



# Do Dolphins Have The Cocktail Party Effect?: Cognitive Mitigation of Masking Effects from Anthropogenic Noise in Bottlenose Dolphin Signature Whistles

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## Introduction

Humans experience the "Cocktail Party Effect", which is the ability to hear and react to their own name or other relevant details through a loud background noise, such as a party.

Common bottlenose dolphins (*Tursiops truncatus*) are the only non-human species known to use representational names, known as signature whistles (Caldwell, Caldwell and Tyack, 1990; Bruck et. al., 2022, Bruck and Pack, 2022).

Anthropogenic noise from boats and jet skis can disrupt dolphin communication, especially between mothers and calves, risking separation and hindering the calves' learning of vital skills like hunting (Janik et. al., 1994).

Knowing bottlenose dolphins have their own version of a name, do they perceive and react to those names similarly to humans? Do they have the "Cocktail Party Effect"? Does anthropogenic noise effect their ability to communicate?

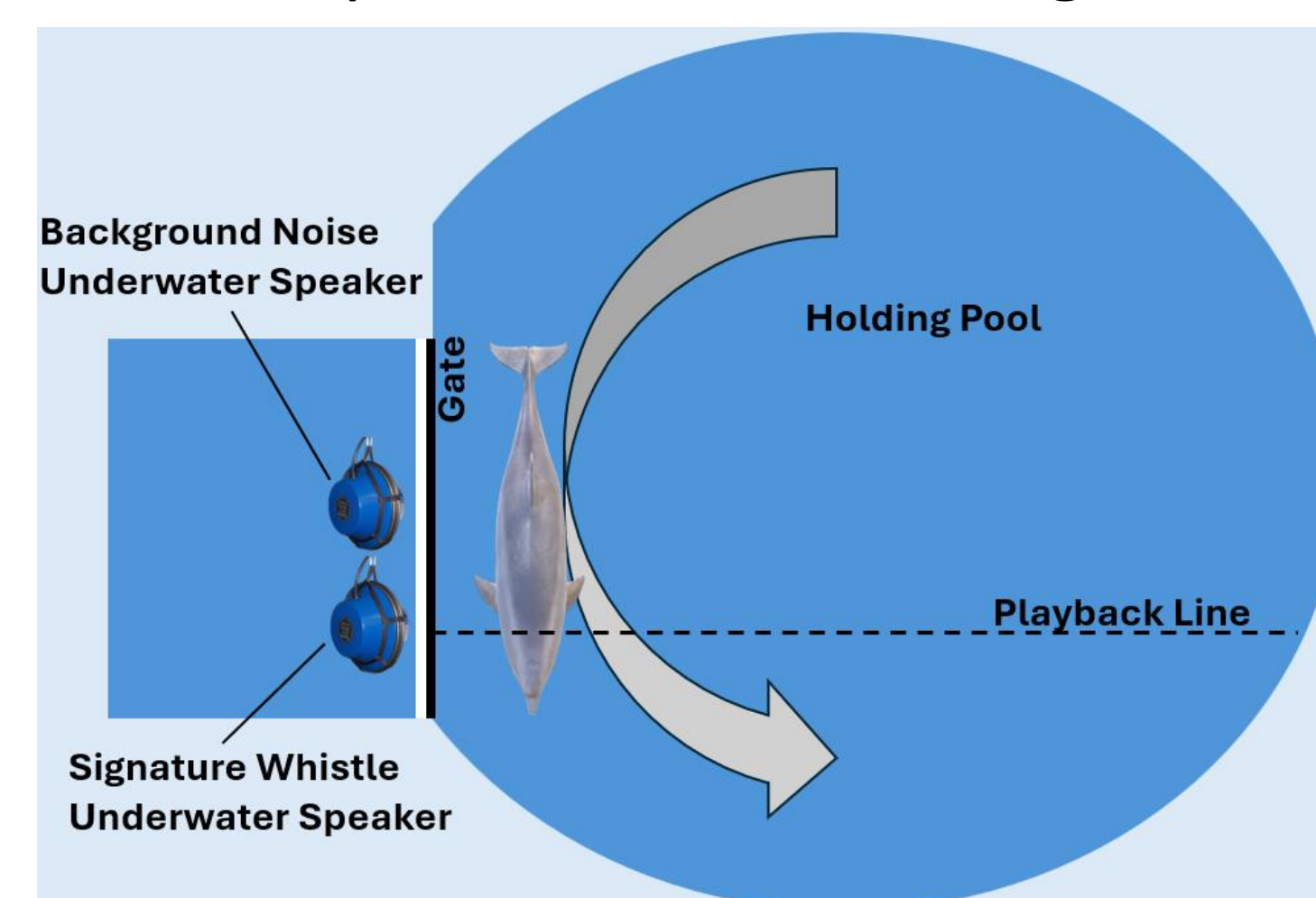
## Methods

This study utilized a total of 27 dolphins, ages 5 to 40 years old, split between the Georgia Aquarium and Dolphin Quest.

