



Everglades National Park

Acoustical Monitoring Snapshot

Winter 2009

Background Information

In August of 2008, the Natural Sounds Program planned to deploy five acoustical monitoring devices in Everglades National Park (EVER) in order to gather information about existing and natural ambient sound levels. These data will be used to inform an Air Tour Management Plan as well as general management plans. To meet this objective, five sites were chosen to be monitored for 30 days in EVER. Due to severe weather, one site, North Nest Key, was not deployed. These weather events also prevented collection of full, 30-day datasets at some sites during the summer. To complete the data collection process, additional acoustic monitoring equipment was set up at the same five sites during the winter season. This briefing serves as a preliminary snapshot of the acoustical conditions at the sites monitored during the winter season. A full acoustical monitoring report will follow for both monitoring seasons, pending further analysis. Table 1 describes the location and characteristics of the monitoring sites.

Table 1. Study area

Site	Site Name	Dates Deployed	Vegetation	Elevation (m)	Latitude	Longitude
EVER001	North Nest Key	2/24-4/13	Mangrove shoots	-2	25.1503	-80.51431
EVER002	Shark Valley Loop Road	2/23-4/16	Emerg. wetlands	10	25.71359	-80.76011
EVER004	Canepatch backcountry	2/27-4/15	Woody Wetlands	-4	25.42191	-80.94398
EVER005	Pinelands	2/28-4/12	Evergreen Forest	1	25.42483	-80.67991
EVER006	Eco Pond	2/27-4/15	Woody Wetlands	3	25.14041	-80.93875

Metrics

Because sound levels fluctuate, the Natural Sounds Program (NSP) uses several metrics in order to provide detail about the characteristics of the soundscape at each site. In order to understand the implications of the acoustic data fully, it is important to describe the distribution of sound levels in relation to potential functional effects, because this information may be useful in resource management decisions. The A-weighted decibel (dBA) is a logarithmic measure of sound energy that approximates human hearing sensitivity (Harris, 1998, p. 1.16). As decibel measures may not be easily comprehended by the layperson, Table 2 presents park sound sources and common sound sources with their corresponding A-weighted decibel levels (dBA) to provide a frame of reference.

Table 2. Interpreting sound levels

Park Sound Sources	Common Sound Sources	dBA
Volcano crater (HALE)	Human breathing at 3m	10
Leaves rustling (CANY)	Whispering	20
Crickets at 5m (ZION)	Residential area at night	40
Conversation at 5m (WHMI)	Busy restaurant	60
Snowcoach at 30m (YELL)	Curbside of busy street	80
Thunder (ARCH)	Jackhammer at 2m	100
Military jet at 100m AGL(YUCH)	Train horn at 1m	120

Note: An increase of 10dBA represents a tenfold multiplication of energy

Table 3 summarizes sound level values that relate to human health and speech, as documented in the scientific literature. Human responses can serve as a proxy for potential impacts to other vertebrates because humans have more sensitive hearing at low frequencies than most species (Dooling and Popper, 2007, p. 5).

Table 3. Explanation of sound level values

Sound Levels (dBA)	Relevance
35	Blood pressure and heart rate increase in sleeping humans (Haralabidis et al., 2008)
45	World Health Organization's recommendation for maximum noise levels inside bedrooms (Berglund, Lindvall, and Schwela, 1999)
52	Speech interference for interpretive programs (U.S. Environmental Protection Agency, 1974)
60	Speech interruption for normal conversation (U.S. Environmental Protection Agency, 1974)

Time above metrics provide information about how much time sound levels are above specified values. By comparing the amount of time that sound levels are above certain values, variations in sound levels can be illustrated. Table 4 reports the percent of time that measured levels were above the values in Table 3. These values should not be construed as thresholds of impact.

