

12. ENERGY AND UNDERWATER NOISE



Harbour porpoise, River Bann at Coleraine

Key Messages

- Underwater noise is important for marine mammals and fish as a means of communication.
- Little data exists for making a quantitative assessment of underwater noise in Northern Ireland or wider UK waters.
- More information is needed on this area to improve understanding on the impacts of noise on animal behaviour and health.
- An understanding of the introduction of man-made sources of energy including noise will become increasingly important as marine renewable energy sources grow around our shores.

Underwater noise levels are important for many marine animals because mammals, fish and even invertebrates use sound to communicate, navigate, locate mates, search for prey and avoid predators and hazards. There are many sources of underwater noise. Some noise is natural from storms, wave, currents and rolling sub-tidal material. Other noise is man made, for example, shipping movements or pile driving. Noise can be short-term during a construction phase or long-term, like shipping noises in a busy port.

Noise may affect marine organisms in several ways. It can mask biologically relevant signals affecting behaviour; hearing organs can be impaired and at very high levels, noise can injure or even kill marine life⁽¹⁾.

Another form of energy that can be introduced into the marine environment is thermal energy. Many power stations are situated along the coast and use sea water as a coolant. As a result the water used to cool the power station plant is returned to the marine environment at a higher temperature as a thermal plume. This is potentially problematic in 2 respects: Firstly, fish are extremely sensitive to temperature and show strong avoidance to temperatures outside their preferred range. Secondly, as water temperature increases the dissolved oxygen decreases. Oxygen is needed for fish to breathe. A thermal plume in a narrow estuary could therefore cause problems by impeding the passage of migratory fish. However, the relationship between temperature and dissolved oxygen is well understood and controls are placed to limit temperature uplift on discharges to ensure that migratory fish and other fauna are protected.

A UK standard has recently been adopted as part of the implementation of the Water Framework Directive. The links below detail the new standards and their supporting technical documents.

- New standards:
www.wfduk.org/UK_Environmental_Standards/LibraryPublicDocs/UKTAG_Report_Surface_Water_Standards_and_Conditions
- Technical documentation:
www.wfduk.org/UK_Environmental_Standards/stakeholder_reviews/stakeholder_review_1-2007/sr1-2007-swreports/

What do we know about noise levels around the Northern Ireland coast?

Water is a good medium for sound propagation; acoustic waves travel 4 times faster in water than in air and can carry further. There is little information on background noise levels within our territorial waters. We would expect some areas, like the north Antrim coast, to be naturally noisy from strong wave action and currents whilst we might expect port areas, like Belfast, to be impacted by noise from man-made (anthropogenic) sources. In considering whether noise will adversely affect the marine environment, it is man-made noise that needs to be controlled. However, a better understanding between the different sources of noise and animal behaviour is required before appropriate controls can be introduced.

AFBI undertakes acoustic surveys off the north Antrim coast using sensitive listening devices (Figure 12.1). These surveys are the first of their kind in our waters and have detected

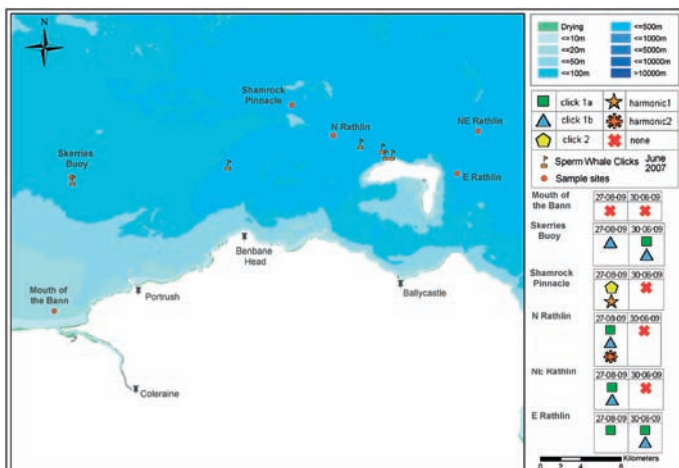


Figure 12.1 Acoustic survey sites and detections off the north Antrim coast.

sperm whales *Physeter macrocephalus*, killer whales *Orcinus orca* and possibly bottlenose whales *Hyperoodon* species. The study showed the potential for future acoustic monitoring in population studies of whales and dolphins, in addition to the assessment of background noise levels (Figure 12.2)⁽¹⁾.

