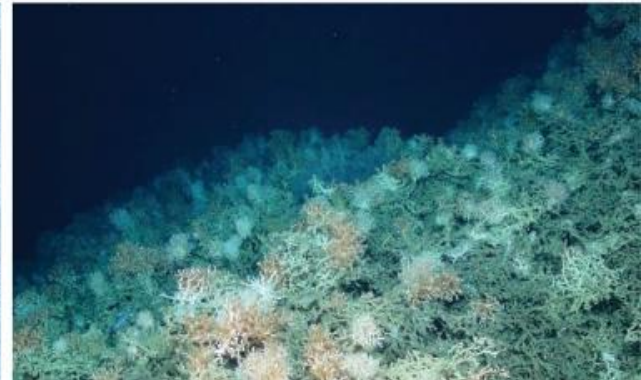




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State of the Science Workshop on Offshore Wind and Wildlife 2020: Cumulative Impacts

Culmination Webinar

May 21, 2021



Photo Credit: White-winged Scoter © Daniel Poleschook; Common dolphins © Anthony Pierce; Sardines © Andrea Izzotti; Dogfish shark © Boris Pamikov; Loggerhead turtle © Kate Sutherland; Big brown bat © Michael Durham; Fresh water coral © Stock photo

Checklist for Virtual Participation

NOTE: this meeting is being recorded.

- ✓ **Rename yourself after logging into Zoom.** Rename yourself by hovering over your name in the “Participants” list and changing your name to First name Last Name and your organization.
- ✓ **Ask questions using the Q&A function** (and upvote or comment on other questions you’d like to see answered). We will save the list of questions after the webinar and do our best to answer questions that we don’t get to via email.
- ✓ **Use the chat function to engage.** The chat function is a useful way to provide feedback and participate. But please post questions in the Q&A, not the chat!
- ✓ **Tech support.** If you are having any technical issues with the webinar (audio or video), please send a direct message in the chat function to Ashley Arayas. If you cannot access the webinar, please email her at Ashley.Arayas@cadmusgroup.com.

Culmination Webinar Agenda

> Welcome and introduction

> Workgroup reports

- Environmental change (changes in stratification)
- Benthos
- Fishes and aquatic invertebrates (sound and vibrations)
- Sea turtles
- *Quick break*
- Marine mammals
- Bats
- Birds

> Panel discussion



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Many thanks to:

2020 State of the Science Workshop Planning Committee

Environmental Technical Working Group (ETWG) members

November 2020 Workshop Speakers and Lightning Talk Presenters

Biodiversity Research Institute

Cadmus Group

NYSERDA Staff

All Workgroup Members

Workgroup Leads

State of the Science Workshop Goal

Understand and avoid cumulative impacts to wildlife from offshore wind development

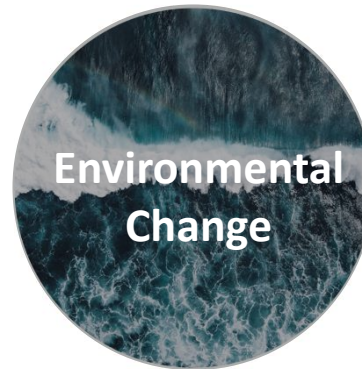
What we mean by cumulative impacts in this context:

- > Biological rather than regulatory
- > Only those due to offshore wind developments



Workgroup Efforts

Seven taxon-specific workgroups



Overall Goal: Develop a research agenda of key studies that could be initiated in the next 5 years to improve our understanding of cumulative biological impacts as the offshore wind industry develops in the eastern United States

Workgroup Leads



Technical Lead: Jeff Carpenter, Helmholtz-Zentrum Hereon, Geesthacht
Workgroup members: 32



Technical Leads: Steven Degraer, Royal Belgian Institute of Natural Sciences, and Zoe Hutchison, University of St Andrews
Co-Lead: Carl Lobue, The Nature Conservancy
Workgroup members: 36



