Southern New England Chapter

American Fisheries Society

2016 Summer Meeting

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June 16, 2016

Save the Bay Center
Providence, RI

Program

AGENDA FOR SNEC AFS 2016 SUMMER MEETING
THURSDAY JUNE 16, 2016

8:30-9:20 ***Registration and Coffee***

9:20-9:30 **Opening Comments.** Glenn Chamberlain, SNEC AFS President

9:30-9:50 **Tracking marine phase Atlantic Salmon with pop-up satellite tags (PSATs) in the Labrador Sea.** Renkawitz, Mark D.[1], Sheehan, Timothy F.[1], Audun Rikardsen[2], Rasmus Nygaard[3], Richard D. Hedger[4], David Righton[5], Cedar M. Chittenden[2], [1]*National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543,* [2]*University of Tromsø, Tromsø, Norway,* [3]*Greenland Institute of Natural Resources, Nuuk, Greenland,* [4]*Norwegian Institute for Nature Research, Sluppen, Trondheim, Norway,* [5]*Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, United Kingdom*

9:50-10:10 **Foraging ecology of Blue Crabs (*Callinectes sapidus*) and their potential impact on Winter Flounder (*Pseudopleuronectes americanus*).*** Fehon, Molly, David L. Taylor, *Roger Williams University, Department of Marine Biology, Bristol, RI 02809*

10:10-10:30 ***Break***

10:30-10:50 **Re-estimation of potential annual fecundity in American Shad from the Connecticut River with the indeterminate fecundity method.** Boucher, Jason M.[1], Richard S. McBride[2], Emilee K. Towle[1], [1]*Integrated Statistics, Woods Hole, MA 02543,* [2]*National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543*

10:50-11:10 **Fatty acid profiles of marine fishes from Rhode Island coastal waters.*** Yurkevicius, Mary[1], Joshua Jacques[1], Nancy E. Breen[2], David L. Taylor[1], *Roger Williams University,* [1]*Department of Marine Biology,* [2]*Department of Chemistry, Bristol, RI 02809*

11:10-11:30 **Assessing cumulative impacts from potential coastal alteration projects in Massachusetts.** Ostrikis, Kate E., *Massachusetts Division of Marine Fisheries, Gloucester, MA 01930*

11:30-12:30 ***Awards and Business Meeting***

12:30-1:30 ***Lunch***

1:30-2:30 **Keynote Speaker. Ecological challenges in fisheries science and management from a fish-eye perspective.** Auster, Peter J.[1,2], [1]*University of Connecticut, Department of Marine Sciences, Groton, CT 06340,* [2]*Mystic Aquarium, Mystic, CT 06355*

2:30-2:50 **Blue Crab predation on juvenile Winter Flounder in New England waters assessed through PCR-based methods.*** Cribari, Kelly J.[1], Abigail K. Scro[2], Kathryn R. Markey[2], David L. Taylor[1], *Roger Williams University,* [1]*Department of Marine Biology,* [2]*Aquatic Diagnostic Laboratory, Bristol, RI 02809*

2:50-3:10 **Development of a population wide index of spawning stock biomass for Atlantic Mackerel.** Carter, Lauren[1], Dave Richardson[2], Kiersten Curti[2], [1]*Integrated Statistics, Woods Hole, MA 02543,* [2]*National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543*

3:10-3:30 ***Break***

3:30-3:50 **Spatial variations in mercury and selenium concentrations in marine fishes of Rhode Island: Risks and benefits to human health.*** Jacques, Joshua, Mary Yurkevicius, David L. Taylor; *Roger Williams University, Department of Marine Biology, Bristol, RI 02809*

3:50-4:10 **Bycatch and changing climate can impact population persistence and biological characteristics of Alewife.** Nelson, Gary A.[1], Benjamin I. Gahagan[1], Michael P. Armstrong[1], Adrian Jordaan[2], [1]*Massachusetts Division of Marine Fisheries, Gloucester, MA 01930,* [2]*University of Massachusetts, Department of Environmental Conservation, Amherst, MA 01930*

