34.5TH ANNUAL MEETING

OF THE

Tidewater Chapter

American Fisheries Society

Maryland – Virginia – North Carolina

APRIL 22, 2021

MEETING PROGRAM

HOSTED BY

VIMS | WILLIAM & MARY

VIRGINIA INSTITUTE OF MARINE SCIENCE

AFS Tidewater Meeting Schedule Overview

April 22, 2021

Note: All times are approximate

Time	Event	Moderator
9:00 – 9:15 AM	Welcoming Remarks	Jan McDowell and Brad Stevens
9:15 – 10:30 AM	Oral Presentations	Vaskar Nepal
10:30 – 10:45 AM	Break	
10:45 – 11:45 PM	Oral Presentations	Vaskar Nepal
11:45 – 1:00 PM	Lunch Break	
1:00 – 2:15 PM	Oral Presentations	David Rudders
2:15 – 2:30 PM	Break	
2:15 – 3:00 PM	Poster Presentations	David Rudders
3:00 – 3:20 PM	Student Lightning Talks	David Rudders
320 – 3:30 PM	Break	
3:30 – 4:30 PM	Business Meeting	
4:30 – 5:30 PM	Awards	Sara Mirabilio

Meeting notes:

1. The Zoom like and password will be delivered to you via email
2. Oral and poster presentations will be given in blocks of 4-5. After the block has ended, you will have an opportunity to ask questions. Please type your questions into the chat box and the moderator will call on you or read your question to the presenter. Please remember to indicate which presenter you would like to address.
3. Always remember to be respectful.

ORAL PRESENTATIONS

Note: Times reflect the start of the time block and presentations are listed in order.
Moderated by: Vaskar Nepal (AM) and David Rudders (PM)

Time	Presenter	Title of Presentation
9:15 AM	Bartlett, B.	Projected Changes of the Distribution of Nassau Grouper Spawning Habitat and Its Management Implications
9:15 AM	Collins, M.	Locating Spawning Aggregations and Assessing Population Connectivity of Southern Flounder in the US South Atlantic using Pop-Up Satellite Tags
9:15 AM	Martinez, J.	Striped Marlin in the Central North Pacific Ocean: One Stock or Two?
9:15 AM	Arai, K.	Otolith Stable Isotopes Reveal Multi-decadal Trends in Contingent Mixing of a Key Transboundary Fishery
9:15 AM	Lee, T.	Macroinvertebrate Assemblages in Invasive *Agarophyton vermiculophyllum*: Biogeographic Assessment along the U.S. Eastern Seaboard
10:45 AM	Lankowicz, K.	Characterizing Juvenile Atlantic menhaden (*Brevoortia tyrannus*) Distribution and Schooling in Shallow Estuarine Waters
10:45 AM	Kinz, M.	Tracking the Seasonal Movement Patterns of *Pylodictis olivaris* Using Active and Passive Acoustic Telemetry
10:45 AM	Clark, K.	The Effect of Density on Reproductive Effort in the Atlantic Sea Scallop, *Placopecten magellanicus*
10:45 AM	Jones, S.	Placement of Dredged Material in Wolf Trap: A Concern for Blue Crab *Callinectes sapidus* in the Chesapeake Bay
1:00 PM	Farmer, M.	The Spatial and Temporal Distribution of Juvenile *Crassostrea virginica* in the Maryland Coastal Bays
1:00 PM	Raza, A.	Comparing Fish and Crustacean Species on Harvested vs. Non-Harvested Oyster Reefs
1:00 PM	White, S.	Characterizing Trends in Participation and Diversification in Small-Scale Fisheries of Virginia
1:00 PM	Dowiarz, S.	Social Media as a Tool for Supplementary Information on the Distribution and Recreational Fishery for Hickory and American Shads

1:00 PM	Ding, Y.	A New Exploratory Assessment of Common Dolphinfish (*Coryphaena hippurus*) in the Western Central Atlantic

ORAL PRESENTATION ABSTRACTS

SO1. 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 Implications

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.

SO2. Authors: **Mason G. Collins**, Michael S. Loeffler, Anne L. Markwith, and Frederick S. Scharf
Presenter Affiliation: University of North Carolina Wilmington

Locating Spawning Aggregations and Assessing Population Connectivity of Southern Flounder in the US South Atlantic using Pop-Up Satellite Tags

The Southern Flounder (*Paralichthys lethostigma*) is an economically important coastal fishery species the U.S South Atlantic and Gulf of Mexico. A recent population assessment indicates that the US South Atlantic stock is overfished. To inform management and recovery efforts, more refined information on spawning locations and ocean habitat use are needed to better define stock boundaries and estimate connectivity among estuaries within the basin. The

goals of this study are to: 1) test a new method of tagging Southern Flounder using Pop-Up Satellite Tags (PSAT's), 2) identify the offshore locations of winter spawning areas, and 3) estimate the degree of connectivity among Southern Flounder populations originating from different estuarine nurseries throughout the US South Atlantic. Tagging efforts will be distributed across three years and multiple regions from North Carolina to Florida. Fish will be tagged during the fall pre-migration period with tags programmed to deploy during winter, spring, and summer to identify spawning areas and post-spawning movements. At present, 130 tagged fish were released during Oct and Nov 2020, and are scheduled to deploy during winter 2021 with release dates spread across the primary spawning period. Identifying the locations of spawning aggregations will allow environmental needs for spawning to be determined as well as providing an opportunity to protect aggregation areas. Future tagging across multiple states will inform the degree of connectivity, helping to determine the appropriate spatial scale for management of the US South Atlantic population.

