

ID: W2955492878

TITLE: Caribbean Sea Soundscapes: Monitoring Humpback Whales, Biological Sounds, Geological Events, and Anthropogenic Impacts of Vessel Noise

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ABSTRACT:

Assessing marine soundscapes provides an understanding of the biological, geological and anthropogenic composition of a habitat, including species diversity, community composition, and human impacts. For this study, nine acoustic recorders were deployed between December 2016 and June 2017 off six Caribbean islands in several Marine Parks: the Dominican Republic (DR), St. Martin (SM), Guadeloupe east and west (GE, GW), Martinique (MA), Aruba (AR), and Bonaire (BO). Humpback whale song was recorded at five sites on four islands (DR, SM, GE, GW and MA) and occurred on 49 to 93% of recording days. Song appeared first at the DR site and began 4 to 6 weeks later at GE, GW and MA. No song was heard in AR and BO, the southernmost islands. A two-week period was examined for the hourly presence of vessel noise and the number and duration of ship passages. Hourly vessel presence ranged from low (20% - DR, 30% - SM), medium (52% -MA, 54% - BO, 77% - GE) to near continuous (99% - GW; 100% - AR). Diurnal patterns were observed at BO, GE, and MA with few to no vessels present during night time hours, possibly reflecting the activity of recreational craft and fishing vessels. At the DR and GW sites, vessel traffic was ubiquitous for most of the day, likely reflecting heavy cruise ship and container ship presence. Soundscapes were diverse across islands with persistent fish choruses, sporadic sperm whale (*Physeter macrocephalus*) and dolphin (*Delphinidae*) presence at BO, minke whales (*Balaenoptera acutorostrata*) from late December to late February at MA and an earthquake recorded across all sites. These analyses provide an important first step in characterizing the health and species richness in Caribbean marine parks and demonstrate a surprising high anthropogenic foot print. Vessel traffic in particular contributes adversely to marine soundscapes, masking marine mammal sounds, potentially changing typical animal behavior and raising the risk of ship strike.

SOURCE: Frontiers in marine science

PDF URL: <https://www.frontiersin.org/articles/10.3389/fmars.2019.00347/pdf>

CITED BY COUNT: 19

PUBLICATION YEAR: 2019

TYPE: article

CONCEPTS: ['Oceanography', 'Sperm whale', 'Soundscape', 'Fishery', 'Minke whale', 'Archipelago', 'Geography', 'Fishing', 'Balaenoptera', 'Whale', 'Sound (geography)', 'Geology', 'Biology', 'Biochemistry', 'Myoglobin']