

# Multi-national Collaboration and Conservation of Humpback Whales with the Caribbean Humpback Acoustic Monitoring Programme (CHAMP)



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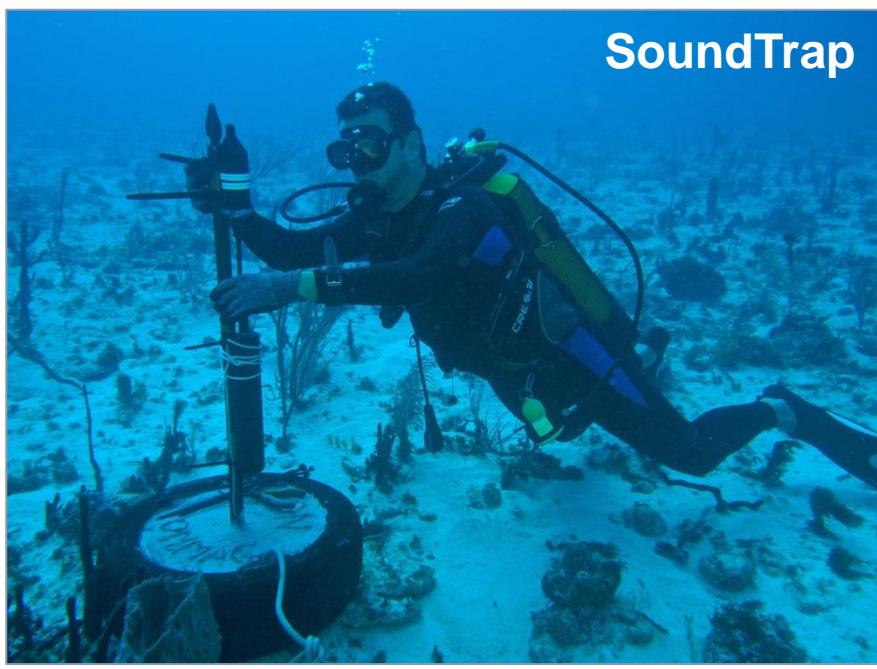
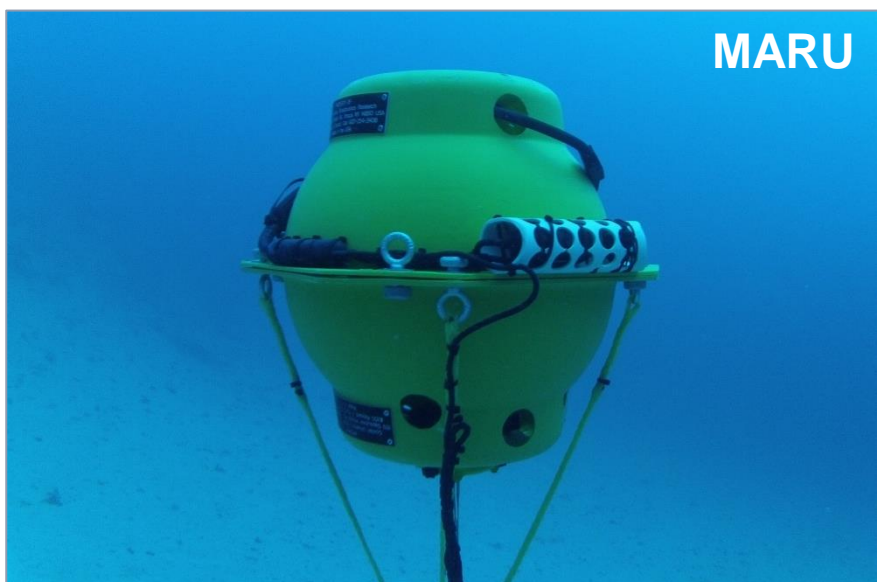
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In September 2016, the West Indies distinct population segment (DPS) of humpback whales (*Megaptera novaeangliae*), was delisted under the US Endangered Species Act. This DPS covers all of the Caribbean breeding grounds. However, growing evidence suggests the West Indies DPS contains more than one breeding population. In response to these changes in humpback status and evidence supporting more than one breeding population in the West Indies, the Caribbean Humpback Acoustic Monitoring Programme (CHAMP) was formed. CHAMP leverages and expands networks already established in the Caribbean to promote and enhance collaborative work on the biology of humpback whales and establish a robust monitoring program, focusing first on passive acoustic monitoring. This multi-national program now includes researchers, government officials, NGO's, managers and others in Aruba, Bonaire, the Dominican Republic, Guadeloupe, Martinique, St. Martin, and the United States. With the significant contributions of a large network of partners and collaborators, nine passive acoustic recording devices were deployed between December 2016 and June 2017. This deployment included three SoundTraps (Ocean Instruments, Auckland, New Zealand) and six Marine Autonomous Recording Units (MARUs; Cornell University, Ithaca, New York). Each site received a single device with the exception of the east coast of Guadeloupe and Bonaire where both devices were collocated. By placing passive acoustic recorders throughout the Caribbean, we are able to monitor humpback whale distribution, assess seasonal differences in arrival and departure of the whales, analyze the content and structure of the whales' song, and use differences in song structure to elucidate different breeding populations to inform management and policy decisions.

