

# Potential Impacts of Anthropogenic Noise on Oyster Toadfish (*Opsanus tau*) Advertisement Calling Behavior

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## Introduction

As urban development across the globe increases, the acoustic environments that surround us become altered by structural changes and the addition of new sounds (Dowling et al., 2012). Thus, anthropogenic noise in the hearing range of animals can have profound effects on wildlife behavior and survival, including deficits in hearing, communication, reproduction, growth and predator-prey interactions in both the terrestrial and aquatic environments (Slabbekorn et al. 2010). Oyster toadfish, commonly found in the Hudson River, are an ideal model system to study adaptations for living in a noisy environment as they depend on detecting conspecific vocalizations for reproduction. During the breeding season, male oyster toadfish (*Opsanus tau*) establish nests in shallow waters off the eastern coast of the U.S. where they produce mating advertisement calls, a “boatwhistle” (80-220 Hz), directed to females (Maruska *et al.*, 2009). Boatwhistles calls can only be effective for mate attraction if they are being received by a potential female; therefore, exposure to noise within their hearing range may cause stress and prevent reproductive success. In the present study, we tested the hypothesis that male toadfish inhabiting the waters near the Hudson River Park’s Pier 25 may produce their advertisement call during short breaks in anthropogenic noise exposure or avoid day-time vocalizations during peak noise times of the days (e.g., construction, boat traffic).

