Ambient soundscape of grey whale feeding grounds in British Columbia, Canada

Jennifer Wladichuk[1], William Megill[2], Philippe Blondel[3]

[1]JASCO Applied Sciences, 2305 - 4464 Markham Street, Victoria, BC, Canada jennifer.wladichuk@jasco.com

[2]Bionics Department, Rhine-Waal University of Applied Sciences, Kleve, Germany

[3]Physics Department, University of Bath, Bath, UK

Abstract: The aim of this research is to investigate and quantify the ambient soundscape as it applies to marine mammals, specifically grey whales (*Eschrichtius robustus)*. The use of vision is restricted underwater yet marine mammals are still able to navigate and find food without any noticeable difficulties. The use of sound, therefore, plays a key role in their survival. Our work focused specifically on grey whales due to their close association with the shallow water environment where there is a variety of environmental acoustic cues present. We examined their feeding grounds along the central coast of B.C., Canada, principally looking at how kelp beds effect the soundscape given their affiliation with grey whales. We also investigated the acoustic characteristics of surf noise on different sediment types. An ambient sound map was produced for a common feeding bay, highlighting acoustic bright and dark spots.

Figure 1. Grey whale feeding in kelp beds (left), diversity of fauna live near kelp gardens (right).

Methods: (1) An over-the-side (OTS) hydrophone deployed from a kayak was used to make ambient noise recordings at the edge of kelp beds and in open water to investigate whether kelp beds produce higher sound levels than background ambient noise.
(2) An underwater speaker was used to emit a broadband signal through kelp beds to examine how the signal is attenuated.
(3) The OTS system was used to record the surf noise on two different shore types – sandy and mixed-sized sediment.

