

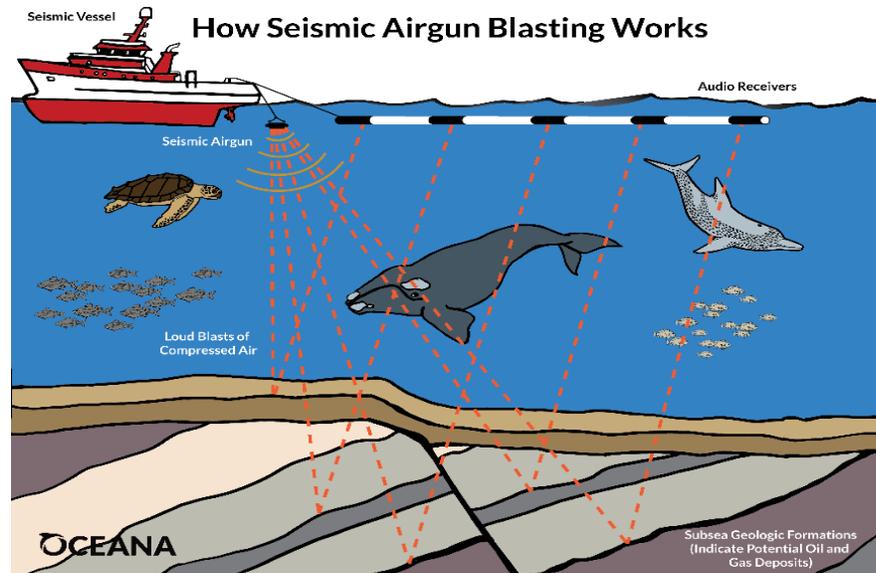


## Offshore Oil & Gas Exploration: Seismic Airgun Blasting

Seismic airgun blasting is a process used to search for and map oil and gas deposits deep below the seafloor. A typical seismic survey involves a ship traveling across the ocean in successive parallel lines while towing one or more seismic airgun arrays. These airguns create one of the loudest sources of noise in the oceans, behind explosives for military testing and shipping.<sup>1</sup>

### How does seismic airgun blasting work?

Seismic airguns release pressurized air blasts to create powerful sound waves that travel through the water column<sup>2</sup> and seabed, and provide information about the seafloor.<sup>3</sup> These sound waves travel as echoes back to the surface, where they are captured by audio monitors called hydrophones.<sup>4</sup>



### Seismic airgun blasting characteristics:

- Loud blasts repeated every 10-12 seconds<sup>5</sup> for days, weeks, or months at a time.<sup>6</sup>
- 12-48 individual airguns are towed in each array; a single ship can tow up to 96 airguns.<sup>7</sup>
- The surface area covered by the largest seismic array was 21 times larger than the National Mall in Washington, D.C.<sup>8</sup>
- Seismic airgun sounds can be heard up to 2,500 miles from the source under some conditions, approximately the distance of a flight from New York to Los Angeles.<sup>9</sup>

### Why is seismic airgun blasting a problem?

Not only is seismic airgun blasting the first step toward dirty and dangerous offshore drilling, but the process itself is harmful to marine life. Seismic airguns produce repetitive, explosive sounds that can travel over large distances.<sup>10</sup> Because sound travels so efficiently underwater, airgun blasts can be heard far from their sources.<sup>11</sup> As the sound waves from the individual seismic blasts move away from the airguns, they merge into continuous noise pollution that drowns out other sounds in the ocean.

