# 29TH ANNUAL MEETING
# OF THE
# AMERICAN FISHERIES SOCIETY


## MARCH 5-7, 2015

## PINE KNOLL SHORES, NC

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# Tidewater AFS Meeting Schedule Overview

## (Mar 5-7, 2015)
## Meeting and Socials Venue: N.C. Aquarium at Pine Knoll Shores
**Hotel: Hilton Doubletree, Atlantic Beach**

**Thursday, Mar 5, 2015**

| | | |
|---|---|---|
| 11:00 am – 12:00 pm<br>& 6:00 pm – 8:00 pm | Registration<br>***(poster presenters can register early / set-up at 5:30pm)*** | Soundside Hall |
| 12:00 pm – 4:00 pm | Continuing Education Course | |
| 5:00 pm – 6:00 pm | EXCOM Meeting | Hilton Doubletree |
| 6:00 pm – 10:00 pm | Poster Social | Soundside Hall & Freshwater Gallery |

**Friday, Mar 6, 2015**

| | | |
|---|---|---|
| 7:45 am – 4:00 pm | Registration | Soundside Hall |
| 8:20 am – 8:30 am | Welcome | |
| 8:30 am – 9:15 am | Student 1-minute presentations | |
| 9:15 am – 11:45 am | Oral Presentations | |
| 11:45 am - 1:15 pm | Lunch | |
| 1:15 am – 4:00 pm | Oral Presentations | |
| 4:00 pm – 5:00 pm | Business Meeting | |
| 6:30 pm – 10:00 pm | Banquet Social | Saltwater Gallery |

**Saturday, Mar 7, 2015**

| | | |
|---|---|---|
| 7:45 am – 10:00 am | Registration | Soundside Hall |
| 8:45 am – 11:45 am | Oral Presentations | |
| 11:45 am | Adjourn | |

## Poster Presentations Thursday, March 5th – Soundside Hall, NC Aquarium

*** denotes student presentation**

| # | Presenter | Poster Title |
|---|---|---|
| 1 | Stephen Poland | Seasonal and size-specific variation of total mercury content in large pelagic fishes off North Carolina |
| 2 | *Stephen W. Parker | Assessing morphological variability in silversides along the Mid-Atlantic Bight |
| 3 | *Evan Knight | Comparing condition indices, maturity, and fecundity between hatchery reared and wild striped bass in the Tar/Pamlico and Neuse Rivers |
| 4 | Jeffrey Dobbs | North Carolina Division of Marine Fisheries observer program |
| 5 | *W. Robert Cope | Assessment of niche partitioning in co-occurring silversides from the Albemarle and Pamlico Sounds of North Carolina |
| 6 | *T. Kyle Tobin | The influence of vessel noise on oyster toadfish (*Opsanus tau*) diets |
| 7 | *M. Chad Smith | Knowledge of water quality among different cultural groups: What can we learn from this? |
| 8 | *Ethan S. Simpson | Estimation of persistence within the North Carolina red drum juvenile abundance index: Performance of fixed versus partial replacement survey design |
| 9 | *Trevor K. Scheffel | Estimating mortality for southern flounder using a combined telemetry and conventional tagging approach |
| 10 | Liza A. Hoos | Reducing sea turtle bycatch in the Pamlico Sound southern flounder fishery by expanding no-fishing zones around inlet corridors |
| 11 | *Liz Brown-Pickren | North Carolina anglers' local ecological knowledge about climate change |
| 12 | *Shelby White | Effects of hypoxia on striped bass and river herring in strategic habitat areas |
| 13 | Jessica S. Thompson | Influence of salinity on thermal preferences and growth of mummichog |
| 14 | John Cooper | Distribution and density of three uncommon or imperiled unionid species in northern New York |

## Poster Presentations Thursday, March 5th – Soundside Hall, NC Aquarium

*** denotes student presentation**

| # | Presenter | Poster Title |
|---|---|---|
| 15 | *****Aimee N. Dexter | Jellyfish Database Initiative (JEDI): Improving estimates of gelatinous zooplankton biomass in the ocean |
| 16 | *****Ian Kroll | Linking habitat to stock assessment: Rigorously modeling the role of estuarine juvenile habitats in adult stock dynamics of black sea bass (*Centropristis striata*) |
| 17 | *Ed Arb | Beach Nourishment's Effect on the Longshore Movements of Juvenile Florida Pompano and Gulf Kingfish |
| 18 | Thomas E. Lankford, Jr. | The UNCW fish collection: A resource for ichthyology research and education |
| 19 | *Walter Rogers | Population structure of river herring in the Albemarle Sound, North Carolina: Does morphometric analysis agree with other stock identification methods? |
| 20 | Aaron Bunch | Northern snakehead distribution in Virginia |
| 21 | Amy Comer | North Carolina multi-species tagging program |

## 2015 Annual Tidewater AFS Poster Abstracts (*denotes student posters)

**E1.** **Authors: Stephen Poland**, Rebecka Brasso, and Fredrick Scharf

**Presenter Affiliation:** University of North Carolina at Wilmington

**SEASONAL AND SIZE-SPECIFIC VARIATION OF TOTAL MERCURY CONTENT IN LARGE PELAGIC FISHES OFF NORTH CAROLINA**

The large pelagic fish community in the US South Atlantic supports valuable commercial and recreational fishing industries in several states. Some members of this community, including blue marlin and wahoo, have previously been found to contain mercury levels sufficient to impact reproduction and survival as well as pose a potential health risk to consumers. However, most regional consumption advisories are based on studies with small sample sizes of fish collected outside of state waters which may not be representative of fish landed by North Carolina anglers. The objectives of our study were to estimate the mercury concentrations in tissues of several large pelagic fish species in state waters and assess seasonal and size-specific variation in mercury concentration. Fish were collected through fishing tournaments and cooperation with charter captains from North and South Carolina. A sample of muscle tissue was dried and homogenized using mortar and pestle then the mercury concentration was estimated using a Tri-Cell Direct Mercury Analyzer (model DMA-80) and values converted to wet weight mercury concentration. Mercury concentrations exceeding the FDA action level of 1.0 ppm were observed in wahoo, blackfin tuna, and blue marlin, with all mercury concentrations for dolphinfish and yellowfin tuna falling below. Mercury concentration increased with increasing fork length and trophic level for all species. Seasonal differences were observed for blackfin tuna, with highest mean mercury concentration during the spring. Trends in mercury concentration from this study support those reported previously for the southeastern US and will help to inform regional advisories from the FDA.

**E2.** **Authors:** ***Stephen W. Parker** and Anthony S. Overton

**Presenter Affiliation:** Department of Biology, East Carolina University

**ASSESSING MORPHOLOGICAL VARIABILITY IN SILVERSIDES ALONG THE MID-ATLANTIC BIGHT**

Inland silversides (*Menidia beryllina*) and Atlantic silversides (*Menidia menidia*) are fishes found ubiquitously in the estuaries on the east coast of the United States. These species are very similar in appearance and may share many morphological traits. The morphological variation in a species is an important component, which repeatedly has been shown to correlate with factors such as diet, habitat and predation risk in fishes. Any significant variance may be a product of genetically differentiated populations as due to reproductive isolation by distance. In this study, I analyzed conspecific silverside populations to characterize morphological variance within and between species. My goal was to determine if geographic differences could point to significant morphological variation among silverside populations in Pamlico and Albemarle Sounds in North Carolina. I also compared these data to populations of silversides in the Chesapeake Bay, Maryland. Aquatic environments such as these have proven to exhibit spatial and temporal variability in a number of habitat parameters. I took pictures of specimens and used seventeen chosen length characteristics to determine sources of physically expressed variation between populations. I hypothesized that morphometric analysis would show significant differences in the morphological features of Inland and Atlantic Silversides between the Albemarle and Pamlico Sounds as well as between the waters of North Carolina and Maryland. I also expected that the inland and Atlantic Silverside populations would have significant phenotypic divergence as a result of distance between populations, with the greatest variance being exhibited between the North Carolina and Maryland populations.

**E3.** **Authors: *Evan Knight** and Roger Rulifson

**Presenter Affiliation:** East Carolina University

**COMPARING CONDITION INDICES, MATURITY, AND FECUNDITY BETWEEN HATCHERY REARED AND WILD STRIPED BASS IN THE TAR/PAMLICO AND NEUSE RIVERS**

The largest stock of striped bass (*Morone saxatilis*) in North Carolina is the Albemarle/Roanoke stock; however, other populations inhabit North Carolina's coastal and riverine waters. The Central Southern Management Area (CSMA) consists of the waters of the Tar/Pamlico River, Neuse River, Cape Fear River, and Pamlico Sound. Striped bass populations have been sustained in the CSMA by stocking (Roanoke River broodstock) from the North Carolina Wildlife Resources Commission (NCWRC), but the goal from the fishery management plan is to establish self-sustaining spawning populations of striped bass in these coastal rivers. The NCWRC instituted an endemic stocking program in 2011 using fish collected on the spawning grounds in the Tar/Pamlico and Neuse River for broodstock in hopes that endemic broodfish will produce offspring that are genetically suited for each individual river system. A maturation and fecundity schedule is needed for stock assessment models and effective management of the CSMA striped bass population. Striped bass were sampled (n=174) on and near the spawning grounds in the Neuse and Tar/Pamlico River by electroshocking during the pre-spawn, spawning, and post-spawn period (February to June 2013 and 2014). Each fish was measured (fork length and total length, mm) and weighed (g). Otoliths were removed for ageing and otolith chemistry. Sex was determined, and gonads were removed and weighed to determine the phase of reproduction. A maturation and fecundity schedule was determined based on results from analyzing otoliths, gonads, and histological samples of individual fish. Condition, fecundity, and maturity were compared between origin and river system.

**E4.** **Authors: Jeffrey Dobbs**, John McConnaughey, Jacob Boyd and Zachary Fasking

**Presenter Affiliation:** North Carolina Division of Marine Fisheries

**NORTH CAROLINA DIVISION OF MARINE FISHERIES OBSERVER PROGRAM**

All species of sea turtles and sturgeon found in North Carolina's estuarine waters have been listed as threatened or endangered under the Endangered Species Act of 1973. These listings give management authority to the National Marine Fisheries Service making incidental captures of any protected species illegal. The North Carolina commercial estuarine flounder gillnet fishery has incidental interactions with protected species, necessitating the need for federal Incidental Take Permits. North Carolina applied for, and received Incidental Take Permit's for sea turtles and Atlantic sturgeon covering the anchored large and small mesh gillnet fisheries throughout the state. One of the main stipulations of the Incidental Take Permits is a comprehensive Observer Program to estimate interactions with sea turtles and Atlantic sturgeon. The Observer Program consists of both onboard and alternative platform observations conducted to meet the coverage goals of 7-10% for the large mesh gillnet fishery, and 1-2% for the small mesh gillnet fishery seasonally for each management unit (A, B, C, D1, D2, E). In addition to its federally mandated functions, this program provides valuable fishery dependent data (i.e. discarded catch, mortality estimates, lengths, weights) on commercially and recreationally important finfish species, for use in statewide and coast-wide Fishery Management Plans.

