

MANAGEMENT OF UNDERWATER SOUND DATA IN THE UK

Position paper produced by

Marine Environmental Data and Information Network (MEDIN)

August 2014

1. Background

The marine environment has become increasingly noisy over the last sixty years and the need to understand the effects of manmade sound on marine life is pressing. Underwater sound data are required to answer research questions and drive policy. As progressively more acoustic data are being collected, it is timely to consider the current arrangements for managing sound data and whether data are being securely archived for future use and are easy to find.

Noise data are being collected for diverse reasons from biological monitoring to military surveillance to assessment of the noise energy produced by offshore wind turbines. At this time, sound data collection is also being driven by the requirements of the EU Marine Strategy Framework Directive 2008/56/EC (MSFD). Member States are signed up to deliver good environmental status (GES) by 2020 across 11 descriptors or environmental themes. Good environmental status for Descriptor 11 will be where *'Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.'* To this end, programmes are being established to measure in situ ambient noise and catalogue activities that generate impulsive noise (see section 'Current arrangements').

2. The importance of data management

Data management involves ensuring that data assets are securely stored for the long term to allow for their reuse. It also means making data discoverable which requires the standardisation of terminology and detailed, standardised metadata.

The EU MSFD Technical Sub Group on Underwater Noise and other forms of energy (2012) highlight the importance of sharing data across regional seas. This necessitates that data are comparable which means the standardisation of data collection in terms of sensor use, sensor handling, signal processing and quality assurance. For reuse of data, this sort of information needs to be recorded and kept within a metadata record.

Guidance documents are available such as the [Good Practice Guide for Underwater Noise Measurement](#) which provides best practice for in situ measurement of underwater sound, the processing of data, and reporting of measurements using appropriate metrics. This document also includes a section on data storage. For specific guidance on the information that should be collected alongside data to ensure it can be reused in the future there is the [MEDIN data guideline for the recording of underwater ambient noise data](#).

3. Aims of this paper

The aim of this paper is to provide a summary of who currently holds underwater sound data in the UK, to enable MEDIN on behalf of the USF to establish:

- whether current data management arrangements are fit for purpose (satisfactory and secure)
- whether a high level of national (UK) coordination for sound data management is required, and if so, what MEDIN can contribute

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4. Current arrangements

The following section describes the noise data held and managed by UK organisations. This list is not exhaustive but covers the main data collection activities that have generated ambient noise data sets.

It is worth noting that there are international initiatives that generate underwater noise data currently. Such as the Listening to the Deep Ocean project and the International Quiet Ocean Experiment (IQOE) plus other European initiatives, for example, the European Sea Floor Observatory Network (ESONET) and Marine Environmental Monitoring Network in the North- and Baltic Sea (MARNET). The focus here is data from within the UK EEZ.

Marine Scotland (MS)

The East Coast Marine Mammal Acoustic Study (ECOMMAS) undertaken by Marine Scotland involves the deployment of a 30 mooring array that primarily monitors the presence and absence of dolphins and porpoises through detection of their echolocation clicks. The increasing development of the Scottish East coast has driven the need to make sure that the populations of marine mammals continue to flourish. On 10 of the moorings there are also recorders for logging ambient noise up to 48 kHz (sampling rate of 96 kHz). This array was first deployed in the summer 2013 and will be deployed (summer only) again up to at least 2016. The equipment records 10 minutes on, 10 minutes off. The storage arrangements for these data have yet to be finalised. The data from these loggers are currently being analysed by the National Physical Laboratory with respect to ambient noise for MSFD work.

Sea Mammal Research Unit, University of Aberdeen

The Scottish Acoustic Marine Mammal Observatory (SAMMO) is three PAMbuoys®, located approximately south of St Andrews Bay, Arbroath and Stonehaven. The data are currently archived at St Andrews and the intention is to submit metadata to BODC. The data comprise 1/3 octave noise levels recorded up to 2.3 kHz, duty cycled recordings, long-term spectral averages and outputs from click and whistle detectors. The Marine Scotland array (ECOMMAS) will be integrated with this more recently deployed network.

JNCC Noise Registry

The JNCC Noise Registry is a proposed inventory of marine activity that creates impulsive noise (pile driving and seismic survey work for example) rather than noise data per se. The Noise Registry is an initiative driven by the requirements of MSFD to assess impulsive noise pressures in UK waters. The sources of information will be licensing consents from DECC, MMO, Marine Scotland, Welsh Government and DOENI. These consents will be used to map where work is to be carried out on the UKCS. The proposal is to record “bang days” within a geographical grid system. Additionally an attribute will be captured around the scale of the noise (eg. size of the hammer being used). It is anticipated that maps can be created showing where noise has occurred to facilitate the assessment of whether past noise generating activities have potentially resulted in significant impacts on noise sensitive species resulting in significant negative changes in distribution.

