Passive Acoustic Monitoring for Marine Mammals at Site A in Jacksonville, FL, February – July 2010

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

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Abstract

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between February and August 2010 in Jacksonville, FL, at Site A in 89 m. This HARP sampled at 200 kHz for 5 minutes of every 15 minutes and recorded for 159 days between 22 February 2010 and 30 July 2010. Long-Term Spectral Averages (LTSAs) were created for three frequency bands (10 Hz – 1000 Hz, 500 Hz – 10 kHz, and 1 kHz – 100 kHz) and scanned for marine mammal vocalizations and mid-frequency active sonar. Vocalizations of minke whales, sperm whales, and unidentified delphinids were detected in the data.

Methods

The February – July 2010 Jacksonville Site A HARP (JAX 03A) was deployed at 30.28111^{o} N, 80.21530^{o} W on 21 February 2010 (recording started on 22 February 2010) and recovered on 26 August 2010 (recording ended on 30 July 2010. The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 89 m. A schematic diagram of the JAX 03A HARP is shown in Figure 2.

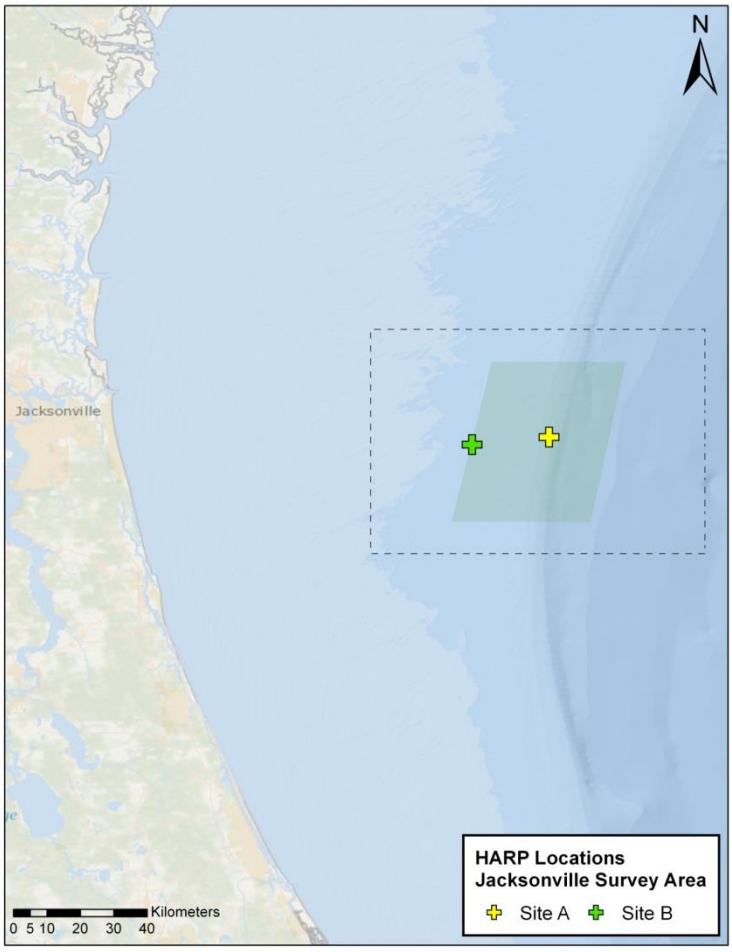

Figure 1. Location of HARP deployment sites in the Jacksonville survey area. The location of the Jacksonville 03A HARP is shown in yellow.

