34TH ANNUAL MEETING

OF THE

Tidewater Chapter

American Fisheries Society

Maryland – Virginia – North Carolina

DOWNTOWN HAMPTON

MARCH 12-14, 2020

MEETING PROGRAM

HOSTED BY

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AFS Tidewater Meeting Schedule Overview

March 12-14, 2020

Thursday March 12, 2020

Time	Event	Location
3:00 – 5:00 PM	Educational Event: Tour of Hampton's Historical Working Waterfront	Hampton Marina Hotel Lobby 700 Settler's Landing Rd, Hampton, VA 23669
3:00 – 5:00 PM	EXCOMM Meeting	Hampton Marina Hotel: Chesapeake Room 700 Settler's Landing Rd
5:00 – 6:00 PM	Poster Set-up and On-site Registration	Hampton History Museum 120 Old Hampton Ln.
6:00 – 9:00 PM	Poster Session (registration available until 8:00 PM)	

Friday March 13, 2020

Time	Event	Location
7:30 AM	Registration Opens	Hampton Marina Hotel Ballroom 700 Settler's Landing Rd
8:00 – 8:30 AM	Coffee Available	
8:30 – 8:40 AM	Welcoming Remarks	
8:40 – 9:00 AM	State of Virginia Fisheries: Pat Geer, VMRC Chief of Fisheries Management	
9:00 – 9:45 AM	Plenary Talk: James Morley, ECU	
9:45 – 10:15 AM	Student Lightning Talks	
10:15 – 10:30 AM	Coffee Break	

10:30 – 12:00 PM	Student Oral Presentations	
12:00 – 1:15 PM	Lunch on your own (including student/mentor lunch)	Downtown Hampton (see Hampton Guide for options)
1:15 – 3:00 PM	Student Oral Presentations	Hampton Marina Hotel 700 Settler's Landing Rd
3:00 – 3:15 PM	Coffee Break	
3:15 – 4:05 PM	Student Oral Presentations	
4:05 – 5:00 PM	Business Meeting	
6:00 – 7:00 PM	Social Hour	Virginia Air & Space Center 600 Settler's Landing Rd
7:00 – 8:30 PM	Dinner	
8:30 – 10:00 PM	Awards, Auction, and Raffle	

Saturday March 14, 2020

Time	**Event**	**Location**
8:00 – 8:30 AM	Coffee Available	Hampton Marina Hotel 700 Settler's Landing Rd
8:30 – 10:30 AM	Professional Oral Presentations	
10:30 – 10:45 AM	Coffee Break	
10:45 – 11:45 PM	Professional Oral Presentations	
12:00 PM	Meeting Adjourned	

Plenary Talk

Projecting Climate Change Impacts on Marine Species: Quantifying Uncertainty and Identifying Vulnerable U.S. Fisheries

James W. Morley

East Carolina University, Coastal Studies Institute

Ocean warming in recent decades has already led to the redistribution of suitable habitat for many marine species. Temperatures are projected to continue increasing during the 21st century, and large-scale shifts in species distribution are expected. Resource managers require projections of future climate impacts on marine species to make proactive decisions. My research has involved conducting high resolution 21st century projections of thermal habitat on the continental shelf system for hundreds of marine species. Suitable habitat for many important resource species may shift northward dramatically. Climate impacts on U.S. fisheries will vary by region and some regions may benefit while others have mostly negative projected impacts. The approach to fisheries management needs to progress from one that assumes relatively static stock dynamics to one of climate adaptability. Future projections will be an important part of climate adaptive management, and the use of multi-model approaches that quantify uncertainty should be used when forecasting climate impacts.

Poster Session

6:00 – 9:00 PM, Thursday March 12, 2020

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

Easel #	Presenter (S = Student)	Title of Poster
1	Frey, B. (S)	Validation of age and growth estimates of Monkfish (Lophius americanus) using microstructural analysis of hardparts
2	Teears, T. (S)	Estimation of recruitment variation using cohort-specific von Bertalanffy growth coefficients: Stock assessment implications
3	Dowiarz, S. (S)	Hickory shad (*Alosa mediocris*) vs. American shad (*Alosa sapidissima*): Comparing aging techniques for congeneric species
4	Rulifson, R.	Hickory shad otolith development as viewed using scanning electron microscopy
5	Hill, C. (S)	Characterizing the life history of hickory shad (*Alosa mediocris*) using otolith microchemistry
6	Itakura, H.	Chesapeake Bay habitat selection by striped bass derived from biotelemetry records
7	Bartlett, B. (S)	Projected changes of the distribution of Nassau grouper spawning habitat and its management applications
8	Martinez, J. (S)	Striped marlin, *Kajikia audax*, in the Central North Pacific Ocean: One stock or two?
9	Pelletier, C. (S)	Movement ecology, reproductive dynamics, and enhanced prey resolution for non-native catfishes in a North Carolina coastal river
10	O'Brien, K. (S)	Characterizing changes in habitat for large coastal and small coastal sharks along the southeastern Atlantic Coast

11	Nichols, Q. (S)	Phenology in a changing environment: Ecological forecasts of Albemarle Sound/Roanoke River striped bass stock migration
12	Rubalcava, K. (S)	Development of a Maryland Coastal Bays ecosystem model to assess the influence of climatic factors on biomass distributions of fish and macroinvertebrates, food web linkages and community structure
13	Cobbs, C. (S) Dryden, E. (S)	Investigating the impact of storm events on the availability of terrestrial insect prey to mummichog (*Fundulus heteroclitus*)
14	Coleman, N. (S)	Association behavior between round scad (*Decapterus punctatus*) and sand tiger sharks (*Carcharias taurus*) as seen on SharkCam may be mutually beneficial
15	Leach, N. (S)	Condition factor and HSI as indicators of overall condition of *Plotosus lineatus* in the Philippines
16	Hodges, K. (S)	Trace metal analysis of menhaden (*Brevoortia tyrannus*), red drum (*Sciaenops ocellatus*), and croaker (*Micropogonias undulatus*) muscle tissue from the Cape Fear River Estuary, North Carolina
17	Milton, I. (S)	MicroRNA isolation from three neurosensory structures in CO2-exposed marine fishes
18	Williams-McLeod, S. (S)	Effects of acidification on the neurosensory biology of red drum (*Sciaenops ocellatus*)
19	Fowler, A.	Field surveys and comparative parasitology of freshwater native and invasive snails in Virginia

20	Robison, C.	Bioaccumulation and depuration of the harmful algal bloom toxin goniodomin A in *Crassostrea virginica*
21	Everhart, J.	Variations in mesozooplankton abundance, species composition, and seasonality in Beaufort Inlet, NC based on semi-automated taxonomic identification with ZooScan
22	Richie, K.	Building strength within the acoustic community
23	Baker, M.	Why you should write about your research for Sea Grant's saltwater angling blog

POSTER ABSTRACTS

PS1. Authors: **Benjamin Frey**, Rosemary Jagus, Anne Richards, and David Secor
Presenter Affiliation: Chesapeake Bay Laboratory

Validation of age and growth estimates of Monkfish (Lophius americanus) using microstructural analysis of hardparts

Without accurate age interpretation or validation, serious errors in the management and understanding of fish populations can occur. Monkfish (Lophius americanus) are one of the most economically valuable species of the Mid-Atlantic fisheries. Conservative fishing quotas were recently required owing to refutation of traditional ageing methods upon which previous stock assessments depended. This study examines age determination methods for Monkfish. The NMFS Northeast Fisheries Science Center has provided monthly archived hardpart samples of ilicia, otoliths, and vertebrae from a cohort of "known-age" monkfish arising from the exceptionally strong 2015 year-class. Still, annuli within these structures are difficult to interpret. This study seeks to employ a novel approach to monkfish ageing using trace element microconstituent analysis of hardparts. Seasonal changes in the hardpart microconstituents (Ca, P, Sr) are analyzed to test whether seasonal cycles in these trace elements correspond with visual interpretations of annuli. 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 practices.

PS2. Authors: **Thomas Teears**, Laura Lee, Shanae Allen, Jie Cao, and Jeffrey Buckel
Presenter Affiliation: North Carolina State University

Estimation of recruitment variation using cohort-specific von Bertalanffy growth coefficients: Stock assessment implications

Recruitment plays a major role in fisheries science as it is the major driver in population dynamics and accurate estimates of variations in recruitment in stock assessment has important implications for management. Recruitment variation has been shown to be difficult to estimate and has previously been linked to environmental factors in stock assessments. Many of those environmental processes also impact growth rates and growth trajectories for juveniles. Recruitment could be negatively (i.e. density-dependent) or positively (i.e. growth-survival) related to growth. We used length-at-age data to estimate variations in recruitment and cohort specific estimates of the von Bertalanffy growth coefficient (*K*) for Florida Atlantic sheepshead. Growth estimates were tested for correlation against the predicted recruitment variations from the most recent stock assessment of Atlantic sheepshead. We found a positive relationship between the cohort-specific growth and recruitment. A stock assessment simulation study confirmed the contribution of using *K* as an index of recruitment which, performed better than an index of abundance. These results suggest that length-at-age data may provide further information for stock assessment by informing recruitment variation. This

may be especially useful when survey derived recruitment indices are unavailable or inadequate. Furthermore, these results emphasize the lasting impacts of processes affecting growth of younger age classes.

PS3. Authors: **Samantha A. Dowiarz** and Roger A. Rulifson
Presenter Affiliation: East Carolina University

Hickory shad (*Alosa mediocris*) vs. American shad (*Alosa sapidissima*): Comparing aging techniques for congeneric species

Hickory Shad (*Alosa mediocris*) are anadromous fish that span the coastal ocean of the eastern United States and ascend freshwater watersheds from the Susquehanna River in Maryland to the St. John's River in Florida to spawn in the spring. Both the Hickory Shad and its relative, the American Shad (*Alosa sapidissima*), comprise important commercial and recreational fisheries throughout their ranges, especially in North Carolina where they represent a multi-million-dollar sport fishery. Exactly how similar these two species are in life history is unknown, but the two species are managed together federally by the Atlantic States Marine Fisheries Commission. Both species are iteroparous, or have multiple spawning cycles throughout a lifetime, and to justify this life history characteristic for American Shad, a study validated spawning years through a scale aging protocol. An aging protocol for Hickory Shad scales has never been published in the primary literature, so we developed a Hickory Shad aging technique for comparison to the published American Shad scale aging protocol. A sex-specific length-at-age distribution will be created based on the fork length (FL) and age, and the length data provided from the North Carolina Wildlife Resource Commission will be included to create an age-length key for each North Carolina watershed.

