Sound Levels and Audibility of Common Sounds in Frontcountry and Transitional Areas in Grand Canyon National Park, 2007-2008

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Cover photograph: NPS Shuttle Bus (natural gas), South Entrance Road near Yavapai Point.

Executive Summary

Title: **Sound Levels and Audibility of Common Sounds in Frontcountry and Transitional Areas in Grand Canyon National Park, 2007-2008**

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In 2005, Grand Canyon National Park (GCNP) began acoustic studies in backcountry areas of the park in order to determine natural ambient sound levels in the four major vegetation types in the park (Ambrose 2006; Levy and Falzarano 2007a and 2007b). Data from these studies helped establish baseline natural ambient sound levels that are being used in aircraft noise modeling efforts. The purpose of this study was to determine sound levels in frontcountry (developed) and transitional areas (trailheads, view points, campgrounds, trails, and corridors) of GCNP. Over 9,000 hours of acoustic and audibility data were collected at 19 frontcountry and transitional areas (11 on the South Rim and 8 on the North Rim) in summer and winter, 2007-2008. Data from this study can be used to characterize current soundscape conditions of frontcountry areas in GCNP, and along with other recent studies, can be used to assess soundscape conditions park-wide. Acoustic data from aircraft overflights were addressed, but the study focused on non-aircraft related sound sources.

The 1995 General Management Plan (GMP) for GCNP states that the frontcountry areas of GCNP, particularly the South Rim, will be managed to provide visitors "direct access to the rim, where panoramas of the canyon provide the park's aesthetic, inspirational, and emotional appeal - some of the main reasons people visit the park" (NPS 1995). The GMP further states that the South Rim area should also provide visitors the opportunity to "experience solitude in natural settings." For the North Rim area, the GMP states that "visitors should be able to experience natural sights and sounds with little or no intrusion from other people." Thus, while the GMP calls for providing access and services in frontcountry areas, it also calls for providing the opportunity to experience solitude and natural sounds.

Sound Levels in Frontcountry Areas
In high-use frontcountry areas of GCNP, human-caused sounds (from vehicles, buildings, people, construction, maintenance, etc.) were common and audible nearly all of the time. To characterize the existing ambient sound level (all sounds, including human-caused), the median sound level (L_{50}), is used. The L_{50} values of the busiest, most visited frontcountry areas (South Entrance Road, Village Loop Road, Mather Point), were approximately 20-30 dBA higher than L_{50} levels in backcountry areas of the same acoustic zone. At frontcountry areas with fewer visitors or with restrictions on vehicle access, the differences were smaller. Night time (1900-0700) L_{50} values for frontcountry and backcountry areas were similar in most areas due to fewer vehicles at night. Winter L_{50} levels in frontcountry areas were lower than summer L_{50} values (this was generally

true in backcountry areas as well). Sound levels at low-use frontcountry locations (areas with no vehicles (along the Bright Angel Trail) or with few visitors (Tuweep Campground) were close to backcountry sound levels.

In frontcountry areas, vehicles were the single most important sound source contributing to higher sound levels and higher percent time non-natural sounds were audible. Very loud vehicles such as motorcycles with altered exhaust systems (80-90 dBA at 15 m) and trains (90-95 dBA at 50 m) contribute significantly to the area of audibility in and around frontcountry areas. Some of these louder sounds could be audible 10 to 15 km (6 to 9 miles) from the sound source in some situations. Train sounds were generally restricted to certain times of day, but motorcycles with altered exhaust systems were common in the summer/fall periods. Areas with bus access only, such as Yaki Point, were considerably quieter than areas with unrestricted vehicle access. Sounds of people camping in Mather Campground were relatively quiet; however, the campground is surrounded by roads and associated vehicle sounds. As a result, noise intrusions from vehicles outside the campground were common and often the loudest sounds in the campground. Enforcement of EPA vehicle noise regulations could significantly reduce the area of audibility of vehicle sounds.

Audibility in Frontcountry Areas

Of the 19 measurement locations, 17 were in high-use areas and two were in low-use areas (few or no vehicles or in remote areas). In high-use areas, non-natural sounds were audible 80 percent of the time (0000-2400) in summer and 73 percent in winter. In low-use areas, non-natural sounds were audible 42 percent of the time (0000-2400) in summer and 31 percent in winter. At locations with the highest number of visitors and activities, human-caused sounds were audible nearly 100 percent of the time in summer and winter. The most common audible human-caused sounds were vehicle-related (driving, idling, horns, and alarm systems). Other audible human-caused sounds were aircraft, people (talking, walking), buildings (doors, air conditioners, and heating units), grounds care activities (trash can lids), other mechanized sounds (generators), and domestic animals.

The most common natural sounds in both high-use and low-use areas were wind-related (wind through vegetation) and birds and insects (primarily in summer). Other audible natural sounds were mammals, water (rain, snow), and thunder.

Noise free intervals (NFI, periods with only natural sounds or no sounds at all) during day time hours (0700-1900) essentially did not exist in high-use frontcountry areas, averaging 0.2 minutes (12 seconds) in summer and winter. In low-use frontcountry areas, NFI metrics were somewhat longer but still very short, averaging 1.8 minutes in summer and 4.2 minutes in winter. The longest NFI in a high-use area was 3.7 minutes (East Rim Road in winter), and the longest NFI in a low-use area was 25.7 minutes (Tuweep Campground in winter).

GCNP established “flight-free zones” to limit aircraft sounds in frontcountry areas. However, at frontcountry locations near air tour routes, air tour aircraft were frequently audible. At Cape Royal and Point Imperial, on the north rim, aircraft were audible 41

percent and 27 percent of the time, respectively, during daytime hours (at both locations, loud vehicle sounds frequently masked aircraft sounds). At two other frontcountry or transitional areas, Hermit's Rest trailhead and near the junction of Hermit's Rest and Dripping Springs trails, aircraft were audible 85 percent and 81 percent of the time, respectively, during daytime hours. Although air tour routes are not directly over frontcountry areas, air tour aircraft sounds are common at locations near air tour corridors. Commercial aircraft (high flying jet aircraft) were audible at all frontcountry locations.

Recommendations

A primary frontcountry management goal at GCNP is to provide access to specific areas of the park, and to provide the opportunity for visitors to experience solitude and natural sounds. To help achieve this second goal, steps could be taken to reduce or eliminate the loudest human-caused sounds. In frontcountry areas, the primary source of human-caused sounds are vehicles, hence many of these recommendations address vehicle-related sounds. Recommendations to help achieve goals of the GMP include:

- Prohibit park access to vehicles that exceed EPA noise regulations. Enforcement of EPA noise regulations would result in a 25 to 50 percent reduction in the area that vehicle sounds are audible.
- Encourage park visitors to disable vehicle alarms and door locking sound systems while in the park.
- Use alternative quieter methods to rumble strips to warn drivers of congested areas or intersections.
- When road improvement or re-surfacing projects are being planned, consider the use of low-noise road surfaces.
- Investigate quieter approaches to safety concerns at rail road crossings. If the train horns are considered historically important, the amplitude of the horns could be reduced (currently being considered).
- Consider adjustments to air tour routes near the Cape Royal and Point Imperial areas and also near the Hermit's Rest trail systems area (currently being considered).

Implementation of any of the above recommendations could reduce sound levels in frontcountry areas and help provide the opportunity for park visitors in frontcountry areas to experience natural sounds. In addition, such steps will assist in park efforts to "preserve the wilderness threshold of the visitor experience along the rim of the canyon" as recommended in the GMP.

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Introduction

Natural sounds and natural soundscapes are considered valuable and important natural resources by the National Park Service (NPS 2006). NPS *Management Policies* reflect a strong desire to protect natural soundscapes in parks, stating: "The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks" (NPS 2006). The Grand Canyon Enlargement Act (1975) requires that natural quiet (that is, natural sounds) be protected as a resource, and lists this resource as a major value of the park.

In 1987, the National Parks Overflight Act (P. L. 100-91) was passed requiring the National Park Service (NPS) and the Federal Aviation Administration to work together to achieve substantial restoration of the natural quiet in GCNP.

In order to assess achievement of substantial restoration of natural quiet, knowledge of acoustic conditions in all areas of the park is needed. In 2005, the NPS initiated acoustic studies to determine sound levels in the primary vegetation types in backcountry areas of the park (Falzarano 2005, Ambrose 2006). From these and more recent studies (Levy and Falzarano 2007a, 2007b), the NPS has a good understanding of sound levels and sources of common sounds in the backcountry areas of GCNP. Acoustic data were needed for other areas of the park, primarily in frontcountry (developed) and transitional areas of GCNP. Transitional areas include access areas, view points, campgrounds, trail heads, and trails.

The primary objective of this project was to collect acoustic and audibility data in frontcountry and transitional areas of the park. A second objective was to collect acoustic data on transportation related sound sources in the park, including shuttle buses, tour buses, trains, and other vehicles. Data from this study can be used to characterize current soundscape conditions of frontcountry areas in GCNP, and, along with other recent studies, can be used to assess soundscape conditions park-wide. Acoustic data from aircraft overflights were addressed, but the study focused on non-aircraft related sound sources.

Study Area

The study area was frontcountry and transitional areas within Grand Canyon National Park (GCNP). Land cover types in GCNP and relative abundance of each are described by Falzarano (2005). Four major vegetation types cover over 96 percent of the park. They are Pinyon-Juniper Woodland, Warm Desert Scrub, Cold Desert Scrub, and Ponderosa Pine Forest (Figure 1). These vegetation types are considered "acoustic zones" because sound levels tend to be similar in like vegetation types. In some areas near the Colorado River (about 15 percent of the park), river sounds are higher than natural ambient sound levels of these vegetation types, and for this reason the Colorado River is considered a separate acoustic zone. This "sound shadow" of the river reduces the size of the other acoustic zones based solely on vegetation type.

Three park management zones are identified in the GCNP General Management Plan (NPS 1995): Proposed Wilderness, Non-Wilderness Areas and Corridors, and Developed Areas (Figure 2). Four Non-Wilderness/Corridors Areas and Developed Areas are identified in the GCNP General Management Plan (GMP):

1. South Rim (Hermits Rest, Grand Canyon Village, and Desert View);
2. North Rim (Bright Angel Point and Walhalla Plateau);
3. Tuweep; and
4. Corridor Trails (Bright Angel Trail, North and South Kaibab Trails; River Trail, and Old Bright Angel Trail).

Corridor trails are often considered "transitional areas," between developed and non-developed areas. These areas are identified in the GMP as Non-Wilderness Areas and Corridors. Transitional and Non-Wilderness areas at the South and North Rims generally occur in association with frontcountry areas, but often with less visitor use than the main developed areas. Other transitional areas include viewpoints and trailheads.

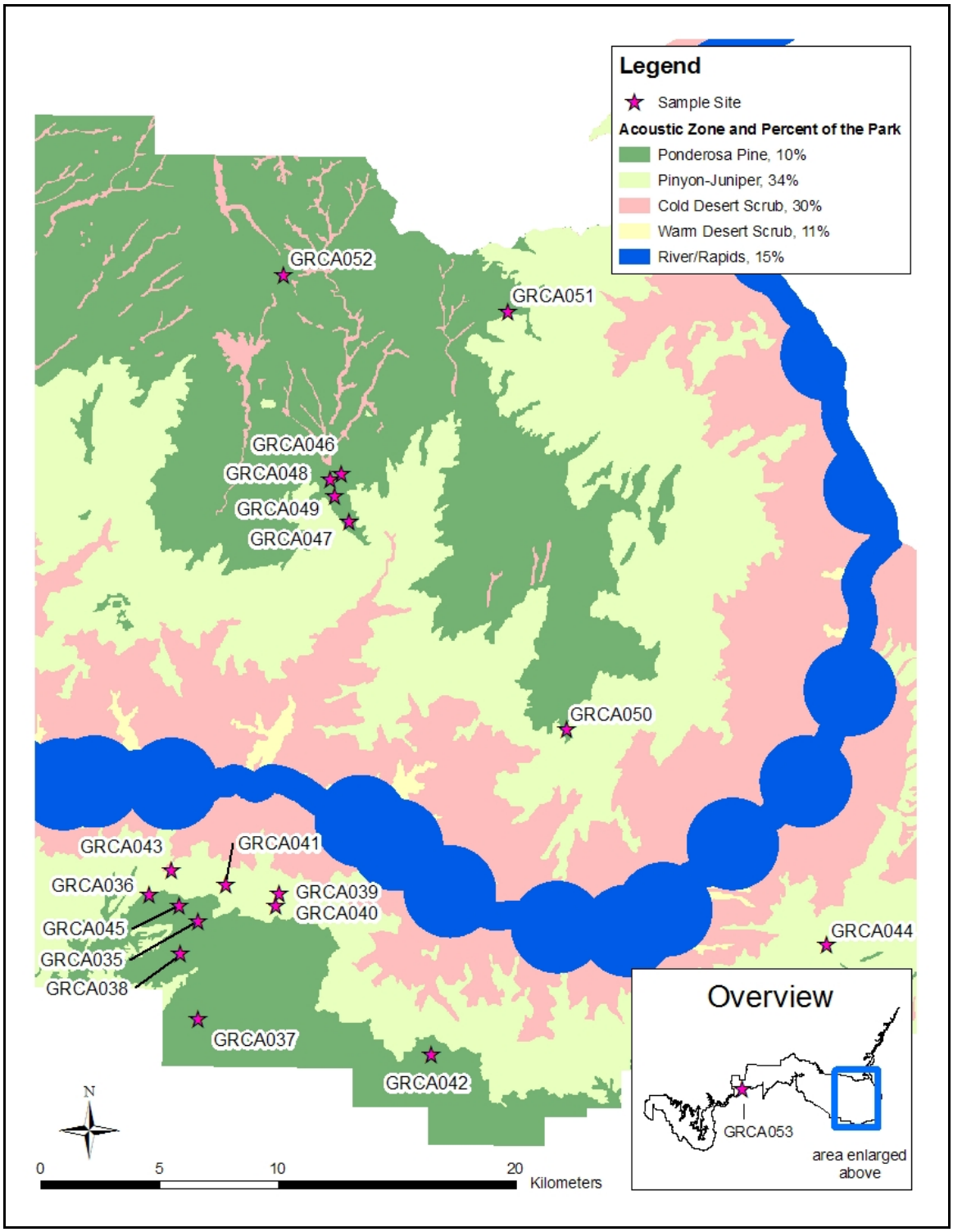

Figure 1. GCNP acoustic zones and measurement locations, 2007-2008.

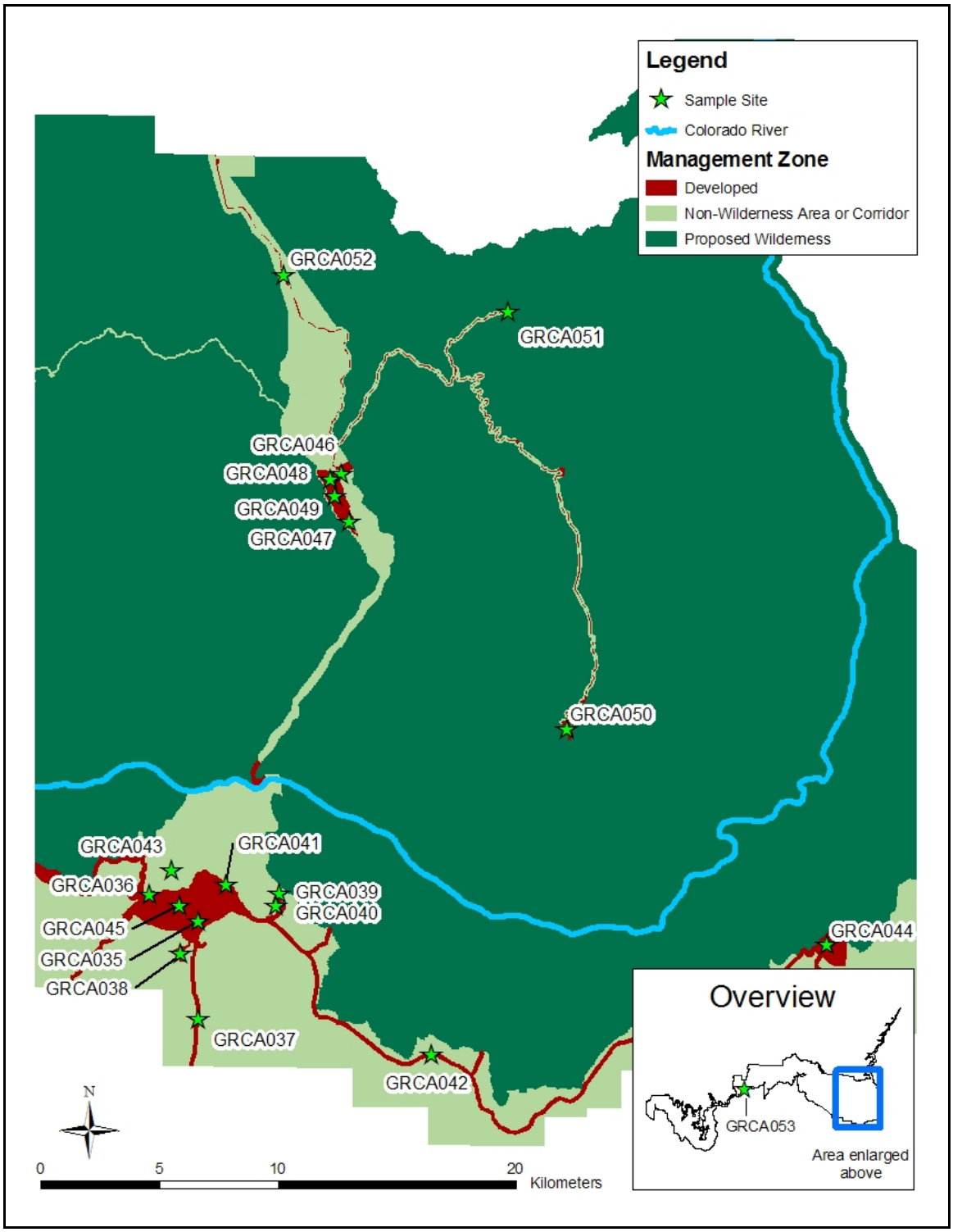

Figure 2. GCNP GMP management zones and measurement locations, 2007-2008.

Methods

Definitions

The following are definitions of acoustic terms used in this report (NPS 2005).

Audibility: Audibility is the ability of animals with normal hearing, including humans, to hear a given sound. Audibility is affected by the hearing ability of the animal, other simultaneous interfering sounds or stimuli, and by the frequency content and amplitude of the sound.

A-Weighting (dBA): A-weighting is used to account for differences in human hearing sensitivity as a function of frequency. A-weighting de-emphasizes the high (6.3 kHz and above) and low (below 1 kHz) frequencies, and emphasizes the frequencies between 1 kHz and 6.3 kHz, in an effort to simulate the relative response of human hearing.

Decibel (dB): A logarithmic measure commonly used in the measurement of sound. The decibel provides the possibility of representing a large span of signal levels in a simple manner as opposed to using the basic pressure unit Pascal. The difference between the sound pressure for silence versus a loud sound is a factor of 1,000,000:1 or more, therefore it is less cumbersome to use a small range of equivalent values: 0 to 130 decibels.

Existing Ambient Sound Level (L_{50}): The sound level of all sounds in a given area, including all natural sounds as well as all mechanical, electrical and other human-caused sounds. The existing ambient sound level will be characterized by the L_{50} exceedence level (i.e., the median).

Frequency: The number of times per second that the sine wave of sound repeats itself. It can be expressed in cycles per second, or Hertz (Hz). Frequency equals Speed of Sound / Wavelength.

Natural Ambient Sound Level (L_{nat}): The sound level of all natural sounds in a given area, excluding all mechanical, electrical and other human-caused sounds. "Natural ambient" is considered synonymous with the term "natural quiet," although natural ambient is more appropriate because nature is often not quiet. The L_{nat} will be characterized by the exceedence value calculated by removing the percent time human-caused sounds are audible.

L_{eq} (Equivalent Sound Level): The logarithmic average (i.e., on an energy basis) of sound pressure levels over a specific time period. "Energy averaged" sound levels are logarithmic values, and as such are generally higher than arithmetic averages. L_{eq} values are typically calculated for a specific time period (1-hour and 12-hour time periods are often used). L_{eq} values are computed from all of the 1-second L_{eq} values for the specific time period. L_{eq} must be used carefully in quantifying natural ambient sound levels because occasional loud sound levels may heavily influence (increase) the L_{eq} value, even though sound levels for that period of time are typically lower.

L_{max}: The maximum sound pressure level for a given period.

L_{min}: The minimum sound pressure level for a given period.

L_x (Exceedence Percentile): This metric is the sound pressure level (L), in decibels, exceeded *x* percent of the time for the specified measurement period.

L_{50} is the sound pressure level exceeded 50 percent of the time (L_{50} is the same as the median). L_{90} is the sound pressure level exceeded 90 percent of the time.
Noise Free Interval (NFI): The length of time (continuous) during which only natural sounds are audible or there is silence.
Octave: The interval between two frequencies having a ratio of 2 to 1. The *octave* is an important frequency interval relative to human hearing, and octave band analysis is a standard for acoustic analysis. The frequency resolution in octave band analysis is relatively poor; hence finer frequency resolution is often used in acoustic analysis. Generally, one-third octave band analysis is used. Three one-third octave bands are in one octave, so the resolution of such a spectrum is three times better than the octave band spectrum.
Sound: Sound can be defined as a pressure variation in air or other media that is within the hearing range of a given species. This pressure variation has two components: amplitude (sound pressure level) and frequency content. Sound pressure is a measure of the fluctuations in air pressure caused by the presence of sound waves.
Sound Level: Generally, *sound level* refers to the *weighted* sound pressure level obtained by frequency weighting, usually A- or C-weighted.
Sound Pressure: Sound pressure is the instantaneous difference between the actual pressure produced by a sound wave and the average barometric pressure at a given point in space. Not all pressure fluctuations detected by a microphone are sound (e.g., wind over the microphone). Sound pressure is measured in Pascals (Pa), Newtons per square meter, which is the metric equivalent of pounds per square inch.
Sound Pressure Level (SPL): The logarithmic form of sound pressure. Generally, *sound pressure level* refers to *unweighted* sound pressure levels of one-third octave bands.

Additional definitions of acoustic terms and examples of metrics are provided in the NPS "Draft Manual for Conducting Acoustics and Soundscape Studies in National Parks" (NPS 2005). A short summary follows.

Some metrics are straightforward while others are not. L_{min} and L_{max} are simply the minimum and maximum measured values. L_{eq} is a logarithmic average (i.e., on an energy basis) of sound levels over a specific time period. In park situations, L_{eq} is useful for quantifying intruding sounds because its magnitude depends heavily on the loudest periods of a time-varying sound. L_{eq} of an intruding source by itself, however, is inadequate for fully characterizing the intrusiveness of the source. Influence of sound intrusions in park environments depends not only upon the amplitude of the intrusion, but also upon the sound level of the "background," in this case, the sound level of the non-intruding sources, usually the natural ambient sound levels. L_{eq} values are not generally appropriate for quantifying natural ambient sound levels; L_{eq} does not translate time-varying exposures into a biologically equivalent measure.

Exceedence metrics (L_{10}, L_{50} and L_{90}) are sound levels, in decibels, exceeded *x* percent of the time for the specified measurement period. The L_{10} value represents the sound

pressure level exceeded 10 percent of the time, and the L_{50} value represents the sound pressure level exceeded 50 percent of the time. L_{50} is the same as the median sound level. The L_{90} value represents the sound pressure level exceeded 90 percent of the time during the measurement period. L_{50} and L_{90} values are commonly used to represent existing ambient and natural ambient sound levels, respectively, in acoustic studies (Bruel & Kjaer. 2000). The L_{50} value is an appropriate metric to represent natural ambient sound levels when no human-caused sounds affect the measurements; however, this is very rare in the United States, even in remote locations in National Parks. Some agencies and local and state governments use the L_{90} metric to represent the "background" sound level.

The dBA metric is a single value, the sum of many dB levels of many different frequencies. This metric can be misleading because one does not know what sound(s) contributed to dBA value. With one-third octave band data, one can assess what frequencies contributed most to the sound levels (and in some cases predict the source of the sound). Models used to predict audibility require one-third octave band data. This is because audibility of a given sound is determined not only by the amplitude of that sound, but also the frequency content of the sound relative to the frequency content of background conditions.

No single acoustic metric (SPL or audibility) can adequately describe acoustic conditions in a given area. Several metrics, using both sound level data and audibility data, are needed to fully understand acoustic conditions (Table 1).

Table 1. Acoustic data collected and metrics computed.

Data Collected:	Metric Computed:
Sound Pressure Level Data (1-second L_{eq} for 1/3 octave bands, 20-20,000 Hz; dBA)	• L_{eq}, L_{10}, L_{50}, L_{90}, L_{min}, and L_{max} for each hour, day, month, season, and entire measurement period • $L_{Existing}$ ambient sound levels
Observer Logging and Digital Recordings	• Percent Time Audible • Identification of sources of sound • Distribution of sources of sounds • Number/duration of loud events, by source • Noise-free interval

Measurement Locations

In consultation with GCNP staff, 19 measurement locations were selected to include a sample of each of the frontcountry and transitional areas (see Figure 2, Table 2). For both the South and North Rim areas, measurements were made at entrance roads, visitor centers, campgrounds, viewpoints, major trailheads, NPS maintenance areas and NPS residential areas. All measurement locations were in Developed management zones except one, the Bright Angel Trail location, 3.7 miles from the South Rim Bright Angel Trailhead. This location is in a Corridor management zone. The Tuweep Campground

and overlook area is also considered frontcountry, and measurements were made at that location. The North Rim at GCNP is closed in winter due to heavy snowfall; therefore, this area is not considered "frontcountry" in winter months. Winter measurements were made at two North Rim locations, the North Rim Access Road (because the road was open occasionally in December 2007), and Tuweep campground which remains open year-round. Measurement locations were in three vegetation types (acoustic zones): ponderosa pine (PP); pinyon-juniper (PJ); and warm desert (WD).

Table 2. Frontcountry and transitional measurement locations, acoustic zone, and activity type, Grand Canyon National Park, 2007-2008.

Site Number	Location	Latitude	Longitude	Acoustic Zone	Activity Type
GRCA035	Mather Campground	36.04698	-112.12080	PP	Campground
GRCA036	Village Loop Rd, West End	36.05687	-112.14369	PP	High-use Area
GRCA037	South Entrance Road	36.00984	-112.12002	PP	Road
GRCA038	NPS Maintenance, Helo, Bus	36.03461	-112.12859	PP	Admin/Mainten.
GRCA039	Yaki Point	36.05815	-112.08314	PP	Overlook
GRCA040	South Kaibab Trailhead	36.05324	-112.08429	PP	Overlook/Trailhead
GRCA041	Mather Point Parking Lot	36.06118	-112.10809	PP	Overlook
GRCA042	East Rim Road, Mile 251	35.99760	-112.01121	PP	Road
GRCA043	Bright Angel Trail, 3.7 Mile	36.06628	-112.13322	PJ	Corridor Trail
GRCA044	Desert View, Parking Lot	36.04074	-111.82677	PJ	High-use Area
GRCA045	SR, Residential Area (NPS)	36.05282	-112.12943	PP	Residential
GRCA046	North Kaibab Trailhead	36.21749	-112.05608	PP	Trailhead
GRCA047	NR VC Parking Lot	36.19932	-112.05216	PP	High-use Area
GRCA048	NPS Admin/Main./Res. Area	36.21510	-112.06132	PP	Admin/Mainten.
GRCA049	NR Campground	36.20921	-112.05932	PP	Campground
GRCA050	Cape Royal	36.12149	-111.94930	PP	Overlook
GRCA051	Point Imperial	36.27956	-111.97906	PP	Overlook
GRCA052	NR Entrance Road	36.29278	-112.08439	PP	Road
GRCA053	Tuweep Camp./Overlook	36.22372	-113.06050	WD	Campground

To characterize vehicle sounds, acoustic data were collected for a one-hour period at three of the above locations, GRCA036, GRCA037, and GRCA042, and also at three other sites. They were GRCASER1, on the South Rim Entrance Road, 420 m south of the turnoff to Yavapai Point; GRCAJDV, at the junction of East Rim Road and South Entrance Road; and GRCASER2, South Entrance Road between park Headquarters and Village Loop Road. Vehicle sound levels measured for this report were very close to levels used in Federal Highways Administration's Traffic Noise Model (except modified

motorcycles), hence only vehicle data from GRCASER1 are presented in this report. At locations documenting vehicle sounds for one-hour periods, a digital video camera was used in conjunction with the SLM and digital recorder.

Equipment

All acoustic monitors used during this study collected continuous 1-second sound level data (dBA and L_{eq} for 1/3 octave bands, 20-20,000 Hz). Continuous digital audio recordings (.wav files at 16-bit/44100 Hz or MP3 files at 192 kbs) were collected at all sites (although only samples of the recordings were analyzed).

Most of the acoustic monitors used in this study consisted of a Larson-Davis 831 sound level meter (SLM), Larson-Davis PRM831 preamplifier, PCB 377B20 microphone, and Larson-Davis ESP106-2 Environmental Shrouds (windscreen and bird spike). A Cowon iAudio X5 MP3 digital recorder was used to make and store digital recordings (MP3, 192 kbs). The digital recorder used the microphone output from the Larson-Davis 831 SLM. A 12-volt battery was used to power the system, and the equipment was stored in a weather-proof container. Figure 3 shows the acoustic equipment in the weatherproof case and Figure 4 shows the microphone (with windscreen and bird spike) and anemometer.

Figure 3. Larson-Davis 831 SLM with digital recorder and anemometer data logger.

Figure 4. Microphone (with windscreen and bird spike) and anemometer.

Two other types of SLMs were used at a few locations. One system consisted of a Larson-Davis 824 SLM, Larson-Davis PRM902 preamplifier, GRAS 40AQ microphone, and a Larson-Davis ESP 106.2 windscreen with bird spike. This type of monitor includes an IBM-compatible notebook computer with sound card to store data and digital recordings, 12-volt batteries to power the system, a solar array to charge the batteries, and a weather-proof container. A third type of acoustic monitor consisted of Sound Technology Spectra 132 sound level software, Sound Technology ST191-DSA external sound card, GRAS 26CA preamplifier, GRAS 40AQ microphone, and a Larson-Davis ESP 106.2 windscreen with bird spike. An IBM-compatible notebook computer was used to run the Spectra 132 software and to store data and digital recordings. A 12-volt battery supply was used to power the system, a solar array to charge the batteries, and a weather-proof container housed the equipment. Both of these types of monitors use considerably more power than the LD831-type system; hence these monitors were deployed where we had 120-volt power available (GRCA038 and GRCA045) or where we could use solar panels for charging batteries (GRCA041 and GRCA046).

All SLMs and components met ANSI Type 1 standards (IEC 804:1985, Integrating-Averaging Sound Level Meters), and were calibrated annually. A B&K 4231 acoustic calibrator that complied with Class 1 accuracy requirements of ANSI S1.40-1984, American National Standard Specification for Acoustical Calibrators (9184), or IEC

942:1988, Sound Calibrators (1988), was used to calibrate the sound level meters in the field.

When possible, wind speed and wind direction were collected to correlate with sound pressure level data. Wind data were collected using a Hobo wind speed sensor and data logger (Onset Computer Company) anemometer. Wind data were not collected at many locations due to high visibility of wind gauges and security concerns.

All instruments (SLMs, computers, anemometers, and recorders) were time-synchronized with GPS time at deployment, and any time off-sets were recorded at the end of the measurement period and rectified before data analysis.

Monitors were capable of operating for extended periods of time through the use of large data storage and solar charging systems. For most of the frontcountry measurement sites, solar panels were not used in order to minimize visibility. Extra batteries were used and changed frequently.

This study followed protocols for acoustic data collection, equipment, and data analysis as outlined in "Acoustics and Soundscape Studies in National Parks-Draft" (NPS 2005) with one exception, microphone height. The NPS manual states that microphone height shall be 1.5 m above ground level unless security concerns necessitate otherwise. The manual further states that if a different microphone height is used, the influence of microphone height on sound levels shall be determined. At some of the measurement locations, many people were near the monitor and the equipment was left unattended for several days. Therefore, security of the equipment was a concern. In these cases, the microphone was placed on top of a parked pickup truck 3.0 m above the ground rather than 1.5 m. The acoustic monitor was placed inside the vehicle and the microphone was on a pole on the top of a camper shell (Figure 5). In order to compare differences in sound levels collected by microphones at different heights, sound levels collected by microphones 1.5 m high and 3.0 m high were compared for 72 hours. The differences in commonly used hourly metrics (L_{eq}, L_{10}, L_{50}, L_{90}, L_{min}, and L_{max}) were small, averaging 0.6 dBA for all metrics. Lower frequencies (<1,000 Hz) were less influenced than high frequencies. Since most vehicle sound energy is in the lower frequencies, measurement data were not significantly influenced by a 3.0 m microphone height as compared to a height of 1.5 m.

Figure 5. Microphone on top of pickup topper, 3.0 m above ground.

Acoustic Data Analysis

Calculations of acoustic metrics for this analysis are described in "Acoustics and Soundscape Studies in National Parks" (NPS 2005). Acoustic data were analyzed using software developed by the NPS Natural Sounds Program, Fort Collins, CO. Four programs most commonly used are:

- NVFormat: Converts SPL data from the sound level meter format to a data format (NVSPL) developed by the NPS Natural Sounds Program in conjunction with the Department of Transportation's Volpe National Transportation Systems Center.
- DayAudibility: Used to code sound sources from observer field and office logs, and provides summary output statistics of different sound sources.
- HourlyMetrics: Analyzes 1-second SPL data to provide summary statistics such as L_{min}, L_{max}, L_{eq}, L_{10}, L_{50}, L_{90}, and L_{nat}.
- SPL Spectrogram Plotter: Plots daily and hourly spectrograms from NVSPL files for quick visual analysis. Used to peruse SPL data for gaps in data or problems. Also used to identify sound sources with distinct frequency/time signature when recordings were not available.

Measurement period

Sound levels can be extremely variable, and measurement periods need to be long enough to capture the full range of variability. The goal of acoustic measurements in National

Parks is to ensure that results from the sample measurement period are not more than 3 dB different from results obtained if the entire season had been sampled (NPS 2005). Based on review of several year-long data sets in other Southwest parks, two seasons were identified that have distinct acoustic qualities: summer and winter. For frontcountry areas where sound levels are fairly constant, a 10 day measurement period is recommended for each season. Data were collected in frontcountry areas for a minimum of 10 days at measurement locations in June, July, and August 2007 (summer), and December 2007 and January and March 2008 (winter). Dates of data collection at each of the measurement locations are shown in Table 3.

Table 3. GCNP frontcountry and transitional area measurement locations and dates of data collection (yyyymmdd), summer and winter, 2007-2008.

	Location	**Date Start Summer**	**Date End Summer**	**Date Start Winter**	**Date End Winter**
GRCA035	Mather Campground	20070620	20070630	20071217	20071229
GRCA036	Village Loop Rd, West End	20070615	20070706	20071228	20080106
GRCA037	South Entrance Road	20070615	20070627	20071206	20071216
GRCA038	SR Maintenance Area	20070615	20070627	20071212	20080103
GRCA039	Yaki Point	20070615	20070627	20071206	20071217
GRCA040	South Kaibab Trailhead	20070616	20070629	20071206	20071217
GRCA041	Mather Point Parking Lot	20070617	20070629	20071213	20071224
GRCA042	East Rim Road, Mile 251	20070621	20070706	20071206	20071217
GRCA043	Bright Angel Trail, 3.7 Mile	20070625	20070703	20080303	20080328
GRCA044	Desert View, Parking Lot	20070626	20070707	20071204	20071213
GRCA045	SR Residential Area	20070705	20070725	20071212	20080103
GRCA046	North Kaibab Trailhead	20070708	20070719	NA	NA
GRCA047	NR Visitor Center	20070708	20070718	NA	NA
GRCA048	NR Admin/Main./Res. Area	20070708	20070719	NA	NA
GRCA049	NR Campground	20070708	20070719	NA	NA
GRCA050	Cape Royal	20070709	20070719	NA	NA
GRCA051	Point Imperial	20070709	20070719	NA	NA
GRCA052	NR Entrance Road, 3.8 Mile	20070709	20070719	20071204	20071215
GRCA053	Tuweep Camp./Overlook	20070801	20070814	20071204	20071214

Observer Logging, Field and Office

Sound level data alone do not allow identification of sources of sounds. When conducting acoustic studies in national parks, it is essential that the source of common sounds, both natural and non-natural, be identified and the percent time audible of each

be calculated. Identification of common sound sources was accomplished by logging all audible sounds on a standardized data sheet and entering that data in a spreadsheet program. Both field logging (continuous one-hour logging sessions) and office logging (listening to a sample of digital recordings for the entire day) were used to identify audible sounds. At each measurement location, two hours of field logging were conducted (one hour in the morning and one hour in the afternoon), and two days of sample recordings (one week day and one weekend day) were analyzed in the office. The sample scheme used for listening to the recordings was a 10-second recording every two minutes. Computerized, automated sound source identification is under development, but currently only trained listeners can accurately identify sounds. For additional discussion comparing office and field logging techniques, see "Sound Levels in the Primary Vegetation Types in Grand Canyon National Park, July 2005" (Ambrose 2006). All field and office listeners/loggers had hearing tests to insure all were within normal hearing norms.

Results

Over 9,000 hours of acoustic data were collected between June 15, 2007, and March 28, 2008, on the South and North Rims of GCNP. Acoustic data and digital recordings were collected at 19 locations, 11 on the South Rim (summer and winter) and eight on the North Rim (eight in summer and two in winter). Summary acoustic and audibility data are presented below in the following sections: Sound Levels; Audibility of Common Sounds and Noise Free Interval; Sources of Sounds >90 dBA; and Vehicle Maximum Sound Levels. Detailed acoustic and audibility data for each site are presented in Appendices I and II. For each location, L_{min}, L_{max}, L_{eq} log mean, L_{eq} arithmetic mean, L_{eq} median, L_{10}, L_{50}, $L_{90,}$ and sound source identification and percent time audible are provided.

Sound Levels

In frontcountry areas of GCNP, non-natural sounds (from vehicles, buildings, construction, and maintenance) were common and audible nearly all of the time. The most commonly used metric to characterize the acoustic conditions for such areas is the *existing ambient* sound level, the L_{50}. In daytime in the summer, L_{50} values range from 23.7 dBA along the Bright Angel trail to 56.6 dBA at the west end of Village Loop Road (Table 4). Night-time and winter levels were generally lower. Sound levels were loudest in high use areas, such as Village Loop Road, near the popular Bright Angel Lodge and Hermit Road interchange. The sound levels were lowest in less visited areas, such as below the rim about 3.7 miles down the Bright Angel Trail. Most sound levels were lower at night, although some, such as along the Bright Angel Trail were higher at night in summer due to insects. Existing ambient sound levels for each of the 19 measurement locations, summer and winter, for three time periods are shown in Table 4.

The existing ambient (L_{50}) sound levels in frontcountry areas were variable (depending on the amount of visitation) but consistently higher than the L_{50} in the same acoustic zone in backcountry areas. The L_{50} of the busiest, most visited frontcountry areas (Village Loop Road, Mather Point, South Entrance Road), were 20-30 dBA higher, perceived by

humans as four to eight times louder, than the L_{50} in backcountry areas of the same acoustic zone. At frontcountry areas with fewer visitors or with restrictions on vehicle access, the differences were much less. For example, Yaki Point, a view point on the South Rim with bus access only had an L_{50} 5-10 dBA higher than the backcountry pinyon-juniper acoustic zone. Night time (1900-0700) L_{50} levels of frontcountry and backcountry areas were much closer in most areas due to reduced traffic at night. Winter L_{50} levels were nearly all lower than summer L_{50} levels, likely due to reduced traffic.

Table 4. L_{50} sound levels (dBA) for summer and winter, for three time periods, 2007-2008.

Site Number	Measurement Location	0700-1900 Summer/Winter		1900-0700 Summer/Winter		0000-2400 Summer/Winter	
GRCA035	Mather Campgrd. (Site 84)	41.3	37.9	35.2	28.5	39.7	34.1
GRCA036	Village Loop Rd, West End	56.6	55.8	43.9	42.5	51.6	51.2
GRCA037	SR South Entrance Road	51.7	46.8	35.2	25.9	49.8	41.7
GRCA038	SR NPS Maintenance Area	43.8	43.5	35.1	31.4	40.5	40.3
GRCA039	Yaki Point	31.8	29.0	30.1	20.5	31.4	26.8
GRCA040	South Kaibab Trailhead	35.4	32.3	40.7	24.0	36.7	30.4
GRCA041	Mather Point Parking Lot	52.3	52.9	40.1	32.5	48.1	46.5
GRCA042	East Rim Road, Mile 251	41.3	32.6	28.6	19.6	36.9	28.7
GRCA043	Bright Angel Trail, 3.7 Mile	23.7	22.3	37.2	18.8	27.3	21.3
GRCA044	Desert View, Parking Lot	47.3	40.2	32.9	26.1	41.9	36.1
GRCA045	SR, Residential Area (NPS)	36.7	36.3	31.3	31.0	35.2	34.7
GRCA046	North Kaibab Trailhead	42.7	NA	35.8	NA	50.5	NA
GRCA047	NR VC Parking Lot	47.0	NA	35.2	NA	44.0	NA
GRCA048	NR Admin/Res. Area	36.9	NA	32.0	NA	35.4	NA
GRCA049	NR Campground (Site 71)	35.9	NA	31.3	NA	34.8	NA
GRCA050	Cape Royal	27.3	NA	30.3	NA	27.9	NA
GRCA051	Point Imperial	31.4	NA	37.9	NA	32.0	NA
GRCA052	NR Entrance Road	37.3	25.5	27.9	22.1	33.2	24.1
GRCA053	Tuweep Camp./Overlook	28.3	22.7	31.8	20.9	30.7	21.6

Audibility of Common Sounds and Noise Free Interval

Of the 19 measurement locations, 17 were in high-use areas and two were in low-use areas (few or no vehicles or in remote areas). Therefore, we analyzed two data sets for audibility and noise free interval (NFI) metrics, one for high-use areas and one for low-use areas.

In high-use areas, non-natural sounds were audible 80 percent of the time (0000-2400) in summer and 73 percent in winter (Table 5). In low-use areas, non-natural sounds were

audible 42 percent of the time (0000-2400) in summer and 31 percent in winter (Table 6). At locations with the highest number of visitors and activities, human-caused sounds were audible nearly 100 percent of the time in summer and winter. The most common audible human-caused sounds were vehicle-related sounds, audible on average 77 percent of the time during the day at high-use frontcountry sites. Vehicle-related sounds include vehicles in motion, idling, horns, doors opening and closing, alarms, and remote locking devices (those that use the horn or other audible signal). Other audible human-caused sounds were aircraft, people (talking, walking), buildings (doors, air conditioners, and heating units), grounds care activities (trash can lids), other mechanized sounds (generators), and domestic animals.

The most common natural sounds in both high-use and low-use areas were wind-related (wind through vegetation) and birds and insects (primarily in summer). Other audible natural sounds were mammals, water (rain, snow), and thunder (Tables 5 and 6).

At the high-use frontcountry locations, vehicle sounds were the most common non-natural sounds heard, averaging 77 percent during the day (0700-1900) and 66 percent at night (1900-0700) in summer. At frontcountry locations with very high vehicle use, existing ambient sounds were higher and as a result, aircraft sounds were less audible (such as Mather Point Overlook). Likewise, aircraft were more audible in winter than in summer probably because there were fewer vehicles in winter which allow aircraft to be heard more often. Aircraft sounds were audible at all locations, particularly those near the Park's maintenance area on the South Rim where the park helicopter landing area is located and daily flights and training are frequent. Aircraft sounds were also common at sites near air tour routes. Sounds of people talking were also common at most high-use locations.

Table 5. Average percent time audible of sound sources at high-use frontcountry areas (does not include GRCA043, Bright Angel Trail, or GRCA053, Tuweep Campground).

Audible Sound Sources	Percent Time Audible 0000-2400		Percent Time Audible 0700-1900		Percent Time Audible 1900-0700	
	Summer	Winter	Summer	Winter	Summer	Winter
No Sound Audible	0.5	4.3	0.1	1.2	1.0	7.3
Aircraft	0.5	0.8	0.9	1.5	0.1	0.2
Jet Aircraft	8.7	17.0	9.0	17.7	8.5	16.4
Propeller Aircraft	1.2	0.8	2.1	1.2	0.3	0.5
Helicopter	1.3	1.0	2.3	1.9	0.3	0.1
Vehicle	58.5	46.1	77.1	66.3	39.9	25.9
Watercraft	0.0	0.0	0.0	0.0	0.0	0.0
Over-snow Vehicle	0.0	0.0	0.0	0.0	0.0	0.0
Train	0.2	0.7	0.3	1.5	0.0	0.0
Motor Sounds	2.8	7.3	1.9	3.0	3.8	11.6
Grounds Care	0.9	0.1	1.6	0.2	0.2	0.0
People	28.3	10.9	40.5	18.7	16.0	3.0
Domestic animal	1.3	2.6	1.5	3.6	1.1	1.6
Building Sounds	10.4	4.6	3.9	0.6	17.0	8.6
Construction	0.1	0.0	0.1	0.0	0.0	0.0
Non-natural Other	1.9	2.0	1.6	2.2	2.2	1.8
Non-natural Unknown	0.8	0.7	1.1	0.3	0.6	1.2
Wind	45.3	48.0	36.3	41.6	54.3	54.4
Water (rain, snow)	2.6	12.6	2.0	15.5	3.1	9.7
Thunder	0.8	0.0	1.4	0.0	0.2	0.0
Mammal	6.8	0.2	0.4	0.0	13.2	0.3
Bird	46.9	16.9	70.2	28.5	23.7	5.3
Reptile	0.0	0.0	0.0	0.0	0.0	0.0
Amphibian	0.0	0.0	0.0	0.0	0.0	0.0
Insect	17.9	7.2	7.3	5.3	28.6	9.1
Animal	0.4	0.6	0.3	0.2	0.6	1.0
Geothermal / Mass Movement	0.0	0.0	0.0	0.0	0.0	0.0
Natural Other	0.4	2.0	0.0	1.3	0.8	2.6
Natural Unknown	0.6	0.7	0.2	0.3	1.0	1.2
Artifact	2.5	1.0	1.9	0.3	3.0	1.7
Unknown	0.0	0.1	0.0	0.0	0.0	0.1
Total Aircraft	11.7	19.6	14.1	22.1	9.2	17.1
Total Road Vehicles	58.5	46.1	77.1	66.3	39.9	25.9
Total Watercraft	0.0	0.0	0.0	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0	0.0	0.0	0.0
Total Non-natural	79.5	72.9	92.1	88.2	67.0	57.6
Total Natural	82.4	63.1	81.4	65.8	83.4	60.4
Total Artifacts	2.5	1.0	1.9	0.3	3.0	1.7

Table 6. Average percent time audible of sound sources at two low-use frontcountry areas (GRCA043, Bright Angel Trail, or GRCA053, Tuweep Campground).

Audible Sound Sources	Percent Time Audible 0000-2400		Percent Time Audible 0700-1900		Percent Time Audible 1900-0700	
	Summer	Winter	Summer	Winter	Summer	Winter
No Sound Audible	0.3	21.9	0.3	13.4	0.3	30.5
Aircraft	2.8	0.5	4.4	0.8	1.2	0.1
Jet Aircraft	16.5	23.3	19.7	32.2	13.3	14.4
Propeller Aircraft	3.8	1.3	5.8	2.6	1.7	0.1
Helicopter	0.2	0.7	0.3	1.5	0.1	0.0
Vehicle	3.3	0.6	4.5	1.3	2.1	0.0
Watercraft	0.0	0.0	0.0	0.0	0.0	0.0
Over-snow Vehicle	0.0	0.0	0.0	0.0	0.0	0.0
Train	0.1	0.1	0.1	0.3	0.0	0.0
Motor Sounds	0.5	0.3	0.3	0.5	0.7	0.2
Grounds Care	0.0	0.0	0.0	0.0	0.0	0.0
People	21.6	6.5	29.3	13.1	13.8	0.0
Domestic animal	0.7	0.5	1.4	1.0	0.0	0.0
Building Sounds	1.6	0.1	1.1	0.2	2.0	0.1
Construction	0.0	0.0	0.0	0.0	0.0	0.0
Non-natural Other	0.0	0.0	0.0	0.0	0.0	0.0
Non-natural Unknown	0.0	0.0	0.0	0.0	0.1	0.0
Wind	62.9	51.3	74.7	45.0	51.0	57.6
Water (rain, snow)	0.9	0.0	1.9	0.0	0.0	0.0
Thunder	0.0	0.0	0.0	0.0	0.0	0.0
Mammal	0.5	0.0	0.2	0.1	0.8	0.0
Bird	42.3	16.5	52.6	29.1	32.0	3.9
Reptile	0.0	0.0	0.0	0.0	0.0	0.0
Amphibian	0.0	0.0	0.0	0.0	0.0	0.0
Insect	59.2	1.9	28.0	3.4	90.4	0.3
Animal	0.9	0.2	0.1	0.4	1.7	0.1
Geothermal / Mass Movement	0.0	0.0	0.0	0.0	0.0	0.0
Natural Other	6.1	0.0	6.0	0.0	6.2	0.0
Natural Unknown	0.1	0.0	0.1	0.0	0.1	0.1
Artifact	4.0	2.0	2.4	1.7	5.6	2.3
Unknown	0.0	0.1	0.0	0.2	0.0	0.0
Total Aircraft	23.3	25.7	30.3	36.9	16.3	14.5
Total Road Vehicles	3.3	0.6	4.5	1.3	2.1	0.0
Total Watercraft	0.0	0.0	0.0	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0	0.0	0.0	0.0
Total Non-natural	42.1	31.2	53.5	47.5	30.6	14.8
Total Natural	96.6	59.0	94.1	57.8	99.1	60.2
Total Artifacts	4.0	2.0	2.4	1.7	5.6	2.3

Noise free interval (NFI) metrics were computed using continuous field logging collected during day time hours (0700-1900; 34 hours in summer and 20 hours in winter). Noise free intervals (NFI) essentially did not exist in high-use frontcountry areas, averaging 0.2 minutes (12 seconds) in summer and winter (Table 7). In low-use frontcountry areas, NFI metrics were somewhat longer but still very short, averaging 1.8 minutes in summer and 4.2 minutes in winter. The longest NFI in a high-use area was 3.7 minutes (GRCA042, East Rim Road in winter), and the longest NFI in a low-use area was 25.7 minutes (GRCA053, Tuweep Campground in winter).

Table 7. Noise free interval metrics during day time hours (0700-1900), in minutes.

	Maximum NFI	Average NFI
	Summer/Winter	Summer/Winter
Low-use Areas	12.3/25.7	1.8/4.2
High-use Areas	2.5/3.7	0.2/0.2

Sources of Sounds >90 dBA

Most sounds >90 dBA were identified and are listed in Table 8. The most common sound >90 dBA was the horn on the train (diesel engine train) at the west end of Village Loop Road (GRCA036), near the train station. The loudest sound was the horn on the steam engine at 99.8 dBA (46 m/150 feet from acoustic monitor). These loud sounds were logged almost every day at about the same time as the train was entering or departing GCNP. The train horn sounds were audible less than 1 percent of the time during the day (0700-0900). Other common loud sounds were thunder, motorcycles, and maintenance trucks (snow plows, garbage trucks). One very loud sound was a raven call (97.9 dBA); this bird was likely perched very close to the microphone.

Table 8. Source of sounds >90 dBA, by location, date and time (hhmmss).

Lmax dBA	**Location**	**Date**	**Time**	**Source**
99.8	GRCA036	7/6/2007	150152	Train (steam engine horn, 50 m)
97.9	GRCA044	6/29/2007	181658	Raven (perched next to microphone)
95.6	GRCA051	7/16/2007	150756	Thunder
95.5	GRCA036	6/15/2007	163209	Train (horn, 50 m)*
95.4	GRCA041	6/20/2007	095046	Unknown (no recording)
95.3	GRCA052	7/18/2007	161053	Thunder
94.5	GRCA036	6/19/2007	150047	Train (horn, 50 m)*
94.5	GRCA036	12/31/2007	150303	Train (horn, 50 m)
94.4	GRCA036	12/30/2007	150319	Train (horn, 50 m)
94.1	GRCA036	6/23/2007	144756	Train (horn, 50 m)*
94.0	GRCA036	12/29/2007	163558	Train (horn, 50 m)
93.7	GRCA036	6/21/2007	163123	Train (horn, 50 m)*

93.6	GRCA036	1/5/2008	132353	Truck (snow plow)
93.2	GRCA036	7/3/2007	151054	Train (horn, 50 m)*
92.8	GRCA036	6/19/2007	163137	Train (horn, 50 m)*
92.8	GRCA036	12/29/2007	151907	Train (horn, 50 m)
92.6	GRCA036	6/18/2007	150257	Train (horn, 50 m)*
92.5	GRCA036	1/1/2008	133356	Train (horn, 50 m)
92.4	GRCA036	1/1/2008	103953	Train (horn, 50 m)*
92.3	GRCA036	6/29/2007	150114	Train (horn, 50 m)*
92.1	GRCA036	6/16/2007	150204	Train (horn, 50 m)*
92.0	GRCA036	1/5/2008	120922	Train (horn, 50 m)
91.7	GRCA036	7/1/2007	123543	Train (horn, 50 m)*
91.6	GRCA044	12/12/2007	115721	Truck (probably garbage)
91.5	GRCA041	6/23/2007	120338	Train (horn, 50 m)*
91.5	GRCA050	7/18/2007	161906	Thunder
91.4	GRCA036	12/30/2007	163339	Train (horn, 50 m)
91.2	GRCA036	6/24/2007	144814	Train (horn, 50 m)*
91.2	GRCA036	12/30/2007	133317	Train (horn, 50 m)
91.1	GRCA036	6/25/2007	144750	Train (horn, 50 m)*
91.0	GRCA036	6/30/2007	163144	Train (horn, 50 m)*
91.0	GRCA036	7/3/2007	121713	Train (horn, 50 m)*
90.9	GRCA036	7/4/2007	163238	Train (horn, 50 m)*
90.9	GRCA044	12/9/2007	092501	Truck (probably garbage)
90.8	GRCA036	6/16/2007	163152	Train (horn, 50 m)*
90.6	GRCA036	12/31/2007	110302	Train (horn, 50 m)
90.6	GRCA048	7/17/2007	152747	Thunder
90.3	GRCA036	6/23/2007	153918	Train (horn, 50 m)*
90.2	GRCA036	7/4/2007	150152	Train (horn, 50 m)*
90.1	GRCA044	6/28/2007	183425	Motorcycle
90.0	GRCA036	7/3/2007	111731	Train (horn, 50 m)*

*Sound source was determined using spectrogram (recording not available).

Vehicle Maximum Sound Levels (L_{max})

The sound levels of common vehicles were measured for a one-hour period at GRCASER1 (South Entrance Road, 420 m south of the turnoff to Yavapai Point), and compared to existing and natural ambient levels for that area. Sound levels were collected 15 m (50 feet) from the centerline of the road. Winds were calm during these measurements. Photographs of common vehicle types and L_{max} sound levels are presented in Appendix III.

Sound level metrics (dBA) for this location, GRCASER1, July 7, 2007, 0800-0900 were:

Hour	L_{eq}	L_{50}	L_{min}	L_{max}	L_{nat}*
0800-0900	59.7	45.2	28.2	80.1	22.8

* The L_{nat} value for this acoustic zone (ponderosa pine) in summer is from Levy and Falzarano 2007b.

The speed limit on this section of road is 25 mph, and although actual vehicle speed was not measured for this study, we did not include those vehicles that we estimated to be clearly exceeding 25 mph. The loudest measured sound at this location, a Harley Davidson motorcycle with an altered exhaust system, was 35 dBA higher than existing ambient at this location, and 57 dBA higher than the natural ambient sound level of the ponderosa pine acoustic zone (Table 9).

Table 9. Maximum sound levels (L_{max} dBA at 15 m) of common vehicles compared to existing ambient (L_{50} = 45.2) and natural ambient (L_{nat} = 22.8) at GRCASER1, July 7, 2007.

Time (hhmmss)	Source	L_{max}	$L_{max} – L_{50}$	$L_{max} – L_{nat}$
083841	Automobile	59.2	14.0	36.4
084134	Automobile	61.4	16.2	38.6
082822	Van, Small	64.4	19.2	41.6
080325	SUV	64.5	19.3	41.7
084239	SUV, Hummer	69.2	24.0	46.4
082122	Bus, Shuttle (NG)*	71.3	26.1	48.5
084730	Bus, Shuttle (NG)	72.5	27.3	49.7
080242	Bus, Tour (Diesel)	74.4	29.2	51.6
083244	Motorcycle	80.1	34.9	57.3

*NG=natural gas

We compared measured L_{max} values for common vehicles with L_{max} values predicted by the Federal Highways Administration's Traffic Noise Model (TNM). Measured L_{max} values for most vehicles were very close to TNM predicted values (generally within 1 dBA). For this reason, vehicle sounds from other locations were not analyzed, in anticipation of using TNM to approximate vehicle noise as needed.

Measured L_{max} values for some motorcycles were 20 dBA greater than TNM predicted values. This was due to exhaust modifications on some motorcycles; however, not all motorcycles were so loud. The sound level of a similar type motorcycle (Harley Davidson) without exhaust modifications was 62.2 dBA at 15 m at approximately 45 mph (measured at the South Rim Entrance Road) compared to 80.1 dBA at 15 m at 25 mph for the Harley Davidson with an altered exhaust system.

Discussion

Sound Levels

Sound levels in any frontcountry area were generally a reflection of the amount of visitor use and vehicle traffic. The very busiest areas (Village Loop Road, Mather Point, South Entrance Road) had the highest sound levels, while the least visited areas had the lowest (Bright Angel Trail, Tuweep Campground). Most visitors access the park by personal vehicles and the higher the number of vehicles, the higher the sound levels in front-country areas. These higher sound levels were exacerbated by very loud vehicles (e.g. motorcycles with altered exhaust systems).

Audibility of Common Sounds

While aircraft are still audible in most of the frontcountry areas (high commercial jet traffic at all locations plus air tour aircraft in some locations), the amplitude of existing sound levels at most frontcountry locations was such that aircraft sounds were often masked by the higher frontcountry ambient levels. Many aircraft sounds occur in the same frequency bands as motor and vehicle sounds, and this tends to add to the masking effect. In addition, while aircraft were more audible in winter than in summer, this is not due to a higher number of flights, but rather lower existing ambient sound levels in winter allowing aircraft to be audible more often.

GCNP established "flight-free zones" to limit aircraft sounds in frontcountry areas and therefore protect the maximum amount of visitors from low altitude aircraft noise. However, at measurement locations near air tour routes, air tour aircraft were frequently audible. At Cape Royal, aircraft were audible 41 percent of the day (0700-1900), and at Point Imperial, 27 percent of the day. Aircraft were audible 85 percent of the day at Hermit's Rest Trailhead and 81 percent of the day at the junction of Dripping Springs Trail and Hermit's Rest trail (unpublished data). Both of these locations are near the Dragon air tour corridor, and air tour aircraft were audible most of the day. Although air tour routes are not directly over most frontcountry areas, air tour aircraft are audible much of the time at locations nearest the air tour corridors. Therefore, some large portions of the flight free zones are not free of aircraft noise.

Vehicle Maximum Sound Levels (L_{max})

The road system in GCNP provides access to sites commonly visited by park visitors, and most visitors use personal vehicles to access the park. Vehicles are the single most significant noise source that contributes to higher sound levels in frontcountry areas of the park. Vehicle speed, engine type, exhaust system, tires, and road surface contribute to the sound level of each vehicle. For example, a standard (unaltered) automobile at 25 mph produces a sound level of about 60 dBA at 15 m (50 feet). At 45 mph, that same automobile produces about 70 dBA (TNM, FHWA 2004) which is perceived by humans to be twice as loud as the slower vehicle. The loudest vehicle we recorded was a motorcycle that produced 90.1 dBA (speed and distance unknown). Another motorcycle that produced 80 dBA at 25 mph would produce about 85-90 dBA at 45 mph. With sound levels such as this, the area of audibility around the park road system is significant. Vehicle sounds tend to attenuate at the rate of about 6 dBA per doubling of distance, and

in some situations, a vehicle sound of 85 dBA could be audible for over 15,360 m (9.7 miles) due to the low natural ambient levels in the park (Table 10). Even in the best attenuating circumstances, the area of audibility of loud vehicles is considerable.

Table 10. Calculated distances for sound levels to attenuate to ponderosa pine natural ambient (L_{nat} = 22.8 dBA) for EPA-legal automobile, bus, motorcycle, and non-legal modified motorcycle (altered exhaust), traveling at 45 mph.

Distance Meter	Distance Feet	Distance Miles	Automobile dBA	Bus dBA	Motorcycle dBA	Motorcycle, (Modified) dBA
15	50	0.0	70*	77*	78*	85**
30	100	0.0	64	71	72	79
60	200	0.0	58	65	66	73
120	400	0.1	52	59	60	67
240	800	0.2	46	53	54	61
480	1600	0.3	40	47	48	55
960	3200	0.6	34	41	42	49
1920	6400	1.2	28	35	36	43
3840	12800	2.4	22	29	30	37
7680	25600	4.8		23	24	31
15360	51200	9.7				25

* Source: TNM
** Source: measured in field

Distances >30 m in Table 10 are calculated estimates; however, these estimates are reasonably close to actual measurements made in a similar vegetation type (coniferous forest) in Yellowstone National Park where, in summer 2007, motorcycles were audible 12,875 m (8 miles) from a road with a speed limit of 45 mph (S. Burson, pers. comm.). A 12,875 m buffer of all paved roads in GCNP shows an area of effect of almost 14% of the park (Figure 6). Considering the limited number of paved roads on the North and South Rims, this is a large area of effect. Prohibiting access to the park to vehicles that exceed EPA noise regulations would reduce the distance of audibility to about 6,430 m (4 miles), resulting in a 25 to 50 percent reduction in the area that vehicle sounds are audible at GCNP.

The complex topography of the canyon may reduce the distance of audibility of vehicle noise in certain areas. At two sites below the rim, both about 1,050 m from a road, vehicles were rarely (<1 percent) audible (Bright Angel Trail, this study, and Papago Canyon, unpublished data). Based on audibility from these locations, we assumed that vehicle noise attenuated quickly at sites below the rim, especially in very steep areas. Therefore, we used an attenuation distance of 250 m for areas below the rim of the canyon in calculating the area of audibility discussed above. This distance would likely

vary depending on the distance between the road and the canyon rim (the attenuation distance would likely be greater when the road was closer to the rim). This is an estimate and needs further study.

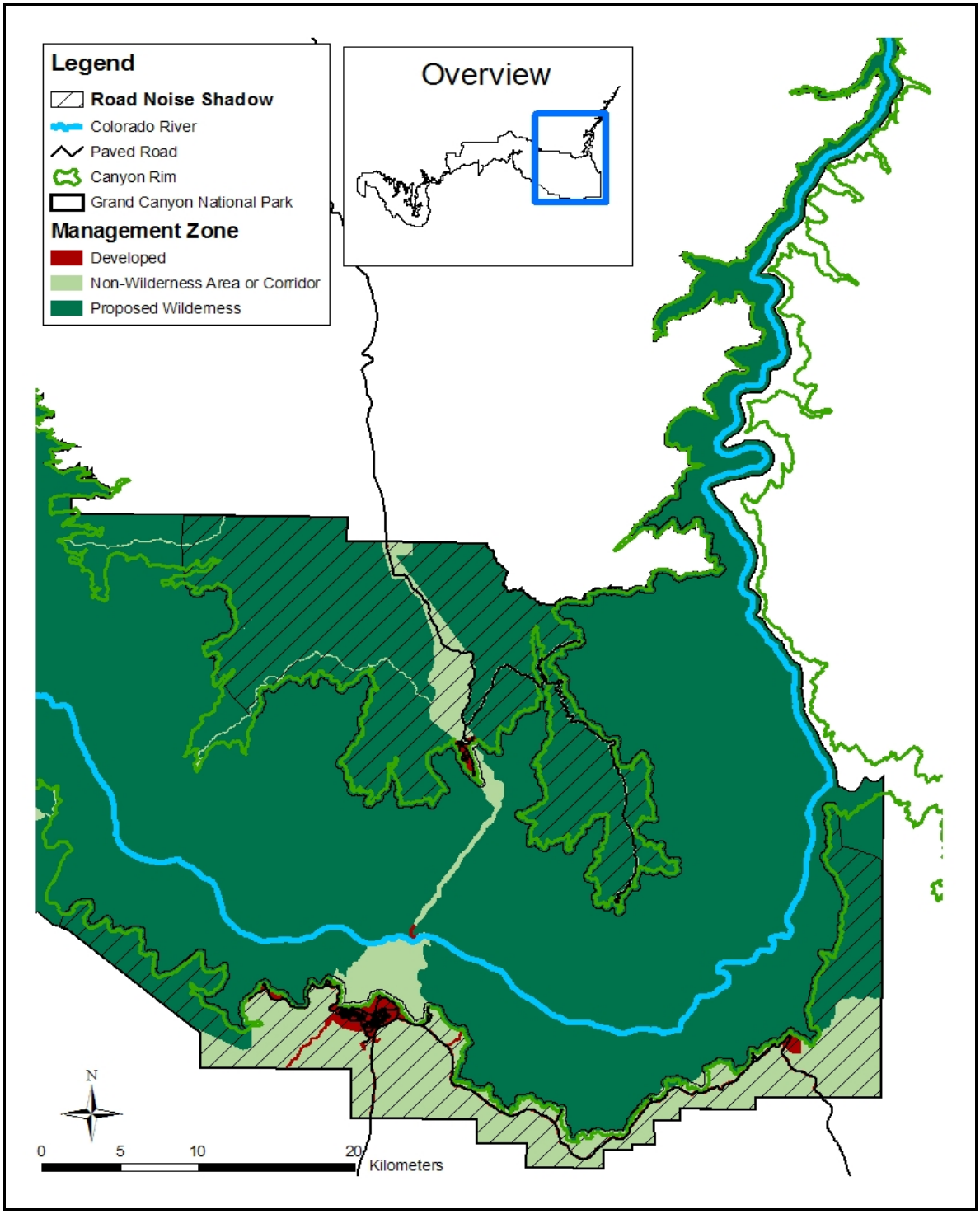

Figure 6. Potential area of audibility of road noise around major roads and developed areas in GCNP (vehicles audible up to 12,875 m).