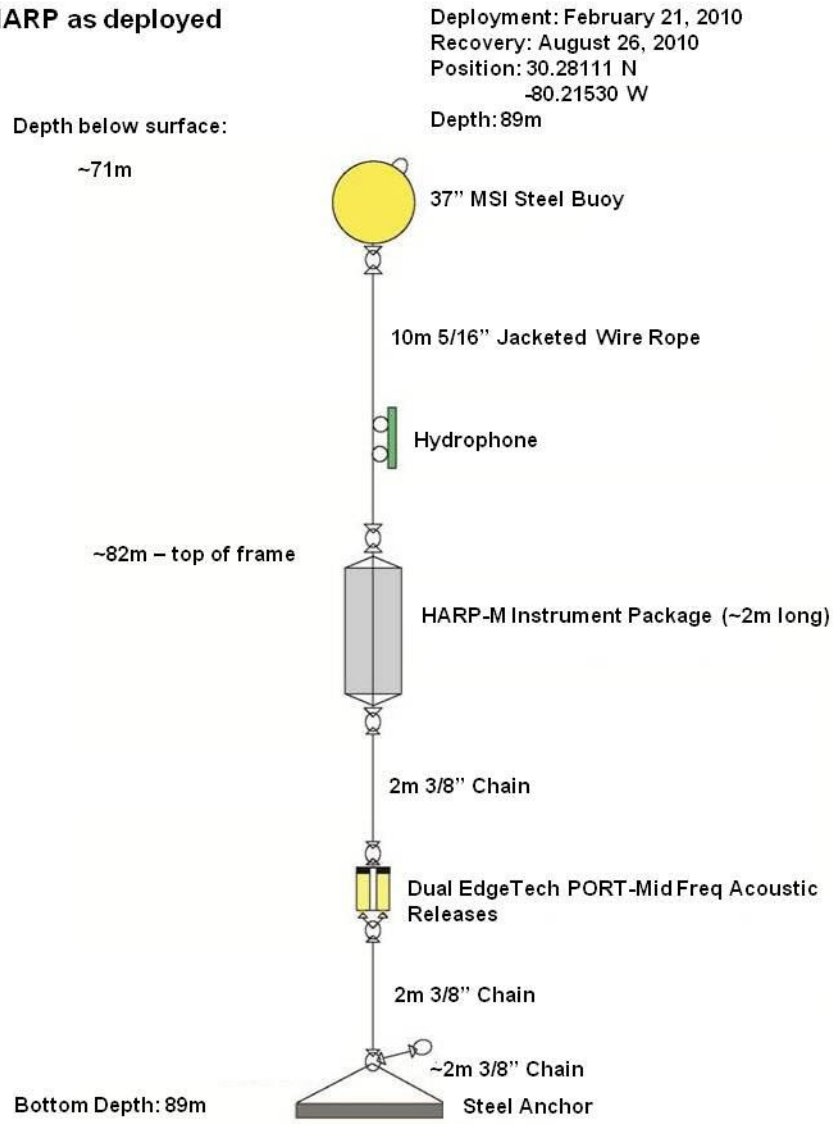

Figure 2. Schematic diagram showing details of the JAX 03A HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 15 minutes during the JAX 03A deployment. This deployment provided a total of approximately 1269 hours of data over the 159 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: 0.5-10 kHz 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. LTSAs that were decimated by a factor of 100 were inspected for sounds produced by minke whales only. These low-frequency data could not be effectively analyzed for marine mammal sounds due to high levels of ambient noise (in large part caused by instrument strumming and fluid flow at the hydrophone due to the shallow water environment). Such high levels of ambient noise decrease the detection ability for low-frequency sounds. Analysis for minke whale vocalizations was performed for a separate project looking at their seasonal presence. The mid-frequency LTSAs (0.5-10 kHz) were inspected for mid-frequency active sonar. Non-decimated LTSAs were inspected for odontocete whistles and clicks. 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 03A 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. Underwater ambient noise during this deployment is shown in Figure 7.

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 97 days mainly at night (Figure 5).

Table 1. Summary of detections of marine mammal vocalizations at Jacksonville, FL, Site A for February – July 2010 (JAX 03A).