Underwater playbacks were conducted using two Lubell LL16 speakers and SQ-26-H1 hydrophones; one speaker played background noise, the other played whistles (Figure 1).

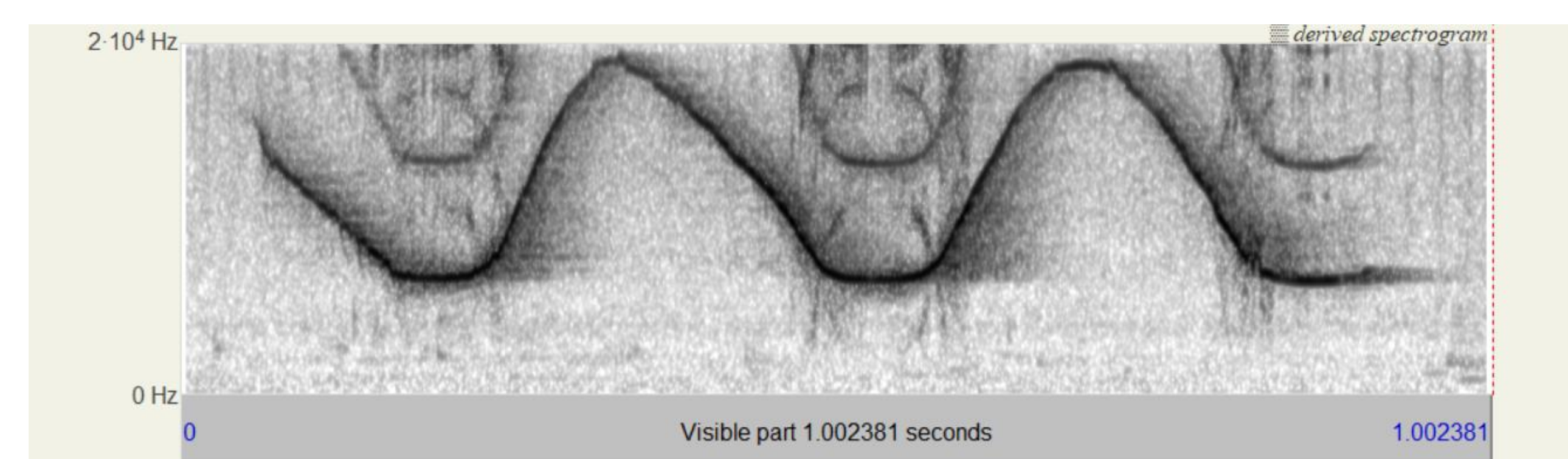
- Three different types of signature whistles: familiar, unfamiliar, and self (with a control 10 kHz used as a baseline)
- Three different types of background noise: ambient noise (no noise), white noise (higher frequency), and cruise ship (lower frequency)
- All sounds were calibrated to a reference amplitude of 84 dB using a ST600 SoundTrap.

**Figure 1. Illustration of playback protocol.** Two underwater speakers are placed behind a gate with one playing noise and the other whistles. Whistle playbacks are triggered when subject swims past the speaker crossing the imaginary "playback line".



All auditory and behavioral responses were recorded during the initial playback. Independent scorers later analyzed audio using Raven Pro 1.6.5 to identify whistles, echolocation, and burst pulses (Figure 2) and behavior using BORIS 8.27.1 (Behavioral Observation Research Interactive Software) (Figure 3).

## Methods cont.



**Figure 2.** Spectrogram of dolphin signature whistle (x axis =time, 3 seconds; y axis = frequency, 0-50 kHz)



**Figure 3.** Dolphin response level 3 to a playback of a familiar whistle through cruise ship noise at Dolphin Quest Hawaii.