Recommendations

In frontcountry areas, vehicles were the most common human-caused sound, and the loudest of these were motorcycles with altered exhaust systems. While many motorcycles were very quiet, many others were very loud. GCNP should consider enforcing EPA noise regulations at entrance stations as is done for snow machines at Yellowstone National Park.

Rumble strips (to warn drivers of upcoming traffic stop or intersection) are common in GCNP. Sounds from these rumble strips were audible at several measurement locations. The safety concerns of warning the driver of upcoming traffic changes should be weighed with their noise impacts, and alternative, quieter methods could be considered.

Train horns are one of the loudest sounds in the park, and were audible from several frontcountry locations. GCNP could investigate different approaches to safety concerns at rail road crossings. If the train horns are considered historically important, the amplitude of the horns could be reduced considerably. There are ongoing efforts at GCNP to restrict the number of times the train horn is used per day, by requesting a change in the railroad safety requirements for train crossings in the park. The GCNP Safety Committee is working on this issue.

Helicopter sounds were frequently audible at Mather Campground, especially on days when the helicopter crews were conducting training at the helipad. GCNP could consider moving helicopter crew training activities to a location more distant from the south rim developed area.

Sounds of campers in Mather Campground were relatively quiet compared to other areas with high visitor use on the South Rim. Unfortunately, Mather Campground is surrounded by roads with high numbers of vehicles. As a result, vehicle noise from outside the campground is common and often the loudest sound in the campground. Future planning efforts should include consideration for minimizing vehicle sounds in campgrounds.

Acknowledgements

Ken McMullen initiated this project and worked with us throughout the project. Sarah Falzarano produced figures for the report and assisted with field work. Laura Levy and Maria Wessel assisted with field work and data analysis. Ric Hupalo and Damon Joyce prepared software for data analysis. Ken McMullen, Sarah Falzarano, Laura Levy, Shan Burson, and Cyndy Lee reviewed drafts of this report and offered numerous improvements. We appreciate the help of all of these individuals.

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Appendix I. Acoustic Metrics for GCNP Frontcountry Locations.

Table I-1. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 6-20-2007 to 6-30-2007 (n=223).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	9	19.0	77.4	44.8	34.5	31.4	34.4	25.2	21.8
1	9	18.0	68.1	41.7	31.8	29.1	30.4	23.2	20.8
2	9	17.4	81.3	49.0	34.2	28.2	31.4	22.5	20.6
3	9	17.6	80.1	54.7	35.4	30.6	32.6	24.4	21.2
4	9	18.1	78.8	47.8	40.4	38.9	43.4	31.1	24.5
5	9	21.0	78.3	44.4	41.1	40.2	43.5	35.5	29.3
6	8	24.8	80.3	50.0	43.7	40.2	43.9	36.3	31.3
7	9	26.6	79.8	46.5	42.7	40.8	43.0	37.5	33.2
8	9	28.3	69.8	42.2	41.7	41.5	44.2	40.0	36.5
9	10	29.5	81.1	46.6	44.5	43.6	46.0	41.6	38.2
10	10	30.4	65.1	44.1	43.3	43.1	45.8	40.8	37.3
11	10	27.8	71.7	44.1	43.5	43.3	46.3	41.6	37.2
12	10	29.1	66.0	44.7	44.4	44.0	47.4	41.9	37.2
13	10	28.5	65.5	44.8	44.7	44.7	47.2	42.5	37.5
14	10	28.2	66.5	48.0	45.2	43.9	47.0	42.1	37.3
15	10	31.4	65.2	44.1	43.8	43.6	47.4	41.9	37.6
16	10	30.3	62.6	43.0	42.8	42.7	45.4	41.3	37.6
17	10	29.1	68.0	43.8	43.0	43.2	46.0	41.3	37.2
18	9	29.5	79.3	45.7	43.4	42.4	45.1	41.0	37.2
19	9	28.4	67.6	41.8	41.5	42.1	44.8	39.7	35.8
20	8	28.8	67.5	43.8	42.8	41.7	44.3	40.3	36.5
21	9	26.3	71.5	42.9	40.1	38.5	41.3	36.0	32.0
22	9	21.1	71.4	39.9	36.7	35.2	39.1	31.9	27.8
23	9	18.5	76.9	44.4	36.2	32.7	35.5	27.7	24.9

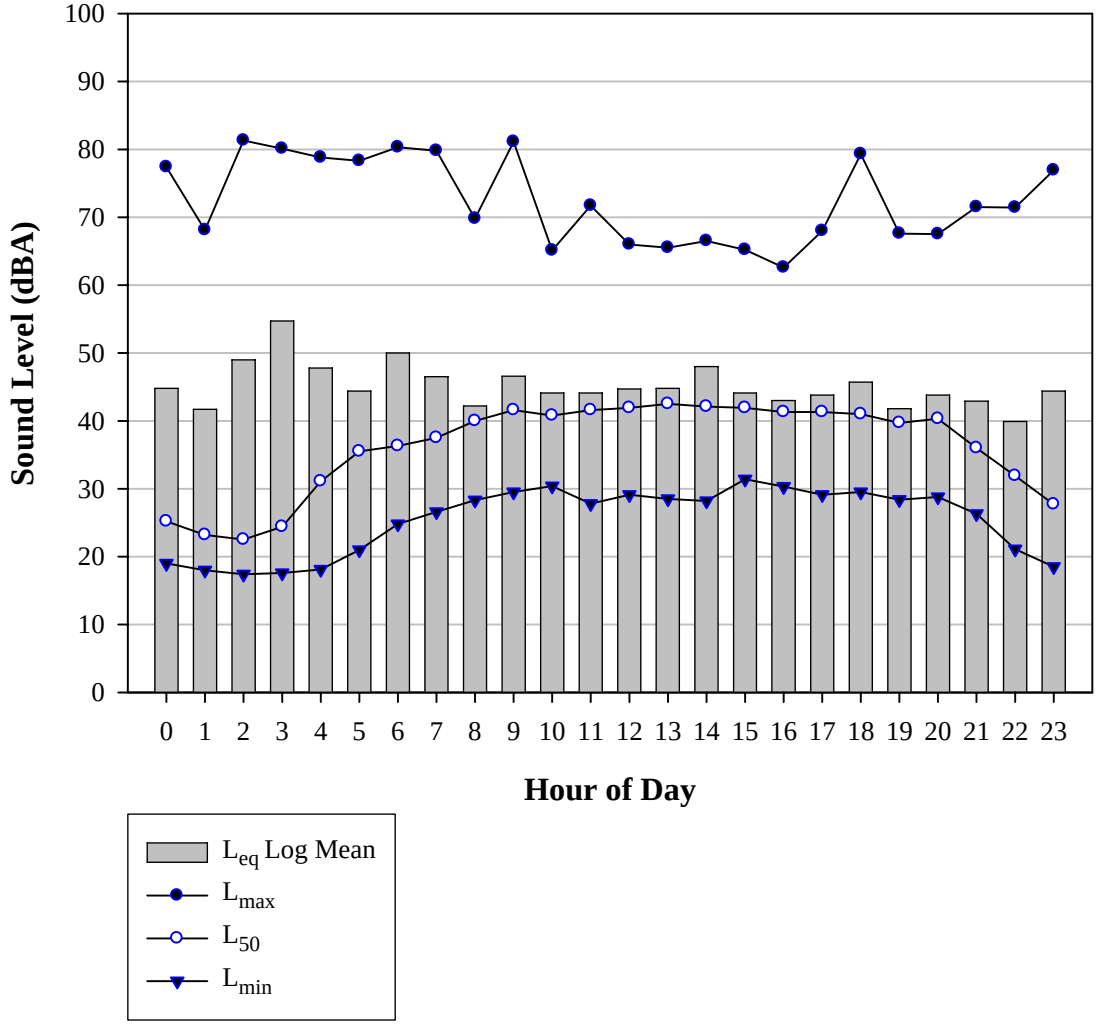

Figure I-1. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 6-20-2007 to 6-30-2007 (n=223).

Table I-2. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 12-17-2007 to 12-29-2007 (n=285).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	12	17.5	54.5	35.2	31.4	30.5	31.2	24.0	20.8
1	12	18.2	57.8	35.9	31.4	28.9	32.0	23.0	20.9
2	12	17.9	51.0	31.2	28.1	26.8	29.0	22.4	20.6
3	12	17.7	52.9	30.0	29.1	29.0	28.5	22.3	20.4
4	12	17.2	53.8	32.1	30.5	30.3	30.8	22.8	20.5
5	12	17.1	56.5	34.3	33.4	33.3	35.7	24.9	21.1
6	12	20.2	58.5	38.3	38.0	37.5	41.0	32.9	26.5
7	12	21.0	57.8	39.5	39.0	38.8	42.2	36.1	30.6
8	11	21.9	57.3	40.2	39.1	39.4	42.1	35.2	29.9
9	11	23.1	66.2	40.9	39.5	38.4	41.3	36.0	32.3
10	11	23.1	63.4	38.8	38.2	37.1	40.3	35.1	31.4
11	12	23.0	56.6	40.4	39.8	39.4	42.4	37.5	33.5
12	12	23.1	58.2	41.6	40.4	40.3	43.0	38.8	35.0
13	12	20.1	62.8	41.8	40.4	41.4	44.0	39.9	36.3
14	12	21.4	57.2	42.1	40.8	41.1	43.7	40.1	36.7
15	12	21.4	72.4	42.9	41.2	41.3	44.2	39.9	35.1
16	12	25.1	59.6	41.5	40.7	40.9	43.5	39.2	34.6
17	12	25.6	65.9	42.1	41.4	41.5	43.6	39.9	35.9
18	12	25.0	60.5	40.9	40.1	39.7	42.7	37.7	32.8
19	12	22.2	55.2	38.5	37.5	36.8	40.3	34.1	28.9
20	12	20.1	57.6	38.5	36.8	36.5	40.1	32.0	26.6
21	12	20.0	64.7	39.4	37.3	35.6	39.2	30.4	25.1
22	12	19.2	62.9	39.1	35.9	34.5	38.5	29.7	24.4
23	12	17.3	56.5	36.6	33.4	32.6	35.2	26.3	22.9

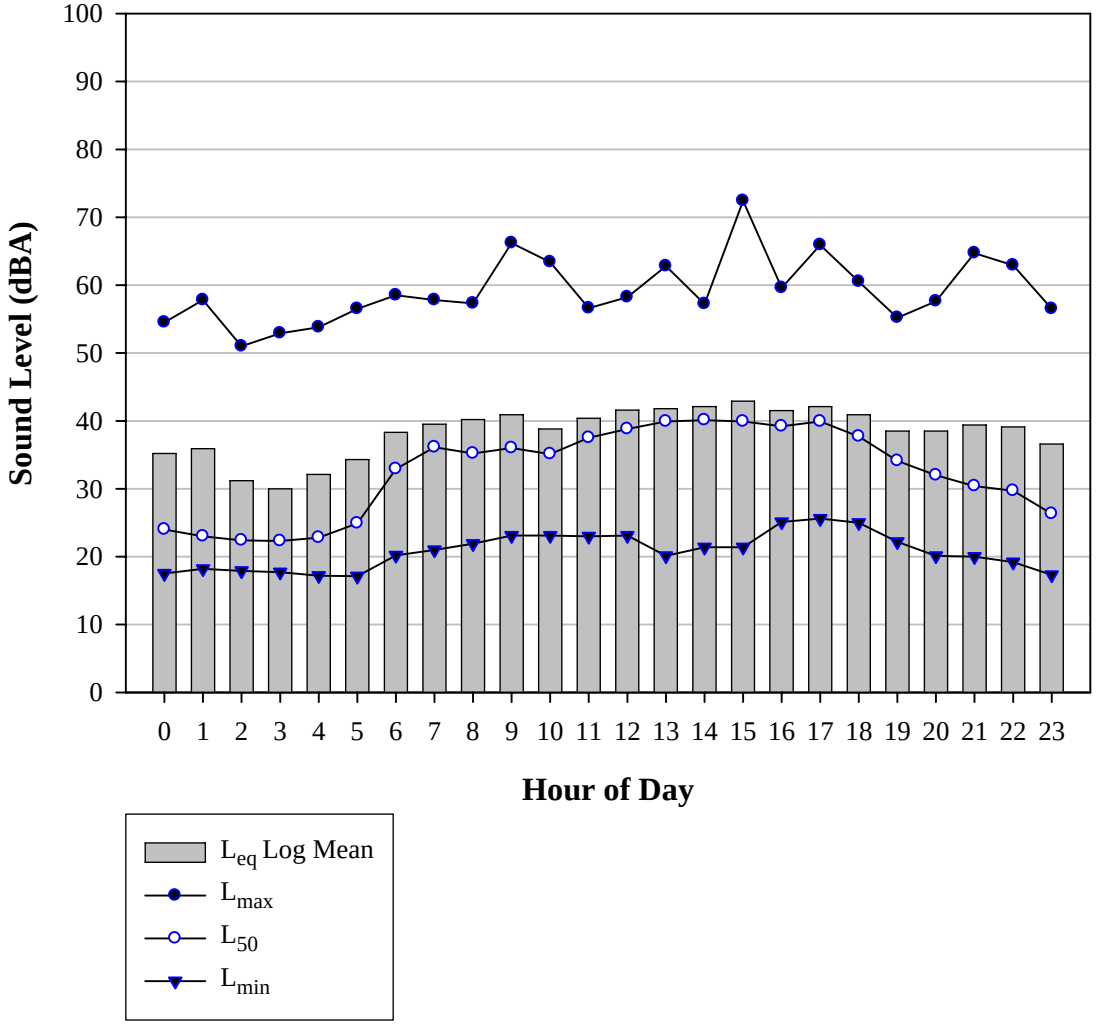

Figure I-2. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 12-17-2007 to 12-29-2007 (n=285).

Table I-3. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 6-20-2007 to 6-30-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	117	26.6	81.1	45.1	43.3	46.0	41.3	37.2
20	117	-14.2	80.2	45.3	44.0	45.8	41.3	38.4
25	117	-13.7	78.0	46.5	45.0	47.0	42.8	39.9
31.5	117	-12.6	82.9	47.7	46.4	49.0	44.5	41.1
40	117	-12.0	77.4	49.1	46.7	49.2	44.3	40.7
50	117	-11.6	80.3	48.8	47.3	49.6	44.1	40.3
63	117	-9.7	95.1	52.3	49.8	51.6	45.7	41.5
80	117	-9.4	79.3	49.1	48.7	50.9	43.7	39.1
100	117	-10.1	76.9	47.4	46.1	48.3	41.3	37.0
125	117	-10.4	79.8	44.4	43.2	45.3	39.0	35.0
160	117	-10.9	80.8	41.6	40.5	42.7	36.5	32.3
200	117	-10.8	79.4	38.8	37.0	39.1	33.3	29.6
250	117	-10.6	78.1	37.3	34.3	36.6	30.9	27.4
315	117	-11.1	77.5	36.0	33.0	35.2	30.4	26.8
400	117	-10.3	76.0	35.4	33.3	36.0	31.5	27.3
500	117	-9.6	75.5	35.7	34.4	36.9	32.6	27.9
630	117	-9.4	73.9	36.2	34.8	37.7	33.2	28.6
800	117	-8.6	73.7	36.5	35.4	38.2	33.5	28.9
1000	117	-7.7	94.1	57.3	35.9	38.5	33.0	28.2
1250	117	-6.9	71.3	35.0	33.5	36.4	30.5	25.1
1600	117	-6.2	70.4	33.4	31.6	34.2	27.4	21.5
2000	117	-5.2	77.0	31.7	26.6	29.5	22.0	16.7
2500	117	-4.3	68.4	28.1	23.7	26.0	18.6	12.7
3150	117	-3.1	71.7	28.8	20.9	23.3	15.7	10.2
4000	117	-2.3	68.7	27.1	19.5	20.9	13.0	8.9
5000	117	-1.3	79.0	30.2	16.8	18.3	11.0	7.7
6300	117	-0.2	71.1	25.7	13.8	14.8	9.3	7.2
8000	117	0.8	66.4	25.6	11.9	13.0	8.4	7.2
10000	117	1.8	68.5	26.0	11.2	11.7	8.0	7.3
12500	117	2.9	67.9	36.2	9.6	10.4	7.9	7.5
16000	117	2.8	66.5	27.5	8.8	9.1	7.9	7.6
20000	117	1.2	67.1	35.8	7.6	7.7	7.1	6.9

Table I-4. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 6-20-2007 to 6-30-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	106	17.4	81.3	47.7	38.5	41.4	35.2	29.2
20	106	-32.1	84.9	48.3	40.8	42.2	37.1	34.0
25	106	-31.4	84.8	47.9	42.6	44.4	38.0	34.5
31.5	106	-31.2	79.6	48.2	44.5	46.6	40.1	35.1
40	106	-30.2	81.3	47.3	43.5	45.7	39.3	34.2
50	106	-29.5	78.8	47.0	43.4	45.6	37.8	32.5
63	106	-28.1	87.1	48.2	45.3	47.3	38.1	33.0
80	106	-27.2	77.6	47.1	45.7	45.5	36.7	31.2
100	106	-26.3	78.1	45.2	41.5	40.8	33.4	28.2
125	106	-26.0	79.6	43.6	37.1	38.5	32.7	28.2
160	106	-24.2	75.3	41.9	33.5	35.3	28.4	23.9
200	106	-23.5	74.8	40.7	29.6	31.7	25.4	21.0
250	106	-21.9	74.0	40.0	27.5	29.3	23.5	18.9
315	106	-21.3	75.0	39.4	26.6	28.6	23.1	19.1
400	106	-20.2	73.8	38.9	27.3	29.2	24.4	19.6
500	106	-18.8	73.8	38.5	28.4	31.2	25.6	20.2
630	106	-18.0	71.4	38.1	29.6	32.6	25.7	19.5
800	106	-17.0	71.4	38.0	30.5	34.1	26.2	18.7
1000	106	-15.9	93.9	58.3	30.4	33.7	24.6	17.2
1250	106	-14.9	71.9	36.7	28.0	31.8	23.7	15.0
1600	106	-13.8	69.3	36.1	25.8	28.5	21.0	12.8
2000	106	-12.9	72.3	35.5	20.7	24.2	16.2	10.2
2500	106	-11.9	68.4	34.8	18.9	20.2	13.7	8.9
3150	106	-10.8	70.6	34.3	16.2	18.1	10.7	7.8
4000	106	-9.8	73.5	34.8	15.5	16.8	10.1	7.9
5000	106	-8.7	66.7	34.1	13.5	14.3	9.3	7.5
6300	106	-7.7	66.5	32.8	10.6	11.8	8.6	7.1
8000	106	-6.8	66.5	32.4	10.4	10.1	8.2	7.1
10000	106	-5.7	66.0	31.9	11.8	11.1	8.3	7.2
12500	106	-4.8	64.8	31.6	14.9	13.3	8.4	7.4
16000	106	-3.9	64.2	31.1	12.2	11.4	7.8	7.4
20000	106	-3.6	63.2	30.3	16.6	14.2	9.9	6.9

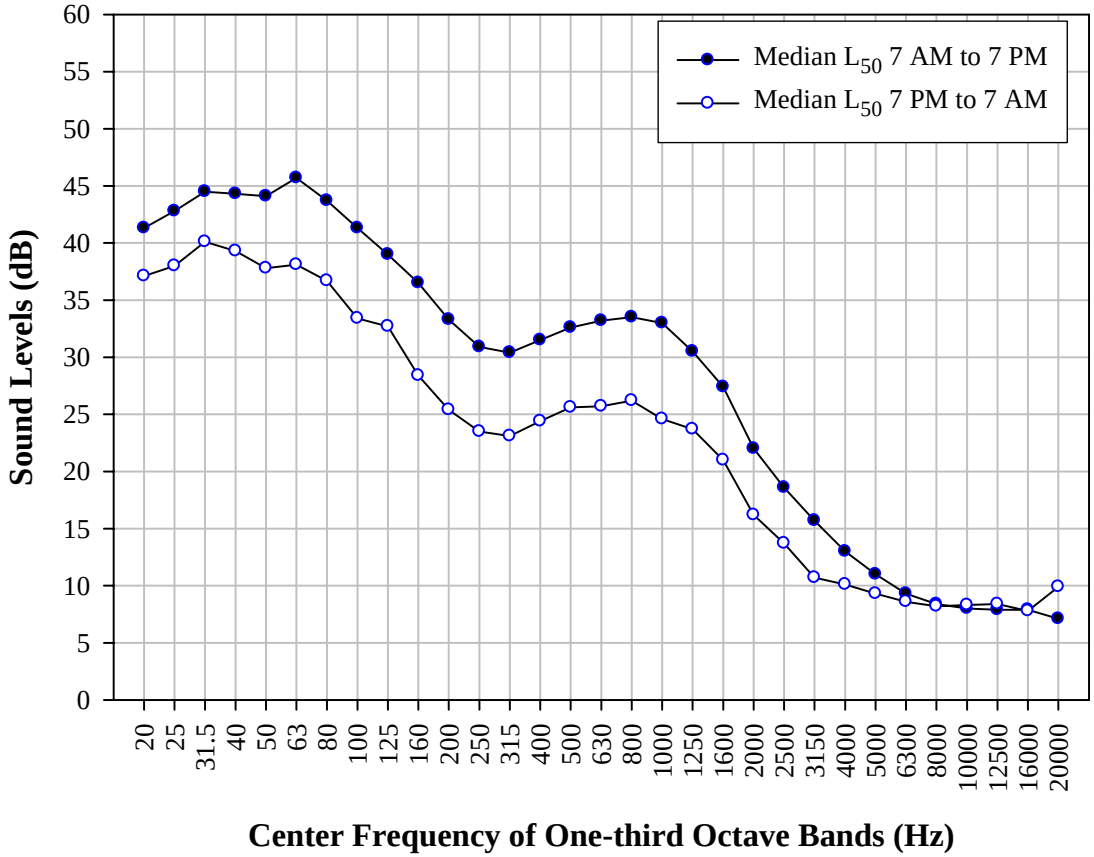

Figure I-3. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 6-20-2007 to 6-30-2007.

Table I-5. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 12-17-2007 to 12-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	142	20.1	93.8	59.8	39.9	42.7	37.9	33.4
12.5	142	-7.4	96.0	48.4	44.1	46.4	40.5	36.2
15.8	142	-3.5	89.9	46.4	43.7	45.9	41.3	37.5
20	142	0.2	89.2	46.1	44.3	46.7	42.0	38.5
25	142	1.6	86.2	46.6	45.5	47.9	43.3	39.6
31.5	142	0.8	85.6	48.4	47.7	50.7	45.1	40.8
40	142	-2.5	87.1	47.3	46.5	49.6	44.3	40.1
50	142	-4.2	82.2	47.3	46.8	49.5	43.5	39.2
63	142	-6.1	80.4	49.3	48.8	51.3	43.6	38.7
80	142	-6.0	79.8	48.8	48.5	49.9	42.0	36.5
100	142	-6.1	76.8	45.5	44.9	45.7	37.9	32.9
125	142	-5.4	76.1	41.9	41.3	42.6	34.6	30.2
160	142	-7.2	79.9	38.5	36.6	39.7	30.9	25.6
200	142	-6.1	77.7	34.4	32.8	35.5	27.6	22.1
250	142	-6.1	84.9	34.6	31.5	33.8	26.6	22.2
315	142	-5.9	77.6	34.1	31.4	33.4	27.8	23.8
400	142	-5.9	71.1	33.8	31.6	33.4	29.0	25.0
500	142	-5.9	70.5	34.0	32.2	34.6	30.1	25.9
630	142	-5.4	68.6	34.2	32.5	35.3	30.5	26.2
800	142	-4.9	75.7	34.8	33.2	36.4	31.4	25.8
1000	142	-4.7	103.3	61.1	31.5	35.2	29.8	23.2
1250	142	-4.0	73.1	31.2	28.8	32.5	26.8	19.4
1600	142	-3.6	72.2	28.3	25.3	29.1	23.0	15.2
2000	142	-2.7	76.3	27.6	19.9	23.7	17.2	8.8
2500	142	-1.9	68.4	21.3	15.0	18.0	11.0	4.9
3150	142	-1.0	69.7	21.9	10.6	12.3	6.8	4.4
4000	142	0.0	68.8	20.0	8.9	9.6	6.1	5.0
5000	142	1.1	67.7	18.5	8.7	8.8	6.3	5.7
6300	142	2.3	66.8	17.7	8.5	8.6	6.8	6.5
8000	142	3.4	66.8	17.5	8.5	8.7	7.5	7.2
10000	142	4.5	71.6	17.8	8.5	8.8	8.1	7.9
12500	142	5.5	64.6	14.6	8.5	8.8	8.3	8.2
16000	142	6.4	73.9	18.3	8.3	8.5	8.2	8.1
20000	142	8.0	66.9	14.7	8.8	8.9	8.7	8.6

Table I-6. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 12-17-2007 to 12-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	144	17.1	64.7	36.7	33.6	36.6	28.5	23.8
12.5	144	14.8	79.1	41.9	36.7	38.8	34.9	31.2
15.8	144	21.3	75.1	41.1	38.7	40.5	37.4	34.2
20	144	23.5	74.4	40.9	39.7	41.5	38.4	35.4
25	144	22.0	72.1	40.9	39.5	41.6	38.5	35.5
31.5	144	22.2	71.6	41.9	38.8	41.1	37.5	34.0
40	144	17.8	64.3	40.4	37.1	39.4	34.2	30.5
50	144	16.0	67.3	40.1	37.6	39.5	33.6	29.2
63	144	18.4	74.6	42.1	38.0	39.4	34.0	30.2
80	144	14.4	75.0	42.5	36.0	36.5	30.2	26.1
100	144	10.3	73.2	39.8	36.4	35.4	27.8	23.4
125	144	9.9	73.3	35.9	33.9	33.3	27.1	23.2
160	144	7.0	69.5	32.5	30.4	31.4	22.4	18.8
200	144	4.4	64.2	28.9	27.1	29.4	19.2	15.2
250	144	5.5	69.9	29.0	26.9	28.7	20.4	16.0
315	144	5.1	58.9	28.5	26.6	28.1	21.2	17.1
400	144	6.1	60.2	28.6	26.7	28.4	22.0	17.7
500	144	4.4	56.1	29.1	26.6	28.9	22.1	17.2
630	144	2.4	54.3	29.5	26.3	29.0	21.6	16.6
800	144	0.2	59.1	29.9	26.6	29.7	19.8	13.9
1000	144	-0.3	60.2	28.7	24.5	28.0	16.4	9.7
1250	144	-0.2	58.0	26.8	21.5	25.0	11.9	5.4
1600	144	0.1	58.4	24.0	18.0	20.7	7.1	2.7
2000	144	0.9	49.1	20.2	12.3	15.2	3.6	2.2
2500	144	1.9	46.7	16.3	7.7	8.9	3.3	2.8
3150	144	2.8	44.2	13.3	5.1	5.9	3.8	3.6
4000	144	3.7	41.8	11.9	5.0	5.2	4.7	4.5
5000	144	4.9	40.7	11.8	5.7	5.8	5.5	5.4
6300	144	5.8	42.4	12.1	6.5	6.6	6.4	6.3
8000	144	6.7	41.9	12.3	7.2	7.4	7.2	7.1
10000	144	7.4	40.7	12.2	7.9	8.0	7.8	7.7
12500	144	7.6	39.5	11.5	8.1	8.2	8.1	8.0
16000	144	7.6	36.7	10.1	8.0	8.1	8.0	7.9
20000	144	8.2	32.0	9.2	8.6	8.7	8.6	8.5

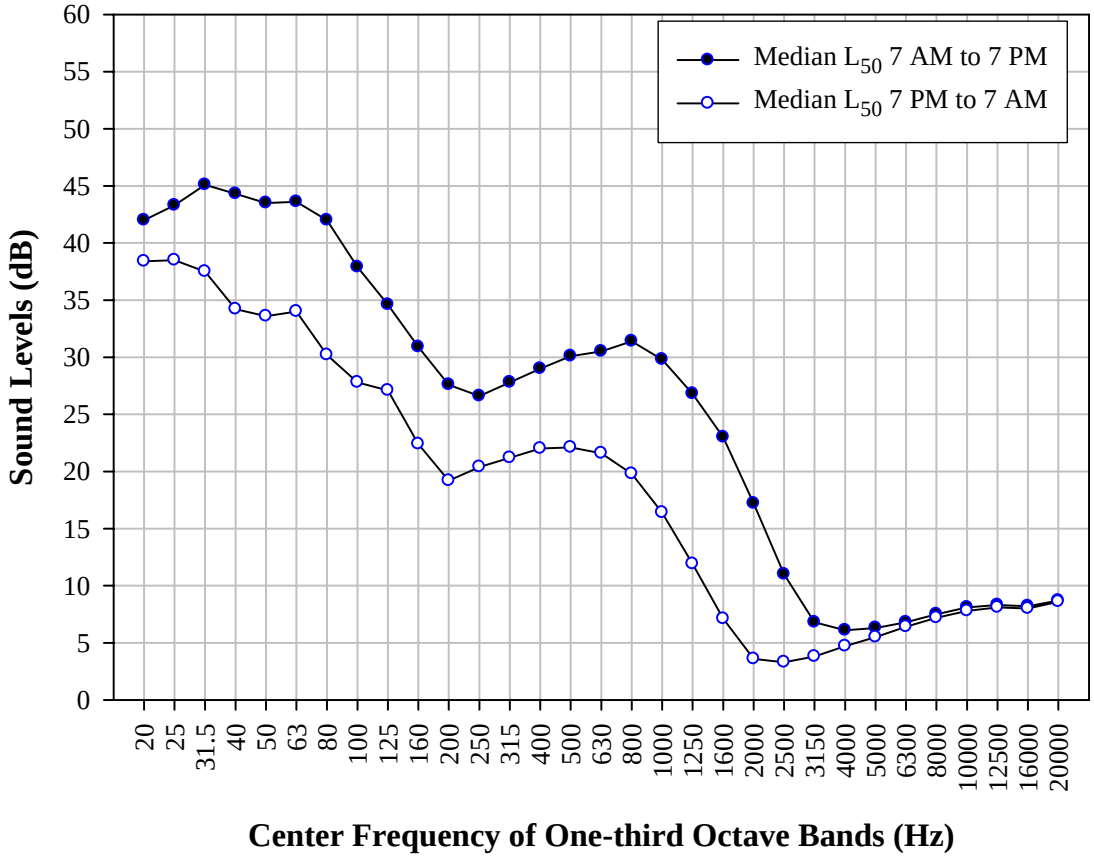

Figure I-4. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), 12-17-2007 to 12-29-2007.

Table I-7. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 6-15-2007 to 7-06-2007 (n=412).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	16	26.3	83.7	48.5	48.0	48.2	44.0	40.1	35.9
1	16	26.5	72.4	45.1	44.6	44.7	40.7	36.2	34.5
2	16	26.3	74.9	44.1	43.0	43.8	40.4	36.5	32.6
3	16	25.8	78.5	45.3	44.2	44.0	38.5	35.5	31.7
4	16	26.3	89.3	54.5	54.1	53.6	54.8	39.8	35.2
5	16	26.7	83.0	54.2	54.1	54.0	56.0	42.7	35.8
6	17	28.6	87.9	55.4	55.2	55.0	56.5	43.9	36.8
7	17	29.9	89.7	59.0	58.2	57.7	59.1	48.9	40.1
8	18	31.6	88.8	59.8	59.3	58.5	61.1	50.7	41.4
9	18	31.1	89.7	59.2	59.0	58.7	62.0	51.7	42.1
10	18	32.9	86.1	60.4	60.1	59.9	62.2	54.3	42.9
11	18	36.4	90.0	63.6	62.9	63.1	63.9	56.4	46.8
12	18	34.1	91.7	63.7	63.5	63.7	64.4	57.6	47.0
13	18	35.4	85.1	61.5	61.4	61.3	63.8	57.4	48.8
14	18	37.6	94.1	62.2	62.0	62.0	64.1	58.3	48.6
15	18	35.9	99.8	65.4	64.9	64.4	65.0	58.6	49.1
16	18	34.4	95.5	65.2	65.1	65.1	64.4	57.3	47.6
17	18	34.6	85.0	60.6	60.5	60.7	63.0	56.9	46.7
18	17	33.6	87.0	60.6	60.4	59.9	62.4	56.7	46.3
19	17	32.8	87.4	59.6	59.4	59.0	61.6	55.1	44.8
20	17	29.5	85.0	59.0	58.9	59.3	61.9	54.0	44.8
21	17	30.0	83.5	55.9	55.7	55.8	58.8	47.1	43.6
22	17	28.0	85.9	55.0	54.9	55.0	57.1	45.4	41.0
23	17	27.4	83.9	52.5	52.4	52.4	50.2	41.1	39.3

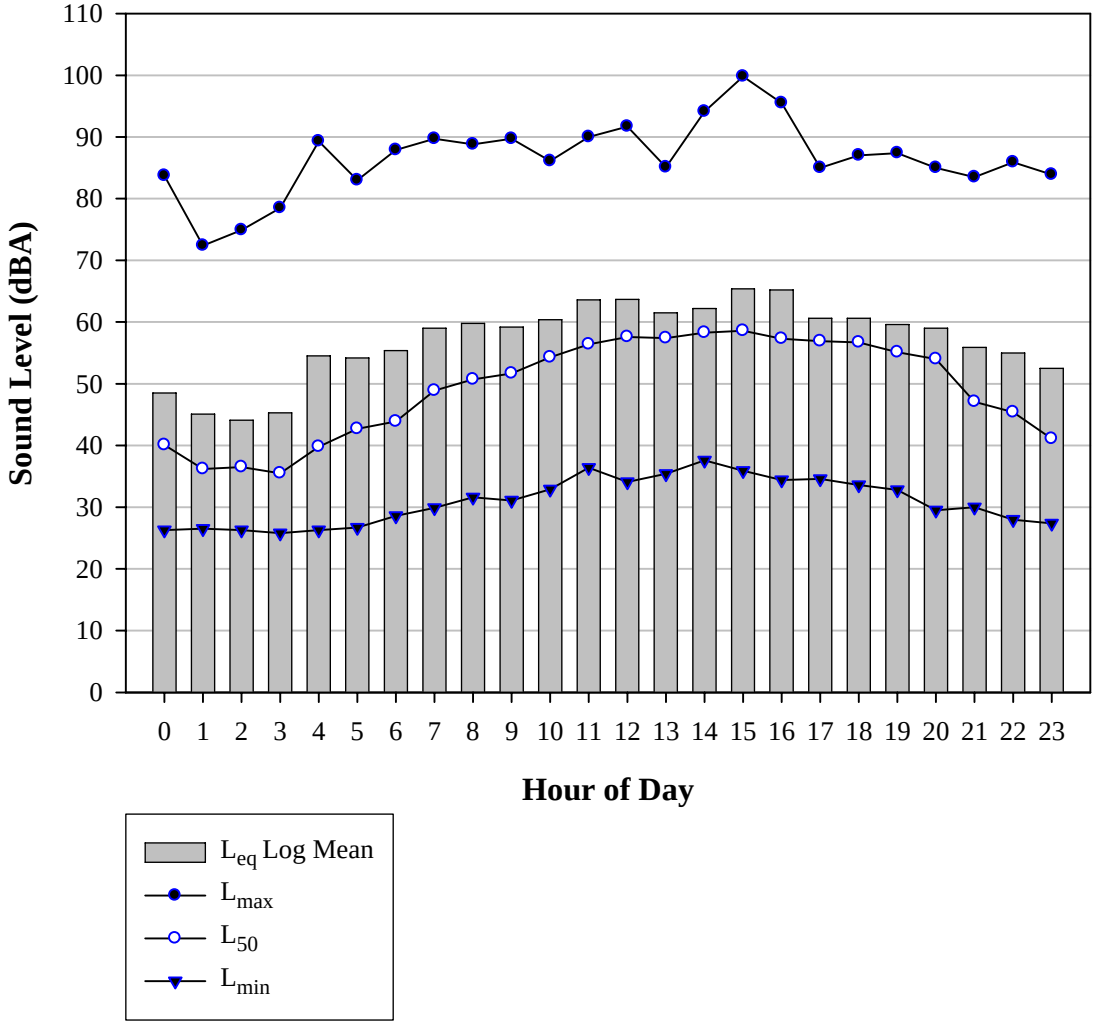

Figure I-5. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 6-15-2007 to 7-06-2007 (n=412).

Table I-8. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 12-28-2007 to 1-06-2008 (n=200).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	9	29.6	77.9	54.4	52.8	51.4	47.2	41.3	39.8
1	9	29.1	76.4	53.6	49.8	49.0	43.7	41.3	35.2
2	8	27.1	75.1	54.1	48.9	47.4	45.0	39.6	35.4
3	8	27.0	74.3	56.2	49.5	47.5	44.9	40.2	37.1
4	8	25.7	78.7	57.6	52.6	50.4	47.9	44.0	39.8
5	8	25.2	80.3	58.3	54.5	52.4	46.5	41.7	38.4
6	8	26.1	85.4	59.7	57.4	55.3	54.8	42.7	38.8
7	8	30.7	85.0	61.4	60.5	59.4	62.8	48.5	44.0
8	8	34.0	86.1	62.2	61.5	61.0	64.1	52.2	46.6
9	8	33.0	83.6	62.3	61.9	61.8	65.4	51.6	43.4
10	8	34.1	92.4	63.4	62.8	62.9	65.9	53.2	44.1
11	8	35.4	90.6	64.2	63.5	62.7	66.0	56.9	48.5
12	8	35.4	92.0	64.5	64.3	63.8	66.3	56.6	49.6
13	8	36.2	93.6	65.8	64.7	64.2	65.8	56.6	47.7
14	8	36.3	88.1	63.2	63.0	62.8	66.0	57.1	48.0
15	8	37.0	94.5	67.3	66.7	66.4	66.8	57.8	48.2
16	8	36.4	94.0	65.3	64.4	63.8	66.4	57.3	48.5
17	8	36.2	83.4	61.5	61.4	61.4	65.5	55.0	47.1
18	9	30.3	80.7	59.4	59.3	59.1	63.4	50.3	39.8
19	9	30.5	77.6	58.0	57.8	57.3	61.2	43.6	37.2
20	9	27.5	85.8	57.9	57.7	57.6	59.6	44.4	37.7
21	9	28.4	82.9	56.8	56.5	55.8	57.2	42.1	37.3
22	9	27.8	79.7	56.8	56.5	56.1	56.5	44.6	39.2
23	9	27.7	80.3	56.1	55.8	55.8	53.9	42.5	38.1

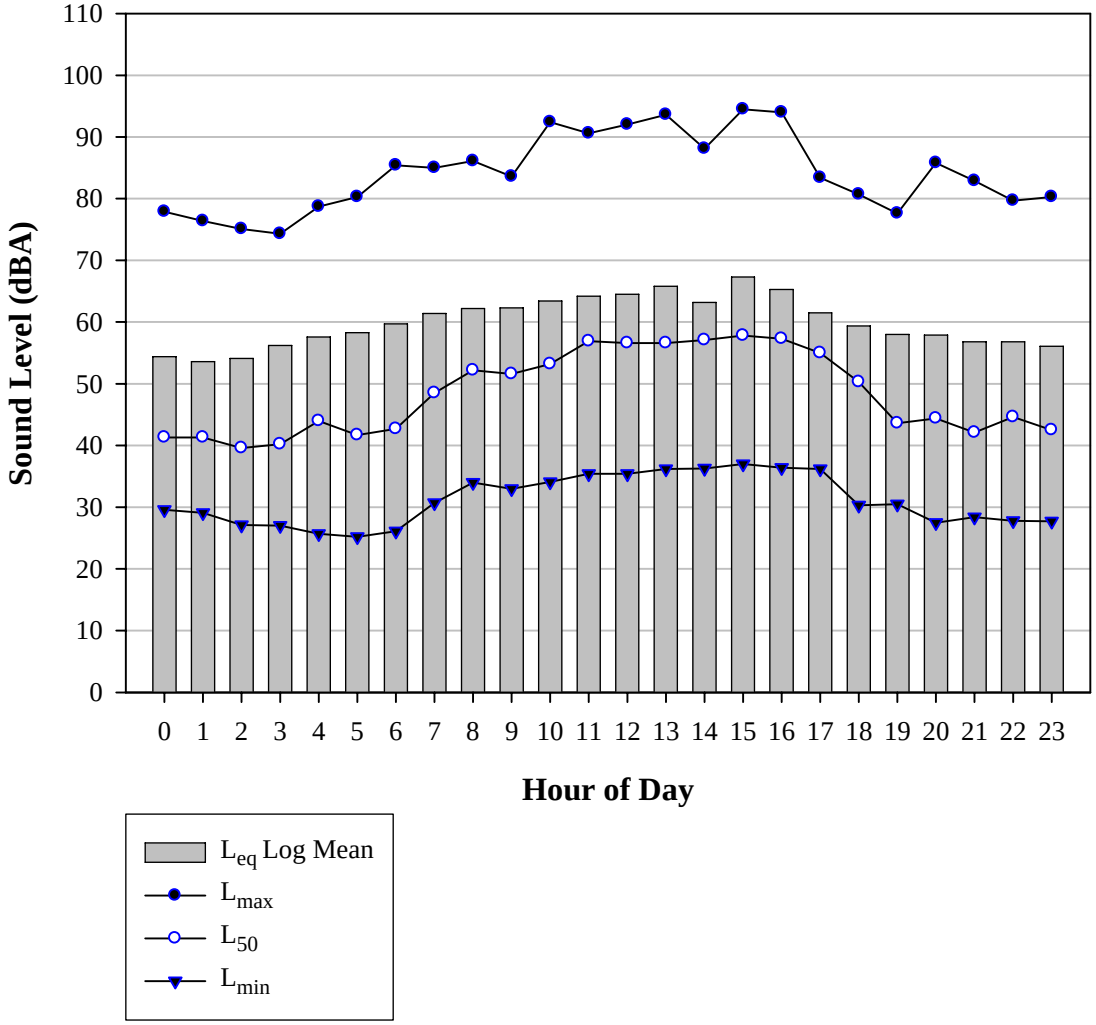

Figure I-6. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 12-28-2007 to 1-06-2008 (n=200).

Table I-9. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 6-15-2007 to 7-06-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	214	29.9	99.8	62.3	61.2	63.2	56.6	46.3
12.5	214	27.2	99.2	66.6	63.2	66.1	55.5	46.2
15.8	214	30.4	98.5	65.4	62.1	64.9	53.9	46.6
20	214	32.0	97.6	63.7	60.6	63.0	53.2	46.3
25	214	32.1	98.0	62.7	60.2	63.2	53.9	47.2
31.5	214	31.5	94.6	70.6	70.3	76.6	58.7	50.1
40	214	32.4	93.0	69.5	69.3	74.0	60.8	51.0
50	214	30.3	96.5	66.3	63.5	64.3	56.3	48.5
63	214	30.8	94.6	65.7	65.4	68.9	57.0	47.7
80	214	32.2	98.5	65.0	64.6	68.1	57.4	47.6
100	214	30.8	103.0	61.8	61.2	62.0	53.9	45.3
125	214	27.6	95.8	61.2	61.1	64.7	54.0	45.2
160	214	24.8	95.8	58.4	57.9	59.6	51.9	41.4
200	214	23.3	93.4	56.8	56.3	57.8	50.2	39.6
250	214	22.3	94.4	57.3	56.1	58.6	49.5	38.8
315	214	21.9	101.0	57.8	53.7	55.6	48.3	38.1
400	214	21.7	94.0	55.1	52.7	54.4	47.5	38.0
500	214	21.9	90.5	54.7	52.0	54.1	47.2	37.7
630	214	21.1	92.2	53.5	52.3	54.9	47.9	37.4
800	214	20.1	91.5	54.4	52.9	55.5	48.1	37.4
1000	214	16.8	91.1	52.7	51.7	54.5	47.2	35.9
1250	214	15.0	86.8	51.0	50.4	52.8	45.5	34.1
1600	214	13.3	85.9	50.0	49.3	51.3	43.9	32.3
2000	214	12.1	89.8	48.4	47.4	48.9	41.3	29.7
2500	214	11.4	89.0	47.0	45.7	46.1	38.2	26.5
3150	214	11.8	86.7	44.6	43.4	43.3	35.5	23.5
4000	214	12.1	86.2	42.5	41.0	40.4	32.4	21.1
5000	214	12.9	84.6	41.5	39.6	37.8	29.5	18.4
6300	214	14.0	83.8	41.1	39.5	35.3	26.6	17.0
8000	214	15.0	84.2	43.3	41.3	33.3	24.1	16.9
10000	214	15.9	84.1	40.9	39.2	31.1	21.7	17.3
12500	214	16.9	87.4	40.4	37.6	28.2	19.7	18.0
16000	214	17.8	84.7	38.1	35.2	24.5	19.3	18.6
20000	214	19.5	77.0	33.7	30.4	21.5	20.3	20.1

Table I-10. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 6-15-2007 to 7-06-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	198	25.8	89.3	54.9	53.9	55.5	43.9	39.4
12.5	198	23.7	95.4	66.4	60.0	63.3	56.9	49.2
15.8	198	26.4	90.9	64.6	58.0	61.4	55.3	47.3
20	198	28.3	90.3	62.4	56.5	59.8	53.1	45.8
25	198	28.5	87.7	60.1	55.9	58.1	51.8	45.6
31.5	198	27.7	92.3	65.1	63.2	62.9	52.3	46.0
40	198	24.4	95.3	64.3	61.8	63.4	50.0	43.9
50	198	23.2	94.2	59.0	57.5	56.5	46.9	41.5
63	198	26.1	93.2	61.4	61.1	60.7	45.7	40.3
80	198	25.2	93.9	60.2	59.5	61.0	45.2	39.0
100	198	22.8	99.1	56.0	53.5	53.0	41.6	36.2
125	198	20.9	94.0	54.3	50.3	51.7	41.0	36.2
160	198	18.7	91.9	51.5	48.2	48.6	36.9	31.3
200	198	17.0	90.1	50.2	47.6	47.9	35.6	31.0
250	198	17.3	88.4	49.9	47.8	48.7	35.6	31.9
315	198	17.5	84.1	46.9	45.4	46.6	35.4	32.5
400	198	16.5	77.4	45.2	43.9	45.3	35.9	32.9
500	198	16.9	79.3	45.3	44.2	46.2	36.5	33.0
630	198	15.4	77.1	45.8	44.7	45.3	37.1	32.6
800	198	13.9	76.8	46.8	45.8	46.0	36.5	31.7
1000	198	10.2	75.5	45.9	44.8	45.8	34.3	29.3
1250	198	8.9	81.3	44.4	43.5	44.1	32.5	26.5
1600	198	9.1	80.3	43.4	42.3	42.9	30.6	24.0
2000	198	9.3	80.7	41.0	39.7	39.6	27.3	20.5
2500	198	9.4	84.4	39.3	37.5	37.4	24.1	18.4
3150	198	10.4	77.4	37.5	35.3	35.2	21.1	15.8
4000	198	11.7	78.5	35.8	33.4	31.8	20.9	17.4
5000	198	12.7	81.9	35.6	32.2	29.3	19.2	15.9
6300	198	13.6	81.7	36.6	32.6	26.0	15.9	14.8
8000	198	14.9	82.5	38.4	33.3	24.2	16.4	15.9
10000	198	15.9	82.7	36.5	31.2	21.7	17.1	16.9
12500	198	16.9	79.6	34.9	30.5	19.9	18.0	17.8
16000	198	17.7	79.4	34.0	28.4	19.2	18.9	18.5
20000	198	17.7	76.2	28.8	23.7	20.6	20.2	20.0

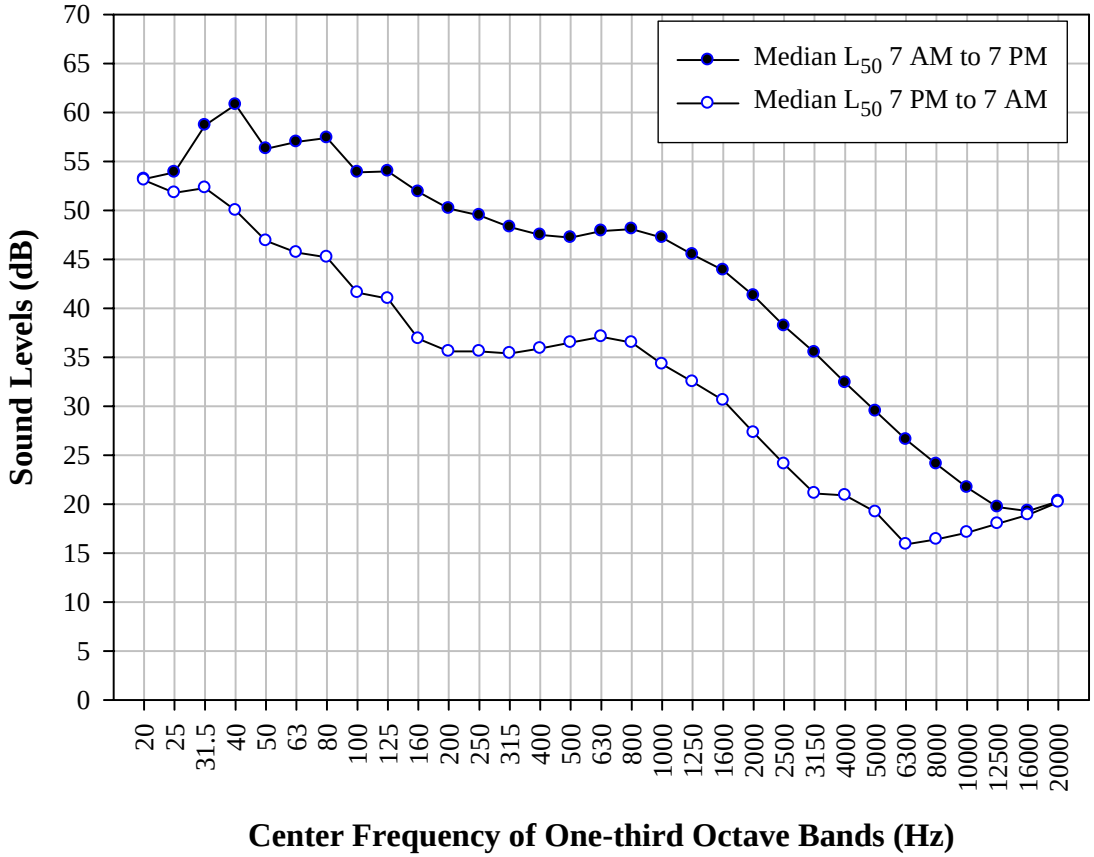

Figure I-7. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 6-15-2007 to 7-06-2007.

Table I-11. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 12-28-2007 to 1-06-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	97	30.3	94.5	63.9	62.3	65.7	55.8	46.2
20	97	36.0	87.8	65.6	58.1	60.2	52.3	47.8
25	97	35.3	92.7	64.7	59.8	61.7	53.8	48.6
31.5	97	37.6	91.3	64.8	62.7	65.4	56.2	50.3
40	97	38.2	87.9	65.0	63.8	66.1	55.7	50.1
50	97	36.2	91.7	65.6	61.4	63.0	54.2	48.5
63	97	35.7	95.1	63.2	62.3	65.4	53.9	48.2
80	97	36.0	88.8	62.5	62.2	64.6	54.4	48.2
100	97	34.1	89.4	59.8	59.0	60.1	51.8	45.7
125	97	32.8	90.0	56.6	55.5	57.9	49.7	43.7
160	97	25.5	90.2	54.3	53.7	56.2	47.4	40.2
200	97	23.6	87.4	53.9	53.0	55.4	45.9	38.6
250	97	24.7	87.5	53.7	52.5	55.6	45.8	38.4
315	97	24.8	92.8	56.5	51.8	54.8	44.9	37.6
400	97	23.7	90.9	55.7	51.2	54.7	44.9	37.7
500	97	22.7	87.3	53.2	51.6	55.1	44.9	37.6
630	97	20.4	87.9	55.1	52.5	56.5	46.0	37.7
800	97	19.6	89.4	55.8	54.4	58.6	47.5	37.9
1000	97	17.0	88.3	55.5	54.0	57.9	47.4	37.4
1250	97	13.2	88.4	54.9	53.2	57.2	46.7	35.5
1600	97	10.9	85.7	53.6	52.1	55.9	45.5	33.9
2000	97	10.4	81.8	51.3	49.5	52.7	42.5	30.7
2500	97	8.5	80.2	49.4	46.6	49.2	39.1	27.8
3150	97	5.1	79.1	47.1	43.9	45.5	35.2	24.0
4000	97	4.1	78.9	45.2	41.8	42.4	31.9	20.5
5000	97	3.6	80.5	43.9	40.9	40.0	30.0	17.9
6300	97	4.0	80.6	43.0	39.7	37.9	27.5	15.8
8000	97	4.7	80.3	42.3	39.0	36.6	25.2	13.7
10000	97	5.4	78.8	41.5	39.0	35.1	23.8	12.8
12500	97	5.2	77.4	40.7	38.9	32.5	21.2	10.5
16000	97	3.0	73.1	37.1	35.1	27.3	15.8	6.5
20000	97	0.3	69.3	31.4	28.8	19.7	8.8	1.8

Table I-12. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 12-28-2007 to 1-06-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	103	25.2	85.8	57.0	55.4	55.7	42.5	37.5
20	103	31.5	83.8	65.9	54.4	57.0	50.1	42.5
25	103	30.4	86.3	64.3	54.1	54.6	47.7	41.6
31.5	103	30.3	88.6	62.5	54.7	55.1	46.9	42.1
40	103	28.4	89.5	60.8	53.2	54.7	46.1	41.7
50	103	28.0	89.4	58.1	52.0	53.0	43.7	39.3
63	103	26.7	85.0	56.8	52.8	51.8	42.9	38.1
80	103	29.8	88.9	55.6	53.0	51.6	42.7	38.8
100	103	27.5	81.0	52.1	49.9	49.5	41.0	36.2
125	103	23.9	82.3	49.5	46.8	47.9	40.2	37.1
160	103	19.2	81.0	47.8	45.6	46.3	35.4	31.3
200	103	19.3	79.4	46.8	45.2	45.4	34.2	30.6
250	103	18.0	82.1	46.5	45.4	44.8	35.1	31.5
315	103	20.1	77.3	45.6	44.1	43.6	34.3	31.5
400	103	18.4	76.7	45.5	44.5	44.1	35.4	31.9
500	103	17.6	78.5	45.8	44.8	44.0	36.0	32.0
630	103	14.1	72.8	47.0	46.0	45.5	36.3	31.6
800	103	14.1	72.2	48.9	48.4	47.8	35.5	30.4
1000	103	10.7	72.0	48.7	47.5	47.7	33.7	27.8
1250	103	7.4	71.3	48.4	46.8	47.3	31.3	24.9
1600	103	5.3	72.5	47.6	45.6	45.7	28.5	22.0
2000	103	3.6	70.3	45.7	42.8	42.5	25.2	18.9
2500	103	3.0	72.3	43.2	39.3	39.5	21.7	16.2
3150	103	2.1	72.9	40.6	35.6	34.3	17.9	11.9
4000	103	2.5	74.6	38.2	32.2	29.7	14.3	8.9
5000	103	2.9	76.1	36.6	30.2	28.0	12.0	7.4
6300	103	3.6	78.1	35.5	28.9	25.3	10.8	7.0
8000	103	4.4	79.6	35.0	27.5	23.9	10.1	6.8
10000	103	5.2	79.7	34.6	27.0	22.2	10.2	7.3
12500	103	5.1	78.2	32.8	24.8	20.1	9.2	6.7
16000	103	2.9	74.0	29.9	20.0	15.2	7.0	4.2
20000	103	0.2	71.1	25.2	16.0	9.3	2.4	1.0

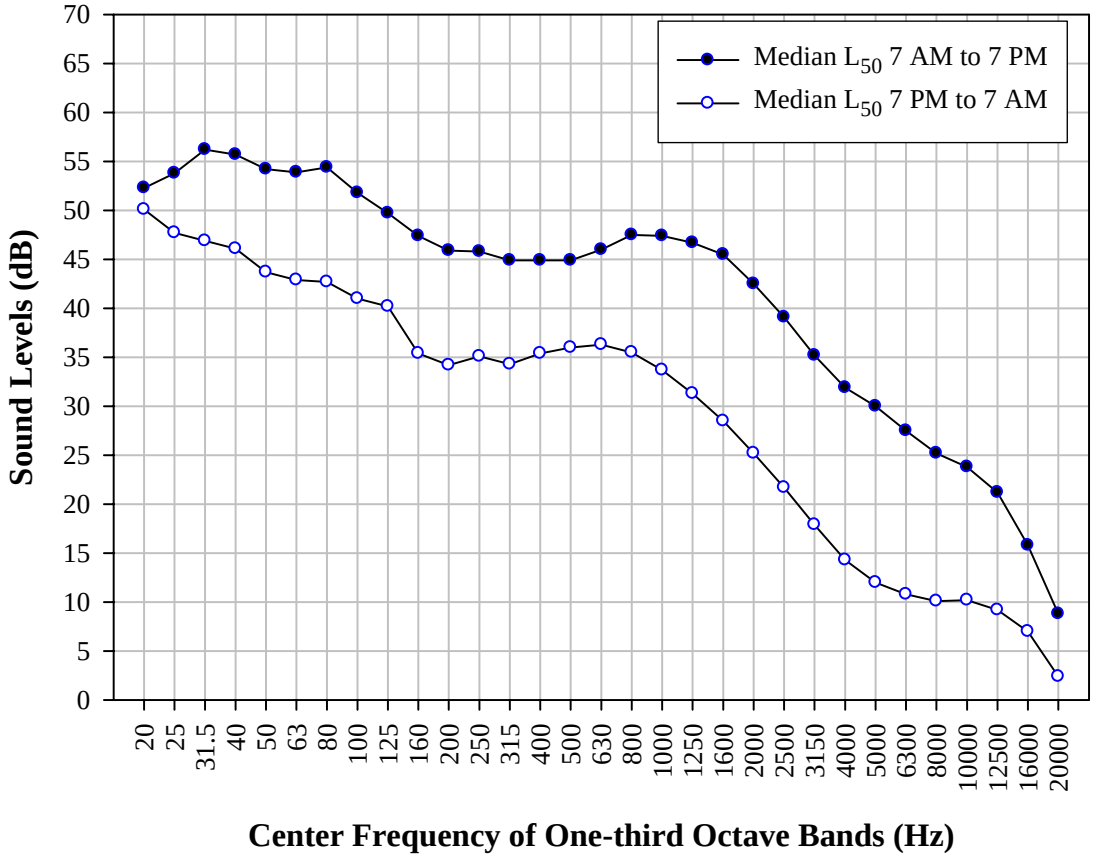

Figure I-8. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), 12-28-2007 to 1-06-2008.

Table I-13. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 6-15-2007 to 6-27-2007 (n=293).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	12	14.4	66.4	42.8	42.5	42.4	43.1	16.0	14.9
1	12	14.3	66.1	39.0	38.1	37.3	29.9	15.0	14.6
2	12	14.3	64.1	36.6	35.5	35.4	23.7	14.8	14.6
3	12	14.3	72.3	41.0	40.7	40.9	35.5	15.0	14.6
4	12	14.5	75.9	48.1	48.0	48.3	51.1	33.0	18.7
5	12	15.2	72.1	50.9	50.9	50.8	55.1	42.7	21.9
6	12	15.9	76.2	53.1	53.1	53.1	57.6	46.8	26.5
7	12	17.1	78.5	54.5	54.4	54.5	58.5	47.0	33.9
8	12	22.7	77.6	55.0	55.0	54.9	58.7	49.5	40.4
9	12	26.6	84.4	55.4	55.3	55.4	58.8	51.6	42.9
10	12	25.7	76.5	55.3	55.3	55.3	58.7	52.0	44.0
11	12	31.6	81.3	55.2	55.2	55.0	58.5	51.9	43.7
12	13	27.4	82.9	55.0	54.9	55.1	58.1	51.4	43.4
13	13	26.6	82.1	55.0	55.0	54.9	58.3	51.7	43.0
14	13	23.6	78.2	55.0	55.0	55.1	58.4	52.2	44.2
15	13	29.6	78.4	55.6	55.6	55.3	58.5	52.6	44.9
16	13	28.1	74.1	55.5	55.4	55.6	58.9	52.7	44.3
17	12	25.9	80.0	55.4	55.4	55.4	58.9	52.2	43.8
18	12	26.5	78.5	55.1	55.1	55.1	58.8	51.6	42.5
19	12	19.3	74.5	54.3	54.3	54.4	58.5	50.0	38.7
20	12	20.5	71.3	55.8	55.8	55.7	59.6	53.7	39.3
21	12	15.7	78.1	52.4	52.4	52.4	57.5	45.7	25.8
22	12	14.7	72.6	49.0	49.0	49.2	53.5	38.3	17.9
23	12	14.5	81.1	47.1	46.1	45.5	47.3	22.2	15.5

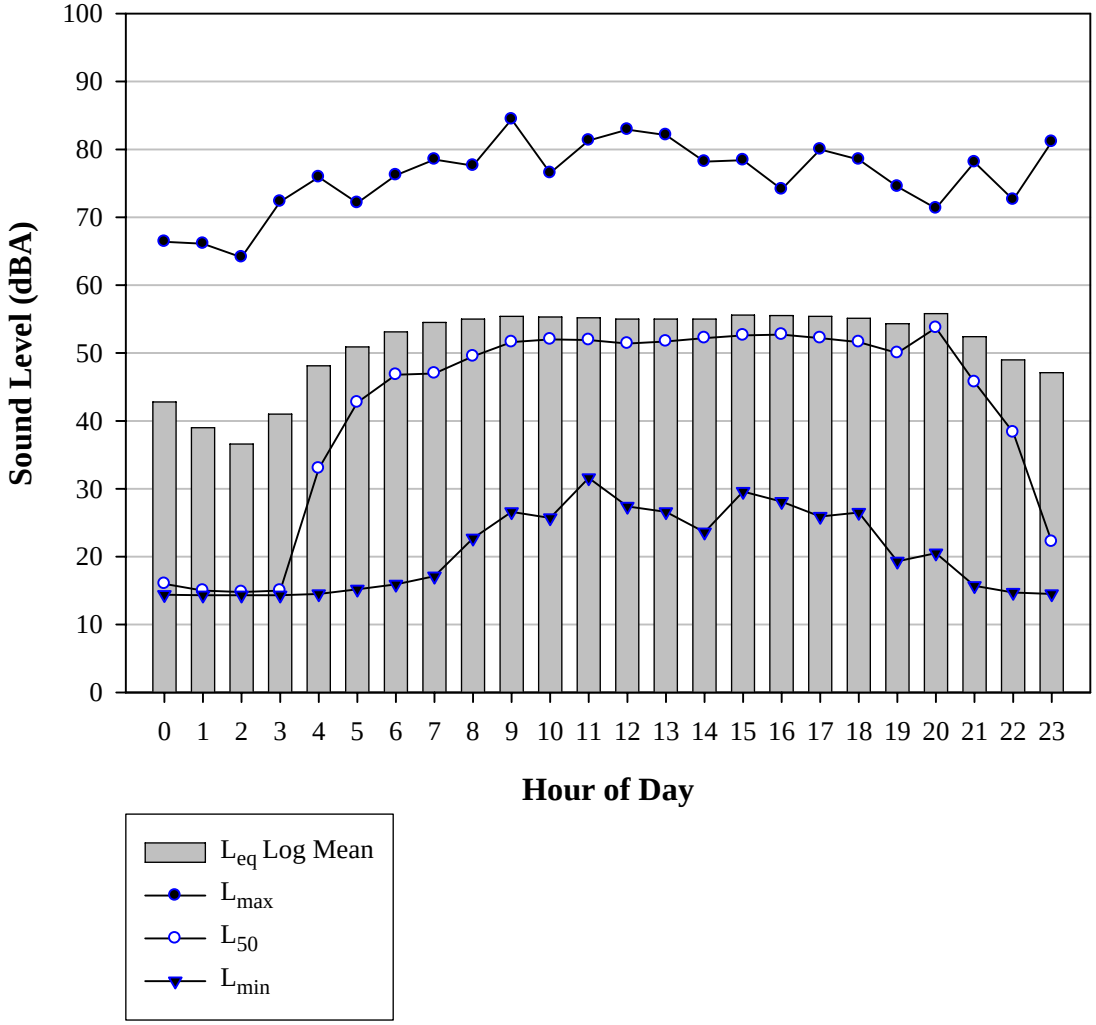

Figure I-9. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 6-15-2007 to 6-27-2007 (n=293).

