



Soundscaping the North Sea

Toward an
implementation
plan for ambient
noise monitoring

Interreg
North Sea Region
Jomopans

European Regional Development Fund



EUROPEAN UNION

A Policy Brief from the
Interreg North Sea Region
Jomopans project

October 2019

Contents

Abstract

The challenge

The Jomopans approach

The expected outcomes

From Jomopans to operational monitoring

3

3

4

6

8

Abstract

Monitoring of ambient noise is essential for marine management. Monitoring programmes are often designed to establish the current status of the environment, or trends in environmental parameters. Jomopans aims to provide this essential information to marine managers, enabling them to manage underwater sound pollution. This policy brief describes the approach taken by Jomopans to meet that goal. The management perspective of monitoring of underwater sound is shown and major issues are introduced. These issues need to be resolved to move toward a fully operational joint monitoring programme.

The challenge

The North Sea is one of the busiest marine areas in terms of transport and maritime industries in the world (oil and gas, renewable energy, etc.). It also represents a crucial asset to North Sea countries by generating economic value and employment. Many of the human activities in the North Sea are set to expand in line with the Blue Growth strategy of the European Commission. At the same time, the North Sea is an important habitat for many marine species.

Marine managers and policy makers face a significant challenge in the coming years. Increased understanding of the economic potential of the sea means that more human activities are taking place at sea. Traditionally shipping and fisheries were the major North Sea economic activities. More recently oil and gas recovery, mining for other resources (like sand and gravel) and offshore wind energy generation have also become important economic activities. But the sea is a valuable habitat for many plants and animals, that have the potential to be threatened by human activity.

Underwater sound is recognised as one of these threats. Sound is omnipresent in the underwater environment and can be produced by natural (waves,

weather, animals) and man-made (shipping, wind farms, oil and gas activities) sources. For marine animals, such as whales, fish and even invertebrates, the auditory senses are very important. Underwater visibility is usually very low in both the North Sea and elsewhere. Animals use sound to navigate, find food, communicate with potential partners and as a warning against various threats. Man-made noise can disturb one or more of these conditions essential to animal survival. Sound is therefore directly relevant for marine life, yet the integrated impact of sound on marine life is largely unknown.

There are indications that the levels of man-made sound have been increasing over recent decades in line with human activities at sea. International concern therefore increasingly focuses on the negative effects of man-made sound on marine life. Questions regarding sound sources, sound transmission, and the distributions of vulnerable species in the North Sea must all be tackled transnationally, as required by the EU Marine Strategy Framework Directive and by the OSPAR Commission. In Jomopans, seven countries along the North Sea are working together in a programme to monitor underwater sound.



Source: Rijkswaterstaat

The Jomopans approach

Marine managers have to find a balance between economic interests and protection of the environment at sea. For this challenging task they require accurate information about the effects of human activities on the environment to inform their decisions. This information must be collected, analysed and processed as part of a monitoring programme. In addition, the level of accuracy of the information and the knowledge gaps relevant to the decision must be identified and presented.

Jomopans will develop a framework for a fully operational joint monitoring programme for ambient

noise in the North Sea. The aim of this programme is to gather information for marine managers in relation to the Marine Strategy Framework Directive (MSFD). MSFD monitoring is needed to evaluate and maintain a Good Environmental Status (GES). In Jomopans, monthly maps of depth-averaged sound pressure levels for the North Sea will be produced¹. These maps will enable marine managers and policy makers to identify, for the first time, where noise may adversely affect the North Sea ecosystem.

For underwater sound, numerical modelling is a major aspect of monitoring. This is because underwater

sound shows a high variability in both time and space. Monitoring based on measurements would require taking samples at a large number of locations and for long periods in time. This is impractical, if not impossible. Measurements are labour intensive and therefore very costly, and it can be difficult to distinguish between different sound sources. Numerical modelling can overcome these practical problems. Sound propagation is based on physical laws and numerical models can be used to produce sound maps for large areas. Also the contributions from different sources and source types can be calculated separately.

Jomopans will use an innovative combination of measurements and numerical modelling to assess the impact of noise on marine life. The strategy will use high quality measurements taken at a few locations in the North Sea, and numerical modelling to provide a full North Sea overview. The measurements at sea and modelling will be integrated into stepwise approach, as is being developed by OSPAR ICG-Noise (Intersessional Correspondence Group on Underwater Noise).



Source: FOI, Swedish Defence Research Agency

¹ Merchant, N. D., Farcas, A., Powell, C. F. (2018) Acoustic metric specification. Report of the EU INTERREG Joint Monitoring Programme for Ambient Noise North Sea (JOMOPANS).