SO3. Authors: **Jackson L. Martinez**, Jan R. McDowell, John E. Graves
Presenter Affiliation: Virginia Institute of Marine Science

Striped Marlin in the Central North Pacific Ocean: One Stock or Two?

Relative to many highly migratory fishes, striped marlin, *Kajikia audax*, exhibit considerable stock structure. At least four genetically distinct stocks of striped marlin have been resolved throughout the Pacific and Indian oceans with stock overlap occurring in some regions. However, stock composition in the central North Pacific (CNP) remains unclear. Genetic evidence from some studies indicates that CNP striped marlin are part of a single North Pacific stock comprising individuals from Japan, Taiwan, Hawaii, and California, but the presence of an additional stock in the CNP has been suggested in two recent studies. The goals of this research were to 1) resolve the genetic stock structure of striped marlin in the CNP and 2) intensively study the stock composition of striped marlin caught in the Hawaii-based pelagic longline fishery (HBPLLF) over a 12-month period. Fishery observers collected 412 samples of striped marlin from the HBPLLF from 2019-2020. Of these, 85 samples underwent genotyping-by-sequencing and the data were co-analyzed with over 61,000 sequences from individuals collected throughout the species' range and reported in a previous study. Clustering analyses, which included the new samples, strongly supported a single CNP stock. Samples from the HBPLLF clustered with either the North Pacific or Oceania (New Zealand, Eastern Australia, Western Australia, and Hawaii sample locations) stocks, indicating mixing of the two stocks in the region. Currently, a panel comprised of single nucleotide polymorphisms (SNPs) with the highest power to discriminate between the two stocks is in development and will be used to assign an additional 327 individuals sampled from the HBPLLF with known capture date and location, size, sex, and reproductive condition to their stock of origin in an effort to better understand striped marlin stock dynamics within the HBPLLF.

SO4. Authors: **Kohma Arai**, Martin Castonguay, David H. Secor
Presenter Affiliation: Chesapeake Biological Laboratory

Otolith Stable Isotopes Reveal Multi-decadal Trends in Contingent Mixing of a Key Transboundary Fishery

The Northwest Atlantic mackerel (*Scomber scombrus*) is comprised of northern and southern components that have distinct spawning sites off Canada (northern contingent) and the US (southern contingent), but seasonal contingent mixing occurs within US fished regions, which likely varies over years and decades. We assessed multi-decadal trends in contingent mixing levels within the US fisheries region through a novel classification approach based on otolith oxygen and carbon stable isotopes ($\delta^{18}O/\delta^{13}C$ values), and characterized contingent composition across seasons, locations, ages, and size classes. Classification of age ≥ 2 adults showed that northern contingent mixing was prevalent within the US fisheries region during the past two decades (2000–2019), providing an important subsidy to the US winter mackerel fishery. The majority of older fish were of the northern contingent during the early 2000s, although the southern contingent contribution increased with age/size class during the recent period (2013–2019). Spatial mixing was strongest during February and March when the northern contingent occurred as far south as the Delmarva Peninsula, but were mostly absent from US waters in May. A positive relationship (albeit not significant; $r = 0.60$, $p = 0.07$) occurred between northern contingent mixing and US winter fisheries landings, which could imply that higher contingent mixing levels might be associated with greater landings for the US winter mackerel fishery. Information on contingent composition could further help develop spatially explicit stock assessment models for the Northwest Atlantic mackerel population to provide advice designed to conserve both contingents.

SO5. Authors: **Timothy S. Lee**, Stacy A. Krueger-Hadfield, Amy E. Fowler, April M.H. Blakeslee
Presenter Affiliation: East Carolina University

Macroinvertebrate Assemblages in Invasive *Agarophyton vermiculophyllum*: Biogeographic Assessment along the U.S. Eastern Seaboard

