Passive Acoustic Monitoring for Marine Mammals at Site A in Onslow Bay, April – August 2009

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Submitted to:
The Department of the Navy
Norfolk, VA

Abstract

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between April and September 2009 in Onslow Bay at Site A in 174 m. This HARP sampled at 200 kHz for 5 minutes of every 10 minutes and recorded for 107 days between 24 April 2009 and 9 August 2009. Long-Term Spectral Averages (LTSAs) were created for two frequency bands (10 Hz – 1000 Hz and 1 kHz – 100 kHz) and scanned for marine mammal vocalizations. Vocalizations of *Kogia* spp., Risso's dolphins, sperm whales, and unidentified delphinids were detected in the data.

Methods

The late spring – summer 2009 Onslow Bay Site A HARP (Onslow Bay 03A) was deployed at 33.78951^{o} N, 76.51920^{o} W on 24 April 2009 (recording started on 24 April 2009) and recovered on 16 September 2009 (recording ended on 9 August 2009). The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 174 m. A schematic diagram of the Onslow Bay 03A HARP is shown in Figure 2.

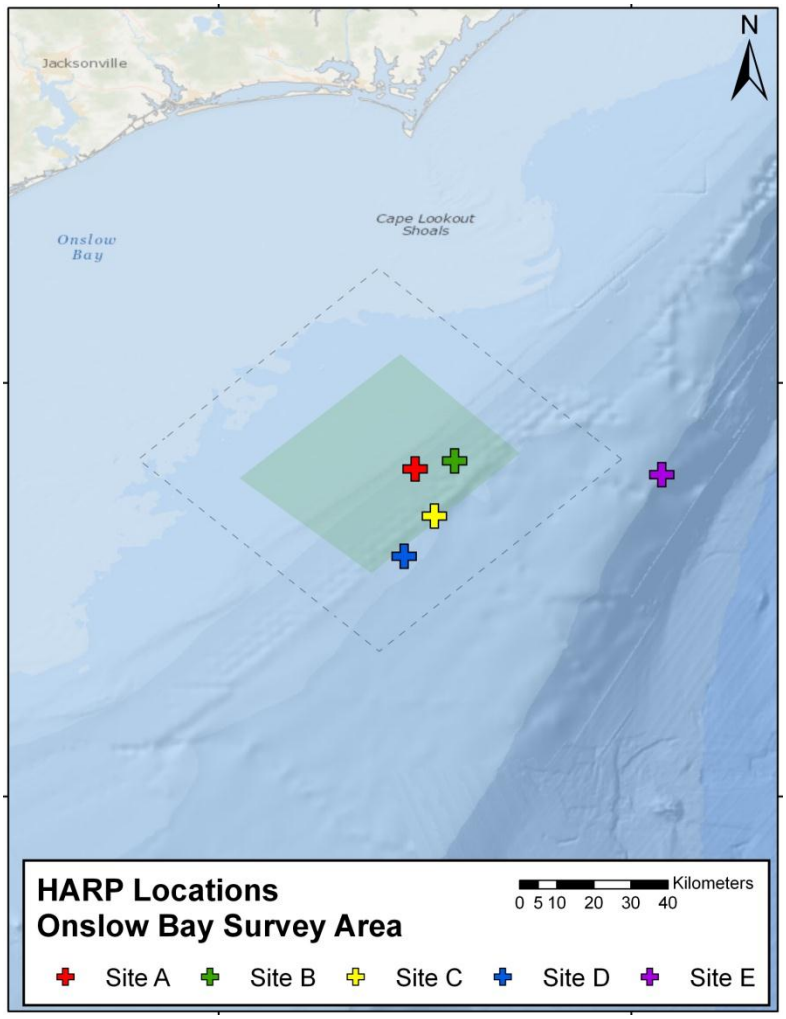

Figure 1. Location of HARP deployment sites in the Onslow Bay survey area. The location of the Onslow Bay 03A HARP is shown in red.

