Summary of Discussions from the Bird and Bat Specialist Committee of the Environmental Technical Working Group (E-TWG)

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Contents

Introduction and Guiding Principles

Offshore wind energy is a relatively new industry in the United States. Federal regulations were only established for the Outer Continental Shelf Renewable Energy Program in 2009, and a variety of regulatory and non-regulatory processes are still in development for the industry. Although a great deal of attention has been given to understanding and mitigating environmental effects of offshore wind energy development during site assessment and site characterization of lease areas, similar practices for the construction and operations of offshore wind facilities have, in many cases, not yet been fully defined.

As directed by the Environmental Technical Working Group for New York (E-TWG), in April 2019 a volunteer Specialist Committee (hereafter 'Committee'; Appendix A) was formed to provide stakeholder input on practices to mitigate (avoid, minimize, reduce, or offset) bird and bat impacts from offshore wind development, as well as practices to measure and understand the effects of offshore wind development on these taxa. Committee goals are to (1) develop recommended practices for environmentally responsible development with the purpose of informing a range of offshore wind-related efforts by developers, regulators, and other stakeholders, and (2) promote regional collaboration around environmental mitigation and monitoring for wildlife at offshore wind projects. The Committee is focused on developing recommendations that:

- Are generalized and applicable to a range of development locations, to guide (but not replace) site-specific assessment and mitigation required in permits and approvals. Recommendations may include variable levels of detail, depending on the degree of site-specific variation that must be considered for implementation.
- Are designed to inform decisions for a range of stakeholders involved with the offshore wind energy development process.
- May go beyond what is mandated in current regulations, while providing flexibility to ensure that recommendations can be reconciled with future changes to regulation and other guidance. For example, recommendations could reinforce existing guidelines, add additional detail or specificity to existing guidelines and regulations, or include practices that are not yet addressed by other guidance, but that the Committee judges would serve to advance the state of knowledge and conservation of wildlife for the offshore wind industry.

Committee discussions and written products could inform a range of state, federal, and stakeholder processes. An initial objective of Committee efforts is to inform the New York State Public Service Commission's (PSC) decision about recommended wildlife mitigation and monitoring practices to include in New York State's Phase 2 offshore wind energy procurement order. In its Order Establishing Offshore Wind Standard and Framework for Phase I Procurement, the PSC stated that it would consider best practices developed by the E-TWG[1], and Department of Public Service (DPS) staff have more recently reiterated the willingness of the PSC to consider recommendations put forward by the E-TWG (and the group's Specialist Committees) for inclusion in future procurements. Thus, recommendations from this Committee may eventually become mandated (if they are implemented in New York's Phase 2 Procurement) or may remain as voluntary guidelines. This summary document is intended (among other purposes) to support public comments to DPS that are submitted from the E-TWG or other

[1] http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b37EE76DF-81B1-47D4-B10A-73E21ABA1549%7d

organizations, by summarizing recommendations and the degree of consensus on those recommendations from the broad range of stakeholders represented on the Committee (Appendix A).

Committee discussions have used the term "best management practices," or BMPs, as a convenient shorthand for referring to these recommendations, in part because this terminology was used in the Framework for Phase 1 Procurement (above). This terminology can also be a source of confusion, however, as the term "BMPs" is used in a variety of ways in different contexts. As it has no specific policy meaning within the context of future New York procurements, we have largely avoided the term "BMPs" throughout the remainder of this document in favor of "recommendations".

The committee is focused on mitigation and monitoring for birds and bats in the eastern U.S., which are protected under the Migratory Bird Treaty Act (MBTA; 16 U.S.C. §§ 703–712, 1918), Endangered Species Act (ESA; 16 U.S.C. §1531 et seq., 1973), Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668c, 1940), and/or a range of state laws and regulations. As offshore wind leases in federal waters fall under the jurisdiction of the Bureau of Ocean Energy Management (BOEM), and as federal protections for birds and bats (under the above laws) are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS), there are federal requirements that must be followed relating to protected species mitigation for offshore wind development projects. Many mitigation and reporting requirements for pre-construction survey activities have already been defined. However, because of the early status of the offshore wind industry in the United States, mitigation and monitoring requirements for the construction and operational periods of offshore wind energy projects have yet to be finalized. Through the state offshore wind procurement process, New York also has the ability to add stipulations for developers selling power to the state, as evidenced by the environmental data transparency requirement and other prerequisites in the Phase 1 procurement (NYSERDA 2018). As such, state requirements have the potential to duplicate, conflict with, or go above and beyond federal requirements. While the state can, in many instances, choose to create these additional requirements, states cannot create conflicts with federal regulations and guidance, and any recommendations developed by this Committee must have the flexibility to be reconciled with federal regulations and guidance. Flexibility in recommendations is important for maintaining project feasibility and practicability. The intention for recommendations generated by the Committee is to help ensure the industry is developed in an environmentally responsible, yet practicable, way.

The work of this Specialist Committee fits within a broader set of efforts to improve our understanding of impacts and reduce risk to birds and bats from offshore wind development, as well as to reduce permitting risk for offshore wind energy developers. Some of these efforts are being led by New York State, and others are being spearheaded by other states, federal agencies, developers, environmental nonprofits, and consortia representing multiple sectors (Appendix B).

Guiding Principles

Committee discussions are informed by a set of underlying principles, namely that recommended mitigation and monitoring[2] at offshore wind projects should:

Apply the Mitigation Hierarchy. Where possible, *avoid* negative effects on biodiversity and ecosystem services; where avoidance is not possible, *minimize* those effects; and where significant

[2] Monitoring in this context refers to that related to active conservation and adaptive management as well as monitoring to improve scientific understanding (Nichols and Williams 2006).

residual effects are predicted to remain, *offset* or *compensate* for those effects (Council on Environmental Quality 2005, NYSERDA 2018). Such efforts could include:

- **Avoid effects through careful planning**. Siting, technology use, and other strategies should be planned in ways that avoid displacement, barrier effects, collision risk, and habitat disturbance when possible. This could include (but is not limited to) strategies such as siting project activities to avoid sensitive areas or regular flight paths.
- **Minimize collision risk at turbines, vessels, and other structures.** This may include mitigation measures to minimize wildlife attraction to wind facilities, which in turn could reduce collisions, and deter at-risk species when appropriate.
- **Minimize habitat disturbance.** This includes disturbance from sound, light, human/vessel activity, structures, and visual obstructions, which may lead to physiological, reproductive, or survival impacts.
- **Offset unavoidable effects.** This may include support of additional scientific research to better understand and mitigate effects, or support for the conservation of target populations by working to reduce negative effects from offshore wind energy or other anthropogenic activities (e.g., other offshore industries).

Assess potential effects to individuals, populations, and ecosystems. This includes consideration of direct effects to individuals and populations, such as changes in behavior, injury, or mortality, as well as considerations of indirect effects such as changes to habitat and food web dynamics.

Use a risk-based approach. Mitigation and monitoring measures should be focused towards areas of greatest need (e.g., highest risk or impact). This includes the identification of species at highest risk of effects at each development site and stage of development, due to their vulnerability to stressors, population status, or other factors.

Use adaptive management. This includes flexibility to suit the needs of each development project based on its location, design, and other considerations. It also includes the adjustment of mitigation plans to incorporate new information and modify mitigation and monitoring approaches as our collective understanding of best practices and wildlife effects becomes more advanced.

Be transparent. Transparency in monitoring and mitigation approaches allows others to build on existing work and allows regulators to understand the effectiveness of implemented mitigation measures and adaptively manage across the offshore wind industry. Transparency in decision-making and process also fosters the broader community's trust in outcomes. Transparency should be fostered through peer review, where applicable (ideally through scientific journal articles, technical memoranda, or similar).

Be collaborative and consider stakeholder input. Stakeholder engagement and communications ensure that a diversity of values is represented, which can lead to higher quality decisions that are better adapted to local contexts. Collaboration and support of environmental research could also include leveraging third-party environmental research funding or contributing to regional conservation and research efforts.

Be inclusive of diverse scientific and technical expertise. Mitigation measures should address conservation objectives, be practicable, be technologically and logistically feasible, and avoid risks to human safety. This balance often requires a range of ecological, engineering, project development, and regulatory expertise.

Be informed by the best available science. At the project scale, this includes using existing baseline information and site-specific monitoring data to inform mitigation approaches during each development phase. This also includes ensuring that studies on the effects of development, and the effectiveness of mitigation practices, are designed in scientifically rigorous ways and in accordance with the current state of knowledge.

Address cumulative effects. Whether at project-specific or regional scales, mitigation and monitoring practices should inform our understanding of cumulative effects associated with the industry, and inform the adaptive management of offshore wind projects to minimize these effects.

