

Impacts of anthropogenic noise on fish reproduction, development and survival

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Project description

Anthropogenic (man-made) noise has changed the acoustic environment on land and underwater, and is now recognised as a pollutant of international concern^{1,2}. Recent research by us and others has demonstrated that fish behaviour and physiology can be detrimentally affected by acute exposure to anthropogenic noise, but studies have been mostly conducted in aquaria and fitness consequences are often difficult to assess¹; findings can be of limited use to regulators and policy-makers. This PhD will use individual tagging and a range of field-based experiments, in combination with sound-field characterisations (in both sound pressure and particle velocity domains), to investigate how chronic exposure to common anthropogenic noise sources (shipping, pile-driving) can impact reproduction, early-life development and survival in two commercially important UK fish species (cod, salmon). Specifically, there are three main objectives:

1. To assess the impact of anthropogenic noise on reproductive success.

The spawning success and fecundity of adult fish exposed to different noise regimes will be determined. How noise potentially masks crucial acoustic communication of cod during mating will also be considered.

2. To determine how early-life exposure to anthropogenic noise affects development.

A series of measures and test paradigms developed and validated during a recent 3-year Defra contract will be used to explore how the exposure of parents, eggs and fry to noise affects directly or indirectly the growth, condition and subsequent behaviour (e.g. anti-predator responses, feeding) and physiology (e.g. metabolic rate, stress) of young fish.

3. To examine the survival consequences of exposure to anthropogenic noise.

Cohorts of fish exposed to chronic noise as part of Objective 2 will also be monitored for survival rates. Well-established tagging and remote monitoring methods will be employed to consider the effect of anthropogenic noise on the salmon smolt run.

The proposed work will benefit from a collaborative venture between academics in the Universities of Bristol

and Exeter (with expertise in underwater bioacoustics, fish biology, carefully controlled experimentation and noise pollution), Marine Scotland (expertise in field-based experiments on cod and salmon, and with strong links to industry, policy-makers and regulators) and Cefas (expertise in individual tagging and remote monitoring of fish). By examining how anthropogenic noise potentially impacts reproduction, development and survival, which directly affect population viability, the research will have both scientific and applied value.

¹Simpson, S.D., Purser, J. & Radford, A.N.(2014) Anthropogenic noise compromises anti-predator behaviour in European eels. *Global Change Biology* Online early. doi: 10.1111/gcb.12685

²Nedelec, S.L., Radford, A.N., Simpson, S.D., Nedelec, B., Lecchini, D. & Mills, S.C. (2014) Anthropogenic noise playback impairs embryonic development and increases mortality in a marine invertebrate. *Scientific Reports* 4: 5891.