The framework for monitoring continuous sounds contains the following elements:

1. Collect information on human activities

The human activities that generate low-frequency continuous sound need to be evaluated. Sources of this information are AIS (for shipping intensities), VMS (for fishery activities) and the OSPAR impulsive noise register (for other sources of noise). These data need to be collected within a 1 hour timeframe.

2. Collect acoustical properties of the sources

Acoustical properties of most of the known sources are not detailed enough. Literature can provide statistical approximates for these properties. By collecting sound data regularly, we will continuously improve the knowledge of the source properties.

3. Collect physical properties of the environment

Bathymetry and properties of the sea bottom (composition) are important for the numerical modelling of sound propagation. These parameters are static.

4. Calculate soundscape maps

Through acoustical propagation modelling soundscape maps will be calculated for the required parameters; Sound Pressure Level (SPL) percentiles (5th, 10th, 25th, 50th, 75th, 90th, and 95th).

5. Measure long term acoustical parameters at a number of stations

At a number of measurement stations the SPL is measured over a long period. From these measurements statistical parameters of the SPL can be derived.

6. Evaluate the soundscape maps and produce confidence maps

The measurements will be analyzed and compared to the sound scape maps. Confidence maps will be produced to show the quality of the sound scape maps.

7. Specify estimated animal density or habitat area of indicator species

Use animal density estimation data if available and appropriate, otherwise use habitat areas (e.g. habitat quality mapping, MPA, Spawning grounds, etc.).

8. Compute exposure/risk map by combining 6 and 7

Including quantitative assessment of confidence in the risk values derived.

9. Compute exposure/risk indicator(s)

A risk indicator must be computed for each relevant region, that can be assessed against a GES criterion.

The expected outcomes

The Jomopans project will deliver the tools necessary for marine managers, policy makers and other stakeholders to incorporate the effects of ambient noise in their assessment of the environmental status of the North Sea and to evaluate measures to improve the environment.

Usually marine managers have no expert knowledge on underwater sound and will need support to present and interpret the outputs from the Jomopans project. Jomopans will therefore develop a web-based management tool to help marine managers to analyse and evaluate the sound maps in relation to other information. The tool will combine sound maps with distribution maps of sensitive species. Marine policy makers can use this information to evaluate GES in relation to underwater sound. The tool can also be used to design and assess appropriate measures to reduce the risk of environmental impacts of underwater sound.

The tool for evaluation of GES can be thought of as a means to address the following questions:

- **Is there a problem?** Specifically, has GES been compromised by underwater noise in the North Sea? The tool will include one or more indicators of the state of the North Sea and agreed criteria (thresholds) for when GES is achieved. Work is ongoing in OSPAR ICG-Noise and at the EU level (TG-Noise) to agree on such criteria.
- **Where is the problem?** This question deals with localizing areas and times of the year where GES is compromised. The tool will identify high risk areas, where there is a large overlap between anthropogenic noise and selected indicator organisms.
- **What is causing the problem?** The tool will allow for separation of the sound maps into contributions from different source types or categories, like ship class.
- **Will measure X solve the problem?** Will activity Y create a problem? These questions are significantly more complex and will not be implemented in the first version of the GES Tool.