4:10-4:30 **Evaluating the effects of culverts on fine scale genetic structuring of Brook Trout.*** Nathan, Lucas R., Ava Smith, Jason C. Vokoun, *University of Connecticut, Department of Natural Resources and the Environment, Storrs, CT 06269*

* Denotes student paper

ABSTRACTS:

Ecological challenges in fisheries science and management from a fish-eye perspective.
Auster, Peter J.[1,2] (keynote speaker), [1]*University of Connecticut, Department of Marine Sciences, Groton, CT 06340,* [2]*Mystic Aquarium, Mystic, CT 06355; peter.auster@uconn.edu*

"Not everything that counts can be counted, and not everything that can be counted counts."
– William Bruce Cameron

"We don't know everything, but we do know some things."
– Paraphrasing some really rude lyrics by Dr. Dre

Studies in fisheries science are generally conducted at the spatial scale of populations while studies in marine ecology are conducted at the scale of individual animals within particular habitats. The habitat and landscape scale variability associated with population scale sampling is often considered ecological noise while the population scale variability within habitat-landscape scale studies is either ignored due to logistical constraints of sampling habitats across an entire species range or it is outside the time frame generally available to complete an ecological study. Both approaches yield valuable insight into patterns and processes useful for management aimed at conservation and sustainable use of resources. However, in practice, the results of small scale studies are often minimized in terms of development of alternatives in the management arena because they do not explicitly comport with population-scale results. Based on almost 40 years spending time underwater on multiple ecological projects using scuba, submersibles, ROVs and related sampling tools, I will review examples of species interactions from a fish-eye perspective that are relevant to management. I will link my observations to ecological theory, relate space and time scale issues and then discuss impediments to the application of the results, and posit a way forward to better link small scale studies to management scale needs.

Re-estimation of potential annual fecundity in American Shad from the Connecticut River with the indeterminate fecundity method. Boucher, Jason M.[1], Richard S. McBride[2], Emilee K. Towle[1], [1]*Integrated Statistics, Woods Hole, MA 02543,* [2]*National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543; jason.boucher@noaa.gov*

The many historic and recent estimates of American Shad fecundity express well two themes common to measuring egg production in fishes. First, that spatial variation occurs;

second, the appropriate method of measuring fecundity depends on the pattern of oocyte development. Regarding the first theme, historic estimates of shad potential annual fecundity (PAF) demonstrate increasing PAF with decreasing latitude. This is linked to survival probability and explains the adaptive significance of natal homing by a marine species. Second, more recent investigations of the underlying pattern of oocyte development have questioned whether a common method for measuring fecundity is accurate across all populations. Historically, the relatively simple determinate fecundity method was used, but a recent study in a Virginia River indicates that this method may be biased, and a more complicated indeterminate method may be necessary. We address both issues with new collections from the shad spawning run in the Connecticut River during 2015. Our new (indeterminate method) mean estimate for potential annual fecundity (PAF; 325,100 + 11,300 sd) was not significantly different than a recent (determinate method) estimate of PAF (303,000 + 73,400; student's t-test, $P > 0.05$). We postulate that this agreement of PAF estimates using different methods for the Connecticut River, but the previously recognized disagreement between methods for a Virginia River, is explained by fundamentally different patterns of oogenesis at different latitudes. Additional comparisons between methods, along a latitudinal gradient is necessary to accept this postulation, but if true, it would preserve the argument for adaptive significance of life history variation and natal homing in this species, while leading to new understandings into sources of fecundity variation between populations, years, and individuals.

