OFFSHORE WIND FARMS IN THE ADRIATIC SEA: THE ANALYSIS OF THE MARINE ECOSYSTEM IN REGIONAL PILOT AREAS

The Project Blue Economy sYnergies fOr sustaiNable Development (BEYOND) aims to transform potential Adriatic offshore wind farms (OWFs) into catalysts for sustainable development in various blue economy sectors, going beyond their traditional role as mere energy producers. By focusing on specific Adriatic offshore hotspots, the project intends to analyse optimal locations for OWF, thereby facilitating a science-based, participatory and sustainable green transition in Italy and Croatia.

The initiative will focus on four pilot regions in the Northern, Central and Southern Adriatic, where OWF systems will be assessed, taking into consideration the potential enhancement of the synergy with blue economy sectors and support of green hydrogen production. A key objective of Beyond is to faciliate cross-border knowledge exchange and stakeholder engagement, focusing on environmental protection and sustainable development.

WHAT

Nine aspects have been considered in the analysis: water ecological characteristics through considering chlorophyll-a; bottom habitats; seagrass habitats; benthic biodiversity; fish species richness; fish species biodiversity; marine mammal distribution; seabird migration routes; and sensitive and protected areas.*

How

OGS has conducted research on the initial ecosystem status of the following four pilot regions: the marine region of Istria and Split-Dalmatia County in Croatia, and the marine regions of Veneto and Apuglia in Italy.

The data used, which is in the highest possible resolution, has been provided by a variety of sources, which spans over several layers of information that is under ongoing collection and analysis. Through this analysis, the most suitable OWF position and shape in terms of environmental impact will be determined. Data sources include: the Copernicus Marine Service, EMODNET, the Ocean Biodiversity Information System (OBIS), the Global Biodiversity Information Facility (GBIF), the Mediterranean International Trawl Survey (MEDITS), and several published maps on the data concerned.

*INDEX OF TERMS: *benthic = marine life inhabiting the bottom sediments or living in strict relationship with the bottom sediments; richness = number of species in a particular area; biodiversity = overall diversity of life, including genetic variation, and the variety of ecosystems species inhabit.*

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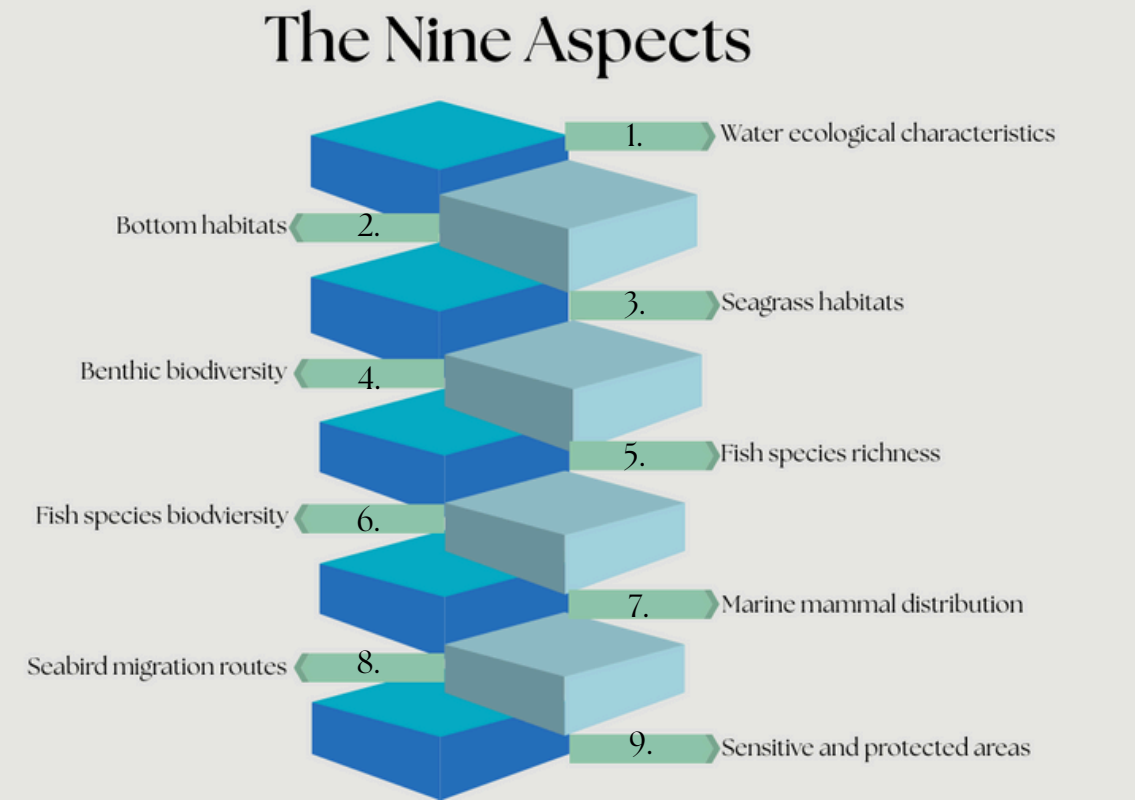
Results

1. For **water ecological characteristics**, the focus on chlorophyll-a across all four areas demonstrated that concentrations at OWF sites are lower compared to the rest of the outside areas, indicating that areas chosen could have relatively low impacts on the productivity of the system, although further studies need to be conducted on the expected effects during the development phase of the OWF.
2. The most useful characteristics of **bottom habitats** analysed for BEYOND were sediment grain size and habitat definition. The Italian sites feature relative finer grain texture than its Croatian counterparts; with each pilot region featuring differing benthic habitats that can be described as sandy or muddy. It is important to analyse bottom habitats, since the composition may influence the structure and type of OWF (e.g., floating or not).
3. Two important **seaweed** species typical of the Mediterranean Sea were considered: *Posidonia oceanica* and *Cymodocea nodosa.* Although present across the four pilot regions, neither species has been detected at the OWF installation sites. As well as providing food and shelter to other underwater species, seaweed also absorbs wave energy and plays a role in preventing coastal erosion. Seaweed also absorbs large amounts of carbon from the atmosphere and is a player in climate change mitigation, as well as an essential contributor to marine biodiversity.