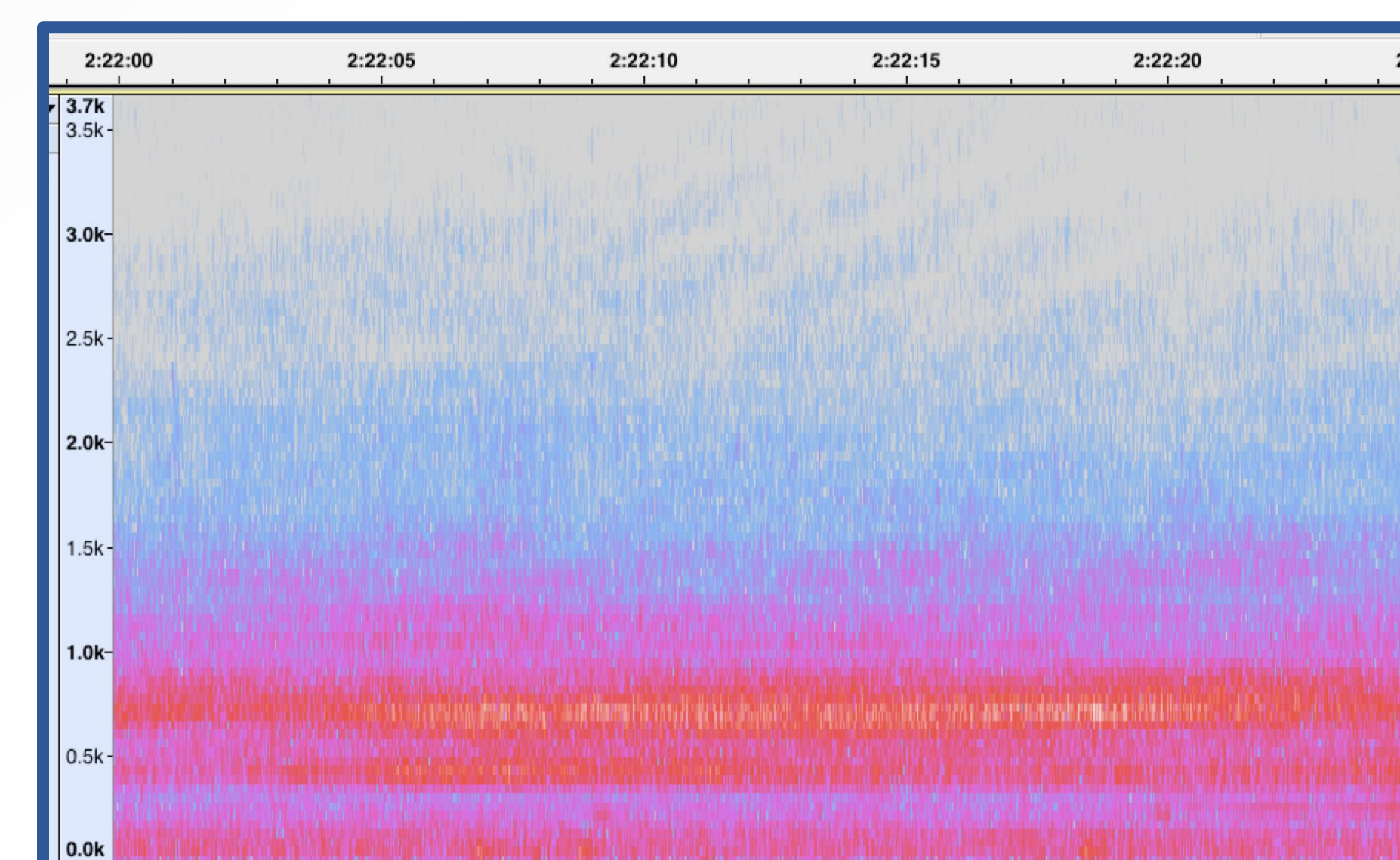


Figure 2A. Drilling noise with a 600 Hz low-pass filter applied