Development of a population wide index of spawning stock biomass for Atlantic Mackerel. Carter, Lauren[1], Dave Richardson[2], Kiersten Curti[2], *[1]Integrated Statistics, Woods Hole, MA 02543, [2]National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543; lauren.e.carter@noaa.gov*

The northwest Atlantic Mackerel stock spawns in both U.S and Canadian waters. The U.S has declared the status of the unit stock as unknown, while a Canadian assessment of the stock's northern contingent indicates biomass at a historic low. An Atlantic Mackerel abundance index derived from the Northeast Fisheries Science Center's (NEFSC) spring bottom trawl survey, which was used in a recent U.S.-Canadian assessment, remains high, but is contradicted by other information about the status of the stock, prompting the need for an additional fisheries independent index. Here we describe the development of an egg index for U.S. waters. Ichthyoplankton were collected each year on the May-June NEFSC Ecosystem Monitoring survey. Fish eggs were sorted and identified to species. Atlantic Mackerel eggs were then developmentally staged. A northward shift in egg distribution has occurred over the past 15 years. Additionally, egg totals have decreased from thousands in the early 2000s to less than a hundred in recent years. We plan to develop a spawning stock biomass index using the egg production method. The new data series, when combined with ongoing Canadian egg abundance surveys, will provide the first range-wide abundance index for the entire northwest Atlantic stock.

Blue Crab predation on juvenile Winter Flounder in New England waters assessed through PCR-based methods. Cribari, Kelly J.[1] (student), Abigail K. Scro[2], Kathryn R. Markey[2], David L. Taylor[1], *Roger Williams University, [1]Department of Marine Biology, [2]Aquatic Diagnostic Laboratory, Bristol, RI 02809; kcribari681@g.rwu.edu*

Increasing water temperatures in the Northwestern Atlantic have resulted in Blue Crabs (*Callinectes sapidus*) extending their geographic range northward to Southern New England waters, including the Narragansett Bay Estuary and associated tidal rivers and coastal ponds. The increased abundance of Blue Crabs in these areas may have important consequences to resident biota. For example, Blue Crabs may adversely affect juvenile Winter Flounder (*Pseudopleuronectes americanus*) populations via trophic interactions. In this study, Polymerase Chain Reaction (PCR)-based methods were used to detect crab predation on juvenile flounder. DNA extractions of crab stomach contents were done using a Qiagen DNeasy Blood and Tissue Kit and then amplified using a Winter Flounder-specific 208 base-pair primer set, specifically attaching to the U12068 (D-loop) position. A total of 122 crabs stomachs were analyzed, of which 26 tested positive for Winter Flounder DNA. This 21.3% positive detection exceeds predation rates estimated from traditional visual analysis of stomach contents, and further suggests that crabs may be an important source of predator-induced mortality for juvenile flounder. Dynamics in this predator-prey interaction were unrelated to crab/flounder body sizes or flounder densities. Conversely, crab predation on flounder significantly decreased at low dissolved oxygen concentrations, possibly due to reduced crab foraging during hypoxic conditions (< 4 mg DO/L). Future work will include the analysis of crabs collected in 2015 and 2016, as well as the comparison of PCR results with visual analysis of the stomach contents.

Foraging ecology of Blue Crabs (*Callinectes sapidus*) and their potential impact on Winter Flounder (*Pseudopleuronectes americanus*). Fehon, Molly (student), David L. Taylor, *Roger Williams University, Department of Marine Biology, Bristol, RI 02809; mfehon618@g.rwu.edu*

The Blue Crab, *Callinectes sapidus*, is a temperate species that is expanding its geographic range northward, thus possibly altering benthic community structure in Southern New England waters. This study examined the potential impact of blue crabs on local fauna by analyzing their abundance, size-structure, and diet. Potential crab predation on Winter Flounder, *Pseudopleuronectes americanus*, was of particular interest due to locally declining populations of this flatfish species. Crabs were collected from the Seekonk River (RI) and Taunton River (MA) from May to August 2012-2015, and subsequently preserved in 95% ethanol. In the laboratory, crabs were measured for carapace width, and prey contents were extracted from stomachs and identified to the lowest practical taxon. Crab abundance exhibited both spatial and temporal variations in the rivers, but overall estimates were consistent with southern Mid-Atlantic populations. Moreover, decomposition of crab length-frequency distributions revealed three distinct cohorts, suggesting that multiple life history stages utilize the riverine habitat. Direct visual analysis of stomach contents indicated that crabs undergo ontogenetic dietary shifts. The main prey of small crabs were crustaceans (e.g., amphipods/isopods, shrimp, and crabs), whereas larger conspecifics preferentially consumed bivalves. There was also evidence of crabs consuming fish, including Winter Flounder, with rates of predation positively related to predator-prey size ratios. The incidence of crab predation on flounder was minimal, however, and thus crabs may not be an important source of mortality for juvenile flounder. Future research will continue to examine the food habits of blue crabs via visual/genetic analysis of stomach contents and measurements of stable nitrogen and carbon isotope signatures in chelae muscle tissue.

