Part II. Introduction

Note: This is an excerpt from "*Guidance for Pre- and Post-Construction Monitoring to Detect Changes in Marine Bird Distributions and Habitat Use Related to Offshore Wind Development".* The full guidance document is available at www.nyetwg.com/avian-displacement-guidance

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1.0 Background and Purpose

Offshore wind (OSW) development is rapidly increasing in the eastern U.S., bringing with it a range of potential effects to bird populations that use the marine environment for foraging, roosting, small- to large-scale movements, and other activities. The potential effects of offshore infrastructure for birds include collision risk (Masden & Cook 2016, Allison et al. 2019), changes in habitat and prey resources (Perrow et al. 2011, Degraer et al. 2020), and behavioral changes that may lead to avoidance (Masden et al. 2009, 2010) or attraction to OSW facilities (Vanermen et al. 2015, Dierschke et al. 2016, Mendel et al. 2019a). For marine birds, changes in offshore habitat use patterns may have the potential to affect individual fitness and, by extension, lead to population-level impacts (Busch et al. 2013).

The Offshore Wind Environmental Technical Working Group (E-TWG) is an independent advisory body to the State of New York with a regional focus on OSW and wildlife issues in the U.S. Atlantic. The E-TWG recognized the need for additional guidance and recommendations for conducting site-level wildlife monitoring at OSW facilities, and with input from biologists at the U.S. Fish and Wildlife Service (USFWS), formed a Committee of subject matter experts (Appendix A) to develop guidance for monitoring changes in marine bird distributions and habitat use at OSW facilities in the U.S. This Committee was chaired by a USFWS biologist with the Migratory Bird Program and includes a range of other expertise from multiple sectors.

Recognizing that there are other potential effects to birds from OSW development (e.g., collisions and micro-avoidance of turbine blades, changes in habitat and prey), this guidance is focused specifically on developing standardized methods to accurately and reliably detect macro- to meso-scale changes (e.g., displacement, attraction, and avoidance) in avian distributions and habitat use at OSW facilities in the U.S. The main objective of this effort is to inform pre- and post-construction monitoring and research approaches for detecting and characterizing displacement, attraction, and macro- to meso-avoidance of marine birds at OSW facilities in U.S. waters. This includes the identification of avoidance and attraction-related research questions and the appropriate methodologies to address those questions (e.g., observational surveys, marine radar, telemetry, and other methods), with a focus on informing study designs for observational boat-based and aerial surveys. The goals of this effort are to:

- Encourage consistency in pre- and post-construction monitoring across projects,
- Facilitate use of site-specific data to address information gaps on the effects of OSW development on birds at regional scales,
- Improve efficiency and thus reduce costs of monitoring,
- Reduce duplicative efforts,
- Ensure the generation of meaningful results, and
- Address knowledge gaps that could inform the broader understanding of potential cumulative impacts from OSW development.

While the focus of this effort is on designing pre- and post-construction monitoring to detect effects, Committee members recognized an immediate need for more detailed guidance to supplement existing BOEM site characterization guidelines (BOEM 2020) for determining when existing avian observational survey data is sufficient for site characterization purposes. This topic is addressed in a separate

Committee document, "Recommendations for Evaluating the Use of Existing Baseline Observational Survey Data in Offshore Wind Site Characterization Processes for the U.S. Atlantic," (Avian Displacement Guidance Committee 2023; hereafter referred to as 'site characterization recommendations'), which is available on the Committee webpage at www.nyetwg.com/avian-displacement-guidance.

1.1 Terminology

A glossary of key terms used throughout this document can be found in Appendix B. **Marine birds**, in the context of this document, are defined as all birds that interact with the offshore marine environment at or below the water's surface for foraging, roosting, loafing, and/or other behaviors. This includes all seabirds, as well as waterbirds and waterfowl that utilize the ocean during parts of their life cycle, and other species such as phalaropes that forage or roost on the water's surface. Species whose only interaction with the offshore marine environment is to fly over it during migration (e.g., most songbirds and shorebirds) are not included in this scope.

