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Eliza Donoghue
Maine Audubon, eliza.donoghue@gmail.com

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by Eliza Donoghue

The potential for offshore wind energy development using floating technology in the Gulf of Maine is enormous. Development in the Gulf of Maine—which boasts some of the highest sustained wind speeds in the world that peak in the winter when Maine's energy needs are the greatest—stands to play a big part in solving our climate puzzle. This opportunity, however, must be considered alongside the known and potential negative impacts to wildlife, fish, and marine habitats in the Gulf. Maine Audubon biologists and policy experts are confident that with meaningful investments in research and monitoring, adaptive management, and the adoption of state and federal policy tools, the benefits to wildlife from offshore wind development outweigh the risks. Climate change is the greatest threat to wildlife in Maine, and we must thoughtfully embrace technologies that will lessen that threat.

CLIMATE CHANGE THREATENS MAINE WILDLIFE

Rising sea levels, warming waters, and rising temperatures all have impacts on Maine wildlife. Iconic Maine species including the Atlantic puffin, saltmarsh sparrow, Eastern brook trout, and Canada lynx have all earned the moniker "highly vulnerable" to climate change along with 51 other Maine vertebrate species (Whitman et al. 2013). Population shifts are already taking place, as evidenced by traditionally Southern species expanding their ranges into Maine, including red-bellied woodpecker and black sea bass (Goldsmith, 2021; Kirchman and Schnieder 2014), and species at the southern edges of their ranges moving north, such as the boreal chickadee and the Canada jay (Wilsey et al. 2019). Absent a rapid transition away from fossil fuels, well-known wildlife may no longer call Maine home.

THE OFFSHORE WIND OPPORTUNITY

Locally produced renewable energy can reduce Maine's reliance on fossil fuels. In particular, floating offshore wind technology can be used to capture massive amounts of clean energy. Winds in the Gulf of Maine have the potential to produce an estimated 156 gigawatts of clean energy per year—more than 70 times the amount of electricity used by the entire state annually (ASCC 2016). Realizing even a fraction of that potential as a part of a diverse portfolio of clean energy sources will catapult Maine toward its targets of cutting emissions by 45 percent by 2030 and 80 percent by 2050, both of which are essential for avoiding the worst impacts of climate change to Maine wildlife.

OFFSHORE WIND AND WILDLIFE

We can glean a great deal about wildlife and habitat responses to offshore wind development from nearly three decades of fixed-bottom wind energy sitings in Europe's North Sea. Research has found that some species may collide with turbines, while others avoid turbines altogether (Drewitt et al. 2006). Wildlife's attempt to avoid the turbines may create a barrier to migration or displace individuals from valuable habitat (Dierschke et al. 2016). Still other species have been found to be attracted to turbines. These effects from wind energy arrays can be seen both above and below water on fish, marine mammals, birds, and bats. While many responses may be extrapolated from research in the North Sea, more research must be done to understand responses of Gulf of Maine wildlife to floating technology.

Above water, we know that mean flight altitudes for migrating birds are typically well above the projected height for turbine blades (Axelson 2021). Furthermore, most migrants tend to concentrate inland and along the coast rather than over the Gulf of Maine. Migratory bats are known to migrate across the Gulf, most often in the fall and in calm conditions (Peterson et al. 2016). Factors such as lighting, turbine spacing, and proximity to high-use areas may affect the likelihood of attraction to or avoidance of turbines (SEER 2022). That said, we do not know the exact migratory paths or heights of all species over the Gulf, nor do we know what atmospheric conditions may bring migratory species down closer to turbines.

Recent research suggests that different seabird species in the North Sea respond differently to turbine arrays.

Loons and gannets showed varying levels of displacement; many species, including shearwaters, alcids, and terns, showed inconsistent displacement; and cormorants and gulls showed attraction (Dierschke et al. 2016). In the Gulf of Maine, studies indicate that most breeding seabird species typically forage within 30 miles of their colonies, but spread throughout the Gulf in other seasons (Welch and Cross 2023). We need to learn more about how other seabird species in the Gulf will react to turbines, exactly where species are when they are away from their breeding islands, and to what extent lessons from Europe are transferable to the Gulf of Maine.

Underwater, studies have shown that electromagnetic field effects from undersea cables have little or no impact on fish (Dunlop et al. 2016; Klimley et al. 2017) or on American lobster (Hutchison et al. 2018). A seven-year study on the fixed-bottom Block Island Wind Farm in Rhode Island found either no impact from turbines or showed positive effects on fish schooling around fixed-bottom turbine structures (Wilber et al. 2022). More information is needed, however, about how fish will interact with the deepwater cable anchors that secure floating turbines and what impact these anchors may have on benthic organisms. While it is unlikely that whales will be directly threatened by these underwater cables because the cables are too taught to cause entanglement, secondary entanglement could be a risk.

