Bat Conservation Trust

Impacts of Noise on Wildlife

Noise Network Plus Launch Meeting 18th March 2025

Dr Lia Gilmour

lgilmour@bats.org.uk

Noise

"A sound that has no function." (McKenna et al. 2016)

Noise and wildlife

- Animals encounter wide range of sounds in their environment
- Natural and anthropogenic sources
- Combine to produce background (ambient) noise level

(Kunc and Schmidt, 2019)

Anthropogenic noise

- Transportation (traffic, rail, aircraft)
- Industry (construction)
- Entertainment (festivals, events, fireworks)
- Acute high-intensity noise events

- **Soundscape alteration (acoustic niche)**
- **Temporary habitat fragmentation**

Responses to noise

- Behavioural responses
- Physiological responses
- **Dependent on evolution and auditory environment**

Behavioural impacts

- Foraging
- Courtship
- Migration
- Predator avoidance
- Social level

- Species distribution and assemblages

Physiological impacts

- Immune
- Cardiovascular
- Reproductive
- Metabolism
- Genetics effects

Mechanisms for noise responses in animals

AUDITORY MASKING

NOISE AVOIDANCE OR AVERSION

DISTRACTION/REDUCED ATTENTION

Masking

- Noise overlaps and masks important sound cues (foraging, reproduction, predator avoidance)
- e.g. contact calls in species that forage in groups (Morris-Drake et al. 2017)
- Adaptation to avoid masking, e.g. temporal and spectral shifts in calling, amplitude (Lombard effect)
- fitness costs?

Noise avoidance

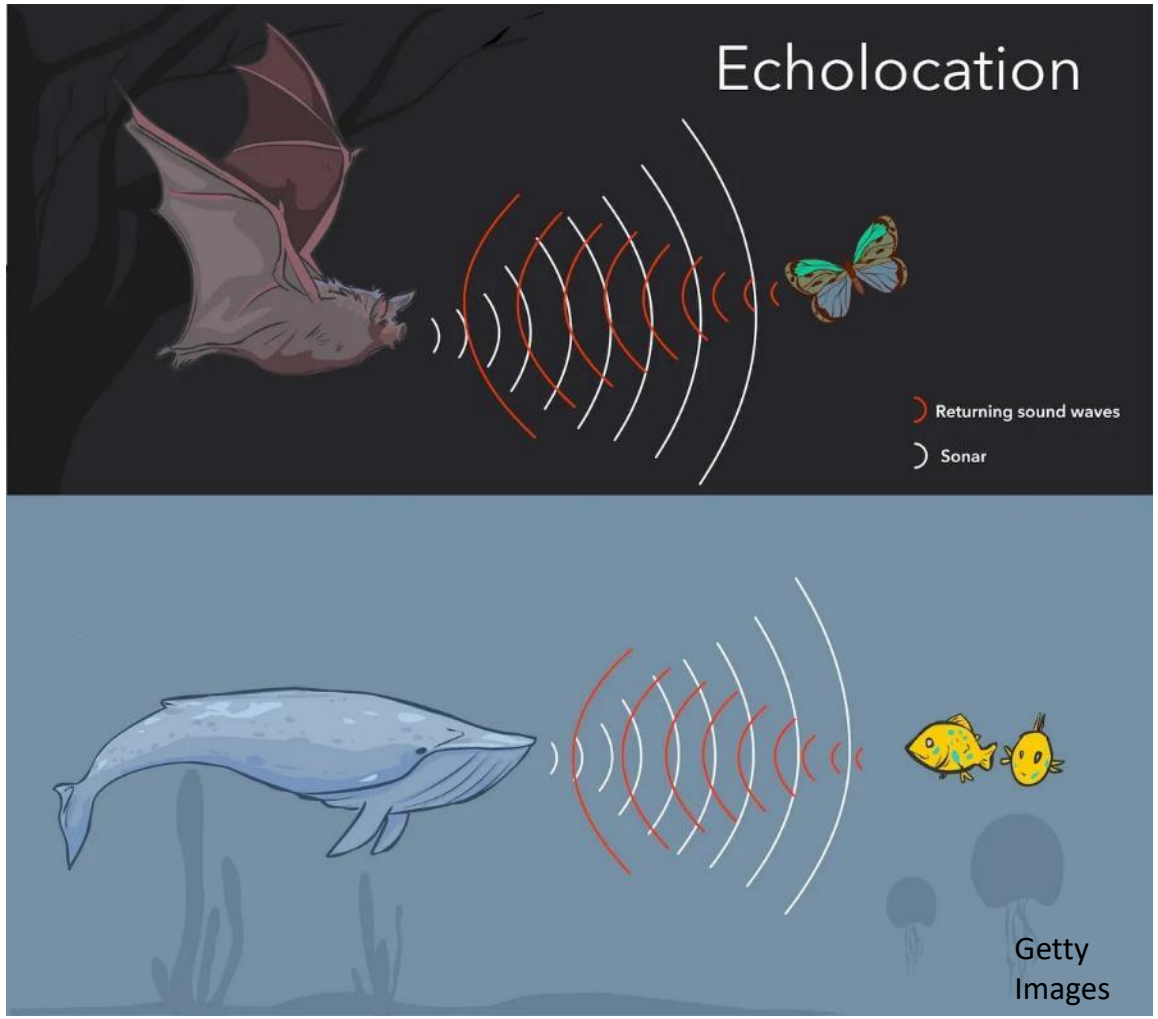
- Noise as a stressful, aversive or uncomfortable stimuli
- Difficult to tease apart from masking and reduced attention hypotheses

