Quantifying the response of Blainville's beaked whales to Naval sonar exercises in Hawaii

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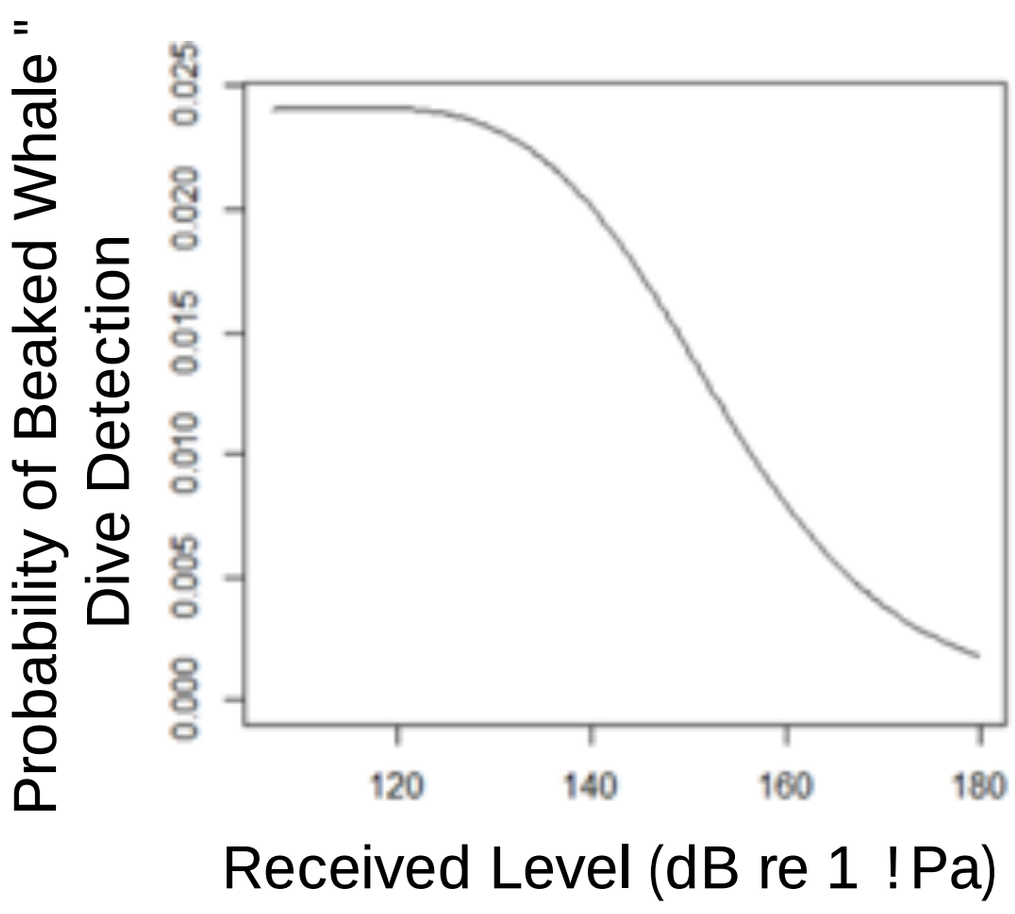
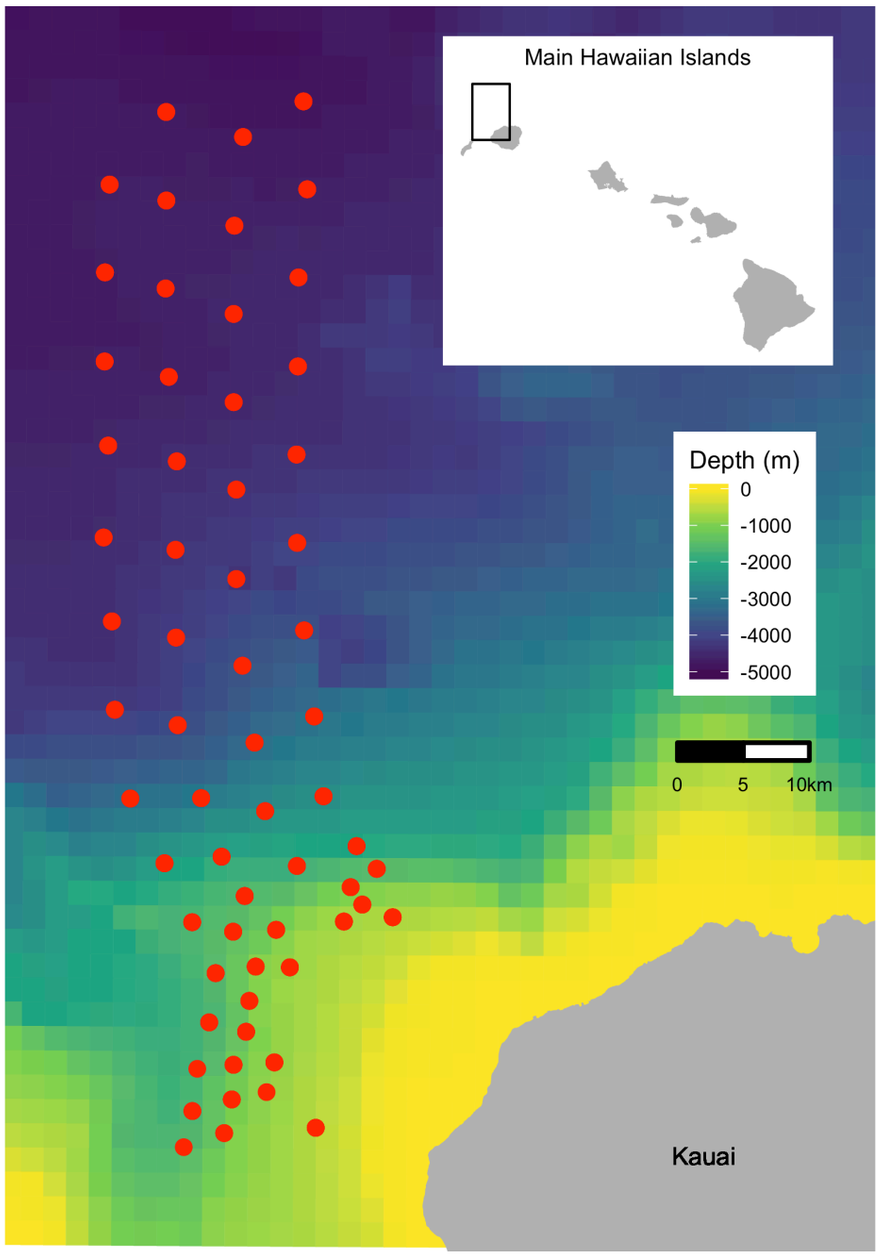
Motivation