Avoidance is a behavioral response in which birds navigate away from structures at the macro-scale (e.g., the entire footprint of an OSW facility, generally occurring within 3 km of turbines), the meso-scale (e.g., avoidance of individual turbines once they have entered the footprint of an OSW facility, or the micro-scale (e.g., last minute avoidance of turbine blades/structures; Fox & Petersen 2019). **Displacement**, in the context of this document, is defined as the change in distributions and habitat use that occurs as a result of macro-scale avoidance. This involves reduced usage of areas around OSW turbines for activities such as foraging, which causes short- or long-term functional habitat loss and is one of the most regularly observed effects of OSW development on seabirds in Europe. Displacement has been noted for species such as Northern Gannets (*Morus bassanus*), Common Murres (*Uria aalge*), and Red-throated Loons (*Gavia stellata*; Dierschke et al. 2016, Mendel et al. 2019b, Peschko et al. 2020). In this document "displacement" is used to refer to changes in distribution/habitat use, while "avoidance" is generally used to refer to changes in movement behavior.

Some avian species may also be **attracted** (the process by which individuals respond to an object or stimulus by moving towards it) to OSW turbines or other structures due to increased foraging or roosting opportunities, artificial lighting, or other causes (Leopold et al. 2011, Rebke et al. 2019). Changes in distributions and habitat use of marine birds can include avoidance at different spatial scales, displacement, and/or attraction; efforts to **detect and characterize** such changes, as described in this document, include documenting shifts in species' distributions as well as the magnitude, temporal extent, and variability of such changes, the conditions under which these changes occur, and (where possible) the drivers of these changes.

Research is any type of hypothesis-driven scientific study that improves our understanding of populations and ecosystems, either generally or in relation to the effects of offshore wind development. Monitoring represents a subset of research that includes systematic or repeated data collection.

Site characterization surveys are new observational surveys of an OSW project site implemented prior to construction, generally by the developer, which are designed to collect environmental data for the project site to inform permitting processes, project design, effect minimization measures, and the development of pre- and post-construction monitoring plans. BOEM has existing guidelines for site characterization surveys (BOEM 2020). However, as recognized by the Atlantic Marine Bird Cooperative

Marine Spatial Planning Workgroup[1] and others, these guidelines do not adequately address the collection of data to detect potential effects to marine birds caused by an OSW facility. Effects surveys are generally conducted both pre- and post-construction to compare differences in distributions, abundances, or behaviors between the two time periods. While site characterization methodologies may resemble pre-construction data collection required to assess effects (e.g., for pre- and post-construction comparisons), these surveys may also vary in key ways, such as the geographic scope and duration of monitoring that is required for each purpose.

Additional terminology relevant to identifying focal taxa for research is defined in Sections 5.1-5.2, and terminology specific to study methods is included in Section 6.1, as well as in the document glossary (Appendix B).

2.0 Rationale

Displacement and other changes to avian habitat use, distributions, and movement patterns have been documented at OSW facilities across Europe. The occurrence and degree of displacement, avoidance, and attraction varies in space and time with individual and species-level responses, site-level characteristics, environmental conditions, and other factors (Fox & Petersen 2019). Standardized pre- and post-construction monitoring at individual OSW facilities is important for detecting, quantifying, and contextualizing such changes. Despite existing efforts[2], there is currently no standard guidance in the U.S. that provides specifics for how to best examine effects of OSW facilities, such as displacement, on marine bird species. Before conducting monitoring activities, it is important to identify a clear set of appropriate questions to be answered, as well as the spatiotemporal scales at which to address these questions, to inform the choice of study methodology. Standardized, repeatable, and transparent methods are critical to achieve the statistical power needed to detect effects such as displacement at individual OSW projects, distinguish changes caused by OSW facilities from background/other sources of variation, and aggregate data across projects to improve broader understanding of potential cumulative effects from OSW development.

This guidance could be used in multiple ways, including being: (1) referenced and/or incorporated into future national OSW-wildlife guidance developed by regulatory agencies, (2) used by OSW developers and their consultants as they develop site-specific monitoring plans, and (3) used by BOEM, states, and other stakeholders in meeting regulatory responsibilities. Site characterization guidance to inform risk assessments already exists (BOEM 2020). The displacement and avoidance-specific guidance for effects studies contained in this document is consistent with, and complements, the existing site characterization survey guidance from BOEM, as well as the site characterization recommendations developed by this Committee (Avian Displacement Guidance Committee 2023) and will be available for BOEM's future use at their discretion. This guidance, which is focused on monitoring at individual OSW facilities, also

[1] See Atlantic Marine Bird Cooperative Marine Spatial Planning Workgroup's 2021 recommendations to BOEM on these avian survey guidelines.