**E5.** **Authors:** ***W. Robert Cope** and Joseph J. Luczkovich

**Presenter Affiliation:** Department of Biology, East Carolina University, Greenville, NC

**ASSESSMENT OF NICHE PARTITIONING IN CO-OCCURRING SILVERSIDES FROM THE ALBEMARLE AND PAMLICO SOUNDS OF NORTH CAROLINA.**

The niche partitioning hypothesis predicts that two species cannot compete for the same limited resources and that one species should differentiate so that the two species are fulfilling separate niches. To test this hypothesis, we collected two co-occurring silverside species, the Atlantic *Menidia menidia* and Inland *Menidia beryllina* from the Albemarle and Pamlico Sounds of North Carolina. Approximately 1100 fish were collected through multiple beach seining trips from 20 sites in the Pamlico Sound and 8 sites from the Albemarle Sound throughout the months of August to November of 2013. The fish from each site were positively identified as being Menidia menidia or Menidia beryllina and their total length was measured (to the nearest mm). Our initial length results showed that Atlantic Silversides from the Albemarle Sound had a dominant frequency of 60-69 mm while the dominant frequencies for Inland Silversides were in the 40-49 mm and 50-59 mm ranges. In contrast, the Pamlico Sound Atlantic Silversides had a dominant length frequency of 70-79 mm while Inland Silversides had a dominant frequency 50-59 mm, a range similar to that observed for this species in the Albemarle Sound. A food habit analysis of these fish is underway and we hypothesize that if niche partitioning is occurring, the food habit analysis should show that the two silverside species are consuming different prey items because of their size differences and niche role in the environment. Gut contents from 10 fish of a given species from each site in the same size range will be combined and passed through a layered sieve system for later composition identification. Statistical analysis will determine whether significant differences exist between Atlantic and Inland Silverside food habit preferences.

**E6.** **Authors: *T. Kyle Tobin**, Cecilia S. Krahforst, Charles W. Bangley, Joseph J. Luczkovich

**Presenter Affiliation:** Department of Biology, East Carolina University

**THE INFLUENCE OF VESSEL NOISE ON OYSTER TOADFISH (*OPSANUS TAU*) DIETS**

Aquatic food webs have been disturbed by human activities. Boat noise alters animal behavior, which may cause changes to the food web. Possible behavioral changes include avoidance of an area with high vessel activity, which could lead to changes in the predator-prey relationships. Here the impact of underwater vessel noise on oyster toadfish (*Opsanus tau*) diets is explored. Oyster toadfish consume mud crabs and mud crabs in-turn consume juvenile bivalves. If vessel noise alters toadfish behavior and diet, reducing predation on crabs, there could be a cascading effect that leads to decreased oyster abundance. Oyster toadfish were collected during 2013 and 2014 from four sites in NC. Two sites had low vessel activity (<20 vessels per day) while the remaining sites had high vessel activity (>200 vessels per day). Artificial dens (36-48 half concrete blocks) were placed at each site in March to attract toadfish. In August 2013, toadfish were collected from each den and stomach contents were analyzed. In 2014, toadfish were collected once a month from May through August for diet analysis. Preliminary results from 2013 suggest that at the noisy sites, mud crabs composed 95% of the dry weight of stomach contents, but at the quiet sites, stomachs contained a variety of species, with mud crabs comprising 30% of the dry mass. These results suggest that oyster toadfish diets are altered by vessel activity, which has implications to ecosystem health. Toadfish and other soniferous fishes behave differently in locations with high vessel noise, affecting trophic relationships.

**E7. Authors: *M. Chad Smith**

**Presenter Affiliation:** Coastal Resources Management Program, East Carolina University

**KNOWLEDGE OF WATER QUALITY AMONG DIFFERENT CULTURAL GROUPS: WHAT CAN WE LEARN FROM THIS?**

Education is often times mentioned when scientists are working towards building a more scientific literate public. The question is what does the public know about water quality, and how does it compare to other group populations (or cultural groups) such as water quality professionals, citizen science volunteers, or fishers? One method to answer this question is cultural consensus theory, which is comprised of analytical techniques and models that can help identify cultural beliefs and how individuals might be grouped based on these beliefs. To determine if there is a consensus between different cultural groups regarding water quality, an online survey of questions was administered to related government and non-profit groups, including social media outlets throughout eastern North Carolina and Virginia. During the survey, respondents identified themselves belonging to one of the following cultural groups: (1) water quality monitoring program volunteer, (2) water quality professional, (3) water quality educator, (4) fisher (both commercial and recreation), and (5) no experience with water quality. As of now, over 250 surveys have been completed. Using UCINET software, individual responses were tested against the aggregate responses from each group to determine if there was a consensus between the groups; multiple dimensional scaling was used to visually group the survey respondents to one another. Results from this study will help identify strengths and weaknesses when it comes to water quality knowledge for the establishment and/or improvement of education campaigns and citizen science projects.

**E8. Authors: *Ethan S. Simpson**, Lee M. Paramore, Frederick S. Scharf

**Presenter Affiliation:** Department of Biology and Marine Biology, University of North Carolina Wilmington

**ESTIMATION OF PERSISTENCE WITHIN THE NORTH CAROLINA RED DRUM JUVENILE ABUNDANCE INDEX: PERFORMANCE OF FIXED VERSUS PARTIAL REPLACEMENT SURVEY DESIGN**

The red drum (*Sciaenops ocellatus*) is a highly valued fishery resource in North Carolina. Population monitoring efforts for red drum include a survey designed to generate an annual juvenile abundance index (JAI). Since its inception in 1991, the JAI has estimated catch per unit effort of young of the year red drum during the fall using beach seines pulled at a set of fixed stations (n ~ 20) throughout the state. In an effort to evaluate the potential for bias in the index due to the fixed-station design, we quantified the spatial and temporal persistence among stations and across sample years. We calculated persistence among stations from year to year (i.e., did differences in catch among stations remain consistent through time?), and also among years from station to station (i.e., were differences in catch among years evident at all stations?). We also examined graphically the temporal pattern in ranked CPUE at each station and the spatial patterns in ranked CPUE across years. Lastly, a pilot study was initiated in two regions of the state to evaluate the potential for the addition of randomly selected stations to the fixed-station design, resulting in a survey with partial replacement. Analysis of the historical data demonstrated that as time between surveys increased, spatial persistence (i.e., consistency of station performance) gradually declined. Also, more recent years (since 2001) displayed higher persistence, with > 72% of pairwise comparisons of years yielding good levels of persistence ($\tilde{\omega} < 0.5$), while only about half of comparisons yielded a similar level of persistence prior to 2001. We also observed some temporal trends in the ranked catches that indicated instability in performance of certain stations. The addition of random stations in the southern region of the state revealed that two of the fixed stations may not be performing as well currently as they have in past years. For the random stations, higher levels of CPUE were primarily found in the mid and upper estuarine regions, while two fixed stations in close proximity to the random stations (in one case the same creek) each failed to catch a single fish during the 2014 survey. We plan to continue the addition of random sampling during 2015 to evaluate the potential for a partial replacement survey design to improve accuracy in the North Carolina JAI.

**E9.** **Authors: *Trevor K. Scheffel**, Jeffrey A. Buckel, Joseph E. Hightower, Frederick S. Scharf

**Presenter Affiliation:** [1]Department of Biology and Marine Biology, University of North Carolina Wilmington

**ESTIMATING MORTALITY FOR SOUTHERN FLOUNDER USING A COMBINED TELEMETRY AND CONVENTIONAL TAGGING APPROACH**

The southern flounder (*Paralichthys lethostigma*) is a valuable marine resource in North Carolina. The most recent (2009) stock assessment concluded that southern flounder were overfished with overfishing still occurring, necessitating updated estimates of fishing (F) and natural (M) mortality. We are using a combination of acoustic telemetry and conventional tagging methods at two spatial scales over three years to generate mortality estimates. Southern flounder tagged with acoustic transmitters will be released and tracked in a single estuary to provide system-specific estimates of F and M, while conventional tags will be deployed across the state to provide direct information about F on a larger scale and indirect information on M. During 2014, 94 southern flounder were tagged with acoustic transmitters and released throughout the New River estuary between June and October. Additional external tags contained contact information and a high monetary reward to meet the assumption of 100% reporting of recaptures. Fish were detected via a passive array of acoustic receivers, with data downloads every ~3 months, and manual tracking that occurred bi-weekly or monthly. Manual tracking efforts yielded detections of 31 different individuals between September and December, 17 of which are still at large in the estuary. To date, 32 fishing mortalities have been reported among the initial cohort of 94 fish released. Commercial harvest was responsible for 2/3 of the reported fishing mortalities, which occurred throughout the estuary and included multiple gears (7 recreational hook and line, 4 recreational gig, 7 commercial gig, 14 commercial gill net). For harvested fish, time at large was highly variable ranging between 1 and 133 days, with an average ± SD of 37 ± 28 days. Among the remaining individuals, we have observed 18 emigrations, 41 individuals are assumed to be still at large in the estuary, and 3 individuals have not been detected since tagging. Active and passive tracking is ongoing to determine the fates of fish still at large in the estuary.

**E10.** **Authors: Liza A. Hoos**, Jacob B. Boyd, Laura M. Lee, and Jeffrey A. Buckel

**Presenter Affiliation:** Department of Applied Ecology, Center for Marine Sciences and Technology, North Carolina State University

**REDUCING SEA TURTLE BYCATCH IN THE PAMLICO SOUND SOUTHERN FLOUNDER FISHERY BY EXPANDING NO-FISHING ZONES AROUND INLET CORRIDORS.**

The southern flounder fishery is the most economically important estuarine finfish fishery in North Carolina. A large portion of this species' landings is caught using large-mesh gillnets, a gear-type known to have high rates of sea turtle bycatch. The NC Division of Marine Fisheries has implemented various adaptive management measures since 1999 to reduce sea turtle bycatch in large-mesh gillnets in the Pamlico Sound, where the largest portion of NC southern flounder are caught. Since 2000, the deep-water portions of the Pamlico Sound as well as three inlet corridors into the sound have been closed to large-mesh gill nets during the southern flounder fishing season (September - December) in order to reduce the number of interactions between the fishery and sea turtles. In past years the fishing season has often been closed or shortened in order to stay below authorized sea turtle incidental take levels, causing fishermen to forego a significant source of income. We will use fishery-independent and -dependent data to create bycatch per unit effort (BPUE) maps for the three species of sea turtles caught by the southern flounder fishery in Pamlico Sound. We will determine a) if BPUE is higher along the edges of the corridors than elsewhere in the sound and b) whether expansion of the closed areas around the three inlet corridors could reduce bycatch of sea turtles in the southern flounder fishery, thereby allowing the fishery to operate more days of the year.

**E11. Authors: *Liz Brown-Pickren**

**Presenter Affiliation:** Coastal Resources Management Program, East Carolina University

**NORTH CAROLINA ANGLERS' LOCAL ECOLOGICAL KNOWLEDGE ABOUT CLIMATE CHANGE**

Anglers who fish in the same spot over time amass local ecological knowledge about the presence and sizes of target species and environmental conditions where they fish, including water temperature, storm activity, salinity and development. A series of intercept surveys of anglers actively fishing along the coast of North Carolina revealed that climate change is not perceived as the cause of changes in catch at the local level, although the anglers were aware of environmental changes.

