Passive Acoustic Monitoring for Marine Mammals at Site B in Jacksonville, FL, March – August 2010

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Individual technical reports of other HARP deployments are available at:
http://www.navymarinespeciesmonitoring.us/reading-room/

Abstract

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between March and August 2010 in Jacksonville, FL, at Site B in 38 m. This HARP sampled at 200 kHz for 5 minutes of every 15 minutes and recorded for 164 days between 9 March 2010 and 19 August 2010. 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 and mid-frequency active sonar. Vocalizations of humpback whales, sperm whales, and unidentified delphinids were detected in the data.

Methods

The March – August 2010 Jacksonville Site B HARP (JAX 04B) was deployed at 30.25919^{o} N, 80.42566^{o} W on 9 March 2010 (recording started on 9 March 2010) and recovered on 26 August 2010 (recording ended on 19 August 2010). The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 38 m. A schematic diagram of the JAX 04B HARP is shown in Figure 2.

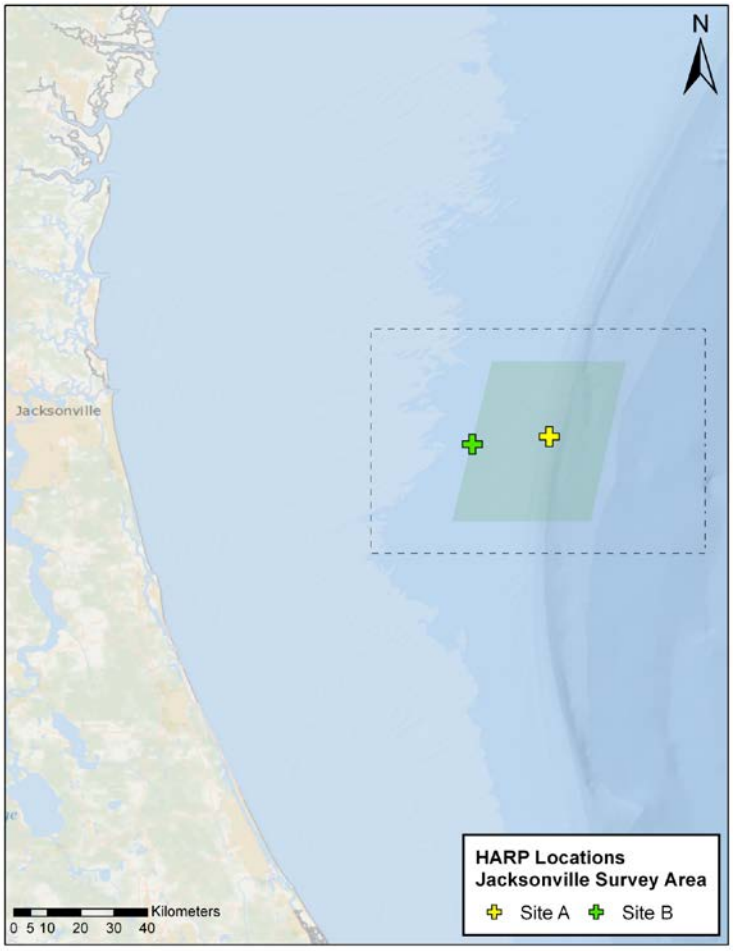

Figure 1. Location of HARP deployment sites in the Jacksonville survey area. The location of the Jacksonville 04B HARP is shown in green.