Spatial variations in mercury and selenium concentrations in marine fishes of Rhode Island: Risks and benefits to human health. Jacques, Joshua (student), Mary Yurkevicius, David L. Taylor; *Roger Williams University, Department of Marine Biology, Bristol, RI 02809; jjacques396@g.rwu.edu*

Mercury (Hg) is a prevalent environmental contaminant that poses risk to human health, and exposure occurs mainly by consuming fish. Therefore, the U.S. Environmental Protection Agency (EPA) introduced a Hg action level of 0.3 ppm (wet weight) in fish tissue, above which consumption may become a health risk. Selenium (Se), a trace element that mitigates Hg toxicity, is also present in fish, thus increasing their health benefits. In this study, total Hg and Se concentrations were measured in the muscle tissue of four fish species collected from the Narragansett Bay (inshore) and Rhode Island/Block Island Sound (offshore), including Summer Flounder (*Paralichthys dentatus*), Scup (*Stenotomus chrysops*), Bluefish (*Pomatomus saltatrix*), and Black Sea Bass (*Centropristis striata*) (offshore: n = 8-10 per species, inshore: n = 19-20 per species). Data were analyzed and compared based on spatial variations (inshore and offshore) relative to fish body size to assess bioaccumulation patterns. Health Benefit Values (HBV) were calculated to estimate the relative health risk vs. benefit of each species for human consumers. There is evidence supporting that offshore Bluefish, Black Sea Bass, and Summer Flounder have less total Hg than inshore conspecifics, whereas total Se concentrations did not vary spatially. Conversely, Scup showed no spatial variation in total Hg or total Se concentrations. Total Hg concentrations were positively related to total length for all fish, and values routinely exceeded the U.S. EPA action level at larger body sizes for inshore and offshore fishes (exception = Summer Flounder). In contrast to Hg bioaccumulation patterns, Se concentrations were relatively constant across fish size. HBVs were inversely related to fish length, suggesting that larger fish pose greater health risks. Among all species, Summer Flounder had the lowest Hg concentration, yet the highest Se content; therefore this species provides the most health benefits according to the matrices of this study. Future work includes increasing the sample size of the offshore species for analysis of total Hg and Se concentrations.

Evaluating the effects of culverts on fine scale genetic structuring of Brook Trout. Nathan, Lucas R. (student), Ava Smith, Jason C. Vokoun, *University of Connecticut, Department of Natural Resources and the Environment, Storrs, CT 06269; lucas.nathan@uconn.edu*

Fragmentation of stream ecosystems is a concern for future persistence of aquatic organisms, due in part to the effects of genetic isolation. Under-road crossings are common barriers to fish movement and can fragment otherwise intact genetic populations when designed without passage considerations. Currently, research and management efforts are in place to examine the passability of culverts, which often include establishing assessment scores for prioritizing upgrades and replacements. Genetics can be used to evaluate the passability of culverts by comparing the genetic differentiation between the individuals above and below a given under-road crossing. In order to understand the effects of culverts on genetic structuring of Brook Trout (*Salvelinus fontinalis*), we assessed 23 culvert road crossings throughout Connecticut using the North Atlantic Connectivity Collaborative (NAACC) protocol and collected genetic data from eight microsatellite loci. Although the assessed culvert scores did not accurately predict the degree of genetic differentiation, sites with culverts were found to have higher genetic differentiation when compared to streams without culverts. These results suggest that the culverts included in this study act as partial barriers. Brook Trout are known as relatively strong swimmers and jumpers; although some individuals certainly passed through the culverts studied in recent generations, population connectivity was disrupted enough to have measurable effect on population genetics. This highlights that even under-road crossings that might not be scored as adequate for fish passage, and therefore not a remediation priority, are still capable of affecting population connectivity.