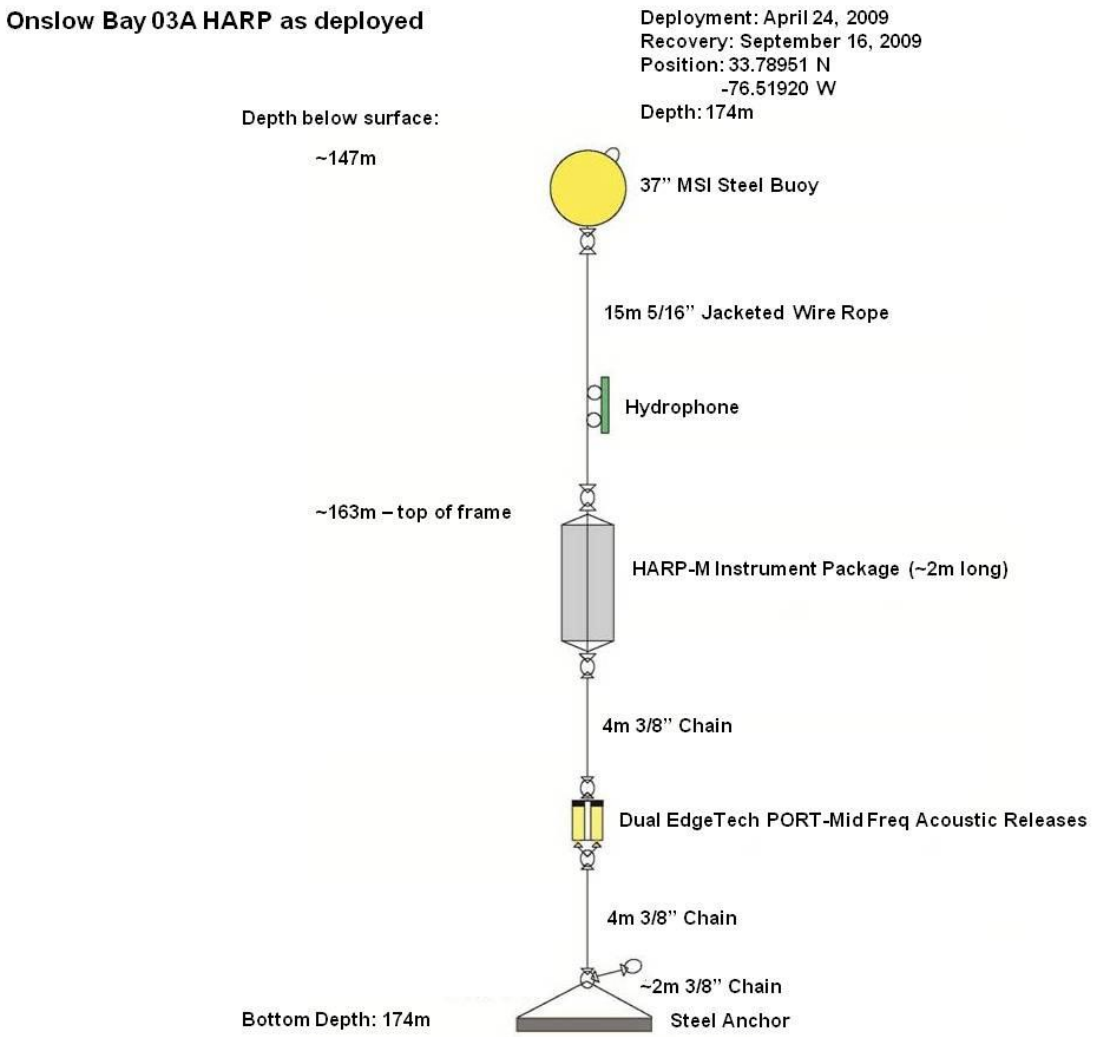

Figure 2. Schematic diagram showing details of the Onslow Bay 03A HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 10 minutes during the Onslow Bay 03A deployment. This deployment provided a total of 1422.5 hours of data over the 108 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 two parts

for this manual review: 10-1000 Hz and 1-100 kHz. The resulting Long-Term Spectral Averages (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) and 5 s in time and 100 Hz in frequency (for the original data: 1-100 kHz band). LTSAs that were decimated by a factor of 100 were inspected for sounds produced by mysticetes. Non-decimated LTSAs were inspected for odontocete whistles, clicks, and burst-pulses as well as mid-frequency active sonar. 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 Onslow Bay 03A 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, whistles, and burst-pulses (Figures 3-6). Most of these detections (93.4%) were assigned to the unidentified odontocete category (Figure 3). *Kogia* spp. were present on only four days during the April – September 2009 Site A deployment (Figure 4), which is consistent with the sporadic occurrence found during previous deployments. Risso's dolphins were also detected throughout the deployment with a stronger

nocturnal presence, again agreeing with earlier findings (Figure 5). Sperm whales were detected on only four days at night (Figure 6).

Table 1. Summary of detections of marine mammal vocalizations at Onslow Bay Site A for April – September 2009 (Onslow Bay 03A).