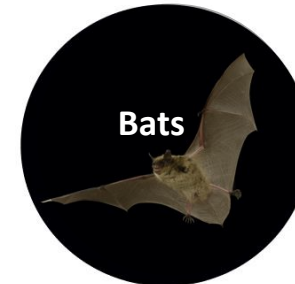
Technical Lead: Arthur Popper, U. Maryland and Environmental BioAcoustics LLC
Co-Lead: Lyndie Hice-Dunton, Responsible Offshore Science Alliance
Workgroup members: 42



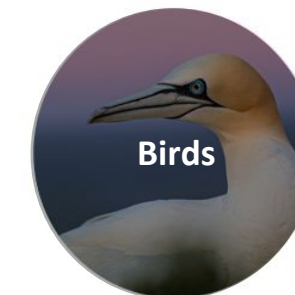
Technical Lead: Gregg Gitschlag, National Oceanic and Atmospheric Administration (retired)
Co-Lead: Ruth Perry, Shell
Workgroup members: 27



Technical Lead: Brandon Southall, Southall Environmental Associates, Inc
Co-Lead: Laura Morse, Ørsted
Workgroup members: 83



Technical Lead: Cris Hein, National Renewable Energy Laboratory
Workgroup members: 37



Technical Lead: Aonghais Cook, British Trust for Ornithology
Co-Lead: Jillian Liner, Audubon New York
Workgroup members: 74

Workgroup Process

> Series of virtual meetings

- Reviewed pre-existing data and efforts, identified key gaps
- Drafted list of potential research priorities
- Refined list and identified potential methods, existing data and resources, additional considerations

> Opportunities to provide written input

- Workgroup leads worked with members and support staff to develop a report detailing short-term research priorities
- All documents shared via collaboration platform (e.g., Google Drive, Microsoft Teams)

> Prioritization exercises

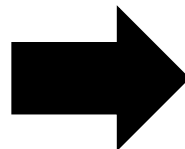
- Online survey(s) with prioritization criteria
- Varied by group, but all had the opportunity to provide input on relative priority of topics



How to Access Workgroup Reports

- > Draft workgroup reports posted for viewing when available at nyetwg.com/2020-workgroups
- > All reports will be finalized and available for download in late June

Click the images to view each workgroup report



State of the Science Workgroups

State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts

Throughout the winter/spring of 2021, seven State of the Science workgroups identified scientific research, monitoring, and coordination needs to improve our understanding of cumulative biological impacts from offshore wind development. The goal for each workgroup was to identify a list of studies for their topic area that could be implemented in the next 5 years to position the stakeholder community to better understand cumulative impacts as the offshore wind industry develops in the U.S.

Through a combination of virtual meetings, online surveys, and virtual collaboration for document development, each group produced a report (below) that highlights recommended research priorities. During the *State of the Science Workshop 2020: Cumulative Impacts* culmination webinar on May 21, 2021 (12 pm-2 pm EDT), workgroup leads will present their recommendations and discuss common themes among groups. [Register for the webinar here.](#)

Many thanks to all workgroup members! Collectively, these workgroups represent over 200 scientific experts and other stakeholders (workgroup members are listed as an appendix in each report). A big thank you is due, in particular, to our workgroup leads, who have put a great deal of time into planning meetings, developing draft reports, and other efforts. Thank you all for your recent (and ongoing) efforts!

Workgroup Reports

Draft workgroup reports will be posted here for viewing when available, but will not be downloadable until finalized by late June 2021.



Environmental Change

Technical Lead
Jeff Carpenter
Helmholtz-Zentrum Geesthacht



Fishes & Mobile Invertebrates

Focus: Sound and Vibrations

Technical Lead
Arthur Popper
University of Maryland

Co-lead
Lyndie Hice-Dunton
Responsible Offshore Science Alliance

An aerial photograph of a coastline where waves are crashing against a dark, rocky shore. The water is a vibrant turquoise color, and the white foam of the waves is prominent. A faint rainbow is visible in the water to the right of the shore. A dark blue circle is overlaid on the left side of the image, containing white text.

