Anthropogenic noise and blue whales in the Gulf of Corcovado, Chile

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Introduction

Blue whales (*Balaenoptera musculus spp.*) are currently listed as endangered on the IUCN Red List of Threatened Species. The Chiloé-Corcovado region in Chile is one of the most important areas in the Southern Hemisphere for blue whales since it functions as a feeding and nursing ground. However, ship traffic has increased considerably in this area during the last decade and noise pollution is a major concern. Between January 2012 and April 2013, six Marine Autonomous Recording Units (MARUs) were deployed at four different locations (Northwest Chiloé, Guafo North, Tic Toc Bay and Locos Islet; Figure 1) to study how noise may be affecting Chilean blue whales.

Main Question

How does anthropogenic noise influence Chilean blue whale communication?

Study area

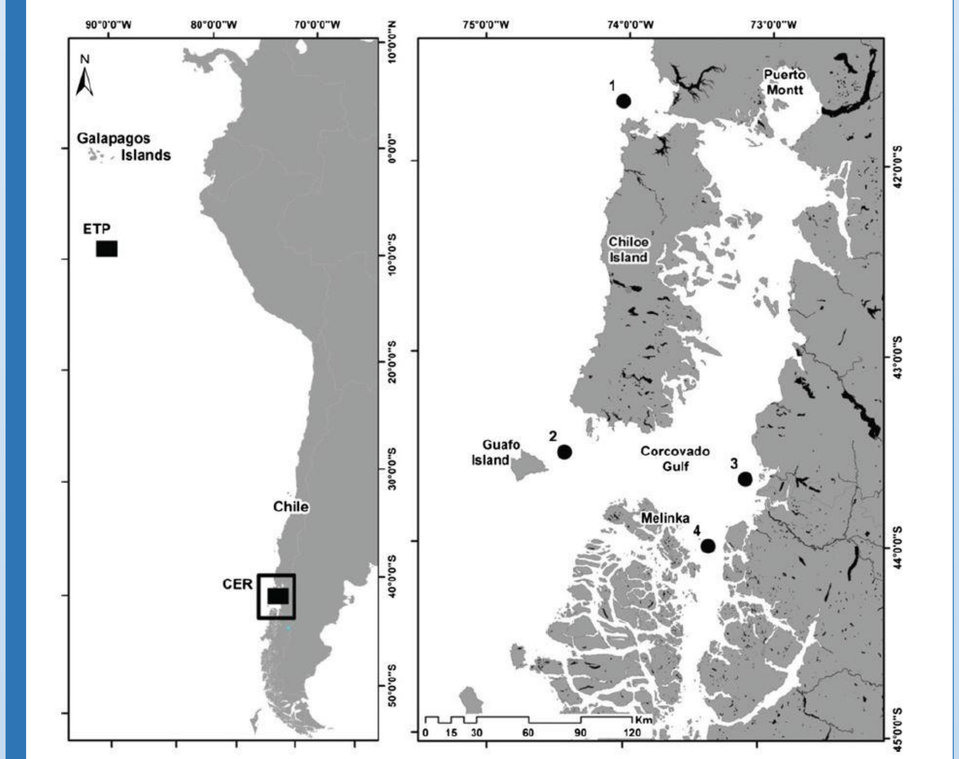

Figure 1: Map showing the four deployment locations in the CER (Chiloense Ecoregion):1. Northwest Chiloe, 2. Guafo North, 3. Tic Toc Bay, and 4. Locos Islet. (ETP: Eastern Tropical Pacific). **Source:** Buchan *et al.*, 2014a

Methods

The custom software program Triton (Wiggins et al. 2010) was used to produce Long-Term Spectral Average (LTSA) plots (5 s temporal and 10 Hz frequency resolution). These plots were used to manually count the number of calls produced by blue whales and to note the duration of anthropogenic noise events. In order to get a more detailed view, a spectrogram window was opened of 180 s by 500 Hz (FFT length of 1000 with 75 % overlap; 2.2 Hz resolution). Three main noise types were recognized (Figure 2), although only type 3 (ship noise) was considered for this study. Three different kinds of blue whale calls were distinguished: SEP1 and SEP2 (Buchan *et al.*, 2014b; see also poster by Wood et al.), and Antarctic blue whale "Z calls" (Rankin et al. 2005).