Seaweeds have vital roles in coastal habitats as ecosystem engineers and foundational species. Many seaweeds are structurally complex and provides habitat, refuge, and nursery grounds for various fish and macroinvertebrates alike. Seaweeds also protect its associated communities from thermal stress. The red seaweed *Agarophyton vermiculophyllum*, native to northwestern Pacific, has invaded much of temperate estuarine habitats around the globe. In the U.S. East Coast, this seaweed has physically transformed soft-sediment estuarine habitats by providing novel habitat complexity. The structure of *A. vermiculophyllum* provides interstitial space to accommodate large abundances and diversities of native macroinvertebrates. While invasive, *A. vermiculophyllum* is considered a foundational species because it has introduced novel structural complexity in soft sediment estuarine habitats

where such physically complex macrophytes originally did not exist. From May-August 2019, we surveyed *A. vermiculophyllum* and their associated macroinvertebrates along the U.S. East Coast, ranging from Durham, NH to Charleston SC, spanning across three biogeographic provinces. Across all sampled sites (n = 17), we found that Gammaridean Amphipods were most prevalent (>72%), followed by *Caprella* spp. (>9%), Common Periwinkle (>7%), and Isopods (>6%), while other taxonomic groups comprised <2% of total prevalence. The prevalence of Gammaridean Amphipods decreased across the biogeographic boundaries from north to south: >84% north of Cape Cod, >66% in Virginian Province, and >52% south of Cape Hatteras. Overall densities of macroinvertebrates increased with *A. vermiculophyllum* biomass (R^2 = 0.151), but the trend was not significant (p = 0.211). Understanding macroinvertebrate abundances associated with *A. vermiculophyllum* on a biogeographic scale is critical at monitoring how the faunal diversity will respond as this invasive seaweed physically transforms these estuarine habitats. Furthermore, the changes brought by *A. vermiculophyllum* may provide additional shelter, refuge, and resources for macroinvertebrates that are critical components of food web that include commercially important fish species.

SO6. Authors: **Katelynn M. Lankowicz** and Hongsheng Bi
Presenter Affiliation: Chesapeake Biological Laboratory

Characterizing Juvenile Atlantic Menhaden (*Brevoortia tyrannus*) Distribution and Schooling in Shallow Estuarine Waters

Schooling behavior is common to forage fish, including juvenile Atlantic menhaden (*Brevoortia tyrannus*). The spatial distribution pattern and morphological characteristics of discrete schools of menhaden could determine the spatial structure of the overall population which subsequently affect abundance estimates. There is a lack of fine-scale *in situ* fish distribution and schooling characteristics data, particularly in shallow waters that are not sampled well by traditional gear. To address this knowledge gap, we utilized an Adaptive Resolution Imaging Sonar (ARIS) to observe young of the year juvenile menhaden within the Patuxent River and three of its connected creeks in May-August 2016-2017. We identified a seasonal trend of increasing abundance of individuals and schools. Menhaden typically formed many schools that were closer together and comprised of fewer individuals when abundance was high. More menhaden schools and individuals occurred in shallow creek habitats than in deeper river channel habitats. School morphological characteristics differed between the habitat types and were seasonally dynamic, although schools tended to have clustered distribution patterns in both habitats. The dynamic and spatially variable menhaden schooling characteristics and distributions documented in this study could provide useful information to design surveys of juvenile menhaden. Further, the comprehensive information on menhaden schooling and distribution detected by sonar imaging may provide valuable insights and predictive tools to inform fishery managers seeking to make robust decisions for sustainable fisheries.

SO7. Authors: **Mitchell Kinz** and Frederick Scharf
Presenter Affiliation: University of North Carolina Wilmington

Tracking the Seasonal Movement Patterns of *Pylodictis olivaris* Using Active and Passive Acoustic Telemetry

The Flathead Catfish is native to the Mississippi River basin but has found success at inhabiting new waterways where it has become invasive. There have been several studies conducted around their movement patterns in their native range, but very little has been studied outside of this range. We performed a year-long study of Flathead Catfish movement using acoustic telemetry within the lower Cape Fear River system. We surgically implanted transmitters in 25 Flathead Catfish divided between several separate release locations in the river system. We had an array of 24 passive receivers placed every 5-15km that recorded fish movement which was supplemented with weekly targeted active tracking. We observed 17 of the 25 total fish an upriver migration in the spring followed by a return downstream throughout the summer and into the fall. We observed some large-scale movements that spanned the entire length of our array of over 130km which has also been observed in studies in their native range. Most of these fish returned from their migration to the same site where they were captured, tagged, and released the previous fall. There also appears to be a relationship between the size of the Flathead and the distance they travelled during migration as the largest fish in the study often travelled the farthest. The remaining 8 fish showed no movements along the river between at least 2 different receivers. Instead, they showed a high site fidelity, rarely travelling more than a few kilometers away, throughout the year.

SO8. Authors: **Kaitlyn R. Clark**, Sally Roman, Roger Mann, and David B. Rudders
Presenter Affiliation: Virginia Institute of Marine Science

The Effect of Density on Reproductive Effort in the Atlantic 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 region and 2013 in the Elephant Trunk region. 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 quarterly sampling trips in 2018 and 2019 with sampling at 21 sites divided among high, medium, and low-density scallop beds. In addition to total catch and length data, 30 scallops were retained at each site to determine meat, viscera, and gonad weights along with sex and reproductive stage. Reproductive effort was quantified as the ratio of gamete

production to total production to determine how this metric differs across population density. Responses varied between sampling locations. In the Nantucket Lightship, scallops at high densities exhibited lower reproductive effort than those at medium or low densities, which is consistent with a density-dependent effect as resources become limiting. In the Elephant Trunk, the response of reproductive effort to population density was more variable, suggesting that other factors such as food availability may be operating between these two regions.

