FRESHWATER ECOACOUSTICS
listening to the ecological status of multi-stressed lowland waters

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BACKGROUND

➤ It is a challenge to identify suitable structural and functional indicators to monitor and assess the effects of anthropogenic stressors on the ecological status of freshwater ecosystems[1].

➤ Passive acoustics could potentially be used to monitor invertebrate species and ecological processes in freshwater environments[2].

WHAT PRODUCES SOUNDS?

➤ **Sound producing taxa**: insects, amphibians, fish and crustaceans[3]

➤ **Ecological processes**: primary production and decomposition[2]

➤ **Anthropogenic activities**[2]

AIM
To test whether passive acoustic monitoring can be used for water quality assessment

METHODS

20 lowland water bodies throughout The Netherlands impacted by agricultural activities and WWTP discharge

Sampling campaign
August 20th and October 23th 2018
➤Various stressors
➤Dissolved oxygen saturation
➤Invertebrate community composition
➤Underwater sounds (acoustic indices)

RESULTS & CONCLUSIONS
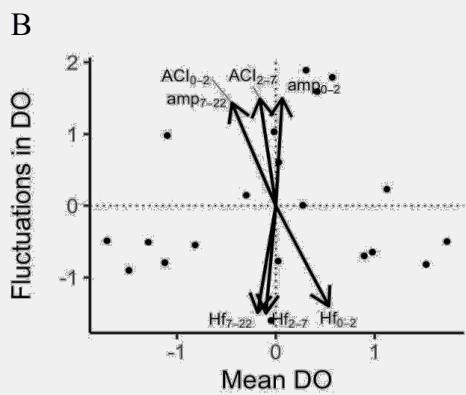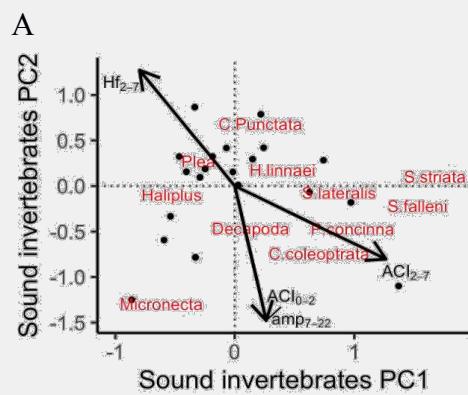
Fig. 1: Relations between the acoustic indices and the ordination of A) sound-producing invertebrates and B) dissolved oxygen dynamics. Taxa are prioritized on abundance. Arrows show the significant relations with acoustic indices ($p<0.05$). Acoustic indices include the acoustic complexity index (ACI), the spectral entropy (Hf), and the sum of raw amplitude from the spectrogram (Amp), each calculated over three frequency bands 0-2 kHz, 2-7 kHz and 7-22.05 kHz. Notation: ACI_{0-2} corresponds to the ACI index over the 0-2 kHz frequency band.

Acoustic patterns related to:
1. the sound-producing invertebrates (Fig. 1A), which were relatively insensitive to anthropogenic stressors (not shown)
2. the fluctuation in dissolved oxygen saturation (Fig. 1B).

Passive acoustic monitoring may potentially overcome some challenges encountered in the estimation of metabolism from dissolved oxygen curves.

1) Bonada et al., 2006; 2) Linke et al., 2018; 3) Desjonquères et al., 2020