

## Seismic Surveys and Protecting the Marine Environment

Seismic surveys are the key tools used in oil and natural gas exploration and the siting of renewable energy facilities. The use of modern seismic technology is similar to ultrasound technology which is commonly used in the medical profession for imaging the human body. Today's advancements in seismic technology, which can pinpoint the most fruitful areas for hydrocarbon potential, have contributed to reducing the overall environmental footprint associated with oil and gas exploration. Seismic technology has also helped to decrease operational and safety risks associated with oil and gas development. Contrary to what has been said, seismic surveying is very well understood and a very safe industry practice.

More than four decades of worldwide seismic surveying and various scientific research indicate that the risk of direct physical injury to marine mammals is extremely low, and currently there is no scientific evidence demonstrating biologically significant negative impacts on marine mammal populations. The seismic industry is committed to conducting its operations in an environmentally responsible manner, including compliance with mitigation and monitoring guidelines and regulations. Industry supports a process of developing and implementing effective mitigation measures that are based on assessing the level of risk or significant impacts on marine animals. Such an approach helps to ensure that the scope of mitigation measures implemented in the field are appropriate to the level of risk and specific to the local population of marine animals.



## Taking Precautions to Protect the Environment

The seismic industry employs a number of measures to ensure that marine life is protected from direct or indirect harm from its operations.

### *Impact Assessments*

Environmental Impact Assessments (EIAs) are an integral part of developing and implementing a seismic survey. Many countries have environmental impact assessment requirements. The assessments include identification of marine species, including protected species, other environmental sensitivities and the human uses of the proposed area of operations. These assessments are conducted during the survey planning stage and evaluate the potential impacts and risks to marine life. The assessments also identify and consider measures to avoid or mitigate such potential impacts and risks. Seismic surveys are generally considered not to be harmful or damaging to the marine environment. Seismic surveys are comparable to many naturally occurring ocean sound sources, are temporary and transitory and the vast majority are conducted at frequencies below the hearing range of many marine species.



*Preparing analysis as part of seismic survey planning*

### *Mitigation and Monitoring*

Mitigation and monitoring must be proportionate to the potential risks identified by an environmental assessment and specific to the local environment and the operation being undertaken. Measures commonly used by the seismic industry include timing seismic surveys to avoid known areas of biological significance, such as whale foraging or breeding areas or avoiding seasonal marine life occurrences such as peak whale and dolphin activity seasons or migration.

Before a seismic operation begins, visual monitoring is undertaken to check for the presence of marine mammals and other marine species within a specified precautionary, or exclusion zone, often using dedicated marine mammal observers (MMOs) or protected species observers (PSOs).



*Protected Species Observer*

Further monitoring may be done using passive acoustic monitoring technology (PAM), which may detect vocalizing marine animals, especially during low visibility and nighttime conditions. In the event marine animals are detected in the exclusion zone, seismic operation will not begin for a certain time period until the marine animal moves away. Similarly, a seismic survey will shut down if the marine animal is observed entering the exclusion zone once operations have begun.

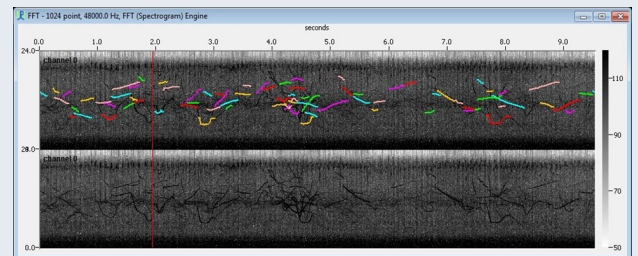


Soft-start or ramping-up procedures are undertaken by seismic vessels as a matter of general operational procedure. Soft starts involve activating a small section of the acoustic sound arrays over a period of time, gradually getting louder until the full acoustic array is operating. This measure also allows a marine animal to swim away before the acoustic source is activated at full strength.

### Environmental Protection Guidelines

Many countries and regional authorities have established guidelines and regulations specific to seismic operations, which are then adapted for the specific location and operation for the permit.

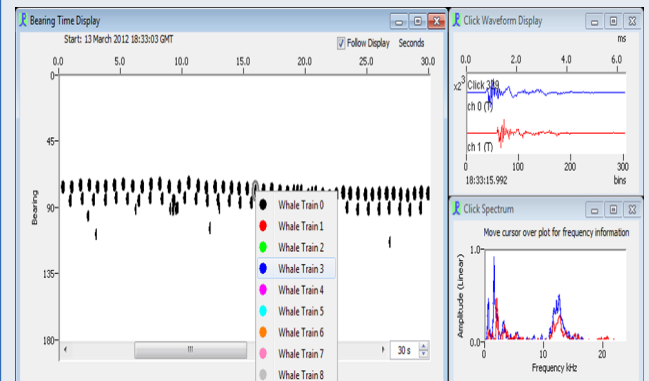
In the absence of regulations or guidelines in a specific area, the industry has committed itself to a set of minimum mitigation measures as outlined in the 2011 International Association of Geophysical Contractors (IAGC) standards document, “Recommended Mitigation Measures for Cetaceans during Geophysical Operations.” IAGC has produced additional documents for mitigation and monitoring guidance for seismic operations, “Guidance for Marine Life Visual Observers” and “Guidance on the Use of Towed Passive Acoustic Monitoring during Geophysical Operations.”



**Dolphin whistles detected using the PAMGuard whistle and moan detector**

### Contributing to Science

IAGC, together with a number of oil & gas companies, supports research to fill knowledge gaps about the effects of seismic surveys on marine life. This is helping to remove some of the uncertainty about possible effects of seismic surveys. More information on our commitment to science can be found at [www.soundandmarinelife.org](http://www.soundandmarinelife.org).



**Marking up Sperm Whale clicks to localize on the map**

### Additional Resources on Seismic Surveys and Protection of the Marine Environment

1. PAM Guidance: <http://www.iagc.org/articles/new-towed-passive-acoustic-monitoring-guidance-for-geophysical-operations/>.
2. Recommended Mitigation Measures for Cetaceans during Geophysical Operations: <http://www.iagc.org/files/4776/>.
3. Sound and Marine Life Protections: [www.soundandmarinelife.org](http://www.soundandmarinelife.org).
4. PAMGuard: <http://www.pamguard.org/>.
5. Marine Mammal Observer Association: <http://www.mmo-association.org/position-statements/111>.
6. Marine Mammal Observers: <http://www.globalseismicmmo.com/mmo-role/>.
7. OGP/IAGC “Seismic Surveys & Marine Mammals”: <http://www.ogp.org.uk/publications/environment-committee/seismic-surveys-and-marine-mammals-joint-ogpiagc-position-paper/>.

### Environmental Stewardship

*The geophysical industry takes a great deal of care and consideration of potential impacts to the marine environment. In its efforts to operate in an environmentally responsible manner, the industry implements measures to ensure that marine mammals are further protected from direct or indirect harm from its operations. For more than 40 years, the industry has demonstrated its ability to operate seismic exploration activities in a manner that protects marine life. Various research studies indicate that the risk of direct physical injury to marine mammals is extremely low, and currently there is no scientific evidence demonstrating biologically significant negative impacts on marine mammal populations*