PS4. Authors: **Roger A. Rulifson** and Tom Fink
Presenter Affiliation: East Carolina University

Hickory shad otolith development as viewed using scanning electron microscopy

The Hickory Shad, *Alosa mediocris*, is an anadromous clupeid with spawning populations between the Susquehanna River, Maryland, and the St. John's River, Florida. To our knowledge, this is the first series of microphotographs of the species using scanning electron microscopy (SEM). Earliest otoliths from a specimen 57 mm TL show few features on the distal side and developing features on the proximal (sulcus) side. Adult otoliths exhibit 11-15 invaginations along the distal ventral edge, often with holes in the calcium matrix midway toward the otolith core. We believe the otolith nucleus contains a magnesium crystal, which may function as the "seed" for otolith formation. Unlike the other Alosines, the end of the antirostrum appears more or less as a rectangle and is not contiguous with the main otolith body. Often the postrostrum possesses an extension, or spur, which can be short or long. The appearance of the spur in the sampled spawning population is significantly related to latitude of the spawning watershed. The function of the spur is unknown at this time.

PS5. Authors: **Christopher R. Hill** and Roger Rulifson
Presenter Affiliation: East Carolina University

Characterizing the life history of hickory shad (*Alosa mediocris*) using otolith microchemistry

Hickory Shad (*Alosa mediocris* (Mitchell 1814)) is an anadromous clupeid found in Atlantic coastal systems. Little information exists regarding the life history of Hickory Shad. and management strategies have relied on life history information from American Shad (*Alosa sapidissima*), as the two species are often assumed to be very similar. We are using otolith microchemistry to better understand the life history of Hickory Shad so that more appropriate management strategies can be devised. Sagittal otoliths were taken from Hickory Shad that were captured in 27 watersheds. Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) was used to measure the concentration of seven different elements (Mg^{2+}, Mn^{2+}, Cu^{2+}, Zn^{2+}, Sr^{2+}, Ba^{2+}, and Pb^{2+}) along cross sections of each otolith, resulting in a chronological record of each individuals life history. We are fingerprinting separate spawning stocks of Hickory Shad, characterizing their migratory movements, and investigating the extent to which they show spawning fidelity to natal rivers. Differences in the chemistry of microstructures at various life stages were analyzed using analysis of variance (ANOVA) and Tukey's honestly significant difference (Tukey's HSD) post-hoc test. A classifier will then be developed using machine learning algorithms to identify watersheds based on the chemistry of each microstructure.

PS6. Authors: **Hikaru Itakura**, Michael H.P. O'Brien, and David H. Secor
Presenter Affiliation: Chesapeake Biological Laboratory

Chesapeake Bay habitat selection by striped bass derived from biotelemetry records

Using both biotelemetry and water quality data recorded throughout Chesapeake Bay, we tested the thermal-niche oxygen squeeze hypothesis for striped bass. Striped bass collected in the Potomac River were implanted with acoustic transmitters and their subsequent distribution was monitored from 2014 to 2016. Telemetry records were shared for receivers deployed throughout Chesapeake Bay. Surface (above the pycnocline) and bottom dissolved oxygen (DO), salinity, and temperature data were obtained from the Chesapeake Bay Program. Water quality values corresponding to each receiver were then interpolated through water-distance-based kriging. Using the predicted DO and temperature, growth rate potential (GRP: g/g/day) of striped bass detected at each receiver was calculated through application of a bioenergetics model. Striped bass selection behavior for these water quality parameters as well as GRP value were evaluated through Single Parameter Quotient analysis. A predictive habitat model of striped bass distribution was constructed using a generalized additive model with zero-inflated Poisson distribution, which included number of detected individuals per receiver as a response variable; and DO, salinity, temperature, and month as predictor variables.

PS7. Authors: **Brian S. Bartlett**, Brad Erisman, and Rebecca G. Asch
Presenter Affiliation: East Carolina University

Projected changes of the distribution of Nassau grouper spawning habitat and its management applications

Nassau Grouper (*Epinephelus striatus*) is an endangered, iconic Caribbean reef fish whose spawning and larval success may be impacted by climate change. These fish typically spawn within aggregations on coral reefs from December to April. Climate change threatens to reduce suitable spawning habitat via thermal stress 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 quantify changes in spawning habitat suitability of *E. striatus* using a multi-model approach to better quantify model uncertainty and determine its influences on management. The GFDL, IPSL, and MPI climate models were used to compare sea surface temperature (SST), seasonal SST gradients, and geostrophic currents from historical (1981-2000) and future periods (2041-2060 and 2081-2100) under two climate change scenarios. These environmental variables were selected as they were determined in prior research to impact the probability of spawning. Under both future periods, SST exceeded the thermal tolerance of *E. striatus* across much of the Caribbean among all three models, with the largest increases in SST seen in the IPSL model. As a result, the models all showed average declines in habitat suitability, with the declines increasing between mid-century and 2100. These findings may have major impacts on the fishery of an iconic species by potentially reducing their reproductive output. Additionally, this shows that MPAs and seasonal spawning sales bans may need to be reevaluated to continue protecting suitable spawning habitat for Nassau Grouper.

PS8. Authors: **Jackson L. Martinez**, Jan R. McDowell, and John E. Graves
Presenter Affiliation: Virginia Institute of Marine Science

Striped marlin, *Kajikia audax*, in the Central North Pacific Ocean: One stock or two?

Relative to many highly migratory fishes, striped marlin, *Kajikia audax*, exhibit considerable stock structure. Five genetically distinct striped marlin stocks have been resolved throughout the Pacific and Indian oceans, but central North Pacific stock composition remains unclear. Genetic evidence from some studies indicates that central North Pacific striped marlin are part of a greater North Pacific stock, which includes individuals from Japan, Taiwan, Hawaii, and California. However, the presence of an additional central North Pacific stock has been suggested by two recent studies, albeit with relatively limited statistical power. The goals of this research are to 1) use genetics to validate the presence of a second stock in the central North Pacific and 2) examine the relative frequency of the two stocks over time. Striped marlin sampled from the Hawaii-based pelagic longline fishery will undergo genotyping-by-sequencing and the data will be used to supplement existing data to validate the presence of a separate central North Pacific stock. If the second stock is resolved, a genetic marker panel comprised of those loci with the highest power to discriminate the two stocks will be developed. Individuals of known size and reproductive condition collected from the central North Pacific over the course of one year will be assigned to one of the two stocks based on their genotype. Through intensive temporal sampling, this study will contribute a better

understanding of central North Pacific striped marlin stock dynamics and represents the first investigation into the fine-scale stock composition of a highly migratory species fishery.

PS9. Authors: **Claire Pelletier**, and Frederick S. Scharf
Presenter Affiliation: University of North Carolina Wilmington

Movement ecology, reproductive dynamics, and enhanced prey resolution for non-native catfishes in a North Carolina coastal river

Ranges of blue and flathead catfish in North Carolina were historically restricted to drainages in the western portion of the state. In the 1960's introductions of both species to Atlantic coastal rivers have led to numerous established non-native populations. To date, research to inform the impacts of these populations on native fauna has focused on estimates of spatial distribution, population demography, and trophic ecology. In the Cape Fear River, recent findings indicate the presence of broad age and size structures of each species, with relatively specialized food habits that demonstrate increased importance of fish prey resources for larger catfish. However, the impacts on native fishes is limited by the recovery of prey in advanced stages of digestion, making identification difficult. Additional areas of research also remain poorly understood, including seasonal movement patterns at fine and broad spatial scales within their introduced range, as well as quantitative estimates of reproductive output which depend on accurate schedules of maturity and the size dependence of egg production. The next phase of non-native catfish research in the Cape Fear River system will include the application of DNA barcoding to improve prey fish identification, passive and active tracking of telemetry-tagged individuals to identify broad seasonal movements and the extent of brackish water habitat use, and the use of histological approaches to estimate catfish maturity schedules and estimate fecundity. These efforts propose to build onto previous work and lead to an improved understanding of the role of non-native catfishes in the lower Cape Fear River ecosystem.

PS10. Authors: **Kaitlyn O'Brien**, Robert Latour, and Enric Cortes
Presenter Affiliation: Virginia Institute of Marine Science

Characterizing changes in habitat for large coastal and small coastal sharks along the southeastern Atlantic Coast

The K- selected life history characteristics of sharks increases their vulnerability to anthropogenic impacts including fishing pressure and climate change. Changes in environmental characteristics are expected to have an impact on fisheries management by impacting management boundaries, migration patterns, and species distributions. Previous analyses for a variety of bony fishes along the U.S. Atlantic Coast shelf show a general northward and eastward shift in distribution to deeper waters. These types of analyses have not been undertaken for species within the large coastal (LCS) and small coastal shark (SCS) complexes. By characterizing historical distribution shifts and preferred abiotic habitat features for representative LCS and SCS species using multiple fishery-independent surveys, this research will assist in understanding of how changing climate is expected to impact sharks along the Southeastern Atlantic. Potential historical changes in species distribution

were evaluated through five different distributional parameters including center of biomass, maximum latitude, mean depth of occurrence, mean temperature of occurrence, and area occupied. Generalized additive models (GAMs) were used to analyze the relationship between survey catch and a suite of abiotic habitat variables, including temperature and depth, to create abiotic character profiles. Resulting character profiles will later serve as the basis for computation of 'present-day' available habitat and interpretation of 'expected future' changes in available habitat and distribution under various Representative Concentration Pathways (RCP). Understanding past and current changes in the range of LCS and SCS species will impact future management and research of the U.S. southeast Atlantic community.

PS11. Authors: **Quentin Nichols**, Rebecca G. Asch, and Roger Rulifson
Presenter Affiliation: East Carolina University

Phenology in a changing environment: Ecological forecasts of Albemarle Sound/Roanoke River striped bass stock migration

Climate change and climate variability are leading to shifts in the seasonal timing of fish migration and reproduction (i.e., phenology) across many ecosystems and species, with changes especially common among anadromous fishes, such as Striped Bass (*Morone saxatilis*). Understanding how Striped Bass will be affected by climate change is an important issue for stakeholders across the US East Coast given its use as a recreationally and commercially targeted species. Other spawning populations of this species vary their spawning migration timing with respect to seasonal temperatures. North Carolina hosts the Albemarle Sound/Roanoke River (A/R) stock, which is the southern most major spawning population of Striped Bass. Large A/R Striped Bass (>900 mm TL) have been shown to migrate long distances in the summer reaching Cape Cod, MA before overwintering offshore in the coastal waters of North Carolina and Virginia and then returning to their spawning grounds in early spring. This study's objective is to create an ecological forecast of the timing of the Roanoke River spawning run, which can be used to determine the best time to protect large spawning females and assess the optimal timing of water releases from dams under future climate change. The study will use historical data from a Striped Bass egg survey conducted from 1959-1992 and a concurrent creel survey data to model spawning migration timing as a function of river, estuarine, and coastal temperature, regional climate indices, dissolved oxygen concentration, wind speed, river flow pulse duration timing, and Striped Bass population size structure. This ecological forecast is important since there is management in place to protect Striped Bass by closing the fishery seasonally, during their migration, yet the timing of this closure does not change. The forecast will make the fishery and the management of the fishery more efficient by providing a predictive tool to its stake holders, which could allow them to adapt the seasonal closure, seasonal fishing effort, or water releases from dams to changing spawning times. Preliminary phenological metrics will be presented comparing migration timing calculated by creel data and the Striped Bass egg survey.

