New research needed on environmental impact of turbulence from deep-water wind farms

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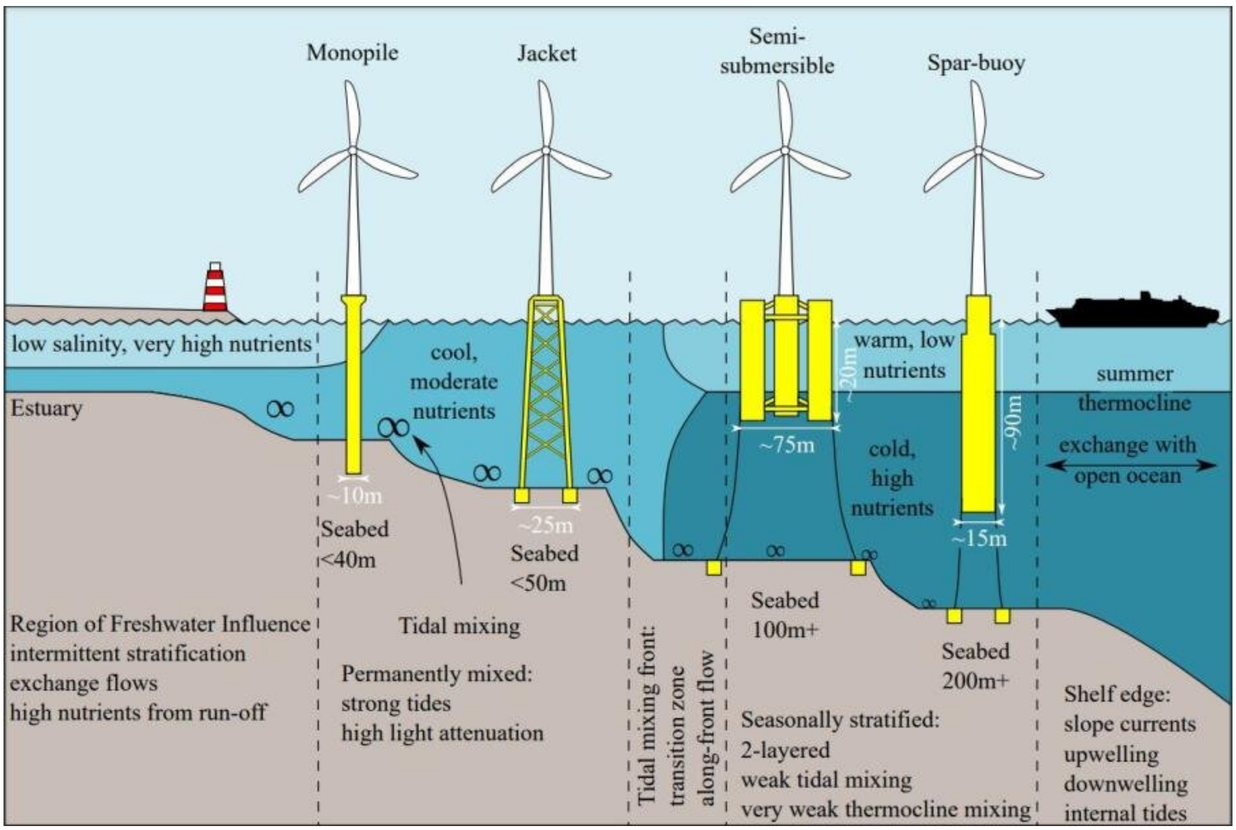


A diagram showing the existing and emerging offshore wind designs including fixed monopile and jacket foundations in shallow water and floating semi-submersible and spar-buoy foundations planned for use in future deep water developments. Credit: Bangor University

Oceanographers from Bangor University are calling for new research to be done into the environmental impact of turbulence caused by tidal flow past floating deep-water wind farms.

