community.

LT6. **Student:** Katherine Fitzenreiter
Affiliation: University of Maryland Eastern Shore

Uncovering patterns of circulation and bay-ocean exchange in Maryland's coastal waters

Lagrangian surface drifters are oceanographic instruments that are designed to follow the movement of water at and near the surface, and they are used to study circulation of water and transport of passive materials (e.g. pollutants, debris, sediments, planktonic larvae) at sea.

They have been used extensively in large-scale systems such as large lakes, the continental shelf, and the deep ocean; however, drifter studies are quite limited in smaller-scale systems such as coastal estuaries. Understanding hydrodynamics in coastal regions is important because the health of estuaries and nearshore waters depends highly on the exchange of water between estuaries and their neighboring ocean. Human populations in coastal communities across the globe are on the rise, making receiving waters increasingly vulnerable to the effects of pollution from anthropogenic activities. The health of the Maryland Coastal Bays (MCBs), a coastal lagoon system, is largely affected by land-based activity that contributes to excess nutrient and chemical loading into the bays. Studies of hydrodynamics in the MCBs are scarce, and those existing rely on current velocity measurements taken from 3 stationary current meters in 2004. While Eulerian instruments are useful for obtaining large quantities of data from one location over time, Lagrangian observations from drifters provide a more direct measure of pathways and fates of water and particles, yielding a more detailed spatio-temporal flow structure. This study aims to uncover circulation patterns and influences of wind and tidal forcing on water movement at the surface in the MCBs and their neighboring nearshore ocean. Over the course of nine field experiments in 2017 and 2018, thirty-nine drifters were deployed within various locations of the bays, and the results are currently being analyzed. Preliminary results show that currents shift direction shortly after shifts in tidal phase occur. Although tidal forcing appears to dominate the current patterns in the region, wind forcing also seems to play an important role in the direction of currents as well, notably when wind speeds reach 6.0 m s^{-1} or greater.

LT7. **Student:** Brian S. Bartlett
Affiliation: East Carolina University

Projections of changes in the distribution of nassau grouper spawning habitat using an ensemble of earth system models

Nassau Grouper (Epinephelus striatus) is an endangered, iconic Caribbean reef fish whose spawning and larval success may be threatened by climate change. These fish spawn within aggregations on coral reefs from December to April. Climate change threatens to reduce spawning habitat and population connectivity via thermal stresses and changing currents. Previous research projects a reduction of up to 80% of spawning habitat utilizing a single earth system model. This research aims to identify thermal refuges of E. striatus using a multi-model approach and better quantify model uncertainty. The GFDL, IPSL, and MPI climate models were used to compare sea surface temperature (SST), seasonal SST gradients, and geostrophic currents from historical and future periods under a business-as-usual climate change scenario. These variables were selected as they were determined in prior research to impact probability of spawning. Under the future period, SST exceeded the thermal tolerance of E. striatus (24-27.5° Celsius) across much of the Caribbean among all three models, with the largest increases in SST seen in IPSL. However, all three models suggest there may be some locations

with thermal refugia. SST gradients and geostrophic currents are not projected to change drastically under future conditions and nor are they projected to exceed the tolerance limits of E. striatus. Since SST may exceed the thermal limits of spawning habitats, these findings may have major impacts on the fishery of an iconic species by potentially reducing their reproductive output. This suggests that management practices, including MPAs, may need to adapt to these changes.

LT8. **Student:** Trevor Hobbs
Affiliation: Christopher Newport University

Effects of body size and temperature on fast start performance in *Fundulus heteroclitus*
In a previous study, the effects of salinity and temperature on fast start performance in mummichogs were tested. It was determined that size plays a marginal role in the fast start performance of mummichogs. In my thesis research, I increase the size difference of the fish being tested in order to determine how strong an effect body size may have on fast start performance. By doing this, the hope is that not only will the effect of body size on fast start performance be determined, but that the effect of size sensitivity to acute temperature change on fast start performance will also be determined. Mummichogs are very important to estuarine food webs as they serve as a food source for many predatory species. Their survival is thus dependent on their ability to escape predators. My thesis research is important because I not only examine how a morphological trait and an environmental factor effect escape performance in mummichogs, but how their interactions effect escape performance as well.

Oral Presentations

Friday, February 8, 2019 - Student Oral Presentations

Time	Presenter	Title of Presentation
10:30 AM	Song, J.	Plasticity in standard and maximum aerobic metabolic rates in two populations of speckled trout (*Cynoscion nebulosus*)
10:45 AM	Nepal, V.	Responses of invasive blue catfish to variation in food resources
11:00 AM	Rothermel, E.	Seasonal and environmental predictors of Atlantic sturgeon and striped bass occurrence in the Maryland Wind Energy Area
11:15 AM	Waclawski, M.	The TIA Alliance: Students and conservation organizations working together for the integrity of our aquatic ecosystems
11:30 AM	Schwieterman, G.	Analyzing elasmobranch blood samples in the field: Blood stability during storage and validation of the Hemocue® hemoglobin analyzer
11:45 AM	Phillips, O.	Striped bass recruitment: Is it time for another look?
1:30 PM	Pochtar, D.	Influence of salinity on the prevalence of the white-tipped mud crab (*Rhithropanopeus harrisii*) and its castrating parasite (*Loxothylacus panopaei*)
1:45 PM	Wiernicki, C.	The influence of summer storm events on black sea bass movement and activity in the Maryland Wind Energy Area
2:00 PM	Askin, S.	A genetic assessment of channeled whelk *Busycotypus canaliculatus* populations in the Mid-Atlantic
2:15 PM	Belkoski, D.	Trophic ecology and demographics of non-native catfish in the lower Cape Fear River ecosystem
2:30 PM	Jones, S.	Occurrence of microplastics in Maryland Coastal Bay fishes

