Seismic Survey Sound, Offshore Ireland

F.Stapleton[1] fiona.stapleton@rpsgroup.com, E. McKeown[1], S. Crawford[2], M. Fabeta[2], G. Lee[3], C. Brown[2], P. Ward[4], G. Nolan[5], and M.White[2]

[1]RPS, [2]Earth and Ocean Sciences, School of Natural Sciences, Ryan Institute, NUI, Galway. [3]School of Environmental Sciences, University of East Anglia, UK, [4]Kongsberg Maritime Ltd., Southampton, UK, [5]Marine Institute, Galway, Ireland

Introduction

RPS Group, in association with the National University of Ireland and the Irish Marine Institute, are working on a Petroleum Infrastructure Project funded project, which aims to: validate an underwater noise model by using site specific measurements and acoustic noise observations from offshore seismic surveys. The project also involves collaboration with Curtin University in Australia.

Objectives:

A) Collect concurrent acoustic noise and hydrographic data in offshore/shelf seas during a seismic survey

B) Develop and validate a 2D acoustic noise propagation model for Irish waters

C) Assess the role of the seabed and water column characteristics, and their influence on noise levels in Irish waters

Motivation

- The Marine Strategy Framework Directive requires anthropogenic underwater noise to be quantified and reported by Member States
- There is no current Irish noise model for seismic surveys on the shelf edge
- This model will input into future management strategies for offshore seismic operations - such as quantifying exclusion zones - and for integration with other research and databases.

Acoustic Data Acquisition

RPS Group were responsible for acquiring the acoustic data for the project. A survey was carried out in July 2014 to monitor a 3D seismic survey that was being carried out by Polarcus Amani in the SW Porcupine Sea Bight (***Fig. 1***).

The aim was to obtain seismic noise data at varying distances and depths from an acoustic source to validate the noise propagation model, as well as acquiring a seismic noise data set for Irish waters.

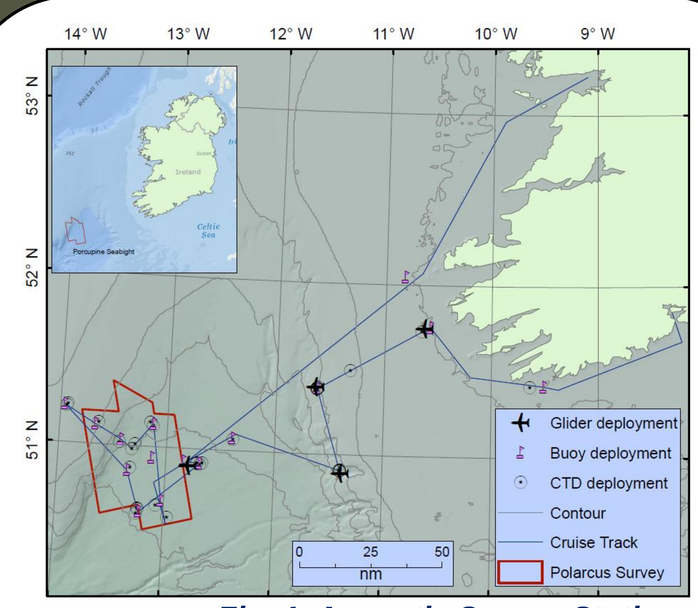


Fig. 1. Acoustic Survey Stations

Methods

Buoy

Noise observations were made using a buoy (***Fig. 2***) at distances ranging from 2.5 nm, up to the shelf edge 80 nm distance, and beyond into shelf waters - such that the influence of varying bathymetry and seabed type on noise attenuation could be quantified. The acoustic recording buoy was equipped with 3 autonomous recorders which were fitted hydrophones with flat frequency response from 2Hz to 30 kHz and sensitivities of -165 dB re 1V/μPa and -240 dB re 1V/μPa. The recorders were attached to the buoy to hang at depths of 15m, 50m and 150m. After each recovery the data was downloaded and checked.

Fig. 2. Buoy Deployment

Fig. 3. Sea Glider Deployment

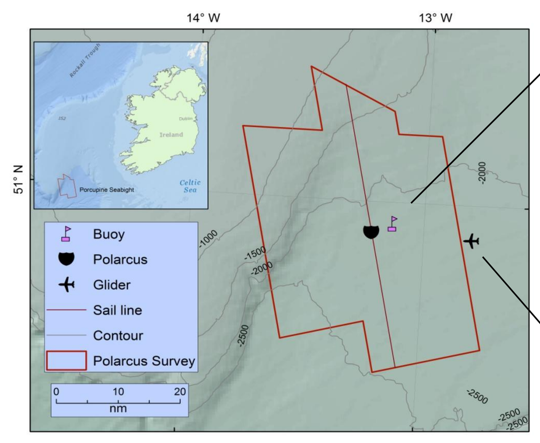
Glider

As a test of potential future acoustic monitoring techniques, the project also included the use of a Sea Glider. This autonomous underwater vehicle is equipped with a passive acoustic monitor and CTD instrument in order to acquire concurrent water column structure and noise levels in the upper 1000 m. The glider was launched and retrieved from the RV Celtic Voyager (***Fig. 3***).

Results

Early analysis has shown that a distinct air gun pulse can be recognised up to 30 nm from the source.

Spatially differing concurrent data from the Glider and the Buoy (***Fig. 4***) show that both devices recorded the shots and produced high quality data.



