Passive Acoustic Monitoring for Marine Mammals at Site B in Onslow Bay, May – September 2008

Lynne Hodge and Andrew Read

Duke University Marine Laboratory
135 Duke Marine Lab Road
Beaufort, NC 28516

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Abstract

A High-frequency Acoustic Recording Package (HARP; Wiggins and Hildebrand 2007) was deployed between May and November 2008 in Onslow Bay at Site B in 232 m. This HARP sampled at 200 kHz for 5 minutes of every 10 minutes and recorded for 103 days between 30 May 2008 and 10 September 2008. 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 blue whales, *Kogia* spp., Risso's dolphins, sperm whales, and unidentified delphinids were detected in the data.

Methods

The May – November 2008 Onslow Bay Site B HARP (Onslow Bay 02B) was deployed at 33.81107^{o} N, 76.42829^{o} W on 30 May 2008 (recording started on 30 May 2008) and recovered on 24 November 2008 (recording ended on 10 September 2008). The instrument location is shown in Figure 1. Bottom depth at the deployment site was approximately 232 m. A schematic diagram of the Onslow Bay 02B HARP is shown in Figure 2.

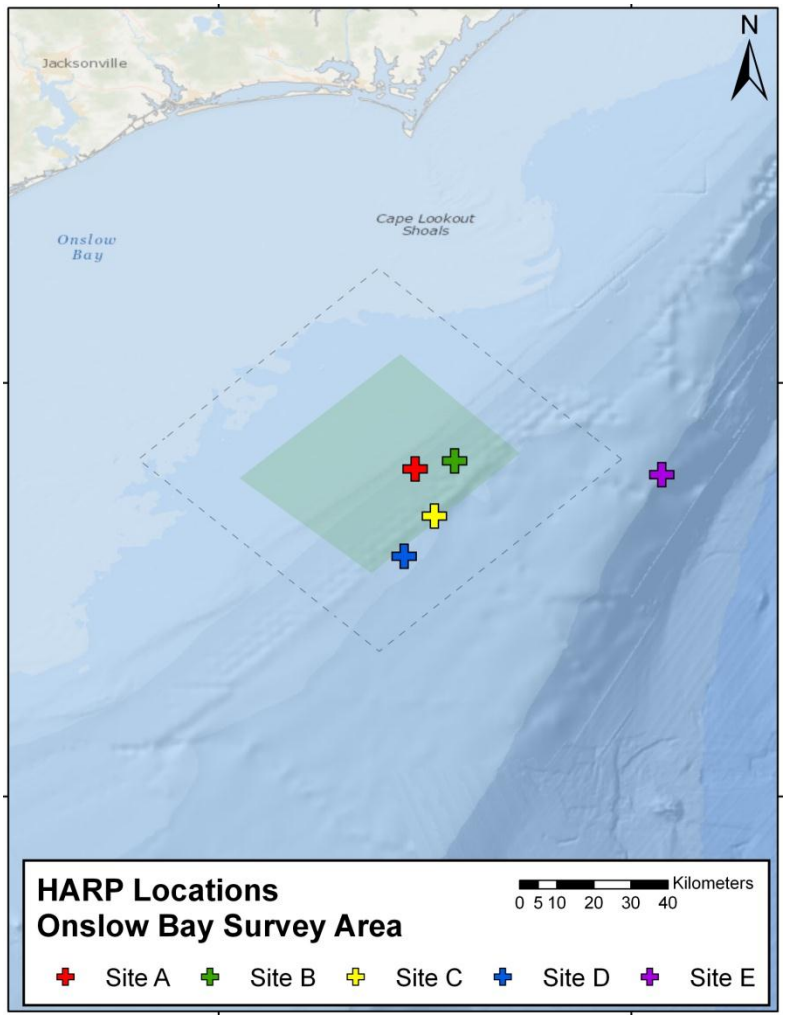

Figure 1. Location of HARP deployment sites in the Onslow Bay survey area. The location of the Onslow Bay 02B HARP is shown in green.

