

**MARINE SCIENCE CO-ORDINATION COMMITTEE (MSCC)**  
**Minutes of the Underwater Sound Forum meeting held at Scottish Government**  
**on Wednesday 20 November 2019**

**Chair:**

Peter Liss UEA

**Secretariat:**

Anne Brazier MSCC

**Attendees:**

Rachel Antill	APEM
Edward Bolger	Napier University
Harriet Bolt	UKHO
Alison Brand	Manta
Andrew Brownlow	SMASS
Sarah Canning	JNCC
Caroline Carter	Natural Scotland
Ross Compton	IAGC
Julie Cook	BEIS
Sarah Dolman	WDT
Karen Diele	Napier University
Ewan Edwards	Scottish Government
Gaynor Evans	BODC
Rebecca Faulkner	Cefas
Phil Gibbs	Swale Technologies
Jonathan Gordon	University of St Andrews
Nicky Harris	Seiche
Vincent Janik	Scottish Oceans Institute
Guillermo Jimenez	Seiche
Sarah Jones	Defra
Jennifer Learmonth	Royal Haskoning DHV
Andrew Logie	Innogy
Natalie Lopez	Orsted
Fraser Malcolm	GoBe
Michael Masters	Xodus Group
Yvonne Mather	Dstl
Tessa McGarry	RPS Group
Marc McKay	BEIS
Nathan Merchant	Cefas
Hannah Millar	Scottish Government
Emma Milner	Gardline
Ceri Morris	Natural Welsh Resources
Ryan Mowat	RS Aqua
Louise Msika	Marine Scotland
David Reeves	Defra
Denise Risch	SAMS
Stephen Robinson	NPL

Steve Simpson	University of Exeter
Rachael Sinclair	SMRU Consulting
Helene Soubies	Xodus Group
Gemma Starmore	RHDHV
Craig Stenton	Napier University
Elaine Tait	Scottish Government
Coretin Troussard	Swale Technologies
Nienke van Geel	SAMS
Ursula Verfuss	SMRU Consulting
Matthew Wale	Edinburgh Napier
Rebecca Walker	Natural England
Kirsty Wright	Scottish Government

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## 1. Welcome

- 1.1. The Chair welcomed attendees to the meeting and commented on both the number of attendees and the fact that Forum meetings consistently attract 50 plus attendees from a number of different disciplines.
- 1.2. Elaine Tait welcomed attendees on behalf of Scottish Government and thanks were extended to Lily Burke and Jayne Burns of Scottish Government for their help in organising the meeting.

## 2. Minutes of last meeting and matters arising

- 2.1. The minutes of the last meeting, held on 21 May 2019, were agreed to be a true and accurate record with no amendment required.

## 3. Themed presentations

**(for more detailed information please contact the presenter direct)**

### **Scottish Government work on underwater noise and bioacoustics**

*Ewan Edwards, Scottish Government*

Ewan provided attendees with an overview of Marine Scotland. A Directorate of Scottish Government, Marine Scotland has approximately 700 staff based in three main offices, in local fishery offices and on vessels. Scotland has a large and busy Exclusive Economic Zone. As well as oil and gas there is an active fishing industry, busy ferry routes to its islands and a burgeoning offshore renewables programme. The growth in offshore renewables may lead to potential impacts to areas within the range of bottlenose dolphins and harbour porpoise and it is part of Marine Scotland's remit to assess the risk to these mammals and to act accordingly.

As of 2012-13, there was little understanding of the anthropological disturbance of marine mammals. There was some information on the mammal populations of the Moray Firth and the Forth of Tay but little beyond that and at this stage it was assumed their environment was pristine. In order to rectify this the East Coast Marine Mammal Acoustic Study ECOMMAS was commenced in 2013 using click detectors and broadband recorders. In 2013 – 14, 3 – 4 months of data was collected which increased to 8 – 9 months since 2015. In addition, Marine Scotland has worked with Cefas, who have provided detail from the southern North Sea, with JOMOPANS and with SAMS and AFBI off the west coast. Combined this has led to the publication of papers etc. which can provide detail on both the presence of marine mammals and the underwater noise levels off the Scottish coast. It is hoped to extend knowledge as offshore renewables move into deeper water.

Attendees asked where humpback and fin whale had been recorded. These had been recorded off Stanton Banks and Tolsta Head. Should any attendee know of sound recorded elsewhere please contact Ewan.