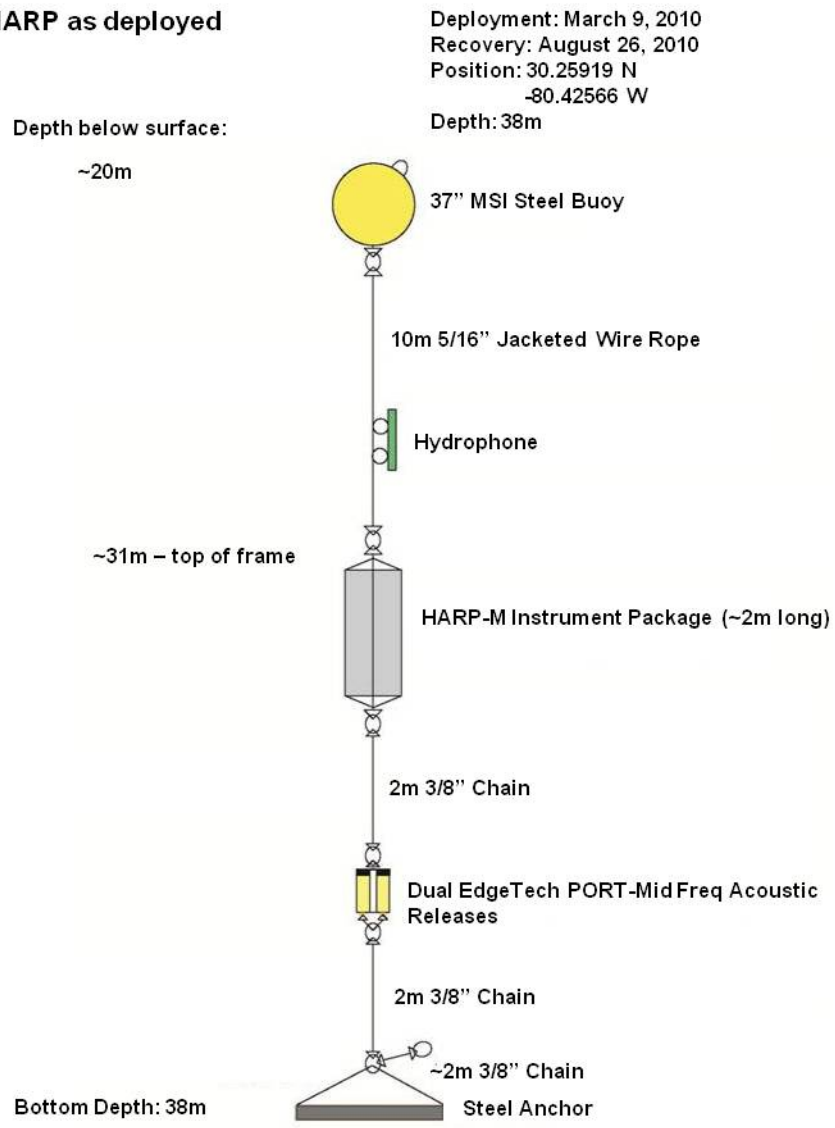

Figure 2. Schematic diagram showing details of the JAX 04B HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 15 minutes during the JAX 04B deployment. This deployment provided a total of approximately 1302 hours of data over the 164 days of recording. The data collected were manually scanned for marine mammal vocalizations using *Triton* (Hildebrand Lab at Scripps Institution of Oceanography, La Jolla, CA). The effective frequency range of the HARP (10 Hz – 100 kHz) was divided into three

parts for this manual review: 10-1000 Hz, 500 Hz – 5000 Hz, and 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). All data were analyzed by visually scanning the LTSAs in appropriate frequency bands or by running automatic detectors. Each LTSA was analyzed for the sounds of an appropriate subset of species or sources. Blue, fin, Bryde's, minke, North Atlantic right, and sei whale sounds, and an unknown sound found during earlier JAX data analysis (the "5pulse" sound), were classified as low frequency; humpback whale and mid-frequency active sonar sounds were classified as mid-frequency; odontocetes were classified as high frequency. Humpback whale call detection effort was automated using a power-law detector (Helble *et al.* 2012). After the generalized power-law algorithm was applied, a trained analyst verified the accuracy of the detected signals. Manual scanning was used to detect mid-frequency active sonar, followed by the use of a custom software routine which detected individual pings and calculated peak-to-peak received sound pressure levels, described in further detail in Johnson *et al.* (2014). See Johnson *et al.* 2014 for a more detailed description of analysis methods. The presence of vocalizations and mid-frequency active sonar was determined in one-minute bins, and vocalizations were assigned to species when possible.

Results

Table 1 summarizes the detected and identified marine mammal vocalizations for the JAX 04B HARP deployment. Figures 3-5 show the daily occurrence patterns for the different marine

mammal groups (classified to species when possible). Figure 6 shows the occurrence of mid-frequency active sonar. More details on the calculated peak-to-peak received sound pressure levels of the mid-frequency active sonar can be found in Johnson *et al.* 2014. Underwater ambient noise during this deployment is shown in Figure 7. High ambient noise levels, caused by instrument strumming and fluid flow at the hydrophone, were prevalent during this deployment and decreased the detection ability for low-frequency sounds.

Humpback whale non-song vocalizations were detected during two days, March 11 and 12, 2010 (Figure 3). There were no instances of humpback whale song detected.

Detected odontocete vocalizations included clicks and whistles (Figures 4-5). Most of these detections were assigned to the unidentified odontocete category (Figure 4). Sperm whales were detected on only six days during daylight hours (Figure 5).

Table 1. Summary of detections of marine mammal vocalizations at Jacksonville, FL, Site B for March – August 2010 (JAX 04B).

Species	**Call type**	**Total duration of vocalizations (hours)**	**Percent of recording duration**	**Days with vocalizations**	**Percent of recording days**
Humpback whale	non-song	1.67	0.12	2	1.22
Unidentified odontocete	clicks	427.45	32.81	142	86.59
Unidentified odontocete	whistles	77.25	5.93	127	77.44
Sperm whale	clicks	91.05	6.99	89	54.27

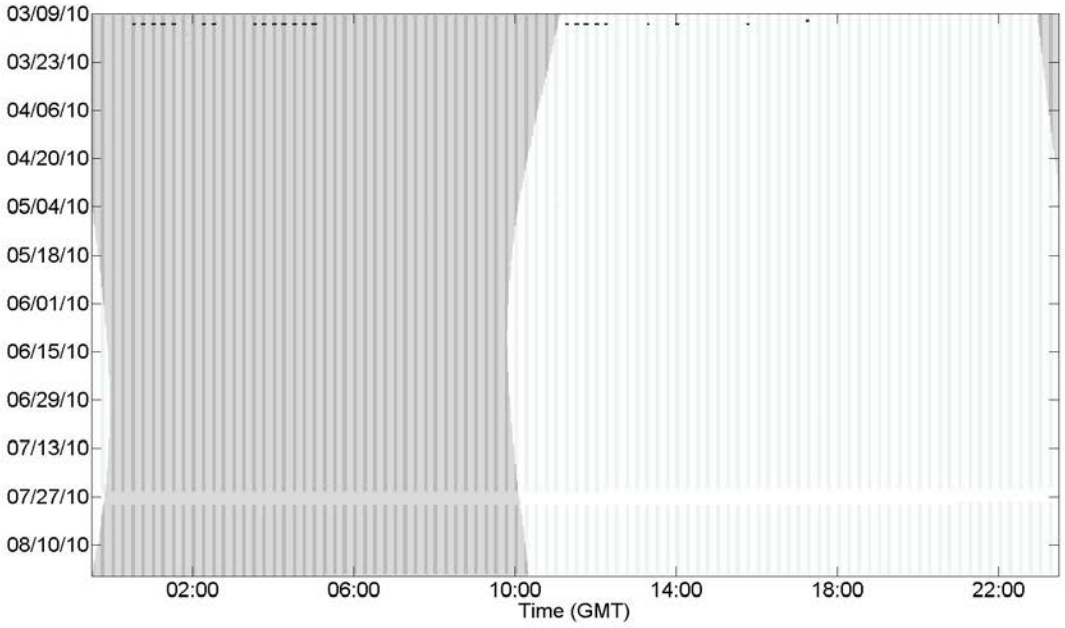

Figure 4. Humpback whale detections (black bars) for the JAX 04B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