[2] Relevant efforts include recent site-specific monitoring guidance to investigate the effects of offshore wind development on fishes and invertebrates (ROSA 2021), BOEM offshore wind energy avian survey guidelines for OSW site characterization activities (BOEM 2020), Atlantic Marine Bird Cooperative recommendations to BOEM on these avian survey guidelines, the bird and bat scientific research framework workshop (NYSERDA 2020); a U.S. Fish and Wildlife-led project to develop guidance for deploying Motus telemetry at OSW facilities, and a concurrent E-TWG effort to develop guidance for regional-scale wildlife research and monitoring in relation to OSW development in the eastern U.S.

complements the guidance for regional-scale research and monitoring efforts that was concurrently developed by another E-TWG Specialist Committee (Regional Synthesis Workgroup 2023).

The geographic scope of this effort was the U.S. Atlantic coast. However, recommendations have been developed with the intention of broad applicability to the U.S. Pacific coast, Gulf of Mexico, Atlantic Canada, and other regions of planned OSW development in North America.

3.0 Focus of Guidance

This effort is focused on developing guidance to detect and characterize changes in distributions and habitat use patterns of marine birds in relation to OSW development. These potential changes include avoidance at meso- and macro scales, displacement from habitat use areas as a result of macro-avoidance, and attraction, which may occur during all periods of the annual cycle (breeding, non-breeding, and migration). These effects may be measured using various metrics, such as the distance from the OSW facility at which change occurs, or the abundance or proportion of a population that is affected. An examination of the individual fitness effects of these changes, potential population-level impacts, and management of these effects is beyond the scope of this effort, as are other types of effects (e.g., collisions, micro-avoidance).

While there are various potential effects from OSW development on marine birds, and all deserve dedicated research recommendations, understanding displacement-related effects from OSW development represents a key research priority. While this should not be the sole focus for project-level studies, when the focus is on displacement, observational surveys represent a key study method. As such, this document outlines various research questions related to changes in distributions, habitat use, and behavior of marine birds and relevant methods at a broad level (Part III), before diving into detailed recommendations for observational surveys (Part IV). Next steps (Part V) include the development of detailed recommendations for other methods (e.g., tracking, radar) and effect types (e.g., collisions) to ensure that all types of research at the project-scale is carried out in an effective and scientifically robust manner in consultation with federal agencies.

A main focus of this guidance is to help OSW developers and their contractors to develop an effective study plan for effects studies. Study plans should include the identification of monitoring methods most appropriate to answer research questions at the OSW project scale, including use of radar, telemetry, boat-based and aerial surveys, and other approaches (Largey et al. 2021). As detailed in the conceptual diagram below (Figure 1), the choice of study method(s) should depend, first and foremost, on the selection of research question(s) of interest (Section 4) and one or more focal taxa (Section 5). For methods that are well suited to collect data on multiple taxa simultaneously (e.g., observational surveys), the choice of focal taxa is still important to inform study designs that adequately detect effects.

In addition to the selection of research question(s) and focal taxa, the study plan should also consider the strengths and limitations of potential methods (Section 6). Following the selection of one or more study method, studies should be designed with the statistical power to detect effects (Section 7) and plans for data sharing and transparency should be explicitly incorporated into the study plan prior to beginning data collection (Section 8). Observational surveys are a key method for detecting displacement, and therefore this document also provides detailed guidance on the use of observational survey methods for pre- and post-construction monitoring (Section 10), recognizing that the scientific community would benefit from detailed recommendations for all study methods. The recommendations in this document

are intended to be widely applicable across studies conducted at the site-level. However, recognizing that project-level considerations will play a role in study design, any deviations from these recommendations should be carefully considered and justified based on statistically and scientifically robust analysis. Recommendations are additionally provided for future refinement and expansion upon the guidance in this document (Part V). We encourage the development of recommended study protocols similar to Section 10 of this document to inform the use of radar, individual tracking, and other study methods. The focus on detailed recommendations for observational surveys relates to the strengths of this method for characterizing displacement while also collecting community-level information, as demonstrated by the widespread use of this method in Europe (Appendix C; Lamb et al. 2024).