**E12. Authors: *Shelby White**, Ryan MacKenzie, Roger Rulifson and Eban Bean

**Presenter Affiliation:** Department of Biology, East Carolina University

**EFFECTS OF HYPOXIA ON STRIPED BASS AND RIVER HERRING IN STRATEGIC HABITAT AREAS**

Hypoxic conditions (<4 mg $O_2$/L) developing during summer and fall will be observed, while conducting *in situ* experiments to determine how Ago 0 *Morone saxatilis and Alosa sp.* respond to hypoxia. Our concern is to find whether these young *Morone saxatilis* and *Alosa sp.* can reside in Albemarle watersheds for extended periods under hypoxic conditions and display normal growth and recruitment to the forming year classes or whether these hypoxic zones, including large areas of SHAs, are excluded as nursery habitat because hypoxic conditions are detrimental to survival. Hypoxia can be identified by the trace manganese in ambient waters and should appear in the juvenile's otoliths. Two sampling platforms will be placed in Albemarle Sound tributaries: Perquimans River (hypoxic) and Pasquotank River (normoxic). Platforms will have automated water samplers collecting samples for analyses from upper/lower portions of the water column at 12-hour intervals. Water quality sondes will measure water quality parameters and will be deployed within upper/lower water columns to determine the vertical structure of hypoxia. Cages containing juvenile striped bass or river herring will be suspended below the platform in upper/lower water columns. Vertical 3 meter control nets will hang from the platform, allowing fish to select their position in the water column. We hypothesize that control fish will choose normoxic waters during hypoxic events. We hypothesize that manganese will only occur in the bottom dwelling fish, exposed to extended hypoxic conditions. Possible causes of hypoxia will be identified through water chemistry, isotopic analyses, and GIS mapping layers.

**E13. Authors: Jessica S. Thompson**

**Presenter Affiliation:** Department of Organismal and Environmental Biology, Christopher Newport University

**INFLUENCE OF SALINITY ON THERMAL PREFERENCES AND GROWTH OF MUMMICHOG**

Mummichogs (*Fundulus heteroclitus*) are a common prey for estuarine piscivores along the east coast of the United States. Any reduction in production of mummichogs due to changes in temperature and salinity associated with climate change may, therefore, have negative repercussions for estuarine food webs. Using mummichogs from a population in the southern Chesapeake Bay, this study determined the thermal preferences of mummichogs at four salinities (2, 12, 22, and 32 ppt). Despite previous evidence that mummichogs prefer cooler temperatures in freshwater than in saltwater, the final temperature preferendum of mummichogs in this study (26.4-26.9ºC) were similar across the salinities tested, suggesting that changes in salinity due to climate change will be unlikely to affect temperatures occupied by mummichog based on habitat selection alone. Mummichog growth rates were then measured for 12 weeks at seven temperatures (range ±7ºC of the preferred temperature) at each salinity. There was a significant interaction between temperature and salinity on mummichog growth. At lower salinities, growth was greater at cooler temperatures, whereas at higher salinities, growth was greater at temperatures close to and just greater than the preferred temperature. Overall, growth was greatest at 22 ppt from 26.6-30.6ºC. These results suggest that mummichog growth will be most negatively impacted at sites that experience a reduction in salinity and increase in temperature due to climate change.

**E14. Authors: John Cooper**

**Presenter Affiliation:** Cooper Environmental Research, Constantia, NY

**DISTRIBUTION AND DENSITY OF THREE UNCOMMON OR IMPERILED UNIONID SPECIES IN NORTHERN NEW YORK.**

The New York Natural Heritage Program lists Eastern pearlshell *Margaritifera margaritifera* as imperiled, and Pocketbook *Lampsilis ovata* and Yellow lampmussel *Lampsilis cariosa* as uncommon in New York. The population and distribution of these mussels in the lower Salmon and Little Salmon rivers (Franklin County, NY) were estimated using double sampling at 10 transects from 2005 through 2012. Thirteen species of mussels were collected in the study area dominated by Eastern elliptio *Elliptio complanata* (89%). Pocketbook, Yellow lampmussel, and Eastern pearlshell each represented 1% or less of the living mussels collected in transects and the distribution of empty shells of Pocketbook was similar to those living; Yellow lampmussel empty shells were more abundant (49% of those collected) at the most upriver part of the Little Salmon River where no living Yellow lampmussel was collected. Eastern pearlshell was found only in 2012. Comparison of midden shells revealed a greater concentration of Pocketbook (90% of those collected in middens) at the lower part of the Salmon River that was not associated with a transect. This midden also produced 72% of Yellow lampmussel collected in all middens. Density of Eastern pearlshell, Pocketbook, and Yellow lampmussel was one-tenth of the average density of all mussels and 95 times less than the density of Eastern elliptio.

**E15.** **Authors: *Aimee N Dexter**, Robert H. Condon, Amanda S. Williard, Vincent S. Saba, Jonathan D.R. *Houghton, Jeanne Boylan & Chris Bonzak*

**Presenter Affiliation:** University of North Carolina Wilmington

**JELLYFISH DATABASE INITIATIVE (JEDI): IMPROVING ESTIMATES OF GELATINOUS ZOOPLANKTON BIOMASS IN THE OCEAN.**

Jellyfish blooms are perceived as a symptom of a degraded ocean but recent evidence suggests that jellyfish populations naturally fluctuate over multidecadal time scales around a stationary baseline. While the driving mechanisms for these cycles are unclear, interpretation of shifts in the long-term baseline is restricted by a lack of spatiotemporal information where jellyfish proliferate. Here, we collate and analyze data on medusae and ctenophore biomass and abundances from coastal waters of eastern USA, including three unpublished data sets associated with fisheries and ecological monitoring programs (SEAMAP, NEAMAP and Long Island Sound), for inclusion in the Jellyfish Database Initiative. Consistently high seasonal biomasses of jellyfish were distributed along southern and mid-Atlantic regions, with several biomass hot spots closer to shore. Long-term trends in jellyfish showed no significant increase but periodicity around species-specific baselines. The data have possible implications for fisheries management and leatherback turtle conservation, including predictability of migration patterns.

**E16.** **Authors: *Ian Kroll**, F. Joel Fodrie, C. Kevin Craig

**Presenter Affiliation:** Institute of Marine Sciences, University of North Carolina at Chapel Hill

**LINKING HABITAT TO STOCK ASSESSMENT: RIGOROUSLY MODELING THE ROLE OF ESTUARINE JUVENILE HABITATS IN ADULT STOCK DYNAMICS OF BLACK SEA BASS (*CENTROPRISTIS STRIATA*)**

Degradation of estuarine and coastal systems has threatened valuable ecosystem services, such as juvenile habitat availability, and, as a result, may impact the stability of fish populations. However, it is unknown how specific nursery habitats influence development, or sexual succession, and how that may affect the resulting population structure. Furthermore, models used in stock assessment often ignore the relationship between habitat availability and fishery production by not incorporating a habitat-specific variable in their simulations. My research, which utilizes elemental analysis of otoliths, attempts to quantify the productivity of estuarine and offshore juvenile habitats as a source for the spawning, adult population as well as introduce a demographic modeling approach to the management of black sea bass (*Centropristis striata*). Preliminary analysis of juvenile otoliths from both inshore (estuarine) and offshore (open-coast) habitats from the years 2008-2014 indicates significant differences in signatures amongst sites. These signatures will be compared to those of adult fishes in order to determine the proportional contributions of estuarine versus offshore habitats in maintaining the black sea bass stock. Growth rate analysis and sex identification of these adults will also help to identify the presence of any carry-over effects resulting from juvenile habitat. Finally, this data will be used to explore the applicability of stage-based population matrices for the assessment of black sea bass.

**E17.** **Authors:** ***Ed Arb** and Tom Lankford

**Presenter Affiliation:** University of North Carolina Wilmington

**BEACH NOURISHMENT'S EFFECT ON THE LONGSHORE MOVEMENTS OF JUVENILE FLORIDA POMPANO AND GULF KINGFISH**

As part of a large ongoing research project investigating the effects of beach nourishment on the surf zone fish assemblages, we wanted to investigate whether nourishing the beach affects the long-shore movement of juvenile fishes that utilize the surf zone as exclusive nursery habitat. To address this question, a mark and recapture study was conducted immediately after a beach nourishment project on the island of Wrightsville Beach, North Carolina, during the summer of 2014. Four sites were designated as tagging sites (2 nourished and 2 unnourished) and 2 species of fishes, Florida pompano, (*Trachinotus carolinus*) and Gulf kingfish, (*Menticirrhus littoralis*) were selected as the targeted species. The targeted species were collected from the surf zone using a 33x2 m bagged haul seine towed parallel to the beach, and implanted with visual implant elastomer (VIE) tags then released at point of capture. Five recapture events were conducted at each tagging site over the next eight weeks, each event consisted of five 100 meter long seines performed in the same technique as the original capture event. Through the course of this study, 1596 pompano (23-98 mm) and 628 kingfish (23-165 mm) were tagged then released; and 31 pompano and 2 kingfish were recaptured, which produces a recapture rate of 1.94% and 0.32% respectfully. A breakdown of the pompano recaptures demonstrated that there was a difference of 1.575% in the recapture rates between the nourished and unnourished sites, with the nourished sites having an average return rate of 0.920% and the unnourished sites averaging 2.495% return.

**E18.** **Authors: Thomas E. Lankford, Jr.**

**Presenter Affiliation:** University of North Carolina Wilmington

**THE UNCW FISH COLLECTION: A RESOURCE FOR ICHTHYOLOGY RESEARCH AND EDUCATION**

The University of North Carolina Wilmington Fish Collection, established by the late Dr. David G. Lindquist, is maintained by the Department of Biology and Marine Biology and provides extensive material in support of ichthyological research and education. The research collection consists primarily of alcohol-preserved specimens and includes >50,000 cataloged and >20,000 uncataloged specimens representing >340 genera and >700 species. Entries (>1,500 lots) span the period 1975-present, providing extensive coverage of 1) marine fishes of the Carolinian province, 2) freshwater fishes of the lower coastal plain of the Cape Fear River drainage, 3) larval fishes of the Onslow Bay mid/outer continental shelf and adjacent Gulf Stream, 4) juvenile fishes of estuarine and ocean surf habitats in southeastern North Carolina, and 5) freshwater endemics of Lake Waccamaw. Geographic coverage includes material from Ecuador, California, Mexico, Bahamas, Florida Keys and southern Appalachia. Also included is an undergraduate teaching collection of isopropyl-preserved juvenile and adult specimens representing >275 species common to marine, estuarine and freshwater habitats of coastal North Carolina, along with skeletal preparations, cleared and stained specimens, digital photographs and otolith reference sets. The collection catalog has recently been computerized to enable an on-line, searchable database. Housed within the UNCW Vertebrate Museum, the fish collection has now reoccupied newly-renovated facilities in Friday Hall. Ichthyologists interested in accessing the collection are invited to contact Dr. Tom Lankford, Curator of Fishes, at lankfordt@uncw.edu.

**E19.** **Authors: *Walter Rogers** and Roger Rulifson

**Presenter Affiliation:** Department of Biology, and Institute for Coastal Science and Policy, East Carolina University

**POPULATION STRUCTURE OF RIVER HERRING IN THE ALBEMARLE SOUND, NORTH CAROLINA: DOES MORPHOMETRIC ANALYSIS AGREE WITH OTHER STOCK IDENTIFICATION METHODS?**

River herring use tributaries of the Albemarle Sound, North Carolina as spawning and nursery habitats. Stocks of these anadromous fish have experienced dramatic declines in North Carolina, and show no sign of recovery. Although the state has designated considerable resources to the management of river herring, we still do not fully understand river herring utilization of North Carolina's estuaries, and know little about the structure and composition of populations. Determining the population, or "stock" structure of species is crucial for the proper distribution of management efforts. We seek to determine the population structure of river herring in the Albemarle Sound system using morphometric analysis, and compare the results of this analysis to those of other stock identification methods utilized in previous studies.

