



# Anthropogenic Noise Impacts on Frog Vocalization at Anastasia State Park and the GTM Research Reserve

Emma Wilkinson, Dakota Chenoweth, Trisha McCaul, and Benjamin Atkinson



## FROGS COMPETE WITH HUMAN NOISE TO BREED



- Frogs use calls to attract mates. Calling takes up energy, so male frogs can only produce so many calls before exhaustion.
- Masking** describes when anthropogenic noise overwhelms the frequencies where frogs vocalize. Masking interrupts breeding since females are unable to hear the calls.
- Anthropogenic noise may compound with other human-induced environmental stressors to contribute to the global decline of amphibian populations.

*We hypothesize that the mean call rate of frogs will change in response to anthropogenic noise.*

## ANALYSIS & RESULTS

### One-way repeated measures ANOVA

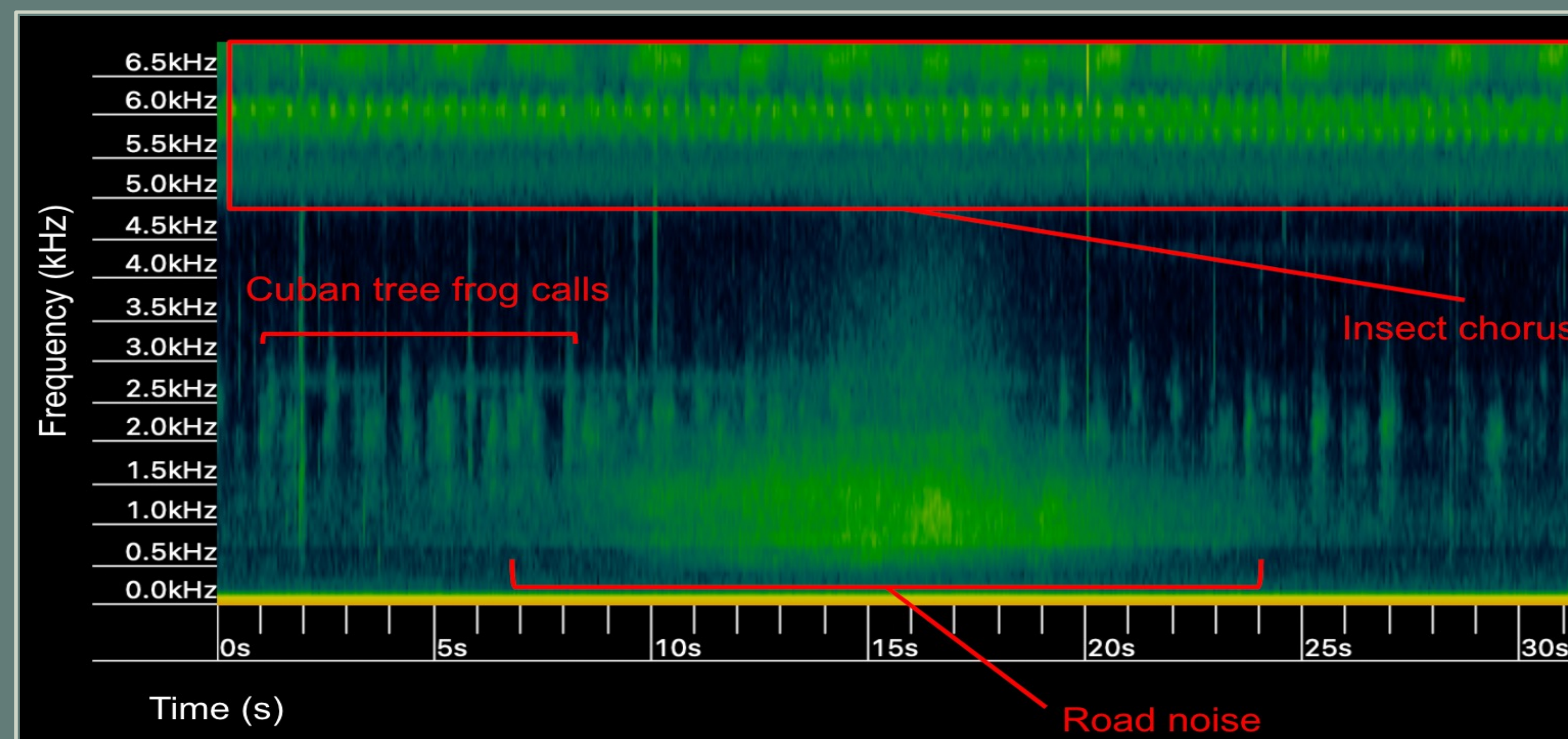
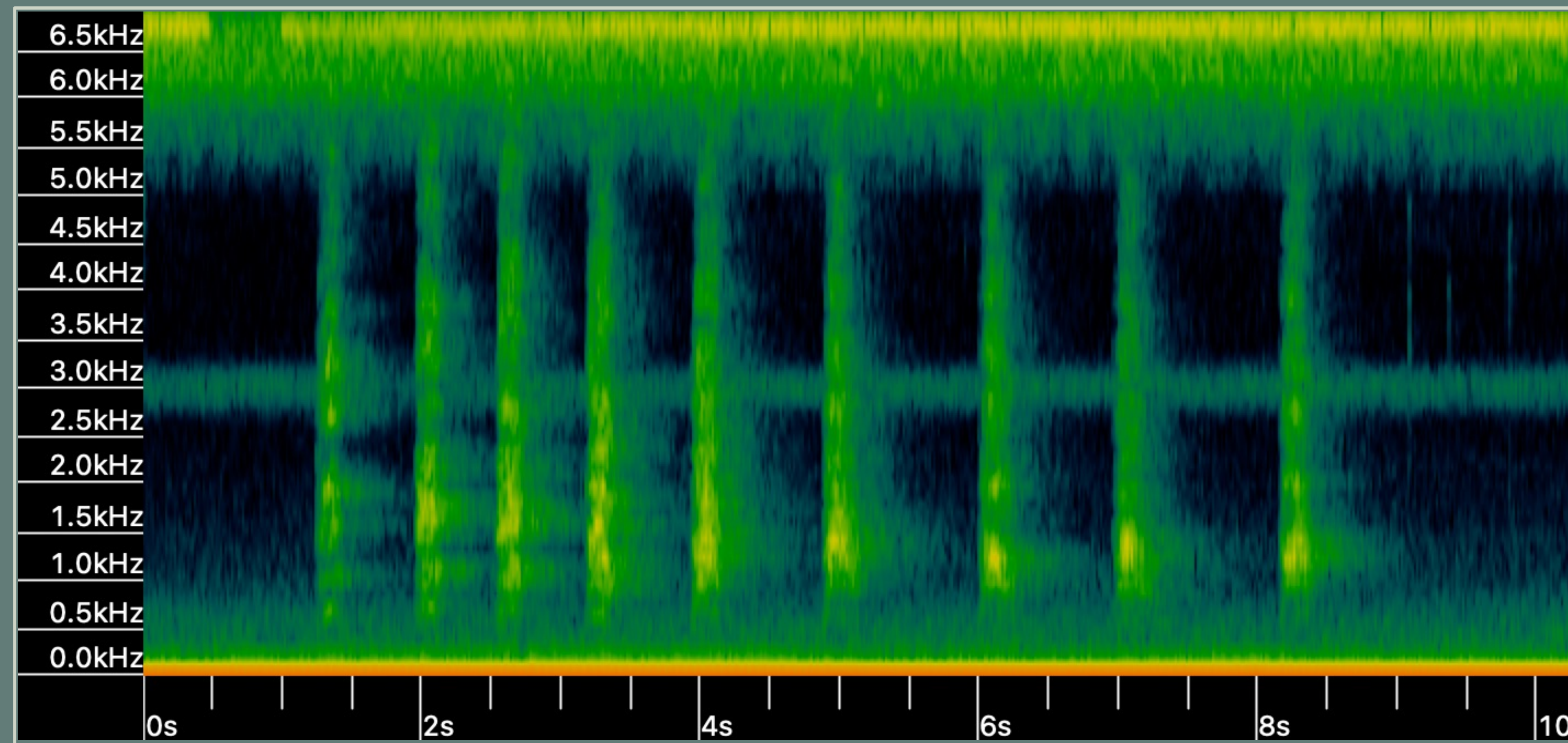
H0:  $\mu$  before =  $\mu$  during =  $\mu$  after  
 H1: at least one  $\mu$  is different  
 ANOVA compares differences in population means between multiple related samples. The ANOVA comparing the mean call rates before, during, and after anthropogenic noise events at ASP resulted in a P-Value of **0.0531**.