As defined by the mitigation hierarchy, the immediate goal of mitigation practices is to avoid impacts. If impacts cannot be avoided, they should be minimized and reduced as much as practical through a combination of project design decisions and operational mitigation at project sites. Unavoidable impacts can be offset by providing off-site conservation support for affected populations or ecosystems. The recommendations below must be considered within this context. For the purposes of these recommendations, the term "mitigate" is defined as avoiding, minimizing, and offsetting negative effects.

Process for Committee Discussions

This summary document reflects recommendations by the Committee for minimizing effects to birds and bats from offshore wind development, as well as summarizing Committee discussions around these topics. This summary includes:

- Background: relevant information on focal topic areas, including input from non-Committee members with relevant expertise.
- Recommendations: recommended mitigation and monitoring practices on topics that have been discussed by the Committee.
- Status: indicates the level to which each recommendation topic has been discussed and the degree of Committee agreement on the specifics of the recommendation (status options are "initial brainstorming", "in progress", and "fully drafted").
- Level of Committee Agreement: indicates the degree to which Committee members expressed that they agree with the recommendations as currently written. For recommendations on which there are a variety of Committee perspectives, these alternate opinions are also described.
- Key Takeaways from Group Discussion: key feedback from Committee discussions, including important points of disagreement or topics for additional discussion, as well as considerations for implementation.

This summary document is the main product of the Bird and Bat Specialist Committee. It is intended to be a living document that will be continually updated to include new details and new topics as Committee discussions progress.

Recommendations from this Committee have been developed via a multi-step process. Existing mitigation and monitoring practices (MMPs) for offshore wind as well as other industries, including offshore oil and gas and terrestrial wind, were initially

The topics in this document are not a comprehensive list of recommendations and are not necessarily those identified by the Committee to be highest priority. The Committee chose to begin discussions on a range of initial topics of varying divisiveness and conservation importance. Additional high priority topics will be addressed as Committee discussions continue.

summarized from the literature using the MMP Tool[3] and other sources. The Committee met via phone every few weeks, as well as meeting several times in person, and included participation from outside experts to inform discussions around particular topics. The topics in this document are a subset of the list of potential recommendation topics identified by the Committee; the Committee chose to begin discussions on a range of initial topics of varying divisiveness, difficulty, and conservation importance. Thus, the topics currently included in this document are not necessarily those identified by the Committee to be highest priority. Additional high priority topics will be addressed as Committee discussions continue.

Recommendations for Reducing the Effects of Lighting on Birds and Bats

Background

Artificial lights are well-known to attract and disorient wildlife, including birds, sea turtles, bats, and other taxa (Witherington 1997, Hüppop et al. 2016, Stantec 2016). Lighted offshore platforms have been observed to attract nocturnally migrating birds, which circle the lights and exhaust themselves, affecting their migration and possibly causing starvation-related mortality (Hope Jones 1980, Russell 2005, Hüppop et al. 2006). Such attraction can also cause mortality through accidental collisions with lighted infrastructure (Hüppop et al. 2016); for example, episodic events involving the deaths of hundreds or even thousands of birds have been observed at offshore oil and gas platforms under certain weather conditions and lighting regimes (Sage 1979, Russell 2005, Hill et al. 2014). Research suggests that hundreds of millions of migrating birds collide with lighted structures (including buildings, communications towers, and wind turbines) every year in the US alone, and it is important to minimize collision risk associated with lighted structures to avoid population declines and the potential for population-level impacts for some species (Drewitt and Langston 2006, Gehring et al. 2009, Calvert et al. 2013, Loss et al. 2015, 2019).

Avian species differ in their vulnerability to lighting-related impacts; species that tend to be nocturnally active are more vulnerable, for example (e.g., petrels; Miles et al. 2010), and neotropical migrants may be most affected by light at certain times of year (during spring and fall migration; Hüppop et al. 2006). Weather conditions and cloud cover affect the degree of attraction and disorientation from lighting for birds (Kerlinger et al. 2010, Ronconi et al. 2015). Moon phase has also been documented to affect light-groundings; during low-moon nights, the contrast of artificial light is greater, causing greater disorientation (Montevecchi 2006). The impact of offshore wind turbines on migrating passerine birds is not well understood, but available data from other industries clearly indicates that artificial lighting on offshore platforms and turbines likely increases collision risk (Russell 2005, Hüppop et al. 2006, Hill et al. 2014).

Although bats typically avoid light, they are known to be attracted to some light sources in coastal areas, such as lighthouses, perhaps in relation to increased densities of insect prey that are attracted to lights (Stantec 2016). The degree to which this type of attraction also occurs in the offshore environment is less clear, but bats are clearly present and interact with turbines offshore (Ahlén et al. 2007, 2009, BOEM 2013, Orr et al. 2013, Hatch et al. 2013, Stantec 2016), and efforts to avoid attracting them to the vicinity of turbines may decrease chances for collisions.

[3] https://nyfisheriestwg.ene.com/Resources/MMPTool

Reducing Impacts

Practicable lighting minimization practices may vary by source (e.g., vessel, buoy, turbine, substation) and development phase (e.g., pre-construction, construction, operations, decommissioning), or may apply across multiple sources and phases. Available evidence suggests that lights should be kept on for the minimum amount of time permitted to meet regulation and safety requirements, and that reducing the amount of light broadcast into the environment can reduce impacts to night-migrating birds and other taxa from lighted structures (Orr et al. 2013). Reduction of light broadcast into the environment can be achieved through multiple mechanisms, including reducing the number of lights, reducing light intensity, down-shielding lights, reducing floodlighting, and using sensors so that lights are only on when needed (Wiese et al. 2001, MMS 2009, Miles et al. 2010, USFWS 2012, Mockrin and Gravenmier 2012, Orr et al. 2013, Lüdeke 2017). In addition, there is evidence that flashing lights cause less disorientation and attraction than steady burning light (Gehring et al. 2009, Kerlinger et al. 2010), and benefits can be maximized by having all flashing lights fire synchronously (USFWS 2012) and set at the lowest flash rate practicable (Patterson 2012).

There have been several investigations into the relative attraction of birds to different colors of light. There is substantial evidence of avian attraction and disorientation to white artificial lights; however, there is conflicting information in the scientific literature regarding the color of artificial light that attract the fewest birds (Evans 2007, Poot et al. 2008, Cook et al. 2011).

Existing Regulations and Guidelines

The Federal Aviation Administration (FAA) requires Aviation Obstruction Lighting (AOL) on structures that could present navigational hazards to airplanes, including wind turbines, substations, and construction equipment. Requirements define the color (red or white), intensity, and placement of AOL lighting, among other characteristics (FAA 2019). Where either red or white lights can be used, red is generally the preferred choice due to higher community acceptance (J. Patterson pers. comm.). The U.S. Coast Guard (USCG) requires Marine Navigation Lighting (MNL) on structures in the water, including lights mounted on access platforms and on peripheral structures (i.e. turbines at the edge of the wind farm), and also has navigation lighting requirements for vessels (USCG 2005, Vandermolen and Nordman 2013). BOEM's Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP) state, *"*Lessees and grantees shall comply with Federal Aviation Administration (FAA) and U.S. Coast Guard (USCG) requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on avian species" (BOEM 2016). This guidance is reinforced in BOEM's draft guidelines for lighting and marking of renewable energy structures (BOEM 2019).

The FAA allows the use of Aircraft Detection Lighting Systems (ADLS) on turbine nacelles, which use radar to detect planes in the vicinity and turn on lights only when a plane approaches. The use of ADLS was included as a requirement in the first New York procurement (NYSERDA 2018), and it is assumed by the Committee that this will also be part of future procurement rounds. The FAA is currently testing other technologies that will allow for the reduction of lighting intensity based on meteorological conditions (Jim Patterson pers. comm., 10/8/19). 'On demand' activity sensors for vessel detection are not currently approved by the USCG for use with marine navigation lighting (Vineyard Wind pers. comm., 11/5/19), though they are used in the case of fog horns (the MRASS, or Mariner Radio Activated Sound System) and could be used if determined to be effective at reducing impact risk to birds and/or bats and approved by the USCG.

Recommendations for Reducing Effects from Lighting[4]

Status: Fully Drafted
Level of Committee Agreement: The committee was in full agreement on this recommendation.

