Part I. Summary

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

Developed by the Avian Displacement Guidance Committee of the Environmental Technical Working Group, with support from the Biodiversity Research Institute

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Part I. Summary

This document was developed by a Specialist Committee convened by the New York Offshore Wind Environmental Technical Working Group (E-TWG) and chaired by a representative from the U.S. Fish and Wildlife Service (USFWS). The goal, developed in consultation with the E-TWG and USFWS staff, was to advance recommendations for the effective detection and characterization of changes in the distributions and habitat use of marine birds in relation to offshore wind (OSW) energy development. Committee members were selected for their knowledge and expertise on marine birds, study design, regional monitoring frameworks, and offshore wind development. The intended audience for these recommendations includes offshore wind energy developers, federal and state agencies that have oversight of marine birds and/or OSW energy activities in the U.S., and others conducting studies of marine birds at offshore wind energy projects.

The Specialist Committee used existing guidance from the Bureau of Ocean Energy Management (BOEM) for site assessment surveys, "Guidelines for Providing Avian Survey Information for Renewable Energy Development" (BOEM 2020), as a starting place, and attempted to clarify and improve on these guidelines, where relevant, to develop guidance specifically for conducting pre- and post-construction research to detect effects on marine birds. This effort was supported with a deep and thorough literature review of previous studies from Europe and elsewhere that have examined displacement, attraction, and macro- to meso-scale avoidance in marine birds (Appendix C), as well as existing relevant power analysis studies to inform recommendations. These recommendations are specifically focused on the following:

- Marine birds and OSW development in the U.S. Atlantic (though, we expect this document to be broadly relevant to OSW development studies in other geographies).
- Studies of changes in movement behavior, distributions and habitat use, namely displacement, attraction, and macro- to meso-scale avoidance. *Micro-scale avoidance and collisions, as well as other types of OSW effects, were not considered here, and additional recommendations should be developed in the future for these other types of studies.*
- Studies intended to detect effects from OSW development, not assess risk or characterize avian resources at the site level prior to construction. Recommendations for site characterization surveys (also known as site assessment surveys) are included in BOEM's current guidelines (BOEM 2020), and in a supplementary document produced by this Committee (Avian Displacement Guidance Committee 2023), that outlines circumstances under which existing data for a project site are sufficient for site characterization purposes.
- Site-specific studies of the effects of individual lease areas. These recommendations are intended to inform project-specific monitoring, because the regulatory framework for OSW development in the U.S. tends to encourage monitoring at this scale. However, many of these recommendations will also be applicable to studies at larger spatial scales.

While there are various potential effects from offshore wind 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 (Sections 4-8), before diving into detailed recommendations for observational surveys (Sections 9-10). Next steps (Sections 11-12) 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 are carried out in an effective and

scientifically robust manner. Prioritization of regional-scale (multi-project) collaborative studies is also recommended to better detect effects beyond the scale of individual OSW projects.

The deliberative and inclusive process used to develop these recommendations (Appendix A) brought together substantial expertise to reach consensus on the best available science to conduct studies of marine birds at OSW facilities. This Specialist Committee firmly recommends that:

1. **Statistically robust monitoring should be conducted at all lease areas to detect and characterize changes in distributions and habitat use of marine birds** and
2. **The guidance in this document forms the basis for federal guidelines focused on how to conduct pre-and post-construction monitoring to detect changes in marine bird distributions and habitat use at individual OSW facilities in the U.S. Atlantic.**

In addition to this summary (Part I), there are four main parts to this document, including an introductory section (Part II) which details the rationale and purpose for this guidance and define the terminology used throughout (additional terminology is also defined in the glossary in Appendix B). Part III provides general study design recommendations for all types of displacement, avoidance, and attraction studies (summarized in S1 below). Part IV provides detailed recommendations for conducting observational surveys (summarized in S2 below). Part V includes recommendations for future guidance and research (summarized in S3 below). Following the literature cited (Part VI), several appendices provide supporting information (Part VII).

S.1 General Recommendations

General recommendations for conducting studies to detect displacement, attraction, and macro- to meso-scale avoidance include recommendations for the identification of research questions (Section 4), selection of focal taxa (Section 5), choice of appropriate methodologies (Section 6), development of an effective study design (Section 7), and reporting and data transparency (Section 8).

