Marine Management Organisation

Modelled mapping of continuous underwater noise generated by activities

Aim

This project explored quantification and mapping of underwater noise in the South marine plan areas.

The principle output of the project was a Geographic Information System (GIS) tool based on transparent methodology that can produce a dataset of underwater noise level and distribution in the South marine plan areas.

It was essential that the tool should be reusable updatable as new information and applications become apparent.

Introduction and methodology

The South Plan Analytical Report identified underwater noise as a current and evolving issue and recognised that there is insufficient data to support a quantitative assessment of underwater noise levels, which is important for understanding the impact of noise on the natural environment at marine plan or national scale.

This project was guided by a number of initiatives that are investigating underwater noise issues, including Marine Strategy Framework Directive (MSFD)[1] and OSPAR Convention (The Convention for the Protection of the marine Environment of the North-East Atlantic)[2] at a European level and national initiatives such as the Underwater Sound Forum. The research and development work undertaken represents an initial step in addressing the recognised gap in availability of consistent plan scale indicative data on anthropogenic underwater noise distribution and levels to support marine planning.

A data and literature review of academic journals, government, non-government organisations and industry reports identified a wide range of marine noise sources. The review found vessel traffic, fishing, and dredging to be the principle sources of anthropogenic continuous noise relevant to the South marine plan areas.

The review also identified a simple sound transmission model that was appropriate for the delivery of an indicative dataset at the broad scale of the South marine plan areas. The simple model was also suitable for incorporation within the period of the project and could be processed by standard computer systems.

Based on these findings a GIS tool was developed that takes consistent plan scale data, applies noise source levels and spreads the noise into the surrounding environment based on a simple model. The tool uses noise source values[3] identified in the literature review in combination with activity layers of Automatic Identification System shipping category density data, Electronic Monitoring System aggregate dredging data and Vessel Monitoring System fishing data, which are consistent at the plan scale.

The GIS tool was produced in ESRI ArcGIS ModelBuilder™, which is a visual programming environment. This allows the GIS tool to be quickly and easily developed and updated without the need for knowledge of software coding.

[1] http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-11/index_en.htm

[2] http://qsr2010.ospar.org/media/assessments/p00436_JAMP_Assessment_Noise.pdf

[3] a measure of noise at the source of the activity that is creating it

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Results

The GIS tool developed has enabled a range of data layers of continuous underwater noise generated by anthropogenic activities to be produced for the purposes of this study. The principle output is in the form of a grid of annual exposure hours at different sound pressure levels; this can be presented as a spatial map of the South marine plan areas or an annual frequency histogram for one or more 2km x 2km grid cells.

Another output of this project is the literature review which identifies the activity sound values and their respective literature source. This provides an initial resource which can be updated and amended as new information becomes available.

Conclusions and recommendations

It should be noted that this is an initial step in understanding the occurrence of underwater noise at a plan scale; the outputs are indicative and not designed for use at smaller scales, such as the basis for specific environmental impact assessments.

There are a number of limitations and caveats associated with the GIS tool output, these relate to output confidence in different conditions and the nature of the available source activity data.

Several recommendations have been made for the further development of the GIS tool. The recommendations that would most improve confidence in the output data are improving the resolution of the activity categories and reducing their respective sound pressure level range values. For example, the Tanker category covers a wide variety of ship sizes and configurations from General Purpose tankers to Very Large Crude Carrier, with a potential source sound pressure level range of 31dB re 1µPa m, for reference 3dB represents a doubling of sound pressure level[4].

To use the GIS tool at a national level, consideration would have to be made for offshore infrastructure such as wind turbines and hydrocarbon installations or other noise sources which are not currently present in the South marine plan areas but could be accounted for in an updated GIS tool.

MMO comments

This report and associated GIS tool are an initial step in understanding the occurrence of underwater noise at a plan scale. Though the outputs are indicative they allow some interim consideration of underwater noise in marine planning, until a better understanding of the relationship between activities, noise and the environment is available. The MMO will use this tool and its outputs to inform policy development in marine planning.

Further information

Please note that the underwater noise data and GIS tool are available on request to accesstoinformation@marinemanagement.org.uk

Please direct any other correspondence to the Evidence Team by emailing evidence@marinemanagement.org.uk

[4] For explanation of sound pressure level units, see http://resource.npl.co.uk/acoustics/techguides/concepts/spl.html