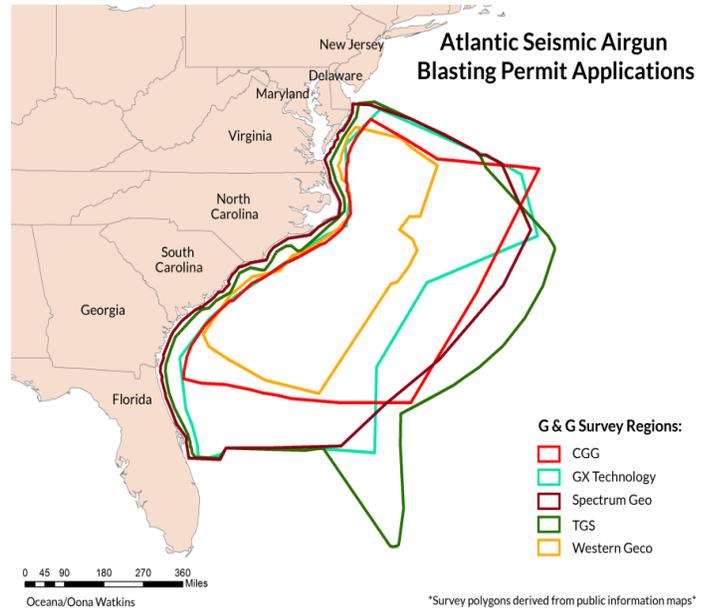


## Where is seismic airgun blasting being considered?

On April 28, 2017, President Trump signed Executive Order 13797 aimed at expanding offshore drilling and exploration in U.S. waters.<sup>12</sup> The order calls for a review of the current Five-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program (for 2017-2022) and directs the responsible agencies to fast-track the permitting process for seismic airgun blasting.

Following that directive, the Department of the Interior reversed a decision made in January 2017 to deny seismic airgun blasting permits in an area twice the size of California, stretching from Delaware to Florida.<sup>13</sup> The Bureau of Ocean Energy Management is now reconsidering issuing those permits. Concurrently, the National Oceanic and Atmospheric Administration resumed evaluation of incidental take authorizations that would grant seismic survey companies permission to harm marine mammals.

If approved, seismic airgun permits would allow overlapping seismic surveys along the Atlantic coast that could result in even more severe impacts to marine life.



Permits for Atlantic seismic surveys being reviewed by BOEM.

## Biological impacts of seismic airgun blasting: Overview

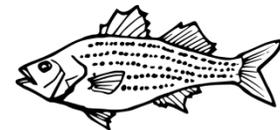
Seismic airgun noise can have significant and wide-ranging impacts on fish, shellfish, whales and sea turtles. According to the government's own estimates, seismic airgun blasting in the Atlantic could injure as many as 138,000 marine mammals, like dolphins and whales, while disturbing the vital activities of millions more.<sup>14</sup>

### Fish

Fish species vary in their ability to detect and use sound, and seismic airgun noise therefore has a range of impacts on fish species. Seismic airgun noise elicits varying degrees of startle and alarm responses in fish, including escape responses, and changes in schooling patterns, water column positions and swim speeds.<sup>15</sup>

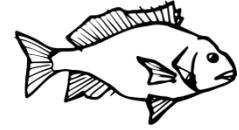
Examples include:

- 40-80 percent reduced catch rates in Atlantic cod, haddock, rockfish, herring, sand eel and blue whiting.<sup>16 17 18 19 20</sup>
- 78 percent decline in reef fish abundance during evening hours, the time of day when fish habitat use is typically highest for the study area.<sup>21</sup>





- Behavioral responses in cod, such as swimming away from seismic sources, and damaged hearing structures in pink snapper.<sup>22</sup>
- Elevated stress hormones and chemicals in sea bass.<sup>23</sup>
- Schools of some fish species, including blue whiting, moving lower in the water column, which could take extra energy or displace the fish from behaviors needed for survival.<sup>24</sup>



### **Invertebrates (shellfish)**

Invertebrate exposure to seismic noise can cause physical injury and mortality at near-distances and impede development of early life history stages.

