State of the Science Workshop 2020 Lightning Talks

Workshop Session 3

12:15-1:30 pm Tuesday, November 17, 2020

12:15-12:20
Status of NMFS Survey Activities Impacted by Wind Development
Andy Lipsky | NOAA Northeast Fisheries Science Center

12:20-12:25
Migratory Paths of Horseshoe Crabs in Peril Due to Offshore Energy Development
John Tanacredi | Center for Environmental Research and Costal Oceans Monitoring (CERCOM)

12:25-12:30
Pelagic Fish and Zooplankton Abundance and Distribution in the New York Bight
Joseph Warren | Stony Brook University

12:30-12:35
Large Bony Fish Information from New York OPA
Jeff Clerc | Normandeau Associates Inc.

12:35-12:40
5 min Q&A and Discussion

12:40-12:45
The BOEM 'RODEO' Program: Lessons Learned from Environmental Monitoring at multiple U.S. Offshore Wind Farms
Kristen Ampela | HDR, Inc.

12:45-12:50
Mapping the Distribution and Habitat Use of Atlantic Cod Spawning Aggregations on Cox's Ledge to Assess Potential Impacts of Offshore Wind Development
Rebecca Van Hoeck | University of North Carolina at Chapel Hill
Ali Frey, University of Massachusetts Dartmouth School for Marine Science & Technology

12:50-12:55
Multi-scale Relationships between Marine Predators and the Distribution of Forage Fish
Evan Adams | Biodiversity Research Institute

12:55-1:00
Benthic habitat and epifaunal monitoring at the Block Island Wind Farm
Zoe Hutchison | University of Rhode Island

1:00-1:05
5 min Q&A and Discussion

1:05-1:10
Expected Effects of Proposed Large Scale Offshore Wind Farm Implementation of Common Guillemots (*Uria aalge*) in the southern North Sea
Verena Peschko | Research and Technology Centre (FTZ), University of Kiel

1:10-1:15
Protected Species Observer (PSO) Detections of North Atlantic Right Whales (NARW): Contributing to Science, Conservation, and Management
Craig Reiser | Smultea Sciences

1:15-1:20
Age-based Habitat Use of Humpback Whales in the New York Bight and Implications for Vessel Strikes
Julia Stepanuk | Stony Brook University Department of Ecology and Evolution

1:20-1:25
Review of Night Vision Technologies for Detecting Cetaceans From Sea
Mari Smultea | Smultea Sciences

1:25-1:30
5 min Q&A and Discussion

Session 7
12:30-1:30 pm Thursday, November 19, 2020

12:30-12:35
Introduction to ICES Offshore Wind Working Group
Andy Lipsky | NOAA Northeast Fisheries Science Center

12:35-12:40
A Stakeholder Driven Vision: Regional Wildlife Science Entity for Atlantic Offshore Wind
Kate McClellan Press | New York State Energy Research and Development Authority

12:40-12:45
The Responsible Offshore Science Alliance (ROSA): Establishing Regional Research and Monitoring for Offshore Wind and Fisheries
Lyndie Hice-Dunton | Responsible Offshore Science Alliance (ROSA)

12:45-12:50
U.S. Offshore Wind Synthesis of Environmental Effects Research
Rebecca Green | National Renewable Energy Laboratory

12:50-1:00
10 min Q&A and Discussion

1:00-1:05
Updating Collision Risk Models to Quantify Cumulative Impacts for Endangered Birds
Christopher Field | University of Rhode Island

1:05-1:10
Analysis and Visualization of Marine-Life Data in the Context of Offshore Wind Energy Development
Marta Ribera | The Nature Conservancy

1:10-1:15
Development of Monitoring Protocols for Automated Radio Telemetry Studies at Offshore Wind Energy Areas
Pam Loring | U.S. Fish and Wildlife Service

1:15-1:20
New Technology Reduces the Probability of Vessel Strikes on Whales – In Certain Situations all the Way to Zero
Dave Steckler | Mysticetus