## Methods

Passive acoustic data were collected with bottom-mounted autonomous recorders from Dec 2016 – Jun 2017. MARUs recorded continuously at a sampling rate of 2 kHz; SoundTraps recorded for 1 hour every 4 hours at a sampling rate of 48 kHz.

All recordings were analyzed for the daily presence/absence of humpback whale song by manually reviewing spectrograms.

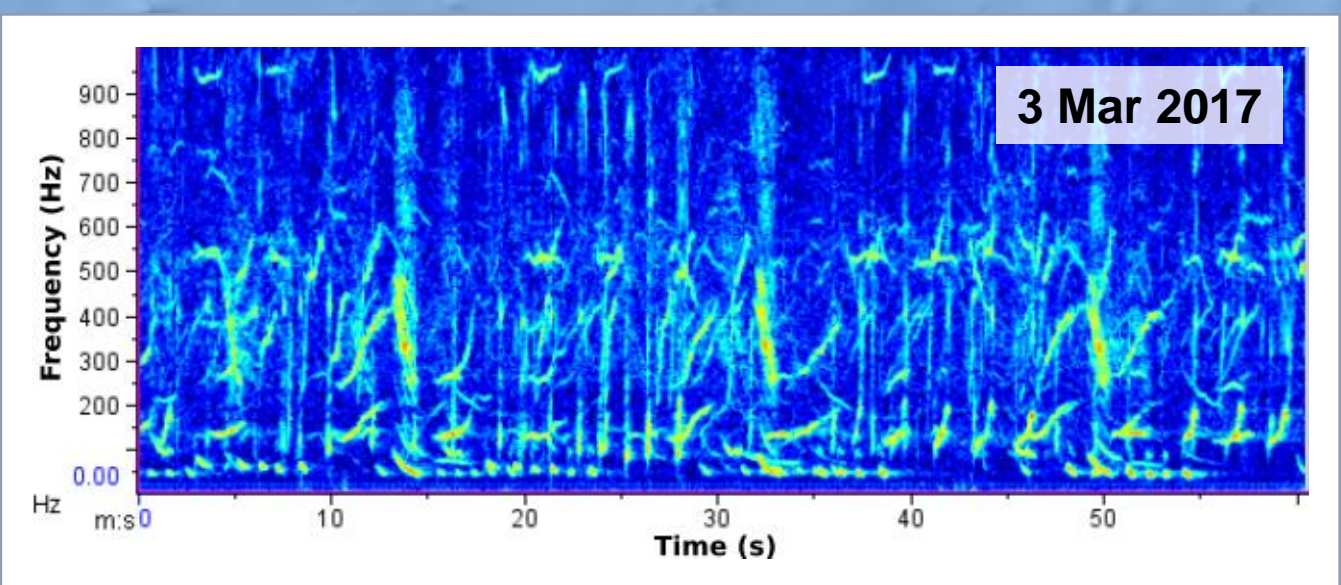
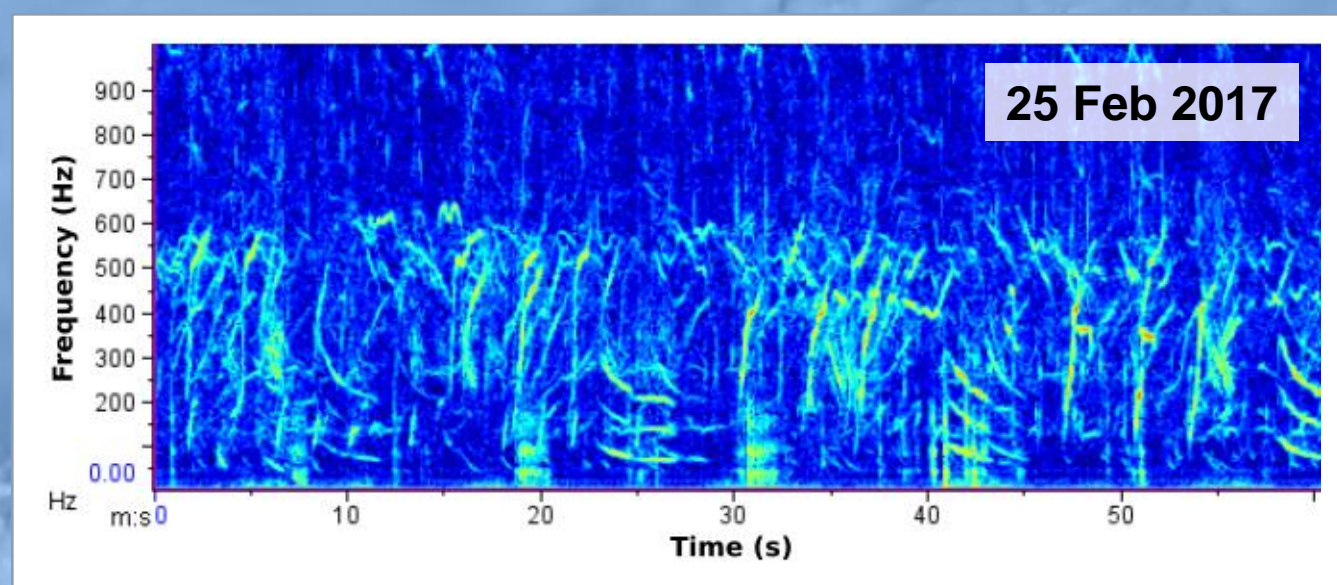