### **Long-term MSFD ambient noise monitoring off eastern Scotland and influence of tidal flow noise at coastal sites**

*Nienke van Geel, Scottish Association for Marine Science (SAMS)*

Nienke described the underwater soundscape – an interplay of natural and anthropogenic sound and how there are increasing concerns over underwater noise pollution. Whilst the Marine Strategy Framework Directive (MSFD) does have a descriptor to cover ambient noise (11.2.1), threshold levels have yet to be set. Nienke described an investigation into tidal influence on MSFD reporting which aimed to identify average RMS levels and any exceedance of hypothetical Good Environmental Status (GES) thresholds in order to understand the movement of bottle nose dolphins.

Acoustic broadband recorders had been set up at ten coastal sites on the east coast of Scotland which collected data between 2013 and 2017. The amount of data collected did vary between year and site. Annual results showed higher noise levels at Cruden Bay and lower RMS levels at Stonehaven and/or Fraserburgh (& Cromarty). Per month, winter levels appear lower but data is limited. Results show that tidal correction is required on sites influenced by tide and should be taken into account for MSFD ambient noise monitoring.

Attendees queried noise recorded around the equipment which is caused by the equipment being there. Remove the recording equipment and the noise will vanish. Also, attendees had reservations about where the recording equipment was placed. Budget constraints had an impact on placements so any results would need to take this into account. Attendees asked whether there were any plans to tease out different noises but were advised there are no current plans to do so.

### **Managing the effects of noise from ship traffic, seismic surveying and construction on marine mammals in Antarctica**

*Vincent Janik, Scottish Oceans Institute*

A workshop held in Germany, and subsequent paper<sup>1</sup> gave an overview of the ongoing efforts to assess the impact of noise on marine mammals in the Antarctic. The Protocol on Environmental Protection of the Antarctic Treaty stipulates that the protection of the Antarctic environment and associated ecosystems has to be considered in the planning and conducting of all activities in the Antarctic Treaty area. The Protocol and Guidelines for Environmental Impact Assessment in Antarctica outline the Environmental Impact Assessment process for activities in the Antarctic. However, not all EIAs have a sound component. Underwater noise in the Antarctic has increased as the number of tourist ships, the amount of days and the number of passengers carried increases. Added to this should be the sound produced by fishing vessels, research vessels and research station support such as construction and service vessels (including aircraft).

Little is known on the mammals within Antarctic waters; for example, baleen whales use Antarctic waters to forage whilst other species are specifically Antarctic. Added

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<sup>1</sup> Doi:10.3389/fmars.2019.00647

to this issue is that different countries with territory in Antarctica have their own criteria for EIAs and some countries do not consider noise a pollutant. Emerging priorities for research include:

- Abundance and distribution data
- Hearing thresholds
- Effectiveness of noise mitigation
- Development of new noise sources
- Noise exposure studies
- The effects of noise on other animals such as krill
- Data sharing
- Management.

Workshops are planned on the effects of underwater noise on mysticetes, odontocetes, pinnipeds and mitigation measures which will be followed by a conference on Antarctic Noise which will hopefully provide clear guidelines on Antarctic Noise. Attendees then discussed the UK process for EIAs which is not clear. A complication is that the UK's territory overlaps that of Chile and Argentina. Many ships enter Antarctic waters on an Argentinian permit which has led, to what other countries would consider as, an excess of permissions granted. Attendees asked if it was felt that some countries were hanging back in putting in thresholds, waiting for other countries to act first and it is felt this is the case.

### **Outcomes of noise abatement workshop held on 12 November 2019 at The Royal Society**

*Nathan Merchant, Cefas*

Nathan provided a verbal report of this workshop, the idea for which came out of a previous Underwater Sound Forum meeting. The workshop's aims were to:

- Review the state of the art in noise abatement for pile driving and UXO detonation
- Gather stakeholder perspectives on the implementation of noise abatement in UK waters
- Clarify the role of noise abatement in delivering UK policy objectives and regulatory requirements.

Noise abatement is the reduction of noise emitted into the marine environment at source. It is not mitigation such as spatial/temporal restrictions, for example the avoidance of noise at spawning time. There are certain issues with noise mitigation. Spatial/temporal restrictions are decided on extant and perhaps incomplete information and using methods such as spotting mammals can be impossible in inclement weather and are also open to observer bias.