Key Research Questions. Section 4 identifies six key questions to be addressed when examining marine bird displacement, attraction, and avoidance at OSW developments. During study planning, one or more of these questions should be selected to be the focus of study and help direct the choice of focal taxon, study method, and other aspects of the research effort. Section 4 also provides brief guidance on best practices for using site-specific data to inform regional-scale questions.

Selection of Focal Taxa. Section 5 describes how to select focal taxa for studying changes in distributions and habitat use at OSW energy projects to inform study design and data collection even for study methods that can collect information on multiple species simultaneously (e.g., observational surveys). The choice of focal species for understanding displacement, attraction, and avoidance at site-specific scales will depend on a variety of considerations: for example, the research question(s) of interest (Section 4), characteristics of the particular OSW project(s) and location(s) being investigated, and species-specific risk inferred from existing information (Appendix C; Lamb et al. 2024). Data-driven focal species selection may also depend on exposure, sensitivity to effects, population sensitivity, and uncertainty in our understanding of responses. A decision tree is proposed to select focal taxa that will best contribute to a broader understanding of offshore wind effects and inform resource management and other decision making.

Selection of Appropriate Methodologies. Section 6 suggests how to select appropriate methodologies that can detect effects of OSW facilities on birds. This includes a multi-step process to identify appropriate methods for the research question and taxon of interest, and to compare available methods that help identify the most effective approach. Applicable study methods include observational surveys, individual tracking, radar, behavioral observations from fixed points, and use of remote visual imagery.

Development of an Effective Study Design. Section 7 provides guidance on how to design and implement an effective study of changes in marine bird distributions and habitat use at OSW facilities. This includes the definition of clear objectives and the identification of appropriate spatial and temporal scales to estimate acceptable statistical power and effect size. In addition to data collection and analytical methods, study planning should include a focus on data sharing and coordination. A suggested assessment rubric for study plans is provided (Appendix D) to help in the review of proposed methods and guide the selection of project-specific study designs.

Recommendations on Reporting, Data Consistency and Transparency. Section 8 provides recommendations on reporting, including standardization, data sharing, and coordination.

S.2 Detailed Recommendations for Observational Surveys

Observational surveys are a key method for detecting displacement, and therefore this document provides detailed guidance on the use of observational survey methods for pre- and post-construction monitoring. We recommend that separate site assessment and pre-construction surveys to detect effects are conducted (Avian Displacement Guidance Committee 2023), given differences in the objectives of each survey as well as challenges associated with timing under current permitting timelines (Section 9). *Recommendations in Section 10 are therefore specific to conducting observational surveys (e.g., boat-based surveys and digital aerial surveys) to detect effects from OSW development on marine birds.* Additional details, including justification of the summarized recommendations below, can be found in each linked section of the document.

S.2.1 Study Design Recommendations for Surveys

- Study Design – It is recommended that observational surveys to detect effects utilize Before-After-Gradient (BAG) study designs.
- Power analysis – Existing data should be used in site-specific power analyses to inform the choice of spatial and temporal coverage of surveys based on the focal taxa at each site. Surveys should collect data on all species observed, but selection of focal taxa can help to refine the specific survey design. To improve statistical power to detect effects if they occur, focal species should have relatively high exposure and high expected magnitude of response (additional criteria discussed in Section 5). For focal species where potential effect size is unknown, effect size should be estimated conservatively to ensure the study is designed with a higher chance of detecting effects, should they occur.
- Buffer size – In order to have the statistical power to detect effects, should they occur, a buffer zone of 4–20 km should be surveyed around the OSW project footprint with a consistent buffer distance in all directions. Choice of buffer size should be based on species presence and focal species sensitivity to displacement (e.g., predicted displacement distance).

- Survey area – The choice of survey area should be informed by the spatial extent at which changes are predicted to occur, such that the total survey area includes the wind farm footprint, as well as a buffer zone that incorporates the predicted effect distance for focal taxa plus 10%.
- Coordination – For adjacent lease areas, we encourage coordinated survey efforts, to the degree feasible given differences in construction timelines, to maximize efficiency and treat the area as a continuous habitat for marine birds.
- Spatial coverage – We recommend at least 20% spatial coverage of the study area for surveys to detect effects, calculated based on effective strip width for focal species.
- Transects – Transect lines should be a distance apart that is >2 times the effective strip width and placed/oriented such that important environmental gradients are fully represented within sampling designs.
- Temporal scale – For studies to detect effects, 12–16 surveys per year for at least two years pre-construction should be conducted to adequately capture variation in distributions. The duration and frequency of post-construction surveys should depend on the question (e.g., interest in temporal patterns of displacement/habituation; Section 4) and levels of variability in site-level data but should include no less than 3 years of 12–16 surveys per year. Post-construction surveys should be initiated within five years of the completion of pre-construction surveys.
- Seasonal distribution – The distribution of surveys within a particular year should take into consideration seasonal patterns of focal species, as increases in power can be achieved if effort is concentrated in seasons in which species of interest are most abundant (Maclean et al. 2013).