To avoid and minimize attraction- and disorientation-related impacts to birds and bats, artificial lighting on offshore wind projects (e.g., flight safety and navigation lighting, work-related lighting) should be reduced to the extent possible while maintaining human safety and compliance with FAA, USCG, and BOEM regulations. This should be implemented during all phases of offshore wind energy development, from pre-construction to decommissioning, and includes the following:

Flight safety and navigation lighting

- *'On demand' activity sensors should be used for transportation safety lighting where allowed by the FAA and USCG, so that lights are kept off unless a vessel or aircraft is approaching (for example, Aircraft Detection Lighting Systems).*
- *Vessels and structures should be lit as little as possible while meeting AOL, MNL, and human safety requirements. The minimum number of turbines should be lit and the fewest lights per turbine should be used that are compatible with FAA/USCG/BOEM requirements. The fewest number of lights should be used on vessels, substations and other permanent infrastructure, and construction structures, such as cranes, that are compatible with regulatory requirements and protection of human safety.*
- *Intensity of obstruction and navigation lighting should be reduced when meteorological visibility sensors indicate that it is safe to do so, if allowed by FAA and USCG regulations and best available technology.*
- *Flashing lights should be used instead of steady-burning lights to the extent possible, particularly at night. Lights should fire synchronously and use the lowest flash rate practicable and as allowable by FAA regulations, where relevant. The use of photocells[5] to switch between steady and flashing lights should be considered in cases where continuous flashing lights are not feasible.*
- *To the extent possible, white lights should be avoided in favor of red or other colors allowable under FAA and USGS regulations.*

Lighting for work activities[6]

- *Light intensity should be kept to the minimum compatible with worker safety. This includes reduced use of high intensity lights such as sodium vapor, quartz, halogen, or other bright spotlights.*
- *Lighting should be hooded, down-shielded, and/or directional (e.g., down-lit) to direct light only to the necessary work areas while minimizing excess light in all other directions, particularly*

[4] Light has also been proposed for use as a deterrent, with the intention of reducing collisions; this is a separate topic from that addressed here. There is limited evidence of the efficacy of using light in this manner to discourage birds from approaching wind turbines, and given the extensive evidence of avian attraction to artificial light, we do not recommend this practice. The use of dim ultraviolet light (outside the visible spectrum for humans) to reduce bat attraction to turbines has shown some promise, but requires further testing prior to commercial deployment in terrestrial or offshore environments.

[5] Photocells, or LDRs (light dependent resistors), are sensors that detect light, and can be used to trigger lights to turn on (or switch between modes) when ambient light in the surrounding environment falls below a certain level.

[6] This includes lighting of work areas on vessels, platforms, and substations; lighting of work equipment; lighting inside turbines; and any other lighting that does not relate to navigation or flight safety during pre-construction, construction, operational, and decommissioning phases of development.

skyward and on the water's surface. "Flood lighting" should be avoided where practicable to do so; this includes lights for work areas on vessels and substation platforms, equipment, and emergency quarters, as well as the use of high intensity lights during wildlife mitigation for other species (assuming effective alternatives are available).

- *Construction and operations and maintenance (O&M) activities that would require extensive lighting should be planned during daylight hours when feasible. This is particularly important for activities requiring flood lighting during periods of high risk to birds and bats. High-risk periods may include: spring and fall migratory periods (approximately April-May and August-October, though this will vary by latitude and project site) when 1) weather conditions are conducive to high levels of migratory activity (e.g., tailwinds; for bats, also relatively warm temperatures and low wind speeds), or 2) low visibility conditions are likely to cause disorientation of avian migrants.*
- *All lights associated with construction should be turned off at night where possible. This is particularly important during the high-risk periods outlined above.*
- *Where feasible, lighting intensity should be reduced or lights should be extinguished on overcast nights within migratory periods, when lights are most likely to attract/disorient migrant passerines.*
- *Lights should be turned off when not in use. To the extent it is compatible with worker safety, automatic timers, motion sensors, heat sensors, or photocells should be used to ensure that lights are turned off when not required. This is most likely to be compatible with worker safety with regards to operational and maintenance lighting in interior work areas on substations and vessels, and internal turbine nacelle and tower lighting.*
- *To the extent possible and compatible with worker safety, white light should be avoided.*

Key Takeaways from Group Discussions

- The Committee agreed that reduction of lighting on turbines, substations, and other infrastructure could help reduce impacts to birds and bats. However, lighting is required to safety reasons in many situations, and lighting conditions must remain safe for workers, vessels, and aircraft.
- Some Committee members agreed that compliance would likely be more consistent if lighting regimes were automated. Most developer Committee members expressed safety concerns with this approach, noting that work lights on sensors must not be allowed to accidentally shut off while crews are working, particularly for outside work on platforms and other areas, which is already dangerous. Other developer Committee members suggested that in this case, workplace safety protocols should require a sensor override when outside work is underway, so that lights will stay on during outside work but are sensor-operated when there is not active work in the vicinity.
- In general, offshore wind developers on the Committee stressed the need for flexibility in specific technologies to be used (e.g., sensors, automation, etc.), to ensure that efforts to reduce lighting impacts are feasible and practicable, effective for deployment in the offshore environment, and are not overly prescriptive.
- There is limited evidence of bird/bat attraction or disorientation due to flashing red aviation obstruction lighting, so long as light numbers, intensity, and flash rate are kept to the minimum that has been identified as safe and allowable by the FAA (Patterson 2012).
- Several Committee members indicated that restricting nighttime construction activity based on lighting concerns would be problematic for developers.

Recommendation for Reducing Perching and Roosting Activity on Wind Energy Infrastructure

Background

Seabirds, songbirds, shorebirds, and bats use the offshore environment during their annual migration, and many species (particularly seabirds) also use offshore habitats for foraging and roosting during breeding and wintering periods. Attraction to structures in the offshore environment, such as wind turbines, may occur for multiple reasons, including increased roosting opportunities (Ronconi et al. 2015). In particular, species such as gulls and cormorants may increase their use of offshore wind farm areas following construction, at least in part because the turbine structures (platforms, handrails, etc.) provide suitable perching sites (Rydell et al. 2012).

The aim of perching and roosting deterrents is to direct animals that might otherwise be attracted to offshore infrastructure away from the vicinity of turbines without permanent harm, so as to reduce the risk of collisions (Gartman et al. 2016). This can be done through the use of physical deterrents to perching and roosting, such as perch guards, spikes, and netting (Cook et al. 2011). More active deterrents are intended to alarm or frighten wildlife to prevent them from perching or roosting, through the use of sound, electromagnetic fields, chemicals, or visual deterrents. There are mixed results in the scientific literature regarding the use of active deterrents, as substantial trial and error is often required, results can be species-specific (Curtis et al. 1993), and there is evidence of habituation to this type of deterrent in many cases (Cook et al. 2011, Arnett and May 2016, Gartman et al. 2016)[7].

The primary reason for implementing perching ad roosting deterrent systems at offshore wind farms in Europe has been human safety concerns due to guano accumulation. In Europe, physical deterrents (spikes with connectors) have been effective at reducing perching for birds on offshore wind farms (as measured by reduction in guano accumulation); trial and error related to the placement and number of deterrents at the wind farm is required to ensure effectiveness (Gareth Johnson, pers. comm.). Integrated deterrent systems for helipads at offshore wind farms in Europe are currently being tested that include a linked motion sensor and PA system that broadcasts different noises to deter seabirds (murres, gulls, etc.) from landing. The system is motion-triggered and uses a range of noises with the aim of reducing habituation. No results on efficacy are available to date (Gareth Johnson, pers. comm.). While in general it is thought that reducing perching and roosting opportunities can help reduce attractiveness of wind farms to birds, which in turn may help reduce collision risk (Gartman et al. 2016), there is no direct evidence linking perching deterrents to collision risk reduction.

Bats are also known to roost on offshore wind turbines (Ahlén et al. 2009, Lagerveld et al. 2014), generally in the grating or nacelle (S. Lagerveld pers. comm., 10/30/19), but little is known about this behavior. Bats have been observed on oil and gas platforms up to 80 km from the coast in the North Sea (Boshamer and Bekker 2008). Neither physical nor active deterrent systems are currently used for bats offshore, nor are bats thought to cause human safety concerns by roosting on turbines (S. Lagerveld pers. comm., 10/30/19). Due to a lack of information about the frequency and implications of this behavior, the below recommendation has been drafted specifically in relation to birds.

Recommendation for Avian Perching Deterrents

[7] Deterrents exist for reducing collision risk to birds and bats that are unrelated to the deterrence of perching and roosting; this is a separate topic from that addressed here. Several acoustic and light-related deterrents are currently being tested for effectiveness at deterring bats from terrestrial turbines, but to date evidence is limited.

Status: Fully Drafted
Level of Committee Agreement: The committee was in full agreement on this recommendation.

Monitoring should be conducted at each wind farm to determine if there is a need for perching-related deterrents to reduce attraction and minimize potential perching and loafing opportunities for birds. If perching and roosting is a common occurrence, physical deterrents to perching, such as spikes and netting or other best available technology, should be implemented to the extent that they do not represent a human safety hazard. If necessary, the use of a combination of active deterrents could also be explored, but should be carefully tailored to the bird species present and designed to minimize chances of habituation. Regardless, monitoring should be conducted to determine the effectiveness of implemented deterrent strategies, modify approaches as necessary, and inform adaptive management of future projects.