Examples include:

- Significant increase in mortality for scallops exposed to seismic airgun noise, particularly over long periods of time.<sup>25 26</sup>
- Stress responses, including physiological changes, in bivalves, which are clam-like species.<sup>27</sup>
- Slower development rates in crabs<sup>28</sup> and scallop larvae<sup>29</sup> after repeated exposure to nearby seismic sound.
- Damage to small organs that control balance and orientation in rock lobsters<sup>30</sup> and spiny lobsters,<sup>31</sup> up to a year after seismic airgun blasting occurred.
- Distinctive flinching response and persistent alterations in reflex behavior for scallops following exposure to seismic airguns.<sup>32</sup>
- Sensory and internal organ damage in seven stranded giant squid after nearby seismic surveys.<sup>33</sup>
- Significant decrease in zooplankton abundance, and a two- to threefold increase in dead adult and larval zooplankton at distances of at least  $\frac{3}{4}$  miles from seismic source.<sup>34</sup>

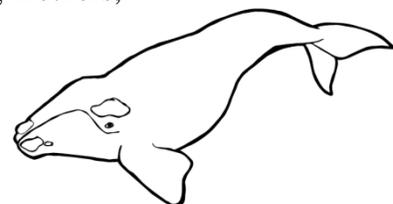


### **Whales**

Marine mammals rely on sound for feeding, communication, navigation and other behaviors necessary for survival. Seismic airgun noise can cause hearing impairment as well as physiological and behavioral changes.<sup>35</sup> These include avoidance, displacement, communication masking, vocalization changes and chronic stress, which could cause increases in stress hormones,<sup>36</sup> lead to behavioral changes, and reduce effectiveness of the immune system.<sup>37</sup>

Examples include:

- Changes in Bowhead Whale breathing patterns, avoidance and silencing of calls, which could interrupt communication between whales, including mothers, calves and potential mates.<sup>38 39 40</sup>
- Declines in the feeding rates of Sperm Whales.<sup>41</sup>
- Altered Fin Whale vocalizations, which are important for communication, and abandonment of habitat.<sup>42</sup>





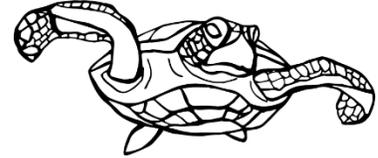
- Responses of North Atlantic Right Whale to other sources of low-frequency noise demonstrates that noise may be associated with increases in stress-related hormones in baleen whales.<sup>43</sup>

### **Sea Turtles**

Sea turtle hearing range overlaps with the higher frequency noises from seismic airguns. Studies show that seismic airgun noise can negatively affect sea turtles.

Examples include:

- Increases in erratic swimming behavior.<sup>44</sup>
- Responses, including swimming away from the noise source, suggesting avoidance of seismic noise.<sup>45</sup>
- Risk of entanglement in survey equipment.<sup>46</sup>



### **Conclusion**

The United States should protect the diverse array of whales, fish, turtles and invertebrates that live along the Atlantic coast and are threatened by proposed seismic airgun blasting. The potential damage to marine animals and ecosystems, and the communities and industries that depend on these resources, is too great to risk.

The National Marine Fisheries Service should not approve Incidental Harassment Authorizations (IHAs) nor should the Bureau of Ocean Energy Management approve the permits for seismic airgun blasting in the Atlantic. If the IHAs and seismic permits are approved, Oceana recommends the following mitigation practices to minimize harm to marine life:

- Sharing of data between companies, the government and the public so seismic airgun blasting happens only once and impacts are minimized.
- Require that companies fund third party passive acoustic monitoring before, during and after seismic airgun blasting to observe any effects on marine life, archive acoustic data recordings and immediately stop seismic airgun surveys if animals are detected during the surveys.
- Require third party visual observers to watch for whales, dolphins and sea turtles before, during and after the seismic airgun surveys, record sightings and immediately stop seismic airgun blasting if animals are within view.
- Do not conduct seismic airgun blasting during endangered and threatened species calving or nesting seasons, or in Critical Habitat areas, Essential Fish Habitat, or in other areas important to the survival of fish, invertebrates, sea turtles or marine mammals.

Citations can be found here:

[http://usa.oceana.org/sites/default/files/662/seismic\\_fact\\_sheet\\_long\\_final\\_7-25.pdf](http://usa.oceana.org/sites/default/files/662/seismic_fact_sheet_long_final_7-25.pdf)



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