1:20-1:25
Ecosystem Dynamics: An Examination of the Relationships Between Environmental Processes, Primary Productivity, and Distribution of Species at Higher Trophic Levels
Frank Thomsen | DHI Group

1:20-1:30
10 min Q&A and Discussion

Lightning Talk Abstracts

Abstracts are in alphabetical order by first author's last name

Multi-scale Relationships between Marine Predators and the Distribution of Forage Fish

Adams, E. (evan.adams@briloon.org)[1], Friedland, K.[2], Gilbert, A.[1], Goetsch, C.[1], Goyert, H.[3], Gulka, J.[1], Stenhouse, I.[1], Williams, K.[1], Winship, A.[3]

[1] Biodiversity Research Institute; [2] NOAA Northeast Fisheries Science Center; [3] NOAA National Centers for Coastal Ocean Science

The trophic structure of marine ecosystems is complex, owing in part to dynamic spatiotemporal variability. To better understand the combined effects of environmental changes and biological interactions on marine species, we are conducting a study of the multiple scales at which forage fish influence marine predators. Forage fish distributions and aggregations are quantified by combining observations from NOAA bottom trawl surveys and digital aerial surveys. These data from the Northeast U.S. Continental Shelf will be used to quantify how forage fish populations affect key seabird predators like Northern Gannets, Red-throated Loons, and Long-tailed Ducks at three scales:

- individual movements and habitat use, where forage fish availability will be connected to predator movements using behavioral models derived from satellite telemetry data;
- seasonal changes in predator distribution and abundance, where integrated modeling techniques will be used to combine data from multiple survey types; and
- long-term population trends, where archival survey data for predator and prey species will be combined to determine temporal correlations in areas with high survey effort.

This project is ongoing; the current focus is on forage fish availability estimation and seabird movement modeling. We will discuss our current approach to forage fish data synthesis using spatially explicit distribution and group size models, and our implementation of Hidden Markov models to estimate seabird movement. Using these techniques to elucidate biotic connections is important to understanding how anthropogenic changes to marine ecosystems—particularly from offshore wind development—could affect predators in multifaceted ways.

The BOEM 'RODEO' Program: Lessons Learned from Environmental Monitoring at Multiple U.S. Offshore Wind Farms

Ampela, K. (Kristen.ampela@hdrinc.com)[1], Khan, A.[1]

[1] HDR, Inc.

The purpose of the BOEM-sponsored Real-time Opportunity for Development Environmental Observations (RODEO) Program is to gather real-time data during construction and operation of offshore wind farms (OWF) at various locations in the U.S. to help assess environmental impacts of current—and planned—OWF facilities. Starting in 2015, a four-year monitoring study was conducted at the Block Island Wind Farm

(BIWF) off Rhode Island, the first commercial wind farm in the U.S. A suite of environmental data was collected, including underwater and airborne noise measurements during construction and initial operations; turbine scour; seafloor disturbance and recovery rates; benthic community abundance and diversity, and epifouling of turbine foundations. Valuable lessons learned and data gathered at BIWF have informed and refined environmental monitoring approaches for future U.S. OWF developments, including improved sensor placement design; expansion of metocean data collection and corrosion monitoring, and increased focus on underwater noise monitoring during construction to better understand potential impacts on marine mammals, sea turtles, and fish. The RODEO Program provides an important framework to align and integrate results from environmental studies of OWFs in multiple regions, involving different design and construction approaches, in a variety of benthic habitats and sediment types. The understanding and insights gained from the Program will also help BOEM to identify, reduce, and mitigate environmental risks in the future, and significantly increase the efficiency of BOEM's regulatory review process for OWF development in the U.S.

Large Bony Fish Information from NY OPA

Clerc, J. (jclerc@normandeau.com)[1], Robinson Willmott, J.[1], Lampman, G.[2]
[1] Normandeau Associates Inc; [2] NYSERDA

NYSERDA commissioned Normandeau-APEM to provide 3 years of seasonal aerial digital surveys over the entire offshore planning area. Although surveys were designed to capture information on birds, marine mammals, turtles and cartilaginous species, they also inadvertently captured information on some large bony fish species, specifically mahi-mahi, sunfish, billfish and tuna species, some of which showed preferences with regard to distance from shore, ocean depth, and/or seasonality. Normandeau would be delighted to share this information with the workshop attendees.