4. For **benthic biodiversity**, data points for the installation sites indicate a very low number of species compared to the rest of the zone, although only limited data are available.
5. For **fish species richness**, OWF installation sites in Apuglia and Split-Dalmatia are located in areas with an intermediate-high richness value compared to the surrounding zone. The Veneto OWF site features an average similar to the rest of the area, with only Istria's OWF site placed in an area of intermediate-low richness value.
6. Only the Split-Dalmatia OWF site coincided with low-stable **fish species biodiversity** levels, while the Istrian site overlaps with a hotspot, and the Italian OWF locations exhibiting higher biodiversity, but with a high degree of variability within the installation OWF areas, leaving space for the optimisation of placement within such areas.

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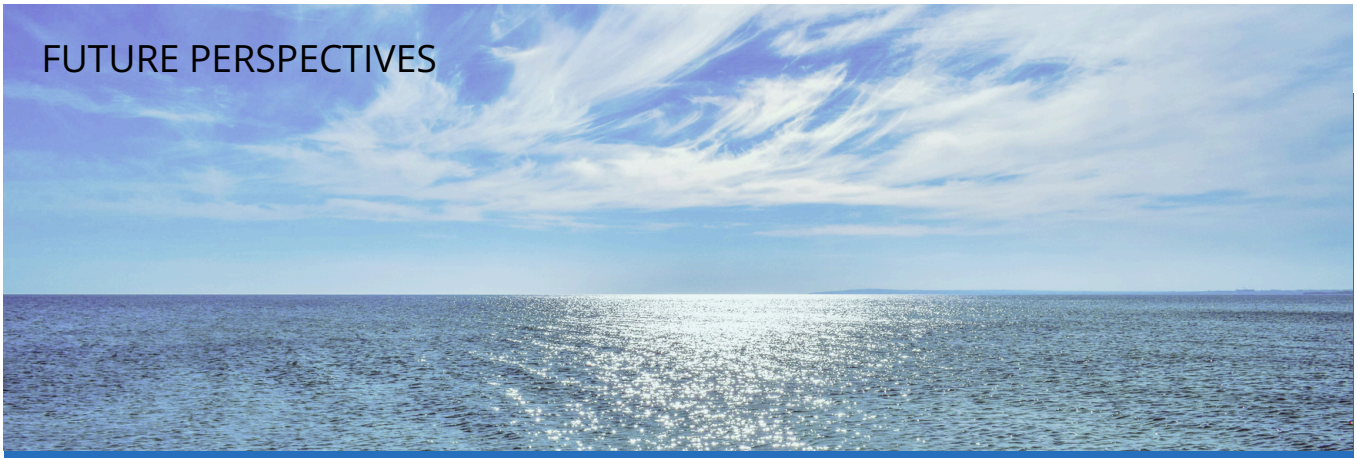
7. The Mediterranean bottlenose dolphin is the dominant **marine mammal** in the Adriatic Sea. In Istria the number of sightings are ranked as high, in Split-Dalamtia low - both OWF sites in Croatia had no or almost no recorded sightings. The few sightings in Veneto seem to overlap with the OWF site while in Apuglia the occurrence rate across the whole zone is low. However, monitoring across the pilot regions is not systematic and therefore, further analysis should make use of additional data.
8. The OWF sites of the four pilot areas show variability in terms of importance of **seabird migration routes**: Istria may be classed as low, Split-Dalmatia high; Veneto intermediate and Apuglia showing a mixed picture across the intallation site. It is crucial to consider this aspect in order to manage the risk of collision between seabirds and OWFs.
9. Many parts of the Adriatic Sea have been designated **sensitive and protected areas** with several different levels of protection present, including ecologically or biologically significant areas (EBSA) or fisheries restricted areas (FRA). The Istrian and Veneto OWF sites are both located in an EBSA while conversely, the site in Split-Dalmatia is outside of all such areas and other conservation areas. The installation site in Apuglia only partly overlaps with an EBSA.

Conclusion

The results of the analysis highlight that the potential OWF locations across the four pilot regions have peculiarities that make each sensitive for a different reason. For Istria, the OWF site is close to an area with a high quantity of bottom dwelling organisms, whereas in Split-Dalmatia and Apulia, the sites coincide with an area known for the presence of migratory birds. In the Veneto region, there is a high presence of marine mammals in the proposed zone. Therefore, these critical aspects specific for each area require further investigation using local, high-resolution data.



There are limitations regarding the use of some of the data taken for this analysis: for example, more research and data needs to be made available for a realistic and reliable benthic biodiversity analysis, while fish species biodiversity shows a degree of variability at the Italian OWF sites, warranting the necessity of more nuanced long-term data collection. Similarly, the observation of dolphin numbers is not systematic and hence, a more rigorous monitoring procedure needs to be put in place to ensure accuracy of result. Lastly, the prospect of applying a marine ecosystem model to dynamically assess the best place for OWF farms, would enhance the validity and reliability of such an analysis. You can read the complete analysis conducted by OGS, which is a partner in BEYOND, on the official website here.

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