Marine Mammal Scientific Support Research Programme MMSS/001/11

MR 8.1 Report

Tests of acoustic signals for aversive sound mitigation with harbour seals

Executive Summary

Some anthropogenic activities that produce intense sound in the marine environment present a risk of causing injury to the body tissues and auditory systems of sensitive marine life. It is an offence to kill or injure a seal under the Marine (Scotland) Act 2010 and in addition both grey and harbour seals are on Annex II of the Habitats Directive and are qualifying features for Special Areas of Conservation set up to promote their conservation. For these reasons, mitigation measures to minimise the risk of causing damage or injury are often a requirement when licences are issued to carry out risky activities in the marine environment. The traditional approach to mitigation is for observers to search for marine mammals (including seals) using visual and acoustic techniques, within a mitigation zone and to delay or halt risky activities if animals are detected. (A mitigation zone should be defined as an area within which animals are at an elevated risk of suffering damage. Joint Nature Conservation Committee (JNCC) guidance suggests that mitigation zones around piling should have a radius of at least 500m.) Such monitoring mitigation is unlikely to be fully effective when animals are difficult to sight at the surface and are rarely vocal, when mitigation ranges are large and when operations are required to continue in poor sighting conditions and at night. Mitigation monitoring can also be very costly to achieve at offshore sites. Aversive sound mitigation is a promising alternative or complimentary approach which would involve moving vulnerable animals out of the mitigation zone before activities such as pile driving commence, using appropriate aversive acoustic signals. In this project data was collected to assess how effectively aversive sound mitigation could be applied to harbour seals by conducting a series of controlled exposure experiments (CEEs).

Three sound sources (a Lofitech ADD, an Airmar ADD and broadcast killer whale calls) were assessed as potential sound sources for aversive sound mitigation. The findings suggest that, of the devices tested, the Lofitech ADD is the most effective at eliciting behavioural responses from harbour seals which should be useful for mitigation.

Our results show that out to a range of around a kilometre, all seals might be expected to show a readily identifiable change in behaviour. However, not all responses resulted in straight forward movement away from the sound source. Response also varied between CEEs in ways which may reflect the particular circumstances of the experiment as well as the motivation and status of the subjects.

Three observations from this work are particularly pertinent to those planning to use aversive sound mitigation. The first is the propensity for seals which are close to shore at the start of a CEE to move very close inshore and then move along shore in very shallow waters. This may well be a general and effective anti-predator response but the extent to which it would protect animals from exposure to intense sound needs further investigation. The second is the observation that animals that were traveling when faced with a CEE ahead of them would rarely reverse their tracks. More commonly they would "swerve" around the sound source, passing closer to it than the range at which avoidance behaviour was first noted and on occasion passing within a few hundred metres of it. Clearly, if this occurred during a mitigation exercise then animals might experience higher sound exposure. Studies should be carried out to investigate how animals respond to multiple sound sources in the field which could inform how they should be spaced to achieve effective mitigation. A final important observation is that animals apparently foraging within an area would often start to return to that area soon after a CEE. An implication of this for aversive sound mitigation is that the potentially damaging activity should start immediately after (or during) the mitigation broadcast.

It will be extremely difficult to measure behavioural response of seals to pile driving because any individual tagged animals would be unlikely to be close to pile driving when it started and it is not feasible to use or replicate pile driving as an experimental sound source. However, the observations made during this study of animals responding to what were clearly aversive signals may provide insights into how seals might react to pile driving. Although seals showed an increase in speed during CEEs this was only modest. This limited response probably reflects energetic constraints on maximum sustainable swim speed which would also limit their escape speed from pile driving. The mean "escape" swim speeds observed during CEEs were lower than those assumed in some exposure models and, in contrast to the assumptions in most models, seals did not always swim directly away from the sound source. These considerations emphasise the desirability of moving animals to a "safe range" using a mitigation sound source whose characteristics can be controlled and measured beforehand using field CEEs.