COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

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for the degree of Doctor of Philosophy (Ph.D.)

"The Detectability of Goliath Grouper Sounds in Nearshore Waters Using Normal Mode Propagation Model"

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Engineering West, Room #187
777 Glades Road
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ABSTRACT OF DISSERTATION
The Detectability of Goliath Grouper Sounds in Nearshore Waters Using Normal Mode Propagation Model

This research presents findings from an in-situ experiment utilizing a hydrophone line array to capture the sound production of the Goliath grouper. Analysis revealed that Goliath grouper calls exhibit multiple frequency components, including one high-amplitude component and 2 to 3 low-amplitude components. The primary high-amplitude component is concentrated in the 30 to 70 Hz band, peaking around 50 Hz, while low-amplitude components span 20 to 30 Hz, 70 to 115 Hz, and 130 to 200 Hz. The loudest recorded Goliath grouper call reached 113.07 dB re 1 µPa in a 1 Hz band. Comparison between in-situ data and results from a normal modes transmission loss model identified regions where echo level increased with propagation distance. This suggests that the loudness of the call may not necessarily indicate proximity, indicating the Goliath grouper might rely on other cues for localization, such as changes in the frequency profile of its call. Two methods for estimating call distance are presented. The first method
utilized a transmission loss model and measured transmission loss across a hydrophone line array. This method could also determine the source level of the calls, yielding source level estimates ranging from 124.01 to 144.83 dB re 1 µPa. The second method employed match field filtering, validating the accuracy of the transmission loss model. Both methods produced similar call distance estimations, ranging from 11.5 to 17.1 meters, placing the grouper inside or near its typical habitat.
The recorded calls and transmission loss model both showed that the transmission loss per frequency band varied, affecting the call frequency magnitude structure over distance. The accuracy of the matched filter can be improved for automatic call detection by using multiple templates. The matched filter was able to detect all 5 calls that were studied in this paper, with the furthest call being 120 meters away. Detecting a call at further distances may be possible depending on the magnitude of the call and the signal-to-noise ratio. It was determined that a call could be theoretically detected up to 21,974 m away by using a detection threshold of -5.6 dB.

BIOGRAPHICAL SKETCH
Born in Long Island, New York
B.S., Florida Atlantic University, Boca Raton, Florida, 2020
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CONCERNING PERIOD OF PREPARATION
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Time in Preparation: 2021-2022

Qualifying Examination Passed: Semester 2022

Published Papers:

[1] J. P. Marcheggiani and S. Glegg, “Noninvasive measurement methods for transient flows in wind tunnels,” AIAA Journal, vol. 61, no. 5, pp. 2208–2216, Feb. 2023. doi:10.2514/1.j062234