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Seismic Surveys and Fish

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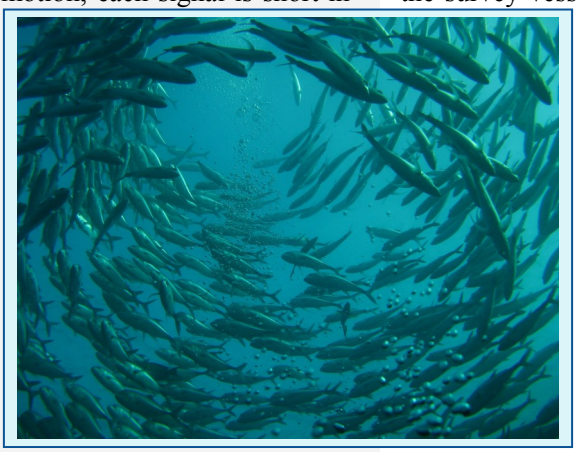
Marine seismic surveys are the only feasible technology available to accurately image the subsurface before a single well is drilled. Marine seismic surveys predominantly transmit low-frequency sound waves from a source directed downward into the subsurface. The sound waves are reflected from the geological layers in the subsurface, and these reflections are captured by receivers (hydrophones) typically towed just below the surface behind the seismic vessel. The recorded data are processed by computers to produce images of the subsurface.

Marine seismic surveys have been conducted since the 1950's, and experience shows that fisheries and seismic activities can and do coexist. There has been no observation of direct physical injury or death to free-ranging fishes caused by seismic survey activity. Any impacts to fish from seismic surveys are short-term, localized and have not led to significant impacts on a population scale.

Are there Physical Impacts to Fish from Seismic Activity?

There has been no observation of direct physical injury or death to free-ranging fishes caused by seismic survey activity. Seismic vessels move along a survey tract in the water creating a line of seismic impulses. A predominantly low-frequency sound pulse is generated by releasing compressed air into the water as the vessel is moving. As the seismic vessel is in motion, each signal is short in duration, local and transient. Fish may react to these pulses by temporarily swimming away from the seismic air source. When fish move away from a survey vessel they often return after the vessel has passed.



Since typical seismic surveys are a moving sound source, any potential effects on fish are inherently local and short-term. While some studies have shown that various life stages of fish may be physically affected by exposure to seismic surveys, in all of these cases, the fish subjects were very close to the seismic source or subjected to exposures that are virtually impossible to occur in free-ranging fishes.

Fish eggs, larvae and fry do not have the ability to move away from a sound source, and may be injured in the unlikely event they are within a few meters of the seismic source. The impact of this damage, however, is insignificant on a population scale compared to the high natural mortality rate of eggs, larvae and fry.

Do Seismic Surveys Affect Fishing?

Active acoustic sound sources such as seismic surveys may result in fish temporarily moving away from the sound source. There is no conclusive evidence, however, showing long-term or permanent displacement of fish. Because the sound output from a seismic survey is immediate and local, there is no contaminate residue or destruction of habitat.

During seismic surveys, a vessel exclusion zone is maintained around the survey vessel and its towed streamer arrays to avoid interruption of commercial fishing operations, including setting of fishing gear. These exclusion zones are dependent on the type of activity and national and local regulations in the area of operation.

Prior to conducting a seismic survey, operators work cooperatively with local fishing communities and regulatory bodies to avoid sensitive spawning grounds and mitigate any potential economic losses to fisherman. The geophysical industry works with fishermen to define and address potential concerns early in the permitting process.

How do Seismic Activities Compare to Other Sources of Risk to Fish?

Separating the effects of sound from other environmental disturbances can be complex. The impacts of sound on fish stocks must be viewed in a wider context, considering how the effects of sound on populations compare to other natural and human influences on the marine environment. Those influences that are known to threaten marine life, such as overfishing, disease, habitat degradation and pollution, have greater impact from an overall risk perspective.

What is the Seismic Industry Doing?

For many years, industry has invested in considerable research regarding the effects of seismic surveys on marine animals including fish. Research projects also address gaps in knowledge and assist in a more comprehensive understanding of potential environmental risks (see www.soundandmarinelife.org). That investment continues today.

In addition to the research, industry employs various mitigation measures to decrease the potential impact of seismic operations on marine life, including avoidance of important fish spawning grounds and use of soft-start/ramp-up procedure, which is a gradual build-up of the seismic sound source to allow fish to swim away. In the US Gulf of Mexico, where seismic activities routinely occur, $980 million of seafood is harvested annually, suggesting that commercial fisheries successfully coexist with seismic surveys.

Additional Resources on Seismic Surveys and Fish

1. Science for Environment Policy, Future Brief: Underwater Noise, European Commission: http://ec.europa.eu/environment/integration/research/newsalert/pdf/FB7.pdf.
2. U.S. Department of Commerce, NOAA. Stocks at a Glance – Status of Stocks: www.nmfs.noaa.gov/stories/2012/05/05_14.
3. Boeger, W.A., Pie, M.R., Ostrensky, A., Cardoso, M.F. The Effect of Exposure to Seismic Prospecting on Coral Reef Fishes. Brazil. J. Oceanogr. 54, 235-239.
4. Marine Pollution Bulletin. 3D Marine Seismic Survey, No Measurable Effects on Species Richness or Abundance of a Coral Reef Associated Fish Community: http://dx.doi.org/10.1016/j.marpolbul.2013.10.031.
5. Hassel, A., Knutsen, T., Dalen, J., Skaar, K., Lokkeborg, S., Misund, O.A., Osten, O., Fonn, M., Haugland, E.K. Influence of Seismic Shooting on the Lesser Sand Eel. ICES J. Mar. Sci. 61, 1165-1173.
6. Pena, H., Handegard, N.O. and Ona, E. Feeding Herring Schools Do Not React to Seismic Air Gun Surveys. ICES J. Mar. Sci: http://icesjms.oxfordjournals.org/content/70/6/1174.short?rss=1.
7. Saetre, R. and E. Ona. Seismic Investigations and Damages on Fish Eggs and Larvae; An Evaluation of Possible Effects on Stock level. Fisken og Havet:1-17, 1-8.
8. Bureau of Ocean Energy Management. Appendix J, Atlantic G&G PEIS: http://www.boem.gov/boem-2014-001-v3/.

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.