DCLDE Rotterdam 2024

ABSTRACTS

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Strengths and weaknesses of using DCLDE algorithms to track baleen whales and examine their behavior using long-term acoustic recordings with a large-scale hydrophone array

G.C. Alongi[1*], T.A. Helble[2], R.A. Guazzo[2], S.W. Martin[1], C.R. Martin[2], E.E. Henderson[2]

[1]*National Marine Mammal Foundation, San Diego, CA, USA*

[2]*Navy Information Warfare Center, San Diego, CA, USA*

**gabriela.alongi@nmmpfoundation.org*

The use of detection, classification, localization, and tracking algorithms on acoustic data recorded at the U.S. Navy's Pacific Missile Range Facility (PMRF) has resulted in a wealth of research on animal behavior. PMRF allows for persistent monitoring and currently uses 63 time-synchronized hydrophones covering a 20 km x 60 km area. Collectively, thousands of baleen whale tracks were produced from their recorded vocalizations over the last decade, including humpback whales, minke whales, Bryde's whales, and fin whales. Track prediction methods and Hidden Markov Models were applied using open-source R packages to characterize whale swimming and calling behavior on the range. Whale movement was examined relative to variables including calendar year, day of year, hour of day, wind speed, wave height, acoustic calling rates, and the presence of Navy sonar. Findings indicated that whales changed their swimming behavior based on a variety of environmental and temporal variables as well as acoustic behavioral state and exposure to mid-frequency active sonar. Even with this near best-case scenario for long-term and broad spatial data collection along with whale localization and tracking capabilities, several limitations have become apparent during these analyses. These include complications with quantifying cue rates, environmental-, behavioral-, and density-dependent probability of tracking, and data deficiencies for tracks under specific conditions, other potentially relevant environment variables, and uncommon events such as storms. We will review the strengths and weaknesses of this system within the broader context of the DCLDE community and consider the implications and what might be transferrable to other research efforts with different acoustic sampling methods.