Key Takeaways from Group Discussion

- There is a lack of direct evidence that birds attracted to turbines for perching or roosting are at a higher risk of collision, though this has been proposed as a justification for deterrent measures in the past (e.g., MMS 2009). Some Committee members felt that reducing attraction may be likely to reduce risk for some species. Most Committee members agreed that reducing attraction at least would not hurt, as well as having human safety benefits.
- Committee members indicated that physical deterrents are to be preferred over active deterrents, at least as a first resort, because there is greater evidence of efficacy. Active deterrents are variably effective and there can be issues with habituation.
- Committee members agreed that deterrents should be implemented only if there is demonstrated risk at the site, as perching and roosting activity appears to be highly variable between wind farms (G. Johnson pers. comm.). If there is an issue with perching at a specific project site, physical deterrents are relatively inexpensive and easy to implement after a wind farm has been built.

Recommendations for Reducing Disturbance and Habitat Loss from Nearshore and Onshore Infrastructure and Development Activities

Background

The majority of infrastructure for offshore wind farms is located in the marine environment. However, the electricity produced via offshore turbines must be transferred from an offshore substation to the onshore electrical grid. An export cable, running along or under the seabed, connects the offshore substation(s) to a landfall site. The subsea cable is usually laid using a jet plow, which blasts water to build a trench for the cable, and then the cable is reburied where possible (MMS 2009, U.S. Army Corps of Engineers 2014, BOEM 2018). There is a transition area or joint bay with underground access where the cable comes ashore, known as the landfall site. From the landfall site, electricity is further transported via underground cables to an onshore substation and eventually interconnected to existing utility grid systems (Vineyard Wind 2018). Ducts are installed to house the cables, and then cables are pulled through the ducts during installation. Regular duct bays are installed along the terrestrial cable route and accessed via manholes from the surface (Vineyard Wind 2018). Ducts and cables at the landfall site and onshore can either be installed via open-cut trenching, where a trench is cut prior to cable laying, or by horizontal directional drilling (HDD), where a drill is driven down into the sediment and then operated horizontally to minimize surface disturbance (Baik et al. 2003). There are environmental, feasibility, and cost considerations regarding the use of HDD versus open-cut trenching. Open trenching is relatively inexpensive, uses standard construction equipment, and allows good access to cables for repair; HDD is more expensive, suitable for areas that are difficult to access (high cliffs, hard rock, sea walls), only feasible with certain geological conditions, and relatively low-impact to bird and bat habitats, as it leaves the surface largely undisturbed (Ørsted pers. comm., 11/25/19).

Birds and bats may potentially be affected by onshore activities and infrastructure during construction (e.g., physical habitat disturbance, displacement due to construction noise/activity, direct mortality from contact with construction equipment), and over the longer term during the operational period (e.g., habitat loss, conversion of habitat). Much of the research to date on the impacts of habitat loss from wind energy development has focused on terrestrial wind farms, which require much larger land areas (Allison et al. 2019). However, many strategies to avoid and minimize adverse effects to birds and bats from habitat loss or conversion of habitat apply across industries.

Existing guidelines for terrestrial wind energy development suggest identifying and avoiding areas of high conservation value, such as wetlands, unique or rare natural communities, major migratory routes, and critical habitat for endangered species (USFWS 2012). Particular habitats are also protected under federal regulation, such as wetlands (under Section 404 of the Clean Water Act; 33 U.S.C. §1251 et seq., 1972), critical habitat for endangered and threatened species listed under the ESA, and essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. ch. 38 § 1801 et seq., 1976). In addition to the protection of specific habitats, the Coastal Zone Management Act (16 U.S.C 1451 et seq., 1972) is aimed at protecting the coastal environment from growing residential, recreational, commercial, and industrial use, and ensures that federal actions are consistent with state coastal management programs[8]. State may have their own protections for particular species and habitats. For instance, New York's Environmental Conservation Law[9] provides additional protections for tidal wetlands and state-listed vulnerable species. The New York Public Service Commission is also currently leading an effort to understand transmission distribution and planning needs in the terrestrial context within the state.

In addition to habitats protected under federal and state regulations, there may be other important habitats that warrant additional consideration and protection to reduce potential impacts to birds and bats from habitat disturbance or destruction, such as important habitat for forage fish species. For the purpose of these recommendations the term "key habitats" include designated critical habitats under the above state and federal regulations (USFWS 2012), conservation lands, and important areas of bird and bat use, including wetlands and marshes, dunes, roosts, breeding habitat, staging areas (including mudflats), and migration corridors (APLIC 2006). In turn, "key species" are those species of regulatory concern that are state or federally listed, or proposed for listing; species otherwise identified as being of conservation concern at the state or federal level; species for which the affected area represents a significant proportion of their habitat or population; or species otherwise identified to be of substantial concern based on best available scientific information.

Recommendations for Nearshore and Onshore Siting

Status: Fully drafted
Level of Committee Agreement: The committee was in full agreement on this recommendation.

[8] https://www.boem.gov/environment/environmental-assessment/coastal-zone-management-act
[9] https://law.justia.com/codes/new-york/2015/env/article-11/

Siting and construction of nearshore and onshore project components for offshore wind farms (including but not limited to nearshore export cable routes, landfall sites, onshore cable routes, and onshore substations) should be conducted in such a way as to avoid or minimize the loss or alteration of bird and bat habitat, as well as avoid or minimize disturbance and direct and indirect effects to bird and bat populations and their prey. Specifically, onshore infrastructure (i.e., landfall site, cable routes, substations) and development activities should 1) maximize the use of previously developed or disturbed areas, and 2) avoid unique or protected habitats, as well as habitat for key species, where feasible. Specific recommendations include:

- *Nearshore cable routes should avoid important habitats for marine bird prey populations, including eelgrass beds, forage fish spawning sites and habitats (including sandlance habitat and areas of high densities of bivalves and mussels), wetlands, and other habitats identified as key for marine bird prey populations.*
- *Nearshore cable routes should avoid areas with high concentrations of key marine bird species, including foraging areas (as identified based on prey habitat information, foraging/behavioral data, and/or distribution and abundance data for these species).*
- *Landfall sites (i.e. the transition from nearshore to onshore cabling) should, to the extent feasible, avoid key habitats for birds and bats and be located in already disturbed areas such as parking lots when possible. This can be accomplished through siting, the use of horizontal directional drilling (HDD) or other means.*
- *Onshore cable routes should, to the extent feasible, be located in already disturbed areas such as parking lots and roads with wide shoulders, and sited to minimize disturbance to adjacent wildlife as much as possible. In instances where cable routes cannot be sited under existing wide roads, other existing infrastructure and disturbed areas should be used to the extent feasible (e.g., narrower roads, areas next to roads, along railroad lines, along utility rights of way).*
- *Onshore cable routes should avoid key habitats for bird and bat species, as well as contiguous areas of otherwise undeveloped land. If avoidance is not possible, surface habitat disturbance should be minimized where possible via use of HDD or other approaches.*
- *Existing onshore substations should be used where possible, as this largely avoids additional habitat loss or alteration. In instances where this is not feasible, substations should preferably be located in already disturbed areas, and sited so as to minimize habitat fragmentation and disturbance to naturally vegetated areas and key habitats for birds and bats.*
- *If the development of new permanent infrastructure (i.e. cable routes, substations) is planned for utility interconnection, the same principles to minimize the loss and alteration of key habitats should be followed as for other project components (above).*
- *Construction work zones and equipment staging spaces should be located in previously developed areas, and minimize disturbance to key habitats and naturally vegetated areas.*
- *If habitat disturbance from construction is unavoidable, construction activities should be planned to occur during periods of time that will minimize disturbance to the degree feasible. For nearshore construction, this should be informed by seasonal distribution data for marine birds. Onshore, construction should avoid the breeding season for bird and bat species of concern, with additional consideration given to important migratory stopover locations during migration periods.*

Key Takeaways from Group Discussion

- There was general agreement among Committee members that avoiding sensitive habitat and natural areas, and developing in already disturbed areas when possible, would mitigate potential impacts to bird and bat species.
- Committee members recognized that while there are several approaches to avoid or minimize impacts to key habitats, the available options are often constrained by site conditions (local geology, etc.). The inclusion of flexibility in the language of the recommendation was a key focus of discussion.
- Several Committee members pointed out the importance of forage fish for supporting bird populations in nearshore areas, but noted that the identification of habitat for many forage fish species may be difficult.
- A Committee member noted that existing plans for offshore wind farms on the east coast of the U.S. generally include the use of existing infrastructure, or in some cases expand existing infrastructure, because these areas already have the necessary load capacity. As offshore wind buildout continues, however, existing infrastructure may no longer be as available, and new substations and other infrastructure may be required.
- Siting of offshore project components was also felt by Committee members to be a priority topic for minimizing impacts to birds and bats (e.g., siting projects farther offshore to avoid nearshore migration routes and higher seabird densities; Paton et al. 2010, Winiarski et al. 2012, Williams et al. 2015). This topic was not addressed during initial discussions due to uncertainty about its relevance for projects that have already obtained leases from BOEM, but some Committee members strongly advocated for development of a siting recommendation for offshore infrastructure, and in the meantime for the inclusion of the word "turbines" in the first parenthetical list in this recommendation.

