2018 Winter Science Meeting

Southern New England Chapter

American Fisheries Society

January 10, 2018

SMAST East, University of Massachusetts Dartmouth
New Bedford, MA

Program

AGENDA FOR THE SNEC AFS 2018 WINTER SCIENCE MEETING
WEDNESDAY, JANUARY 10, 2018

8:00 – 8:20 ***Registration and Coffee***

8:20 – 8:30 **Opening Comments** Sara Turner, SNEC President

8:30 – 8:45 **New Technology and Old Infrastructure: Using High Resolution Imaging Sonar to Study Fish Passage.*** Rillahan, Chris[1], Derrick Alcott[2], Theodore Castro-Santos[3], Pingguo He[1], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744,* [2]*Organismic and Evolutionary Biology, University of Massachusetts Amherst, Amherst, MA 01003,* [3]*Leetown Science Center, S.O. Conte Anadromous Fish Research Center, U.S. Geological Survey, Turners Falls, MA 01376*

8:45 – 9:00 **Use of Two Proxies to Predict the Location of Vulnerable Marine Species, Communities, Habitats and Ecosystems.*** Huepel, Eric E.[1], Peter J. Auster[1,2], [1]*University of Connecticut-Avery Point, Groton, CT 06340,* [2]*Mystic Aquarium – Sea Research Foundation, Mystic, CT 06355*

9:00 – 9:15 **Distribution and Abundance of Cephalopod Paralarvae on the Northeast US Shelf.** Walsh, Harvey[1], David Richardson[1], Leah Lewis[2], Liz Shea[3], [1]*NOAA Northeast Fisheries Science Center, Narragansett, RI 02882,* [2]*Scripps Institute of Oceanography, San Diego, CA 92037,* [3]*Delaware Museum of Natural History, Wilmington, DE 19807*

9:15 – 9:30 **Using Habitat Preferences and Management Strategies to Predict Northern Quahog Abundance in Narragansett Bay.** McManus, M. Conor, Dennis Erkan, *Division of Marine Fisheries, Rhode Island Department of Environmental Management, Jamestown, RI 02892*

9:30 – 9:45 **Movement Patterns and Temperature Preferences of Thorny Skate (*Amblyraja radiata*) in the Gulf of Maine.** Kneebone, Jeff[1], Tobey Curtis[2], James Sulikowski[3], John Mandelman[1], [1]*Anderson Cabot Center for Ocean Life, New England Aquarium, Boston, MA 02110*, [2]*Atlantic Highly Migratory Species Management Division, NOAA National Marine Fisheries Service, Gloucester, MA 01930*, [3]*University of New England, Biddeford, ME 04005*

9:45 – 10:00 **Habitat Use of Young-of-the-Year White Sharks (*Carcharodon carcharias*) in Three Dimensions.** Curtis, Tobey[1], Michael McCallister[2], Gregory Metzger[3], Christopher Fischer[4], Matthew Ajemian[2], [1]*Atlantic Highly Migratory Species Management Division, NOAA National Marine Fisheries Service, Gloucester, MA 01930*, [2]*Harbor Branch Oceanographic Institute, Florida Atlantic University, Ft. Pierce, FL 34946*, [3]*South Fork Natural History Museum, Southampton, NY 11932*, [4]*OCEARCH, Park City, UT 84098*

10:00 – 10:15 ***Break***

10:15 – 10:30 **Moving Beyond the Quadrat: Digitally Mapping and Quantifying Oysters Using Sonar and Photogrammetry.** Legare, Bryan, Samantha McFarland, *Center for Coastal Studies, Provincetown, MA 02657*

10:30 – 10:45 **Quantifying Fisheries Balance with a Novel Production Estimation Method.*** Zottoli, Joseph[1], Jeremy Collie[1], Sara

Schumann[2], Kate Masury[2], Hirotsugu Uchida[3], [1]*Graduate School of Oceanography, Unversity of Rhode Island, Narragansett, RI 02882*, [2]*Eating with the Ecosystem, Warren, RI 02885*, [3]*Department of Environmental and Natural Resources Economics, University of Rhode Island, Kingston, RI 02892*

10:45 – 11:00 **"So, Where Do You Come From?" Accounting for Spatial Population Structure in Recruitment Estimation.** Cadrin, Steve[1], Gavin Fay[1], Molly Morse[1], Daniel Goethel[2], Lisa Kerr[3], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*NOAA Southeast Fisheries Science Center, Miami, FL 33133*, [3]*Gulf of Maine Research Institute, Portland, ME 04101*

11:00 – 11:15 **Evaluating Alternative Management Strategies for Mixed Recreational and Commercial Fisheries: Can Harvest Slots Save the Day?*** Kasper, Jacob M.[1], Jeffrey Brust[2], Amanda Caskenette[3], Jason McNamee[4], Jason Vokoun[1], Eric T. Schultz[1], [1]*University of Connecticut, Storrs, CT 06269*, [2]*New Jersey Deparment of Environmental Protection, Port Republic, NJ 08241*, [3]*Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada, Burlington Ontario, Canada*, [4]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

11:15 – 11:30 **Feasibility of a Hook and Line Survey to Assess Tautog (*Tautoga onitis*) Abundance in Buzzards Bay and Vineyard Sound Massachusetts.** Cunningham, Tiffany, Brendan Reilly, Robert Glenn, *Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

11:30 – 11:45 **Fishery-Dependent Research for a Newly Managed Fishery: Biological Characterization of the Jonah Crab, *Cancer borealis*,**

in Rhode Island Waters.* Truesdale, Corrine[1], M. Conor McManus[2], Jeremy S. Collie[1], [1]*Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

11:45 – 12:00 ***Awards and Business***

12:00 – 13:00 ***Lunch***

13:00 – 13:15 **Avoidance of Atlantic Cod in the New England Groundfish Fishery.** Eayrs, Steve[1], Mike Pol[2], Jon Knight[3], Jim Ford[4], [1]*Gulf of Maine Research Institute, Portland, ME 04101*, [2]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*, [3]*Superior Trawl, Narragansett, RI 02882*, [4]*F/V Lisa Ann III, East Kingston, NH 03827*

13:15 – 13:30 **Contrasting Trends in the Northeast United States Groundfish and Scallop Processing Industries.** Georgianna, Daniel[1], Min-Yang Lee[2], John Walden[2], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Northeast Fisheries Science Center, Woods Hole, MA 02543*

13:30 – 13:45 **The Presence and Evolution of Na+, K+-ATPase Paralog-Switching in a Euryhaline Fish, the Alewife.*** Colby, Rebecca[1], Jonathan Velotta[2], Eric Schultz[1], [1]*Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT 06269*, [2]*Division of Biological Sciences, University of Montana, Missoula, MT 59812*

13:45 – 14:00 **Fecundity and Reproductive Life History of Anadromous Rainbow Smelt.** Chase, Bradford[1], Scott Elzey[2], Sara Turner[1], Matt Ayer[2], [1]*Massachusetts Division of Marine Fisheries, New*

Bedford, MA 02740, [2]*Massachusetts Division of Marine Fisheries, Gloucester, MA 01930*

14:00 – 14:15 **Characterizing Changing Ecosystem Phenology in Response to Climate in a Large Temperate Estuary.*** Langan, Joseph[1], Gavino Puggioni[1], Candace Oviatt[1], Lis Henderson[2], Jeremy Collie[1], [1]*Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882*, [2]*Stony Brook University, Stony Brook, NY 11794*

14:15 – 14:30 ***Break***

14:30 – 14:45 **Transmission of Apicomplexan Infection in Gray Meat Atlantic Sea Scallops.** Inglis, Susan D.[1], Jennifer Koop[2], Árni Kristmundsson[3], Mark Freeman[4], Daniel Georgianna[1], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Department of Biology, University of Massachusetts Dartmouth, Dartmouth, MA 02747*, [3]*Institute for Experimental Pathology at Keldur, University of Iceland, Reykjavik, Iceland*, [4]*Ross University School of Veterinary Medicine, Basseterre, St. Kitts, West Indies*

14:45 – 15:00 **Engaging Fishermen to Address Data Gaps and Evolve Management of the Quahog (*Mercenaria mecenaria*) in Narragansett Bay.** Malek Mercer, Anna[1], Dale Leavitt[2], M. Conor McManus[3], Thomas Heimann[1], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*Roger Williams University, Bristol, RI 02809*, [3]*Division of Marine Fisheries, Rhode Island Department of Environmental Management, Jamestown, RI 02892*

15:00 – 15:15 **Working with the Fishing Industry to Fill Data Gaps and Improve Management of the Lobster (*Homarus americanus*)**

and Jonah Crab (*Cancer borealis*) Resources in the Northeast USA. Malek Mercer, Anna[1], Aubrey Ellertson[1], David Spencer[2], Robert Glenn[3], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*CFRF Board Member, Owner of F/V Nathaniel Lee and Newport Lobster Shack, Newport, RI 02840*, [3]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

15:15 – 15:30 **The Northeast Ocean Data Portal – A Decision Support Tool for Ocean Planning.** Shumchenia, Emily[1], Nicholas Napoli[2], Kelly Knee[3], Peter Taylor[4], Kathryn Ford[5], [1]*E&C Enviroscape, Ashway, RI 02804*, [2]*Northeast Regional Ocean Council, ME*, [3]*RPS ASA, South Kingstown, RI 02879*, [4]*Waterview Consulting, Harpswell, ME*, [5]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

