Memo

Subject: Jomopans/IQOE workshop summary- Monitoring continuous underwater sound – beyond acquisition
Date: Friday 24 April 2020
From: Mathias Andersson (FOI) and Niels Kinneging (RWS)
To: Participants of the Jomopans/IQOE workshop

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1. Background

Acoustic measurements at sea require a lot of resources but many organisations are required to to invest in acquiring high quality acoustical data. The Joint Monitoring Programme for Ambient Noise North Sea (Jomopans) is utilising data collected at realizes 14 measurement stations for continuous sound. These data should be made available to managers, policy makers, scientists, and the public. This goal is aligned with that of the IQOE Working Group on Data Management and Access that wants to make acoustic datasets available for re-use. To do this, standards on data formats, technical solutions for storage and disclosure and presentation tools are needed. In addition, other barriers should be lowered such as end user involvement, legal obstacles and willingness to share data.

To discuss the requirements for data management and ways to find practical solutions, the Jomopans project organised a workshop on the topic **Monitoring continuous underwater sound – beyond acquisition** in co-operation with IQOE. The workshop's **objective** was to discuss the requirements for data management, trying to find ways to make the monitoring data available to scientists, policy makers and the public in order to find solutions for best possible harmonisation.

In conjunction with this workshop, another workshop was organised by IQOE named "Guidelines for observation of ocean sound" that focused on standardisation of measuring, processing and reporting sound data. The summary record of this workshop can be found here.

The workshop took place on 13 July 2019 at the Park Hotel in The Hague, The Netherlands, and this memo summarises the participating projects and main outcome of the discussion and finally the joint declaration the participants agreed to.

2. Presentations

During the workshop, nine large scale and long term monitoring projects and programs were presented from three continents (North America, Europe and Australia), that were conducted in the time period from 2008 to 2019/2020. Each invited speaker was asked to present their project or program in the light of the below questions:

1. What is the aim of the monitoring?
2. Who are the end users?
3. What practical standards are used?
4. How is data disseminated?

Projects and presenters:

- Joint Monitoring Programme for Ambient Noise North Sea (Jomopans) - Niels Kinneging,
- IQOE WG on Data Management and Access - Robert McCauley,
- Australian Integrated Marine Observing System (IMOS) - Robert McCauley,
- Enhancing Cetacean Habitat and Observation (ECHO) Program - Roberto Racca,
- NOAA Sound Monitoring - Carrie Wall Bell, attended by video,
- The Atlantic Deepwater Ecosystem Observatory Network (ADEON) - Bruce Martin,
- Acoustic Monitoring of Canada's East Coast (ESRF) - Bruce Martin,

- Soundscape Interreg V-A - Nikolina Rako-Gospic,
- Joint Framework for Ocean Noise in the Atlantic Seas (JONAS) - Gerry Sutton,
- Baltic Sea Information on the Acoustic Soundscape (BIAS) - Mathias Andersson.

3. Outcome

The following section gives a summary of the results from the presentations and discussions when describing the responses of each project to the four questions.

1. **What was the aim of the monitoring?**

   Two of the programs were larger monitoring programs than just recording underwater sound (IMOS, ADEON). The others had as a main objective to record underwater sound. Seven programs aim to build up a monitoring program while two utilise existing programs and infrastructure. All programs aim to gather data in order to understand the regional spatial and temporal distribution of sound and to gain an understanding of the pressure from continuous noise on the marine ecosystem, or on one case, on a certain species (the ECHO program studies the effect on killer whales). All projects in Europe aim to gather data that could be used in the reporting for the Marine Strategy Framework Directive (MSFD). Finally, two of the projects have as one of their goals the study of effective measures to reduce the pressure of underwater noise on the marine ecosystem. This shows that most projects are driven by the need from managers to obtain data for regional or local reporting and to have an overall understanding of the soundscape, not of the respective contribution of natural and anthropogenic sound sources to the soundscape.