Table I-14. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 12-06-2007 to 12-16-2007 (n=254).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	15.3	70.7	45.6	41.6	40.9	36.6	17.9	15.9
1	11	15.3	66.0	45.2	37.5	36.7	30.3	16.6	15.8
2	10	15.4	69.1	44.5	35.8	36.8	24.0	16.3	15.9
3	10	15.4	63.9	44.3	30.1	29.8	21.2	18.3	16.4
4	11	15.3	70.6	44.6	35.3	39.2	21.5	16.0	15.8
5	11	15.3	72.8	46.7	43.1	42.1	37.5	19.6	16.3
6	11	15.5	82.4	52.2	50.3	49.2	50.5	30.1	18.6
7	10	15.9	78.6	51.6	51.2	51.7	55.2	41.0	25.5
8	10	16.0	75.3	53.3	52.4	52.3	56.7	42.9	30.2
9	8	16.0	73.3	52.7	52.4	53.0	57.3	43.6	31.6
10	10	16.2	82.7	54.7	54.1	53.4	57.8	45.0	35.0
11	11	17.8	79.9	55.1	54.5	54.2	58.7	46.8	36.4
12	11	19.1	71.2	55.3	54.5	54.0	58.7	47.8	37.1
13	11	18.3	76.9	55.1	54.5	54.1	58.4	46.6	36.8
14	11	18.1	85.0	55.6	55.1	54.4	58.7	47.9	37.8
15	11	17.1	76.5	55.0	54.8	54.5	59.1	48.3	38.5
16	11	17.6	72.8	55.2	54.9	55.3	59.7	49.0	40.2
17	10	18.0	78.7	55.4	55.2	55.5	59.9	49.7	40.2
18	11	15.7	69.5	52.6	52.4	52.9	58.0	45.6	33.5
19	10	15.9	72.7	50.2	50.0	50.0	54.6	40.8	27.8
20	11	15.7	72.9	49.0	48.7	49.2	52.8	39.8	20.7
21	11	15.9	70.4	47.3	46.5	47.0	47.2	36.4	19.8
22	11	15.5	80.6	48.2	46.7	45.3	44.8	28.2	17.2
23	11	15.4	74.2	45.8	43.9	43.7	44.5	24.9	16.1

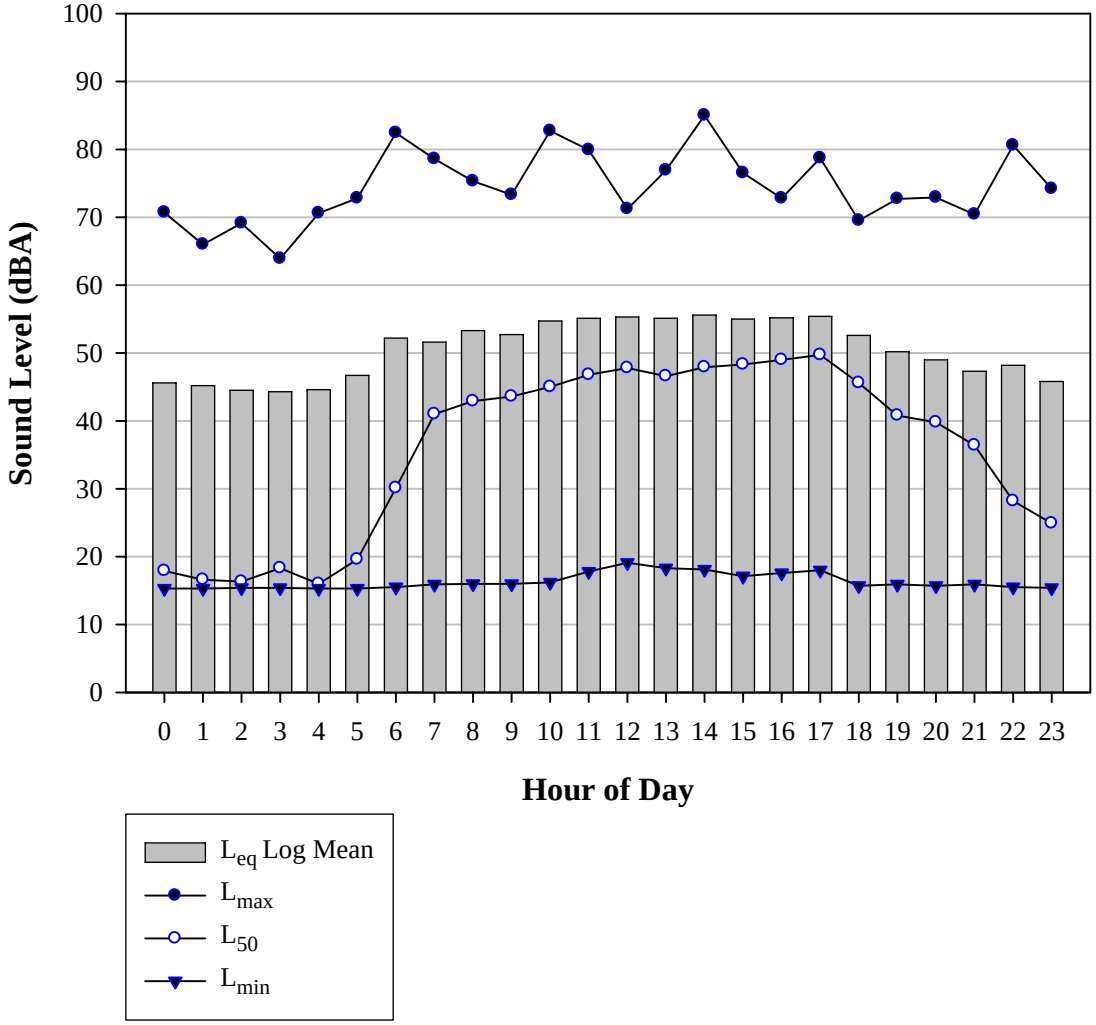

Figure I-10. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 12-06-2007 to 12-16-2007 (n=254).

Table I-15. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	149	17.1	84.4	55.2	55.1	58.5	51.7	43.0
12.5	149	20.2	93.4	50.2	50.2	53.4	45.8	38.5
15.8	149	20.9	91.9	49.3	49.2	52.4	44.2	37.5
20	149	19.7	85.1	50.7	50.6	52.7	44.4	38.0
25	149	18.9	88.9	50.0	49.7	52.7	45.4	39.2
31.5	149	21.2	87.1	50.9	50.4	53.2	46.2	39.6
40	149	18.8	90.1	52.9	52.4	54.6	46.9	39.8
50	149	16.1	91.0	55.1	53.9	55.4	47.3	39.7
63	149	13.9	93.2	58.6	57.8	57.8	48.2	39.4
80	149	12.0	90.6	58.2	58.0	57.4	47.6	38.6
100	149	9.5	90.6	57.1	56.4	55.8	46.1	36.9
125	149	9.2	91.6	54.2	53.2	52.6	43.0	34.4
160	149	7.3	86.2	51.1	50.4	49.6	40.9	32.0
200	149	4.5	82.6	47.4	46.6	46.8	38.4	29.8
250	149	4.8	80.3	44.8	43.9	44.4	36.4	29.2
315	149	5.6	78.8	43.0	42.1	43.1	36.0	29.8
400	149	6.3	74.2	41.8	41.6	43.4	37.0	31.3
500	149	6.1	75.3	42.9	42.9	45.4	39.0	33.3
630	149	5.4	74.8	45.3	45.2	48.1	41.2	34.8
800	149	5.4	71.3	47.1	47.1	50.7	43.7	36.4
1000	149	5.6	81.0	47.8	47.7	51.5	44.8	36.0
1250	149	6.3	80.2	47.1	46.9	50.7	43.9	33.8
1600	149	7.0	80.4	45.8	45.7	49.5	42.5	30.7
2000	149	7.7	74.9	43.2	43.1	47.0	39.0	25.1
2500	149	8.8	69.6	39.6	39.6	43.0	34.0	18.7
3150	149	9.8	67.2	35.7	35.6	38.8	29.1	14.7
4000	149	10.7	65.7	32.5	32.1	35.2	25.1	13.4
5000	149	11.8	64.2	29.7	29.2	31.9	21.8	13.2
6300	149	12.9	63.3	26.5	25.9	28.0	18.6	14.0
8000	149	13.9	63.0	23.3	22.3	23.8	17.0	15.0
10000	149	15.1	62.9	21.8	20.4	20.9	16.7	15.8
12500	149	16.3	63.1	20.7	19.4	19.9	17.2	16.7
16000	149	17.0	62.6	19.9	19.0	19.2	17.8	17.6
20000	149	18.5	57.0	19.7	19.4	19.5	19.2	19.1

Table I-16. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	144	14.3	81.1	50.7	48.9	52.4	35.2	17.9
12.5	144	12.7	72.7	38.4	35.8	36.6	30.6	26.6
15.8	144	12.2	74.2	40.1	37.2	38.4	29.9	25.4
20	144	10.9	74.0	40.4	37.9	39.6	29.5	23.8
25	144	8.4	76.9	41.0	38.4	39.8	28.9	21.9
31.5	144	6.2	74.7	43.1	40.6	42.1	30.3	21.8
40	144	5.3	80.5	45.4	41.8	42.7	31.0	22.0
50	144	4.2	86.3	47.9	43.7	44.2	29.8	21.4
63	144	5.9	87.3	51.8	47.3	45.3	29.2	20.4
80	144	4.6	86.0	49.8	46.5	44.5	26.9	18.8
100	144	2.1	88.2	48.6	44.5	43.0	24.1	14.6
125	144	1.1	88.2	46.1	41.5	40.1	22.4	12.7
160	144	0.6	83.2	42.3	38.0	37.1	19.1	8.6
200	144	0.2	74.6	38.3	34.2	34.1	17.4	7.0
250	144	0.5	71.8	35.5	32.1	32.8	18.3	7.8
315	144	0.9	76.2	34.5	31.5	32.9	18.8	7.7
400	144	1.2	73.5	34.5	31.8	34.5	21.1	6.7
500	144	1.7	76.1	36.6	34.6	37.6	23.5	6.0
630	144	2.4	72.7	39.9	38.0	41.3	25.4	5.4
800	144	3.4	77.4	43.0	41.4	45.1	28.5	5.9
1000	144	4.3	80.4	43.9	41.8	45.7	28.3	6.2
1250	144	5.1	77.6	43.3	41.3	45.1	25.2	6.7
1600	144	6.1	74.1	42.0	40.2	44.0	20.8	7.4
2000	144	7.2	66.3	39.0	37.3	40.1	14.9	8.2
2500	144	8.2	68.6	34.4	32.8	35.2	12.6	9.2
3150	144	9.2	66.2	29.9	28.1	30.2	10.8	10.2
4000	144	10.5	64.8	26.4	24.7	27.1	11.5	11.1
5000	144	11.5	59.5	23.9	22.3	24.3	12.4	12.2
6300	144	12.7	59.9	20.9	19.6	20.2	13.5	13.3
8000	144	14.0	55.5	18.7	17.5	16.3	14.5	14.4
10000	144	15.0	53.3	17.8	16.9	16.4	15.9	15.7
12500	144	16.0	54.2	18.3	17.6	17.1	16.7	16.6
16000	144	16.9	52.3	18.0	17.6	17.5	17.3	17.2
20000	144	18.5	48.3	19.3	19.2	19.2	19.1	19.0

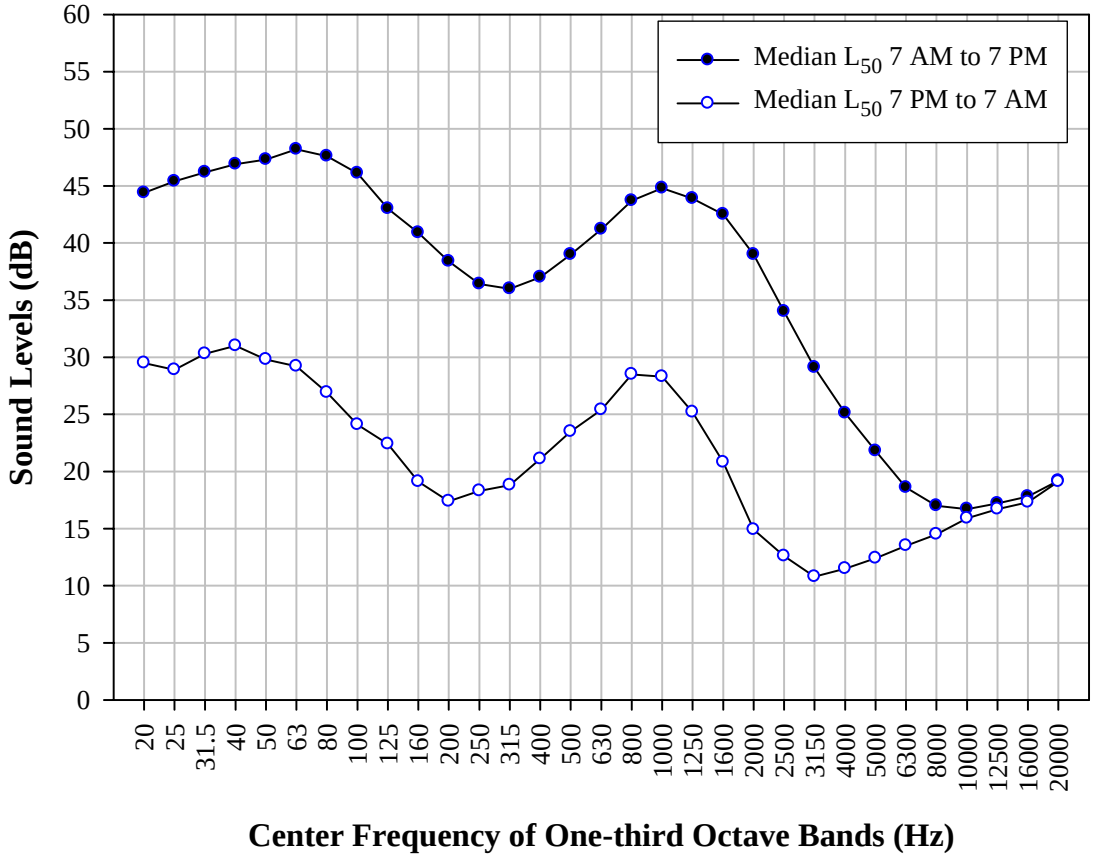

Figure I-11. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 6-15-2007 to 6-27-2007.

Table I-17. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 12-06-2007 to 12-16-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	125	15.7	85.0	54.5	54.0	58.5	46.8	36.3
12.5	125	12.8	88.5	51.8	47.0	48.5	40.2	34.8
15.8	125	19.7	84.3	50.0	45.9	47.6	39.8	34.8
20	125	22.4	87.6	49.2	46.1	47.4	39.9	35.1
25	125	21.0	84.2	48.0	45.6	47.9	40.6	35.4
31.5	125	20.5	83.0	47.5	46.3	49.0	40.8	35.0
40	125	19.5	90.8	48.8	47.5	49.7	41.0	34.8
50	125	15.1	88.6	50.9	49.7	51.3	41.7	34.9
63	125	12.3	92.1	54.2	53.0	53.2	42.2	34.1
80	125	8.2	88.4	53.9	53.3	52.8	41.5	32.4
100	125	3.3	86.8	52.1	51.3	51.8	40.0	30.1
125	125	1.1	86.6	50.8	49.7	49.9	38.9	28.0
160	125	-1.8	82.5	47.5	46.4	47.8	36.6	25.7
200	125	-1.4	79.9	44.3	43.1	45.1	33.0	23.1
250	125	-0.7	75.9	42.4	40.6	42.7	31.2	22.9
315	125	-1.4	76.2	40.1	38.0	39.5	29.8	23.0
400	125	-1.1	72.3	39.6	37.1	39.6	31.1	24.2
500	125	-1.4	69.6	40.8	39.0	42.1	33.3	25.8
630	125	-1.3	73.1	43.4	42.6	45.6	36.4	27.9
800	125	-1.6	74.3	45.7	45.4	49.5	39.5	29.6
1000	125	-1.2	82.0	46.4	46.1	50.6	39.8	28.1
1250	125	-0.7	81.2	46.5	46.1	50.7	39.2	26.0
1600	125	-0.1	81.1	45.9	45.4	50.3	37.4	22.0
2000	125	0.6	74.1	44.1	43.5	48.5	33.3	16.2
2500	125	1.6	69.2	41.2	40.2	45.1	27.5	8.9
3150	125	2.6	68.5	38.3	36.3	41.1	21.6	5.7
4000	125	3.7	64.2	35.7	32.4	36.8	16.4	5.2
5000	125	4.8	63.1	33.6	29.0	33.2	12.1	5.9
6300	125	5.7	59.8	31.0	25.5	29.2	9.7	6.6
8000	125	6.7	57.6	28.1	22.2	25.1	9.2	7.3
10000	125	7.4	55.9	25.1	19.4	20.9	9.0	7.9
12500	125	7.6	52.8	21.9	16.5	17.5	8.8	8.2
16000	125	6.9	48.9	17.7	12.8	13.2	8.0	7.6
20000	125	7.0	45.6	12.5	9.2	9.5	7.6	7.4

Table I-18. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 12-06-2007 to 12-16-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	129	15.3	82.4	47.7	44.1	44.5	25.9	17.7
12.5	129	13.8	88.9	49.2	35.4	37.3	32.5	28.5
15.8	129	18.4	87.4	47.2	36.1	37.5	32.6	29.2
20	129	17.0	86.3	45.3	36.3	37.8	32.6	29.0
25	129	14.2	83.1	43.0	36.0	38.0	31.4	27.6
31.5	129	11.4	82.0	41.4	36.8	38.4	31.0	25.5
40	129	8.6	80.3	40.7	37.3	38.5	30.8	23.6
50	129	7.7	77.9	41.9	38.7	38.6	29.0	21.9
63	129	4.9	83.2	45.4	41.8	38.0	27.7	19.5
80	129	0.0	85.1	46.3	42.4	37.0	25.4	16.2
100	129	-2.1	85.8	45.6	41.3	36.9	22.1	13.2
125	129	-2.8	83.9	43.4	38.5	37.6	19.8	12.5
160	129	-3.8	79.7	41.1	36.2	36.4	17.0	9.7
200	129	-4.2	72.7	37.1	34.0	32.9	16.5	8.0
250	129	-4.4	72.0	35.6	32.0	31.0	18.4	8.0
315	129	-4.2	66.4	33.9	30.2	30.9	17.2	7.9
400	129	-4.2	70.0	34.7	30.4	31.4	18.7	8.0
500	129	-3.6	72.3	35.9	31.5	33.1	19.3	7.0
630	129	-3.3	73.1	37.7	33.9	34.8	18.3	4.9
800	129	-2.9	73.9	39.5	35.9	37.4	17.3	3.0
1000	129	-2.2	74.8	40.0	36.6	36.9	13.7	1.3
1250	129	-1.4	75.5	39.9	36.5	35.8	9.0	0.7
1600	129	-0.5	74.9	38.8	35.5	33.2	4.5	0.9
2000	129	0.5	70.7	36.6	33.5	28.8	2.8	1.6
2500	129	1.4	67.3	33.4	30.0	23.2	3.0	2.4
3150	129	2.5	64.3	29.8	26.2	18.4	3.7	3.4
4000	129	0.6	58.8	26.3	21.7	13.8	4.6	4.3
5000	129	1.4	58.8	23.5	18.4	10.5	5.5	5.2
6300	129	2.2	56.4	21.0	16.3	8.9	6.4	6.2
8000	129	3.4	53.9	19.2	13.7	8.7	7.2	7.0
10000	129	4.1	63.2	18.9	11.7	8.6	7.8	7.7
12500	129	5.2	52.9	16.9	10.4	8.5	8.0	7.9
16000	129	6.0	55.6	15.1	8.4	7.7	7.5	7.3
20000	129	6.9	44.7	11.0	7.5	7.5	7.3	7.2

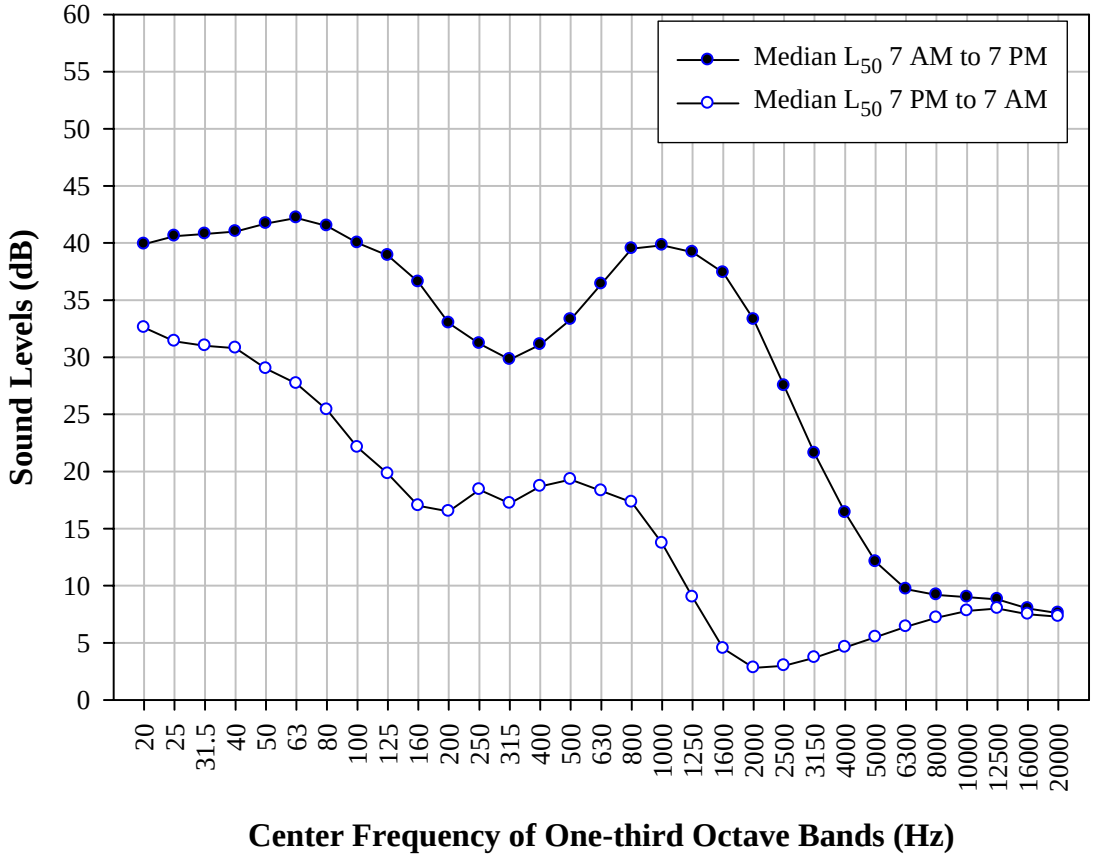

Figure I-12. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), 12-06-2007 to 12-16-2007.

Table I-19. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 6-15-2007 to 6-27-2007 (n=263).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	21.1	62.9	41.5	39.0	38.7	41.4	28.5	23.9
1	11	21.0	60.5	33.8	31.4	30.9	27.5	25.0	23.3
2	11	21.2	61.9	31.7	27.9	25.8	26.1	24.8	23.8
3	11	21.4	65.4	47.2	45.9	44.8	47.3	40.4	24.8
4	11	23.2	64.3	46.7	45.6	45.2	47.8	44.0	34.9
5	11	22.9	63.4	41.9	41.0	42.3	45.7	33.9	27.2
6	11	22.6	62.5	44.4	44.0	43.5	46.5	40.1	30.9
7	11	24.7	75.0	47.4	46.2	45.4	47.9	41.9	34.9
8	11	23.7	79.3	53.2	47.2	45.4	47.3	42.4	35.3
9	11	27.3	81.0	56.5	48.7	46.8	48.7	42.1	37.6
10	11	26.5	81.3	58.2	50.0	49.1	50.2	42.3	36.7
11	10	25.2	76.0	50.9	49.9	49.7	52.6	44.4	38.1
12	11	24.2	82.7	59.0	50.6	48.6	51.6	44.3	36.5
13	11	27.4	77.5	51.6	50.2	49.4	52.8	45.5	38.1
14	11	29.0	77.8	52.7	50.4	49.9	52.7	45.6	37.3
15	11	28.0	80.8	57.1	50.1	47.7	51.4	44.9	38.2
16	11	28.0	76.0	50.2	47.2	45.6	48.7	44.5	36.0
17	11	27.3	83.2	59.2	48.0	43.4	46.9	40.6	36.2
18	11	26.9	78.5	52.4	46.7	44.6	47.6	42.1	35.3
19	11	23.4	76.9	51.1	41.0	39.1	42.8	36.1	29.3
20	11	23.6	76.1	46.6	44.3	42.8	46.1	39.5	31.4
21	11	23.4	61.3	43.3	42.2	41.7	45.0	36.4	28.1
22	11	22.7	68.3	39.9	39.6	39.2	42.6	33.0	25.2
23	11	21.7	62.7	41.2	40.8	40.6	44.4	32.2	25.3

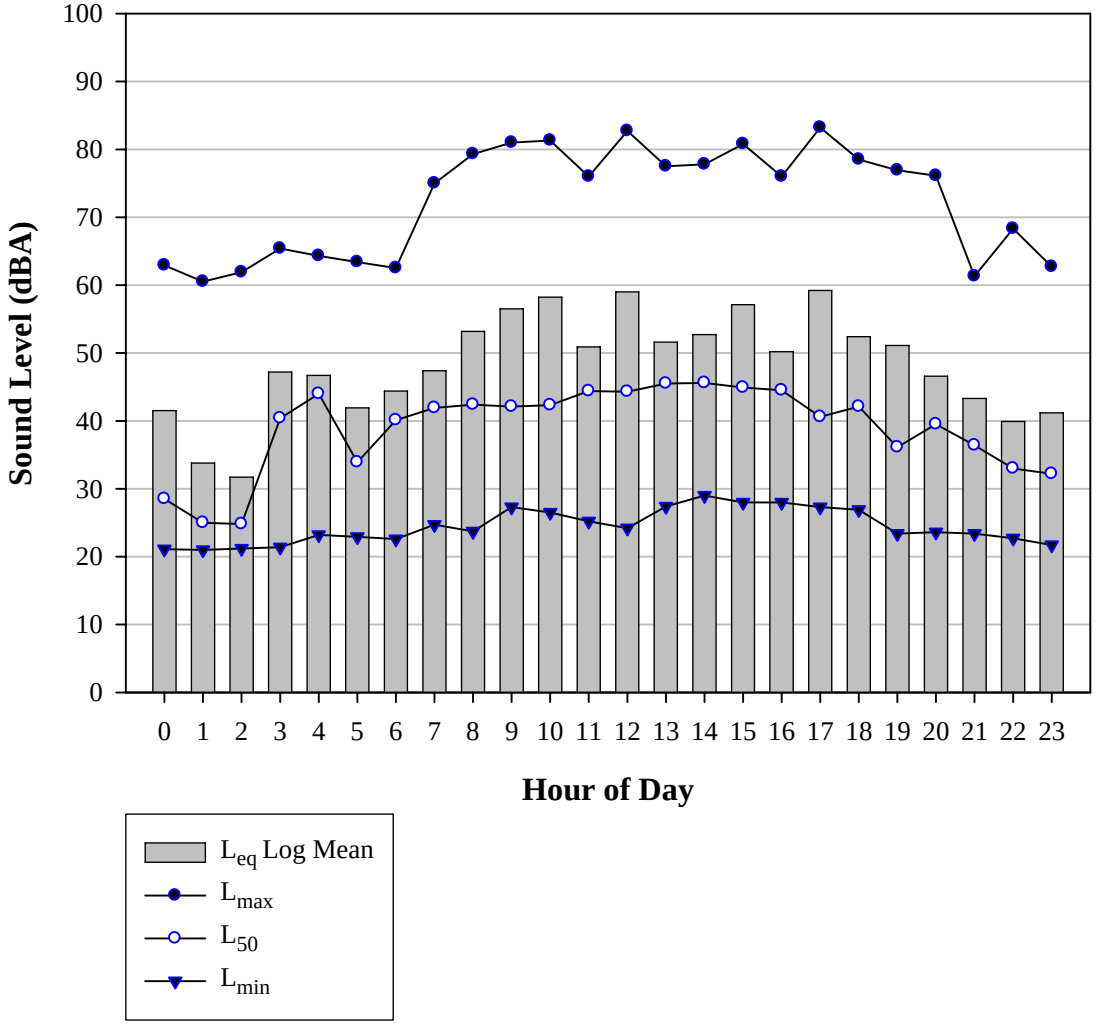

Figure I-13. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 6-15-2007 to 6-27-2007 (n=263).

Table I-20. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 12-12-2007 to 1-03-2008 (n=526).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	22	21.8	64.9	40.3	34.5	32.6	32.8	27.8	25.4
1	22	21.0	65.8	41.7	34.7	32.2	33.0	27.8	26.1
2	22	20.5	64.3	40.2	32.7	30.4	31.5	27.8	25.8
3	22	20.7	64.3	39.1	31.9	29.5	29.9	28.0	26.4
4	22	21.3	73.0	41.5	32.9	30.5	30.3	27.8	25.6
5	22	21.6	66.0	49.7	48.6	47.9	52.1	46.1	28.3
6	22	22.8	69.4	49.7	48.1	49.2	51.3	47.5	43.5
7	22	33.0	69.8	51.3	50.4	50.1	52.7	48.7	45.1
8	22	25.6	85.3	53.9	49.3	48.6	50.7	45.2	42.3
9	22	24.9	86.8	60.6	50.7	48.9	51.0	46.6	41.0
10	21	23.7	87.9	60.6	52.4	51.8	53.6	45.8	40.6
11	21	23.3	86.9	63.8	53.9	47.8	48.9	42.7	37.8
12	22	25.2	86.1	59.4	50.0	46.4	49.0	44.0	38.9
13	22	22.8	84.5	62.1	52.4	48.8	51.1	43.3	38.0
14	22	23.6	88.5	63.7	54.4	48.8	52.1	44.0	38.9
15	22	23.9	84.6	62.1	51.5	48.3	48.7	42.5	37.4
16	22	24.3	83.4	57.3	47.4	45.3	46.6	40.8	36.0
17	22	24.9	75.2	44.1	42.2	41.2	43.7	37.5	31.6
18	22	24.1	64.6	43.5	41.8	40.9	44.7	37.9	31.9
19	22	21.7	63.1	42.6	41.2	41.5	43.9	37.8	30.6
20	22	21.9	60.1	41.7	39.0	39.0	40.6	34.0	27.7
21	22	22.6	71.6	43.9	40.5	38.8	42.4	33.1	28.3
22	22	22.5	68.5	42.6	39.0	39.0	38.1	30.1	27.1
23	22	22.0	62.1	40.3	34.7	32.4	34.3	28.3	26.2

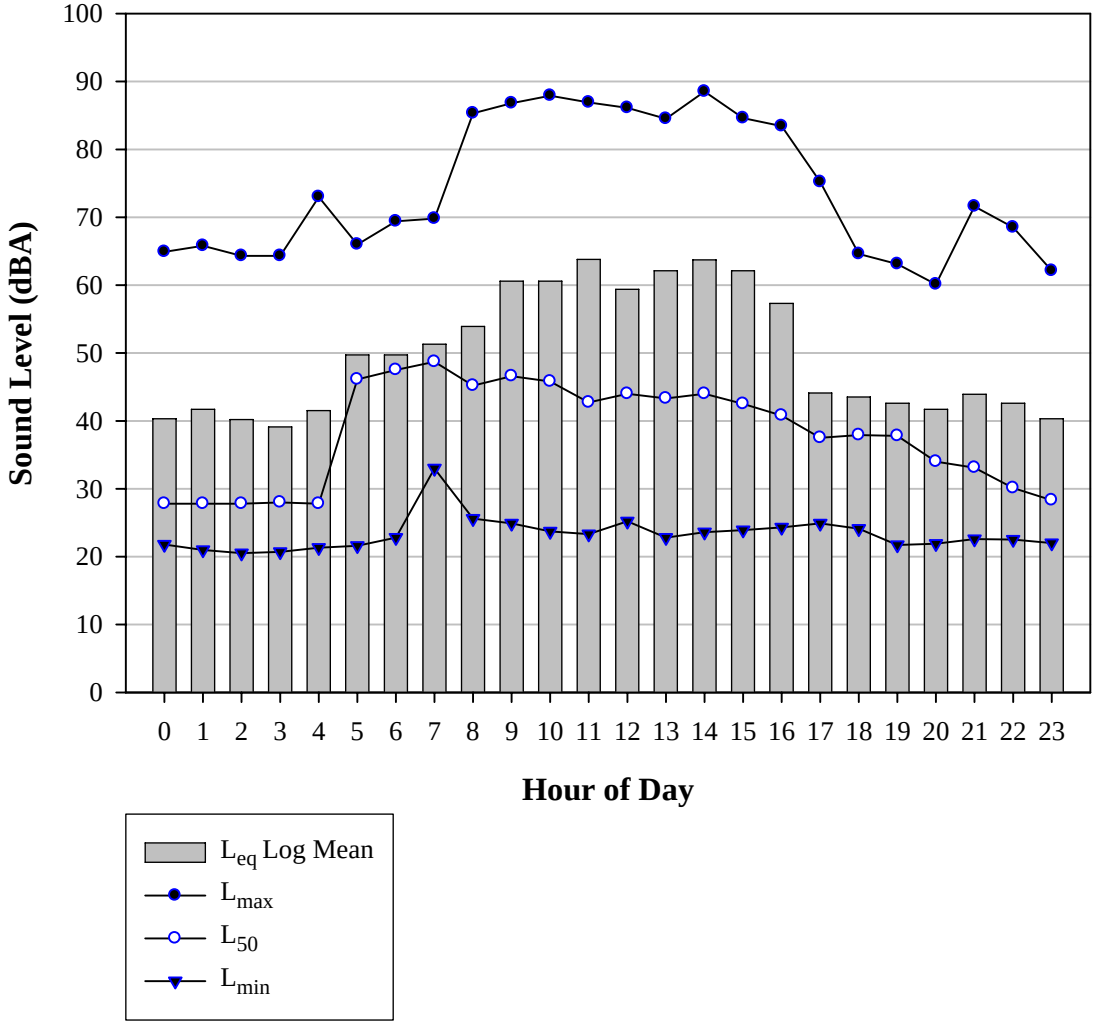

Figure I-14. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 12-12-2007 to 1-03-2008 (n=526).

Table I-21. Acoustic metrics (dBA and un-weighted one-third octave bands 20-10k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	131	23.7	83.2	55.5	47.8	50.2	43.8	36.8
20	131	26.9	80.1	55.5	54.5	57.6	46.6	39.0
25	131	28.1	86.3	59.5	52.9	55.7	45.7	39.3
31.5	131	27.4	90.1	59.0	54.9	56.1	44.8	38.3
40	131	25.7	82.3	62.4	59.0	62.8	47.1	38.4
50	131	22.7	79.9	57.0	54.0	55.4	45.0	37.3
63	131	25.0	88.4	54.4	52.2	52.9	43.9	36.9
80	131	22.6	83.8	56.6	50.7	53.6	44.1	35.6
100	131	19.6	80.3	55.2	47.7	50.6	42.2	33.4
125	131	24.1	77.8	50.2	46.6	49.4	41.2	36.7
160	131	15.9	78.0	48.9	42.3	45.1	35.9	29.6
200	131	14.7	72.9	45.1	38.6	40.6	33.2	27.4
250	131	13.8	81.2	47.2	36.9	38.5	32.2	27.2
315	131	12.2	77.6	46.5	36.2	38.1	32.5	27.1
400	131	12.6	76.7	46.6	37.1	39.0	33.7	28.1
500	131	12.9	76.8	48.7	37.9	40.4	35.0	28.6
630	131	11.7	78.9	49.3	39.0	41.2	35.4	28.8
800	131	11.3	76.7	48.6	39.3	41.9	35.0	27.9
1000	131	10.7	78.0	47.4	38.9	41.9	33.8	26.6
1250	131	9.1	75.8	45.8	38.8	40.7	32.5	24.0
1600	131	8.2	72.6	43.8	37.0	39.8	30.3	21.2
2000	131	7.3	70.9	40.5	33.6	35.4	26.5	18.2
2500	131	6.9	66.8	37.1	30.3	32.4	23.0	15.0
3150	131	6.9	60.3	32.6	28.1	30.5	20.5	13.0
4000	131	7.3	56.1	29.4	26.8	29.6	19.5	11.9
5000	131	7.7	58.6	27.1	25.3	27.3	17.0	10.6
6300	131	8.5	54.5	23.4	20.8	23.0	14.0	10.2
8000	131	9.4	52.1	22.2	18.7	20.3	13.2	10.7
10000	131	10.3	54.9	22.4	17.1	18.6	13.0	11.2

Table I-22. Acoustic metrics (dBA and un-weighted one-third octave bands 20-10k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	21.0	76.9	45.0	41.2	44.3	35.1	26.8
20	132	24.8	73.7	46.3	42.9	45.2	38.1	32.6
25	132	24.0	78.0	50.3	45.8	48.3	38.9	33.0
31.5	132	19.6	79.5	56.6	53.7	54.9	38.0	30.9
40	132	21.2	81.9	63.6	59.5	63.4	39.8	29.5
50	132	21.4	81.9	56.1	55.3	53.4	38.0	28.7
63	132	22.8	79.9	54.2	53.2	54.7	37.2	28.9
80	132	18.2	78.4	53.4	50.2	53.4	36.6	25.3
100	132	17.2	80.6	52.7	43.8	46.3	32.9	23.1
125	132	17.6	75.1	48.1	42.3	45.1	36.2	31.5
160	132	12.8	72.2	40.0	36.6	38.8	28.8	21.1
200	132	10.0	69.9	36.0	32.7	34.6	24.1	17.5
250	132	10.5	67.4	35.1	30.5	32.5	24.5	18.9
315	132	9.5	66.7	34.7	28.6	31.0	23.2	16.7
400	132	12.1	65.4	34.7	29.2	31.8	24.9	19.5
500	132	9.8	68.0	35.4	29.7	32.7	25.6	18.2
630	132	8.9	70.2	36.1	30.0	33.4	25.0	16.9
800	132	6.3	70.9	36.4	29.8	33.2	24.2	15.9
1000	132	4.9	71.7	35.8	29.2	31.9	23.6	14.2
1250	132	4.3	69.2	36.6	32.2	32.6	21.6	11.4
1600	132	4.5	67.4	32.7	26.5	29.4	19.6	9.9
2000	132	4.7	63.5	28.9	23.9	26.6	16.3	9.8
2500	132	5.2	62.6	26.2	21.3	23.7	13.9	8.2
3150	132	6.1	54.9	23.8	19.4	21.1	11.6	7.6
4000	132	6.9	57.8	24.2	17.7	18.7	10.8	8.3
5000	132	7.6	61.4	24.1	16.0	16.1	9.6	8.3
6300	132	8.3	55.5	19.4	14.1	14.0	9.5	8.9
8000	132	9.3	55.7	17.0	13.8	13.2	10.2	9.9
10000	132	10.1	51.2	17.3	14.7	13.3	10.9	10.6

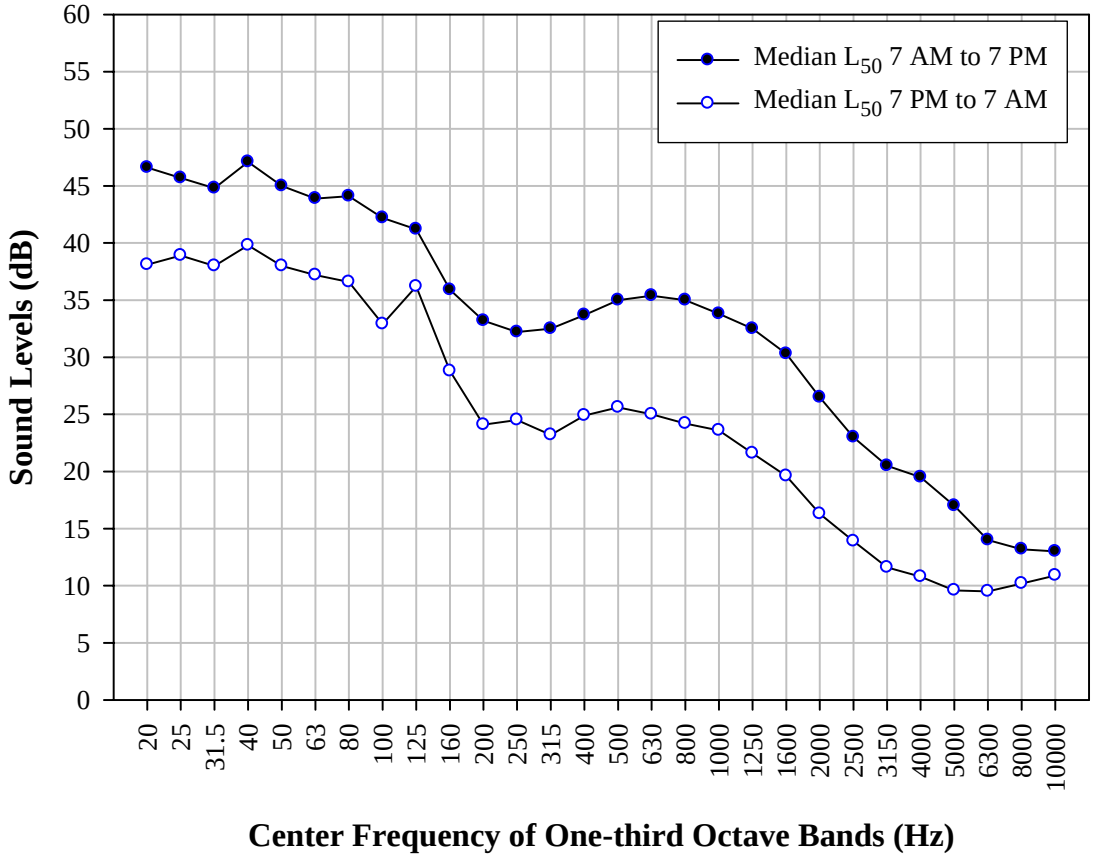

Figure I-15. L_{50} for one-third octave bands (20-10k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 6-15-2007 to 6-27-2007.

Table I-23. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 12-12-2007 to 1-03-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	262	22.8	88.5	60.0	47.5	48.9	43.5	38.7
12.5	262	20.5	86.3	57.4	51.1	54.1	46.6	39.6
15.8	262	24.4	85.4	56.2	50.8	53.7	47.0	41.3
20	262	25.5	84.3	55.9	50.4	54.0	45.4	39.9
25	262	26.3	89.4	59.8	50.7	52.7	46.7	40.9
31.5	262	26.2	90.1	65.3	58.1	59.6	49.7	41.6
40	262	24.8	84.6	65.4	62.0	65.4	53.6	41.0
50	262	24.2	84.8	65.7	57.6	56.7	50.3	40.8
63	262	25.2	89.7	59.7	57.5	58.3	50.0	40.0
80	262	23.7	86.2	59.0	55.7	58.5	51.3	39.7
100	262	20.4	85.4	59.9	50.4	52.6	44.9	37.5
125	262	21.0	82.3	51.3	48.2	50.2	43.3	38.8
160	262	15.2	81.3	49.1	43.6	45.4	38.4	32.7
200	262	13.0	81.8	47.6	40.4	41.6	34.3	29.2
250	262	11.8	84.6	50.5	37.6	38.6	32.3	27.8
315	262	10.6	83.7	52.0	35.7	37.7	32.0	27.5
400	262	10.0	84.9	52.4	36.1	37.4	32.5	28.1
500	262	10.5	84.3	52.7	36.6	38.6	33.5	28.9
630	262	9.8	85.3	52.7	37.9	39.7	34.2	29.0
800	262	8.8	84.8	53.1	37.8	40.1	33.6	28.1
1000	262	8.4	81.2	51.8	37.9	39.8	32.2	26.2
1250	262	7.1	78.9	51.6	38.2	38.9	30.6	23.3
1600	262	4.9	78.4	48.3	34.7	36.6	27.9	20.8
2000	262	4.4	77.0	45.3	31.7	32.9	24.1	17.1
2500	262	4.4	73.0	43.7	28.4	29.8	20.1	12.8
3150	262	5.0	70.6	39.4	25.0	26.1	16.6	10.0
4000	262	5.5	67.3	36.5	23.0	24.2	14.2	8.7
5000	262	6.1	65.2	34.9	20.6	21.0	11.8	8.0
6300	262	6.3	63.8	32.9	19.2	18.5	10.4	7.9
8000	262	6.2	62.8	31.3	16.7	15.9	8.6	7.1
10000	262	6.0	58.9	28.1	13.4	12.6	7.7	6.7
12500	262	5.5	70.8	35.0	12.1	10.4	7.0	6.4
16000	262	5.0	59.5	21.5	10.4	8.6	6.0	5.6
20000	262	3.7	51.8	15.2	6.7	5.8	4.6	4.3

Table I-24. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 12-12-2007 to 1-03-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	264	20.5	73.0	44.4	37.5	39.3	31.4	27.5
12.5	264	13.3	88.7	55.3	39.0	41.7	36.3	32.2
15.8	264	18.0	87.3	54.0	40.4	42.3	36.9	32.7
20	264	20.0	83.7	53.4	40.6	41.4	36.0	32.3
25	264	20.7	85.0	51.6	42.3	43.8	37.4	34.3
31.5	264	20.8	80.9	57.3	44.0	44.9	39.7	36.6
40	264	17.8	86.0	64.5	45.2	43.6	34.4	28.6
50	264	17.9	86.8	64.3	44.7	42.3	33.7	28.5
63	264	20.8	82.3	53.7	48.5	41.4	34.2	30.1
80	264	19.0	81.2	53.0	42.7	39.9	34.0	31.0
100	264	16.3	82.6	54.2	40.4	39.0	32.3	28.7
125	264	19.6	80.5	46.2	42.1	42.2	37.9	35.0
160	264	12.7	75.1	40.7	35.2	37.7	29.5	25.1
200	264	7.3	71.6	37.9	32.4	34.1	26.3	21.9
250	264	6.6	67.7	34.5	30.9	31.8	25.0	21.2
315	264	8.2	67.1	33.6	29.9	31.2	24.2	18.9
400	264	8.9	66.8	33.0	28.7	30.4	24.1	20.3
500	264	8.7	63.0	33.7	27.7	30.0	24.0	19.3
630	264	8.8	63.1	34.9	27.7	30.2	23.7	18.3
800	264	6.5	67.7	35.3	27.1	29.0	22.5	15.7
1000	264	5.3	62.1	34.8	25.4	27.5	19.9	14.1
1250	264	4.6	65.4	35.4	24.5	25.1	16.8	12.9
1600	264	3.1	60.7	32.4	21.7	22.2	13.2	10.5
2000	264	2.6	58.9	28.5	18.6	18.6	9.9	7.5
2500	264	2.9	56.8	24.7	14.9	14.6	7.2	5.8
3150	264	3.4	55.0	22.0	12.6	11.5	6.3	5.7
4000	264	3.9	52.6	19.2	10.9	9.6	6.5	6.0
5000	264	4.9	53.2	16.9	9.8	8.6	6.8	6.5
6300	264	5.5	52.8	15.5	9.1	8.1	7.0	6.8
8000	264	5.6	51.3	13.7	8.5	7.4	6.7	6.5
10000	264	5.7	49.6	11.9	7.5	7.0	6.5	6.3
12500	264	5.7	48.6	10.6	6.8	6.5	6.2	6.1
16000	264	4.9	47.3	9.2	5.7	5.6	5.4	5.3
20000	264	3.6	42.7	6.6	4.3	4.3	4.2	4.1

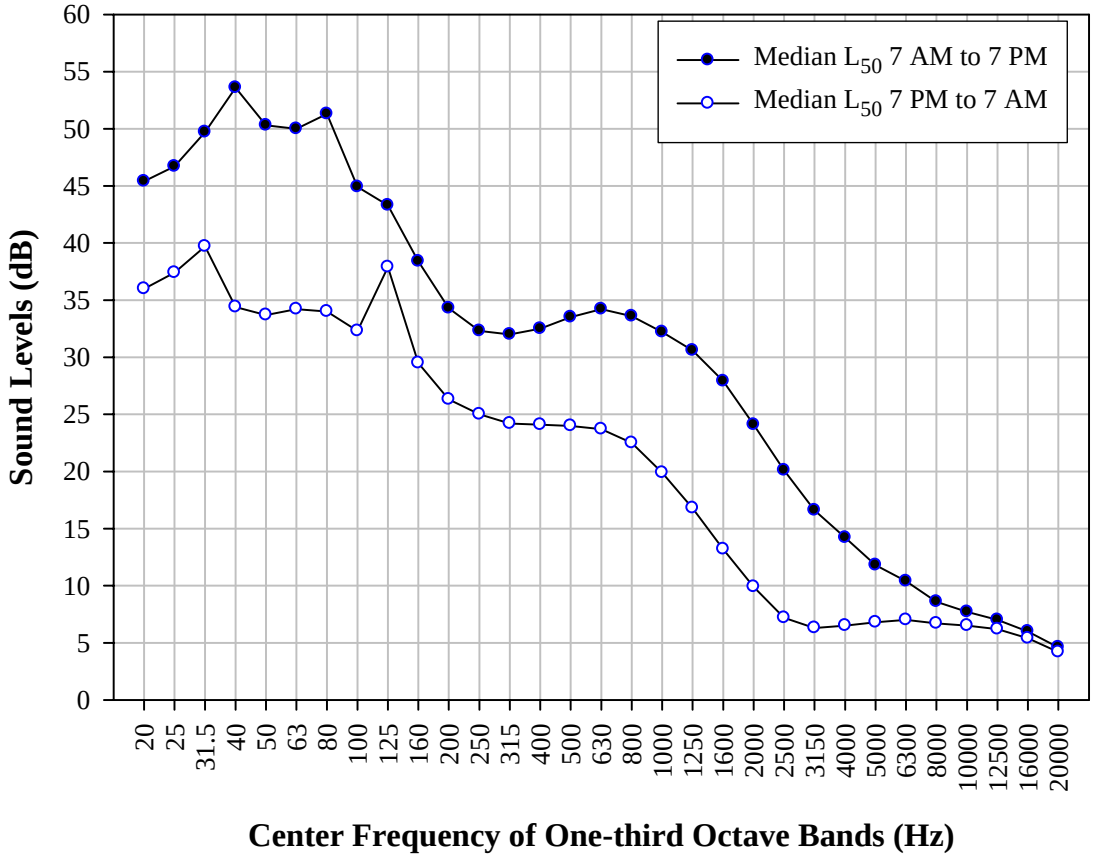

Figure I-16. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), 12-12-2007 to 1-03-2008.

Table I-25. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 6-15-2007 to 6-27-2007 (n=289).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	12	16.0	60.4	39.1	31.6	29.5	30.1	27.1	25.1
1	12	15.2	58.6	35.3	30.0	27.0	29.5	25.4	22.8
2	12	14.8	56.6	32.8	29.5	28.6	30.6	23.2	20.5
3	12	15.0	58.1	30.3	27.2	26.6	28.4	23.6	20.0
4	12	15.0	70.7	44.1	43.9	44.0	35.8	22.9	19.2
5	12	15.8	72.5	47.2	47.2	47.4	44.3	24.3	19.9
6	12	15.9	71.6	47.2	47.2	47.3	44.3	25.8	20.7
7	12	16.3	71.2	47.5	47.5	47.5	44.3	27.2	22.5
8	12	16.1	74.6	48.6	48.4	48.0	44.5	30.7	23.9
9	12	16.1	73.9	49.0	48.9	48.7	46.6	31.8	25.9
10	12	17.4	81.2	49.0	48.8	48.6	44.5	30.7	25.4
11	12	18.7	73.0	48.1	48.1	48.0	44.0	31.4	25.5
12	12	19.1	73.6	48.8	48.7	49.0	45.5	32.8	26.3
13	12	17.2	73.5	48.3	48.0	47.9	44.2	31.8	25.3
14	13	16.3	74.3	48.1	48.0	47.9	45.0	33.4	26.2
15	12	18.0	74.8	48.5	48.4	48.1	45.7	33.3	25.7
16	12	17.0	73.7	48.2	48.1	48.3	45.0	31.7	24.8
17	12	18.3	72.9	47.9	47.9	48.0	45.5	31.4	24.2
18	12	18.0	72.2	48.2	48.1	47.9	46.3	35.2	26.6
19	12	20.1	72.4	49.1	49.0	48.9	47.9	38.8	28.4
20	12	24.7	70.3	48.9	48.5	48.2	49.2	41.0	36.1
21	12	23.8	65.1	44.5	39.9	39.9	42.9	38.1	33.4
22	12	17.2	64.4	43.1	39.5	39.0	42.3	36.2	33.0
23	12	16.5	63.4	40.3	33.6	33.0	34.7	31.2	28.4

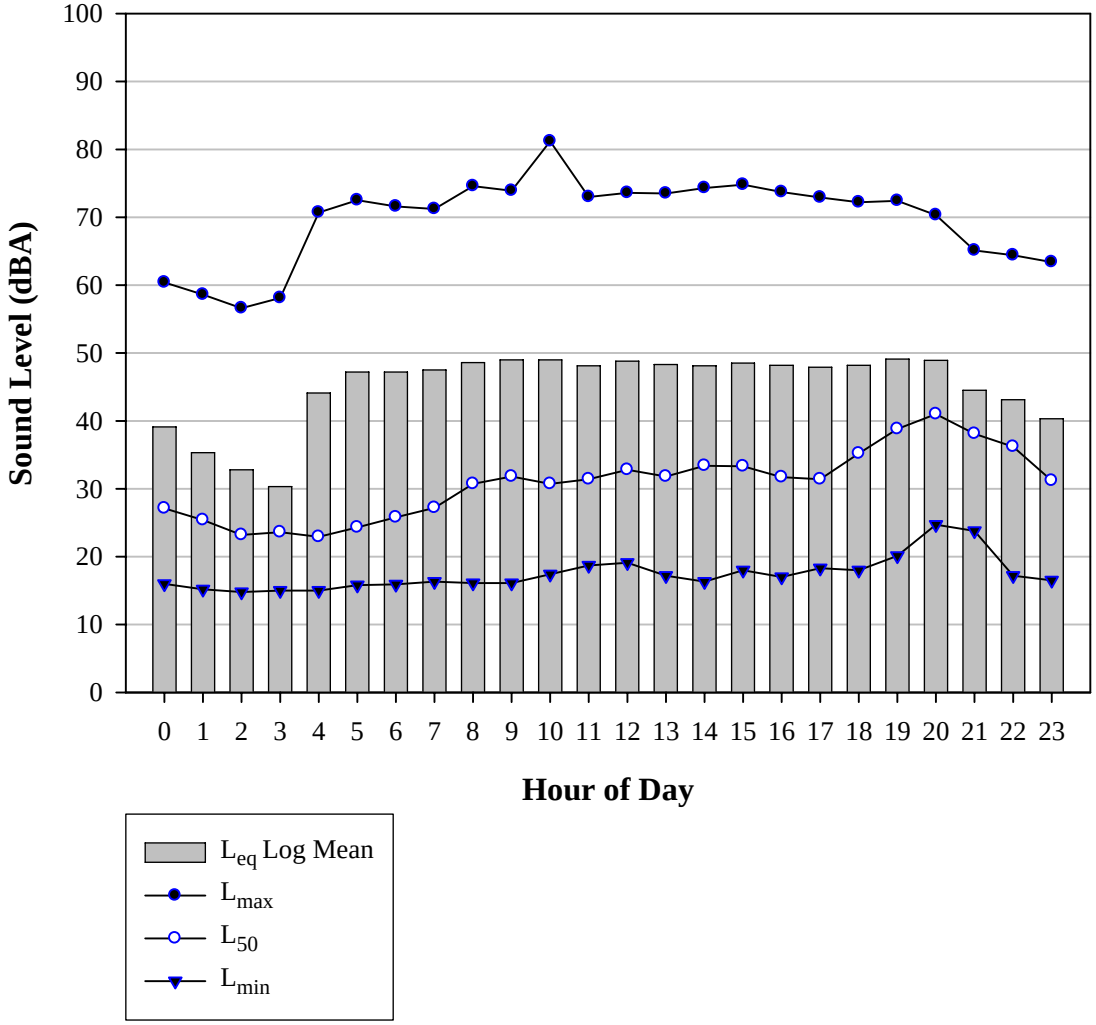

Figure I-17. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 6-15-2007 to 6-27-2007 (n=289).

Table I-26. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 12-06-2007 to 12-17-2007 (n=258).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	8	16.3	69.7	49.2	36.4	34.4	36.5	27.8	22.0
1	11	16.3	71.7	49.5	34.0	32.9	34.5	18.8	17.0
2	11	16.2	74.6	53.7	31.9	25.4	23.7	18.6	17.2
3	11	16.2	75.7	53.7	30.8	26.7	21.2	17.7	16.7
4	11	16.2	75.1	54.5	28.8	23.1	25.6	19.8	17.0
5	11	16.2	73.3	53.5	30.7	25.2	26.4	20.3	17.3
6	11	16.3	75.5	52.3	46.6	44.9	41.7	24.7	19.6
7	11	16.4	83.5	52.6	49.9	48.5	45.6	26.8	22.0
8	10	16.4	73.5	53.0	48.3	47.3	45.9	30.1	22.8
9	10	16.5	77.1	51.6	49.0	48.8	46.2	31.4	23.8
10	10	16.5	74.2	48.8	47.6	46.6	45.5	30.9	24.7
11	11	16.8	74.0	49.5	47.7	46.4	44.4	30.7	25.0
12	11	17.8	79.0	54.0	48.8	47.1	45.1	28.8	22.8
13	11	16.8	79.1	53.5	48.6	47.4	45.6	29.1	23.5
14	11	16.9	77.7	52.9	48.3	46.5	44.9	29.1	23.4
15	11	16.5	76.0	53.9	48.5	46.4	44.9	27.7	22.1
16	11	16.6	76.7	56.0	49.5	47.1	45.4	28.0	22.7
17	11	16.5	77.8	56.5	48.9	45.2	43.7	27.4	22.2
18	11	16.3	75.8	56.2	48.2	45.0	43.2	25.0	19.7
19	11	16.3	74.1	53.3	36.3	28.0	31.6	21.8	18.2
20	11	16.3	72.5	51.1	35.3	29.2	30.7	21.7	18.3
21	11	16.3	69.7	49.1	34.0	29.2	32.3	21.6	17.7
22	11	16.2	65.3	45.9	32.7	27.9	30.1	20.3	17.6
23	11	16.2	68.5	44.9	32.1	26.5	29.5	22.4	18.4

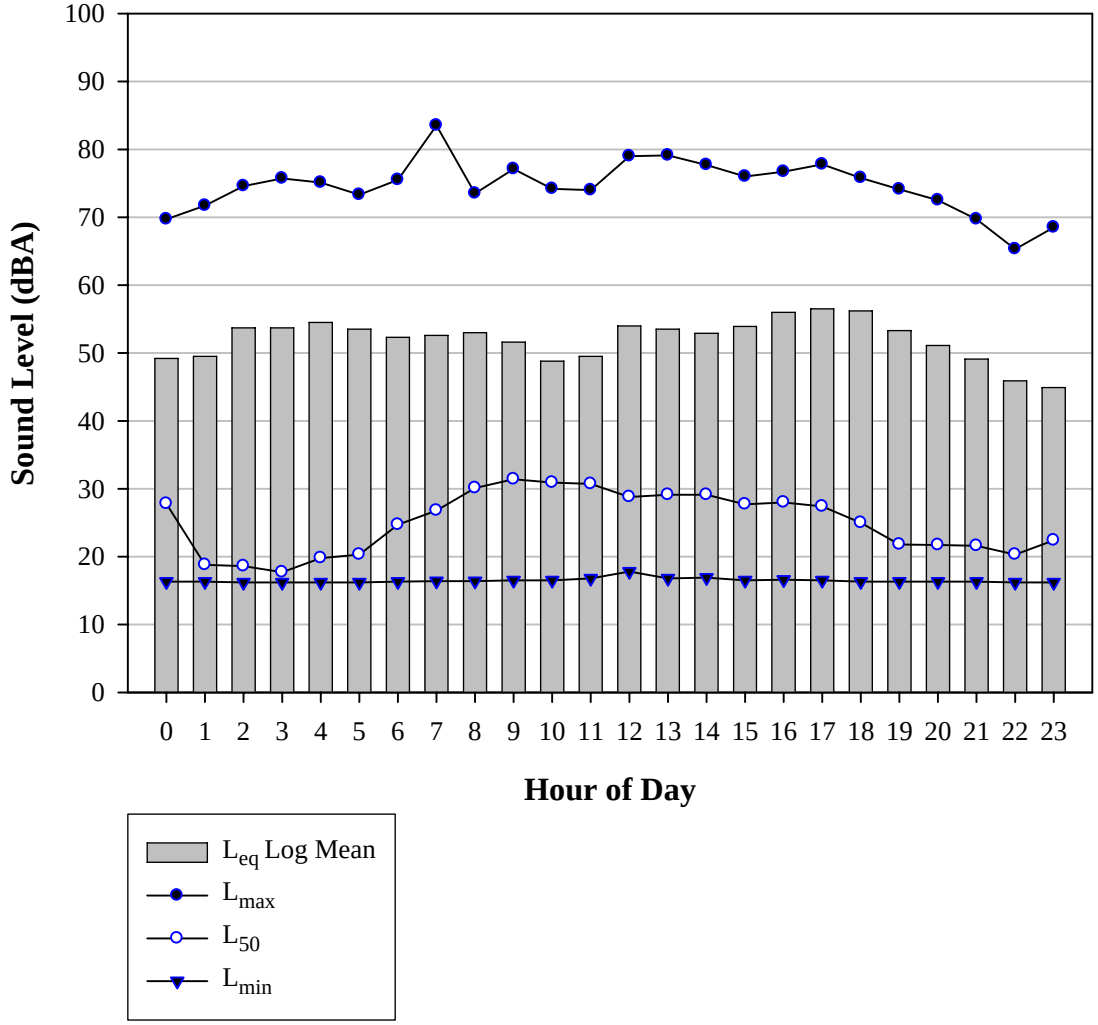

Figure I-18. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 12-06-2007 to 12-17-2007 (n=258).

