Anthropogenic noise is a global problem on land and underwater

Fishes are impacted by man-made noise:
- Damaged hearing
- Cortisol
- Communication
- Aggression

Current situation UK:
- Government wants new large offshore wind farms (fig. 1)
- Building of farms (using pile driving) starts in 2014

Knowledge gap:
- Underwater noise is included in (inter)national legislation
- Accurate assessment of the impacts of noise are missing!

Modelling tool:
- HR Wallingford developed a model to predict movement of fish in response to noise (HAMMER*: see definition bottom of poster)
- However, experimental scientific data are missing

Research aim:
- Improve HAMMER* ecologically and obtain experimental data to feed into the model.

Effects of pile driving noise on an important North Sea fish

Experiments examining the impact of piling noise on physiology and behaviour in sea bass (*Dicentrarchus labrax*)

Opercular beat rate (stress)

Piling playback

Focal fish

Treatments:
- Ambient noise: Amb
- Piling noise: Amb

Speaker

Op ercular beat rate difference

Ambient Piling

Fig. 2. Piling increases stress

Open field test

- Similar noise setup as above (using playbacks)
- All tank walls, apart from one, were white to create a novel environment
- All movement automatically scored as soon as the fish was introduced
- Fish were free swimming

Treatments:
- Ambient noise: Amb
- Piling noise: Amb

Fig. 3. Fish tend to decrease time close to tank edge following piling

Output HAMMER modelling tool with new parameters

A

B

C

D

E

F

Fig. 4. Modelling response of migrating sea bass to pile noise (results).

Are sea bass affected by piling noise?
- Fish increased opercular beat rates during noise, indicating ↑ stress
- Following piling noise, fish tended to spend less time close to the tank edge, suggesting ↓ anxiety
- Sea bass behaviour and physiology is negatively impacted by noise

Does the model predict that migrating sea bass are impacted by noise?
- Noise sensitive fish reach the shallow breeding ground much later ➔ Later arrival to suitable breeding grounds could lead to less offspring, reduced fitness and less recruits for harvested fish stocks!

Definitions

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