15:30 – 17:00 **Poster Social**

* Denotes student paper

Poster Session

P1 **Does Ocean Acidification Impact Winter Flounder (*Pseudopleuronectes americanus*) otoliths?**** Ray, Aliza[1], Elizabeth A. Fairchild[1], Christopher R. Chambers[2], [1]*Department of Biological Sciences, University of New Hampshire, Durham, NH 03824*, [2]*James J Howard Marine Sciences Laboratory, NOAA/NMFS/NEFSC, Highland, NJ 07732*

P2 **A Spatial Point Process Model to Estimate Centers of Activity from Passive Acoustic Telemetry Data.**** Winton, Megan[1], Jeff Kneebone[2], Douglas Zemekis[3], Gavin Fay[1], [1]*Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Anderson Cabot Center for Ocean Life, New England Aquarium, Boston, MA 02110*, [3]*Department of Agriculture and Natural Resources, New Jersey Agricultural Experiment Station, Rutgers, The State University of New Jersey, Toms River, NJ 08755*

P3 **Evaluating an Ecosystem-Based Fishery Management Procedure for Georges Bank Using Ceilings on System Removals.**** Hart, Amanda, Gavin Fay, *Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*

P4 **Evaluation of Otolith Growth Decoupling Phenomena in Juvenile Anadromous Alewives.**** Froburg, Kate, Lian Guo, Matthew Devine, Adrian Jordaan, *University of Massachusetts Amherst, Amherst, MA 01003*

P5 **Pop-Up Satellite Archival Tagging and Geolocation of Atlantic Halibut off Cape Cod.**** Liu, Chang[1], Crista Banks[1], Geoffrey Cowles[1], Steven Cadrin[1], Douglas Zemekis[2], Christopher McGuire[3], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Rutgers University, Department of Agriculture and Natural Resources, Toms River, NJ 08755*, [3]*The Nature Conservancy, Boston, MA 02111*

P6 **Impacts of Winter Water-Level Lake Drawdowns on Fish Growth.**** Remiszewski, Tansy T., Allison H. Roy, Jason Carmignani, *Department of Environmental Conservation, University of Massachusetts Amherst, Amherst, MA 01003*

P7 **The Gulf Stream Orphan Project: Using Citizen Science and Field Surveys to Assess the Distribution of Wayward Tropical Species along the New England Coast.**** O'Neill, Michael, *New England Aquarium, School for the Environment, University of Massachusetts Boston, Boston, MA 02125*

P8 **Determining Habitat Usage of Fourspot (*Paralichthys oblongus*) and Windowpane (*Scopthalmus aquosus*) in RI Waters.**** Housden, Ryan, Joseph Zottoli, *School of Oceanography, University of Rhode Island, Kingston, RI 02882*

P9 **Characterizing the Response of the Winter-Spring Ichthyoplankton Community to Environmental Change.**** Frey, Alison[1], J.A. Langan[1], M.C. McManus[2], J.S. Collie[1], [1]*Graduate School of Oceanography, University of Rhode Island 02882*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

P10 **Can Underappreciated Species be Part of New England's Restaurant Markets?**** Davis, Amanda[1,2], Daniel Remar[3], Michelle Staudinger[1,4], [1]*University of Massachusetts Amherst, Amherst, MA 01003*, [2]*Our Wicked Fish, South Deerfield, MA 01373*, [3]*University of New Hampshire, Durham, NH 03824*, [4]*DOI Northeast Climate Science Center, Amherst, MA 01003*

P11 **Larval Fish Shrinkage Rates.**** Nichols, Quentin[1], Harvey Walsh[2], Katrin Marancik[2], [1]*University of Massachusetts Amherst, Amherst, MA 01003*, [2]*NOAA Northeast Fisheries Science Center, Narragansett, RI 02882*

P12 **Using Observer Data to Characterize Bait Usage and Gear Configurations in the American Lobster Pot/Trap Fishery.** Chamberlain, Glenn, Sara Weeks, Amy Martins, *Northeast Fisheries Science Center, Woods Hole, MA 02543*

P13 **Performance Comparison of Length- and Age-Based Multispecies Models to Provide Fisheries Management Advice.** Boucher, Jason M.[1], Kiersten L. Curti[2], Sarah K. Gaichas[2], [1]*Integrated Statistics, Woods Hole, MA 02543*, [2]*Northeast Fisheries Science Center, Woods Hole, MA 02543*

P14 **Advancing Fishery Dependent Data Collection for Black Sea Bass (*Centropristis striata*) in the Southern New England and Mid-Atlantic Region Utilizing Modern Technology and a Fishing Vessel Research Fleet Approach.** Malek Mercer, Anna[1], Thomas Heimann[1], Jason McNamee[2], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

P15 **The Other EBFM: Ecosystem Based Fisheries Marketing Strategies to Complement Ecosystem Based Fisheries Management.** Collie, Jeremy[1], Kate Masury[2], Sarah Schumann[1], Hirosugu Uchida[3], Joe Zottoli[1], [1]*Graduate School of Oceanography, University of Rhode Island, Kingston, RI 02892*, [2]*Eating with the Ecosystem, Warren, RI 02885*, [3]*Department of Environmental and Natural Resources Economics, University of Rhode Island, Kingston, RI 02892*

P16 **Metrics to Assess Fish Assemblages in the Narragansett Bay Watershed.** Rashleigh, Brenda[1], Eivy Monroy[2], [1]*U.S. Environmental Protection Agency, Narragansett, RI 02882*, [2]*Narragansett Bay Estuary Program, Providence, RI 02908*

P17 **Towards Estimating Habitat Potential for River Herring Upstream of a Dam.** Honea, Jon, *Emerson College, Boston, MA 02116*

P18 **Exploring Potential Microscopic Changes to the Shell and Mantle of Deformed Freshwater Mussels (Unionidae and Margaritiferidae) from the Nashua River, Massachusetts.** McElwain, Andrew[1], Andrew Gascho Landis[2], Peter D. Hazelton[3], [1]*Department of Biological Sciences, State University of New York at Oswego, Oswego, NY 13126*, [2]*Department of Fisheries, Wildlife, and Environmental Science, State University of New York at Cobleskill, Cobleskill, NY 12043*, [3]*Massachusetts Division of Fisheries and Wildlife, Westborough, MA 01581*

** Denotes student poster

Abstracts:
Platform Presentations

"So, Where Do You Come From?" Accounting for Spatial Population Structure in Recruitment Estimation. Cadrin, Steve[1], Gavin Fay[1], Molly Morse[1], Daniel Goethel[2], Lisa Kerr[3], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*NOAA Southeast Fisheries Science Center, Miami, FL 33133*, [3]*Gulf of Maine Research Institute, Portland, ME 04101*

The estimation of recruitment relies on the identification of a self-sustaining stock, but representing geographic structure in a stock assessment model can be challenging. Stock identification, alternative stock assessment models, and simulation testing for several Atlantic fisheries demonstrate how assumed stock structure influences estimates of recruitment. Incorporating stock structure and stock mixing into estimation models changed the perception of recruitment events for yellowtail flounder, Atlantic bluefin tuna, and the northern stock of black sea bass. The influence of stock structure on recruitment estimates depended on movement rates and relative stock sizes. Estimates for the smaller of multiple connected population components were more sensitive to connectivity. Simulation testing, conditioned on these case studies, suggested that recognizing population structure, either in management unit definitions or estimation model structure, improved recruitment estimates. Accurate movement rates were estimated from high-quality catch and survey data, especially for the movement of strong yearclasses. However, estimating movement with intermittent tagging or stock composition data does not always improve the performance of estimation models significantly, particularly when there is limited understanding of movement dynamics. The challenge of representing geographic structure in stock assessment emphasizes the advantages of defining self-sustaining management units if possible to justify a unit-stock assumption. Accurately representing more complex population structures requires investments in high-quality data on movement and stock composition.

Fecundity and Reproductive Life History of Anadromous Rainbow Smelt. Chase, Bradford[1], Scott Elzey[2], Sara Turner[1], Matt Ayer[2], [1]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*, [2]*Massachusetts Division of Marine Fisheries, Gloucester, MA 01930*

Anadromous rainbow smelt (*Osmerus mordax*) are a small, short-lived fish that mature in near-coastal waters in the Northwest Altantic Ocean and migrate in spring to spawn in coastal rivers. Smelt formerly supported important fisheries in the Canadian Maritime Provinces and the U.S. Gulf of Maine. Smelt are important prey for a wide range of fish and wildlife in coastal rivers and marine habitats. Concerns have increased over the status of smelt in recent years due to range-wide declines in smelt harvest and range contraction at their southern extent. Despite these concerns, smelt populations are poorly assessed with details on reproductive life history remaining fragmented or undescribed. Relatively few measures of anadromous smelt fecundity have been reported, and limited information is available on age-fecundity relationships and unbiased size and age of maturity. We collected pre-spawning run smelt from coastal waters of Massachusetts to estimate fecundity, maturity, condition and other reproductive biology indicators, and compared condition, and size/age characteristics with spawning runs at coastal rivers. Nearly all spawning run smelt were mature with few fish older than age-2 (8%). Pre-spawning run smelt also had few fish > age-2 (11%), and 10% of the smelt approaching age-1 were immature. The pre-spawning run samples had stable relative fecundity (eggs/body weight) among age classes while mean total fecundity approximately doubled with each age class from age-1 to age-3 (9,026 to 42,957 eggs). The spawning run data demonstrated differences in size at age and spawning phenology among coastal rivers over a narrow geographic range.