Updating Collision Risk Models to Quantify Cumulative Impacts for Endangered Birds

Field, C. (christopher.field@uconn.edu)[1], Loring, P.[2], Gerber, B.[3]
[1] University of Rhode Island; [2] Division of Migratory Birds, U.S. Fish and Wildlife Service, [3] Department of Natural Resources Science, University Of Rhode Island

Developing a decision support framework for the potential impacts of offshore wind on wildlife requires addressing several challenges. These include propagating and communicating multiple sources of uncertainty, interpreting models for non-specialists, and the need for agility in the face of shifting data availability. We will discuss our recent efforts to address these challenges as we develop an online support tool for quantifying the impacts of offshore wind on endangered birds. We will discuss specific challenges to adapting recent European efforts for U.S.-based policy, including differences in the availability of key data sources. We will highlight our efforts to integrate data from the Motus wildlife tracking network and quantify cumulative impacts across offshore projects. We will also discuss the generalizability of our work, including key similarities

and differences between our work and other efforts to model and communicate risk associated with offshore wind.

U.S. Offshore Wind Synthesis of Environmental Effects Research

Gorton, A.[2], Green, R. (Rebecca.green@nrel.gov)[1], Harker-Klimes, G.[2], Hein, C.[1], Straw, B.[1]
[1] National Renewable Energy Laboratory; [2] Pacific Northwest National Laboratory

At the direction of the Department of Energy, Pacific Northwest National Laboratory (PNNL) and the National Renewable Energy Laboratory (NREL) are partnering on the U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER) project. The multi-year collaborative effort will facilitate knowledge transfer for offshore wind (OSW) research around the world to synthesize key issues and disseminate existing knowledge about environmental effects, inform applicability to U.S. waters, and prioritize future research needs. Research related to monitoring and mitigating impacts from OSW development on wildlife, habitats, and related environmental processes will inform environmental research prioritization among stakeholders, reduce redundancy among stakeholder group activities, and catalyze solution development. The outcomes of this project will build relationships among various OSW environmental stakeholders to support strategic research efforts by increasing communication, encouraging collaboration, and reducing redundancy. Where feasible, work products will identify key areas where misinformation persists and issues that have been thoroughly studied, are well understood, and can be considered low priority or resolved.

This presentation will include: project impetus, goals, and objectives; stakeholder outreach and engagement efforts; research topics and prioritization; project products and outcomes; and dissemination methods.

The Responsible Offshore Science Alliance (ROSA): Establishing Regional Research and Monitoring for Offshore Wind and Fisheries

Hice-Dunton, L. (lyndie@rosascience.org)[1]
[1] Responsible Offshore Science Alliance

The Responsible Offshore Science Alliance (ROSA) is a partnership formed by fishermen and offshore wind leaders, in collaboration with US federal and state management experts to enhance scientific understanding necessary to support the coexistence of wind energy development and sustainable fisheries. Formed in early 2019, ROSA provides for and advances regional research and monitoring of fisheries and offshore wind interactions through coordination and cooperation. Modelled after successful partnerships in Europe and elsewhere, ROSA's mission is to advance our understanding of interactions in US state and federal waters. The organization's goal is to increase salient and credible data on fisheries and wind development and improve our knowledge on of the effects of wind energy development on fisheries and ocean ecosystems. ROSA will maximize public-private partnerships to enhance understanding of the ocean

environment that fisheries and offshore wind energy activities occupy, through rigorous and unbiased science and research efforts. Specifically, ROSA aims to: identify regional research and monitoring needs; provide a forum for coordinating existing programs; advance regional understanding through collaboration, partnerships, and cooperative research; facilitate and improve standardization and access to data; administer research; and disseminate research and communicate findings. The presentation will focus on an overview of ROSA's formation, progress to date, and future actions of the organization.

