

# Appendix B. Glossary of Key Terminology

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](http://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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**Abundance** – The number of animals in a sampled population. “Low abundance,” in the context of this document, refers to animals that are uncommon within the geography of interest. See also “Relative Abundance,” below. Deriving an unbiased measure of abundance requires accounting for detection and other biases (see ‘Availability’ and ‘Detectability’).

**Aerial Survey** – A method of systematic animal observation that can be used to inform estimates of species abundance and distribution. Can be conducted from the air via airplane, helicopter, or unmanned aerial vehicle (UAV). Surveys may be conducted with visual observers on board (visual aerial survey) or by taking video or photo imagery to capture the presence of wildlife (digital aerial survey). Survey methodologies vary depending on platform and observation technique; for example, human observers often use distance sampling, while digital aerial surveys are often strip transects.

**Attraction** – The process by which individuals respond to an object or stimulus by moving towards it, also known as “taxis”. In the offshore wind context, this may include attraction to individual structures or to the entire wind energy facility for perceived food, shelter, or other resources. It may also include attraction to other features of offshore wind infrastructure, such as artificial lighting (e.g., phototaxis). In the context of this document, attraction is used to refer to changes in both movement behavior and habitat use.

**Automated Radio Telemetry** – Digitally coded radio tracking technology in which transmitters attached to wildlife are detected by receiving stations at fixed locations. Commonly this term is synonymous with the Motus Wildlife Tracking System (brand names include “nanotags” and “lifetags,” among others); other platforms include the ATLAS system.

**Availability** – The probability that animals using a survey area are in a detectable state. Availability bias is systematic error in a survey caused by animals in the population of interest using a survey area but unavailable to be detected. For diving species, the greater the frequency and length of foraging dives (which remove the animal from a space detectable by the observer), the greater the likelihood of availability bias in abundance and distribution estimates. See also “Detectability”.

**Avoidance** – Changes in movements, such as migration or daily movements, in which an individual animal takes evasive action to maintain a certain distance/separation from a wind facility or its components. Avoidance may occur at the scale of the wind facility (macro-avoidance), at the scale of the turbine, cable, or other structure (meso-avoidance), or at the scale of the turbine blade, e.g., a last-minute evasion to prevent collision (micro-avoidance; NYSERDA 2020, May 2015). See also “Barrier Effects” and “Displacement.”

**BACI** – Before-After Control-Impact. An experimental design for studying the effects of a stressor such as displacement. In this design, one or more control sites are paired with one or more impact sites (i.e., sites where the stressor will operate). These are monitored both before and after the start of the stressor. The paired design allows changes due to the stressor (which should affect only the impact site) to be distinguished from background changes (which should affect both control and impact sites). Control sites must be carefully chosen to ensure they are physically and ecologically similar to impact sites but are located outside the zone of potential impacts.

**BAG** – Before-After-Gradient. An experimental design for studying the effects of a stressor, such as displacement, using methods such as observational surveys or radar. In this design, monitoring is conducted pre- and post-construction within the wind facility itself, as well as in a buffer area around the facility, to assess possible relationships between impact and distance from the facility. Buffer size must be carefully chosen to ensure it encompasses the full zone of potential impacts. This study design allows for non-linear relationships, incorporation of some types of environmental covariates, and a more informative assessment of effect size than BACI designs.

**Behavior** – A response of an individual or group in response to internal or external stimuli (Levitis et al. 2009). In the context of effects, behavioral change may indicate response to OSW activities.

**Baseline** – Characterization of the prior states, situations, or conditions (in the absence of a particular activity) that can be used as a reference when determining effects (ROSA 2021). In the context of offshore wind development, collecting baseline data allows potential impacts of a project to be assessed and/or monitored.

**Barrier Effects** – The effects to animals due to obstacles to movement (such as increased energetic requirements to fly around, rather than through, a wind facility).

**Boat-Based Survey** – A method of systematic observation of animals from a moving vessel that can be used to inform estimates of species abundance and distribution.

**Collision** – The instance of an individual striking or being struck by an object, causing potential injury or mortality. In the context of offshore wind development, this includes collisions of volant animals with offshore wind infrastructure (including turbine blades and other structures).

**Community** – A group of species occupying a habitat.

**Control** – Selected reference site or condition that is isolated from, but similar to, an affected offshore wind site or condition with regard to biological, physical, and environmental characteristics, as well as other anthropogenic uses (e.g., fishing, shipping activities; ROSA 2021).

