AGENDA FOR THE SNEC AFS 2024 SUMMER SCIENCE MEETING
Tuesday, June 11th, 2024
University of Rhode Island Bay Campus, Narragansett RI

Welcome:	
8:30 – 9:00	***Registration and Coffee***
9:00 – 9:10	**Opening Comments**. Corinne Truesdale, SNEC President
Plenary Presentation:	
9:10 – 10:10	**Ramping up the AI learning curve: 'Big Data' applications to fisheries acoustics.** Jech, Mike
10:10 – 10:20	***Break***
Contributed Oral presentations, Morning Session:	
10:20 – 10:40	**Migratory Patterns of Sand Tiger Sharks (*Carcharias taurus*) Along the US East Coast.*** DeLoof, Bethany, Dewayne Fox, Danielle Haulsee, Jeff Kneebone, Brad Wetherbee
10:40 – 11:00	**Temporal patterns and regional comparisons of recruitment rates of United States fish stocks.*** Marshall, Rachel C. Jeremy Collie, Richard Bell, Paul Spencer, Cóilín Minto
11:00 – 11:20	**Traces of Life: Investigating trace elements in Shortfin Mako *(Isurus oxyrinchus*) vertebrae to reconstruct life histories.*** Hennessy, Peter, Lisa Natanson, Joung Shoou – Jeng, Chi – Ju Yu, Malcom Francis, Rui Coelho, Gibson Kesley, Kwang – Ming Liu, Susan Zernike, Nathan R. Miller, Alicia Cruz – Uribe, R.J. David, John A Mohan
11:20 – 11:40	**Using eDNA to estimate seasonal residency of Striped Bass (*Morone saxatilis*) in the Saco River.*** Tyrrell, Kade, Markus Frederich, John A. Mohan

11:40 – 12:00	**Investigating movement patterns and natal origins of Striped Bass (*Morone saxatilis*) in Maine by linking acoustic telemetry and scale chemistry.*** Gowell, Benjamin, Michael Nguyen, Alexa Cacacie, John Mohan
12:00 – 12:45	***Awards and Business Meeting***
12:45 – 1:45	***Lunch***
Contributed Oral presentations, Afternoon Session I:	
1:45 – 2:05	**Crayfish sampling in a Connecticut urban stream raises further questions on the distribution and movement patterns of our local crayfish species**.* Pezzulo, Robert, Dr. Michelle Kraczkowski
2:05 – 2:25	**Evaluating objectives and design considerations for a nearshore survey in Long Island Sound**. Miller, Michael
2:25 – 2:45	**Chewing gum and walking: How can we decarbonize the economy while also striving for fishery ecosystem resilience?** Schumann, Sarah, Vanessa Sedore
2:45 – 3:05	**The fishery – independent surveys of the NEFSC: Adapting to offshore wind development.** Ford, Kathryn, Peter Chase, Catherine Foley, Madison Hall, Andy Lipsky, Dana Morton
3:05 – 3:15	***Break***
Contributed Oral Presentations, Afternoon Session II:	
3:15 – 3:35	**Spawning phenology of Atlantic herring: analysis of reproductive condition determined on NEFSC bottom trawl surveys**. Wuenschel, Mark
3:35 – 3:55	**Territorial and occupancy behavior of black sea bass on oyster aquaculture gear and boulder habitat.** Conroy, Christian W, Adam D Armbruster, Renee Mercaldo – Allen, Julie M. Rose, Kristen Seda, Paul Clark, Gillian Phillips, Dylan Redman
Adjournment:	
3:55 – 4:10	**Closing comments,** *Abigail Archer, SNEC President*

Keynote Speaker: Mike Jech, NOAA, National Marine Fisheries Service, Northeast Fisheries Science Center

Ramping up the AI Learning Curve: 'Big Data' applications to fisheries acoustics

J. Michael Jech, NOAA/Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543, michael.jech@noaa.gov

Advances in active acoustic technology have outpaced our ability to process and analyze the data in a timely manner. Currently, scientists rely on manual scrutiny or limited automation to classify acoustic backscatter to biologically-meaningful taxa. Classification of acoustic backscatter to its source is a grand challenge of fisheries acoustics and many methods have been developed to partition backscatter for accurate abundance estimates of living marine resources. I explore artificial intelligence (AI), machine learning (ML), and other 'Big Data' methods to classify active acoustic data collected at the NOAA Northeast Fisheries Science Center. We have been collecting active acoustic data since 1998 and our processing and classification methods have evolved as we learn and as methods become available. Even with large volumes of data, we found we were limited by available training data for supervised approaches, so we are looking into unsupervised and self/semi-supervised methods as well as synthesizing training data using physics-based acoustic scattering models. These advanced analytical techniques are the next step in our quest to interpret remotely-collected data and provide accurate and timely information to stock assessment and ecosystem-based management.