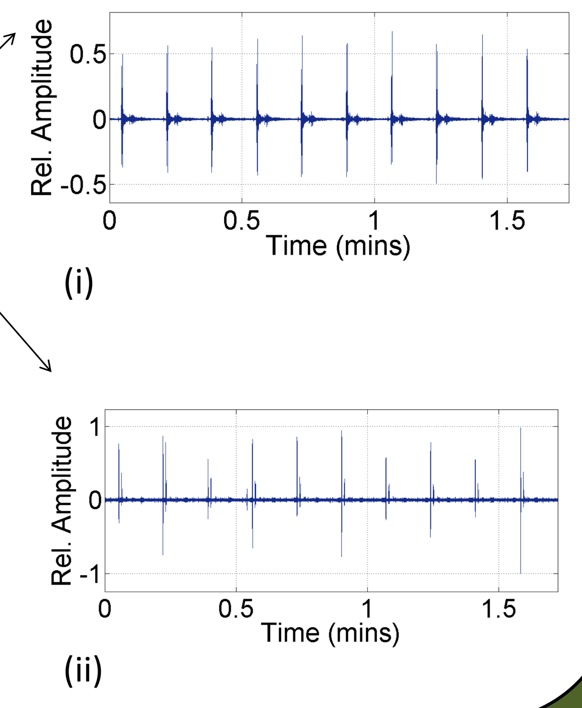
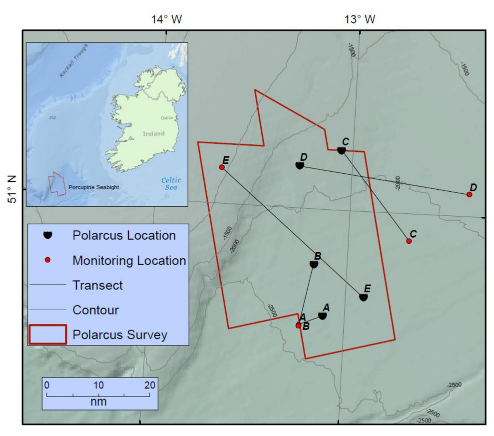


Fig. 4. Map showing the Polarcus, Buoy and Glider positions at time of data acquisition for raw data plots (i) Buoy, 3.7 nm from source and (ii) Glider, 16 nm from source, at 600 m water depth.

The results of monitoring locations at increasing distances from the seismic source suggest that deep water noise attenuation, close to the survey area, essentially follows a predictable logarithmic decay (***Fig. 5***); but attenuation appears to be amplified above a standard logarithmic relation for shallower depths (<1000 m).



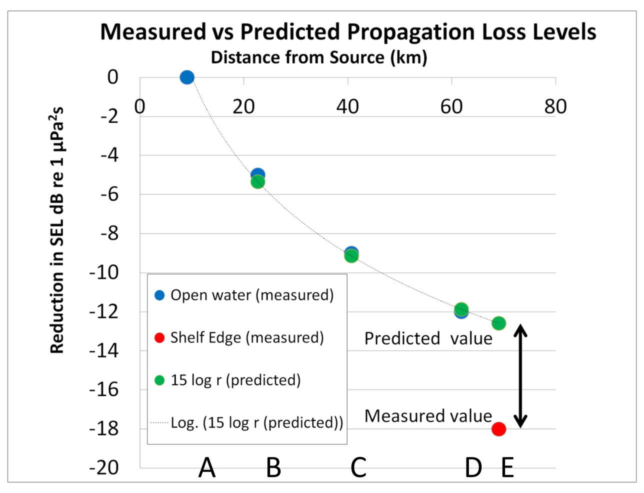


Fig. 5. Graph of measured versus predicted propagation loss levels for monitoring locations A – E shown on map. A-D are deeper (in basin) whereas E is shallower (on the shelf).

Conclusions

Both methods for acoustic data acquisition provided high quality data.

The flexibility of the glider in obtaining data at various and greater depths demonstrated it is a useful tool for underwater noise measurement.

This project has demonstrated that the measured propagation loss on a shelf slope is significantly greater than that predicted by simple propagation formula.

Ultimately, the project aims to support evidence for science based decisions for operational exclusion zones, management of sensitive areas such as SACs, and provide a database of offshore noise levels to integrate with other research.

Being able to accurately model propagation loss ensures that appropriate cost effective mitigation measures can be put in place where required.

Future Work

Acoustic data is being used to prepare, calibrate and validate a model of noise levels in Irish waters resulting from offshore seismic operations, in conjunction with the Centre of Marine Science and Technology (CMST) Curtin University Australia.

More detailed analysis and use of the acoustic model will be required to identify and quantify the attenuation processes.

Acknowledgements

"This project is jointly funded by the Irish Shelf Petroleum Studies Group (ISPSG) of the Petroleum Infrastructure Programme and Nalcor Energy (on behalf of the Offshore Geoscience Data Program with the Government of Newfoundland and Labrador). The ISPSG comprises: Atlantic Petroleum, Cairn Energy Plc, Chrysaor E&P Ireland Ltd, Chevron North Sea Limited, ENI Ireland BV, Europa Oil & Gas Plc, ExxonMobil E&P Ireland (Offshore) Ltd, Husky Energy, Kosmos Energy LLC, Maersk Oil North Sea UK Ltd, Petroleum Affairs Division of the Department of Communications, Energy and Natural Resources, Providence Resources plc, Repsol Exploración SA, San Leon Energy Plc, Serica Energy Plc, Shell E&P Ireland Ltd, Sosina Exploration Ltd and Woodside Energy (Ireland) Pty Ltd".

RPS | PIP Petroleum Infrastructure Programme | NUI Galway OÉ Gaillimh | UEA University of East Anglia | Ryan Institute