Recommendations for Pre- and Post-Construction Monitoring

Background

The two main types of potential effects that have been identified for birds and bats at offshore wind facilities are 1) behavioral effects (most notably displacement, but also attraction and barrier effects) and 2) collisions with wind facility infrastructure (Cook et al. 2018). Environmental monitoring is essential for detecting changes associated with resource management activities (Levine et al. 2014), and in order to better understand and assess the effects of offshore wind development on wildlife, pre- and post-construction monitoring has undergone a considerable evolution as the industry has progressed. Monitoring in this context refers to that related to active conservation and adaptive management as well as monitoring to improve scientific understanding (Nichols and Williams 2006).

Behavioral Effects

The presence of a wind farm can result in avoidance responses, particularly in seabirds, which may result in effective habitat loss or increased energetic costs (Bailey et al. 2014). This includes displacement from habitat used for foraging, roosting, or other daily activities (Drewitt and Langston 2006), and barrier effects, in which birds avoid proximity to a wind farm and thereby extend migration flights or commuting flights between colonies and foraging areas (Masden et al. 2010). The primary methods for monitoring behavioral effects to birds from offshore wind energy development include surveys (boat-based, visual aerial, digital aerial) to examine changes in abundance and distribution before and after wind farms have been built (Maclean et al. 2006, Buckland et al. 2012, Vanermen et al. 2015), and tracking individuals (GPS, satellite tags, nanotags) to understand individual movement and potential avoidance behavior in relation to wind farms (Montevecchi et al. 2012, Cleasby et al. 2015, Thaxter et al. 2018, Loring et al. 2019). Radar has also been combined with various types of visual observations to understand avian movements in and around wind farms (e.g., Desholm and Kahlert 2005).

Monitoring methods should be chosen that work best for the key species of interest. It is important to design the monitoring program in such a way that potential changes can be detected. This can be done by surveying a large enough area outside of the project footprint and over a long enough period to ensure that displacement impacts can be differentiated from normal variation in distributions for the species of interest Power analyses should be used to help identify appropriate pre- and post-construction monitoring methods and study designs that should be implemented to effectively analyze risk and evaluate impacts (MacLean et al. 2013). The more information is available on environmental covariates and other components of the system, the more likely it is to be able to disentangle the behavioral effects of the offshore wind farm from changes caused by other factors (Mackenzie et al. 2013).

Collision Risk

Birds and bats colliding with wind turbines is likely to lead to direct mortality, and as such, understanding and measuring collision risk is an important aspect of monitoring (Cook et al. 2018). Collision mortality at terrestrial wind energy facilities is generally monitored via ground-based carcass searches, which are impossible in the offshore environment (Collier et al. 2011). Because of this, understanding of offshore collision-related impacts to birds and bats relies on collision risk modeling (Masden and Cook 2016) as well as technologies that can be deployed at wind facilities to record interactions between wind turbines and wildlife (Drewitt and Langston 2006). There are several such detection technologies in various stages of development, including: 1) video, 2) acoustic monitoring, 3) infrared/thermal imaging systems, 4) radar systems, and 5) impact detection systems. All technologies have strengths and weaknesses, and many collision detection systems try to integrate multiple types of technology (K. Peters pers. comm., 12/3/19). At this stage, few existing technologies have undergone third party testing of effectiveness or have been successfully deployed offshore (K. Peters pers. comm., 12/3/19).

Existing Guidance and Efforts

Existing guidelines include BOEM-issued pre-construction avian survey guidelines (BOEM 2017), and limited additional guidance in their Guidelines for Construction and Operations Plans (BOEM 2016). There is a recognized need for more detailed monitoring guidance for the construction and operation periods to ensure proper study design and standardization across projects, improve our ability to understand cumulative impacts, and inform adaptive management of future projects. Several early offshore wind projects have developed avian and bat post-construction monitoring plans (ESS Group Inc. 2012, Tetra Tech Inc 2014), and post-construction monitoring is ongoing at the only commercial offshore wind farm in the U.S., the Block Island Wind Farm. Developer-led pre-construction monitoring (2009-2011) for Block Island included shore-based surveys, onshore beach surveys, bird and bat acoustic monitoring, boat-based avian surveys, and high definition video aerial surveys (Tetra Tech Inc 2012)[10]. Post-construction monitoring for this project was designed to largely occur one, three, and five years

[10] Additional baseline information was also collected in relation to this project, including a radar-based bird and bat monitoring project conducted by New Jersey Audubon in collaboration with the University of Rhode Island. More information:
https://tethys.pnnl.gov/sites/default/files/publications/Radar_Monitoring_of_Bird_and_Bat_Movement.pdf

after construction. It includes bat acoustic monitoring from vessels and turbines, beach surveys, boat-based avian surveys, proof-of-concept testing of turbine-mounted radar and cameras for avian collision monitoring at select turbines, and nanotag telemetry to help assess changes in temporal and spatial patterns of avian and bat occurrence (Tetra Tech Inc 2014). Developers of other projects will likely also conduct monitoring activities appropriate to their site.

Other industries and markets can inform monitoring design, such as the terrestrial wind industry and the offshore wind industry in Europe. In addition, NYSERDA is currently supporting the development of a bird and bat scientific research framework to guide specific studies of potential impacts to birds and bats from offshore wind energy development in the eastern U.S. as well as efforts to develop research priorities for understanding cumulative impacts to birds and bats (Appendix B).

Pre- and Post-Construction Monitoring Recommendation

Status: Fully Drafted
Level of Committee Agreement: The committee was in full agreement on this recommendation.

Pre- and post-construction monitoring should be designed to improve our understanding of the impacts of offshore wind energy development and operations on birds and bats. Specific questions and focal taxa should be chosen for each development project, either based on site-specific avian and bat risk assessment or in relation to broader regional efforts to assess variation between sites and understand cumulative impacts for sensitive species. These questions may focus on collisions, displacement, or other effects, as deemed appropriate for each project site. Monitoring should, to the extent practicable, use appropriate study designs and methodologies to effectively analyze risk prior to construction and evaluate impacts during construction and operation by testing hypotheses and ensuring sufficient statistical power for meaningful data analysis. Outside expertise should, if practicable, be consulted during study design and data analysis processes.

Studies to detect displacement and other behavioral effects should, to the extent practicable, be based on the best available science, including:

- *Designing the monitoring program to answer specific questions (including identifying key species of interest)*
- *Defining an appropriate geographic and temporal resolution to have sufficient power to detect the effect of interest. This includes appropriate buffer zone sizes to detect displacement for species of interest, based on displacement findings from other studies (if applicable) and a sufficient number of years of pre- and post-construction surveying to characterize baseline levels of variation and be able to distinguish the effects of development activities*
- *Using up-to-date analytical techniques, such as before-after gradient (BAG) designs*
- *Contributing to our understanding of impacts at the project site, and when possible, to larger-scale efforts to understand cumulative impacts*

Due to current technological limitations, efforts to inform our understanding of collision risk should use any of a variety of mechanisms, including but not limited to:

- *Deploying collision monitoring technology to measure collisions at an operational offshore wind facility*
- *Contributing funding to technology development for collision monitoring*
- *Providing host site and logistical support for technological development/testing for collision monitoring technologies*
- *Collecting information that informs or validates collision risk models*

- *Collecting information that improves our understanding of high-risk periods for nocturnal migrants*

Key Takeaways from Group Discussion

- Committee members recognized a clear need for pre- and post-construction monitoring to inform our understanding of impacts and the adaptive management of future projects. However, they felt that project-specific monitoring plans should be based on site-specific risk assessments and adequate data. In particular, risk assessments should help drive the decision to focus on displacement or behavioral effects vs. collision risk, as well as to help identify specific questions, monitoring methods, and focal species.
- Substantial technological challenges may prevent effective collision monitoring offshore, particularly in the short term. In recognition of the current state of technological development on this topic, the Committee expressed the need to incorporate flexibility into the recommendation such that an offshore wind project may contribute to our collective understanding of collision risk to birds and bats through any of a variety of ways, including support for continued development of collision monitoring technologies.
- Federal agencies that are directing monitoring (BOEM, USFWS) should be involved in planning discussions.
- There was discussion among Committee members about whether the choice of focal species for monitoring should be based solely on project-specific information, or whether larger-scale regional concern should play a role. Based on this discussion, one Committee member suggested that focal species for monitoring should be chosen based on both the expected risk at the project site as well as predicted cumulative risk.
- Some Committee members indicated that a timeline for pre- and post-construction monitoring could help provide more certainty to developers while also ensuring that enough data are collected to examine impacts to birds and bats. However, the Committee did not make a concerted attempt to define a recommended timeline. There was also a feeling among some Committee members that the amount of additional monitoring that is undertaken at a specific project site should be influenced by the amount of pre-existing data and a site-specific understanding of risk.
- Several Committee members felt that this recommendation could be more robust. One Committee member suggested adding language to the recommendation explicitly recommending that each development project to commit to developing and implementing an approved pre- and post-construction monitoring plan. Another Committee member noted that it will be important to update this recommendation on a regular basis to reflect the best available science about known and hypothesized impacts.