Migratory Patterns of Sand Tiger Sharks (*Carcharias taurus*) Along the US East Coast.* DeLoof, Bethany[1], Dewayne Fox[2], Danielle Haulsee[3], Jeff Kneebone[4], Brad Wetherbee[1]

[1]College of Environment and Life Sciences, University of Rhode Island, Kingston, RI
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[3]Hubbs-SeaWorld Research Institute, San Diego, CA
[4]Cabot Center for Ocean Life at the New England Aquarium, Boston, MA

Sand tigers (*Carcharias taurus*) are often taken as bycatch in commercial fisheries and captured by recreational anglers despite being prohibited. They also have one of the lowest rates of reproduction among elasmobranchs, producing two offspring every two or three years. These traits have generated concern about the sustainability of sand tiger populations along the US East Coast and interest in characterizing movements and essential habitat for this species. A total of 396 sand tigers, ranging from 100-300 cm total length, were tagged with acoustic transmitters from 2007-2019 to investigate their seasonal migratory patterns along the US East Coast. From 2008-2020, these sharks were detected nearly four million times on acoustic receivers from Massachusetts to Florida. Different demographics of sand tigers exhibited distinct and consistent spatial and temporal migrations, moving seasonally between summer and winter habitats. While mature sharks were primarily detected in Delaware Bay in summer,

immature sharks were also detected further north in nursery habitats, as far as Massachusetts. Sharks primarily wintered in North Carolina waters. Nine out of 81 individual mature females remained in North Carolina in summer rather than migrating north to Delaware Bay. These sharks, which did migrate north in subsequent years, were hypothesized to be pregnant. Timing of migration to and from summer and winter habitats also differed between immature and mature sharks, consistent with the spatial segregation between demographics observed during resident periods. These results provide insight for protecting habitat frequently occupied by this highly migratory species.

Temporal patterns and regional comparisons of recruitment rates of United States fish stocks.* Marshall, Rachel C.[1] Jeremy Collie[1], Richard Bell[2], Paul Spencer[3], Cóilín Minto[4]

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[2]Richard Bell, The Nature Conservancy, Narragansett, RI, USA
[3]NOAA Fisheries, Alaska Fisheries Science Center, Seattle, WA, USA
[4]Marine & Freshwater Research Centre, Department of Natural Resources and the Environment, Atlantic Technological University, Galway, Ireland

Several previous studies of marine fish stocks have demonstrated time-varying recruitment productivity and indicated that including time-varying parameters can track process variation in recruitment. Few studies have synthesized signal-to-noise ratios and underlying reasons for time-variation across stocks and regions. Using Peterman's Productivity Method (PPM), we provide a broad synthesis of time-varying density-independent productivity in 84 stocks across five regions of the United States. Of all stocks investigated, 49 were found to have time-varying productivity, challenging assumptions on the stationarity of recruitment parameters and dependent reference points. Our results show regional differences in time-varying patterns, particularly the signal-to-noise ratio (SNR) of low- to high-frequency variation. The SNR was lower in the California Current region than in two Atlantic regions and two Alaska regions. Generalized linear modeling used to synthesize results suggests that stocks with higher contrast in spawning stock biomass over time were more likely to have time-varying productivity than stocks with low contrast. The likelihood of time-variation in productivity of a given stock was also found to be closely related to the autocorrelation of the recruitment time series. Our results demonstrate the power of PPM for synthesizing the form and pattern of recruitment time-variation among regions, including general summaries of directional change over time. Such inter-regional comparisons of variation are vital in understanding the roles of local and global environmental change on fish productivity.

