



Kenai Fjords National Park

Acoustical Monitoring Snapshot

February 2009

Background Information

The Natural Sounds Program received a technical assistance request from Kenai Fjords National Park (KEFJ) in FY08 for acoustical monitoring. The purpose of this monitoring was to capture the park's natural ambient sound levels as well as to provide data for natural resource planning, soundscape management planning, and other planning documents. To meet this objective, monitoring sites were set up in the four management zones established in the Exit Glacier Area Plan: the Visitor Facilities Zone, the Pedestrian Zone, the Hiker Zone, and the Backcountry Semi-primitive Zone. This briefing serves as a preliminary snapshot of the acoustical conditions at the sites monitored during the summer season. 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 Deployed	Vegetation and surroundings	Elevation	Latitude	Longitude
KEFJ001	Visitor Facilities Zone	July 16 – August 21, 2008	Edge of forest near SE corner of parking lot for Exit Glacier Nature Center. Deciduous trees: willow, cottonwood, Alder shrubs, and rocky/moraine material.	131 m	60.18830	149.63137
KEFJ002	Hiker Zone	July 17 – August 25, 2008	Harding Icefield trail. Alder, heather, hellebore, and snow cover.	630 m	60.18374	149.66438
KEFJ003	Pedestrian Zone	July 18 – August 23, 2008	Exit Glacier trail on an exposed rock face. Alder, willow, moss, and 75% bedrock (moraine).	179 m	60.18231	149.64233
KEFJ004	Backcountry semi-primitive Zone	July 21 – August 14, 2008	Nike site. Spruce, cottonwood, willow, lichen, moss, dwarf fireweed; glacier deposit – gravel.	105 m	60.19999	149.60349

Metrics

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. Table 2 presents park sound sources and common sound sources with their corresponding A-weighted decibel levels (dBA). The dBA is a logarithmic measure of sound energy that approximates human hearing sensitivity (Harris, 1998, p. 1.16).

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)

Table 4 reports the percent of time that measured levels were above the values in Table 3. The top value in each cell focuses on frequencies affected by transportation noise whereas the lower values use the conventional full frequency range.

Table 4. Percent time above metrics

Site	% 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
KEFJ001	100.00 ¹	2.90	0.25	0.01	100.00	0.34	0.02	0.00
	100.00 ²	20.55	1.89	0.07	100.00	1.60	0.22	0.01
KEFJ002	100.00	0.33	0.05	0.00	100.00	0.04	0.00	0.00
	100.00	3.20	0.13	0.01	100.00	2.87	0.03	0.00
KEFJ003	100.00	6.37	0.33	0.03	100.00	1.05	0.03	0.00
	100.00	92.39	1.28	0.06	100.00	99.34	0.25	0.01
KEFJ004	54.40	0.64	0.23	0.05	80.30	0.04	0.00	0.00
	88.60	3.93	0.29	0.07	99.35	0.28	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 10-20,000 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 in KEFJ. The top value in each cell focuses on frequencies affected by transportation noise whereas the lower values use the conventional full frequency range.

Table 5. Exceedence levels for existing conditions

Site	Exceedence levels (dBA): 0700 to 1900			Exceedence levels (dBA): 1900 to 0700		
	L ₉₀	L ₅₀	L ₁₀	L ₉₀	L ₅₀	L ₁₀
KEFJ001	37.3 ¹	38.7	41.6	37.8	38.5	39.7
	39.5 ²	41.4	45.1	39.6	40.4	41.5
KEFJ002	39.3	40.2	41.3	39.9	40.6	41.4
	41.8	42.7	43.7	42.5	43.3	44.0
KEFJ003	41.9	42.7	43.9	42.2	42.8	43.4
	45.5	46.3	47.7	45.9	46.4	47.1
KEFJ004	34.6	35.7	37.0	35.1	35.9	36.8
	36.6	38.0	40.6	36.8	37.6	38.6

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 10-20,000 hertz.

Figures 1-4 plot the dB levels for 33 one-third octave band frequencies over the day and night periods at the four monitoring sites. 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.

