Variance request to allow for the use of targeted acoustic startle technology (TAST) on ASC certified farms

We have applied previously for another VR (VR 259) regarding criteria 2.5.1 at one of our farms, Rensoya N, which is ASC certified. This VR is still under assessment, but in support of it and in an attempt to find a solution to the animal welfare and salmon health issues related to the presence of seals around our farms, we have been investigating various alternative, non-lethal means to deter seals.

We appreciate the ASC’s goals of environmental protection and healthy fish. ASC specifically prohibits the use of acoustic deterrence devices by certified farms under Standard 2.5.1. The newly available targeted acoustic startle technology (TAST) promotes both environmental protection and healthy fish; and we seek a variance to use TAST as a predator deterrent on ASC certified farms.

TAST was initially developed by researchers at the University of St. Andrews, and subsequently in conjunction with GenusWave. We have studied compelling research regarding the use of TAST which show that it offers a significant advance over traditional ADDs/AHDs.

TAST harnesses the acoustic startle reflex, which has been shown to induce avoidance behavior without a decrease in responsiveness over time in the majority of tested seals (Götz and Janik 2011). This approach only requires low noise doses by using:

- brief, isolated sound pulses that are
- emitted at significantly lower duty cycles and
- lower source levels compared to ADDs.

Target-specificity is achieved by choosing a frequency band where hearing sensitivity in the target-species (seals) is higher than in non-target species (porpoise & dolphins).

This method has been shown to be successful in deterring seals from a fish farm while not adversely affecting the behavior and distribution of harbor porpoise (Götz and Janik 2015). The effect on seals was limited to a confined area around the fish farm of less than 250m.

Equally important is the long-term success of the deterrence. Target mammals do not habituate to TAST. Instead, repeated exposure increases animal responsiveness.

In a consecutive study, a startle-reflex based system reduced seal predation by ~91-97% on a fish farm over the course of one year while operating at a duty cycle of only 1% (Janik & Götz
The device tested in this study emitted a noise dose that was more than one order of magnitude (more than factor 10) lower than any ADD. The 2nd study also replicated the previous result, i.e. that harbor porpoise distribution around the fish farm remained the same during control and test periods.

There is therefore no risk of hearing damage associated with this method when considering realistic exposure scenarios (see discussion and supplementary material).

As we previously mentioned in VR 259, Nordland County (where all our farms are located) has the highest estimated population of harbor seals (Phoca vitulina) in the whole of Norway. A study from the Norwegian Institute of Marine Research (Havforskningsinstituttet) found that 1.5 times more seals are estimated to live here than in the county with the second highest estimated population (Nilsen and Bjørge 2015). We have previously documented and informed the ASC of numerous instances of seals in close proximity to our farms, in some cases leading to panic swimming and other stress induced reactions from the salmon.

Using the TAST device will keep the seals away from our salmon which will provide our salmon with a more tranquil, less stressful and healthier environment.

TAST is more aptly described as an ASD (acoustic startle device), not an ADD, due its different approach and acoustic emission pattern. The TAST approach allows the:

- noise dose to be lowered dramatically,
- effects on non-target species (harbor porpoise) to be mitigated,
- avoidance of harm to the target mammal.

As a result, TAST achieves fish and mammal health as well as environmental compliance.

Therefore, instead of requesting permission to use an ADD, we are requesting the inclusion of this ASD in the allowed predator control measures. The justification is based on the fact that the TAST ASD is the only acoustic predator control solution available on the market whose efficacy and environmental compliance has been documented in peer-reviewed papers in the scientific literature.

TAST has been implemented in an industrial prototype and is available for use on fish farms as ‘SalmonSafe’ marketed through GenusWave ltd. (www.Genuswave.com).

It is also important to note that TAST will enable us to comply with Norwegian law. Norwegian law requires us to reduce stress on our salmon from predators (akvakulturdriftsforskriften, §30).

We believe that TAST is the only viable solution that provides improved welfare and health for our salmon. TAST avoids unnecessary stress (as required by Norwegian law (akvakulturdriftsforskriften, §30)) and avoids impact on other wildlife.

We therefore request the ASC’s approval for the use of targeted acoustic startle technology on ASC certified farms.