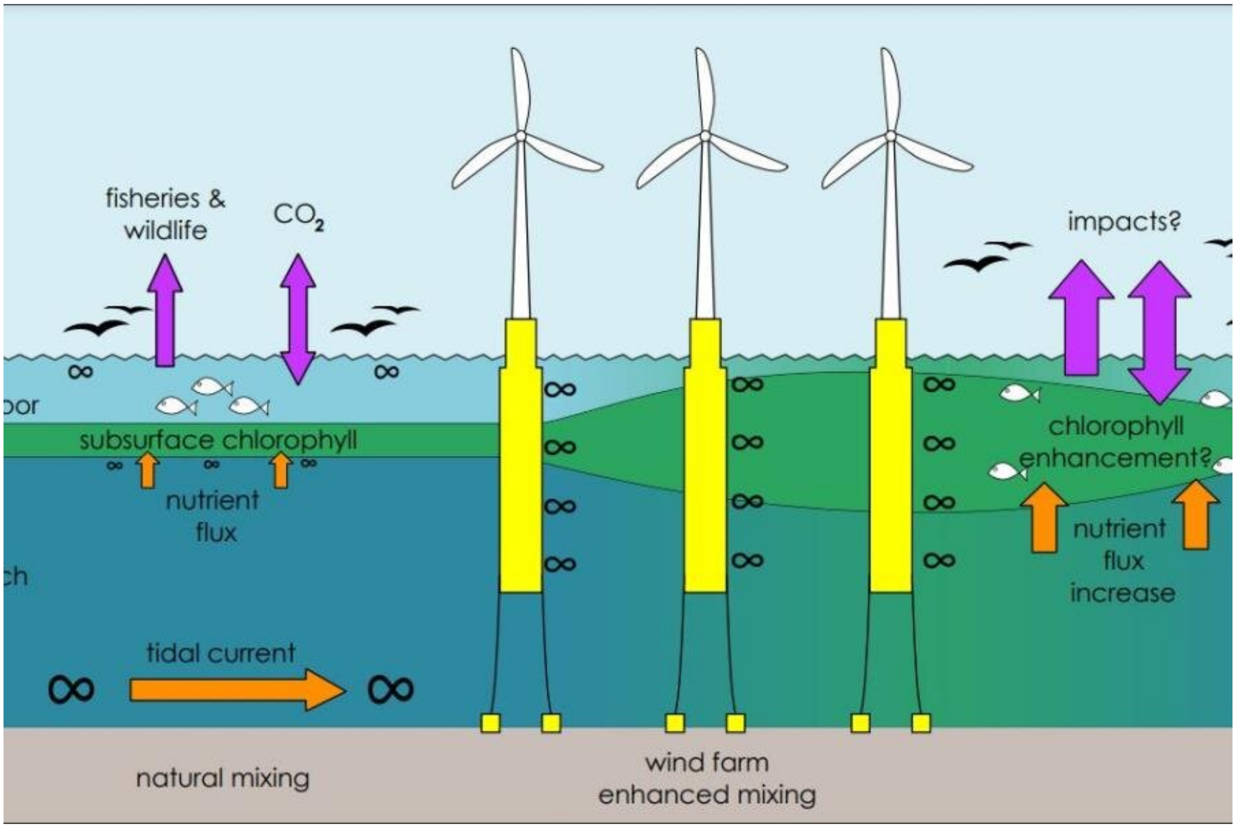
The U.K. leads offshore wind energy production globally, with current power generation meeting one third of the national demand (~10GW).

New floating offshore wind turbines in the deep shelf seas have been identified as a major pathway toward achieving NetZero for the U.K. The technology involved has extended growth targets—the current target to produce 50GW by 2030 is an increase of 67% on the target set just 12 months ago.

But with an additional 20,000 wind turbines set to be built, we need to ensure that we're fully aware of the positive and negative effects their presence could have on the surrounding environment.

Most of the world's wind farms are conveniently located in the shallow waters near the shore. However, new offshore sites at a depth of over 50 meters are very different in nature to the shallow coastal sites that have been used so far.

Dr. Ben Lincoln of Bangor University explains, "Our shelf seas are fully mixed during winter, but during summer months the deeper regions stratify, with a warm surface layer overlying the cooler water below. This triggers a phytoplankton bloom which can be seen from space and forms the base of the marine food chain, supporting fish, seabirds and whales. During summer months following the spring bloom, phytoplankton growth is supported by nutrients stirred up from below by turbulence associated with wind and tides. This turbulence also mixes oxygen down to the deep water, where it is required for other key biological processes."



This illustration shows the potential impact of wind infrastructure mixing in stratified water. Flow past the floating foundations will generate turbulence which could mix cold nutrient rich bottom water with warm nutrient poor surface water, weakening stratification and potentially enhancing plankton growth. This mixing enhancement could have fundamental impacts on ecosystem functioning, wildlife and fisheries. Credit: Bangor University

New research is needed to fully understand how siting varying types of wind turbines could affect not only the seabed, but the waters, and everything they contain.

"Environmental assessments for the shallow shelf seas have focused on wildlife using or living within the affected areas. The difference with the deeper seas is that the fundamental functioning of the seas themselves could be affected," explains Dr. Lincoln.

"Turbulent mixing determines the timing and rate of the food supply on which marine ecosystem and key species rely. Flow past deep water wind farms will introduce 'anthropogenic' or man-made turbulence, and increase mixing. This fundamental change could lead to significant regional impacts, which must be assessed. However, impacts are not necessarily negative, with the potential to enhance productivity and offset the impact of increasing stratification due to climate change.

"There's no doubt that this growth in renewable energy is essential to meet global 2050 Net Zero commitments.

"However, we urgently need a deeper understanding of the dynamics involved in placing offshore wind farms, from a single unit to large arrays, and how that will affect the functioning of our shelf sea ecosystems. This understanding will help guild the planning of new wind farms to ensure they have a positive impact on the ecosystem."

This paper is titled "Anthropogenic Mixing in Seasonally Stratified Shelf Seas by Offshore Wind Farm Infrastructure" and is published in *Frontiers in Marine Science*.

More information: Robert M. Dorrell et al, Anthropogenic Mixing in Seasonally Stratified Shelf Seas by Offshore Wind Farm Infrastructure, *Frontiers in Marine Science* (2022). DOI: 10.3389/fmars.2022.830927

Provided by Bangor University

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