Species	**Call type**	**Total duration of vocalizations (hours)**	**Percent of recording duration**	**Days with vocalizations**	**Percent of recording days**
Unidentified odontocete	clicks, whistles, burst-pulses	135.58	9.53	91	84.26
Kogia spp.	clicks	0.15	0.01	4	3.70
Risso's dolphin	clicks	6.70	0.47	13	12.04
Sperm whale	clicks	2.68	0.19	4	3.70

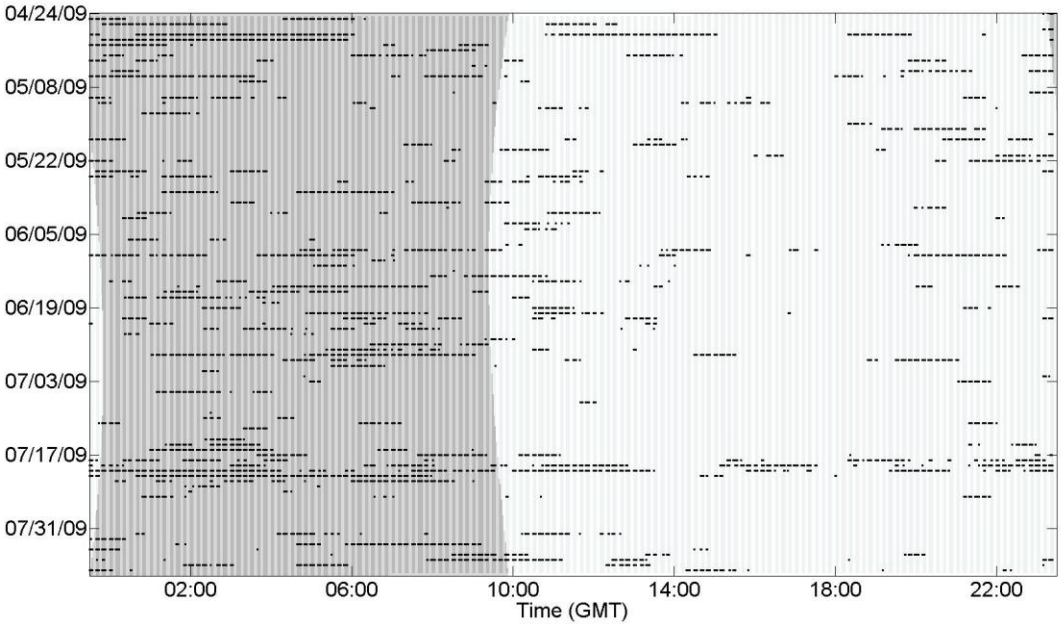

Figure 3. Unidentified odontocete vocalization detections (black bars) for the Onslow Bay 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

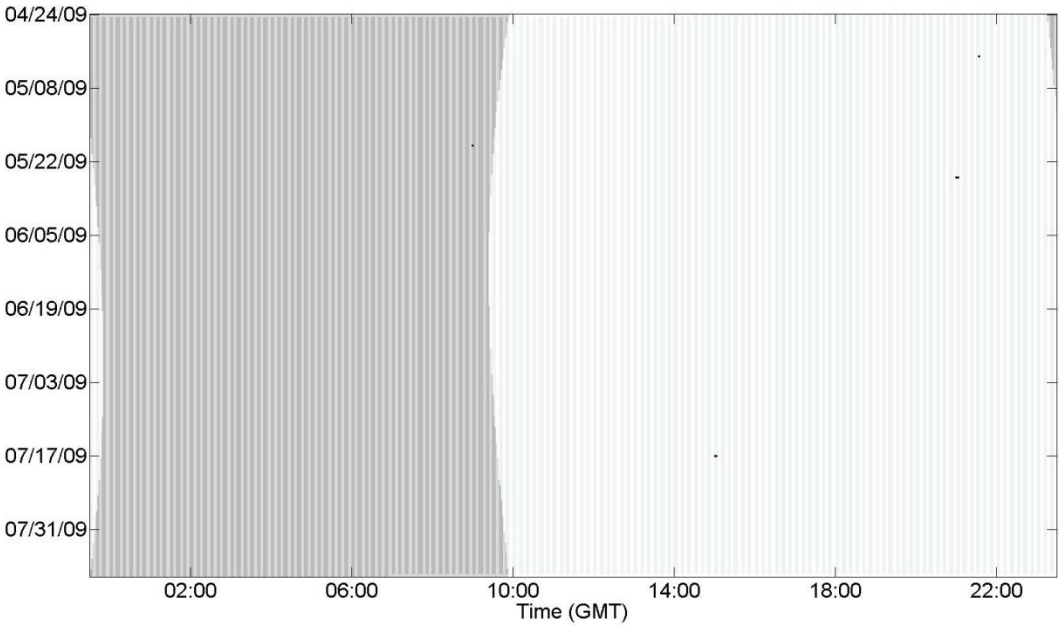

Figure 4. *Kogia* spp. click detections (black bars) for the Onslow Bay 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

