

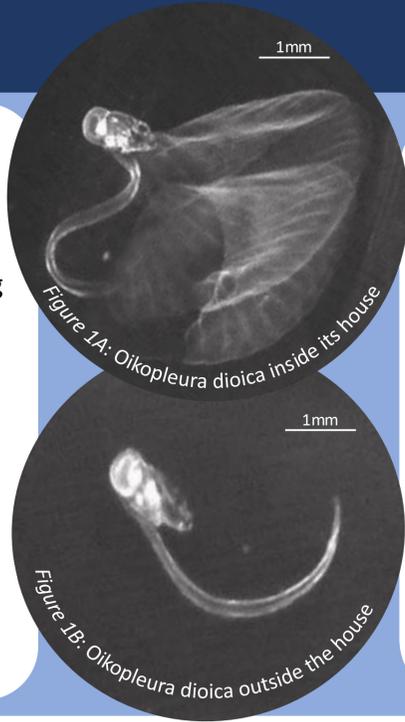
NOISE EXPOSURE'S EFFECT ON OIKOPLEURA DIOICA BEHAVIOR AND FERTILITY



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BACKGROUND

Maritime traffic in European waters generates underwater noise that impacts marine life, including around 350 species of tunicates (Bay-Nouailhat & Virgili, 2024). Studies have found that average noise levels in these regions range from 125 to 130 dB, with peaks reaching up to 155dB during boat transit (Zambon et al., 2023). In response, the Deutero Noise project seeks to investigate how such noise affects tunicates (DeuteroNoise Project, 2022).



Oikopleura dioica is a very small tunicate that lives near the surface of the ocean (Glover, 2020). The animal builds a “house” that filters algae and bacteria from the water for consumption. When the animal is stressed or the filters become clogged, it exits the house and begins constructing a new one. *Oikopleura* has two phenotypes: outside and inside the house (Figure 1A-1B). In our lab, this small tunicate has a lifespan of approximately 7 days at $12 \pm 0,5^{\circ}\text{C}$. On the seventh day, the animals become fertile and differentiate into males or females, releasing eggs and sperm.

Aim: Investigate noise exposure's effect on *Oikopleura dioica* behavior and fertility, as part of the Deutero Noise project.



METHOD

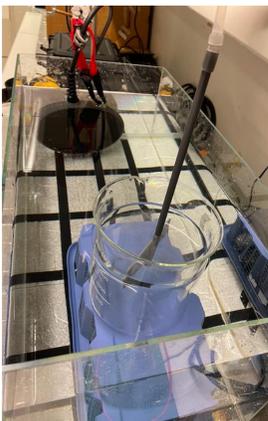


Figure 2A: Setup for noise exposure.



Figure 2B: The tracker used for recording animal behavior.

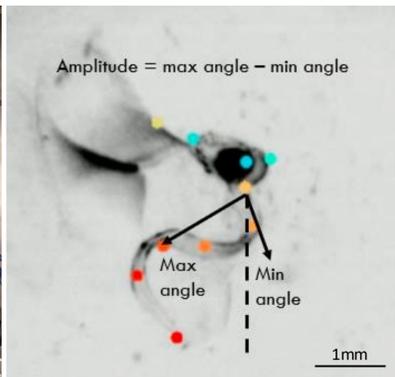


Figure 2C: Inverted image of animal with tracking points for analysis. Amplitude was calculated as: $\text{Amplitude} = \text{max angle} - \text{min angle}$

BEHAVIORAL EXPERIMENT
Oikopleura (day 5) were exposed to noise at 145.65dB and 151.28 dB for 1h (Figure 2A). They were recorded in a tracker for 15min before noise exposure, immediately after, and 1h after recovery (Figure 2B).

The footage was inverted, and tracking points were added to the animals using DeepLabCut (Figure 2C). Amplitude of the tail was analyzed.

FERTILITY EXPERIMENT (pilot project)
On day 5, *Oikopleura* were exposed to noise at 151.28dB for 2h. On the 7th day, once the gonads had matured, eggs were released and counted (Figure 3).



Figure 3: *Oikopleura* egg image captured by microscope.

