



Everglades and Dry Tortugas National Parks

Acoustical Monitoring Snapshot

Summer 2008

Background Information

In August of 2008, the Natural Sounds Program planned to deploy six acoustical monitoring devices in Everglades (EVER) and Dry Tortugas (DRT0) National Parks 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 and one site was chosen from DRT0. Due to severe weather, one site at Everglades (North Nest Key) was not deployed. These weather events also prevented collection of complete 30-day datasets at some sites. This briefing serves as a preliminary snapshot of the acoustical conditions at the sites monitored. A full acoustical monitoring report will follow, pending further data collection and analysis. Table 1 describes the location and characteristics of the monitoring sites.

Table 1. Study area

Site	Site Name	Dates		Elevation (m)	Latitude	Longitude
		Deployed	Vegetation			
EVER002	Shark Valley Loop Road	8/15-9/8	Emergent wetlands	10	25.71359	-80.76011
EVER004	Canepatch backcountry	8/14-9/26	Woody Wetlands	-4	25.42191	-80.94398
EVER005	Pinelands	8/12-9/24	Evergreen Forest	1	25.42483	-80.67991
EVER006	Eco Pond	8/15-9/15	Woody Wetlands	3	25.14041	-80.93875
DRT0001	Garden Key	8/14-8/16	Open Water	4	24.62926	-82.87163

Metrics

Since sound levels fluctuate, the Natural Sounds Program (NSP) uses several metrics in order to provide some detail about the characteristics of the soundscape. 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 since 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. 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. The bottom value in each cell uses the full frequency spectrum, from 12.5-20,000 hertz.

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
EVER002	100-800	64.22	7.45	1.04	0.06	22.23	1.58	0.18	0
	12.5-20,000	85.04	20.94	3.54	0.45	85.04	20.94	3.54	0.45
EVER004	100-800	24.08	3.68	0.55	0.03	5.26	0.78	0.11	0
	12.5-20,000	98.62	25.9	3.41	0.16	99.97	89.72	67.63	8.23
EVER005	100-800	48.14	5	0.51	0.04	6.3	1.08	0.12	0
	12.5-20,000	75.52	13.19	1.27	0.08	92.66	73.37	30	0.3
EVER006	100-800	17.1	0.78	0.11	0	12.18	0.24	0.02	0
	12.5-20,000	63.27	3.66	0.31	0.03	94.59	21.12	3.35	0.73
DRTO001	100-800	66.04	10.31	2.06	0.3	78.78	2.46	0.41	0.19
	12.5-20,000	91.35	49.57	5.02	0.4	99.61	58.97	3.15	0.21

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

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}
EVER002	100-800	32	36.5	42.4	23.3	26.9	33.3
	12.5-20,000	35	39.5	46.2	48.9	51.3	53.3
EVER004	100-800	26.1	30.4	37.7	16	18	23.8
	12.5-20,000	39.1	42.9	46.9	52.6	54.6	56.9
EVER005	100-800	52.6	54.6	56.9	14.6	17.8	27.5
	12.5-20,000	33.4	38.3	43.9	45.2	49.1	52.3
EVER006	100-800	25.3	29.1	35.5	19.7	22.5	28.8
	12.5-20,000	32.9	37.1	42.3	40.6	42.6	45.6
DRTO001	100-800	36.6	39.6	45.1	36.3	38.5	41.7
	12.5-20,000	42.4	45.7	50.4	43.9	45.9	49.6

Figures 1-5 plot the dB levels for 33 one-third octave band frequencies over the day and night periods at EVER and DRTO. 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.