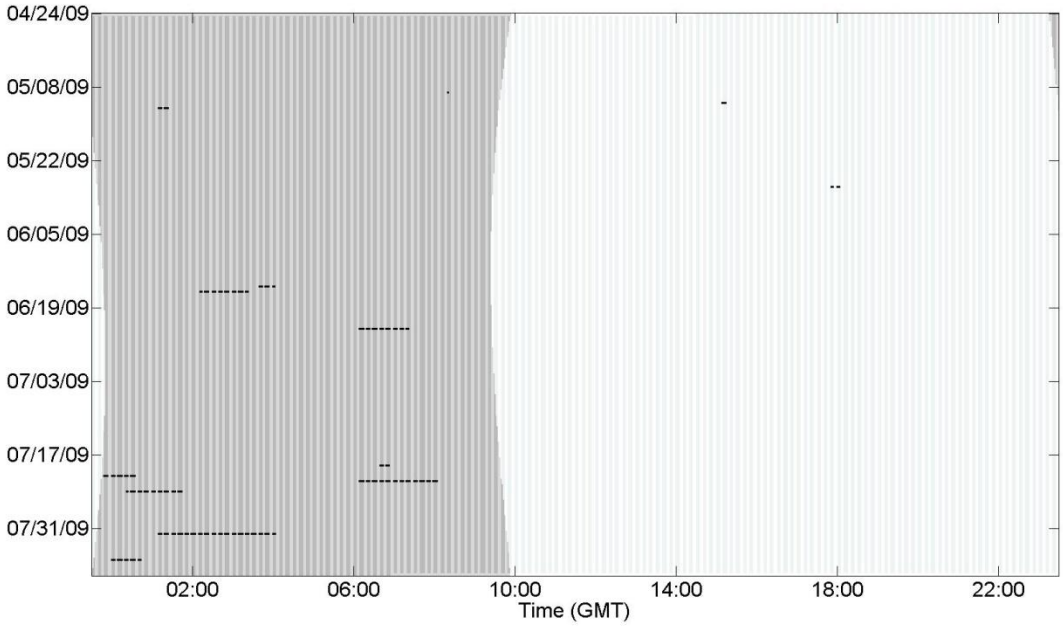

Figure 5. Risso's dolphin click detections (black bars) for the Onslow Bay 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

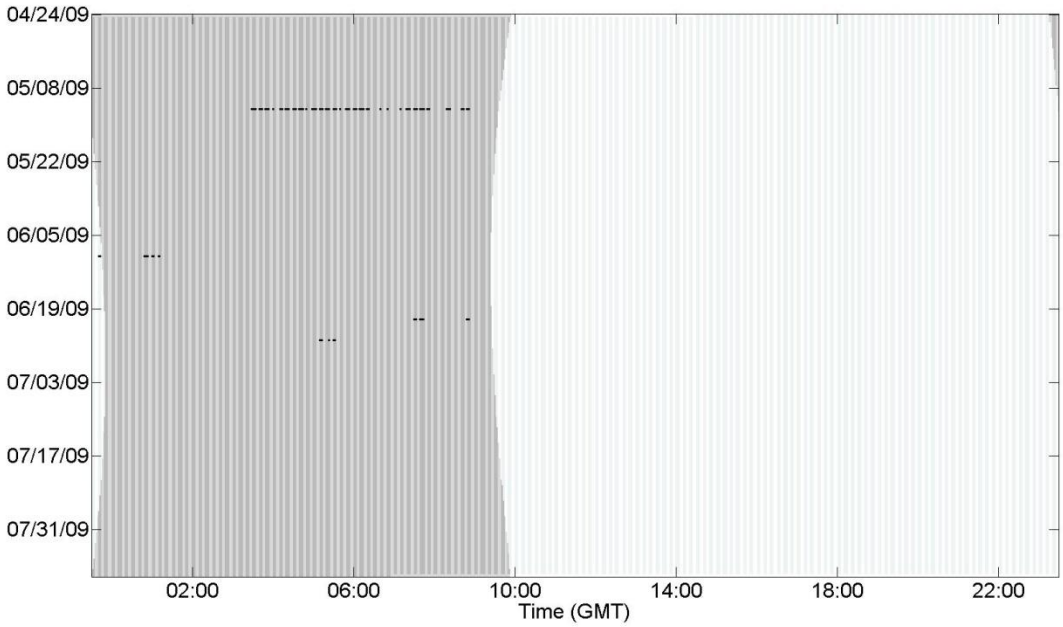

Figure 6. Sperm whale click detections (black bars) for the Onslow Bay 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