S.2.2 Data Collection, Analysis, and Reporting Recommendations for Surveys

- Consistent methods – Survey methods, including data collection methods, should be consistent across pre- and post-construction surveys so as not to introduce biases (BOEM 2020). Unavoidable changes should be assessed via calibration studies.
- Sampling method – Line transects with distance-sampling methods should be used for boat-based surveys (Buckland et al. 2001; Camphuysen et al. 2004), while strip-transect or grid sampling should be used for digital aerial surveys (BOEM 2020).
- Platform – The same platform should be used for pre- and post-construction surveys, traveling at consistent speeds (boat-based 7–10 knots, digital aerial 185–350 km/hr). For boat-based surveys, an adequate position above sea level is necessary to detect birds within a minimum of 300 m of the trackline for focal taxa, have a clear 90 field of degree view, and be safe and stable. For digital aerial methods, surveys should be flown at a consistent altitude (500 m minimum), with optimal flight height chosen to balance image resolution, disturbance to wildlife, and human safety.
- Surveyor qualifications – Observers/biologists conducting surveys must have documented experience with identifying and counting seabirds (50–100 hours training minimum) and demonstrated ability to rapidly identify seabirds in the region in various conditions.
- Survey conditions – Surveys should be conducted in a sea state of Beaufort 4 or less (depending on survey type), in conditions with enough light to identify birds to species. Survey angle and location should be designed to minimize glare.
- Data collection – Survey data collection should include effort data and information on conditions, as well as observations (see Section 10.4 for full list of data) collected in a standardized way for incorporation in the Northwest Atlantic Seabird Catalog and other repositories. Birds should be identified to species wherever possible (with high confidence), color images should be captured

at adequate resolution (boat: where possible with telephoto lens; digital aerial: minimum 2 cm resolution).

- In-situ environmental data – Careful consideration should be given to the collection of *in situ* environmental and prey data simultaneous with bird observations, continuously or at regular intervals.
- Review of data – Data should be summarized and reviewed by observers for errors (boat) or 20% of data should be independently audited by an expert during detection and identification (digital aerial).
- Data analysis – Development of a clearly defined analysis plan should include specific models and statistical tests, methods to account for biases (e.g., detectability, availability), choice of an appropriate modeling framework, methods to account for spatial and temporal autocorrelation in the data, and a comprehensive identification of covariates.
- Data reporting – Standardized reporting should include information on data collection, spatial and temporal coverage (e.g., % spatial coverage, buffer size, distance between transects, overall survey area, timing of surveys), spatially-explicit density estimates and associated variance by species/taxonomic group, and information on site characteristics (e.g., latitude and longitude, footprint size, number, height, and spacing of turbines, water depth, and distance to shore).
- Public availability – Observational survey datasets from effects studies should be made publicly available as soon as possible (maximum two years following collection, if feasible) via the Northwest Atlantic Seabird Catalog and/or OBIS SEAMAP. This should include the final processed dataset, co-collected environmental covariate data, complete effort data, and comprehensive metadata. Reports and analysis code should also be public and easily accessible.

S.3 Future Directions

Part V (Sections 11-12) provides recommendations for further development and refinement of the guidance in this document, as well as recommendations for additional priority guidance and research. While the recommendations presented in this document represent a key first step in developing standardized methods to accurately and reliably detect macro- to meso-scale changes in marine bird distributions and habitat use at OSW facilities, with an emphasis on observational surveys, further steps will be needed for effective implementation of this guidance at a regional scale. This could include developing specific recommendations for non-observational survey methodologies (which were largely beyond the scope of this document) and improving quantitative analyses that could incorporate different types of data. It will also be important for both OSW developers and regulators to actively pursue coordinated data collection and analysis. This guidance is primarily focused on the individual lease area scale, given the current regulatory framework being applied to OSW projects in the United States. However, broader regional monitoring programs in Europe have typically been much more effective than studies of individual lease areas for detecting change caused by OSW development, due to larger spatiotemporal scales of inference.