Modelling the impact of anthropogenic noise on fish

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Abstract

Anthropogenic noise is recognized as a global polluter [1] and there is growing concern about its impact on aquatic organisms [2, 3]. Offshore pile driving (e.g. during wind farm construction) creates high intensity impulsive noise which differs from natural noise sources, although its frequency range overlaps with hearing ranges of many marine organisms. Several predictive models have been developed that predict the propagation of noise in aquatic environments, however models combining underwater noise propogation, hydrodynamics and likely animal behavioural responses have been lacking. HAMMER (Hydro-Acoustical Model for Mitigation of Ecological Response [4]) is a tool that predicts underwater noise propagation while taking hydrodynamics into account and it subsequently predicts behavioural responses of animals using individual based modelling (IBM).

As the quality of any predictive model is largely defined by its parameters, we decided to obtain crucial behavioural data for commercially important North Sea fish species exposed to a realistic noise source. To allow realistic behavioural responses, a field experiment using impact piling was conducted in a former dry-dock (size: 85 x 18 x 3 m). Behavioural and physiological data of Atlantic cod (*Gadus morhua*), plaice (*Pleuronectes platessa*) and black sea bream (*Spondyliosoma cantharus*) were obtained and incorporated into the HAMMER model.

Here, we will discuss the results of the field experiment and the value of the tool for predicting animal behaviour in realistic marine environments.

References

[1] H. Slabbekoorn, N. Bouton, I. van Opzeeland, A. Coers, C. ten Cate, and A. N. Popper, "A noisy spring: the impact of globally rising underwater sound levels on fish," *Trends in Ecology & Evolution* 25: 419–427, 2010.

[2] R. Bruintjes and A. N. Radford, "Context-dependent impacts of anthropogenic noise on individual and social behaviour in a cooperatively breeding fish," *Animal Behaviour* 85: 1343–1349, 2013.

[3] S. D. Simpson, J. Purser, and A. N. Radford, "Anthropogenic noise compromises antipredator behaviour in European eels," *Global Change Biology,* doi:10.1111/gcb.12685, 2014.

[4] K. Rossington, T. Benson, P. Lepper, and D. Jones, "Eco-hydro-acoustic modeling and its use as an EIA tool," *Marine Pollution Bulletin* 75: 235–243, 2013.