The Presence and Evolution of Na+, K+-ATPase Paralog-Switching in a Euryhaline Fish, the Alewife.* Colby, Rebecca[1], Jonathan Velotta[2], Eric Schultz[1], [1]*Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT 06269*, [2]*Division of Biological Sciences, University of Montana, Missoula, MT 59812*

The invasion of freshwater from marine habitats has prompted extensive diversification of aquatic taxa. Mechanisms permitting this habitat switch can be investigated in extant euryhaline fishes, those that can tolerate a wide range of salinities. One potential mechanism involves the evolution and diversification of Na+, K+-ATPase (NKA), a salt transporter that powers osmoregulation at the gills. Such gene diversification may arise via genome duplication events resulting in different forms of the same gene, or paralogs. Two NKA paralogs, alpha1a and alpha1b, occur in the gills of salmonids, and are reciprocally expressed in freshwater (FW) and seawater (SW). These paralogs share a single evolutionary divergence among salmonids. Our study sought to identify NKA paralogs in a representative for an early branching lineage of teleosts, Alewife (*Alosa pseudoharengus*), test their function, and reveal their phylogenetic relationship to those of salmonids. NKA alpha1a and alpha1b were identified in Alewife and found to exhibit paralog-switching (reciprocal expression), whereby alpha1a is more highly

expressed in FW than SW and alpha1b is more highly expressed in SW than FW. Notably, in landlocked populations of Alewives paralog-switching is dampened, possibly due to lack of selective pressure for SW tolerance. Phylogenetic analysis suggests that paralog divergence in Alewife is independent of - and predates - that of Salmonids. This indicates that functional solutions to the problem of euryhalinity have arisen independently in multiple fish lineages.

Feasibility of a Hook and Line Survey to Assess Tautog (*Tautoga onitis*) Abundance in Buzzards Bay and Vineyard Sound Massachusetts. Cunningham, Tiffany, Brendan Reilly, Robert Glenn, *Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

Tautog (*Tautoga onitis*) is a relatively sedentary, slow-growing, and long-lived wrasse species, strongly associated with benthic structure. Tautog support valuable recreational and commercial fisheries in the North and Mid-Atlantic regions. Fishery-independent trawl survey data suggest that the southern New England stock has declined substantially since the 1980s. However, due to their preference for structured habitat, Tautog are not well sampled by bottom-tending trawl gear. Bottom trawls are most effective when sampling featureless substrate types (e.g., sand, mud), but are unable to sample areas of complex bottom (e.g., rock, cobble, boulder). This raises concern about the efficacy of using trawl-based abundance indices to determine stock status of this structure dwelling species. We evaluated an alternate sampling methodology using a random depth-stratified survey design, using hook and line gear, to survey areas with complex bottom types in Buzzards Bay and Vineyard Sound, Massachusetts. We compared CPUE, size, and age structure from our hook and line survey with similar data collected from fishery-independent trawl and trap surveys from the same area, to evaluate the potential contributions of a directed Tautog survey.

Habitat Use of Young-of-the-Year White Sharks (*Carcharodon carcharias*) in Three Dimensions. Curtis, Tobey[1], Michael McCallister[2], Gregory Metzger[3], Christopher Fischer[4], Matthew Ajemian[2], [1]*Atlantic Highly Migratory Species Management Division, NOAA National Marine Fisheries Service, Gloucester, MA 01930*, [2]*Harbor Branch Oceanographic Institute, Florida Atlantic University, Ft. Pierce, FL 34946*, [3]*South Fork Natural History Museum, Southampton, NY 11932*, [4]*OCEARCH, Park City, UT 84098*

Young-of-the-year (YOY) and juvenile white sharks (*Carcharodon carcharias*) have been poorly studied compared to older age classes in the northwest Atlantic Ocean. The New York Bight is a summer nursery area that has recently emerged as a new site for field research. To gain insights into movement and habitat use patterns in this area, we deployed acoustic and satellite-linked

Smart Position or Temperature transmitting (SPOT) tags on 20 white sharks (119-158 cm fork length), including six individuals additionally fitted with high-rate pop-up satellite archival tags (PSATs). Horizontal movements were generally parallel to Long Island's southern shoreline over bottom depths of less than 40 m, and across sea surface temperatures of 16-25 °C. Data from the PSATs revealed vertical oscillations between the surface and bottom, as deep as 200 m and temperatures as low as 6 °C, but the sharks spent the majority of their time swimming at depths of 10 m (± 9 m, SD), and in water temperatures of 19.5 °C (± 2 °C, SD). Thermal preferences and prey availability are likely primary influences on both horizontal and vertical habitat use within this nursery area, however additional research is needed to better quantify feeding habits and explore the potential influence of other environmental factors. These results will help to better assess exposure of YOY white sharks to recreational and commercial fishing activity, offshore energy development, and coastal habitat degradation in the New York Bight.

Avoidance of Atlantic Cod in the New England Groundfish Fishery. Eayrs, Steve[1], Mike Pol[2], Jon Knight[3], Jim Ford[4], [1]*Gulf of Maine Research Institute, Portland, ME 04101*, [2]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*, [3]*Superior Trawl, Narragansett, RI 02882*, [4]*F/V Lisa Ann III, East Kingston, NH 03827*

Avoiding or preventing the entry of low-quota species into a bottom trawl is a logical approach to reduce their mortality from capture or potential injury and risk of post-escape mortality. For fishermen, it is also an attractive option that can increase fishing time for other, more abundant target species. In the New England groundfish fishery, Atlantic cod quotas have fallen to historic lows and restrict fishing for healthier stocks of groundfish. A collaborative team of fishermen, fishing gear technologists, and a net maker developed several prototype cod-avoiding trawl designs. These designs were numerically and/or physically modelled. One design, the Ultra-low Opening Trawl (ULOT), was selected by consensus for field testing against a standard flatfish trawl in May-June 2016 in the Gulf of Maine. Six species/species groups (Atlantic cod, American plaice, yellowtail flounder, witch flounder, American lobster, and unclassified skates) comprised 92% of the total catch by weight. Catch rates of Atlantic cod were significantly reduced using the ULOT, by an average of 42.6 kg h-1or 45.2%. Catch rates of the five other species were not significantly different. Catches of small American plaice (<30 cm) were reduced by 27.9%. Small differences in catches of the largest yellowtail and witch flounder were observed. These results indicate the ULOT can increase profitability by almost 40% by conserving cod quota, and by almost 60% if cod quota is leased. ULOT may be a viable option, along with topless trawls, for fishermen to avoid cod and effectively access quotas of healthier groundfish.

Contrasting Trends in the Northeast United States Groundfish and Scallop Processing Industries. Georgianna, Daniel[1], Min-Yang Lee[2], John Walden[2], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Northeast Fisheries Science Center, Woods Hole, MA 02543*

In the northeast United States, groundfish landings have declined almost continually since 1983. Fresh groundfish processors have redeployed their capital by substituting other seafood products in place of regional groundfish and expanding into different input and output markets. Meanwhile, northeast U.S. Atlantic sea scallop landings sharply increased starting in 1998, peaked in 2004, remained relatively constant until declining in 2013. In order to leverage their favorable access to increased landings, scallop processors invested in development of new products, such as individually quick frozen (IQF) scallops, and marketing to attract new customers, both domestic and foreign. This behavior is consistent with theories of diversification in response to declining landings and investments in product development and marketing in response to increasing landings. Price and quantity indicators used to examine the effects of shifting landings and composition of landings on exvessel values show that declines in groundfish exvessel values were driven by declining quantities, which is consistent with processors substituting other products rather than biding up exvessel prices. Increases in scallop exvessel values were driven by both increasing prices for all sizes and by increasing quantities for large scallops, which is consistent with investment in marketing for larger scallops.

Use of Two Proxies to Predict the Location of Vulnerable Marine Species, Communities, Habitats and Ecosystems.* Huepel, Eric E.[1], Peter J. Auster[1,2], [1]*University of Connecticut-Avery Point, Groton, CT 06340*, [2]*Mystic Aquarium – Sea Research Foundation, Mystic, CT 06355*

As use of the ocean continues to grow in intensity and scale, management of impacts to vulnerable species, communities, habitats and ecosystems, becomes more pressing. Legal and economic pressures to improve management of these vulnerable species and habitats increase, yet data gaps in our knowledge of their distribution and abundance continue to exist. Proxies are needed for predicting potential distributions of vulnerable species and communities to aid precautionary decision-making, especially for data poor regions and species. Landscape ecology indices can be applied to bathymetric data even in data poor regions with new worldwide bathymetry coverage. We explored the utility of two proxies adapted from landscape ecology to bathymetric data as proxies for vulnerable species, communities, habitats and ecosystems. We found that these indices worked effectively as proxies for vulnerable species in general and when combined with basic information about the potential suite of species and habitats, a

more detailed and nuanced distribution can be produced for use by policymakers, managers and stakeholders.