PS12. Authors: **Kasondra Rubalcava**, Howard Townsend, and Paulinus Chigbu
Presenter Affiliation: Virginia Institute of Marine Science

Development of a Maryland Coastal Bays ecosystem model to assess the influence of climatic factors on biomass distributions of fish and macroinvertebrates, food web linkages and community structure

The Maryland Coastal Bays (MCBs) are a system of shallow lagoons on the US East Coast connected to the Atlantic Ocean by two inlets. They are one of the most ecologically diverse estuaries on the east coast and serve as a nursery for many commercially important species such as black sea bass, summer flounder and blue crabs. Due to their significant use by the public, MCBs are vulnerable to environmental and human pressures. Understanding how environmental factors affect the ecosystem can help in managing this dynamic ecosystem. We created a fisheries ecosystem model for the MCBs consisting of 22 functional groups using Ecopath with Ecosim (EwE) software to explore the influence of environmental factors on biomass distributions of key fish species including summer flounder, black sea bass, bay anchovy, weakfish, and blue crab. The biomass input data used for Ecopath were estimated from abundance indices data from the Maryland Department of Natural Resources (MDDNR) Coastal Bays Fisheries Investigation Trawl and Beach Seine Surveys. Time series data imported from 1990-2017 through the MDDNR survey was used to fit the model. Climate change scenarios were run using changes in temperature and salinity to evaluate the effects they have on key species in the MCBs. The results of this study will aid in management of the MCBs as it's a nursery habitat for commercially important species.

PS13. Authors: **Cade Cobbs**, **Emma Dryden**, Jessica Thompson, and Heather Harwell
Presenter Affiliation: Christopher Newport University

Investigating the impact of storm events on the availability of terrestrial insect prey to mummichog (*Fundulus heteroclitus*)

Estuarine and intertidal habitats are impacted by climate change due to rising sea level, increasing temperatures, and more frequent storm events. Global change could have major implications for the resident species living in these habitats. The objective of this study was to investigate how terrestrial insect prey availability for the mummichog (*Fundulus heteroclitus*) was impacted by storm events within Hoffler Creek, a tidal creek in Portsmouth, VA. This study compared the gut contents of mummichogs collected at two sites along an upstream-downstream gradient before and during storm events in June and July 2019. Fish were collected using unbaited minnow traps, humanely euthanized using MS-222, and preserved in 10% buffered formalin. Prey items within the first two sections of the gut were cataloged. Fisher's Exact tests were performed to compare (1) the proportion of terrestrial insect prey consumed and (2) the proportion of fish that consumed terrestrial insect prey during pre-storm and storm events during each month and at each site. The proportion of insects consumed at the upstream site in June was higher during the storm event ($p=0.04$). In all other cases, storm events did not have a significant impact on the terrestrial prey consumed by mummichogs ($p \geq 0.09$). There may, however, be seasonal differences in the availability of insects which could affect mummichog diet. Additional samples are currently being processed to address this possibility.

PS14. Authors: **Nicholas Coleman** and Erin Burge
Presenter Affiliation: Coastal Carolina University

Association behavior between round scad (*Decapterus punctatus*) and sand tiger sharks (*Carcharias taurus*) as seen on SharkCam may be mutually beneficial

SharkCam is an underwater live streaming camera used to survey a hard-bottom reef approximately 60 km off the coast of Cape Fear, North Carolina. The camera is sited in 15 m of water at the base of Frying Pan Tower. Video footage from SharkCam was used to capture the association behavior between round scad (*Decapterus punctatus*), a small forage fish, and sand tiger sharks (*Carcharias taurus*). We hypothesized that the association is mutually beneficial by reducing the vulnerability of round scad to pelagic meso-predators (e.g. jacks and tuna) and increasing predation opportunities for sand tiger sharks on meso-predators. Meso-predators were categorized based on their feeding style and literature reports confirming predation on round scad. Archived videos (n=216), each 20 minutes in length, containing sand tiger sharks were categorized regarding the association between round scad and sand tiger sharks from the following categories: no visible interaction, loosely aggregated, and tightly aggregated. Pearson's Chi-Square test was conducted to assess the frequency of association behaviors in the presence of meso-predators. It was found that tightly associated behavior happened more frequently than expected (p= 0.0001), supporting the hypothesis that round scad benefit from a close physical association with sand tiger sharks.

PS15. Authors: **Nichole A. Leach**
Presenter Affiliation: Old Dominion University

Condition factor and HSI as indicators of overall condition of *Plotosus lineatus* in the Philippines

The striped eel catfish, *Plotosus lineatus,* is a benthic marine fish prevalent in tropical reef ecosystems that feeds on bottom-dwelling organisms, making the striped eel catfish particularly susceptible to pollutants in its environment. The current study searches for a correlation between the overall condition of *P. lineatus* and pollutant trends in the Philippines where both marine biodiversity and pollution are high. Length-weight relationship (LWR) and condition factor (CF) were calculated for a total of 120 individuals from three different sites in the Philippines to determine the growth patterns at each locality. The hepatosomatic index (HSI), was then calculated and used in combination with LWR and CF to estimate the overall condition of specimens at any given length. LWR results illustrate negative allometric growth and lower HSI values for specimens from two localities, suggesting these populations may be in worse condition than the other site, which showed stable isometric growth and larger HSI values. However, CF shows successful populations at each site, evidence that these results may lag behind LWR and HSI, as CF is relative. This data could potentially help in determining overall ecosystem health in the Philippines, as this research highlights the potential utility of *P. lineatus'* condition as an indicator on the effects of pollution in the environment and how sites can be conserved accordingly.

PS16. Authors: **Katherine L. Hodges**
Presenter Affiliation: University of North Carolina Wilmington

Trace metal analysis of menhaden (*Brevoortia tyrannus*), red drum (*Sciaenops ocellatus*), and croaker (*Micropogonias undulatus*) muscle tissue from the Cape Fear River Estuary, North Carolina

The Cape Fear River estuary is the largest river basin in North Carolina and is highly impacted by urbanization and agricultural inputs. These inputs can potentially contain high concentrations of potentially toxic trace metals, including copper, zinc, and arsenic. Some of these metals can bioconcentrate within organisms and biomagnify up the food chain. Past studies on the Cape Fear River have focused on metal accumulation in ribbed mussels and oysters, but fish studies are rare, and more analyses need to be done to properly monitor trace metal concentration levels within this estuary. This study's objective is to determine the concentrations of heavy metals such as arsenic, copper, zinc, manganese, chromium, and nickel in the muscle tissue of menhaden (*Brevoortia tyrannus*), red drum (*Sciaenops ocellatus*), and croaker (*Micropogonias undulatus*) from the Cape Fear River. It is hypothesized that fish sampled from highly anthropogenic areas (upper Cape Fear) will have higher concentrations of metals than the lower Cape Fear fish species. Preliminary data results show moderate levels of Cu, Zn, Mn, Cr, and Ni within all three fish species. Elevated levels of As was detected in a few individuals in all three species.

PS17. Authors: **Isaiah Milton**, Carolina Bonin, Nefertiti Smith, Kendra Dorsey, Olivera Stojilovic, Janelle Layton, Deidre Gibson, and Andrij Z. Horodysky
Presenter Affiliation: Hampton University

MicroRNA isolation from three neurosensory structures in CO2-exposed marine fishes

The predicted decline in ocean pH will lead to physical and behavioral changes in marine organisms, including significant changes in neurophysiological performance of the auditory systems of soniferous marine fishes. Therefore, we need to explore both physiological responses and underlying molecular mechanisms through which fishes respond to ocean acidification. MicroRNAs are small (~22 nt) non-coding RNAs known to "fine-tune" gene expression during physiological responses to stress. These molecules are highly conserved among taxa allowing for the exploration of molecular responses in organisms lacking an annotated genome. We conducted an assessment of microRNA yields of three candidate neurosensory structures: eyes, brain, and endolymph-bathed otoliths. Tissue samples were obtained from two species, red drum (*Sciaenops ocellatus*) and Arctic cod (*Boreogadus saida*). Tissues were preserved frozen at -20°C in RNAlater (Invitrogen) upon dissection. Otoliths were pulverized manually for processing and all tissues were processed in duplicate. In average, 0.05g of soft tissue and 0.09g of otololith powder were processed per extraction. Small RNA extractions were conducted using a commercial kit (mirVana, Life Technologies). Small RNA yields were: 27.65 ng/µl (eye); 80.25 ng/µl (eye); 20.65 ng/µl (otoliths), while 260/280 ratios ranged from 1.5 to 1.6. Our findings demonstrate successful isolation of microRNAs from all three tissue types and suggest the utility of microRNA assays to mechanistically investigate neurosensory deficits in fishes facing environmental change.

PS18. Authors: Andrij Z. Horodysky, Richard W. Brill, **Sierra Williams-McLeod**, and Caroline Turner
Presenter Affiliation: Hampton University

Effects of acidification on the neurosensory biology of red drum (Sciaenops ocellatus)

The increasing uptake of carbon dioxide (CO2) by the world's oceans has caused ocean pH to decline by over 30%. There is thus an exigent need to explore the mechanisms through which fishes respond to ocean acidification. The OANeuro Project used computer-controlled CO2 dosing systems paired with specialized electrophysiological neurosensory techniques and morphological analyses to examine the effects of projected CO2 concentrations over the next two centuries on the form and function of coastal temperate red drum visual and auditory systems. This project examined the effects of both acute (two-week) and chronic (eight week) aqueous CO2 exposure on the: (1) morphological development of sensory end-organs, (2) ecophysiological performance of the visual and auditory systems, and (3) capability of a GABAA receptor antagonist to alter potential sensory deficits during acute and chronic acidification. Red Drum exposed to high CO2 concentrations experienced significant sensory deficits associated with neurotransmitter dysfunction, with evidence of some morphological change in chronic exposures.

PS19. Authors: **Amy E. Fowler**, Grace Loonam, and April M.H. Blakeslee
Presenter Affiliation: George Mason University

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

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 and 2019, 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. Genetic sequencing of 70 individuals confirmed that the invasive snails were the Japanese mystery snail (*Cipangopaludina japonica*), but the presence of only two haplotypes in the invaded region suggests a strong genetic bottleneck. In addition, five native snail species were collected. 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 included ciliates and a symbiotic oligochaete, *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.