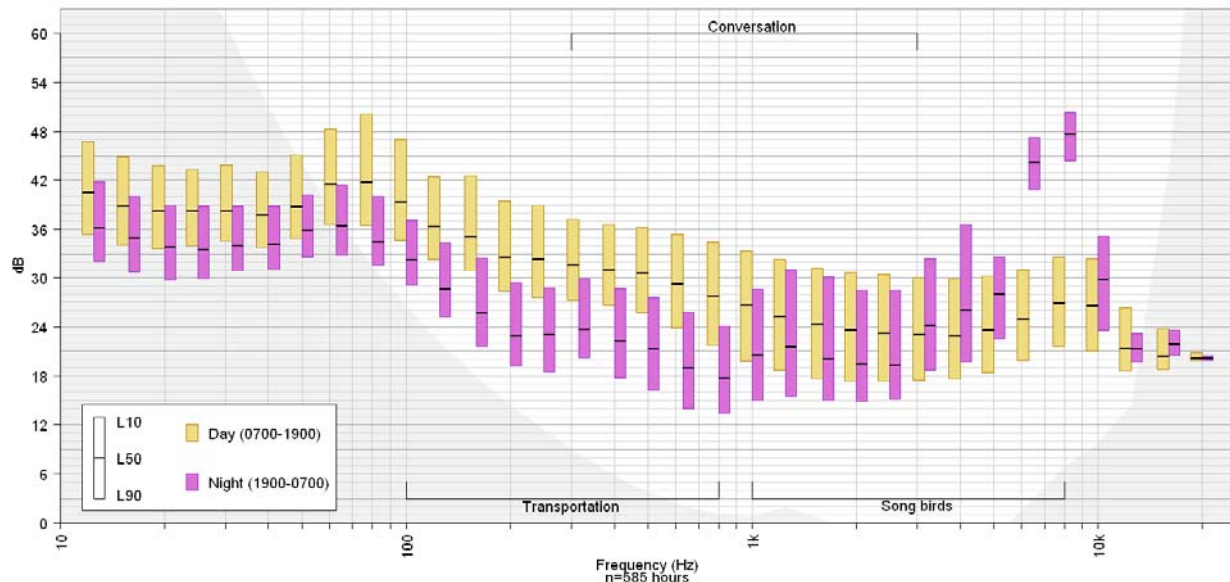


Figure 1. Day and night dB levels for 33 one-third octave bands at EVER002 Shark Valley.

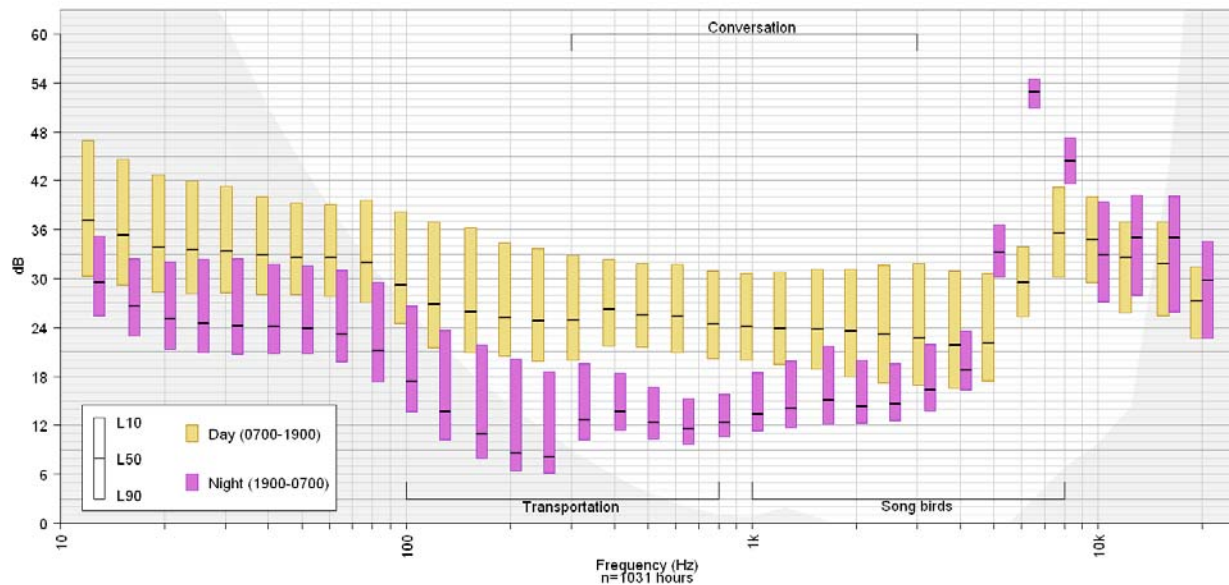


Figure 2. Day and night dB levels for 33 one-third octave bands at EVER004 Cane Patch.