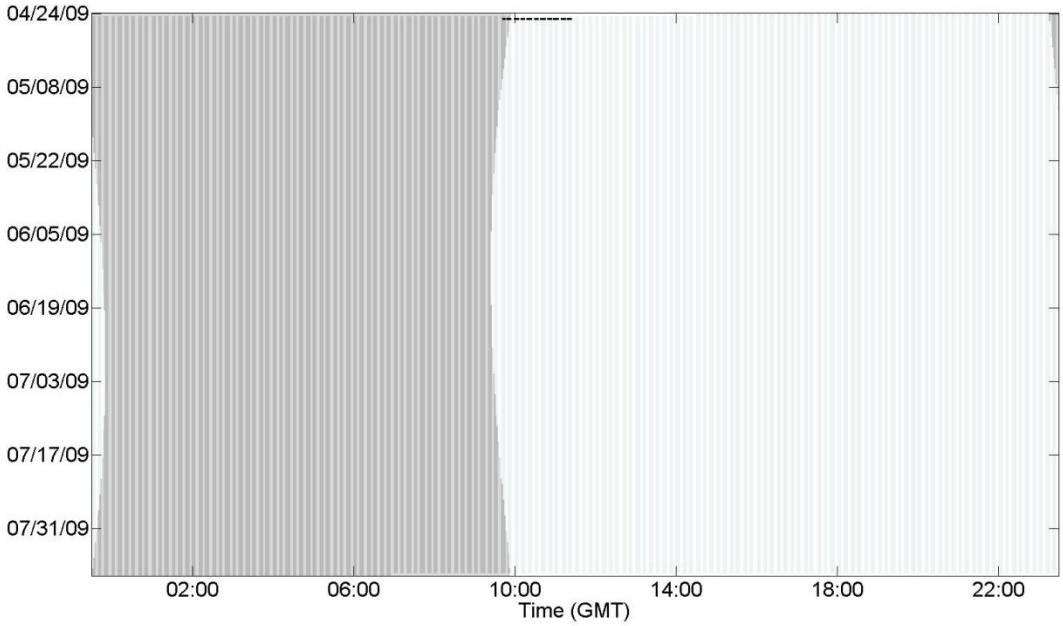

Figure 7. Mid-frequency active sonar (black bars) detected during the Onslow Bay 03A deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

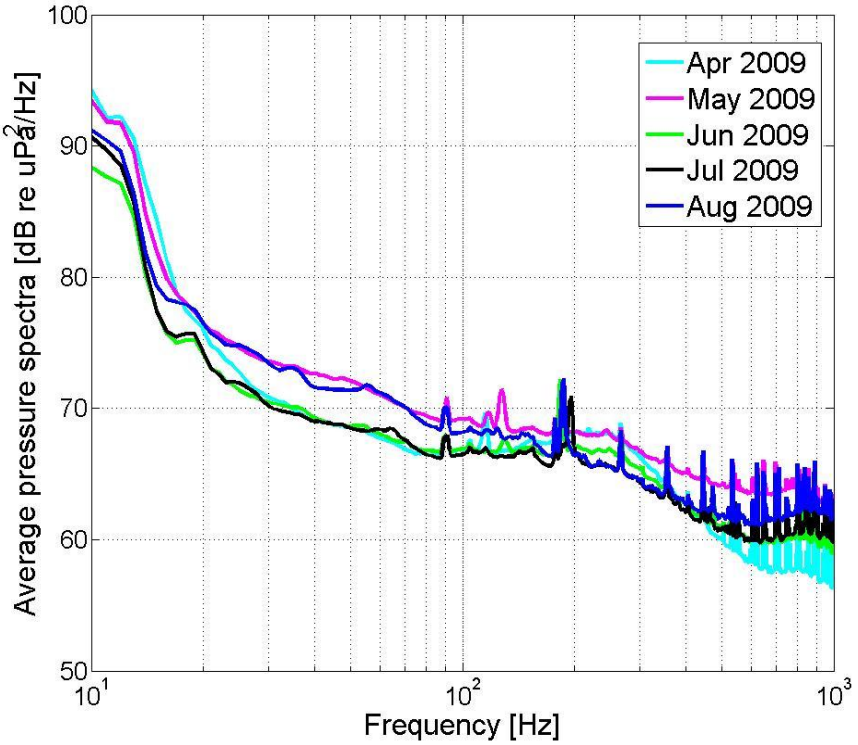

Figure 8. Monthly averages of ambient noise at Onslow Bay Site A for April – September 2009.

References

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.