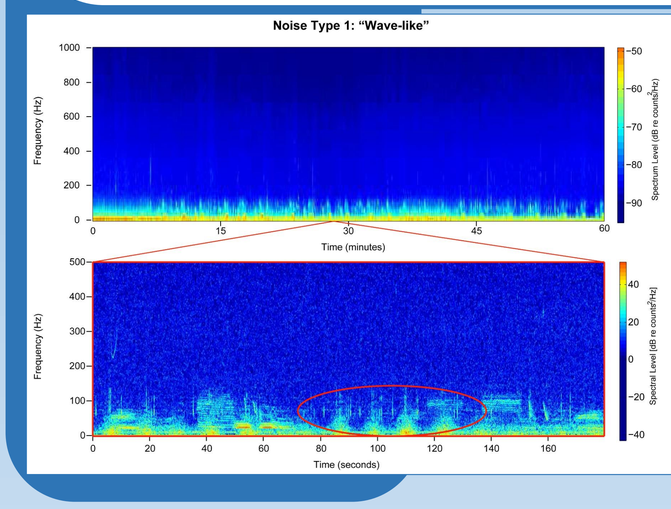

Figure 2: The three main noise types, each shown in two different time scales: minutes and seconds

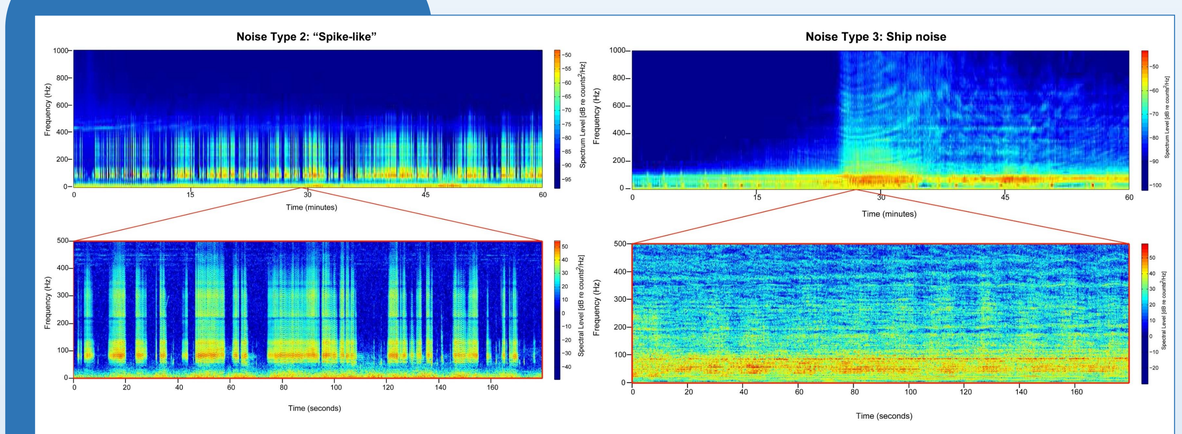

Figure 2 (cont.): The three main noise types, each shown in two different time scales: minutes and seconds

Results & Discussion

Preliminary analysis of data from January and February 2012 from Northwest Chiloé (Figure 1), shows respective daily averages of 18 and 61 SEP 1 phrases and 118 and 705 SEP 2 phrases. During the last week of February, there were noticeably more SEP1 and SEP 2 vocalizations (daily averages of SEP1 and SEP 2 calls for the last 7 days were 156 and 1014 respectively). Calls of Antarctic blue whales were more prevalent than those of Chilean blue whales in January (averaging 135 calls/day), but were no longer detected in February, suggesting that these whales were migrating through the area.