**E20.** **Authors: Aaron Bunch**, John Odenkirk, Mike Isel, and Scott Herrmann

**Presenter Affiliation:** Virginia Department of Game and Inland Fisheries

**NORTHERN SNAKEHEAD DISTRIBUTION IN VIRGINIA**

Northern Snakehead *Channa argus* were first discovered in the Potomac River system in 2004 and have spread into nearly the entire tidal Potomac system and several additional coastal tributaries in Virginia. Ecosystem-level impacts of this non-native species are uncertain. A centralized statewide database containing all Northern Snakehead observations was used to develop distribution maps. Most fish were collected during standard electrofishing surveys while other data sources included verified reports from anglers and commercial fishers. To date, the species has been collected in the Potomac River, Rappahannock River, and as far south as the Piankatank River. Anglers have also illegally introduced the fish into at least five impoundments. Northern Snakehead have shown a propensity to survive relatively high salinities during migration**,** as river mouths entering the Chesapeake Bay have elevated salinity relative to upper river sections and tributaries. Movement likely occurs downstream during seasonal freshets and other periods of high freshwater inflow to the Bay system, and upstream during spring pre-spawn dispersal**.** Continued monitoring is needed to document future spread and distribution.

**E21.** **Authors:** Michael S. Loeffler, Charlton H. Godwin, Lee M. Paramore, William E. Smith, Thomas F. Wadsworth, **Amy M. Comer**

**Presenter Affiliation:** North Carolina Division of Marine Fisheries

**NORTH CAROLINA MULTI-SPECIES TAGGING PROGRAM**

The fisheries management plans for southern flounder, spotted seatrout, striped bass, and red drum include research recommendations to estimate migration and mortality rates through tagging studies. NC Division of Marine Fisheries tagging programs have existed for some species, such as striped bass and red drum, for many years, but auxiliary studies must be completed to fully address all tag-return model assumptions and estimate population rates from tag-return data. Traditional assessments for species like spotted seatrout are difficult to interpret because assumed rates of natural mortality (*M*) may not be valid. Tag-return models provide direct estimates of fishing mortality (*F)* without relying on assumed rates of *M*. Tag-return estimates of *F*, *M*, and abundance provide an independent check on traditional catch-based assessment models and can be combined with catch data in an integrated model to further increase precision and accuracy. As a multi-species study, efforts to maximize tagging opportunities and cost are optimized. We have implemented a statewide, multispecies tag-return program, following consistent, valid study protocols that will eliminate inconsistencies among species while improving the ability to assess the current status of each species. Our four main study objectives included tagging 1,000–1,500 individuals per year with standard reward tags, double-tagging to assess tag loss, implementing high-reward tagging to assess reporting rates, and field experiments to estimate mortality related to capture and tagging. The resulting tag-return data will provide independent estimates of *F*, *M*, abundance/biomass, and migration rate that can be combined with traditional catch data to obtain precise and accurate results that improve management.

**Student Oral Presentations Friday, March 6th – Soundside Hall, NC Aquarium**

*** denotes student presentation**

| Time | Speaker | Title |
|---|---|---|
| 820 | | Welcome |
| 830 | Scott Baker | Ice-Breaker / Student Introductions |
| Moderator: Todd Kellison | | |
| 915 | *Derek Burton | Analysis of RNA and DNA as an indicator of ecosystem health; Metrics to determine the impacts if land-use on fish habitat |
| 930 | *Jared H. Flowers | Annual movement patterns of Roanoke River Atlantic sturgeon, including inter-DPS marine movements and spawning periodicity |
| 945 | *Cecilia S. Krahforst | Boat noise influences spawning site selection, population size, and reproductive success in the oyster toadfish |
| 1000 | Break | |
| 1015 | *Jacob R. Krause | Sources of mortality and movements of weakfish tagged in North Carolina |
| 1030 | *Danielle Keller | Landscape setting affects the structure and function of oyster restoration at the salt marsh edge |
| 1045 | *Charles Bangley | Habitat partitioning among coastal sharks in a North Carolina estuary |
| 1100 | *Cara A. Simpson | Mysterious early lives of Atlantic menhaden |
| 1115 | *Nathan D. Messenger | Identifying factors driving estuarine habitat use of southern flounder (*Paralichthys lethostigma*) using acoustic telemetry and fine-scale environmental sampling |
| 1130 | *Samantha M. Binion | Describing the feeding ecology of three piscivores in Pamlico Sound estuary, North Carolina using a hierarchical community approach |
| 1145 | Lunch (1145 – 1315) | |

**Student Oral Presentations Friday, March 6th – Soundside Hall, NC Aquarium**

*** denotes student presentation**

| Time | Speaker | Title |
|---|---|---|
| Moderator: Rob Aguilar | | |
| 1315 | *Matthew D. Kenworthy | Movement ecology of a mobile predatory fish reveals limited landscape-scale connectivity within a temperate estuary |
| 1330 | *Verena H. Wang | Population genetic structure of southern flounder inferred from multilocus dna profiles |
| 1345 | *Lisa D. Hollensead | Monitoring movement of southern flounder (*Paralichthys lethostigma*) to elucidate residence time and migration dynamics in a North Carolina estuary |
| 1400 | *S. Gray Redding | Transplanting experimental oyster reefs enhances oyster restoration in coastal tidal creeks |
| 1415 | *Benjamin J. Marcek | Habitat use of juvenile Atlantic bluefin tuna |
| 1430 | *Brian K. Gallagher | Partial migration in juvenile white perch (*Morone americana*) within the Hudson River estuary |
| 1445 | Break | |
| Moderator: Rob Aguilar | | |
| 1500 | *Ian R. Kroll | Environmental effects on elemental uptake in the shells of the Eastern oyster, *Crassostrea virginica*: implications for the use of geochemical tagging to assess connectivity |
| 1515 | *Matt Siskey | Historical effects of fishing on age structure and stock mixing in Northwest Atlantic bluefin tuna fisheries |
| 1530 | *Alexandra N. Atkinson | Influence of environmental conditions on the age, growth, and hatch dates of juvenile Atlantic menhaden in the Choptank River |
| 1545 | *Ryan W. Schloesser | Condition dynamics of juvenile fishes throughout Virginia estuaries |
| 1600 | Tidewater AFS Business Meeting | |
| 1700 | Adjourn | |
| 1830 | Dinner Social @ Aquarium Saltwater Gallery | |

**Professional Oral Presentations Saturday, March 7th – Soundside Hall, NC Aquarium**

| Time | Speaker | Title |
|---|---|---|
| 840 | Scott Baker | Welcome |
| Moderator: Fred Scharf | | |
| 845 | William E. Smith | Review of southern flounder migratory dynamics and implications for regional management |
| 900 | Ray Mroch | Stock assessment for Albemarle Sound/Roanoke River striped bass |
| 915 | Scott Baker | Potential for vessel speed and other variables to predict fishing activity in the snapper grouper vertical line fishery |
| 930 | Jenny Vander Pluym | Investigating fish communities of NC offshore hardbottom habitats in a potential wind energy area |
| 945 | Laura M. Lee | The forgotten need for persistence in fixed-station surveys |
| 1000 | Rob Aguilar | Movement of non-native blue catfish, *Ictalurus furcatus,* in two upper Chesapeake bay tidal tributaries. |
| 1015 | Break | |
| 1030 | Mike O'Brien | Lévy flight in spawning and non-spawning striped bass (*Morone saxatilis*) |
| 1045 | David H. Secor | Migration ecology of marine fishes: "the most essential things are invisible to the eye." |
| 1115 | Sally Roman | Developing management approaches to reduce bycatch and bycatch mortality of Atlantic sturgeon in Virginia's commercial gill net fisheries with limited data |
| 1130 | Aaron Bunch | Blue catfish population characteristics in a small tidal tributary in coastal Virginia |
| 1145 | Adjourn | |

## 2015 Annual Tidewater AFS Oral Presentation Abstracts (*denotes student presenters)

**Friday, March 5th**

**Time – 915**
**Authors: *Derek Burton**, Lonnie Gonsalves, Jim Uphoff, Carrie Hoover, Alexis Park, Joe Pitula
**Presenter Affiliation:** NOAA Living Marine Resources Cooperative Science Center, University of Maryland Eastern Shore

**ANALYSIS OF RNA AND DNA AS AN INDICATOR OF ECOSYSTEM HEALTH; METRICS TO DETERMINE THE IMPACTS OF LAND-USE ON FISH HABITAT**

Development within estuarine watersheds can induce a suite of environmental stressors that negatively impact ecosystem health. Previous studies by the Maryland Fisheries Habitat and Ecosystem Program have linked development in Chesapeake Bay watersheds to degradation of habitat for both adult and larval fish. This study utilizes analysis of RNA and DNA content in yellow perch (*Perca flavescens*) larvae as an indicator of larval condition and metric of fish habitat quality. Larvae were collected from the Mattawoman (suburban) and Nanjemoy (rural forested) rivers, using conical plankton nets towed in the upper tidal sections of each watershed from late March – May 2014. A total of 623 larvae were analyzed for RNA and DNA content. Concentrations of DNA/mg of sample were higher in the Mattawoman River, indicating that these larval were in poor condition relative to samples from the Nanjemoy River. Interestingly, further analysis shows that there is a significant difference in RNA: DNA ratio between rivers with Mattawoman fish maintaining higher values. This presentation will further cover results from larval diet, growth characteristics, and their respective relationship with condition as measure by RNA and DNA content.

**Time – 930**
**Authors: *Jared H. Flowers** and Joseph E. Hightower
**Affiliation:** North Carolina Cooperative Fish and Wildlife Research Unit, Department of Applied Ecology, North Carolina State University

**ANNUAL MOVEMENT PATTERNS OF ROANOKE RIVER ATLANTIC STURGEON, INCLUDING INTER-DPS MARINE MOVEMENTS AND SPAWNING PERIODICITY**

Successful restoration of the endangered Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus* depends on a solid foundation of biological data. For Roanoke River, North Carolina Atlantic Sturgeon, there are questions regarding annual migration patterns, including spawning timing and movements, and marine movements. Six adult Atlantic Sturgeon (presumably males) from the Roanoke River were implanted with acoustic telemetry tags from 2010-2012. These sturgeon were monitored through a network of passive receivers in North Carolina and eight additional states. We used a multi-state model to estimate movement probabilities among riverine, estuarine, and marine areas. From September 2010 to June 2014, five of six of our Atlantic Sturgeon were detected in three different marine areas defined by the National Oceanic and Atmospheric Administration as Distinct Population Segments. Seasonally, sturgeon were observed to either spend the entire year in marine waters or winter-spring in marine waters, summer in Albemarle Sound and fall in the Roanoke River spawning. The multi-state model suggests that movement probabilities were seasonably variable. Annual estimated Atlantic Sturgeon mortality during the study was low (0.03) and detection probability high (>0.50) in most study areas. Sturgeon were observed to spawn in consecutive years or with a year in between spawning events. The complexity of Atlantic Sturgeon movements and the mixing of populations in marine waters add to the potential difficulty in managing the recovery of this species.

**Time – 945**
**Authors:** ***Cecilia S. Krahforst** and Joseph J Luczkovich
**Affiliation:** Department of Biology, East Carolina University/Coastal Resources Management, East Carolina University

**BOAT NOISE INFLUENCES SPAWNING SITE SELECTION, POPULATION SIZE, AND REPRODUCTIVE SUCCESS IN THE OYSTER TOADFISH**

Male oyster toadfish (*Opsanus tau*) produce "boop" sounds to attract gravid females to dens in shallow water estuaries. These calls are produced in soundscapes that include other biologic and anthropogenic sounds (i.e. vessel noise). This study aims to determine the impact of anthropogenic noise on oyster toadfish populations and their reproduction. Previous work showed that boat noise drops to ambient sound pressure levels in 1 m depth at a horizontal distance of ~30 m. Artificial toadfish dens (half concrete blocks) were deployed in March 2014 in Back and Core Sounds (NC) both near (~7 m) and far (~ 35 m) from boat channels at four sites (2 with high and 2 with low vessel traffic). Each den was checked every ~9 days over 15 weeks from May through August for the number and size of toadfish and embryos were counted. There were more toadfish at quiet sites ($p<0.001$) and far from the channel ($p=0.002$). Noisy sites had fewer embryos than quiet sites. At one noisy site, no embryos were recorded; at the other noisy site, there were embryos deposited, but no difference was observed in the number of embryos in the near and far treatments. At the quiet sites, there were on average 500 more embryos per clutch far from the channel. These data suggest that vessel noise alters spawning site selection, population size, and reproductive output of toadfish. In busy navigation channels, repetitive boat noise disturbance may cause reduced mating success for oyster toadfish in a natural soundscape.

