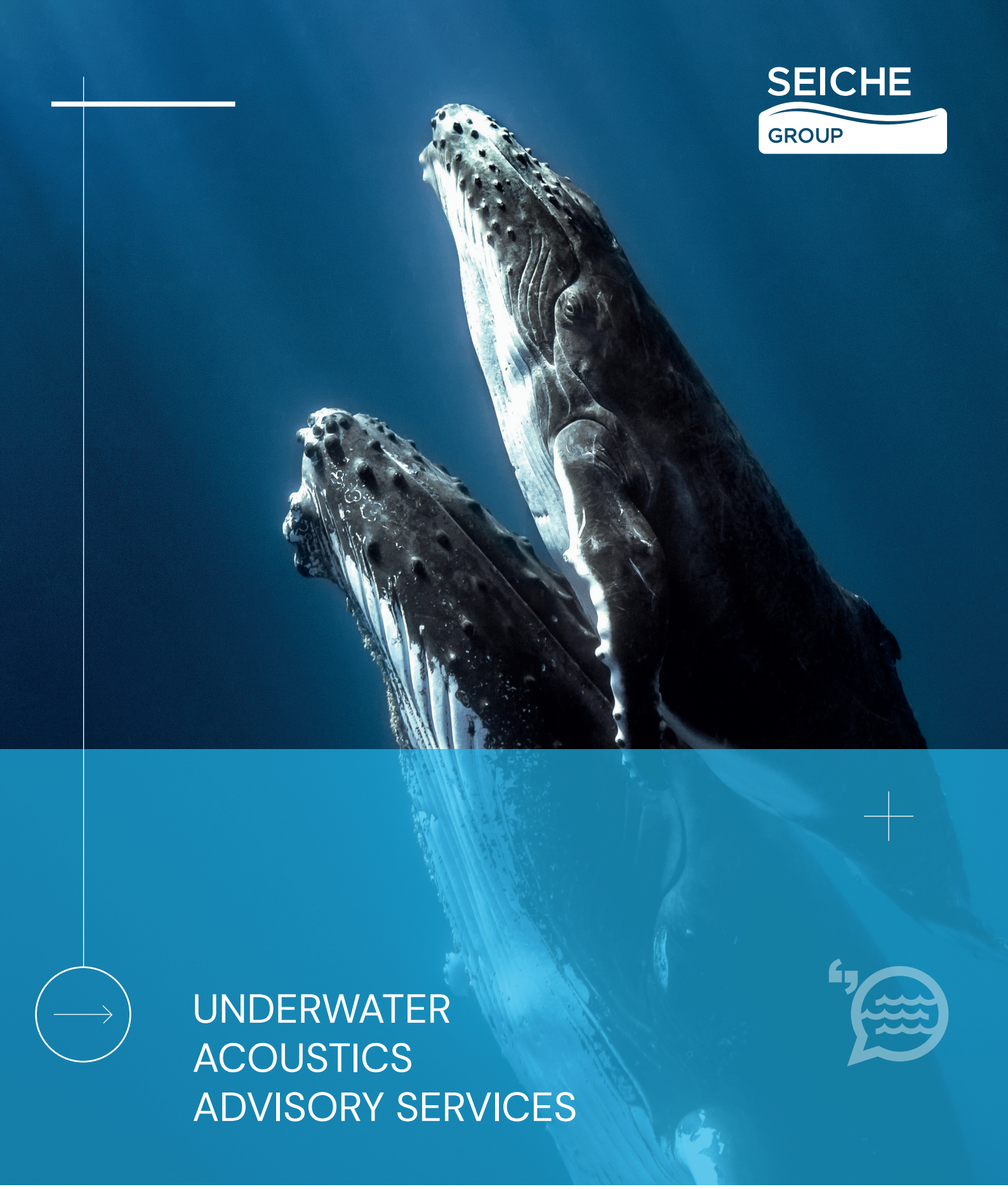
SEICHE GROUP



UNDERWATER ACOUSTICS ADVISORY SERVICES

Subsea noise monitoring, modelling, assessment and mitigation services to the marine, coastal and energy industries.

OVERVIEW

Sound is readily transmitted underwater and there is potential for sound emissions associated with marine, coastal and infrastructure developments to injure or disturb marine life. Legislation and guidance across the world is increasingly concerned with assessing the potential effects of underwater sounds on marine life and, if possible, mitigating and minimising the effects.

The Acoustics Team at Seiche specialises in providing advice on underwater sound to various industries, including offshore renewables, oil and gas, energy, ports, harbours and aquaculture. We deliver a high quality, independent service to help our clients achieve their business goals while ensuring compliance with environmental legislation and managing environmental impact.