SO9. Authors: **Sarah A. Jones** and Thomas J. Miller
Presenter Affiliation: Chesapeake Biological Laboratory

Placement of Dredged Material in Wolf Trap: A Concern for Blue Crab *Callinectes sapidus* in the Chesapeake Bay

Increases in the sizes of container ships has required increased maintenance of approach channels to ports through dredging. Proposed locations for dredge disposal often overlaps with key habitat for benthic organisms. For example, placement of material from the lower approach channels in Wolf Trap designated in the Chesapeake Bay overlaps with overwintering locations for mature female blue crab. The possible impacts of the placement of dredged material on overwintering blue crab in Wolf Trap has not been quantified even though the location is an active placement site. To determine the percentages of blue crab and female blue crab that could be affected in Wolf Trap, we applied a geostatistical approach to 29 years (1990–2018) of data from the winter dredge survey to map and calculate blue crab abundance in Wolf Trap and Chesapeake Bay. The abundance estimates were used to calculate the percentages of blue crab and female blue crab affected in Wolf Trap each year, assuming 100% mortality (i.e., the worse-case scenario), to infer possible impacts from the placement of the material. The average percent of blue crab overwintering in Wolf Trap was 0.09% of the total Bay-wide overwintering population while an average of 0.34% of female blue crab were found to be overwintering in Wolf Trap out of the total Bay-wide overwintering population. Given the results of the geostatistical analysis, the percentages of overwintering blue crab and female blue crab in Wolf Trap out of the total Bay-wide population were low, but more research needs to be done to determine the impacts of placement of dredge material in Wolf Trap on blue crab and female blue crab.

SO10. Authors: **Madeline Farmer** and Bradley Stevens
Presenter Affiliation: University of Maryland Eastern Shore

The Spatial and Temporal Distribution of Juvenile *Crassostrea virginica* in the Maryland Coastal Bays

Drastic declines of the Eastern oyster, *Crassostrea virginica*, and its numerous ecological benefits have spurred oyster restoration initiatives. To have a successful oyster restoration project, several factors must be considered, including evaluating the recruitment, or settlement and survival of oyster larvae in the target waterbody. Enhancing the eastern oyster population in the Maryland Coastal Bays (MCBs), U.S.A., a shallow lagoonal estuary, through restoration is of interest to federal and state agencies, but the location and timing of natural recruitment is not known. To fill these knowledge gaps, we assessed the spatial and temporal variation in juvenile oysters throughout the MCBs using horizontal ceramic tiles and PVC plates. Newly settled oyster larvae (recruits) were monitored biweekly from June to September 2019 and 2020 at 12 sites in the MCBs and in Wachapreague, Virginia for sampling gear comparison (substrate material and design), along with water quality parameters (temperature, salinity, dissolved oxygen, turbidity, and pH). Peak settlement began during the period from late June through July and oyster larvae were most heavily recruited in well-flushed areas that were closest to Ocean City and Chincoteague inlets. As the first recruitment study on oyster larvae in the MCBs, the results of this study provide insight into their spatial and temporal distribution, and baseline data that can serve as a foundation for future recruitment studies in other lagoonal estuaries and be used to inform stakeholders in evaluating oyster restoration projects.

SO11. Authors: **Aiman Raza**, Allison Tracy, and Matthew Ogburn
Presenter Affiliation: University of Maryland, Baltimore County

Comparing Fish and Crustacean Species on Harvested vs. Non-Harvested Oyster Reefs

Oysters support one of the largest and most important fisheries in the Chesapeake Bay. They provide many ecological services such as water filtration, denitrification, and habitat for other species. In the 19th century, the Chesapeake oyster fishery was the largest in the world. However, due to issues such as habitat degradation, disease-causing parasites, and over-harvesting, the number of oysters in the bay has significantly decreased. Oysters have been the subject of intensive management efforts, but there are many gaps in our understanding of oyster reef ecosystems. I am interested in seeing how protecting oyster reefs affects other species that live around them, specifically fish and crustaceans. To answer this question, I analyzed GoPro video footage of oyster reefs from three tributaries in the Chesapeake Bay: the James, Great Wicomico, and Choptank Rivers. Each tributary had one reef that was actively harvested and a neighboring reef where harvesting was prohibited. For each video, I recorded the number and type of fish and crustaceans and tried to identify each to the species level. I analyzed the abundance and diversity datasets using generalized linear

models and found that harvest status and tributary location were the most important factors explaining the abundance and diversity of species. There was a higher abundance of fish and crustaceans on protected reefs compared to harvested reefs, as well as higher diversity in protected reefs. The James River had a higher abundance and diversity of organisms compared to the other two sites. This study provides evidence that fish and crustacean species benefit from creating no-harvesting areas and highlights the importance of oyster reefs for healthy ecosystems. Expanding this study to more sites could provide new data to help guide oyster reef management in the future.

