

Passive Acoustic Monitoring for Marine Mammals at Site A in Jacksonville, FL, September – December 2009

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Individual technical reports of other HARP deployments are available at:
<http://www.navy-marine-species-monitoring.us/reading-room/>

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Abstract

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between September 2009 and February 2010 in Jacksonville, FL, at Site A in 83 m. This HARP sampled at 200 kHz for 5 minutes of every 15 minutes and recorded for 91 days between 16 September 2009 and 15 December 2009, at which point the hydrophone was damaged possibly from an animal bite. 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, Risso's dolphins, sperm whales, and unidentified delphinids were detected in the data.

Methods

The September – December 2009 Jacksonville Site A HARP (JAX 02A) was deployed at 30.28052° N, 80.21603° W on 16 September 2009 (recording started on 16 September 2009) and recovered on 21 February 2010 (recording of usable data ended on 15 December 2009, earlier than expected due to the hydrophone being damaged, possibly from an animal bite). The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 83 m. A schematic diagram of the JAX 02A HARP is shown in Figure 2.

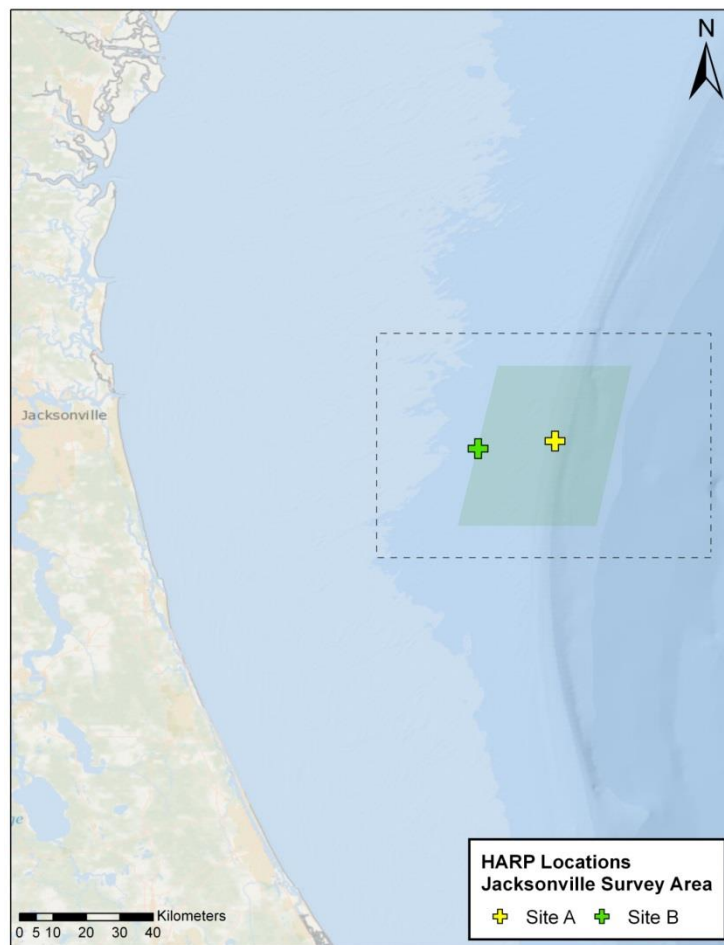


Figure 1. Location of HARP deployment sites in the Jacksonville survey area. The location of the Jacksonville 02A HARP is shown in yellow.