Our Services

- **UNDERWATER NOISE MODELLING USING PEER REVIEWED METHODOLOGIES, INCLUDING ASSESSMENT OF:**
  - Impact, vibratory and drilled piling
  - Blasting and UXO
  - Seismic surveys
  - Geotechnical / Geophysical surveys (e.g. SBP, MPES, SSS, CPT, sparker)
  - Drilling and exploration activities
  - Decommissioning activities (e.g. punch guns, jet cutting)
  - Construction, including OWFs, cables, pipelines, bridges, oil and gas installations
- **UNDERWATER NOISE IMPACT ASSESSMENTS AND INPUT TO EIAS**
- **LIVE MODELLING WORKSHOPS (E.G. TO DE-RISK PDE CONSENTING)**
- **MARINE SURVEY PERMIT APPLICATIONS**
- **TECHNOLOGY DEVELOPMENT AND RESEARCH STUDIES**
- **UNDERWATER NOISE DESIGN STUDIES FOR NEW VESSELS**
- **UNDERWATER NOISE SURVEYS AND MONITORING INCLUDING:**
  - Baseline soundscape (ambient)
  - Construction and decommissioning
  - UXO, blasting, punch guns
  - Piling
  - Operational activities
  - In-field sound source verification (SSV)
- **ADVICE ON MITIGATION INCLUDING NOISE REDUCTION, SOFT START, MMO, PAM AND ADD**
- **PROVISION OF TRAINING COURSES, INCLUDING :**
  - Underwater Acoustics in the Marine Environment
  - Underwater Acoustic Modelling
  - Underwater Acoustics and Sonar Systems
- **EXPERT WITNESS, INCLUDING REPRESENTATION AT DCO HEARINGS**
- **PEER REVIEW OF ASSESSMENTS**

Our Approach

BALANCE BETWEEN TECHNICAL ROBUSTNESS, SPEED AND PRACTICABILITY

We understand that projects often need to be delivered within tight timescales whilst delivering the appropriate degree of technical robustness balanced against project practicability and costs. This means that for higher risk projects (e.g. high sound source levels, impulsive sound, sensitive areas) a higher degree of complexity in the assessment will be warranted than for lower risk projects. At Seiche, we pride ourselves on being highly responsive to our clients needs and expectations. In particular, we understand that early identification of high consenting risks allows workable, practicable solutions to be developed early in the project in order to increase the chances of project success.

PEER REVIEWED METHODOLOGIES

Integrity, honesty and transparency are at the heart of our approaches to noise modelling, monitoring and mitigation. We always use the most recent technical standards and guidance and our noise modelling utilises up-to-date peer reviewed methodologies. Seiche has collaborated with the National Physical Laboratory, Plymouth University, Bath University and ZCAT Science to combine in-depth knowledge of underwater sound propagation, computational algorithms and practical knowledge of the marine environment. To this end, our clients can be assured that our work will be delivered to the high standard expected by our clients, regulators and consultees.

The choice of acoustic model will depend upon the geo-acoustic, site and project specific parameters. Examples of models used by Seiche include:

- **RAY-TRACING: BOUNCE, BELLHOP**
- **NORMAL MODES: KRAKEN, KRAKENC**
- **PARABOLIC EQUATION: RAM, RAMS**
- **FAST-FIELD OR WAVENUMBER INTEGRATION: SCOOTER**
- **WESTON ENERGY FLUX MODEL**

Exposure modelling for animals can be based on static animal or moving animal and source scenarios. We work closely with marine ecologists to determine the most appropriate thresholds, criteria and exposure modelling parameters for each project.

CLEAR AND EASY TO UNDERSTAND REPORTING

The subject of underwater acoustics can often be difficult for non-specialists to understand. Rather than produce academic reports, we pride ourselves on communicating the complex issues in an easy to understand manner, which in turn reduces the consenting risk as regulators can fully appreciate the assessment outcomes. To this end, we work closely with regulators and their advisors to hone our underwater noise assessments and to ensure that we always reflect the latest scientific research and best practice.

JOINT TEAM EFFORT

In order to ensure project success, it is essential that the acoustician's, marine ecologists, engineers and consenting teams all work together in a proactive way. We approach assessments in an integrated way utilising the expertise of our acoustics, bio-acoustics and offshore mitigation teams to define robust criteria and assessment methodologies, bringing industry-leading knowledge and experience to each project. For delivery of all of our projects, the Seiche specialist teams work constructively with our clients to ensure that the most appropriately experienced people are available to add value to our clients' projects regardless of geographical location.

AGREED APPROACH WITH REGULATORS

Early and on-going consultation with regulators, SNCBs and their advisors is vital to ensure that any acoustic assessment will be delivered to the required standard. Our acoustics team is often approached by regulatory bodies and their advisors to provide technical advice and we are actively involved in several technical working groups in relation to underwater noise assessments and marine life, including the UK Oil and Gas underwater noise modelling group, the UK Underwater Sound Forum (a sub-group of the Marine Science Co-ordination Committee) and BSI committee EH/1/7 on underwater acoustics. We are actively engaged in progressing knowledge of underwater acoustics and participate in major research projects.

UNDERSTANDING OF ENTIRE PROJECT LIFECYCLE AND CONSENTING RISKS

Seiche is routinely involved in scoping, designing and carrying out environmental monitoring and mitigation programmes. We recognise that environmental assessments, offshore monitoring and practical mitigation can be very expensive and must be proportionate to the scale of the project and the potential impacts and associated risks. In addition, our appreciation of project practicalities and timescales, including the industry specific concerns of working offshore, means that we can offer informed advice based on the best available practice.

CRITICALLY, SEICHE OFFERS PRACTICAL SOLUTIONS RATHER THAN PRESENTING PROBLEMS.

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