2. **Who are the end users?**

   The obvious end user of the results from the monitoring programs are, in all projects, managers dealing with marine issues. Marine spatial planners are also mentioned, as well as industry. All projects mention scientists or academia, and biologists are specifically mentioned once. Only two programs have the navy as a stated end-user, and both are in the USA. The public is mentioned by some of the projects as well. This shows that most projects are driven initially by the need of data from managers, and secondly by scientists.

3. **What practical standards are used?**

   Due to the lack of any ISO or ANSI standard on how to measure, analyse and report ambient sound, all projects have come up with their own national or regional standards in order to make data comparable. This is especially true when more than one organisation is involved. One project mentions the ANSI standard for ship signature measurements. BIAS was one of the first large monitoring programs, and the project drafted the first regional ambient noise measurement standard. BIAS also did a so-called ring test, where sample data and an analysis script was given to all participating nations and a comparative analysis of each nation's results was carried out. The results showed that not all partner organisations came to the same results, which highlights the need for a standard. However, after some iteration, all got the same results. Jomopans did a similar test with similar results.

   The importance of calibration was raised by several projects and not only the hydrophones, which are in almost all cases calibrated by the manufacturer, but the whole instrument or monitoring station, including the cable and data acquisition system. A common view of the workshop was that an ISO/ANSI standard for ambient noise measurements is needed and the standards defined by these projects could be used by a future drafting group as a starting point.

   How is data disseminated?

   Sharing data from monitoring programs is a central issue and all projects have various levels of data dissemination. It goes from sharing raw or data processed in some time resolution, to sharing only results in terms of reports. Some projects have a publicly available data portal where some data can be downloaded, or a restricted portal until the end of the project thereafter the portal is public. There are projects with different levels of access to data. However, most countries have restrictions on how acoustic data can be shared due to national security reasons. One example from BIAS was that the lowest resolution of shared data was 20-second averages. Several projects have an agreed lowest resolution level.

   Regarding frequencies reported there are differences between projects due to the research questions asked. All projects record frequency bands from about 10 Hz up to a certain band but some only report a few of them. This especially applies to Europe, where one of the aims is to gather data to report for the MSFD which requires that the sound level at the 1/3 octave bands with centre frequency 63 and 125 Hz are reported.

The need from the scientific community to utilise data from these monitoring programs is high. However, as mentioned, most have restrictions in what data can be shared outside projects and that the upkeep of project data repositories ceases after the project ends. It would be beneficial if some organisation(s) have the responsibility to store data. In Europe, the International Council for the Exploration of the Sea (ICES) has been proposed as a data host for some of the monitoring programs. Other examples exist as well from other parts of the world.

It should be encouraged to share as much as possible since most projects do not have time to analyse the data in more ways than the aim of the projects allows for. The data can be used in numerous ways, to study various aspect of the soundscape such as presence of biological sounds, source level characteristics and much more.

4. Joint declaration

The participants of the workshop agreed on a **joint declaration** as an output from the workshop:

The participants of the workshop "*Monitoring continuous underwater sound: beyond acquisition" state that the sharing of knowledge and data in the field of underwater acoustics is essential to progress in the scientific field as well as on the management of underwater sound.*

International co-operation needs to be established and supported in order to realize a facility for sharing and disseminating acoustical data from monitoring programmes".

5. Attendance list

Name	**Family name**	**Project/Organisation**
Mathias	Andersson	Jomopans/BIAS/FOI
Fritjof	Basan	Jomopans/BSH
Joost	Brinkkemper	Waterproof
Niels	Kinneging	Jomopans/RWS
Bruce	Martin	ADEON/Jasco
Hrvoje	Mihanovic	Institute of oceanography
Mirko	Mustonen	BIAS/TalTech
Nikolina	Rako – Gospić	Soundscape Interreg V-A
Ana	Širovic	Texas A&M Galveston
Gerry	Sutton	Jonas
Predrag	Vukadin	Soundscape Interreg V-A
Rob	McCauley	IQOE
Carrie	Wall Bell	NOAA
Mike	Vanderschaar	UPC