Reduced attention

- Noise represents a distracting stimulus
- Reduced attention to important cues
- Distraction from important behaviours (predator avoidance, communication, finding/catching prey) (Chan et al. 2010)

Bats

- Special case (along with cetaceans)
- Echolocation and active listening for echoes, S:N
- Anthropogenic noise, impact ability to process own echolocation cues

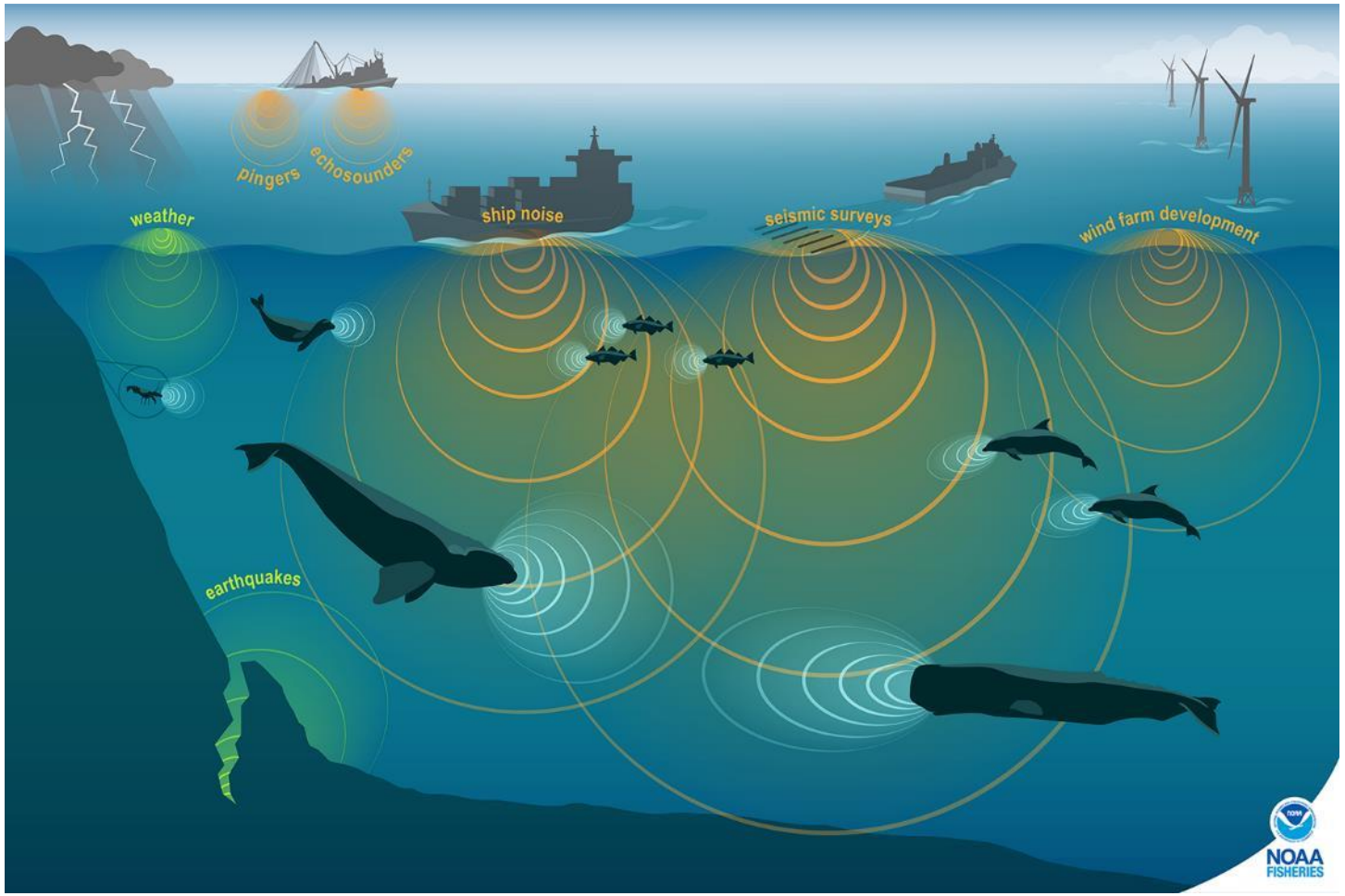


Bats

- Passive listening for prey generated sounds, gleaning
- At risk from masking of prey-generated sounds (Luo et al. 2015)
- Communication (e.g. maternal contact calls)

Evidence needs

- Most studies focus on birds and marine mammals
- Lack of data on bats, despite potential as bioindicator species and UK and EU protection