Transmission of Apicomplexan Infection in Gray Meat Atlantic Sea Scallops. Inglis, Susan D.[1], Jennifer Koop[2], Árni Kristmundsson[3], Mark Freeman[4], Daniel Georgianna[1], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Department of Biology, University of Massachusetts Dartmouth, Dartmouth, MA 02747*, [3]*Institute for Experimental Pathology at Keldur, University of Iceland, Reykjavik, Iceland*, [4]*Ross University School of Veterinary Medicine, Basseterre, St. Kitts, West Indies*

Scallops with small, darkened and stringy adductor muscle (gray meat) occur episodically along the Eastern Atlantic Seaboard. These scallops are associated with reduced marketable biomass and mass mortality events. The condition is linked to a highly pathogenic apicomplexan parasite that targets muscle and connective tissue in scallop hosts. A series of laboratory infection trials were conducted to test whether live gray meat scallops or shucked gray meat tissue were vectors for infection to naïve scallops. Experimental groups were monitored for number of mortalities, clinical symptoms (meat color and weight, gonad condition) and the presence and intensity of the apicomplexan infection through molecular and histological analysis. Results from these experiments confirmed the parasite could be directly transmitted to scallops from freshly dead gray meat scallop tissue. However, infection trials conducted with live gray meat scallops as a vector did not transmit the infection. Apicomplexan parasites have complex life histories that include both asexual and sexual reproduction. Histological analysis identified all asexual reproductive forms, but no sexual gametes in scallop tissue. Recently the definitive host for this parasite, the common whelk Buccinum undatum, was identification in Iceland waters. Molecular analysis confirmed that the apicomplexan infecting sea scallops is Merocystis kathae in common whelks. Thus, sea scallops are the intermediate host for this parasite and transmission can be direct from highly infected scallops when they die, or from infected whelks in scallop populations. Current studies focus on identifying the presence and range of the infection in whelks associated with Atlantic sea scallops.

Evaluating Alternative Management Strategies for Mixed Recreational and Commercial Fisheries: Can Harvest Slots Save the Day?* Kasper, Jacob M.[1], Jeffrey Brust[2], Amanda Caskenette[3], Jason McNamee[4], Jason Vokoun[1], Eric T. Schultz[1], [1]*University of Connecticut, Storrs, CT 06269*, [2]*New Jersey Deparment of Environmental Protection, Port Republic, NJ 08241*, [3]*Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada,* *Burlington Ontario, Canada*, [4]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

The importance of exponentially more fecund female “megaspawners” has gained recent attention in literature because they are likely to stabilize fish stocks. In depleted stocks, modifying fishery selectivity is a mechanism hypothesized to rebuild age structure thus reestablishing megaspawners. We are modeling the implementation of such an alternative management strategy following the recent stock assessment of the Long Island Sound Tautog, Tautoga onitis. The assessment indicated that the stock is overfished, overfishing is occurring, and a 50% probability of ending overfishing within three years requires a 50% harvest reduction. Traditionally, the fishery was managed by temporal closures, bag limits, and minimum possession size. Over time, regulatory changes have increased seasonal closures, reduced daily bag limits and increased minimum harvest size from 12 to 16 inches– which may increase fishing mortality on megaspawners. As an alternative management strategy, we evaluate the use of harvest slot limits. Tautog are a candidate species for harvest slots because they are long-lived, slow growing and likely to survive release (release mortality = 2.5%). The current analysis indicates that a 16-18.5 inch harvest slot would result in a 47% harvest reduction, meeting management goals without a reduction in daily bag limits or additional seasonal closures. Long-term population projections suggest that the relative proportion of megaspawners increased dramatically under harvest slot management and once megaspawner abundance is rebuilt the stock is more resilient to overfishing. This result is likely to apply to other long-lived slow growing species.

Movement Patterns and Temperature Preferences of Thorny Skate (*Amblyraja radiata*) in the Gulf of Maine. Kneebone, Jeff[1], Tobey Curtis[2], James Sulikowski[3], John Mandelman[1], [1]*Anderson Cabot Center for Ocean Life, New England Aquarium, Boston, MA 02110*, [2]*Atlantic Highly Migratory Species Management Division, NOAA National Marine Fisheries Service, Gloucester, MA 01930*, [3]*University of New England, Biddeford, ME 04005*

Despite the establishment of a possession ban in 2003, thorny skate (*Amblyraja radiata*) are currently at historically-low biomass levels in the Gulf of Maine (GOM). At present, it is not known if their continued decline is due to ongoing fishing mortality, environmental factors that are affecting the stock through reduced productivity, distribution shifts, or a combination of these factors. Irrespective of the basis, it is critical to understand the spatial scale at which these factors may be affecting thorny skate populations; however, virtually nothing is known about thorny skate population structure in the GOM. To partially address this data gap, we examined the movement patterns of thorny skate in the GOM using conventional fisheries-

dependent tag recaptures and Wildlife Computers Mark-Report Pop-up Archival Tags (mrPAT). Fisheries-dependent recaptures (n=11) and mrPAT reports (n=88) suggest that thorny skate exhibit limited movement within the GOM over periods of 24 – 305 days, with minimum linear displacements from tagging sites ranging from 1.2 – 48.3 km. Daily temperature data obtained from mrPATs suggest that the species experiences temperatures of 2.5 – 12.5°C throughout the year, with different thermal profiles being experienced in sub-regions of the GOM. Collectively, these data suggest that thorny skate may exist as a series of localized groups in the GOM, with limited or no exchange of individuals occurring within or beyond the region in the short-term. These findings have direct implications for thorny skate vulnerability to fishing mortality and climate change, as well as for the establishment of appropriate stock boundaries and conservation measures.

Characterizing Changing Ecosystem Phenology in Response to Climate in a Large Temperate Estuary.* Langan, Joseph[1], Gavino Puggioni[1], Candace Oviatt[1], Lis Henderson[2], Jeremy Collie[1], [1]*Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882*, [2]*Stony Brook University, Stony Brook, NY 11794*

Recent work has demonstrated that interannual variation, multidecadal oscillation, and long-term change in climate can impact both the distribution and phenology of marine organisms. However, the respective impacts of these environmental drivers on seasonal patterns of habitat use remain unclear due in part to the extensive data required for such an investigation. Conducted in Narragansett Bay, a large temperate estuary near the thermal extreme of many species' ranges, the University of Rhode Island weekly fish trawl survey (1959-Present) presents a unique opportunity to understand how climate impacts the seasonality of the nearshore marine ecosystem. This dataset suggests that species' residence times have shifted by as much 3-4 months and emergent patterns may be synchronous across subgroups of organisms. Candidate species for analysis were identified as those of which 30 individuals were observed in at least 20 years of the survey and classified into "summer" and "winter" groups based on the seasonality of their presence in the estuary. For each candidate species, Dirichlet regression of the day of first and last observation in each year revealed that climate change, the North Atlantic Oscillation, seasonal temperature variation and precipitation patterns appear to impact fish and shellfish phenology in this nearshore environment. These results suggest that the residence time of seasonal resident species in inshore habitats has non-linear relationships with environmental drivers that will be critical considerations for the accurate interpretation of survey results in stock assessments and the development of seasonal harvest restrictions in the future.

Moving Beyond the Quadrat: Digitally Mapping and Quantifying Oysters Using Sonar and Photogrammetry. Legare, Bryan, Samantha McFarland, *Center for Coastal Studies, Provincetown, MA 02657*

The Eastern Oyster (*Crassostrea virginica*) is economically one of the most important shellfish species in New England and a foundation species that delivers a wide range of ecosystem services. Growing in a variety of intertidal and subtidal areas along the eastern seaboard and Gulf of Mexico, oysters have undergone a long history of overfishing that reduced oyster reefs to a fraction of their historic size. Historically, quantifying oyster abundance is a labor-intensive task requiring quadrat sampling, tongs, dredges or other potentially destructive forms of point sampling. Recent advances in technology have allowed for rapid quantification of habitat that is less destructive and more spatially complete. Here, we demonstrate the use of high-resolution boat-mounted sonar and a camera mounted on a low-flying Unmanned Aerial Vehicle to identify the spatial extent of intertidal oysters in Provincetown, MA. In addition, we demonstrate the usability of consumer grade handheld cameras and structure from motion photogrammetry to rapidly collect data and create 3D mosaics of oyster reefs insitu. With the ability to create a 3D representation of oysters at a resolution of one millimeter, this method can be used to quickly collect oyster biomass data equivalent to a what would be collected via quadrat sampling, and creating a digital record while collecting additional information about reef structure.

Working with the Fishing Industry to Fill Data Gaps and Improve Management of the Lobster (*Homarus americanus*) and Jonah Crab (*Cancer borealis*) Resources in the Northeast USA.

Malek Mercer, Anna[1], Aubrey Ellertson[1], David Spencer[2], Robert Glenn[3], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*CFRF Board Member, Owner of F/V Nathaniel Lee and Newport Lobster Shack, Newport, RI 02840*, [3]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

Despite the economic and cultural importance of the lobster and Jonah crab fisheries, scientists, managers, and industry members agree that the data being used to assess these stocks lack sufficient spatial and temporal coverage, particularly in Southern New England. Specifically, there is a mismatch between the location of primary lobster fishing grounds in this region (10-200 miles offshore) and the location where data are being collected (0-3 miles from shore). Similarly, Jonah crab fishery management efforts are hindered by major gaps in the understanding of the catch composition and operational characteristics of the fishery. The Commercial Fisheries Research Foundation developed the Lobster & Jonah Crab Research Fleet in 2013 to begin addressing these data needs and inform the assessment and management of these valuable fisheries resources. Research Fleet participants use a specialized tablet app, digital calipers, and wireless water temperature sensors to record information about their lobster and Jonah crab catch and the environment as part of their routine fishing practices.