Are there any existing controls over noise levels in the marine environment?

Although there is little knowledge or monitoring of background noise, noise reduction and avoidance have been a condition of many marine licences. Marine construction projects are often prohibited during known sensitive periods of the year in order to protect the passage of migratory fish, such as eels *Anguilla anguilla*, sea-trout *Salmo trutta* and salmon *Salmo salar*. This mitigation approach is reasonably successful where the behaviour of the animals is known. However, for many fish or marine mammals, relatively little is known about movements and behaviour.

Currently there are no controls over the noise of shipping or of marine renewable installations.

For the future?

There is considerable uncertainty about the impacts of the long-term continuous noise that is anticipated in the growth of the marine renewable energy industry. Up until now, even noisy sea areas like ports have quiet periods within the operation. Information on the impacts of continuous noise will increasingly be needed as marine renewable energy installations will operate around the clock. In the recent licensing of a marine current turbine

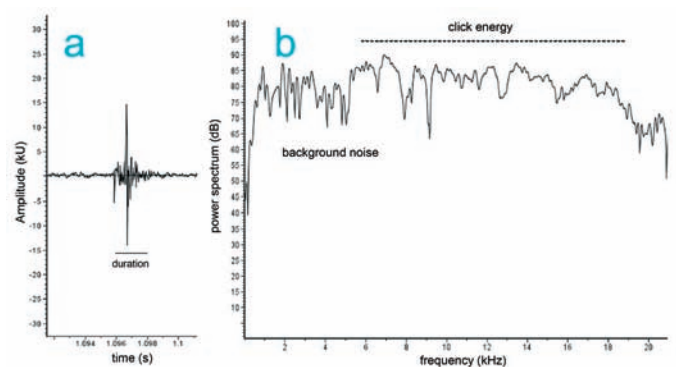


Figure 12.2 Sperm Whale click recorded off the North Antrim coast, illustrating the energy in the click (a) and the background noise (b).

within Strangford Lough, one of the conditions of the licence is to record and interpret sound information. This condition was included to aid our understanding of the potential impact of sound from the turbine on marine species.

The results of this work and observations have shown that the harbour seal *Phoca vitulina* will show avoidance behaviour around the turbine. It is not yet clear if this is due to the noise emitted from the turbine. Further studies are required over time to see whether the avoidance behaviour could result in long-term effects on the seal populations. These studies are filling key gaps in knowledge.

Much more information is needed on background noise levels, the noises of marine activities such as shipping and renewables and also on the impact of man-made noise on marine ecology.



Marine Current Turbine in Strangford Lough

Legislation

Legislative Driver	Comments
Marine Strategy Framework Directive Descriptor 11 Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment	
Other relevant EC Directives (full references and corresponding regulations – Appendix II)	
Habitats Directive	It is an offence to disturb European protected species, like seals and cetaceans
Environmental Impact Assessment Directive	An assessment of the environmental impacts of plans or projects must be made before a consent or licence is granted. These can include underwater sound assessments as appropriate
International Agreements	
OSPAR Convention for the protection of the marine environment of the North East Atlantic	OSPAR includes noise in its definition of pollution and has produced an overview of the impacts of anthropogenic underwater sound in the marine environment (OSPAR, 2009) http://www.ospar.org/documents/dbase/publications/p00441_Noise%20Background%20document.pdf
Local legislation	
Part II Food and Environment Protection Act, 1985	This allows NIEA to regulate deposits in the sea, and can set licence conditions to ensure that environmental noise is limited in marine construction projects. New marine licensing legislation is due to be introduced in April 2011
Water (Northern Ireland) Order, 1999	NIEA sets consent conditions for discharges to the water environment. These can include thermal limits

References

- (1) Southall B.L., R.J. Schusterman & D. Kastak 2000 Masking in three pinnipeds: underwater, low frequency critical ratios. *Journal of the Acoustic Society of America* 108:1322–1326.
- (2) Dunlop R.A. and A. Mellor 2008 Acoustic recordings of sperm whales (*Physeter macrocephalus*) along the North Antrim coast, Northern Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy* 108B (3), 135 – 141.