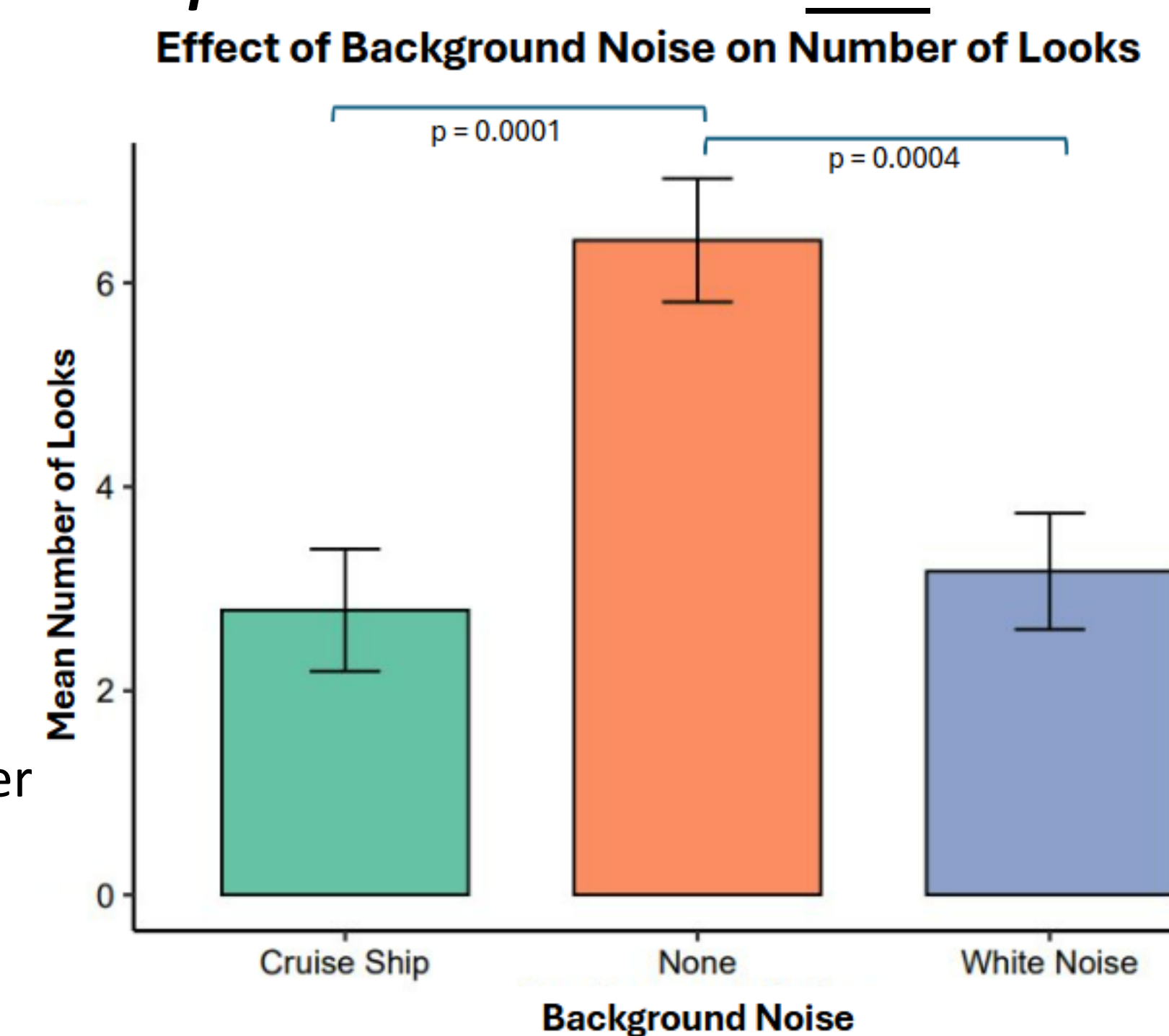
## Results

Results here are based on data from 13 Dolphin Quest Hawaii animals (5:8). A GLMM was run in RStudio version R.4.4.3 with a negative binomial error distribution with subject as a random effect and all other variables fixed.

### Does noise impact dolphin communication? **YES**

The number of looks in response to playbacks was significantly lower during both background noises when compared to no noise ( $p = 0.0001$  and  $p = 0.0004$ , respectively; see Figure 4).

