

## **Using Passive Acoustics to Monitor the Presence of Marine Mammals during Naval Exercises**

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Passive acoustic data collected from Marine Autonomous Recording Units during fall (13 September to 8 October) and winter (3 December to 8 January) 2009-2010 were analyzed for acoustic detections of marine mammals and patterns resulting from these detections. The study site coincided with the United States (U.S.) Navy's planned Undersea Warfare Training Range (USWTR) located approximately 60-150 kilometers off Jacksonville, Florida. Acoustic data consisted of both 2-kilohertz (kHz) and 32-kHz sample rate recordings. Data were initially reviewed using long-term spectral averages, and then evaluated in greater detail from spectrograms using the MATLAB program Triton (Wiggins 2007). Probability of vocalization event occurrence was calculated for each species relative to sonar events. Species and species groups detected included minke whale, North Atlantic right whale, sei whale, (probable) humpback whale, sperm whale, blackfish, and unidentified delphinids. Results indicated that minke whales were present almost continuously during the winter deployment period. Right whale vocalizations were most concentrated during winter, as expected, but were also detected at deep sites (>300 meters), which was somewhat unexpected. Sperm whales occurred exclusively near the continental shelf break, and showed a strong diel pattern with almost all vocalization events occurring between dawn and dusk. There were less obvious patterns for delphinid vocalization events, perhaps because of the grouping of species. Future efforts will include improving species-specific analysis of delphinids. Blackfish were detected relatively infrequently but were most common at the shallow-water sites. Minke whales showed the strongest relationship between sonar events and vocalizations. The probability of minke whale vocalization events occurring in the presence of sonar activity was much less than in the absence of sonar. The results reported here provide an assessment of marine mammal occurrence and distribution within the U.S. Navy's planned USWTR and insights on species-specific vocal responses to sonar events.



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