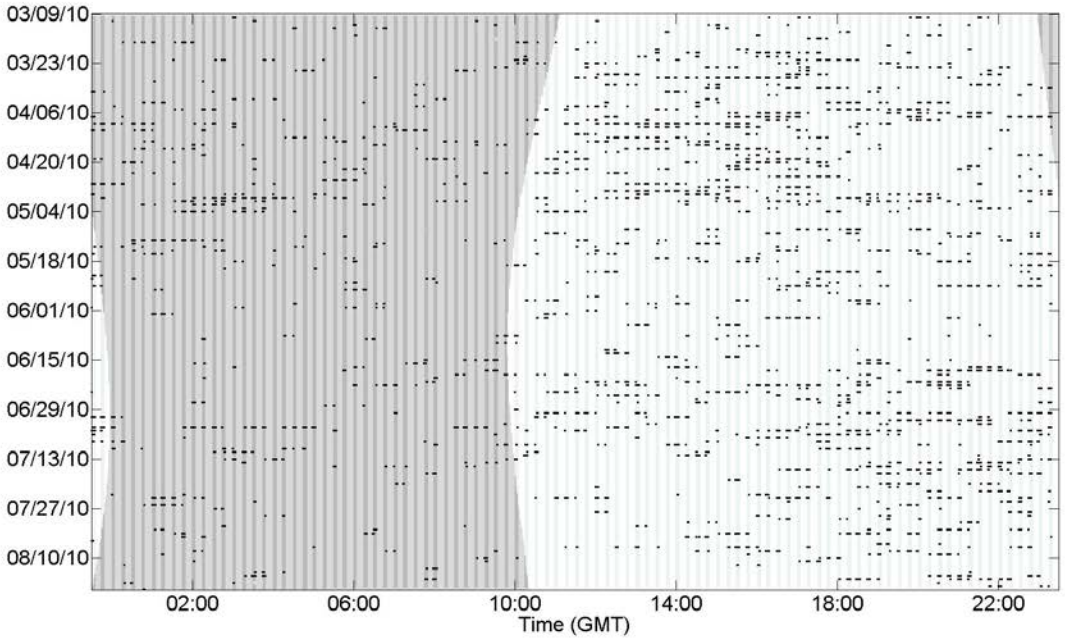

Figure 4. Unidentified odontocete vocalization detections (black bars) for the JAX 04B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

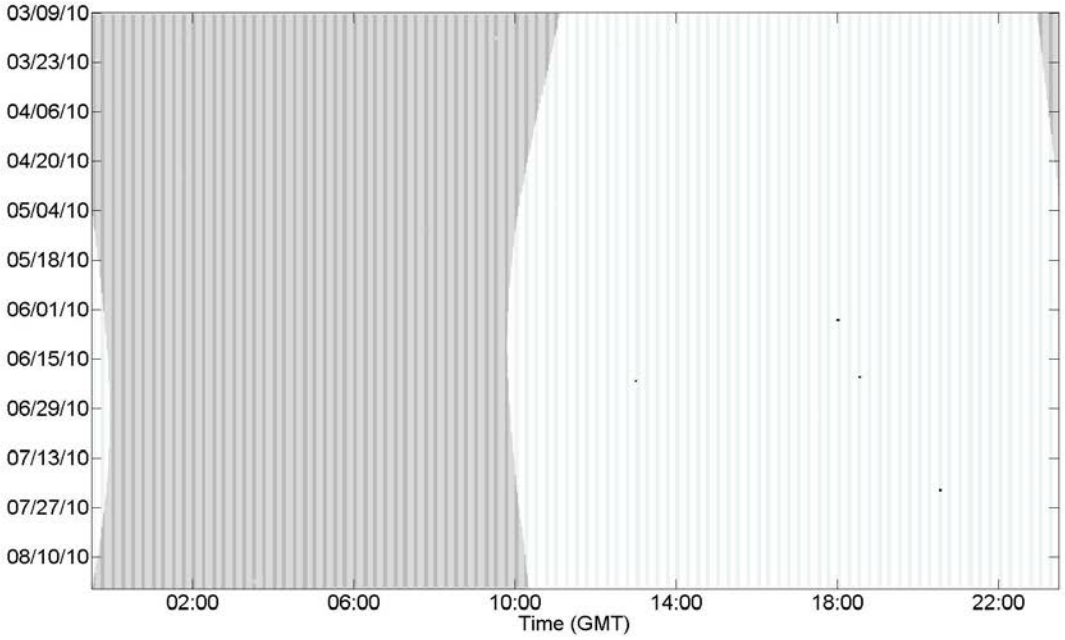

Figure 5. Sperm whale click detections (black bars) for the JAX 04B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

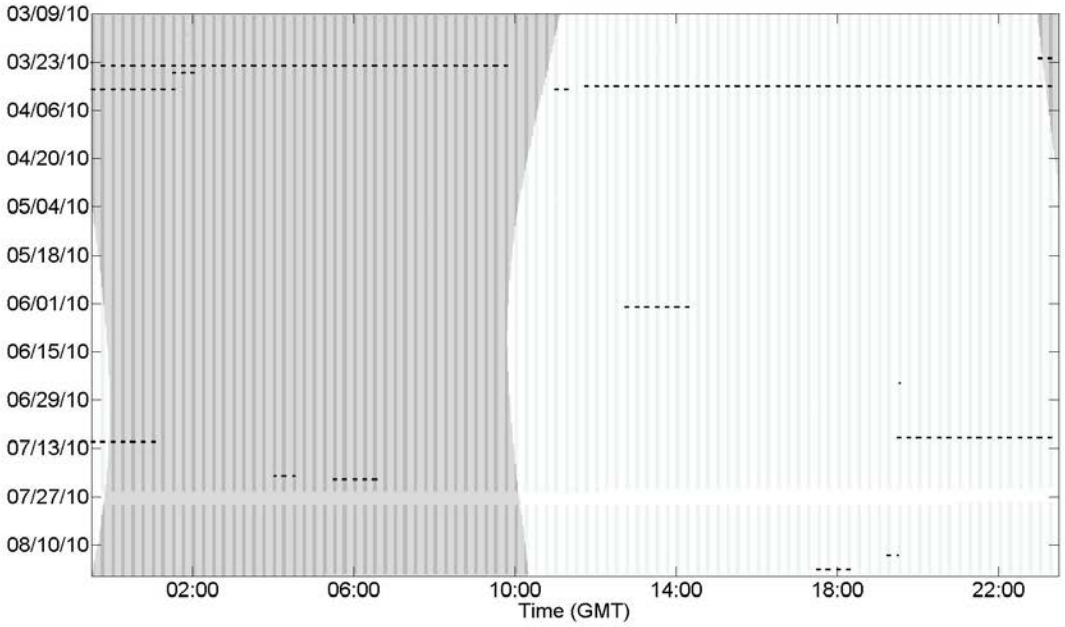

Figure 6. Mid-frequency active sonar (black bars) detected during the JAX 04B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

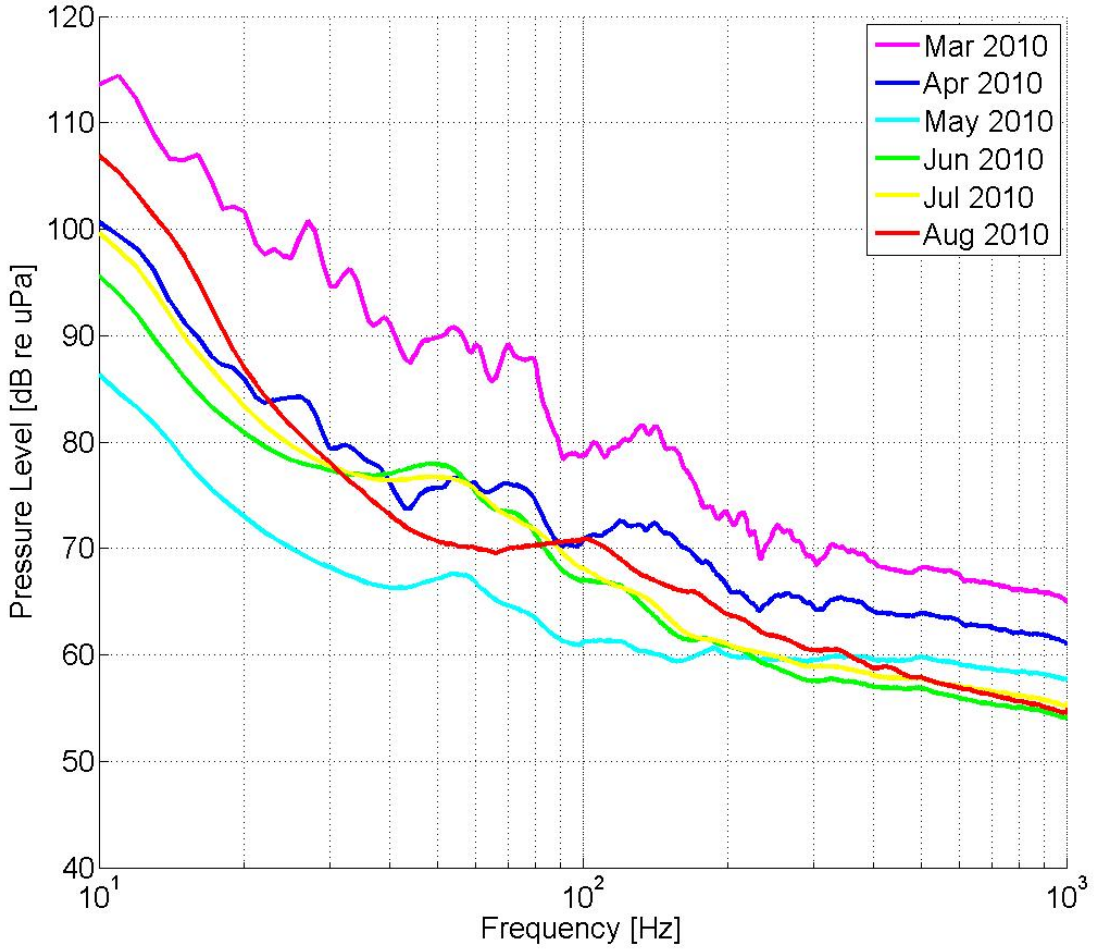

Figure 7. Monthly averages of ambient noise at Jacksonville, FL, Site B for March – August 2010.

References

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