2:45 PM	Rubalcava, K.	Influence of Environmental Factors on the Abundance and Growth of Spot (*Leiostomus xanthurus*) in the Maryland Coastal Bays
3:15 PM	Goldberg, D.	Gone with the Wind?: Environmental and demographic factors contributing to large year classes of juvenile red drum in North Carolina
3:30 PM	Rosales, Detbra	Harmful algae succession and vibrio association in the Delaware inland bays

Saturday, February 9, 2019 - Professional Oral Presentations

Time	**Presenter**	**Title of Presentation**
8:30 AM	Blakeslee, A.	Reconstructing the Invasion History of the Asian shorecrab, Hemigrapsus sanguineus, in the Western Atlantic
8:45 AM	Jesian, R.	Fish Passageway
9:00 AM	O'Brien, M.	Increased ultrasonic transmitter detection range in bottom waters due to thermal stratification in the mid-Atlantic bight
9:15 AM	Rudershausen, P.	Can meta-analysis and dockside sampling predict a rate of discard mortality of dolphinfish *Coryphaena hippurus* in the U.S. South Atlantic recreational fishery?
9:30 AM	Uphoff, J.	Does organic matter matter to feeding success of yellow perch larvae in Chesapeake Bay subestuaries?
9:45 AM	Mace, M.	Using censored regression when estimating abundance and exploitation rate with catch-effort data to account for daily catch limits
10:15 AM	Bangley, C.	Possible origins and migratory connections of juvenile bull sharks (*Carcharhinus leucas*) in Pamlico Sound, North Carolina
10:30 AM	Gallagher, B.	Exploring asynchrony in juvenile striped bass recruitment among Chesapeake Bay nursery areas

10:45 AM	Kahn, D.	Potential overestimation of the fishing mortality rate in catch-at-age modeling due to an increase in the natural mortality rate in Mid-Atlantic and New England waters caused by an increase in predator abundance
11:00 AM	Luczkovich, J.	Monitoring fish and marine mammal sounds with a wave glider
11:15 AM	Ogburn, M.	Animal telemetry in the Mid-Atlantic: Opportunities and challenges

Oral Presentation Abstracts

(presenting author listed in bold)

Friday, February 8, 2019 - Student Oral (SO) Presentations

SO1. **Authors: Jingwei Song**, Rich Brill, Jan McDowell
Presenter Affiliation: Virginia Institute of Marine Science

Plasticity in standard and maximum aerobic metabolic rates in two populations of speckled trout (*Cynoscion nebulosus*)

Local adaptation in natural populations are common, yet the underlying physiological mechanisms are not well understood especially in aquatic organisms. A better understanding of population-specific physiological response to acute temperature change can improve the success of conservation and management planning in an era of rapid climate change. One recent hypothesis suggests that the capacity of the oxygen delivery system sets the limits of thermal tolerance in aquatic ectotherms. To test this hypothesis, we used intermittent flow respirometry and measured weight-specific standard metabolic rate (SMR) and maximum metabolic rate (MMR) of adult speckled trout (*Cynoscion nebulosus*) belonging to two genetically distinct populations. Over a steep thermal gradient from 5°C to 30°C, individuals from the northern population exhibited SMR up to 50% higher than their southern counterparts when measurements were made at the same temperatures. The metabolic rates of individuals from the southern population showed greater thermal sensitivity (i.e., higher Q_{10} values) across the entire range of experimental temperatures than their northern counterparts, consistent with the observation that they live in a more thermally stable environment. Taken together, our results indicate physiological differences exist between the northern and southern populations of speckled trout and provide a mechanistic basis for predicting population-specific responses to climate change.

SO2. **Authors: Vaskar Nepal**, Mary C. Fabrizio and Richard W. Brill
Presenter Affiliation: Virginia Institute of Marine Science

Responses of invasive blue catfish to variation in food resources

Blue catfish (*Ictalurus furcatus*) is an invasive species of increasing management concern in the Chesapeake Bay region. We contend that it is necessary to assess growth and metabolic rates at various ration levels to understand the responses of blue catfish to complex conditions in the wild, and thus their ability to invade new environments and their potential impacts on the ecosystem. We compared the growth rates, body condition, and metabolic rates of subadult

blue catfish (N = 10 per treatment level) fed commercial fish pellets at three ration levels (*ad libitum*, 66% *ad libitum* and 33% *ad libitum*) for four months. We did not observe any statistically significant differences in mean growth rates or body condition among the different ration levels. There were, however, measurable decreases in weight-specific standard metabolic rates that were directly related to ration level, which may account for the lack of the observed differences in body condition. Blue catfish therefore appear to have mechanisms which enable them to survive low rates of caloric intake, suggesting that this species has the potential to expand to the more oligotrophic areas in the Chesapeake Bay region.

SO3. **Authors: Ella Rothermel**, Michael O'Brien, Dewayne Fox, Ben Gahagan, Ian Park, Matt Balazik, David Secor
Presenter Affiliation: U. of Maryland Center for Environmental Science - Chesapeake Biological Laboratory

Seasonal and environmental predictors of Atlantic sturgeon and striped bass occurrence in the Maryland Wind Energy Area

Multiple regions within the US Mid-Atlantic Bight are leased for offshore wind development. Although economically important Striped Bass and endangered Atlantic Sturgeon seasonally migrate through these regions, the timing and distribution of their movements in near-shelf waters is poorly known. To evaluate seasonal incidence of these species, 20 acoustic-release telemetry receivers were deployed in a gradient design centered on the Maryland Wind Energy Area. From November 2016 to December 2018, 316 tagged Striped Bass and 378 tagged Atlantic Sturgeon were logged by the acoustic receiver array, with many detections occurring within the proposed Wind Energy Area. Generalized Additive Models (GAM) were used to evaluate the influence of seasonal and environmental factors on the daily presence or absence of both species. Depth, sea surface temperature, chlorophyll-a concentration, and day-of-year were significant predictors of occurrence for both species. However, the form of variable response and interaction differed; Atlantic Sturgeon had increased probability of occurrence between 5 and 20 °C and were more broadly distributed over the shelf region in autumn compared to the spring, while Striped Bass were nearly absent during summer. Further, they shifted to deeper waters during winter as sea surface temperatures cooled. Despite potential differences in seasonal habitat selection by Striped Bass and Atlantic Sturgeon, the infrequency of detections for both species in summer suggests these months could be considered as a potential window for wind tower construction, should these migratory species be a priority.