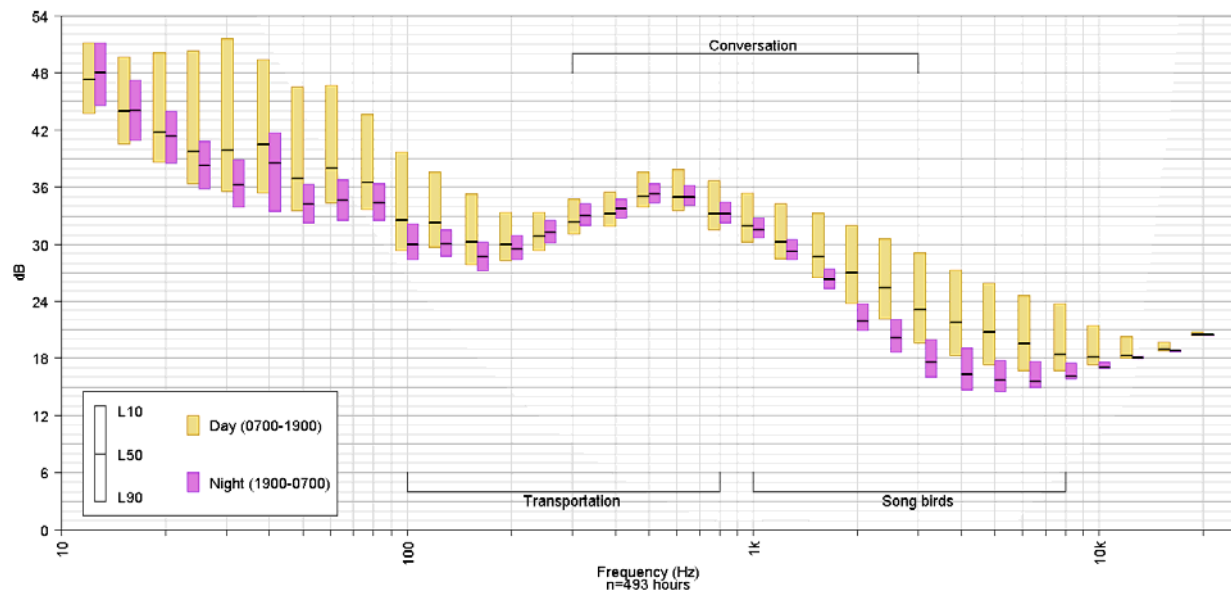


Figure 1. Day and night dB levels for 33 one-third octave bands at KEFJ001

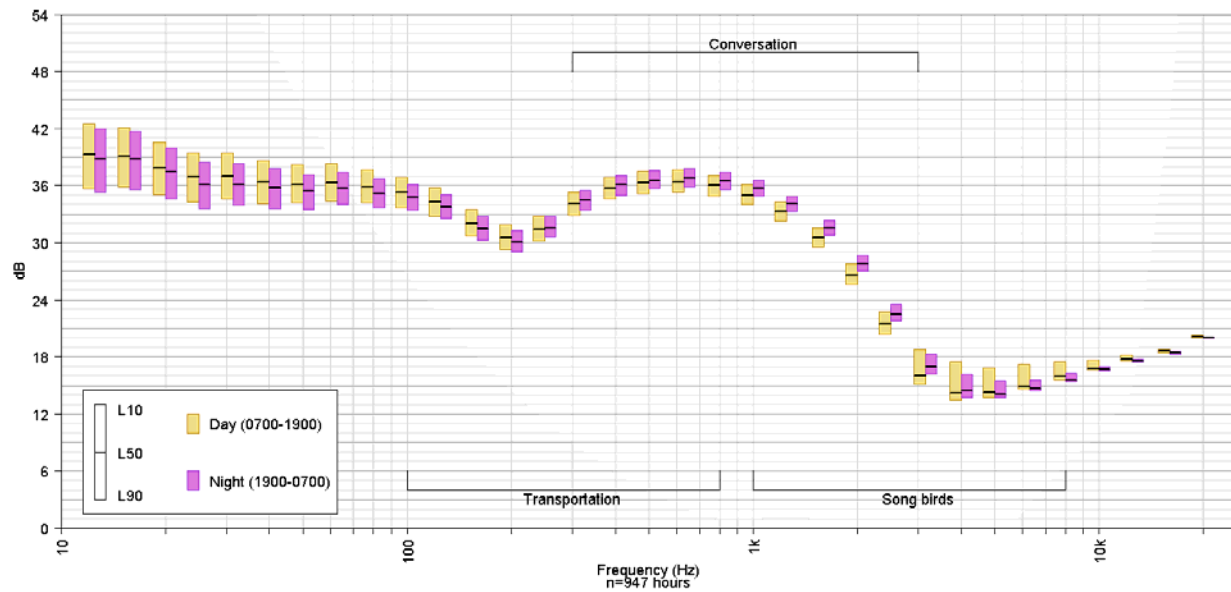


Figure 2. Day and night dB levels for 33 one-third octave bands at KEFJ002

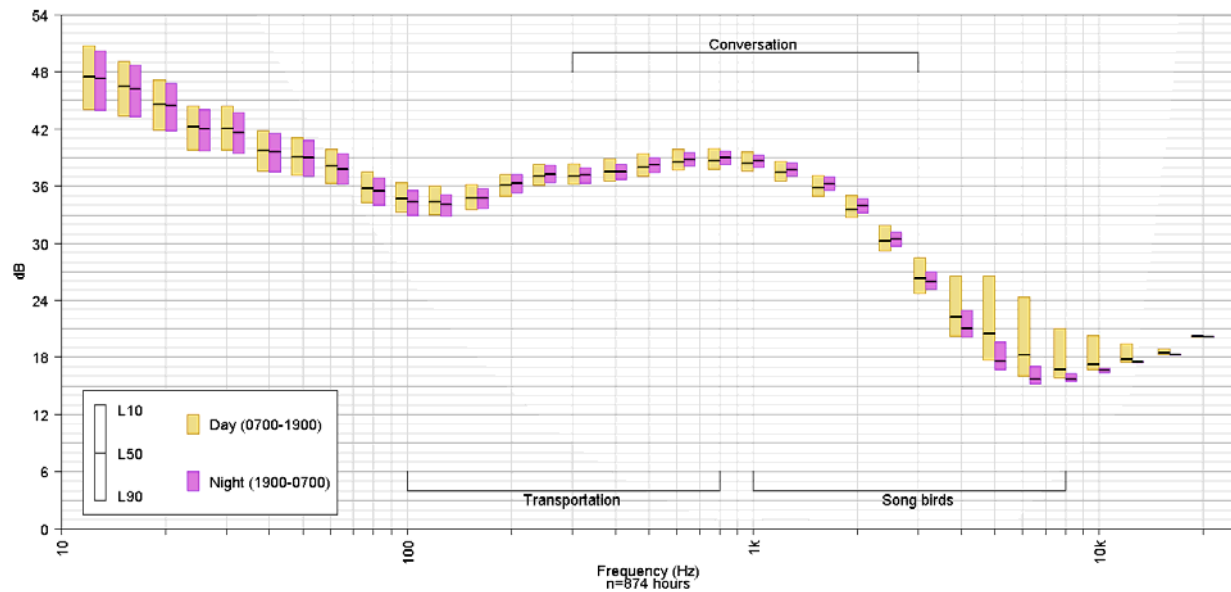


Figure 3. Day and night dB levels for 33 one-third octave bands at KEFJ003