Table I-27. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	145	16.1	81.2	48.4	48.1	45.0	31.8	25.2
12.5	145	15.7	93.4	50.6	47.9	48.2	38.3	32.6
15.8	145	18.9	86.2	49.0	46.8	47.1	37.1	31.5
20	145	17.8	91.6	48.7	47.6	47.1	37.5	32.0
25	145	17.0	83.8	49.0	48.5	47.5	37.6	32.7
31.5	145	18.3	90.7	50.2	48.5	50.7	38.3	33.3
40	145	17.7	94.8	61.2	60.6	57.8	39.3	34.2
50	145	15.1	92.8	59.6	58.5	50.9	37.5	32.6
63	145	14.6	92.5	62.3	62.3	50.4	37.4	32.3
80	145	17.6	88.9	60.7	60.9	55.9	37.9	32.2
100	145	11.1	87.3	51.7	50.9	48.4	33.0	27.7
125	145	6.8	87.3	51.0	48.1	49.7	30.0	24.4
160	145	5.9	79.2	46.1	45.2	42.8	27.7	21.5
200	145	5.2	73.6	42.5	42.7	40.6	26.1	19.9
250	145	5.4	73.2	41.0	41.1	37.4	25.2	19.3
315	145	4.3	71.4	41.1	41.2	35.1	24.4	18.1
400	145	5.4	71.2	40.0	40.0	34.7	24.2	17.3
500	145	6.3	68.3	38.8	38.7	35.2	23.7	17.2
630	145	6.3	68.0	38.3	38.1	34.9	22.5	16.0
800	145	6.3	71.1	39.0	38.7	34.9	21.3	14.7
1000	145	7.3	70.5	39.2	39.0	34.1	19.2	12.4
1250	145	7.9	68.1	37.2	36.8	32.5	16.9	10.8
1600	145	8.7	73.4	35.5	35.2	30.7	15.0	10.6
2000	145	9.5	76.8	33.4	32.9	27.4	13.4	10.9
2500	145	10.6	69.3	30.4	29.9	24.4	12.7	11.5
3150	145	11.5	62.4	27.7	27.0	21.3	13.0	12.4
4000	145	12.4	68.2	26.0	24.9	21.1	13.8	13.3
5000	145	13.8	63.8	28.8	24.4	21.3	14.6	14.3
6300	145	14.9	62.1	29.0	23.9	20.1	15.7	15.4
8000	145	16.2	63.9	29.6	22.7	18.9	16.8	16.6
10000	145	17.3	64.1	23.7	21.4	18.5	17.8	17.7
12500	145	18.4	65.6	24.3	21.0	19.2	18.9	18.7
16000	145	19.3	79.2	25.7	20.4	19.9	19.7	19.6
20000	145	20.9	65.8	22.1	21.4	21.4	21.3	21.2

Table I-28. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 6-15-2007 to 6-27-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	144	14.8	72.5	44.8	42.3	40.2	30.1	26.0
12.5	144	14.7	93.4	52.0	45.7	44.7	37.4	32.4
15.8	144	12.9	89.5	50.0	44.9	43.8	36.5	31.8
20	144	11.9	91.2	48.5	45.1	42.1	35.5	31.4
25	144	11.2	83.3	47.0	44.8	43.1	35.2	31.1
31.5	144	7.3	80.6	45.9	42.6	43.6	35.6	30.8
40	144	6.9	85.8	56.3	42.6	43.1	35.1	30.3
50	144	4.9	92.4	56.1	41.9	41.7	32.8	29.3
63	144	5.7	92.3	58.3	40.1	41.1	32.9	28.2
80	144	5.5	87.3	56.0	37.5	39.0	31.9	26.9
100	144	3.6	87.7	48.4	34.9	36.4	26.7	22.6
125	144	3.1	87.1	46.8	33.0	33.8	24.1	19.9
160	144	2.4	77.1	40.5	31.4	30.9	20.1	15.8
200	144	2.1	68.9	37.4	29.6	29.0	19.0	14.3
250	144	2.8	68.8	36.1	30.4	29.0	19.4	14.8
315	144	2.8	68.7	35.7	30.9	28.9	19.4	15.3
400	144	3.2	66.5	35.1	31.8	29.9	20.6	16.3
500	144	4.2	65.4	35.0	32.7	31.1	21.1	16.6
630	144	4.9	65.9	35.0	32.8	31.3	21.8	17.1
800	144	5.6	66.5	35.9	33.0	31.3	21.5	16.4
1000	144	6.4	65.5	36.1	33.2	30.7	20.9	15.7
1250	144	7.4	65.6	34.7	30.2	28.5	19.3	14.0
1600	144	8.4	61.5	33.1	28.9	26.7	17.4	12.6
2000	144	9.3	60.3	30.8	26.4	23.6	15.1	11.7
2500	144	10.1	59.6	27.9	23.2	20.7	14.5	12.2
3150	144	11.4	56.8	25.0	20.7	17.7	12.9	12.4
4000	144	12.6	58.5	23.8	20.0	17.5	14.7	13.9
5000	144	13.7	59.2	26.3	19.7	16.6	14.9	14.5
6300	144	14.9	60.7	20.7	17.2	15.9	15.5	15.4
8000	144	16.1	60.6	20.4	18.2	17.0	16.7	16.5
10000	144	17.2	60.1	21.3	19.4	18.1	17.8	17.6
12500	144	18.4	61.5	26.0	21.1	20.3	18.9	18.7
16000	144	19.3	70.1	26.4	21.5	20.1	19.7	19.6
20000	144	20.9	57.6	22.6	21.4	21.4	21.2	21.2

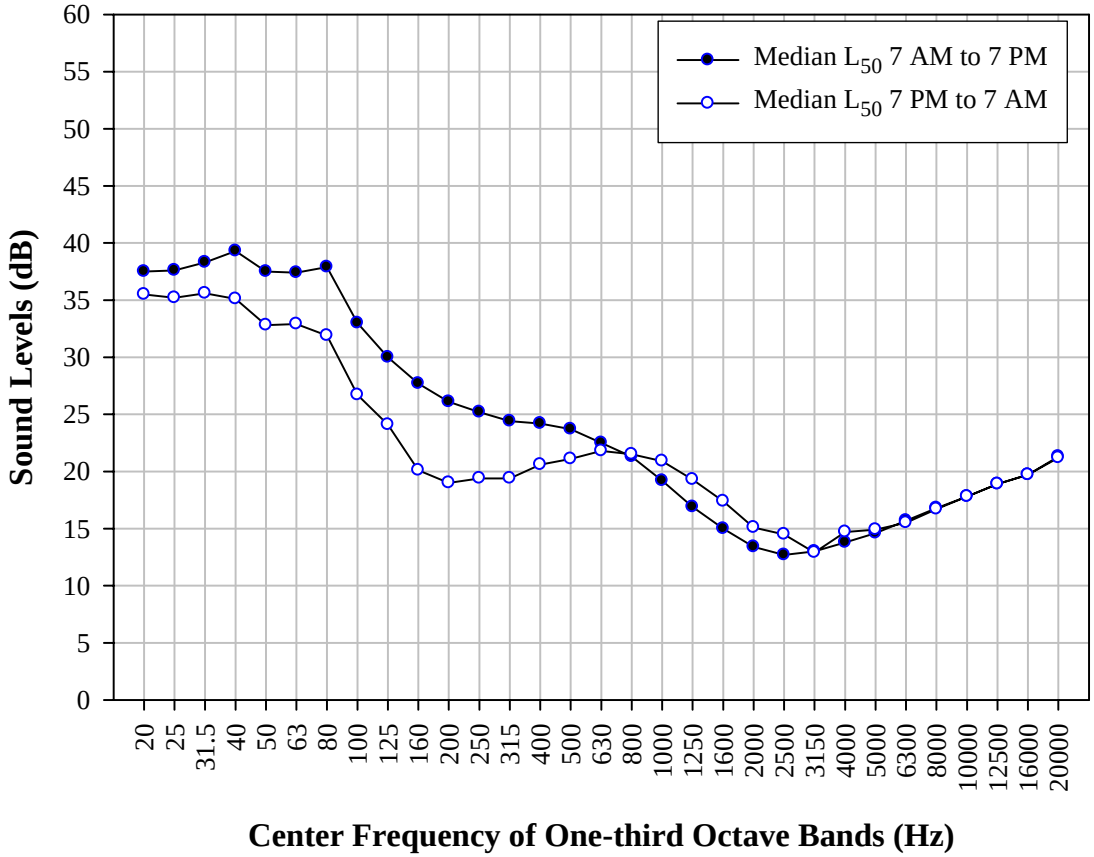

Figure I-19. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 6-15-2007 to 6-27-2007.

Table I-29. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	129	16.3	83.5	53.8	46.9	45.4	29.0	22.8
12.5	129	-4.8	93.8	60.6	47.6	47.6	39.3	34.4
15.8	129	1.2	93.4	58.9	47.1	46.9	38.6	34.1
20	129	-2.3	91.5	57.5	49.3	47.4	38.8	34.3
25	129	2.0	91.3	55.8	49.2	48.0	39.1	34.2
31.5	129	1.1	88.2	54.4	49.2	51.5	39.0	33.8
40	129	-0.8	95.3	63.6	63.0	54.2	39.4	33.6
50	129	-2.6	93.1	61.6	61.5	55.1	36.3	30.9
63	129	-4.3	92.0	61.9	62.1	50.1	34.5	28.6
80	129	-5.9	90.5	60.5	59.8	53.4	34.0	27.3
100	129	-4.4	87.0	53.4	52.1	47.5	28.5	21.3
125	129	-3.8	86.6	51.9	50.5	44.8	26.7	16.8
160	129	-5.9	81.1	44.4	41.4	38.6	26.4	15.7
200	129	-5.3	78.9	42.2	38.1	36.1	25.3	16.9
250	129	-6.7	78.7	41.6	37.7	35.5	24.8	17.5
315	129	-6.3	79.2	41.3	37.3	34.5	23.9	16.2
400	129	-5.9	80.4	41.7	37.2	34.3	22.8	15.9
500	129	-6.0	78.1	42.2	37.6	35.1	21.3	15.5
630	129	-5.3	75.9	42.4	35.7	34.2	19.0	13.4
800	129	-5.3	75.2	43.4	36.9	33.7	16.9	11.2
1000	129	-4.6	103.7	56.4	37.1	32.1	13.7	8.1
1250	129	-3.9	73.6	44.5	35.4	31.5	10.2	4.5
1600	129	-3.0	72.5	44.5	33.9	29.5	8.8	3.3
2000	129	-2.4	87.2	44.0	31.6	26.4	7.4	3.8
2500	129	-1.5	69.3	42.0	28.9	22.7	6.9	4.2
3150	129	-0.3	83.8	40.2	26.7	19.6	7.0	4.7
4000	129	0.6	75.4	37.7	24.7	17.3	6.6	5.3
5000	129	1.7	69.0	35.7	23.0	15.5	6.7	6.0
6300	129	2.8	69.8	33.1	22.1	15.3	7.4	6.7
8000	129	4.0	68.2	30.8	20.7	14.4	8.0	7.4
10000	129	5.1	66.5	28.5	19.5	12.5	8.6	8.1
12500	129	6.2	66.7	26.7	17.9	12.3	9.0	8.6
16000	129	7.0	66.3	23.7	15.6	11.5	8.8	8.5
20000	129	7.6	67.0	18.2	11.3	10.0	9.2	9.1

Table I-30. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	129	16.2	75.7	51.8	28.6	30.7	20.5	17.6
12.5	129	12.7	91.4	57.1	39.9	39.1	34.4	30.4
15.8	129	16.2	89.7	55.1	37.3	38.6	33.9	30.1
20	129	17.3	89.7	53.2	35.9	38.3	33.2	29.7
25	129	15.6	87.1	51.2	35.7	38.5	32.3	28.4
31.5	129	14.0	88.7	49.3	35.4	38.1	31.5	26.8
40	129	10.7	86.4	52.7	34.0	37.2	30.7	24.9
50	129	6.0	92.4	52.9	32.4	35.8	28.2	22.1
63	129	3.3	92.3	51.1	30.4	32.8	25.5	19.3
80	129	-0.5	87.3	48.6	28.8	30.7	22.5	15.8
100	129	-1.3	81.9	43.4	29.1	30.9	18.2	11.6
125	129	-2.6	84.4	42.6	30.6	31.7	15.7	8.0
160	129	-2.8	76.0	37.4	29.0	31.7	15.2	6.7
200	129	-2.3	66.9	36.6	27.5	29.5	15.6	8.1
250	129	-2.8	66.6	37.6	27.7	27.5	15.7	8.9
315	129	-2.5	64.9	37.5	25.2	26.2	14.7	8.7
400	129	-2.5	64.0	38.6	24.2	24.3	14.1	8.0
500	129	-2.1	64.2	39.4	22.3	22.5	11.6	5.7
630	129	-1.7	63.3	40.1	20.5	19.4	9.4	3.4
800	129	-1.3	62.8	41.2	17.9	17.2	6.7	1.8
1000	129	-0.5	62.9	42.2	14.3	13.0	4.8	1.2
1250	129	0.1	64.5	43.1	10.5	9.7	3.4	1.5
1600	129	0.9	65.9	43.2	8.8	7.1	3.0	2.1
2000	129	1.8	66.4	42.5	8.9	7.1	3.2	2.7
2500	129	2.7	66.2	40.7	8.1	6.8	3.9	3.5
3150	129	3.6	64.7	38.4	7.6	6.4	4.6	4.3
4000	129	4.5	62.7	35.9	8.4	6.5	5.3	5.1
5000	129	5.2	60.9	33.6	8.2	7.1	6.0	5.8
6300	129	4.6	60.8	30.7	8.7	7.8	6.8	6.5
8000	129	4.5	61.7	27.8	9.2	8.5	7.5	7.3
10000	129	5.2	61.2	25.2	9.6	9.3	8.2	8.0
12500	129	5.9	61.0	22.5	10.2	9.9	8.7	8.5
16000	129	6.5	59.9	18.8	9.7	9.6	8.6	8.4
20000	129	7.4	53.2	12.9	9.4	9.4	9.2	9.1

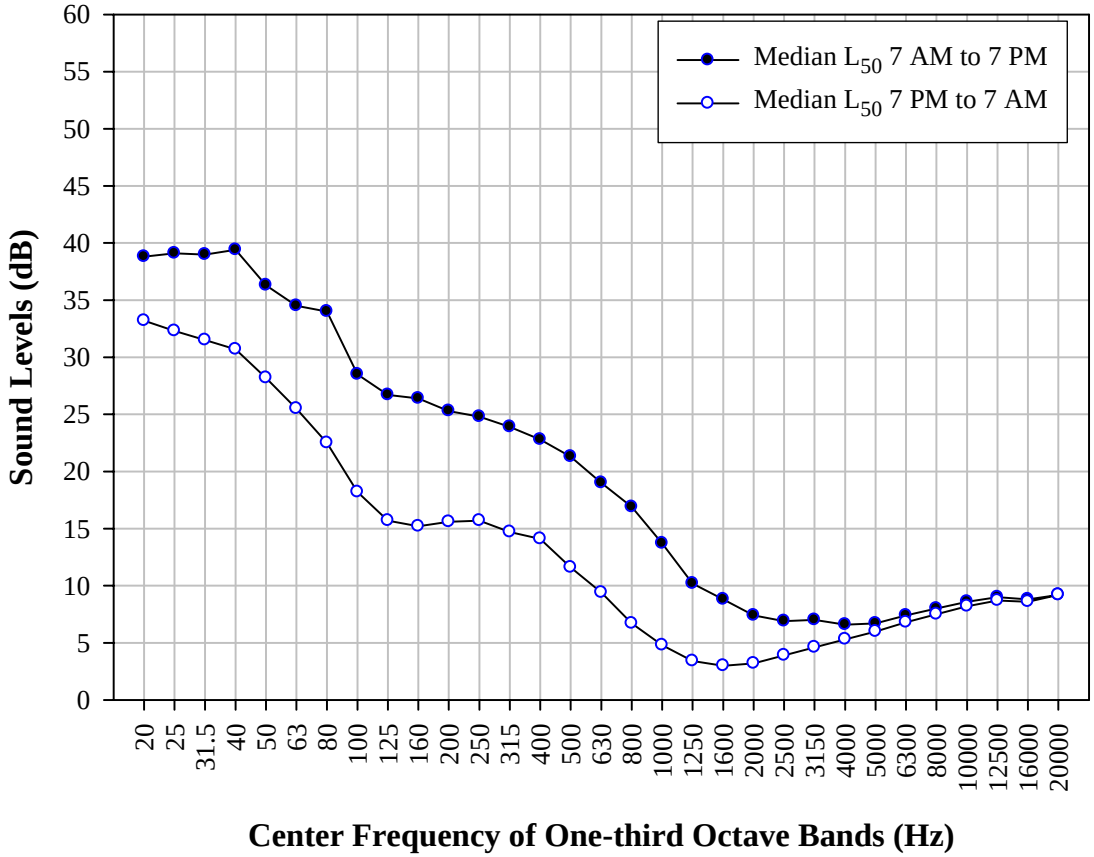

Figure I-20. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), 12-06-2007 to 12-17-2007.

Table I-31. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 6-16-2007 to 6-29-2007 (n=255).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	20.7	61.6	45.3	42.5	41.5	43.9	41.1	39.2
1	11	21.4	59.9	43.3	40.8	40.0	41.5	38.2	34.8
2	11	19.2	56.3	41.5	38.8	37.6	40.0	35.8	30.9
3	11	17.8	58.2	40.0	37.0	36.6	39.6	34.9	33.1
4	11	16.3	58.2	40.1	38.3	37.7	38.3	31.8	28.2
5	11	15.9	58.7	41.6	40.4	39.8	41.5	33.5	28.6
6	11	16.5	63.6	42.0	40.6	39.4	40.4	32.6	28.1
7	11	18.5	63.1	40.4	39.8	39.6	40.9	31.9	26.5
8	10	17.6	62.1	40.1	39.3	38.6	40.6	32.4	27.3
9	9	18.9	60.0	41.2	40.4	39.8	42.8	34.5	29.3
10	10	20.2	82.0	44.7	42.1	41.5	42.7	34.9	30.6
11	10	19.2	61.7	40.0	39.8	39.6	41.9	34.0	29.7
12	10	22.1	69.5	40.8	40.4	40.2	42.2	34.8	30.4
13	10	20.4	65.4	40.7	40.5	40.4	42.7	35.4	30.5
14	10	22.3	64.3	41.6	41.3	41.0	44.2	35.8	30.4
15	10	19.8	64.6	42.7	42.4	42.0	46.0	37.3	31.0
16	11	20.6	68.7	43.1	42.7	43.4	45.6	37.3	31.4
17	11	22.8	62.5	42.6	42.0	41.1	44.3	37.1	30.6
18	11	21.4	61.8	42.5	42.0	41.7	44.7	36.2	30.5
19	11	22.3	59.5	43.3	42.1	40.8	43.5	36.4	30.6
20	11	25.8	65.2	49.3	48.1	48.3	51.3	47.5	39.4
21	11	32.8	65.4	50.9	49.7	50.9	53.6	50.0	44.8
22	11	31.2	68.6	51.1	49.4	47.5	51.3	46.5	44.0
23	11	23.6	66.4	48.7	46.3	46.3	48.1	44.9	42.1

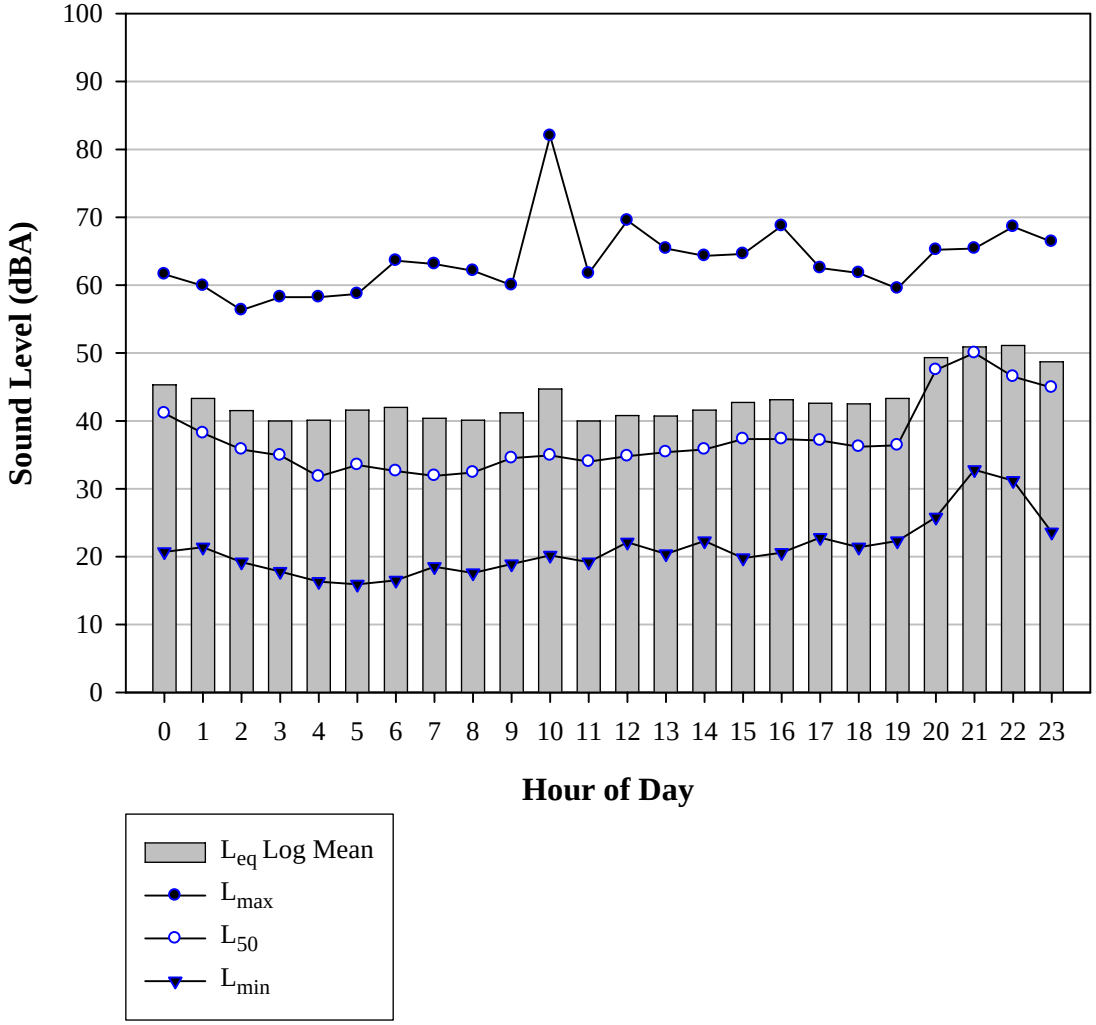

Figure I-21. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 6-16-2007 to 6-29-2007 (n=255).

Table I-32. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 12-06-2007 to 12-17-2007 (n=262).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	15.8	67.0	44.9	32.8	34.0	37.1	26.7	20.3
1	11	15.8	70.6	47.2	33.6	31.3	33.6	26.9	20.9
2	11	15.9	72.5	50.5	30.7	23.7	24.3	19.0	17.1
3	11	15.8	72.1	49.9	30.1	27.8	22.8	18.7	17.2
4	11	15.8	76.4	50.0	28.5	24.0	25.9	21.7	17.6
5	11	15.9	74.1	52.0	32.5	29.8	29.4	25.1	20.6
6	11	15.9	70.6	49.0	39.4	37.1	38.5	27.3	23.1
7	11	16.0	73.0	48.0	42.4	40.7	40.8	32.8	28.1
8	10	16.1	76.1	50.7	40.3	39.0	41.1	31.9	25.8
9	10	16.4	74.0	47.9	41.2	39.8	41.9	32.3	26.9
10	11	16.4	74.4	44.9	40.0	38.7	40.7	32.7	26.8
11	11	16.9	75.7	46.6	40.0	38.5	40.0	31.4	25.6
12	11	18.9	79.7	51.5	40.7	38.8	40.3	31.1	26.6
13	11	16.7	79.4	52.6	40.9	39.6	39.8	32.3	26.4
14	11	16.7	77.9	51.6	41.4	38.8	41.4	32.6	26.6
15	11	16.7	76.0	51.4	41.1	38.7	40.9	31.4	27.3
16	11	16.6	74.9	52.0	41.8	39.5	41.3	32.8	26.9
17	11	16.7	73.6	51.5	41.8	38.6	40.6	32.6	27.2
18	11	15.9	72.1	49.5	39.0	35.7	38.3	27.5	22.4
19	11	15.9	76.1	47.7	38.1	33.1	34.6	24.8	19.3
20	11	16.0	68.1	45.9	34.5	28.2	30.9	22.9	19.5
21	11	15.9	68.8	43.6	32.7	28.5	32.9	22.8	19.0
22	11	15.7	67.9	42.4	31.8	28.0	30.7	24.1	20.2
23	11	15.8	65.7	42.4	31.2	27.2	28.2	20.3	17.2

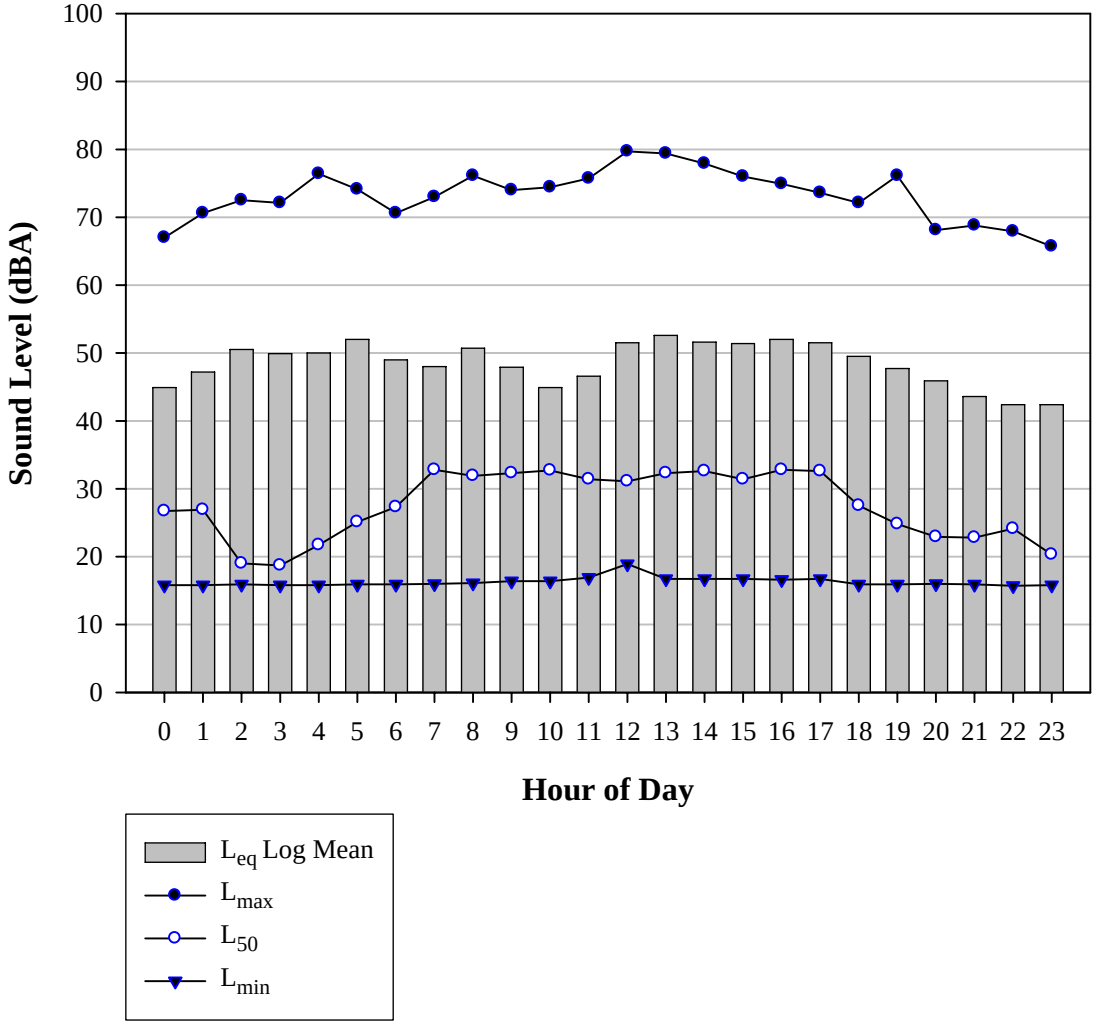

Figure I-22. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 12-06-2007 to 12-17-2007 (n=262).

Table I-33. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 6-16-2007 to 6-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	123	17.6	82.0	41.9	40.6	43.5	35.4	30.2
12.5	123	18.9	84.7	50.7	49.6	50.6	40.3	34.4
15.8	123	18.7	80.4	48.4	47.0	47.9	39.4	34.0
20	123	16.7	80.2	46.5	45.6	47.4	40.0	34.0
25	123	20.8	85.9	45.8	45.2	46.9	40.3	35.5
31.5	123	22.1	86.3	46.3	45.4	48.9	40.9	36.1
40	123	20.8	81.6	54.1	53.7	50.3	41.1	36.4
50	123	21.2	81.2	49.0	48.0	47.4	39.8	35.5
63	123	21.4	84.9	54.5	55.0	50.6	40.8	35.8
80	123	22.3	78.2	54.8	55.3	54.8	44.0	36.3
100	123	18.7	84.9	48.2	47.9	47.4	37.5	32.7
125	123	17.5	81.7	45.9	41.7	44.5	34.8	29.7
160	123	13.2	80.8	41.2	40.4	41.1	32.3	26.7
200	123	10.3	81.1	38.4	37.8	37.7	29.9	24.1
250	123	8.7	76.8	35.0	34.2	34.8	28.0	23.3
315	123	7.9	81.6	34.2	32.3	34.2	27.4	22.9
400	123	7.6	78.7	32.3	30.6	33.5	26.5	22.1
500	123	7.2	79.1	32.1	30.0	33.3	26.4	21.7
630	123	6.7	77.1	32.0	30.1	33.0	25.7	20.7
800	123	6.9	74.7	32.1	30.4	33.0	25.1	20.3
1000	123	7.1	72.0	31.9	30.0	32.6	24.2	18.2
1250	123	7.7	69.0	30.7	28.5	31.0	21.8	15.4
1600	123	8.4	64.1	28.9	26.3	29.1	19.3	12.7
2000	123	9.2	61.8	26.9	24.3	26.6	16.8	11.5
2500	123	10.2	59.2	24.7	22.5	24.0	14.7	11.5
3150	123	11.2	57.0	22.6	20.4	21.1	13.7	12.1
4000	123	12.2	57.3	20.8	18.8	19.3	13.7	13.0
5000	123	13.4	60.7	21.8	18.5	18.0	14.3	14.0
6300	123	14.4	60.1	21.7	18.0	17.2	15.3	15.1
8000	123	15.7	58.1	21.1	17.8	17.2	16.4	16.2
10000	123	16.9	58.6	18.4	17.8	17.8	17.5	17.3
12500	123	17.9	59.6	19.0	18.7	18.7	18.5	18.4
16000	123	18.9	66.6	20.1	19.5	19.6	19.4	19.3
20000	123	20.5	57.7	21.0	20.9	21.0	20.9	20.8

Table I-34. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 6-16-2007 to 6-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	15.9	68.6	46.6	42.3	45.2	40.7	36.8
12.5	132	13.7	88.0	58.3	54.0	57.0	44.9	37.8
15.8	132	13.7	85.6	56.1	51.1	52.9	42.8	37.1
20	132	13.6	82.2	53.5	48.3	49.6	41.2	36.5
25	132	16.8	79.3	50.6	46.0	48.0	40.3	36.2
31.5	132	11.7	78.1	47.9	45.2	48.1	40.1	35.5
40	132	7.5	77.5	50.0	46.2	46.4	39.3	34.8
50	132	11.9	78.5	46.1	44.1	44.6	37.5	33.7
63	132	15.7	79.4	51.1	43.1	45.2	38.4	33.5
80	132	11.0	79.0	51.1	41.5	43.3	38.1	33.4
100	132	8.7	76.9	44.3	40.8	41.9	34.8	31.0
125	132	11.0	77.5	42.5	38.7	40.4	33.3	29.9
160	132	7.4	66.6	38.0	37.0	38.5	31.5	28.5
200	132	5.8	61.9	36.2	35.1	36.3	30.0	26.8
250	132	4.7	58.3	34.4	33.1	33.9	28.8	25.6
315	132	5.3	59.1	34.0	31.5	33.8	28.8	25.2
400	132	4.6	55.9	34.2	31.3	34.2	29.1	25.6
500	132	5.3	54.7	35.3	32.2	35.4	30.4	26.7
630	132	5.4	55.7	36.3	33.2	36.2	31.2	27.6
800	132	5.8	55.8	37.2	33.6	36.7	31.9	28.3
1000	132	6.5	57.3	37.9	33.7	36.6	32.4	28.3
1250	132	7.2	58.7	37.6	33.2	35.9	32.1	27.4
1600	132	8.0	59.4	36.6	31.7	34.5	30.6	25.1
2000	132	9.0	59.7	35.2	30.0	32.6	29.0	22.6
2500	132	9.9	57.8	32.8	27.1	29.6	25.9	19.1
3150	132	11.0	56.5	30.1	23.8	26.5	22.4	15.9
4000	132	12.3	54.9	28.4	25.0	26.9	23.5	20.0
5000	132	13.4	53.3	26.0	21.9	24.2	20.5	16.8
6300	132	14.5	51.8	22.6	17.7	19.0	16.4	15.4
8000	132	15.7	52.8	22.5	19.6	20.2	16.9	16.4
10000	132	16.8	57.5	27.4	20.8	21.1	18.0	17.5
12500	132	17.9	61.8	39.1	26.8	26.9	19.6	18.6
16000	132	19.0	59.8	38.8	23.2	20.4	19.5	19.4
20000	132	20.5	60.8	31.9	21.9	21.3	21.0	20.8

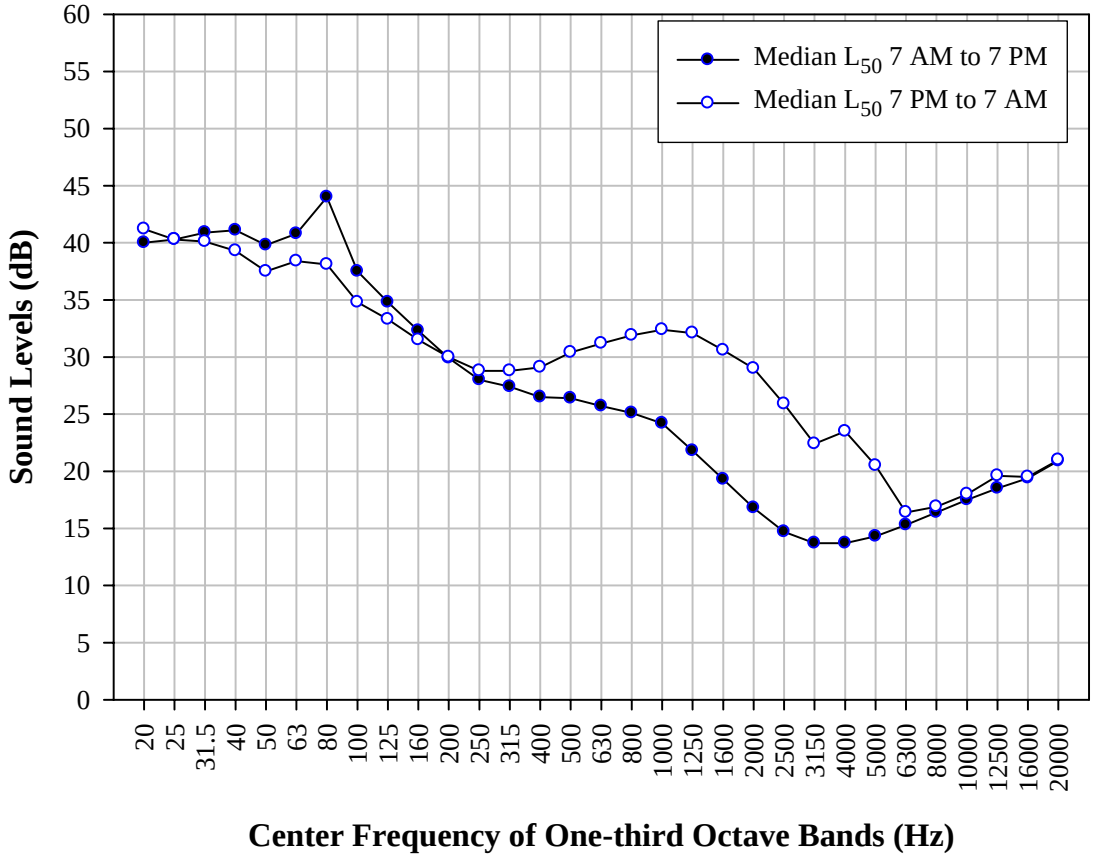

Figure I-23. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 6-16-2007 to 6-29-2007.

Table I-35. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	130	15.9	79.7	50.4	39.0	40.8	32.3	26.6
12.5	130	20.4	92.4	60.2	45.7	48.2	40.4	34.9
15.8	130	21.6	90.9	58.4	44.1	47.3	39.9	34.5
20	130	21.3	90.6	56.6	44.8	47.4	40.2	35.0
25	130	22.6	86.0	54.5	45.9	48.0	40.2	35.3
31.5	130	20.2	85.3	52.7	46.6	50.3	40.9	35.1
40	130	18.7	81.4	56.3	55.2	51.3	41.6	35.0
50	130	15.4	79.9	51.5	50.7	50.0	39.2	33.5
63	130	12.4	79.4	55.3	55.3	50.7	39.3	32.2
80	130	7.2	79.5	54.7	54.7	52.3	39.9	32.0
100	130	3.0	79.3	49.1	48.0	45.7	33.2	26.4
125	130	1.2	75.3	45.3	42.9	42.1	30.3	24.0
160	130	-0.2	75.2	41.0	35.6	38.6	27.9	19.7
200	130	-0.6	69.5	39.5	32.9	36.0	26.5	19.4
250	130	-0.2	67.6	39.1	32.8	34.5	26.4	20.6
315	130	-0.2	66.5	38.3	30.8	33.1	24.9	19.8
400	130	-0.5	65.7	37.7	29.5	31.6	23.7	18.9
500	130	-0.4	69.9	37.9	28.5	30.5	22.8	18.1
630	130	-0.5	69.2	38.7	26.8	29.5	22.1	16.9
800	130	-0.9	67.1	39.7	26.5	29.1	21.4	15.8
1000	130	-1.1	67.7	40.7	26.0	28.6	19.7	12.5
1250	130	-0.6	69.0	41.4	24.1	26.4	16.6	9.2
1600	130	0.0	70.3	41.3	22.0	24.5	13.3	6.1
2000	130	0.9	70.5	40.4	19.8	21.2	10.1	4.3
2500	130	1.6	69.9	38.8	17.5	19.3	8.0	3.8
3150	130	2.8	68.5	36.8	15.5	16.7	6.4	4.1
4000	130	3.8	67.5	34.7	13.8	13.9	6.1	4.7
5000	130	4.4	66.5	32.9	12.8	12.2	6.4	5.6
6300	130	3.2	64.8	30.7	12.3	11.4	7.0	6.5
8000	130	3.7	63.2	28.3	11.6	10.6	7.7	7.3
10000	130	4.4	61.0	25.8	10.8	10.0	8.2	7.9
12500	130	5.3	58.7	23.1	10.3	9.9	8.4	8.1
16000	130	6.5	55.3	19.6	9.5	9.3	8.1	7.9
20000	130	7.2	53.7	14.9	9.1	9.1	8.6	8.4

Table I-36. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	15.7	76.4	48.2	30.7	32.6	24.0	18.9
12.5	132	14.5	93.5	58.3	43.2	45.8	35.9	30.3
15.8	132	15.0	86.9	56.2	40.6	43.0	34.2	30.0
20	132	18.5	87.3	54.1	39.2	41.2	33.7	29.8
25	132	14.5	84.7	51.7	38.8	39.9	33.1	28.9
31.5	132	14.9	86.1	48.8	36.7	38.7	32.6	27.6
40	132	10.7	83.2	48.4	35.4	38.3	31.6	26.0
50	132	10.0	81.3	45.2	34.6	37.1	30.2	24.3
63	132	7.3	80.0	46.7	32.8	35.4	28.6	23.2
80	132	2.9	78.3	44.7	30.9	32.7	25.9	19.8
100	132	-0.4	78.1	40.5	29.6	31.3	23.0	16.5
125	132	0.3	74.0	38.4	30.3	31.4	21.4	16.1
160	132	-1.9	67.4	35.9	29.4	31.3	18.4	11.4
200	132	-1.9	65.6	35.0	26.6	29.4	18.1	12.2
250	132	-2.1	65.4	35.7	27.6	28.2	19.6	13.0
315	132	-1.6	68.3	35.3	25.9	27.1	18.5	11.9
400	132	-1.7	65.8	35.5	24.4	25.0	16.9	10.9
500	132	-1.3	62.5	35.8	22.4	23.9	16.5	9.3
630	132	-1.4	62.6	36.8	20.5	22.9	15.3	8.2
800	132	-1.6	62.9	37.9	19.5	21.1	13.3	5.4
1000	132	-1.3	64.8	38.9	17.7	18.6	11.1	3.1
1250	132	-0.7	65.6	39.4	14.7	15.1	7.4	1.7
1600	132	-0.1	66.7	39.3	13.4	11.6	4.6	1.4
2000	132	0.8	67.2	38.4	11.6	8.6	3.3	1.9
2500	132	1.7	66.1	36.8	9.5	6.6	3.5	2.7
3150	132	1.3	64.7	34.7	8.2	6.5	4.0	3.5
4000	132	1.9	63.3	32.4	7.6	6.8	4.8	4.4
5000	132	2.4	62.0	30.2	7.7	7.3	5.7	5.4
6300	132	2.9	60.2	27.7	8.2	7.7	6.6	6.4
8000	132	3.7	58.4	24.9	8.6	8.6	7.4	7.2
10000	132	4.7	56.1	22.1	8.9	8.9	8.0	7.8
12500	132	5.7	53.3	18.8	8.9	9.0	8.2	8.0
16000	132	6.5	48.6	15.2	8.4	8.6	7.9	7.8
20000	132	7.2	42.0	11.4	8.6	8.7	8.5	8.4

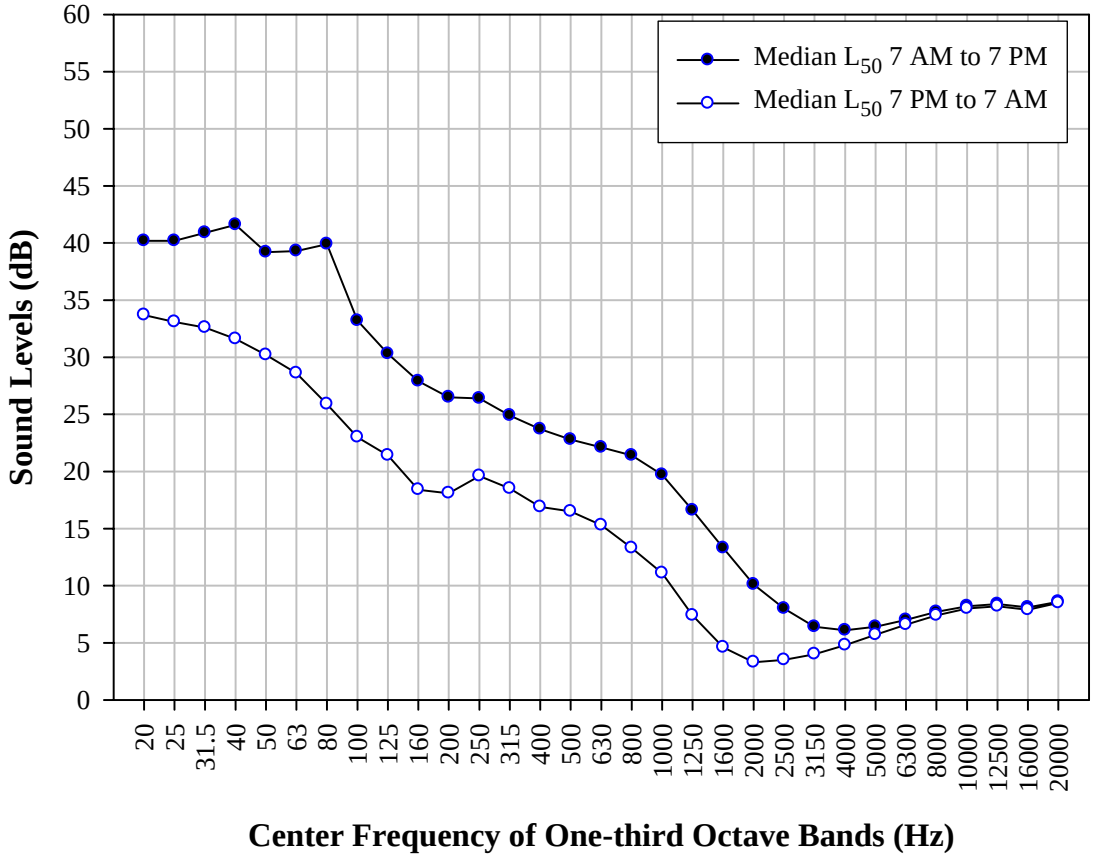

Figure I-24. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), 12-06-2007 to 12-17-2007.

Table I-37. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 6-17-2007 to 6-29-2007 (n=234).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	21.8	66.9	41.2	40.8	41.1	40.5	36.2	32.2
1	11	17.7	67.2	39.7	38.6	38.5	39.8	34.9	29.3
2	11	17.5	70.4	36.9	34.3	33.7	34.2	29.2	24.4
3	11	17.5	63.8	37.5	36.8	37.2	35.2	30.3	27.6
4	11	18.2	77.7	47.9	47.7	47.9	49.9	37.8	30.9
5	10	19.5	74.1	50.8	50.7	51.1	54.5	44.3	35.2
6	10	21.9	78.3	50.0	49.6	49.3	53.2	42.0	33.9
7	10	23.5	77.9	52.3	52.2	52.0	55.3	46.3	36.0
8	9	26.4	79.1	54.9	54.8	54.5	57.2	49.9	42.3
9	9	33.7	95.4	56.6	56.0	55.3	57.7	51.6	45.1
10	9	34.4	79.4	56.8	56.7	56.8	58.7	52.4	47.7
11	8	38.0	78.6	57.1	56.8	57.1	58.5	52.1	47.7
12	9	37.3	91.5	56.4	56.1	56.2	57.6	52.3	48.0
13	9	37.1	80.0	57.1	57.0	56.8	59.2	53.2	48.7
14	9	36.7	79.0	56.3	56.2	56.0	58.2	53.1	48.4
15	9	37.7	82.1	56.2	56.0	55.5	57.9	52.6	48.5
16	9	35.8	78.1	56.2	56.0	56.0	58.3	52.8	47.8
17	9	36.7	82.1	55.6	55.2	54.6	57.4	51.9	46.4
18	9	37.2	83.6	55.1	55.0	55.1	57.3	51.9	46.2
19	9	33.6	77.6	54.2	54.1	54.2	56.8	50.6	44.4
20	9	34.8	76.7	54.0	53.9	53.9	56.5	50.5	43.4
21	11	30.3	79.2	50.0	49.8	49.4	52.4	44.5	40.9
22	11	29.9	72.5	46.4	46.1	45.8	47.1	41.7	38.6
23	11	27.7	66.5	43.4	42.9	42.7	42.5	38.2	35.6

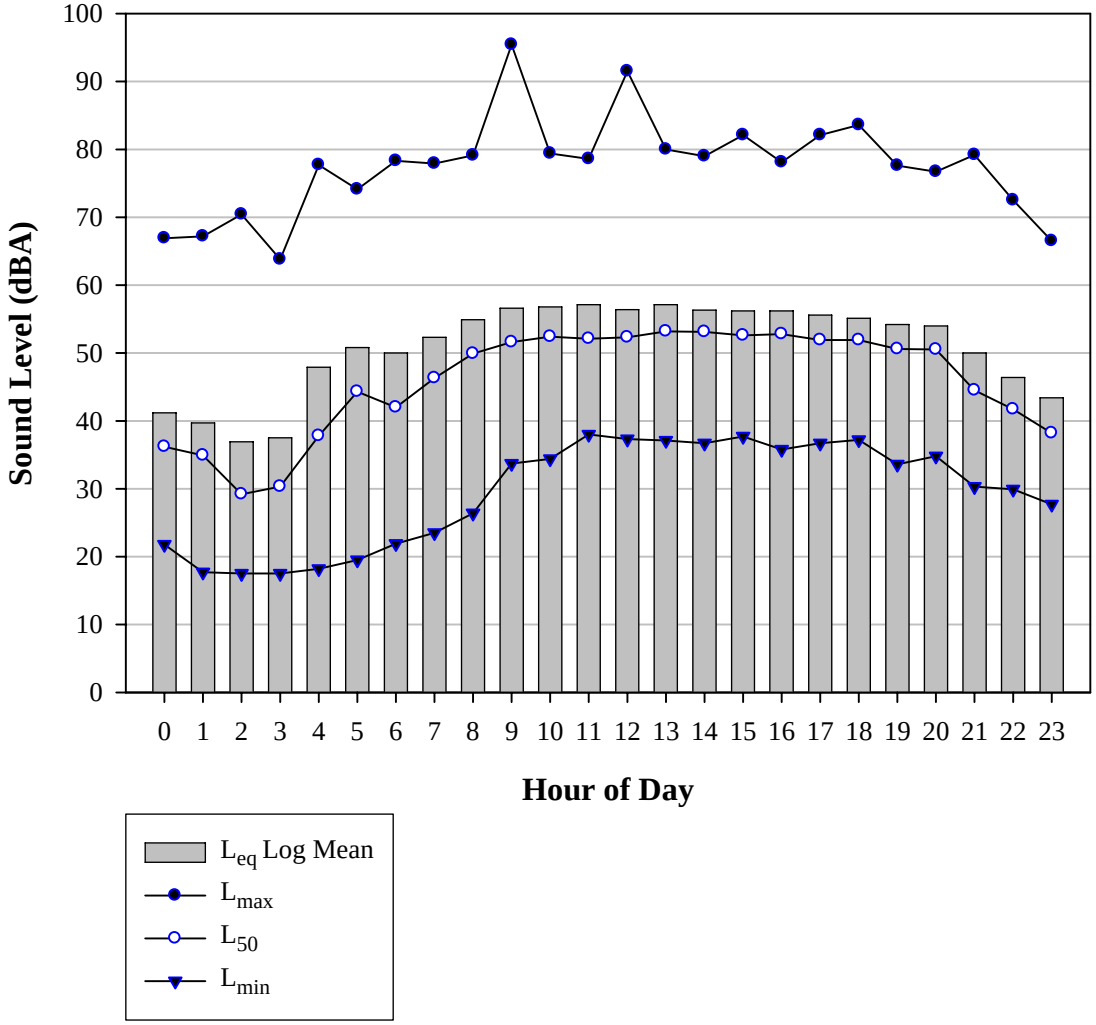

Figure I-25. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 6-17-2007 to 6-29-2007 (n=234).

Table I-38. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 12-13-2007 to 12-24-2007 (n=265).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	17.1	67.0	43.7	41.4	41.4	40.9	29.9	23.4
1	11	16.4	64.7	42.0	38.2	39.4	37.0	28.1	22.8
2	11	16.3	66.7	38.3	34.9	36.7	32.9	21.2	19.2
3	11	16.7	73.4	38.4	35.4	36.8	36.9	29.9	25.4
4	11	16.5	63.6	39.6	36.1	36.8	38.5	30.2	24.1
5	11	16.5	71.7	44.6	41.8	42.3	43.3	34.7	26.3
6	11	17.7	89.7	54.8	50.6	48.8	49.5	41.9	34.4
7	11	27.6	87.4	57.6	56.4	56.1	57.5	50.6	43.1
8	11	30.9	78.7	55.4	55.2	55.4	58.3	51.2	43.0
9	11	25.8	84.4	56.3	55.7	55.6	58.6	50.9	43.2
10	11	31.8	81.8	57.5	57.2	57.6	60.1	52.9	46.4
11	11	33.6	86.0	57.9	57.7	57.9	60.5	54.2	47.6
12	11	35.4	79.0	57.2	57.0	57.2	59.7	53.2	47.7
13	11	36.3	89.8	57.9	57.6	57.4	60.1	53.5	47.0
14	11	35.8	84.0	57.7	57.4	57.6	60.0	54.1	48.4
15	11	36.1	83.1	57.2	57.0	57.0	60.0	54.2	49.1
16	11	37.4	80.8	57.7	57.5	57.4	59.7	54.6	48.3
17	11	33.1	80.9	57.2	57.0	57.1	59.4	53.5	48.5
18	12	21.8	75.5	51.5	50.7	50.1	53.9	43.6	35.5
19	11	17.7	76.7	48.7	47.5	47.5	49.3	40.2	30.5
20	11	18.2	71.1	46.8	45.8	46.6	46.5	33.9	25.2
21	11	17.4	68.6	47.9	44.1	43.0	44.8	32.4	27.0
22	11	17.1	74.9	47.3	43.4	43.1	44.7	34.2	25.8
23	11	16.8	65.8	44.6	40.8	42.2	42.5	30.7	21.4

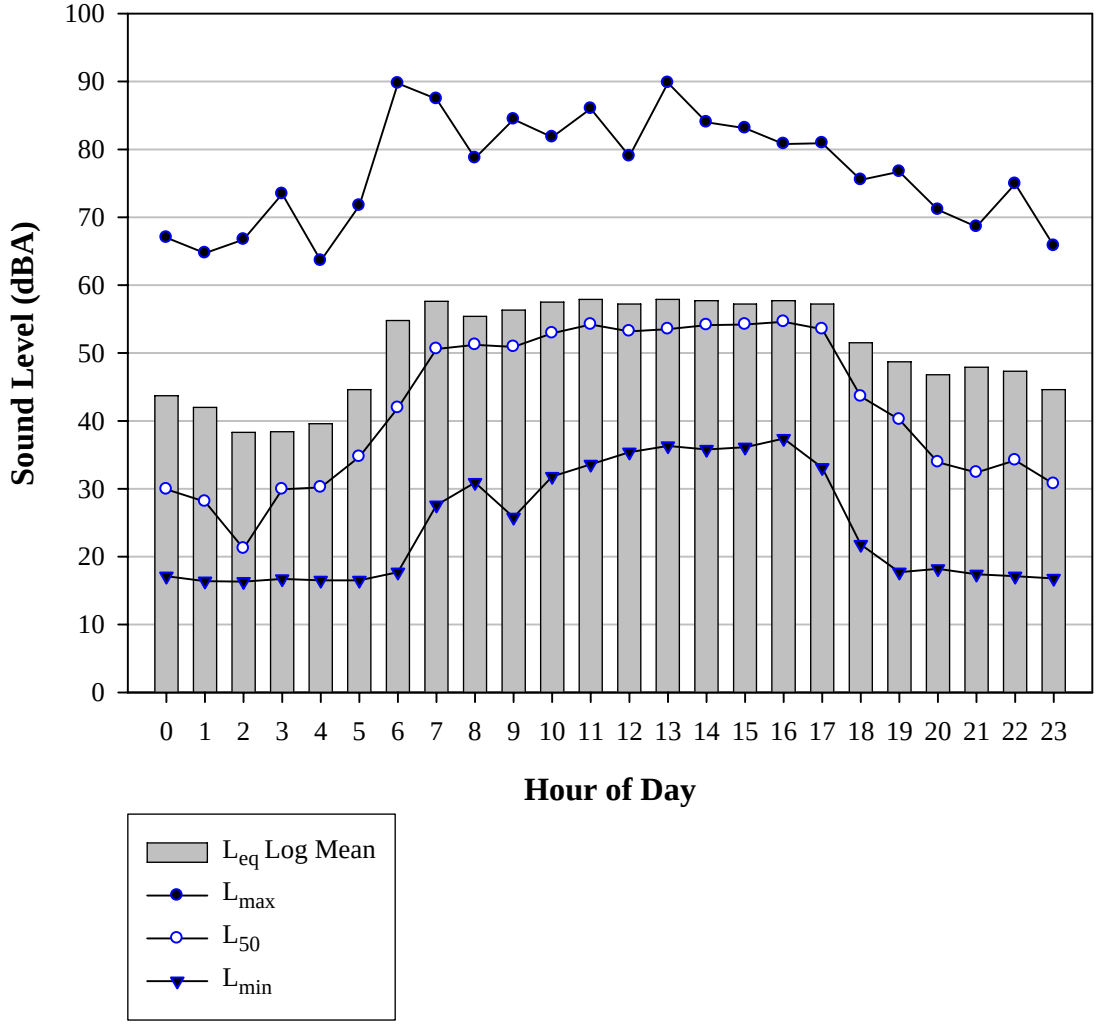

Figure I-26. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 12-13-2007 to 12-24-2007 (n=265).

Table I-39. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 6-17-2007 to 6-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	108	23.5	95.4	56.0	55.6	57.9	52.3	47.0
12.5	108	24.2	96.3	59.8	58.5	59.8	49.2	42.5
15.8	108	26.6	98.7	60.2	59.6	60.5	49.4	43.0
20	108	32.6	94.1	61.0	60.8	61.5	51.0	45.0
25	108	31.3	95.1	62.6	62.5	65.4	56.2	48.8
31.5	108	28.4	93.1	62.8	62.2	65.1	58.0	51.6
40	108	29.2	91.6	63.4	63.0	66.2	59.1	52.8
50	108	25.6	92.0	60.7	60.4	63.1	55.1	50.3
63	108	25.9	93.8	60.3	59.3	61.0	51.9	45.5
80	108	25.0	93.2	60.2	59.4	60.4	52.3	46.6
100	108	20.7	90.5	59.6	58.4	59.2	51.3	45.3
125	108	20.8	88.1	56.9	55.8	56.4	48.7	42.8
160	108	17.0	87.7	55.0	53.8	54.8	47.7	41.5
200	108	14.5	84.2	51.4	50.7	52.0	45.2	39.6
250	108	14.9	81.0	48.9	48.4	50.1	44.3	39.0
315	108	13.8	79.6	47.9	47.7	49.8	43.6	38.4
400	108	13.2	78.5	47.2	47.0	49.4	43.3	38.2
500	108	12.8	82.6	46.9	47.0	49.2	43.4	38.3
630	108	12.0	76.6	46.1	46.2	48.5	43.1	38.3
800	108	12.4	83.1	46.7	46.6	49.1	43.5	38.4
1000	108	12.0	92.1	46.9	46.3	48.9	43.5	38.0
1250	108	10.9	89.5	46.0	45.4	47.8	42.0	36.4
1600	108	10.8	81.7	44.2	43.7	46.1	40.2	34.5
2000	108	10.6	89.5	42.8	41.8	43.9	38.1	32.1
2500	108	10.6	78.2	41.2	40.6	42.5	36.0	29.7
3150	108	11.5	75.1	39.7	38.8	40.4	33.8	27.0
4000	108	12.2	81.4	37.1	35.9	37.7	31.0	24.2
5000	108	13.2	73.0	35.0	34.0	35.3	28.1	21.2
6300	108	14.3	79.3	35.0	32.9	32.8	25.7	19.2
8000	108	15.5	79.2	34.5	32.0	30.8	23.6	18.4
10000	108	16.6	72.7	33.3	31.0	28.8	21.9	18.2
12500	108	17.6	80.8	44.0	42.1	27.5	20.9	18.5
16000	108	18.6	81.2	36.5	32.1	24.0	20.2	19.2
20000	108	20.2	74.2	32.6	29.1	21.8	20.8	20.7

Table I-40. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 6-17-2007 to 6-29-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	126	17.5	79.2	48.9	46.3	47.9	40.1	34.0
12.5	126	16.9	89.0	50.4	47.2	46.1	39.1	34.4
15.8	126	23.4	93.8	51.4	47.2	45.4	38.6	34.8
20	126	31.1	92.0	52.8	47.5	46.4	41.9	39.4
25	126	28.4	86.6	53.5	48.0	49.2	41.3	37.6
31.5	126	15.0	84.7	53.4	49.4	53.8	42.3	34.9
40	126	12.6	83.3	53.5	47.9	50.7	39.0	32.7
50	126	7.5	83.9	51.4	47.0	45.4	36.4	29.4
63	126	10.1	86.3	51.3	49.3	50.4	37.5	29.7
80	126	9.9	90.4	51.5	47.6	49.2	38.0	29.6
100	126	9.2	91.1	51.1	46.1	45.6	34.3	28.8
125	126	11.7	85.4	48.4	43.3	42.8	33.3	28.8
160	126	12.2	83.0	46.0	40.3	40.7	32.7	27.8
200	126	10.4	82.3	42.5	38.2	38.6	30.9	26.2
250	126	9.0	78.6	40.7	35.9	37.4	30.3	25.7
315	126	7.2	75.9	39.7	36.1	37.0	30.4	25.9
400	126	5.3	74.7	39.3	36.1	36.5	30.7	26.3
500	126	5.7	70.7	39.5	36.9	37.8	31.8	27.2
630	126	5.7	70.1	39.8	37.2	38.8	32.3	27.3
800	126	5.4	70.6	41.0	39.0	40.2	32.6	26.3
1000	126	6.2	73.1	40.8	38.7	39.8	31.5	24.5
1250	126	7.9	71.4	39.3	37.4	38.8	30.2	22.5
1600	126	8.3	72.3	37.8	35.3	37.0	27.7	20.3
2000	126	8.7	67.4	35.3	32.6	34.4	25.0	18.0
2500	126	9.5	74.0	33.5	30.2	31.9	22.2	15.9
3150	126	10.9	71.9	31.8	27.1	28.9	19.7	14.7
4000	126	12.2	65.7	29.3	24.3	26.0	19.5	15.7
5000	126	13.2	68.3	27.0	21.5	22.4	16.8	14.9
6300	126	14.2	73.0	25.7	19.9	20.5	16.5	15.2
8000	126	15.4	77.4	28.2	19.2	19.6	16.8	16.1
10000	126	16.6	73.2	24.4	19.5	19.2	17.4	17.0
12500	126	17.5	75.2	30.7	21.7	19.1	18.2	17.9
16000	126	18.5	75.3	27.3	20.9	19.3	19.0	18.8
20000	126	20.2	70.6	26.1	21.4	20.7	20.6	20.5

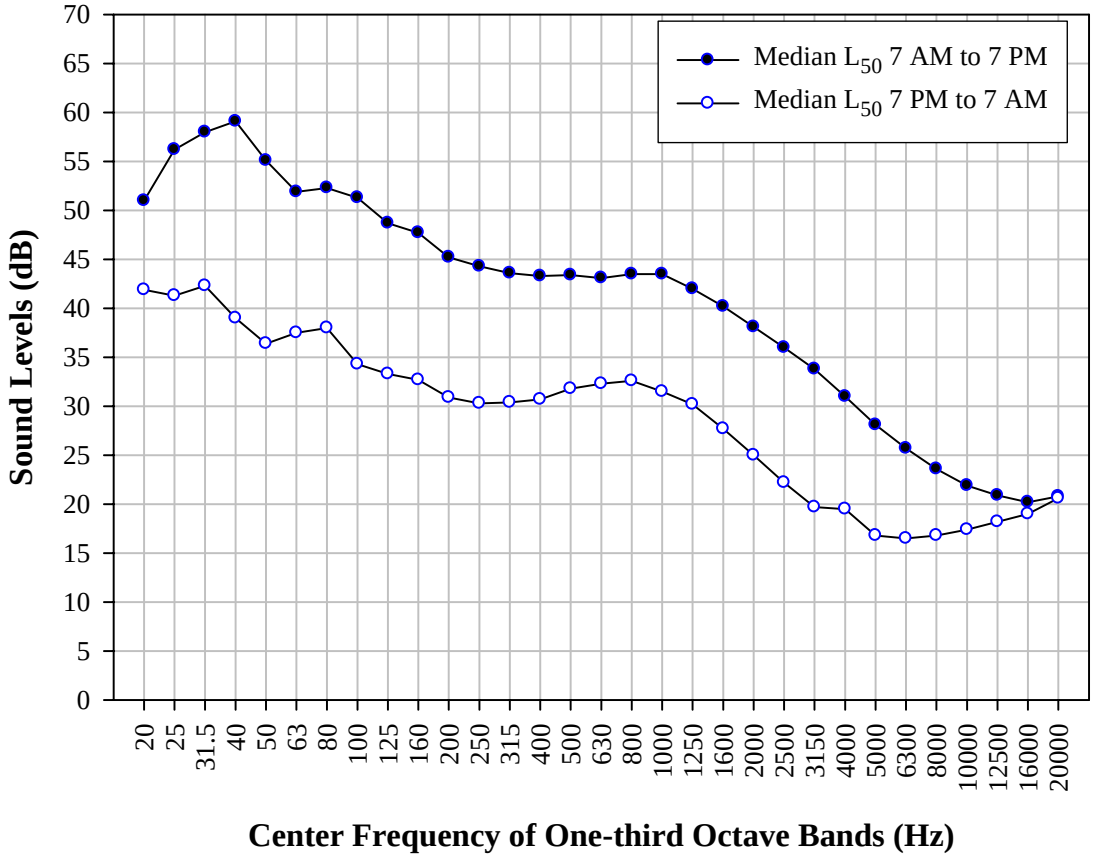

Figure I-27. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 6-17-2007 to 6-29-2007.