SO4. **Authors: M. Waclawski,** B. R. Murphy, A. K. Smith
Presenter Affiliation: James Madison High School, Vienna, VA

The TIA Alliance: Students and conservation organizations working together for the integrity

of our aquatic ecosystems

Signed November 2018, the TIA Alliance charter is a symbolic culmination of activities initiated six years ago by students on the Trout Out of the Classroom team at James Madison High School, Vienna, VA. Composed of **T**rout Unlimited (TU), the **I**zaak Walton League of America (IWLA), and the **A**merican Fisheries Society (AFS), the TIA Alliance will work to emulate Trout Out of the Classroom's AAA (Awareness, Action, Analysis) Process across the USA. Awareness entails identifying an environmental problem, followed by Action in which students conduct a pre-assessment and field research. In the third step, Analysis, students examine data, conduct a post-assessment, and share quality-assured results with the scientific community. Mission-driven in nature, the process can be replicated anywhere, no matter the problem to be addressed. The Alliance will provide students with resources and training required to implement an action plan that can make a tangible difference in their local watersheds. TIA organizational direction will develop through consensus of the TIA governors. Youth engagement in natural resource conservation activities will benefit not only the students involved, but also the respective TIA organizations. TU can implement a defined program for high schoolers to bridge the gap between their *Trout in the Classroom* and *5 Rivers* programs. IWLA will institute steps to help reach their goal of monitoring 100,000 streams by 2022. AFS is working to create special membership and mentoring opportunities for high school students. This synergy will create an ideal platform for engaging future generations of environmentally aware citizens.

SO5. **Authors: Gail D. Schwieterman**, Ian Bouyoucos, Jodie L. Rummer, Richard W. Brill
Presenter Affiliation: Virginia Institute of Marine Science

Analyzing elasmobranch blood samples in the field: Blood stability during storage and validation of the Hemocue® hemoglobin analyzer

Blood samples collected from wild-caught individuals can provide important information on the effects of capture and indicate the ability of fishes to survive after release. Unfortunately, blood samples often cannot be analyzed immediately upon sampling, and blood parameters (e.g., blood oxygen levels and acid-base parameters) are well known to change with storage duration because fish red blood cells are metabolically active. We obtained blood samples from both stressed and unstressed individuals of two elasmobranch species (*Carcharhinus melanopterus, Negaprion acutidens*). We measured hematocrit, hemoglobin concentration ([Hb]), and blood pH immediately upon sampling and after 30, 90, and 180 minutes after storage on ice. We found no significant effects of storage time on measured parameters (using a repeated measures ANOVAs). Moreover, to validate the usability of a HemoCue® hemoglobin analyzer (a point-of-care device), we compared data from this device to [Hb] determined using the well-established Drabkin's method with blood samples from 10 individuals from the aforementioned species, plus *Hemiscyllium ocellatum*. Values from the HemoCue consistently overestimated [Hb], and we therefore developed the necessary correction equations. The

slopes of the correction equations were not statistically different among the elasmobranch species, but did differ from published corrections developed using blood from temperate teleost fishes. Although the HemoCue is useful in those situations where use of the Drabkin's method is not feasible, development of species-specific calibration equations may be necessary be ensure the reliability of inter-species comparisons of blood [Hb].

SO6. **Authors: Olivia M. Phillips**, Mary C. Fabrizio
Presenter Affiliation: Virginia Institute of Marine Science

Striped bass recruitment: Is it time for another look?

Striped bass (*Morone saxatilis*) in the Chesapeake Bay have a unique management history, wherein the population recovered from collapse as a direct result of strict management regulations, favorable environmental conditions, and several years of strong recruitment. Following recovery, the spawning stock biomass fluctuated above the 1995 target, reached a peak in 2004, and has since declined towards the 1995 target. In addition, water temperatures have risen in the Chesapeake Bay since 1984. The purpose of this study is to understand how these population-level and environmental changes affect recruitment of striped bass. We compared recruitment dynamics during the pre- and post-recovery periods using hatch-date distributions and mortality rates. Juvenile striped bass were collected from 26 sites in the James and Rappahannock subestuaries from 1986 to 2017. We measured lengths of all juvenile striped bass and collected otoliths from a subsample of the fish from 2011, 2016, and 2017. Otolith-derived daily-ages were used to estimate hatch-dates for each subestuary and for each of the three years; daily-ages and lengths were used to construct subestuary-specific age-length keys. Annual instantaneous mortality rates for the 1986 to 2017 year classes were also estimated. Mean estimated hatch-dates were earlier in recent years than they were at the beginning of our time series, which is consistent with warming water temperatures and suggests that in the post-recovery period fish may spawn earlier, eggs may hatch earlier, or both. Instantaneous mortality rates in summer in the post-recovery period were not significantly different from those in the pre-recovery period. This pattern suggests that factors affecting survival of juvenile striped bass in summer may be similar in both the pre- and post-recovery periods.