**Environmental
Change -
Stratification**
Jeff Carpenter

Environmental Change Workgroup: Stratification

- > Offshore wind development is predicted to alter the local physical environment through:
 - **Changes in stratification (focus of this group)**
 - Turbulence
 - Suspended sediment
 - Wind- and ocean-wake effects
- > OSW structures impact physical processes, which may have knock-on effects on wildlife as well as other oceanographic and anthropogenic processes
- > **Workgroup identified six short-term priorities**



Environmental Change Workgroup: Stratification

Key Take-Home Messages

- > **Long-term, broad-scale monitoring**, including coordination and adjustment of existing long-term monitoring efforts with site-specific studies at offshore wind development locations, will be essential to understand changes in physical oceanographic processes in relation to both offshore wind energy development and climate change
- > The highest priority topics identified by the group include a mix of efforts that address **issues of key ecological importance** and those that **set the stage for needed research** (e.g., development of metrics and methods)
- > **Coordination of research and data collection at a range of spatiotemporal scales** will allow for an improved understanding of how offshore wind energy structures impact physical processes, and in turn affect wildlife and their habitats



Environmental Change Workgroup: Stratification

Key Short-term Research Topics

1. Develop a methods and metrics document to define what short- and long-term monitoring should be done and how to differentiate offshore wind effects from natural and climate variability
2. Use integrated modeling approaches to link the physical impacts of offshore wind energy development to biological effects (linkages could occur via a variety of mechanisms)
3. Formalize coordination of existing efforts to maximize utility of available resources, expand scale of inference, and develop standardized methods and new techniques

Additional topics: 4. Conduct feasibility studies to identify the types and scale of potential effects and focus research in the eastern U.S.; 5. Examine impacts of offshore wind energy development on ocean stratification; 6. Assess changes in light conditions

Benthos

Steven Degraer
and
Zoë Hutchison

Benthos Workgroup

- > The marine benthos has a strong influence on the functioning of marine ecosystems
- > There is a substantial body of literature on benthic effects of OSW development (Dannheim et al. 2020, Degraer et al. 2020, Gill et al. 2020)
- > Offshore wind energy development presents a range of pressures or changes to benthic ecosystems at various points in the development and operations process
- > Workgroup identified 35 research topics, categorized into first order (n=14), second order (n=11) and third order (n=10) priorities

How to think about cumulative effects on the benthic ecosystem

Dimension 1: Along Pressure Type

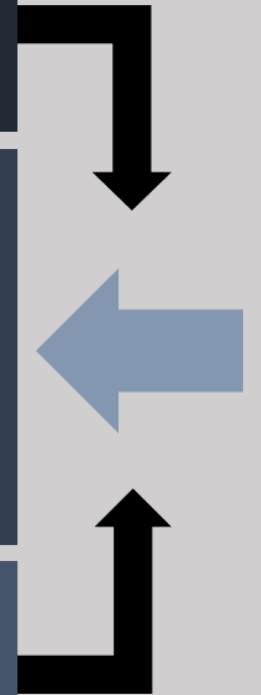
- Artificial reef effect
- Mechanical seafloor disturbance
- Introduction of energy (sound, EMF)

Dimension 2: Along Ecological Theme

- **Ecosystem structure**
 - Community structure
 - Distribution patterns (space/time)
- **Ecosystem function**
 - Food webs
 - Productivity
 - Biochemistry
 - Connectivity

Dimension 3: Along Development Phase

- Construction
- Operation
- Decommissioning



Benthos Workgroup

Key Take-Home Messages

> Considering the benthic cumulative effects, requires broad consideration of topics

		Artificial reef effect	Seafloor disturbance	Introduction of energy*
Ecosystem structure 1	Community structure	1 0 2	0 1 0	0 0 1
	Distribution	2 2 0		1 0 1
Ecosystem function 1	Food webs	2 0 2		1 0 0
	Productivity	3 1 2		0 1 1
	Biogeochemistry	1 1 1		0 0 1
	Connectivity	2 1 1		

• Other: 5, 4, 3

*Noise not considered

Benthos Workgroup

First Order Short-term Research Topics (n=14)

> **Practical considerations.**


- Can we create an integrated survey design for trawl surveys and stock assessment practices both inside and outside of wind farms, allowing for comparison biases & limitations of different survey methods?
- What QA/QC should be standard practice for new data collection?

