DEUTERO NOISE

"The DeuteroNoise project's primary objective is to assess noise pollution" and "examine its impact on the behavior, nervous system, sensory organs, immune system, and resilience of marine deuterostomes." [1]

# The effects of noise exposure on *Ciona intestinalis* larvae

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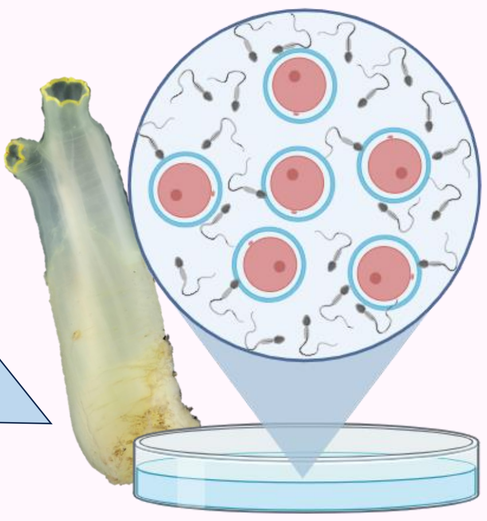
**Background:** Noise pollution is known to affect communication, navigation, marine ecosystems and can even cause injury. Compared to other marine life, very little research on the effect of noise pollution on marine deuterostomes has been done. The deuterostome of choice, *Ciona intestinalis* larvae, was exposed to varying level of noise exposure, filmed and tracked. [2, 3]

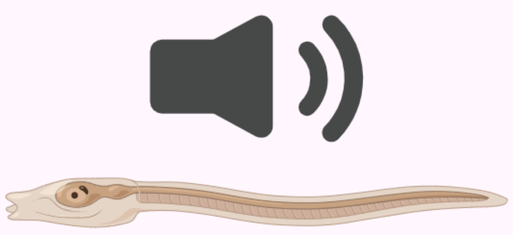
**The aim: examine impact of noise pollution on behaviour**

**Why *C. intestinalis*?**
Abundant in oceans world-wide, local and easy access, rapid development from egg to larvae with year-round egg production, small and easy to work with in large numbers. [4]



**Fertilisation**

**Incubation** 40 hours 14 °C



**Noise Exposure**

**Method – Noise exposure**
This study included 2 methods of noise exposure in which larvae were exposed to artificial noise peaking at 63 and 125 Hz. Larvae were exposed for 1 hour before tracking in method B, and 15 minutes during tracking in method D.

| | | | | |
|---|---|---|---|---|
| B (dB) | 135 | 142 | 150 | 158 |
| D (dB) | 87 | 94 | 101 | |

**Table 1.** *Noise levels tested in method B and D.* The noise were measured with a hydrophone in method B, and in air in method D.