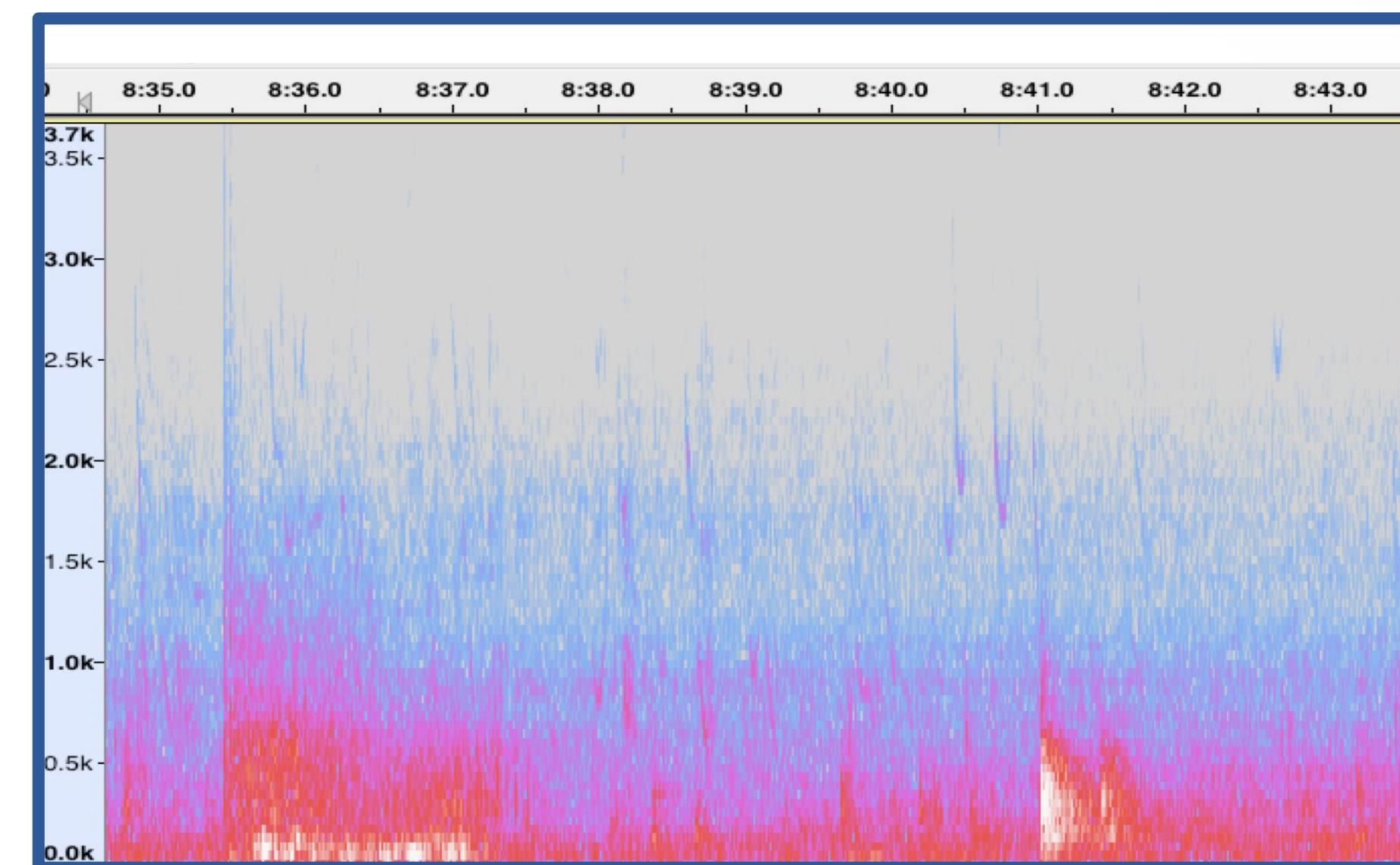


Figure 2B. Boat noise with a 600 Hz low-pass filter applied