Other Topics Discussed by the Committee

Several other topics were mentioned during Committee phone calls but have not yet been discussed in depth. These topics, and comments from Committee members on their potential implementation, include:

- **Baseline Monitoring** – Committee members indicated that baseline monitoring is important to inform project siting, inform risk assessments, identify key taxa and questions to target during pre- and post-construction monitoring, and understand impacts to birds and bats. However, it was suggested by a Committee member that baseline monitoring may not be necessary when there are already enough existing data for a project site to inform risk assessment sufficiently. Another Committee member suggested that to achieve sufficient statistical power, research questions should be identified as a regional scale, with baseline monitoring to address those questions implemented at multiple projects.

- **Monitoring of Mitigation Efficacy** – Throughout discussions of mitigation practices, Committee members recognized that the effectiveness of many such practices is poorly understood. Thus, some Committee members indicated that measures of efficacy should be evaluated against a set of expectations (including comparison with other projects that have implemented a similar practice) to allow for quantitative evaluation and adaptation of management practices where needed. There may be existing resources from other industries that could inform the development of these expectations.

Topics Requiring Further Study

Research on the efficacy of a range of proposed mitigation measures would be beneficial to the industry and allow for the most effective mitigation of the impacts of offshore wind farms on birds and bats. During discussions, the Specialist Committee identified several research needs and data gaps regarding proposed mitigation measures that would benefit from further study, including:

- Determining the necessity for, and efficacy of, bat deterrent measures. It is currently unclear whether offshore wind impacts to bats will be substantial enough to warrant concern. Several types of bat deterrents, including ultrasonic and UV deterrents, are currently being tested and require additional research prior to implementation.
- Understanding of collision risk. This remains a key gap in our understanding of impacts to birds and bats; in order to fill this gap, funding and research should be allocated for development and testing of technologies to detect collisions of birds and bats at offshore wind farms.
- Development of more effective bird deterrents for species at risk. Bird perching and attraction deterrents using light, sound, chemicals, or other approaches often lead to habituation and a reduction in efficacy over time, and require additional research. We also want to avoid displacing species that might not otherwise be at risk of collision.
- Assessing the efficacy of suggested lighting mitigation measures to inform adaptive management of offshore wind project to minimize effects on birds and bats. This could include:
    - Determining the effects of color/wavelength on avoidance for different taxa of birds and bats. Experimental research should be conducted with different lighting colors in the offshore environment, under a range of environmental conditions and with taxa of particular concern for offshore wind projects, to determine which light colors cause the least disturbance.
    - Determining the efficacy of lighting reduction measures in reducing disturbance across avian taxa.
    - Understanding the effects of overcast and inclement weather conditions on both migrating and foraging birds relative to lighting regimes, to better identify higher-risk periods.
- Improving our understanding of the relationship between turbine height and/or rotor-sweep area and collision risk. While modeling efforts (e.g., Johnston et al. 2014) have improved our understanding of flight height of marine birds and possible exposure, additional study is required to relate exposure to collision risk. A subtopic would be understanding the relationship

between bird attraction/disorientation and the height of lighting on turbines and other structures as it may contribute to collision risk.

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Appendix A. Specialist Committee Members

This list includes both current and former Committee members, and their alternates (if they were unable to make specific meetings), who contributed to discussions and the formulation of recommendations in this document.

Brita Woeck	Ørsted
Catherine Bowes ad Jim Murphy	National Wildlife Federation
David Bigger	Bureau of Ocean Energy Management
David Mizrahi and Nellie Tsipoura	New Jersey Audubon
David Phillips, Martin Goff, and Laura Morales	Equinor
Jennifer Daniels	EDF Renewables
Jillian Liner	Audubon New York
Jo Anna Lutmerding	USFWS Headquarters
Koen Broker, Paul Phifer, and Louis Brzuzy	Shell New Energies
Matthew Robertson	Vineyard Wind
Scott Johnston, Caleb Spiegel, and Pamela Loring	USFWS Northeast Region

Convened by:

Kate McClellan Press and Gregory Lampman	NYSERDA

Support staff:

Kate Williams and Julia Gulka	Biodiversity Research Institute
Bennett Brooks	Consensus Building Institute

Appendix B. Related Efforts and Resources

The work of this Specialist Committee fits within a broader set of efforts to improve our understanding of impacts and reduce risk to birds and bats from offshore wind development, as well as to reduce permitting risk for offshore wind energy developers. Some of these efforts are being led by New York State (Figure 1), and others are being spearheaded by other states, federal agencies, developers, environmental nonprofits, and consortia representing multiple sectors (Table 1). The scope of each effort, and the organizations involved, are listed by type (working group, guidance/recommendations, procurement, state of the science assessment, permitting, and research) in further detail below.

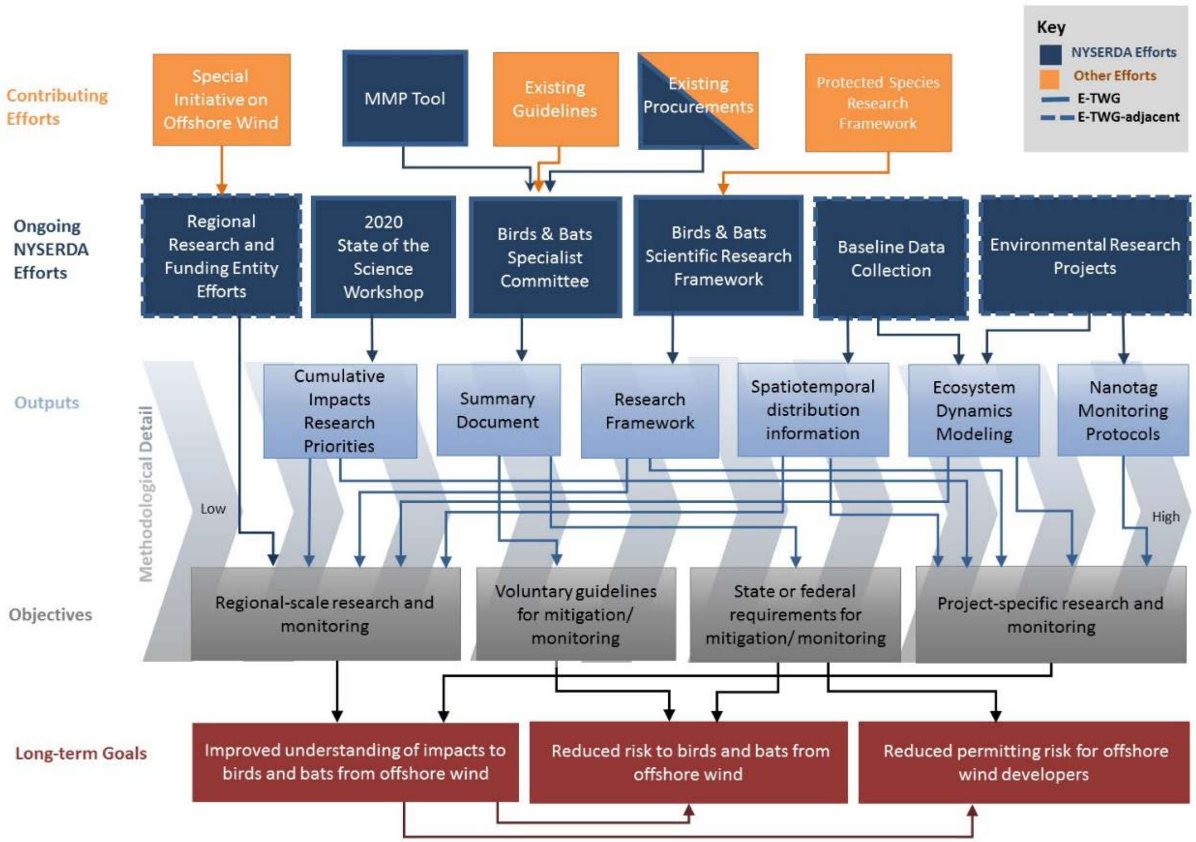

Figure 1. Efforts relating to birds and bats and offshore wind that are being led by the New York State Energy Research and Development Authority (NYSERDA). These efforts include those led by the Environmental Technical Working Group (E-TWG) as well as E-TWG-adjacent activities.