JAX 02A HARP as deployed

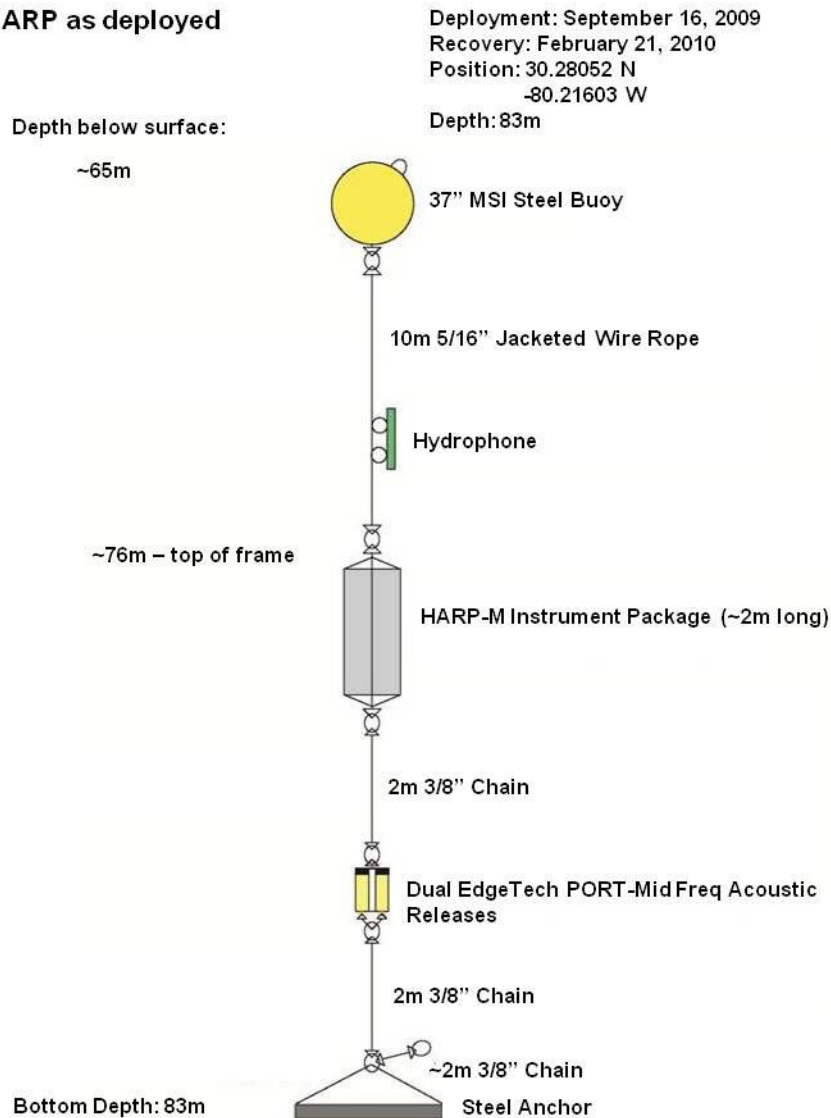


Figure 2. Schematic diagram showing details of the JAX 02A HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 15 minutes during the JAX 02A deployment. This deployment provided a total of approximately 714 hours of data over the 91 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 02A HARP deployment. Figures 3-6 show the daily occurrence patterns for the different marine mammal groups (classified to species when possible). Figure 7 shows the occurrence of mid-frequency active sonar. Underwater ambient noise during this deployment is shown in Figure 8.

Detected odontocete vocalizations included clicks and whistles (Figures 4-6). Most of these detections were assigned to the unidentified odontocete category (Figure 4). Risso's dolphins were detected on only one day (Figure 5). Sperm whales were detected on only seven days mainly during daylight hours (Figure 6).

Table 1. Summary of detections of marine mammal vocalizations at Jacksonville, FL, Site A for September – December 2009 (JAX 02A).

Species	Call type	Total duration of vocalizations (hours)	Percent of recording duration	Days with vocalizations	Percent of recording days
Minke whale	pulse trains	0.77	0.10	7	7.69
Unidentified odontocete	clicks	252.88	31.17	91	100
Unidentified odontocete	whistles	37.4	4.61	79	86.81
Risso's dolphin	clicks	0.25	0.03	1	1.10
Sperm whale	clicks	0.47	0.06	7	7.69

