eDNA breakthrough set to revolutionise ecological surveys for offshore wind

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As we rapidly transition to renewable energy sources to help tackle climate change, supply chain resources are increasingly under pressure. There has never been a greater need for new technology and practices that help to maximise resources. Thanks to an industry collaboration, Natural Power and its project partners, EDF Renewables, environmental DNA and nature intelligence experts, NatureMetrics, have launched a ground-breaking report[1], validating the use of fish environmental DNA (eDNA) survey methods that will transform offshore wind farm environmental impact assessments.

Easing pressure on the existing supply chain for offshore wind developments includes satisfying the environmental and consenting requirements under EIA legislation, whilst balancing limited resources such as vessel and staff availability.

Innovative methods are needed to help resolve the many challenges we face as an industry, and using eDNA for the collection of biological data without an increase in frequency and survey effort is one such method that is being successfully explored.

To provide an evidence base for the potential acceptance of eDNA-based methods as a valid alternative to conventional fish trawl surveys, both eDNA and trawl methods were conducted in parallel at an offshore wind installation. The sampling was carried out seasonally during a 12-month timeframe at four locations around EDF Renewables' Blyth Offshore Demonstrator which is located 0.5 miles from the coast at Blyth, Northumberland.

Crucial to this technique is NatureMetrics' pioneering use of eDNA to identify fish species around the world. Collecting and filtering a few litres of seawater concentrates the DNA left behind in species' waste products, such as skin and tissue cells, which can then be processed in the lab to identify all the different fish species present. It means there is no need to physically catch or even see the fish to know they are there.

Samples can be collected by anyone and from a wide range of vessels, which means the task can be carried out during other site investigation surveys, such as geophysical surveys, reducing costs, time, and resource requirements.

Michelle Elliott

During the surveys at Blyth Offshore Demonstrator, it was found that eDNA consistently detected a greater number of species than trawl data, indeed some 54 species were detected by eDNA, compared to 26 species in trawls. Samples captured using eDNA alone included commercially important species such as mackerel, seabass, herring and anchovy; and migratory species such as eel, salmon and sea trout; as well as bottom-dwelling species such as dragonets, rockling, blenny and goby species which can provide key ecosystem roles. The most abundant species identified were consistent across both trawl data and eDNA collections as well as being in line with historical trends at the site.

Seasonal and spatial patterns in species occurrence and community composition were similar between the trawl and eDNA-based sampling methodologies, as were diversity scores across stations, with broad seasonal similarities to historic trends at the site. This indicates that eDNA methods not only pick up individual species trends but can also be used to calculate ecological diversity metrics and track seasonal and spatial differences in community composition.

Utilising this eDNA-based sampling technique allowed surveying of areas adjacent to turbines, which had not previously been possible to sample using the traditional trawling method. This is the case around most offshore wind farms as the potential for snagging gear poses serious health and safety risks. Using eDNA, it was possible to sample close to the turbines for the very first time.

The species detected from these samples supports the hypothesis that the artificial habitat created by turbines may be providing shelter and food for fish, with some reef-associated species including goldsinny, Norway bullhead and four-bearded rockling, at higher relative densities compared to stations outside of the turbine area. This could be a crucial tool in assessing the positive impacts and biodiversity net gain created by the wind farm structures on the fish ecology in the area.

Other species were also identified in the eDNA samples including marine mammals, such as minke whale, harbour porpoise, bottlenose dolphin and white-sided/ white-beaked dolphin, and sea birds.

Understanding the seasonal occurrences of key mammal species can be used to inform targeted mitigation measures by avoiding certain construction methods at particular times of the year. The information provided by eDNA can complement that of dedicated site surveys for marine mammals that are largely restricted to visual observations at the surface.

Furthermore, initial reviews of invertebrate eDNA results proved encouraging and the project scope was extended to allow for ground truthing of the eDNA data. Results from the invertebrate assay are currently being investigated in detail but provide data on a range of polychaetes, gastropods and

echinoderms from the Edna water sample, which would be typically found in a benthic grab sample.

As floating wind technologies continue to develop, passive samplers for monitoring eDNA are also being developed and improved. They could be used to monitor fish and mammal communities and interactions around floating offshore wind farms, the impacts of which are currently not well understood. A better understanding of these interactions will lead to better avoidance and mitigation measures.

In summary, this pioneering study demonstrates eDNA based surveys are a market-ready solution to optimise consenting phase surveys of offshore wind site development, as well as ongoing monitoring and targeted mitigation strategies.

Replacing traditional survey methods for assessing fish communities around offshore wind farms with eDNA sampling provides greater opportunities for developments to collect the data required as a larger pool of vessels becomes accessible to undertake the survey work and can be combined with other site-based activities, such as site investigation work. This could greatly reduce the costs, resource consumption such as fuel, and risks of delays to surveys from, for example, competition for the limited number of suitable trawl vessels as well as adverse weather conditions, which ultimately lead to subsequent consenting delays.

By reducing the number of vessels and trips required to conduct these surveys and continually improving technology such as passive eDNA samplers, this data can be collected in a way that also reduces the overall carbon footprint of the development.

Environmental DNA provides a wealth of information that can be used by developers to ensure the construction of their offshore wind farm in a way that poses minimal negative impacts on the ecosystem it inhabits while providing positive ecological impacts during the lifetime of the development.

The adoption of this method has the potential for huge benefits to the industry by providing more efficient, affordable, and scalable consenting and site survey solutions. This could speed up the development of offshore wind farms and reduce costs for developers, ultimately reducing the cost of overall energy production.

Regulator and stakeholder acceptance of eDNA methods for use in offshore baseline setting and monitoring will be a key step towards accelerating and improving environmental monitoring for future offshore wind development.

[1] Assessing fish ecology around OWFs using eDNA: Natural Power

Natural Power

Natural Power is an independent consultancy and service provider that supports a global client base in the effective delivery of a wide range of renewable projects including onshore wind, solar, renewable heat, energy storage and offshore technologies.

It has a global reach, employing more than 500 staff across 14 international offices. Its experience extends across all phases of the project lifecycle from initial feasibility, through construction to operations and throughout all stages of the transaction cycle.

www.naturalpower.com

NatureMetrics

NatureMetrics is a world leader in the use of DNA-based tools for biodiversity assessment.

It has long believed in the potential of eDNA to address global data gaps for biodiversity and has also recognised that realising this potential will inevitably involve a large, coordinated effort of multiple stakeholders and citizen scientists, spanning many different countries, environments, languages and with different levels of access to resources.

NatureMetrics is a private company seeking to build a world-leading DNA-based biomonitoring business while also delivering positive impacts for biodiversity conservation.

www.naturemetrics.co.uk

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