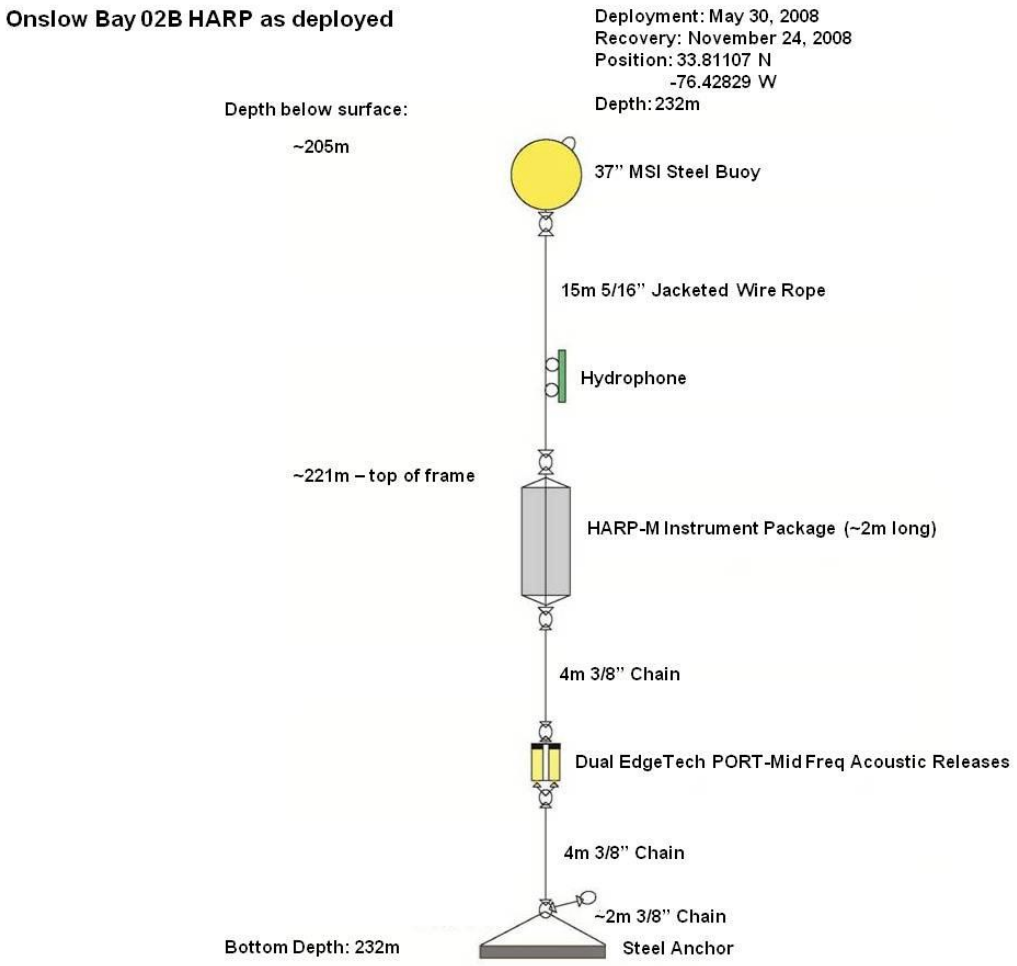

Figure 2. Schematic diagram showing details of the Onslow Bay 02B HARP. Note that diagram is not drawn to scale.

Data were acquired at a 200 kHz sampling rate for 5 minutes every 10 minutes during the Onslow Bay 02B deployment. This deployment provided a total of 1373.5 hours of data over the 104 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 02B HARP deployment. Figures 3-7 show the daily occurrence patterns for the different marine mammal groups (classified to species when possible). Figure 8 shows the occurrence of sonar. Underwater ambient noise during this deployment is shown in Figure 9.

Blue whale calls (mainly Type A) were present starting in mid-August (Figure 3).

Detected odontocete vocalizations included clicks, whistles, and burst-pulses (Figures 4-7). Most of these detections (91.1%) were assigned to the unidentified odontocete category (Figure 4). *Kogia* spp. were present on only five days during the 2008 Site B deployment (Figure 5), which is consistent with the sporadic occurrence found during the previous deployment in Onslow Bay. Risso's dolphins were detected throughout the deployment with a stronger

nocturnal presence, again agreeing with earlier findings (Figure 6). Sperm whales were detected on six days throughout the deployment, during both day and night (Figure 7).

Table 1. Summary of detections of marine mammal vocalizations at Onslow Bay Site B for May – November 2008 (Onslow Bay 02B).

