Study Committee C3

POWER SYSTEM ENVIRONMENTAL PERFORMANCE

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Exploring Environmental Impacts of Submarine power cables from offshore wind farms

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Motivation

- Increasing number of submarine power cables (SPC) projects in France and Europe linked to Marine Renewable Energy (MRE) development.
- A need to improve knowledge on potential interactions SPC for marine renewable energy (MRE) projects and benthic organisms in coastal marine ecosystems.

Approach

Development of methodologies for measurement and monitoring during the 3 years SPECIES project (2017-2020)

- *Method to characterize the potential heat* produced by the passage of electric current through cables
- Development of measurement tools, including instrumentation for generating and recording electromagnetic fields in situ and in the laboratory (Mobile measurements of electromagnetic fields, Fixed measurements of electromagnetic fields).
- Methods for monitoring subtidal benthic communities near cables, epibenthic communities and benthic megafauna associated with cable protection structures (Fig. 1)

Fig 1 : Sampling on a reference station

Locations

Research were conducted in France at Paimpol-Bréhat in the Côtes d'Armor, Fromveur in Finistère and SEM-REV in Loire-Atlantique.

Conclusion

- In situ measurements of electromagnetic fields produced by subsea power cables lack standardization.
- For a given cable, the strength produced could be given in µT/MW at a distance of one meter.
- Uncertainty remains concerning the potential role of thermal insulation played by the epibenthic fauna having colonized the cables

Results & Discussion

- Measurement of physical effects: Temperature measurement :

Data acquired at three different site tests showed no heating of cables surface – and therefore of their immediate environment – at a sensitivity level of 0.06°C (Fig. 2). However, the longest monitoring had a higher power rating than the cables at the other test sites, so ecological impact related to the temperature of cables laid on the seabed during operation might be negligible.

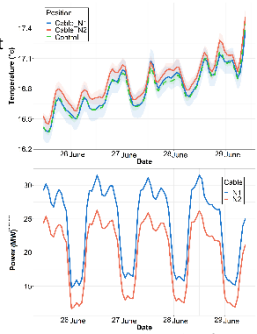

Fig 2 : Temperature measured every hour from 25 to 29 june at the surface of two cables (50 (N1) and 90 (N2) MW) and at a control station in Channel waters (top) and power flowing through both cables at same dates (bottom).

- Studies of succession of epibenthic communities colonizing artificial structures :

Using four years of image-based underwater surveys, SPECIES results highlight that artificial structures add elevated and stable substrata in unstable environments because of strong sediment abrasion of natural rocks (Fig. 3). These data support that structurally complex taxa facilitate an overall increase in local diversity. Visual counts and video-based surveys during five years have revealed that mattresses provide a suitable habitat for 5 taxa of large crustaceans and fish. In particular, two commercially valuable species, i.e. the crab *C. pagurus* and the European lobster *H. gammarus*.

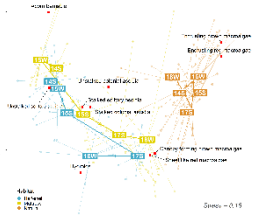

Fig 3 : Non-metric multidimensional composition of the epibenthic communities based on the Bray-Curtis similarly index of the images. Each point represents an image and the lines connect all of the images from the same measurement campaign and habitat to its centroid. The arrows show the evolution over time (S = summer, W = winter).

The shape and the number of shelters available below individual mattresses largely determine potential for colonization by mobile megafauna.

- Maintaining long-term continuous survey of coastal artificial reef habitats will be a key to better discriminate between long-term ecological successions and shorter-term variability.
- High density of cables should represent priority study areas for *in situ* subsea power cables impacts on benthic communities.

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