The workshop concluded that, where possible, all sources of noise pollution should be abated at source where possible and necessary. Germany, Denmark, the Netherlands and Belgium all apply noise abatement thresholds and there is no technical reason why UK waters should not have noise abatement thresholds applied. There are various abatement technologies that could be used such as bubble curtains, alternative piling technologies and for UXO, deflagration (although information on the successful use of this technology on historic UXO is still

outstanding). The workshop further concluded that there is no need to change policy or regulation within the UK; conditions within licenses can be used. A report of the workshop will be written and disseminated, as will presentations (with presenter consent).

### **Accepting limitations and embracing benefits: why we need both laboratory and field-based studies in aquatic sound research**

*Craig Stenton and Edward Bolger, Edinburgh Napier University*

Craig and Edward are student in the Aquatic Noise Research Unit at Edinburgh Napier University and have an interest in underwater noise and vibration, especially its effects on marine invertebrates. Craig and Edward opened up a discussion with the Forum on laboratory versus field research. Recordings of actual and replicated pile driving were played and it was obvious to all that the replicated sounds were not realistic so should lab experiments be accepted as being better than nothing? In laboratory-based experiments big is better when it comes to tank size, especially for low frequency sounds, but there is a dead zone on either side of the speakers in tank, thus causing a sound cone. In smaller tanks, you do again get a sound cone but you can better observe the effects on different organisms.

Laboratories however do offer different opportunities. They are beneficial for methodologically challenging biological assays and/or performance biomarkers, long-term monitoring of growth and development of early life stages and additional and/or multiple stressor studies. In conclusion, laboratory-based studies in collaboration with field studies is a good way forward and lessons learnt in the lab can be applied to the field. Attendees asked how vibration was simulated in the lab. This was through the use of a shaker table, although it is very hard to get vibrational recordings to play through shaker tables.

### **Sound level analysis for an offshore oil and gas drilling activity**

*Guillermo Jimenez, Seiche*

This presentation focussed on a sound field mapping survey which took place in 2017 during the normal operation of a 6<sup>th</sup> generation Mobile Offshore Drilling Unit (MODU) in deep water. Five drift buoys and one unmanned surface vehicle (AutoNaut) were used for data collection, with the objective being to collect a complete dataset, with emphasis in the source proximity, and which could be used to update historical, limited empirical data and to contribute to future modelling capabilities. This ambition to collect a dense data set had challenges such as simultaneous operations taking place which created sound and a 500m safety exclusion zone around the MODU.

Four drift buoys recorded 41 hours of data at 1 – 5 m, and the USV recorded 75 hours of data 0.1 – 5.5 km, from the MODU most of which was within 500 metres. This resulted in dense mapping between 100 m and 5.5 km, all azimuths covered, and 117 hours of usable audio and navigation data, 15.5 hours of which was with drilling. The conclusions are:

#### **High confidence that processed sounds are associated with MODU**

- Seismic pulses and vessel close passes excluded from analysis

- Chirps, pings and self-noise removed by downsampling
- Minimal contribution of ambient noise and seismic reverberation

#### **Acoustic variability**

- Complex dependence of sound levels with time, range, azimuth
- Causes: propagation path, thruster depth and load, receiver depth

#### **Characteristics of measured sound**

- Predominantly low-frequency (99% energy < 100 Hz)
- Tonal components close to the MODU attenuate with range

#### **Source Level Spectrum of MODU**

- Measured sound levels lower than simulations in near field
- Source level only applicable for far-field propagation modelling.

An article focussing on the acoustic analysis will be published soon and, if possible, will be circulated to the Forum.

#### **Acoustic detections of minke whales in Scottish waters**

*Denise Risch, SAMS*

Denise provided the Forum with the initial findings from two large-scale monitoring programmes, the East Coast Marine Mammal Acoustic Study (ECOMMAS) and the West Coast Marine Mammal Acoustic Study (COMPASS), which aimed to find out whether minke whales could be acoustically detected in Scottish waters and how a minke whale detector, trained on data from the western North Atlantic performs in a Scottish context and whether observed spatial, seasonal and diel patterns compared to visual data. Minke whales are present in Scottish waters from April to October. Whilst visual sightings peak in summer (July – August) winter distribution data is mostly missing which can only be rectified by improved monitoring tools. In the summer of 2019 a consultation took place on two proposed MPAs in Scottish water with minke whales as a protected feature. Acoustically, minke whales produce low frequency pulse trains with most previous recordings being taken from the western North Atlantic and the Mid Atlantic Ridge. There was only one record from Scotland, taken off the Isle of Mull.