Centre for Environment, Fisheries and Aquaculture Science (Cefas)

Cefas have developed a “Sound Library” which is a MySQL database that stores metadata describing *WAV files. It holds ambient noise measurements mainly derived from the CEFAS/Defra project ‘Monitoring ambient noise in support of the MSFD in UK waters’ (completed January 2014). There are three datasets from this project; two datasets are recordings over a period of a year and the

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other for a period of six weeks. The “Sound Library” is currently in the beta testing phase but will be available online via authentication using username and password. The database will be used to export data to feed into sound propagation models.

British Oceanographic Data Centre (BODC)

The British Oceanographic Data Centre (BODC) holds noise data from the Sea Mammal Research Unit (SMRU), University of St Andrews. There are currently 2.7 Tb of raw *WAV files at BODC with a further 15 Tb expected. These are data from hydrophones mounted on vessels, moorings and gliders and are not available to the user currently as a method of delivering large WAV files needs to be devised. The issue for a data centre like BODC is that the whole data file is of potential interest to a future user and has to be archived whereas to a data collector like SMRU the interest is in cetacean specific sound events within the file.

BODC hold, on behalf of the UKHO, a dataset of averaged ambient noise levels (db) collected using air-deployed RAF sonobuoys for the period 1988-2009.

QinetiQ

There was a deployment of autonomous recording units (ARUs) or “pop-ups” by QinetiQ in 2004 to measure ambient noise off the west coast of Scotland. These data were used in a later report (2006) for the Department of Trade and Industry’s offshore energy Strategic Environmental Assessment programme (Harland and Richards, 2006). The data are presumed to be archived with QinetiQ.

University of Bath/University of Exeter

A postdoctoral research study of broadband ambient noise was conducted near Falmouth Bay to assess temporal variability due to shipping and biological sources. For 20 days in July and August 2010, an Autonomous Multichannel Acoustic Recorder (AMAR; Jasco Applied Sciences Ltd) was deployed in the bay. Data continue to be collected (pers. comm. Nathan Merchant).

Chickerell BioAcoustics

Data are/have been collected from a seabed mounted hydrophone 400 metres off Durlston Head near Swanage and a seabed mounted hydrophone located in the lower Fleet near Weymouth. In both cases these are semi-processed data giving daily spectrograms; there are only limited raw acoustic recordings available for either system. Data collection at the Durlston Head site has now ceased but the Weymouth site is operational and will start recording raw acoustic data on a sampled basis soon. The primary purpose of data collection is to monitor biological activity rather than ambient noise and as such none of the data are fully calibrated.

The Crown Estate

Ambient noise data have been collected over the last decade when monitoring has been undertaken to assess the impact of offshore renewable energy projects. Access to these data, which are archived by The Crown Estate, can be found online at the Marine Data Exchange

<http://www.marinedataexchange.co.uk/>.

5. Summary and recommendations:

Summary of current data management practices

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- The number of activities initiated to collect underwater noise data has increased markedly since 2000 as a result of marine mammal research, assessment of the noise from offshore renewable work and in response to the EU MSFD.
- Compared to other fields of marine science there are relatively fewer ambient noise data sets
- The management of underwater noise data is not well developed because of the emerging nature of the field. This is an appropriate time to start getting good practice in place for data collection and data management.
- Cefas, The Crown Estate and BODC have provision for archival of noise data.
- Noise data files can be in the order of gigabytes and terabytes in size and therefore have a significant computing overhead.

Recommendations to the USF

- Ensure funders of projects/data collection make adequate provision for data stewardship within the projects budget.
- Promote the use of MEDIN Guidelines to data collectors to allow comparability and reuse of datasets.
- Ensure all noise data sets are discoverable within the MEDIN metadata discovery portal. There is merit in holding metadata on all datasets whether available for use by a third party or not (conditions of use information are held within the metadata). Currently there are fifty nine records providing information on existing underwater noise datasets.
- National coordination of noise data archival through the creation of a Noise Data Archive Centre (Noise DAC) would not be advisable at present. The storing, managing and delivery of gigabytes of noise data has not progressed to the stage of routine archival and online delivery. The aim at this stage would be to provide long term storage for data and ensure that all datasets have well formed metadata records in the MEDIN portal.
- Data collectors, without access to appropriate archiving facilities, should be encouraged to discuss potential archival of their data sets with BODC, a national facility for preserving and distributing marine data. Data acquired by BODC would be securely archived and curated in line with BODC's normal long-term stewardship practice. As demand for an online delivery system for noise data matures, BODC will engage users in the design and implementation of an archival and online delivery system.

6. References

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Date approved and published to the MEDIN website: 24 August 2011.

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