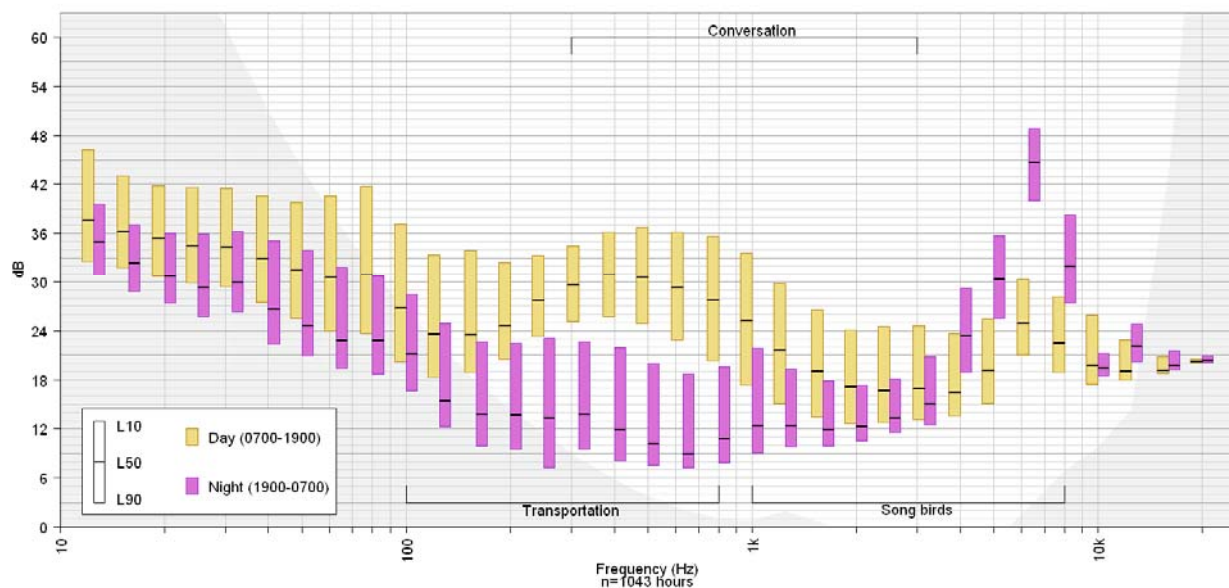


Figure 3. Day and night dB levels for 33 one-third octave bands at EVER005 Pinelands.

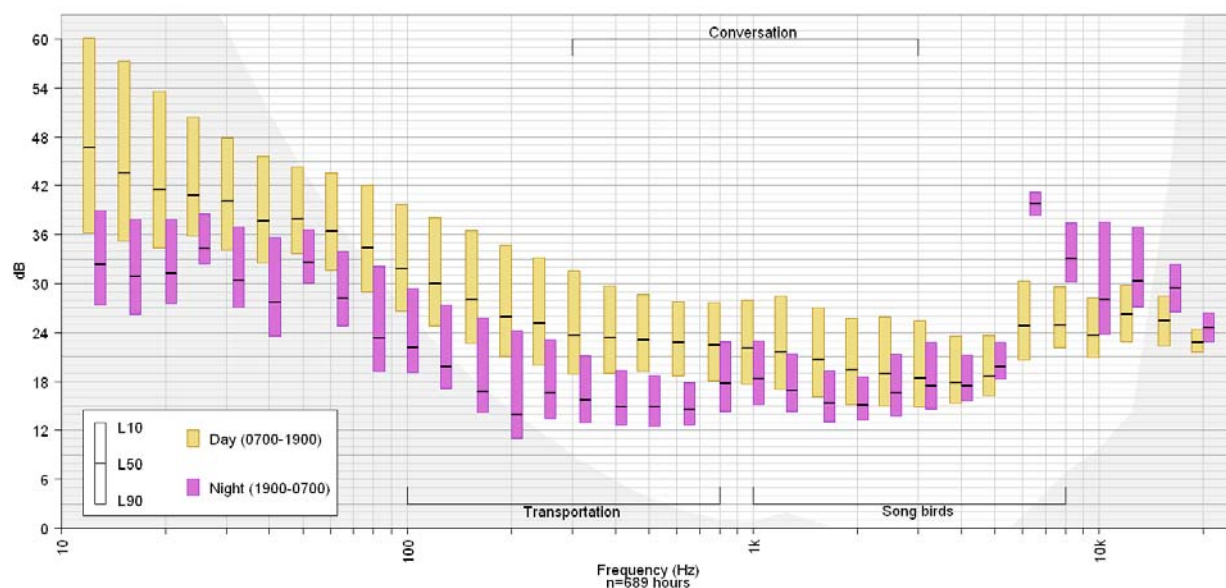


Figure 4. Day and night dB levels for 33 one-third octave bands at EVER006 Eco Pond.

