BOEM
Bureau of Ocean Energy Management

Understanding High Resolution Geophysical (HRG) Surveys

What are HRG Surveys?

Before offshore wind construction begins, companies gather information to characterize the seafloor with high-resolution geophysical (HRG) surveys. HRG surveys use a suite of active sound sources to produce sounds that are reflected off features within the water column, on the seafloor, and below the seabed.

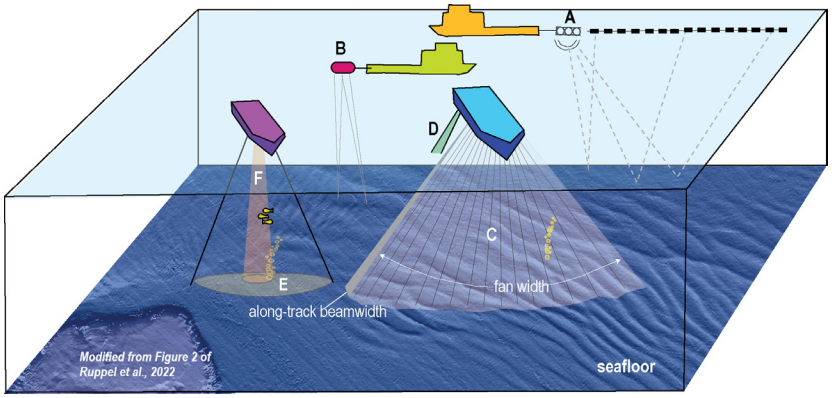
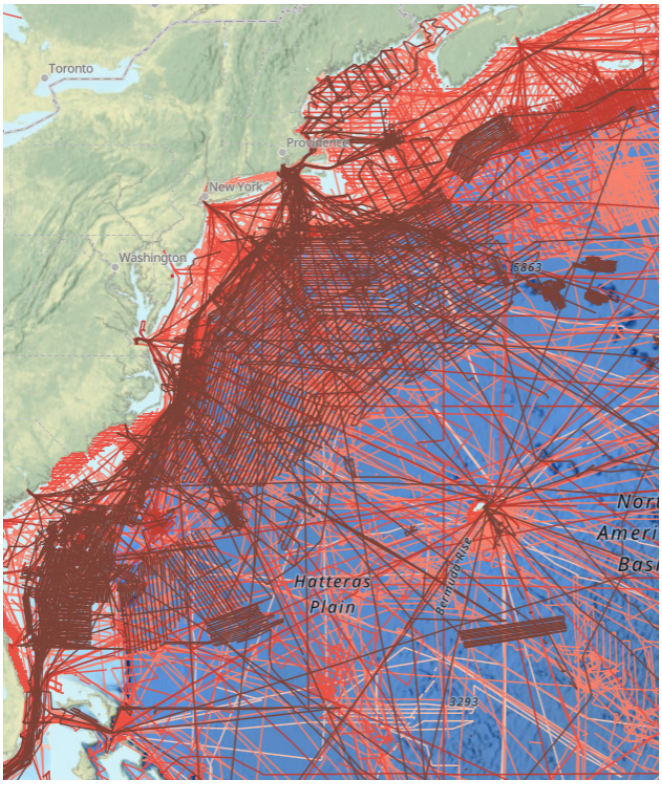


Figure 1 Schematic diagram of different active acoustic sources. A) depicts most HRG sources, B) shows towed subbottom profilers, C) shows multibeam echosounders, D) shows an acoustic doppler current profiler, E) shows a hull-mounted SBP, and F) shows a scientific echosounder. From Ruppel et al (2022)

Survey equipment can be mounted on the ship or towed behind a survey vessel. HRG surveys often combine tools, such as multibeam echosounder, side-scan sonar, and sub bottom profiler into one subsurface package: an Autonomous Underwater Vehicle (AUV), which is operated approximately 50 feet above the seafloor.

The sound sources used in HRG surveys are much lower in energy than deep penetration seismic airgun surveys, which use high-energy sound pulses to penetrate deeper (thousands of meters) into the seafloor to map certain geological features, such as oil and gas deposits. Offshore wind energy projects do not use deep penetration seismic airgun surveys.

Government, academic, and industry researchers have used HRG/acoustic surveys to map, explore, and characterize the marine environment for decades. The National Centers for Environmental Information has tracked survey data since 1939 and makes it available to review via the Trackline Geophysical Data Viewer: https://www.ncei.noaa.gov/maps/trackline-geophysics/.



This image provides a snapshot of survey tracks – including those using single-beam bathymetry, subbottom profilers, magnetometers, gravitometers, side-scan sonars, and seismic airguns – in the Atlantic from 1970 to 2024. This database may not be inclusive of all surveys, but the information can be found at the National Centers for Ecological Information Geophysical data viewer.

How do HRG surveys affect marine mammals?

BOEM is committed to the protection of marine mammals and the ocean environment, as well as the avoidance, minimization, and mitigation of any potential impacts from our regulated offshore energy activities

BOEM scientists coauthored a scientific paper that describes key physical attributes of HRG sources – such as beamwidth, exposure duration, and frequency – that make them unlikely to injure whales or other endangered species. They concluded that the HRG surveys associated with offshore wind development in the Atlantic are not likely to injure whales or other endangered species. They analyzed multiple factors in the findings, including:

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Frequency (or pitch) and source level: Not all sound sources are audible by all marine species. For example, high-frequency side scan sonars used in HRG surveys are not likely to be audible by fish, turtles, and baleen whales, while species like porpoises may not be able to detect some of the low-frequency sources. Source level is the intensity of the sound. Some HRG survey sources are quiet enough that even if an animal swam within 25-50 meters of the sound source, it still would not be exposed to sound that is loud enough to cause behavioral harassment.

Beamwidth: Many of the HRG survey sources emit sound in narrow beams or fan-shaped patterns, which means that the odds of an animal swimming directly into this very small beam of sound is highly unlikely, given the average density of marine mammals in the ocean.

Degree of exposure: Many of the HRG survey sources have small duty cycles, meaning they are only on for 1/100th or 1/1000th of the time during a survey. This leaves significant periods of quiet time between pulses.

More information about HRG surveys

BOEM relies on the best sources of science available to assess whether HRG surveys could lead to injury or behavioral harassment of marine mammals. Links to additional resources are available on BOEM's website.

Additional Resources