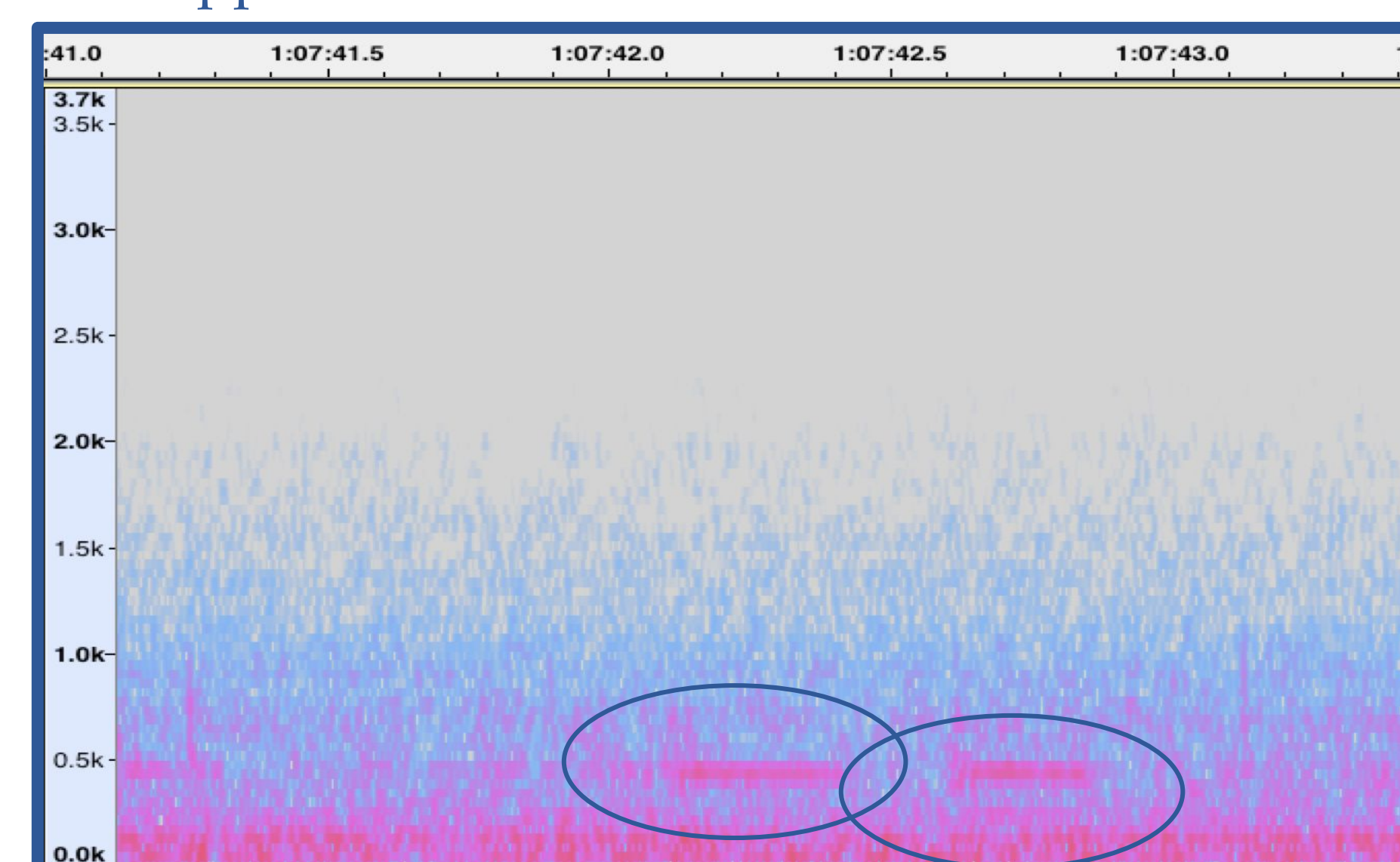


Figure 2C. Two Oyster toadfish boatwhistles calls with a 600 Hz low-pass filter applied