Species	**Call type**	**Total duration of vocalizations (hours)**	**Percent of recording duration**	**Days with vocalizations**	**Percent of recording days**
Blue whale	A and B calls (mainly A)	2.40	0.17	9	8.65
Unidentified odontocete	clicks, whistles, burst-pulses	177.50	12.92	98	94.23
Kogia spp.	clicks	0.30	0.02	5	4.81
Risso's dolphin	clicks	15.28	1.11	22	21.15
Sperm whale	clicks	4.48	0.33	6	5.77

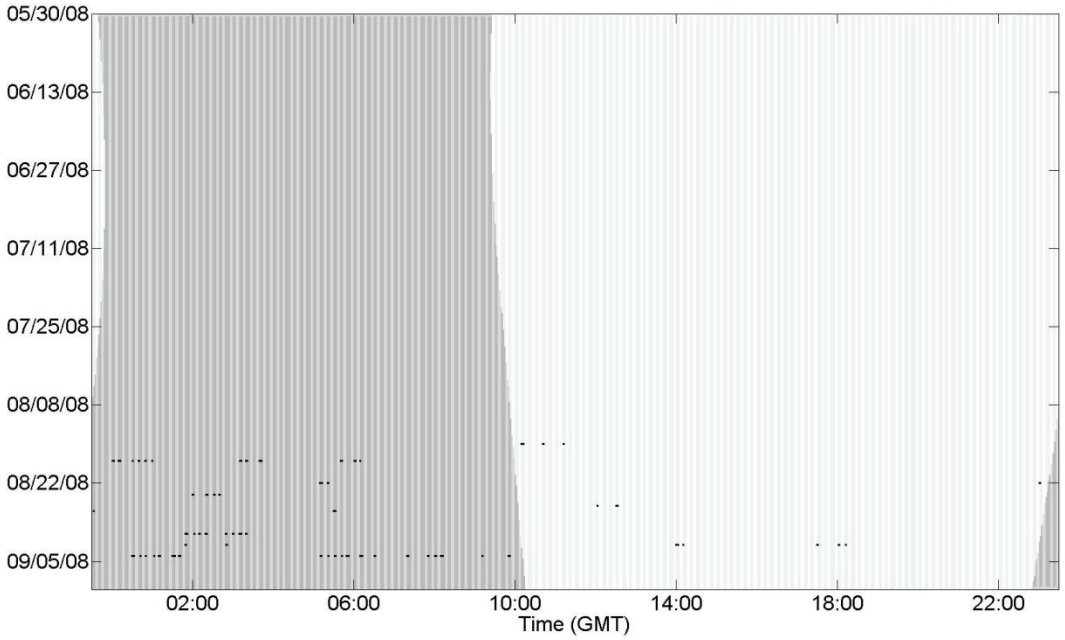

Figure 3. Blue whale Type A and B call detections (black bars) for the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

