# Acoustically Advertising Male Harbour Seals in Southeast Alaska Do Not Make Biologically Relevant Acoustic Adjustments in the Presence of Vessel Noise

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**Supplemental Materials**

**Model Comparison Table and AIC values**



Model comparison with AIC values, estimates, and confidence intervals for each call parameter. Selected models appear in bold. Models were considered ecologically significant if the estimated parameters exceeded spectrogram and/or instrument resolution. All models assumed a gaussian distribution with a linear link function.

**Supplemental Figures for Model Assessment and Validation**

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Figure 1- Histogram of residuals, and scatterplot of residuals versus fitted values used for duration model validation.

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Figure 2- Histogram of residuals, and scatterplot of residuals versus fitted values used for duration model validation.

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Figure 3- Histogram of residuals, and scatterplot of residuals versus fitted values used for pulse duration model validation.

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Figure 4- Histogram of residuals, and scatterplot of residuals versus fitted values used for source level model validation.

Visual inspection of the data revealed several outliers in the source level dataset. Outliers were removed from the dataset and the modeling processes was repeated with no appreciable differences in results. The observed relationship between call source level and ambient noise fell below the threshold for instrument error (0.13 dB increase in source level for ever 1 dB increase in noise, 95% CI=0.13-0.2 dB) for models where outliers were omitted, and were functionally identical to models that included the full dataset. To more fully describe the ecological variability in the data, the entire dataset with the outlier observations was included in the full analysis.

**Methodological Supplement: Localization and Noise Values**

All harbour seal roars in this study were documented during the monts of June and July and localized using the program RavenPro 2.0 (Cornell Lab of Ornithology) using the near-field beamforming method. The near beamforming method searches for the set of time of arrival delays that give maximum power from the beamformer output (Hawthorne and Salisbury, 2016). We selected a simulated annealing algorithm to determine the point in space that generated maximum power for each call and a sound speed of 1481 m/s based on CTD casts done in the study area. Sound speed profiles did vary slightly over time, however the choice of a sound speed (range 1472–1481m/s) had a negligible impact on source level estimates (<1dB). We selected the sound speed that corresponded to the oceanographic conditions in 2015 was selected. We used Bartlett’s estimate the variance of the energy output from the beamformer, which resulted in error values for the northern and eastern bearings for each call. To select for the highest quality calls, only calls that were localized to the array center, with an error less than 100 m and a signal-to-noise ratio (SNR) of 6 dB or higher, were included in analysis. The locator tool was ground truthed by comparing the localization output for sounds intentionally produced on a nearby vessel which was recording second by second locations with a fine-scale GPS.

Noise values in this study were fairly ubiquitous throughout the study area; however, to minimize discrepancies between the noise an animal experienced and the noise recorded by the hydrophones, both received levels and noise values included in analysis were extracted from the hydrophone nearest to the calling seal. Initial data exploration did not find significant differences in ambient noise levels between hydrophones at the scale of this study. Additionally, only animals which were localized to within the 1 km hydrophone array were included in this study, which minimizes the likelihood of ambient noise levels varying between the seal and the hydrophone.

**References**:

Hawthorne DL, Salisbury DP. 2016. Passive acoustic localization of North Atlantic Right Whales using a modified near-field Bartlett beamformer. J. Acous. Soc. Am. 140(4), 3181.