Goal was to develop a behavioral dose-response function for Blainville's beaked whales in Hawaii

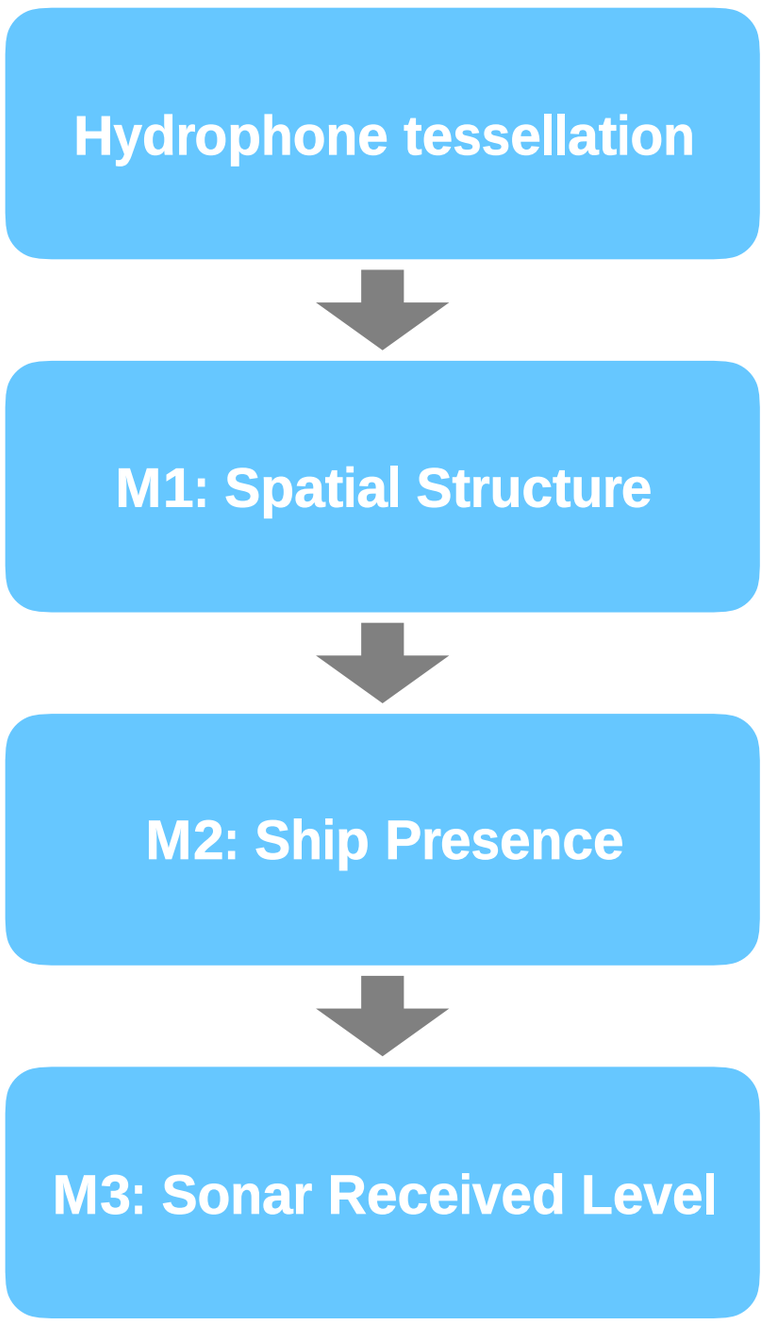


Data

- 62 hydrophones NW of Kauai"
- Data from before and during six training events over three years"