**Time – 1000 ----------BREAK----------**

**Time – 1015**
**Authors: *Jacob R Krause**, Jeffrey A Buckel, and Joseph E Hightower
**Presenter Affiliation:** Center for Marine Science and Technology, North Carolina State University

**SOURCES OF MORTALITY AND MOVEMENTS OF WEAKFISH TAGGED IN NORTH CAROLINA**

Weakfish (*Cynoscion regalis*) is an important recreational, commercial, and ecological species in North Carolina, but currently their population is at an all-time low. The most recent stock assessment of weakfish had great uncertainty in assigning sources of mortality and in understanding weakfish movements. The goal of our study is to better understand weakfish movements and to estimate fishing and natural mortality through a combined conventional tagging and telemetry approach over three years. For conventional tagging in the first year, weakfish were captured using hook and line and tagged with $100 high reward internal anchor tags throughout North Carolina. A subset of these fish (~33%) were double tagged to estimate tag loss. For telemetry tagging, weakfish were captured in the New River and surgically implanted with Vemco V13 transmitters. In 2014, a total of 1,281 weakfish were tagged and 42 returned from the fishery (~3% return rate). Tag returns by sector consisted of 18 commercial (16 harvested and 2 released) and 24 recreational (15 harvested and 9 released). The estimated annual tag loss was very high at ~80%. In the New River,13 weakfish were released with transmitters of which 1 weakfish was never relocated, 9 emigrated, and 3 are still active in the system; telemetered weakfish had an average residence time of 19 days. These preliminary results will be used in model simulations to evaluate the number of tagged fish needed for precise estimates of F and M for weakfish in subsequent sampling years.

**Time – 1030**
**Authors: *Danielle Keller**, Rachel Gittman, Justin Ridge, Michelle Brodeur, Matthew Kenworthy, Antonio Rodriguez, F. Joel Fodrie
**Affiliation:** Institute of Marine Sciences, University of North Carolina at Chapel Hill

**LANDSCAPE SETTING AFFECTS THE STRUCTURE AND FUNCTION OF OYSTER RESTORATION AT THE SALT MARSH EDGE**

Coastal estuarine shorelines are shaped by natural and anthropogenic processes, which often induce ecosystem stressors, causing a need for protection and restoration. Tools like oyster restoration may be used to mitigate ecosystem loss and even facilitate salt marsh accretion. However, the success of oyster reef restoration has been variable across different estuarine landscapes. Therefore, we examined the importance of landscape setting for oyster reef restoration success in a temperate estuary of North Carolina, measured by production of oysters and community composition of nekton utilizing reefs. We constructed oyster reefs across 3 unique salt marsh landscapes (scarp, ramp, creek) that were paired with non-restored reference sites (i.e. experimental controls). All sites were monitored for biotic composition by using $1m^2$ quadrats, fyke nets, and gill nets. We found a significantly higher density of live oysters on restored reefs compared to the control, though these densities were still slightly lower than on naturally existing oyster reefs. Furthermore, we found most spat initially settled on the ramp and scarp landscapes, but in following years the greatest spat densities were found in the creek. We hypothesize the mechanism driving this trend is physical stress (wave energy) along the ramp and scarp landscapes. Additionally, we found a greater abundance of macrofauna in the creek landscape regardless of whether reefs were restored or not. These results indicate landscape setting has an effect on the production of restored oyster reefs and community composition of nekton utilizing reefs in a temperate estuary.

**Time – 1045**
**Authors: *Charles Bangley** and Roger Rulifson
**Affiliation:** East Carolina University

**HABITAT PARTITIONING AMONG COASTAL SHARKS IN A NORTH CAROLINA ESTUARY**

Coastal sharks often use estuaries as nursery and foraging habitats, and can be an important component of the top predator and mesopredator communities within inshore waters. Pamlico Sound, North Carolina, is the second-largest estuarine system in the continental United States, and includes a wide variety of microhabitat types. Data from North Carolina Division of Marine Fisheries fishery-independent gillnet and longline surveys from 2007-2014 documented the presence of 11 shark species in Pamlico Sound, though six principle species appear to make regular use of the estuary: the Atlantic Sharpnose Shark, Blacktip Shark, Bull Shark, Sandbar Shark, Smooth Dogfish, and Spiny Dogfish. Abiotic environmental and spatial habitat preferences were determined for each species using Generalized Linear Models of shark abundance and presence, and differences between species were assessed using Discriminant Function Analysis. Habitat preferences or seasonal presence significantly differed between all species except Atlantic Sharpnose and Blacktip Sharks, where were both associated with warm, high-salinity waters near inlets. Smooth Dogfish were captured year-round but were most abundant in the summer, and Pamlico Sound may function as a primary nursery for this species. Habitat partitioning or seasonal differences in abundance may allow multiple shark species to coexist in Pamlico Sound.

**Time – 1100**

**Authors: *Cara A. Simpson**, Michael J. Wilberg, Hongsheng Bi, Amy M. Schueller, Geneviéve M. Nesslage & Harvey J. Walsh
**Presenter Affiliation:** Chesapeake Biological Laboratory, University of Maryland Center for Environmental Sciences

**MYSTERIOUS EARLY LIVES OF ATLANTIC MENHADEN**

Despite experiencing a major decline in both recruitment and juvenile production in the Chesapeake Bay during the 1990s, Atlantic menhaden (*Brevoortia tyrannus*) supports one of the oldest and largest commercial fisheries on the US east coast. In order to understand the underlying causes of this decline, knowledge of recruitment is essential. We used larval data collected from two large-scale Northeast Fisheries Science Center ichthyoplankton surveys during 1977-2013 that occurred from Nova Scotia, Canada to Cape Hatteras, NC. We standardized the larval abundance data to a day-0 age by applying an age-length key from a larval ingression study in the Chesapeake Bay. Next, we used a general linear model to account for spatial and temporal changes in sampling to obtain an index of abundance. We used a similar procedure to examine mean length from the survey. Due to a lack of a direct relationship between our larval estimates of abundance and juvenile abundance in the bay, we examined several environmental factors (temperature, Chesapeake Bay discharge, AMO, and wind speed/direction) that could have an effect on survival. In our study area, we found larval Atlantic menhaden abundance increased over time. Larval abundance was highest in the winter, with most individuals detected at near-shore stations. There was also a clear pattern of larger larvae on average at near-shore stations. Although, there were trends suggesting a negative relationship of survival and temperature and a non-linear relationship between survival and wind speed, none of the environmental factors had a significant effect on relative survival.

**Time – 1115**

**Authors:** ***Nathan D. Messenger**, Lisa D. Hollensead, Frederick S. Scharf
**Presenter Affiliation:** Department of Biology and Marine Biology, University of North Carolina Wilmington

**IDENTIFYING FACTORS DRIVING ESTUARINE HABITAT USE OF SOUTHERN FLOUNDER (*PARALICHTHYS LETHOSTIGMA*) USING ACOUSTIC TELEMETRY AND FINE-SCALE ENVIRONMENTAL SAMPLING**

Quantifying habitat use of a species and identifying important habitat features is critical to understanding its ecology and for implementation of spatial management strategies. While several habitat features have been linked to habitat selection in fishes, the strength of habitat-fish relationships remain poorly understood at finer spatial scales. The southern flounder *Paralichthys lethostigma* is a valuable coastal finfish in North Carolina that is harvested during its juvenile life stage while inhabiting shallow estuarine systems. Beyond settlement habitat preferences, little is known about the factors shaping southern flounder habitat use on the nursery grounds. The goal of this study was to examine several biotic and abiotic habitat features in attempting to explain fine-scale habitat use patterns of southerxn flounder during estuarine residency. Both active and passive acoustic telemetry was used to monitor the habitat use and movement of southern flounder (n = 26, average ± SD TL = 397.2 ± 26.5 mm) between June and October 2014 in Northeast Creek, a tributary in the New River estuary, NC. The composition of the potential prey fish community was measured bi-weekly from an otter trawl survey with a stratified random design. For each trawl, species richness, abundance, and size composition of all potential prey fishes were measured. To evaluate benthic characteristics, sediment samples (n = 72) were collected at a scale of 200$m^2$ using an alternating grid pattern. Both organic content analysis and particle size analysis were completed. The presence/absence of southern flounder in specific locations of the creek was then modeled as a function of prey fish community composition and sediment properties. Previous southern flounder diet studies indicate nearly complete piscivory for fish in the size range that we tagged, and that bay anchovy *Anchoa mitchilli*, spot *Leiostomus xanthurus*, and spotfin mojarra *Eucinostomus argenteus* are often major contributors to the diet. Preliminary results found bay anchovy, spot, pinfish *Lagodon rhomboides*, and spotfin mojarra to be the most abundant prey species encountered during the trawl surveys. Prey fishes were most abundant in early summer, and were concentrated in mid-creek regions consistently. The average ± SD organic content of the sediment was 17.69 ± 9.64%, with variation both along the creek length and across the creek, and the highest organic content near the creek mouth. Southern flounder were most frequently found using mid-creek habitats, in areas associated with high prey fish density and low organic content.

**Time – 1130**
**Authors: *Samantha M. Binion**, Brian J. Reich, and Jeffrey A. Buckel
**Presenter Affiliation:** Center for Marine Sciences and Technology, North Carolina State University

**DESCRIBING THE FEEDING ECOLOGY OF THREE PISCIVORES IN PAMLICO SOUND ESTUARY, NORTH CAROLINA USING A HIERARCHICAL COMMUNITY APPROACH**

Longnose gar (*Lepisosteus osseus*), red drum (*Sciaenops ocellatus*), and bluefish (*Pomatomus saltatrix*) are some of the top piscivorous predators in Pamlico Sound Estuary, North Carolina. Stomachs from 350 red drum, 885 longnose gar, and 720 Bluefish were sampled in 2012 from fishes collected during the North Carolina Division of Marine Fisheries fisheries-independent gill net survey. Bluefish and longnose gar both fed almost exclusively on fish prey and their diets were dominated (*i.e.* high percent frequency of occurrence and percent weight) by Atlantic menhaden (*Brevoortia tyrannus*). Spot (*Leiostomus xanthurus*) and Atlantic croaker (*Micropogonias undulatus*) were also dominant prey items in longnose gar diets. Red drum diets were also heavily comprised of fish prey, but their diets were more varied and contained many invertebrates, with swimming crabs (Portunidae) being the most dominant. One of the biggest limitations of food habits studies is the inability to identify all prey types within a predator's diet. To account for this imperfect detection of prey types, a Bayesian hierarchical community model was used to estimate the total number of prey types (observed and unobserved) in each predator's diet. The number of unobserved prey types was lowest for longnose gar and higher for red drum and bluefish. The model was also used to evaluate the relationship of environmental covariates, such as salinity and temperature, with diversity of prey. These data will ultimately be incorporated into an ecosystem model of Pamlico Sound Estuary.