Since 2013, the 18 fishermen participating in the Research Fleet have collected biological data from over 105,000 lobsters and 44,000 Jonah crabs as well as coupled bottom water temperatures from the Gulf of Maine to the Mid-Atlantic. The data collected by the Research Fleet are integrated into federal biosamples databases and used extensively in the lobster stock assessment and Jonah crab management plan. Ultimately, the project's approach increases the transparency of the assessment process and promotes the fishing industry's trust in the data sources being used in management measures.

Engaging Fishermen to Address Data Gaps and Evolve Management of the Quahog (*Mercenaria mecenaria*) in Narragansett Bay. Malek Mercer, Anna[1], Dale Leavitt[2], M. Conor McManus[3], Thomas Heimann[1], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*Roger Williams University, Bristol, RI 02809*, [3]*Division of Marine Fisheries, Rhode Island Department of Environmental Management, Jamestown, RI 02892*

The quahog (*Mercenaria mercenaria*) fishery is the most valuable fishery in Narragansett Bay, with a dockside value over $5 million. The quahog's complex population and fishery dynamics in combination with aggregated distribution patterns make it difficult to accurately assess the population and thus, properly manage the resource. This work pilots a novel technique that involves commercial shellfishermen using a tablet app to collect quahog data via bullrake sampling year-round, focusing on regions of Narragansett Bay not assessed by the Rhode Island Department of Environmental Management (RI DEM) hydraulic dredge survey. The catch efficiency of bullrake sampling and the RI DEM hydraulic dredge survey are calibrated via in-situ SCUBA observations, enabling integration of project data with the existing dredge survey time series. Preliminary results suggest that quahog density varies at a suite of spatial scales as a result of complex environmental conditions. Furthermore, bullrake sampling appears to document higher quahog densities than the hydraulic dredge survey by accessing different areas and habitats within Narragansett Bay. A variety of alternative stock assessment approaches that incorporate the spatial and seasonal dynamics of the quahog resource are currently being explored. Results of these alternative models will be compared to the traditional quahog stock assessment and used to refine reference points and management measures. Ultimately, this work fosters a transparent and accurate quahog management system by providing commercial shellfishermen an opportunity to actively participate in the scientific and management process.

Using Habitat Preferences and Management Strategies to Predict Northern Quahog Abundance in Narragansett Bay. McManus, M. Conor, Dennis Erkan, *Division of Marine Fisheries, Rhode Island Department of Environmental Management, Jamestown, RI 02892*

The Northern quahog (*Mercenaria mercenaria*) is a recreationally and commercially significant species in Narragansett Bay. A sessile filter-feeding shellfish, quahogs have several habitat requirements (e.g. substrate type, phytoplankton, bottom water temperatures) that can influence abundance. Quahog spatial management is complicated by regulations pertaining to water quality concerns and stock sustainability. Narragansett Bay has several areas with quahog biomass that are either permanently or conditionally closed to harvest (polluted/conditional areas) due to human consumption risks. Further, certain areas have reduced harvest through lowered daily possession limits and/or fishing seasons (shellfish management areas) intended to help sustain the stock. These area designations can limit harvest, and thus contribute to observed quahog standing stock. Since 1993, the Rhode Island Department of Environmental (RI DEM) has conducted a dredge survey to monitor the upper Narragansett Bay quahog population. To date, these data have yet been used to describe quahog abundances based on habitat features and management regulations. Such research can be valuable in identifying favorable conditions for quahogs and assessing the impact that area designations have on the stock. This work aims to use RI DEM's quahog dredge survey data to predict spatio-temporal abundances of quahogs in upper Narragansett Bay with species distribution models that account for habitat preferences and geographically-discrete management strategies. Predictions are summarized to produce annual abundance indices for comparison to mean abundance indices that have been used in previous stock assessments. These modeled-derived abundances will be considered for incorporation in Rhode Island's upcoming quahog stock assessment.

New Technology and Old Infrastructure: Using High Resolution Imaging Sonar to Study Fish Passage.* Rillahan, Chris[1], Derrick Alcott[2], Theodore Castro-Santos[3], Pingguo He[1], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Organismic and Evolutionary Biology, University of Massachusetts Amherst, Amherst, MA 01003*, [3]*Leetown Science Center, S.O. Conte Anadromous Fish Research Center, U.S. Geological Survey, Turners Falls, MA 01376*

It is well known that human-caused alterations to the natural environment can have significant effects on wild fish migration, behavior and subsequently their populations. However, some of these effects may be difficult to quantify due to difficulties of making observations in coastal and estuarine environments where water visibility is typically poor. This study used a high-

resolution imaging sonar (ARIS Explorer 3000) to study the predator-prey dynamics of striped bass and river herring around the Herring River dike (Wellfleet, MA). The dike, built in 1909, significantly altered the hydrodynamics of the estuary system, resulting in a high flow channel and a deep scour pool. Data from this study has shown that striped bass use this pool as a feeding area when foraging for migrating river herring. Striped bass were observed to enter the pool approximately one hour before the outgoing tide. Large numbers of individuals remained in this pool during peak outflow then moved back out to coastal waters during incoming tides. Herring passage duration, as well as the passage success appears to be inversely correlated with the arrival of migratory striped bass. These results illustrate that striped bass have exploited the changes in the ecosystem structure to increase predation opportunities.

The Northeast Ocean Data Portal – A Decision Support Tool for Ocean Planning. Shumchenia, Emily[1], Nicholas Napoli[2], Kelly Knee[3], Peter Taylor[4], Kathryn Ford[5], [1]*E&C Enviroscape, Ashway, RI 02804*, [2]*Northeast Regional Ocean Council, ME*, [3]*RPS ASA, South Kingstown, RI 02879*, [4]*Waterview Consulting, Harpswell, ME*, [5]*Massachusetts Division of Marine Fisheries, New Bedford, MA 02740*

The Northeast Ocean Data Portal is an online, public repository of scientific data and maps describing key aspects of the ocean ecosystem and human uses in the Northeast U.S. The Portal is intended to be a shared source of regional information that will inform and support decision-making and the activities of the many stakeholders who interact with the ocean. The Portal was developed as a foundational element of the Northeast Ocean Plan, the first regional ocean plan in the U.S. It is maintained by a Portal Working Group with oversight by the Regional Planning Body (RPB; a federal-state-tribal partnership). The Portal provides authoritative data and maps pertinent to managers and analysts working in various agencies or institutions on diverse topics and at various scales, including fisheries and fisheries management. The Portal enables access to thousands of maps, and users can download many of the underlying datasets that support the maps. Regional-scale maps and downloadable datasets related to fisheries resources and management include bathymetry, federal and state trawl data, Vessel Monitoring System (VMS) data, and fisheries spatial regulations. Maps and datasets on the Portal are accompanied by reports, animations, story maps, and other tools that convey important considerations for how the data could be applied or used. This presentation will introduce the Portal and describe some of the tools that facilitate users' understanding of the content, as well as some of the case studies developed by the RPB and others to document uses of the Portal in decision-making.

Fishery-Dependent Research for a Newly Managed Fishery: Biological Characterization of the Jonah Crab, *Cancer borealis*, in Rhode Island Waters.* Truesdale, Corrine[1], M. Conor McManus[2], Jeremy S. Collie[1], [1]*Graduate School of Oceanography, Unversity of Rhode Island, Narragansett, RI 02882*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

The Jonah crab, *Cancer borealis*, supports a growing fishery in southern New England. However, management of the species has lagged its commercial popularity and no stock assessment currently exists due to a lack of available data on Jonah crab life history and fishery dynamics. In this study, fishery-dependent sampling was conducted on commercial fishing vessels targeting Jonah crab between June 2016 and August 2017 in Rhode Island Sound (NMFS Statistical Areas 537 and 539). Biological data on Jonah crabs, including carapace width, sex, ovigerous condition, shell condition, and cull status, were recorded for 9,485 individuals caught in commercial traps. Catch-per-trap and bycatch species composition was described for a random subset of traps within each trawl. These data were analyzed to describe length frequencies in the commercial fishery as well as seasonal trends in catch per trap, sex ratios, and growth. This data provides essential information that has direct relevance for future stock assessments. Further, this project serves as a pilot monitoring program which could be implemented to collect biological data across the species' range, supporting the needs of future Jonah crab stock assessments.

Distribution and Abundance of Cephalopod Paralarvae on the Northeast US Shelf. Walsh, Harvey[1], David Richardson[1], Leah Lewis[2], Liz Shea[3], [1]*NOAA Northeast Fisheries Science Center, Narragansett, RI 02882*, [2]*Scripps Institute of Oceanography, San Diego, CA 92037*, [3]*Delaware Museum of Natural History, Wilmington, DE 19807*

Cephalopod paralarvae were identified from plankton collections from the Ecosystem Monitoring program of the NEFSC to examine the species composition, seasonality, and habitat use. Paralarvae were identified from almost 1400 stations that were conducted on shelf-wide surveys from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia during multiple seasons from 2010 to 2012. Twenty-one taxa of cephalopods from 13 families were identified. Longfin inshore squid (*Doryteuthis pealeii*) was the most abundant taxon and comprised over 75 % of the total abundance of paralarvae collected. Cephalopod paralarvae were most abundant in the Middle-Atlantic Bight, Southern New England, and Georges Bank regions of the Northeast US Shelf and least abundant in the Gulf of Maine. Longfin inshore squid were collected during all seasons, but most abundant from July to October with the preferred habitat on the mid-shelf (20 – 50 m) with surface water temperatures from 17 – 25 o C and salinities less than 33. The

other taxa were also most abundant from July to October, but at deeper stations (> 80 m) with surface water temperatures > 21 o C and salinities > 34. We estimated Longfin inshore squid ages based on wild paralarval European squid (*Loligo vulgaris*) growth rates to calculate hatch dates. More than 85 % of the Longfin inshore squid collected were estimated to have hatched during July to October, and along with abundance and size distribution patterns indicate spawning on the Northeast US Shelf occurred mainly in the summer.