Bycatch and changing climate can impact population persistence and biological characteristics of Alewife. Nelson, Gary A.[1], Benjamin I. Gahagan[1], Michael P. Armstrong[1], Adrian Jordaan[2], [1]*Massachusetts Division of Marine Fisheries, Gloucester, MA 01930,* [2]*University of Massachusetts, Department of Environmental Conservation, Amherst, MA 01930; gary.nelson@state.ma.us*

A simulation model was created to explore potential impacts of bycatch and changing climate on population persistence and biological characteristics of Alewife. The population model is length- and platoon-based, has a daily time step, and incorporates egg, yolk-sac, post-larvae, juvenile and adult sub-models in which mortality, growth and movement are influenced by climate variables (temperature and precipitation) in four geographical regions (ocean, estuary, river and lake systems). A bycatch sub-model applies size-selective mortality to juvenile and adults in the ocean during pre-specified months of the year. To explore the impacts of bycatch over fifty years of changing climate, simulations were run at different levels of bycatch mortality using time series of lake, river, estuary and ocean temperatures and precipitation data from 1962-2012. Results showed that the probability of persistence is high in absence of bycatch mortality, but it declines with increasing bycatch mortality. Declines in size and age of mature adults observed historically in several New England Alewife runs were replicated by the model at high bycatch mortality.

Assessing cumulative impacts from potential coastal alteration projects in Massachusetts. Ostrikis, Kate E., *Massachusetts Division of Marine Fisheries, Gloucester, MA 01930; Katelyn.Ostrikis@state.ma.us*

The Massachusetts Division of Marine Fisheries (*MarineFisheries*) is responsible for reviewing coastal alteration projects and provides recommendations to avoid, minimize, and mitigate potential impacts to marine fisheries resources and habitats. *MarineFisheries* acts in an advisory capacity to local town, state, and federal permitting agencies. After decades of reviewing projects we wanted to assess these cumulative impacts. In 2013 we created an Access database to record specific project information including location, size of impacts, habitat type impacted,

type of construction, and marine resources present. We used this information to examine spatial patterns and temporal trends with respect to project location, size of cumulative impact, and type of habitats and resources impacted. We located hotspots of activity and impact to see if there was any spatial distribution, track changes over time, and assess how much pressure is put on a given resource. Between January 2013 and October 2015, we reviewed over 1100 projects in and/or along Massachusetts coastal waters with the potential to impact up to 1200 acres. The majority of these projects occurred in Boston Harbor, the Merrimack River, the Bass River, Gloucester Harbor, and Buzzards Bay. The most common type of projects included docks, piers, floats, shoreline stabilization and/or dredging. Over fifty percent of projects occurred in mapped shellfish habitat. Our goal is to provide this cumulative impact analysis to resource and permitting agencies to create more streamlined management guidelines to reduce cumulative project impacts.

Tracking marine phase Atlantic Salmon with pop-up satellite tags (PSATs) in the Labrador Sea. Renkawitz, Mark D.[1], Sheehan, Timothy F.[1], Audun Rikardsen[2], Rasmus Nygaard[3], Richard D. Hedger[4], David Righton[5], Cedar M. Chittenden[2], *[1]National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543, [2]University of Tromsø, Tromsø, Norway, [3]Greenland Institute of Natural Resources, Nuuk, Greenland, [4]Norwegian Institute for Nature Research, Sluppen, Trondheim, Norway, [5]Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, United Kingdom; Mark.Renkawitz@NOAA.gov*