Kelp beds as an acoustic shadow

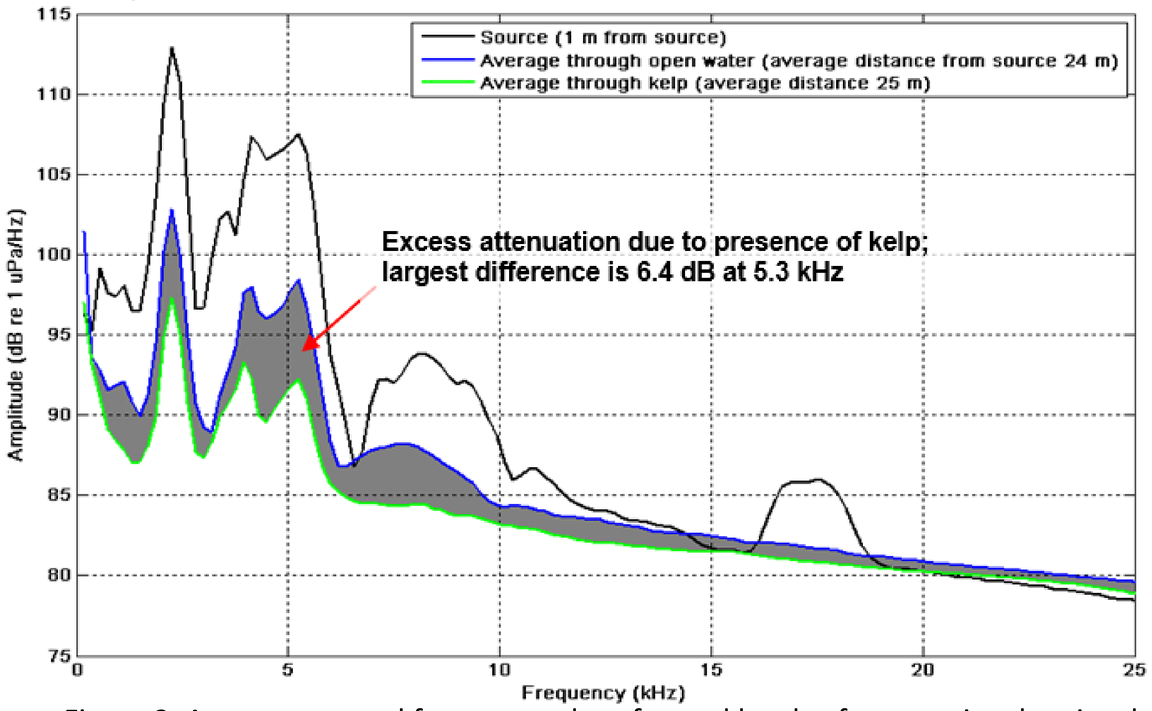

Figure 3. Average spectral frequency plot of sound levels of source signal emitted through kelp beds (black), received levels from 24 m transmission in open shallow water (blue), received levels from 25 m transmission through kelp (green).

Kelp beds as an acoustic source

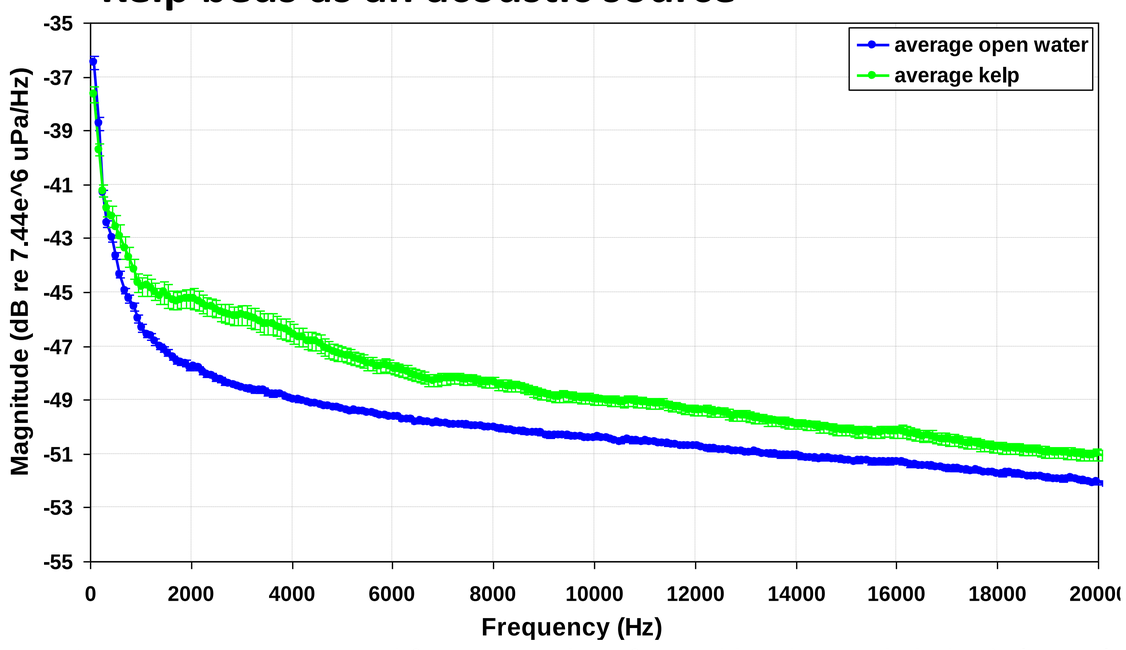

Figure 2. Average spectral frequency plot of sound levels near kelp beds (green) and in open shallow water (blue).