Traces of Life: Investigating trace elements in shortfin mako *(Isurus oxyrinchus*) vertebrae to reconstruct life histories.* Hennessy, Peter[1], Abigail Hayne[2], Lisa Natanson[2], Michelle Passerotti[2], Joung Shoou-Jeng[3], Chi-Ju Yu[3], Malcom Francis[4], Rui Coelho[5], Luis Gustavo[6], Kesley Gibson Banks [7], Kwang-Ming Liu[8], Susan Zernike[8], Nathan R. Miller[9], Alicia Cruz-Uribe[10], R.J. David Wells[11], John A Mohan[1],

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[2]National Oceanic and Atmospheric Association, Northeast Fisheries Science Center
[3]National Taiwan University
[4]NIWA New Zealand
[5]IPMA Portugal: Instituo Portugeus do Mar e da Atmosfera
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[11]Texas A&M University at Galveston

Analysis of trace element concentrations in biominerals of fish can reveal life history information. The integration of trace elements into metabolically inert calcified tissue, such as vertebral cartilage, has the potential to reflect environmental and metabolic conditions experienced by individual sharks. This study investigated potential applications of vertebral trace elements in shortfin mako sharks (*Isurus oxyrinchus*), including maternal signatures pre-birth, edge signature reflecting locations prior to capture, and lifetime profiles reflecting age. Vertebrae from 62 individuals (185 ± 61 cm fork length) were opportunistically collected from north and south regions of the Atlantic Ocean, east, west and south regions of the Pacific Ocean, and the Indian Ocean (N=6 total ocean regions). We investigated multi-elemental signatures of barium, strontium, zinc, manganese, and magnesium as a means of differentiating between regions of residency but found limited efficacy to distinguish among regions. Multivariate classification success ranged from 66% for maternal to 60% for recent time scales. We next explored the use of manganese (Mn) peaks as an objective age estimation method to decrease the subjectivity of visual band pair counting. Coupling between vertebral band pairs and concentration peaks of Mn was complicated by band pair compression at older ages, which decreased contrast in Mn variation. Peak counting algorithms were then adapted to align with compressing band pair spacing throughout ontogeny. This study presents preliminary results on the limitations and advantages of using vertebral chemistry to reveal life histories of sharks.

Using eDNA to estimate seasonal residency of striped bass (*Morone saxatilis*) in the Saco River.* Tyrrell, Kade[1], Markus Frederich[1], John A. Mohan[1]
[1]University of New England, Biddeford ME

Environmental DNA (eDNA) is generated by fish as they excrete and shed genetic material while moving through aquatic environments. We first quantified striped bass eDNA persistence in controlled conditions through a series of replicated laboratory trials. Striped bass were tested at high (n=4 fish) and low (n=1 fish) densities in 3 m diameter pool tanks (20 ± .34 °C) for two hours. After, fish were removed and water samples were serially sampled throughout a 24-hour period at time points 0, 2, 4, 8, 12, 20, 24 hours post fish removal. A total of 126 water samples were filtered and analyzed using qPCR techniques and striped bass specific primers. Under the conditions tested, striped bass eDNA was quantifiable up to 4 hours after the removal of fish. Results were used to develop a field survey to elucidate presence or absence of a hypothesized overwintering population of striped bass in the Saco River. Monthly surface water samples were collected from three sites between the Cataract Dam to the mouth of the Saco River Inlet from October 2023 to June 2024. By analyzing water samples using eDNA techniques, we test the hypothesis that a holdover population of striped bass utilize the Saco River through the winter.

Investigating movement patterns and natal origins of striped bass (*Morone saxatilis*) in Maine by linking acoustic telemetry and scale chemistry.* Gowell, Benjamin[1], Michael Nguyen[1], Alexa Cacacie[1,2], John Mohan[1]

[1]University of New England, Biddeford ME
[2]NOAA Greater Atlantic Regional Fisheries, Gloucester, MA

Striped bass (*Morone saxatilis*) are an anadromous species and exhibit long distance coastal migrations along the Atlantic coast. Populations of Atlantic striped bass collapsed in the 1980s, but stocks were rebuilt with fisheries management action. Emergency management measures were enacted in 2023 to protect strong year classes of striped bass cohorts. An increasing challenge in striped bass fisheries management is the complex seasonal movement patterns of juveniles and adults. The migratory stocks include fish from the Chesapeake Bay, Delaware River, and Hudson River. These multiple spawning stocks exhibit varying degrees of residency and migration and the stocks mix as fish move north during the spring, and south during the fall. It is unclear what spawning habitat contributes the majority of fish captured in Maine recreational fisheries and if that source varies year to year. This study explores the fine scale movement patterns of striped bass that utilize the Saco River system through acoustic telemetry. From 2022 to 2024, thirty fish ranging in size from 47 to 109.5 cm total length were implanted with V13 acoustic tags. Both fine scale and broad scale patterns in fish detections will be explored. Further, this study aims to link migratory movements to spawning origins through trace elemental signatures of non-regenerative scales. This paired approach will characterize striped bass stocks and movement behaviors exhibited in Maine recreational fisheries with the overarching goal to enhance management strategies.