**Time – 1145 ----------1.5 Hour LUNCH----------**

**Time – 1315**
**Authors: *Matthew D. Kenworthy**, Jonathan H. Grabowski, Craig A. Layman, Graham D. Sherwood, Sean P. Powers, Rachel K Gittman, Danielle A. Keller, and F. Joel Fodrie
**Presenter Affiliation:** Institute of Marine Sciences and Department of Marine Sciences, University of North Carolina at Chapel Hill

**MOVEMENT ECOLOGY OF A MOBILE PREDATORY FISH REVEALS LIMITED LANDSCAPE-SCALE CONNECTIVITY WITHIN A TEMPERATE ESTUARY**

Understanding the population ecology of mobile animals is often confined by the limitations of monitoring their movement, distribution, and habitat use in a predominantly opaque ocean. The scales over which fishes move mediate habitat requirements, food-web dynamics, adaptability to environmental perturbations, and management strategies. We acoustically tagged and monitored the movement ecology of 34 red drum (*Sciaenops ocellatus*) within a temperate North Carolina estuary answering the following questions: 1) What is the dispersal rate of red drum from a representative marsh complex, 2) What is the spatial extent of their foraging arena (area covered per unit time) within the estuarine landscape, and 3) What is the degree of connectivity between spatially distinct marsh complexes (0.5 – 2.0 km apart)? We analyzed fish detection data through time relative to hydrophone distances from the release location and the spatial variance structure of those detections among all hydrophones to address our research questions. While we observed a variety of behaviors, the movement patterns could be readily characterized after only 1-2 weeks showing that fish typically remained within a 2-4 km radius of the release location until leaving the array. Within this dispersal range, red drum consistently occupied foraging arenas of ~1 $km^2$ during each week for the duration of the study. Overall, red drum demonstrated a high degree of fidelity to a single marsh complex, and there was relatively little connectivity with similar habitat complexes even across distances of <1 km. These data highlight potential within-estuary spatial structure for mobile fishes, and should guide subsequent efforts to track energy flows in coastal food webs, predict the footprint of local habitat restoration benefits, and design survey regimes to quantify overall population demography.

**Time – 1330**
**Authors: *Verena H. Wang**, Michael A. McCartney, Frederick S. Scharf
**Presenter Affiliation:** Center for Marine Biology, Department of Biology and Marine Biology, University of North Carolina Wilmington

**POPULATION GENETIC STRUCTURE OF SOUTHERN FLOUNDER INFERRED FROM MULTILOCUS DNA PROFILES**

Population genetic analyses have been useful in aligning the stock definitions used by fisheries managers with the spatial structure of marine populations. We examined genetic variation in southern flounder (*Paralichthys lethostigma*) within and between the U.S. South Atlantic and Gulf of Mexico basins in order to assess the scale of population structure in this wide-ranging species. We analyzed amplified fragment length polymorphism (AFLP) fingerprints and mitochondrial control region sequences, and found clear divergence between ocean basins with both molecular markers. No genetic differentiation was detected within the U.S. South Atlantic at broad (among states) or fine (among estuarine regions within North Carolina) spatial scales when using mitochondrial DNA. Increased genetic resolution was observed with AFLP data, and we found significant subdivision between nearly all southern flounder geographic populations, suggesting that finer scale genetic population structure may be present within the U.S. South Atlantic. However, AFLP genetic cluster analysis also revealed evidence for high gene flow within the Atlantic basin, and patterns of variation were not clearly aligned with geography. When examining the partitioning of genetic variation among groups using analysis of molecular variance, we found no evidence that North Carolina southern flounder, which are managed on the state level as a unit stock, are differentiated from the remainder of the U.S. South Atlantic. Our findings indicate only weak structure and the potential for basin-wide mixing among Atlantic southern flounder, suggesting that cooperation among U.S. South Atlantic states will be essential for effective assessment of stock dynamics and future management plans.

**Time – 1345**
**Authors: *Lisa D. Hollensead**, Frederick S. Scharf, J. Wilson White
**Presenter Affiliation:** University of North Carolina Wilmington

**MONITORING MOVEMENT OF SOUTHERN FLOUNDER (*PARALICHTHYS LETHOSTIGMA*) TO ELUCIDATE RESIDENCE TIME AND MIGRATION DYNAMICS IN A NORTH CAROLINA ESTUARY**

Recently, the application of spatial and temporal closures in fisheries management has increased, often supplementing traditional approaches. However, effective use of spatial and temporal strategies requires a comprehensive understanding of fish habitat use, residence time, and identification of migration timing and corridors. Effective management is a particular concern for commercial and recreationally important species such as the southern flounder (*Paralichthys lethostigma*), which supports economically valuable fisheries in North Carolina. Southern flounder movements and habitat use were monitored during summer and fall of 2012 and 2013 in the New River estuary, located in southeastern North Carolina, using acoustic telemetry. The primary objectives were to identify broad-scale patterns of habitat use as well as emigration corridors and timing, relating observed patterns to several potential abiotic predictors. Eighty-one flounder were tagged across the two sampling seasons (2012 n = 41; 2013 n = 40). During the first year, about half (n = 17) of fish emigrated and most of those fish (76%) exited via the New River Inlet. The remaining emigrants left the system through the intracoastal water way (ICWW) north of the inlet. Nearly all (>90%) emigrating fish left during October and November. Similarly, in 2013, 18 individuals were observed to emigrate the estuary, and did so mainly during the months of October and November. Sixty-one percent exited via the inlet compared to using the northern ICWW corridor. There was no obvious relationship between average daily air temperature (°F) or daily average wind speed (mph) on rate of movement (km/day). However, variation in fish movement (indexed with the standard deviation of movement rate) showed dramatic increases during periods of high winds. During the summer nursery period, southern flounder demonstrated high site fidelity and limited movement. Our findings have important implications for the placement of potential summer fishery closures and the timing of temporal closures during the migratory period.

**Time – 1400**
**Authors:** ***S. Gray Redding**, Niels Lindquist, Adam Tyler, David Cessna, Alexia Pool, Abigail K. Poray, and F. Joel Fodrie
**Presenter Affiliation:** Chesapeake Biological Laboratory, University of Maryland Center for Environmental Sciences

**TRANSPLANTING EXPERIMENTAL OYSTER REEFS ENHANCES OYSTER RESTORATION IN COASTAL TIDAL CREEKS**

A species' potential niche is determined by the environmental factors it can tolerate, while the realized niche of a species' is forced by biotic interactions, including competition and predation. In the upper reaches of tidal creeks, where periodic low salinity conditions exclude many oyster pests, the survival potential for oysters should be high. However, lack of hard substrates and low larval supply potentially limit oyster abundance in upper creek regions. While these limitations do not typically apply to lower portions of tidal creeks, intense biotic pressures likely limit oyster populations there to intertidal zones where physical stresses tolerated by oysters exclude many oyster pests. To test the validity of these putative controls on oyster populations in tidal creeks, we deployed sets of cement-coated crab pots as mini-reefs across the salinity gradients of six tidal creeks along the central coast of North Carolina, and subsequently transplanted sets of spat-dense reefs from low-creek to mid- and upper-creek stations. We found progressively lower larval recruitment levels but higher rates of oyster survival and growth moving from the low- to upper-creek stations, which resulted in spat-dense reefs transplanted to mid- and upper-creek stations developing exceptionally high levels of oyster biomass compared to reefs left at the lower stations and bare reefs initially placed at mid and upper stations. The robust results of this study showed that tidal creek oyster populations can be rapidly enhanced by moving spat-coated substrates from lower regions of tidal creeks to more upper regions where biotic stresses are largely alleviated.

**Time – 1415**
**Authors:** ***Benjamin J. Marcek**, Mary C. Fabrizio, and John E. Graves
**Presenter Affiliation:** Virginia Institute of Marine Science, College of William and Mary

**HABITAT USE OF JUVENILE ATLANTIC BLUEFIN TUNA**

We investigated the habitat use of juvenile Atlantic Bluefin Tuna along the Northeast coast of the United States using pop-up satellite archival tags and applied a general linear mixed model with repeated measures to determine factors affecting the mean depth occupied by fish. We also applied a beta regression with repeated measures to understand factors associated with variation in the proportion of time fish spent at depth. Two 'batches' of tags were deployed, one in New Jersey in June (n=3) and the other in Massachusetts in August and September (n=16), representing the availability of fish to the recreational fishery. Our results indicate that the batch * ordinal day interaction and the batch * lunar illumination interaction significantly affected the mean depth occupied by juvenile Atlantic Bluefin Tuna. Batch 2 fish occupied deeper mean depths than batch 1 fish, and the mean depth of batch 2 fish increased with ordinal day. Additionally, the mean depth occupied by batch 2 fish increased with increasing lunar illumination. The proportion of time that juvenile bluefin tuna occupied deep (>30 m) habitats did not vary significantly between day and night; furthermore, fish spent more time in deep water as the season progressed. These results highlight some of the spatial and temporal differences in habitat use of juvenile Bluefin Tuna and suggest a need for greater fisheries-independent monitoring of Bluefin Tuna behavior.

**Time – 1430**
**Authors:** ***Brian K. Gallagher**, David H. Secor and Philip M. Piccoli
**Presenter Affiliation:** Chesapeake Biological Laboratory, University of Maryland Center for Environmental Sciences

**PARTIAL MIGRATION IN JUVENILE WHITE PERCH (*MORONE AMERICANA*) WITHIN THE HUDSON RIVER ESTUARY**

Partial migration, the presence of multiple migratory groups within the same population, is likely common in marine and estuarine fishes, but has not been extensively studied. Previous work in the Chesapeake Bay has established white perch as a model species for evaluating the causes and consequences of partial migration, yet how white perch partial migration operates in other estuarine systems has not been investigated. The purpose of this study was to characterize migratory behavior in young-of-the-year (YOY) white perch in the Hudson River Estuary and compare larval size-at-age, hatch dates, and growth rates between resident and migratory groups (contingents). Fish were collected during the NY Department of Environmental Conservation fall seine survey in 2013, and were assigned to contingents based on otolith strontium:calcium (Sr:Ca) profiles. Analysis of otolith microstructure and growth back-calculation were employed to test whether migratory behaviors were associated with larval and juvenile growth rates. Otolith Sr:Ca profiles identified a resident contingent, which only utilized freshwater habitats, and a migratory contingent which spent early life in freshwater before dispersing to brackish habitats. Residents tended to originate from later hatch dates than migrants, while larval and juvenile growth rates differed between contingents. Overall, results suggest that conditions during the larval period influence migratory behavior, which in turn affects subsequent juvenile growth rates. Thus, YOY white perch in the Hudson River generally conform to the pattern of partial migration observed in the Chesapeake Bay.