- Guidance on noise disturbance and bats very limited



Evidence needs

- Bats and noise pollution studies, mainly traffic noise
- Lab studies, playbacks- traffic, abstract noise
- Field studies rarer, methodological failings

Evidence needs

- Aircraft, rail
- Industry e.g. oil and gas
- Temporary noise event, festivals
- **Need to understand recovery after noise exposure**

Evidence needs

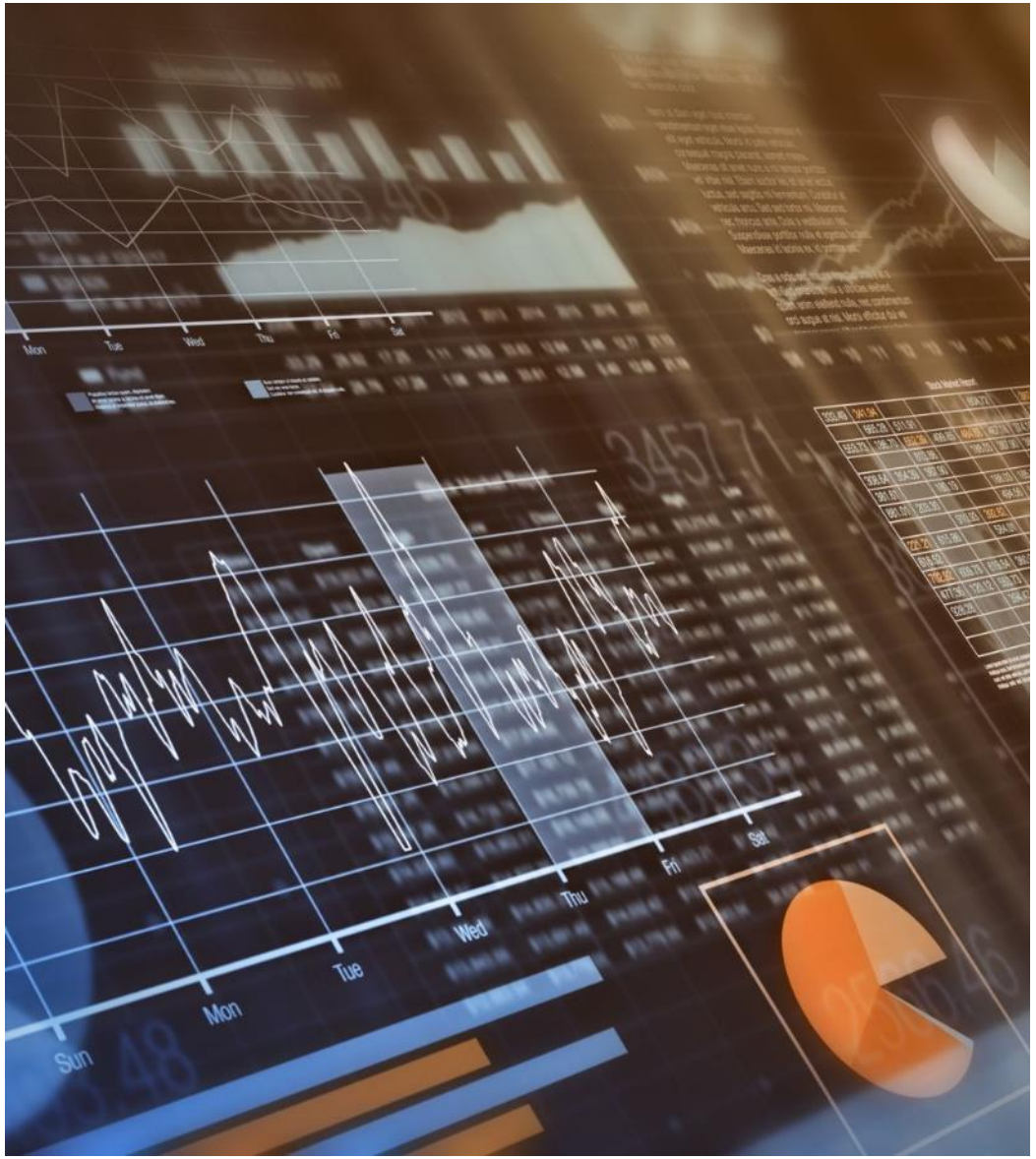
- Healthy soundscapes and human wellbeing
- Nature connection and links to biodiversity levels
- Access to natural sounds, masked by traffic noise (Gilmour et al. 2024)
- Electric vehicle noise and impact on bats and other wildlife