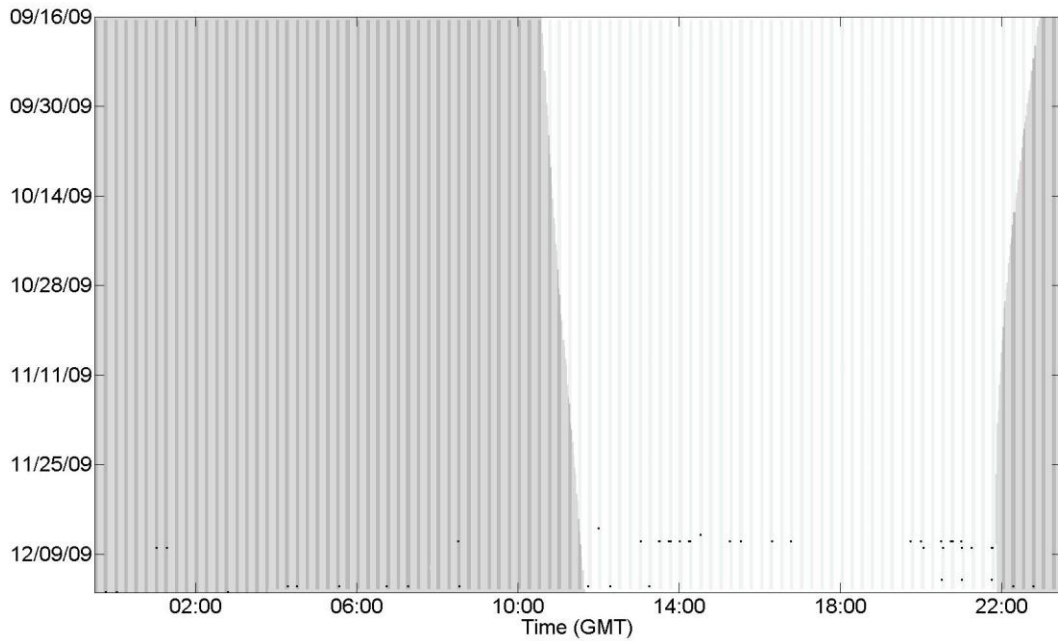


Figure 3. Minke whale pulse train detections (black bars) for the JAX 02A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

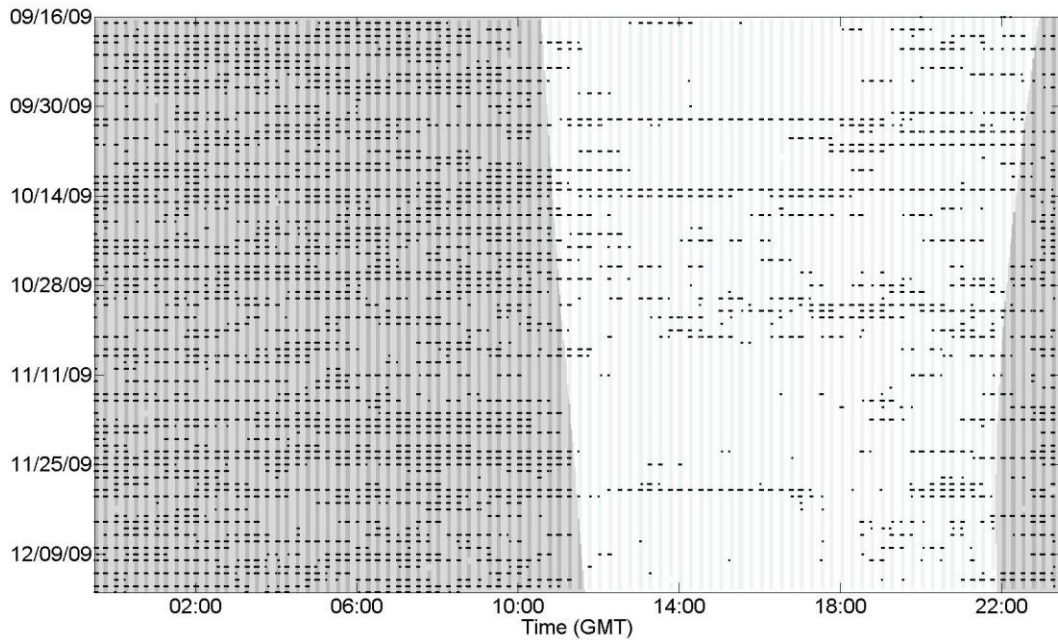


Figure 4. Unidentified odontocete vocalization detections (black bars) for the JAX 02A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

