TROPHIK

Modelling of the role of offshore wind turbines in modifying the functioning of coastal food webs and the accumulation of impacts

DURATION: 24 months (2016-2019) | **BUDGET:** €525k

CONTEXT

The environmental impact studies of offshore wind energy projects focus on considering the sensitivity to potential disturbances of each of the ecological compartments (benthos, birds, marine mammals), in a fractional way. In this context, it is necessary to develop an integrated view of the ecosystem, through the implementation of modeling tools, allowing to consider the trophic network as a whole. This approach is complementary to those used during impact studies.

OBJECTIVE

To model the role of offshore wind turbines and other anthropogenic activities in modifying the functioning of thefood webs of the Bay of Seine by taking climate change into account.

MAIN ACHIEVEMENTS

- Statistical modelling of the Bay of Seine ecosystem and study of the sensitivity of network indices to cumulative impact
- Spatial 2D modelling of the food web of the extended Bay of Seine
- Modelling of the effect of climate change (IPCC scenarios RCP 2.6 and RCP 8.5) on the modification of the distribution ranges of the 73 most sensitive species in the ecosystem
- Modelling of different anthropogenic pressures and climate change on the emerging properties of the food web

CONCLUSION

TROPHIK has initiated a methodology to move from the sectoral vision of environmental impact studies to a functional and holistic approach. The analysis of the sensitivity of the functioning of the food web to the development of offshore wind farms represents a solid basis for recommending new areas of implantation. This approach will be completed within the framework of APPEAL and WINDSERV by integrating the societal and economic environment as well as biogeochemical forcings.

TECHNOLOGIES

STAGES OF THE VALUE CHAIN

Preliminary studies

RESOURCES GENERATED

- **Models representing the trophic functioning of the ecosystem** from 0 to 2 dimensions (Ecopath, Ecosim, Ecospace) or statistical (inverse linear)
- **Methodology** for modelling the current and future distribution of marine species at the local scale
- **Recommandations pour une approche écosystémique des aires d'implantation d'énergies marines renouvelables.** Cas d'étude du parc éolien offshore de Courseulles-sur-mer. (2019) Plouzané : France Energies Marines Editions, 60 p.
- **Impacts potentiels de la construction et de l'exploitation de parcs éoliens sur les mammifères marins** et éléments associés de réflexion sur les mesures de compensations. (2019) Caen : Université de Caen Normandie, 22 p.

PARTNERS

This project has received €225k French State funding managed by the French National Research Agency under the Investment for the Future Programme (ANR-10-IEED-0006-12).

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LIST OF SCIENTIFIC PUBLICATIONS RESULTING FROM THE PROJECT

2020

- Niquil *et al.* **Toward an Ecosystem Approach of Marine Renewable Energy: The Case of the Offshore Wind Farm of Courseulles-sur-Mer in the Bay of Seine.** *Estuaries and Coastal Zones in Times of Global Change*, p. 137-148
  -> https://doi.org/10.1007/978-981-15-2081-5_9
- Raoux *et al.* **Isotopic analyses, a good tool to validate models in the context of Marine Renewable Energy development and cumulative impacts.** *Estuarine, Coastal and Shelf Science*, Vol. 237, 106690
  -> https://doi.org/10.1016/j.ecss.2020.106690
- Ben Rais Lasram *et al.* **An open-source framework to model present and future marine species distributions at local scale.** *Ecological Informatics*, Vol. 59, 101130
  -> https://doi.org/10.1016/j.ecoinf.2020.101130
- Halouani *et al.* **A spatial food web model to investigate potential spillover effects of a fishery closure in an offshore wind farm.** *Journal of Marine Systems*, Vol. 212, 103434
  -> https://doi.org/10.1016/j.jmarsys.2020.103434
- Haraldsson *et al.* **How to model social-ecological systems? - A case study on the effects of a future offshore wind farm on the local society and ecosystem, and whether social compensation matters.** *Marine Policy*, Vol. 119, 104031
  -> https://doi.org/10.1016/j.marpol.2020.104031
- Nogues *et al.* **Cumulative effects of marine renewable energy and climate change on ecosystem properties: Sensitivity of ecological network analysis.** *Ecological Indicators*, Vol. 121, 107128
  -> https://doi.org/10.1016/j.ecolind.2020.107128

2019

- Raoux *et al.* **Measuring sensitivity of two OSPAR indicators for a coastal food web model under offshore wind farm construction.** *Ecological Indicators*, Vol. 96, p. 728-738
  -> https://doi.org/10.1016/j.ecolind.2018.07.014
- Safi *et al.* **Vitamine ENA: A framework for the development of ecosystem-based indicators for decision makers.** *Ocean & Coastal Management*, Vol. 174, p. 116-130
  ->https://doi.org/10.1016/j.ocecoaman.2019.03.005
- Araignous *et al.* **Recommandations pour une approche écosystémique des aires d'implantation d'énergies marines renouvelables. Cas d'étude du parc éolien offshore de Courseulles-sur-mer.** Plouzané : France Energies Marines Editions, 2019, 60 p.
  -> france-energies-marines.org/centre-de-ressources

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FRANCE ENERGIES MARINES

Parc éolien en mer du Calvados

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