> **Broad-scale questions for assessing impacts.**

- How do we disentangle changes due to OSW from those due to climate change (shifting baselines)?
- What species should be considered when siting OSW projects and examining potential impacts?

> **Understanding the effects on ecosystem structure and function.**

- How do natural and artificial substrata compare in their structural and functional ecology & why?
- What is the influence of changes in recruitment, connectivity, and settlement around OSW areas?
- How much organic enrichment and increased productivity occurs & what is the spatial extent?
- Does EMF from OSW affect predator-prey interactions? Does it affect the ability of species to derive locational cues?



**Fishes &
Aquatic
Invertebrates -
Sound and
Vibrations**
Arthur Popper

Fishes and Aquatic Invertebrates: Sound and Vibrations

- > Given other ongoing efforts, this workgroup chose to focus on the effects of sound and vibration on fishes and aquatic invertebrates
- > Anything that interferes with the ability of animals to detect sounds of biological relevance has the potential to impair the survival of individuals and populations
- > There are substantial gaps in what is known about fish and invertebrate bioacoustics
- > **Workgroup identified seven short-term priorities**



Fishes and Aquatic Invertebrates: Sound and Vibrations



Key Take-Home Messages

- > Current gaps in knowledge of the effects of sound and substrate vibration on fishes and aquatic invertebrates precludes assessment of cumulative impacts, but **longer-term goal should be to inform cumulative effects models**
- > **Requires a careful selection of study species** that represent a broad range of hearing capabilities and mechanisms will be key
- > **Need to focus on behavioral response** as well as hearing
- > **Need a balance of studies** in lab, controlled field conditions, and OSW sites
- > **All sound-related impacts should be considered** (particle motion, substrate vibration, sound pressure)

Fishes and Aquatic Invertebrates: Sound and Vibrations

Key Short-term Research Topics

1. Identify key species/groups for studies of effects of OSW sound exposure on fishes and invertebrates
2. Conduct behavioral response studies to examine non-displacement changes in relation to sound exposure and substrate vibration
3. Conduct a multi-method behavioral response study to examine displacement from noise and vibration generated by wind farm construction and operation

Additional topics: 4. Develop recommendations to promote standardized data collection; 5. Conduct hearing sensitivity studies for selected species; 6. Develop a long-term, highly instrumented field site for research; 7. Feasibility study to examine sound mitigation options

A photograph of a sea turtle swimming in the ocean. The turtle's head and part of its shell are visible above the water. The water is a deep blue with small waves. A dark blue circular overlay is on the left side of the image, containing white text. In the bottom right corner, there is a small copyright notice.

Sea Turtles
Gregg Gitschlag

Sea Turtle Workgroup

- > Little is known about potential sea turtle interactions with OSW, though some information is available about sea turtle interactions with other industries
- > Possible short-term effects of OSW development on sea turtles include displacement, behavioral disruption, stress, temporary hearing impairment, vessel interactions, and changes to prey availability
- > Long-term impacts may include changes in the distribution of sea turtles and their prey, changes in vessel traffic, and ecosystem enhancement
- > **Workgroup identified eight short-term priorities**



Sea Turtle Workgroup



© Kate Sutherland

Key Take-Home Messages

- > Substantial spatial and temporal data gaps in our understanding of populations and distributions in wind energy areas, as well as potential effects to sea turtles posed by OSW development
- > Workgroup members prioritized research to fill gaps in **baseline data on sea turtle distributions, abundance, habitat use, and movements**, with an emphasis on understanding environmental drivers
- > A focus is also needed in the immediate term on stressor-specific investigations of **OSW effects to turtles, such as artificial reef effects, entanglement, vessel strike, noise, or EMF**