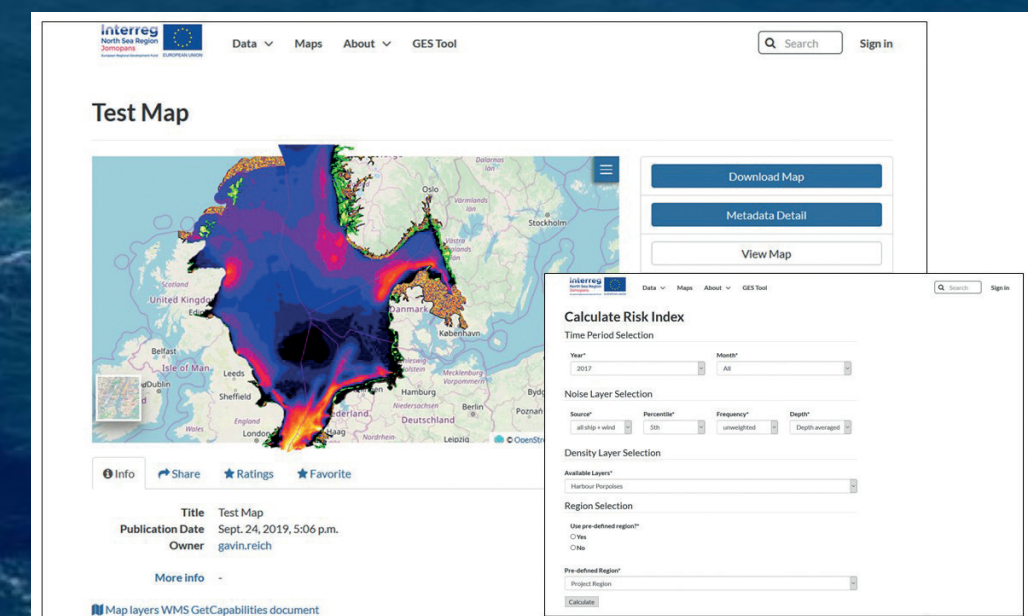
Photo: Trianel/Lang

In addition to the management tool, Jomopans will make a contribution to standardisation in the field of ambient noise monitoring. Standard procedures are being developed for internal use on:

- **terminology for marine acoustic monitoring²**
- **measurements, including equipment performance, calibration and deployment³**
- **analysis of measured data, including benchmarking of analysis methods⁴**
- **propagation modelling**

These standards will also be made available to the wider acoustical community. They will be submitted for discussion in standardisation committees to provide input to the drafting of international standards and the preparation of new work item proposals, for example within ISO TC43 SC3.

Finally, during the Jomopans project underwater noise data will be collected throughout 2019 at 14 measurement stations. These measurements form a valuable data set which can be shared with experts around the world. Within the International Quiet Ocean Experiment, a data management working group has been formed to improve the sharing of underwater acoustic data and to reduce the legal and financial obstacles to do so. Jomopans has representation on this working group.



GES Data courtesy of Jomopans/TNO

²Wang, L. Robinson, S. (2018) Standard for terminology. Report of the EU INTERREG Joint Monitoring Programme for Ambient Noise North Sea (JOMOPANS).

³Robinson, S, Wang L, Crawford, N. (2018) Standard procedure for equipment performance, calibration and deployment, Report of the EU INTERREG Joint Monitoring Programme for Ambient Noise North Sea (JOMOPANS).

⁴Wang, L, Ward, J, Robinson, S. (2019). Standard for Data Processing of Measured Data. Report of the EU INTERREG Joint Monitoring Programme for Ambient Noise North Sea (JOMOPANS).

From Jomopans to operational monitoring

It is essential for the evaluation of GES that a monitoring programme for ambient noise remains in operation. Jomopans will supply the major building blocks of an operational monitoring programme in the North Sea. This programme will not stop at the end of the Jomopans project and needs to be implemented as part of the ongoing monitoring efforts of the North Sea countries.

A decision to start a joint monitoring programme should be endorsed by all national authorities of the North Sea countries. To prepare for this decision the Jomopans project has formed a Policy Advisory Board (PAB). The members of the PAB are the marine managers of the North Sea countries responsible for underwater sound issues. The PAB discusses major issues for a joint monitoring programme, which may occur in governance, financing and national control on the programme. These issues will take time to resolve, but addressing them is necessary to move toward a fully operational joint monitoring programme.

Jomopans cannot solve all questions that exist on continuous underwater sound. Some questions are beyond the scope of Jomopans. These questions have been identified by the project partners. Below a list of topics for future work is given:

- GES Tool. Jomopans will deliver a first basic version of a GES Tool. Further development is foreseen.
- Effects of continuous noise on marine life. More work is needed on effects (injury and/or behavior) of noise on various marine species.
- Sound emission from ships. The influence of various parameters (ships speed, draught, propeller) on the sound emission of ships is largely unknown.
- Data management. There is a demand for better access to underwater sound measurements.
- Management measures. Governments, together with the stakeholders, should reflect on measures to reduce underwater noise.

North Sea Chart: Jomopans/Federal Maritime and Hydrographic Agency (BSH)



● = one measurement station.
 ■ = Jomopans partner organisation



Photo: Denise Risch, of the Scottish Association for Marine Science (COMPASS Interreg VA project)

Joint monitoring

Jomopans primarily aims to solve technical issues and provide information to support a decision. Yet, it is important to agree on what the joint monitoring programme will be. Also the question of information needs is relevant to Jomopans. For example, one of the information needs is the obligation from the MSFD, but this is not applicable to all countries. Similarly, OSPAR obligations are not as binding as EU obligations. Relevant questions to be discussed by the PAB are:

- **What is joint monitoring?**
- **What information need should the programme support?**
- **What are the advantages and disadvantages of joint monitoring of continuous sound?**
- **Is the framework for monitoring continuous sound complete? Or are there elements that are missing or need to be improved?**