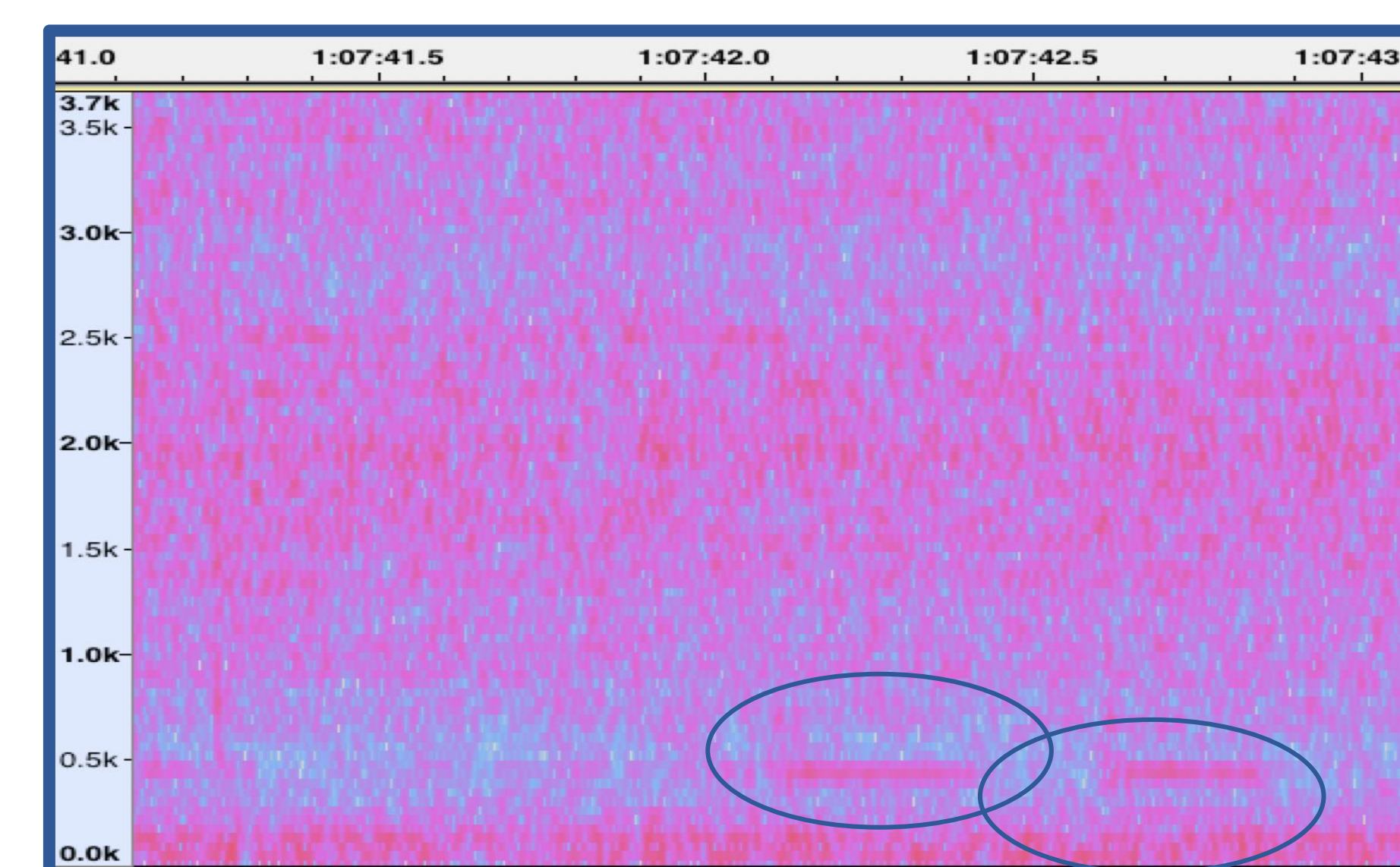


Figure 2D. Corresponding snapshot of boatwhistle calls with no filter

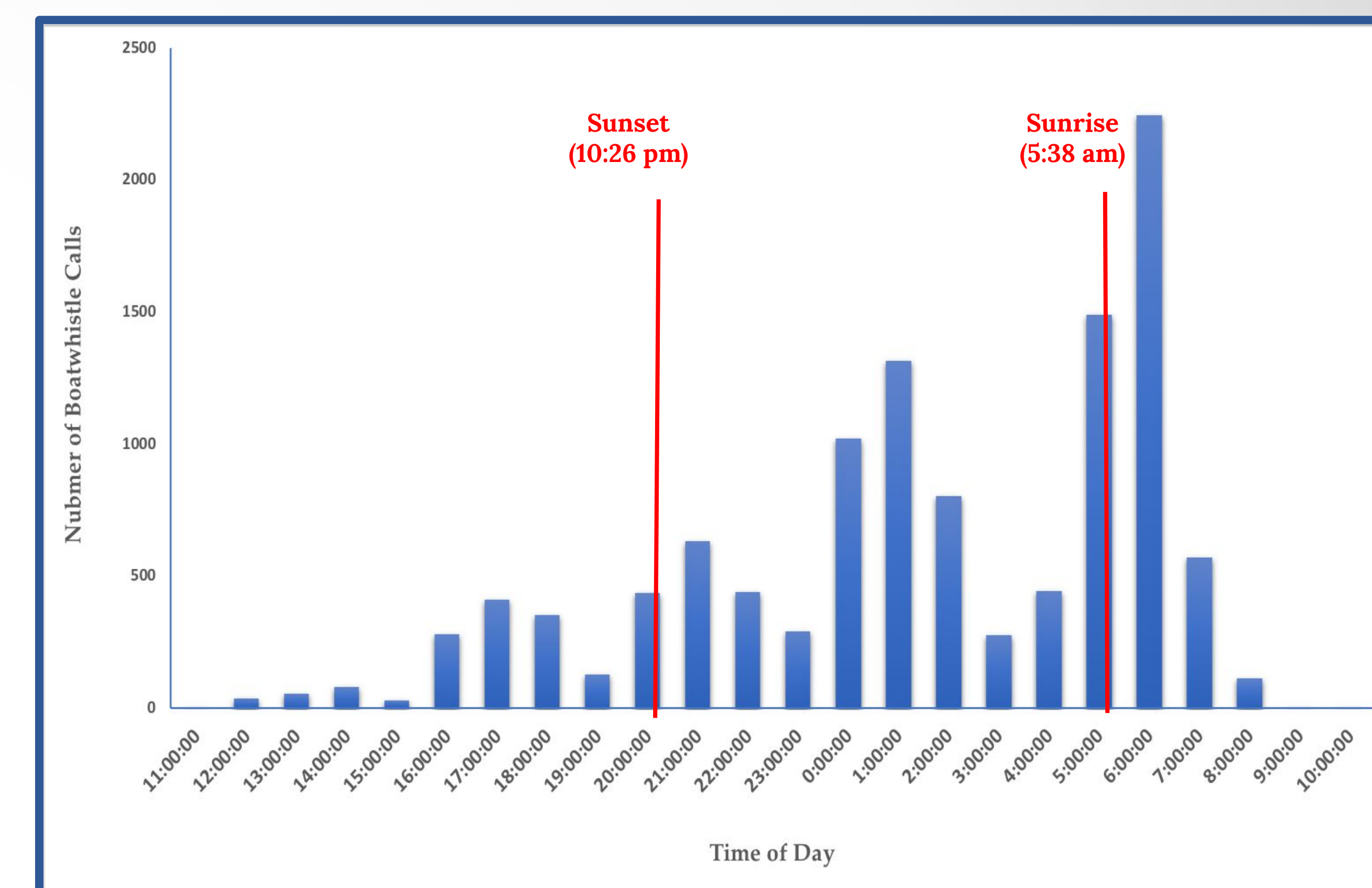


Figure 3. Number of boatwhistle calls over a 21-hour period recorded July 15th to July 16th, 2019. A total of 11,472 calls were collected with a the largest portion being heard at 6:00. Red lines indicate sunset (20:26) and sunrise (05:38).