The methods used for pulse train detection and classification were spectrogram conditioning, image processing, the application of energy projection function and application of rules for pulse train detection and feature extraction and rule-based classification. Minke whales were acoustically detected with seasonal acoustic patterns matching visual data on the east coast although the west coast seems to be more complex. Findings prove that current detectors do need improvement to account for local noise conditions (seismic, shipping, piling etc.). Attendees asked whether results were biased by weather, for example in winter, but this has not yet been looked at. Attendees also asked about the travelling distance of vocalisations. This is uncertain in UK waters but in the Boston area vocalisations travelled up to 15 km.

#### 4. Updates

##### **Update on characterisation of acoustic fields generated by UXO removal**

*Stephen Robinson, NPL*

This was an update to the presentation provided by Paul Lepper at the May 2019 Forum meeting. Funded by BEIS through its Offshore Energy Strategic Environmental Assessment Programme this project aimed to provide a guidance protocol for those undertaking the detonation of UXO in the ocean. The project had recently completed a series of controlled field trials to compare high order and low order (deflagration) at Limehillock Quarry, Aberdeenshire. The trial compared 'like for like' with detonations taking place at 7m depth. Charge sizes ranged from 15g to 18,700g and both low order and high order detonations were used with 5kg and 10kg shells.

Deflagration uses a small charge that penetrates the shell by vaporizing a magnesium cone that injects a plasma which initiates the deflagration burning. Attendees were shown the high order detonation of a 5kg shell which was then compared with a low order detonation of a 5kg shell. The trial found that: low order deflagration gives a much lower amplitude of peak sound pressure than high order; deflagration peak sound pressure appears to be due only to the size of the shaped donor charge; logistics of applying deflagration are similar to high order. It is hoped that further updates will be given at future Forum meetings.

##### **Standards update**

*Stephen Robinson, NPL*

Many members of the Forum are involved with the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC). Current working groups of the ISO of interest to Members are: working group 1 on ship noise measurement, working group 2 on definitions and terminology, working group 3 on marine pile driving and working group 4 on active sonar calibration using standard targets. Members may wish to note that ISO standard 17208-3 Ship Noise – requirements for shallow noise measurement is in progress with a likely publication date of 2021.

In regard to the IEC, Members may wish to note that IEC 60565: Calibration of hydrophones Part 2 Low frequency calibrations was published in September 2019 and IEC 60565 Part 1 Free-field calibrations is due to be published in December 2019. Anyone wishing to get involved to please contact Stephen Robinson ([Stephen.robinson@npl.co.uk](mailto:Stephen.robinson@npl.co.uk)).

##### **Verbal update on Forum's strategic implementation plan**

*Anne Brazier, MSCC*

As a 'Partnership Initiative' of the Marine Science Co-ordination Committee (MSCC) the Forum is obligated to produce a strategic implementation plan to help fulfil certain of the MSCC's nine high-level science and evidence priorities. The Forum is required to work towards helping to fulfil:

*Priority Two: Better understand the structure, function, resilience and variability of marine ecosystems*

*Priority seven: Better understand cumulative and in-combination impacts on the capacity of marine systems to supply food, energy and mineral resources as well as mitigate against the risks and effects of natural hazards.*

The Forum submitted its Strategic Implementation Plan to the MSCC for discussion at the September 2019 Forum and will have an obligation to submit an update showing progress made in time for the March 2020 Plenary meeting.

## **5. Any other business**

- 5.1. The UK Acoustics Network (UKAN) has a special interest group on underwater acoustics. UKAN does fund special interest workshops so if anyone has any ideas for a pertinent workshop to advise Stephen Robinson.
- 5.2. The ICUA2020 International Conference on Underwater Acoustics will take place 6 – 10 July 2020 at the Leonardo Royal Grand Harbour Hotel Southampton. Paper and poster abstracts should be submitted by 31 January 2020. Please see [www.icua2020.org](http://www.icua2020.org)
- 5.3. Anne Brazier gave a verbal goodbye to the Forum. Having been involved with the Forum since 2006, and citing it as one of the most interesting experiences of her career, Anne was reluctant to go but ill health had forced an early retirement.

## **6. Date and venue of next meeting**

- 6.1. The next Forum meeting will be held at the UK Hydrographic Office (UKHO) Taunton on Wednesday 6 May 2020. As the UKHO is part of the MoD there will be strict rules on entry and Members will be required to show picture identification on arrival. Thanks were given to the UKHO for this kind offer to host. The UKHO are keen that a poster presentation will be part of the day so do please consider submitting a poster.
- 6.2. The Chair thanked attendees for their input to meeting, Anne Brazier for her contribution to the Forum and to Marine Scotland.