SO12. 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 trends in participation and diversification in capture fisheries and marine-related sectors through time series and multiple correspondence analyses, as well as the development of Herfindahl-Hirschman indices (HHI) using commercial landings data. Results indicate average HHI values for commercial landings and income are more than 80% and the percentage of fishers diversifying into more than one capture fishery is less than half of those licensed and has not varied widely. The number of fishers diversifying into marine-related industries, however, has increased, likely due to aquaculture expansion. Analyses suggest there is overlap between fishers participating in blue crab and finfish fisheries (in terms of permit holdings) and similar overlap for individuals participating in commercial fishing and seafood processing and sales. Understanding decision-making behaviors and broader livelihood strategies of small-scale fishers is integral in assessing the socio-economic impacts of environmental and management changes, as well as the ability of fishers and fishing communities to adapt to these changes.

SO13. Authors: **Samantha Dowiarz** and Roger A. Rulifson
Presenter Affiliation: East Carolina University

Social Media as a Tool for Supplementary Information on the Distribution and Recreational Fishery for Hickory and American Shads

The Facebook group "NC-Shad" was mined for data from 2013-2019 on Hickory Shad (*Alosa mediocris*) and American Shad (*A. sapidissima*) fishing location, catch information, lure characteristics, and the social constructs of the anglers and members of the group. A majority of posts included location information, so Geographic Information Systems (GIS) was employed to examine spatiotemporal patterns in fishing location and Hickory and American shad Catch Per Unit Effort (CPUE) throughout the study period. An increase in membership over time may have influenced some results, but overall, Local Ecological Knowledge (LEK) was a major forced guiding this group, and members could provide novel information on spawning grounds and distribution where Conventional Scientific Knowledge (CSK) is inadequate. Between the Roanoke, Tar, Neuse, and Cape Fear rivers, the Roanoke had the highest Hickory Shad CPUE (CPUE=26.9). This may be a result of the Roanoke Rapids Dam restricting upstream migration, forcing the species to pool at the most upstream location making them more susceptible to fishing pressure. As for American Shad, the Tar River had the highest American Shad CPUE (CPUE = 0.9), suggesting that the Cape Fear may not provide the bulk of the American Shad fishery as once thought. Although a statistically significant spatiotemporal trend was not found for either Hickory or American shad, multiple Consecutive Hot Spots near Goldsboro for American Shad CPUE suggests that the Neuse River stocking program may have successful natal homing individuals. While the information on "NC-Shad" may not accurately reflect the fishing activity by each member, there may be potential to form a network of anglers willing to participate in monitoring programs. This study demonstrates that social media data mining could be a cost-effective alternative to obtain supplementary information on recreationally important fish species.

SO14. Authors: Yinan Ding, Matt Damiano, and Jie Cao
Presenter Affiliation: North Carolina State University

A New Exploratory Assessment of Common Dolphinfish (*Coryphaena hippurus*) in the Western Central Atlantic

Common dolphinfish has been called an ideal species for a fishery due to its rapid growth and early maturity and has a long history of being harvested by the East Coast United States and Caribbean countries. Studies have suggested that dolphinfish caught in the Western Central Atlantic (WCA) comprise a single stock and that the population may be declining. The population status, however, remains unknown, and few studies have been done to investigate the population dynamics of dolphinfish. This has largely been due to the lack of high-quality data, which has prevented the estimation of reference points in the past. New

methods have been pioneered since the first exploratory assessment 20 years ago. Therefore, we tested a potential tool, Just Another Bayesian Biomass Assessment (JABBA), to conduct a new exploratory assessment of common dolphinfish in the WCA. JABBA is a generalized Bayesian state-space estimation framework for modeling biomass dynamics that allows us to incorporate prior values and consider process errors. We fit a JABBA model to nominal catch-per-unit-effort (CPUE) data from the US pelagic longline fishery logbooks in the WCA and aggregated landings by country reported to the FAO during 1991-2018. We conducted several sensitivity analyses, including different time ranges of data, Plim values, and priors. The results suggested that we could not draw reliable conclusions about common dolphinfish population status due to many uncertainties associated with the data and model. However, this was an important step in understanding the limitations of current methods and determining necessary next steps for assessing common dolphinfish. In the near term, we intend to derive model-based indices to explain the spatial variation in the longline data and explore the potential effects of environmental drivers, then refit JABBA models. In the long-term, this project will move toward a spatially explicit assessment model.