RESULTS

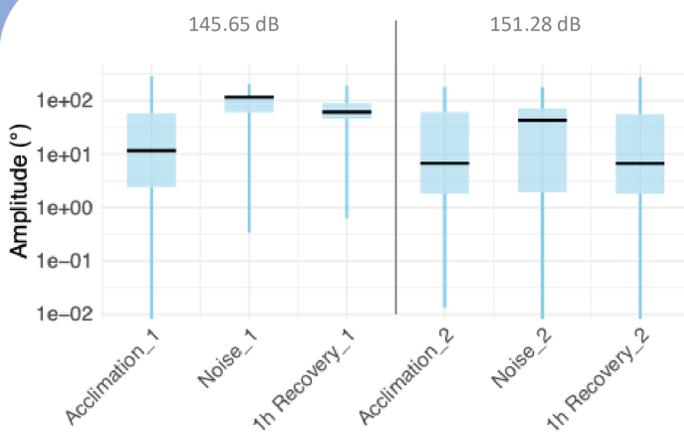


Figure 4: Diagram illustrating the amplitude of the *oikopleura* tail.

Both 145.65dB and 151.28dB groups increased the median amplitude immediately after 1h noise exposure, compared to the acclimation (Figure 4). Animals exposed to 145.65dB displayed higher amplitude after noise exposure and after 1h recovery, compared to the acclimation.

For the animals starting outside a house: the 151.28dB group made houses during acclimation and 1h recovery recording, while no animal from the 145.65dB group made a house (Figure 5A). Most animals (86%) in the 145.65dB group that started in a house exited it, while none from the 151.28dB group exited their house (Figure 5B).

The noise-exposed group (2h noise) had a slightly lower egg count than the control group (Figure 6).

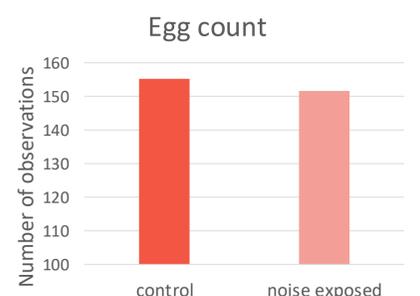


Figure 6: Diagram representing the mean egg count for noise-exposed and control groups.

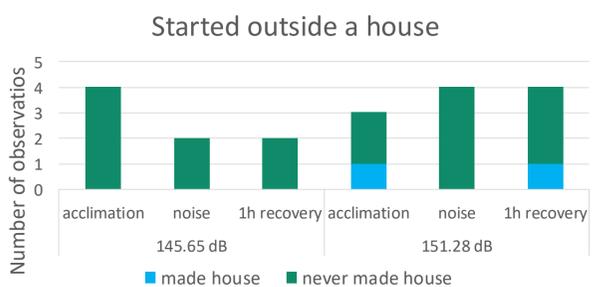


Figure 5A: Diagram representing all animals that started in a house when recorded, and their further behavior.

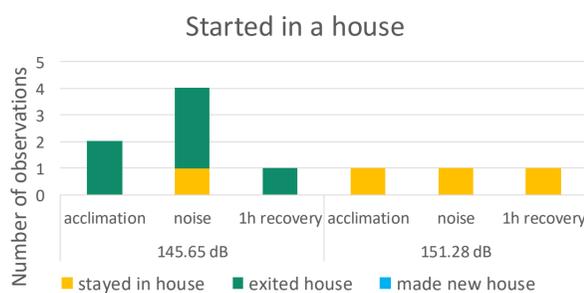


Figure 5B: Diagram illustrating all animals that started outside a house when recorded, and their further behavior.

CONCLUSION

- The 145.65 dB group showed higher tail **amplitude**, possibly due to more animals in houses, compared to the 151.28 dB group, which had more animals outside houses.
- **No house** was created immediately after 151.28 dB noise exposure, but some were made during acclimation and after 1h recovery. This can indicate that noise is a stressor, but the animals can reestablish after stress.
- There was no clear difference in **egg count**. More experiments are required and exposing animals for noise earlier in the life cycle.

REFERENCES

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