PS20. Authors: **Clara L. Robison**, Juliette L. Smith, William M. Jones, Gail P. Scott, and Kimberly S. Reece
Presenter Affiliation: Virginia Institute of Marine Science

Bioaccumulation and depuration of the harmful algal bloom toxin goniodomin A in *Crassostrea virginica*

Alexandrium monilatum is a toxigenic algal species known to form harmful algal blooms (HABs) in marine and estuarine waters on the southeastern coast of the US and in the Gulf of Mexico. This species produces goniodomin A (GDA), a lipophilic toxin that has been isolated from *Alexandrium* spp. in Asia, the Gulf of Mexico, and Chesapeake Bay. Laboratory research has demonstrated adverse impacts of both *A. monilatum* cells and isolated GDA to marine life, including larval fish mortality and gill pathology, as well as mortality of juvenile oysters and grazing inhibition of oysters and other shellfish species. The precise mechanism of toxicity contributing to these adverse impacts is currently unknown. In addition, no controlled bioaccumulation and depuration assay has been carried out in the laboratory to investigate whether this toxin accumulates in animal tissues and, if so, to what extent depuration occurs and over what period of time. In a preliminary study to examine uptake and depuration of toxin, sub-market size oysters (*Crassostrea virginica*) were placed in individual jars and exposed to a clonal strain of *A. monilatum* isolated from a Chesapeake Bay bloom. After 48 hr, oysters were placed in clean seawater. Throughout the experiment, oysters were collected for GDA quantification via LC-MS/MS. Preliminary data indicate GDA concentrations increased in oysters during exposure to GDA and declined over 24-48 hr when oysters were placed in clean water. A full-scale study is planned to more comprehensively investigate uptake and transport to different tissues and longer-term depuration.

PS21. Authors: **J.P. Everhart**, J. Bailey, and R.G. Asch
Presenter Affiliation: East Carolina University

Variations in mesozooplankton abundance, species composition, and seasonality in Beaufort Inlet, NC based on semi-automated taxonomic identification with ZooScan

Mesozooplankton are an important food source of larval fishes in estuaries around the world. Climate change has the potential to alter the abundance, distribution, and phenology of larval fishes and zooplankton in distinct ways that could affect the spatial and temporal overlap between them. To better understand how oceanic and climatic factors may affect such trophic interactions between mesozooplankton and larval fishes, we have been collecting weekly zooplankton samples over the last three years concurrently with the NOAA Beaufort Inlet Ichthyoplankton Sampling Program, a 33-year time series monitoring larval fishes in the Newport River estuary. Samples were analyzed using Zooscan and EcoTaxa, which semi-automatically classify zooplankton into higher taxonomic groups using a machine learning algorithm. Copepods, crustacea, and appendicularia were present and comprise ~70% of the zooplankton in our samples. Other species present throughout most of the year include: larval fishes, amphipods, annelids, bivalve larvae, chaetognaths, cumacea, nauplii, and polychaetes. Cnidaria, salps, cladocera, sea star larvae, and ostracods were less common. No statistically significant relationship between temperature, salinity, dissolved oxygen, pH and chlorophyll and the abundance of copepods, crustacea, appendicularia, or

overall mesozooplankton were detected based on preliminary results. In addition, there was no seasonal or yearly variability in overall mesozooplankton, copepod, crustacea and appendicularia abundance in Beaufort Inlet, NC. This is in contrast with historical data from this estuary in the 1970s showing spring and fall zooplankton blooms. These changing patterns of seasonal zooplankton productivity may be indicative long-term changes in ecosystem structure and function that deserve greater research.

PS22. Authors: **Kimberly Richie** and Matthew Ogburn
Presenter Affiliation: Smithsonian Environmental Research Center

Building strength within the acoustic community

A number of researchers in the Mid-Atlantic and all over the east coast have been implanting acoustic tags (transmitters) in many different fish species. Researchers track these fish movements via acoustic receivers deployed in the water. These receivers, managed by the researchers that own them, record any acoustic transmitter that may swim by even if it is tagged by another researcher. The Animal Acoustic Network (ACT) was created to help manage and enable data sharing between researchers to pass on tag detections to their owners. Building off the data sharing within the ACT community, MATOS evolved. Mid-Atlantic Acoustic Observation System (MATOS) is a mapping system to store your transmitter and receiver metadata as well as holding all the receiver tag detections. This enables researchers to be able to track their fish movements throughout the community while still keeping data secure from unwanted viewers. MATOS is now compliant to start automatic tag matching with other telemetry groups like Florida Animal Tracking Network (FACT) and other Ocean Tracking Network (OTN) nodes to make sharing data across the entire East Coast more efficient. Efficiently sharing tag detections through the entire Atlantic Coast will make for a stronger more effective animal tracking community.

PS23. Authors: **M. Scott Baker, Jr.** and Sara Mirabilio
Presenter Affiliation: North Carolina Sea Grant

Why you should write about your research for Sea Grant's saltwater angling blog

Hook, Line and Science (www.HookLineScience.com) is a science blog from North Carolina Sea Grant designed to share new fisheries research results or status of on-projects with saltwater anglers in particular – and coastal stakeholders in general. Since we launched the blog in December 2018, there have been 62 original posts, including 7 posts by guest authors, 4 of which were students. Each Monday we have a new post that summarizes a recent marine fisheries research paper, dataset or work-in-progress using a template-based format that is easy for the public to read and digest. Once published, posts are shared with traditional news outlets and social media channels. We seek out blog posts that cover a variety of topics of interest to anglers and coastal stakeholders, always leading the reader with a question to be answered. We welcome guest posts from fisheries professionals and students. Stop by the poster to read the top 10 reasons why you should write a guest post for Sea Grant's saltwater angling blog.

Student Lighting Talks

Friday March 13, 2020

Moderated by David Rudders

Time	Presenter	Title of Presentation
9:45 AM	Baldisimo, J.	Determining Ecological and Evolutionary Trends in Coral Reef Fish Utilized for the Marine Ornamental Trade to Bridge Science and Policy
9:50 AM	Warfel, Z.	Variability in Morphometric Condition of Larval Atlantic Croaker and Mojarra as a Function of Temperature, Zooplankton Abundance, and Seasonality
9:55 AM	Loeher, M.	Watching a virus evolve: Quantifying pathogen fitness of IHNV in rainbow trout and sockeye salmon
10:00 AM	Farmer, M.	Assessment of the spatial and temporal distribution of *Crassostrea virginica* spat and fouling organisms in the Maryland coastal bays
10:05 AM	Clark, K.	The effect of density on the growth, yield, and reproduction of the sea scallop, *Placopecten magellanicus*

STUDENT LIGHTNING TALK ABSTRACTS

LT1. Authors: **Jemelyn G. Baldisimo**
Presenter Affiliation: Old Dominion University

Determining Ecological and Evolutionary Trends in Coral Reef Fish Utilized for the Marine Ornamental Trade to Bridge Science and Policy

Changes in species diversity, abundance and composition occur both at the ecological and evolutionary time scales. Using both approaches can provide a holistic insight for managing coral reef resources and policy-making. This proposed study aims to determine ecological trends in the marine ornamental trade and uncover evolutionary trends in genetic diversity for coral reef fish utilized for the marine ornamental trade. The first component of the study is an assessment of the global status of traded marine ornamental fish through the method prescribed by the International Union for the Conservation of Nature (IUCN). At the local scale, changes in genetic diversity of marine ornamental fish, which may potentially affected by harvesting and other anthropogenic activities throughout a centennial period, will be determined through next generation sequencing at a site where there is high demand for marine ornamental trade--the Philippines. Connectivity between reef fish populations will be investigated, which may provide insight on potential 'rescue effects'. Findings from the study can assist in promoting the conservation of coral reef fish biodiversity, understanding evolutionary consequences of environmental changes coupled with harvesting reef fish, managing the marine ornamental trade sustainably, creating policies with respect to the marine ornamental trade and management of coral reefs.

LT2. Authors: **Zachary Warfel**, Erika Desiderio-Segovia, Martina Plafcan, and Rebecca Asch
Presenter Affiliation: East Carolina University

Variability in morphometric condition of larval Atlantic croaker and mojarra as a function of temperature, zooplankton abundance, and seasonality

The success of fisheries often is determined by recruitment, which is the number of young adult fish entering the fishery each year after completing juvenile stages. Recruitment can vary by several orders of magnitude and can be unpredictable from year-to-year. This high variability influenced in oceanic conditions experienced by fish larvae can have serious effects. While larval abundance has been recorded over the past three decades in Beaufort, NC, variations in larval abundance have not been consistently related to recruitment for several fisheries species. By studying how environmental factors affect larval fish condition, we may be able to better anticipate when a high or low recruitment year occurs since condition affects larval fish growth and survival. Knowledge about how the environment affects fish condition can then be used to provide fishery managers with an early warning about changes in the productivity of a fishery. This project aims to understand the relationship between morphometric condition in comparison with temperature, prey

abundance, and seasonality among two North Carolinian fishes, Atlantic Croaker (*Micropogonias undulatus*) and Mojarra (*Eucinostomus* sp.). In this experiment, we want to confirm that when zooplankton is abundant, there will be better body condition of larval fishes. We will test to see if morphometric condition of fish will decrease due to stress caused by winter temperatures. Lastly, we want to see if Mojarra will be more affected by lower temperature as a comparison with Atlantic croaker since Mojarra are normally located at the more southern locations. We plan to test these hypotheses by looking into morphometric conditions of Atlantic Croaker and Mojarra when larval fish pass through Beaufort Inlet. These measurements will be compared to environmental conditions which the fish experience. These measurements will allow us to use ratios between different body lengths and widths to see if there is an increase or decrease in condition due to environmentally caused stress. Previous work on this project examined data on Atlantic Croaker. We identified a relationship between low temperature winters and worse morphometric condition in Croaker larvae. We aim to do a longer term study analyzing data from at least three consecutive years (2016-2018) to determine if seasonality and inter-annual variability affect morphometric condition.

LT3. Authors: **Malina M. Loeher**
Presenter Affiliation: Virginia Institute of Marine Science

Watching a virus evolve: Quantifying pathogen fitness of IHNV in rainbow trout and sockeye salmon

In rainbow trout (*Oncorhyncus mykiss*) aquaculture production, infectious hematopoietic necrosis virus (IHNV) represents a serious disease concern and can result in >90% mortality of juvenile fish. Considered endemic to the Pacific Northwest, IHNV first emerged in sockeye salmon (*O. nerka*), but made a host jump to rainbow trout and is now found in aquaculture facilities worldwide. IHNV in North America has evolved since its host-jump, exhibiting higher virulence in rainbow trout and greater thermal tolerance. Utilizing select isolates from North American IHNV genogroups, I plan to quantify IHNV's fitness before and after its host-jump by conducting shedding assays in both sockeye and rainbow trout, at their respective optimal temperatures, 10°C and 15°C. After water exposure to virus, shedding (quantified by reverse transcription PCR), time-to-death, and total mortality data will be used to characterize viral potential for transmission. Aquaculture settings potentially provide drivers for viruses to move and adapt in new ways, with possibility for spillback to wild host populations. This work will provide insight into pathogen evolution and guide subsequent management to control disease in salmonid fish production.