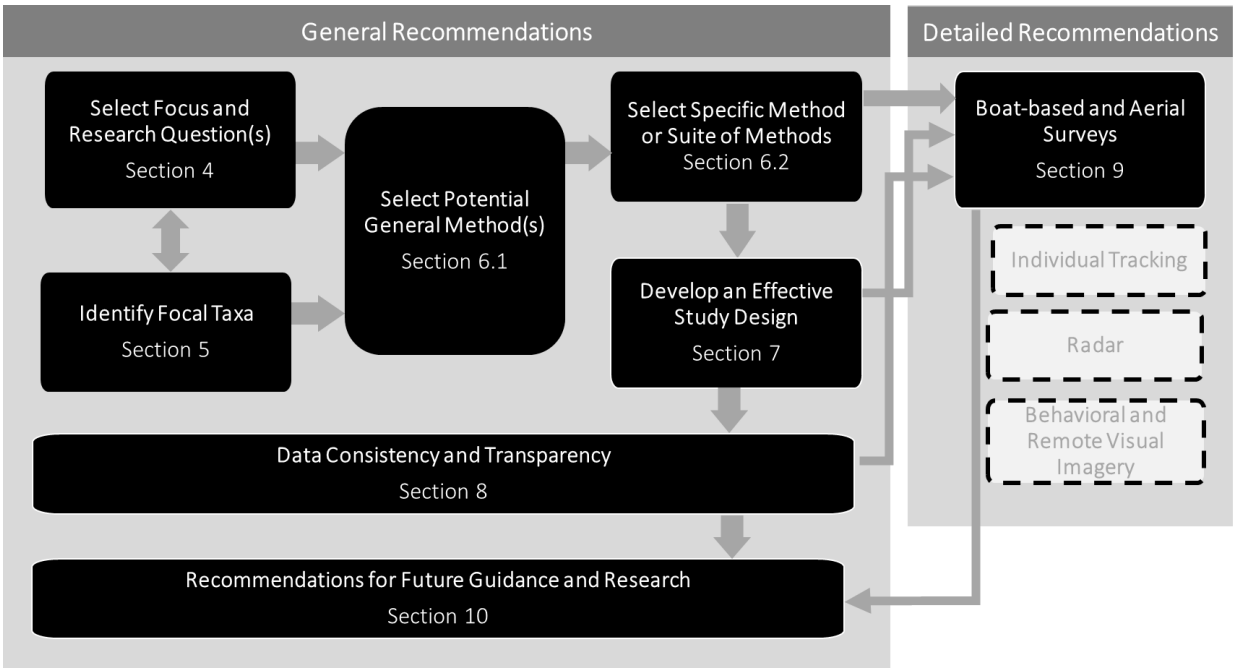

Figure 1. *Conceptual diagram for the main components (black boxes) of this guidance document for the selection of study design options for studies of macro- to meso-scale changes in avian habitat use around offshore wind facilities broadly and detailed recommendations specific to conducting observational surveys (e.g., boat-based and aerial). Detailed recommendations for other methods (grey boxes) are outside of the scope of this effort (see Part V for future guidance recommendations). Processes for each step in this diagram are further detailed in the referenced sections of the text.*

A literature review of existing empirical studies of macro- to meso-scale changes in marine bird distributions and habitat use at OSW facilities (Appendix C) informed the development of the recommendations in this document, particularly those related to spatial and temporal scale of study design as well as consistency of reporting. The literature review analyzed 55 journal articles and monitoring reports from European OSW facilities to document aspects of study design and the type and level of effects identified for suites of marine bird taxa. Results suggest that many factors influence the type and level of response detected, as well as the ability of the study design to have the statistical power to detect effects of OSW development on marine birds. Influencing factors include focal taxa, the pre-construction abundance of focal taxa in the area of interest, aspects of study design (e.g., inclusion of pre-construction data, gradient vs. control-impact design, spatial and temporal scale), site characteristics, and the stage of the annual cycle, among other factors. The literature review can be used to inform the

selection of research questions and focal taxa based on the type and magnitude of species-specific responses of previous studies as well as key aspects of study design, including spatial scale. The literature review also highlights challenges associated with aggregating results across studies, particularly when key components of methods, analyses, and results are not comprehensively reported. Gaps identified during the literature review informed recommendations for reporting across methods in this document, as well as specifically for observational surveys.