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TITLE: Seismic Surveys Negatively Affect Humpback Whale Singing Activity off Northern Angola

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ABSTRACT:

Passive acoustic monitoring was used to document the presence of singing humpback whales off the coast of Northern Angola, and opportunistically test for the effect of seismic survey activity in the vicinity on the number of singing whales. Two Marine Autonomous Recording Units (MARUs) were deployed between March and December 2008 in the offshore environment. Song was first heard in mid June and continued through the remaining duration of the study. Seismic survey activity was heard regularly during two separate periods, consistently throughout July and intermittently in mid-October/November. Numbers of singers were counted during the first ten minutes of every hour for the period from 24 May to 1 December, and Generalized Additive Mixed Models (GAMMs) were used to assess the effect of survey day (seasonality), hour (diel variation), moon phase and received levels of seismic survey pulses (measured from a single pulse during each ten-minute sampled period) on singer number. Application of GAMMs indicated significant seasonal variation, which was the most pronounced effect when assessing the full dataset across the entire season ($p<0.001$); however seasonality almost entirely dropped out of top-ranked models when applied to a reduced dataset during the July period of seismic survey activity. Diel variation was significant in both the full and reduced datasets (from $p<0.01$ to $p<0.05$) and often included in the top-ranked models. The number of singers significantly decreased with increasing received level of seismic survey pulses (from $p<0.01$ to $p<0.05$); this explanatory variable was included among the top ranked models for one MARU in the full dataset and both MARUs in the reduced dataset. This suggests that the breeding display of humpback whales is disrupted by seismic survey activity, and thus merits further attention and study, and potentially conservation action in the case of sensitive breeding populations.

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