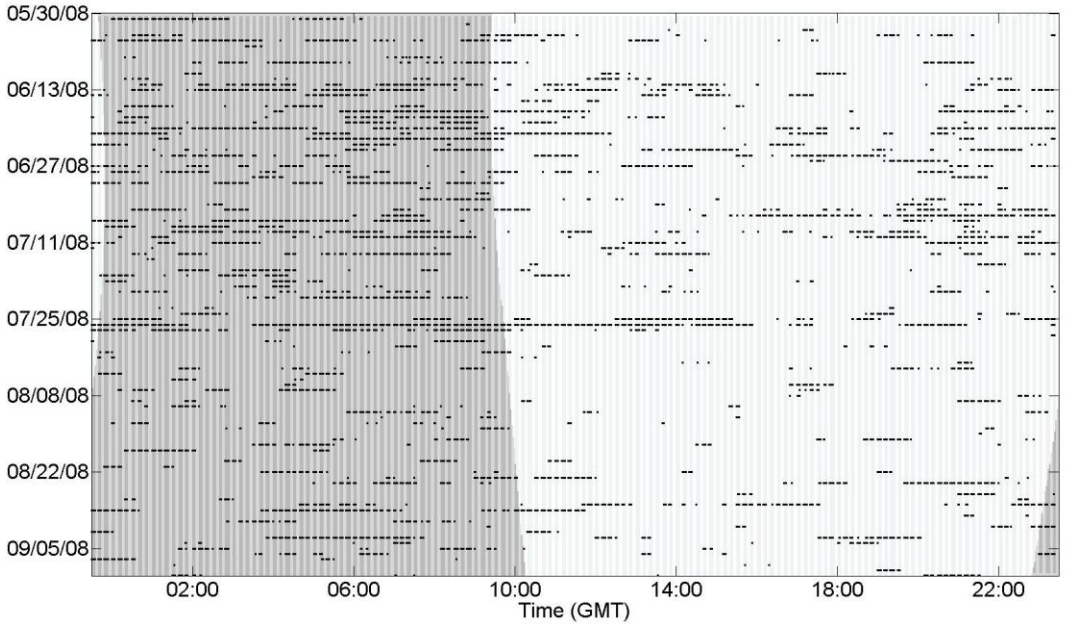

Figure 4. Unidentified odontocete vocalization detections (black bars) for the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

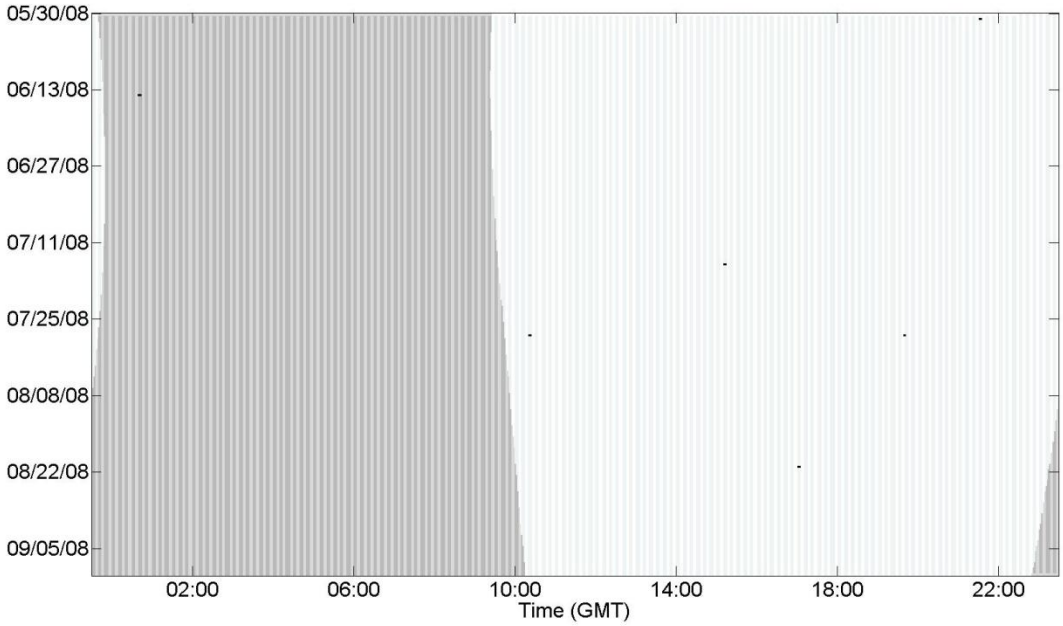

Figure 5. *Kogia* spp. click detections (black bars) for the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