Crayfish Sampling in a Connecticut Urban Stream Raises Further Questions on the Distribution and Movement Patterns of our Local Crayfish Species.* Pezzulo, Robert[1], Dr. Michelle Kraczkowski[1]

[1]Central Connecticut State University, New Britain, CT

Freshwater crayfishes are highly diverse and can be found on every continent besides Antarctica. North America alone is home to over 400 species across 12 genera, and 9 of these species across 3 genera have been identified in Connecticut waters. Despite being so widespread and diverse, little is known of their most up to date statewide distribution and life history traits. The aim of this research project is to add to our body of knowledge on crayfish distribution within Connecticut. Our sampling efforts were focused on 2 locations in Bass Brook, an urban stream local to Central Connecticut State University. Beginning in February, stream temperatures were continually monitored in hourly intervals at each location. Based on the literature, we hypothesized that the effective trapping of crayfishes should be possible once water temperatures rise to 10°C, as crayfish activity is known to increase at this threshold. The majority of crayfishes are detritivores, and thus their presence is important to the nutrient cycling processes of stream ecosystems. Our hypothesis assumes that crayfish are present at our sites and not absent due to poor water quality, lack of suitable habitat, or their migratory nature and the seasonal timing of our sampling. No crayfish were captured in the brook during our sampling efforts, leading us to further questions about the seasonal movement patterns and temporal distribution of Connecticut's crayfishes. Our findings from this research project provides preliminary data for future research on the distributions of our local crayfish species.

Chewing gum and walking: How can we decarbonize the economy while also striving for fishery ecosystem resilience? Schumann, Sarah[1], Vanessa Sedore[2]

[1]Fishery Friendly Climate Action
[2]Brown University

Ecosystems are increasingly being called into service to help solve the climate crisis by providing space for renewable energy infrastructure, sequestration and storage capacity for legacy and hard-to-abate emissions, and sources of minerals and feedstocks for clean energy generation and transmission. As these trends escalate in the years ahead, there is a need to co-optimize the attainment of decarbonization goals (e.g., net zero by 2050) with the maintenance and integrity of fishery-supporting ecosystems and the human communities that depend on them. Clear, user-friendly, decision support tools are needed to help planners and stakeholders do both things at once.

We will present key findings and lessons from an expert elicitation pilot project in Southern New England that scored the relative likelihood and intensity of positive and negative impacts to fishery ecosystems anticipated to occur in relation with 30 decarbonization solutions. Decarbonization solutions are defined as technologies, policies, or strategies that can help mitigate the climate crisis, and they include both emissions reduction approaches (e.g., offshore wind, rooftop solar, hydropower, building energy efficiency, walking and biking) and carbon removal approaches (e.g., direct air capture, forest carbon sequestration, ocean alkalinity enhancement). The purpose of this exercise was to create quantitative inputs that can be integrated into a decarbonization pathway model to illuminate plausible decarbonization scenarios that co-optimize progress towards decarbonization goals with societal goals related to fisheries sustainability and ecosystem stewardship. Participants will be invited to brainstorm next steps and to participate in moving this urgent need forward.

The fishery-independent surveys of the NEFSC: adapting to offshore wind development. Ford, Kathryn[1], Peter Chase[1], Catherine Foley[1], Madison Hall[1], Andy Lipsky[1], Dana Morton[1]

[1]NOAA National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA

The NOAA Fisheries Northeast Fisheries Science Center is responsible for more than a dozen fishery-independent surveys monitoring fish, invertebrates, and protected species in the Northwest Atlantic. These surveys are considering how to adapt their methods and designs to accommodate offshore wind development. This talk will present an update on the latest activities around survey activities, pressures, and suggested adaptations with a focus on the bottom trawl and scallop surveys.