Table 4. Percent time above metrics

Site	Frequency (Hz)	% Time above sound level: 0700 to 1900				% Time above sound level: 1900 to 0700			
		35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
EVER001	100-800	52.45 ¹	1.71	0.26	0.03	30.78	0.34	0.01	0.00
	12.5-20,000	79.05 ²	6.67	0.48	0.05	95.15	20.24	0.11	0.00
EVER002	100-800	36.85	3.57	0.60	0.03	1.77	0.23	0.05	0.00
	12.5-20,000	62.6	13.66	2.02	0.10	65.04	24.72	0.72	0.01
EVER004	100-800	20.89	1.58	0.23	0.01	1.55	0.23	0.03	0.00
	12.5-20,000	76.08	19.33	4.18	0.29	74.30	33.06	8.48	0.05
EVER005	100-800	67.13	5.15	0.34	0.02	8.01	0.89	0.09	0.00
	12.5-20,000	82.06	19.44	2.58	0.05	55.69	25.60	3.68	0.00
EVER006	100-800	23.1	0.80	0.08	0.00	3.04	0.12	0.00	0.00
	12.5-20,000	61.56	2.57	0.26	0.01	86.19	4.83	0.06	0.00

¹. The top value in each cell focuses on frequencies affected by transportation, which approximately correspond to 100-800 hertz. This range does not correspond to a specific vehicle or type of transportation.

². The bottom value in each cell uses the full frequency spectrum, from 12.5-20,000 hertz.

Exceedence levels (L_x) are metrics used to describe acoustical data. They represent the dBA exceeded x percent of the time during the given measurement period (e.g. L_{90} is the dBA that has been exceeded 90% of the time). Table 5 reports the L_{90} , L_{50} , and L_{10} values for the sites measured at EVER.

Table 5. Exceedence levels for existing conditions

Site	Frequency (Hz)	Exceedence levels (dBA): 0700 to 1900			Exceedence levels (dBA): 1900 to 0700		
		L_{90}	L_{50}	L_{10}	L_{90}	L_{50}	L_{10}
EVER001	100-800	32.6 ¹	35.4	39.4	29.1	31.4	34.6
	12.5-20,000	35.8 ²	38.5	42.3	39.2	41.4	43.9
EVER002	100-800	25.1	32.5	39.9	7.0	10.5	19.2
	12.5-20,000	29.9	37.2	45.1	35.8	38.8	42.3
EVER004	100-800	23.5	29.1	36.1	8.8	12	19.1
	12.5-20,000	34.7	39.8	44.9	38.6	41.2	43.9
EVER005	100-800	32.4	37.3	42.4	8.0	13.9	28.6
	12.5-20,000	34.7	40.1	45.7	32.9	38.6	44.3
EVER006	100-800	27.7	31.6	36.7	17.1	20.5	27.7
	12.5-20,000	32.1	35.9	40.7	39.8	41.4	43.1

¹. The top value in each cell focuses on frequencies affected by transportation, which approximately correspond to 100-800 hertz. This range does not correspond to a specific vehicle or type of transportation.

². The bottom value in each cell uses the full frequency spectrum, from 12.5-20,000hertz.

Figure 1 - Figure 5 show the dB levels for 33 one-third octave band frequencies over the day and night periods at EVER. The grayed area represents sound levels outside of the typical range of human hearing. The typical frequency levels for transportation, conversation and songbirds are presented on the figure as examples for interpretation of the data. These ranges are estimates and are not vehicle-, species-, or habitat- specific.