Benthic habitat and epifaunal monitoring at the Block Island Wind Farm

Hutchison, Z.L. (zoe_hutchison@uri.edu)[1,2], Bartley, M.L.[1,3], King, J.W.[1], English, P.[4], Grace, S.[5], Khan, A.[6]

[1] Graduate School of Oceanography, University of Rhode Island; [2]School of Biology, University of St. Andrews; [3]Natural Resource Stewardship and Science Directorate, National Park Service; [4]FUGRO GB Marine Ltd.; [5]Department of Biology, Southern Connecticut State University, [6]HDR

As part of the RODEO Program, a three-year benthic habitat and epifouling monitoring effort took place at Block Island Wind Farm (BIWF) between late-2016 and late-2019. The aim of the study was to observe and quantify near-field spatio-temporal changes in the seabed, focusing on the sediment grain size, organic enrichment and benthic macrofaunal communities present. Efforts were later extended to characterize the epifaunal growth on the BIWF turbine foundation structures. On the structure, the epifaunal communities were dominated by the blue mussel, *Mytilus edulis*. Other species of note were the coral, *Astrangia poculata* and invasive tunicate, *Didemnum vexillum* and an abundance of black sea bass, *Centropristis striata*. Within the turbine foundation footprints, particularly at Turbine 1, mussel aggregations had formed. In areas of dense mussel aggregations increased sediment fines and organic enrichment were evident. Within the 30-90 m area from the center of the turbine, no specific gradients of change with distance from the structure were detected in sediment grain size or organic enrichment. The macrofaunal composition and characteristics were variable between turbines and years. Turbine 1 was more distinct from Turbine 3 and 5 in macrofaunal community characteristics. Within the Turbine 1 study area, mussels had become more abundant and there were few, but distinct areas of strong change associated with mussel presence. The results suggest that future expansion of offshore wind farms across the east coast continental shelf should consider the cumulative benthic modification where similar jacket foundation types are installed.

Status of NMFS Survey Activities Impacted by Wind Development

Lipsky, A. (andrew.lipsky@noaa.gov)[1]

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TBD

Introduction to ICES Offshore Wind Working Group

Lipsky, A. (andrew.lipsky@noaa.gov)[1]
[1] NOAA Northeast Fisheries Science Center

TBD

Development of Monitoring Protocols for Automated Radio Telemetry Studies at Offshore Wind Energy Areas

Loring, P. (pamela_loring@fws.gov)[1]*, Johnston, S.M.*[1]*, Williams, K.A.*[2]*, Adams, E.M.*[2]*, Gilbert, A.*[2]*, Paton, P.W.C.*[3]*, Mackenzie, S.A.*[4]*.*
[1] U.S. Fish and Wildlife Service Division of Migratory Birds; [2] Biodiversity Research Institute; [3] University of Rhode Island Department of Natural Resources Science; [4] Birds Canada

We are developing guidance for using automated radio telemetry to monitor bird and bat movements at offshore wind energy areas throughout the U.S. Atlantic with funding from NYSERDA. This collaborative project will include: 1) a monitoring framework for pre and post-construction tracking studies with a focus on federally threatened or endangered terns and shorebirds; 2) a guidance document for co-locating and operating receiving stations on offshore wind turbines and buoys; 3) a free online tool to optimize site-specific study designs at offshore wind projects; 4) a simulation study to estimate detection probability for focal species; and 5) a framework to coordinate data from tracking efforts throughout the U.S. Atlantic with the Motus Wildlife Tracking System. We are developing study products with extensive stakeholder input, including a Project Advisory Committee with representatives from industry, government, and research sectors. In 2021, we will hold a series of workshops to refine study products and work with developers to field test new technology at lease areas. The overarching goal of this effort is to help develop and coordinate automated radio telemetry studies for monitoring avian and bat movements through individual lease areas and the broader U.S. Atlantic offshore region using the best available science. Final study products are anticipated in early 2022.