Sea Turtle Workgroup

Key Short-term Research Topics

1. Develop a better understanding of sea turtle movements, distributions, and habitat use patterns, including changes in habitat use in relation to OSW development
2. Collate existing tracking and survey data to update density/abundance estimates, characterize baseline habitat use patterns, and develop analytical approaches to integrated analysis
3. Assess sea turtle use of OSW structures such as turbine foundations and the artificial reefs that form on these structures

Additional topics: 4. Examine physiological and behavioral responses of sea turtles to OSW sound; 5. Improve our understanding of sea turtle hearing and morphology; 6. Assess vessel strike risk posed to sea turtles by OSW activities; 7. Assess risk to sea turtles from OSW-related entanglement with fishing gear; 8. Examine sea turtle behavioral responses to electromagnetic fields (EMF)



Break

A photograph of a whale's tail fluke breaching the ocean surface. The tail is dark with a lighter, mottled pattern. The water is a deep blue-green color. In the background, there are dark, forested hills under a clear sky. A small white bird is visible in the sky above the hills.

**Marine
Mammals**
Brandon Southall

Marine Mammal Workgroup

- > Gaps remain in our understanding of marine mammal distributions and populations, as well as responses to human disturbance during construction and operation of offshore wind developments
- > Little known about OSW interactions with baleen whales, in particular
- > Modified cumulative impacts framework to structure discussions
- > Workgroup identified 19 short-term priorities categorized into highest (n=3), high (n=4) and medium (n=13) priority



Category	Description	# Topics
Occurrence	Basic information on the distribution, abundance, and habitat use of species	7
Conditions & Stimuli	Includes noise, vessel strike risk, changes to habitat, and changes to prey base	4
Response	How animals respond to exposure to a stressor, including behavior change, individual physical condition, habitat use, and individual or group responses	6
Consequences	Modifications to distribution, behavior, social groupings, or/and foraging success and how these changes affect fitness and population outcomes	2

Marine Mammal Workgroup



Key Take-Home Messages

- > Though marine mammals are some of the most well-studied marine species, gaps remain for particular taxa - **research on baleen whales is a priority**
- > Need to **better delineate high-priority species by region and lease area**, based on a combination of exposure (e.g., spatiotemporal distributions) and potential vulnerability to offshore wind stressors
- > For critically imperiled species (e.g., NARW) an **immediate focus on mitigating near-term impacts** may be highest priority, followed support for modeling efforts and ongoing monitoring and research
- > **It is important to understand environmental drivers** of presence and distributions in OSW areas and collect pre-construction data to inform models

Marine Mammal Workgroup

Key Short-term Research Topics

1. Estimate habitat use, distribution, and abundance in OSW development areas by season, and identify dynamic environmental variables driving these patterns (Baleen Whales, Odontocetes, Pinnipeds)
2. Identify acoustic exposure and contextual conditions associated with potential acute response to OSW stressors to support development and refinement of risk and consequence assessment (Baleen Whales, Odontocetes)
3. Establish individual baseline movements and behavioral patterns (foraging, diving, reproductive etc.) in OSW development areas (Baleen Whales, Pinnipeds)

Additional topics: 4. Evaluate relative threat of mortality/injury from vessel strikes associated with OSW and non-OSW activities (Baleen Whales); 5. Evaluate ambient sound levels in OSW development areas prior to development activities, as well as during all development phases (Baleen Whales); 6. Determine spatially and temporally explicit species presence in OSW development areas (Baleen Whales, Odontocetes); 7. Evaluate changes in ecosystem and prey conditions in OSW development areas from the pre-construction to operational periods (Pinnipeds)