### Welch two-sample t-test

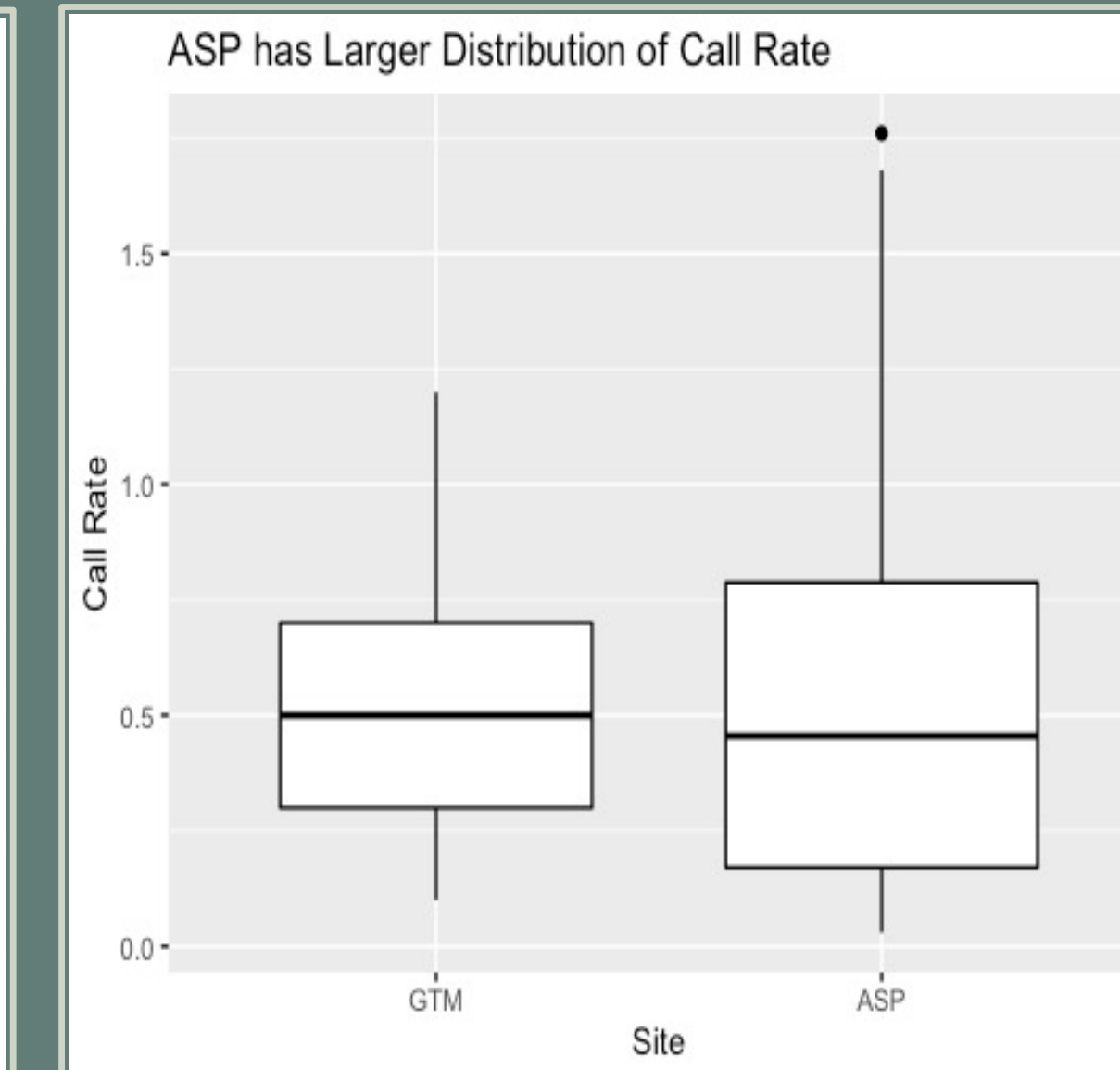
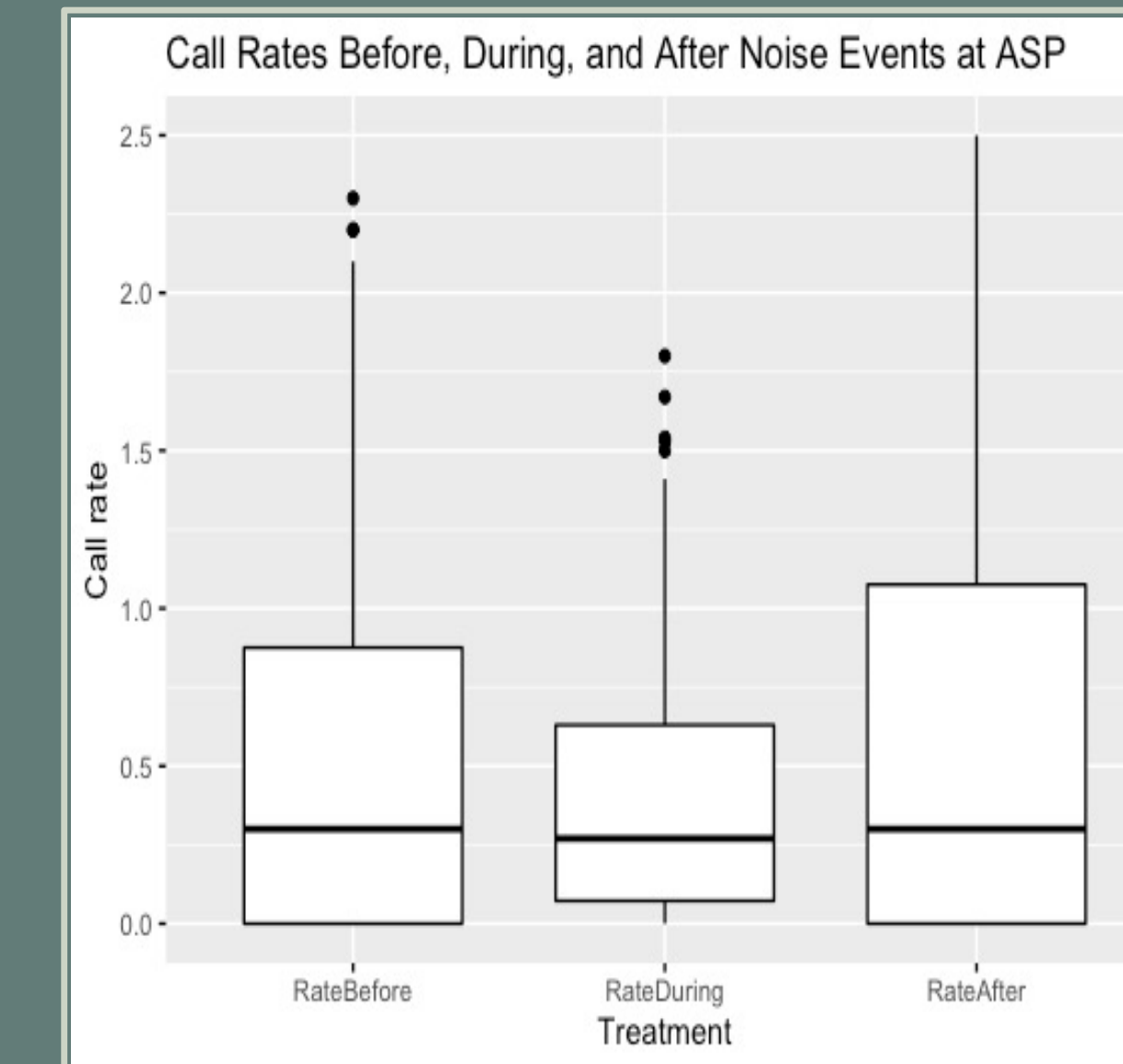
H0:  $\mu$  ASP =  $\mu$  GTM  
 H1:  $\mu$  ASP  $\neq$   $\mu$  GTM  
 T-test compares the differences in means between two unrelated samples. The t-test comparing the mean call rates of ASP and the GTM resulted in a P-Value of **0.72**.