Expected Effects of Proposed Large Scale Offshore Wind Farm Implementation on Common Guillemots (*Uria aalge*) in the southern North Sea

Peschko, V. (peschko@ftz-west.uni-kiel.de)[1]*, Schwemmer, H.*[1]*, Markones, N.*[1]*, Borkenhagen, K.*[1]*, Mercker, M.*[2]*, Garthe, S.*[1]
[1] Research and Technology Centre (FTZ), University of Kiel; [2] Bionum GmbH- Consulting in Statistical Ecology & Biostatistics

As climate change is rapidly progressing, the pressure for governments to massively reduce greenhouse gas emissions is stronger than ever. The German government plans to implement 40 GW of offshore wind power in the German Exclusive Economic Zone (EEZ) by 2040. As one of the most numerous seabird species in the world, the common guillemot (*Uria aalge*) is prone to interfere with offshore wind farms (OWF). To quantify the possible conflict between guillemot occurrence and current plans of the German government regarding implementation of large scale OWFs, we used a long-term dataset on the distribution and abundance of guillemots in combination with recent estimates of the OWF avoidance by guillemots in German waters. If the current plans are realized, the footprint of the installed OWFs would cover 17% of the German EEZ. Because guillemot density is significantly reduced inside the OWFs and within a radius of 9 km around the OWFs, the 'affected area' would equal 53% of the German EEZ. In total, 54,000

(i.e. 60%) of the guillemots occurring in the German North Sea in autumn are using the 'affected area'. As guillemot density was reduced by 49% inside the 'affected area', 30% of the German guillemot population in autumn would experience habitat loss. This clearly illustrates the possible threat for guillemots in the southern North Sea if the current plans of the German government are implemented. The estimates provided here are essential for the development of a sustainable scenario to reduce the human CO2 footprint while protecting biodiversity.

A Stakeholder Driven Vision: Regional Wildlife Science Entity for Atlantic Offshore Wind

Press, K. McClellan (kate.mcclellanpress@nysderda.ny.gov)[1], Lampman, G. [1], Bolgen, N.[2], Carlisle, B.[2]
[1] New York State Energy Research and Development Authority; [2] Massachusetts Clean Energy Center

Starting at the inaugural State of the Science Workshop in 2018, stakeholders expressed the importance of developing a multi-sectoral regional science entity to support research and monitoring on wildlife and offshore wind energy. The effort was further advanced through a series of workshop hosted by the New York State Energy Research and Development Authority (NYSERDA), the Special Initiative for Offshore Wind and the Massachusetts Clean Energy Center (MassCEC). Building from these early efforts, a strong stakeholder engagement process was advanced to develop the current vision for a Regional Wildlife Science Entity (RWSE) for Atlantic offshore wind. The process has been led by a "Coordinating Group", or representative group of stakeholders including NYSERDA, MassCEC, the Bureau of Ocean Energy Management (BOEM), the National Oceanic and Atmospheric Administration (NOAA), Shell, Equinor, the Natural Resources Defense Council (NRDC), and the National Wildlife Federation (NWF). Since 2019, the effort has engaged with stakeholders through meetings, workshops, and interviews to better understand the need for coordinated regional science, define the scope and identify potential organizational designs, which are documented in the RWSE's Organizational Vision. In late 2020, the Coordinating Group has been gathering letters of support and will solicit proposals for a fiscal agent and director through a Request for Qualifications (RFQL) from NYSERDA.

Protected Species Observer (PSO) Detections of North Atlantic Right Whales (NARW); Contributing to Science, Conservation, and Management

Reiser, C.M. (craig.reiser@smulteasciences.com)[1], *Smultea, M.A.*[1], *Silbur, G.*[1]
[1] Smultea Sciences