**Time- 1445 ----------BREAK----------**

**Time – 1500**
**Authors: *Ian R. Kroll,** Poray, Abigail K., Puckett, Brandon J., Eggleston, David B., and Fodrie, F. Joel
**Presenter Affiliation:** Institute of Marine Sciences, University of North Carolina at Chapel

**ENVIRONMENTAL EFFECTS ON ELEMENTAL UPTAKE IN THE SHELLS OF THE EASTERN OYSTER, *CRASSOSTREA VIRGINICA*: IMPLICATIONS FOR THE USE OF GEOCHEMICAL TAGGING TO ASSESS CONNECTIVITY**

Geochemical tags are a successful tool in discerning larval dispersal and connectivity among commercially important fishes. This study expands the utility of tagging methods to invertebrate populations across an entire estuary. We examined how estuarine-scale gradients in temperatures (26.5°C or 21°C), salinities (20 ppt or 12.5 ppt), and trace metal concentrations (ambient, +16 ppb Mn/0.16 ppb Pb, or +32 ppb Mn/0.32 ppb Pb) affect *Crassostrea virginica* larval shell uptake of Mn, Sr, Ba, and Pb in controlled mesocosms. We also utilized field-collected, newly settled oysters across Pamlico Sound, NC, to explore uptake variability among natural temperature and salinity gradients and examine the spatial resolution at which elemental signatures can be used to discriminate between collection sites. Our larval incubations revealed strong interactive effects between temperature and salinity, favoring Sr uptake in cooler, fresher water and no interactive or main effects of these factors on Ba uptake. Mesocosm trials also showed that uptake of Mn was directly related to seawater concentration, however this relationship did not hold for Pb. Our field collections showed similar patterns of high Sr at low salinities and temperatures and no clear pattern for Ba. Grouping sites based on geographical location within Pamlico Sound along coarse salinity and temperature gradients (quadrants, approximately 35 km in diameter) resulted in the highest classification success during our discriminate function analysis. This study validates the use of geochemical tags to assess larval connectivity of the Eastern oyster, although spatial scale needs to be carefully considered in order to properly contextualize results.

**Time – 1515**
**Authors:** ***Matt Siskey**, David H Secor
**Presenter Affiliation:** University of Maryland Center for Environmental Science

**HISTORICAL EFFECTS OF FISHING ON AGE STRUCTURE AND STOCK MIXING IN NORTHWEST ATLANTIC BLUEFIN TUNA FISHERIES**

Over the past 40 years, Northwest Atlantic bluefin tuna have experienced high rates of exploitation, fisheries targeting the largest size classes of the population, and an unknown degree of Mediterranean-stock contribution despite management assumptions of no mixing between stocks. Evaluating the effects of fishing on historical demographics of this population requires an interdisciplinary approach that can simultaneously evaluate changes in abundance, age structure, and degree of mixing between Gulf of Mexico-origin and Mediterranean-origin stocks. Historical comparisons of age-structure, size-at-age, and stock mixing were conducted using archived otoliths from two National Marine Fisheries Service sampling efforts to investigate demographic changes between a period prior to (1974-1978; N=359) and after high exploitation (1996-2000; N=146). Comparisons of age structure indicated strong age truncation had occurred: ages for the historical and more recent samples ranged from 1-33 and 1-20 years, respectively, while size distribution between samples remained similar (50-310 and 50-270 cm CFL). Individuals in the historical sample were comprised of 56% 11+ year olds, while only 5% of the more recent sample was included in this age category. Otolith stable isotope analysis of the archived samples indicated a substantially higher contribution of Mediterranean origin fish in the 1990s, consistent with published research. Integrated methods have shown that historical high rates of size-selective fishing has caused (1) age truncation and a population largely comprised of recruit spawners; (2) diminished recruitments; and (3) increased levels of subsidy by Mediterranean origin bluefin tuna to North American fisheries in the 1990s.

**Time – 1530**
**Authors:** ***Alexandra. N. Atkinson**, R. L. Wingate, M. H. P. O'Brien, and D.H. Secor
**Presenter Affiliation:** University of Maryland Center for Environmental Science

**INFLUENCE OF ENVIRONMENTAL CONDITIONS ON THE AGE, GROWTH, AND HATCH DATES OF JUVENILE ATLANTIC MENHADEN IN THE CHOPTANK RIVER**

Historically, Chesapeake Bay served as the central nursery habitat for the shelf-spawning Atlantic menhaden, but over the past two decades juvenile production has fallen to < 20% of its former level. Otolith-derived hatch dates have indicated that most recruits originate from spring-ingressed larvae, rather than larvae entering in early- and mid-winter. We hypothesized that prolonged exposure to low winter temperatures and low food availability in the Chesapeake was sub-lethal to larvae, shaping subsequent recruitment patterns. Hatch dates and back-calculated growth rates of juvenile menhaden were compared between cold- and warm-winter years with varying chlorophyll phenology. In addition, summer juvenile abundance from 1995-2012 was evaluated with respect to preceding winter temperatures. During 1995-2012, average winter temperatures ranged from 3.7$^{o}$C to 8.5$^{o}$C and exhibited an overall warming trend. However, we failed to detect differences in hatch-date distributions between warm- and cold-winter years. We observed higher growth rate in 2006, which was associated with warmer winter conditions coupled with high early spring chlorophyll concentrations. A bioenergetics model developed by Annis et al. 2011 to estimate menhaden growth as a function of chlorophyll and temperature was applied to the Choptank River. Resultant modeled fish lengths and growth rates were compared with field-sampled juvenile menhaden. Although early growth conditions were associated with warmer winters, hatch-date distributions of recent years and a long-term retrospective analysis failed to detect a strong influence of winter severity on early juvenile menhaden survival within the Chesapeake Bay.

**Time – 1545**
**Authors: *Ryan W. Schloesser** and Mary C. Fabrizio
**Presenter Affiliation:** Virginia Institute of Marine Science, College of William & Mary

**CONDITION DYNAMICS OF JUVENILE FISHES THROUGHOUT VIRGINIA ESTUARIES**

Recruitment is a key process that sustains marine fish stocks, but it is highly variable among years. The condition of individuals in a year class may contribute to recruitment variability due to differential survival of poor- and well-conditioned fish, particularly during periods of physiological stress (e.g., migration or winter). We hypothesize that temporal variation in condition reflects preparation for physiological stressful periods, and that spatial variation reflects the quality of nursery areas. Condition of juvenile Summer Flounder (n=2,357) and Atlantic Croaker (n=3,762) was assessed monthly from June 2011 to January 2014 using three indices of condition that reflect different energy storage strategies: Fulton's condition factor (K), the hepatosomatic index (HSI), and subdermal lipid estimates from the Distell fish fatmeter. Mean values for these indices varied among year classes for both species. Seasonal patterns in mean K and subdermal lipid values suggest that these species use different energy storage strategies to prepare for migration, but individuals of both species require high values of HSI to survive winter. The heterogeneous environment in Virginia estuaries resulted in different spatial patterns in condition between species, and these patterns were influence by a negative influence of density for Atlantic croaker, and a positive influence of density for Summer Flounder. Observed temporal and spatial patterns suggests that condition assessments may improve our understanding of recruitment variability.

**Saturday, March 7th**

**Time – 845**
**Authors: William E. Smith**, J. K. Craig, F. S. Scharf, and T. Wadsworth
**Presenter Affiliation:** North Carolina Division of Marine Fisheries

**REVIEW OF SOUTHERN FLOUNDER MIGRATORY DYNAMICS AND IMPLICATIONS FOR REGIONAL MANAGEMENT**

Southern flounder are a flatfish commonly found from North Carolina to the Gulf of Mexico. All US states in their range have recreational fisheries for the species, and at least two South Atlantic states have substantial commercial fisheries targeting southern flounder. Research over the past twenty years has generated genetic, otolith morphometric, and tagging evidence indicative of extensive mixing of southern flounder populations within the Gulf of Mexico and the South Atlantic basins, but with limited or no exchange between basins. Collectively, multiple lines of evidence strongly suggest that southern flounder in the South Atlantic represent a single population; however, the current management structure for southern flounder does not provide for interstate management or cooperation. Although past stock assessments have attempted to estimate southern flounder stock status in North Carolina, we now must assume that emigration of spawning adults results in the loss of fish from North Carolina waters and recruitment in North Carolina may be subsidized by spawning in continental shelf waters off the coasts of other South Atlantic states; therefore, it is our assertion that only a regional South Atlantic stock assessment that incorporates basin-scale ecological processes can accurately describe the population dynamics of southern flounder.

**Time – 900**
**Authors: Ray Mroch**
**Presenter Affiliation:** North Carolina Division of Marine Fisheries

**STOCK ASSESSMENT FOR ALBEMARLE SOUND/ROANOKE RIVER STRIPED BASS**

The striped bass, *Morone saxatilis*, is found throughout the Atlantic coast of the United States. It is targeted by numerous fisheries during spawning migrations into freshwater systems. A combination of popularity of the fish as a food source and recreational fishing target, as well as environmental phenomena and its life history and have resulted in dramatic variability in historical landings and abundance. The striped bass stock of North Carolina is managed separately from the coastal stock and adjacent systems. The striped bass stock experienced years of overfishing, culminating in severe restrictions of the various fisheries in the 1980s. Since the implementation of a North Carolina fishery management plan in 1993 for the Albemarle Sound/Roanoke River stock, various stock assessment methods have been used, increasing in sophistication with better data, modeling techniques, and computing technology. For much of the first decade of its management, all stock characteristics were on a favorable trajectory, and the stock was declared recovered in 1997. As the stock size increased, allowable and actual landings increased until 2004, when spawning stock biomass declined to levels near the point at which the stock was declared recovered; however, fishing mortality remains below the management threshold value. So, while the stock is not overfished nor is it currently undergoing overfishing, the results of the most recent North Carolina stock assessment and recent trends in spawning stock biomass and abundance indicate that striped bass management should proceed cautiously.

**Time – 915**
**Authors: Scott Baker**, Marc Benjamin Sciance and Joanne N. Halls
**Presenter Affiliation:** North Carolina Sea Grant Program, University of North Carolina Wilmington

**POTENTIAL FOR VESSEL SPEED AND OTHER VARIABLES TO PREDICT FISHING ACTIVITY IN THE SNAPPER GROUPER VERTICAL LINE FISHERY**

Currently there exist few ways to calculate fishing effort without logbooks, observers and/or electronic monitoring (EM). The use of vessel speed alone from Global Positioning Systems (GPS) data to isolate fishing activity has worked well for trawl fisheries but proven less successful in stationary fisheries. Five trips on four vessels from a vertical hook and line reef fish fishery were used to examine the efficacy of GPS (speed and time) and EM specific sensors (drum and video) to corroborate an observer's account of effort. Four minutes was the minimum data collection interval required to capture ~100% of documented fishing events (locations). Vessels spent on average 29.4% of time away from port fishing. No fishing occurred at night, opportunistically defined as the seven hours > 2200 and < 0500 hours. Four nested logit models were applied across two conditions: using all combined data (24 hour) and a subset of combined data (17 hour) – the latter of which sheltered all night records from model predictions. Models performed best when all variables were used. Comparisons with observer effort by individual trip suggest that the simplest logit models (GPS only) are effective only when night records are sheltered from model prediction. Previously collected observer data suggests the night record exclusion is warranted for general effort estimation purposes. Given that GPS data can be collected from a variety of low-cost, real-time communication devices, the automated approach outlined here may have broad utility in this and similar fisheries, including the marine recreational fishing sector.

**Time – 930**
**Authors: Jenny Vander Pluym**, Chris Taylor, Christine Buckel, Erik Ebert
**Presenter Affiliation:** National Centers for Coastal Ocean Science, National Ocean Service, NOAA

**INVESTIGATING FISH COMMUNITIES OF NC OFFSHORE HARDBOTTOM HABITATS IN A POTENTIAL WIND ENERGY AREA**

In an effort to provide a baseline biological assessment of the distribution of marine fishes and develop a map of seafloor habitats of a potential wind energy area off of Cape Fear, NC, NOAA and partners conducted an expedition in May, 2014. Using multi-beam and side scan sonar, investigators identified apparent hardbottom habitats ledge, mixed hardbottom/sand, pavement and two artificial reefs (wrecks). Using band transects, science divers identified fish to species and size class along with estimating benthic cover and topographic measurements at 52 sites. Preliminary analysis suggests that ledge and mixed hardbottom/sand habitats support the greatest abundance and biomass of fish species within the call area. Abundance and biomass of large individuals (>50 cm TL) were greater on ledge habitats and are also positively correlated with hardbottom height collected in situ and with rugosity derived from multibeam files. Large fish were also found to be positively correlated with macroalgal cover, which was greater for ledge habitats. Most of these individuals are members of the snapper grouper complex and are important to commercial and recreational fisheries. While more diverse and numerous fish communities were documented over rugose habitats during dive operations, acoustic sampling conducted during the evening and night showed high concentrations of fish biomass over sand and soft bottom habitats as well. This research suggests that the diverse fish community found offshore is not only dependent on presence of rugose hardbottom habitats, but that high macroalgal cover and the presence of a variety of habitats may also be important.