Pop-up satellite archival tag (PSAT) technology facilitates fine-scale data collection on individuals when conventional methods are inadequate or impractical. Overcoming a suite of associated challenges is still necessary to capitalize on its utility. PSATs were attached to 25 Atlantic Salmon in West Greenland to monitor thermal habitat, depth occupancy, seasonal distribution, and movement patterns in the Labrador Sea. Multiple capture methods were employed with varying levels of efficiency. Overall, thirteen tags reported between 41-100% of the archived data, which required evaluation for temporal biases associated with transmission gaps. Two tags remained attached for the programmed ~210 day duration while 11 tags popped-off between 8 and 31 days post-release. Of those, three tags released from inferred predation/mortality and 8 released from time-at-depth early-release mechanism activation. Six of the 13 fish commonly occupied a narrow depth band (~3m) for 2-3 consecutive days, implicating this swimming behavior as a potential source of early-release mechanism activation. Programming PSATs with wider early-release parameters to better reflect variability in species behavior may improve tag-retention and temporal coverage of recovered data. Acquiring novel information on marine phase Atlantic Salmon adults has greatly expanded understanding of this elusive life-stage and will improve the efficacy of future PSAT efforts.

Fatty acid profiles of marine fishes from Rhode Island coastal waters. Yurkevicius, Mary[1] (student), Joshua Jacques[1], Nancy E. Breen[2], David L. Taylor[1], *Roger Williams University, [1]Department of Marine Biology, [2]Department of Chemistry, Bristol, RI 02809; myurkevicius061@g.rwu.edu*

Marine fish are an excellent source of omega-3 fatty acids, including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which provide numerous health benefits to human consumers. Further, the majority of consumed fish are of marine origin, thus underscoring the importance of research focused on this topic. In this study, fatty acids were analyzed in Rhode Island coastal fishes, including Summer Flounder, *Paralichthys dentatus* (n = 10); Black Sea Bass, *Centropristis striata* (n = 10); Striped Bass, *Morone saxatilis* (n = 6); Scup, *Stenotomus chrysops* (n = 11); Winter Flounder, *Pseudopleuronectes americanus* (n = 10); and Bluefish, *Pomatomus saltatrix* (n = 11). Fatty acid profiles of fish muscle tissue were determined by esterification and gas chromatography. Data were categorized as mono-saturated, saturated, omega-3, and omega-6 fatty acids, and results were expressed as concentrations (mg/100 g wet weight; [FA]) and percent of total fatty acid content (%FA). Irrespective of fish species, mono-saturated fatty acids had the highest [FA] and %FA (mean [FA] = 183.5 mg/100 g; %FA = 46.2%), followed by saturated ([FA] = 146.6 mg/100 g; %FA = 32.7%), omega-3 ([FA] = 44.3 mg/100 g; %FA = 18.6%), and omega-6 fatty acids ([FA] = 7.5 mg/100 g; %FA = 2.5%). Fatty acid profiles also demonstrated significant inter-species differences. With respect to %FA, mono-saturated fatty acids were significantly higher in Scup and Bluefish relative to Summer Flounder and Striped Bass (SCP = 54.6%, BF = 48.8%, SF = 40.1%, SB = 39.3%). Conversely, omega-3 fatty acids were significantly higher in both flounder in comparison to Black Sea Bass and Scup (SF = 31.1%, WF = 26.3%, BSB = 12.1%, SCP = 8.3%). With respect to [FA], Bluefish had significantly higher concentrations of mono-saturated and saturated fatty acids relative to Summer Flounder (BF = 245.4-307.4 mg/100 g, SF = 52.5-81.3 mg/100 g). Ratios of omega-6-to-omega-3 (n6:n3) fatty acids were reduced in flounder and Striped Bass (n6:n3 = 0.14-0.23) relative to Scup, Bluefish, and Black Sea Bass (n6:n3 = 0.30-0.36); hence suggesting the former species provide greater health benefits for human consumers. Future research will examine total mercury and selenium concentrations of each fish species to further evaluate their respective health risks and benefits to human health.