Challenges

- Field studies, very difficult to control for other stimuli
- Control of sound stimuli playback, attenuation of different Fs, topography, humidity
- Easier to control in lab, but less indicative of real-life scenario

Emerging tech

- Passive acoustic monitoring (PAM)
- Taxon specific vs taxon free approaches
- Machine learning (ML) classifiers



Emerging tech

- Monitoring bats better via the BCT Sound Classification System and BatDetect2 algorithm
- Woodland health metric
- Contribute to tracking global and national change
- Autonomous acoustic sensors

Potential collaboration

HOW DO SOUNDSCAPES AFFECT HUMANS AND WILDLIFE?

DO HEALTHY SOUNDSCAPES MEAN HEALTHY ECOSYSTEMS?

BCT SOUNDSCAPES PROJECT

BIG DATA THROUGH THE BCT SCS

References

Chan A, Giraldo-Perez P, Smith S, Blumstein DT. 2010. Anthropogenic noise affects risk assessment and attention: the distracted prey hypothesis. Biology Letters **6**:458-461.

Finch, D., Schofield, H. and Mathews, F. (2020) Traffic noise playback reduces the activity and feeding behaviour of free-living bats. *Environmental Pollution* [online]. 263.

Gilmour, L.R., Bray, I., Alford, C. and Lintott, P.R., 2024. Natural soundscapes enhance mood recovery amid anthropogenic noise pollution. *PloS one*, *19*(11), p.e0311487.

Kunc, H.P. and Schmidt, R. (2019) The effects of anthropogenic noise on animals: a meta-analysis. *Biology Letters* [online]. 15 (11), p. 20190649.

Luo, J., Siemers, B.M. and Koselj, K. (2015b) How anthropogenic noise affects foraging. *Global Change Biology* [online]. 21 (9), pp. 3278–3289.

McKenna, M.F., Shannon, G. and Fristrup, K. (2016) Characterizing anthropogenic noise to improve understanding and management of impacts to wildlife. *Endangered Species Research* [online]. 31, pp. 279–291.

Morris-Drake A, Bracken AM, Kern JM, Radford AN. 2017. Anthropogenic noise alters dwarf mongoose responses to heterospecific alarm calls. Environmental Pollution **223**:476-483.

Morris-Drake A, Kern JM, Radford AN. 2016. Cross-modal impacts of anthropogenic noise on information use. Current Biology **26**:R911-R912.

Purser J, Radford AN. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). PLoS ONE **6**:e17478.

Siemers, B.M. and Schaub, A. (2011) Hunting at the highway: Traffic noise reduces foraging efficiency in acoustic predators. *Proceedings of the Royal Society B: Biological Sciences* [online]. 278 (1712), pp. 1646–1652.

Bunkley, J.P. and Barber, J.R. (2015) Noise Reduces Foraging Efficiency in Pallid Bats (Antrozous pallidus). *Ethology* [online]. 121 (11), pp. 1116–1121.

Bunkley, J.P., McClure, C.J.W., Kleist, N.J., Francis, C.D. and Barber, J.R. (2015) Anthropogenic noise alter bat activity levels and echolocation calls. *Global Ecology and Conservation* [online]. 3, pp. 62–71.

Zhou Y, Radford, A. N., & Magrath, R. D. 2019. Why does noise reduce response to alarm calls? Experimental assessment of masking, distraction and greater vigilance in wild birds. Functional Ecology **33**:1280-1289.