POSTER PRESENTATIONS

Poster Presentations

Note: Times reflect the start of the time block and presentations are listed in order.
Moderated by: David Rudders

Time	Presenter	Title of Presentation
2:15 PM	Damiano, M.	When One-Size-Does-Not-Fit-All: A Management Strategy Evaluation Tool for Examining Tradeoffs Between Management Objectives for Commercial and Recreational Fisheries
2:15 PM	Nichols, Q.	Phenology in a Changing Environment: Ecological Forecasts of the Albemarle Sound/Roanoke River Striped Bass Stock Migration
2:15 PM	Rocco, A.	Adapting an Individual-Based Model for Use between Distantly-Related Species
2:15 PM	Teears, T.	Estimation of Recruitment Variation Using Cohort-Specific von Bertalanffy Growth Coefficients: Stock Assessment Implications

Poster Abstracts

PS1. Authors: **Matthew Damiano,** Jie Cao, Kyle Shertzer, and Grant Murray
Presenter Affiliation: North Carolina State University

When One-Size-Does-Not-Fit-All: A Management Strategy Evaluation Tool for Examining Tradeoffs Between Management Objectives for Commercial and Recreational Fisheries

Traditional fisheries management techniques are based on achieving maximum sustainable yield (MSY) and intrinsically designed to achieve commercial fishing objectives, however, fishing fleets for many stocks are shared equally with or dominated by recreational fishing. The needs and priorities of commercial and recreational user groups can fundamentally differ where no one-size-fits-all strategy addresses the myriad fishing objectives. Recreational fishing in the United States (US) plays a strong role, particularly in the Southeast (SE) US fisheries, therefore it is necessary for resource managers to explicitly account for the different, potentially competing objectives of different sectors in fishery management plans. To address this, we developed a management strategy evaluation (MSE) tool to explicitly examine the tradeoffs between commercial and recreational objectives and applied it to two fisheries in the SE US: the black sea bass (*Centropristis striata*) and Atlantic cobia (*Rachycentron canadum*) fisheries. The MSE tool consisted of an operating model (OM) conditioned to mimic the population and fishery dynamics, and a length-based integrated assessment model (AM) that were connected to form a closed-loop simulation. The tool will focus on exploring the effects of catch reallocation-, MSY- and catch rate-based management strategies on fish population dynamics and future behavior of fishermen. This project has resulted in a generalized MSE framework that is broadly applicable to fisheries that are managed using length-based measures. Results of the MSE for black sea bass and Atlantic cobia will be available during summer 2021.

PS2. Authors: **Quentin Bratkowski Nichols**, Rebecca G. Asch, and Roger Rulifson
Presenter Affiliation: East Carolina University

Phenology in a Changing Environment: Ecological Forecasts of the 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. North Carolina hosts the Albemarle Sound/Roanoke River

(A/R) stock, which is the southernmost major spawning population of Striped Bass. 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. The study will use historical data from a Striped Bass egg survey and creel survey conducted from 1959-1993 to model spawning migration timing as a function of river and coastal temperature, regional climate indices, dissolved oxygen concentration, wind speed, river flow pulse duration timing, and Striped Bass population size structure. The forecast will be split into two different models, one based on egg survey data and the other based on creel survey data due to the differences in the average date of key phenology events. These differences reflect that spawning activity and migratory patterns of adult Striped Bass are different biological processes. Initial analysis of temperature data from Roanoke River and Virginia Beach area shows very similar modes of variability from 1960-1993. 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.

PS3. Authors: **Alex Rocco**, Jie Cao, and Yan Li
Presenter Affiliation: North Carolina State University

Adapting an Individual-Based Model for Use between Distantly-Related Species

Individual-based models, which build a population of individual organisms with variable characteristics such as growth rates, fecundity, and survival, are widely used in fisheries science. The variability of characteristics between individuals helps bridge the gap between small-scale ecological processes and large-scale effects. We are adapting an individual-based model for smallmouth bass (*Micropterus dolomieu*) to model the life history of blue crabs (*Callinectes sapidus*) in North Carolina. Despite their lack of physiological similarities, there are commonalities in the two species' life histories. For example, both *M. dolomieu* and *C. sapidus* are r-selected species with post-reproductive male guarding behavior. Further, both *M. dolomieu* and *C. sapidus* are sensitive to anthropogenic chemical pollution such as bioactive estrogen. There are, however, still major differences which need to be addressed. The main difference in the model is the molt-mediated growth of *C. sapidus*. Fish growth is continuous and can be modeled using a Von Bertalanffy growth function, but growth for *C. sapidus*, and crustaceans in general, is discrete, occurring incrementally when the individual sheds its exoskeleton. To address this, some submodels must be altered, some must be removed, and some must be added. We will use this adapted model to demonstrate that individual-based models are a flexible framework that can be extended to accommodate invertebrate population dynamics. The resulting model will be used to inform a projection of *C. sapidus* populations as climate change and urbanization continue to affect North Carolina's waters.

PS4. Authors: **Thomas Teears**, Shanae Allen, Jie Cao, Yan Li, and Jeffrey Buckel
Presenter Affiliation: North Carolina State University, North Carolina Division of Marine Fisheries

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.