SO7. **Authors: Darby L. Pochtar**, A. Whitman Miller, Gregory Ruiz, Amy E. Fowler
Presenter Affiliation: George Mason University

Influence of Salinity on the Prevalence of the White-Tipped Mud Crab (*Rhithropanopeus harrisii*) and its Castrating Parasite (*Loxothylacus panopaei*)

The interaction between the castrating rhizocephalan barnacle parasite (*Loxothylacus panopaei* – *Lp*) and the white-tipped mud crab (*Rhithropanopeus harrisii* – *Rh*) is influenced by salinity in estuaries. While *Rh* can exploit low salinities, *Lp* cannot survive salinities <10 ppt. Therefore, lower salinity may act as a refuge for *Rh* against infection. When *Lp* infects a host, it creates a network of internal nutrient rhizoids that hijack the hosts' reproductive system and alter host behavior in favor of *Lp*'s own reproduction. Infected crabs are castrated and now act as a vessel, aiding in the creation and spread of *Lp*. While native to the Gulf of Mexico, *Lp* was introduced to the Chesapeake Bay via the oyster aquaculture trade in the 1960s and can infect up to 90% of *Rh* populations. Long-term (2004–2015) host-parasite abundances from 10 sites in the Chesapeake Bay were examined to explore correlations between salinity and *Rh*-*Lp* population-level demography. Initial exploration showed a sharp increase in *Lp* prevalence in *Rh* populations experiencing salinities >10 ppt, indicating that *Rh* may successfully evade infection at lower salinities. However, these patterns are highly variable between sites, highlighting the patchy distribution of *Lp* and the correlation with other well-known large-scale patterns in parasite ecology.

SO8. **Authors: Caroline Wiernicki,** Michael O'Brien, and David Secor
Presenter Affiliation: U. of Maryland Center for Environmental Science, Chesapeake Biological Laboratory

The influence of summer storm events on black sea bass movement and activity in the Maryland Wind Energy Area

As sedentary residents to shallow shelf waters, black sea bass are a model species for investigating offshore wind energy impacts on coastal fisheries. To better understand the responsiveness of black sea bass to impacts, we conducted baseline telemetry studies of their movement behavior in the Maryland Wind Energy Area. During the summers of 2016-2018, 8-15 black sea bass were released with acoustic transponders at each of three reef sites, which were surrounded by data-logging receivers. Data were analyzed for activity levels, reef departures, and fluctuations in ambient noise and temperature. Periods of ocean column destratification were observed following storms events of differing distribution and magnitude, with oscillations in bottom temperatures sometimes >10ºC. Movement rates were depressed with each consecutive major storm, and late-season storms were associated with permanent evacuations. Because Mid-Atlantic Bight shelf waters will show storm-induced destratification events each summer and fall, wind energy construction impacts in this region must be considered against this source of natural disturbance.

SO9. **Authors: Samantha E. Askin**, Robert A. Fisher, Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

A genetic assessment of channeled whelk Busycotypus canaliculatus populations in the Mid-Atlantic

Channeled whelk, *Busycotypus canaliculatus* (Linnaeus, 1758), are predatory marine gastropods found in intertidal regions of the continental slope along the U.S. East Coast from Cape Cod, MA to Cape Canaveral, FL. Channeled whelk are an economically important species that supports a commercial fishery. The life history characteristics of channeled whelk including slow growth, late maturation, and direct development make them vulnerable to overexploitation. Currently, the channeled whelk resource is managed at the state level in the mid-Atlantic region. The current minimum landing size (MLS) is 127 millimeters (mm) shell length (SL) in New Jersey, 152.4 mm in Maryland and Delaware, and 139.7 mm in Virginia. Females reach sexual maturity at 149-159 mm SL as compared to 121-134 mm in males. Channeled whelk harvested in Virginia and New Jersey have a low probability of being sexually mature. The purpose of this research is to use microsatellite markers to determine the level of genetic connectivity among channeled whelk along the U.S. East Coast. Foot tissue was sampled from 300 whelk from Eastern Shore, VA, Virginia Beach, VA, and Ocean City, MD. We used high throughput shotgun sequencing to identify microsatellite markers for channeled whelk. These markers are being used to delineate the genetic structure of channeled whelk along the U.S. East Coast. We are also using finer scale sampling to assess the realized dispersal of channeled whelk in the mid-Atlantic region. The results of this study will be discussed relative to appropriate scaling for management of the channeled whelk resource.

SO10. **Authors: David J. Belkoski**, Frederick S. Scharf, Kevin J. Dockendorf, Kyle T. Rachels, and Clinton Morgeson
Presenter Affiliation: University of North Carolina - Wilmington

Trophic ecology and demographics of non-native catfish in the lower Cape Fear River ecosystem

The introduction of non-native catfishes has been identified as a major structuring force in central and southern US Atlantic coastal rivers. The flathead (*Pylodictis olivaris*) and blue (*Ictalurus furcatus*) catfish are large-bodied apex predators with established populations in several North Carolina coastal rivers. In 2017, we began an examination of catfish trophic ecology and population demography in the lower Cape Fear River ecosystem to assess potential impacts on anadromous and native fish communities. To date, over 2000 catfish have been sampled across broad size (65 – 1120 mm TL) and age (1 – 23 years) ranges. Stomach contents indicate a strong dependence on fish (49% FO and 77% W) and crustacean (58% FO) prey by flathead catfish, with blue catfish feeding more heavily on molluscs (54% FO). Stable isotope analyses have flathead as a top trophic predator with blue catfish occupying a slightly lower level, indicating higher rates of omnivory. A mark-recapture was conducted during July-Sept

2018 using a closed population estimator applied to eight independent river reaches (6-12 km). A total of 646 tags were deployed with 104 recaptures occurring within 8-12 days of tagging. The assumption of population closure was assessed by acoustically tracking a subset of fish (n = 46) within three of the river reaches, which also provided an independent estimate of capture probability. Most density estimates were ~40-45 fish/river km, with lower estimates (~25 fish/river km) in the Black River and higher estimates (70-100 fish/river km) in two of the reaches. Spring sampling for diets will continue in 2019 and additional mark-recapture work will provide estimates of the short-term effects of Hurricane Florence.