LT4. Authors: **Madeline Farmer**, Daniel Cullen, and Bradley Stevens
Presenter Affiliation: University of Maryland Eastern Shore

Assessment of the spatial and temporal distribution of *Crassostrea virginica* spat and fouling organisms in the Maryland coastal bays

There are numerous oyster restoration initiatives in the Chesapeake Bay and its tributaries, but fewer restoration efforts have occurred in the neighboring Maryland Coastal Bays (MCBs). The MCBs are shallow lagoonal estuaries that have small populations of eastern

oysters, *Crassostrea virginica*. There is an interest in enhancing the eastern oyster population through an oyster restoration project, but it is not known if and where natural recruitment occurs. In addition, fouling organisms can positively and negatively influence spat settlement, but the distribution of these fouling organisms in the MCBs in relation to oyster recruits is not known. To fill these knowledge gaps, spat and fouling organisms were monitored biweekly from June through August 2019 at 12 sites (six bay and six pier sites) throughout the MCBs using horizontal PVC settlement plates. We assessed the spatial and temporal variation in abundance of spat and the most prevalent fouling organisms, in addition to water quality parameters (temperature, salinity, dissolved oxygen, turbidity, and pH). Peak settlement occurred during the expected time period from late June through July 2019 and spat were most abundant closest to the inlets (Ocean City and Chincoteague Inlets). The information collected may serve as a baseline for future biofouling and spat monitoring studies. In addition, this project provides insight into the spatial and temporal distribution of spat and fouling organisms that can be used to inform stakeholders and support oyster restoration project evaluation in the MCBs.

LT5. Authors: **Kaitlyn R. Clark**, Sally Roman, Roger Mann, Theresa Redmond, and David B. Rudders

Presenter Affiliation: Virginia Institute of Marine Science

The effect of density on the growth, yield, and reproduction of the sea scallop, *Placopecten magellanicus*

The Atlantic sea scallop fishery employs a rotational area management strategy designed to increase future yield-per-recruit and spawning potential due to fast growth observed by scallops afforded protection from fishing pressure. However, it is unclear how well the analytical models that underpin this strategy hold under conditions that deviate from long-term averages, such as the high-density recruitment events observed in 2012 in the Nantucket Lightship and 2013 in the Elephant Trunk. The scallops at these sites have persisted at high densities and appear to be exhibiting varying degrees of impacted performance. The effect of scallop density on growth, yield, and reproduction was investigated through eight trips to each area with sampling of high, medium, and low-density scallop beds. In addition to catch and length data, 30 scallops were retained at each site to determine meat, viscera, and gonad weights along with sex, reproductive stage, and meat quality. Reproductive effort was quantified as the ratio of gamete production estimated as gonad weight to total production including meat weight and viscera weight to determine how reproductive effort changes with population density. Scallops at high densities had lower performance than those at medium or low densities, which is consistent with a density dependent effect as resources become limiting.

Oral Presentations

Friday March 13, 2020 – Student Oral Presentations

Moderated by David Rudders (morning) and Jim Gartland (afternoon)

Time	Presenter	Title of Presentation
10:30 AM	Ropp, A.	Molecular markers for *Mercenaria mercenaria*: Addressing wild population structure in the hard clam
10:45 AM	White, S.	Characterizing trends in participation and diversification in small-scale fisheries of Virginia
11:00 AM	Whalen, J.	Decadal changes in reef fish diversity in the central Visayas
11:15 AM	Gorman, C.	Global conservation status of the family Sciaenidae (croaker and drum)
11:30 AM	Song, J.	Signatures of selection and phenotypic plasticity of an estuarine-dependent teleost, spotted seatrout (*Cynoscion nebulosus*)
11:45 AM	Marens, M.	Movement and habitat use of female sand tiger sharks (*Carcharias taurus*) in North Carolina coastal waters
1:15 AM	Kohli, A.	Pathogen lesions and parasite invasions in American eels
1:30 PM	Schonfeld, A.	Influence of Chesapeake Bay environmental conditions on estuary utilization by mid-Atlantic fishes
1:45 PM	Best-Otubu, C.	Ecosystem dynamics of the summer flounder
2:00 PM	Gardner, S.	Contribution of ontogenetic diet and habitat shifts to variable first year growth in southern flounder (*Paralichthys lethostigma*)

2:15 PM	Jesse, J.	Quantifying drivers of mycobacteriosis in Atlantic striped bass from Maryland waters of the Chesapeake Bay
2:30 PM	Lee, T.	Biogeographic diversity of fish-infecting digenean trematodes in estuaries dominated by non-native macroalga
2:45 PM	Arai, K.	Decadal trends in stock mixing of Northwest Atlantic mackerel from otolith oxygen and carbon stable isotopes
3:15 PM	Nelson, L.	The long and short of clearnose skate morphometric and meristic comparisons
3:30 PM	Askin, S.	Population genetic structure of channeled whelk: Implications for management in the mid-Atlantic
3:45 PM	Stevens, B. (Professional)	The ups and downs of trap fishing: Environmental impacts, entanglement, and the future of trap fishing

Saturday March 14, 2020 – Professional Oral Presentations

Moderated by Chris Bonzek

Time	**Presenter**	**Title of Presentation**
8:30 AM	Scharf, F.	Assessing the potential for bias in a long-term juvenile abundance index and the implementation of a partial-replacement survey design
8:50 AM	Roman, S.	Selectivity of two commercial dredges fished in the northwest Atlantic sea scallop fishery
9:10 AM	Phillips, O.	An inside look at fisheries management in Virginia

9:30 AM	Bangley, C.	Snowbirds of the sea: Environmental associations of migratory cownose ray (*Rhinoptera bonasus*) presence in their summer and winter habitats along the U.S. Atlantic Coast
9:50 AM	Asch, R.	Assessing the reliability of species distribution model projections in the face of climate and ecosystem regime shifts: Small pelagic fishes in the California Current ecosystem
10:10 AM	Aguilar, R.	Chesapeake Bay Barcode Initiative (CBBI): The first comprehensive genetic library for fish and invertebrates of the Mid-Atlantic US
10:45 AM	Blakeslee, A.	Host–switching among crabs: Species introduction results in a new target host for native parasites
11:05 AM	Davis, C.	Results of the 2019 Virginia shrimp experimental gear permit fishery in Virginia
11:25 AM	Luczkovich, J.	Ciguatoxin detection and model predictions for use in fisheries management in Puerto Rico

ORAL PRESENTATION ABSTRACTS

Friday March 13, 2020 – Student Oral (SO) Presentations

SO1. Authors: **Ann J. Ropp**, Kimberly Reece, Richard Snyder, and Jan McDowell
Presenter Affiliation: Virginia Institute of Marine Science

Molecular markers for *Mercenaria mercenaria*: Addressing wild population structure in the hard clam

Virginia leads the nation in production of aquacultured hard clams, *Mercenaria mercenaria* (Linnaeus, 1758), with an estimated farm gate value of $38.8 million in 2018. Despite the high economic value, there are few genomic resources available to support the hard clam aquaculture industry. To develop effective genetic tools for industry, it is important to first understand population structure. Hard clams have a pelagic larval phase that allows for dispersal, but the level of genetic connectivity is not well understood. This study uses genotyping-by-sequencing to delineate the genetic stock structure of wild clams sampled along the East Coast of North America. Samples were collected from 15 locations from Prince Edward Island, Canada, to South Carolina, USA. Following DNA isolation, 452 individuals were sequenced and 153,842 single nucleotide polymorphisms (SNPs) were identified. The SNP loci were filtered for quality control and subsequently analyzed to delineate population structure and quantify levels of genetic divergence among populations. Data provides evidence of several genetically distinct populations with more structure than previously recognized. Data will be used to identify a subset of SNP markers capable of geographic discrimination and population assignment, and these will be tested on wild and hatchery clams to confirm their utility. The validated loci will be available as an assay panel that is tailored to address industry needs, such as tracking hatchery lines, monitoring genetic variation, and differentiating among wild and hatchery clams and among hatchery lines.

SO2. Authors: **Shelby White** and Andrew Scheld
Presenter Affiliation: Virginia Institute of Marine Science

Characterizing trends in participation and diversification in small-scale fisheries of Virginia

The small-scale coastal fisheries of Virginia account for a significant portion of the state's total annual landings and employ thousands of individuals. Despite the value of these fisheries, the number of commercial licenses sold has declined more than 15% since 1994. Declines are attributed to various factors, but indicate potential shifts in participation and resource dependence that may be consequential. Similar to other occupations dependent on natural resources, small-scale fishers are vulnerable to shocks and often employ diversification strategies within and outside of the fishing sector. Using state license and permitting data, this research investigates changes in participation and diversification in capture fisheries and

marine-related sectors through structural change and multiple correspondence analyses. Preliminary results indicate the percentage of fishers diversifying into more than one capture fishery (i.e. blue crab (*Callinectes sapidus)*, clam (*Mercenaria mercenaria*), oyster (*Crassostrea virginica*), or finfish species) is less than half of those licensed and has not varied widely since 1994, despite overall declines in participation. The number of fishers diversifying into marine-related sectors, however, has increased, likely due to aquaculture expansion. Analyses suggest that fishers participating in blue crab fisheries are more similar to those participating in finfish fisheries (in terms of permit holdings) than those in clam or oyster fisheries. Results also indicate that fishers participating in charter fishing are less similar to fishers participating in other marine-related sectors. Understanding individual decision-making behavior and the broader livelihood strategies of small-scale coastal fishers is integral in addressing the socio-economic impacts of environmental and management changes.