Table I-41. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 12-13-2007 to 12-24-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	133	21.8	89.8	57.0	56.7	59.3	52.9	46.2
20	133	33.7	87.4	63.5	62.2	64.7	55.5	48.5
25	133	34.4	86.4	63.9	63.5	67.0	58.4	49.9
31.5	133	32.8	84.1	62.4	61.9	65.4	58.3	51.4
40	133	32.4	91.0	62.0	61.8	65.5	57.9	51.4
50	133	28.0	85.9	58.5	58.2	61.5	54.0	47.2
63	133	25.4	87.4	57.4	57.2	60.4	52.5	45.7
80	133	24.0	90.4	57.9	57.0	60.0	52.6	46.7
100	133	19.9	90.5	56.3	55.3	57.6	50.4	43.6
125	133	17.6	88.8	54.8	53.5	56.0	48.7	41.5
160	133	14.5	85.9	51.8	50.7	53.2	45.9	39.3
200	133	15.1	83.6	49.1	48.2	51.0	44.3	37.9
250	133	16.5	82.1	47.6	47.1	49.8	43.6	37.6
315	133	16.1	83.5	46.7	46.2	48.9	42.6	36.9
400	133	13.3	81.3	47.3	46.8	49.4	43.1	36.8
500	133	11.8	84.7	48.0	47.6	50.0	43.7	37.1
630	133	11.0	79.4	47.1	46.8	49.9	43.4	37.0
800	133	7.3	79.8	48.4	48.0	51.1	44.3	37.5
1000	133	3.7	79.9	48.4	48.0	51.2	44.4	36.7
1250	133	1.3	81.3	47.5	47.2	50.0	43.4	35.7
1600	133	1.3	80.2	46.8	46.2	49.0	41.8	34.4
2000	133	2.0	84.6	44.9	44.1	46.7	39.3	31.5
2500	133	2.8	79.1	43.1	42.1	44.4	37.1	29.0
3150	133	3.4	82.5	41.5	39.8	41.8	34.8	26.4
4000	133	4.0	71.3	38.2	37.0	39.1	32.2	23.4
5000	133	4.7	74.8	36.5	35.1	37.0	29.8	21.5
6300	133	5.3	69.4	35.1	33.6	35.2	27.9	19.5
8000	133	6.0	75.7	34.5	32.1	33.9	26.2	18.0
10000	133	6.9	79.3	37.8	33.8	32.5	24.7	16.9
12500	133	6.7	80.4	43.3	35.8	31.3	23.0	14.9
16000	133	4.4	78.3	38.5	30.7	25.9	17.3	9.9
20000	133	1.9	69.6	28.6	23.7	18.6	9.7	4.3

Table I-42. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 12-13-2007 to 12-24-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	16.3	89.7	47.4	42.3	42.9	32.5	26.3
20	132	30.4	85.2	61.6	49.7	51.7	46.6	43.9
25	132	30.5	84.0	60.0	50.2	52.4	45.8	43.0
31.5	132	25.3	83.0	57.8	47.7	50.4	41.3	35.5
40	132	21.3	82.9	56.4	47.6	49.9	39.5	33.7
50	132	18.6	80.9	52.6	45.2	46.5	37.2	31.2
63	132	15.9	87.9	50.5	43.4	44.9	36.4	29.1
80	132	15.0	90.0	50.5	42.9	44.9	34.7	26.8
100	132	11.8	92.7	49.5	42.1	42.8	32.3	24.6
125	132	8.1	93.1	46.6	39.8	40.7	30.8	23.0
160	132	6.1	83.5	43.3	37.1	38.1	28.2	21.3
200	132	5.7	78.8	40.2	34.6	37.0	27.0	21.1
250	132	7.1	77.4	38.5	34.4	36.0	27.0	22.1
315	132	6.7	82.6	38.4	33.4	35.0	26.5	21.0
400	132	4.8	80.9	38.1	33.2	34.4	25.5	19.6
500	132	3.6	79.0	38.0	33.6	34.4	25.0	18.1
630	132	0.6	78.9	38.3	33.6	34.8	23.6	16.8
800	132	0.0	83.0	39.5	34.5	34.8	22.9	15.4
1000	132	-0.4	83.5	39.2	33.7	33.5	21.3	12.6
1250	132	0.1	80.4	38.1	32.8	31.9	19.6	10.4
1600	132	0.8	79.4	36.5	31.3	29.8	17.3	7.2
2000	132	1.5	75.4	34.1	28.7	26.7	14.8	4.5
2500	132	2.3	75.0	32.7	25.5	23.7	12.2	3.9
3150	132	3.0	72.5	31.0	22.2	20.1	10.0	4.1
4000	132	3.7	70.2	27.6	19.3	16.5	7.8	4.5
5000	132	4.4	66.0	24.7	17.6	14.0	6.8	5.1
6300	132	5.1	62.2	22.8	15.9	12.7	6.6	5.6
8000	132	5.9	58.1	20.9	14.5	12.0	6.9	6.4
10000	132	6.7	71.6	22.1	14.0	11.3	7.6	7.2
12500	132	6.1	57.1	18.7	12.5	10.3	7.4	7.0
16000	132	3.7	62.3	16.2	9.6	7.7	5.2	5.0
20000	132	1.2	64.0	14.9	6.1	4.8	2.6	2.3

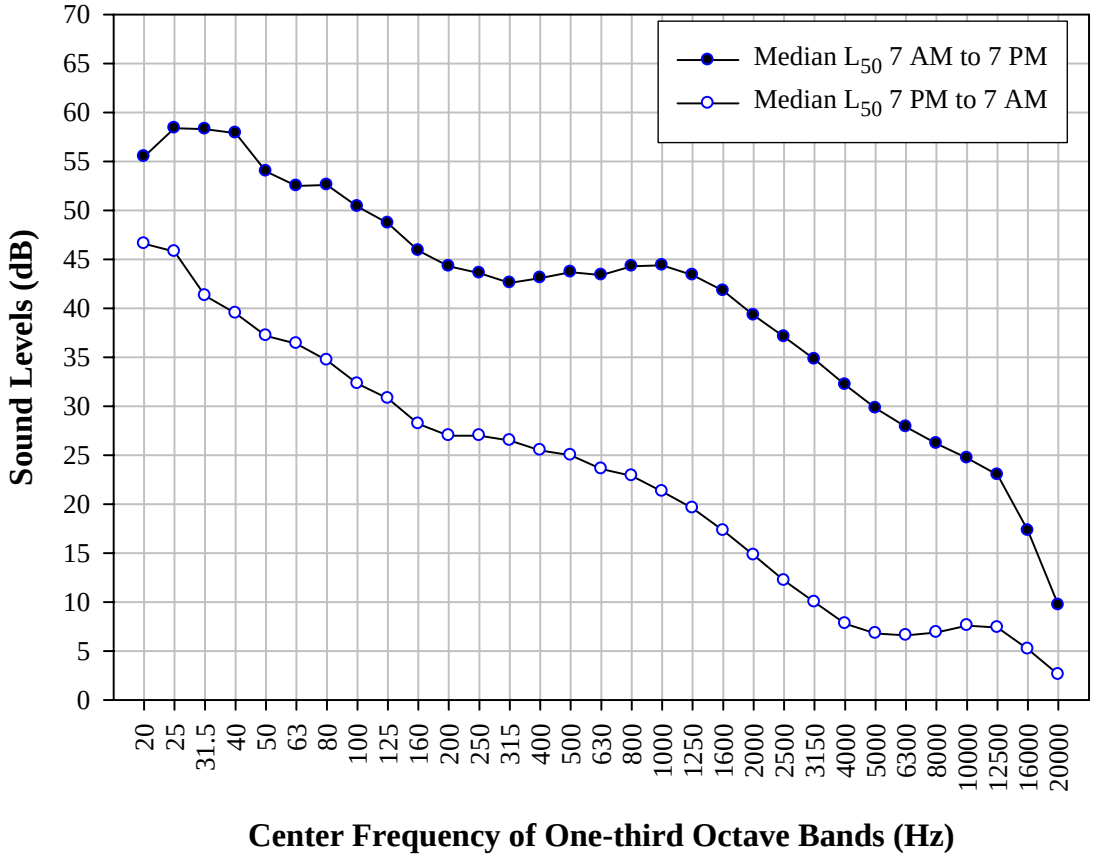

Figure I-28. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), 12-13-2007 to 12-24-2007.

Table I-43. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 6-21-2007 to 7-06-2007 (n=313).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	12	16.5	68.1	37.3	36.5	35.5	32.7	27.7	24.8
1	12	16.3	59.9	36.9	29.5	28.8	28.3	25.5	23.2
2	12	16.2	59.0	31.6	27.8	27.2	27.7	24.2	22.0
3	12	16.2	65.9	34.0	31.7	32.9	28.7	26.0	22.0
4	12	16.3	71.7	41.1	40.1	39.8	32.9	24.2	21.5
5	12	16.7	64.7	42.8	42.6	43.2	39.1	26.0	22.3
6	12	17.6	74.4	46.8	46.1	46.5	47.4	27.4	23.4
7	12	18.1	73.1	47.4	46.9	47.3	49.7	30.9	25.2
8	13	19.2	75.2	48.8	48.4	48.9	52.7	37.4	31.4
9	14	19.7	76.4	49.6	48.5	49.8	53.6	38.7	30.7
10	13	21.4	72.9	50.4	50.4	50.1	54.4	41.7	33.6
11	14	21.4	72.8	50.5	50.4	50.7	54.6	41.5	32.5
12	14	21.8	75.5	51.0	50.9	51.1	55.2	42.8	32.4
13	14	21.7	78.0	51.2	51.0	50.7	55.1	42.7	33.9
14	14	21.2	72.2	51.2	51.1	51.2	55.1	43.4	35.8
15	14	19.8	77.2	51.2	51.1	51.0	55.3	44.2	36.2
16	14	19.2	72.9	51.1	51.0	51.0	55.1	42.8	34.5
17	14	20.1	68.7	50.1	50.1	50.1	54.7	41.5	32.9
18	14	20.8	71.7	49.8	49.7	49.4	54.3	40.8	31.8
19	14	18.7	76.1	49.0	49.0	49.0	53.6	37.6	27.8
20	13	19.5	69.5	48.9	48.9	48.8	53.9	38.1	30.0
21	13	19.5	73.7	43.5	43.3	42.9	43.0	33.3	30.0
22	13	19.6	67.5	41.6	41.3	41.2	39.9	33.3	30.7
23	12	18.9	64.6	38.0	37.4	37.7	34.8	30.5	27.1

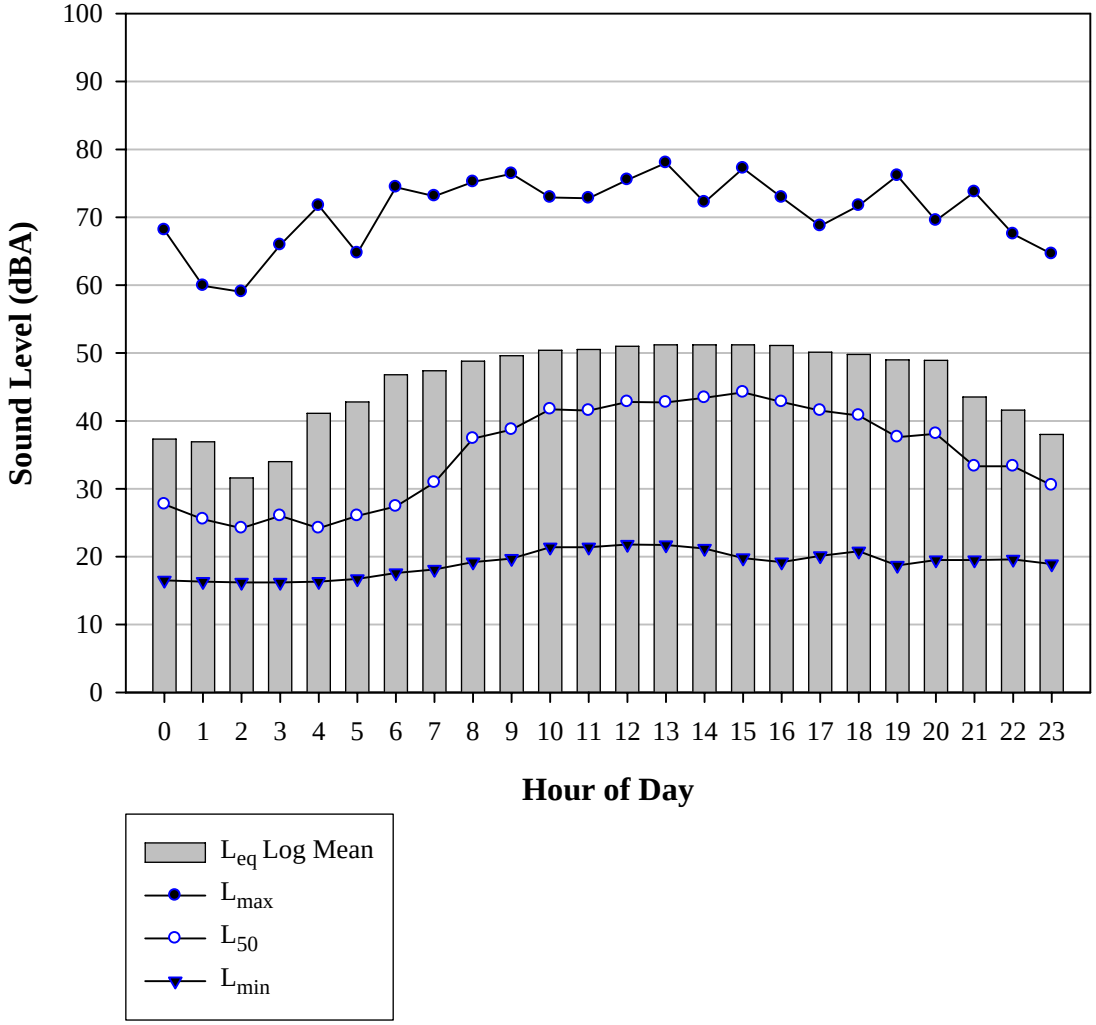

Figure I-29. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 6-21-2007 to 7-06-2007 (n=313).

Table I-44. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 12-06-2007 to 12-17-2007 (n=253).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	7	15.0	67.5	48.5	32.5	27.3	27.1	18.8	16.6
1	10	15.0	60.9	41.3	32.4	33.7	30.5	21.5	17.6
2	11	14.9	70.7	50.5	31.1	24.1	24.3	19.4	17.5
3	11	15.0	70.5	51.1	30.1	24.9	20.0	17.8	15.5
4	11	15.0	69.7	50.2	30.8	31.6	22.0	18.4	15.6
5	11	15.0	72.9	51.2	35.7	35.8	24.9	17.2	15.7
6	10	15.1	73.8	51.7	39.4	37.9	29.4	20.3	18.0
7	11	15.1	78.9	52.4	45.2	44.5	31.5	19.7	17.3
8	9	15.2	79.5	46.8	43.8	44.8	41.8	24.2	18.6
9	11	15.4	79.7	52.8	46.6	45.0	42.0	32.1	23.6
10	11	15.5	77.5	51.5	46.0	44.9	44.9	31.7	23.9
11	11	15.3	75.2	51.4	46.8	46.4	46.8	32.5	26.2
12	11	15.5	77.8	52.4	48.1	47.0	47.0	33.7	27.0
13	11	15.5	78.3	53.6	48.3	48.2	47.8	33.5	27.0
14	10	16.0	78.6	53.8	48.7	48.0	51.1	34.4	24.1
15	11	15.3	71.9	53.2	48.8	47.2	50.6	34.8	23.8
16	11	15.3	69.6	51.8	48.4	48.0	51.2	39.4	22.9
17	11	15.1	69.6	50.7	46.8	47.0	49.6	34.5	21.8
18	10	15.0	66.3	49.1	43.4	42.9	43.8	24.8	16.1
19	11	15.1	68.1	49.6	41.6	40.5	38.2	20.6	15.6
20	10	15.0	77.8	50.1	42.6	41.5	37.4	20.9	15.7
21	11	15.0	68.0	48.2	38.3	34.1	33.8	21.4	16.1
22	11	15.1	66.9	47.1	35.7	32.8	31.5	18.7	16.3
23	11	15.0	69.4	48.1	33.1	31.8	27.9	17.7	16.1

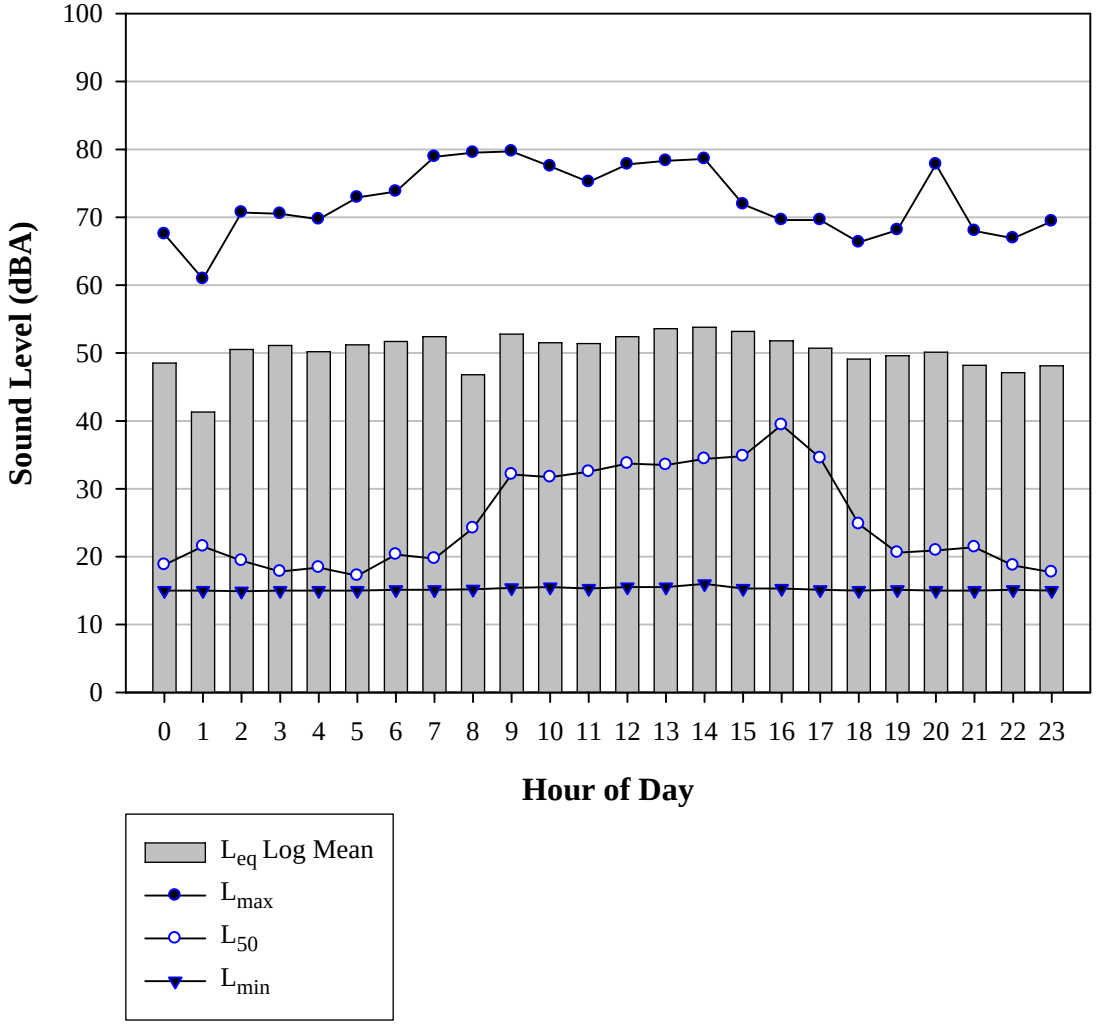

Figure I-30. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 12-06-2007 to 12-17-2007 (n=253).

Table I-45. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 6-21-2007 to 7-06-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	164	18.1	78.0	50.4	50.2	54.6	41.3	33.1
20	164	-15.4	81.5	45.2	44.5	46.6	37.3	31.8
25	164	-14.8	79.4	44.8	44.5	47.0	37.5	31.7
31.5	164	-13.7	80.7	45.7	45.4	47.9	37.8	31.4
40	164	-13.5	82.7	47.2	46.8	48.8	38.2	31.6
50	164	-11.9	86.7	48.6	47.8	49.6	37.6	30.7
63	164	-10.9	90.7	52.0	51.0	51.3	37.6	29.8
80	164	-9.9	87.3	53.6	52.7	51.2	36.5	27.6
100	164	-8.8	91.3	53.5	52.1	50.6	36.1	26.3
125	164	-7.8	86.5	50.0	49.3	47.4	33.7	23.7
160	164	-6.6	80.2	45.4	44.6	43.5	30.4	20.3
200	164	-5.6	76.9	42.8	42.0	41.0	28.8	21.3
250	164	-4.4	72.6	38.3	37.6	37.9	28.2	22.2
315	164	-3.3	74.7	37.9	36.8	37.3	29.7	24.1
400	164	-2.3	75.4	38.3	37.8	39.4	31.8	25.9
500	164	-1.0	70.3	39.5	39.4	41.9	33.1	26.7
630	164	0.0	69.7	41.6	41.5	44.8	34.1	26.8
800	164	1.0	68.2	43.4	43.4	47.8	35.0	26.2
1000	164	2.1	68.1	43.8	43.7	48.7	34.4	23.6
1250	164	3.1	68.4	42.0	41.8	46.8	31.9	19.2
1600	164	3.3	68.9	39.4	39.2	44.0	28.5	15.0
2000	164	1.8	66.1	35.7	35.3	40.1	23.5	10.9
2500	164	2.0	65.0	31.9	31.5	35.4	18.8	8.9
3150	164	2.3	65.9	28.7	28.0	31.2	15.2	8.4
4000	164	2.8	65.7	25.8	24.7	27.5	13.1	8.5
5000	164	3.7	62.5	22.8	21.5	23.9	11.6	8.9
6300	164	4.5	61.6	21.4	18.6	21.0	11.0	9.6
8000	164	5.3	61.6	21.7	16.2	17.9	11.0	10.3
10000	164	6.1	65.0	23.8	14.9	15.8	11.4	11.1
12500	164	7.1	64.4	24.7	14.0	14.6	12.2	11.9
16000	164	7.9	58.9	17.4	13.4	14.1	12.8	12.6
20000	164	7.5	55.8	14.2	12.7	13.0	12.4	12.3

Table I-46. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 6-21-2007 to 7-06-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	149	16.2	76.1	44.1	41.2	38.4	28.6	25.0
20	149	14.2	75.7	36.9	33.0	33.8	28.2	25.2
25	149	11.6	74.9	37.2	32.8	34.1	27.5	24.0
31.5	149	7.9	77.3	37.8	34.0	34.6	26.6	22.5
40	149	4.8	72.7	39.1	34.4	34.3	25.7	20.7
50	149	3.4	84.7	41.1	34.9	33.4	24.2	18.5
63	149	0.2	88.0	43.3	35.4	31.6	22.5	16.6
80	149	-0.2	84.1	43.5	35.1	29.0	19.9	14.1
100	149	1.1	84.1	43.7	35.7	29.3	17.9	12.7
125	149	-1.5	77.6	40.4	32.8	28.9	16.4	12.3
160	149	-1.6	81.3	36.5	29.5	27.0	15.9	12.5
200	149	-1.5	74.4	33.2	26.8	25.0	17.9	14.3
250	149	-1.7	67.8	30.1	26.8	26.4	21.1	16.9
315	149	-1.4	71.8	30.6	27.8	28.2	23.1	18.9
400	149	-1.7	67.9	32.2	29.8	30.1	24.5	20.3
500	149	-1.4	70.8	33.7	32.0	31.5	24.8	19.4
630	149	-1.2	69.9	35.7	33.4	31.8	23.3	17.3
800	149	-0.9	72.2	38.0	34.8	31.9	20.8	14.9
1000	149	-0.3	67.0	37.8	34.8	30.3	16.8	11.3
1250	149	0.6	68.6	35.8	32.3	28.5	12.9	7.9
1600	149	-0.3	67.7	32.9	29.6	24.1	9.4	5.8
2000	149	-0.1	66.6	28.9	25.4	19.5	8.4	5.6
2500	149	0.3	58.5	25.1	21.6	15.2	9.8	6.6
3150	149	1.1	58.1	21.7	17.3	10.5	7.3	6.8
4000	149	1.8	56.4	18.5	13.9	9.2	7.9	7.6
5000	149	2.5	56.7	16.0	11.7	9.1	8.6	7.7
6300	149	3.3	53.4	13.8	10.6	9.8	9.4	7.5
8000	149	4.0	52.4	12.8	10.7	10.5	9.2	8.0
10000	149	4.8	48.4	13.0	11.4	11.3	9.5	8.8
12500	149	5.4	49.4	14.3	12.0	12.0	10.0	9.5
16000	149	5.5	48.7	14.7	12.6	12.7	10.0	9.7
20000	149	3.7	45.9	11.7	12.3	11.9	8.5	8.3

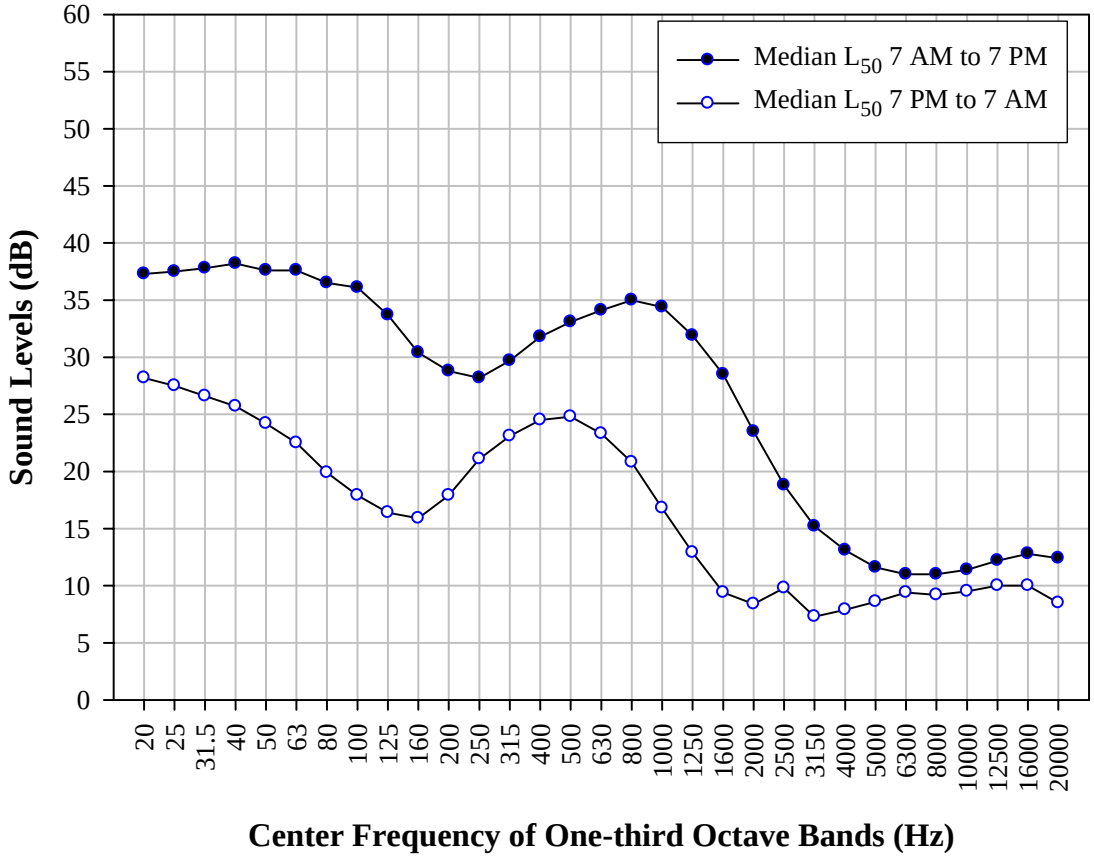

Figure I-31. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 6-21-2007 to 7-06-2007.

Table I-47. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	128	15.0	79.7	52.0	46.6	46.7	32.6	23.5
12.5	128	13.5	89.1	52.1	42.9	44.5	38.2	33.4
15.8	128	19.2	88.2	50.7	42.0	43.3	37.0	32.8
20	128	19.8	86.9	49.5	41.6	42.6	37.0	33.0
25	128	17.6	85.6	48.2	41.4	43.0	36.7	31.9
31.5	128	13.6	86.2	46.9	41.5	43.5	35.6	30.2
40	128	12.8	81.5	46.1	42.5	43.6	34.7	28.8
50	128	8.3	81.0	45.8	43.2	43.6	33.2	25.8
63	128	4.7	86.8	47.0	44.3	42.7	29.8	22.4
80	128	-1.1	85.8	46.7	42.8	39.3	25.9	18.1
100	128	-1.3	85.5	46.8	41.7	38.5	24.0	14.3
125	128	-1.4	80.6	44.1	36.8	38.8	23.7	13.0
160	128	-2.0	76.1	42.5	34.8	37.9	23.9	13.6
200	128	-2.3	74.9	41.4	32.9	35.0	24.9	15.9
250	128	-2.6	70.4	41.3	33.3	35.1	24.2	17.1
315	128	-3.1	68.2	40.4	33.6	35.1	24.2	18.0
400	128	-3.2	68.7	40.6	34.6	35.7	24.3	17.6
500	128	-3.3	71.9	41.4	36.2	36.8	24.5	16.1
630	128	-3.3	71.9	42.7	38.3	38.1	23.6	13.3
800	128	-2.8	73.1	44.1	40.1	39.8	23.9	10.5
1000	128	-2.1	74.2	44.5	39.9	40.0	20.8	7.0
1250	128	-1.5	74.5	43.8	37.9	38.5	16.7	4.9
1600	128	-0.7	70.7	42.4	35.4	36.0	13.8	3.8
2000	128	0.4	66.7	40.1	31.6	31.9	11.1	3.5
2500	128	1.4	65.1	37.4	28.2	27.7	9.2	3.8
3150	128	2.3	63.3	34.8	25.0	23.6	7.8	4.4
4000	128	3.3	64.6	32.5	22.1	21.0	7.0	4.7
5000	128	4.3	64.3	30.8	20.2	18.8	6.9	5.4
6300	128	5.4	62.9	28.7	18.0	16.8	7.5	6.2
8000	128	6.1	63.9	27.4	16.8	15.1	8.0	6.8
10000	128	6.6	64.3	26.3	14.7	13.3	8.3	7.3
12500	128	6.8	64.8	25.1	13.3	12.5	8.3	7.5
16000	128	6.4	64.1	23.4	10.7	11.2	7.7	7.1
20000	128	6.8	59.6	18.1	8.4	8.8	7.4	7.1

Table I-48. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 12-06-2007 to 12-17-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	125	14.9	77.8	49.6	34.4	31.2	19.6	16.1
12.5	125	13.3	91.6	52.5	34.5	36.5	32.7	28.8
15.8	125	15.2	88.4	50.9	33.8	36.0	31.8	28.5
20	125	15.2	86.2	48.9	33.3	35.7	31.1	27.7
25	125	14.2	85.3	47.1	32.9	35.8	29.8	26.2
31.5	125	11.1	83.1	45.1	32.7	35.8	28.1	23.9
40	125	8.4	81.4	43.4	32.6	35.0	26.3	20.9
50	125	4.4	79.4	42.1	31.3	33.6	24.0	16.9
63	125	-0.4	77.8	41.3	30.0	30.4	20.8	12.4
80	125	-3.1	85.0	41.8	27.5	26.3	16.0	7.4
100	125	-3.9	79.0	40.5	27.1	27.5	12.4	5.0
125	125	-3.7	77.7	41.3	29.1	30.3	12.3	4.3
160	125	-3.3	71.3	40.5	28.5	30.3	13.0	4.5
200	125	-3.7	75.6	39.1	25.9	28.0	14.8	6.0
250	125	-3.9	66.4	39.3	26.5	26.7	16.2	6.1
315	125	-4.1	65.8	38.2	26.5	26.4	14.0	5.7
400	125	-3.9	69.9	38.2	26.6	25.4	11.7	3.8
500	125	-4.0	69.4	38.7	27.5	23.5	8.7	1.7
630	125	-3.6	71.8	39.8	26.8	20.5	4.7	0.1
800	125	-2.8	71.6	41.0	27.1	17.1	1.6	-0.3
1000	125	-2.4	71.9	41.6	26.4	13.2	1.0	-0.2
1250	125	-1.7	69.4	41.4	24.3	9.2	1.3	0.2
1600	125	-0.7	67.7	40.4	21.7	6.3	1.4	0.7
2000	125	0.4	63.0	38.5	18.0	5.8	1.9	1.4
2500	125	1.2	62.2	35.8	14.4	6.3	2.7	2.2
3150	125	2.3	60.8	33.0	11.5	5.8	3.5	3.1
4000	125	3.3	59.4	30.1	9.6	6.3	4.4	4.0
5000	125	4.3	58.0	27.6	9.2	7.3	5.3	5.0
6300	125	5.3	56.0	25.2	9.1	8.0	6.1	5.9
8000	125	6.1	54.9	23.2	9.0	8.7	6.8	6.6
10000	125	6.6	55.3	21.5	8.9	8.9	7.3	7.0
12500	125	6.8	54.9	19.8	8.8	8.8	7.4	7.2
16000	125	6.5	49.3	17.2	8.1	8.1	7.0	6.8
20000	125	6.7	44.3	11.9	7.4	7.4	7.1	7.0

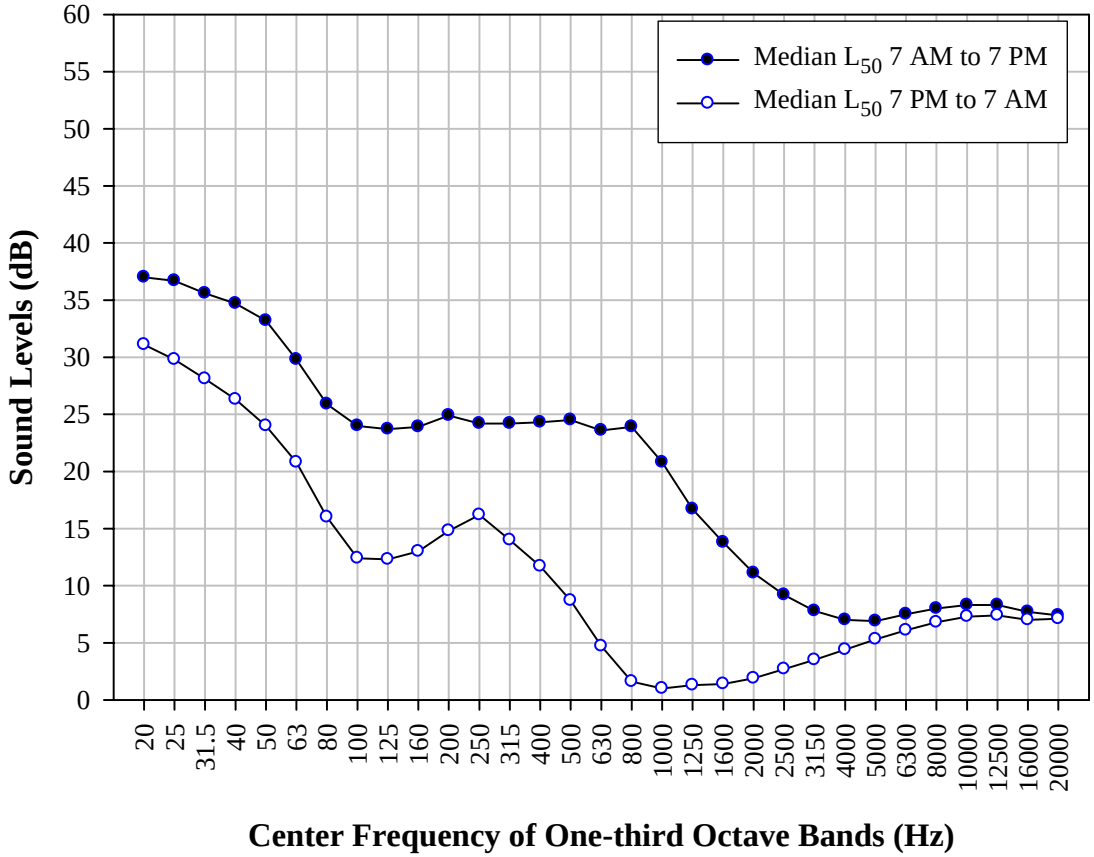

Figure I-32. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), 12-06-2007 to 12-17-2007.

Table I-49. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 6-25-2007 to 7-03-2007 (n=174).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	8	26.5	68.4	42.7	41.2	42.5	44.1	41.0	38.5
1	8	24.6	65.5	42.0	40.2	40.4	42.1	39.2	35.6
2	7	25.0	57.7	40.6	39.7	39.6	42.2	39.2	35.2
3	7	24.4	51.6	41.7	38.6	38.5	42.6	36.1	31.3
4	7	16.6	74.9	41.3	36.2	34.8	37.4	27.6	23.1
5	7	15.2	55.0	30.7	28.2	27.0	28.8	22.6	18.7
6	7	15.1	53.4	30.2	27.7	25.7	27.0	18.9	16.2
7	7	14.9	54.4	31.0	28.6	28.0	31.9	19.5	16.6
8	7	15.2	52.6	27.6	27.0	27.5	27.7	21.1	17.1
9	7	15.9	68.1	33.0	30.1	28.9	31.4	22.5	18.1
10	7	16.6	57.2	29.9	29.4	29.9	32.0	25.1	21.0
11	7	17.0	57.6	31.8	31.1	31.9	34.5	27.4	22.4
12	7	17.6	61.1	35.0	33.3	32.9	33.0	27.5	22.4
13	7	17.4	54.7	31.4	30.7	30.1	33.1	28.2	23.5
14	7	17.2	70.5	41.2	33.9	32.3	33.8	26.0	20.7
15	7	17.0	59.4	32.4	30.5	28.8	32.5	24.2	19.9
16	7	15.7	69.9	37.3	31.5	30.8	33.0	23.3	18.7
17	7	15.3	58.6	29.6	28.6	29.2	28.5	21.3	17.7
18	7	15.3	54.1	26.8	25.8	26.5	27.4	20.8	17.7
19	7	15.3	52.9	26.9	26.3	26.2	28.4	21.5	18.1
20	8	15.8	69.8	41.5	40.0	40.5	43.7	38.8	22.0
21	8	30.1	69.4	43.8	43.2	43.0	45.8	41.1	38.3
22	8	29.4	53.2	43.9	42.5	41.6	45.1	39.5	35.3
23	8	25.7	55.1	43.4	41.5	41.9	45.6	40.8	37.7

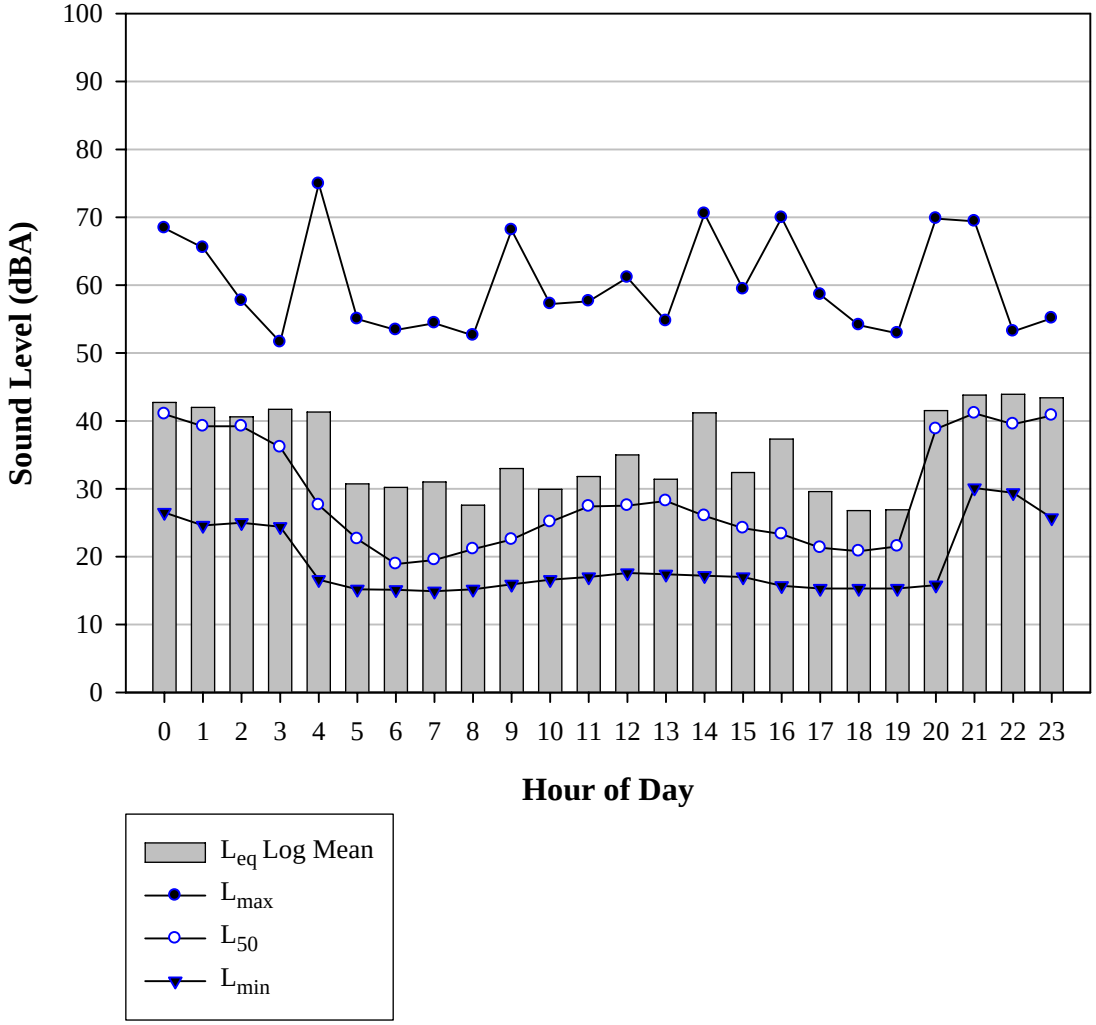

Figure I-33. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 6-25-2007 to 7-03-2007 (n=174).

Table I-50. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 3-03-2008 to 3-28-2008 (n=598).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	25	16.4	53.8	30.7	25.7	24.1	22.2	17.3	17.0
1	25	16.4	56.9	32.3	25.9	24.0	21.9	17.8	17.1
2	25	16.4	55.4	31.7	25.7	23.6	21.2	17.6	17.0
3	25	16.4	57.3	32.0	26.2	25.1	20.9	18.0	17.2
4	25	16.4	58.3	33.3	26.4	24.5	20.6	17.7	17.1
5	25	16.3	66.0	34.7	27.6	25.5	23.3	18.2	17.5
6	25	16.5	76.8	37.9	31.3	30.6	30.7	18.5	17.3
7	25	16.5	65.1	35.0	30.9	29.0	32.1	19.0	17.6
8	25	16.6	59.7	34.1	32.4	31.5	35.3	21.1	17.9
9	24	17.0	74.1	35.9	32.3	31.6	33.9	21.7	18.5
10	24	17.2	64.8	35.3	32.7	31.6	34.4	23.6	19.9
11	25	17.5	84.0	38.2	32.9	31.7	35.6	24.4	20.1
12	25	17.4	59.2	32.3	31.0	30.9	32.4	23.5	19.8
13	25	17.3	67.7	35.4	32.6	31.5	33.7	24.7	20.6
14	25	17.1	62.0	32.2	30.7	30.7	32.6	22.9	19.6
15	25	16.7	76.6	39.5	33.1	31.7	34.2	21.9	19.2
16	25	16.7	63.7	33.4	30.9	29.7	31.9	20.5	18.6
17	25	16.4	68.3	33.5	31.3	31.8	35.0	20.8	18.1
18	25	16.5	67.2	33.6	30.9	30.3	33.5	20.9	18.1
19	25	16.7	61.5	32.8	30.4	29.8	32.3	19.8	18.0
20	25	16.7	69.2	35.9	31.9	30.9	34.1	19.9	17.7
21	25	16.5	57.2	34.2	31.2	31.2	33.7	21.0	17.5
22	25	16.5	58.3	32.4	28.1	26.3	29.2	18.5	17.3
23	25	16.4	64.1	30.8	27.0	25.0	25.8	17.8	17.2

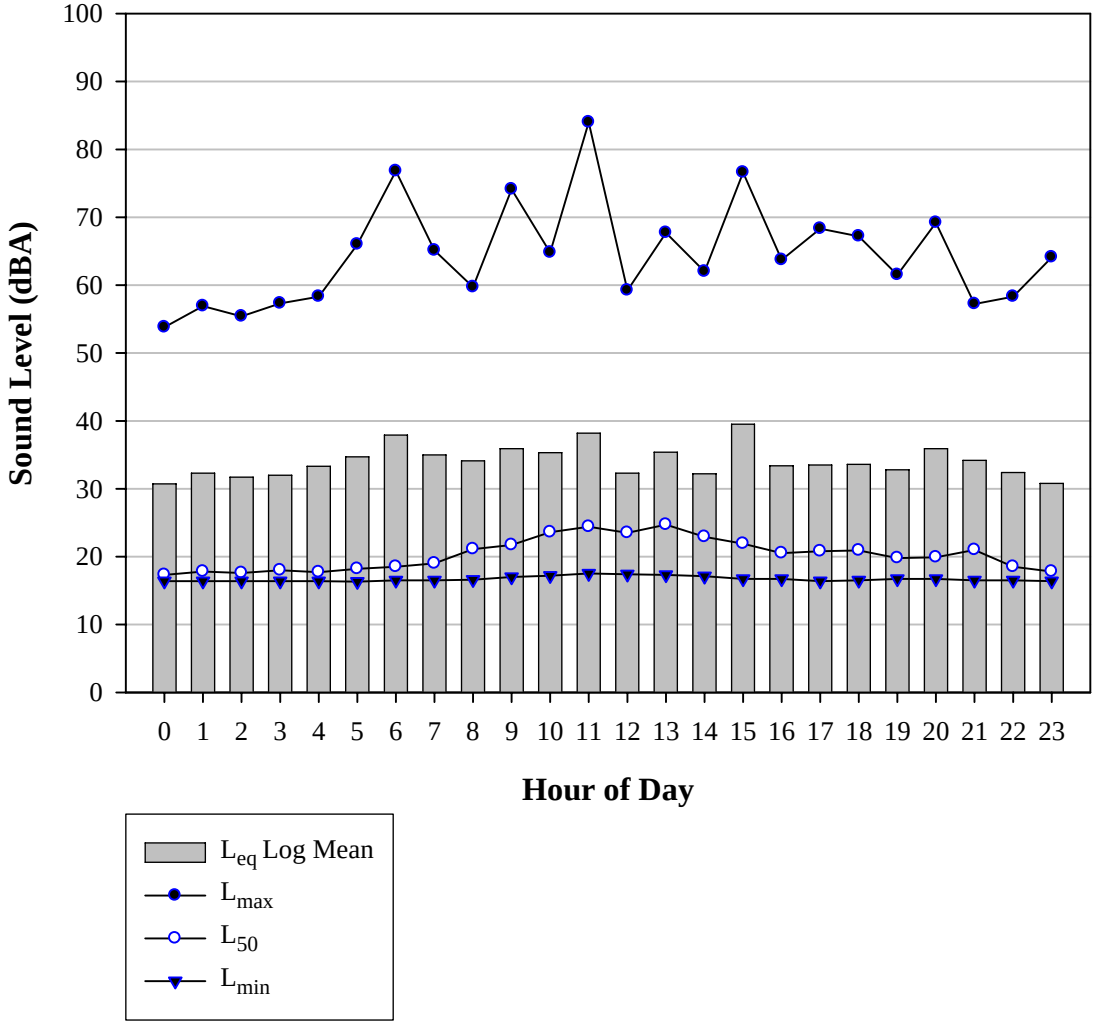

Figure I-34. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 3-03-2008 to 3-28-2008 (n=598).

Table I-51. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 6-25-2007 to 7-03-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	84	14.9	70.5	34.3	29.9	31.9	23.7	19.5
12.5	84	11.1	90.9	54.4	51.2	52.0	36.9	28.1
15.8	84	8.9	84.5	52.2	48.2	48.4	34.6	26.7
20	84	8.6	86.1	50.2	45.5	45.3	33.2	26.1
25	84	7.7	84.1	47.7	41.8	42.5	31.2	24.6
31.5	84	7.2	84.2	45.6	39.3	39.8	30.4	24.5
40	84	6.6	79.6	41.6	36.3	36.9	28.6	23.2
50	84	7.5	78.1	38.3	33.5	35.5	26.5	20.8
63	84	7.7	72.3	36.3	31.7	35.0	24.1	19.1
80	84	5.9	70.2	33.9	30.8	34.2	23.5	18.6
100	84	5.1	72.5	33.3	29.4	32.4	22.2	17.6
125	84	6.3	68.3	31.7	28.2	31.0	21.7	17.4
160	84	5.1	64.5	29.7	26.5	29.6	20.0	15.8
200	84	4.9	65.4	29.3	25.2	28.2	19.2	15.2
250	84	4.7	65.0	29.1	24.6	26.9	19.0	14.6
315	84	4.2	66.6	29.2	23.2	25.6	18.0	13.4
400	84	4.8	65.6	27.5	21.2	23.5	16.9	12.8
500	84	4.9	65.9	27.3	20.2	22.6	16.2	11.8
630	84	4.4	64.8	27.3	19.6	22.4	15.3	10.6
800	84	5.1	64.3	25.9	18.6	21.2	13.9	9.5
1000	84	5.4	63.4	24.0	17.3	19.4	12.2	8.4
1250	84	6.3	61.8	23.2	15.2	17.4	10.5	8.0
1600	84	7.0	59.7	20.2	13.8	15.0	9.6	8.4
2000	84	7.9	55.9	17.4	12.5	13.5	9.7	9.0
2500	84	8.8	55.0	16.0	12.7	13.2	10.4	9.8
3150	84	9.9	58.0	17.0	13.6	13.5	11.1	10.7
4000	84	11.0	63.5	20.2	14.2	13.6	11.9	11.6
5000	84	12.0	64.0	20.9	16.1	17.1	13.0	12.7
6300	84	13.2	58.7	18.8	15.0	15.0	14.1	13.8
8000	84	14.3	50.9	16.2	15.6	15.8	15.0	14.8
10000	84	15.5	41.4	16.6	16.4	16.7	16.1	15.9
12500	84	16.6	43.2	17.6	17.4	17.6	17.1	16.9
16000	84	17.4	50.5	18.7	18.1	18.2	17.9	17.8
20000	84	19.1	54.2	20.1	19.6	19.6	19.5	19.4

Table I-52. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 6-25-2007 to 7-03-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	90	15.1	74.9	41.4	39.3	41.9	37.2	31.6
12.5	90	9.6	91.6	58.2	52.3	54.0	36.7	27.6
15.8	90	8.0	87.8	56.2	50.0	50.3	34.5	26.7
20	90	8.1	86.1	53.9	47.1	46.4	32.9	25.9
25	90	4.5	82.9	51.1	43.9	43.3	31.5	24.6
31.5	90	5.7	83.1	47.7	40.2	40.3	30.1	24.1
40	90	3.4	81.9	44.1	37.1	38.5	27.9	22.5
50	90	4.1	75.0	40.6	34.2	36.4	25.4	20.5
63	90	4.7	72.8	37.3	32.0	34.6	24.0	19.5
80	90	4.2	70.5	34.6	30.4	33.1	23.8	19.5
100	90	3.4	68.0	32.1	28.1	31.0	22.5	18.2
125	90	4.8	64.1	30.2	27.2	29.6	22.9	18.7
160	90	3.4	61.6	28.5	25.4	27.8	21.4	17.6
200	90	2.3	66.9	27.7	24.9	27.0	21.1	17.3
250	90	2.7	64.6	27.8	24.1	26.8	21.1	17.5
315	90	3.4	60.2	28.4	23.5	25.3	20.6	17.1
400	90	3.3	57.4	26.2	22.4	24.6	19.8	16.4
500	90	3.7	58.6	25.6	21.9	24.0	19.5	16.0
630	90	3.8	60.4	25.7	20.8	22.9	18.7	15.0
800	90	4.6	58.1	25.4	19.2	21.4	17.3	13.5
1000	90	5.2	56.2	24.2	16.9	19.1	15.1	11.5
1250	90	5.8	57.0	23.4	15.2	17.5	12.7	9.6
1600	90	6.7	57.0	22.0	13.4	15.0	10.8	8.9
2000	90	7.7	64.2	21.8	12.1	12.7	9.7	8.9
2500	90	8.6	64.6	21.1	12.2	12.7	10.2	9.6
3150	90	9.9	55.2	17.6	13.6	14.8	12.2	10.9
4000	90	10.8	61.1	32.9	23.3	26.3	19.9	14.8
5000	90	12.1	74.0	38.7	34.2	37.8	32.9	25.7
6300	90	13.3	68.8	27.9	18.6	20.6	16.4	14.8
8000	90	14.3	64.5	21.0	15.9	16.5	15.2	14.9
10000	90	15.5	60.0	19.3	18.2	19.6	17.3	16.2
12500	90	16.6	58.8	18.6	17.6	18.1	17.3	17.0
16000	90	17.4	60.2	19.5	18.8	19.2	18.2	17.9
20000	90	19.2	55.0	21.2	19.8	19.8	19.5	19.4

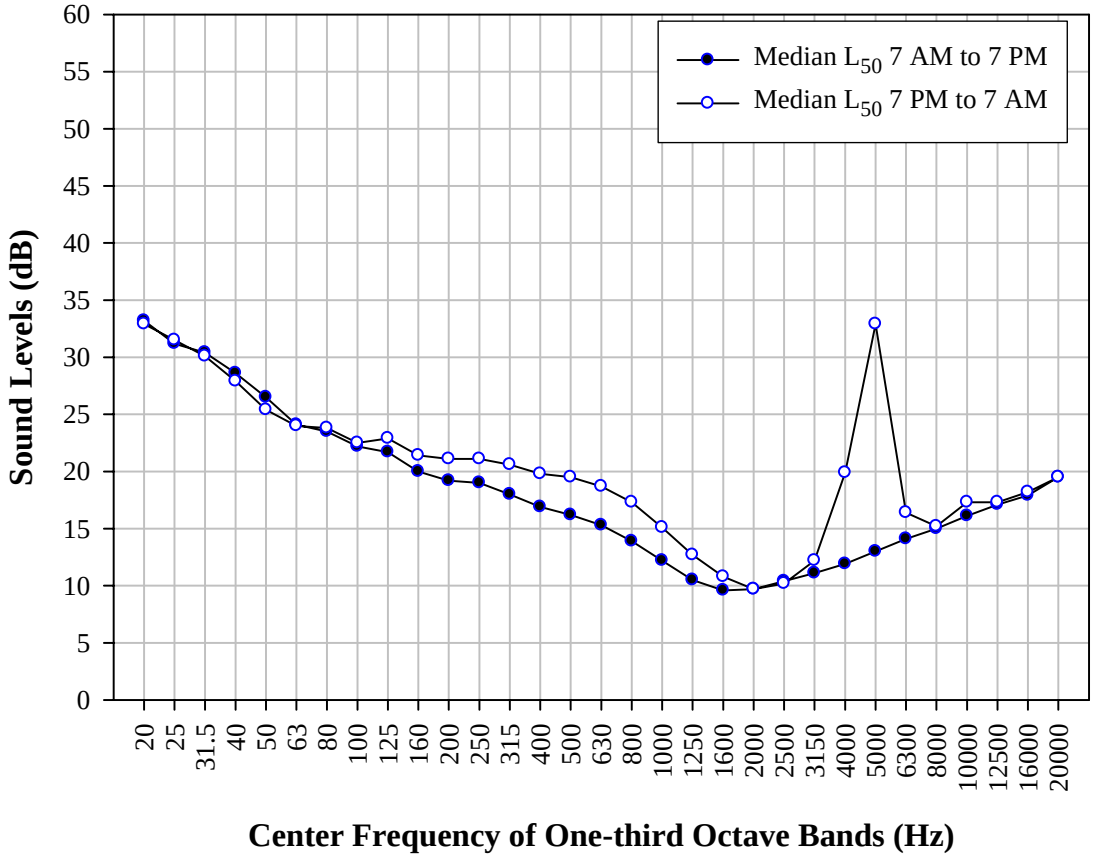

Figure I-35. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 6-25-2007 to 7-03-2007.

Table I-53. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 3-03-2008 to 3-28-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	298	16.4	84.0	35.4	31.3	34.0	22.3	19.2
12.5	298	5.9	93.4	51.0	45.3	47.2	34.5	25.6
15.8	298	8.0	85.6	48.9	42.8	44.2	32.6	25.2
20	298	9.1	91.4	46.9	40.0	41.8	32.1	25.8
25	298	10.9	88.4	44.5	37.4	39.8	30.8	25.3
31.5	298	12.0	83.8	42.2	36.8	39.5	31.5	26.0
40	298	9.6	80.9	39.7	34.9	38.2	29.9	24.5
50	298	10.6	81.3	38.8	34.8	38.2	29.1	23.8
63	298	9.0	81.3	36.6	34.1	37.7	28.8	22.9
80	298	8.0	72.5	34.8	33.0	37.0	26.4	19.9
100	298	6.3	74.6	34.2	31.6	35.4	24.7	18.5
125	298	3.9	76.6	33.6	30.2	33.7	21.8	15.1
160	298	1.1	71.2	33.4	30.6	33.4	19.1	11.9
200	298	1.1	77.2	35.0	31.7	34.3	17.4	10.0
250	298	1.1	75.8	33.7	30.8	33.5	16.9	10.3
315	298	1.6	76.1	31.6	28.2	31.0	15.9	10.6
400	298	0.6	72.8	31.0	26.6	29.0	13.9	9.8
500	298	0.3	71.2	29.2	24.6	25.8	12.0	7.9
630	298	-1.2	71.7	27.5	22.1	23.3	11.4	7.7
800	298	-1.7	68.3	25.1	18.4	19.7	10.5	7.2
1000	298	-2.4	65.8	22.3	15.2	16.8	8.7	5.2
1250	298	-2.1	71.3	20.4	12.0	13.6	6.5	3.6
1600	298	-1.5	75.2	19.6	9.1	10.5	5.2	2.5
2000	298	-0.6	75.7	18.5	6.8	8.3	3.6	1.9
2500	298	0.2	76.3	17.6	5.0	6.2	2.9	2.0
3150	298	1.5	72.8	14.7	4.4	4.9	3.3	2.8
4000	298	2.9	76.0	17.6	5.3	5.2	4.3	3.9
5000	298	4.4	68.9	16.3	6.9	6.3	5.6	5.3
6300	298	5.9	68.4	18.6	8.4	7.4	6.8	6.6
8000	298	7.3	70.2	19.3	8.9	8.4	8.1	7.9
10000	298	8.9	67.6	16.7	9.7	9.7	9.5	9.3
12500	298	10.2	66.6	16.1	10.8	10.9	10.7	10.6
16000	298	11.6	64.8	15.2	12.2	12.3	12.1	12.0
20000	298	12.6	64.5	15.2	13.3	13.4	13.2	13.1

Table I-54. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 3-03-2008 to 3-28-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	300	16.3	76.8	33.8	27.7	29.0	18.8	17.4
12.5	300	-0.9	92.9	54.1	47.0	48.9	36.4	25.3
15.8	300	2.7	89.8	52.2	44.4	45.9	33.4	23.6
20	300	5.7	86.3	50.1	41.5	43.0	31.0	22.6
25	300	7.2	83.9	47.8	38.2	40.3	28.9	21.9
31.5	300	8.0	83.5	45.2	35.5	38.0	27.6	21.6
40	300	5.4	79.3	42.3	33.6	36.5	25.7	19.9
50	300	6.1	79.1	39.5	32.0	35.4	24.8	19.2
63	300	1.9	80.8	37.0	30.8	34.0	22.3	16.4
80	300	2.8	75.1	34.8	30.1	33.1	20.0	14.3
100	300	1.1	73.1	32.6	28.0	31.1	20.6	15.2
125	300	0.1	71.2	30.6	26.3	28.7	15.2	10.1
160	300	-1.3	80.0	31.4	26.5	26.6	11.8	7.2
200	300	-1.0	82.6	32.3	27.4	26.5	10.3	6.3
250	300	-1.0	85.4	32.3	26.3	26.0	10.7	6.5
315	300	0.3	72.1	28.6	23.7	24.0	11.0	7.2
400	300	-0.8	70.4	27.7	22.2	21.7	9.4	6.6
500	300	-1.1	64.0	25.4	19.9	20.0	8.3	5.6
630	300	-1.9	58.0	24.5	18.0	17.1	7.5	4.5
800	300	-2.2	56.7	23.7	15.7	14.2	5.6	3.4
1000	300	-2.4	51.8	22.7	11.3	10.2	4.1	1.8
1250	300	-2.3	52.4	22.4	6.9	6.6	2.3	0.9
1600	300	-1.6	52.5	21.6	3.9	4.1	1.4	0.4
2000	300	-0.7	52.2	20.2	2.6	2.5	1.2	0.7
2500	300	0.2	51.6	18.0	2.8	2.3	1.8	1.4
3150	300	1.5	53.1	16.2	3.5	3.2	2.8	2.5
4000	300	2.9	49.3	13.0	4.2	4.3	4.0	3.8
5000	300	4.4	48.6	12.0	5.5	5.7	5.4	5.2
6300	300	5.8	49.2	12.8	6.7	6.9	6.7	6.5
8000	300	7.3	51.4	12.3	8.1	8.2	8.0	7.9
10000	300	8.8	48.5	11.3	9.5	9.6	9.5	9.3
12500	300	10.2	42.7	11.4	10.7	10.9	10.7	10.6
16000	300	11.6	41.7	12.5	12.1	12.2	12.1	12.0
20000	300	12.7	40.0	13.5	13.2	13.3	13.2	13.1

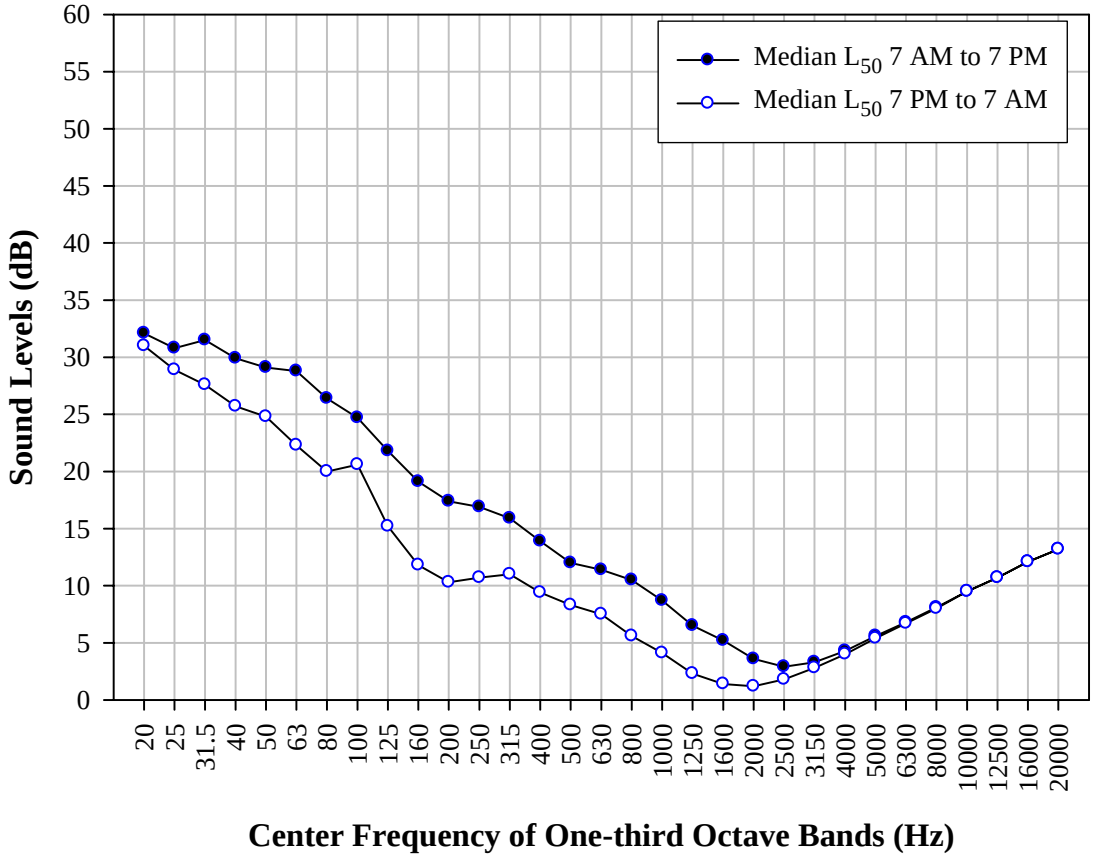

Figure I-36. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), 3-03-2008 to 3-28-2008.

