# A Framework for Assessing Cumulative Effects of Offshore Wind Energy Development on Wildlife: A Case Study on Northern Gannets in Atlantic Canada

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Offshore wind energy development (OSW) is pivotal for renewable energy transition and climate resiliency. However, OSW activities may negatively affect wildlife, contributing to cumulative effects (CE) from other human activities and natural processes. In 2025, we published a flexible, regional, species-centric framework for assessing the CE of OSW and other pressures on wildlife (https://doi.org/10.1016/j.eiar.2025.107912), drawing on best practices used in Europe, the USA, and Canada. We now demonstrate its application through a case study on the Northern Gannet population (*Morus bassanus*) in Atlantic Canada, a region preparing for large-scale offshore wind development. The aim of our study is to show how this framework (1) handles species with different levels of information quality, (2) integrates data from multiple pressures, and (3) uses a combined CE metric to evaluate alternative wind farm arrangements. The scope of sources and pressures in the assessment include behavioral disturbance (e.g., displacement) and collision from wind farms, oil pollution, fisheries bycatch, and behavioral disturbance from vessel traffic. Our analytical strategy uses spatial optimization to generate wind farm arrangements that minimize predicted collision risk mortality under scenarios defined by turbine technology and density and build out goals. A CE metric is then calculated for the optimized arrangements and other OSW configurations, enabling direct comparison among

alternatives. With refinement, CEAs using this methodology could support early planning for OSW by providing a structured way to weigh multiple pressures and identify licensing areas that may carry lower cumulative risk for wildlife.