



### Airgun Impacts with Citations

Recent evidence confirms that the noise from airguns used in seismic operations can have devastating effects on marine mammals. Noise from a single seismic survey can blanket an area of over 300,000 km<sup>2</sup> and raise noise levels 100 times higher than normal on a continuous basis, for days at a time.<sup>1</sup> One recent research study recorded airgun noise almost 4000 km from a survey vessel.<sup>2</sup> The same study found that, in analyzing 10 years of recordings from the Mid-Atlantic Ridge, noises from seismic surveying were present >80% of the days/month for more than twelve consecutive months in some locations.<sup>3</sup>

Airgun noise can harm marine mammals through hearing impairment, physiological changes through stress,<sup>4</sup> behavioral impacts such as avoidance or displacement from important habitats,<sup>5</sup> and masking (when sounds obscure other noises of interest and inhibit an animal's ability to communicate, find prey, or detect predators).<sup>6</sup> For example, one recent

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<sup>1</sup> Marine Mammal Commission, *Marine Mammals and Noise: A Sound Approach to Research and Management*, Appendix 1, Advisory Committee on Acoustic Impacts on Marine Mammals at C-3 (Feb. 1, 2006). (“Seismic noise from eastern Canada measured 3,000 km away in the middle of the Atlantic was the loudest part of the background noise heard underwater.”).

<sup>2</sup> Nieuwkirk, S. L., et al., Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean 1999-2009, *Journal of the Acoustical Society of America*, 131(2): 1102-1112 (2012).

<sup>3</sup> *Id.*

<sup>4</sup> Rolland, R.M., et al., Evidence that ship noise increases stress in right whales, *Proceedings of the Royal Society B: Biological Sciences*, doi:10.1098/rspb.2011.2429 (2012)

<sup>5</sup> Castellote, M. Clark, C.W., Lammers M.O. “Potential negative effects in the reproduction and survival on fin whales (*Balaenoptera physalus*) by shipping and airgun noise.” International Whaling Commission report SC/62/E3 - 2010

<sup>6</sup> Gordon, J., et al., A review of the effects of seismic surveys on marine mammals, *Marine Technology Society Journal*, 37(4): 16–34 (2004); see also Castellote, M., C.W. Clark, and M.O. Lammers, Acoustic and behavioral changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise, *Biological Conservation*, 147: 115-122 (2012) (finding a seismic survey caused extended displacement of fin whales that lasted well beyond the length of the survey); Rolland, R.M., et al., Evidence that ship noise increases stress in right whales, *Proceedings of the Royal Society B: Biological Sciences*, doi:10.1098/rspb.2011.2429 (2012)

study found endangered bowhead whales in the Beaufort Sea significantly dropped their calling rates when exposed to airgun sounds at of at least 116 dB re 1  $\mu$ Pa.<sup>7</sup> Seismic surveys have also been linked to whale mortalities and strandings.<sup>8</sup> In fact, the fatal impacts of noise will often remain undetected – only 2% of all cetacean carcasses are detected, on average.<sup>9</sup> The extreme threat of seismic surveying recently sparked over 30 members of the House and Senate to send letters to President Obama urging his administration to disallow the “dangerous practice” of seismic surveying in the Atlantic Ocean, stating that seismic airguns are “incredibly harmful” and could injure or kill marine mammals and fish.<sup>10</sup>

While seismic airgun surveys are becoming an increasingly large noise footprint of our offshore oil exploration and production activities, we are only recently beginning to understand the wide ranging impacts on marine life and commercial fisheries.



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(indicating that shipping noise along can induce chronic stress in marine mammals); Di Iorio, L., and C. W. Clark, Exposure to seismic survey alters blue whale acoustic communication, *Biology Letters*, doi:10.1098/rsbl.2009.0651 (2009) (finding a low-level seismic “sparker” caused blue whales to modify their vocalizations, likely as a means of compensating for the additional noise); Clark C.W., et al., Acoustic masking in marine ecosystems: intuitions, analysis, and implication, *Marine Ecology Progress Series*, 395: 201-222 (2009) (describing how seismic sounds can cause masking for mysticetes); Miller P.J.O et al., Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico, *Deep-Sea Research I* 56 (7): 1168–1181. doi:10.1016/j.dsr.2009.02.008 (2009) (demonstrating that the effects of airgun noise can be difficult to detect); Parente, C.L., J.P. Araújo, and M.E. Araújo, Diversity of cetaceans as tool in monitoring environmental impacts of seismic surveys, *Biota Neotropical*, 7 (1): 49-55 (2007) (finding a reduction in cetacean species diversity with increasing numbers of seismic surveys despite no significant oceanographic changes during the same period); Stone, C.J. and M.L. Tasker, The effects of seismic airguns on cetaceans in UK waters, *Journal of Cetacean Research and Management*, 8(3): 255-263 (2006) (demonstrating disturbance from seismic surveys); Weller, D.W., et al., Influence of seismic surveys on western gray whales off Sakhalin Island, Russia in 2001, Paper No. SC/54/BRG14 presented to the International Whaling Commission Scientific Committee (2002) (documenting displacement of western gray whales due to seismic surveys); Richardson, W.J., G.W. Miller, and C.R. Greene Jr., Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea, *Journal of the Acoustical Society of America* 106:2281 (1999) (demonstrating that migrating bowhead whales in the Beaufort Sea almost completely avoided airgun sounds).

<sup>7</sup> Blackwell, S.B., et al., Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea, *Marine Mammal Science*, DOI: 10.1111/mms.12001 (2013).

<sup>8</sup> Hildebrand, J.A., Impacts of anthropogenic sound in Reynolds, J.E. et al. (eds.), *Marine mammal research: conservation beyond crisis*. The Johns Hopkins University Press, Baltimore, Maryland, pp. 101-124 (2005); see also Gray, H. and K. Van Waerebeek, Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuata*, in proximity to operating airguns of a geophysical seismic vessel. 19 (6): 363-367 (2011); Mann, D., et al., Hearing loss in stranded odontocete dolphins and whales, *PLoS ONE*, 5(11): e13824. doi:10.1371/journal.pone.0013824 (2010).

<sup>9</sup> Williams, et al., Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. *Conservation Letters* 4: 228–233 (2011).

<sup>10</sup> See, e.g., Letter to President Barack Obama (April 17, 2013); Letter to President Barack Obama from eight U.S. Senators (January 30, 2013).