Species	**Call type**	**Total duration of vocalizations (hours)**	**Percent of recording duration**	**Days with vocalizations**	**Percent of recording days**
Minke whale	pulse trains	0.10	0.01	2	1.26
Unidentified odontocete	clicks	464.97	32.32	157	98.74
Unidentified odontocete	whistles	80.40	5.59	139	87.42
Sperm whale	clicks	95.03	6.61	97	61.01

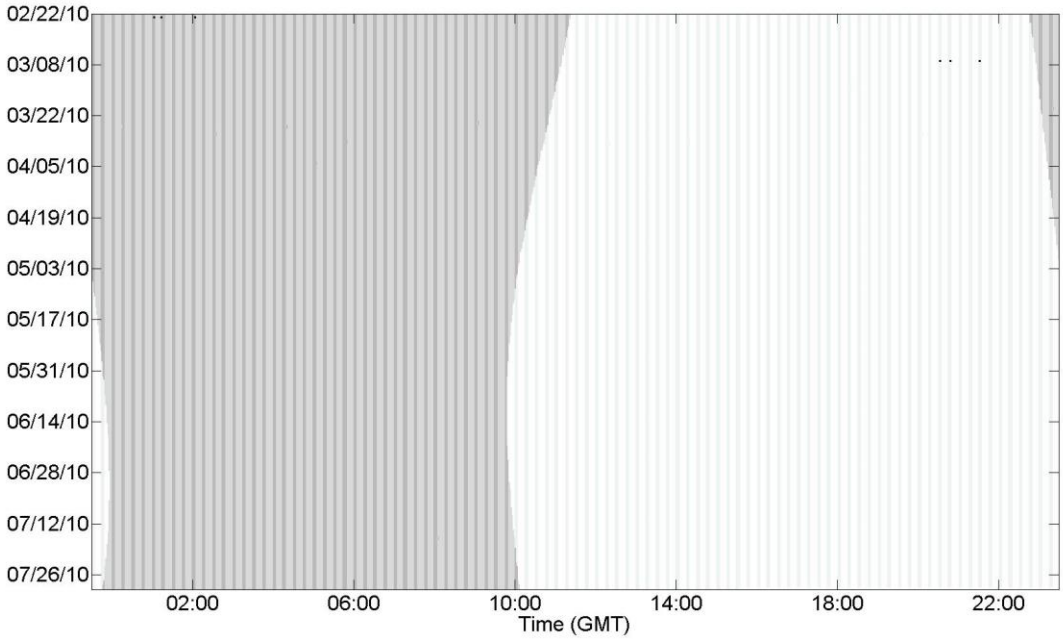

Figure 3. Minke whale pulse train detections (black bars) for the JAX 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

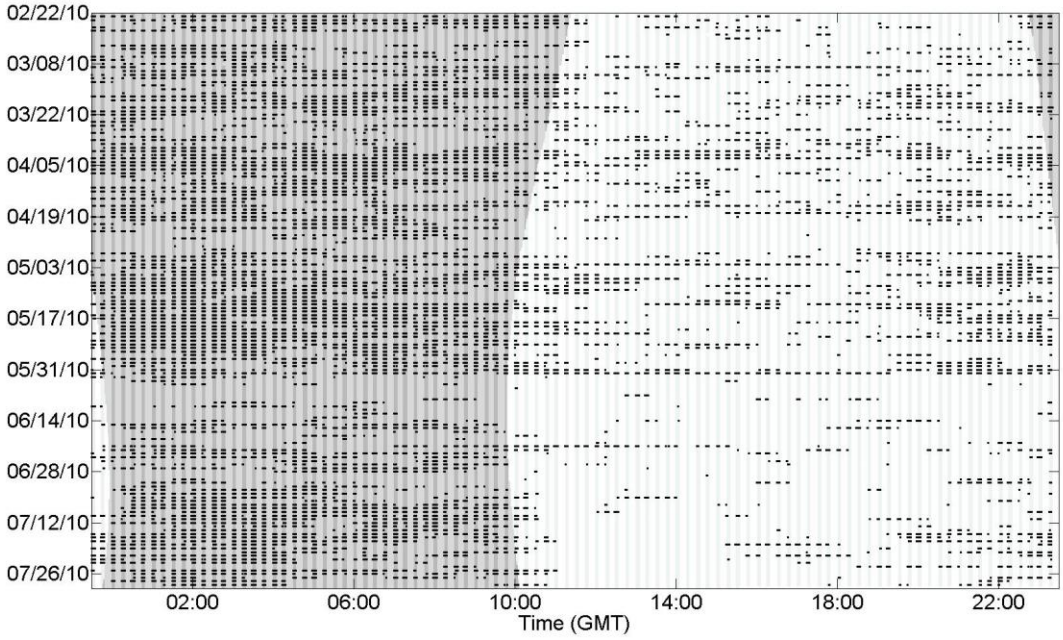

Figure 4. Unidentified odontocete vocalization detections (black bars) for the JAX 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