Offshore wind development in the US Atlantic Ocean relies on protected species observers (PSOs) to conduct dedicated monitoring and mitigation of all vessel operations. These efforts entail a great deal more than simply satisfying a suite of regulatory requirements. In particular, numerous industry operators have expanded their baseline PSO monitoring and mitigation programs to add considerable value to North Atlantic right whale (NARW) conservation efforts through data sharing and reporting measures. Detections of NARW by PSOs are significant events that begin long before passionate PSOs mobilize to vessels, and they extend well beyond completion of a survey. Countless hours are spent vetting, hiring, training, and preparing PSOs for the moment when they detect a NARW. PSOs are fortified with a multitude of tools and technologies to assist their real-time assessment of appropriate mitigation measures. These tools include Mysticetus' data collection software, configured within a regional network of project vessels to allow for automated sharing of detections between vessel PSO teams, as well as

automated NARW text and email alerts for onshore project managers. PSOs document all NARW with high definition cameras. Detection data are shared immediately with the NOAA Right Whale Sighting Advisory System via the Whale Alert smartphone application. Photos are shared with NOAA's Northeast Fisheries Science Center and the New England Aquarium. These proactive efforts are made to ensure – first and foremost – all NARW encounters are mitigated, but also to contribute to the overarching goal of advancing NARW science, conservation, and management for the greater good.

Analysis and Visualization of Marine-Life Data in the Context of Offshore Wind Energy Development

Ribera, M. (marta.ribera@tnc.org)[1], Anderson, M.[1], Bruce, C.[1], Martin, E.[1], McGuire, C.[1], McGee, S.[1]
[1] The Nature Conservancy

In the past few years, there has been an acceleration in the interest for the development of commercial offshore wind energy sites along the US Atlantic seaboard, with over 4.5 million acres of ocean habitat off the east coast of the US either already leased (1.75M) or formally in the process of being considered for leasing (2.75M). The Nature Conservancy wants to ensure that siting, construction, and operation of wind development offshore is done with the environment in mind, considering key habitats and species. We believe it is critical to provide the best scientific information to stakeholders to guide the planning and review process. However, stakeholders reviewing Environmental Impact Assessments for wind development projects either don't have access to all the needed information or the capacity to quickly review each submission within the time allowed. Regional data portals compile the best available regional data, but reviewing and interpreting all appropriate information is often an overwhelming task. Also, stakeholders can only view each dataset in isolation, without any interpretation of what it means in the context of other species and processes in the region. TNC is developing a peer-reviewed decision support tool to contextualize siting of wind energy projects, and to avoid and monitor potential negative environmental impacts. By summarizing important natural resources for an area, users can identify potential red flags in the development and operation of wind energy offshore.

Review of Night Vision Technologies for Detecting Cetaceans From Sea

Smultea, M. (mari@smulteasciences.com)[1], Siber, G.[1], Donlan, P.[2], Wilson, S.[3], Morse, L.[3], Fertl, D.[1,4], Steckler, D.[2]
[1] Smultea Sciences; [2] Mysticetus; [3] Deepwater Wind Power Ørsted; [4] Ziphius Ecoservices

Data are sparse on specific model, specification, cost and at-sea effectiveness of vision-enhancing devices for detecting cetaceans during darkness. We identified/evaluated/compared 15 specific vision-enhancing devices used/useful to meet U.S. Atlantic regulatory requirements for marine mammal mitigation/monitoring during darkness for Ørsted and Deepwater Wind offshore wind development activities in 2017-19. Evaluation focused on cetacean detection at distances of 200, 500 and 1000 m from a vessel. We compiled available literature, personal communications with experts, our own in-field results and internet searches. Results indicate that for regulated zones <200 m in radius, recently used specific hand-held infra-red (IR) and hand-held light-enhancing devices are considered reasonably effective. At 200-500+ m, more expensive yet reasonably priced mounted IR devices providing automatic detection software, image stabilization, remote display, and/or mitigation zone delineation improve objective

mitigation decision-making and alleviate observer eye strain of handheld devices. Multiple camera use and video/still image review capability improve sighting effectiveness and reduce false negative indications. Device performance is influenced by weather conditions (fog, rain). Using mounted IR cameras we detected whales and delphinid groups 1+ km away in good conditions. Newly available devices should be reviewed on a continuum to identify improvements/affordability. Testing of night/low-light vision devices via controlled systematic studies is needed for regions where offshore wind development and operations occur during low-light conditions, focusing on seasons and areas where sample sizes of cetacean visual detections can be maximized. Compilation and statistical comparisons of Atlantic sightings data is highly recommended to examine robustness/effectiveness of devices under various conditions.