Bats
Cris Hein



Bat Workgroup

- > The primary concern for bats offshore is potential collision risk
 - Derived from knowledge of the effects to bats from terrestrial wind energy
 - Apparent attraction to terrestrial turbines
- > Paucity of offshore bat data
- > What we know:
 - Widespread offshore, but generally lower activity levels than on land
 - Similar seasonal/weather patterns of offshore and onshore activity
- > **Workgroup identified eight short-term priorities**



Bat Workgroup

Overarching goal: Assess whether cumulative OSW impacts to bats are substantial enough to require mitigation, and if so, implement effective mitigation measures

1. Information Gap

Problem:

We lack much of the necessary information on bat populations.

Solution:

Examine the *relative* risk to bats posed by OSW vs. terrestrial wind energy.

2. Monitoring Gap

Problem:

We lack a validated mortality monitoring approach that can be broadly implemented offshore.

Solutions:

1. Widespread measurement of bat activity levels offshore (e.g., using activity levels as a proxy for risk)
2. Focus on technology development and validation to directly detect collisions and measure risk.

3. Mitigation Gap

Problem:

We lack a validated mitigation approach for OSW.

Solutions:

1. Explore possible mitigation options.
2. Continue developing mitigation approaches for terrestrial wind energy for transfer offshore

Key Take-Home Messages

- > Uncertainty in level of risk posed to bats by OSW development → focus on assessing activity levels and relative risk compared to terrestrial wind development
- > Quantifying mortality will require additional technological development and validation
- > Data standardization and transparency will be essential to answer key questions
- > Varying opinions among workgroup members regarding the timeline on which mitigation should be implemented

Bat Workgroup

Key Short-term Research Topics

1. Collect activity data at the wind energy facility during the operational phase of the project
2. Quantify bat mortality at OSW facilities to determine whether mortality rates are high enough to be a regulatory or conservation concern

Non-Research Priorities

1. Data standardization
2. Data transparency
3. Technology integration for monitoring at OSW sites
4. Exploration of mitigation approaches

Additional topics: Collect baseline data at the proposed site during the pre-construction or construction phases of the project; Collect acoustic data to assess potential activity and movement thresholds from shore

Birds
Aonghais Cook



Bird Workgroup

- > European studies have demonstrated potential effects to birds from offshore wind development, including avoidance/displacement, attraction, and collision risk
- > Cumulative effects for the U.S. are largely unknown
- > Workgroup identified 19 short-term priorities categorized as Tier 1 (n=7), Tier 2 (n=6), and Tier 3 (n=6)

Themes	# Topics
Preliminary needs to understand baseline information and risk	4
Links between distribution, habitat, and resource availability	4
Seabird connectivity	2
Exposure of migratory populations	2
Information to inform collision risk models	2
Demographics and population modeling	2
Other	3



Bird Workgroup



Key Take-Home Messages

- > A mix of short-term and long-term research and monitoring efforts should be initiated in the next five years (should not be precluded by suggested desktop studies)
- > Establish core 'taxa of concern' by OSW site/region to focus funding and research towards species of highest exposure/vulnerability
- > Focus on **habitat and prey drivers** of seabird distributions and behaviors
- > Important to develop **reliable estimates of collision risk**
- > Begin to assess the potential for **population-level impacts** to key taxa of concern via population modeling

Bird Workgroup

Key Short-term Research Topics

- > Develop an exposure/vulnerability risk matrix to identify priority species by OSW lease area
- > Develop preliminary population models and sensitivity analyses
- > Assess the role of habitat and/or prey abundance in species distribution and movements
- > Assess seabird behaviors and flight heights relative to environmental covariates to inform collision risk models

Additional topics: > Develop standardized protocols for collecting and storing data; > Review available tracking data across all taxa of interest

Panel
Discussion



Thank you!

- > Thank you again to all our workgroup leads, and particularly the technical leads who presented today
- > Webinar slides and recording will be posted on the E-TWG website: nyetwg.com/2020-workgroups