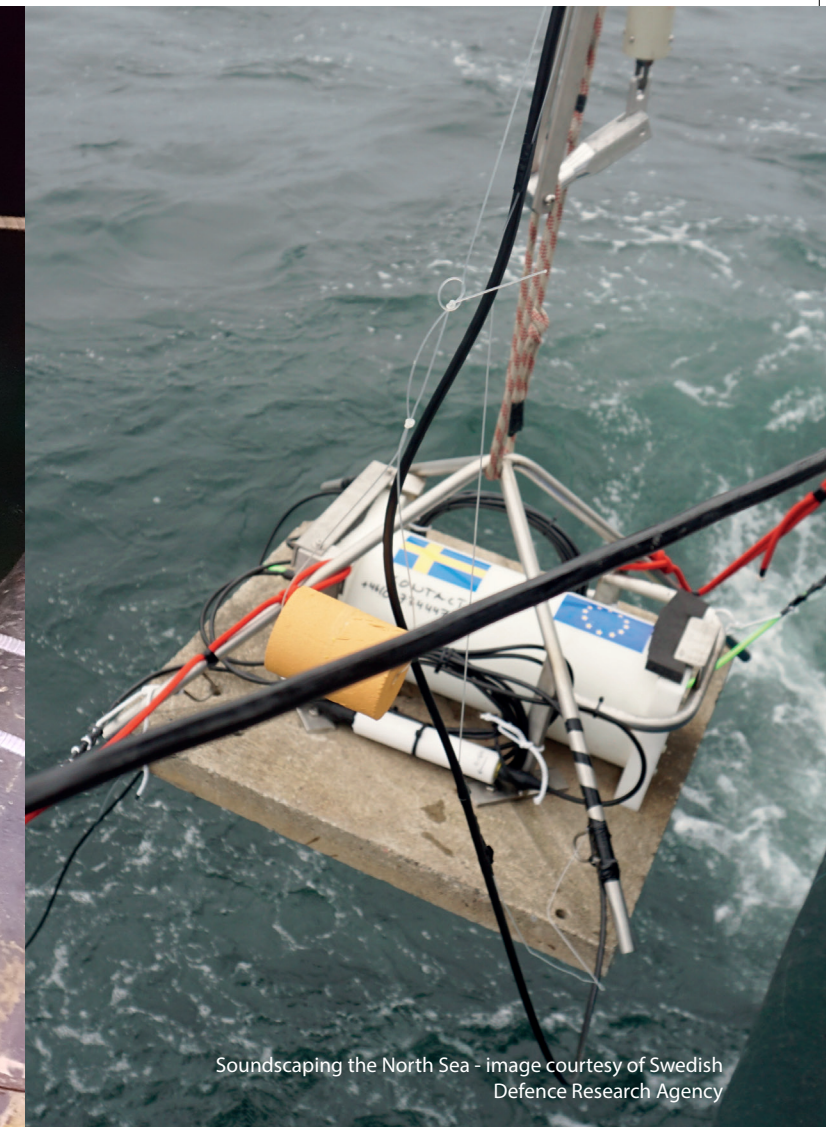


Photo: Waterproof b.v.

Implementation

Issues of organisation and governance can be very difficult and could cause problems if not prepared and discussed properly. The idea of joint monitoring is that tasks should be done by those parties that are best equipped to do so. At the same time, a good balance should be found in distributing the tasks among the participating countries. Finally all countries should have influence on the programme. Relevant questions to be discussed by the PAB are:

- **How should the programme be organised?**
- **What is the governance of the programme?**
- **What could best be organised jointly and what is best done nationally?**
- **For which shared actions do the countries volunteer?**
- **What role can OSPAR play in the programme?**



Soundscaping the North Sea - image courtesy of Swedish Defence Research Agency

Financing

Finances will be a determining factor in this project. Jomopans will deliver a monitoring programme for the best price possible. During the project we will refine the calculations as part of a full business case. Relevant questions to be discussed by the PAB are:

- **What size budget is needed for the monitoring programme?**
- **What are shared costs and what are the costs for individual countries?**
- **How should the shared costs be divided among countries?**
- **What is the best way to organise the financing?**

Contact

Project leader

Niels Kinneging - niels.kinneging@rws.nl

Work Package leads

Communication and harmonisation:

Mathias Andersson - mathias.andersson@foi.se

Standardisation:

Stephen Robinson - stephen.robinson@npl.co.uk

Modelling:

Christ de Jong - christ.dejong@tno.nl

Measurements and Data management:

Jens Fischer - jens.fischer@bsh.de

Combination Modelling and Measurements:

Nathan Merchant - nathan.merchant@cefas.co.uk

GES Tool

Jakob Tougaard - jat@bios.au.dk

More detail, including technical reports, can be found on the Jomopans project website: <https://northsearegion.eu/jomopans>

Partnership

The following organisations participate in the Jomopans project:

