

# **Passive Acoustic Monitoring for Marine Mammals at Site B in Jacksonville, FL, February – July 2011**

A Summary of Work Performed by Amanda J. Debich, Simone Baumann-Pickering, Ana Širović, Sara M. Kerosky, Lauren K. Roche, Sarah C. Johnson, Rachel S. Gottlieb, Zoe E. Gentes, Sean M. Wiggins, and John A. Hildebrand

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## **Abstract**

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between February and July 2011 in the Jacksonville, FL, survey area at Site B in 37 m. This HARP sampled at 200 kHz for 5 minutes of every 15 minutes and recorded for 163 days between 2 February 2011 and 14 July 2011. Long-Term Spectral Averages (LTSAs) were created for three frequency bands (10 Hz – 1000 Hz, 500 Hz – 5000 Hz, and 1 kHz – 100 kHz) and scanned for marine mammal vocalizations. Calls of humpback whales and unidentified delphinids were detected in the data.

## Methods

The February – July 2011 Jacksonville Site B HARP (Jacksonville 06B) was deployed at  $30.25768^{\circ}$  N,  $80.42782^{\circ}$  W on 1 February 2011 (recording started on 2 February 2011) and recovered on 14 July 2011 (recording ended on 14 July 2011). The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 37 m. A schematic diagram of the Jacksonville 06B HARP is shown in Figure 2.

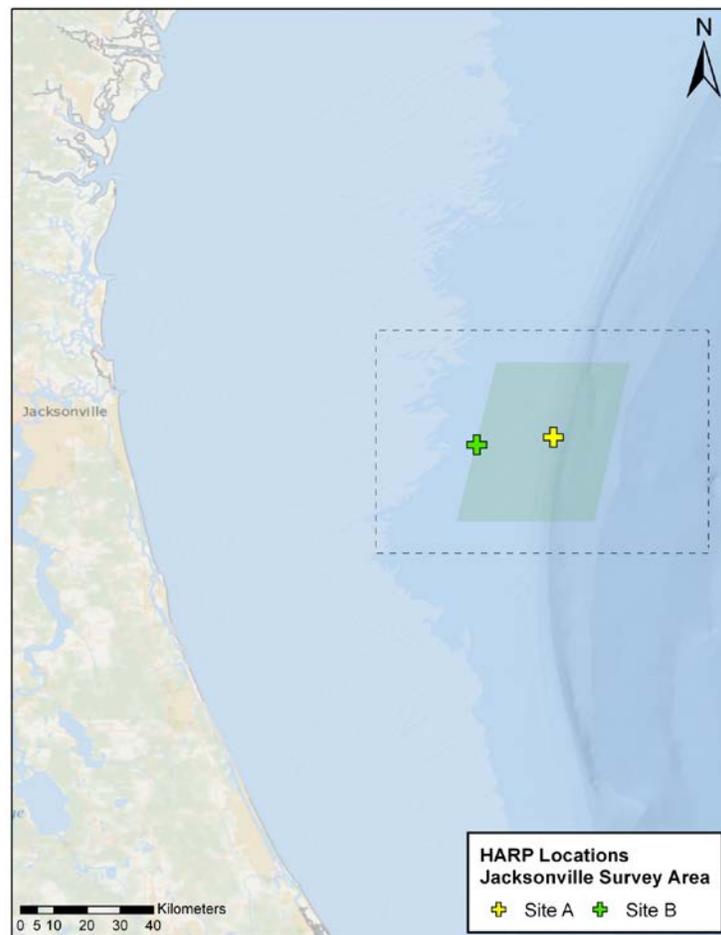


Figure 1. Location of HARP deployment sites in the Jacksonville survey area. The location of the Jacksonville 06B HARP is shown in green.

## JAX 06B HARP as deployed

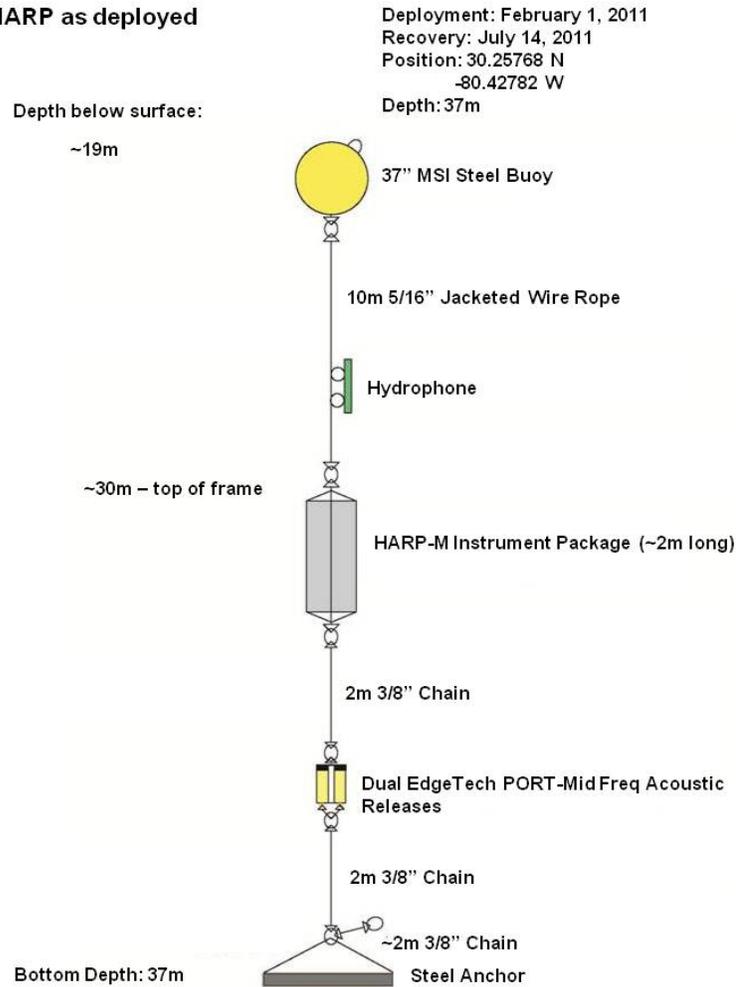


Figure 2. Schematic diagram showing details of the Jacksonville 06B HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 15 minutes during the Jacksonville 06B deployment. This deployment provided a total of 1362.2 hours of data over the 163 days of recording.

The following methods are a summary of Debich *et al.* (2013). Members of the Scripps Whale Acoustics Lab manually scanned the data from the Jacksonville 06A HARP deployment for

marine mammal vocalizations and anthropogenic sounds (sonar, explosions, and shipping) using LTSAs. As a first pass for data analysis, segments of data that did not allow for further analysis due to disk malfunctions or strumming noise were identified. For Jacksonville 06B, there were gaps in the high-frequency data between 9 February 2011 07:00 and 12 February 2011 05:02 that could not be analyzed. Also for Jacksonville 06B, the low- and mid-frequency data between 2 February 2011 14:20 and 12 February 2011 05:02 could not be analyzed. For effective analysis of marine mammal and anthropogenic sounds, the usable data were divided into three frequency bands ((1) low frequencies, between 10 – 1000 Hz, (2) mid frequencies, between 500 – 5000 Hz, and (3) high frequencies, between 1 – 100 kHz). The resulting LTSAs had resolutions of 5 s in time and 1 Hz in frequency (for the data decimated by a factor of 100: 10-1000 Hz band), 5 s in time and 10 Hz in frequency (for the data decimated by a factor of 20: 500-5000 Hz band), and 5 s in time and 100 Hz in frequency (for the data not decimated: 1-100 kHz). Each LTSA was analyzed for the sounds of an appropriate subset of species or sources. Blue, fin, sei, Bryde's, and North Atlantic right whale and a subset of minke sounds were classified as low frequency; humpback, minke, shipping, explosions, and mid-frequency active sonar were classified as mid-frequency; and the remaining odontocete and sonar sounds were considered high-frequency. Low- and mid-frequency sounds were analyzed in hourly bins; high-frequency vocalizations were analyzed in one-minute bins. Vocalizations were assigned to species when possible.

## Results

Table 1 summarizes the detected and identified marine mammal vocalizations for the Jacksonville 06B HARP deployment. Figures 3-4 show the daily occurrence patterns for the different marine mammal groups (classified to species when possible). Underwater ambient noise during this deployment is shown in Figure 5.

Humpback whales were detected during this deployment (Figure 3). Only a few detections were made, likely because the migratory path of western North Atlantic humpbacks does not include the southeast US coastline, as they migrate from feeding areas in the Gulf of Maine (Katona and Beard 1990, Smith *et al.* 1999) to breeding areas in the Caribbean (Katona and Beard 1990, Stevick *et al.* 1998).

Debich *et al.* (2013) report on the detection of a single low-frequency pulse train in June during the Jacksonville 06B deployment. This single pulse train was originally assigned to a minke whale (which would be the first detection at this shallower site and also the first detection in the summer in the Jacksonville survey area); however, upon closer inspection<sup>1</sup> of the frequency characteristics of the sound, it is unclear as to if an animal produced the sound versus a boat and thus will not be discussed further here.

Detected odontocete vocalizations included clicks and whistles (Figures 4). All of these detections were assigned to the unidentified odontocete category (Figure 4), with clicks being

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<sup>1</sup> Closer inspection was made by Lynne Hodge (Duke University) and Denise Risch (Passive Acoustic Research Group, Northeast Fisheries Science Center).

divided into five main groups based on spectral patterns (see Debich *et al.* 2013 for more details). In comparison to the Jacksonville 06A deployment which occurred during the same time period, rates of unidentified odontocete detections were lower during the Jacksonville 06B deployment.

Table 1. Summary of detections of marine mammal vocalizations at Jacksonville Site B for February – July 2011 (Jacksonville 06B). \*For mysticetes, total duration of vocalizations (hours) and percent of recording duration are based on data analyzed in hourly bins; for odontocetes, total duration of vocalizations (hours) and percent of recording duration are based on data analyzed in one-minute bins.

<b>Species</b>	<b>Call type</b>	<b>Total duration of vocalizations (hours)*</b>	<b>Percent of recording duration*</b>	<b>Days with vocalizations</b>	<b>Percent of recording days</b>
Humpback whale	song or non-song (unspecified)	1	0.03	1	0.61
Unidentified odontocete	clicks, whistles, burst-pulses	316.43	23.23	139	85.28

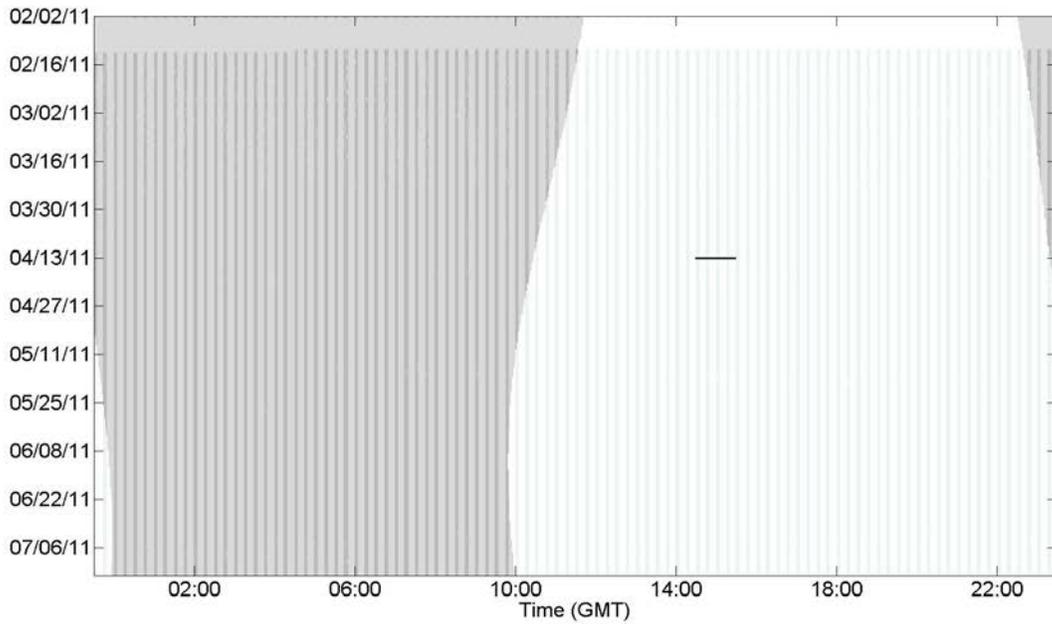


Figure 3. Humpback whale detections (black bars) in hourly bins for the Jacksonville 06B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

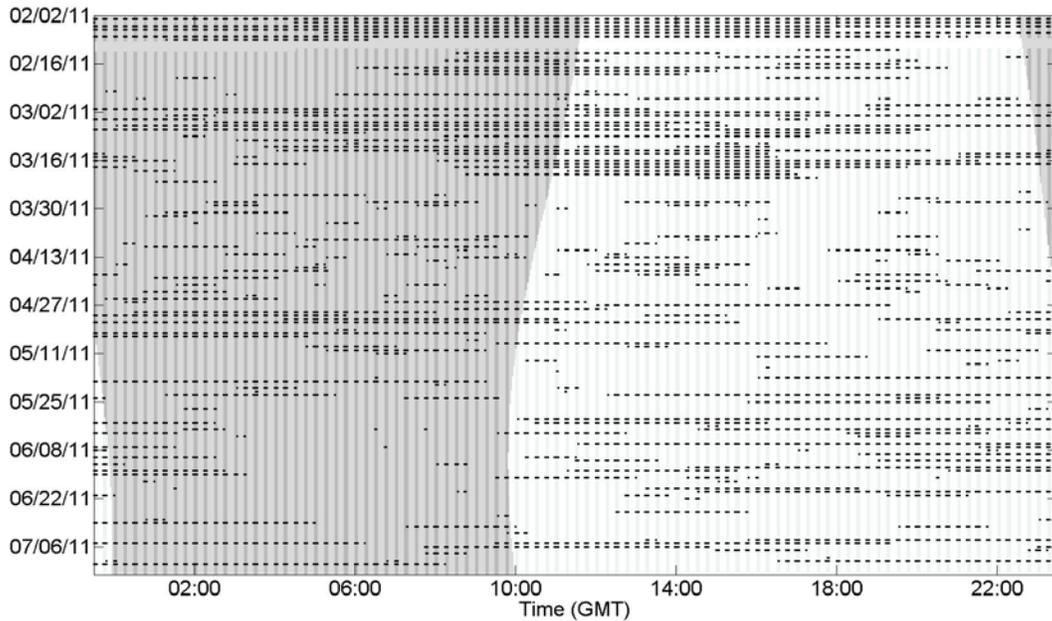


Figure 4. Unidentified odontocete vocalization detections (black bars) in one-minute bins for the Jacksonville 06B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

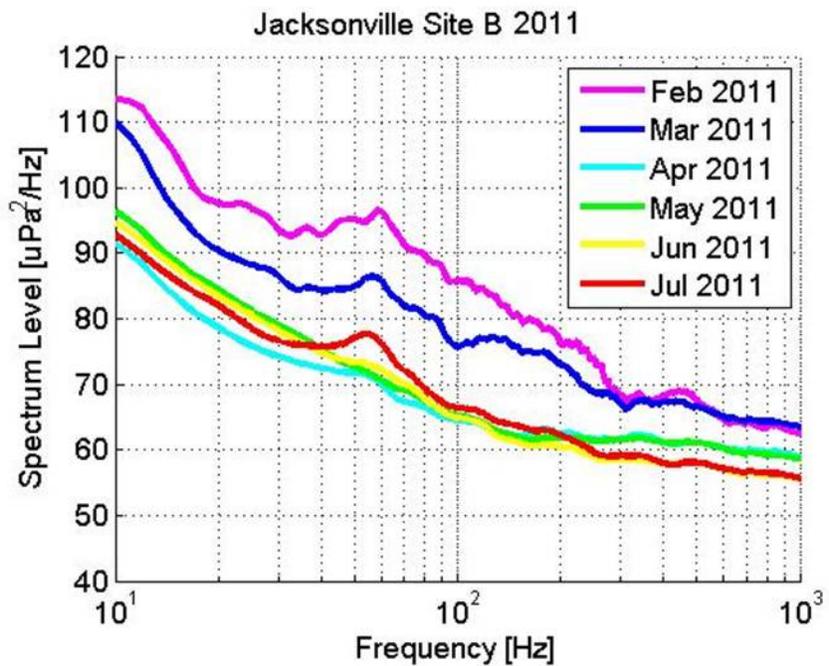


Figure 5. Monthly averages of ambient noise at Jacksonville Site B for February – July 2011.

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