**Figure 4.** Mean (+/- SE) number of looks at the speaker during the playback session, by background noise.



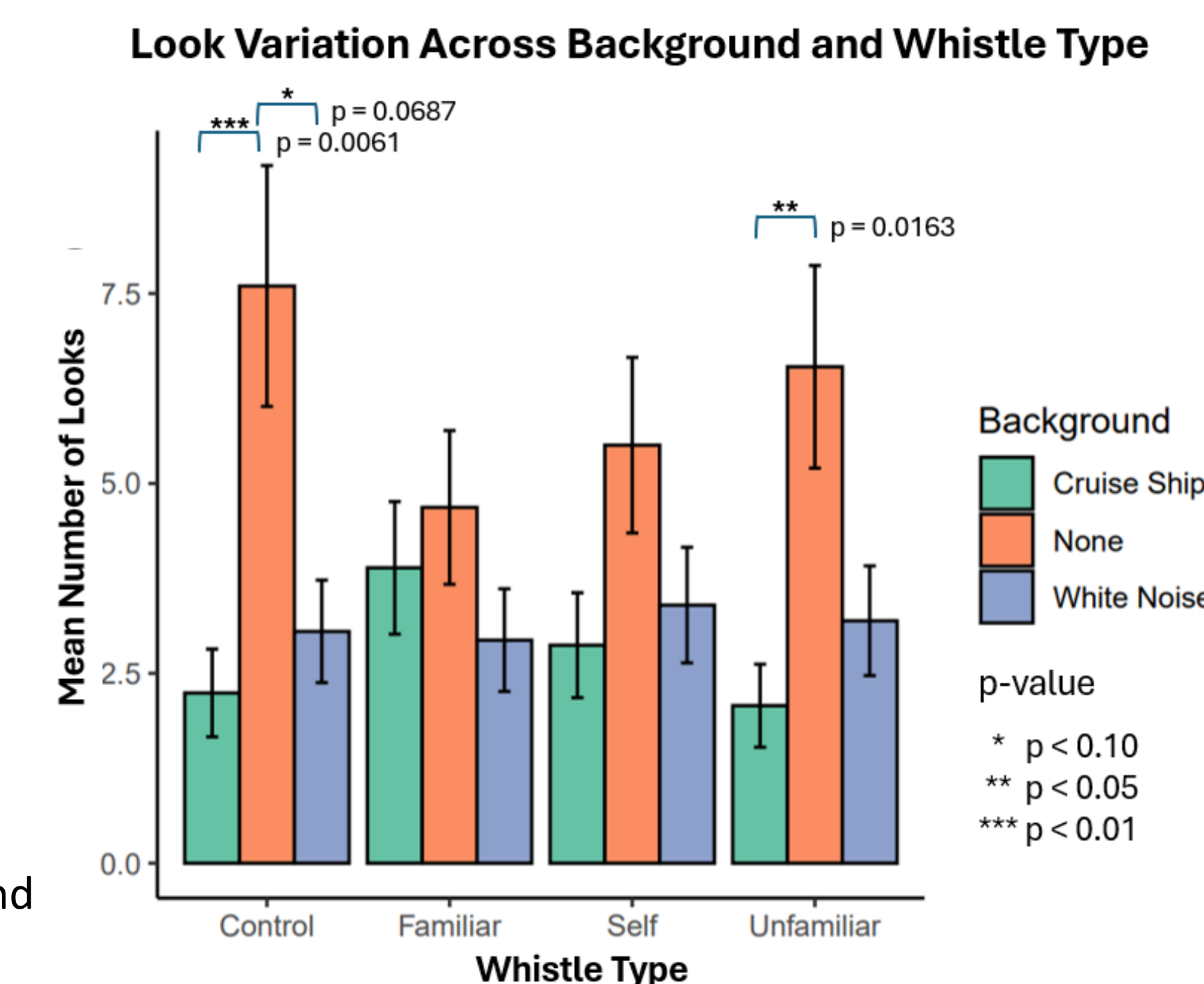
## Results cont.

### Do dolphins exhibit the Cocktail Party Effect using signature whistles?

#### Maybe

For just the Dolphin Quest Hawaii animals, number of looks to self-signature playbacks were not significantly greater than other whistle types (with or without noise).

Looks to the control and unfamiliar whistle playbacks were significantly higher with no noise than with cruise ship ( $p=0.00061$ ,  $p=0.0163$ , respectively; see figure 5).



**Figure 5.** Mean (+/- SE) number of looks by whistle playback type and background noise.

## Discussion

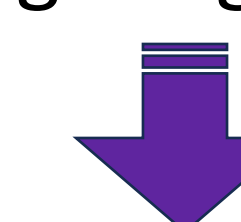
These results support the conclusion that background noise impairs dolphin communication, as participants looked significantly less often at control and whistle playbacks with background noise compared to no noise.

However, these data do not yet demonstrate the cocktail party effect, likely due to the limited sample size. The self-signature whistle average looks did not show significance, but this may change when all the data is analyzed.

## Future Directions

Familiar signature whistles came from both current and former facility mates, some of which have been separated for several years. This raises the question of whether time apart might affect how the dolphins respond (Bruck, 2013).

33% of the unfamiliar whistles used in this study were produced by wild dolphins, who typically with longer signature whistles than dolphins under professional care.



Anecdotal observations suggest that dolphins respond more to these wild whistles, raising the question of whether wild whistles' structure or length helps them cut through anthropogenic noise as an adaptation to humans.

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