**Covariate** – An independent variable that can influence the outcome of a given response variable, but which is not of direct interest. In the context of marine bird response to offshore wind development, covariates might include environmental conditions and those related to other anthropogenic factors (e.g., proximity to shipping lanes).

**Cumulative Impacts** – Impacts on a species, population, or community that add to, or interact with, other impacts on a similar temporal and/or spatial scale to produce population or community-level consequences.

**Data Management** – The process of gathering, organizing, vetting/reviewing, storing, and sharing data. This includes topics related to data transparency and standardization.

**Data Transparency** – Sharing data or otherwise making it available to other users, whether publicly or on request. May include sharing of summary information and/or derived data products, such as model outputs, as well as sharing of original datasets.

**Density** – The number of a specified organism per unit area.

**Detectability** – The extent to which an animal can be perceived by an observer or camera. The specific features of some animals make them more or less detectable depending on environmental conditions, survey platform and methodology, and other factors. Biases in detectability may be introduced with factors such as platform height, distance, sea state, light conditions, clutter, or image resolution.

**Developer** – Private-sector entity involved in the planning, construction, and/or operation of offshore wind development(s).

**Development Phase** – Phase(s) of the development of an offshore wind energy project, including pre-construction activities (such as seismic surveys), construction activities, operation and maintenance, and decommissioning.

**Diet** – The combination of foods typically consumed by a species or group of organisms. May vary by age class, sex, breeding stage, location, and other factors.

**Displacement** – The result of macro-scale avoidance that causes functional habitat loss. Displacement effects may be of varying duration. In this document “displacement” is generally used to refer to changes in distribution/habitat use, while “avoidance” is generally used to refer to changes in movement behavior. As such, “attraction” may refer to changes in either distribution/habitat use or movement behavior.

**Distribution** – The pattern by which taxa, species, or individuals are spatially arranged (NYSERDA 2020).

**Disturbance** – Disruption of the structure of an ecosystem, community, population, or individual organism, causing changes to the physical environment, resources/habitat, physiology, behavior, or life history (White and Picket 1985).

**Ecosystem** – A biological community of plants and animals and their physical environment.

**Ecological Drivers** – The natural or human-induced factors that directly or indirectly induce changes to individuals, communities, or ecosystems. Often used to refer to environmental and oceanographic conditions that may influence distributions, movements, or behaviors.

**eDNA** – DNA released by organisms into the environment, which can be monitored using molecular methods to detect species presence over a short temporal scale.

**Effect** – A change or response in a receptor that is linked to (1) an exposure to specific conditions or stimuli (e.g., an offshore wind-related activity) and (2) sensitivity of the receptor to that activity, including both individual and population sensitivity. Effects represent a departure from a prior state, condition, or situation (called the “baseline” condition; Hawkins et al. 2020). While National Environmental Protection Act (NEPA) regulations consider effect and impact synonymous, for the purposes of this effort, effect and impact are defined differently (see “Impact”), unless in reference to an “Environmental Impact Assessment”.

**Effect Size** – An index of the magnitude of the effect that one variable or set of variables has on another variable, including a slope parameter and associated uncertainty. Effect size can be used to determine the statistical significance of a receptor’s response to specific conditions and stimuli and represents the basic unit of observation in a meta-analysis.

**Effects Surveys** – Surveys conducted to detect potential effects to marine birds caused by an offshore wind development. Generally conducted both pre- and post-construction to compare differences in

distributions, abundances, or behaviors between the two time periods. Can be conducted using either BACI or BAG designs (see respective definitions, above).

**Energetics** – The energy-related properties of animals. Animals have energy budgets, in which they must take in sufficient energy to perform necessary activities, such as foraging, reproducing, and migrating. Energetic impacts, or disruptions to these energy budgets, may have short- or long-term influences on individual reproductive success and/or survival.

**Exposure** – The frequency, duration, and intensity of contact or co-occurrence between an offshore wind stressor or activity and an environmental receptor that may allow the stressor to act on the receptor in some way (Goodale and Milman 2016). Marine bird exposure to offshore wind stressors is dictated by their abundance, distribution, and behavior.

**Facility** – An offshore wind energy development project, including all infrastructure and development and maintenance activities. Also referred to as a “project”.

**Focal Taxa/Taxon** – A species or group of species that are the focus of research.

**[Project/Facility] Footprint** – The project footprint includes areas of offshore wind projects containing turbine and substation structures. The project footprint represents part of the project site (see also “Project” and “Site-specific Scale”).

