MANAGING THE IMPACTS OF UNDERWATER SOUND

State-of-the-art acoustic risk assessments to support your project and the environment

WATER IS AN IDEAL MEDIUM FOR SOUND

Sound behaves differently in water than it does in air – it travels more than four times faster and significantly further underwater. Consequently, man-made sounds can affect marine life over very large distances. This is especially true as marine animals may rely heavily on sound to communicate, to exploit and investigate the environment, to find prey and to avoid obstacles.

RISK ASSESSMENT FRAMEWORK FOR SOUND-RELATED IMPACTS

Human activities in the aquatic environment generate underwater sound. These include offshore construction for oil and gas platforms and wind farms, dredging, shipping, military and other sonar, seismic surveys and many other actions. The effects of such underwater sound on marine life can range from very subtle behavioural reactions to physical damage at very high sound exposures.

The European Union (EU) Marine Strategy Framework Directive addresses noise impacts. Outside Europe, developers and planners have to consider and manage sound-related impacts with increasing importance as well. We offer a risk assessment that represents a systematic approach to sound impact studies.

We have extensive experience in advising industry and policy makers on noise-related issues. Based on this, as well as on our high scientific profile, our experts provide you with state-of-the-art knowledge in risk identification. We can also advise you on the impacts that have to be considered very early in the project phase.

Sound behaves differently in water than it does in air – it travels more than four times faster and significantly further underwater. Thus, for killer whales and other marine mammals, hearing is the most important of the five senses. Shutterstock © Chase Dekker

CLIENT

Offshore Industries such as:

- oil and gas exploration and production
- dredging
- drilling
- marine construction
- offshore wind farm developers
- shipping

CHALLENGE

- Potential impacts of project activity-generated underwater sound on marine life
- Need to assess noise-related impacts and develop feasible mitigation measures

SOLUTION

- Risk assessment framework for a systematic approach to sound impact studies
- Accurate source description via own database
- Exposure assessment using numerical noise modelling
- Dore-response analysis using international exposure criteria and up-to-date research results including own studies
- Risk management applying meaningful and costs-effective mitigation measures

VALUE

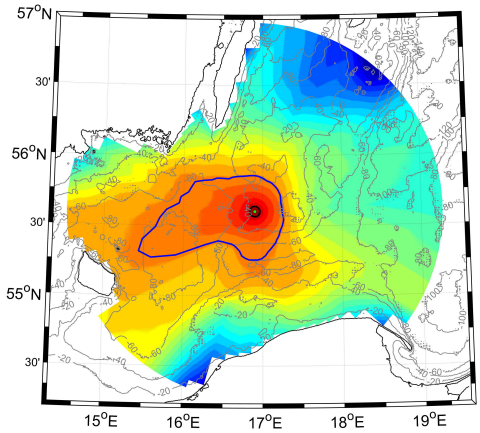
- Effective management of the environmental impacts of underwater sound
- Effective support to project consent and operation
- Security in planning and investment for marine users
- Reduced environmental footprint and impact on marine life

Depending on your project plans, the sound that is generated will vary widely. We have a large database of all possible aquatic sound sources and can provide detailed information on the characteristics of the sounds generated by your project. This will help enormously in targeting the Environmental Impact Assessment (EIA) to the issues at hand and will spare time when consulting with regulators and stakeholders on possible impacts.

COMBINING BIOLOGICAL EXPERTISE WITH ACOUSTIC MODELLING

A unique selling point is the integration of our biological expertise with our top-level modelling capabilities. This enables us to provide you with a realistic exposure assessment. Our in-house software solution, the MIKE Powered by DHI Underwater Acoustic Simulator (UAS), is a state-of-the-art range dependent acoustic model that solves the Parabolic Equation to predict the acoustic field.

As part of our standard procedures, we analyse all relevant properties of the 3D sound field with the help of sound maps, transects passing through the most interesting features and spectra showing the frequency-dependent attenuation and absorption. Sound maps are used in conjunction with data on the distribution and abundance of fish and marine mammals to provide an estimate of the number of individuals affected. The impact is then extrapolated using empirical data on hearing sensitivities and demonstrated effects.



This sound map shows the sound propagation from a hypothetical impact pile-driving activity in the Baltic Sea. The blue, black and green solid lines indicate impact ranges for specific mammals. Such maps are usually used in sound impact assessments together with data on the distribution and abundance of marine animals. © DHI

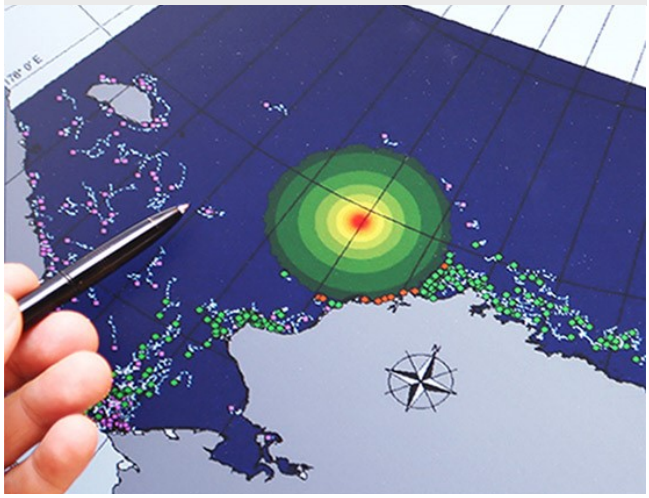
ACOUSTIC MODEL FACTSHEET

- MIKE Underwater Acoustic Simulator (UAS) solving the Parabolic Equation
- 3D sound field from N x 2D transmission loss
- Frequency range: 16 Hz – 40 kHz
- Frequency sampling: 1/12, 1/3, 1 Octave
- Typical transect lengths: 150 km @ 100 m sampling
- The model accounts for sound speed profiles from temperature and salinity
- Automated calculation of volume attenuation from salinity, pH and temperature

USING AGENT- BASED MODELLING (ABM) IN IMPACT STUDIES

At DHI, we are developing agent-based models which account for the movements of whales and seals before, during and after noise exposure. Together with our noise modelling using UAS, the agent-based modelling can be used in environmental risk assessments, for example, in identifying the times and areas where the risk to marine life is lowest.

These modelling studies lead to much more precise estimates of animals affected and thus can reduce environmental risks. Better knowledge gained through the ABMs can accelerate the consent process and in that way reduce costs.



DHI uses agent-based models to assess the effects of sound on marine life. © DHI

DHI has applied the agent based modelling to humpback whales in the Barents Sea. Photo: iStockphoto © miblue5

TESTING MITIGATION MEASURES AND DECISION MAKING

Depending on the scale and amplitude of the impact, several mitigation measures are possible. Selecting the most effective mitigation solution is crucial considering the costs of mitigation operations. DHI offers testing of several mitigation scenarios through acoustic modelling followed by re-evaluation of impact ranges.

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