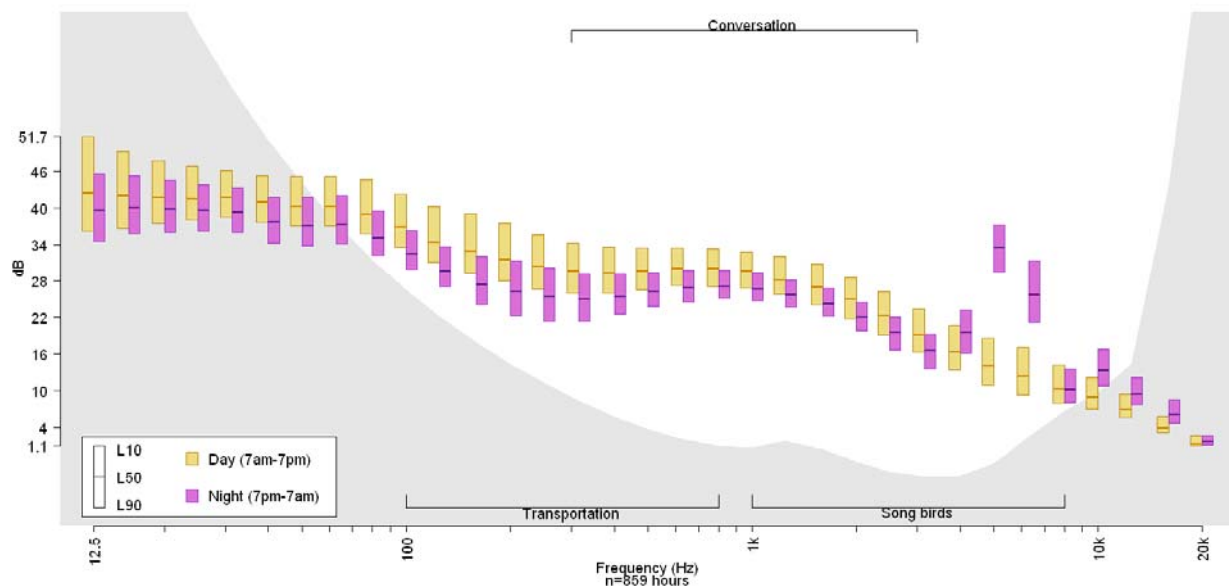


Figure 1. Day and night dB levels for 33 one-third octave bands at EVER001

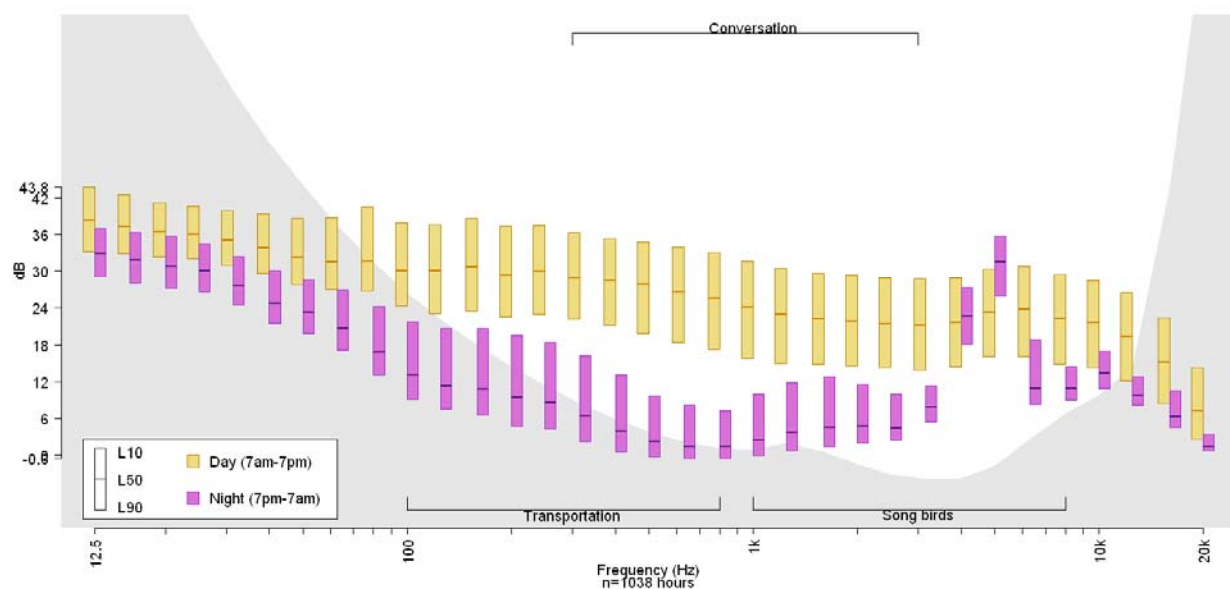


Figure 2. Day and night dB levels for 33 one-third octave bands at EVER002

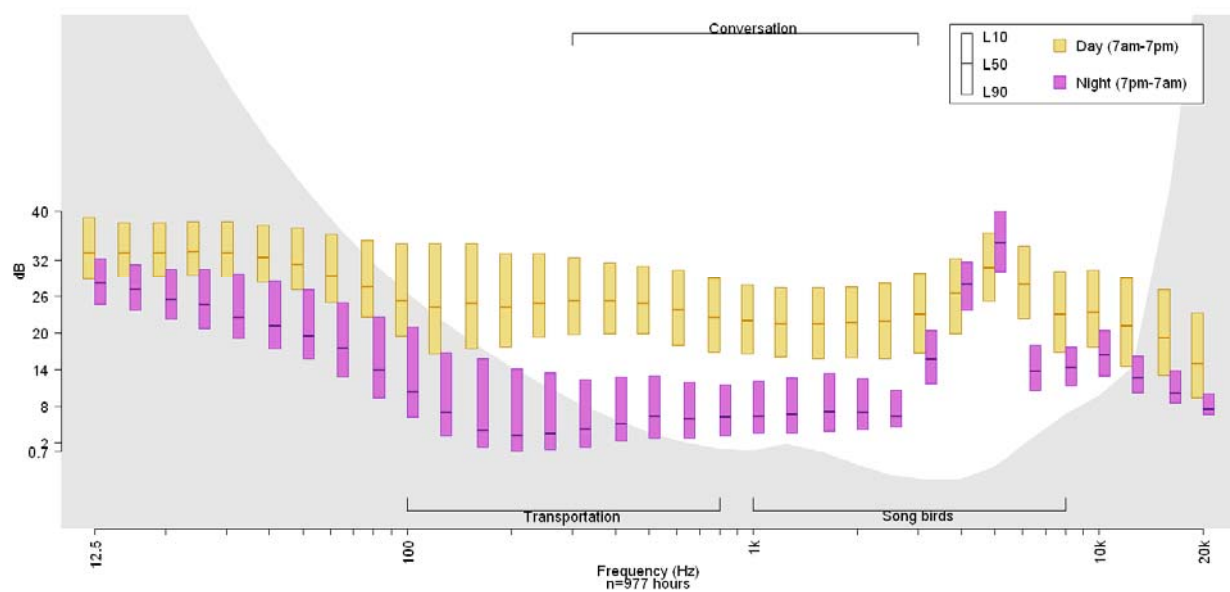


Figure 3. Day and night dB levels for 33 one-third octave bands at EVER004