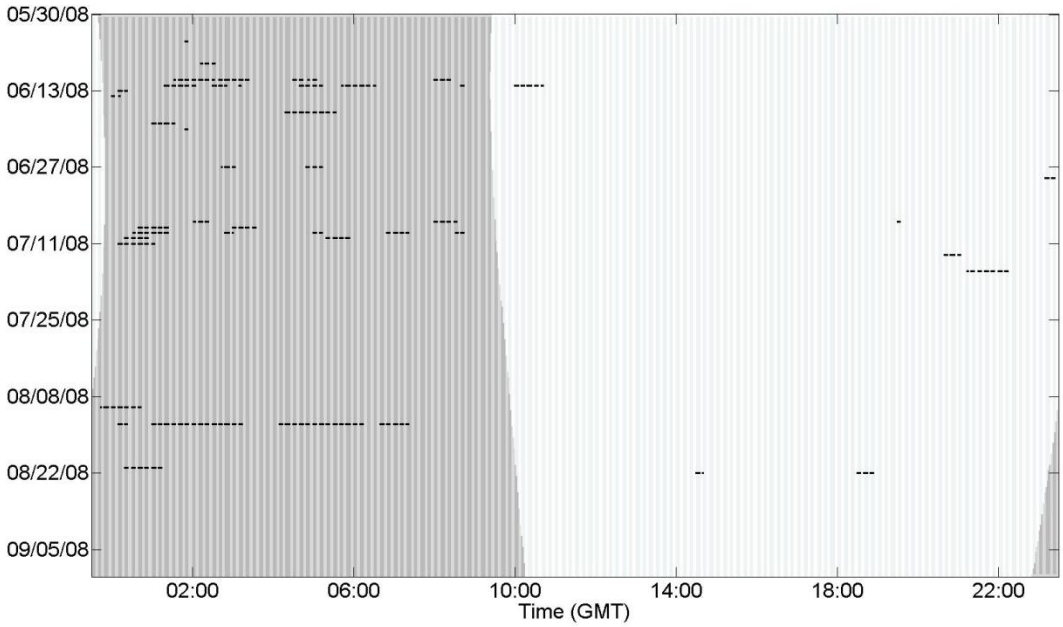

Figure 6. Risso's dolphin click detections (black bars) for the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

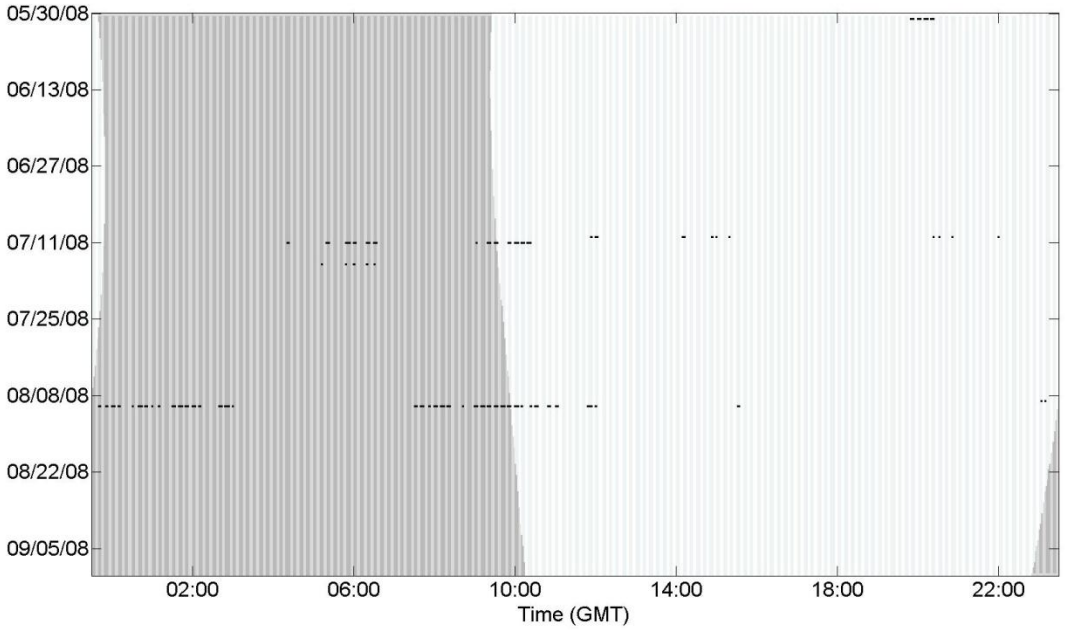

Figure 7. Sperm whale click detections (black bars) for the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