SO3. Authors: **John C. Whalen**, Jemelyn Grace P. Baldisimo, Eric Garcia, Abner A. Bucol, Jeffrey T. Williams, David Catania, Angel C. Alcala, and Kent E. Carpenter
Presenter Affiliation: Old Dominion University

Decadal changes in reef fish diversity in the central Visayas

The central Visayas of the Philippines is a global epicenter of marine fish biodiversity, but recent studies have observed low species richness, which has been associated with stressors such as habitat degradation, overfishing, and harvesting individuals for the aquarium trade. Many marine protected areas (MPAs) have been established throughout the Philippines in order to mitigate the cumulative negative effect of these stressors. While most of the country's MPAs lie within the central Visayas, this region has been termed the "epicenter of conservation adversity" within the Philippines, in part due to the lack of proper enforcement that prevents the benefits of MPAs from being fully realized. This study examines patterns of diversity in selected reef fish communities within the central Visayan region that were sampled in two distinct time periods: 1970s and 2010s. These two surveys used similar sampling methods and were conducted by the United States Smithsonian Institution and the California Academy of Sciences, respectively. Individual- and sample-based species accumulation and rarefaction curves were used to create snapshots of species diversity from these distinct periods. Results indicate that species richness has been reduced by 7.4% per decade in the central Visayas over the past four decades, a greater rate than previously suggested. Despite observations of increases in species richness at local scales and a high abundance of MPAs, species richness is decreasing in the central Visayas. Unless threats to these marine resources are reduced, further declines can be expected.

SO4. Authors: **C. Gorman**, N.L. Chao, and K.E. Carpenter
Presenter Affiliation: Old Dominion University

Global conservation status of the family Sciaenidae (croaker and drum)

Marine biodiversity is under threat from an array of anthropogenic stressors. Understanding how these stressors impact marine fauna is a critical step in the effort to conserve species and ecosystems. Global extinction risk assessments were completed for the 286 species of fishes in the family Sciaenidae. These species play important ecological roles in a variety of marine and freshwater habitats and support commercial and artisanal fisheries globally. The International Union for Conservation of Nature (IUCN) Red List methodology for assessing extinction risk was applied to all species of Sciaenidae to determine which are at highest risk and what are the drivers and indicators of risk. Preliminary results indicate that most species have a low risk of biological extinction; however, many species do not have enough data to determine an appropriate category and are currently assessed as Data Deficient. The best estimate for the percentage of elevated concern is 12.6%, with a range of 9.1-36.5% to account for the uncertainty in the true status of the species assessed as Data Deficient. The primary driver of risk for species of elevated concern is overexploitation. These species are also likely to possess life history characteristics that make them particularly susceptible to population decline, such as large body size and the formation of spawning aggregations. This study will provide a baseline for future research efforts and conservation priorities by highlighting data gaps and species of elevated conservation concern.

SO5. Authors: **Jingwei Song**, Rich Brill, and Jan McDowell
Presenter Affiliation: Virginia Institute of Marine Science

Signatures of selection and phenotypic plasticity of an estuarine-dependent teleost, spotted seatrout (*Cynoscion nebulosus*)

Resilience to directional climate change depends on a specie's evolutionary potential and phenotypic plasticity. An insufficient understanding of the relative importance of both factors, however, hinders our ability to predict future performance. We combined intermittent-flow respirometry and RNA-sequencing to quantify how genetically distinct spotted seatrout populations respond to thermal challenge, and genotyping-by-sequencing to look for genomic signatures of selection. Fish from the northern population of spotted seatrout exhibited standard metabolic rates up to 35% higher than their southern counterparts when measurements were made at the same temperatures (ranging from 5°C to 30°C). Differential gene expression analyses revealed both shared and unique gene sets were expressed in both populations in response to thermal stress. Annotations of differentially expressed genes give insight into the common and different molecular pathways involved in responses to thermal stress. F_{ST}-based analyses of genomic data identified 40 single nucleotide polymorphisms (SNPs) as outliers, which are putative targets for directional selection. Annotations of these outlier loci revealed homologs with predicted functions in transcription regulation, cell cycle control, and cellular transport. These results advance our understanding of population-specific differences in spotted seatrout which can be incorporated into mechanistic models to predict their resilience directional climate change.

SO6. 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*) range from the Gulf of Maine-Gulf Mexico and are listed as a species of concern due to their coastal aggregating behavior and slow life-history strategy. The reproductive cycle of *C. taurus* includes seasonal migrations extending hundreds of kilometers. 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 southern US Atlantic waters and are presumed to be associated with seasonal reproduction. However, patterns of seasonal residency, habitat use, and migration at finer spatial scales are lacking. It is hypothesized that pregnant females may utilize habitats differently than resting females and that residency of mature female sand tigers exist in North Carolina coastal waters. From 2016-2019, mature female sand tigers were equipped with internal acoustic transmitters to identify movement patterns. On-board ultrasound imaging confirmed pregnant sharks in various stages and residence time was quantified to identify essential reproductive habitats using passive tracking techniques. Sand tigers displayed seasonal and year-round residency in North Carolina surrounding Cape Fear-Cape Lookout during Oct 2017- Nov 2019. Continuous residence times (CRT) at finer spatial scales (individual reefs) were typically short (0-2 days), but occasional longer residences (2+ weeks) hint at strong fidelity within seasons (CRT = 0-136 days). More extensive movements were also observed in individuals along the western North Atlantic during spring and fall months with all individuals returning to North Carolina.

SO7. Authors: **Amanpreet Kohli**, Andrew Wargo, and Wolfgang Vogelbein
Presenter Affiliation: Virginia Institute of Marine Science

Pathogen lesions and parasite invasions in American eels

American eel (*Anguilla rostrata*) is a commercially, recreationally, and ecologically important finfish in the Chesapeake Bay. Eels held in rudimentary aquaculture facilities experience up to 20% disease-associated mortality from an infectious disease characterized by severe skin ulceration. This 'red disease' may also be contributing to the declining wild eel stocks, in addition to other eel parasites. Anecdotal evidence suggests a bacterial pathogen, and spatial and temporal variation in the distribution of this disease in the wild. However, there isn't much scientific knowledge about its etiology, epidemiology or impacts on the fishery. Similar diseases in European and Japanese eels have been extensively studied but research on pathogenic lesions of American eels is limited. Using standard bacteriological and molecular methods, pathogens isolated from the external lesions and internal organs of diseased fish were identified to be species of *Vibrio, Aeromonas,* and *Pseudomonas*. Due to its potentially severe impacts on the eel fishery and emerging aquaculture industry, there is an urgent need to better understand the red disease. We propose to elucidate the

environmental correlates of this disease, and experimentally quantifying the impacts of environmental stressors on disease expression. Our findings will be instrumental in effective disease mitigation and management of eel losses, both in aquaculture and wild.

SO8. Authors: **Adena Schonfeld**, James Gartland, and Robert J. Latour
Presenter Affiliation: Virginia Institute of Marine Science

Influence of Chesapeake Bay environmental conditions on estuary utilization by mid-Atlantic fishes

Habitat preference and climate-driven distributional shifts have been well documented for fishery resources inhabiting the continental shelf of the US East Coast, while little attention has been given to adjacent estuarine systems. The Chesapeake Bay serves as an important habitat for many fish species that represent a variety of life history modes and occupy unique ecological niches. Although the realized and projected effects of climate change on the physical environment of Chesapeake Bay have been evaluated, impacts on fauna inhabiting this estuary have not been explored. Several species within Chesapeake Bay, such as summer flounder (*Paralichthys dentatus*) and Atlantic croaker (*Micropogonias undulatus*), once supported robust commercial and recreational fisheries, however, fishery-independent survey data indicate finfish utilization of the bay has diminished substantially in recent years. The impacts of changing environmental conditions in Chesapeake Bay on its associated fauna were evaluated using 16 years of data from a fishery-independent bottom trawl survey. A Bayesian analysis framework, Integrated Nested Laplace Approximation, was used to develop habitat utilization models for selected species. Survey catch per unit effort was related to a suite of environmental covariates measured synoptically at each site to provide a baseline characterization of habitat preferences. Model output indicates that shifting environmental conditions within Chesapeake Bay are causing a decline in estuarine utilization by ecologically and economically important fishery resources. Results of this study contribute important information to the growing body of literature on global change biology and to marine fishery resource managers facing policy development challenges amidst a changing environment.

SO9. Authors: **Chryston Best-Otubu**, Robert Gamble, and Scott Large
Presenter Affiliation: University of Maryland Eastern Shore

Ecosystem dynamics of the summer flounder

This research analyzed the condition factor (a weight/length relationship) of female summer flounder, *Paralichthys dentatus,* using structural equation modeling (SEM). The higher the condition factor, the more energy that can potentially go into egg production. Data was collected from stock assessments, as well as internal NOAA reference documents and databases of the Northeast Fisheries Science Center (NEFSC). Using structural equation modeling, framework models were built to evaluate how environmental indicators influence summer flounder condition. They also evaluated the relationship/impact between condition factor and fishing pressure on the spawning stock biomass of this species. The models were

fit using the lavaan package in R. Our findings showed that condition factor has a negative relationship with biomass. This led to the formation of a density dependence hypothesis, that higher biomass leads to more intraspecific competition for food and a decline in condition factor. Another potential hypothesis involves the recent northward range shift of summer flounder due to climate change. Since the flounder are spending more energy moving and searching for food, this might mean less time feeding and a decrease in condition factor. These kinds of analyses have the potential to improve stock assessments and future decisions in fisheries management by providing more information on how environmental indices affect life history traits of managed stocks.

SO10. Authors: **Spencer T. Gardner** and Frederick S. Scharf
Presenter Affiliation: University of North Carolina Wilmington

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 a large influence on growth and subsequent survival. Considerable variation in body size at the end of the first year of growth is evident for southern flounder in North Carolina estuaries. Previous research suggests that age and settlement timing only contribute marginally to a ~2-fold difference in length at age-1. We hypothesize that the timing of ontogenetic shifts in diet and habitat may be largely responsible for observed growth variation in southern flounder. Biweekly sampling followed the 2018 southern flounder cohort each month. Stomach contents were used to quantify the occurrence of piscine prey. Muscle and liver tissues provided an analysis of $\delta_{13}C$ and $\delta_{15}N$ to document habitat and trophic shifts over weeks to months. Otoliths were removed, sectioned, and examined to estimate growth rates in the most recent 30-45 d period. A controlled growth experiment in 2019 validated the assumed positive relationship between somatic growth and otolith growth. Muscle and liver tissues extracted from field sampling produced $\delta_{13}C$ signatures that largely differed between low and high salinity habitats, with only moderate overlap. Stomach contents and $\delta_{15}N$ tissue signatures documented an ontogenetic shift to piscivorous feeding that occurred at smaller body sizes within mesohaline habitats relative to fish found in oligohaline habitat. Otolith analysis revealed increased growth rates in flounder captured from mesohaline habitats that coincided with higher rates of piscivorous feeding.