## Results

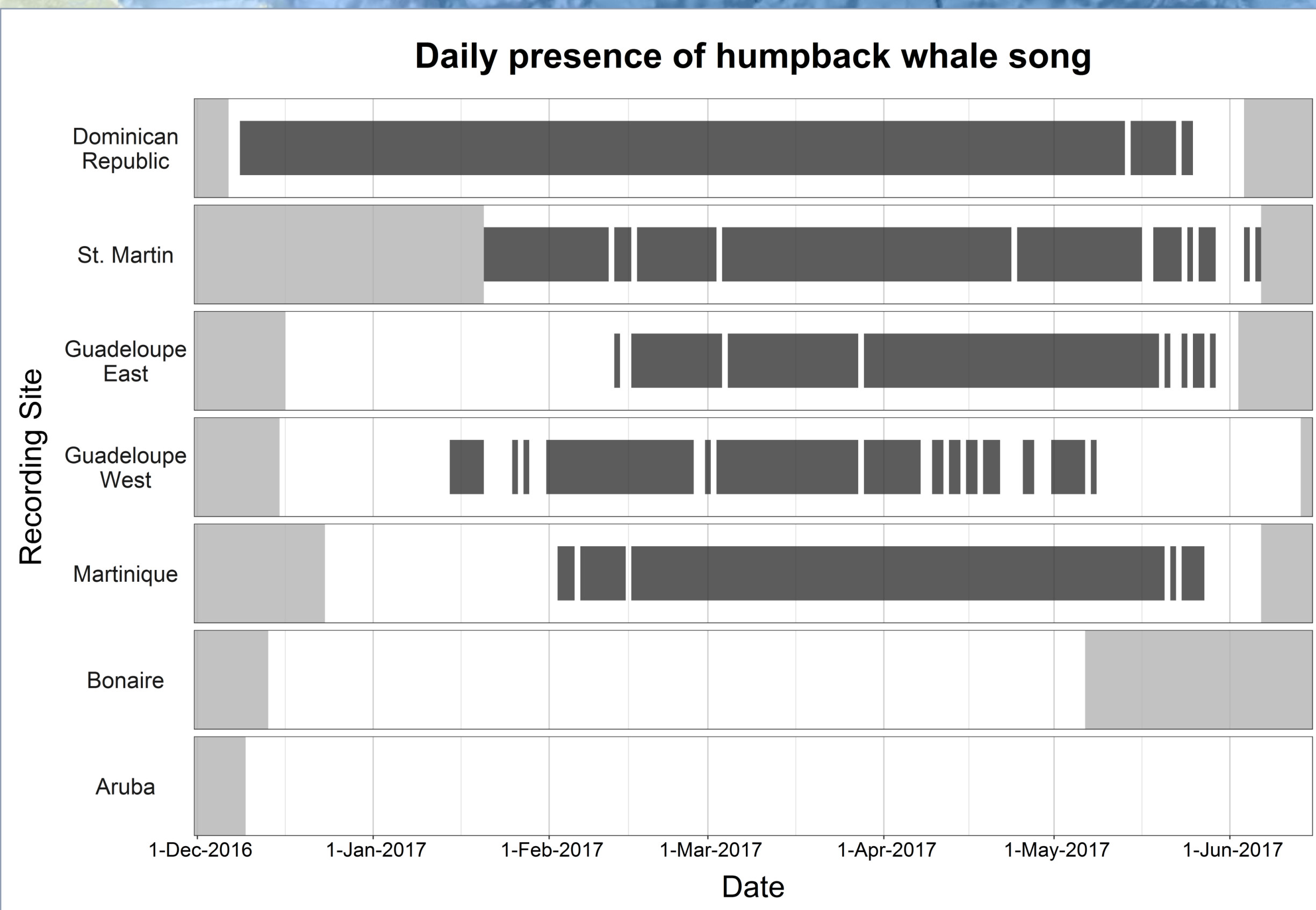
Humpback whale song was recorded at five of the seven monitoring sites, and was generally present from January through May, with some variation in the seasonal timing of song presence across sites (**Fig. 1**). Singing activity was particularly intense at the Dominican Republic recording site located on Silver Bank, where multiple singers were often recorded simultaneously. Seasonal changes in the structure of song themes were also observed. Other biological and anthropogenic sounds of interest were noted opportunistically during the humpback song analysis; for example, dolphin whistles and sperm whale clicks were detected in the SoundTrap recordings from Bonaire (**Fig. 2**).

