

September 11, 2018

This letter is in response to a request by the Wilderness Society to evaluate the proposal of SAExploration to conduct a winter seismic exploration survey in the USFWS Arctic National Wildlife Refuge. I am a Full Professor with a research speciality in fish sensory processing and especially the role of anthropogenic noises on fish hearing and communication. The importance of natural and anthropogenic sounds on marine and freshwater organisms has received increasing research interest over the last 15 years and is recognized as a key area of concern for the underwater environment. Important review articles and technical guidelines have been published, especially in the last 5 years (Popper et al. 2014, Nolet 2017, deSoto et al. 2013, McCauley et al. 2017) that have clearly shown detrimental impacts of sonic exploration on marine organisms and it is generally recognized that greater attention must be paid to quantifying sound sources used in exploration and finding ways to minimize impacts. The current proposed survey by SAExploration appears to ignore all this best practice literature.

In the Seismic Exploration Plan, SAExploration proposes to have moveable camps of up to 160 people driving across the frozen areas of the coast with no consideration of what effect this traffic noise will have on the animals living under the ice surface. It is well known that traffic over ice roads transmit high levels of noise into the aquatic environment (Stewart 2001; Mann et al. 2009) and that this noise can disrupt activity of fish living below (Mann et al. 2009, Cott et al. 2012). SAExploration proposes to have large trucks travelling and aircraft landing on the ice surface, certainly disrupting the acoustic soundscape of fish living under these ice sheets. Travel over ice can increase the sound level of the underlying water by up to 50 dB above ambient sound levels and low frequency sounds are especially affected (Mann et al. 2009).

Of potentially greater concern is the effects of the sonic exploration itself. The seismic noise source will be 12-15 wheel-mounted vibrators spread out over a linear distance of 8 miles. These vibrators will emit a frequency of 1.5-96 Hz for durations of 24 sec/sweep. The only indication of sound level is that it is so low that no ear protection is necessary for their workers. This lack of detail on source level is quite worrying and goes against all known guidelines (refs). The fact that the vibrators will direct sound downwards means the transmitted sound level through the ice will greatly exceed the perceived sound level by human observers on the ground and will likely have to be fairly loud for the sound to be transmitted to a receiver. The frequency range provided is well within the hearing range of all fish so will certainly be perceptible and low frequencies such as these can be especially damaging at high intensities. Of particular concern and also unmentioned in the proposal is the particle motion aspect of sound. Sound travels underwater as both a pressure wave and as particle motion and it is the particle motion that directly impacts fish auditory sensory cells. At low frequencies the particle motion will travel further from the source than at higher frequencies so the proposed 1.5-96Hz sound waves would have significant particle accelerations far the source that would be detectable by the fish.



The fish species known to overwinter in the affected area would all be able to hear the projected sound as all can hear low frequencies preferentially (see Mann et al. 2007) and would be expected to be impacted by the projected sounds. There is a wide array of known affects of anthropogenic sounds on fish (see Hawkins & Popper 2016, McCauley et al. 2002, de Soto et al. 2013). Without defined sound levels provided I am unable to assess how precisely the sound might be expected to affect local fishes but previous studies have found effects as mild as fish avoiding the area up to and included physical damage and death of fishes (e.g. McCauley et al. 2002, Popper et al. 2014, Mickle & Higgs 2017). The large amounts of activity in the current proposal would likely have negative impacts on the fish in the area under the ice but without much more detail on sound levels and sources it is impossible to judge how extensive these impacts would be.

References

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Sincerely,



Department of Biological Sciences



Dennis M. Higgs, PhD.
Professor and Head
Department of Biological Sciences
University of Windsor
e-mail: dhiggs@uwindsor.ca
phone: 519-253-3000 ext. 4771

