

Fish physiological stress response when exposed to wind turbine noise



Context and objectives



Because of their inner ear and lateral line, fish are sensitive to acoustic perturbations such as those generated by offshore wind farms.

Risk assessments are primarily based on noise levels that cause hearing damage. However, effects can occur at lower levels, including behavioral changes and physiological disturbance that may affect survival and reproduction.

ECHO's approach combines laboratory, semi-controlled environment and *in-situ* tests, with numerical modelling to answer:

How noise from an operating wind turbine may impact fish health?

A first fieldwork was conducted using an engaging approach in the fall of 2025.

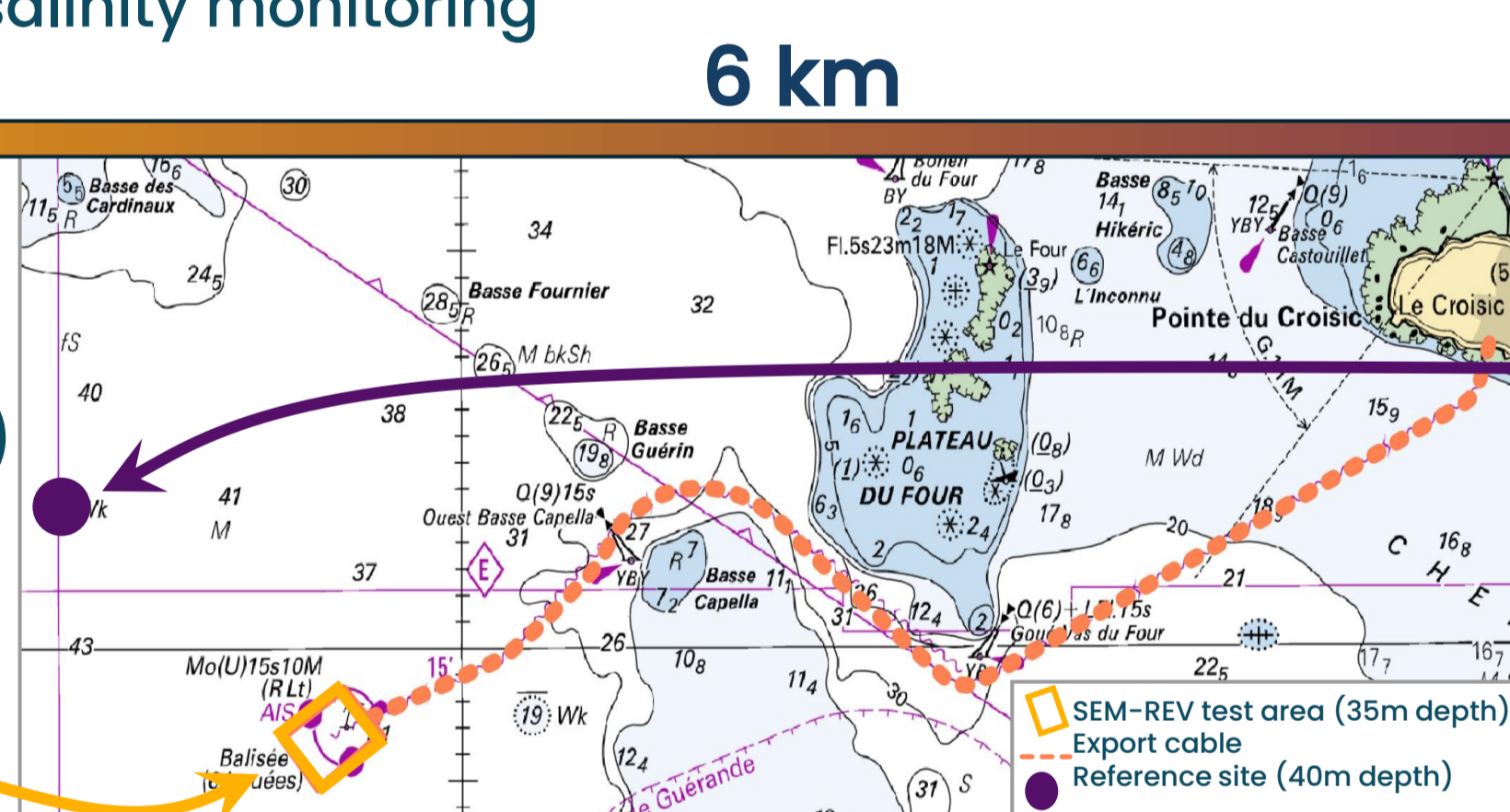
Methods

In-situ campaign, 52 days exposure

- Two locations with 4 cages (approx. 60 sea bass juveniles) per site
- On each site : acoustic, T°, O₂, salinity monitoring