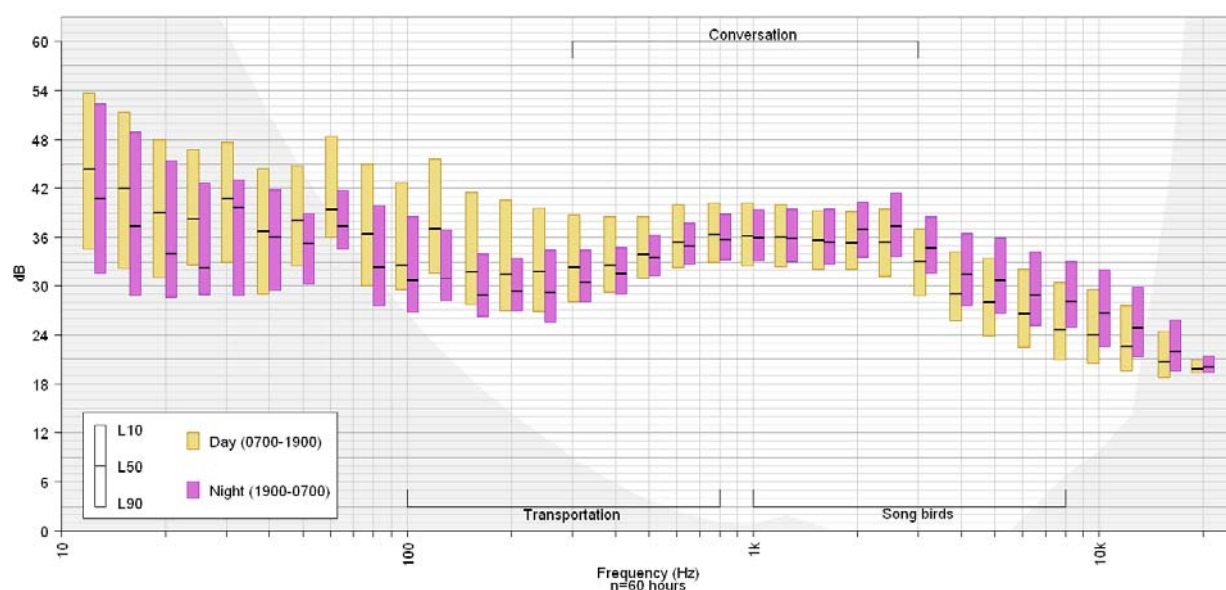


Figure 5. Day and night dB levels for 33 one-third octave bands at DRTO001 Garden Key.

Please note that this is a preliminary snapshot designed to get salient acoustical information back to the park as quickly as possible. This does not replace a full acoustical report, which will follow, pending further data collection and analysis. A second season (30 days) of acoustical monitoring is slated to begin in late February. If you have 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.

Natural Resource Program Center

Natural Sounds Program
1201 Oakridge Drive, Suite 100
Fort Collins, CO 80525
(970) 267-2104

<http://www.nature.nps.gov/naturalsounds/>

EXPERIENCE YOUR AMERICA™

Literature Cited

Berglund, B., Lindvall, T., & Schwela, D.H. (Eds.). 1999. Guidelines for community noise. World Health Organization, Geneva.

Dooling, R., & Popper, A. (2007). *The effects of highway noise on birds*. Rockville, MD: Environmental BioAcoustics LLC.

Haralabidis, A, Dimakopoulou, K., Vigna-Taglianti, F., Giampaolo, M., Borgini, A., Dudley, M., Pershagen, G., Bluhm, G., Houthuis, D., Babisch, & others. 2008. Acute effects of night-time noise exposure on blood pressure in populations living near airports. *European Heart Journal* **29**:658-664.

Harris, C. M. (1998). *Handbook of Acoustical Measurements and Noise Control*, 3rd ed. McGraw-Hill, New York.

U.S. Environmental Protection Agency (EPA). 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. EPA, Washington, D.C.