The upper panel of Figure 3 shows daily variation in Chilean blue whale vocalizations for the first week (left) and second week (right) of February, as well as the prevalence of ship noise that could potentially mask blue whale calls. In February, 26% of all calls were at least partially masked during the first week and 30% during the second week. In addition, the lack of call detections during some time periods (e.g., top panel of upper right figure) may have been due to masking by ship noise rendering detection impossible.

The lower panel shows averages of all blue whale calls for both analyzed months with respect to time of day. No day/night patterns were observed.

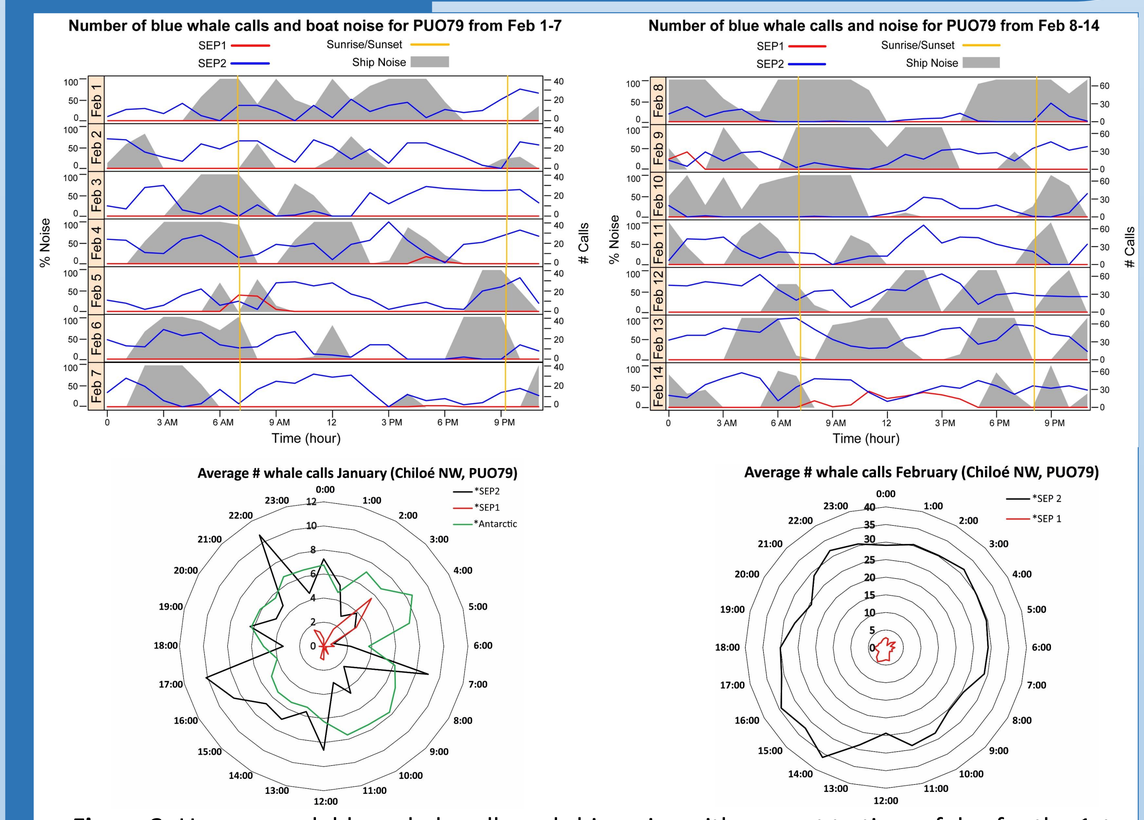

Figure 3: Upper panel: blue whale calls and ship noise with respect to time of day for the 1st (left) and 2nd (right) weeks of February. The percentage of noise indicates the number of minutes in one hour during which there was noise that at least partially masked blue whale calls. Lower panel: average numbers of the three different types of blue whale calls for January (left) and February (right) with respect to time of day.

References

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Acknowledgments

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