**Forage Fish** – Small, schooling fish species such as herring and menhaden, which occupy a key role in the marine food web, transferring energy from lower to higher trophic levels.

**Geolocator** – Light-level geolocators are small archival tracking devices that can be attached to animals to record ambient light levels in their vicinity, which provides an approximate location. Data must be physically downloaded from the device (e.g., the device must be recovered). These tags are generally used to broadly map migration routes and identify important habitat use areas; location accuracy limitations can be substantial and vary by location, species, tag attachment technique, and other factors.

**Gray literature** – Reports produced by organizations outside of academic and/or peer-reviewed publishing, including government and commercial industry reports.

**Habitat** – The array of physical factors (e.g., temperature, light) and biotic factors (e.g., presence of predators, availability of food) present in an area that support the survival of a particular individual or species.

**Hypothesis** – An explanation for an observable phenomenon, usually expressed in a testable manner. In the context of offshore wind development, a hypothesis represents a potential explanation for a receptor’s response or a relationship between variables.

**Impact** – An effect that results in a change whose direction, magnitude, and/or duration is sufficient to have biologically significant consequences for the fitness of individuals or populations (Hawkins et al. 2020). While National Environmental Protection Act (NEPA) regulations consider effect and impact synonymous, for the purposes of this effort, effect and impact are defined differently (see “Effect”).

**LIDAR** – Light Detection and Ranging is a remote sensing method that, for purposes of wildlife monitoring, is typically deployed from a survey plane. The system uses light in the form of a pulsed laser to measure distance and, when combined with other equipment, to generate three-dimensional spatial information.

**Lighting** – The use of artificial lights to illuminate infrastructure, vessels, planes, and other objects, with the potential to cause attraction in some animals (see “Attraction”).

**Magnitude** – The size or extent of something. In the context of changes in marine bird habitat use, the magnitude of an effect relates the strength and distance of change from a population perspective, and proportion of individuals and/or behaviors from an individual perspective.

**Marine Bird** – In this context, marine birds 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 definition.

**Marine Radar** – Electronic instruments that use a rotating antenna to emit microwaves along the water’s surface; microwaves reflect off nearby objects and generate an image of the radar’s surroundings. Marine radars can also be operated vertically to reflect off objects directly above the radar. X-band or S-band marine radars can be used to detect birds and bats flying through the atmosphere. The detectable size of flying animals depends in part on the wavelength emitted by the radar, as well as the amount of interference presented by weather and other objects in the vicinity.

**Monitoring** – A subset of research that involves collecting systematic observations to inform understanding of effects.

**Movement** – A change in the spatial location of an individual organism over time.

**Nanotag** – A small (0.2–3 g) digitally coded VHF or UHF radio transmitter that is attached to an animal to automatically record their presence as they pass within range of receiver antennas.

**NEXRAD** – Next Generation Radar, also known as WSR-88D weather surveillance radar. A network of these S-band Doppler weather radars is operated across the U.S. by the National Weather Service. They are designed to detect precipitation in the atmosphere by transmitting radio waves (wavelengths ~ 3–10 cm) and receiving back the electromagnetic energy scattered by precipitation particles. Weather surveillance radars also regularly detect “bioscatter,” or reflectivity of the electromagnetic energy caused by biological entities in the atmosphere, such as birds, bats, and insects. With distance from the radar station, the average height of the volume of air sampled by the radar beam increases in altitude and the power of the beam weakens, so it can be difficult to detect low-altitude and low-density objects with increasing range from a radar unit.

**Occurrence** – Basic information on the distribution, abundance, and temporal habitat use of receptors, including seasonal and interannual variability and elements of behavioral, movement, and acoustical ecology, among other characteristics (Southall et al. 2021). Used to inform understanding of exposure (above).

**Population Dynamics** – How a population (i.e., a group of individuals of the same species that occupy a specific area over a certain period of time) changes in abundance or density over time. In an ecological context, often used specifically to refer to factors influencing reproductive success, survival, and/or immigration/emigration.

**Population Sensitivity** – The properties of the global or regional population of a species related to demography (e.g., survival, reproduction) and conservation status that informs the degree to which pressures from offshore wind development could influence the size of the population.

**Power Analysis** – Statistical methods that estimate *a priori* the minimum sample size required to detect a specified magnitude of change with a given degree of confidence (NYSERDA 2020).

**Productivity** – The rate of generation of new biomass in an ecosystem. Primary productivity is the creation of energy from sunlight (photosynthesis) by plants and algae that form the basis of the food chain; productivity for upper trophic levels, such as seabirds, refers to recruitment of new individuals into the population via sexual reproduction.