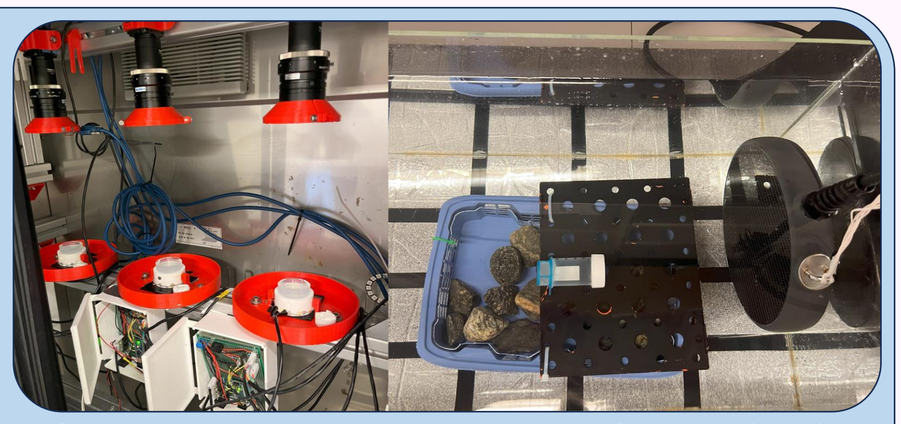
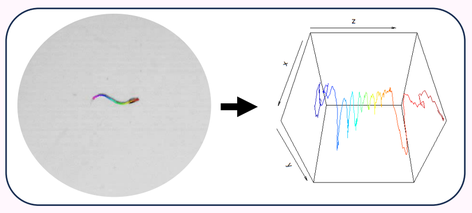
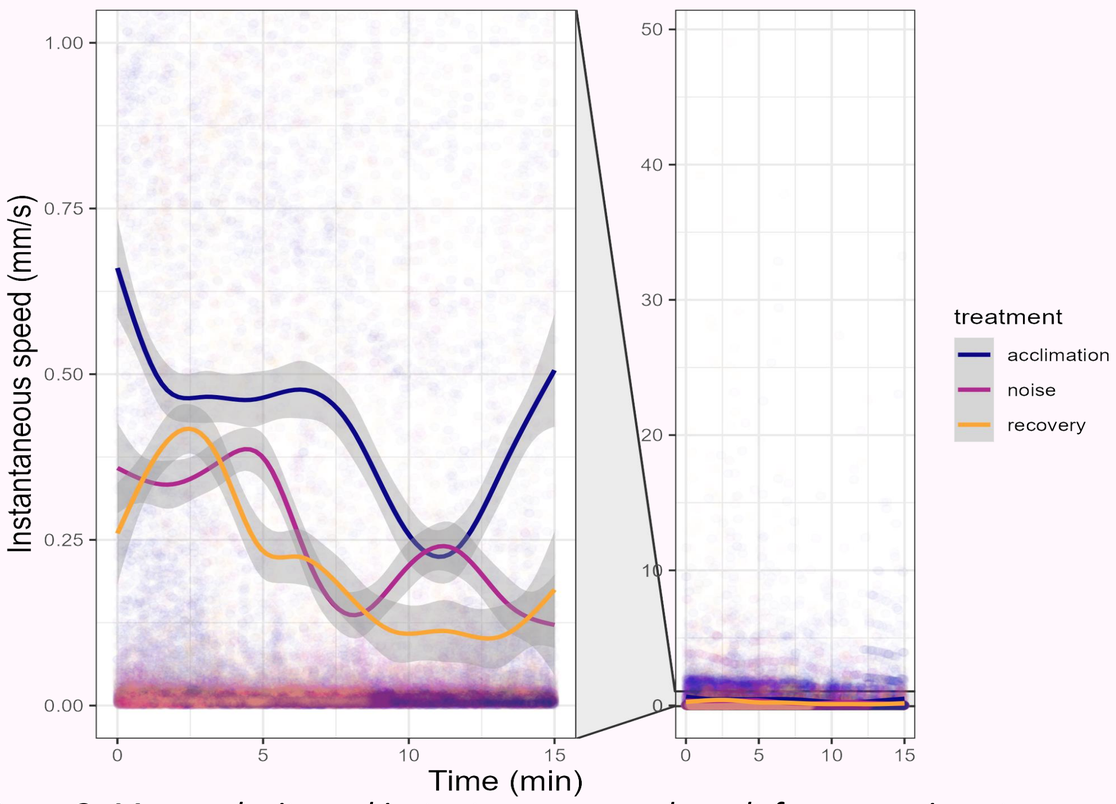


**Figure 1.** *Noise exposure stations.* 110dB control. Left: Tracking station containing speaker. Right: Calibrated tank with underwater speaker.

**Tracking**



**Method – Tracking**
Each larva filmed were traced with nodes using DeepLabCut. The node positions were saved each frame and graphed across time (z). Graph characteristics and patterns were used to determine behaviour. [5, 6]