Table I-55. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 6-26-2007 to 7-07-2007 (n=254).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	10	19.7	65.9	38.6	37.8	37.4	40.2	32.6	28.4
1	11	19.5	67.5	41.5	37.7	35.2	38.3	30.5	25.4
2	11	18.5	65.0	39.6	36.4	37.2	39.8	32.5	27.7
3	11	17.3	59.2	37.4	36.0	35.9	38.7	31.8	26.2
4	11	17.3	62.0	38.1	37.8	38.0	38.4	31.5	27.2
5	11	18.0	77.8	44.2	43.6	43.4	43.6	33.4	26.4
6	10	19.2	78.7	45.9	44.7	44.8	45.8	35.6	27.7
7	11	19.5	79.2	48.4	47.4	46.8	48.6	39.9	32.1
8	11	22.7	80.3	49.5	48.9	49.9	51.1	42.8	35.4
9	11	28.1	82.0	53.2	52.6	52.8	53.8	45.3	38.8
10	11	28.5	81.7	53.3	52.6	51.9	53.9	45.8	40.4
11	11	30.5	79.3	52.8	52.6	52.4	54.2	47.7	41.0
12	11	32.1	80.8	53.7	53.3	52.6	54.9	48.3	42.9
13	10	31.7	79.4	53.0	52.9	53.4	54.6	48.5	43.7
14	10	33.9	80.8	53.8	53.5	53.8	55.1	48.8	43.6
15	10	33.5	86.0	54.0	53.5	53.3	54.8	48.7	43.1
16	10	31.7	77.1	51.9	51.8	52.0	54.4	48.0	42.1
17	10	29.2	77.6	52.5	52.3	51.8	54.3	47.2	41.7
18	10	28.3	97.9	60.0	53.9	52.0	52.9	46.1	40.3
19	10	22.6	78.0	49.9	49.3	49.4	51.4	43.2	35.0
20	10	22.1	82.1	48.0	47.6	47.8	50.3	41.4	32.3
21	11	19.1	68.6	39.8	38.8	38.2	41.0	31.1	26.4
22	11	18.7	61.5	38.1	37.5	36.7	39.8	31.6	26.3
23	11	19.0	67.2	40.7	37.9	37.1	39.0	31.4	27.6

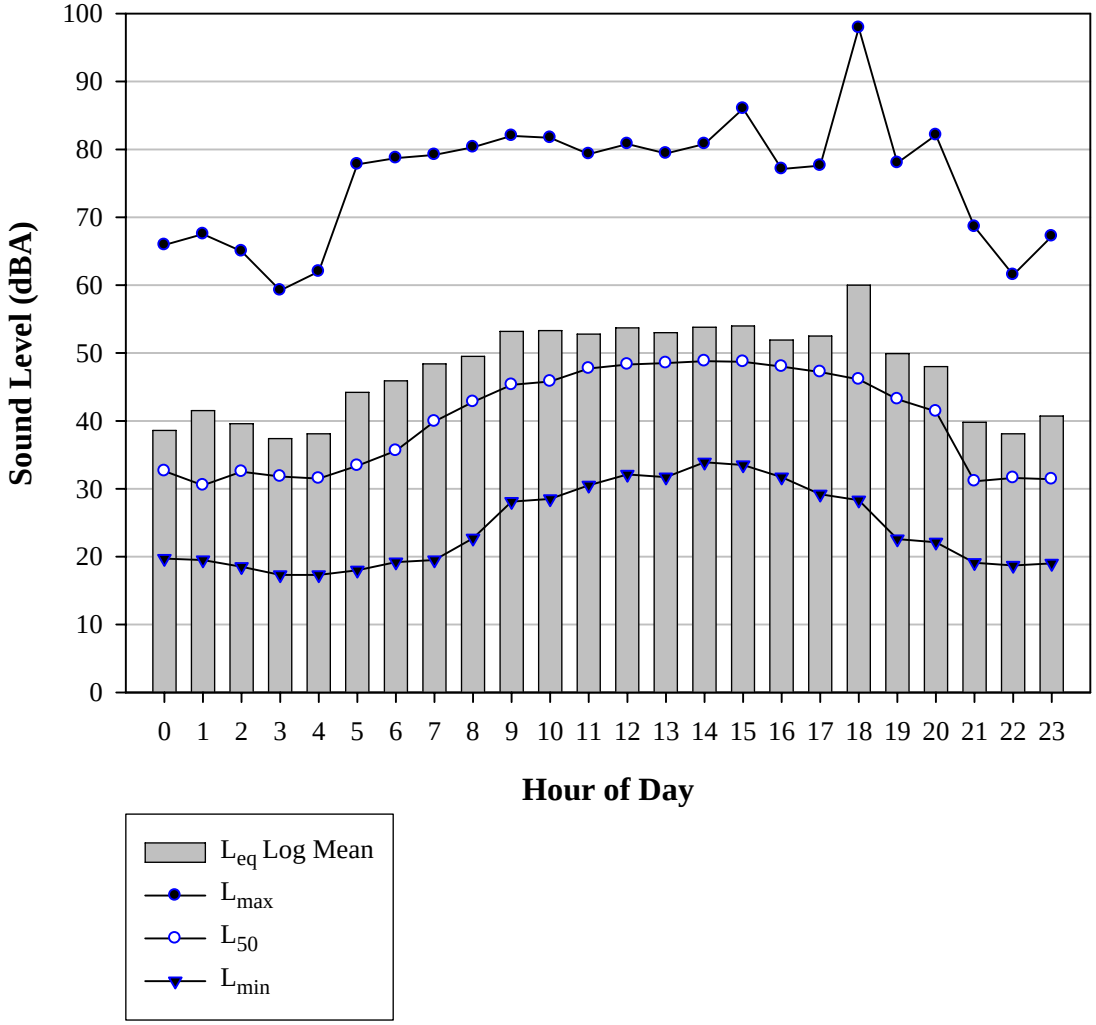

Figure I-37. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 6-26-2007 to 7-07-2007 (n=254).

Table I-56. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 12-04-2007 to 12-13-2007 (n=225).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	9	16.4	73.3	52.7	35.5	32.2	35.6	24.4	21.1
1	9	14.4	76.8	54.6	36.1	38.0	39.4	29.9	24.1
2	9	15.8	77.6	55.7	34.4	30.4	31.9	22.4	19.6
3	9	15.5	77.0	54.3	31.2	28.1	24.7	18.9	18.1
4	9	16.8	74.6	54.3	32.8	28.6	29.2	22.7	18.9
5	9	15.2	74.9	53.1	35.2	33.8	32.1	22.7	19.6
6	9	15.6	82.0	56.8	47.7	49.0	43.3	28.8	22.1
7	9	17.0	78.3	58.5	48.4	49.1	50.0	36.9	23.2
8	10	17.6	82.1	59.3	49.6	46.8	47.8	39.1	27.0
9	10	16.7	90.9	68.6	51.6	48.1	49.9	40.6	29.4
10	10	17.9	84.0	66.7	54.2	51.1	50.4	43.7	32.4
11	10	17.5	91.6	68.0	58.7	58.5	53.8	43.6	35.7
12	10	17.9	84.7	66.6	53.8	50.6	51.6	42.0	33.9
13	10	18.1	88.7	66.0	54.4	49.6	52.4	41.2	31.8
14	10	17.9	84.8	66.5	52.3	50.8	50.8	38.3	29.6
15	10	17.1	87.5	69.2	52.2	50.5	51.0	40.5	33.7
16	10	17.9	85.6	64.8	51.2	49.2	50.7	41.4	34.8
17	9	17.0	78.6	60.2	51.5	48.1	49.2	37.5	31.1
18	9	14.9	75.6	58.3	44.3	42.8	40.7	29.5	23.4
19	9	14.7	78.9	59.5	43.5	42.9	43.9	29.8	22.3
20	9	14.9	75.1	58.4	43.0	38.3	39.5	24.9	20.2
21	9	15.0	75.5	55.7	41.0	35.3	36.9	27.0	22.0
22	9	16.0	75.2	54.6	37.5	35.9	38.2	26.5	22.3
23	9	15.1	74.9	53.2	37.6	33.2	36.6	25.7	21.9

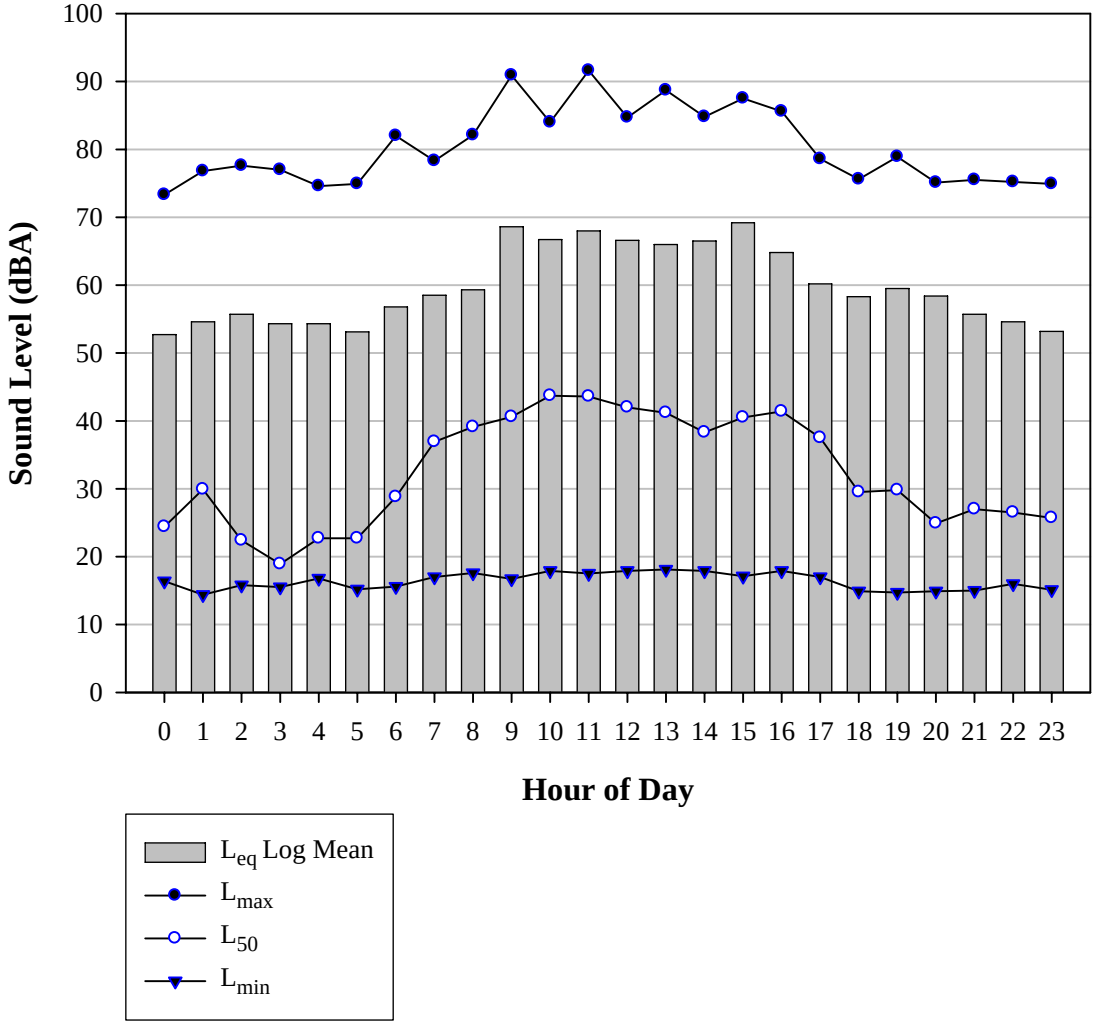

Figure I-38. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 12-04-2007 to 12-13-2007 (n=225).

Table I-57. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 6-26-2007 to 7-07-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	126	19.5	97.9	54.0	51.9	54.1	47.3	41.1
12.5	126	22.6	99.1	68.0	64.4	66.8	54.8	42.0
15.8	126	21.1	98.8	66.7	62.8	65.6	53.7	41.3
20	126	21.6	96.1	65.3	61.8	64.2	52.7	42.3
25	126	22.6	93.5	64.1	62.0	65.0	55.5	44.8
31.5	126	21.6	93.8	62.2	60.3	63.4	54.8	46.1
40	126	18.0	91.8	61.3	60.8	63.1	54.9	47.4
50	126	17.2	92.0	59.1	58.5	60.5	51.6	44.1
63	126	19.4	92.4	59.1	57.9	59.4	50.1	43.6
80	126	22.7	93.7	59.0	57.0	58.7	50.2	43.7
100	126	18.4	93.7	58.1	55.5	57.3	48.9	42.6
125	126	22.7	92.2	55.9	54.0	55.3	47.0	41.3
160	126	14.2	89.5	53.6	51.7	52.7	45.1	38.8
200	126	12.2	86.8	51.1	49.3	50.7	43.3	37.0
250	126	10.6	88.6	48.8	47.1	48.6	41.4	35.4
315	126	9.5	89.1	46.6	45.6	47.3	40.2	33.6
400	126	9.3	82.5	44.6	44.1	46.2	38.9	32.3
500	126	8.5	80.8	43.0	43.0	45.0	38.1	31.7
630	126	8.5	84.1	42.7	42.3	44.6	37.9	31.6
800	126	7.7	84.5	43.6	42.4	44.7	37.7	31.5
1000	126	7.6	78.9	42.3	41.6	44.0	36.7	30.1
1250	126	10.9	77.6	41.4	40.9	42.7	35.5	28.5
1600	126	8.0	96.0	47.1	39.6	41.4	33.7	26.8
2000	126	8.7	83.3	39.5	37.8	39.5	32.1	24.5
2500	126	9.5	78.5	37.7	36.7	37.7	30.1	23.0
3150	126	10.5	82.7	37.2	34.7	35.9	27.9	20.7
4000	126	11.5	80.6	34.5	31.7	33.4	24.7	18.0
5000	126	12.4	81.3	33.4	29.7	30.4	22.3	16.5
6300	126	13.7	78.0	31.3	28.4	28.1	20.2	15.9
8000	126	14.9	78.2	30.9	27.7	26.3	18.9	16.1
10000	126	16.0	73.1	28.7	26.1	24.3	18.5	16.9
12500	126	17.0	70.0	27.3	24.7	22.2	18.3	17.6
16000	126	17.9	69.0	25.4	21.5	20.1	18.6	18.4
20000	126	19.6	62.8	21.8	20.5	20.4	20.1	20.0

Table I-58. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 6-26-2007 to 7-07-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	128	17.3	82.1	43.8	38.9	41.3	32.9	27.4
12.5	128	17.6	96.7	68.8	66.7	69.3	59.2	46.8
15.8	128	13.0	95.2	67.3	65.0	67.7	57.4	43.8
20	128	13.1	92.5	65.4	62.9	65.8	54.5	41.0
25	128	16.2	89.7	63.2	60.9	63.7	52.0	38.9
31.5	128	12.5	88.0	60.7	58.3	60.9	48.9	37.0
40	128	7.2	89.0	57.8	54.8	57.6	45.6	34.4
50	128	11.9	83.8	54.5	51.5	53.7	42.7	32.1
63	128	12.1	84.2	51.7	48.6	50.7	39.6	29.8
80	128	18.2	85.7	49.7	46.6	48.1	37.5	28.9
100	128	14.3	86.6	48.2	43.8	45.6	34.7	25.8
125	128	17.1	86.0	46.2	41.4	43.3	34.5	28.9
160	128	10.1	84.2	44.5	38.5	40.4	30.0	22.6
200	128	6.3	84.5	41.7	35.6	37.8	27.7	21.4
250	128	7.4	78.7	38.6	33.3	34.8	25.6	19.7
315	128	5.2	78.4	36.3	30.8	32.1	24.3	17.9
400	128	3.8	72.9	35.1	29.3	31.1	23.7	17.2
500	128	4.5	71.1	33.8	28.5	30.3	23.3	17.8
630	128	5.4	70.4	33.3	27.8	29.8	22.6	15.8
800	128	5.4	74.7	34.1	28.8	30.6	22.4	15.1
1000	128	6.4	73.2	33.4	27.9	30.1	21.1	14.0
1250	128	7.8	73.3	32.6	26.8	29.1	20.0	15.9
1600	128	7.1	69.6	31.2	25.7	26.9	16.5	10.6
2000	128	8.1	68.4	29.2	23.7	24.5	14.5	10.1
2500	128	9.1	69.6	27.8	21.6	22.1	14.6	11.3
3150	128	10.2	80.5	30.3	20.5	22.4	13.8	11.6
4000	128	11.4	70.3	25.0	20.3	21.5	15.2	13.0
5000	128	12.5	63.0	21.6	16.8	16.7	13.4	13.0
6300	128	13.7	62.7	20.4	16.1	15.4	14.4	14.1
8000	128	14.8	64.4	20.6	16.6	16.2	15.5	15.3
10000	128	15.9	64.8	22.0	19.2	17.9	16.6	16.4
12500	128	16.9	69.6	30.8	25.0	19.1	17.6	17.4
16000	128	17.9	65.7	27.1	21.4	18.9	18.4	18.3
20000	128	19.6	57.6	23.3	20.8	20.4	20.1	20.0

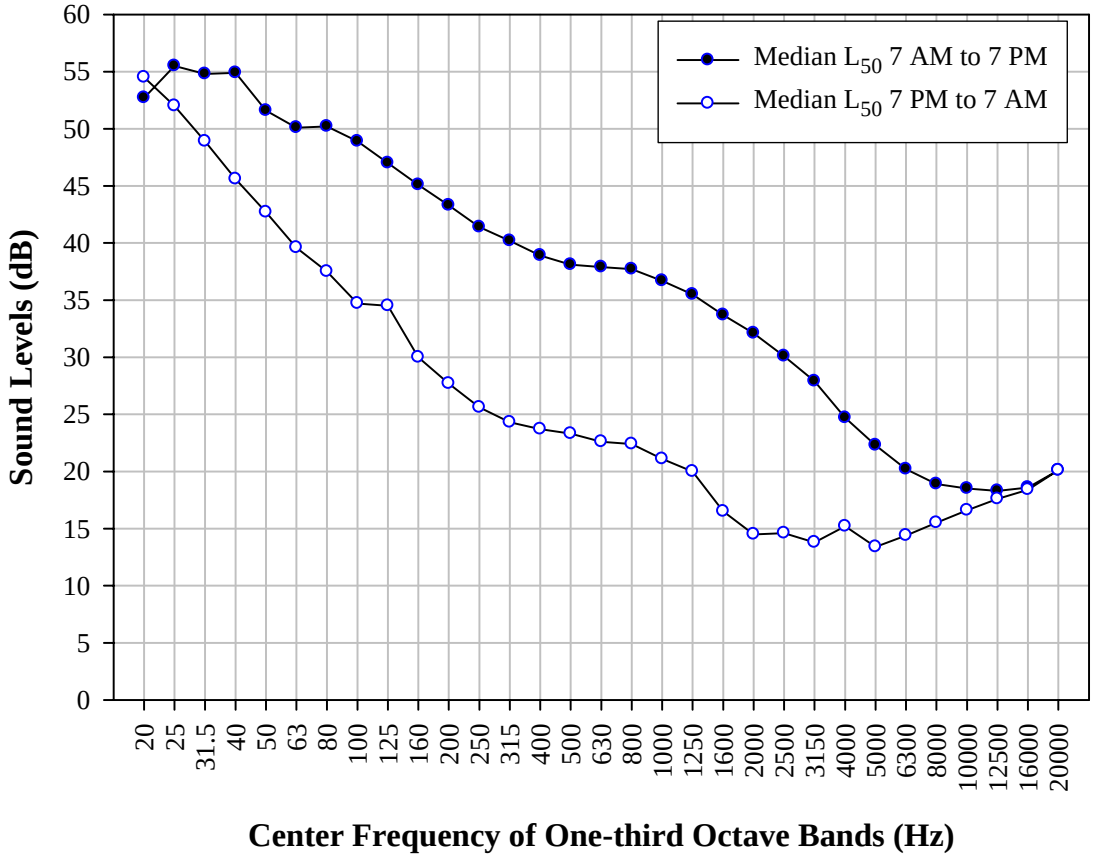

Figure I-39. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 6-26-2007 to 7-07-2007.

Table I-59. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 12-04-2007 to 12-13-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	117	14.9	91.6	65.9	49.6	50.6	40.2	31.5
20	117	23.6	89.5	71.2	50.9	53.8	46.0	39.8
25	117	21.8	88.9	69.9	50.5	54.1	46.2	39.1
31.5	117	20.2	85.7	68.7	51.7	54.9	46.1	38.8
40	117	18.1	85.7	68.2	52.2	54.6	46.5	38.3
50	117	16.7	90.0	68.5	51.2	52.9	44.3	36.4
63	117	14.5	92.1	70.1	50.4	51.2	43.0	34.6
80	117	13.9	96.5	74.9	49.9	51.3	43.0	34.5
100	117	13.1	96.0	70.8	50.4	51.4	42.0	33.3
125	117	5.5	92.1	65.7	47.4	48.5	39.3	31.1
160	117	-0.1	88.7	64.3	45.4	46.2	37.1	28.1
200	117	-0.7	87.6	61.9	42.9	44.3	35.0	25.8
250	117	0.2	87.5	60.9	42.0	42.9	33.8	24.4
315	117	-0.4	85.8	58.3	39.9	41.5	32.1	22.9
400	117	1.3	86.3	56.9	39.8	40.9	30.9	22.6
500	117	-0.6	86.9	56.1	39.3	40.8	30.3	21.7
630	117	-0.5	84.4	56.7	39.3	40.6	30.1	21.0
800	117	-1.2	86.6	60.5	40.7	42.2	30.1	19.6
1000	117	-0.2	87.6	59.1	40.8	41.9	30.3	18.9
1250	117	-1.7	81.5	53.1	40.1	40.9	28.6	17.6
1600	117	-1.6	79.3	49.9	38.4	39.6	26.8	15.2
2000	117	-0.8	77.4	47.0	37.0	37.0	24.8	13.4
2500	117	-0.4	74.4	43.9	35.1	34.9	22.3	10.8
3150	117	0.6	73.9	41.8	33.0	32.4	19.5	9.2
4000	117	1.6	70.4	40.1	29.9	29.8	16.1	7.4
5000	117	2.6	67.1	39.1	28.1	26.9	13.4	6.5
6300	117	-0.4	66.5	38.5	26.0	24.1	11.7	6.4
8000	117	-1.6	65.2	38.2	24.1	21.9	10.4	6.9
10000	117	-1.7	65.4	37.7	22.1	19.0	9.8	7.7
12500	117	-0.9	63.4	35.8	19.8	16.3	9.0	7.9
16000	117	0.6	59.8	31.7	16.8	12.7	8.2	6.3
20000	117	1.8	59.1	28.6	14.6	13.5	7.5	6.5

Table I-60. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 12-04-2007 to 12-13-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	108	14.4	82.0	55.8	35.0	37.5	26.1	21.5
20	108	20.3	86.3	70.5	49.4	53.1	44.0	36.3
25	108	18.7	85.6	69.5	48.1	51.1	42.0	34.5
31.5	108	16.6	84.8	68.3	46.5	48.5	39.4	32.1
40	108	13.1	84.3	66.8	44.1	47.1	36.9	30.2
50	108	15.8	83.3	64.9	41.7	44.2	34.9	29.7
63	108	12.5	83.8	62.5	39.9	43.2	33.3	26.9
80	108	15.2	81.1	59.9	38.7	41.7	32.3	26.8
100	108	15.0	78.1	57.1	38.2	40.3	31.1	28.4
125	108	0.5	76.9	54.3	36.0	38.3	28.5	21.8
160	108	-1.5	73.4	51.9	33.7	36.0	24.8	16.9
200	108	-2.8	72.3	50.0	32.5	35.3	23.0	14.5
250	108	-1.6	72.0	49.6	32.7	34.7	22.3	13.4
315	108	-1.7	70.9	48.4	31.3	33.2	20.4	12.4
400	108	0.8	71.6	47.7	29.7	31.2	19.3	14.6
500	108	-1.5	69.8	47.3	27.3	30.1	17.2	10.9
630	108	-1.9	68.5	46.4	25.6	27.8	15.7	9.8
800	108	-2.4	78.1	45.6	24.9	24.9	14.4	8.5
1000	108	-0.5	68.7	45.1	23.7	23.5	12.2	7.2
1250	108	-2.0	68.6	44.8	22.3	21.8	10.1	5.4
1600	108	-1.5	75.6	44.0	20.1	19.3	8.6	4.3
2000	108	-0.9	73.7	42.9	17.9	16.6	8.2	4.1
2500	108	-0.6	69.3	41.6	15.7	14.7	6.9	3.8
3150	108	0.5	68.2	40.5	13.8	14.3	5.8	4.4
4000	108	1.5	64.8	39.6	12.4	12.5	5.8	4.8
5000	108	2.6	63.7	39.5	11.9	11.8	5.8	5.2
6300	108	3.9	64.2	39.5	11.6	10.8	6.1	5.6
8000	108	5.6	65.2	39.5	10.8	10.6	6.8	6.4
10000	108	6.9	66.0	39.4	11.0	10.5	7.7	7.5
12500	108	6.8	65.0	37.4	10.5	9.6	8.1	7.7
16000	108	4.7	60.7	32.2	10.2	10.1	8.8	7.6
20000	108	2.0	54.1	25.0	13.7	14.0	11.3	6.8

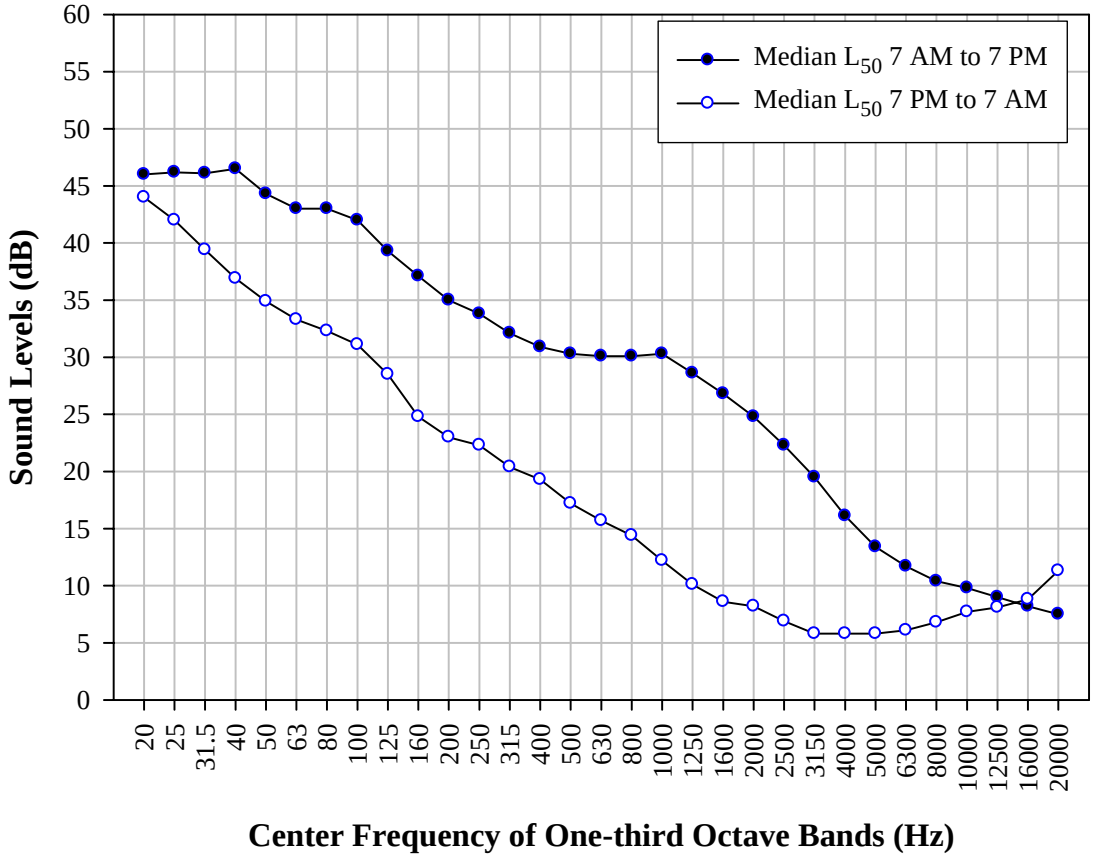

Figure I-40. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), 12-04-2007 to 12-13-2007.

Table I-61. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Residential Area (GRCA045), 7-05-2007 to 7-25-2007 (n=480).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	20	23.2	54.5	32.1	31.7	31.5	33.2	29.4	27.7
1	20	22.6	58.1	32.1	31.4	31.4	32.6	28.3	27.5
2	20	21.7	53.2	30.3	29.7	30.2	30.1	28.4	27.5
3	20	22.1	54.5	30.9	30.4	30.3	31.6	28.5	27.4
4	20	22.5	67.4	35.7	33.9	32.7	35.0	29.9	27.9
5	20	23.3	58.7	37.4	36.9	36.2	39.6	33.9	29.8
6	20	24.9	64.6	38.5	38.2	38.8	41.3	36.5	32.2
7	20	25.7	74.0	41.7	39.7	38.2	40.0	35.1	31.6
8	20	26.5	70.7	39.8	39.1	38.9	40.5	35.3	31.9
9	20	25.7	67.8	39.9	39.3	39.3	41.3	35.9	32.3
10	20	15.2	79.9	43.1	40.8	39.3	41.0	36.2	32.7
11	20	27.0	80.4	44.3	40.8	39.4	41.3	36.2	32.5
12	20	26.4	78.6	45.2	40.8	39.8	41.9	37.2	33.6
13	20	27.6	78.6	42.1	40.6	40.6	41.9	37.0	33.3
14	20	27.5	82.3	46.2	42.7	41.0	42.7	37.8	34.2
15	20	27.7	87.7	50.6	45.0	41.8	44.1	39.4	35.6
16	20	24.6	73.7	42.8	41.1	41.2	43.5	37.9	34.4
17	20	25.3	83.8	42.1	40.3	39.8	42.2	37.1	33.6
18	20	26.0	68.3	39.2	38.7	38.2	40.6	36.0	32.6
19	20	26.0	70.2	38.7	38.5	38.4	40.4	35.9	32.5
20	20	25.6	64.9	38.1	37.9	37.9	40.0	35.9	32.7
21	20	24.1	61.2	36.8	36.1	35.2	37.3	33.0	29.9
22	20	24.4	77.5	36.4	34.8	34.4	36.6	31.7	29.1
23	20	22.3	60.8	33.3	32.9	32.5	34.7	30.1	28.0

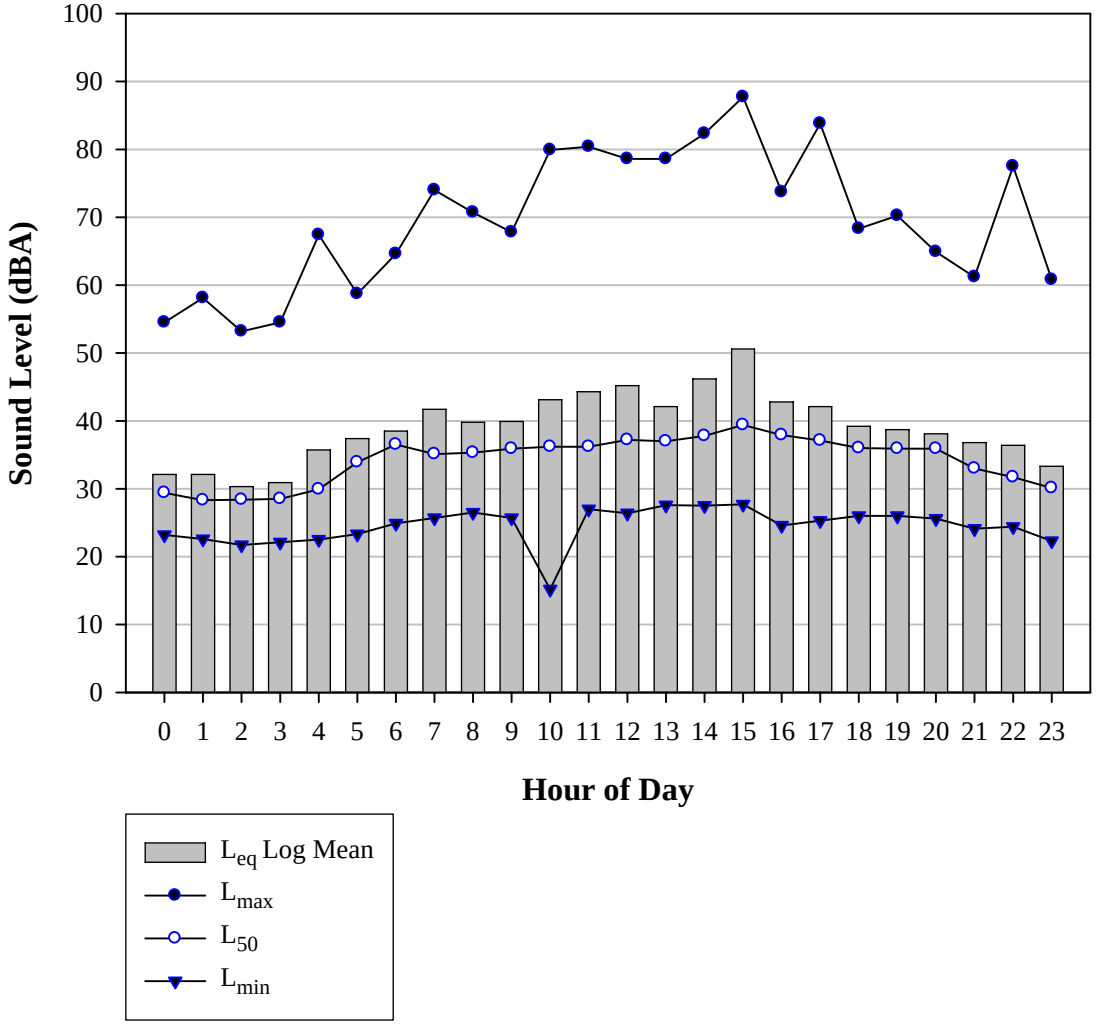

Figure I-41. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Residential Area (GRCA045), 7-05-2007 to 7-25-2007 (n=480).

Table I-62. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Residential Area (GRCA045), 12-12-2007 to 1-03-2008 (n=431).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	18	20.5	62.4	39.6	34.7	32.5	35.3	27.8	26.0
1	18	20.5	68.5	40.0	34.6	32.7	34.4	27.8	25.5
2	18	20.2	62.8	39.2	32.2	29.9	31.5	26.5	24.8
3	18	20.0	61.2	37.6	32.0	30.6	31.3	27.2	25.0
4	18	20.4	63.1	39.8	32.6	30.4	32.9	27.7	25.5
5	18	21.5	65.9	40.1	35.2	33.0	35.8	28.6	25.5
6	18	22.7	70.4	41.8	39.3	38.3	41.2	34.3	28.3
7	18	23.7	67.6	44.1	41.5	40.9	42.8	37.6	31.4
8	18	25.1	78.6	44.6	40.8	39.1	41.3	35.9	31.3
9	18	23.7	70.9	44.0	41.0	39.8	40.9	35.3	31.5
10	18	23.7	72.9	42.2	40.5	39.2	41.9	36.1	31.9
11	17	23.9	73.5	44.1	42.0	40.9	42.5	37.3	32.7
12	17	24.3	70.2	43.4	41.6	41.1	43.6	37.3	32.8
13	18	24.1	75.0	43.2	41.3	40.5	42.1	36.8	33.9
14	19	25.7	79.1	44.2	42.1	41.1	42.2	36.3	33.0
15	18	25.0	73.2	44.4	42.1	40.6	42.5	37.0	33.6
16	18	24.1	63.1	41.4	40.0	40.3	41.8	36.3	33.0
17	18	25.4	68.7	41.4	40.3	39.4	41.5	36.2	33.4
18	18	23.5	64.7	41.8	38.7	37.5	39.7	35.2	31.1
19	18	22.3	62.6	39.8	37.5	37.1	38.5	34.2	30.3
20	18	22.0	62.7	39.8	37.6	36.1	39.5	33.2	29.7
21	18	21.4	64.0	41.2	37.7	36.5	39.3	32.6	27.9
22	18	20.5	61.0	40.6	36.8	35.1	38.3	31.8	28.3
23	18	20.3	63.8	39.9	36.4	34.5	37.4	30.0	26.4

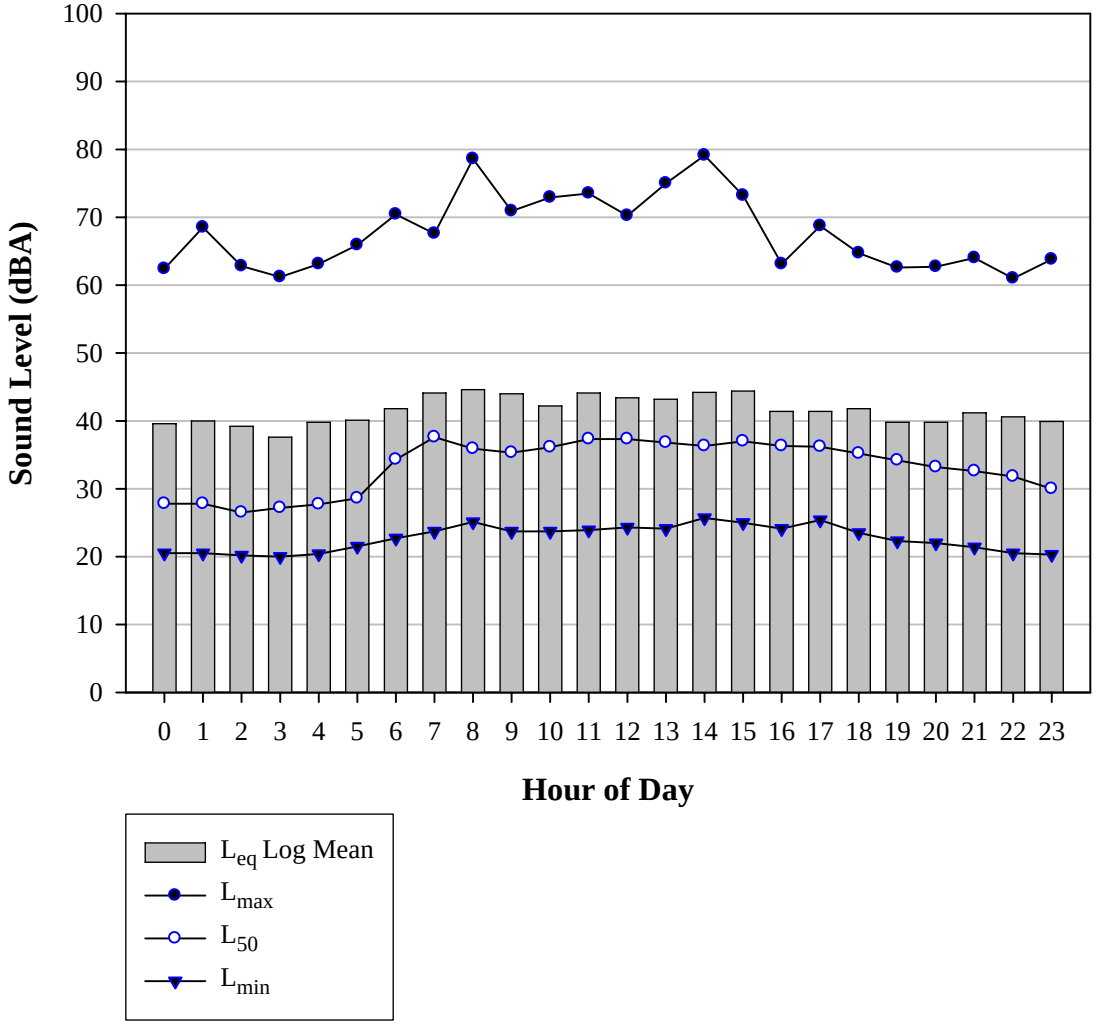

Figure I-42. Acoustic metrics (dBA) by hour for Grand Canyon National Park, South Rim, Residential Area (GRCA045), 12-12-2007 to 1-03-2008 (n=431).

Table I-63. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 7-05-2007 to 7-25-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	240	15.2	87.7	44.4	39.8	41.7	36.7	33.2
12.5	240	-17.3	89.8	51.9	49.5	52.4	43.9	38.7
15.8	240	-16.2	85.2	50.5	48.2	50.8	43.8	39.3
20	240	-15.4	82.3	49.4	47.4	49.6	43.8	40.0
25	240	-13.8	86.0	49.4	47.6	49.7	44.7	41.1
31.5	240	-11.7	89.1	51.6	50.4	53.1	48.1	43.7
40	240	-12.1	88.1	53.2	50.5	52.9	47.3	42.8
50	240	-10.4	87.8	51.2	48.6	51.0	44.5	39.9
63	240	-10.5	94.1	52.5	48.8	51.0	44.6	40.4
80	240	-9.6	85.2	49.7	48.1	50.1	42.3	37.4
100	240	-8.7	84.7	47.0	45.0	46.4	37.9	33.4
125	240	-8.5	84.7	45.1	40.3	41.6	35.2	32.1
160	240	-7.9	84.3	42.7	36.6	38.3	31.0	27.4
200	240	-7.5	83.1	41.5	34.3	35.6	27.9	23.8
250	240	-6.7	86.2	40.6	32.3	33.0	26.3	23.0
315	240	-6.2	83.5	39.3	31.4	32.6	26.3	23.3
400	240	-5.5	83.2	38.2	30.7	31.9	26.4	23.3
500	240	-4.7	83.1	37.1	30.2	31.8	25.9	22.7
630	240	-4.2	81.2	35.6	29.1	31.0	25.4	22.0
800	240	-3.2	79.9	34.5	29.3	30.7	25.5	22.2
1000	240	-2.4	78.1	33.1	28.1	29.7	24.8	21.4
1250	240	-1.5	76.5	31.6	26.9	28.5	23.0	19.6
1600	240	-0.2	73.5	30.9	26.0	26.7	20.8	17.4
2000	240	0.3	73.8	29.7	22.8	23.8	17.8	14.5
2500	240	1.1	72.2	28.3	24.0	24.7	17.8	13.4
3150	240	1.9	70.7	29.5	27.2	30.3	22.7	14.4
4000	240	2.9	69.2	29.1	27.2	30.3	22.7	13.8
5000	240	3.9	66.1	25.8	22.4	24.3	16.3	9.6
6300	240	5.0	62.9	24.0	20.2	22.6	13.7	8.3
8000	240	5.8	59.3	22.7	17.3	19.1	11.2	7.2
10000	240	4.7	60.0	21.0	12.3	13.2	7.9	5.7
12500	240	4.4	55.9	19.0	8.4	9.3	6.1	5.2
16000	240	3.5	54.4	16.3	5.9	6.5	4.9	4.5
20000	240	2.1	55.2	12.7	4.0	4.3	3.6	3.4

Table I-64. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 7-05-2007 to 7-25-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	240	21.7	77.5	35.9	34.4	36.5	31.3	28.7
12.5	240	18.1	77.5	42.3	39.2	41.3	37.1	33.4
15.8	240	22.1	77.6	41.7	39.6	41.7	37.8	34.5
20	240	23.7	79.3	41.4	40.0	42.0	38.5	35.3
25	240	24.2	75.4	42.6	41.6	44.1	39.2	36.2
31.5	240	23.1	72.8	46.5	45.9	49.1	40.8	35.4
40	240	18.7	77.8	45.6	43.9	47.0	38.9	33.3
50	240	18.3	79.5	43.6	40.8	43.1	35.8	31.9
63	240	20.6	76.9	44.5	42.4	44.6	38.4	35.4
80	240	18.0	72.7	44.7	43.5	44.7	36.4	31.5
100	240	13.5	81.9	41.2	39.3	39.1	31.3	28.0
125	240	19.7	72.5	37.6	36.5	38.5	34.8	31.4
160	240	13.5	66.2	33.0	31.3	32.4	27.8	25.5
200	240	10.1	65.1	30.2	28.4	29.9	23.7	21.3
250	240	11.7	62.9	29.3	27.3	28.1	23.3	21.8
315	240	10.1	62.5	29.0	27.5	28.4	24.5	22.9
400	240	11.3	63.5	28.3	26.6	28.1	24.1	22.1
500	240	13.2	62.6	28.2	26.8	28.3	24.1	21.9
630	240	12.4	67.0	27.5	25.4	27.6	22.9	20.3
800	240	11.9	67.8	27.3	25.3	27.3	21.9	19.5
1000	240	11.5	64.5	25.9	24.1	25.9	20.8	18.1
1250	240	9.6	65.7	24.6	22.3	24.0	18.8	16.4
1600	240	7.4	68.6	22.9	19.7	21.2	16.3	14.4
2000	240	5.3	67.4	19.6	16.1	17.4	13.1	11.7
2500	240	4.5	67.3	18.9	13.2	13.3	10.3	9.4
3150	240	4.2	68.5	20.2	10.8	9.5	7.8	7.0
4000	240	4.4	67.0	20.6	8.4	7.4	6.2	5.8
5000	240	4.9	62.2	17.3	7.4	6.6	6.0	5.7
6300	240	5.9	59.0	15.0	7.8	7.1	6.6	6.4
8000	240	5.5	58.8	14.5	9.9	6.7	6.2	6.1
10000	240	4.6	50.7	13.8	9.6	6.1	5.2	5.0
12500	240	4.2	53.6	15.8	10.8	6.0	4.9	4.7
16000	240	3.4	46.2	8.2	5.0	4.6	4.2	4.1
20000	240	2.3	48.8	9.9	6.1	3.6	3.3	3.2

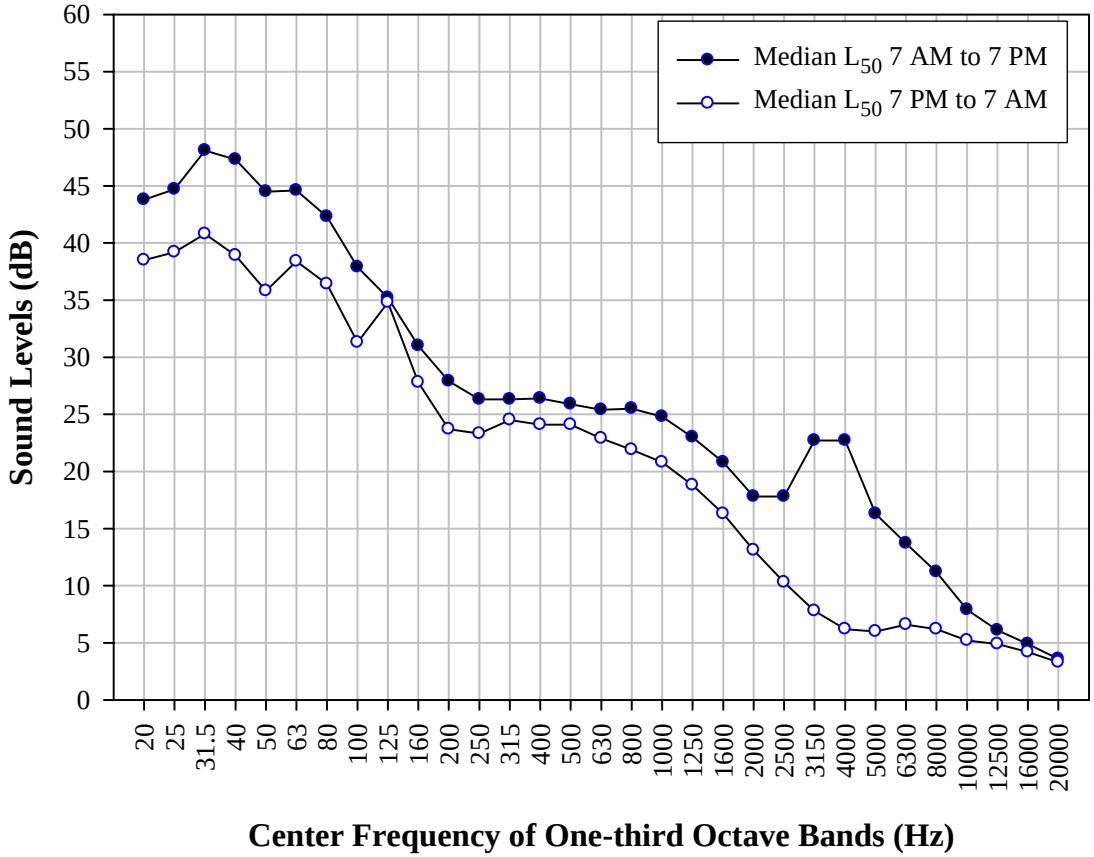

Figure I-43. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 7-05-2007 to 7-25-2007.

Table I-65. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 12-12-2007 to 1-03-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	215	23.5	79.1	43.4	40.2	42.0	36.3	32.6
12.5	215	23.2	84.2	49.8	45.9	48.1	42.6	38.2
15.8	215	27.2	82.1	48.4	45.2	47.3	42.3	38.6
20	215	29.6	83.9	50.0	49.1	52.1	46.1	40.4
25	215	31.2	80.7	48.1	47.1	49.2	44.6	41.2
31.5	215	31.4	78.9	49.6	49.3	51.9	46.4	42.3
40	215	29.1	80.6	49.2	47.9	50.7	45.4	41.0
50	215	26.2	80.5	48.8	47.6	49.9	44.3	40.2
63	215	27.3	88.8	50.1	48.5	50.6	43.7	39.1
80	215	24.4	82.7	47.5	46.7	49.2	41.6	36.8
100	215	19.9	81.3	44.4	43.5	45.2	38.1	33.8
125	215	19.6	82.4	42.2	40.6	42.6	36.1	32.5
160	215	14.5	75.8	38.8	37.3	40.0	31.3	27.0
200	215	13.0	74.9	36.3	34.7	37.1	29.0	24.7
250	215	14.5	71.6	34.7	33.1	35.0	28.2	24.6
315	215	11.9	72.1	34.5	32.3	34.2	27.8	24.0
400	215	11.8	72.9	34.6	31.8	33.6	28.0	24.2
500	215	13.5	73.1	34.7	31.8	33.7	28.6	25.0
630	215	12.3	80.9	35.0	31.1	33.2	27.7	24.4
800	215	11.4	72.3	34.8	30.8	33.0	28.0	23.8
1000	215	9.1	69.7	34.6	30.3	31.9	26.2	21.8
1250	215	5.1	65.3	33.9	28.8	30.0	23.2	19.1
1600	215	4.0	67.9	32.6	26.9	27.1	19.9	15.6
2000	215	4.1	68.5	30.5	23.9	23.8	15.7	12.1
2500	215	4.7	69.0	29.0	22.5	21.4	12.9	9.6
3150	215	5.3	62.7	25.8	20.6	20.6	12.6	8.7
4000	215	5.9	64.9	25.1	21.0	22.1	12.6	8.6
5000	215	6.5	65.8	24.1	20.2	20.7	11.7	8.7
6300	215	6.9	65.6	22.1	18.8	19.8	11.6	8.5
8000	215	7.1	64.2	20.6	17.9	19.4	11.2	8.3
10000	215	7.2	60.9	16.4	13.7	14.6	9.7	8.2
12500	215	7.1	65.9	15.7	11.6	12.4	9.0	7.9
16000	215	6.8	60.5	13.6	10.6	11.6	8.6	7.6
20000	215	5.9	58.8	11.4	8.9	9.8	7.4	6.8

Table I-66. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 12-12-2007 to 1-03-2008.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	216	20.0	70.4	40.1	34.6	37.2	31.0	27.0
12.5	216	20.1	83.5	46.6	39.3	41.2	37.4	33.8
15.8	216	22.6	81.8	44.9	39.7	41.8	38.1	34.9
20	216	26.1	84.4	49.6	49.6	53.2	43.2	37.2
25	216	26.7	82.9	43.2	41.8	43.5	40.2	37.1
31.5	216	24.9	74.3	44.3	42.7	46.3	38.9	35.4
40	216	22.5	72.0	41.5	38.2	40.3	35.7	32.6
50	216	21.5	83.9	41.9	39.4	41.9	37.5	32.4
63	216	18.5	81.4	42.8	40.7	43.5	37.3	31.8
80	216	15.7	72.6	40.5	36.7	38.1	33.9	30.7
100	216	13.2	69.7	38.0	36.0	37.3	33.3	28.8
125	216	18.4	73.8	36.8	35.6	37.1	33.4	30.5
160	216	10.2	65.2	33.6	32.1	34.5	26.8	23.2
200	216	6.5	62.2	31.2	29.8	32.5	24.9	21.0
250	216	11.5	65.4	30.8	29.2	30.3	24.1	20.5
315	216	4.7	63.2	30.4	28.0	29.5	23.4	20.3
400	216	4.0	64.7	30.7	27.5	29.4	23.6	20.2
500	216	8.3	62.8	31.8	27.5	29.7	24.6	20.8
630	216	3.1	63.0	32.3	26.9	29.5	23.6	18.9
800	216	3.3	63.4	32.9	27.2	30.0	22.3	17.0
1000	216	2.3	61.1	32.2	25.5	28.3	20.1	14.1
1250	216	2.8	60.7	31.1	22.9	25.4	17.5	11.8
1600	216	3.0	61.1	29.3	19.9	21.6	14.3	9.5
2000	216	3.6	59.3	26.8	15.8	16.8	10.0	7.0
2500	216	4.3	60.1	24.2	12.7	11.8	7.4	5.9
3150	216	5.1	56.9	21.2	10.4	8.2	6.4	6.0
4000	216	5.7	55.7	18.3	9.1	7.4	6.7	6.5
5000	216	6.6	52.5	15.8	8.9	7.9	7.5	7.3
6300	216	6.8	52.3	13.8	8.4	8.0	7.5	7.3
8000	216	6.9	48.8	11.9	8.1	7.7	7.5	7.4
10000	216	7.2	50.9	10.9	8.0	7.9	7.6	7.5
12500	216	7.1	51.9	10.1	7.8	7.7	7.5	7.4
16000	216	6.8	48.5	9.5	7.5	7.5	7.3	7.2
20000	216	6.0	47.2	8.1	6.6	6.6	6.4	6.4

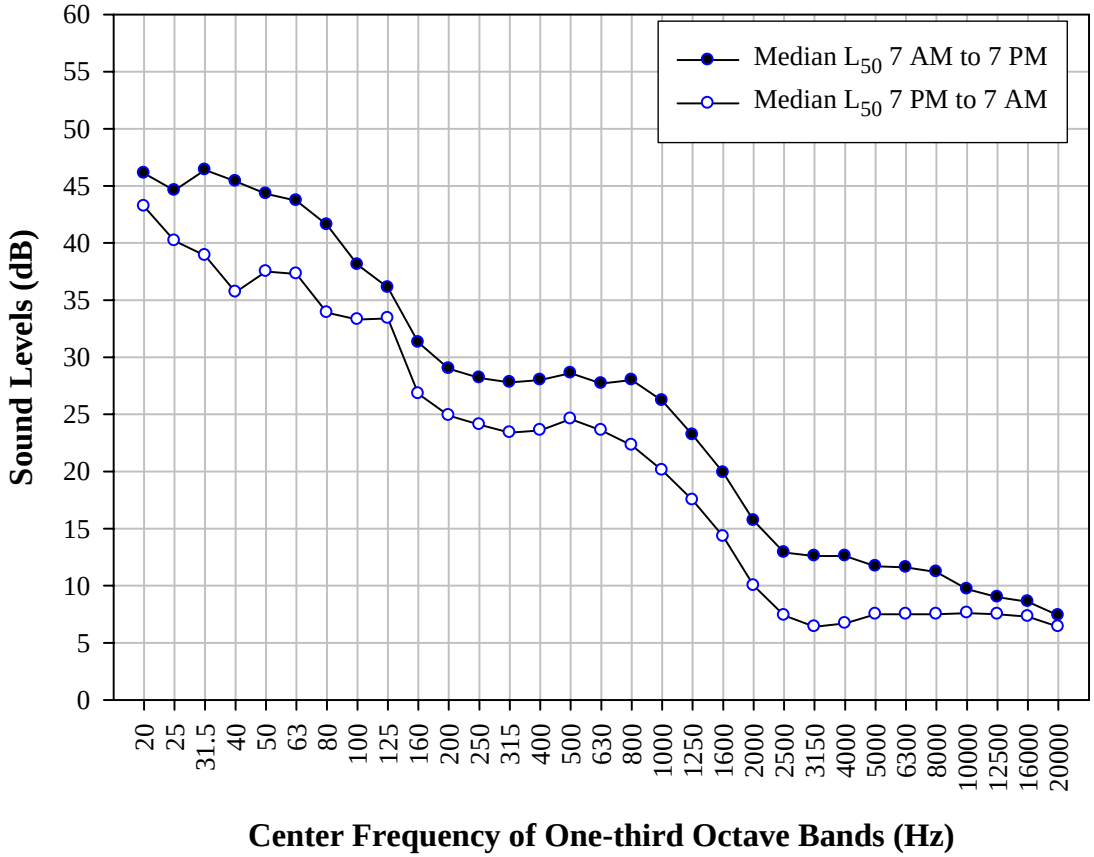

Figure I-44. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, South Rim, Residential Area (GRCA045), 12-12-2007 to 1-03-2008.

Table I-67. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), 7-08-2007 to 7-19-2007 (n=163).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	7	19.3	68.8	42.7	37.7	37.5	39.7	31.4	24.9
1	7	19.5	52.1	42.1	37.4	34.8	36.9	33.9	31.4
2	7	20.4	54.9	43.2	38.0	34.7	38.3	32.6	30.4
3	7	20.0	87.5	55.5	42.9	39.1	38.1	35.4	33.4
4	7	19.9	60.9	43.5	39.7	39.7	40.7	33.0	28.7
5	7	21.1	75.1	48.1	47.8	47.1	42.6	32.6	28.7
6	7	20.8	71.2	47.1	46.8	46.3	49.6	37.4	31.1
7	7	23.8	76.6	52.0	51.8	51.6	51.8	42.8	33.7
8	5	24.1	81.9	53.0	52.0	51.2	51.5	41.7	32.9
9	6	25.2	79.0	51.6	51.3	51.1	52.3	43.3	34.3
10	6	25.0	77.2	54.3	51.4	49.9	51.3	42.7	34.7
11	6	25.8	74.0	49.1	48.5	47.8	50.5	41.7	33.9
12	6	26.2	76.1	51.8	51.7	51.7	52.3	42.6	34.1
13	8	27.6	76.7	52.1	51.4	51.5	52.3	43.3	36.3
14	7	25.5	75.1	51.9	51.4	51.1	51.9	42.3	34.0
15	7	28.1	87.0	54.7	53.8	53.4	53.8	44.5	36.2
16	7	24.1	83.6	54.2	51.3	50.2	52.6	43.9	35.6
17	7	23.5	73.0	48.5	48.1	47.3	50.4	41.9	32.8
18	7	21.1	80.5	48.9	47.3	46.5	49.2	38.2	29.8
19	7	20.8	71.6	45.2	45.0	44.7	47.9	39.6	31.8
20	7	22.4	67.3	45.3	44.5	44.9	47.6	38.3	30.5
21	7	20.1	64.5	43.9	42.5	42.4	47.0	33.3	24.5
22	7	21.1	65.9	44.3	41.2	41.2	44.5	38.8	30.1
23	7	20.7	63.1	44.7	40.4	37.8	40.0	35.2	26.7

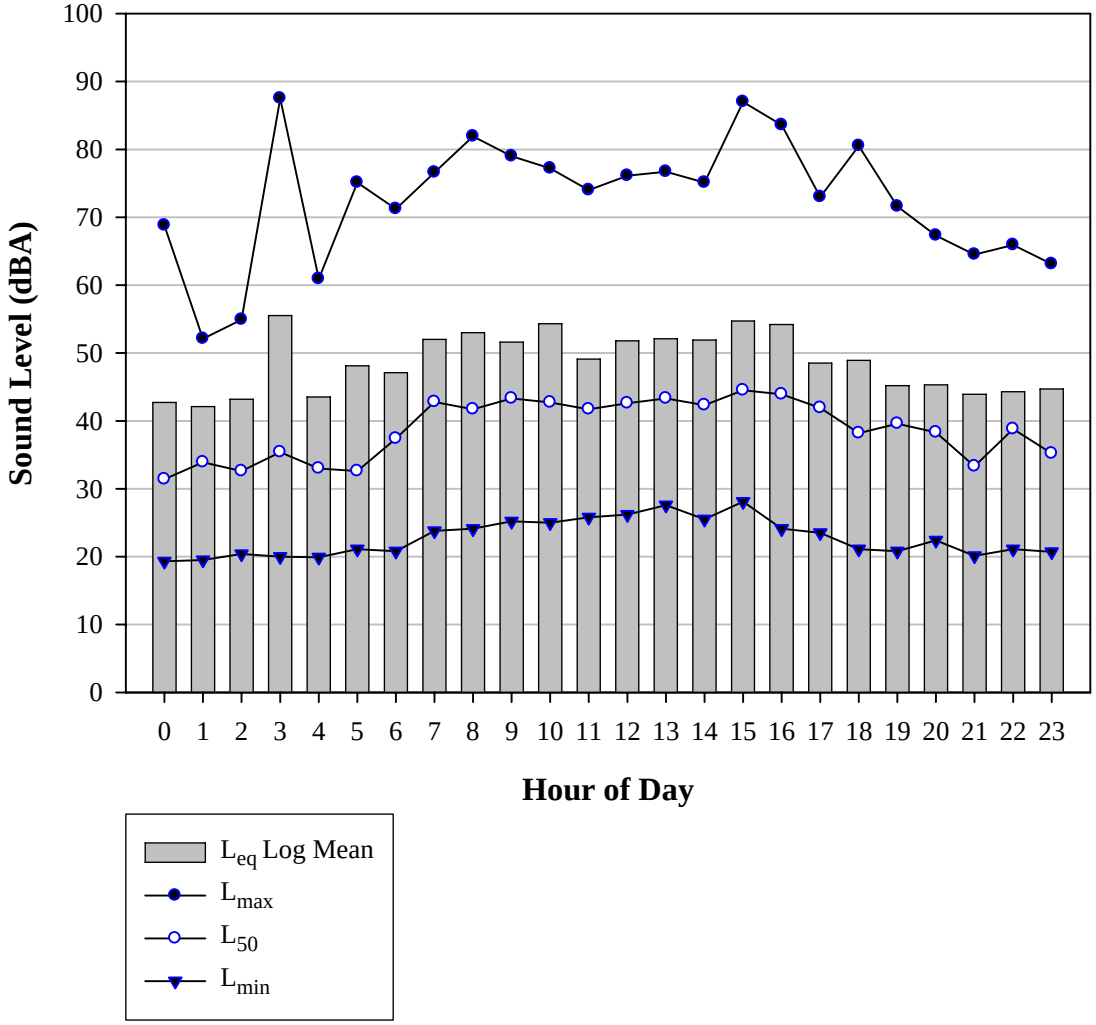

Figure I-45. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), 7-08-2007 to 7-19-2007 (n=163).