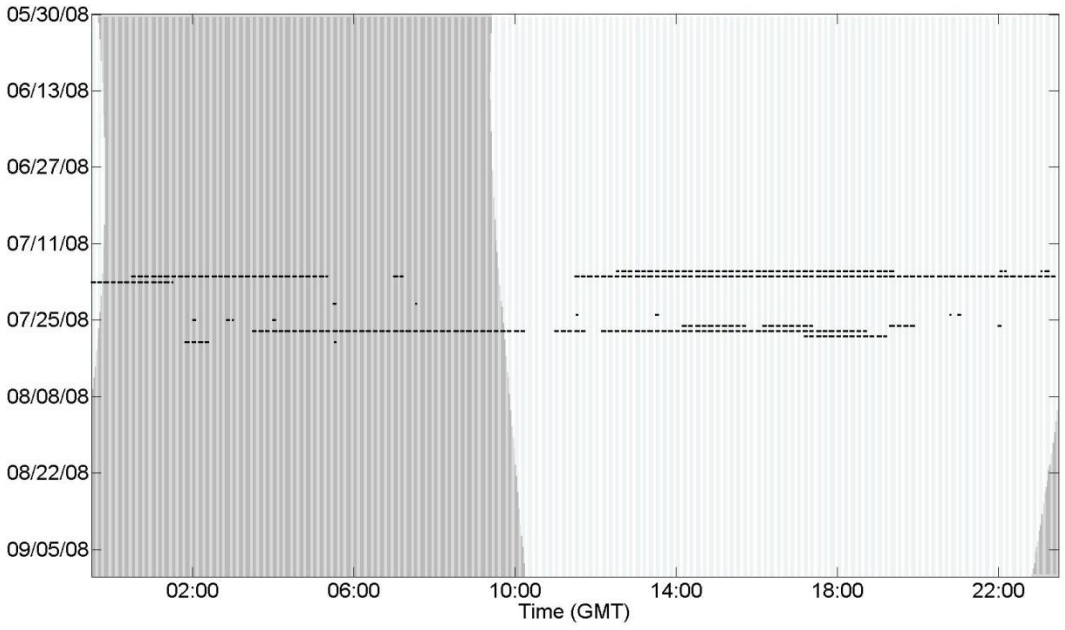

Figure 8. Mid-frequency active sonar (black bars) detected during the Onslow Bay 02B deployment. Dark gray shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil). Lighter shading indicates recording/analysis effort.

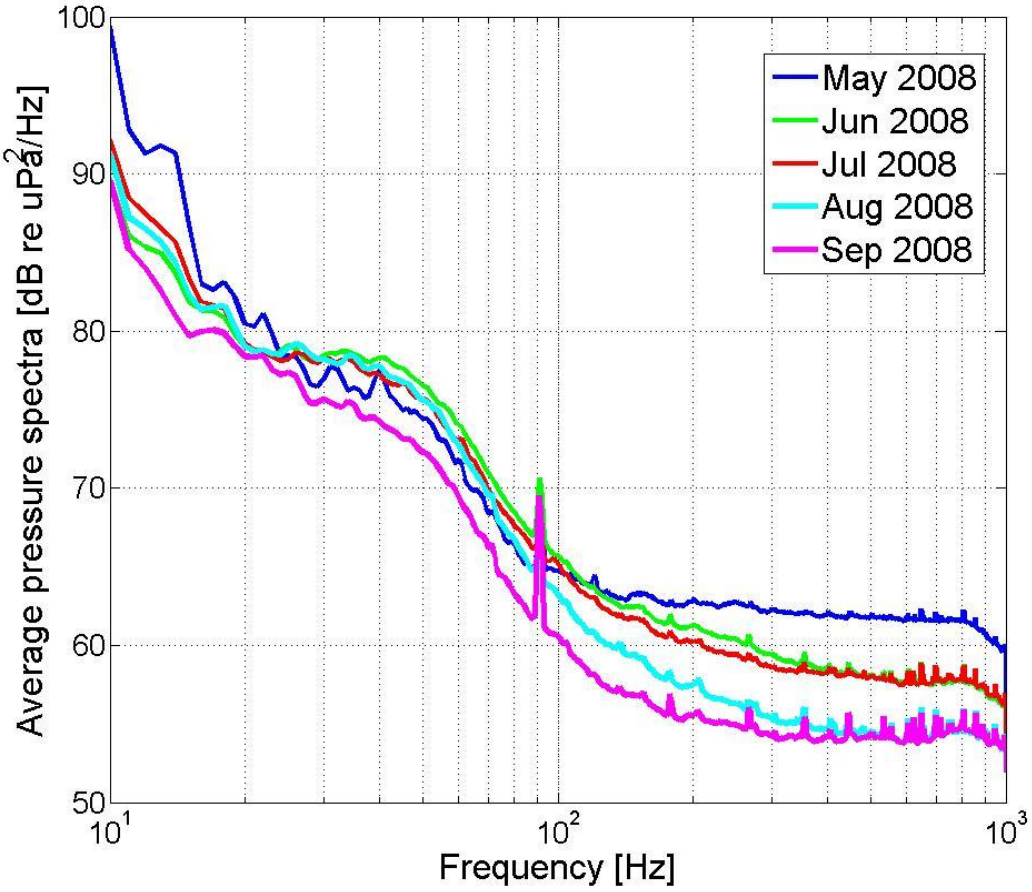

Figure 9. Monthly averages of ambient noise at Onslow Bay Site B for May – November 2008.

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.