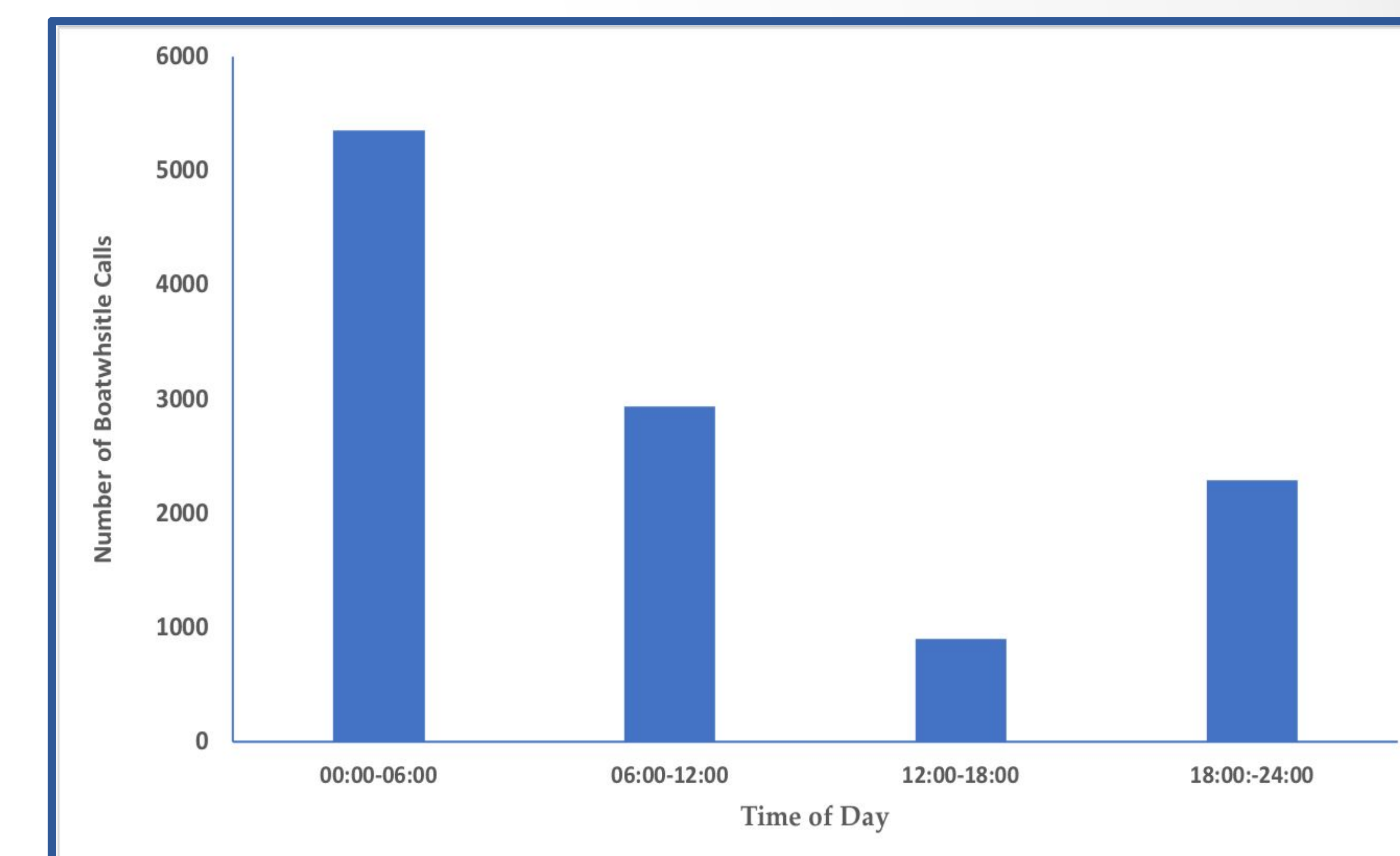


Figure 4. Total number of boatwhistle calls every 6 hours over a 21-hour period recorded July 15th to July 16th, 2019.



Figure 1. (A) Oyster toadfish (*Opsanus tau*) is a native to the Hudson River, and frequently nests beneath the Lilac steamboat. (A-D) Pictures of the steam boat (The Lilac) where acoustic measurements were taken. (E) Picture of a crab pot trap used for data collection.

## Data Collection

In collaboration with The River Project, audio data was collected at the Hudson River Park’s Pier 26 where a hydrophone (underwater microphone) was attached to crab pot and deployed off of the Lilac Preservation steam boat. Audio data was collected a 24-hour period starting July 15th and analyzed using Audacity. In order to efficiently detect calls, a 600 Hz low-pass filter was applied to all files

## References

Dowling, J.L., Luther D.A., and Marra, P.P. 2012. Comparative effects of urban development and anthropogenic noise on bird songs. *Behavioral Ecology*. 23(1): 201-209.  
 Maruska, K. P., and Mensinger, A. F. 2008. Acoustic characteristics and variations in grunt vocalizations in the oyster toadfish *Opsanus tau*. *Environmental Biology of Fishes*.  
 Slabbekorn, H., Bouton, N., Opzeeland, I., Coers, A., Carel, C., and Popper, A. N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in Ecology and Evolution*. 25(7): 419-427.

## Results & Discussion

- Male oyster toadfish made over 11,000 calls over the course of 21 hours
- Males were observed to produce the largest number of calls between the hours of 00:00 and 06:00.
- We hypothesize that daytime on Pier 40 and nearby boating activity may coincide with reduced number of calls after 06:00. By decreasing calls after 06:00, male Oyster toadfish are potentially able to reduce the likelihood of masking
- Future analysis will include alignment of anthropogenic noise levels with call times to determine if there exists a negative relationship between number of boatwhistle calls and peak noise periods

## Acknowledgement:

We would like to thank The River Project, the Lilac Preservation Project, Nina Hitchings, and Siddhartha Hayes for their assistance and giving us access to the Lilac to conduct this research. Funding provided by the National Science Foundation.