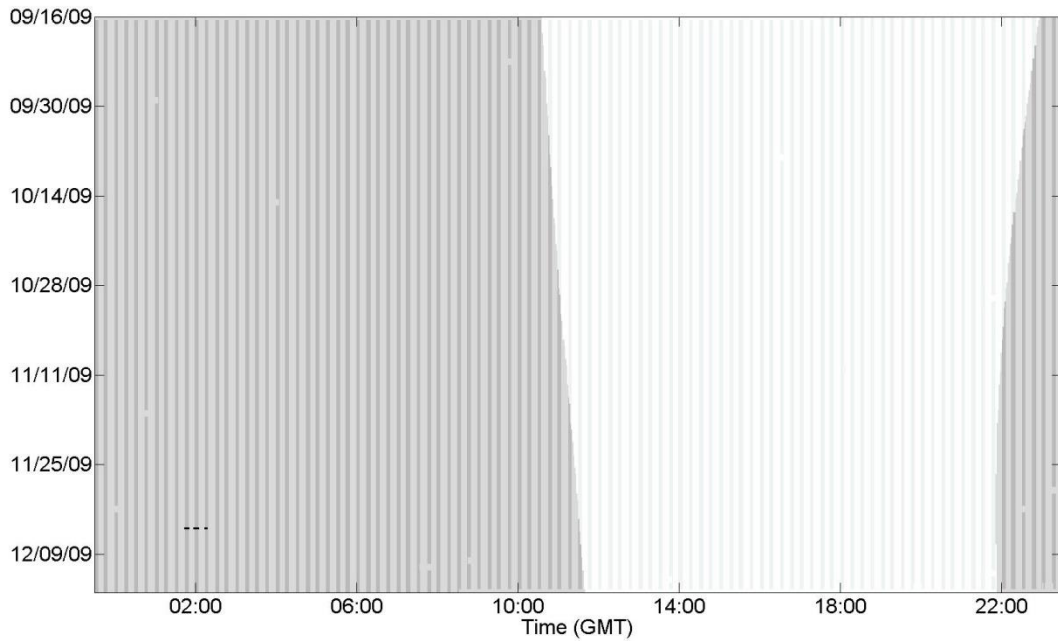


Figure 5. Risso's dolphin click detections (black bars) for the JAX 02A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

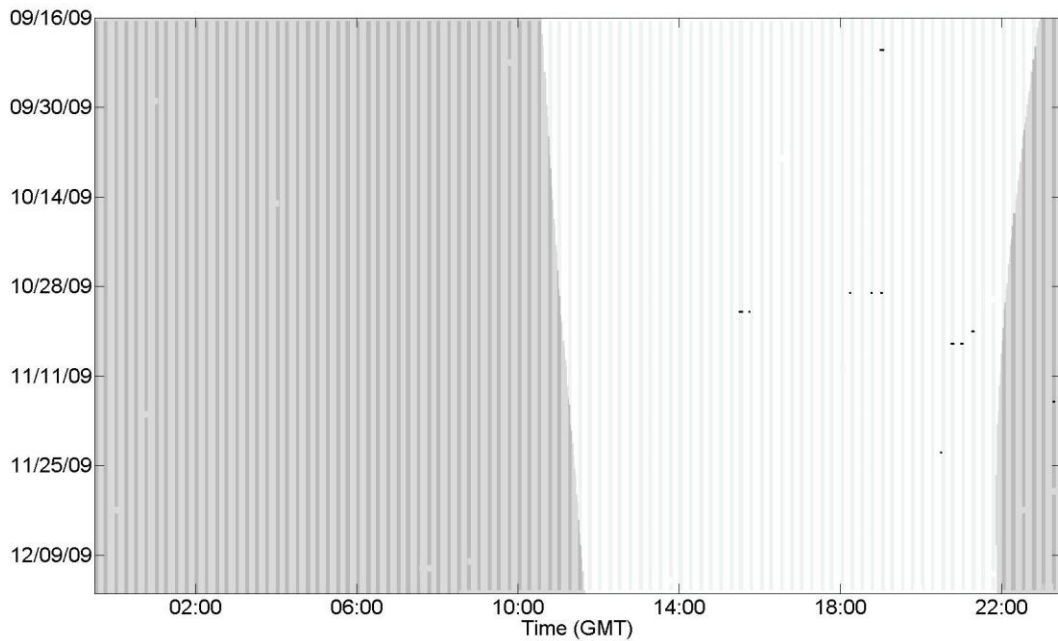


Figure 6. Sperm whale click detections (black bars) for the JAX 02A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