Table I-68. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	79	21.1	87.0	52.3	50.9	51.9	42.7	34.2
20	79	25.4	88.4	53.5	52.8	50.3	40.3	34.8
25	79	25.1	86.7	53.7	53.2	52.3	40.5	34.3
31.5	79	23.7	85.8	54.1	53.4	53.7	41.2	34.2
40	79	22.5	84.7	53.8	52.6	52.6	41.4	34.0
50	79	19.5	87.7	54.1	53.0	52.6	40.5	32.4
63	79	17.0	88.5	55.6	54.2	52.7	40.2	31.9
80	79	17.8	86.8	54.1	51.7	52.1	40.6	31.6
100	79	14.9	85.5	53.6	51.9	51.7	39.6	30.7
125	79	13.9	83.8	50.7	49.1	49.3	37.2	28.6
160	79	13.1	83.1	48.7	46.6	46.6	34.9	26.7
200	79	11.9	83.8	47.1	44.5	44.6	33.7	25.6
250	79	9.2	83.8	46.0	42.6	43.2	33.3	25.6
315	79	8.6	85.2	45.1	41.2	41.8	32.4	25.3
400	79	9.1	81.8	44.7	41.1	41.9	32.7	25.3
500	79	8.8	81.4	44.4	41.5	42.4	33.4	25.9
630	79	8.1	78.9	43.4	40.9	42.5	34.0	26.1
800	79	7.5	78.1	44.4	43.1	44.2	34.9	26.3
1000	79	8.4	77.1	42.7	41.5	43.5	34.2	25.0
1250	79	6.5	76.0	42.1	41.5	42.1	32.4	23.0
1600	79	5.6	73.4	40.8	40.1	41.0	30.2	20.5
2000	79	7.0	71.2	39.0	37.9	38.3	27.2	17.7
2500	79	6.1	73.8	37.7	36.7	36.1	24.5	15.5
3150	79	7.7	73.3	35.5	34.1	33.5	22.2	14.7
4000	79	7.9	67.0	32.4	30.6	31.3	21.1	14.1
5000	79	8.5	64.3	30.5	29.1	29.9	18.8	12.3
6300	79	9.3	71.8	29.0	26.6	27.1	16.1	11.6
8000	79	9.7	71.2	28.8	24.4	24.4	14.4	11.0
10000	79	10.6	72.4	26.5	22.9	22.3	13.0	11.3
12500	79	10.9	59.9	23.2	20.3	20.1	12.5	11.6
16000	79	11.1	60.7	21.2	16.8	15.8	12.3	11.7
20000	79	11.0	55.0	15.7	13.3	13.6	12.1	11.6

Table I-69. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	84	19.3	87.5	47.6	44.2	44.5	35.8	30.1
20	84	20.0	82.3	46.9	42.0	41.6	35.4	30.5
25	84	20.2	83.1	46.0	41.7	40.5	34.5	30.1
31.5	84	17.7	80.4	45.5	40.8	40.8	33.9	30.4
40	84	15.6	82.6	44.6	40.4	40.4	32.4	27.4
50	84	11.7	84.6	44.9	39.3	39.0	30.6	25.1
63	84	12.1	80.2	43.8	39.2	38.2	29.2	23.6
80	84	10.4	75.2	44.1	40.7	39.0	29.4	23.0
100	84	7.4	79.4	43.4	38.9	37.6	28.4	21.3
125	84	7.9	78.8	40.5	36.4	36.0	26.7	21.2
160	84	5.8	74.9	39.0	34.9	33.9	26.4	21.0
200	84	5.6	72.0	36.1	32.6	32.9	26.0	21.4
250	84	5.4	68.3	35.3	33.6	33.5	27.8	23.0
315	84	4.7	66.1	35.3	33.9	34.7	29.0	23.7
400	84	5.0	70.8	37.0	35.0	36.5	29.2	23.0
500	84	4.3	66.6	37.2	35.8	37.6	29.8	23.2
630	84	3.9	68.6	37.8	35.9	38.1	29.2	21.8
800	84	3.4	70.8	38.1	36.3	38.3	27.9	20.4
1000	84	5.1	65.4	36.8	35.0	36.9	26.8	19.1
1250	84	3.3	66.6	35.3	34.0	34.4	23.0	15.6
1600	84	3.8	63.7	32.9	31.8	31.4	19.8	12.7
2000	84	5.7	62.3	30.3	28.5	28.8	16.6	11.3
2500	84	5.2	65.0	29.3	25.8	26.0	15.1	10.0
3150	84	6.9	86.2	43.0	23.6	23.4	15.0	10.2
4000	84	7.4	59.3	24.6	21.9	22.9	14.7	10.4
5000	84	8.1	55.3	22.8	20.6	21.3	13.9	10.5
6300	84	9.2	53.6	20.8	18.5	19.2	12.8	10.6
8000	84	9.7	57.7	20.1	17.1	16.7	12.0	10.6
10000	84	10.7	55.4	18.1	15.5	14.7	11.6	11.1
12500	84	10.9	72.0	23.7	14.9	13.6	11.7	11.4
16000	84	10.9	71.1	22.4	13.3	12.9	11.9	11.6
20000	84	11.0	52.0	17.6	13.5	12.9	12.0	11.6

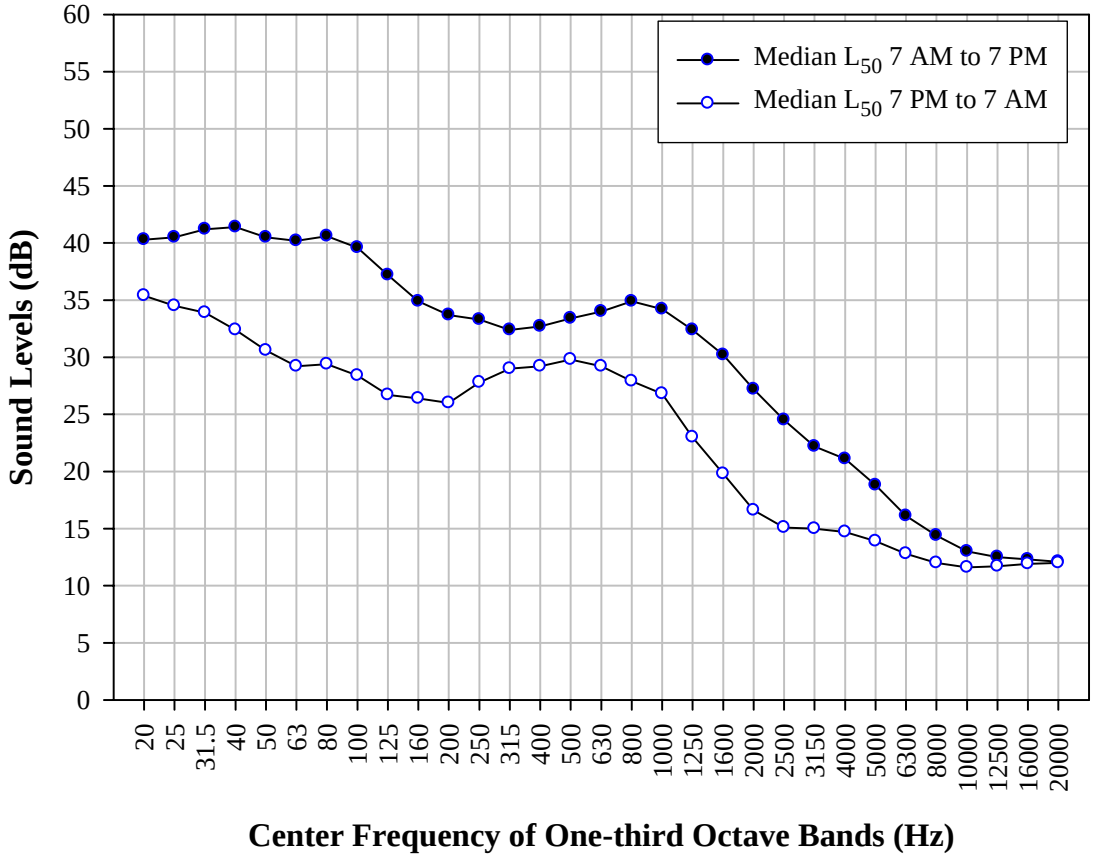

Figure I-46. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), 7-08-2007 to 7-19-2007.

Table I-70. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), 7-08-2007 to 7-18-2007 (n=234).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	10	21.9	66.8	37.6	36.5	36.6	37.9	28.1	24.7
1	10	21.5	59.2	37.1	35.0	34.9	36.6	27.8	24.8
2	10	22.0	58.8	41.0	34.8	32.6	35.6	26.4	24.6
3	10	21.9	64.7	43.8	37.1	35.1	36.8	26.6	24.3
4	10	21.8	68.2	44.0	39.2	37.8	41.4	28.6	24.6
5	10	22.8	72.3	44.5	42.7	41.7	44.7	34.2	26.6
6	10	24.3	73.5	47.2	46.0	45.2	48.1	39.1	31.4
7	10	26.5	77.9	50.1	49.4	48.8	51.0	42.7	35.8
8	9	29.7	77.3	51.0	50.4	50.1	52.9	44.4	38.0
9	9	30.7	76.5	51.4	51.3	51.5	54.1	45.9	40.3
10	9	31.3	77.1	52.2	51.9	51.7	54.6	47.5	41.4
11	9	32.4	80.7	54.2	54.1	54.4	55.0	48.3	41.9
12	9	31.7	84.7	55.9	53.6	52.3	55.1	47.6	42.0
13	9	31.5	77.7	53.1	52.7	53.1	55.1	48.0	42.3
14	10	34.8	76.1	52.8	52.6	52.3	54.6	48.1	43.1
15	10	33.6	73.6	53.9	52.8	52.2	54.5	47.7	42.6
16	10	30.6	88.5	56.5	53.2	51.7	54.6	46.9	41.3
17	10	30.5	79.2	52.1	51.7	51.3	53.6	45.8	39.2
18	10	27.7	76.6	51.1	50.7	50.6	53.1	44.7	38.4
19	10	26.6	83.0	50.6	50.3	50.1	52.3	44.4	36.7
20	10	25.9	71.0	49.6	48.4	47.5	50.5	41.9	34.3
21	10	24.6	68.8	47.3	44.9	43.9	46.6	38.1	31.3
22	10	23.0	72.8	44.7	43.5	43.6	44.9	36.9	30.1
23	10	22.0	73.2	40.6	39.7	38.9	41.4	33.0	26.8

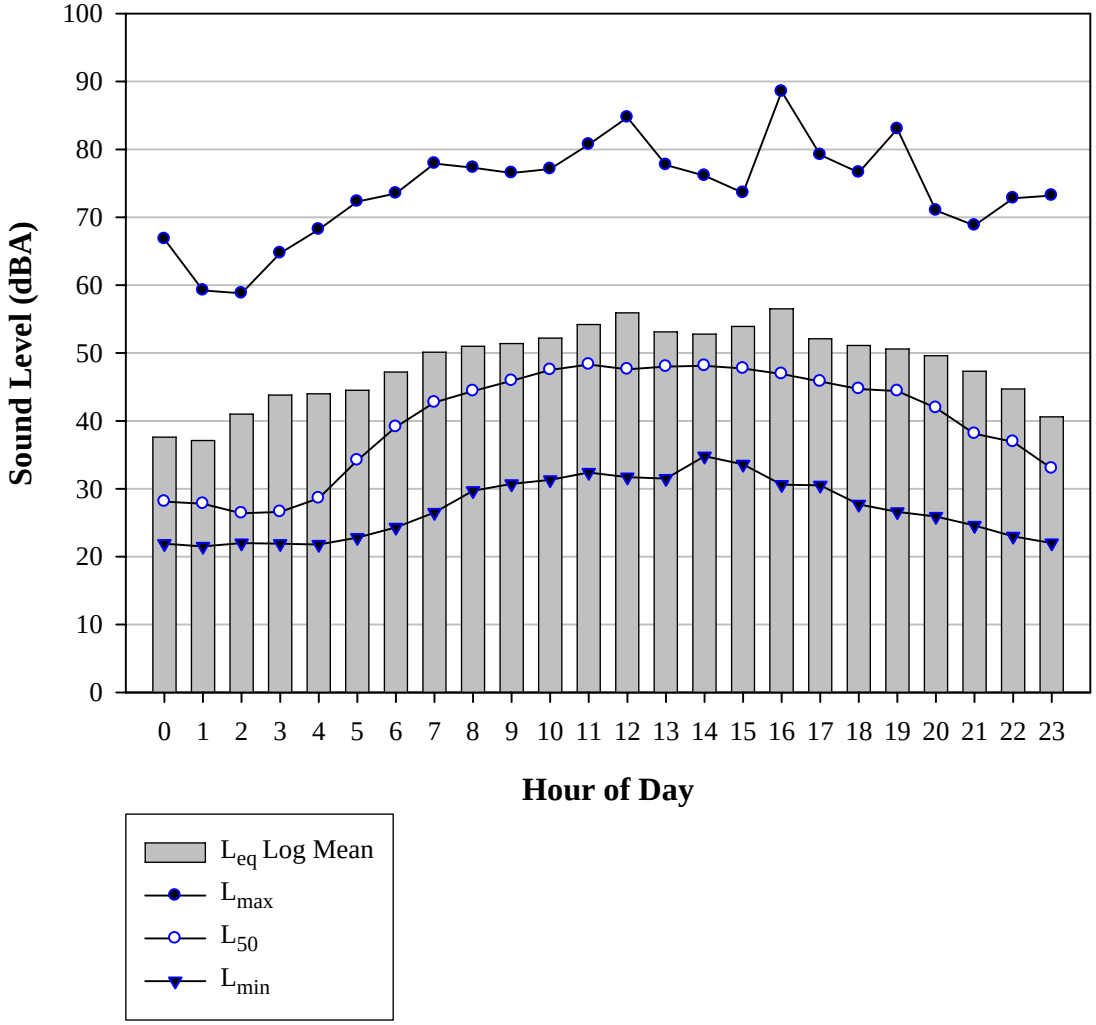

Figure I-47. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), 7-08-2007 to 7-18-2007 (n=234).

Table I-71. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), 7-08-2007 to 7-18-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	114	26.5	88.5	53.3	51.8	54.3	47.0	41.2
20	114	25.6	88.5	55.8	55.5	57.1	47.1	40.0
25	114	28.4	83.8	56.5	55.9	58.4	49.3	41.7
31.5	114	26.8	89.3	56.0	55.6	58.4	50.2	42.6
40	114	24.9	87.9	56.9	56.3	58.9	50.1	43.0
50	114	24.9	89.1	57.0	54.9	57.2	47.9	40.6
63	114	26.5	88.3	57.1	54.9	56.3	47.3	40.1
80	114	24.7	87.8	56.9	55.3	56.7	48.2	41.4
100	114	23.8	85.7	55.7	54.0	55.3	46.8	40.3
125	114	27.4	86.3	54.1	52.0	53.9	45.4	39.8
160	114	21.4	85.9	52.3	50.0	51.9	43.7	36.9
200	114	21.0	84.7	49.8	48.0	49.7	41.7	35.1
250	114	17.7	84.8	47.3	45.2	47.8	39.9	33.8
315	114	15.4	84.7	45.8	43.4	46.2	38.4	31.9
400	114	15.5	83.7	45.0	42.3	45.0	37.3	31.2
500	114	14.5	86.1	46.2	42.0	45.0	37.4	31.1
630	114	15.3	82.3	43.5	41.6	44.4	37.1	31.2
800	114	15.2	81.9	44.2	42.5	45.0	37.5	31.4
1000	114	14.4	79.7	43.3	41.7	44.2	37.1	30.8
1250	114	11.7	77.5	42.4	41.3	43.7	36.1	29.8
1600	114	12.3	75.2	41.3	40.3	42.7	35.1	28.9
2000	114	11.1	75.5	39.9	38.8	41.1	33.4	27.3
2500	114	10.1	70.8	39.3	38.0	39.7	31.8	25.6
3150	114	9.7	75.4	37.9	36.3	37.7	29.8	23.3
4000	114	9.0	63.6	34.8	33.1	35.4	27.5	21.1
5000	114	9.1	64.3	33.3	31.5	33.2	25.3	18.2
6300	114	9.6	65.0	31.6	29.1	31.0	22.5	16.1
8000	114	10.3	70.0	30.0	27.5	28.4	20.0	14.1
10000	114	11.1	71.7	30.1	25.0	26.0	17.7	13.1
12500	114	11.7	68.9	27.3	22.9	23.6	15.9	12.9
16000	114	12.3	67.5	26.3	22.0	21.0	14.5	13.1
20000	114	11.8	63.3	21.8	17.9	16.1	13.2	12.6

Table I-72. Acoustic metrics (dBA and un-weighted one-third octave bands 20-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), 7-08-2007 to 7-18-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	120	21.5	83.0	45.8	41.7	44.4	35.2	28.0
20	120	18.6	85.0	49.7	45.4	43.5	33.6	27.9
25	120	24.6	84.6	49.1	44.8	43.3	34.6	31.3
31.5	120	23.0	82.9	48.8	44.2	43.4	33.6	29.4
40	120	19.8	85.3	48.2	44.4	42.8	32.2	26.9
50	120	17.9	85.7	47.3	41.5	41.7	30.7	25.9
63	120	20.6	85.8	47.8	40.4	41.6	31.1	26.9
80	120	21.0	82.6	47.4	43.1	44.0	33.5	29.0
100	120	22.6	79.9	45.9	40.7	41.8	31.3	28.0
125	120	22.5	77.7	44.4	39.1	40.7	34.8	31.6
160	120	17.8	77.3	42.9	38.1	39.2	27.9	23.3
200	120	15.7	78.8	41.0	35.1	37.0	26.7	22.6
250	120	12.2	78.0	38.9	34.5	36.3	26.2	20.1
315	120	9.8	72.6	36.6	32.0	34.4	25.2	17.9
400	120	8.8	67.8	36.0	32.5	33.8	26.3	18.1
500	120	7.3	66.6	36.3	32.5	34.9	26.8	17.7
630	120	8.2	62.8	36.5	32.0	34.7	26.7	17.7
800	120	6.7	66.7	37.3	32.3	35.1	25.7	16.7
1000	120	5.7	69.5	37.3	32.1	34.6	24.6	15.6
1250	120	5.1	70.6	36.2	31.1	33.8	23.3	13.1
1600	120	5.1	65.7	34.7	29.7	32.4	21.3	11.9
2000	120	5.5	66.6	32.6	27.6	30.2	19.0	10.6
2500	120	5.9	65.6	30.8	26.1	28.3	16.4	9.3
3150	120	6.7	81.6	31.4	25.3	25.9	14.0	8.7
4000	120	7.4	63.3	26.4	23.5	23.0	15.9	9.0
5000	120	8.1	67.1	24.8	20.5	20.8	12.9	9.1
6300	120	8.8	72.5	24.6	18.8	18.2	10.7	9.6
8000	120	9.7	63.7	21.6	16.8	16.1	11.0	10.4
10000	120	10.6	62.5	21.1	17.9	18.3	12.1	11.3
12500	120	11.4	59.6	29.4	24.1	21.0	13.2	12.1
16000	120	12.1	64.8	27.5	21.1	17.5	13.1	12.7
20000	120	11.7	58.6	26.7	23.0	22.0	13.2	12.4

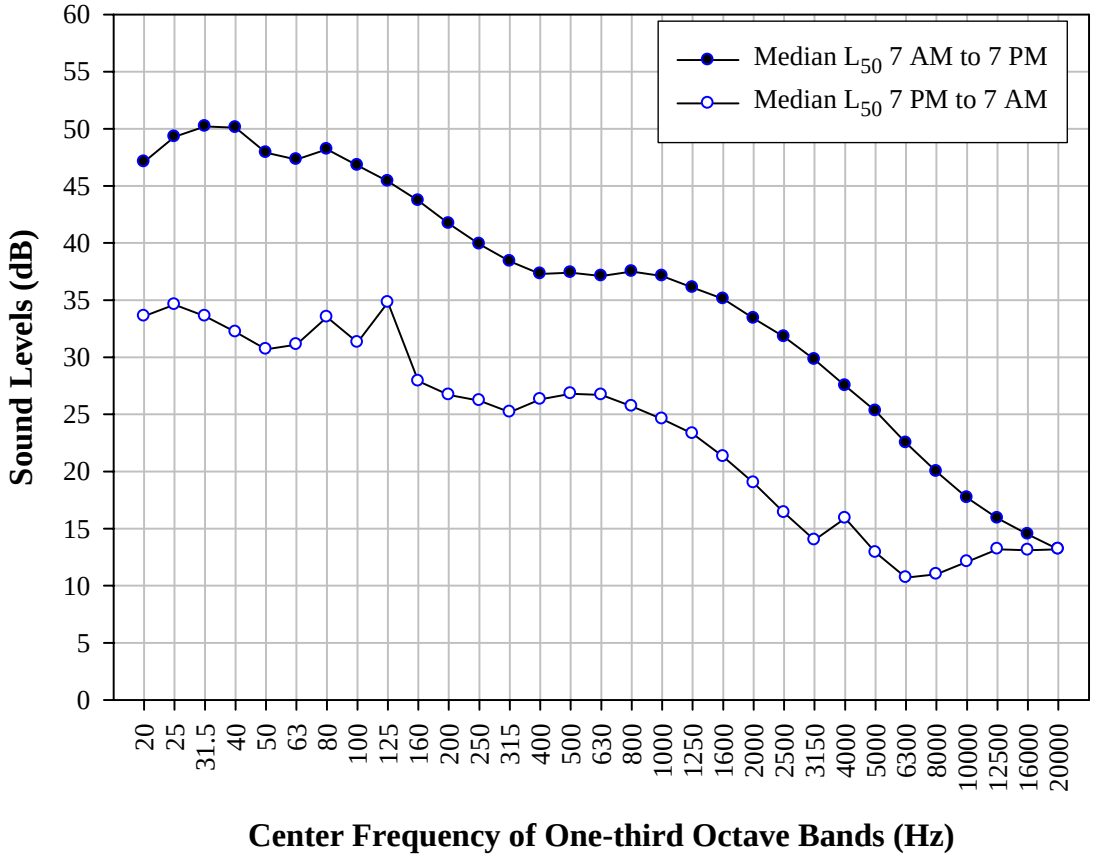

Figure I-48. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), 7-08-2007 to 7-18-2007.

Table I-73. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), 7-08-2007 to 7-19-2007 (n=257).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	19.4	59.3	34.4	32.7	33.9	35.4	27.7	25.3
1	11	20.9	57.0	34.4	32.8	32.1	33.7	28.7	27.0
2	11	21.9	51.6	33.8	31.6	30.7	32.8	29.1	25.9
3	11	21.3	50.2	33.3	30.7	28.9	30.8	27.7	25.3
4	11	20.8	54.9	34.4	32.9	33.0	33.8	31.6	28.8
5	11	21.4	57.5	35.8	35.4	35.1	37.8	29.2	26.8
6	11	21.9	70.0	41.1	40.3	40.1	42.1	33.2	27.8
7	11	21.0	70.4	47.7	46.5	46.6	46.4	36.5	28.4
8	10	21.0	68.4	46.5	44.1	42.4	44.1	35.7	29.0
9	11	21.8	73.8	46.1	44.3	43.3	44.7	36.9	29.4
10	10	22.7	69.9	46.0	44.4	43.4	45.1	37.0	31.2
11	10	24.1	69.3	44.8	43.7	43.8	45.5	37.2	31.3
12	10	22.2	66.5	44.6	43.3	42.2	44.0	37.2	31.3
13	10	24.7	75.8	46.8	43.1	41.8	44.5	37.9	32.5
14	10	24.2	71.0	44.3	43.0	42.6	44.5	37.7	31.4
15	10	23.9	90.6	50.4	45.9	46.0	46.2	38.8	32.5
16	11	23.9	84.8	49.9	45.3	44.0	45.1	37.6	31.6
17	11	21.4	73.3	46.0	43.0	41.7	44.2	35.9	30.3
18	11	21.7	66.7	40.5	40.1	39.6	41.7	33.6	28.2
19	11	22.2	62.1	40.1	39.9	40.1	42.7	35.3	27.8
20	11	20.5	58.0	37.8	37.4	36.9	40.3	33.2	26.7
21	11	20.6	61.0	37.7	37.2	37.1	39.5	31.7	26.1
22	11	20.1	61.2	39.6	37.6	37.9	40.8	35.6	26.4
23	11	19.6	55.8	36.6	34.0	31.7	33.9	29.1	25.7

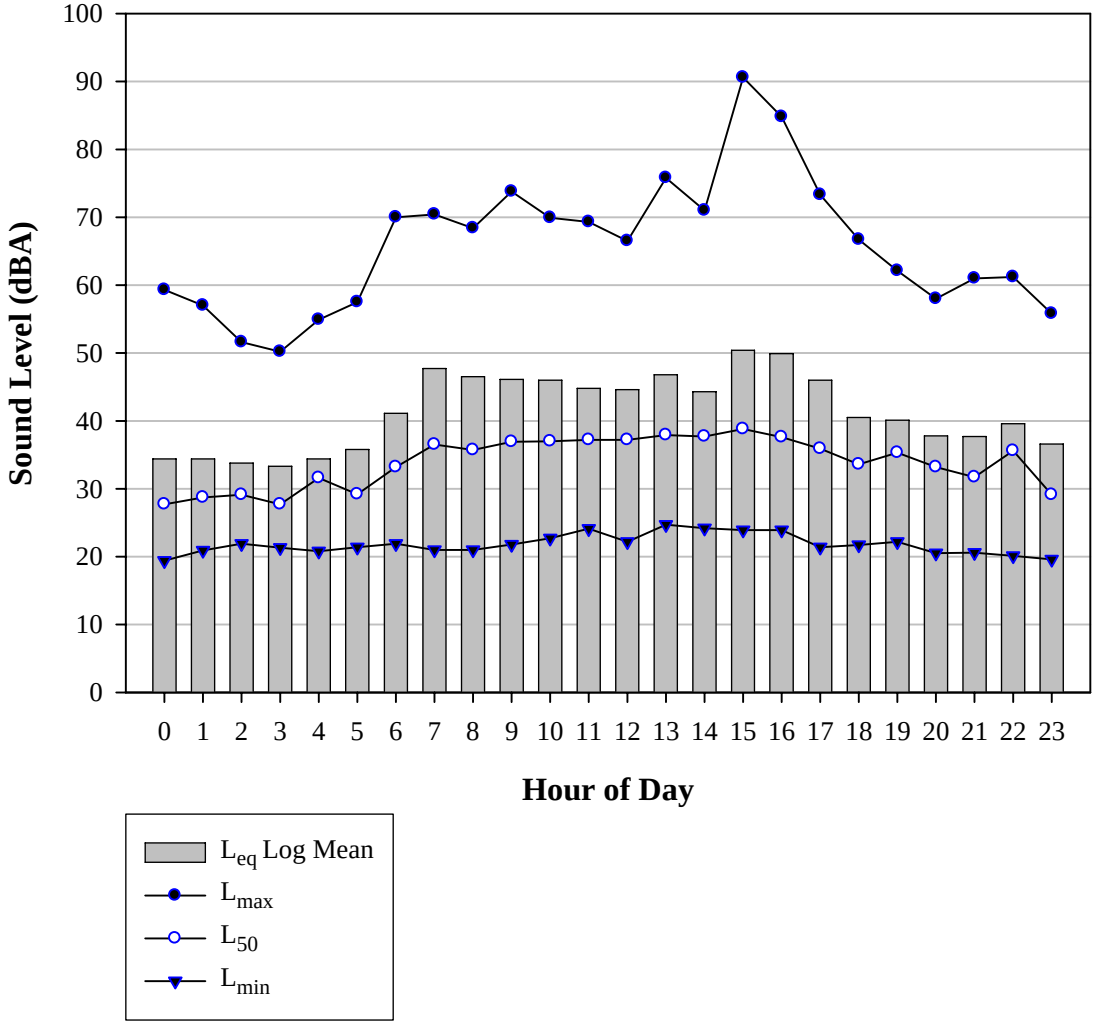

Figure I-49. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), 7-08-2007 to 7-19-2007 (n=257).

Table I-74. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	125	21.0	90.6	46.8	42.9	44.8	36.9	30.9
12.5	125	19.6	81.4	45.0	41.5	44.1	37.7	33.0
15.8	125	19.5	82.2	44.5	41.9	44.1	37.6	32.7
20	125	20.1	84.9	45.0	42.3	44.7	38.1	33.0
25	125	20.6	85.3	46.8	42.8	45.0	38.4	33.4
31.5	125	22.4	85.0	47.5	45.0	46.8	39.6	34.7
40	125	19.2	85.9	52.1	47.0	48.9	40.4	34.4
50	125	18.8	94.1	55.0	47.9	49.5	40.2	33.7
63	125	20.1	92.8	55.4	49.0	50.6	41.3	33.8
80	125	15.3	87.9	54.8	49.2	50.6	39.7	32.0
100	125	12.0	84.2	51.5	48.2	49.3	37.4	29.1
125	125	19.7	85.5	46.6	44.9	45.8	38.2	34.5
160	125	9.1	88.6	43.8	40.3	41.9	29.7	21.9
200	125	6.8	86.7	42.1	37.4	38.9	27.3	19.8
250	125	10.0	89.0	40.8	34.0	35.7	25.8	20.7
315	125	6.3	86.8	39.7	32.1	33.4	24.4	18.3
400	125	7.7	87.6	38.9	31.2	33.1	24.7	19.4
500	125	7.7	83.9	39.5	31.1	33.7	25.5	19.1
630	125	8.4	83.5	37.7	32.1	34.5	26.5	19.2
800	125	8.8	82.7	37.4	33.2	36.1	28.1	19.7
1000	125	8.8	81.1	36.8	33.5	36.1	28.2	19.2
1250	125	9.4	79.6	37.8	33.4	35.0	26.3	17.8
1600	125	9.5	77.4	34.3	31.9	32.8	23.7	16.0
2000	125	10.1	74.2	32.3	30.0	30.1	20.8	14.4
2500	125	10.8	71.1	31.1	28.4	28.2	18.5	13.7
3150	125	11.8	66.2	28.3	26.1	26.9	17.7	14.1
4000	125	12.9	64.7	27.2	25.7	27.2	20.2	15.7
5000	125	13.9	66.2	27.5	26.3	28.6	21.1	16.2
6300	125	15.0	66.8	24.9	23.1	24.6	18.0	15.9
8000	125	16.1	64.5	22.8	20.6	20.9	17.0	16.6
10000	125	17.3	62.7	22.2	19.6	19.9	17.9	17.6
12500	125	18.3	60.1	22.1	19.6	19.9	18.9	18.7
16000	125	19.1	60.4	21.7	19.9	20.0	19.6	19.5
20000	125	20.8	44.0	21.5	21.2	21.3	21.2	21.1

Table I-75. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	19.4	70.0	37.4	35.5	37.6	32.0	26.5
12.5	132	17.2	80.9	39.5	36.9	39.5	33.9	29.7
15.8	132	15.2	77.5	37.6	35.7	38.2	32.0	27.8
20	132	14.0	76.3	36.5	34.0	36.6	30.6	26.5
25	132	17.5	74.3	36.5	34.3	36.4	31.2	27.7
31.5	132	16.5	70.3	37.8	36.1	37.6	33.0	29.4
40	132	12.2	71.0	38.2	36.0	36.4	29.3	25.6
50	132	11.6	79.4	39.3	35.2	35.8	27.8	23.0
63	132	14.9	77.4	41.1	36.8	36.0	29.2	25.2
80	132	8.3	79.8	39.8	36.0	34.9	25.1	19.8
100	132	6.6	72.1	38.5	34.5	32.7	23.0	18.1
125	132	15.1	74.9	39.4	38.6	39.1	37.1	35.5
160	132	6.5	67.6	32.9	30.0	29.0	20.1	15.9
200	132	5.0	64.0	29.6	28.0	27.4	20.7	15.7
250	132	5.8	62.6	27.9	26.9	27.6	22.0	17.9
315	132	6.2	63.6	27.5	26.2	27.9	21.7	16.5
400	132	7.3	63.0	28.5	26.8	28.6	22.7	17.8
500	132	7.1	58.8	29.1	27.4	30.1	23.6	18.0
630	132	7.1	58.5	29.5	27.6	30.3	23.6	17.9
800	132	7.3	59.8	29.8	27.8	30.2	22.9	16.9
1000	132	7.7	59.9	29.0	27.2	30.0	21.2	15.2
1250	132	8.3	61.2	27.6	25.2	27.5	18.3	13.2
1600	132	8.9	61.2	25.5	23.1	24.7	15.7	11.9
2000	132	9.7	60.5	23.3	20.9	21.2	13.9	11.6
2500	132	10.4	60.9	22.0	18.1	18.7	13.4	11.9
3150	132	11.5	55.1	20.0	17.3	18.5	14.1	12.6
4000	132	12.6	56.8	20.0	17.6	18.9	15.1	13.5
5000	132	13.7	52.8	20.2	17.6	19.1	15.5	14.4
6300	132	14.8	49.9	18.6	17.2	18.1	15.9	15.4
8000	132	16.0	47.8	18.1	17.3	17.5	16.7	16.5
10000	132	17.2	56.6	18.7	18.2	18.2	17.7	17.5
12500	132	18.2	52.3	20.1	19.2	19.0	18.7	18.6
16000	132	19.1	53.2	19.9	19.6	19.7	19.5	19.4
20000	132	20.7	39.4	21.2	21.1	21.2	21.1	21.0

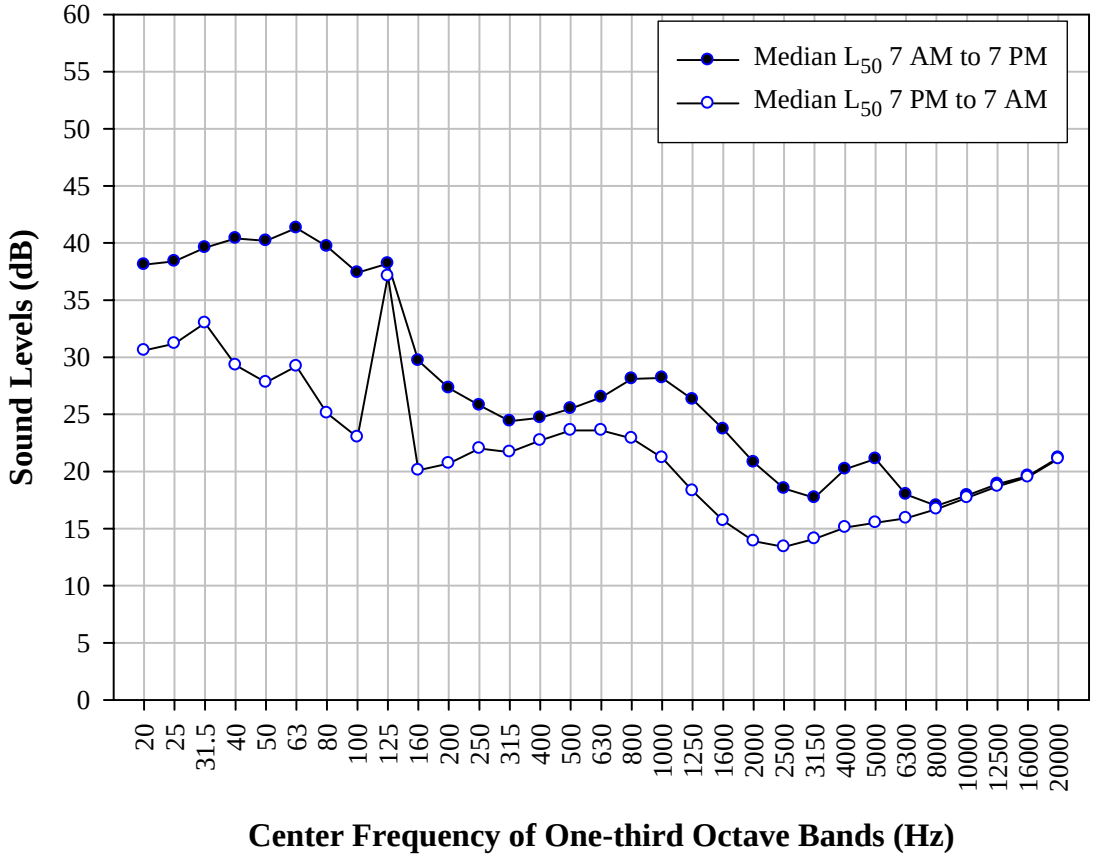

Figure I-50. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), 7-08-2007 to 7-19-2007.

Table I-76. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), 7-08-2007 to 7-19-2007 (n=254).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	17.7	53.3	34.9	31.0	31.7	33.1	25.8	21.2
1	11	17.2	51.4	36.5	31.5	29.0	30.3	26.3	21.9
2	11	17.5	58.5	37.4	30.6	25.9	27.9	24.0	21.2
3	11	17.0	54.1	37.9	29.9	25.9	27.5	25.1	20.9
4	11	17.0	54.0	38.1	31.6	29.7	30.4	26.0	21.7
5	11	17.3	56.2	38.1	33.5	31.1	33.5	27.7	22.6
6	11	20.5	69.3	38.7	37.2	36.0	37.3	31.3	27.6
7	10	25.1	72.4	42.3	40.9	40.2	42.8	37.7	32.2
8	10	27.3	73.8	45.2	42.0	40.6	42.8	37.1	33.4
9	10	23.2	68.0	42.7	41.8	41.4	43.8	36.3	31.8
10	10	24.0	74.7	40.4	39.7	39.6	42.6	34.2	30.1
11	10	24.0	61.9	38.8	38.2	37.5	39.7	34.2	30.3
12	10	25.7	69.4	43.7	41.5	41.0	43.9	36.8	30.7
13	10	26.7	78.3	44.7	41.9	39.8	42.1	35.1	30.8
14	10	23.7	68.0	40.1	39.5	39.8	42.0	36.0	31.1
15	10	24.8	83.7	46.5	41.7	40.6	41.9	36.1	31.6
16	10	26.2	89.2	51.6	43.1	40.8	43.1	36.5	31.1
17	11	25.7	78.9	42.8	41.0	39.5	41.9	35.8	31.9
18	11	25.2	71.8	40.9	40.0	39.3	41.6	35.8	33.4
19	11	25.2	71.9	41.2	40.4	39.9	43.1	37.2	33.1
20	11	23.8	61.4	41.2	39.9	39.3	42.9	36.7	32.7
21	11	21.3	66.0	39.6	37.3	39.0	41.2	33.1	27.7
22	11	18.5	64.0	42.1	38.8	38.0	41.1	34.8	29.1
23	11	17.3	53.6	35.7	32.4	31.5	34.9	29.4	23.5

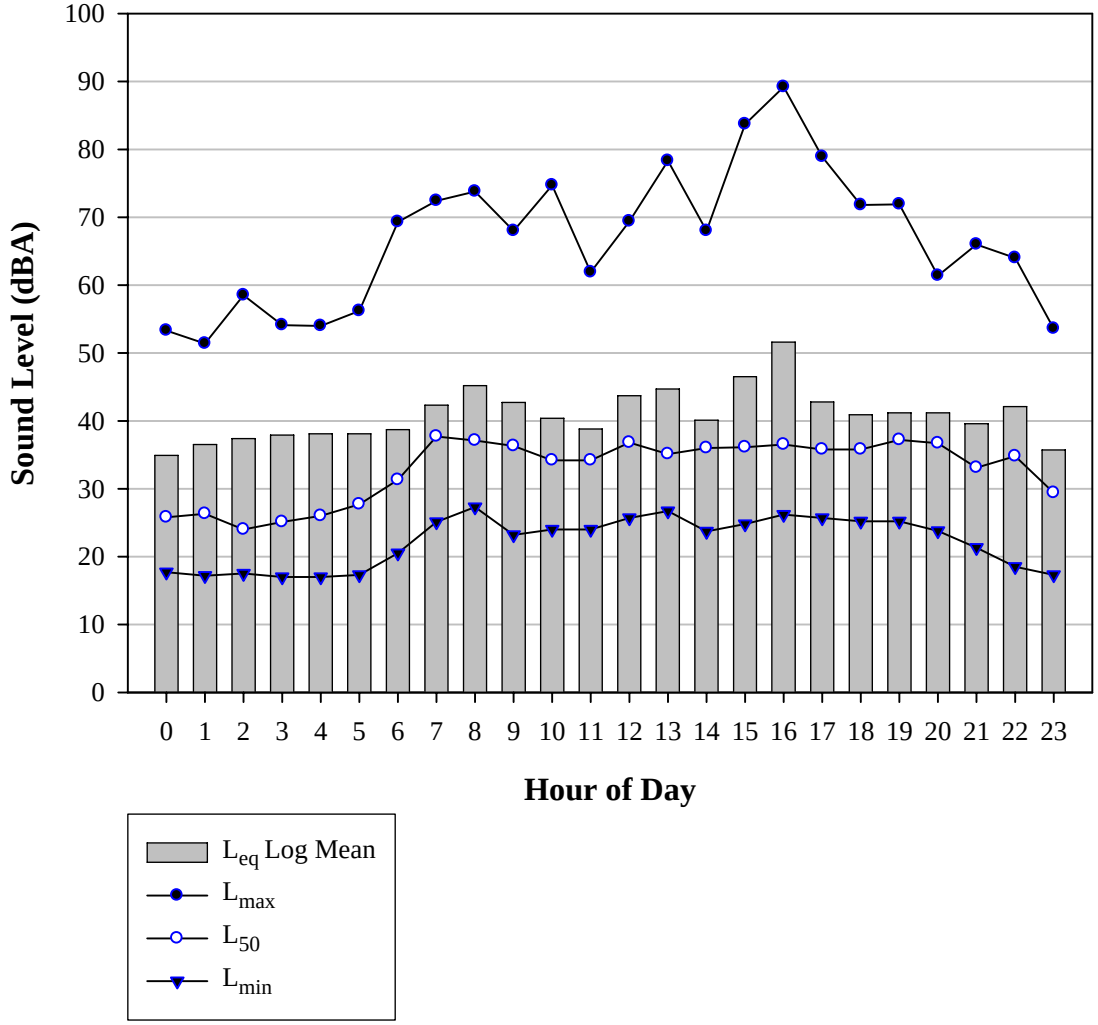

Figure I-51. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), 7-08-2007 to 7-19-2007 (n=254).

Table I-77. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	122	23.2	89.2	44.9	40.0	42.4	35.9	31.6
12.5	122	8.0	103.7	54.7	47.5	49.6	40.1	34.0
15.8	122	8.0	99.8	51.5	46.1	47.7	39.0	33.5
20	122	6.3	101.7	51.8	45.4	46.7	39.4	33.9
25	122	4.5	100.2	50.9	44.8	46.2	39.6	35.0
31.5	122	4.3	96.2	51.4	46.2	48.0	42.5	38.8
40	122	3.8	97.8	50.6	45.5	48.1	41.3	35.8
50	122	4.4	96.7	51.4	46.1	49.0	40.9	35.4
63	122	1.2	94.4	52.0	47.1	49.9	41.7	36.4
80	122	2.9	94.8	50.1	46.0	48.1	40.9	36.3
100	122	1.2	93.7	50.0	44.8	46.8	38.7	33.2
125	122	-0.1	94.0	48.1	41.7	44.0	36.9	32.0
160	122	1.0	96.9	47.9	38.7	41.5	33.8	29.3
200	122	0.9	97.4	46.9	36.3	38.3	31.0	26.2
250	122	1.0	97.5	46.0	34.0	36.3	28.8	24.3
315	122	1.9	98.2	45.9	31.7	33.6	26.7	22.1
400	122	2.6	94.8	43.9	30.3	32.7	25.4	20.7
500	122	3.3	93.6	42.9	29.2	31.8	25.1	21.0
630	122	3.5	92.1	40.7	29.2	31.8	25.1	20.5
800	122	4.7	90.9	40.7	29.1	31.4	25.2	21.1
1000	122	5.2	94.0	53.6	29.1	31.4	25.0	20.5
1250	122	6.7	88.5	38.8	29.4	31.6	24.0	19.3
1600	122	7.3	86.0	37.1	28.1	30.3	22.8	17.7
2000	122	8.4	87.2	36.6	26.5	28.9	21.0	16.0
2500	122	9.5	87.2	35.8	25.1	26.8	19.4	15.0
3150	122	10.5	89.2	36.5	23.2	24.8	18.0	14.5
4000	122	11.9	85.9	34.0	22.0	24.2	17.5	14.4
5000	122	12.9	83.8	32.6	21.4	23.0	16.7	14.6
6300	122	13.9	83.2	31.3	19.7	20.7	16.2	15.2
8000	122	15.2	82.9	31.6	19.0	18.9	16.5	16.1
10000	122	16.6	82.5	31.1	18.4	18.2	17.3	17.1
12500	122	17.7	82.4	30.5	18.7	18.6	18.3	18.1
16000	122	18.7	81.9	30.4	19.3	19.3	19.1	19.0
20000	122	20.3	81.0	29.8	20.7	20.7	20.6	20.6

Table I-78. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), 7-08-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	17.0	71.9	39.0	34.8	37.0	31.3	26.5
12.5	132	17.0	82.5	45.0	41.3	43.4	36.1	30.9
15.8	132	16.2	78.1	43.2	40.7	42.5	34.4	29.3
20	132	15.6	76.7	41.9	39.7	40.9	33.6	28.7
25	132	19.5	72.7	40.8	38.8	40.4	33.9	30.2
31.5	132	25.5	71.3	42.7	40.8	42.7	39.7	36.4
40	132	15.5	71.9	39.2	35.9	38.5	32.0	27.4
50	132	15.2	76.3	40.6	36.5	38.3	33.7	28.5
63	132	14.9	81.1	42.0	36.7	39.0	32.8	28.1
80	132	12.9	74.8	40.3	37.2	39.2	35.3	27.5
100	132	13.1	79.9	39.4	33.1	35.0	29.1	24.8
125	132	17.6	76.0	36.7	32.0	33.4	30.1	27.0
160	132	11.5	71.6	34.1	30.3	31.7	27.0	23.2
200	132	9.9	66.8	30.9	27.7	29.5	23.8	20.0
250	132	9.3	67.6	29.7	27.9	29.5	23.9	18.8
315	132	6.8	65.2	28.7	27.2	28.5	22.3	17.9
400	132	6.8	58.9	29.9	27.0	29.0	22.6	17.1
500	132	7.1	62.3	31.0	26.7	28.5	23.0	17.3
630	132	7.0	57.9	31.7	26.3	28.4	23.2	16.9
800	132	7.2	59.2	32.0	25.7	28.6	23.2	16.6
1000	132	7.2	61.8	31.2	24.3	26.9	21.5	15.2
1250	132	7.4	70.9	29.7	22.3	25.2	19.1	14.5
1600	132	7.9	64.1	27.2	19.8	22.7	16.8	13.0
2000	132	8.8	61.9	24.5	18.0	20.0	14.5	12.0
2500	132	9.7	65.1	22.3	16.2	18.0	13.6	11.7
3150	132	10.9	62.0	20.9	16.3	18.3	13.9	12.0
4000	132	11.9	50.2	18.2	15.5	16.1	13.8	12.8
5000	132	13.1	55.3	17.7	14.9	15.6	14.2	13.7
6300	132	14.2	56.7	17.1	15.3	15.6	15.0	14.7
8000	132	15.4	61.7	17.9	16.3	16.4	16.0	15.8
10000	132	16.5	47.8	18.0	17.4	17.3	17.1	16.9
12500	132	17.6	47.8	19.9	18.5	18.3	18.1	18.0
16000	132	18.6	44.0	19.3	19.1	19.1	19.0	18.9
20000	132	20.2	42.8	20.6	20.6	20.6	20.5	20.4

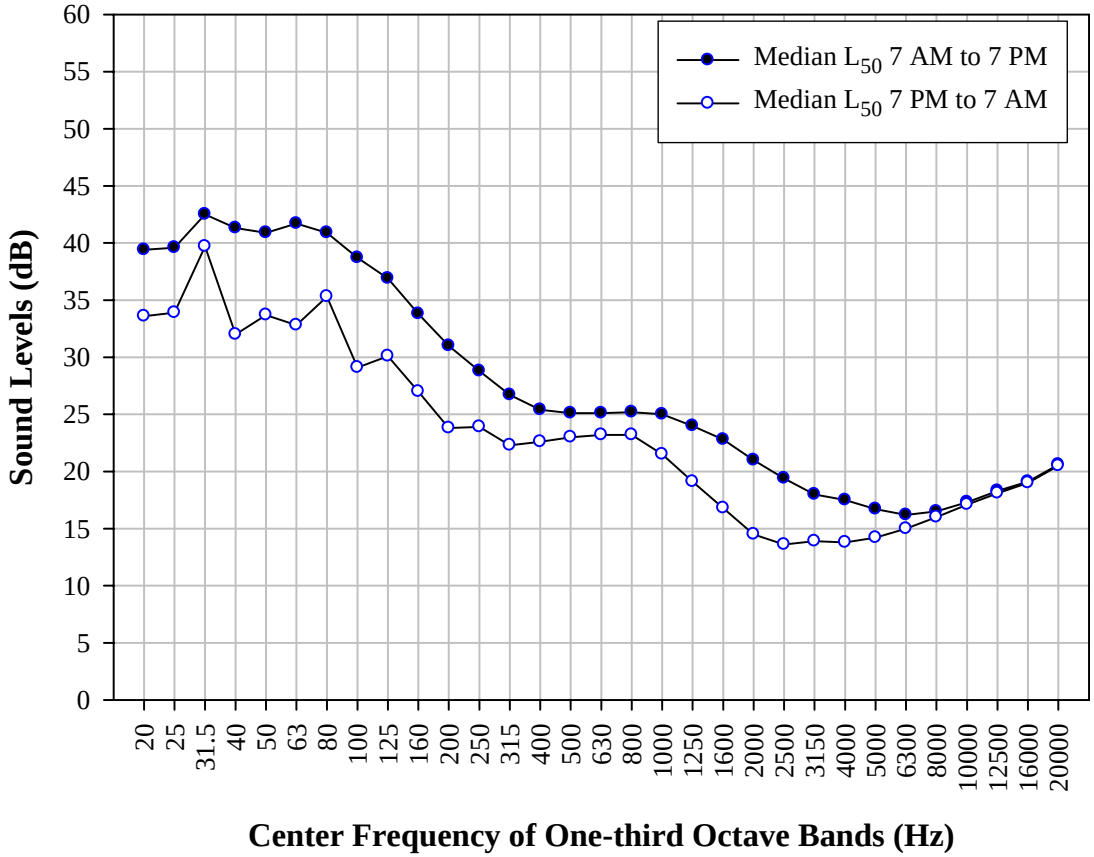

Figure I-52. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), 7-08-2007 to 7-19-2007.

Table I-79. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Cape Royal (GRCA050), 7-09-2007 to 7-19-2007 (n=239).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	10	15.8	55.2	43.0	36.2	40.0	43.0	33.8	26.4
1	10	15.9	58.2	41.4	35.9	36.9	40.1	35.5	30.6
2	10	15.4	53.7	39.6	32.9	34.7	38.4	31.8	24.2
3	10	15.4	54.3	38.4	29.7	26.0	29.2	22.4	17.9
4	10	14.7	52.7	35.9	28.3	27.1	22.8	17.4	15.8
5	10	14.7	56.7	34.9	30.6	29.2	30.9	19.2	16.6
6	10	14.9	56.0	35.0	31.1	30.3	30.5	19.8	17.6
7	10	15.8	57.8	33.4	29.1	28.5	30.1	21.0	17.8
8	10	15.7	73.1	40.1	32.6	31.2	31.5	22.5	18.7
9	10	16.1	56.9	31.7	31.2	31.1	32.0	24.0	19.8
10	10	16.9	62.5	32.6	31.2	30.0	32.0	25.2	21.9
11	9	18.4	65.7	33.8	32.5	31.4	33.1	27.4	23.1
12	10	17.9	69.1	36.8	34.0	32.6	34.5	27.7	23.2
13	10	18.2	56.5	32.5	32.1	32.5	35.9	27.8	22.8
14	10	18.8	73.0	38.6	35.0	32.3	35.0	28.5	23.6
15	10	16.9	78.1	42.2	38.8	39.4	39.2	29.6	24.2
16	10	16.7	91.5	56.2	41.9	37.8	40.3	32.7	23.9
17	10	16.6	76.0	41.6	38.0	37.2	39.4	32.8	24.1
18	10	16.4	62.0	36.1	35.2	35.7	38.0	29.5	22.1
19	10	15.6	67.6	41.8	37.4	36.4	37.1	31.0	24.8
20	10	17.6	57.1	43.0	38.3	37.4	41.9	33.3	28.5
21	10	17.2	59.2	44.4	38.6	38.0	41.3	36.2	32.3
22	10	15.9	60.4	46.5	38.8	41.8	45.2	38.7	28.6
23	10	15.5	60.6	46.4	39.0	41.0	43.9	40.0	35.4

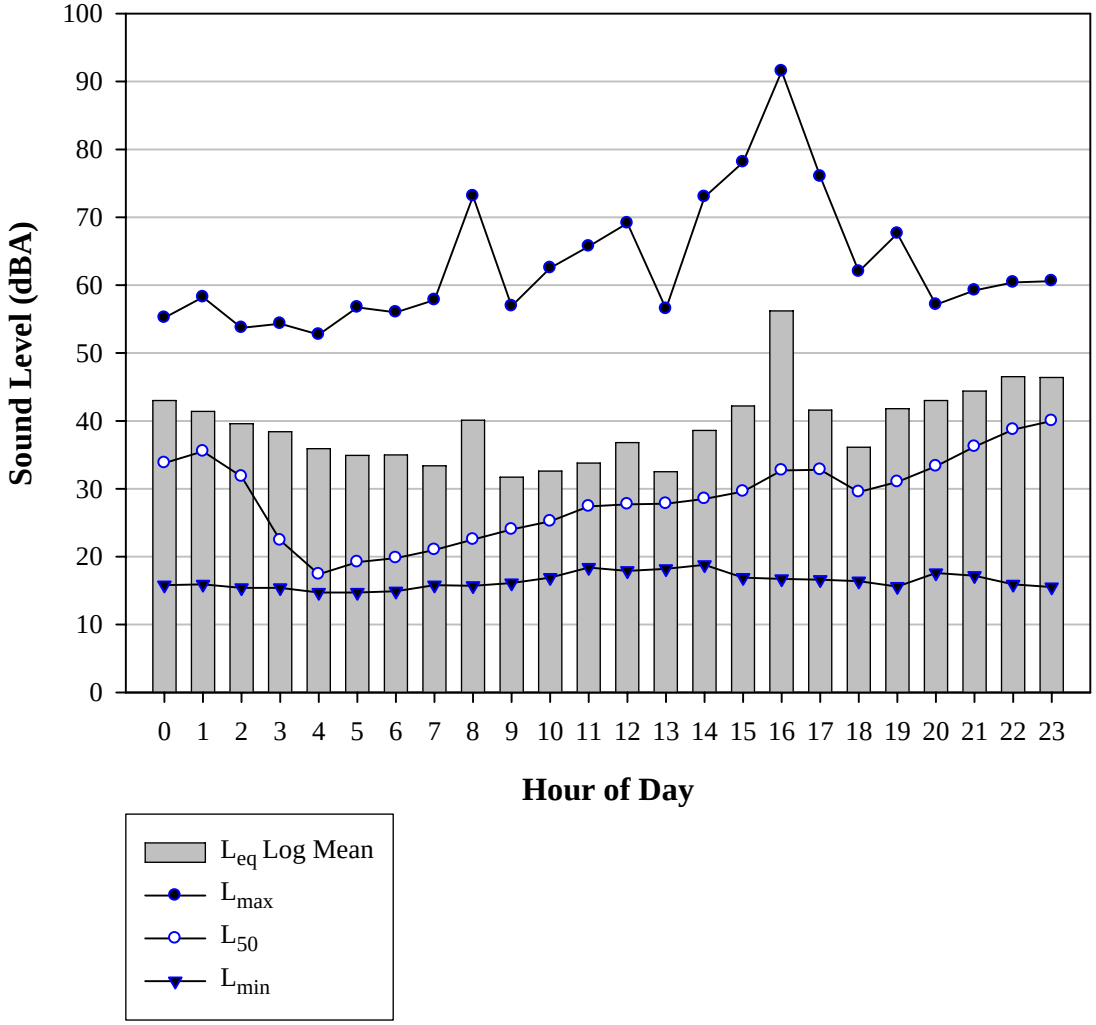

Figure I-53. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Cape Royal (GRCA050), 7-09-2007 to 7-19-2007 (n=239).

Table I-80. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	119	15.7	91.5	46.1	32.4	34.0	27.3	22.4
12.5	119	11.2	98.4	50.5	38.9	41.2	34.7	30.5
15.8	119	8.3	100.4	50.1	39.5	40.9	33.8	29.2
20	119	8.4	99.3	49.2	40.8	42.6	34.6	29.2
25	119	7.0	98.3	48.8	40.7	43.4	34.8	28.7
31.5	119	1.8	97.1	48.6	40.4	43.7	35.0	28.2
40	119	2.4	99.7	49.3	40.5	43.5	35.5	28.7
50	119	4.0	100.4	49.3	39.4	41.5	33.8	27.1
63	119	3.1	101.0	49.7	38.1	40.2	32.9	26.5
80	119	3.5	96.1	47.5	37.5	39.4	32.1	25.6
100	119	1.0	98.4	47.4	36.1	37.8	30.2	23.6
125	119	-0.8	91.0	46.1	34.7	35.4	27.1	20.4
160	119	-0.7	96.3	46.9	31.7	33.7	24.5	17.7
200	119	-0.6	97.6	47.1	28.2	30.5	21.1	15.2
250	119	0.1	92.5	44.9	26.4	27.6	18.4	13.3
315	119	-1.5	97.5	45.3	24.7	25.7	16.9	11.7
400	119	-0.8	94.2	43.3	23.9	24.6	16.8	11.1
500	119	0.2	94.3	43.0	22.5	24.0	16.9	11.3
630	119	0.1	94.8	42.3	21.2	24.1	16.9	11.3
800	119	0.5	93.3	40.8	21.4	23.5	15.9	10.8
1000	119	1.4	112.1	58.6	20.0	22.4	14.8	10.4
1250	119	1.9	92.5	39.4	18.6	20.9	13.7	9.8
1600	119	2.2	92.7	39.0	17.9	19.2	12.9	9.6
2000	119	2.6	100.8	45.7	15.0	16.4	11.4	9.5
2500	119	3.1	87.5	35.2	13.6	14.2	10.8	9.8
3150	119	3.9	89.9	38.8	13.7	13.3	11.1	10.6
4000	119	4.7	89.8	37.1	16.0	14.0	11.8	11.4
5000	119	5.4	88.0	35.7	16.6	14.7	12.7	12.4
6300	119	6.2	87.1	35.2	17.9	16.1	13.7	13.5
8000	119	6.8	86.7	34.0	16.8	15.7	14.9	14.6
10000	119	7.4	85.3	33.2	16.1	16.1	15.8	15.6
12500	119	8.0	86.1	32.6	16.8	16.9	16.7	16.5
16000	119	7.7	86.1	32.7	17.7	17.8	17.6	17.4
20000	119	7.3	85.8	31.5	19.1	19.2	19.1	19.0

Table I-81. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	120	14.7	67.6	42.4	33.6	36.0	30.3	23.7
12.5	120	14.3	75.5	42.2	37.4	38.3	32.8	28.5
15.8	120	14.0	70.6	39.8	35.2	36.9	31.1	26.9
20	120	13.7	73.4	38.2	35.0	36.4	30.0	25.9
25	120	9.6	68.2	37.2	34.4	36.5	29.1	24.1
31.5	120	7.8	63.2	36.7	34.2	36.6	28.8	22.5
40	120	4.1	63.3	36.3	33.7	36.3	28.4	21.2
50	120	3.9	65.4	35.9	33.1	35.9	27.7	20.3
63	120	3.0	70.4	35.5	31.9	34.5	26.7	19.3
80	120	2.1	64.4	34.3	30.4	32.9	25.6	18.3
100	120	0.8	68.4	33.2	29.2	31.3	23.4	16.1
125	120	0.1	70.7	32.7	28.9	29.9	21.3	14.3
160	120	-0.8	62.4	30.4	28.0	28.5	19.2	11.9
200	120	-2.6	62.5	28.6	25.2	26.3	16.9	10.5
250	120	-2.8	61.6	29.0	24.9	25.1	17.5	10.6
315	120	-3.0	60.4	29.3	24.2	25.2	19.3	12.6
400	120	-3.1	57.1	30.2	25.4	25.7	21.0	13.8
500	120	-2.4	52.2	31.5	25.5	27.2	22.5	13.3
630	120	-1.9	54.9	32.5	24.8	27.4	22.2	13.8
800	120	-1.5	56.4	33.6	24.5	27.2	20.7	12.2
1000	120	-0.7	54.1	34.3	22.9	26.3	18.3	10.2
1250	120	-0.1	61.4	34.1	20.4	23.5	15.4	8.7
1600	120	0.8	65.5	33.6	19.9	21.1	12.9	8.4
2000	120	1.8	59.0	31.5	15.9	17.8	10.9	8.5
2500	120	2.6	50.9	28.9	15.7	15.2	10.9	9.6
3150	120	3.6	51.1	27.2	19.3	21.1	15.3	11.6
4000	120	4.5	52.9	24.8	17.6	18.0	14.4	12.5
5000	120	5.3	54.1	22.0	15.2	15.7	13.3	12.5
6300	120	6.0	52.0	18.9	13.9	14.8	13.5	13.3
8000	120	6.7	50.4	16.4	14.9	14.9	14.6	14.4
10000	120	7.4	49.7	19.5	16.1	16.1	15.9	15.7
12500	120	7.9	59.7	25.9	16.8	16.7	16.6	16.4
16000	120	7.6	57.9	25.0	17.5	17.5	17.4	17.3
20000	120	7.3	55.0	21.2	19.2	19.2	19.1	19.0

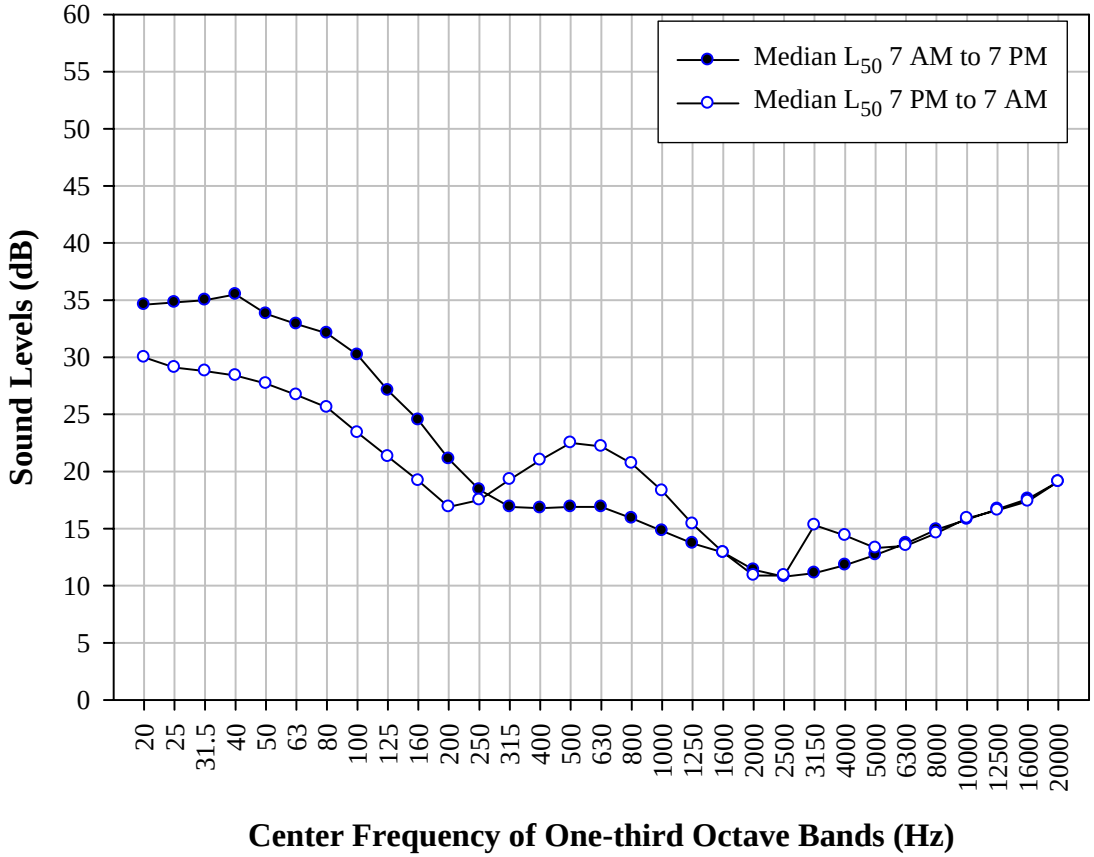

Figure I-54. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), 7-09-2007 to 7-19-2007.

Table I-82. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Point Imperial (GRCA051), 7-09-2007 to 7-19-2007 (n=238).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	9	19.7	68.1	51.2	41.3	38.0	42.2	33.5	29.4
1	9	26.1	56.4	46.0	40.8	45.3	48.2	44.3	35.1
2	10	26.7	55.6	44.3	38.2	41.2	44.6	39.1	34.5
3	10	19.3	58.2	43.8	35.5	32.9	36.2	31.4	27.9
4	10	20.9	58.8	43.1	36.5	36.1	38.2	31.3	27.1
5	10	18.6	54.9	41.1	35.1	31.8	34.2	27.4	27.0
6	10	18.6	56.4	39.6	35.1	33.2	34.6	28.3	27.3
7	10	18.6	60.3	39.0	34.8	32.6	34.3	28.4	27.4
8	10	19.1	64.8	35.8	34.9	34.0	36.4	29.2	27.6
9	10	20.5	60.9	35.3	34.9	34.4	36.7	29.7	27.7
10	10	20.7	63.7	36.9	36.0	35.6	37.6	30.9	28.1
11	10	19.7	69.7	38.8	37.6	36.7	38.2	31.4	28.4
12	10	20.7	66.0	37.7	37.3	37.4	38.7	31.7	28.5
13	10	20.3	75.7	39.7	39.1	38.2	40.2	31.7	28.2
14	10	21.2	83.0	45.0	40.2	38.7	40.0	32.3	28.6
15	10	20.1	95.6	55.9	43.9	40.9	40.7	34.2	29.2
16	10	20.2	86.3	48.8	43.0	41.0	43.9	36.6	29.3
17	10	19.0	75.1	44.5	39.8	38.7	39.5	34.1	28.5
18	10	18.8	64.3	43.5	40.8	40.3	42.2	36.9	30.9
19	10	19.0	60.9	45.8	42.2	47.3	50.0	43.3	31.9
20	10	26.8	61.1	48.3	41.7	41.4	44.1	39.9	37.8
21	10	26.8	60.3	49.5	44.4	45.6	49.2	43.0	36.7
22	10	25.0	62.7	50.4	44.2	46.9	50.0	44.9	41.3
23	10	26.8	66.8	51.8	43.8	48.2	50.8	48.0	42.7

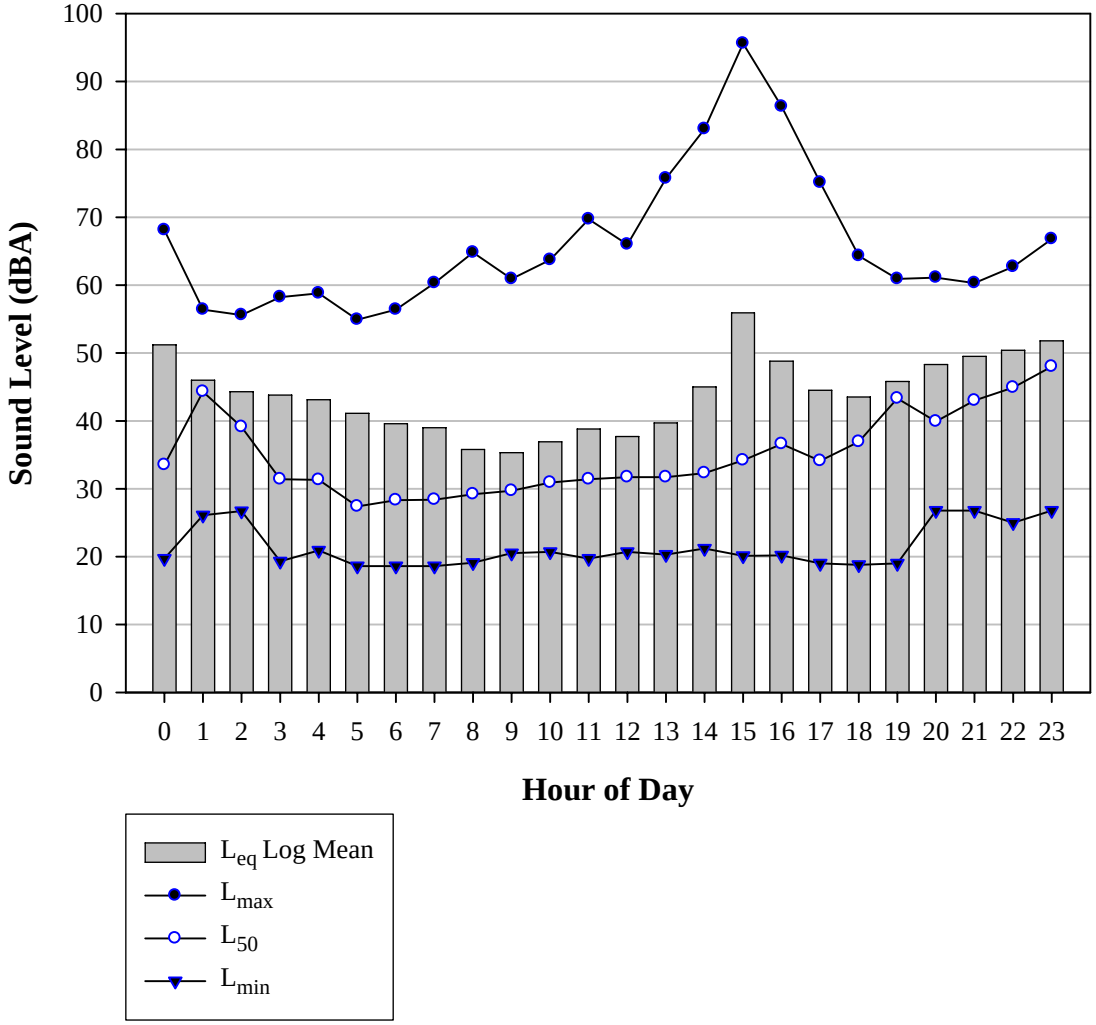

Figure I-55. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Point Imperial (GRCA051), 7-09-2007 to 7-19-2007 (n=238).