**Project (also “Offshore Wind Project”)** – Geographic space and infrastructure that comprise an offshore wind energy facility. Includes both onshore and offshore areas. Also includes areas in which environmental effects from the facility occur, including areas potentially outside the actual footprint of the facility (see “Footprint,” above).

**Radar** – see “NEXRAD” and “Marine radar,” above.

**Raw Data** – Original data following QA/QC procedures such that errors have been removed but the data is not summarized, manipulated, or processed in any way that would hinder the ability to replicate or re-analyze the data. Metadata should be included that, among other things, clearly details the QA/QC processes.

**Receptor** – Individual animal, group, population, or community that has the potential to be affected by exposure to a stressor. In the context of marine birds and OSW, typically used to refer to the individual animal.

**Regional Scale** – Geographic extent that includes data collection focused outside of offshore wind project areas, instead of (or in addition to) focusing on wind project areas alone. Examples of regional-scale research include examination of broad-scale (e.g., Atlantic) or smaller scale (e.g., New York Bight) population characteristics, such as demography or regional distributions, or the examination of interactive effects across multiple industries.

**Relative Abundance** – How common or rare a species is relative to others in a certain location or community, or how common or rare a species is in a given location relative to other locations. Relative abundance indices may be used as proxies of true abundance.

**Research** – 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 is considered a subset of research.

**Response** – How receptors may be influenced by or react to exposure to an activity, on either acute or long-term time scales. Responses can include measurable changes in physiological condition or behavior (e.g., communication, navigation, movements, habitat use) of an individual, group, population, or community (Southall et al. 2021).

**Risk** – The intersection of the probability of an effect, and the consequence or severity of that effect (Copping et al 2021). See “Effect”. “Risk assessments” or “impact assessments” are a typical part of the regulatory process prior to construction of OSW facilities.

**Sensitivity** – Properties of an organism or system that influence relative susceptibility to a stressor (Goodale and Stenhouse 2016). This encompasses sensitivity to effects as well as population sensitivity. See also “Vulnerability”.

**Sensitivity to Effects** – Includes the expected response of receptors to a stressor (in this case an offshore wind development-related stressor), at both the individual/local scale.

**Site Characterization Surveys** – New observational surveys of an OSW project site, generally conducted by the developer, that are designed to describe avian use of the project site to inform permitting processes (e.g., Construction and Operations Plan, Impact Assessments), project design, effect minimization measures, and the development of pre- and post-construction monitoring plans.

**Site-specific Scale** – Geographic extent within which effects and responses occur in relation to individual turbines or a single offshore wind project.

**Stressors** – Physical, chemical, or biological factors that may affect the health and productivity of a species or ecosystem. Offshore wind-related stressors include noise, artificial light, and the physical presence of structures, among others.

**Study Design** – A well-structured plan for implementing research, including data collection methods, sample sizes, and analytical approaches, informed by power analyses. Part of a larger research plan that should also identify study objectives, research questions, focal taxa, testable hypotheses, and data sharing and coordination plans.

**Study Methods** – Set of tools, procedures, and approaches used to collect and analyze data to test a specific hypothesis (De Vaus 2001).

**Technology** – Man-made methods, systems, or devices. In the context of offshore wind environmental research needs and data gaps, technologies are generally machines or other devices that allow for or improve the data collection, analysis, and storage of data, or that aim to mitigate the effects of offshore wind activities on wildlife or ecosystems.

**Telemetry** – The measurement of location data at a remote source and transmission of data (e.g., via radio waves or satellite) to a monitoring station. Used to track animal movements.

**Variable** – A measured attribute associated with research. Includes independent or “explanatory” variables, dependent or “response” variables, and confounding variables (extraneous variables that relate to the study’s independent and dependent variables and should be controlled for in study design and post-hoc analyses to constrain variance and potential bias of results).

**Vessel** – A boat that could be used for a variety of purposes, including conducting observational surveys, as well as other purposes unrelated to offshore wind development (e.g., fishing, shipping). In the context of research on offshore wind development’s effects on marine birds, large vessels (>30–100 m length with >15 day at sea endurance) are typically used only for broadscale baseline studies, while small vessels



(<30–50m, <5 day at sea endurance) represent the type of vessel that would primarily be used for surveys at the individual offshore wind project scale.

**Vulnerability** – The combination of individual sensitivity to a particular effect and population sensitivity, encompassing the degree to which a receptor or system is expected to respond to their exposure to a stressor.