Spectral levels of surf on different shore types

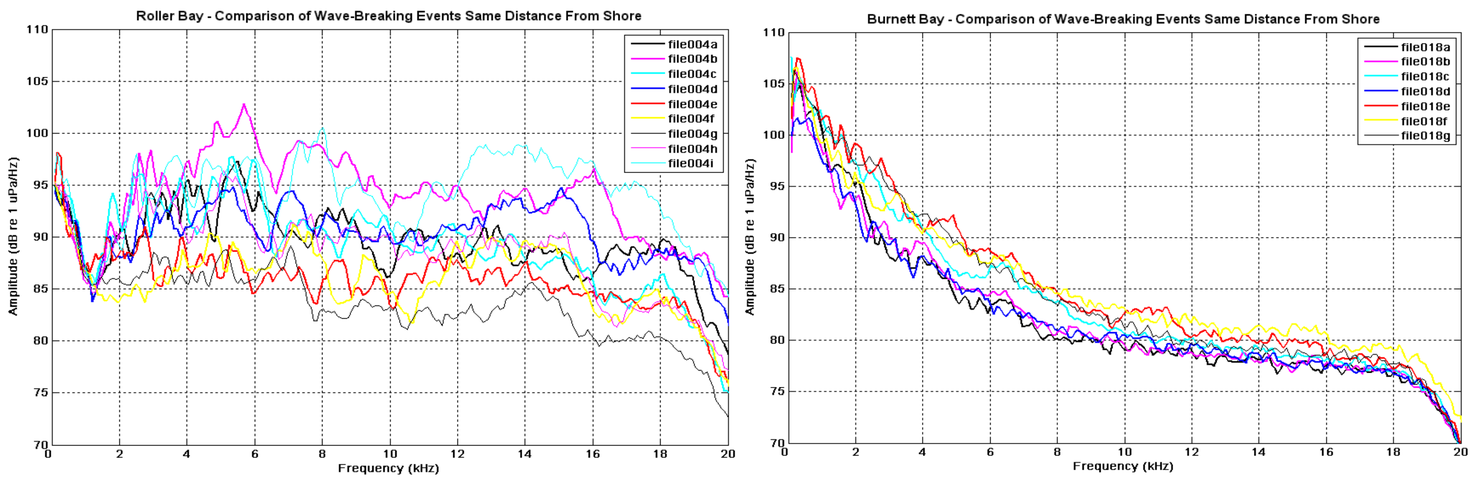

Figure 4. Frequency plot of received sound levels of surf noise on mixed sediment shore (left), fine sand beach (right).

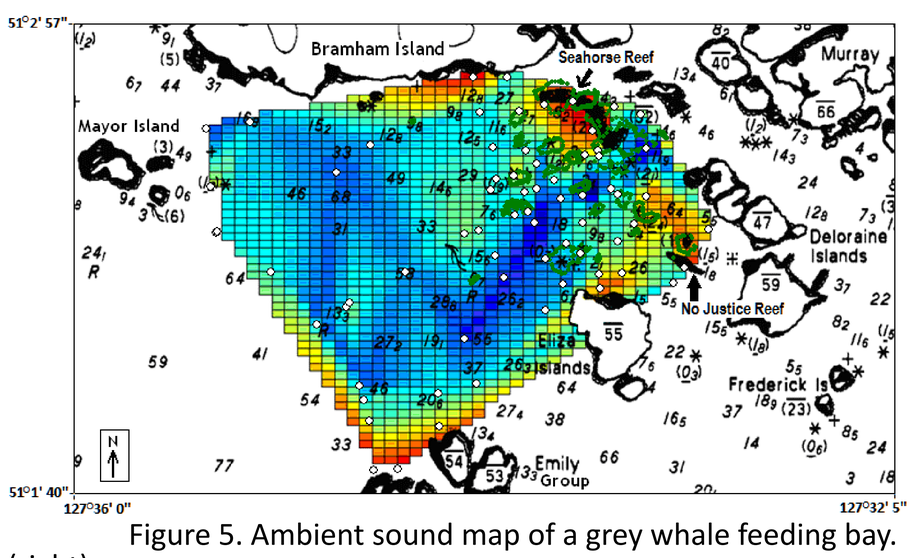

Figure 5. Ambient sound map of a grey whale feeding bay.

Conclusion: Kelp beds act as both an acoustic source (maximum increase in sound levels was 3 dB at 3.1 kHz) and they also create acoustic shadows due to scattering by air-filled stipes (maximum decrease was 6.4 dB at 5.3 kHz). The frequency composition of surf noise can indicate the shore type (broadband signature for mixed sediments and peak at 1.1 kHz for sandy shore). The ambient sound map of a feeding bay highlights the acoustic bright and dark spots revealing cues which the whales could use to aid navigation.