$$\text{Call rate} = \frac{\# \text{ of calls}}{10 \text{ seconds}}$$

Since the P-values were greater than  $\alpha = 0.05$  in both tests, there was **no statistically significant difference** in the mean call rates of frogs in response to anthropogenic noise at ASP or between sites.

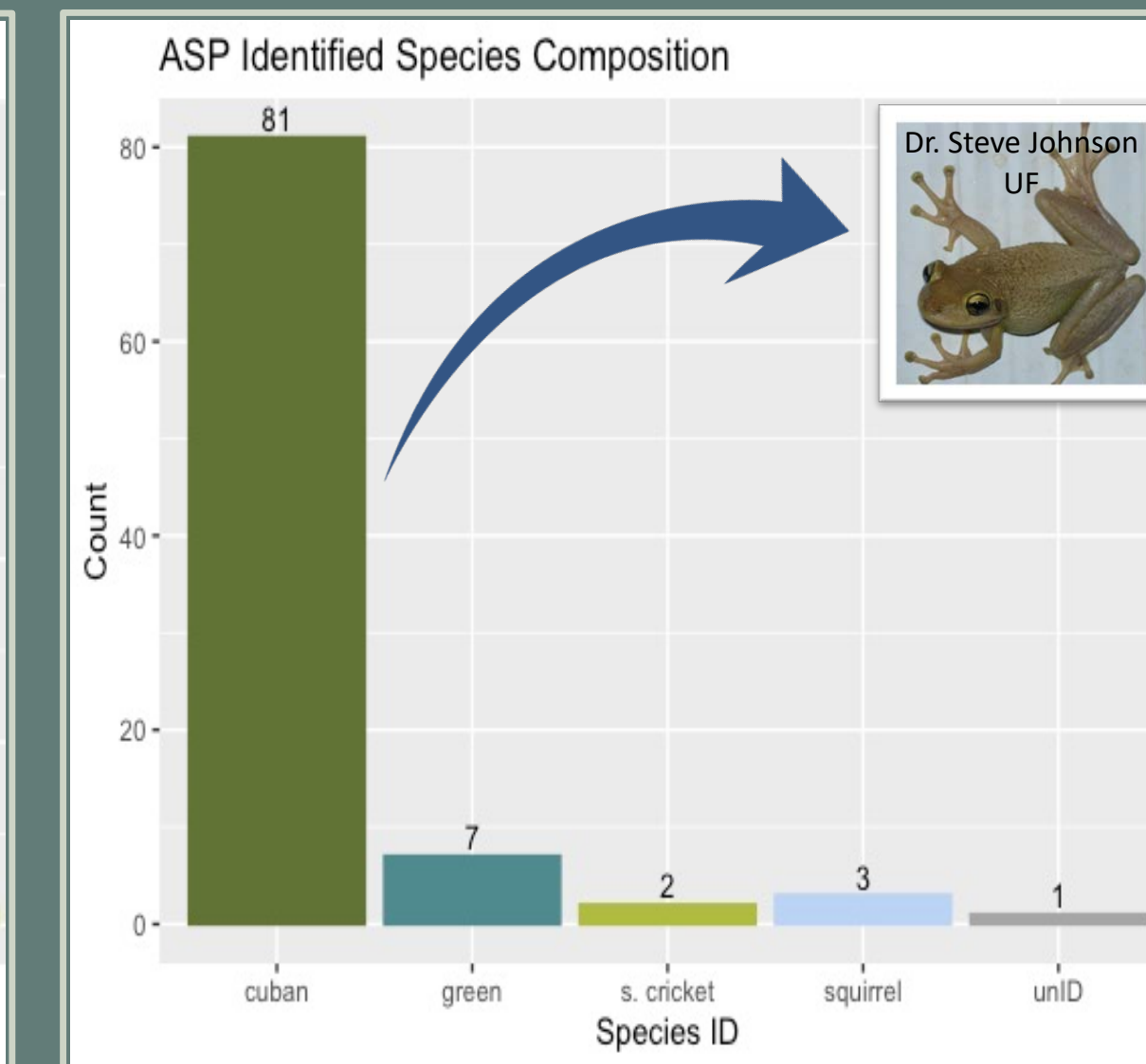
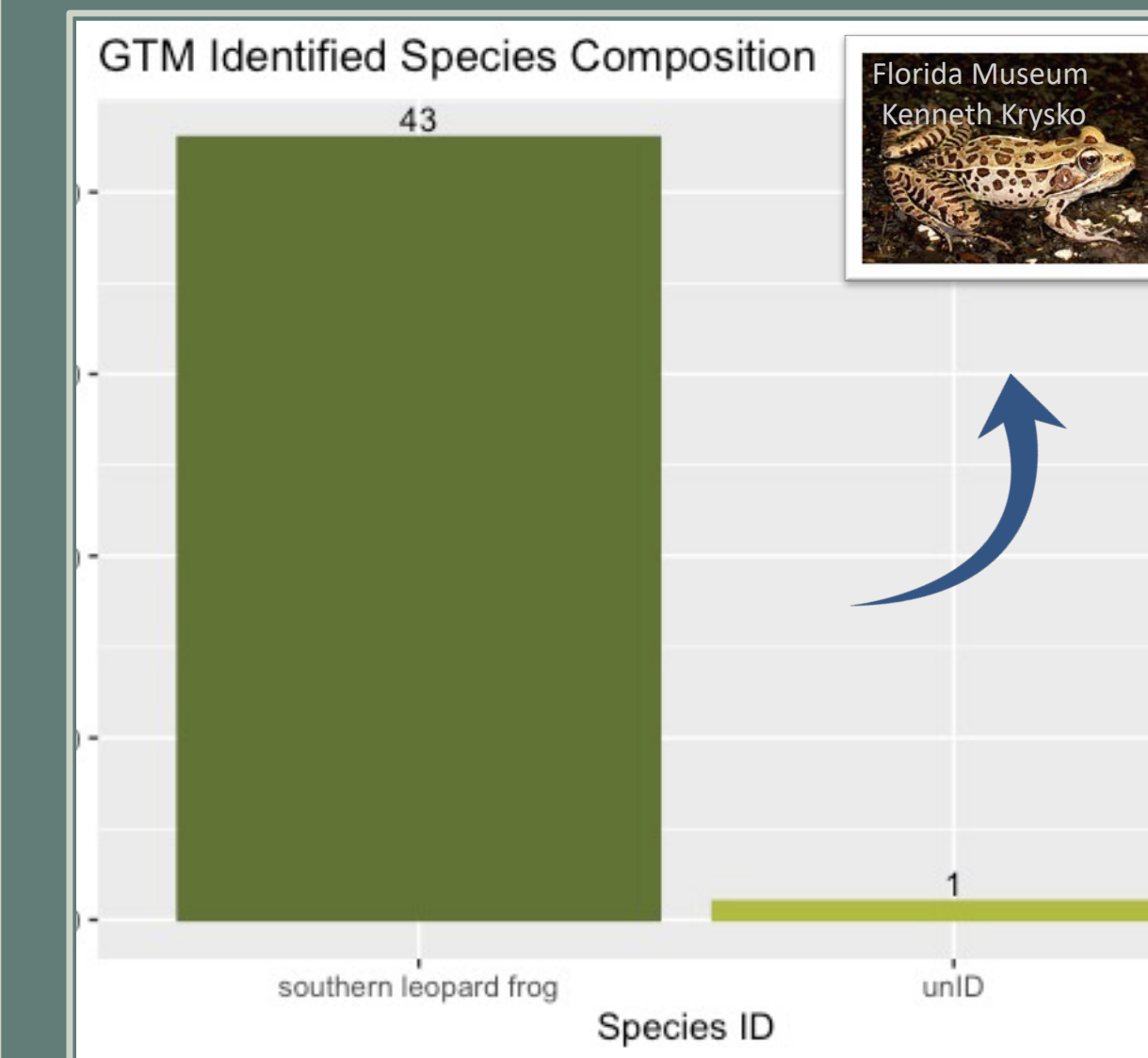