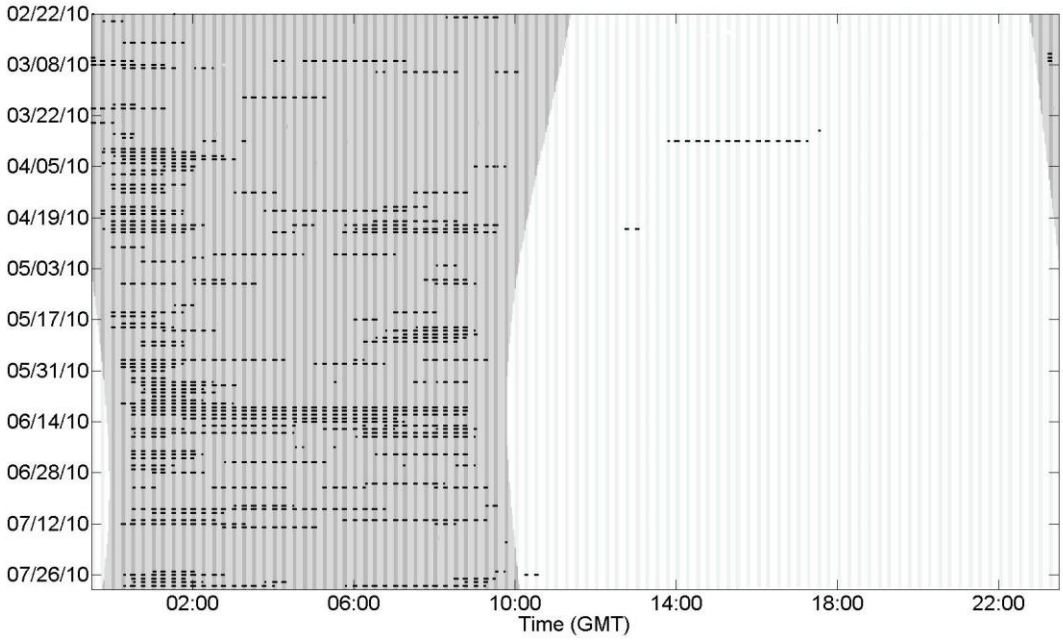

Figure 5. Sperm whale click detections (black bars) for the JAX 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