Quantifying Fisheries Balance with a Novel Production Estimation Method.* Zottoli, Joseph[1], Jeremy Collie[1], Sara Schumann[2], Kate Masury[2], Hirotsugu Uchida[3], [1]*Graduate School of Oceanography, Unversity of Rhode Island, Narragansett, RI 02882*, [2]*Eating with the Ecosystem*, [3]*Department of Environmental and Natural Resources Economics, University of Rhode Island, Kingston, RI 02892*

The selective tendencies of fisheries lead to disproportionate removals of biomass from the ecosystem. These removals can disrupt ecosystem structure and function and lead to reduced total yield. Harvesting species in proportion to their biomass production is a potential ecosystem-based fishery management solution. We quantified the degree of symmetry between the production and catch of the dominant species in four ecological production units on the Northeast U.S. continental shelf from 1991-2015. Production estimates were obtained by adding annual biomass lost through mortality to surplus production estimates from fitted stochastic surplus production models in continuous time. Results show that both catch and relative exploitation have decreased since 1991. Calculation of Levin's normalized niche breadth reveals that the Mid-Atlantic Bight fishery-ecosystem balance has increased while Georges Bank, the Gulf of Maine, and Western Scotian Shelf balances have fluctuated with a net decline largely driven by recent years. The modern decline in balance appears to be due to disproportionate increases in lobster landings in the northern ecosystems. Linear regression of Simpson's reciprocal index applied to catch and production found a positive correlation ($R = 0.16$, $p\text{-val}=0.05$) indicating that Northeast U.S. fisheries respond to or drive ecosystem structure.

Abstracts:
Poster Presentations

Performance Comparison of Length- and Age-Based Multispecies Models to Provide Fisheries Management Advice. Boucher, Jason M.[1], Kiersten L. Curti[2], Sarah K. Gaichas[2], [1]*Integrated Statistics, Woods Hole, MA 02543*, [2]*Northeast Fisheries Science Center, Woods Hole, MA 02543*

Accounting for species interactions in both stock assessment modeling and fisheries management is of increasing interest. Most current scientific advice for fisheries management is based on results from single species population dynamics models, but, if fisheries management is to become ecosystem-based, models that consider multispecies interactions are required. Multispecies models provide a level of intermediate complexity between single population and full ecosystem models and potentially combine the best aspects of current single species assessment models with key ecological linkages between species. Before such models can be made operational, it is necessary to fully understand them. Here, we develop and evaluate two multispecies models for tactical use in providing fisheries management advice. A general multispecies statistical catch-at-age model and a length-based multispecies model are fit to a dataset of the Georges Bank fish community to evaluate model performance. Age-based models have the added benefit of better accounting of recruitment and year-class strength, while also directly incorporating the size-dependent processes of predation and fishing mortality. The primary objective of this work is to assess the impact of structural uncertainty in length- and age-based multispecies population dynamic models on the estimation of underlying population parameters, with a focus on biomass, recruitment, mortality, and predation as metrics of performance. This comparison is particularly important for multispecies models, which incorporate an added source of mortality through size-dependent predation.

Using Observer Data to Characterize Bait Usage and Gear Configurations in the American Lobster Pot/Trap Fishery. Chamberlain, Glenn, Sara Weeks, Amy Martins, *Northeast Fisheries Science Center, Woods Hole, MA 02543*

The Northeast Fisheries Observer Program (NEFOP) deploys highly trained fisheries observers across a wide range of gear types in fisheries from Maine to North Carolina. Since 2012, NEFOP has covered the pot/trap lobster fishery on trips ranging from a few hundred yards from shore

to the U.S.-Canada border. The suite of data collected during these trips includes a comprehensive description of the gear used during a trip and haul-level bait data. The configuration of gear deployed and bait used changes temporally and spatially. As interest develops in fixed gear use along our coastlines and trends in bait usage drive other important fisheries, these data are becoming more important to the fishing industry, fishery managers, and other stakeholders. The New England Fishery Management Council recently used bait data as part of an amendment to the Atlantic Herring fishery management plan, and the Protected Resources Division of the Greater Atlantic Regional Fisheries Office plans to make use of the gear data.

The Other EBFM: Ecosystem Based Fisheries Marketing Strategies to Complement Ecosystem Based Fisheries Management. Collie, Jeremy[1], Kate Masury[2], Sarah Schumann[1], Hirosugu Uchida[3], Joe Zottoli[1], [1]*Graduate School of Oceanography, University of Rhode Island, Kingston, RI 02892*, [2]*Eating with the Ecosystem Warren, RI 02885*, [3]*Department of Environmental and Natural Resources Economics, University of Rhode Island, Kingston, RI 02892*

Participants from across the fisheries governance spectrum see a need to understand the structure and functioning of marine ecosystems and to apply this understanding to the management of fisheries. But fisheries practitioners have been slower to apply ecosystem-based logic to seafood marketing. This project begins to address this gap by exploring a basic question for New England fisheries: how well does the composition of species in our regional New England seafood marketplace match the composition of species in our local ecosystems (and what would make these two things match better)? One phase of this multiphase interdisciplinary project utilized a citizen science research project where we enrolled 85 consumers from across New England in a 6 month study which resulted in about individual 3000 market visits, over 1000 purchased local fish, and 425 pairwise comparisons to assess the market availability of New England caught seafood to New England consumers and the role of consumer preference in driving disparities between ecosystem production and market share for certain species, as well as helping to identify opportunities for growth for those species that are underrepresented in the marketplace but enjoyed by consumers.

Can Underappreciated Species be Part of New England's Restaurant Markets? Davis, Amanda[1,2], Daniel Remar[3], Michelle Staudinger[1,4], [1]*University of Massachusetts Amherst, Amherst, MA 01003*, [2]*Our Wicked Fish, South Deerfield, MA 01373*, [3]*University of New Hampshire, Durham, NH 03824*, [4]*DOI Northeast Climate Science Center, Amherst, MA 01003*

In 2015, ninety percent of all seafood consumed in the U.S. was imported and consumers spent over $60 billion on seafood in restaurants. In New England, a region viewed as a seafood destination, restaurant menus offer a monotony of heavily imported and historically exploited fish like salmon, swordfish, and tuna, instead of local species considered "underappreciated" like monkfish, scup, or whiting. While underappreciated species are available to restaurants through Community Supported Fishery Programs (CSFs) - where fishermen coalitions deliver their catch to restaurants- few restaurants partner with these CSFs to date. New collaborations between restaurants and CSFs could bolster the local fishing economy, reduce fishing pressure on commonly targeted species, and offer consumers a diversity of seafood choices that are not imported or overly-exploited species. During summer 2018, this project will partner six New England restaurants with CSFs or similar distributors to evaluate consumers' perceptions and demand for underappreciated species for sixteen weeks. Results will assess whether certain underappreciated species could grow in popularity with consumers and restaurants if the species were more accessible in the marketplace. Additionally, we will evaluate whether these species are anticipated to remain accessible to fishermen in the face of changing climate conditions. Ultimately this study will clarify if restaurants could have a new role within New England's fishery and consider if underappreciated species can be alternative and stable sources of local protein in the coming decades. These social, economic, and environmental evaluations will help stakeholders prepare and plan a sustainable future for New England's fishery.

Characterizing the Response of the Winter-Spring Ichthyoplankton Community to Environmental Change. Frey, Alison[1], J.A. Langan[1], M.C. McManus[2], J.S. Collie[1], [1]*Graduate School of Oceanography, University of Rhode Island 02882*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

Estuaries provide essential nursery habitats for many marine fish. In this role, Narragansett Bay, the largest estuary in New England, likely contributes significantly to the productivity of regional fisheries. However, the ichthyoplankton community of this system has yet to be fully characterized. As climate change is expected to particularly impact the early life stages of many species, this work will focus on the rapidly warming winter-spring period to gain insight into the patterns of abundance, diversity, and spatial distribution of larval fish across Narragansett Bay. Larval fish were collected, identified, and counted in monthly plankton tows conducted by the RI Department of Environmental Management (DEM) in late winter/early spring across 14 stations throughout the Bay from 2001 - 2008. These data were then supplemented with an identical survey performed by the URI Graduate School of Oceanography and DEM during the same portion of the year in 2016 and 2017. Using this time series, the composition and phenology of the ichthyoplankton were evaluated and patterns were compared to trends in early spring conditions. Further, analyses of differences in larval fish community between the original (2001-2008) and update (2016-2017) surveys sought to identify any environmentally-driven ecological shifts that occurred over the intervening decade. With an improved understanding of the nursery dynamics of Narragansett Bay, the results from this project will aid in creating better assessments of the role of this estuary in fisheries production and anticipating future trends in community composition with continued climate change.