Regards,
Samuel Anderson
Environmental Adviser
References


Appendix 1: Supplemenary material (abstracts of relevant papers)


Abstract:

Carnivore depredation on human livestock is a worldwide problem with few viable solutions. Non-lethal management tools such as acoustic devices show highly varying success and often pose a conservation risk due to noise pollution and habitat degradation. We tested the long-term effectiveness of a deterrence system which harnesses an autonomous reflex (startle) to selectively inflict avoidance responses in a target species (phocid seals) by emitting band-limited noise pulses with sharp onset times. Seal predation was monitored at a marine salmon farm (test site) over a full production cycle (19 month) with a multi-transducer deterrent system deployed for the final year. Predation was also monitored for several months at two control sites and additional short-term tests were carried out at sites which suffered higher predation rates. Generalized linear (mixed) models revealed that sound exposure caused a 91% reduction in lost fish when comparing predation levels within the test site and 97% when comparing the test site against both control sites. Similarly, sound exposure led to a 93% reduction in the number of fish lost due to seal damage at a short-term test site. Visual monitoring of marine mammals around the long-term test site showed that the number of seal surfacings within 100 m from the loudspeakers was only slightly lower during sound exposure. Harbor porpoise and otter distribution around the farm was not affected by sound exposure. By adjusting the frequency composition of startle stimuli, our method has the potential to provide solutions for managing human–wildlife conflicts in terrestrial and marine habitats by selectively deterring target species


Acoustic deterrent devices (ADDs) have often been considered a benign solution to managing pinniped predation. However, ADDs have also been highlighted as a conservation concern since they can inflict large-scale habitat exclusion in toothed whales (odontocetes). We tested a new method that selectively inflicted startle responses in harbor seals (Phoca vitulina) at close ranges to the loudspeaker but not in a non-target species, the harbor porpoise (Phocoena phocoena), by using a frequency range where porpoise hearing was less sensitive than that of phocid seals. The sound exposure consisted of isolated 200 ms long, 2–3 octave-band noise pulses with a peak frequency of 1 kHz, which were presented at a source level of ~180 dB re 1 Pa. Field tests were carried out within a 2-month period on a fish farm on the west coast of Scotland where marine mammal behavior was observed within three distance categories. Seal numbers dropped sharply during sound exposure compared with control observation periods within 250 m of the sound source but were unaffected at distances further away from the farm. A Poisson regression model revealed that the number of seal tracks within 250 m of the device decreased by ~91% during sound exposure and was primarily influenced by sound exposure with no evidence for a change in the effect of treatment such as habituation, throughout the experiment. In contrast to seals, there was no shift in the number of porpoise groups in each distance category as a result of sound exposure and porpoises were regularly seen close to the device. We also sighted six common minke whales during sound exposure while only one was seen during control periods. Our data demonstrate that the startle method can be used to selectively deter seals without affecting porpoises.
Acoustic deterrent devices (ADDs) to prevent pinniped predation on fish farms and fisheries are widely used but show highly varying success. Recently, ADDs have also been highlighted as a conservation concern due to their adverse impact on toothed whales. We review the available literature on the efficiency of commercial ADDs, evaluate the unintended impact on behavior, communication and hearing of marine life, and suggest solutions based on psychophysiological predictions. The main problems associated with ADDs are a lack of long-term efficiency, introduction of substantial noise pollution to the marine environment and long-term effects on target and non-target species. Odontocetes have more sensitive hearing than pinnipeds at the frequencies where most ADDs operate, which may explain the reported large-scale habitat exclusion of odontocetes when ADDs are used. Furthermore, long-term exposure to ADDs may damage the hearing of marine mammals. Fish and invertebrates have less sensitive hearing than marine mammals and fewer efforts have been made to quantify the effects of noise on these taxa. Solutions can be found by decreasing sound exposure, exploiting neuronal reflex arcs associated with flight behavior and making use of differences in species’ hearing abilities to increase target specificity. To minimize adverse effects, environmental impact assessments should be carried out before deploying ADDs and only effective and target-specific devices should be used.
Appendix 2: Translation of chapter 3, section 30 of the Norwegian Law on Aquaculture Facilities (Forskrift om drift av akvakulturanlegg (akvakulturdriftsforskriften))

**Original text**

§ 30.Predatorer, alger og maneter

Ved vesentlig fare for skade eller unødige påkjenninger fra predatorer, alger eller maneter skal det iverksettes tiltak som sikrer et forsvarlig fiskehold.

**English translation**

§ 30.Predators, algae and jellyfish

Steps should be taken to ensure for sound fishery conditions in the event of considerable danger for injury or unnecessary stress from predators, algae or jellyfish.