Marine mammals are sensitive to underwater noise and may be affected by increased vessel traffic, which both increases ocean noise and increases the potential for vessel strikes. The blasting and drilling associated with the construction of fixed-bottom turbines, which may impact marine mammal behavior (Ketten et al. 1993), is not expected to be a component of floating offshore wind development. Existing long-term and future marine mammal-specific research will help identify exactly where cetaceans (whales and porpoises) and pinnipeds (seals) are in the Gulf in all seasons, as well as what effect, if any, electromagnetic fields associated with offshore wind arrays have on marine mammals.

CLOSING THE KNOWLEDGE GAP, THOUGHTFUL SITING, AND ADOPTING POLICY TOOLS

Investments must be made in understanding impacts to Gulf of Maine wildlife, fish, and marine habitats from floating offshore wind technology. Though floating technology has been successfully used in projects off Scotland, Portugal, and Norway, the technology remains relatively new. Moreover, compared to other areas off the US Atlantic coast, little is known about when and how species use the Gulf of Maine. Efforts are underway to close this knowledge gap. For example, the Bureau of Ocean Energy Management (BOEM), the federal agency in charge of offshore wind development, has devoted resources to gathering essential baseline data. The Maine Offshore Wind Research Consortium, composed of fisheries and wildlife experts as well as other stakeholders, is developing a research plan based on Maine stakeholders' most pressing research questions.

Though those research questions are pressing and the knowledge gaps are wide, a good deal of information is already in hand to guide thoughtful siting of offshore wind development. Right now, BOEM is identifying areas in the Gulf of Maine to lease for commercial development. Based on the knowledge that breeding seabird species typically forage within 30 miles of their colonies and that migratory bird species typically skirt the Maine coast, for example, it is likely that wind development areas will be located at least 20 miles from the coast and islands if not more. Locating projects well away from the coast will go a long way toward avoiding impacts to species.

But locating projects in areas that avoid impacts to wildlife, fish, and the marine environment is only one strategy in reducing overall negative effects. Maine, in collaboration with private developers, is establishing a research array with ten turbines located approximately 40 miles south of Portland. The research array will collect information about strategies to minimize impacts, such as spacing turbines to allow for safe passage within the array, technology to prevent or detect ghost gear that may wrap around underwater cables and lead to entanglements, or sensors to turn off or slow down turbine blades at times of peak bird and bat migration. We can also glean similar information from forthcoming commercial development off the coasts of New York, Massachusetts, and Rhode Island that will precede development in the Gulf of Maine. Such projects must be prepared to adapt their operations as new information becomes available.

A great deal of this work is happening at the initiative of federal regulatory agencies and private developers. However, state law can also encourage thoughtful siting and coexistence with Gulf wildlife and ocean users. On July 27, 2023, Governor Janet Mills signed into law LD 1895—An Act Regarding the Procurement of Energy from Offshore Wind Resources. This law directs Maine to purchase 3 gigawatts of energy from offshore wind projects in the Gulf of Maine by 2040, with specific standards. Those standards require that any energy that flows to Maine come from projects that have documented plans to avoid and

minimize impacts to Gulf wildlife, fish, and marine habitats and have contributed meaningful funds to research, monitor, and conserve species that may be affected. The law also creates incentives for the purchase of energy from projects that are located outside key fishing grounds; sets comprehensive labor and workforce development standards; and supports the creation of a world-class, Maine-built offshore wind port that will provide unprecedented economic development opportunities.

These state and federal policies, combined with smart siting and operation practices that take into account existing knowledge and ongoing research, give us many reasons to be confident that offshore wind development can coexist with Gulf of Maine wildlife. That confidence has emboldened Maine Audubon and the vast majority of our partners in environmental science and advocacy to embrace offshore wind as a critical component of a transition to clean, renewable energy. But we cannot be complacent. Continued investment must be made in research and monitoring to understand wildlife and habitat responses to offshore wind development—investment at the state and federal level, as well as by private entities. Our collective understanding of those responses will evolve over time, as more projects are developed and research is performed. We need to be prepared to adapt existing and future development based on that new knowledge. And we must continue to adopt policies that will enable research investment and development adaptation, as well as policies that support renewable energy development at the scale and speed that our climate crisis demands. Maine wildlife—and people—can't wait.

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Eliza Donoghue is the former director of advocacy and staff attorney for Maine Audubon, a Maine-based nonprofit wildlife conservation organization. Maine Audubon works to conserve Maine's wildlife and wildlife habitat by engaging people in education, conservation, and action.