SO11. Authors: **Jerelle Jesse**, Geneviève Nesslage, Mark Matsche, Howard Townsend, John Jacobs, Chunqi Shen, and Jeremy Testa
Presenter Affiliation: Chesapeake Biological Laboratory

Quantifying drivers of mycobacteriosis in Atlantic striped bass from Maryland waters of the Chesapeake Bay

In 1997, mycobacteriosis was first identified as a cause for declining health in Atlantic striped bass (*Morone saxitilis*) in the Chesapeake Bay. Water quality and nutritional stress are suggested drivers for the epizootic. We tested this hypothesis using data collected by

Maryland DNR fish health program which assessed disease status and fish condition from striped bass collected in Maryland waters from 1998 – present. Estimates of hypoxic volume and high water temperature duration were derived from a coupled hydrodynamic-biogeochemical model (ROMS-RCA). We constructed a generalized linear model (GLM) to examine the influence of dissolved oxygen volume (< 3 mg/L), temperature duration (days >29 C), and body condition (Fulton's K) on presence of mycobacteriosis in pre-migratory striped bass. We constructed a GLM for disease severity that included the previous variables with the additional influence of age and sex for fish ages 1+. Hypoxic volume was a significant predictor of disease presence, indicating disease susceptibility in pre-migratory fish is likely influenced by hypoxia which limits suitable summer habitat. Sex, age, Fulton's K, and hypoxic volume were significant predictors of severity. Severity increased with age and decreasing condition. Females exhibited significantly lower severity likely due to their propensity to migrate at an earlier age. Severity declined with increasing hypoxic volume suggesting the linkage with water quality may be complicated by adult mobility or other unknown factors. Water quality was an important factor for determining mycobacteriosis presence in pre-migratory striped bass; however, the environmental factors we examined did not appear to influence disease progression.

SO12. Authors: **Timothy S. Lee** and April M.H. Blakeslee
Presenter Affiliation: East Carolina University

Biogeographic diversity of fish-infecting digenean trematodes in estuaries dominated by non-native macroalga

Digenean trematodes are a diverse group of parasites that require multiple host organisms to complete their life cycles. In the east coast of North America, nine species of trematodes infect the eastern mudsnail *Tritia obsoleta* (TO) as a first-intermediate host. Four species of these trematodes infect fish as their definitive hosts. Estuarine habitats of the east coast have also been colonized by red alga *Agarophyton vermiculophyllum* (AV), which provides nursery, refuge, and shelter for native macroinvertebrates, including TO. The arrival of this non-native macroalga changed abundance and diversity of macroinvertebrates, and subsequently the changes in these macroinvertebrates' parasites. To understand the biogeographic pattern of fish-infecting trematodes in AV-colonized estuaries, we sampled sixteen estuarine habitats along the US east coast from Charleston, SC to Durham, NH in summer 2019. Per site, we recorded AV biomass, TO density, and environmental variables (e.g., temperature, salinity, dissolved oxygen), and randomly collected 100 TO for parasite dissections. Overall, we found 11.75% infection prevalence across all TO (n = 1,600). Of those infected, 57% were infected by trematodes using fish as definitive hosts. Using GLM and AIC, we found that the biomass of AV was one of the best variables predicting parasite diversity measures (e.g. richness, diversity index, prevalence). The transformation of estuaries by AV can change population structures of fish and macroinvertebrates that are obligatory hosts for these trematodes. Thus, trematode diversity can be used as a proxy to determine and forecast population dynamics of hosts and potentially fisheries in these rapidly changing estuaries.

SO13. Authors: **Kohma Arai**, Martin Castonguay, and David H. Secor
Presenter Affiliation: Chesapeake Biological Laboratory

Decadal trends in stock mixing of Northwest Atlantic mackerel from otolith oxygen and carbon stable isotopes

The Northwest Atlantic mackerel is comprised of northern and southern contingents that have distinct spawning grounds and migratory patterns centered off Canada and the US, but substantial mixing occurs between the two contingents in US fisheries, which likely varies over years and decades. Otolith carbon and oxygen stable isotopes ($\delta_{13}C/\delta_{18}O$) were analyzed to discriminate northern and southern contingents given that the two contingents are exposed to waters of different seawater $\delta_{18}O$ and temperature in their juvenile period. Using archived otoliths and developing a classification baseline based on juvenile otolith carbon and oxygen stable isotopes, we assessed the degree of stock mixing in US waters during two phases of the US mackerel fishery (high landings: 1998–2000 year-classes; and low landings: 2011–2015 year-class). While strong discrimination occurred between the two contingents for 1998–2000 year-classes and the 2015 year-class baselines, the degree of discrimination was weak for the 2011–2014 year-class baselines. Random Forest classification for year-classes 1998–2000 showed that age-2 fish were mostly comprised of the southern contingent, whereas age 3+ fish were predominately the northern contingent, indicating strong incursion of the northern contingent into US waters. Classification of 2015 year-class fish indicated that age 2+ fish were dominated by the northern contingent, and the southern contingent were mostly absent from US waters. Results suggested that both contingents contributed to the US mackerel fishery during the period with higher landings, whereas during the most recent depleted phase, the US fishery was almost exclusively drawn from the northern contingent.

SO14. Authors: Lindsey N. Nelson, Eric J. Hilton, and Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

The long and short of clearnose skate morphometric and meristic comparisons

Clearnose skates, *Rostroraja eglanteria* (Bosc 1800) inhabit the United States coastal waters of the western Atlantic Ocean and the eastern Gulf of Mexico. They are often incidentally caught in bottom trawl fisheries, discarded at sea, and poorly monitored. Unlike their more charismatic relatives, skates have been afforded little attention by fisheries managers and conservation groups. Therefore, fisheries management plans can be implemented or improved, but in order to do that, additional life history data are needed. In particular, understanding population structure can aid in better characterizing connectivity, sexual segregation, migration, local adaptation, and phenotypic variation within *R. eglanteria*, allowing managers to delimit stocks and more accurately manage fisheries impacts. We tested whether clearnose skates consist of a single panmictic population by examining variation of physical traits. For the purposes of our research, *R. eglanteria* were sampled from three geographic regions; north of Cape Hatteras, south of Cape Hatteras to Florida, and the Gulf of Mexico. A suite of 86 variables including measurements and counts of thorns, teeth, and skeletal elements, and presence and distribution of dermal denticles were collected from whole specimens. Using Multiple Analysis of Variance and Principal Component Analysis

these characters were used to test for morphological variation within and among the study regions. These results will be used in tandem with fine scale genetic analysis to provide insight into *R. eglanteria* population structure.

SO15. Authors: **Samantha E. Askin**, Robert A. Fisher, and Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

Population genetic structure of channeled whelk: Implications for management in the mid-Atlantic

Channeled whelk, *Busycotypus canaliculatus*, (Linnaeus, 1758) are a commercially important gastropod found throughout the United States Atlantic coast from Cape Cod, Massachusetts to Cape Canaveral, Florida. Channeled whelk exhibit direct development, slow growth, and late maturation; making them vulnerable to overexploitation. The resource is managed at the state level in the mid-Atlantic region and minimum landing size (MLS) varies by state. In 2018, Massachusetts performed the first stock assessment for channeled whelk. This assessment concluded that channeled whelk populations in Nantucket Sound are likely overfished and overfishing is occurring. Currently, the population genetic structure of channeled whelk is unknown. This study aimed to determine the level of genetic differentiation of 239 channeled whelk collected in 10 resource areas from Massachusetts to South Carolina, with fine-scaled sampling in the mid-Atlantic region. A total of 5,328 single nucleotide polymorphisms (SNPs) was used to estimate genetic diversity and delineate population structure among resource areas along the Atlantic coast. A preliminary analysis of the data revealed estimates of genetic divergence ranging from 0.002 – 0.432, with the largest F_{ST} values observed between Massachusetts and South Carolina and the smallest values observed between Light Tower and Eastern Shore. F_{ST} values were highest (0.106 – 0.432) when comparing North Carolina Pamilco Sound, North Carolina Wilmingtton, and South Carolina to all other resource areas, with elevated levels of genetic divergence across known biogeographic barriers. These preliminary findings underscore the need for new management strategies for the channeled whelk fishery in resource areas along the Atlantic coast.

SO16. Authors: **Bradley G. Stevens**
Presenter Affiliation: University of Maryland Eastern Shore

The ups and downs of trap fishing: Environmental impacts, entanglement, and the future of trap fishing

Traps have been the preferred gear for catching crustaceans over millennia, during which they have been modified into many specialized versions adapted for particular species, habitats, and fishing methods. Most traps share common traits including methods of attraction, entry, and escape, although methods of deployment may differ between fisheries. Yet for all their benefits, traps also have a downside. While much research has been conducted on bycatch of target and non-target species, little research has been conducted on the environmental impacts of trap fishing. Traps are extremely inefficient sampling devices for most target species, as only a small fraction of available organisms enter them, and those that do enter can escape at high rates, leading to extremely low relative catch. Trap fishing may have direct impacts on target populations, impacts on non-target populations, and

impacts on the environment or habitat. Trap deployment and recovery often impacts organisms through dragging of traps along the seafloor, which can lead to damage and destruction of habitat components such as corals, sea pens, and other epifauna. In certain areas, trap lines are sources of whale entanglement, and there is much interest in reducing the number of vertical lines as well as their potential for entanglement. Along with whale-safe rope, new methods for deploying, locating, and recovering rope-less traps using ultrasonic devices are now being developed. The future of fisheries that depend on traps will require investment in research on new ways to reduce their negative impacts on benthic and pelagic resources.

Saturday March 14, 2020 – Professional Oral (PO) Presentations

PO1. Authors: Danielle A. Goldberg, Lee M. Paramore, Laura Lee, and **Frederick S. Scharf**
Presenter Affiliation: University of North Carolina Wilmington

Assessing the potential for bias in a long-term juvenile abundance index and the implementation of a partial-replacement survey design

The primary objective when designing a population survey is to ensure that the segment of the population that is sampled will be representative of the entire population of interest. In 1991, the North Carolina Division of Marine Fisheries initiated a yearly survey to estimate the relative abundance of age-0 juvenile red drum (*Sciaenops ocellatus*) to serve as an index of recruitment. The survey samples a set of fixed stations and therefore, lacks a random component, creating the potential for bias due to several possible sources. Analysis of the historical data suggested low potential bias stemming from hyperstability in CPUE, but did indicate the potential for bias due to spatial and temporal variation in station/region performance. In addition, estimates of spatial and temporal persistence revealed the possibility of bias in some years. From 2016-2018, an equal number of randomly selected stations were sampled in addition to the historical fixed stations as a partial replacement survey design to reduce the potential for bias. Examination of the catch data revealed mostly similar CPUE overall, but with the presence of spatial variation and also the timing of peak catch rates differing between fixed and random stations. In general, it appears that the historic survey has performed well, with only limited bias. The short duration of the additional random sampling (3 years) challenges more thorough comparison, but with additional years of sampling, retrospective calibration of the historic fixed-station design should be possible.