Table 1. Additional information about bird and bat related efforts, including status, geographic scale, relevant offshore wind development phase, level of detail, point of contact, and links to additional information.

Item	**Type**	**Status**	**Geographic Scale**	**Development Phase**	**Level of Detail**	**Point of Contact**	**Additional Information**
Bird and Bat BMPs Specialist Committee	Working Group	Initiated Spring 2019	Regional	Construction/ Operations	Low	Kate Williams	www.nyetwg.com
E-TWG	Working Group	Ongoing	Regional	All	Low	Kate McClellan Press	www.nyetwg.com
Avian "Dream Team"	Working Group	Ongoing	Regional	All	Moderate	Jillian Liner	
CT Commission on Environmental Standards	Working Group	Initiated 2019; ongoing	State	All	Low	CT DEEP	www.ct.gov/deep/cwp
MA Habitat Working Group	Working Group	Initiated 2011; ongoing	Regional	All	Low	MA CZM/CEC	www.mass.gov
NJ Environmental Resource OW Working Group	Working Group	Initiated Nov 2019;	Regional	All	Low	NJ DEP	
Atlantic Marine Bird Cooperative (AMBC) Marine Spatial Planning (MSP) Working Group	Working Group	Initiated Nov. 2018; ongoing	Regional	All	Moderate	Caleb Spiegel/Holly Goyert	www.fws.gov/northeast/migratorybirds/marinebirdconservation.html
Developer site-specific alignment on monitoring	Working Group	Summer 2019	Project	All	High	Developers	
Development of Monitoring Protocols for Nanotag Studies at Offshore Wind Farms	Guidance/ recommendations	Starting Fall 2019	Project	Construction/ Operations	High	Pam Loring	www.nyserda.ny.gov
Bird and Bat Scientific Research Framework	Guidance/ recommendations	Initiated Summer 2019	Regional	All	Moderate	Kate Williams	
BOEM Pre-construction Avian Survey Guidelines	Guidance/ recommendations	Last updated 2017	National	Pre-construction	High	David Bigger	www.boem.gov/Avian-Survey-Guidelines

Item	Type	Status	Geographic Scale	Development Phase	Level of Detail	Point of Contact	Additional Information
BOEM draft guidelines for lighting renewable energy structures	Guidance/ recommendations	Released Oct 2019	National	Construction/ Operations	High	Angel McCoy	https://www.boem.gov/sites/default/files/documents/about-boem/regulations-guidance/federal-register/84-FR-57471.pdf
USFWS draft avian guidelines for offshore wind	Guidance/ recommendations	In Progress	National	All	Moderate	Jo Anna Lutmerding	
USFWS Land-based Wind Energy Guidelines	Guidance/ recommendations	Published in 2012	National	All	Moderate	varies by USFWS region	www.fws.gov
Existing BMPs in CT procurement	Procurement	RFP published August 2019	State	Construction/ Operations	Low	CT DEEP	www.ct.gov/deep/cwp
Existing BMPs in MA procurements	Procurement	First RFP 2018; second RFP 2019	State	Construction/ Operations	Low	MA DER	https://macleanenergy.com
Existing BMPs in NY procurements	Procurement	First RFP 2018; second RFP expected 2020	State	Construction/ Operations	Low	Kate McClellan Press	https://nyserda.ny.gov
State of the Science Workshops	State of the Science assessments	Initiated Nov. 2018; ongoing	Regional	All	Moderate	Kate Williams	www.nyetwg.com
DOE State of the Science Reports	State of the Science assessments	Not initiated	National	All	Moderate	Jocelyn Brown-Saracino	
Environmental permitting for offshore wind energy projects	Permitting	Ongoing	Project	All	High	BOEM	https://www.boem.gov/renewable-energy/regulatory-framework-and-guidelines

Item	Type	Status	Geographic Scale	Development Phase	Level of Detail	Point of Contact	Additional Information
DOE-funded projects	Research	Ongoing	National	All	Low	Jocelyn Brown-Saracino	www.energy.gov
NYSERDA-funded projects	Research	Ongoing	Regional	All	Low	Kate McClellan Press	https://www.nyserda.ny.gov/About/Newsroom/2019-Announcements/2019-08-08-NYSERDA-Selects-Five-Projects-to-Advance-Understanding-of-Environmental-and-Fishery-Topics-in-Support-of-Responsible-Offshore-Wind-Development

Bird and Bat BMPs Specialist Committee

Effort Type: Working Group
Lead: NYSERDA
Involved: NWF; Audubon NY; NJ Audubon; USFWS; BOEM; Shell New Energies; EDF Renewables; Equinor; Vineyard Wind; Ørsted
Scope: The New York State Environmental Technical Working Group (E-TWG) has convened a specialist Committee to develop best management practices (BMPs) for minimization and mitigation of offshore wind energy impacts to birds and bats. This group is made up of volunteers including offshore wind developers, environmental NGOs, federal and state agencies. The main end product of the Committee is a public document that summarizes recommendations discussed by the Committee and the level of Committee support or degree of consensus for each recommendation. This document will be used to inform New York efforts including future procurements and site-specific environmental mitigation plans.

Environmental Technical Working Group (E-TWG)

Effort Type: Working Group
Lead: NYSERDA
Involved: Audubon NY, NWF, NRDC, TNC, EDF Renewables, Equinor, Ørsted, Shell New Energies, U.S. Wind, Vineyard Wind, NY Offshore Wind Alliance, BOEM, NOAA, USFWS, Delaware DNREC, Maryland DNR, Massachusetts DOS, New York DEC, New York DOS, Rhode Island CRMC, New Jersey DEP, New Jersey BPU, Virginia DEQ
Scope: The New York State Environmental Technical Working Group (E-TWG), convened by the New York State Energy Research and Development Authority (NYSERDA), is a team of stakeholders that provides advice on how to advance offshore wind energy development in environmentally responsible ways. The group meets quarterly and is working on efforts including the development of best management practices, state of the science workshops, and other efforts to better inform New York's development of offshore wind.

Avian "Dream Team"

Effort Type: Working Group
Lead: eNGOs
Involved: Audubon NY, NJ Audubon, NWF, Defenders of Wildlife, others
Scope: A group of environment NGOs interested in impacts from offshore wind energy development on birds (including Audubon New York, National Wildlife Federation, Defenders of Wildlife, American Bird Conservancy) are working to develop a guidance document with a series of recommendations to reduce impacts to birds (similar to the BMP document for right whales[11]; The target audience for this is developers/industry.

Connecticut Commission on Environmental Standards

Effort Type: Working Group
Lead: Connecticut DEEP
Involved: NWF; CT Sea Grant; Audubon CT; CT General Assembly; TNC; commercial fishermen; NMFS; Northern New England Fishermen and Lobstermen's Association

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[11] https://www.nrdc.org/sites/default/files/best-management-practices-north-atlantic-right-whales-during-offshore-wind-energy-construction-operations-along-us-east-coast-20190301.pdf).

Scope: In order to guide its development of standards for environmental and fisheries mitigation plans, in June 2019, DEEP announced plans to convene a Commission on Environmental Standards to develop recommendations and accept public input. The Commission's recommendations were incorporated into the August 2019 RFP.

Massachusetts Habitat Working Group

Effort Type: Working Group
Lead: Massachusetts Executive Office of Energy and Environmental Affairs, MassCEC
Involved: Mass Audubon; New England Aquarium; Center for Coastal Studies; NWF; TNC; Conservation Law Foundation' USGS; NMFS; MA state agencies;
Scope: Massachusetts convened two working groups for marine habitat and fisheries issues in 2011, which meet 0-2 times per year. The working groups are voluntary and informal, and are intended to maintain dialogue with key stakeholders, get their feedback and guidance, and identify issues and concerns. Input from the working groups has resulted in accommodations to avoid important marine habitat, fishing grounds, and marine commerce routes in the designation of wind energy lease areas. The working groups will continue to provide advice as leaseholders proceed through the development process. Recent conversations have focused on identifying research priorities and providing input on survey guidance. There is also interest in developing policies or BMPs on several types of human activities in the marine environment, including floating offshore wind development.

New Jersey Environmental Resources Offshore Wind Working Group

Effort Type: Working Group
Lead: New Jersey Department of Environmental Protection
Scope: In November 2019, New Jersey Department of Environmental Protection (NJ DEP) announced this newly established working group of fishing and conservation groups to provide guidance to the state's overall strategy and approach to achieving its offshore wind goals. The objectives of the group are to 1) enhance communication and coordination between stakeholders, 2) provide a platform for meaningful input from stakeholders, 3) share existing data, research and information, 4) provide information on current uses of offshore areas, and 5) support scientific and technical research.