SO11. **Authors: Sarah Jones,** Maurice Crawford, and Delaney Harrison-Peters
Presenter Affiliation: University of Maryland Eastern Shore

Occurrence of microplastics in Maryland Coastal Bay fishes

We surveyed fish species in the Maryland Coastal Bays (MCBs) for the presence of microplastics. Microplastics (< 5 mm) are formed by the breakdown of plastics through UV radiation, oxidation, and abrasion. A number of marine organisms are affected by the entanglement or ingestion of plastics which can lead to impaired movement, reduced reproductive output and death. Microplastics may also be caught in the digestive tract where they may clump and block the passage of food. Our objectives were to (1) describe the types of microplastics found in MCB fishes; (2) determine the prevalence of microplastics in the fish and (3) compare our results with previous studies. Between July and October 2019, we collected 211 fishes (composed of five species) via trawls and seines from locations in the MCBs. Samples were prepared by removing the entire intestinal tract and digesting it in 10% KOH at 40 degrees Celsius for up to 72 h. The digested guts were then passed through a 0.5 mm sieve and the material that was retained we examined under a dissecting microscope for microplastics. Our study found that the microplastics in these fish consisted mainly of small fibers between 0.5 to 3 mm in length. It also appears that pelagic feeders have higher levels of microplastics in their guts compared to benthic feeders. Our most conservative estimate of microplastic contamination across all 211 fish was 5.9% which is at the low end when compared to previous studies which ranged between 2.6% and 37%.

SO12. **Authors: Kasondra Rubalcava**, Hector Malagon, Cloee Grainger and Paulinus Chigbu
Presenter Affiliation: University of Maryland Eastern Shore

Influence of Environmental Factors on the Abundance and Growth of Spot (*Leiostomus xanthurus*) in the Maryland Coastal Bays

Information is scarce on the influence of environmental factors on the abundance and growth of juvenile spot (*Leiostomus xanthurus*) in the mid-Atlantic estuaries. The recruitment and growth of spot in the Maryland Coastal Bays were evaluated using 26 years (1990 – 2016) of juvenile fish survey data collected monthly from 20 sites. Spot recruitment varied between years with the highest abundance occurring in 1994, although there was no apparent increasing or decreasing trend. Recruitment was lower in Sinepuxent Bay than in the other Bays within the MCBs system. There was a significant positive relationship between spot recruitment index and NAO index, perhaps due to warmer winters associated with positive NAO indices that might have resulted in higher survival of the fish than during colder winters associated with negative NAO indices. The mean size attained by 0+ spot in September varied between years and was negatively correlated with spot recruitment index, but not temperature or salinity, suggesting density-dependent growth.

SO13. **Authors: Danielle A. Goldberg** and Frederick S. Scharf
Presenter Affiliation: University of North Carolina–Wilmington

Gone with the Wind?: Environmental and demographic factors contributing to large year classes of juvenile red drum in North Carolina

The identification of factors contributing to strong year classes of marine fishes has been a constant goal to improve the understanding of recruitment variability. In 1991, the North Carolina Division of Marine Fisheries initiated a yearly survey to estimate the relative abundance of juvenile red drum to serve as a recruitment index. Here, we hypothesize that several hydrological and atmospheric variables may contribute to reproductive success and larval transport, and at least partially explain the periodic occurrence of large year classes. Specifically, we plan to examine late summer and fall coastal water temperatures, chlorophyll-a concentrations, and nearshore wind stress for their influence on year class strength, based on the potential for these factors to affect egg and larval survival and transport. We plan to examine interannual variation of catch and body size distributions to identify possible associations between year class strength, larval delivery, and growth rates. We will apply generalized linear models to quantify the variance in year class strength explained by environmental forcing variables and identify the functional relationships with arrival timing and growth. This project will build upon previous efforts to understand important processes shaping recruitment in red drum near the northern edge of the species range.

SO14. **Authors: Detbra Rosales,** Gulnihal Ozbay, Salina Parveen, John Jacobs, and Joseph Pitula
Presenter Affiliation: University of Maryland Eastern Shore

Harmful algae succession and vibrio association in the Delaware inland bays

The Delaware Inland Bays (DIBS) are a collection of salt marshes, saltwater creeks, and shallow open waters. Over the years, the ecological health of certain areas in the DIBs has deteriorated because of poor water quality. Historically, oyster reefs were evenly distributed in the DIBS, but oyster disease caused the population to collapse in the 1950s. In 2013, the Delaware State Legislature instructed the Delaware Department of Natural Resources and Environmental Control to create an oyster aquaculture industry. Recent studies have suggested an association between the abundance of phytoplankton and the pathogenic bacterium *Vibrio parahaemolyticus* in the DIBs. The presence of *V. parahaemolyticus, V.vulnificus,* and several harmful algal bloom (HAB) species causes concerns for the proposed aquaculture sites due to environmental and human health risks associated with these organisms. We are examining the areas near proposed aquaculture sites to determine the impacts of water quality and proliferation of pathogenic bacteria on oyster aquaculture. Using a combination of microscopy, PCR, and MPN-QPCR-based methodologies, we are comparing the HAB community and Vibrio spp. in the water column. In 2017 and 2018 we were able to identify the presence of many bloom forming algal species such as *Karlodinium veneficum, Dinophysis spp.*, *Heterosigma akashiwo* and *Chattonella subsalsa* in the DIBs. *V. parahaemolyticus* and *V. vulnificus* were also detected in environmental samples. However, *Vibrio* spp. abundance varied between sites and was positively correlated with temperature. On average nutrient levels where relatively higher at Torquay canal, DE in comparison to other areas in the DIBs. We will present data on HAB, bacterial communities, and Vibrio spp. from water that analyzes potential human health risks at the proposed DIB oyster aquaculture sites.