Exposed site

200 m from **FLOATGEN (BW IDEOL)**
a floating wind turbine located
20 km off the coast



Reference site

6km away from **FLOATGEN**
outside its acoustic influence

Data collection and analysis

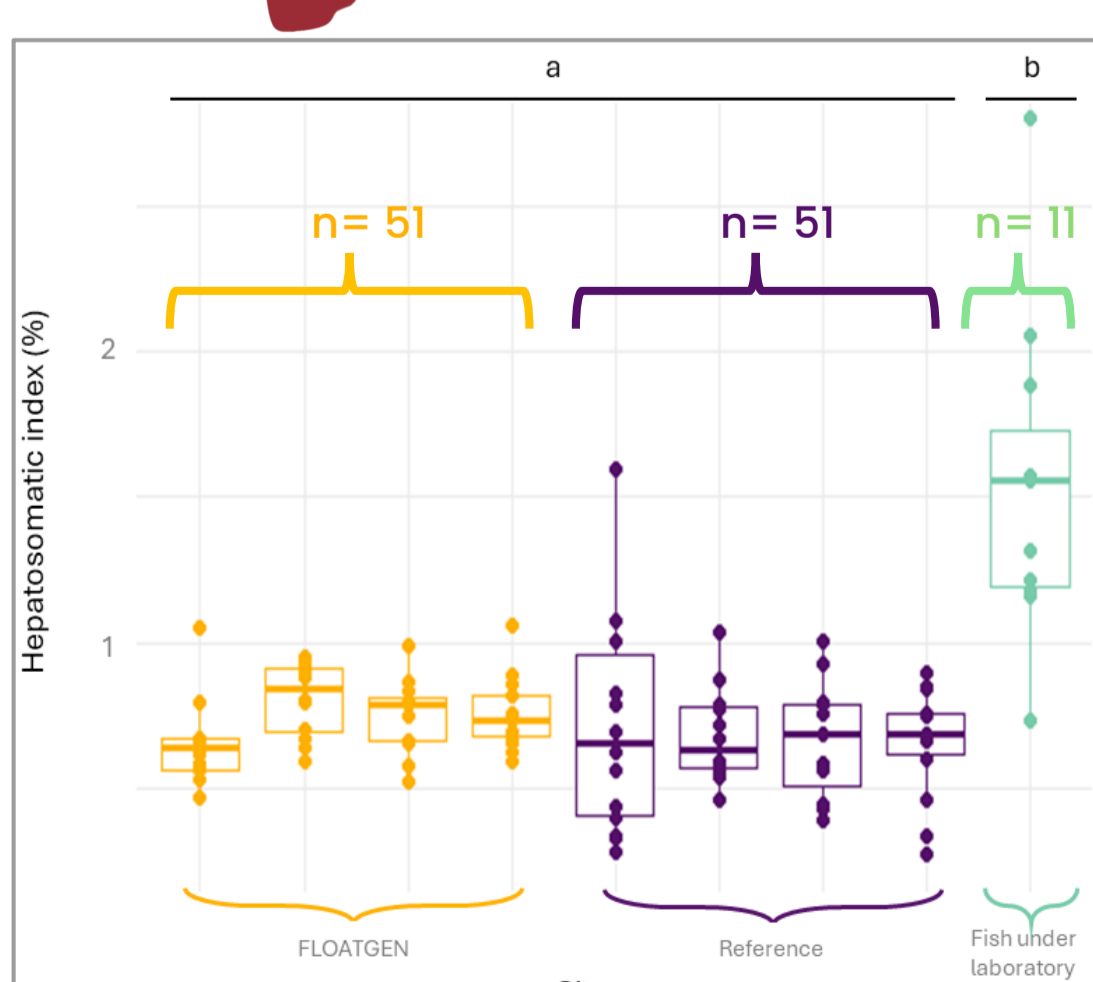
- For encaged sea bass and sea bass raised in laboratory as a control, we estimated ...
- Survival rates and condition indicators (growth and hepatosomatic index)
 - Physiological stress indicators: RNA/DNA ratios, oxidative stress, cortisol level

Preliminary results

After caging:

Fish survival rates were similar between the 2 sites, ranging from 80% to 100% near **FLOATGEN** and from 80% to 93,9% at the **reference site**.

Hepato-somatic index (HSI) ... on liver



RNA-DNA ratio provides information on **growth and condition**. Generally, ratios increased when fish live in good conditions: well-fed, and metabolically active. RNA-DNA ratios found in wild juveniles seabass usually ranges between 3-6. Here, fish have similar RNA-DNA ratios in this range both in cages and in the laboratory.