Atlantic Marine Bird Cooperative Marine Spatial Planning Working Group

Effort Type: Working Group
Lead: AMBC
Involved: USFWS; NOAA; BOEM; Canadian Wildlife Service; USGS; NWF; University of Rhode Island; Memorial University; ABC; BRI; DNV GL; Clemson University; HiDef; West-Inc; Normandeau; APEM; CUNY CSI; Mass Audubon;
Scope: The AMBC is a collaborative forum for resource managers, research scientists, and other professionals working to conserve marine birds in the coastal and offshore ecosystems of eastern North America through partner-driven science and action. The marine spatial planning (MSP) working group was formed out of the larger AMBC in November 2018 to help inform management and conservation decisions related to marine spatial planning. The group's (draft) mission is to identify, synthesize, evaluate, and utilize offshore distribution and movement information on marine birds, to help inform management and conservation decisions related to marine spatial planning. Future efforts are likely to include working with BOEM to update existing avian survey pre-construction guidelines (above) and providing other technical expertise in data analysis, monitoring, and research to inform offshore wind energy development.

Developer Site-specific Alignment on Monitoring

Effort Type: Working Group
Lead: Offshore Wind Developers
Scope: Developers are working to develop principles to aid alignment for upcoming site-specific avian monitoring. Developers are internally discussing how best to proceed and will then reach out to other key stakeholders like Audubon and USFWS.

Development of Monitoring Protocols for Nanotag Studies at Offshore Wind Farms

Effort Type: Guidance/Recommendations
Funded by: NYSERDA
Involved: USFWS, BRI, University of Rhode Island, Bird Studies Canada, Acadia University, BOEM
Led by USFWS and funded by NYSERDA, this two-year project is aimed at developing guidance and decision support tools to enable the widespread use of nanotag VHF transmitters to monitor birds and bats in relation to offshore wind energy development. This will include guidance on how/when nanotags are an appropriate study method, and detailed implementation methodologies.

Birds and Bats Scientific Research Framework

Effort Type: Guidance/Recommendations
Lead: NYSERDA
Involved: eNGOs, developers, federal and state agencies
Scope: Under the auspices of the E-TWG, NYSERDA is supporting the development of a scientific research framework to guide the long-term study of potential impacts to birds and bats from offshore wind energy development. The framework will identify key questions and testable hypotheses to improve our understanding of impacts, and outline potential methods to test these hypotheses. To aid in the development of the framework, a stakeholder workshop is planned for March 2020, and the aim is to finalize the framework document by the end of 2020.

BOEM Pre-construction Avian Survey Guidelines

Effort Type: Guidance/Recommendations
Lead: BOEM
Involved: USFWS, stakeholder engagement
Scope: Guidance for how avian survey information should be collected for Site Assessment Plans, Construction and Operations Plans, or General Activities Plans. These site characterization guidelines include suggestions and information on survey methods and scope, data management and reporting, and coordination with BOEM.

BOEM Draft Proposed Guidelines for Providing Information on Lighting and Marking of Structures Supporting Renewable Energy Development

Effort Type: Guidance/Recommendations
Lead: BOEM
Scope: Guidance for lighting and marking designs for wind energy facilities on Federal renewable energy leases on the Outer Continental Shelf. Lighting recommendations are designed to be consistent with FAA regulatory requirements that apply to structures sited within 12 nm of shore. Draft guidelines were released in October 2019 for public comment.

USFWS Draft Avian Guidelines for Offshore Wind

Effort Type: Guidance/Recommendations
Lead: USFWS
Scope: USFWS is in the process of developing voluntary avian guidelines for reducing impacts to avian and bat species from offshore wind energy development. The draft guidelines include a recommended step-wise approach for minimizing effects of offshore wind development on migratory birds and bats, analogous to the Land-based Wind Energy Guidelines. The guidelines have not been shared outside of USFWS to date, and there is no defined timeline for their release.

USFWS Land-based Wind Energy Guidelines

Effort Type: Guidance/Recommendations
Lead: USFWS
Involved: Stakeholders
Scope: USFWS worked with a range of stakeholders to develop voluntary guidelines for addressing wildlife conservation concerns at all stages of land-based wind energy development. The guidelines include a recommended step-wise approach for minimizing effects of terrestrial wind development on birds and bats (e.g., avoid impacts via siting, then minimize impacts at each step of the development process, with the findings from earlier steps informing the need for additional studies or mitigation).

Existing BMPs in Connecticut Procurement

Effort Type: Procurement
Lead: Connecticut DEEP
Scope: CT DEEP released an RFP in August 2019, to procure up to 2 GW of offshore wind energy and the selected project was announced in December 2019. RFP language required bidders to include an Environmental and Fisheries Mitigation Plan, including: 1) an Adaptive Plan with clearly identified stakeholders, a stakeholder engagement process, a plan for pre-construction and risk assessment, a process to avoid, minimize, and mitigate risks to stakeholders throughout the project phases, and a reporting schedule; 2) addressing how the bidder will inventory, avoid, minimize, and mitigate risk to commercial fisheries, risk to marine mammals and sea turtles with specific reference to underwater sound and collision, and risk to birds and bats; and 3) a Data Reference and Sharing Plan that addresses coordination with relevant regional working groups and a plan to store and share inventory and monitoring data. (This RFP is Connecticut's first solicitation specifically for offshore wind, though a 2018 solicitation focused on multiple energy resources led to the state's purchase of 304MW of offshore wind energy).

Existing BMPs in Massachusetts Procurements

Effort Type: Procurement
Lead: Massachusetts DOER
Scope: MA DOER released an RFP in 2018 for their first phase of offshore wind energy procurement, for up to 800 MW; the contract was finalized in April 2019. The second round of procurements for up to another 800 MW was opened in March 2019 with project selection in October 2019. Section 83C of the RFP required that, where possible, a proposed project must demonstrate that it mitigates any environmental impacts; and the proposed project must demonstrate through a fisheries mitigation plan its proposed approach to avoid, minimize and mitigate impacts on commercial fishing industry.

Existing BMPs in New York Procurement

Effort Type: Procurement
Lead: NYSERDA, NY DPS
Scope: NYSERDA released an RFP in 2018 for their first phase of offshore wind energy procurement, for up to ~800 MW. Selected projects were announced in July 2019. RFP language included the following environmental BMPs and requirements for bidders: 1) data sharing and transparency, 2) use of aircraft detection lighting systems (ADLS) for turbines, 3) development of site-specific environmental and fisheries mitigation plans, to be further developed in collaboration with the technical working groups, and 4) participation in technical working groups. The second phase of procurements are expected to be announced in 2020; the Public Service Commission, which directs NYSERDA on procurements, has indicated that additional BMPs developed by the technical working groups will be considered for inclusion in the next RFP.

State of the Science Workshops

Effort Type: State of the Science Assessment
Lead: NYSERDA
Involved: eNGOs; developers; federal and state agencies; academics; other offshore wind stakeholders
Scope: NYSERDA held the first State of the Science Workshop on wildlife and offshore wind energy development in November 2018. The meeting brought together stakeholders to discuss the state of knowledge, share ongoing efforts to understand, minimize, and mitigate environmental impacts, and promote regional coordination and collaboration. The next workshop is planned for Spring 2020 with a focus on cumulative impacts.

Department of Energy State of the Science Reports

Effort Type: State of the Science Assessment
Lead: DOE EERE
Scope: The Department of Energy Office of Energy Efficiency and Renewable Energy (DOE EERE) has indicated an interest in developing "state of the science" reports on wildlife impacts from offshore wind energy development, analogous to the 2016 report on the environmental effects of wave and tidal power[12]. This report(s) would be produced by DOE national laboratories, and the effort may involve workshops or other stakeholder engagement to inform development. A scope of work for the project is in development, but the effort has not yet been initiated.

Environmental Permitting for Offshore Wind Energy Development Projects

Effort Type: Permitting
Lead: Various
Scope: Throughout the process of planning, construction, and operations of offshore wind projects, a series of plans and assessments are made. These documents include Site Assessment Plans (SAPs), Construction and Operations Plans (COPs), Environmental Impact Statements (EISs), and post-construction monitoring plans, among others. Developers may also undertake new field survey efforts in support of SAPs and/or COPs. These permitting-related efforts may include particular monitoring and mitigation provisions relating to birds and bats.

[12] https://tethys.pnnl.gov/publications/state-of-the-science-2016

Department of Energy-funded Research

Effort Type: Research
Lead: Department of Energy
Involved: Various
Scope: In 2019, the DOE funded research relating to smart curtailment to minimize impacts to bats, technological development of bat deterrent technologies, and pre- and post-construction monitoring and mitigation solutions, including bird and bat collision detection technology offshore.

NYSERDA-funded Research

Effort Type: Research
Lead: NYSERDA
Involved: Various
Scope: Since 2017, NYSERDA has funded baseline monitoring and primary research focused on understanding avian distributions in the offshore environment to inform offshore wind energy development. This has included digital aerial surveys of the New York Bight, as well as research on predator-prey dynamics and modeling efforts to understand environmental predictors of seabird distributions and movements.