



# 21st Biennial Conference on the Biology of Marine Mammals

13-18 DECEMBER 2015  
HILTON SAN FRANCISCO UNION SQUARE  
SAN FRANCISCO, CA USA

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## High-frequency clicks associated with low-frequency minke whale pulse trains recorded at three separate locations in the Western North Atlantic

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Recent analysis of passive acoustic data collected from autonomous recorders deployed in the Western North Atlantic have resulted in characterization of three main types of low-frequency minke whale pulse trains ('speed-up', 'slow-down' and 'constant' type) in the Western North Atlantic. These pulse train types show varying interpulse interval structure and appear to exhibit some geographic variation in signal structure as well as relative occurrence at different sites. Most past data were collected at low sampling rates, equal to or below 2000 Hz, so only lower frequencies components of these signals, showing peak frequencies between 50 and 130 Hz, have been described to date. In the present study we analyzed higher frequency recordings (sampling rate: 200 kHz) from two types of fixed autonomous acoustic recorders deployed at three locations along the US east coast (Cape Hatteras and Onslow Bay, North Carolina and Jacksonville, Florida). At each of these sites we identified high frequency clicks that were associated with two types of low frequency minke whale pulse trains ('slow-down' and 'constant') at each of these sites. We analyzed a total of 750 high frequency clicks, associated with 23 pulse trains of high signal-to-noise ratio (SNR). High frequency clicks were characterized by mean peak frequencies of 12 kHz and mean center frequencies of 14 kHz and generally preceded the associated low frequency pulses within a pulse train. To our knowledge this is the first description of click production at such high frequencies in baleen whales. The function of these clicks within the minke whale vocal repertoire is presently unknown, but this is an important finding and should be investigated further. Our study highlights the importance of broadband recordings and taking into account SNR when analyzing marine mammal vocalizations to allow for a more complete description of species-specific signals.

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