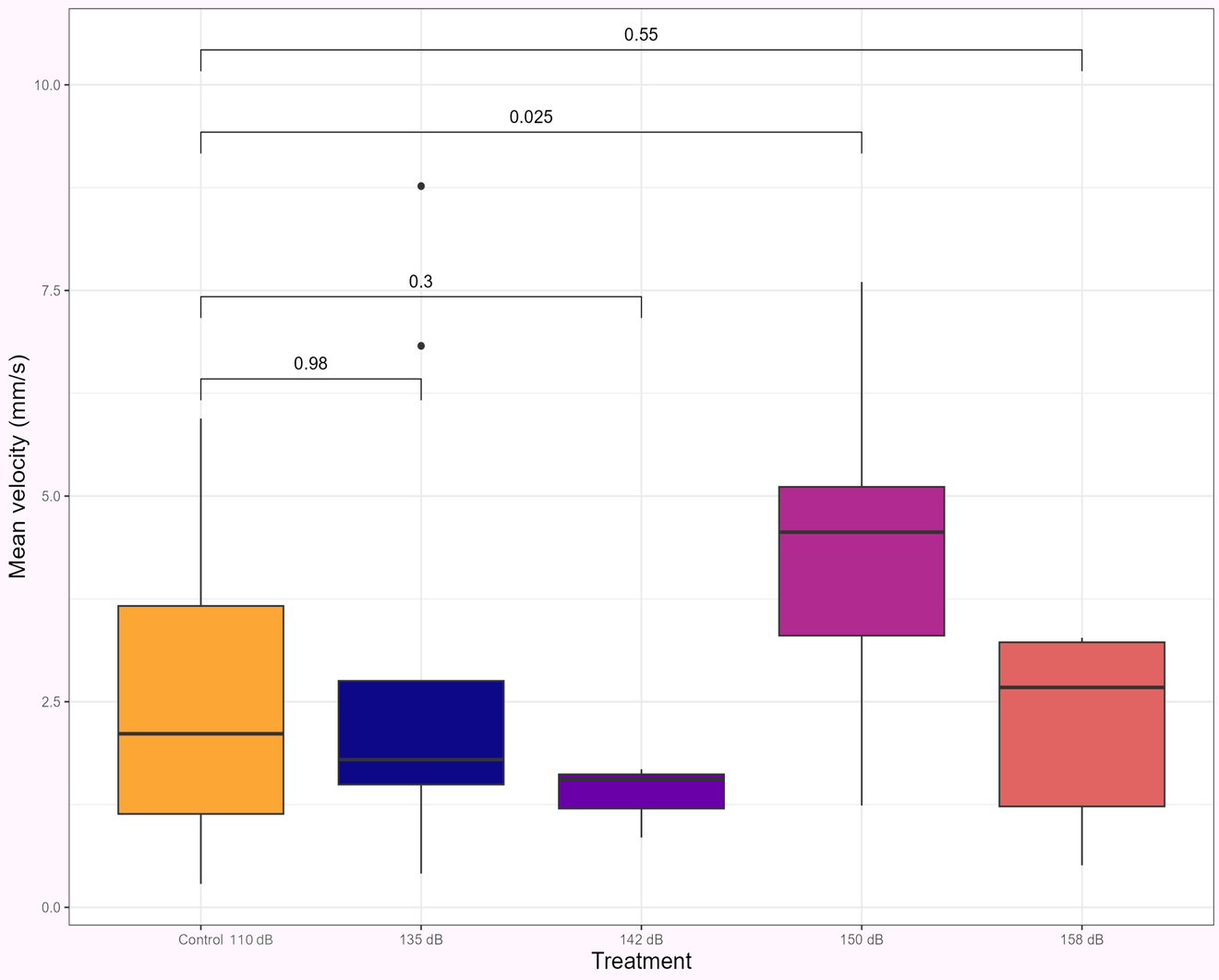




**Figure 2.** *Mean velocity and instantaneous speed result from experiment B and D.* Left: boxplot containing mean velocity when swimming from experiment B, velocity below 0.2 mm/s was ignored. Above: mean instantaneous swimming speed from experiment D, exposure at 87 db.

## Results

The parameters tested, active/inactive, change from/to active/inactive, mean velocity when active and mean instantaneous speed (MIS), gave mostly non-significant results. From experiment D, there was a slight decrease in MIS after exposure, but more data is required to determine any significance. Every result from experiment B gave non-significant results, with one exception:

**The only significant impact measured was noise pollution at 150 db, which increased mean swimming velocity.**

References:

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4. Liu LP, Xiang JH, Dong B, Natarajan P, Yu KJ, Cai NE. Ciona intestinalis as an emerging model organism: its regeneration under controlled conditions and methodology for egg dechorionation. J Zhejiang Univ Sci B. 2006 Jun;7(6):467-74. doi: 10.1631/jzus.2006.B0467. PMID: 16691641; PMCID: PMC1473992.
5. Athira A, Dondorp D, Rudolf J, Peytral O, Chatzigeorgiou M (2022) Comprehensive analysis of locomotion dynamics in the protochordate *Ciona intestinalis* reveals how neuromodulators flexibly shape its behavioral repertoire. PLOS Biology 20(8): e3001744. https://doi.org/10.1371/journal.pbio.3001744
6. Rudolf, J., Dondorp, D., Canon, L. et al. Automated behavioural analysis reveals the basic behavioural repertoire of the urochordate Ciona intestinalis. Sci Rep 9, 2416 (2019). https://doi.org/10.1038/s41598-019-38791-5

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