New Technology Reduces the Probability of Vessel Strikes on Whales – In Certain Situations all the Way to Zero

Steckler, D. (davesteckler@mysticetus.com)[1]
[1] Mysticetus

Recent advances and cost reductions in internet technology has resulted in most medium-to-large working vessels on the ocean possessing internet connectivity 24x7. These systems have already been used by Protected Species Observers (aka Marine Mammal Observers, or PSO, MMO) in the Atlantic working on mitigation of anthropogenically impactful activities such as wind farm construction. Specifically, PSO tasks include monitoring for protected species including whales, dolphins and sea turtles, and directing appropriate mitigation actions to protect animals when detected. Previously such internet systems were mostly used for simple tasks such as email of status reports, Dropbox file transfer, etc. Here we present a new interconnectivity system, The Mysticetus Sharing Network, that leverages near-universal internet connectivity to instantly share and map animal sightings amongst all participants, including audible alerts, text and email notifications to all stakeholders, and collision prediction and automated avoidance recommendations. We also present one example where the use of this system reduced the probability of vessel strike on two specific North Atlantic Right Whales to absolute zero. According to our analysis, these types of situations where the Mysticetus Sharing Network diverts vessels away from whales sighted by others occur approximately once a month. We will also present extensions to the Mysticetus Sharing Network that include the tracking and sharing of information from other data sources increase PSO situational awareness. This includes PAM-enabled drones and moored buoys from Woods Hole, and Rutgers and Dalhousie Universities; instant integration of animal sightings from select non-profits such as the New England Aquarium and Center for Coastal Studies; and (coming soon) instant integration from various external data sources such as sea turtle sighting networks and stranding networks.

Age-based Habitat Use of Humpback Whales in the New York Bight and Implications for Vessel Strikes

Stepanuk, J. (Julia.stepanuk@stonybrook.edu)[1], *Heywood, E.I.*[2], *Thorne, L.H.*[2]
[1] Stony Brook University Department of Ecology and Evolution; [2] Stony Brook University School of Marine and Atmospheric Sciences

There is an ongoing Unusual Mortality Event (UME) of humpback whales (*Megaptera novaeangliae*) along the eastern seaboard of the US, and juvenile whales represent a high proportion of large whale strandings in this region. In the New York Bight, juvenile humpback whales have been observed lunge feeding on Atlantic menhaden (*Brevoortia tyrannus*) close to

shore, but it is unclear whether there are age-specific patterns of habitat use and foraging behavior in humpbacks. We compare the habitat use and foraging behavior of juvenile and adult humpback whales in the New York Bight, and examine implications for the vulnerability to anthropogenic impacts (e.g., vessel strikes, wind farm development). We conducted boat-based surveys in the NYB from 2018-2020 and conducted focal follows to identify individual whales, document foraging behavior, and obtain morphometric measurements using a DJI Phantom 4 Pro+ Unmanned Aerial Vehicle. We determined animal lengths and age class from morphometric data and compared the sightings of adult vs. juvenile whales based on distance from shore, foraging behavior, and age-class composition. Whales foraging in nearshore waters were exclusively juveniles that were surface feeding, while both juveniles and adults foraged cooperatively in offshore waters. The nearshore habitat use and surface foraging behavior of juvenile humpback whales may make them particularly vulnerable to anthropogenic impacts in nearshore waters.

Migratory Paths of Horseshoe Crabs in Peril Due to Offshore Energy Development

Tanacredi, J. (jtanacredi@molloy.edu)[1],
[1] Center for Environmental Research and Coastal Oceans Monitoring (CERCOM)

Limulus polyphemus, the North American Horseshoe Crab, for over 445 million years has migrated ashore along the Atlantic coast with amazing site fidelity to numerous breeding beaches. These migratory tides of HSCs during the peak breeding season of May through September each year have provided their eggs to support millions of shorebirds on their annual and synchronized migration each year as well. The potential impacts from offshore energy development to these living fossils' consistent fecundity, to their nearshore breeding beaches and to the adjacent nearshore lands has never been investigated nor adequately assessed.