## Conclusions & Future Directions

These results provide an initial overview of the seasonal occurrence of humpback whale song across the Caribbean. Further analyses will focus on quantifying temporal and spatial variation in song structure. Differences in song structure can be used to identify separate breeding populations, which may ultimately help inform management and policy decisions.



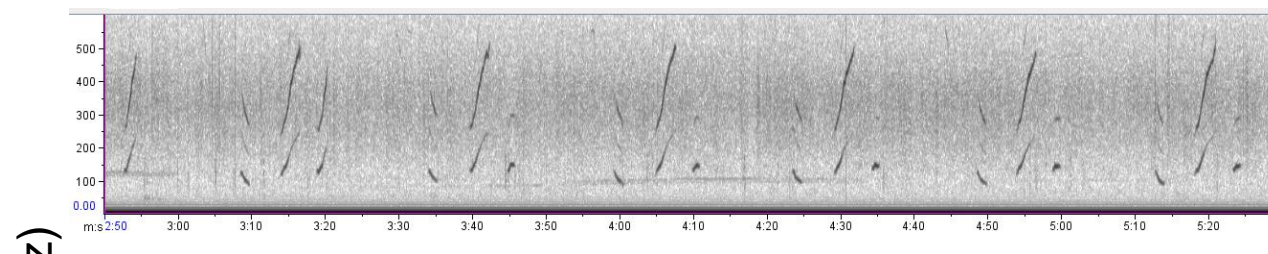
Dominican Republic



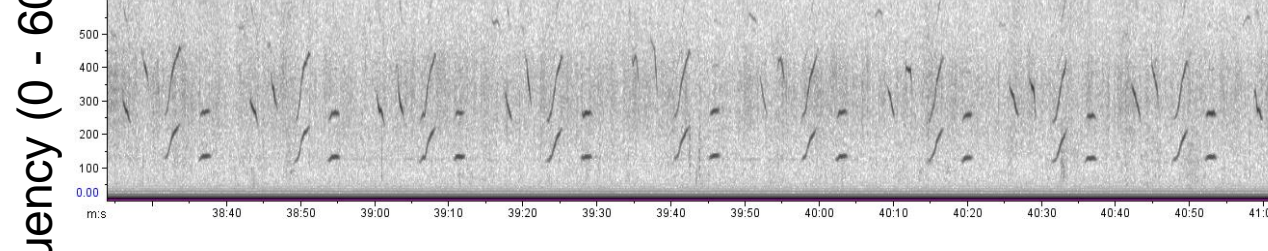
**Figure 1.** Seasonal occurrence of humpback whale song from Dec 2016 to Jun 2017 across all recording sites, shown from north (top) to south (bottom). Dark gray bars indicate recording