**Time – 945**
**Authors: Laura M. Lee**, Jason E. Rock
**Presenter Affiliation:** NC Division of Marine Fisheries

**THE FORGOTTEN NEED FOR PERSISTENCE IN FIXED-STATION SURVEYS**

Standard sampling designs have associated design-based estimators that have well known statistical properties—they are designed to provide unbiased estimators of the mean and variance. Application of these estimators to fixed-station surveys is not technically valid but can result in unbiased differences between years if the data exhibit spatial persistence. A persistent system is one in which the station differences maintain themselves from year to year (i.e., the rank of catches among the stations persists from year to year). In a fully persistent system, the changes in abundance derived from fixed stations will be unbiased. Here, the persistence of a fixed-station survey intended to monitor the recruits of economically important species is evaluated. The results can be used to infer for which species changes in abundance estimated from fixed-station surveys will be more accurate than changes estimated from random surveys.

**Time – 1000**
**Authors: Rob Aguilar**, MB Ogburn, MR Goodison, PM Roberts, KD Richie, KE Heggie, MA Kramer, B Weigel, T Flock, AH Hines
**Presenter Affiliation:** Smithsonian Environmental Research Center

**MOVEMENT OF NON-NATIVE BLUE CATFISH, *ICTALURUS FURCATUS,* IN TWO UPPER CHESAPEAKE BAY TIDAL TRIBUTARIES.**

The rapid range expansion and increase in abundance of non-native blue catfish (*Ictalurus furcatus*) in upper Chesapeake Bay have raised serious management concerns. The blue catfish is a large, long-lived, moderately salt-tolerant top predator that has become established in tidal portions of several Maryland tributaries and has been associated with the decline of the native white catfish (*Ameiurus catus*) in Virginia. However, little is known about the movement and behavior of blue catfish in these non-native systems. During 2013-2014, a total of 37 blue catfish >350mm TL were surgically implanted with VEMCO V13 ultrasonic transmitters – 23 in Patuxent River and 14 in Marsyhope Creek. Transmitters pinged at random intervals every 60-180s. Tagged fish were tracked during regular survey transects using a mobile VR100 receiver unit and arrays of static VR2 receivers. Twelve receivers were deployed between Wooton's Landing and Broomes Island in the Patuxent River (maintained by the Smithsonian Environmental Research Center) and 5 receivers (maintained by Maryland Department of Natural Resources/University of Maryland) were deployed between Federalsburg, Sharptown and Ragged Point in Marshyhope Creek/Nanticoke River. To date, over 1 million detections have been recorded. Several tagged fish displayed directed downriver movement during the early spring. Moreover, a number of individual blue catfish moved extensively during the study period, some averaging nearly 2km/d . These data provide fisheries managers with valuable information regarding the movement and behavior of non-native blue catfish in Chesapeake Bay.

**Time- 1015 ----------BREAK----------**

**Time – 1030**
**Authors: Michael HP O'Brien**, David H Secor
**Presenter Affiliation:** Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science

**LÉVY FLIGHT IN SPAWNING AND NON-SPAWNING STRIPED BASS (*MORONE SAXATILIS*)**

Potomac River striped bass (*Morone saxatilis*) dispersal patterns were modeled from coastal telemetry records of 72 telemetered fish tagged and released during spring 2014. Path data (body length/s) was summarized across receivers arrayed in the Chesapeake Bay and in US Mid-Atlantic/New England coastal water by sex and size strata, including 55-65 cm, 65-80 cm, and >80 cm size classes. Normalized frequencies of swimming velocity during the spring period of spawning deviated significantly from a Lévy flight distribution (power-law exponent = 2), with all size-classes exhibiting a near-random distribution (i.e., exponent ≤ 1). Non-spawning periods (summer-winter) approached a Lévy flight distribution across size classes, with exponents ranging from 1.45 to 1.88. Sex-specific velocity distributions exhibited a similar pattern between seasons. Random movement within the spawning time period suggests either passive search patterns for mates or active search occurring at a smaller spatial scale than can be resolved by this study (< 1 km). Conversely, near-optimal Lévy flight during non-spawning periods indicates search for and movement between areas of suitable habitat. Development of simple process models from telemetry records could serve as a future basis of state-space and other predictive movement and habitat models.

**Time – 1045** **30 minute presentation**
**Authors: David H. Secor**
**Presenter Affiliation:** Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science

**MIGRATION ECOLOGY OF MARINE FISHES: "THE MOST ESSENTIAL THINGS ARE INVISIBLE TO THE EYE."**

The digital age has ushered in countless discoveries on the previously hidden lives of marine fishes. What have we learned? Have organizing principles emerged from this deluge of discovery? Can we harness new found diversity to improve stewardship of fisheries and marine ecosystems? From the millions of telemetered paths, turns, dives, stops, and spins comes movement ecology – a focus on what motivates the individual. Compelling and elegant rules such as Lèvy flights and area restricted search behaviors give rise models that forecast shorter term aggregate behaviors, but across seasons and years, collective agencies (schooling, homing, straying, irruptions, partial migration) take hold leading to non-linear, multi-modal, and non-stationary population outcomes. Migration ecology embraces such collective emergent behaviors, with emphasis on (1) the alignment of mating systems with larval dispersal, (2) the migration of cohorts through size-structured marine foodwebs, and (3) the synergy of natal homing, straying, and partial migration in populations that are both open and closed to immigration. Through complex life cycles, populations build contingents for contingencies, a property that managers could harness to build resilience and stability in marine fisheries against future nonstationary and novel ecosystem states.

**Time – 1115**
**Authors: Sally Roman**, Joe Grist, and Rob O'Reilly
**Presenter Affiliation:** Virginia Marine Resources Commission

**DEVELOPING MANAGEMENT APPROACHES TO REDUCE BYCATCH AND BYCATCH MORTALITY OF ATLANTIC STURGEON IN VIRGINIA'S COMMERCIAL GILL NET FISHERIES WITH LIMITED DATA**

The Commonwealth of Virginia is applying for a general incidental take permit, required under the ESA for activities resulting in an interaction with an endangered or threatened species (Atlantic sturgeon). This permit will allow commercial gill net gear, the major gear used to harvest finfish, to prosecute fisheries, while remaining under an annual number of interactions of the species through an adaptive management approach. A component of the permit is to identify methods/management measures to minimize and mitigate the bycatch and bycatch mortality of the species. Approaches to reduce bycatch and bycatch mortality range from gear modifications to time/area management measures and bycatch hotspot analysis. Currently, data available to develop some of these approaches are limited. Data on interactions during commercial fishing operations is restricted to federal observer data, which is spatially limited, and self-reported data, which lacks spatial resolution and gear information needed to assess the impact of gill net activity on the bycatch of Atlantic sturgeon. To address these limitations and allow for adaptive management, a state-managed observer program will collect data on commercial gill net trips throughout the state. Research conducted by academic intuitions, federal agencies and other state agencies will be included in the process as results become available. Collaborative fisheries research will be promoted to encourage involvement by industry stakeholders. An adaptive and collaborative management approach will allow for longterm utilization of fisheries resources, while minimizing economic hardships that may result from fisheries closures as a result of exceeding annual interaction estimates.

**Time – 1130**
**Authors: Aaron Bunch**, Yan Jiao, Bob Greenlee, and Eric Brittle
**Presenter Affiliation:** Virginia Department of Game and Inland Fisheries

**BLUE CATFISH POPULATION CHARACTERISTICS IN A SMALL TIDAL TRIBUTARY IN COASTAL VIRGINIA**

Blue Catfish *Ictalurus furcatus*, commonly found in coastal rivers entering the Chesapeake Bay provide trophy recreational fishing opportunities; however, ecosystem-level impacts of this nonnative species is uncertain and effective management has proven difficult. We used mark-recapture techniques to inform closed population models in Powell Creek, a small tidal tributary to the lower James River in Virginia in 2007 and 2014. Movement patterns were assessed using acoustic telemetry methods to evaluate model assumptions. In 2007, Blue Catfish densities were 708 fish/km (95% confidence intervals [CI] 692—725) and 6201 fish/ha (95% CI 6058—6344). In 2014, densities decreased to 338 fish/ha (95% CI 325—352) and 2961 fish/km (95% CI 2842—3080). Tracked fish maintained high site fidelity with 88% accounted for within the study area throughout the duration of the mark-recapture period. Previous studies have indicated that the James River and its tributaries are highly productive and have the largest Blue Catfish populations within the Chesapeake Bay watershed. These data can inform models to evaluate coastal fisheries issues in Virginia, but extrapolating to the entire Chesapeake Bay watershed should be done with caution. Our estimates provided snapshots on the population size of the Blue Catfish in Powell Creek and offered solid prior of the abundance in these 2 years that can further be used for other population dynamics analyses based on monitoring of its relative abundance and harvest.

**Time- 1145 ----------ADJOURN----------**

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## List of Restaurants in the Area

| Restaurant Name | Phone | Description |
|---|---|---|
| Amos Mosquito's Restaurant/Bar | 252-247-6222 | Dinner only: American, Sushi, Seafood |
| Beach Tavern | 252-247-4466 | Bar food |
| Bella Pizza and Subs | 252-247-4702 | Pizza and sandwiches |
| Bojangles' | 252-240-3818 | |
| Channel Marker | 252-247-2344 | Lunch/Dinner: Seafood, Steakhouse |
| Clamdigger | 800-338-1533 | Inside the Clamdigger Hotel |
| 4 Corners Diner | 252-240-8855 | Breakfast/Lunch/Dinner |
| Crab's Claw | 252-726-8222 | Lunch/Dinner: Seafood |
| Dairy Queen | 252-726-3039 | |
| El Zarape | 252-727-9410 | Lunch/Dinner: Mexican |
| Island Grille | 252-240-0000 | Dinner |
| Kelli's at the Beach | 252-773-0022 | Seafood/Steakhouse |
| McCurdy's Restaurant & Deck | 252-808-3663 | Dinner: American. Seafood |
| McDonalds | 252-726-3443 | |
| Michaelangelo's Pizza | 252-240-3333 | Pizza by the slice, Calzones, etc. |
| Monkey Bar & Grill | 252-726-2552 | Lunch/Dinner: American |
| New York Deli | 252-773-0729 | Deli sandwiches |
| Prime 1079 | 252-240-1155 | Restaurant inside the Doubletree |
| Ragtime Tavern | 904-241-7877 | American |
| Resort Grill | 252-240-3176 | Breakfast/Lunch: American |
| Roma Pizza and Subs | 252-247-2020 | Pizza |
| Shark Shack | 252-723-5266 | Seafood |
| Sub Tropics | 252-240-0400 | Deli |
| Subway | 252-648-8800 | |
| Surfari Restaurant & Bar | 252-622-4854 | Dinner only; Seafood |
| White Swan BBQ & Chicken | 252-726-9607 | Eastern NC BBQ and fried chicken |

**Most of these places are located in Atlantic Beach – where you crossed over the high-rise coming from Morehead City.**