Ecosystem Dynamics: An Examination of the Relationships Between Environmental Processes, Primary Productivity, and Distribution of Species at Higher Trophic Levels

Thomsen, F. (frth@dhigroup.com)[1], Courbis, S.[2], Marean, K.[3], Mortensen, L.O.[1], Skov, H.[1], Tuhuteru, N.[1], Bell, M.A.[1], van Berkel, J.[1], White, K.[3]
[1]DHI Group; [2]Advisian Worley Group; [3]WSP

The state of New York is committed to pursuing development of 9,000 MW of offshore wind energy by 2035. As part of planning and assessment related to this effort, NYSERDA has developed a Master Plan and undertaken several field and desktop studies to reduce risk and inform and improve siting and authorization processes. Here we present a NYSERDA project to examine the relationships between environmental processes, primary productivity, and distributions of species at higher trophic levels to help predict animal use patterns at differing temporal scales in the New York Bight. This effort will evaluate data coverage, sensitive variables, data gaps, and will pave the way for comparative assessments of the power of available ecosystem data to predict wildlife distribution and movement during all stages of wind farm development.

This collaborative project is developing hydrodynamic models based on data about the distribution of oceanographic characteristics in the New York Bight and applying these models and observations of taxa to develop dynamic habitat models that show temporally changing predictions of use of areas by loggerhead sea turtles, fin whales, red-throated loons, and

northern gannets. The dynamic habitat models for red-throated loons and fin whales will further be used as a driver in agent-based models to predict movements of individuals in the New York Bight. This approach to modeling allows for consideration of dynamic environmental preferences and can be adjusted to consider future conditions in addition to assessing average expectations.

Mapping the Distribution and Habitat Use of Atlantic Cod Spawning Aggregations on Cox's Ledge to Assess Potential Impacts of Offshore Wind Energy Development

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Atlantic cod (*Gadus morhua*) is an ecologically, economically, and culturally important groundfish species that has been historically overexploited. Many studies have described the spawning dynamics of cod in other areas, but uncertainty remains concerning cod in Southern New England. Several aspects of cod spawning behavior, such as forming large, dense spawning aggregations, increases their vulnerability to disturbance. Offshore wind energy development may impact cod through loss of essential spawning habitat and disruption of spawning behavior. Through the use of interdisciplinary methodologies, this study aims to map the spatiotemporal distribution of spawning and track life history parameters of Atlantic cod in Southern New England, while serving as a pre-construction baseline study for characterizing interactions with planned offshore wind farms. Beginning in November 2019, we tagged spawning cod with telemetry transmitters and deployed a receiver array in and around the South Fork wind area. An autonomous glider, carrying a telemetry receiver and hydrophone to record cod spawning vocalizations, swam an approximately 1,500 km2 area over Cox's Ledge. Additionally, historical passive acoustic recordings were reviewed for spawning activity in this area. Fisheries dependent biological samples were collected to track growth, maturity, and the onset of spawning. Preliminary results suggest spawning spans from November to March, with high residence on Cox Ledge, and some regional spawning outside the area. Combined results over the three year study will fill knowledge gaps regarding the spawning dynamics and habitat usage of Atlantic cod in Southern New England and facilitate assessment of offshore wind energy impacts.

Pelagic Fish and Zooplankton Abundance and Distribution in the New York Bight

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Ship-based echosounder surveys have been conducted seasonally in the New York Bight over the past three years to monitor pelagic aggregations of fish and zooplankton. By using multiple acoustic frequencies, we can often identify aggregations of fish or zooplankton and quantify their distribution and relative abundance. Trawl and net tows provide information on the species present in the region during each cruise. Spatial and temporal variability in these data

will be discussed as well as how some aggregations may be related to environmental parameters or bathymetric features.