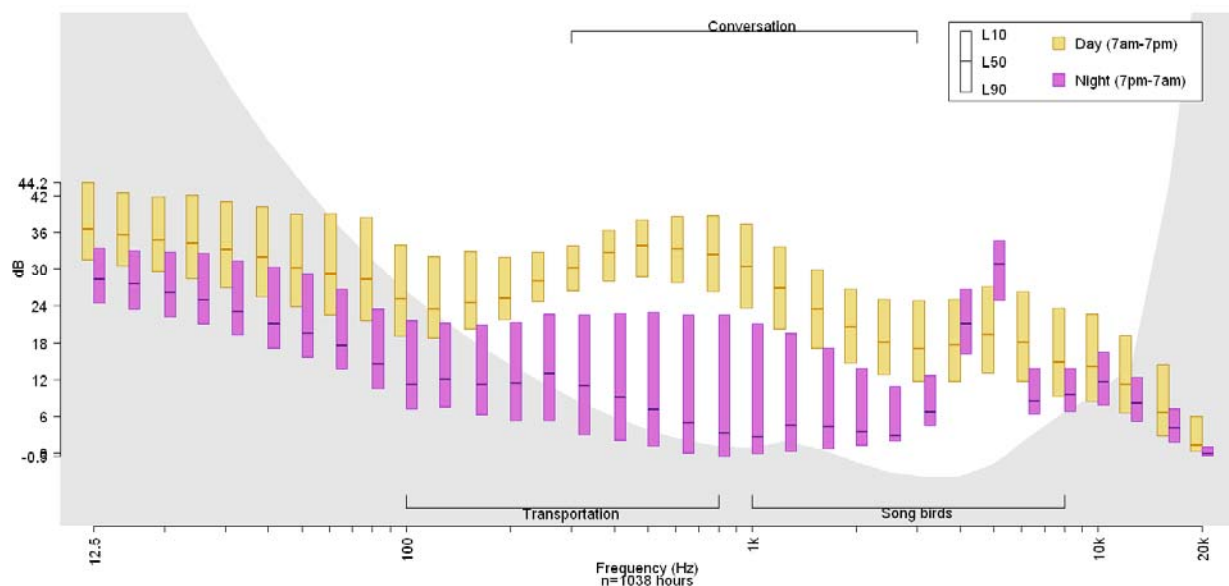


Figure 4. Day and night dB levels for 33 one-third octave bands at EVER005

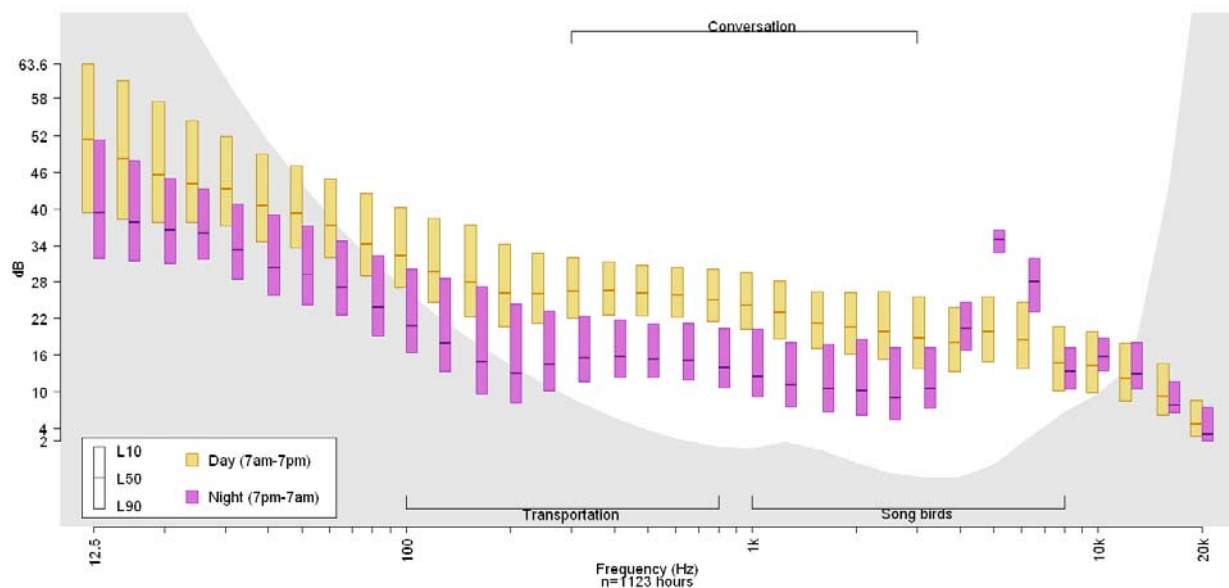


Figure 5. Day and night dB levels for 33 one-third octave bands at EVER006

Please note that this is a preliminary snapshot designed to get salient acoustical information back to the park as quickly as possible. A full acoustical report will follow, pending further data analysis. If there are any questions or concerns about the information in this document, please contact the Natural Sounds Program. Thank you for your interest and participation in acoustical resource monitoring.

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Literature Cited

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