PO2. Authors: **Sally A. Roman** and David B. Rudders
Presenter Affiliation: Virginia Institute of Marine Science

Selectivity of two commercial dredges fished in the northwest Atlantic sea scallop fishery

Size selectivity curves were estimated for two commercial dredges fished in the U.S. Atlantic sea scallop (*Placopecten magellanicus*) fishery. Traditionally, the New Bedford Style dredge (New Bedford dredge) has been used by the commercial fleet; however, since 2013, the Coonamessett Farm Turtle Deflector dredge (turtle dredge) has been required seasonally in the Mid-Atlantic region. This analysis provides selectivity and relative efficiency estimates for both dredges. Selectivity information for the turtle dredge is currently not quantified and selectivity for the New Bedford dredge was originally assessed in 2008. The SELECT method was employed to model scallop catch-at-length data for each commercial dredge with data collected during the Virginia Institute of Marine Science fishery independent surveys in 2015 – 2017. The surveys were conducted in the Mid-Atlantic and Georges Bank regions of the resource in three distinct areas. A paired study design was employed, where a non-selective National Marine Fisheries Service sea scallop survey dredge and either a turtle dredge or New Bedford dredge were towed simultaneously at each survey station. Results indicated the 50 percent retention length was 98.2 mm, with a selection range of 28.2 mm, and a relative efficiency of 0.83 for the turtle dredge. New Bedford dredge results estimated a 50 percent retention length of 107.4 mm, selection range of 50.5 mm, and relative efficiency of 0.81. Selectivity profiles for both dredges were also compared to the 2008 results to assess for time varying changes in selectivity. Results indicated a shift toward increased retention of smaller scallops.

PO3. Author: **Olivia M. Phillips**
Presenter Affiliation: Virginia Marine Resources Commission

An inside look at fisheries management in Virginia

Our goal as fisheries managers is to use the best available science to maintain sustainable fisheries. Marine fisheries resources serve as a protein source, provide enriching recreational opportunities, and ultimately, support many people's livelihoods. That is, the status of fisheries resources can affect many groups of people. In Virginia, management involves input from science advisers (VIMS), interstate management groups (ASMFC), industry (e.g., recreational and commercial) advisers, other stakeholder groups (NGOs), as well as the general public. As a result, management actions are science-based, and often incorporate feedback from these other stakeholders. I present two case studies (speckled trout and blue crab) to illustrate the management process in Virginia, and to highlight the importance of industry and stakeholder input in science-based management.

PO4. Authors: **Charles W. Bangley**, Michelle L. Edwards, Claire Mueller, Robert A. Fisher, and Matthew B. Ogburn
Presenter Affiliation: Smithsonian Environmental Research Center

Snowbirds of the sea: Environmental associations of migratory cownose ray (*Rhinoptera bonasus*) presence in their summer and winter habitats along the U.S. Atlantic Coast

Identifying the mechanistic drivers of migration can have important implications for conservation and management policies. The Cownose Ray (*Rhinoptera bonasus*) is a relatively poorly-understood elasmobranch species that undergoes large-scale seasonal migrations along the U.S. Atlantic coast. To better understand the drivers and timing of Cownose Ray migration, we used telemetry detections of 51 mature Cownose Rays (38 female, 13 male) tagged with acoustic transmitters in Chesapeake Bay. Detections in their summer habitat within Chesapeake Bay and winter habitat in the vicinity of Cape Canaveral were matched with publicly-available sea surface temperature (SST) data recorded by data buoys representative of the area of tag detection, and with local photoperiod and day of year. These variables were used in boosted regression tree models of ray presence (all rays combined, females only, and males only) in each seasonal habitat. Models were developed for presence during the entire season, and during the time period of arrival and departure from summer and winter habitats. Presence in both summer and winter habitats was associated with distinct temperature, photoperiod, and date ranges, but males arrived in the upper Chesapeake Bay later and departed earlier than females. Southward migration from Chesapeake Bay was most strongly associated with SST for all rays, but northward departure from Cape Canaveral was most strongly associated with SST for females and with day of year for males. These findings allow for prediction of the timing of Cownose Ray presence in their seasonal habitats, and suggest possible responses to changing ocean temperatures.

PO5. Authors: **Rebecca G. Asch**, Keo Chan, and Joanna Sobolewska
Presenter Affiliation: Princeton University and East Carolina University

Assessing the reliability of species distribution model projections in the face of climate and ecosystem regime shifts: Small pelagic fishes in the California Current ecosystem

Species distribution models (SDMs) are a common tool used to project changes in organismal occurrence, abundance, and phenology under climate change. An often untested assumption of SDMs is that relationships between organisms and the environment are stationary. To evaluate this, we examined whether habitat use by larvae of four small pelagic fishes in the California Current remained steady across three different types of climate and ecosystem regime shifts. Generalized additive models (GAMs) were constructed separately for each regime using temperature, salinity, dissolved oxygen, and mesozooplankton volume as predictors of fish occurrence. We assessed non-stationarity with six metrics: 1) variables included in SDMs; 2) linear vs. non-linear form; 3) rank order of deviance explained by variables; 4) response curve shape; 5) degree of responsiveness of fishes to a variable; 6) preferred range of environmental variables used by fishes. Across all species and time periods, non-stationarity was ubiquitous, affecting at least one of the six

indicators. Non-stationarity was most common among periods defined by changes in zooplankton productivity. The relationship between fishes and temperature was more stable than relationships with other environmental variables. Respectively, sardine, chub mackerel, anchovy, and jack mackerel exhibited non-stationarity across 83%, 75%, 61%, and 58% of indicators. Relatively small present-day differences among GAMs in habitat suitability became amplified by the end of the 21st century under two climate change scenarios. This suggests that the widespread non-stationarity in how fishes utilize their environment could hamper our ability to reliably project how species will respond to future changes.

PO6. Authors: **A.M.H. Blakeslee**, R.B. Barnard, K. Matheson, and C.H. McKenzie
Presenter Affiliation: East Carolina University

Host-switching among crabs: Species introduction results in a new target host for native parasites

Non-indigenous species are increasingly influential in community interactions, e.g. parasites. Invaders may acquire and/or introduce parasites in novel regions. Such host-switching could either enhance or dilute parasite transmission/spread among species utilized in parasite life cycles, including commercially valuable species. We investigated invasion influence on microphallid trematode parasitism in two Newfoundland bays, one with an invasive crab, *Carcinus maenas* (*CM*), and one without. We additionally assessed infection prevalence and intensity of microphallid trematodes in the commercially valuable native crab *Cancer irroratus* (*CI*) crabs and trematode prevalence in native periwinkle (*Littorina obtusata*, *L. saxatilis*) snails. We also used DNA barcoding to compare trematode identities across host species in the region. We found higher microphallid prevalence but lower intensity in *CI* where both crabs co-occur, versus where *CM* is absent. Additionally, *CM* had higher intensity than *CI*, and for both crabs, males had higher intensity than females. For snails, there was little difference in prevalence between the two bays. Sequencing data detected genetically divergent trematode clade, including those dominant in *CI*, suggesting a native origin for these trematodes which now also utilize *CM*. Altogether, our results demonstrate the complexity of parasite infection in systems with prominent invasions and how species invasion can affect the influence of parasites on native species.

PO7. Authors: **Christopher Davis**
Presenter Affiliation: Virginia Marine Resources Commission

Results of the 2019 Virginia shrimp experimental gear permit fishery in Virginia

Annual abundance of shrimp within Virginia waters has varied greatly in the past (from rare to very common). However, warming water temperatures over the past 30 years have made penaeid shrimp much more abundant in the fall, sparking interest in the viability of a potential commercial harvest. The most common method of harvest for shrimp in the U.S. is trawling, however trawling is prohibited in Chesapeake Bay. Temporal and spatial restrictions in Virginia's coastal waters (out to three nautical miles) is allowed with the

Commission's authorization. Six special experimental permits were granted to Virginia commercial watermen to allow shrimp trawling using a 16-foot beam trawl equipped with a bycatch reduction device from October 1st through December 31st on the ocean side of Virginia Beach, and November 1st through December 31st on the ocean side of the Eastern Shore. A total of 83 fishing trips were reported on the ocean side of Virginia Beach with four fishing trips reported on the ocean side of the Eastern Shore. A total of 62,010 pounds of shrimp and 26,576 pounds of fish (bycatch) were reported. Nine fishing trips were taken with VMRC observers onboard, recording shrimp and bycatch data from 61 trawls. Commercial and recreational species of interest comprised 24% of the bycatch. In 2019, VMRC increased the number of experimental shrimp trawling permits, and observed a large increase in shrimp landings compared to 2018 as well as fishing effort. VMRC staff noticed catch-per-unit-effort (CPUE) of shrimp was higher in 2019 compared to 2018, indicating more shrimp were landed on a per trip basis, which supports a growing and successful shrimp fishery.

PO8. Authors: **Joseph J. Luczkovich**, Henry A. Raab, Chris Holland, Wayne Litaker, Miguel del Pozo, Sylvia M. Vélez-Villamil, Cindy Grace-McCaskee, and David Griffith
Presenter Affiliation: East Carolina University

Ciguatoxin detection and model predictions for use in fisheries management in Puerto Rico

A natural neurotoxin ciguatoxin (CTX) produced by dinoflagellates is found in fish caught commercially in the Caribbean. Ciguatoxin occurring in fish tissues at > 0.1 ppb can cause ciguatera fish poisoning. People consuming fish have symptoms like gastrointestinal problems, numbness in mouth and limbs, hot and cold temperature sensation reversals, equilibrium loss, and in some cases, death. Ciguatoxin reportedly biomagnifies in the food web, so that low-trophic-level organisms have small amounts of CTX stored in their tissues, but apex predators have much more. We identified ciguatera "hotspots" in Puerto Rico by conducting open-ended interviews with fishers at *villas pesqueras*. Next, we obtained fish samples from high-trophic and low-trophic level species from these "hotspot" and low-ciguatera-incidence "coldspot" locations. The top five species mentioned by fishers as causing CTX poisoning included great barracuda, hogfish, amberjack, black jack, and king mackerel. We determined how much CTX was found in the fishes at each trophic level, using a neuroblastoma (N2A) bioassay for CTX and ECOPATH/ECOTRACER model for determining trophic position. In addition, we collected the dinoflagellate *Gambierdiscus* sp. strains from the "hotspot" and "coldspot" locations using "collector" screens which were deployed on the seafloor for 24-hrs. Dinoflagellate cell counts were significantly greater at the "hotspot" areas and fishes had higher levels of CTX at the high trophic levels compared to matched "coldspot" samples. We can now simulate the rate of accumulation of CTX in fishes at hotspot areas; we are sharing our data with the Caribbean Fishery Management Council.

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Adopted by the Governing Board of the American Fisheries Society on January 30, 2019, at the mid-year meeting in Cleveland, Ohio.