

PROJECT TITLE: Ocean Soundscapes in a Changing World

DTP Research Theme(s): Living World, Changing Planet

Lead Institution: University of Bristol

Lead Supervisor: Prof. Steve Simpson, School of Biological Sciences, University of Bristol

Co-Supervisor: Prof. Andy Radford, School of Biological Sciences, University of Bristol

Co-Supervisor: Dr Rob Ellis, Biosciences, University of Exeter

Co-Supervisors: Dr Miles Parsons, Australian Institute of Marine Science

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Project keywords: bioacoustics, animal communication, reef restoration, acoustic enrichment



Simpson recording coral reef soundscapes (BBC Blue Planet II)



Simpson studying clownfish communication (BBC Blue Planet II)

Project Background: The oceans are full of sound, with a vast array of intentional (e.g., communication) and incidental (e.g., feeding) sounds produced by marine mammals, fish and invertebrates, as well as an increasing contribution of noise emanating from human activities. Soundscapes influence behaviour of reef organisms at key moments in their life (e.g., selecting habitat, mate choice and courtship, avoiding predators), but habitat loss and noise pollution can disrupt behaviour with direct fitness consequences. Ocean soundscapes offer new ways to map, monitor and restore marine ecosystems. Since most sounds on coral reefs are produced by the resident community, classifying the soundscape (e.g., phonic richness, density of sound producers) provides insight into reef health and community structure (including assessment of cryptic and nocturnal species usually missed by visual census), long-term acoustic monitoring allows us to track habitat degradation and recovery, and adding sound in degraded habitats can accelerate recovery. This is a field still in its infancy, with great opportunity for major breakthroughs in acoustic classification and attribution of biological sources of sound, biodiversity monitoring and mapping, automated acoustic analyses, restoration through acoustic enrichment, and delivery of new scientific knowledge into environmental policy, marine management, public understanding and natural history films.

Project Aims and Methods: This project offers a wide range of opportunities that will be developed in detail with the successful candidate, taking into consideration the most promising research directions, student interests and background, and fieldwork and media opportunities. Four potential aims include:

1. Using acoustics to track community development on restoration reefs at Lizard Island. This will involve taking long-term acoustic recordings, video capture and diver/snorkeler census.
2. Developing scalable approaches to collect, rear and release early life stages of corals, mobile invertebrates and fishes at coral reef restoration sites. Acoustic tools for acoustic conditioning, enrichment and anchoring will be a particular focus.

3. Developing ecoacoustic tools for measuring ecosystem health, monitoring habitat degradation and accelerating recovery around the world. This could include a strong citizen science element.
4. Designing multi-sensor systems to increase understanding of marine soundscapes, including animal communication and biodiversity assessments, and working alongside natural-history filmmakers to enrich the viewer's experience of the oceans.

Candidate requirements: The student will have a strong track record in one or more of the following disciplines: marine biology, biology, behavioural ecology, bioacoustics, computer science. We welcome and encourage student applications from under-represented groups. We value a diverse research environment.

Project partners: The student will train with Prof. Steve Simpson and Prof. Andy Radford (University of Bristol) in marine biology, bioacoustics and behavioural ecology, join Dr Miles Parsons (Australian Institute of Marine Science) on the Great Barrier Reef *ReefSong* restoration project, and develop aquaculture skills with Dr Rob Ellis (University of Exeter).

Training: This project offers the opportunity for the student to train to PADI Divemaster, undertake accredited powerboat training and expedition first aid training. The student will be supported with structured bioacoustics training, receive formal and ongoing training in experimental design, statistics and scientific writing, and encouraged to develop science communication and public engagement skills.

Background reading and references

Duarte et al. (2021) The soundscape of the Anthropocene ocean. *Science* 371:eaba4658.

<https://doi.org/10.1126/science.aba4658>

Gordon et al. (2018) Habitat degradation negatively affects auditory settlement behavior of coral reef fishes.

Proceedings of the National Academy of Sciences USA 115:5193–5198. <https://doi.org/10.1073/pnas.1719291115>

Gordon et al. (2019) Soundscape restoration enhances fish community development on degraded coral-reef habitat.

Nature Communications 10:5414. [doi:10.1038/s41467-019-13186-2](https://doi.org/10.1038/s41467-019-13186-2)

Lamont et al. (2021) The sound of recovery: coral reef restoration success is detectable in the soundscape. *Journal of*

Applied Ecology <https://doi.org/10.1111/1365-2664.14089>[https://www.nature.com/articles/s41467-](https://www.nature.com/articles/s41467-019-13186-2)

[019-13186-2](https://www.nature.com/articles/s41467-019-13186-2)

Simpson et al. (2016) Anthropogenic noise increases mortality by predation. *Nature Communications* 7:10544.

<https://doi.org/10.1038/ncomms10544>

Useful links

<https://research-information.bris.ac.uk/en/persons/steve-simpson>

<http://www.bristol.ac.uk/biology/courses/postgraduate/>

Bristol NERC GW4+ DTP Prospectus:

<https://www.bristol.ac.uk/study/postgraduate/research/great-western-four-doctoral-training-partnership-nerc/>

How to apply to the University of Bristol:

<http://www.bristol.ac.uk/study/postgraduate/apply/>

Please note: If you wish to apply for more than one project please contact the Bristol NERC GW4+ DTP Administrator to find out the process for doing this.

The application deadline is Tuesday 9 January 2024 at 2359 GMT. Interviews will take place from 26 February to 8 March 2024.

For more information about the NERC GW4+ Doctoral Training Partnership please visit

<https://www.nercgw4plus.ac.uk>

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