Evaluation of Otolith Growth Decoupling Phenomena in Juvenile Anadromous Alewives.
Froburg, Kate, Lian Guo, Matthew Devine, Adrian Jordaan, *University of Massachusetts Amherst, Amherst, MA 01003*

Alewife, *Alosa pseudoharengus*, are an ecologically and economically valuable species whose population dynamics are not well-understood. Measurements of juvenile alewife growth rate could be used as a metric of population health during freshwater life stages. In many fish species, otolith increment widths are used to estimate somatic growth rate, but this method has yet to be validated in alewife and assumes isometric change with age. Otolith growth rates can become decoupled with somatic growth rates at higher temperatures in some species and therefore, no longer accurately estimate somatic growth. Additionally, food intake can further impact how well otolith growth reflects somatic growth. In this study, we tested for decoupling phenomena in juvenile alewife by examining the relationship between otolith growth and somatic growth for fish growing in ecologically-relevant environmental temperatures and multiple levels of food availability. Field-collected anadromous juvenile alewives were maintained in experimental tanks in two temperatures (21°C or 25°C) and two levels of food availability (fed 1% or 2% tank biomass daily). Fish were weighed on day 7 and day 20 of the experiment to calculate a specific growth rate. After 20 days of exposure to treatments, all fish were sampled and otoliths were removed for analysis. We measured increment widths of the outermost 20 rings to determine the otolith growth rate during the experiment. The relationship between increment width and somatic growth rate was examined across temperatures and food treatments to determine the presence of decoupling phenomenon in juvenile alewife otoliths.

Evaluating an Ecosystem-Based Fishery Management Procedure for Georges Bank Using Ceilings on System Removals. Hart, Amanda, Gavin Fay, *Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*

As ecosystem based fishery management gains traction, there is an increasing need to develop and evaluate management procedures and ecosystem models capable of producing management advice comparable to that of single species assessments. Multi-species production models provide a useful framework to assess the performance of different management strategies by including species interactions and monitoring catch of individual species, aggregate trophic groups, and entire ecosystems. We developed an ecosystem based management framework that imposes a ceiling on total system removals and assessed its performance using Management Strategy Evaluation. Simulations were carried out for a model system containing ten species characteristic of the commercially targeted fish community on Georges Bank, USA. We evaluate the performance of management procedures with different ceilings on system removals using ecological, societal, and economic objectives and compare their performance to simulations under status quo management. Our results show how ecosystem reference points such as ceilings on system removals can be a useful component of strategies aimed towards improving management performance against ecosystem goals in a complex multispecies fishery.

Towards Estimating Habitat Potential for River Herring Upstream of a Dam. Honea, Jon, *Emerson College, Boston, MA 02116*

Many owners of old mill dams are unaware of the negative environmental impacts of their dams. This poster describes a project to develop materials to help educate dam owners and other affected stakeholders, including members of the public, about one of those negative impacts: diminished river herring populations. In 2016, there were 3 substantial dams on the Shawsheen River in Andover, Massachusetts. By spring of the following year—due to the years'-long efforts of nonprofits, state and federal natural resource agencies, and local officials—only 1 remained and 4 miles of the river was again flowing freely to the Merrimack River and Gulf of Maine. A hastily organized, but ultimately popular, volunteer herring count produced data to estimate that approximately 1,500 river herring had strayed into the newly opened reach during the 2017 spawning season, with many dozens of herring observed at the base of the last remaining dam. If the owners of that dam were made aware of the potential spawning habitat upstream of their dam, which appears to be substantially more than that opened by the other 2 dams, they might be more willing to have it removed. To that end, this project aims to adapt a current river herring model or re-parameterize a population model developed for endangered populations of Pacific salmon in the Pacific Northwest to estimate the potential for the habitat upstream of the remaining dam to support additional river herring.

Determining Habitat Usage of Fourspot (*Paralichthys oblongus*) and Windowpane (*Scopthalmus aquosus*) in RI Waters. Housden, Ryan, Joseph Zottoli, *School of Oceanography, University of Rhode Island, Kingston, RI 02882*

Southern New England waters including Narragansett Bay have offered historically favorable environmental conditions for windowpane (*Scopthalmus aquosus*) and fourspot flounder (*Paralichthys oblongus*), making coastal Rhode Island important habitat for these understudied and data-poor species. Catch accountability measures have been in place since 2015 recently culminating with gear restrictions in the area south of Block Island in 2017. It is imperative that we understand where these flounder reside in order to relieve the burden of local fishermen. We aim to characterize the timing, life stages, and inter-annual variability of the use of Rhode Island waters by these species using data from the URI GSO weekly fish trawl and the RI DEM seasonal survey. Furthermore, we plan to use the physical characteristics collected by the surveys and substrate type as predictors in a generalized linear model to identify important environmental determinants of habitat. Preliminary analysis of life-stages calculated using the von-Bertalanffy growth equation, length data, and published age-at-maturity show that the primary constituents in Narragansett Bay are adult fourspot (>2.7 years) and juvenile windowpane (<3 years). Initial investigation of seasonal trends shows that fourspot are summer residents in the Bay while the windowpane were present year-round, with a peak during the summer until recently. By fitting a GLM in addition to age-based observations, we should glean enough information to better understand the preferred habitats of various life stages of fourspot and windowpane flounder.

Pop-Up Satellite Archival Tagging and Geolocation of Atlantic Halibut off Cape Cod. Liu, Chang[1], Crista Banks[1], Geoffrey Cowles[1], Steven Cadrin[1], Douglas Zemekis[2], Christopher McGuire[3], [1]*School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Rutgers University, Department of Agriculture and Natural Resources, Toms River, NJ 08755*, [3]*The Nature Conservancy, Boston, MA 02111*

Atlantic halibut are a 'Species of Concern' in U.S. waters and very little is known about their stock structure and life history. The rejection of the 2015 stock assessment has drawn attention to the paucity of information for assessing and managing this stock. To investigate movement patterns and stock structure, we initiated a program during the summer of 2017 in which halibut were tagged off Cape Cod using pop-up satellite archival tags (PSATs; n=9) and data storage tags (DSTs; n=4). A hidden Markov model-based geolocation method that was previously developed for other groundfish species will be used to estimate the movement tracks of the tagged halibut, based on the tag-recorded depth and temperature data. To

demonstrate the applicability of the method to halibut, we geolocated an existing PSAT dataset derived from halibut tagged off coastal Maine by the Maine Department of Marine Resources. The data allowed us to quantify the sensitivity of the geolocation to archival time step and instrument precision, thereby permitting specification of optimal tag setup for the current project. Geolocations of halibut from the Maine DMR dataset as well as sensitivities to tag settings will help us to accurately model movements of halibut.

Advancing Fishery Dependent Data Collection for Black Sea Bass (*Centropristis striata*) in the Southern New England and Mid-Atlantic Region Utilizing Modern Technology and a Fishing Vessel Research Fleet Approach. Malek Mercer, Anna[1], Thomas Heimann[1], Jason McNamee[2], [1]*Commercial Fisheries Research Foundation, Kingston, RI 02881*, [2]*Rhode Island Department of Environmental Management, Jamestown, RI 02892*

Black sea bass is an ecologically and economically important species, but assessment and management efforts have not been reflective of the shifting distribution and growing abundance of this species, in part due to a dearth of data from throughout the species range. As a result, thousands of pounds of black sea bass are discarded at-sea and economic opportunities are lost. To address this issue, the Commercial Fisheries Research Foundation developed the Black Sea Bass Research Fleet to engage fishermen from the trawl, lobster pot, fish pot, gillnet, and rod and reel fisheries in collecting critically needed biological black sea bass data from areas and times of year not covered by existing surveys. Research Fleet participants use a specialized app to collect data about their fishing effort, catch, and bycatch, including the length/sex of individual black sea bass. Black sea bass are also retained for analysis of sexual maturity, diet, and age. To date, the Research Fleet has sampled over 6,000 black sea bass at sea and collected over 900 black sea bass for laboratory analysis. By virtue of the Research Fleet's inclusion of a wide variety of gear types and vessel sizes, the data are seasonally and spatially comprehensive, thus providing a unique perspective into large-scale trends, such as the presence of three strong year classes that are persistent in both offshore and inshore waters. Ultimately, the data from the Research Fleet will be used to reduce uncertainties in the stock assessment, inform management, and expand fishery opportunities.

Exploring Potential Microscopic Changes to the Shell and Mantle of Deformed Freshwater Mussels (Unionidae and Margaritiferidae) from the Nashua River, Massachusetts. McElwain, Andrew[1], Andrew Gascho Landis[2], Peter D. Hazelton[3], [1]*Department of Biological Sciences, State University of New York at Oswego, Oswego, NY 13126*, [2]*Department of Fisheries, Wildlife, and*

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The inland waters of the United States and Canada contain approximately 298 species of freshwater mussels (Margaritiferidae: 5, Unionidae: 293). Freshwater mussels are intriguing because they are parasites of fishes during their larval period and because they use their gills for brooding glochidia, respiration, and filter feeding. Freshwater mussels are valued for the ecosystem service of removing particles from the water; however, this form of feeding leaves them vulnerable to contaminants in the water. Unfortunately, we are losing many species as a result of contaminants, habitat degradation, non-native species introductions, and potentially diseases. Herein we report preliminary results from an investigation into a shell deformity among *Elliptio complanata*, *Lampsilis radiata*, *Strophitus undulatus* (Unionidae), and *Margaritifera margaritifera* (Margaritiferidae) from the Nashua River, Massachusetts that were collected during the summer of 2017. Affected mussels display a truncated posterior shell margin and the severity of this deformity ranges from slight to severe. Prevalence values and sample sizes (data sourced from whole mussels and empty shells) are as follows: *E. complanata*, 49%, n = 71; *L. radiata*, 33%, n = 3; *S. undulatus*, 100%, n = 1; *M. margaritifera*, 57%, n = 7. It has been proposed that these deformities are caused by either agricultural or household chemicals, or possibly parasitic infection (Strayer 2008). We are interested in exploring the mechanisms that are responsible for this shell deformity to hopefully shed light on the responsible factors. We are examining potential microscopic changes to the shell using light and scanning electron microscopy, histopathological changes to the mantle, and shell thin-sections to look for changes in growth and longevity. We are presently uncertain whether this deformity results from shell damage or cellular changes to the mantle that would alter shell growth. Although the primary literature contains little information about shell deformities among freshwater mussels, we suspect this problem may occur elsewhere in the Northeastern U.S.