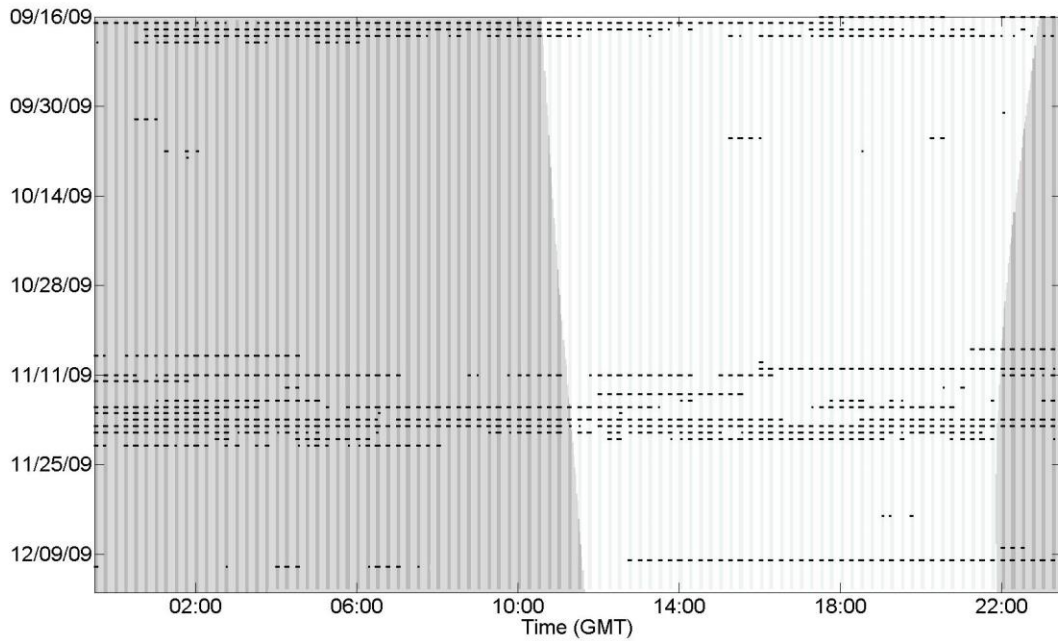


Figure 7. Mid-frequency active sonar (black bars) detected during the JAX 02A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (<http://aa.usno.navy.mil>). Lighter shading indicates recording/analysis effort.

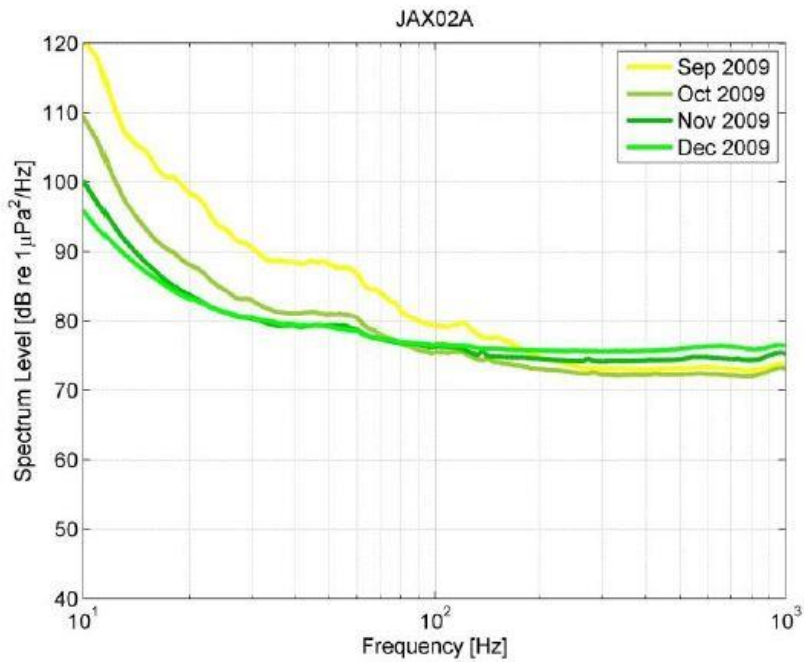


Figure 8. Monthly averages of ambient noise at Jacksonville, FL, Site A for September – December 2009. Figure from Appendix 6 of Wiggins 2015.

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.

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