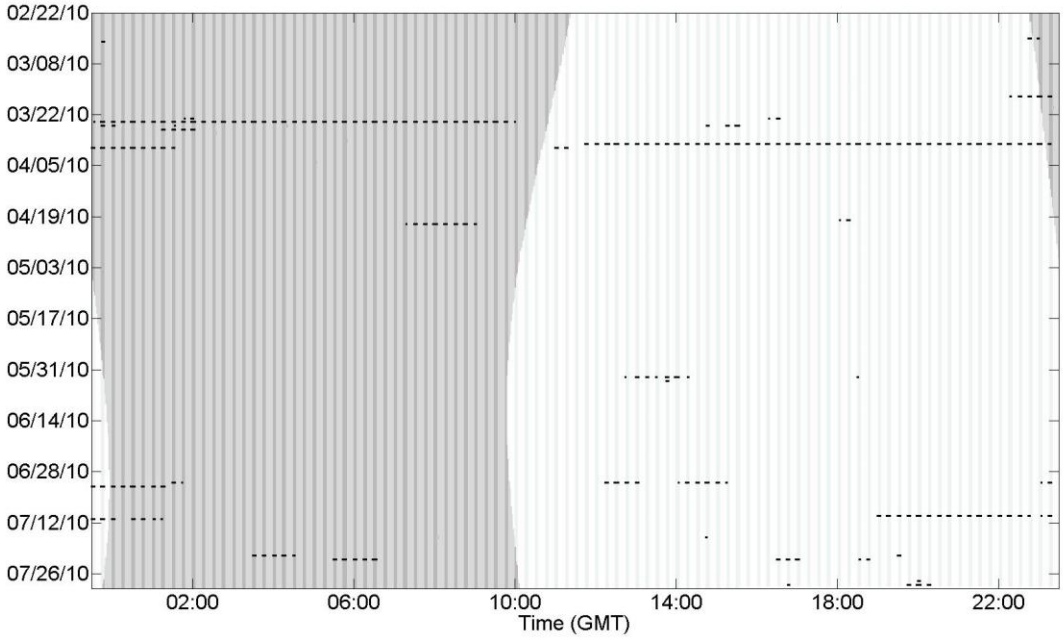

Figure 6. Mid-frequency active sonar (black bars) detected during the JAX 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

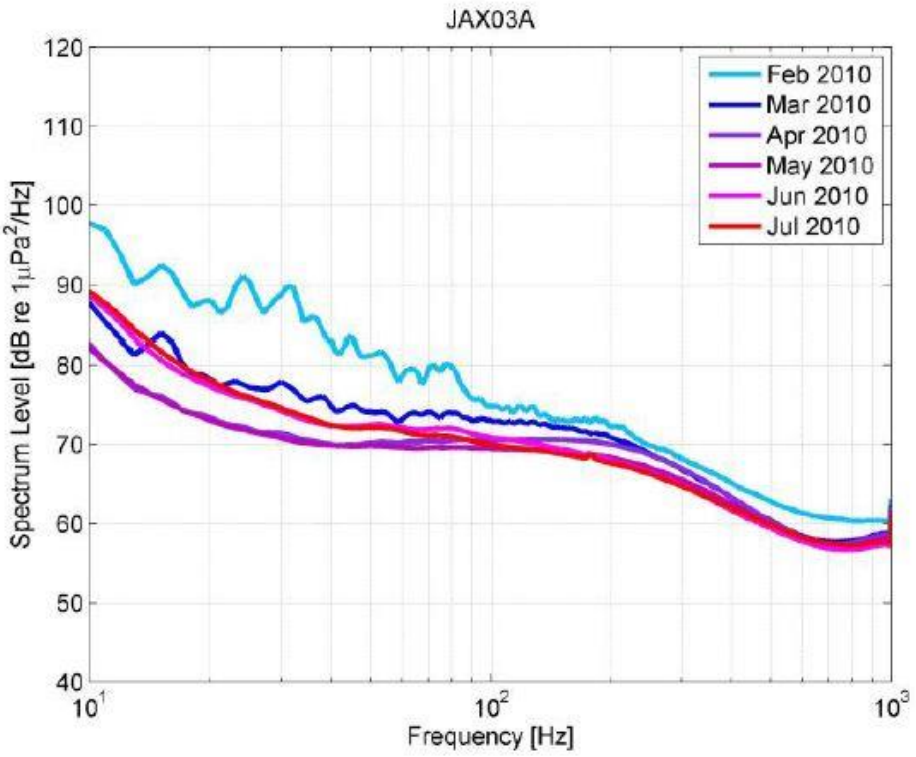

Figure 7. Monthly averages of ambient noise at Jacksonville, FL, Site A for February – July 2010. Figure from Appendix 6 of Wiggins 2015.

References

Wiggins, S.M. 2015. Low-frequency ambient noise offshore of North Carolina and Florida 2007-2014. Final Report. Marine Physical Laboratory Technical Memorandum 556. April 2015. Submitted to Naval Facilities Engineering Command (NAVFAC) Atlantic, Norfolk, Virginia, under Contract No. N62470-10-D-3011- Task Order Number 051 issued to HDR, Inc.

Wiggins, S.M. and J.A. Hildebrand. 2007. High-frequency Acoustic Recording Package (HARP) for broad-band, long-term marine mammal monitoring. In: *International Symposium on Underwater Technology 2007 and International Workshop on Scientific Use of Submarine Cables & Related Technologies 2007*: 551-557. Tokyo, Japan: Institute of Electrical and Electronics Engineers.