dates with humpback song present; light gray shading indicates periods with no recording effort. Recordings were collected continuously at all sites except for St. Martin, where a 25% duty-cycle (1 h / 4 h) was used.

## Seasonal change in song theme

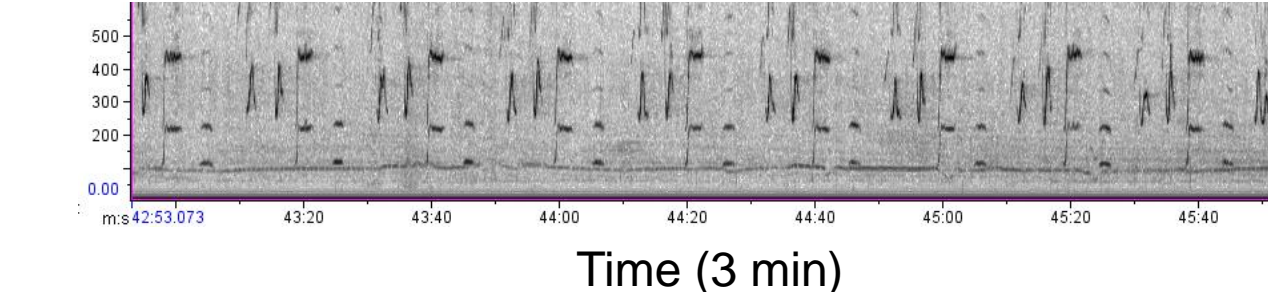
February 2017



March 2017



May 2017



Saint Martin

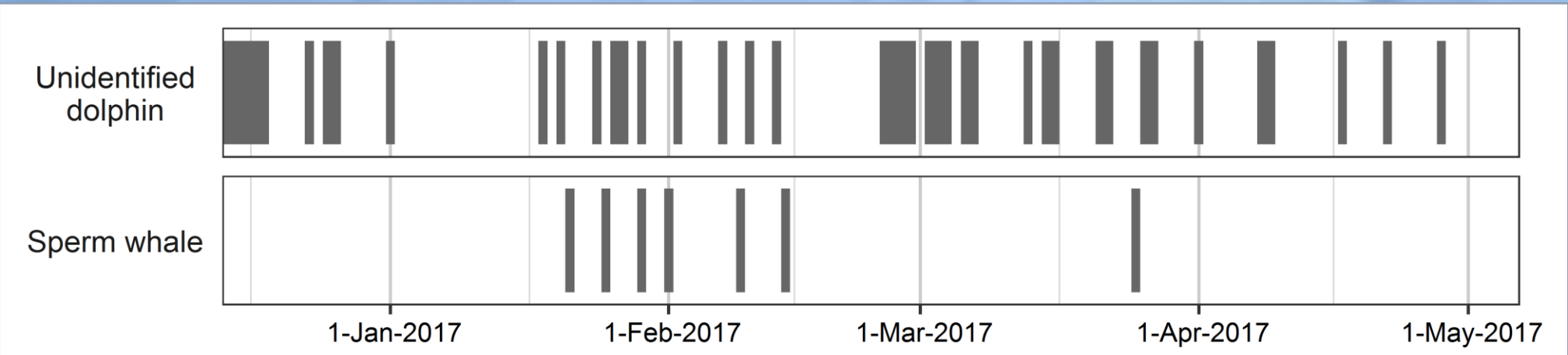
Guadeloupe East

Guadeloupe West

Martinique

Aruba

Bonaire



**Figure 2.** Daily presence of odontocete detections in Bonaire between 14 Dec 2016 and 06 May 2017. Recordings were collected with a SoundTrap on a duty-cycled recording schedule of 1 h / 4 h.

▲ MARU

● SoundTrap

★ MARU & SoundTrap