Larval Fish Shrinkage Rates. Nichols, Quentin[1], Harvey Walsh[2], Katrin Marancik[2], [1]*University of Massachusetts Amherst, Amherst, MA 01003*, [2]*NOAA Northeast Fisheries Science Center, Narragansett, RI 02882*

Fish larvae shrink during death and preservation, largely due to water loss. Shrinkage rates are used to estimate the live length of fish larvae, to improve estimates of length-age relationships. Larval fish abundance and age are then used to estimate information about fish populations integral to stock assessments and other fisheries management questions. Shrinkage rates have been calculated for several species, individually, but a broad assessment of shrinkage across species has not been published and there are no data for most taxa. We calculated shrinkage rates and compared among groups of 150 fish collected in the Slope Sea, between the northeast United States continental shelf edge to the Gulf Stream, and the southeast United States continental shelf from North Carolina to Florida. The larvae were measured on board the ship immediately after removal from the net, before being preserved in either formalin or ethanol. These fish were then remeasured in the lab after preservation to calculate a shrinkage rate. We estimate an average shrinkage of 10.8% across species. The relationship showed a clear change from the live length to the post preservation length (R^2=0.974, $p<0.001$) that was similar among species. The shrinkage rates calculated in this study were also similar to those calculated in three single-species studies estimating shrinkage, suggesting a master model to calculate live length from preserved length may be possible.

The Gulf Stream Orphan Project: Using Citizen Science and Field Surveys to Assess the Distribution of Wayward Tropical Species along the New England Coast. O'Neill, Michael, *New England Aquarium, School for the Environment, University of Massachusetts Boston, Boston, MA 02125*

Each summer, the Gulf Stream is responsible for transporting tropical fish, larvae, and eggs north to the coast of New England. Many, if not all, will fail to survive their first New England winter as water temperatures drop below the tolerance of these Caribbean species. For decades, marine research institutions, universities, aquariums, divers, and hobbyists have observed this seasonal phenomenon and have independently collected data and specimens but the transmission of data has been largely anecdotal. From August to October 2017, in partnership with the Center for Coastal Studies and New England Aquarium, the Gulf Stream Orphan Project conducted a field survey of Pleasant Bay in Orleans, Massachusetts to assess species distribution and environmental factors that correlate with the Gulf Stream Orphan phenomenon. The coupling of formal research endeavors and citizen science engagement may help evaluate the ecological impact and biogeographic implications of this phenomenon in the Northeast. The goal of the Gulf Stream Orphan Project is to build a comprehensive data set with contributions from researchers and citizen scientists to better understand the phenomenon and its environmental impact.

Metrics to Assess Fish Assemblages in the Narragansett Bay Watershed. Rashleigh, Brenda[1], Eivy Monroy[2], [1]*U.S. Environmental Protection Agency, Narragansett, RI 02882*, [2]*Narragansett Bay Estuary Program, Providence, RI 02908*

Freshwater fish are ecologically important in stream ecosystems, and they provide significant value to humans. Historically, the streams and rivers of southern New England supported moderately diverse and abundant assemblages of native fishes. Currently, these habitats are impacted by both environmental change and land development, altering flow and increasing water temperature. As a result, the Narragansett Bay Estuary Program and its bi-state stakeholders are interested in assessing status and trends of freshwater fish in the watershed. Fish data collected by state environmental agencies were compiled for the watershed, and two metrics –relative abundance of fish species that prefer cold or cool water and/or flowing water – were calculated and summarized by HUC10 watersheds. In the Narragansett Bay watershed, the percent relative abundance of cold-coolwater and fluvial species ranged from 11% and 9% in the Palmer River, to 67% and 65% in the Upper Blackstone River, respectively. The pattern was largely driven by brook trout, a coldwater, fluvial species that is highly valued for conservation and recreation. Lower values of these metrics may be due to stressors or environmental setting (e.g., coastal streams); higher metric values are indicative of good environmental health, and their distribution within the study area provides a benchmark for future assessment. Future steps include calculating additional metrics and indices, and relating these to environmental factors and stressors.

Does Ocean Acidification Impact Winter Flounder (*Pseudopleuronectes americanus*) otoliths?

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Winter flounder (*Pseudopleuronectes americanus*), an economically important flatfish found in the northwest Atlantic, inhabits variable carbon dioxide (CO_2) environments during spawning and its early life stages. Winter flounder in the Gulf of Maine (GOM) may be especially susceptible to ocean acidification; as a cold water body with many freshwater and nutrient loading inputs, the GOM may have less capacity to buffer against acidification than other marine systems. Ocean acidification, coupled with increased global ocean temperatures, is known to impact shell calcification in marine calcifiers and otolith formation in some fish. Impacts to otoliths could result in variable calcium carbonate precipitation leading to altered otolith shape because of decreased seawater pH and physiological stress to the fish. To determine if these scenarios would be possible, we examined how the morphology of winter flounder otoliths varied with exposure to different levels of CO_2 and temperature conditions during the early life history period. Adult winter flounder were collected from the southern GOM, spawned in the laboratory, and fertilized eggs were reared under three different pCO_2 treatments (ambient, mid-level pH, and high level pH) and three different temperature combinations for embryos (~4, 7, and 10°C) and larvae (~7, 10, and 13°C). Winter flounder were reared until fish underwent metamorphosis, classified by left eye migration, and then were preserved for otolith analysis. Sagittal otoliths (n=183) were extracted, imaged using scanning electron microscopy, and analyzed using ImageJ to measure morphological metrics including size (length, width), shape (circumference, roundness), and surface structure (presence of secondary growth lobes). Deviations driven by CO_2 from normal (isometric), population-specific relationships between otolith dimensions and fish size were tested by computing residuals from these relationships and analyzed for patterned deviations due to CO_2 treatment. Results to date will be discussed.

Impacts of Winter Water-Level Lake Drawdowns on Fish Growth. Remiszewski, Tansy T., Allison H. Roy, Jason Carmignani, *Department of Environmental Conservation, University of Massachusetts Amherst, Amherst, MA 01003*

Winter water-level drawdowns are conducted in many New England lakes with the goal of killing nuisance aquatic vegetation, among other purposes. If winter drawdowns reduce vegetation, there may be negative consequences for littoral fish, as the complex structure of naturally vegetated lake habitat functions as a resource base and refugia for many species of fish. We asked whether winter drawdowns alter growth rates of three native fish species: largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), and yellow perch (*Perca flavescens*). We sampled 12 lakes with a range of annual drawdown magnitude and 2 non-drawdown controls using boat electrofishing and a beach seine. A subset of the sampled fish were brought into the lab where fish were measured and aged using sagittal otoliths. Annuli lengths were used to calculate yearly growth rates for the first 3 years of life and growth rates were compared to annual drawdown metrics (e.g., amplitude, degree of shoreline exposed). We expect that pumpkinseed and young of year largemouth bass growth rates will be negatively affected related to winter drawdown amplitude since these fish feed on littoral macroinvertebrates that are likely to be impacted by drawdowns. Older bass and yellow perch, in comparison, may show less impact by drawdowns since feeding habits are more diversified among both littoral and pelagic habitat and among trophic levels. Our results may be used to inform lake management strategies that minimize impacts to native fish species.

A Spatial Point Process Model to Estimate Centers of Activity from Passive Acoustic Telemetry Data. Winton, Megan[1], Jeff Kneebone[2], Douglas Zemekis[3], Gavin Fay[1], [1]*Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA 02744*, [2]*Anderson Cabot Center for Ocean Life, New England*

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Failure to account for time-varying detection ranges when inferring space use of marine species from passive acoustic telemetry data can bias estimates and result in erroneous biological conclusions. While the need to address this potential source of bias is widely cited, it is more often ignored in practice due to a lack of available statistical methods. Here we describe and apply a hierarchical spatial point process model for estimating individual centers of activity (COAs) from acoustic telemetry data that can be easily modified to account for time-varying detection probabilities. We use simulation testing to evaluate the suitability of the proposed models for estimating COAs and compare their performance to that of the popular weighted mean COA approach over a variety of scenarios. We illustrate how the approach can be applied to correct for variable detection ranges, even when mechanistic drivers of variability are not well understood, by integrating data from moored, known-location test tags. Finally, we demonstrate how accounting for time-varying detection probabilities can impact estimates of space use by fitting the model to acoustic detection data from a tagged black sea bass (*Centropristis striata*) collected on a receiver array off the east coast of the United States. Our approach provides a general framework for estimating individual COAs that can be modified on a study-specific basis to ensure that resulting patterns of space use truly reflect a species' movements and behavior, rather than variation in receiver detection ranges.