Saturday, February 9, 2019 - Professional Oral (O) Presentations

O1. **Authors: April M.H. Blakeslee,** Yumi Kamakura, Jaclyn Onufrey, Wataru Makino, Jotaro Urabe, Susan Park, Carolyn L. Keogh, A. Whitman Miller, Mark S. Minton, James T. Carlton, Osamu Miura
Presenter Affiliation: East Carolina University and Smithsonian Environmental Research Center

Reconstructing the Invasion History of the Asian shorecrab, Hemigrapsus sanguineus, in the Western Atlantic

The invasion history of many marine species remains unclear, including those that are highly abundant. The Asian shorecrab, *Hemigrapsus sanguineus* (HS), is one of the most common intertidal species along rocky/structured shores from VA to mid-coast ME; yet no large-scale population genetics study had been undertaken to determine introduction source, vector, and multiple introduction status. We sampled 51 populations in HS's native (east Asia) and non-

native (east USA) regions. We analyzed 731 cytochrome oxidase I sequences and 500 microsatellites over two time periods: 2001–2002 and 2013–2014. Explorations of both genetic and historical data indicated that multiple introductions to USA are probable, with the greatest genetic diversity concentrating around Long Island (near New York City). Analyses of ballast water flux and genetic data suggest that introductions from Japan via shipping are the likely source and pathway of introduction to the USA. We found unexchanged ballast arriving to the USA (notably New York) from sources throughout Japan, including southern and northern areas where closer genetic connections to introduced USA populations were detected. Western Europe was also a prominent source of unexchanged ballast, suggesting possible trans-Atlantic transfers. HS has numerous ecological impacts in eastern USA, including interactions with commercially-valuable species. Our study demonstrates the importance of comprehensive biogeographic studies for resolving key invasion history questions. In turn, while mandatory ballast water exchange in USA has greatly lessened ballast-borne invasions, our study underscores that hotspots of unexchanged ballast can remain potential sources of novel or supplemental introductions worldwide.

O2. **Authors: Roman Jesien**, Katherine Phillips, and Amanda Poskaitis
Presenter Affiliation: Maryland Coastal Bays Program

Fish Passageway

Considering the detrimental effects of dams on fish populations and an estimated 500 dams in Maryland, innovative techniques to mitigate these effects are needed. We present an approach to providing some of the benefits of an open stream while maintaining an historic mill pond. The Bishopville Stream Corridor Enhancement Project consisted of the modification of a popular but aging mill dam to create a nature-like fish passageway along Maryland's Atlantic coast. The project goal was to remove the dam while maintaining the existing pond and create fish passage using regenerative stream channel (RSC) techniques. The RSC consisted of a series of rock grade control riffles that served as a stream corridor to transition from non-tidal to tidal waters. Specifically, we removed the existing 85-ft long, 4-ft high steel dam and replaced it with a series of 6 gentle sloping rock riffles in which each riffle stepped the stream elevation down in 1-foot increments. The riffle controls consisted of boulders, cobble and clean fill that slowed stream velocity and created resting areas for fish to navigate further upstream. The riffle structures were further stabilized with herbaceous and woody wetland species including Atlantic white cedar and bald cypress. Details of the RSC and description of the construction sequence is provided. We view that this technique is applicable in situations where pond habitat needs to be maintained concurrent with fish passage. Since the project was completed in fall 2014, anadromous fish including alewife, white perch and gizzard shad successfully moved upstream during subsequent spawning runs.

O3. **Authors: Michael HP O'Brien** and David H. Secor

Presenter Affiliation: U. of Maryland Center for Environmental Science - Chesapeake Biological Laboratory

Increased ultrasonic transmitter detection range in bottom waters due to thermal stratification in the mid-Atlantic bight

The detection range of acoustic biotelemetry receivers varies greatly in response to the physical environment, yet many studies incorporating range test components do not test over the full range of deployment conditions. The coastal waters of Maryland are near the southern edge of the mid-Atlantic cold pool, a dominant summer-fall stratification feature. The gradual emergence and rapid destruction of the cold pool each year creates a non-uniform vertical distribution of temperature that varies seasonally and directly impacts sound transmission within the water column. We deployed a near-bottom telemetry range test array for a 13-month period, inclusive of a cycle of cold pool evolution and destruction (Nov 2017 – Dec 2018), to investigate daily changes in detection distance. Distance at 50% detection frequency (D50) was calculated at the transmission power level of commonly-used VEMCO© transmitters and modeled as a function of bottom and surface water parameters in a GAMM framework. D50 varied significantly between seasons, increasing from 500m to >1km after cold pool formation, then returning to 500m after cold pool destruction. The best model explained 85.4% of D50 variation and included bottom records of receiver tilt angle and ultrasonic noise; surface records of wind speed, wave height, dominant wave period; and the difference between sea surface and bottom water temperature, a proxy of cold pool strength. The results indicate that higher sea states can substantially diminish telemetry detection ranges, but that this effect is much less following cold pool formation, likely due to a decrease in transmission of ultrasonic noise across the thermocline.

O4. **Authors: Paul J. Rudershausen**, Steven J. Poland , Jeffrey H. Merrell, Claire B. Pelletier, C.S. Mikles, and Jeffrey A. Buckel
Presenter Affiliation: North Carolina State University Center for Marine Science and Technology

Can meta-analysis and dockside sampling predict a rate of discard mortality of dolphinfish Coryphaena hippurus in the U.S. South Atlantic recreational fishery?