LIGHTING TALKS

Student Lightning Talk Presentations

Note: Times reflect the start of the time block and presentations are listed in order.
Moderated by: David Rudders

Time	Presenter	Title of Presentation
3:05 P.M.	Clerkin, P.	Exploration of Deepwater Seamount-Associated Chondrichthyans of the Southern Indian Ocean Using Genetic barcoding, eDNA, and Deepwater Cameras
3:05 P.M.	Lambert, M.	Juvenile Fish Utilization of Strategic Habitat Areas (SHAs) in the Cape Fear River Estuary: Measuring Growth and Production to Assess Habitat Function
3:05 P.M.	McMains, A.	Acoustic Tagging on an Oyster Lease: The Use of Aquaculture Gear as Habitat for Juvenile Sheepshead (*Archosargus probatocephalus*)
3:05 P.M.	Meckler, K.	The Influence of Aerial Exposure on Parasite Occurrence in Intertidal Oyster Reefs
3:05 P.M.	Pelletier, C.	Estimating Aspects of Reproductive Biology and Enhancing Diet Resolution for Non-native Catfishes in the Cape Fear River Estuary
3:05 P.M.	Speight Youtsey, L.	A Transcriptomic Look into the Effects of Low Salinity on the Hard Clam, *Mercenaria mercenaria*

LIGHTNING TALK ABSTRACTS

LT1. Authors: **Paul J. Clerkin** and Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

Exploration of Deepwater Seamount-Associated Chondrichthyans of the Southern Indian Ocean Using Genetic barcoding, eDNA, and Deepwater Cameras

Chondrichthyans (sharks, rays, and chimaeras) are top predators in almost every environment they inhabit and thus are important to overall ocean health. However, the biology of deep-sea species of the Indian Ocean is poorly understood; these species are difficult to monitor and assess due to misidentification by inexperienced observers, a high incidence of cryptic species, and overall limited accessibility to remote sites. These limitations can be overcome by combining traditional taxonomy and life history with advanced technologies. We will work with commercial vessels deep-sea fishing along seamounts from the Madagascar to the 90 East Ridge to explore the chondrichthyan fauna of the Southern Indian Ocean by using a combination of methods: 1) cataloging species complete with life history and including an associated genetic barcode of each species encountered, 2) collection of eDNA samples from each seamount to estimate species richness and relative abundance, 3) use of gear-mounted deep-water cameras to observe species and bottom conditions. The findings from this study will contribute to our currently limited knowledge of the chondrichthyan species in the Southern Indian Ocean. The results will include a database of life history, distribution, habitat information, and other biological information that can be used as a baseline to monitor seamount health and prioritize conservation management.

LT2. Authors: **Melinda S. Lambert**, Frederick S. Scharf, and Troy D. Alphin
Presenter Affiliation: University of North Carolina Wilmington

Juvenile Fish Utilization of Strategic Habitat Areas (SHAs) in the Cape Fear River Estuary: Measuring Growth and Production to Assess Habitat Function

Measurements of juvenile fish production have been previously used to evaluate habitat quality and recruitment variability. The total biomass of juveniles recruiting to an adult fishery can be used to measure the contribution of juvenile and nursery habitats. Discrete regions within the Cape Fear River have been designated as strategic habitat areas (SHAs) based on the application of optimal arrangement models and corroboration with existing data to identify locations that could potentially provide excellent habitat functionality with low human alteration and activity. Estimates of the growth and production during the juvenile life stage for a target group of fish species will be used to quantify the role of SHA and non-SHA habitats in the Cape Fear River. Comparison using a paired site design should provide insights into the relative contributions of designated and undesignated habitats as well as the

methodology behind their designations. Historical data from the North Carolina Division of Marine Fisheries estuarine trawl survey will be compared with data collected during a multi-habitat survey to evaluate changes in fish community structure, habitat associations, and timing of important life history events. Seasonal changes in the presence and absence of multiple fish will be used to track recruitment timing and ontogenetic changes in habitat preference throughout the juvenile life stage. Sampling will be conducted monthly at stratified random and fixed sites within three regions of the river (Upper, Middle, Lower). SHA habitats, as well as adjacent non-SHA habitats, will be sampled using multiple gears at multiple depths to measure fish growth and production.

LT3. Authors: **Andrew McMains** and James Morley
Presenter Affiliation: East Carolina University

Acoustic Tagging on an Oyster Lease: The Use of Aquaculture Gear as Habitat for Juvenile Sheepshead (*Archosargus probatocephalus*)

Sheepshead are known to utilize highly structured habitat throughout their life span. As aquaculture continues to rise in prominence in the eastern United States, it is important to understand how structurally oriented species, like sheepshead, will use these installations as habitat. To address this question, we installed a VEMCO Positioning System (VPS) array on a floating bag oyster lease in Cedar Island Bay, NC. We surgically tagged 27 juvenile sheepsheads with acoustic transmitters and tracked their movement around the lease and surrounding area from July through November 2020. Across the entire study 29% of the pings were recorded from within the lease boundary. On average, fish spent slightly more time on standard lease bags (56.3%) than grow bags (43.7%). Fish were ~20% more likely to be detected on the lease during the nighttime. Preliminary analyses have shown that fish spend a higher percentage of their time on the lease during periods of colder weather. These results support the hypothesis that oyster leases can add suitable habitat for structure-oriented species. Further analysis is needed to quantify the site fidelity of sheepshead to the lease habitat; animations of tagging data demonstrated consistent homing behavior of foraging sheepshead.