Spawning phenology of Atlantic herring: analysis of reproductive condition determined on NEFSC bottom trawl surveys. Wuenschel, Mark[1]

[1]NOAA National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA

Spawning phenology, the annual timing of reproduction, determines when spawning occurs and is therefore important to understanding individual fish energetics and condition, as well as the timing and location of release of eggs. Fish undergo seasonal patterns of weight change related to spawning, therefore, shifts in survey timing and/or spawning seasonality over time could produce changes in calculated weight based condition indices. Maturity data collected on NEFSC bottom trawl surveys were evaluated to determine changes in spawning seasonality over the available time series. Multinomial logistic regressions were fit to summarize and evaluate the relative significance of sampling week, bottom temperature, and decade, on the spawning condition of fish sampled during spring and fall surveys. The spring survey encounters the lesser abundant spring spawning contingent, increasing at later dates with higher temperatures, but temperature did not have a strong effect in spring. While the raw proportions of developing females have increased recent decades, the modeled probabilities show less change, suggested this is due more to a change in sample timing as opposed to spawning timing for the spring contingent. The fall survey occurs closer to spawning for the more abundant fall spawning contingent. Temperature did have a strong effect on spawning condition in fall, with greater probabilities of developing and ripe stages at higher temperatures occurring earlier during the fall cooling period. Individual weights in spring, when most fish are resting, should not be influenced by spawning condition, while those in fall may be affected by sample timing.

Evaluating objectives and design considerations for a nearshore survey in Long Island Sound. Miller, Michael[1]

[1]Connecticut Department of Energy and Environmental Protection, Old Lyme, CT

Connecticut Department of Energy and Environmental Protection (CT DEEP) monitors important finfishes across a variety of habitats in Long Island Sound. Due to constraints of current monitoring programs, there is limited information evaluating finishes that utilize nearshore habitat. Additionally, questions remain pertaining to the long-term effects climate change may have on nearshore habitats. To address these knowledge gaps, CT DEEP is brainstorming ideas to effectively sample finfishes and associated biological information within Connecticut's embayment's, reefs, and estuaries. Among the gear types being considered are fish pots, beach seines, and light traps. Fish pots may be effective at sampling fishes in structured habitat that are normally underrepresented by other gears. Deploying beach seines using a vessel may be an effective way to create a comprehensive finfish index along Connecticut's coastline. Light traps may be well suited for determining spatial and temporal trends of positively phototactic ichthyoplankton species in nearshore habitat. Collectively, our objective is to collaborate with agencies, stakeholders, and other organizations to effectively collect pertinent information in nearshore habitat within Long Island Sound.

Territorial and occupancy behavior of black sea bass on oyster aquaculture gear and boulder habitat. Conroy, Christian W[1], Adam D Armbruster[1], Renee Mercaldo-Allen[2], Julie M. Rose[2], Kristen Seda[3], Paul Clark[2], Gillian Phillips[4], Dylan Redman[2]

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[2]Milford Laboratory, Northeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Milford, CT
[3]Norwich Public Schools, Norwich, CT
[4]A.I.S. Inc., North Dartmouth, MA

Observations of fish behavior can provide insights into habitat preferences and use. Black sea bass, *Centropristis striata*, are a territorial temperate reef finfish species known for their high commercial and recreational value and association with structured habitat. We used underwater cameras to record video of black sea bass to assess territorial (agonistic, ambush, displacement) and occupancy (station-keeping) behaviors on shelf and bag style oyster aquaculture cages at a shellfish farm, and on boulders at a natural rock reef near Milford, Connecticut in Long Island Sound. Black sea bass demonstrated higher frequency of these behaviors in association with oyster cages when compared to boulders. However, when behaviors were normalized to total fish sightings, no significant difference in frequency of behaviors were observed between habitats, indicating that per-fish rates of behavior were similar. The high abundance of black sea bass observed on cages relative to boulders suggests an affinity for the vertical structure created by aquaculture gear. Black sea bass at a variety of life stages, including young-of-the-year, juveniles (1+) and adult males, were associated with cages. Demonstration of territorial and occupancy behaviors by black sea bass on, and around cages suggests that aquaculture gear provides structured habitat and ecosystem services for this species. These results suggest that essential fish habitat descriptions of manmade structures used by black sea bass could be broadened to include aquaculture gear. Our study provides novel information on behavioral interactions of black sea bass with oyster cages that may support aquaculture permitting and consultation processes.