Field studies to estimate discard mortality are labor-intensive, expensive, and often take several years or more to accomplish. Thus, discard mortality estimates are not always available when needed for stock assessments or management purposes. We examined whether an inexpensive and relatively fast approach - meta-analysis coupled with dockside sampling - would provide discard mortality estimates for dolphinfish Coryphaena hippurus comparable to an estimate from a multi-year capture-mark-recapture (n = 4,648 tags) for the recreational hook and line fishery for this species in the U.S. South Atlantic. The first step of the meta-analysis approach was to sample dolphinfish (n=2,141) for anatomical hooking location from dockside landings in

the fishery. The second step was to mine published literature for hooking location-specific rates of discard mortality on teleosts. A model was fitted to these proportion-by-hooking location (dockside sampling) and mortality-by-hooking location (publication) data. The estimated median proportional rate of discard mortality from the meta-analysis approach [0.18 (95% credible set: 0.17, 0.19)] was similar and had overlapping credible intervals with the estimate from the capture-mark-recapture experiment [0.25 (95% credible set: 0.05, 0.39)]. This combined approach using published data on other species and freely available fishery-dependent samples on the species of interest may be applicable in other situations where limited data and logistics prevent estimating discard mortality directly on the focal species. We caution that this type of approach should be applied only when the principal source(s) of mortality can be accounted for through both published literature and representative sampling of the fishery.

O5. **Authors: Jim Uphoff**, Margaret McGinty, Carrie Hoover, Alexis Park, and Marek Topolski
Presenter Affiliation: Maryland Department of Natural Resources

Does organic matter matter to feeding success of yellow perch larvae in Chesapeake Bay subestuaries?

We examined whether development negatively influenced watershed organic matter (OM) dynamics, altering zooplankton available for first-feeding Yellow Perch larvae in Chesapeake Bay subestuaries. Successful first-feeding is an important influence on year-class success of fishes. Urbanization may negatively impact quantity of OM by diminishing marshes and forests that provide OM and disconnecting natural OM transport. During 2010-2016, feeding success (ranked from 0 to 4) and diet composition (presence of copepods, cladocerans, or “other”) of 6-9 mm TL larvae (first-feeding) were measured and compared with proportion of samples without OM (OM0) in eight subestuaries with rural to early suburban watershed development. Amount of organic matter present was negatively influenced by development and this relationship was described by a non-linear power function depicted OM0 increasing towards 1.0 (OM completely absent) at a decreasing rate with development. Dome shaped quadratic relationships described how mean fullness rank of early larvae changed with OM0. Presence of copepods also had a significant dome-shaped relationship with OM0 and mean fullness rank was positively and linearly related to presence of copepods, but not remaining food items. Copepods represented a much larger food item. Dome-shaped relationships with feeding variables suggested there might be too much OM (acting as a prey refuge), too little (not enough to support zooplankton), and an optimum amount for first feeding yellow perch larvae. Subestuaries with too little OM were exclusively suburban.

O6. **Authors: Marvin Mace III**, and Michael J. Whilberg
Presenter Affiliation: Chesapeake Biological Laboratory

Using censored regression when estimating abundance and exploitation rate with catch-effort data to account for daily catch limits

In fisheries where there is a limit on total catch in a given period, catch-per-unit-effort (CPUE) data may not be proportional to total population size because CPUE values may be censored at the catch limit. Commonly used depletion estimators (e.g., Leslie method) could be biased when ordinary least squares (OLS) regression is used with censored CPUE data to estimate abundance. We used simulations to examine the performance of OLS regression and a censored regression approach when estimating abundance and exploitation rate using censored CPUE data with a range of known exploitation rates. We also applied the censored regression approach to data from the commercial fishery for the eastern oyster *Crassostrea virginica* in Fishing Bay, a tributary of the Chesapeake Bay, to estimate abundance and exploitation during 2009 to 2017. The censored regression approach was always less biased and more precise when estimating abundance and exploitation rate than the OLS regression in our simulations except at the lowest exploitation rate (0.1). Harvest and estimated abundance of oysters in Fishing Bay increased during 2009 to 2013 and then decreased through 2016, while exploitation rates had no substantial trend over time. The censored regression approach could be useful for estimating abundance and rate of exploitation using catch-effort data when the distribution of CPUE data are affected by catch limits.

O7. **Authors: Charles W. Bangley**, Erica Knowles Atkins, Katrina Lohan, Robert Aguilar, Matthew Ogburn, Roger Rulifson
Presenter Affiliation: Smithsonian Environmental Research Center

Possible origins and migratory connections of juvenile bull sharks (*Carcharhinus leucas*) in Pamlico Sound, North Carolina

Juvenile Bull Sharks (*Carcharhinus leucas*) were historically rare in fishery-independent surveys of Pamlico Sound, North Carolina but have been consistently documented in parts of the estuary since 2012, raising the possibility of nursery habitat range expansion into the estuary. If this does represent a range expansion, then determining their origins would provide valuable insight into the responses of highly migratory marine predators to large-scale ecosystem shifts like climate change. We hypothesize that juvenile Bull Sharks found in Pamlico Sound were born in the estuary from parents originating from Florida's Indian River Lagoon, the main primary nursery for the species on the U.S. Atlantic coast. Because evidence for philopatry has been found among Bull Sharks, analysis of movement behavior and genetic population structure may reveal the origin of Pamlico Sound's sharks. We deployed acoustic transmitters on juvenile Bull Sharks caught in Pamlico Sound and opportunistically collected dorsal fin clips

from tagged sharks and mortalities in North Carolina Division of Marine Fisheries surveys. Mitochondrial DNA regions that have been found to indicate population structure and philopatry in other studies were sequenced and compared with sequences from other Bull Shark nurseries on the U.S. Atlantic coast and in the Gulf of Mexico. Acoustic telemetry results from a young-of-year shark tagged in Pamlico Sound documented a long-distance migration to Cape Canaveral, Florida during the winter. Genetic analysis is ongoing and will assess the relationships of juvenile sharks in Pamlico Sound with those found in the Indian River Lagoon and the Gulf of Mexico.