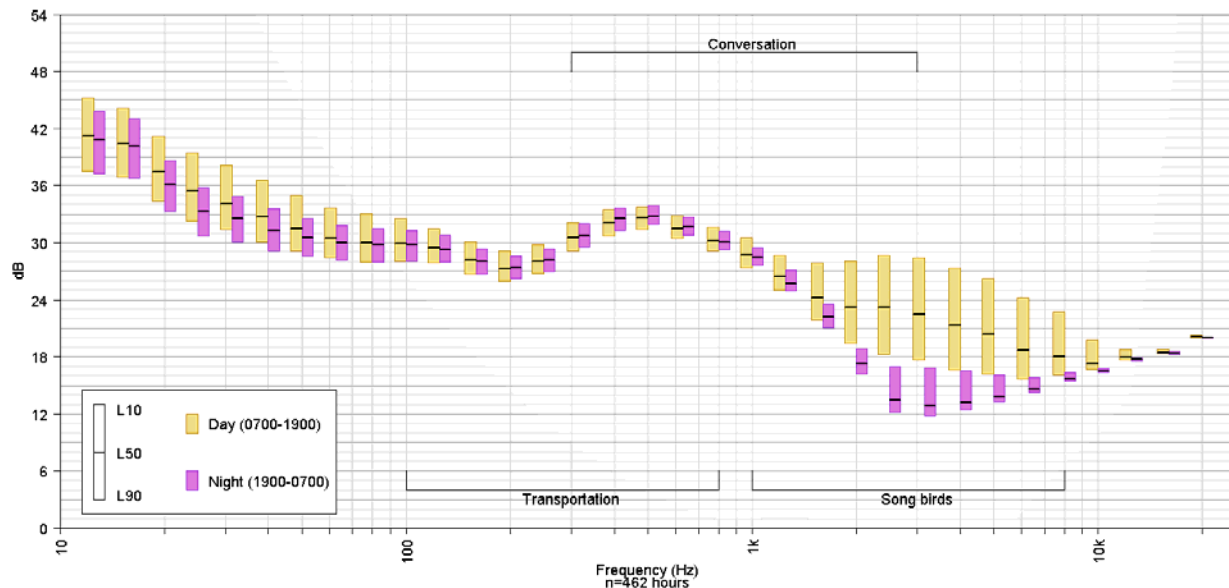


Figure 4. Day and night dB levels for 33 one-third octave bands at KEFJ004

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 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.

Natural Resource Program Center

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