- For each hydrophone and each 30-min period:"
  - Beaked whale presence*"
  - Ship presence/absence "
  - Sonar received levels"
  - N = 190,928



Approach



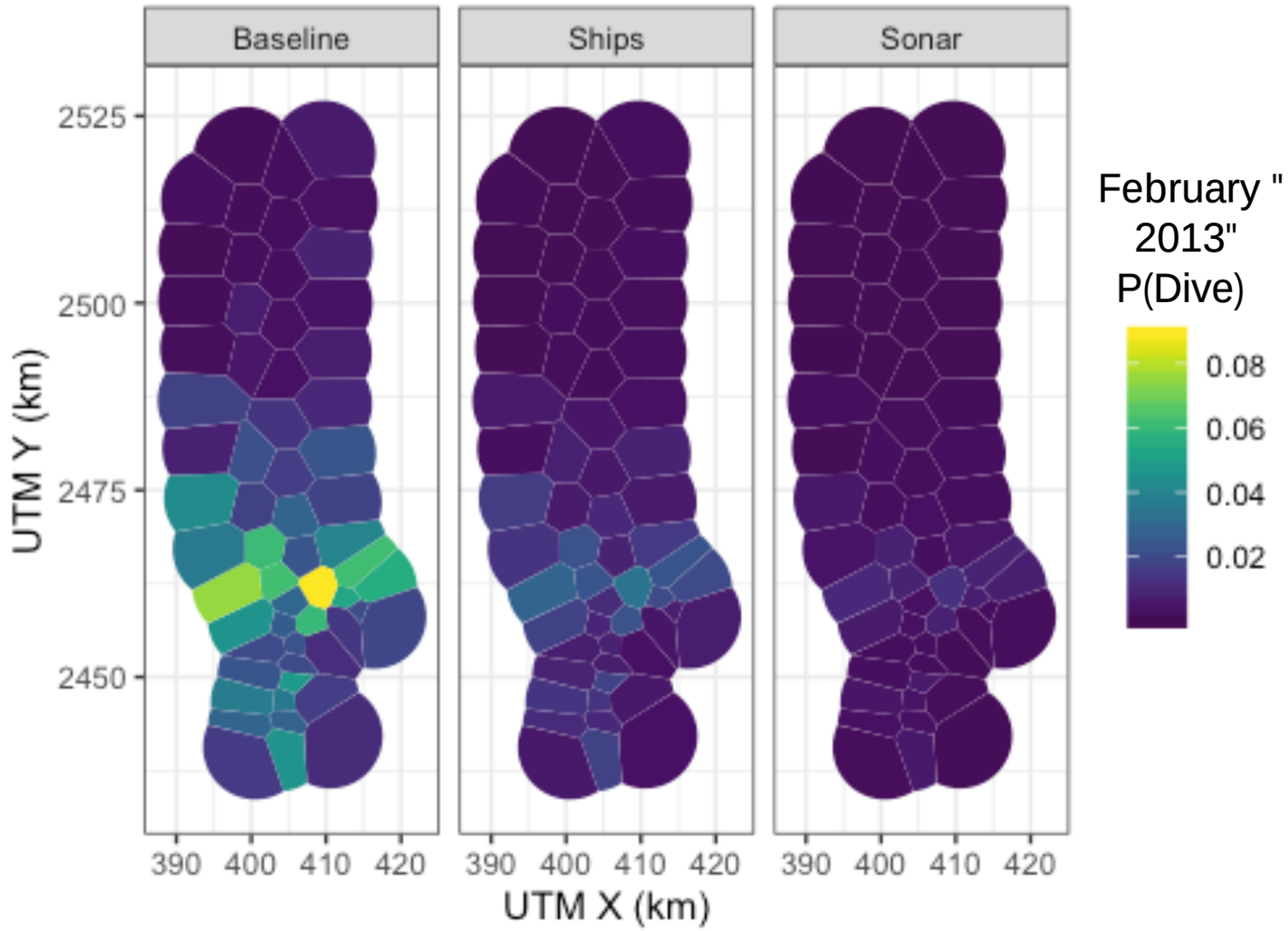
Needed to account for spatial correlations between animal density and sonar intensity"