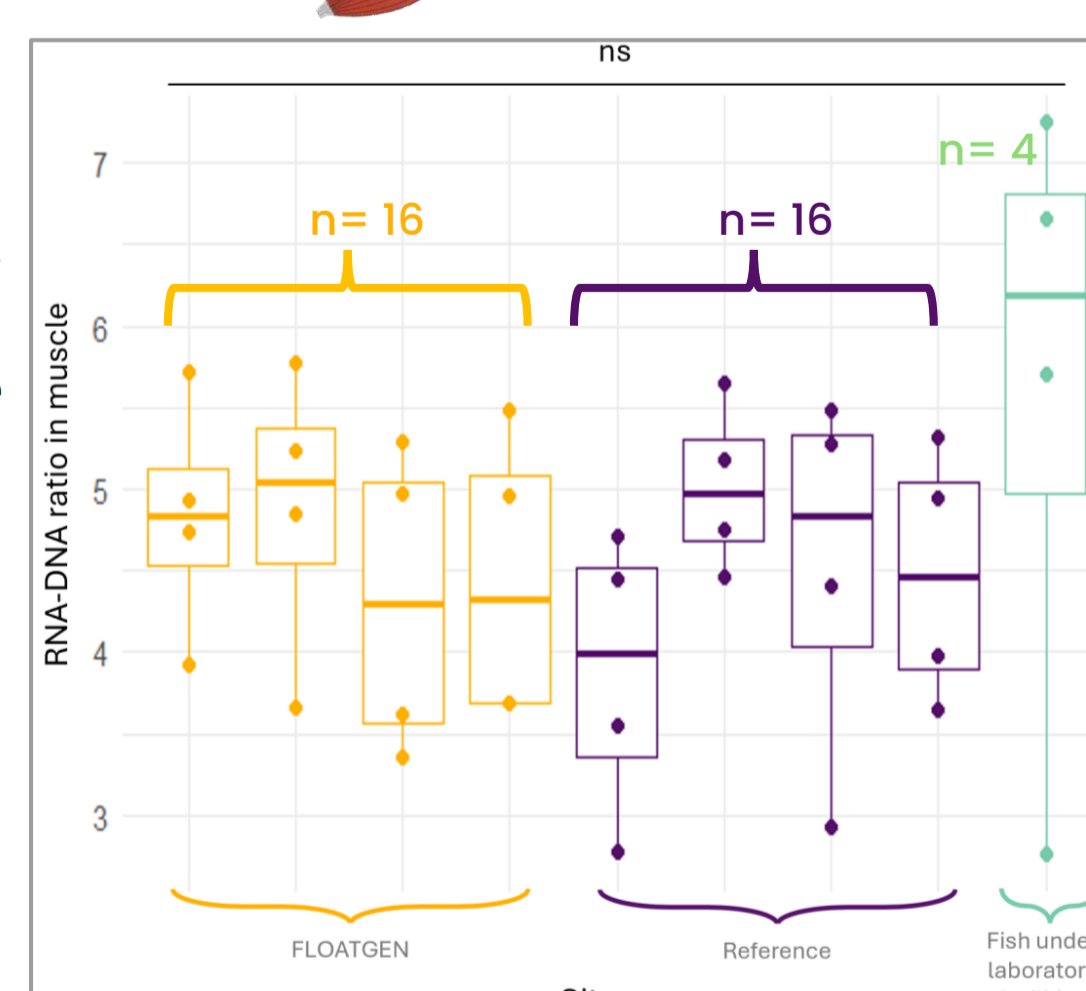
HSI index provides information on the **fish condition**, in particular regarding their **energy reserves**.

In juvenile sea bass, the HSI index generally ranges between 1% and 2%, as observed in our laboratory-reared sea bass.

All caged fish have a similar HSI index that is slightly below this range, regardless the site.



RNA-DNA ratio ... on muscle



Conclusions

At this stage

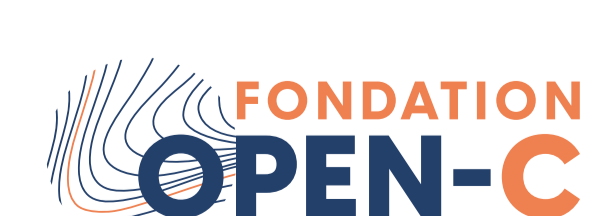
- Survival rates, HSI and RNA-DNA ratios were found to be similar between **FLOATGEN site** and the **reference site** after the 52-days caging period.
- Values suggest fish are in similar and, overall, good condition from an energetic perspective.
- Offshore fish caging was found to be feasible for *in situ* surveys, even at a significant depth of 30-40 m.

Future work

- Continue analysis in laboratory using additional physiological markers.
- Conduct mechanical studies in laboratory and semi-controlled environment.



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