O8. **Authors: Brian K. Gallagher**, Mary C. Fabrizio, and Troy D. Tuckey
Presenter Affiliation: Virginia Institute of Marine Science

Exploring asynchrony in juvenile striped bass recruitment among Chesapeake Bay nursery areas

Striped bass (*Morone saxatilis*) are an ecologically important species that support large fisheries along the United States east coast. Recruitment from dominant estuarine nursery areas in the Hudson River, Delaware Bay and Chesapeake Bay is crucial for the maintenance of harvestable biomass, but the relative contribution of each nursery area to coastal striped bass abundance varies spatially and temporally. In addition, spatial asynchrony in recruitment within individual nursery areas is not well studied, despite its potential to stabilize abundance through portfolio effects and buffer populations against environmental change. To address this research gap, we analyzed eight time-series of recruitment from Chesapeake Bay nurseries (James, York, Rappahannock, Potomac, Patuxent, Upper Bay, Choptank and Nanticoke). Recruitment was expressed as an index of juvenile striped bass abundance from seine surveys conducted by the Maryland Department of Natural Resources and the Virginia Institute of Marine Science. A dynamic factor analysis (DFA) was implemented to identify common trends across all time-series over a 61-year period from 1957 to 2017, and relate each common trend to three covariates that have been hypothesized to influence striped bass recruitment (spring temperature, spring river flow and the North Atlantic Oscillation index). We also estimated tributary-specific loadings that were subsequently used to infer spatial asynchrony and potential portfolio effects. Such information may yield valuable insights into stability and resilience of striped bass recruitment in the face of environmental change, and motivate more detailed studies of spatial variation in the ecology of juvenile striped bass within and among nursery areas.

O9. **Author: Desmond M. Kahn**
Presenter Affiliation: Delaware Division of Fish and Wildlife, retired

Potential overestimation of the fishing mortality rate in catch-at-age modeling due to an

increase in the natural mortality rate in Mid-Atlantic and New England waters caused by an increase in predator abundance

Recently, analysis of the stock assessments and management performance of the New England groundfish fishery concluded that, on average, the harvest rate (i.e. the instantaneous fishing mortality rate) attained was 150% of the target harvest rate, yet the landings were only 79% of the allocated quota. This result appears contradictory. If the fishery only lands 79% of the allocated quota, then the harvest rate should be only 79% of the target rate, unless a miscalculation has occurred. That analysis, however, made the assumption that the estimated harvest rates in the stock assessments were accurate. In fact, if natural mortality has risen, but the assessments assume natural mortality is constant, the assessment methods of catch-at-age models will usually overestimate the harvest rate. Given the increased abundance of piscivores in the Northeastern coast, including pinnipeds, spiny dogfish and striped bass, natural mortality of groundfish and other assessed species may have increased. I will present an example of this bias in the case of weakfish. While the recent discovery of underreporting of groundfish landings complicates matters, data from the 2013 assessment of Georges Bank yellowtail flounder also is consistent with a bias in assessing harvest rate.

O10. **Authors: Joseph J. Luczkovich**, Roger A. Rulifson , Mark W. Sprague
Presenter Affiliation: East Carolina University

Monitoring fish and marine mammal sounds with a wave glider

Remote observations of marine animal behavior have one distinct advantage over direct observations: the observer is not present to disturb the animals. There are no vessel noises, no diver's bubbles, no people present that could alter the behavior of the animals being observed. We report here how an autonomous vehicle, a Liquid Robotics SV2 wave Glider equipped with hydrophone (Reson 4014) and Decimus Passive Acoustic Monitoring (PAM) System and acoustic tag detector (Vemco VR2C), was used to document habitat use by fishes and whales in the coastal ocean. We identified spawning sounds associated with red drum, *Sciaenops ocellatus*, from offshore locations near an artificial reef in Onslow Bay, NC on 16 Sep 2015. Other fishes identified were striped cusk eels, *Ophidion marginatum*, sea robins *Prionotus* sp. and oyster toadfish *Opsanus tau*). We also recorded marine mammal sounds (bottlenose dolphins *Tursiops truncatus*), which are predators on these fishes. The fish sounds are in the lower frequency range (the red drum calls have a dominant frequency of 0.125 kHz; striped cusk eel chattering calls are dominant at 1.5 kHz with a range of 1.0-2.5 kHz). The wave glider and Decimus PAM System allowed us to record red drum spawning calls on the continental shelf near an artificial reef for the first time off North Carolina. The passive acoustic system documented essential fish habitat locations for this federally managed species that could be affected by seismic surveys, wind power, and oil and gas energy development projects planned on the continual shelf off North Carolina.

O11. **Author: Matthew B. Ogburn**
Presenter Affiliation: Smithsonian Environmental Research Center

Animal telemetry in the Mid-Atlantic: Opportunities and challenges

Animal telemetry provides a window into the hidden lives of aquatic species and has great potential for application to fisheries management and conservation. The fisheries research and management community in the mid-Atlantic has pioneered many advances in technology, data analysis, and research networks. With the development of the US Animal Telemetry Network (ATN), we are entering a new era with great potential for researchers and data users to realize the full potential of telemetry data for scientific inquiry and addressing societal needs. Opportunities identified in a workshop at the 2018 AFS National Meeting included "building community, incorporating telemetry further into fisheries science, disease ecology, social science, and other fields, broadening the diversity of species studied, and expanding into pelagic zones and the deep sea". The community also faces challenges including a lack of stable funding for telemetry arrays, a need for agreement on policies and practices for data sharing and use, transition of acoustic telemetry data sharing to a regional database node of the ATN, and many others. This talk provides an overview of the state of the field and is intended to spark discussion of short and long term opportunities.