Used a multi-stage GAM modelling approach to isolate the e$ect of sonar"

The output of each model was used as an o$set in the next"

Bootstrapped to propagate uncertainty through models

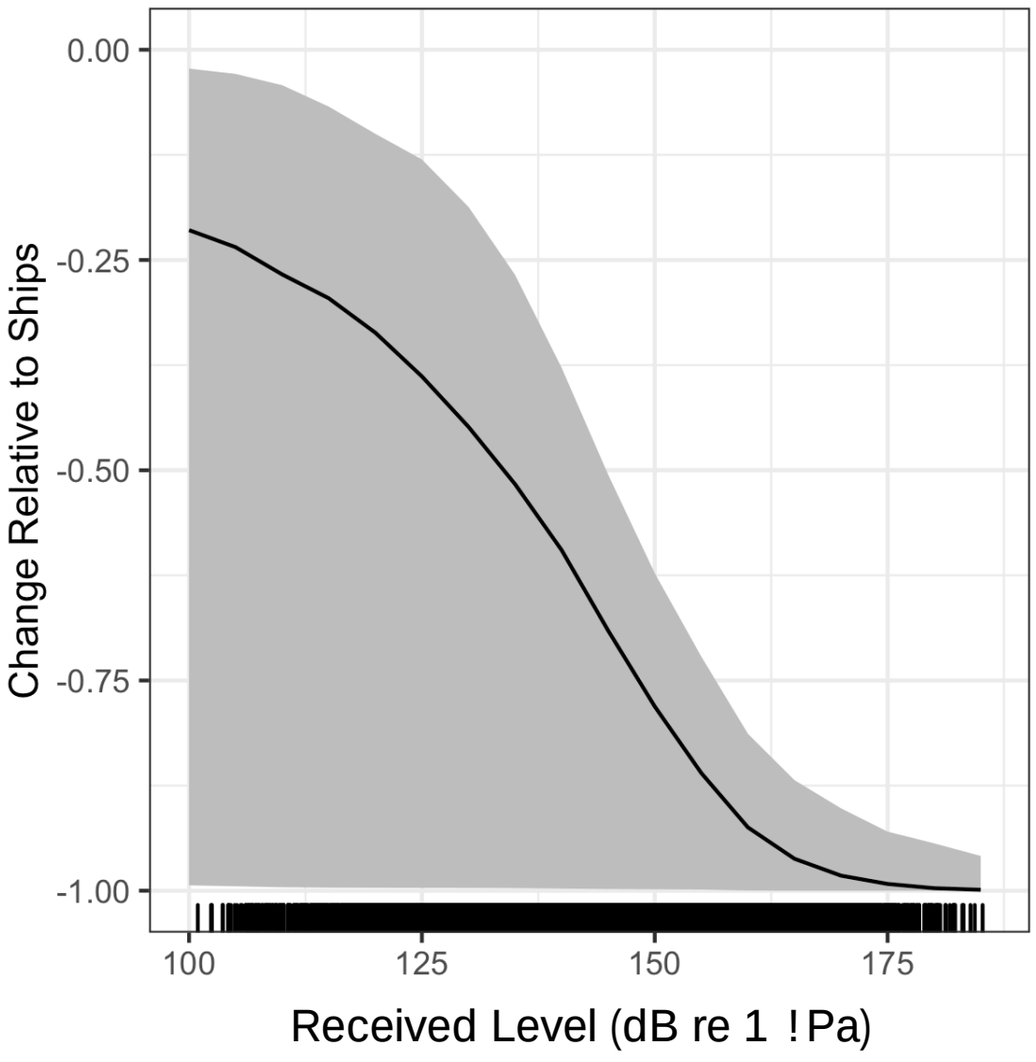
Results

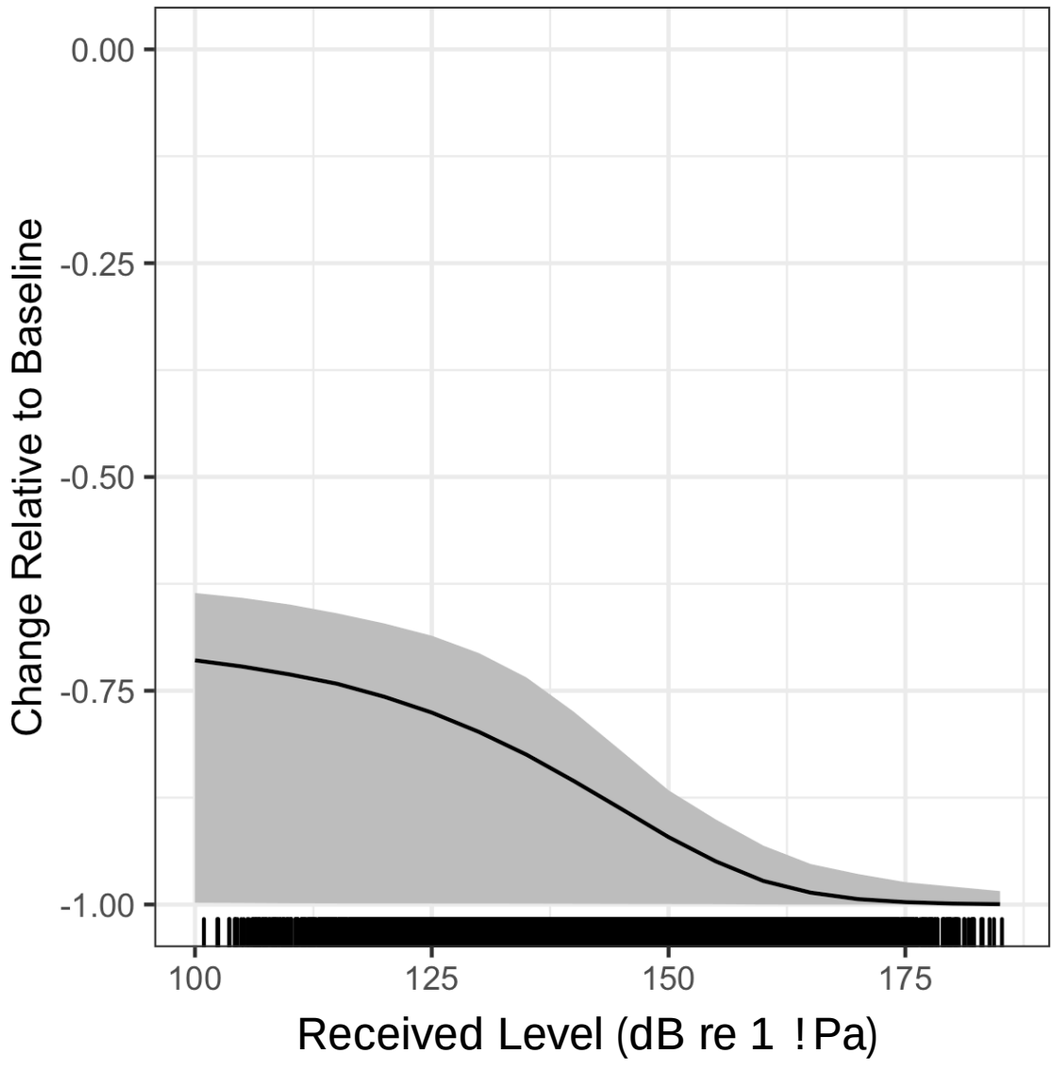


Ship presence results in 64% (95% CI 59-68%) reduction in probability of beaked whale detection relative to baseline

Results

Sonar received level of 150 dB re 1 ！Pa results in 78% (95% CI 62%-100%) reduction relative to when ships are present, but 92% (95% CI 87%-100%) reduction relative to baseline





Conclusions

- Animals are responding to stimuli other than active sonar"
  - Need to investigate possible mechanisms for observed response to ship presence"
  - Periods when ships are present should not be used as control periods"
- Probability of dive presence decreased by >50% relative to baseline with any level of sonar exposure