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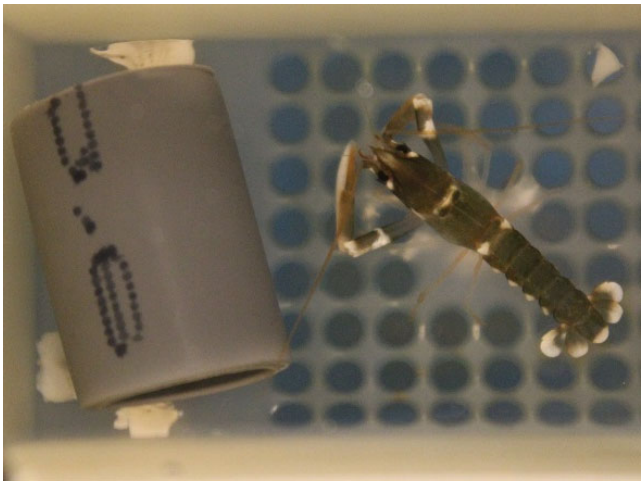
Magnetic field of subsea power cables: 1st experimental results on the sensitivity of the European lobster

The behaviour of juvenile European lobsters is not affected by a magnetic field of similar intensity to that measured and modelled at one metre from high power electrical interconnections (1 GW). This is the main result of a study conducted by Ifremer and France Energies Marines, in collaboration with MAPPEM Geophysics, a Breton SME, and the Institute of Marine Research in Norway.



Left: Experimental set-up in the laboratory (© Institute of Marine Research) - Right: Lobster juvenile near its shelter (© Institute of Marine Research)

Environmental and economic issues

The first commercial offshore wind farms will soon see the light of day in France. Their potential environmental impacts are an important subject of study. Citizens and scientists, among other questions, are asking 'what is **the effect of the magnetic field** produced by the export power cable on marine organisms?' To answer this question, **an innovative experiment** has been carried out by scientists from France Energies Marines and Ifremer, in collaboration with the Institute of Marine Research in Norway.

The animal chosen for this study is the European lobster, a benthic species with high economic and ecological value. It has been shown that similar species (other lobsters, crayfish) are sensitive to changes in the local magnetic field. Several scientific studies have also shown that European lobsters are frequent visitors to the electrical connection corridors of several offshore renewable energy projects because the concrete protective mattresses for the cables provide shelter.

2 hypotheses: sensitive or indifferent?

The experiment was conducted on **three-week-old lobster juveniles** that were about 1 cm in size. This is a sensitive stage in the life cycle of these animals which, until now, had never been studied regarding the effect of a magnetic field. The one generated by export cables has been reproduced using a device designed by the Breton SME MAPPEM Geophysics: two 600 m coils of electric wires allow the passage of an alternating or direct current. **The field strength value used, 200 µTesla, corresponds to an intensity measured and modelled at one meter from high power electrical interconnections (1 GW).** By way of comparison, the value found at one meter from a 500 MW offshore wind farm export cable should be between 10 and 50 µTesla.

In the first phase of the experiment, the aim was **to determine whether the juveniles were attracted, repelled or indifferent to this magnetic field**. In the second phase, the aim was to study the effects of a seven-day exposure to this same magnetic field on mortality and on the natural behaviour of the animal, and in particular **its ability to find shelter**. The behaviour of the lobsters was monitored by video so that the experimenter would not disturb the experimental set-up.

▶ Experimental protocol in video: **https://www.youtube.com/watch?v=ehhJ7MuZ7n4&t=47s**

Clear and rigorous results that dispel the first fears

FA first, very important point: **no mortality was observed in juveniles during the experiment**. A second major result: the analysis of the video recordings clearly indicates that the animals are neither attracted nor repelled by the magnetic field and, above all, **their exploratory behaviour to find shelter, and thus protect themselves from predators, is not modified for the tested magnetic field intensity**. These results have just been published in issue 220 of the scientific journal Aquatic Toxicology[1]. They provide the first objective and substantiated information on lobster in a field where experimental data remain scarce.

▶ Scientific paper on line: **https://doi.org/10.1016/j.aquatox.2019.105401**

A scientifically and technically rich context

This experiment was carried out in the facilities of the Institute of Marine Research, in close collaboration with several researchers from this Norwegian research center. It is part of the **SPECIES collaborative R&D project** (2016-2020). This project aims to improve knowledge on the potential interactions between power connection cables from offshore renewable energy projects and organisms living on the seabed. Coordinated by France Energies Marines and scientifically led by Ifremer, the project brings together a **consortium of 9 academic and private partners** with complementary skills and contributions. Discussions will take place within the consortium in the spring in order to define the project follow-up .

▶ SPECIES project: **en.france-energies-marines.org/R-D/Projects-in-progress/SPECIES**

In the lab

The main actor in this experiment is Bastien Taormina, who recently completed his PhD at France Energies Marines and Ifremer. His thesis focused on the potential impacts of subsea power cables from offshore renewable energy projects on benthic communities.

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[1] Taormin B., Di Poi C., Agnalt A.-L., Carlier A., Desroy N., Escobar-Lux R. H., D'eu J.-F., Freytet F. & Durif C. (2020) Impact of magnetic fields generated by AC/DC submarine power cables on the behavior of juvenile European lobster (*Homarus gammarus*). *Aquatic Toxicology, 220, 1054019*

SPECIES project partners

(Submarine Power Cables Interactions with Environment & associated Surveys)