Spectrograms depicting the call signature of a Cuban tree frog (top) and Cuban tree frog chorus concurrent with anthropogenic noise (bottom). The anthropogenic noise masks the frog calls. Call rates were calculated before, during, and after noise events.



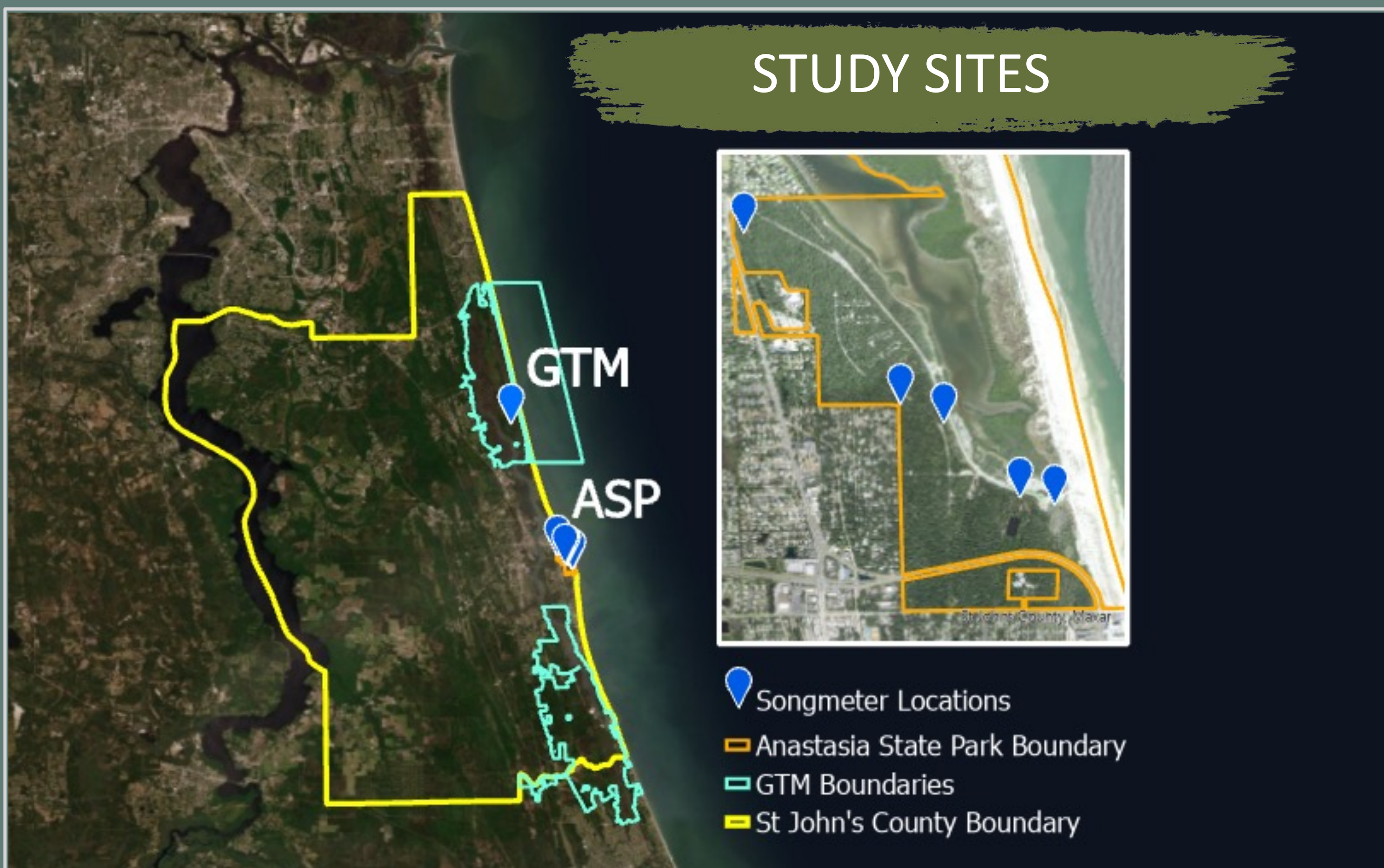
ANOVA	P-value	Alpha
	0.0531	0.05

Two sample t-test	P-value	Alpha
	0.72	0.05



Bar charts showing the species composition of GTM (left) and ASP (right) based on calls identified in passive acoustic monitoring data. The majority of calls identified at ASP were Cuban tree frogs while the majority of calls identified at the GTM were southern leopard frogs

## STUDY SITES



## METHODS

- Two Songmeters were moved between five Anastasia State Park (ASP) sites throughout October. One Songmeter was set up at the Guana Tolomato Matanzas Research Reserve (GTM) for the whole study period. Songmeters were set to record from 7 p.m. to 6 a.m.
- We used the software Kaleidoscope to create spectrograms of the recordings and visually identified frog calls/noise events.
- We calculated the call rate before, during, and after noise events. Ten-second windows were used to calculate call rates before and after anthropogenic noise events.



## REFERENCES

Barber, J. R., Crooks, K. R., & Fristrup, K. M. (2010). The costs of chronic noise exposure for terrestrial organisms. *Trends in Ecology & Evolution*, 25(3), 180–189. <https://doi.org/10.1016/j.tree.2009.08.002>  
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 Sun, J. W. C., & Narins, P. M. (2005). Anthropogenic sounds differentially affect amphibian call rate. *Biological Conservation*, 121(3), 419–427. <https://doi.org/10.1016/j.biocon.2004.05.017>

## DISCUSSION & TAKEAWAYS

- There is environmental significance despite statistical insignificance
- Sampling during various breeding seasons may strengthen results
- Different species call at different rates, so different species composition at each site makes for a difficult comparison
- Possible future studies include analyzing additional call components like frequency or amplitude, as well as the potential for modeling acoustic habitat at ASP and the GTM.

*Our results do not support a change in mean call rate in response to anthropogenic noise.*

## ACKNOWLEDGEMENTS

Thank you to Zach Lepera of the GTM Research Reserve, David L. Jones of ASP, Dr. Patrick Baker of West Point Academy, Dr. Coleman Sheehy of the Florida Museum, Dr. Chris Kao of Flagler College, and John Wooldrige of Flagler College