LT4. Authors: **Karli Meckler**, Joel Fodrie, and Zofia Knorek
Presenter Affiliation: University of North Carolina Chapel Hill

The Influence of Aerial Exposure on Parasite Occurrence in Intertidal Oyster Reefs

The intensity of interspecific relationships can be partially dictated by the abiotic factors that exist within a system; where organisms lie along an environmental stress gradient may result in differing costs for themselves and their symbionts. Among many factors driving oyster declines and inhibiting recovery of these populations, parasitic bioeroders like mud blister worm (Polydora spp.) and boring sponge (Cliona spp.) may pose a notable threat. These biotic stressors may interact with abiotic stressors such as tidal exposure, though few studies

have directly considered the effect of aerial exposure on susceptibility to parasitism. This study explored worm and sponge distribution patterns across an intertidal gradient (-0.81m, -0.09m; NAVD88) on oyster reefs in North Carolina, while examining the effects of both stressors on oyster condition. Change in oyster condition and parasite infection metrics across the elevation range was consistent with existing knowledge about environmental stress gradients. Performance of these organisms decreased at the upper and lower elevation extents, where the limits of their tolerance to certain stressors were tested. However, the relationship between performance and elevation was weak for each metric, pointing to the influence of additional factors in determining oyster condition and parasite occurrence in intertidal reef systems. Our findings suggest that while worms and sponges are not likely to be the sole inhibitors of reef growth and recovery, they are a factor that might be considered. Attention to project siting within the tidal extent of a system can minimize the impacts of parasites on oyster restoration and aquaculture efforts.

LT5. Authors: **Claire Pelletier** and Frederick S. Scharf
Presenter Affiliation: University of North Carolina Wilmington

Estimating Aspects of Reproductive Biology and Enhancing Diet Resolution for Non-native Catfishes in the Cape Fear River Estuary

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 and the use of histological approaches to estimate catfish maturity schedules and estimate fecundity. Preliminary data shows a correlation between increased GSI and the proposed spawning season for blue and flathead catfish. Increased sample sizes and continued work will build onto previous findings and lead to an improved understanding of the role of non-native catfishes in the lower Cape Fear River.

LT6. Authors: **Leslie Speight Youtsey,** Kimberly S. Reece, and Jan R. McDowell
Presenter Affiliation: Virginia Institute of Marine Science

A Transcriptomic Look into the Effects of Low Salinity on the Hard Clam, *Mercenaria mercenaria*

The hard clam, *Mercenaria mercenaria*, industry is the most economically valuable aquaculture industry in Virginia. Growth is currently limited by number of higher salinity habitats on the seaside of the Eastern Shore of Virginia or lower Chesapeake Bay. Although wild hard clams in Chesapeake Bay can be found as far north as Pocomoke and Tangier Sound, they are not abundant in salinities below 18 ppt and are restricted to salinities above 12 ppt. Even in areas of higher salinities, hard clams are vulnerable to rapid drops in salinity caused by increased rain fall and run off. To understand the climate change effects of increased storms and hurricanes predicted to impact the US East Coast and to enable expansion of the hard clam aquaculture industry, the biological adaptations that hard clams use to deal with osmotic, or low salinity, stress needs to be investigated. The physiological and cellular responses that occur during osmotic stress are regulated by proteins translated from mRNA. By exploring the RNA expression patterns of hard clams when faced with varying salinity conditions, I can characterize gene expression patterns and make inferences on the molecular activity, i.e., ion transport, signaling, etc. at different salinities. By comparing clam lines derived from distinct genetic populations, it may be possible to identify those that demonstrate different responses to lower salinities, both phenotypically and genotypically. Once identified, the loci responsible for these phenotypic (expression level) and genotypic (genome level) differences can then be used to develop molecular markers to enable rapid selection for improved performance under lower salinity conditions.

AFS Meetings Code of Conduct

Purpose:
American Fisheries Society (AFS) meetings are among the most respected scientific meetings of fisheries professionals in the natural resource scientific community. AFS values the diversity of views, expertise, opinions, backgrounds, and experiences reflected among all attendees, and is committed to providing a safe, productive, and welcoming environment for all meeting participants and AFS staff. All participants, including, but not limited to, attendees, speakers, volunteers, exhibitors, staff, service providers, and others, are expected to abide by this Meetings Code of Conduct. This Code of Conduct applies to all AFS meeting-related events, including those sponsored by organizations other than AFS but held in conjunction with AFS events, in public or private facilities.

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- Consequences to unacceptable behavior will be determined by the AFS Ethics and Professional Conduct Committee in conjunction with AFS officers and the AFS Executive Director.
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    - Dismissal from the meeting without refund
    - Reporting to your agency
    - Exclusion from any future AFS (sub unit/chapter/division) meetings for five years
    - Revoke of AFS membership without the opportunity for renewal for five years
    - If the offense is criminal, local law enforcement will be contacted.

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