Table I-83. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	120	18.6	95.6	46.9	37.1	39.0	31.4	28.1
12.5	120	15.1	81.6	50.1	44.1	47.2	37.9	32.3
15.8	120	17.3	83.2	48.4	42.6	45.1	36.8	30.9
20	120	16.5	90.8	48.1	44.6	48.0	37.4	30.4
25	120	16.1	86.0	47.1	43.8	47.0	37.1	29.5
31.5	120	12.2	89.1	47.1	43.5	46.7	36.4	28.4
40	120	11.4	89.6	47.9	44.0	47.0	37.3	28.0
50	120	7.2	88.4	47.1	42.7	45.0	35.1	26.7
63	120	8.6	88.7	47.8	42.4	44.7	34.8	25.9
80	120	6.2	87.2	46.9	42.0	43.8	33.2	23.7
100	120	5.2	86.6	45.9	39.8	41.2	30.0	20.8
125	120	3.2	88.9	44.7	36.4	37.6	25.6	16.0
160	120	0.8	93.7	45.1	33.1	34.3	22.2	13.5
200	120	0.4	93.4	44.4	31.0	32.3	21.8	14.5
250	120	0.7	92.4	43.7	29.9	30.7	21.3	14.9
315	120	0.4	92.7	42.7	28.2	29.4	21.1	14.6
400	120	0.5	90.7	41.7	27.8	28.7	21.5	14.9
500	120	0.0	89.7	40.8	27.5	29.3	21.8	15.1
630	120	0.1	88.8	39.9	27.3	29.2	21.2	14.7
800	120	0.2	87.6	38.7	28.0	30.3	20.5	13.6
1000	120	0.4	86.7	37.3	27.4	30.1	19.1	12.0
1250	120	0.7	82.7	34.6	25.1	27.3	16.6	11.0
1600	120	1.5	79.9	31.5	22.4	24.2	14.1	10.5
2000	120	2.5	75.1	27.9	20.0	20.9	12.7	10.7
2500	120	3.6	71.9	25.8	19.1	19.4	12.8	11.5
3150	120	4.8	68.2	24.6	19.1	19.8	13.6	12.7
4000	120	6.0	63.8	24.9	21.0	22.1	14.8	14.0
5000	120	7.3	60.9	24.7	20.7	21.4	15.9	15.5
6300	120	8.6	59.2	23.8	19.0	19.5	17.2	17.0
8000	120	9.8	58.7	24.6	20.3	20.3	18.8	18.6
10000	120	11.1	56.2	24.3	20.6	20.7	20.4	20.3
12500	120	12.1	57.6	24.6	22.0	22.1	22.0	21.9
16000	120	12.9	55.6	24.9	23.8	23.9	23.8	23.7
20000	120	14.2	51.3	25.4	26.3	26.4	26.3	26.2

Table I-84. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	118	18.6	68.1	47.8	39.5	42.4	37.9	31.0
12.5	118	18.5	80.1	57.8	49.6	53.5	42.0	34.1
15.8	118	15.2	81.8	55.7	46.8	50.1	39.6	32.3
20	118	13.3	78.8	53.1	43.9	47.5	38.7	31.0
25	118	10.9	75.6	49.9	41.1	45.0	37.2	29.3
31.5	118	7.9	71.3	47.0	38.8	42.6	35.6	28.0
40	118	4.2	69.1	44.5	38.1	40.4	33.5	27.0
50	118	3.7	69.2	42.3	37.1	38.3	32.0	25.7
63	118	3.6	70.7	40.7	36.3	37.1	31.0	24.5
80	118	1.2	77.1	39.1	34.8	34.7	28.9	22.1
100	118	1.7	76.1	38.2	32.9	33.3	26.8	19.5
125	118	0.8	71.3	37.4	31.8	33.0	23.3	16.3
160	118	0.0	78.5	37.7	30.2	32.2	23.7	17.5
200	118	-0.5	73.3	36.4	28.1	30.1	25.5	20.3
250	118	0.0	65.7	36.1	29.0	30.9	27.7	22.8
315	118	0.1	61.1	36.0	30.4	32.5	28.9	24.2
400	118	0.0	58.2	36.8	32.0	34.3	30.6	25.1
500	118	0.2	56.6	38.3	33.2	35.7	32.0	24.9
630	118	0.3	56.4	39.8	33.7	36.5	32.5	24.4
800	118	-0.3	57.3	40.8	33.4	36.6	31.9	22.7
1000	118	0.5	58.7	40.6	32.3	35.2	29.8	19.7
1250	118	1.0	59.3	39.6	30.3	32.8	26.8	16.0
1600	118	1.5	58.7	37.4	26.5	28.7	22.5	12.0
2000	118	2.4	57.7	34.5	22.1	24.4	17.9	10.6
2500	118	3.3	56.7	31.4	19.7	21.7	14.7	11.3
3150	118	4.2	53.9	28.3	18.7	19.9	13.9	12.5
4000	118	5.8	52.0	26.1	18.9	21.0	14.4	13.8
5000	118	7.2	51.4	23.7	18.1	19.2	15.7	15.4
6300	118	8.5	48.2	20.7	17.3	17.9	17.1	16.9
8000	118	9.8	51.0	20.1	18.8	18.9	18.7	18.5
10000	118	11.0	45.7	20.0	20.4	20.5	20.3	20.2
12500	118	12.1	50.1	21.0	22.0	22.0	21.9	21.8
16000	118	12.9	46.1	22.5	23.8	23.9	23.8	23.7
20000	118	14.0	44.7	25.0	26.3	26.4	26.3	26.2

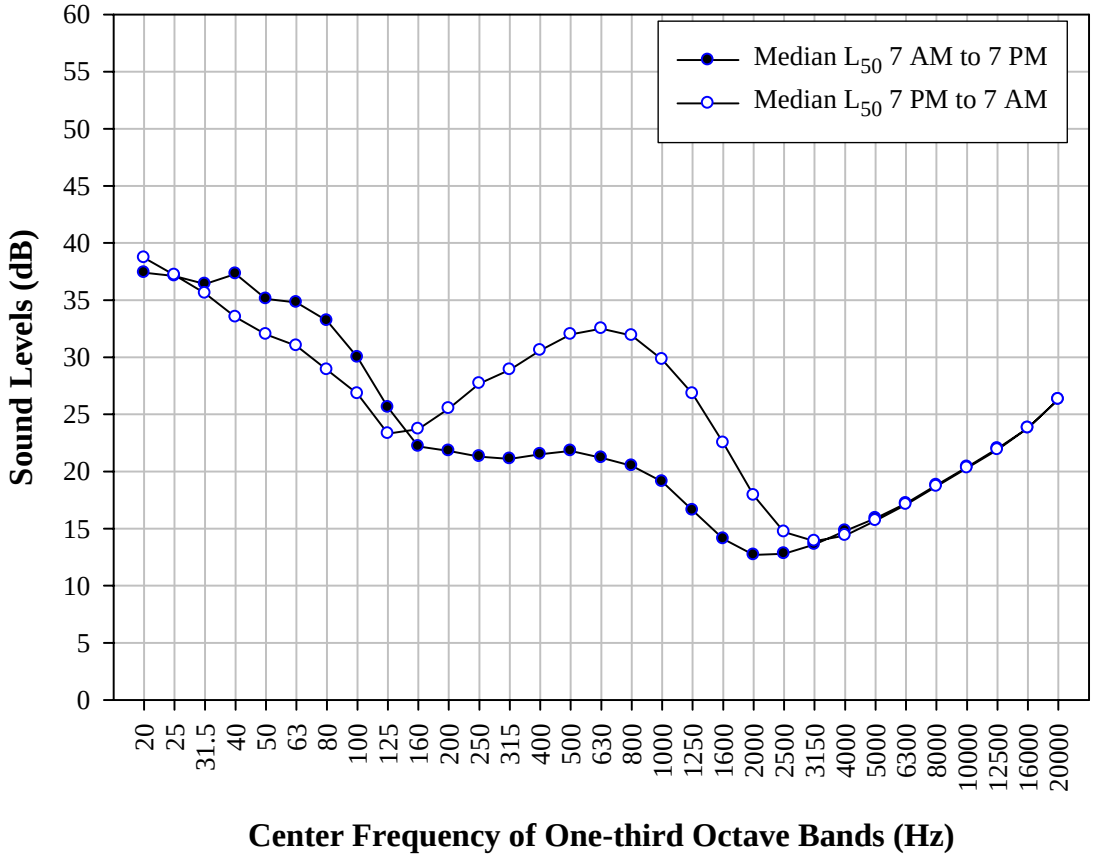

Figure I-56. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), 7-09-2007 to 7-19-2007.

Table I-85. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 7-09-2007 to 7-19-2007 (n=237).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	10	26.0	67.5	36.5	35.2	36.9	28.4	26.4	26.3
1	10	26.0	62.0	31.9	30.4	29.9	26.9	26.3	26.2
2	10	26.0	68.1	32.5	30.1	27.3	26.9	26.2	26.2
3	10	26.0	65.4	33.5	32.0	33.1	26.8	26.3	26.2
4	10	26.0	69.4	40.5	39.0	39.7	32.0	26.4	26.2
5	10	26.3	71.0	42.8	42.4	42.8	37.4	29.9	27.4
6	10	26.3	76.0	48.0	47.8	47.7	45.7	33.0	28.4
7	10	26.4	80.0	50.6	50.4	50.4	49.8	35.1	29.9
8	10	26.7	76.5	51.7	51.5	51.5	52.0	36.1	30.2
9	10	26.9	75.1	52.4	52.4	52.4	53.9	37.5	30.4
10	10	26.8	78.2	52.8	52.8	52.6	54.6	38.1	30.6
11	10	27.0	78.0	52.8	52.7	52.6	55.0	37.5	30.1
12	10	26.8	76.8	52.4	52.4	52.3	54.1	37.5	30.0
13	9	27.0	79.8	52.7	52.6	52.4	54.6	37.2	29.5
14	9	27.0	77.0	52.9	52.8	52.9	56.0	38.6	30.1
15	9	26.8	80.2	54.3	54.0	53.5	56.8	39.5	31.8
16	10	26.8	95.3	57.2	54.2	52.8	55.7	37.9	29.3
17	10	26.7	77.2	52.0	51.8	51.7	53.4	35.7	28.7
18	10	26.4	88.4	52.6	51.7	51.3	52.1	34.3	27.9
19	10	26.2	71.8	49.8	49.6	49.3	49.0	32.1	28.2
20	10	26.1	76.0	49.7	49.5	49.8	49.7	30.8	26.6
21	10	26.1	67.8	44.4	44.2	44.8	40.9	27.9	26.4
22	10	26.1	68.4	41.8	41.4	41.1	34.7	28.9	27.2
23	10	26.1	66.7	37.7	36.9	37.9	29.2	26.7	26.4

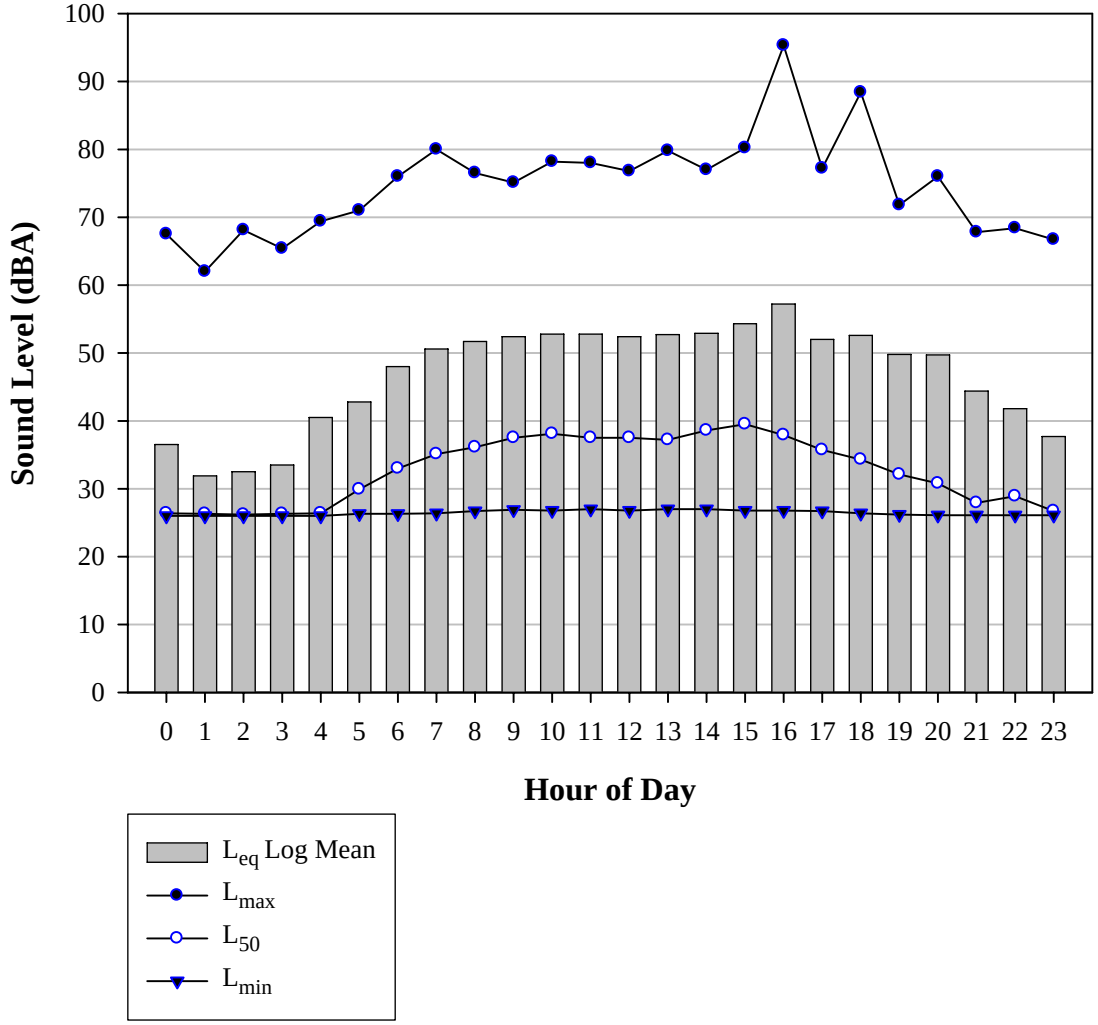

Figure I-57. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 7-09-2007 to 7-19-2007 (n=237).

Table I-86. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 12-04-2007 to 12-15-2007 (n=260).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	18.5	57.8	39.7	28.6	24.6	27.1	21.3	20.2
1	11	18.5	62.1	40.5	28.9	24.7	25.6	22.6	21.0
2	11	18.5	58.6	40.8	27.3	24.0	23.1	21.9	20.4
3	11	18.5	59.6	39.0	27.6	24.7	25.5	22.0	20.4
4	11	18.5	60.5	39.3	26.8	23.6	25.1	22.7	20.1
5	11	18.5	55.6	37.8	25.5	21.4	23.1	20.8	19.5
6	11	18.5	63.2	42.4	27.2	23.7	20.9	19.4	19.0
7	11	18.5	62.9	44.3	28.7	25.4	22.7	19.8	19.0
8	11	18.6	68.5	46.2	30.9	27.7	28.4	20.8	19.4
9	11	18.6	62.4	40.9	33.5	33.5	32.6	25.0	21.4
10	10	18.7	61.0	36.5	32.4	31.7	31.6	26.5	22.8
11	10	18.7	63.9	38.8	32.8	31.6	33.7	28.6	23.9
12	10	18.7	65.5	43.8	34.3	32.4	34.7	28.2	23.8
13	10	18.7	68.2	48.4	34.3	31.7	32.9	26.3	23.8
14	11	18.8	67.2	47.7	36.4	33.9	33.4	27.3	23.1
15	11	18.7	66.4	47.1	33.7	31.2	33.3	26.2	22.9
16	11	18.7	66.4	45.0	34.3	33.4	30.1	23.6	20.9
17	11	18.6	66.0	43.7	33.1	30.7	30.0	21.7	19.5
18	11	18.6	67.6	44.0	32.1	29.4	30.2	24.6	20.8
19	11	18.6	57.8	41.1	30.4	27.5	29.7	25.7	23.0
20	11	18.6	57.3	41.1	31.1	29.2	32.0	25.0	22.9
21	11	18.6	57.3	39.4	29.8	28.5	31.0	24.6	22.6
22	11	18.6	61.9	39.8	31.5	29.6	29.5	24.1	22.2
23	11	18.5	56.2	36.5	28.7	24.3	25.7	21.8	20.4

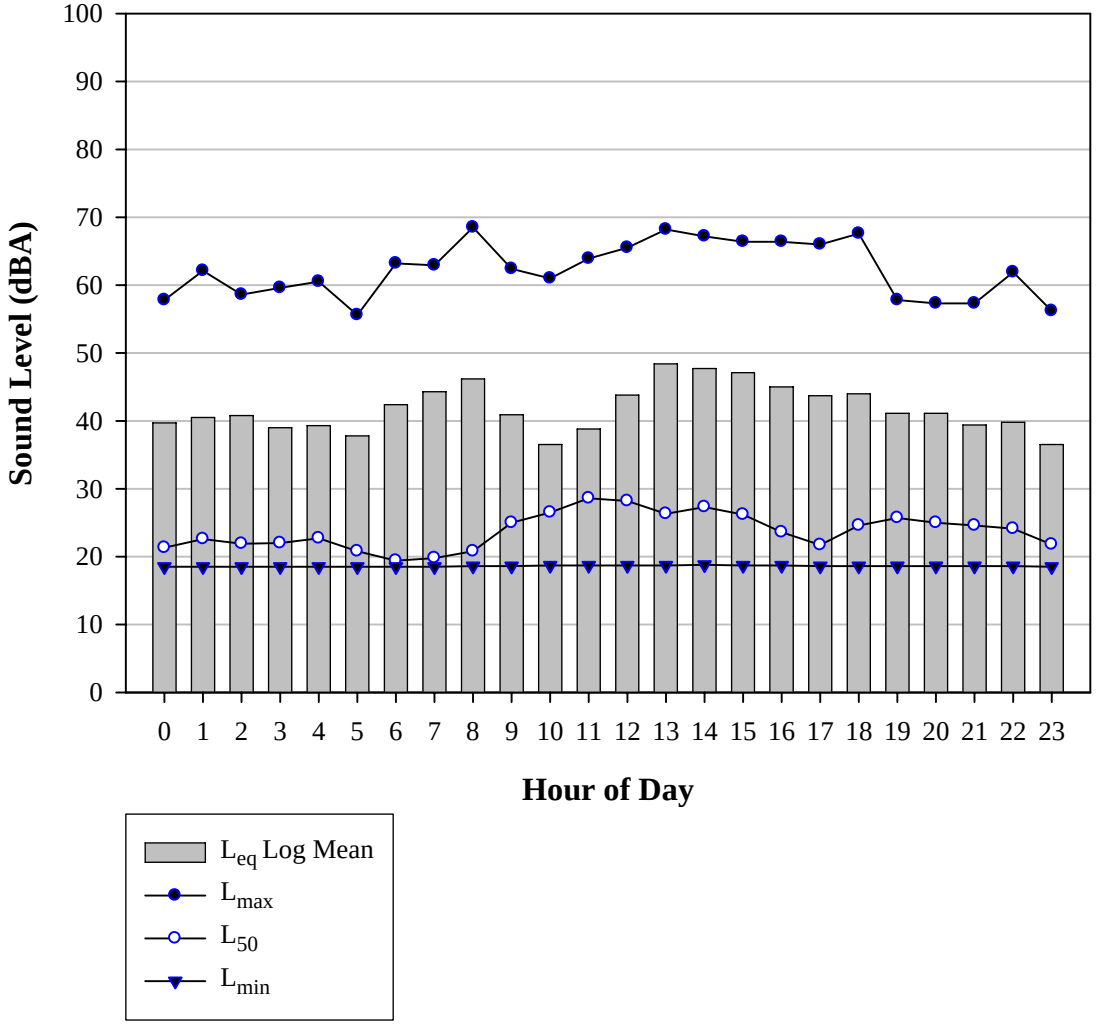

Figure I-58. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 12-04-2007 to 12-15-2007 (n=260).

Table I-87. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	117	26.4	95.3	53.2	52.4	54.3	37.3	29.8
12.5	117	7.1	99.2	51.4	43.5	45.7	35.7	30.9
15.8	117	7.7	100.6	51.5	43.6	45.3	35.2	30.0
20	117	2.8	102.2	51.4	44.4	46.6	35.0	29.1
25	117	1.8	102.3	51.1	43.7	45.9	34.4	28.0
31.5	117	3.3	96.7	50.3	45.0	45.9	34.6	27.0
40	117	1.6	92.6	50.9	47.8	47.6	35.4	26.5
50	117	2.3	95.1	51.6	48.6	48.3	35.4	25.7
63	117	1.0	99.1	53.8	51.0	49.7	34.5	23.9
80	117	1.5	101.1	56.4	54.1	50.9	34.5	22.8
100	117	1.1	100.9	55.5	53.4	49.6	32.2	20.0
125	117	-0.6	97.0	52.1	49.8	47.3	28.9	16.6
160	117	0.0	96.6	49.8	45.4	44.1	25.4	14.1
200	117	0.1	95.2	48.4	41.9	40.4	22.2	13.5
250	117	0.4	94.8	47.5	40.9	37.9	22.0	14.3
315	117	0.4	96.7	47.2	40.3	38.4	23.0	15.0
400	117	0.9	94.1	45.6	39.7	39.6	24.2	16.0
500	117	2.0	91.4	44.6	40.4	41.2	25.2	15.7
630	117	2.7	91.8	45.6	43.2	44.0	26.5	15.5
800	117	3.4	91.7	47.0	45.6	47.3	28.5	15.2
1000	117	4.6	94.0	55.3	46.0	48.3	28.7	14.7
1250	117	5.4	88.8	44.9	43.9	46.3	26.3	13.1
1600	117	6.5	92.4	43.3	41.0	43.2	21.8	11.6
2000	117	7.9	86.3	40.0	37.5	39.0	17.7	11.1
2500	117	9.1	87.1	38.4	34.3	35.1	16.5	12.1
3150	117	10.4	88.2	38.6	32.5	33.2	17.8	13.7
4000	117	12.1	86.1	37.8	31.4	32.3	19.2	15.2
5000	117	13.8	88.1	38.4	29.8	30.3	19.0	16.0
6300	117	15.9	89.0	39.0	27.1	27.4	18.8	17.1
8000	117	17.4	89.5	38.7	28.1	29.2	20.9	18.9
10000	117	19.1	89.9	38.4	24.0	23.4	20.0	19.7
12500	117	20.9	94.4	40.5	22.9	22.3	21.4	21.2
16000	117	22.5	93.5	39.7	23.4	23.3	23.2	23.0
20000	117	25.3	94.8	40.7	25.7	25.7	25.7	25.6

Table I-88. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 7-09-2007 to 7-19-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	120	26.0	76.0	44.5	40.3	34.3	27.9	26.4
12.5	120	15.4	73.9	34.9	33.1	34.8	31.3	27.8
15.8	120	14.1	71.1	34.8	31.6	32.5	28.2	24.7
20	120	11.5	68.4	34.3	30.5	31.1	25.7	22.2
25	120	8.2	73.8	34.5	30.6	30.9	23.2	19.5
31.5	120	5.6	72.6	35.3	31.0	31.1	21.3	16.7
40	120	3.2	77.2	37.3	32.3	30.9	19.4	14.7
50	120	3.3	81.4	39.7	33.8	31.9	18.4	13.3
63	120	2.7	87.4	43.4	34.9	30.2	16.4	11.5
80	120	1.8	89.0	44.5	34.7	28.7	15.3	10.1
100	120	0.2	84.1	42.0	34.0	25.5	12.9	7.9
125	120	1.5	84.2	39.8	31.5	22.9	11.4	7.9
160	120	0.5	78.3	35.3	28.7	21.2	9.9	5.7
200	120	0.8	72.7	31.0	25.2	21.5	9.7	5.9
250	120	1.7	76.1	31.3	25.9	22.6	11.3	6.5
315	120	1.1	75.9	31.8	26.4	23.1	12.4	7.0
400	120	2.6	73.2	30.9	26.8	23.2	12.8	8.0
500	120	2.9	68.5	32.0	28.0	23.3	12.1	7.0
630	120	3.1	68.2	35.0	30.8	22.9	11.1	6.6
800	120	4.0	67.4	38.0	33.8	22.2	10.2	6.6
1000	120	4.9	68.5	38.5	34.3	20.8	9.8	6.9
1250	120	5.9	67.8	36.5	31.7	17.5	9.6	7.4
1600	120	6.9	63.8	33.4	28.6	15.7	9.4	8.2
2000	120	8.2	60.2	29.8	25.6	15.0	10.1	9.2
2500	120	9.2	59.3	26.4	22.5	17.0	10.9	10.3
3150	120	10.8	57.1	25.0	21.2	17.4	12.2	11.6
4000	120	12.4	57.2	24.6	20.5	17.8	13.5	13.1
5000	120	14.0	57.3	23.1	19.5	17.3	14.9	14.6
6300	120	15.8	61.3	21.6	18.6	17.5	17.2	17.0
8000	120	17.4	56.0	22.5	19.4	18.8	18.4	18.1
10000	120	19.1	53.4	20.8	20.1	19.8	19.6	19.5
12500	120	20.8	54.9	21.7	21.5	21.4	21.3	21.1
16000	120	22.5	46.0	23.1	23.0	23.1	23.0	22.9
20000	120	25.2	43.7	25.6	25.6	25.7	25.6	25.5

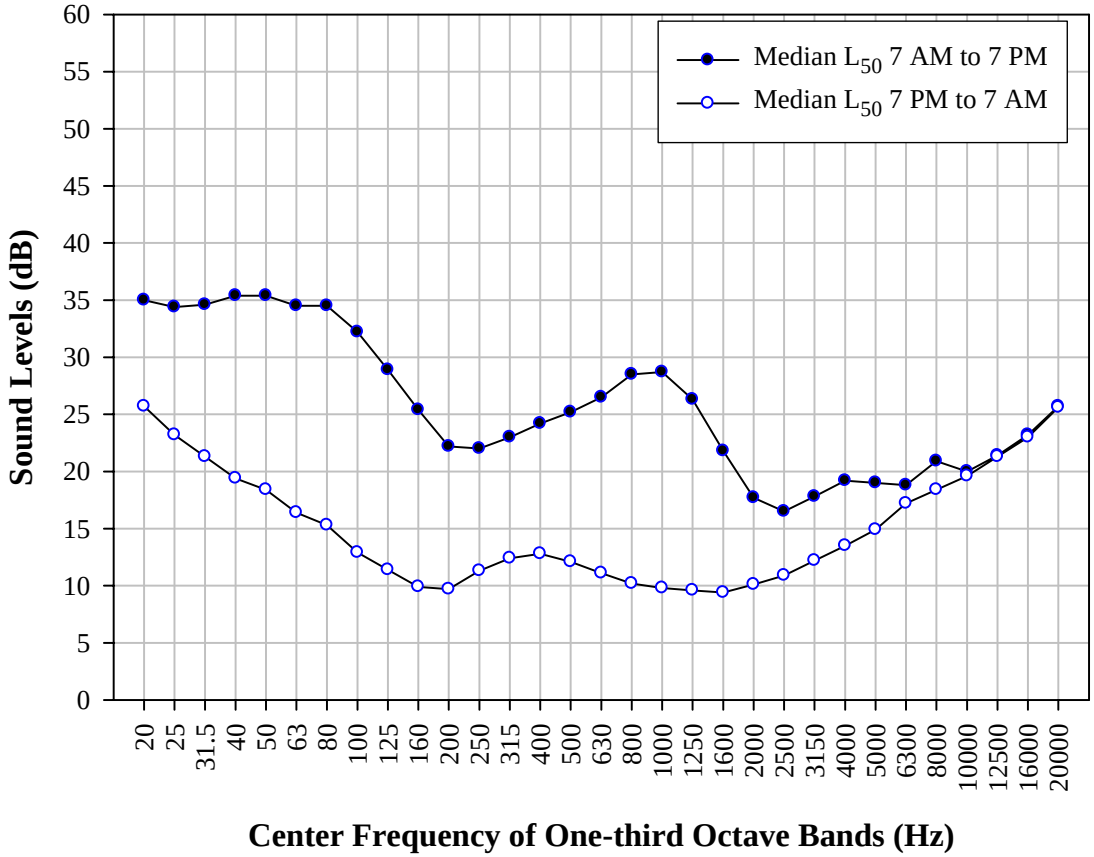

Figure I-59. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 7-09-2007 to 7-19-2007.

Table I-89. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 12-04-2007 to 12-15-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	128	18.5	68.5	45.0	31.4	31.4	25.5	22.4
12.5	128	-6.0	93.7	51.8	39.1	39.8	34.3	30.5
15.8	128	-2.3	90.4	49.6	36.6	37.8	32.6	29.1
20	128	-0.3	87.1	47.9	35.3	36.5	31.9	28.4
25	128	0.1	86.6	45.8	33.2	35.0	29.3	25.7
31.5	128	0.9	83.6	43.4	30.4	32.7	25.5	21.8
40	128	-1.8	83.3	40.7	28.6	30.9	21.8	18.0
50	128	-3.3	84.0	39.2	27.4	29.8	19.4	14.9
63	128	-6.1	81.8	37.3	25.5	28.1	17.6	11.6
80	128	-6.2	81.4	36.2	24.9	26.7	15.8	9.7
100	128	-8.2	82.4	35.8	25.7	27.2	15.5	7.8
125	128	-5.3	82.6	35.7	27.0	28.1	15.7	7.7
160	128	-6.5	76.6	35.2	27.6	28.8	15.8	9.7
200	128	-5.5	82.3	36.4	27.8	29.4	17.4	13.0
250	128	-6.1	83.3	37.2	27.0	28.7	18.7	15.0
315	128	-5.9	80.3	36.5	25.2	26.9	18.8	15.5
400	128	-5.6	81.2	36.6	25.3	25.6	19.0	14.6
500	128	-5.2	77.6	36.2	24.1	23.7	18.5	13.1
630	128	-4.7	74.5	36.2	23.0	22.3	17.2	10.6
800	128	-4.2	72.1	36.4	21.8	20.4	14.8	7.6
1000	128	-3.5	97.1	58.1	19.6	18.0	11.7	5.3
1250	128	-2.7	72.6	36.4	17.8	15.0	8.7	4.4
1600	128	-1.9	72.3	35.3	14.9	12.1	7.0	4.2
2000	128	-1.0	84.8	34.9	12.3	11.2	6.5	4.2
2500	128	-0.2	76.8	31.3	11.8	10.4	5.9	4.7
3150	128	1.2	76.3	29.7	12.0	10.7	6.6	5.6
4000	128	2.7	73.4	28.2	12.1	10.5	7.6	6.8
5000	128	4.3	72.0	26.7	11.9	11.5	8.7	8.2
6300	128	5.7	72.2	26.2	12.2	12.4	9.9	9.4
8000	128	7.4	70.2	26.7	13.1	13.1	11.1	10.7
10000	128	9.0	72.3	27.4	13.8	14.1	12.3	12.0
12500	128	10.5	74.1	28.2	14.5	15.0	13.3	13.1
16000	128	12.5	73.3	28.1	14.8	15.4	14.4	14.1
20000	128	15.3	75.7	27.1	16.2	16.5	16.1	15.9

Table I-90. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 12-04-2007 to 12-15-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	18.5	63.2	40.0	25.3	27.1	22.1	20.4
12.5	132	10.3	80.1	44.2	32.6	34.9	31.0	27.2
15.8	132	11.0	85.3	42.3	31.2	33.0	29.3	26.0
20	132	10.6	80.9	40.0	29.5	31.6	27.9	24.4
25	132	9.8	79.2	37.4	27.9	30.2	25.0	21.4
31.5	132	7.5	80.2	34.9	26.3	29.0	22.1	18.0
40	132	2.4	79.2	32.1	24.5	27.8	18.5	14.4
50	132	-0.2	72.7	29.6	23.3	25.9	15.1	11.3
63	132	-2.4	68.8	27.1	21.2	24.4	12.8	8.4
80	132	-3.3	62.8	25.4	19.9	23.4	10.6	6.4
100	132	-3.0	59.7	25.6	20.5	22.7	10.2	6.2
125	132	-2.9	58.4	27.1	22.0	22.5	10.6	7.2
160	132	-3.4	55.9	28.1	23.7	22.3	11.9	8.5
200	132	-3.2	56.3	28.8	23.1	23.0	14.1	10.8
250	132	-3.4	58.3	29.6	22.9	23.2	16.0	13.0
315	132	-3.4	57.6	29.6	22.0	22.5	16.7	13.2
400	132	-2.9	65.0	30.0	20.5	21.3	16.7	12.6
500	132	-2.7	56.4	30.5	18.6	19.9	15.3	10.7
630	132	-2.2	54.2	31.2	15.9	18.0	13.1	7.9
800	132	-1.7	52.3	31.5	13.3	15.7	10.5	5.3
1000	132	-1.3	52.5	31.6	9.7	12.1	7.7	3.3
1250	132	-0.2	53.1	30.9	7.6	9.1	5.2	2.5
1600	132	0.8	53.7	29.3	5.5	6.6	3.8	2.6
2000	132	2.0	52.9	27.0	5.1	5.9	3.9	3.3
2500	132	3.1	51.2	24.0	5.0	5.5	4.6	4.2
3150	132	4.3	49.3	22.1	6.1	6.3	5.6	5.3
4000	132	5.8	48.3	21.8	7.2	7.5	6.8	6.6
5000	132	7.4	49.4	23.0	8.4	8.6	8.1	7.9
6300	132	8.8	50.8	24.2	9.6	9.8	9.5	9.3
8000	132	10.1	52.3	25.5	10.9	11.1	10.8	10.6
10000	132	11.5	53.5	26.7	12.2	12.5	12.1	11.9
12500	132	12.5	54.3	27.4	13.3	13.5	13.1	13.0
16000	132	13.7	54.3	26.7	14.3	14.5	14.1	14.0
20000	132	15.5	51.5	24.3	16.0	16.1	15.9	15.8

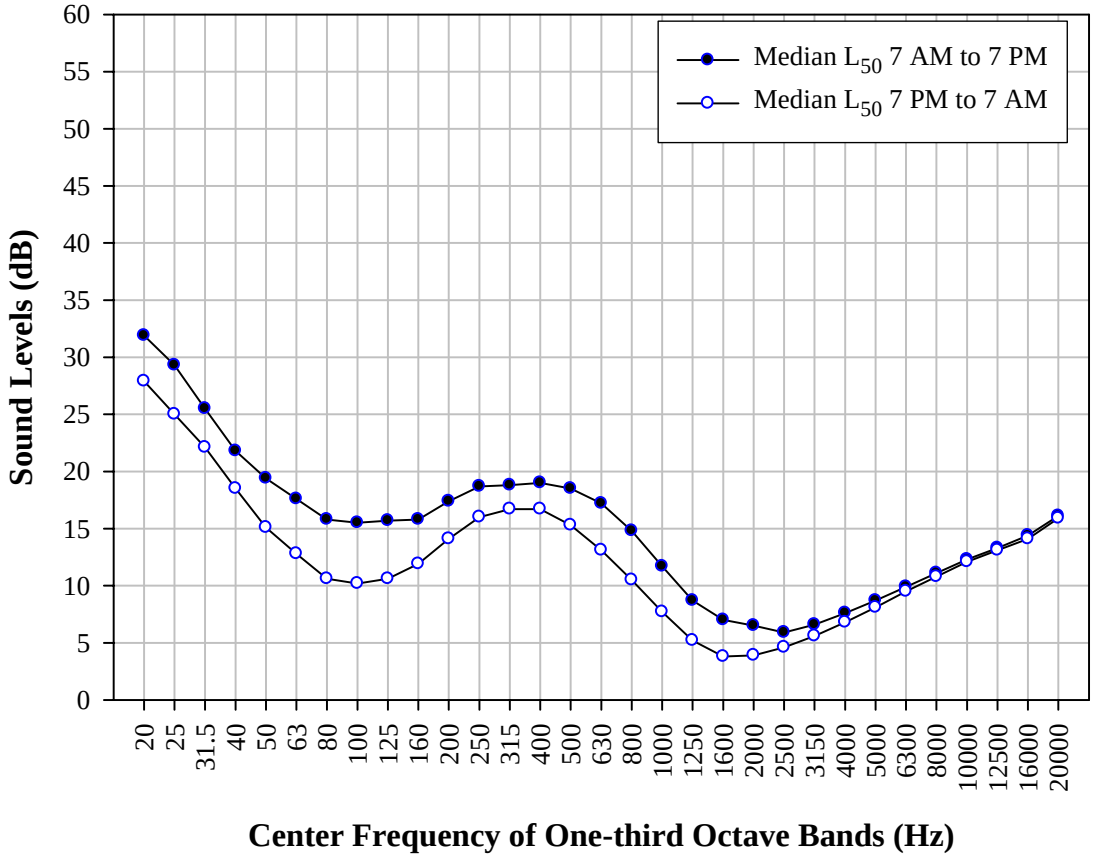

Figure I-60. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), 12-04-2007 to 12-15-2007.

Table I-91. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 8-01-2007 to 8-14-2007 (n=254).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	11	22.8	53.9	36.7	34.0	31.5	34.3	31.8	28.2
1	11	23.0	55.4	36.3	33.9	32.1	34.0	31.7	29.1
2	11	22.9	45.6	35.2	33.3	31.5	35.8	30.8	27.8
3	11	23.1	54.6	36.2	34.6	35.0	35.1	33.5	31.4
4	11	23.1	51.3	35.3	33.5	32.0	34.6	31.7	29.8
5	11	22.0	54.9	31.0	29.5	30.2	32.9	27.4	22.8
6	11	22.0	56.0	28.8	27.1	26.7	27.5	22.9	22.3
7	10	22.1	71.5	39.2	32.8	31.1	30.0	23.3	22.5
8	10	22.1	60.0	31.0	30.0	29.1	30.5	23.9	22.8
9	10	22.2	65.8	35.3	32.0	29.8	28.2	23.4	22.7
10	10	22.4	66.4	35.6	32.7	31.4	33.7	24.7	22.9
11	10	22.4	57.1	37.8	34.4	35.9	39.5	30.6	24.8
12	10	22.5	61.3	38.1	35.9	36.9	38.3	32.4	26.8
13	10	22.5	72.5	41.5	37.9	38.1	41.7	33.7	25.6
14	10	22.6	63.7	37.6	36.1	37.9	41.9	32.5	24.5
15	10	22.7	70.0	42.9	40.6	40.2	44.0	35.4	26.0
16	10	22.6	74.0	41.1	38.5	38.2	41.4	33.0	26.1
17	11	22.6	68.5	39.5	36.2	36.0	37.9	30.9	25.4
18	11	22.3	73.0	39.6	37.2	38.3	35.4	28.7	25.1
19	11	22.3	64.2	35.2	33.8	33.5	34.4	28.5	25.1
20	11	24.2	62.1	40.3	38.9	38.3	40.3	36.2	32.4
21	11	24.0	56.8	38.7	37.1	35.8	39.1	35.1	30.6
22	11	23.2	55.3	39.3	36.6	37.2	39.0	35.5	32.1
23	11	23.4	48.6	37.8	35.5	35.2	38.7	33.0	28.7

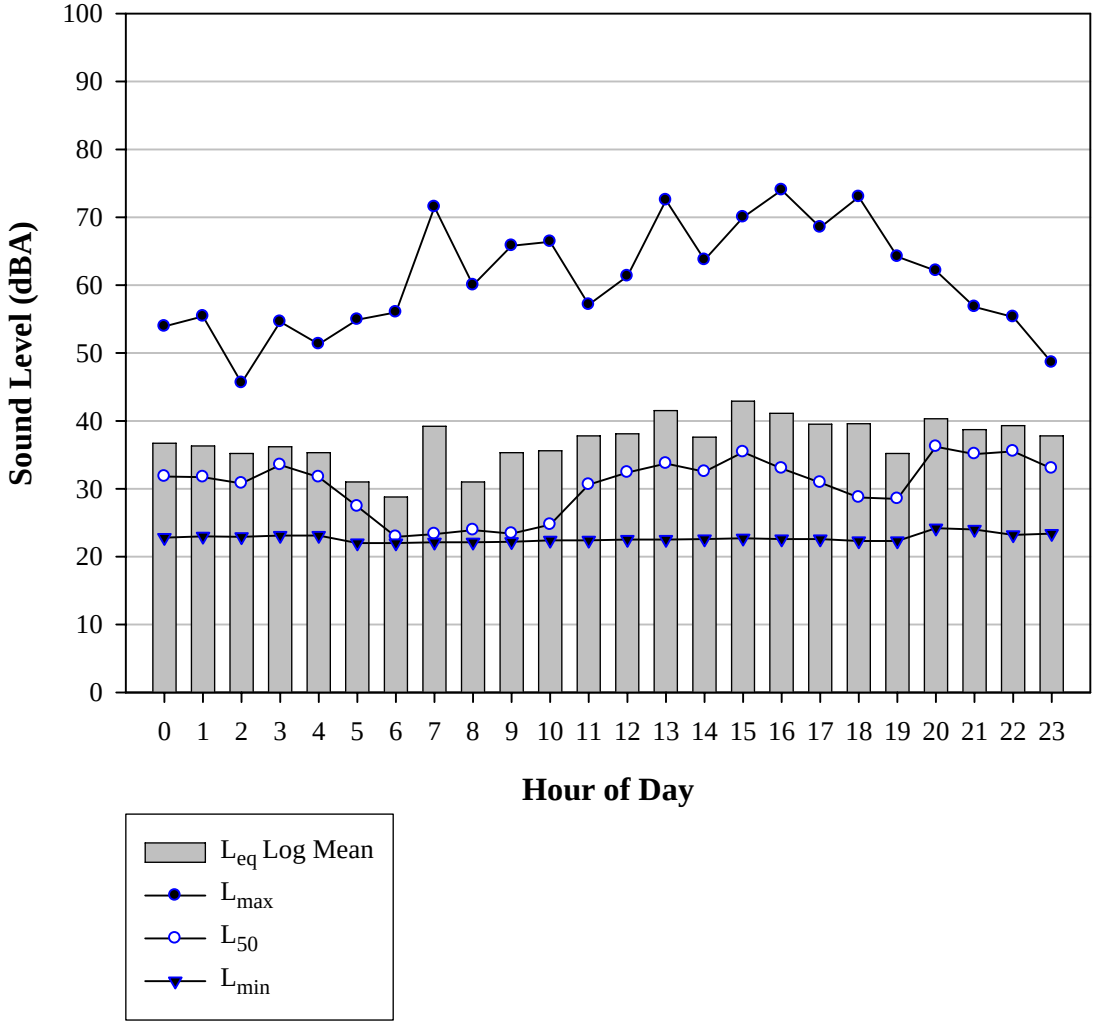

Figure I-61. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 8-01-2007 to 8-14-2007 (n=254).

Table I-92. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 12-04-2007 to 12-14-2007 (n=232).

Hour of Day	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	Leq A. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
0	10	17.5	54.0	31.8	26.4	25.2	25.3	20.8	20.5
1	10	16.5	56.3	33.1	26.6	25.2	25.6	21.0	20.4
2	10	17.5	62.6	38.7	26.4	23.4	24.2	20.7	20.4
3	10	17.7	55.7	33.1	23.8	21.5	23.3	20.5	20.4
4	10	18.6	49.1	29.1	23.8	22.3	23.7	21.5	20.5
5	10	19.3	51.1	34.8	25.9	24.3	24.4	21.5	20.5
6	10	17.5	51.1	31.9	26.1	24.4	25.2	22.0	20.4
7	10	17.5	74.8	39.9	31.7	28.0	26.9	21.1	20.5
8	10	17.6	65.6	44.8	31.2	29.9	30.9	21.5	20.5
9	10	18.2	72.1	40.6	32.0	31.0	31.8	23.6	20.8
10	10	17.7	65.4	39.8	31.2	29.0	30.4	24.9	21.3
11	9	17.9	63.9	44.2	31.7	28.9	30.9	23.1	20.8
12	9	17.8	63.0	47.4	34.1	30.7	30.5	24.1	21.6
13	9	17.8	63.7	40.9	32.9	31.3	30.1	23.2	21.4
14	9	18.2	79.8	47.3	34.9	32.2	33.2	25.7	20.6
15	9	17.8	63.1	45.5	34.2	32.2	31.4	24.2	20.8
16	9	17.6	71.4	37.0	30.3	28.2	28.6	22.5	20.8
17	9	15.5	57.0	39.3	26.8	23.8	25.6	20.7	20.4
18	9	17.6	53.6	30.3	26.2	24.7	28.3	20.9	20.4
19	10	17.6	44.7	26.4	25.0	24.8	28.0	21.5	20.6
20	10	17.5	59.4	32.3	27.9	25.5	27.6	21.0	20.5
21	10	17.5	49.8	27.4	25.5	25.0	26.4	21.1	20.5
22	10	16.0	57.0	28.0	24.7	22.6	24.1	20.8	20.4
23	10	16.6	62.4	34.3	28.5	25.0	24.9	20.8	20.4

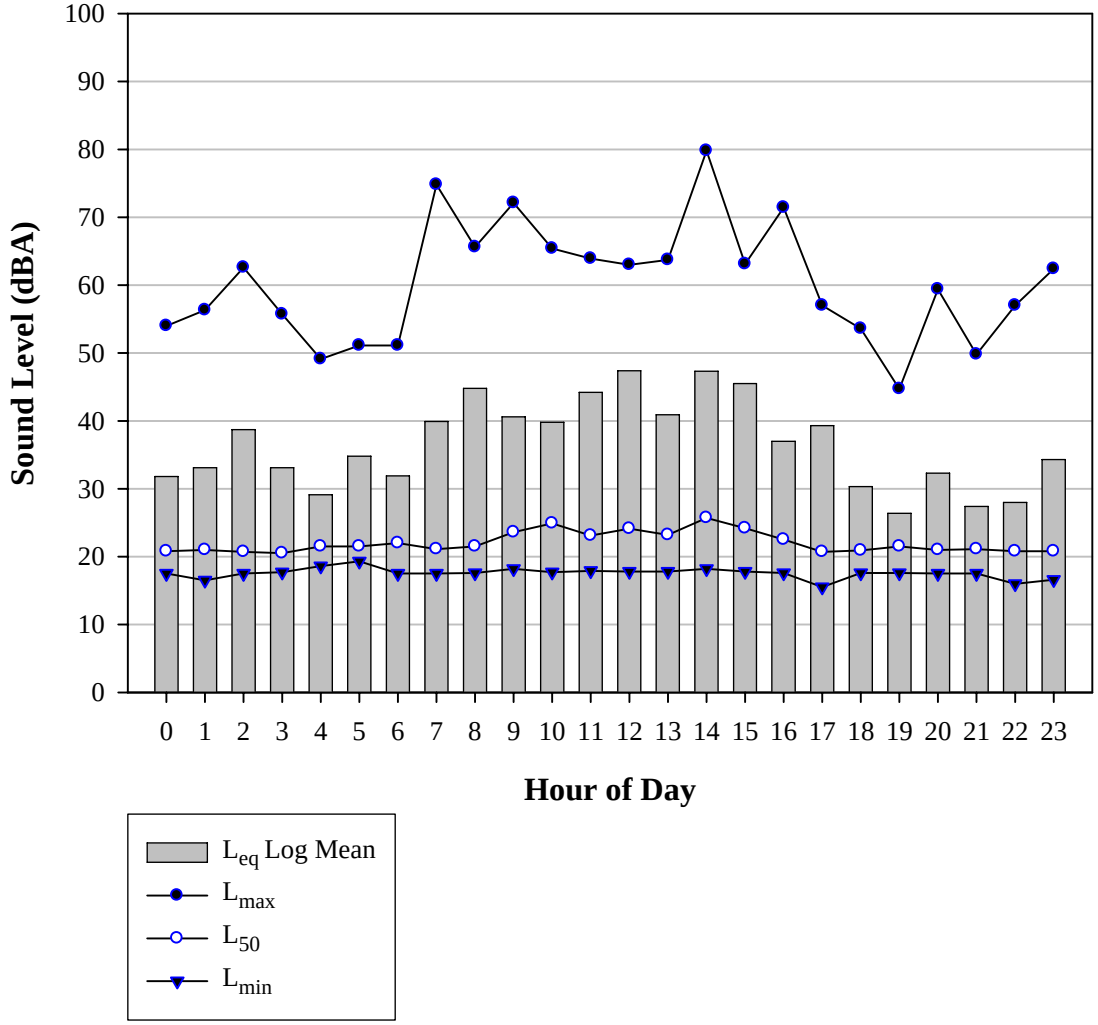

Figure I-62. Acoustic metrics (dBA) by hour for Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 12-04-2007 to 12-14-2007 (n=232).

Table I-93. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 8-01-2007 to 8-14-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	122	22.1	74.0	39.2	36.2	36.8	28.3	24.3
12.5	122	15.8	85.5	57.5	53.8	57.0	46.7	37.7
15.8	122	16.5	84.6	55.3	51.4	54.6	44.7	35.9
20	122	14.1	89.3	53.2	49.2	52.7	43.1	34.0
25	122	13.7	77.9	50.6	47.4	50.8	41.9	32.1
31.5	122	9.5	76.4	48.5	46.6	49.7	40.3	29.7
40	122	8.3	85.5	48.0	45.3	48.6	38.4	27.0
50	122	5.2	78.1	45.6	43.9	47.5	35.9	23.8
63	122	3.2	79.9	44.9	42.8	45.8	33.2	20.8
80	122	3.6	79.5	43.8	41.3	43.5	31.0	19.2
100	122	2.6	81.8	44.3	40.6	41.7	28.6	19.4
125	122	1.5	81.6	40.7	37.3	37.8	24.9	16.7
160	122	0.1	74.8	37.0	33.7	33.6	22.0	14.7
200	122	-0.7	72.8	33.7	30.1	30.0	20.8	13.6
250	122	-1.0	68.7	32.0	28.2	28.2	20.4	13.5
315	122	-1.1	69.4	31.0	27.0	27.7	19.7	13.3
400	122	-1.2	70.7	30.2	26.7	27.6	20.2	12.5
500	122	-0.9	69.3	30.2	27.4	28.3	20.2	11.1
630	122	-0.7	66.3	30.2	27.4	28.9	18.8	9.7
800	122	-0.2	67.1	30.1	27.4	28.6	16.6	8.0
1000	122	0.5	64.2	29.3	26.0	26.3	14.3	6.4
1250	122	1.2	62.9	27.9	24.5	23.9	12.0	5.1
1600	122	2.2	59.8	26.2	22.5	21.2	9.7	4.8
2000	122	3.6	58.1	24.5	20.1	19.1	8.3	5.3
2500	122	4.8	58.3	22.5	18.5	16.8	7.7	6.2
3150	122	6.4	58.4	22.1	17.7	16.1	8.4	7.5
4000	122	8.1	57.2	22.1	17.6	16.2	9.7	9.1
5000	122	10.0	60.7	22.2	16.6	15.0	11.3	10.9
6300	122	11.7	73.0	23.4	15.2	14.1	12.8	12.5
8000	122	13.6	70.2	20.8	15.7	15.2	14.5	14.3
10000	122	15.7	66.2	21.9	16.9	16.9	16.5	16.2
12500	122	17.3	69.7	23.7	18.6	18.6	18.3	18.1
16000	122	19.2	80.4	31.0	20.5	20.7	20.4	20.1
20000	122	21.7	76.5	26.3	22.9	23.2	22.8	22.5

Table I-94. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 8-01-2007 to 8-14-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	132	22.0	64.2	36.8	34.1	36.0	31.8	28.3
12.5	132	12.1	79.8	47.7	39.5	43.1	33.7	27.7
15.8	132	9.1	77.2	45.3	37.2	40.9	31.6	25.4
20	132	9.8	75.8	43.0	35.0	38.8	29.8	23.2
25	132	8.7	70.9	40.9	33.5	36.5	27.4	21.3
31.5	132	6.3	69.9	38.8	31.8	34.6	25.0	17.9
40	132	3.0	69.2	37.5	29.9	33.2	22.3	15.2
50	132	2.0	66.6	35.6	28.0	31.2	18.2	12.1
63	132	0.6	69.8	34.1	26.6	28.8	15.2	9.8
80	132	0.6	74.8	33.8	25.6	27.5	14.5	9.5
100	132	0.6	74.3	32.5	25.1	26.6	14.8	9.7
125	132	0.5	64.7	27.4	21.7	23.1	11.9	7.6
160	132	-0.9	60.0	24.0	18.8	19.3	9.7	5.6
200	132	-1.2	59.3	21.8	17.1	18.3	7.7	4.4
250	132	-1.5	61.4	21.4	16.3	16.4	7.5	3.5
315	132	-1.9	61.6	21.4	15.0	15.2	7.2	2.3
400	132	-2.0	58.6	20.3	12.9	13.6	5.6	1.7
500	132	-1.9	56.0	19.4	10.9	10.9	3.7	1.2
630	132	-1.5	53.5	19.2	7.6	7.9	2.7	1.1
800	132	-0.9	59.4	19.0	5.4	5.9	2.2	1.0
1000	132	-0.4	57.9	18.1	3.5	4.7	1.9	1.2
1250	132	0.6	48.0	16.1	3.4	4.1	2.4	1.9
1600	132	1.8	49.7	14.0	4.1	4.4	3.4	3.0
2000	132	3.2	45.5	12.9	5.4	5.7	4.5	4.2
2500	132	4.6	51.3	12.1	6.3	6.5	5.7	5.4
3150	132	6.2	47.6	11.3	7.3	7.5	7.2	6.9
4000	132	8.0	50.8	22.9	18.6	21.4	15.8	11.4
5000	132	9.9	53.6	35.2	30.1	32.9	28.1	24.1
6300	132	11.6	64.1	20.7	16.3	18.5	13.7	12.7
8000	132	13.5	55.0	17.0	14.7	14.9	14.4	14.2
10000	132	15.6	54.3	18.1	17.0	17.3	16.5	16.3
12500	132	17.2	55.2	18.8	18.2	18.4	18.1	17.9
16000	132	19.1	59.1	21.3	20.5	20.9	20.2	19.8
20000	132	21.6	52.1	25.0	22.7	22.8	22.4	22.1

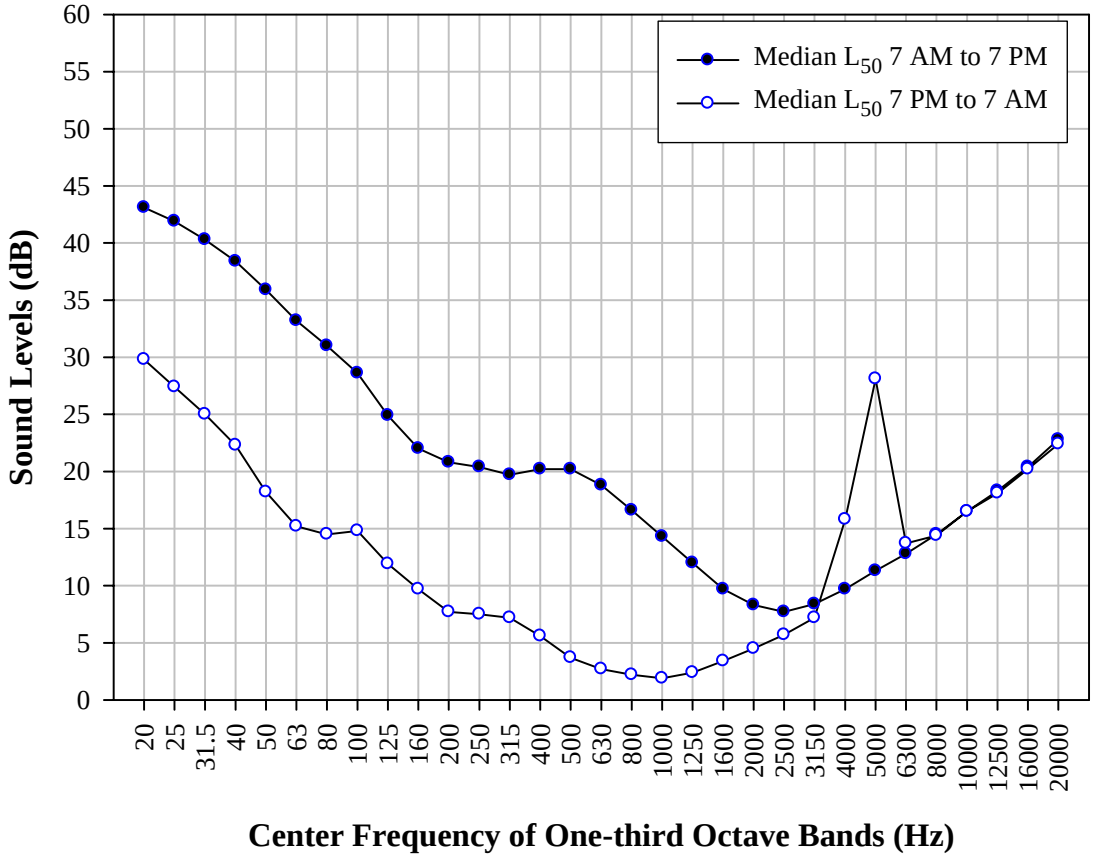

Figure I-63. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 8-01-2007 to 8-14-2007.

Table I-95. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 AM to 7 PM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 12-04-2007 to 12-14-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	112	15.5	79.8	43.3	29.5	30.1	22.7	20.7
12.5	112	13.5	90.4	51.0	41.5	43.8	38.1	33.5
15.8	112	18.9	87.1	49.0	41.0	42.9	37.7	33.8
20	112	20.1	84.8	46.9	40.0	42.6	38.2	34.0
25	112	19.1	82.2	44.6	39.4	42.3	37.2	32.9
31.5	112	18.2	86.0	42.0	35.7	38.4	33.4	30.1
40	112	14.3	81.8	39.5	34.7	37.6	31.9	28.0
50	112	8.9	80.4	37.3	33.4	36.8	29.8	25.3
63	112	4.9	77.3	35.4	32.5	35.7	26.5	20.8
80	112	1.5	72.9	34.0	31.5	34.6	24.5	17.4
100	112	-0.8	68.6	32.5	29.4	32.7	22.3	13.5
125	112	-2.3	65.1	31.1	27.5	29.5	19.3	10.5
160	112	-3.1	66.4	30.4	25.8	27.6	16.6	8.0
200	112	-2.5	65.8	29.8	24.3	26.2	14.3	6.2
250	112	-2.8	65.2	28.9	23.5	25.8	12.8	4.6
315	112	-2.9	61.4	28.5	22.2	24.5	11.6	3.8
400	112	-2.7	61.8	28.6	19.6	21.7	9.1	2.8
500	112	-2.6	59.5	28.7	15.6	16.8	7.3	3.1
630	112	-2.4	57.6	29.0	12.6	13.3	5.9	2.5
800	112	-2.2	57.5	29.8	10.6	11.2	4.8	1.2
1000	112	-1.7	58.4	30.2	11.5	10.7	3.7	0.4
1250	112	-1.1	60.1	30.8	11.9	10.3	3.0	0.6
1600	112	-0.2	58.5	31.3	11.4	8.9	2.9	1.5
2000	112	0.7	59.7	31.1	10.1	8.7	3.5	2.5
2500	112	1.7	66.0	31.0	13.6	9.3	4.3	3.7
3150	112	2.2	68.1	30.7	12.9	9.5	5.7	5.2
4000	112	1.9	72.5	31.2	11.9	9.6	7.3	7.0
5000	112	3.8	74.4	32.6	12.7	11.0	9.3	9.0
6300	112	4.8	70.8	32.5	14.8	12.8	11.0	10.8
8000	112	6.2	71.7	34.0	16.0	14.2	12.8	12.6
10000	112	7.2	69.0	33.9	15.8	15.2	14.5	14.3
12500	112	7.0	67.3	33.1	16.0	16.0	15.5	15.3
16000	112	6.7	59.8	30.4	17.1	17.1	16.8	16.7
20000	112	7.7	54.1	25.0	19.6	19.7	19.6	19.5

Table I-96. Acoustic metrics (dBA and un-weighted one-third octave bands 12.5-20k Hz) 7 PM to 7 AM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 12-04-2007 to 12-14-2007.

dBA/Freq	Num. Hours	L_{min}	L_{max}	L_{eq} L. Mean	L_{eq} Median	L_{10} Median	L_{50} Median	L_{90} Median
dBA	120	16.0	62.6	33.1	24.0	24.9	20.9	20.5
12.5	120	13.9	82.7	46.8	35.6	37.7	32.7	28.8
15.8	120	16.3	83.1	44.8	35.2	37.5	32.9	29.4
20	120	18.5	80.0	42.6	34.1	36.2	32.1	28.8
25	120	15.1	80.5	40.1	33.0	35.5	30.8	27.6
31.5	120	16.3	77.7	37.5	31.8	34.4	29.3	26.1
40	120	12.8	78.2	35.1	30.3	33.0	26.4	22.7
50	120	8.5	71.4	32.6	28.7	31.7	23.2	19.1
63	120	4.0	68.8	30.6	27.2	30.1	19.7	15.2
80	120	0.7	65.0	28.6	25.3	28.2	16.8	11.7
100	120	-0.7	60.1	26.7	23.6	26.0	14.1	8.8
125	120	-1.3	58.1	25.1	22.0	23.4	11.7	6.7
160	120	-3.3	63.8	25.3	21.3	21.6	9.6	5.1
200	120	-2.7	68.5	25.9	20.4	20.2	7.2	3.5
250	120	-3.1	64.0	25.5	19.0	19.5	5.3	2.0
315	120	-2.7	65.2	25.0	18.5	18.8	3.8	1.3
400	120	-2.6	63.5	24.2	16.7	15.1	4.0	1.7
500	120	-2.4	56.3	22.8	14.3	11.5	4.1	1.8
630	120	-2.2	51.9	22.5	9.5	8.4	3.3	1.2
800	120	-2.3	52.1	22.4	5.2	5.4	1.6	0.2
1000	120	-1.8	51.5	22.2	2.3	2.7	0.5	-0.3
1250	120	-1.1	51.6	22.0	1.8	2.6	0.7	0.1
1600	120	-0.2	51.2	21.2	2.5	3.6	1.6	1.1
2000	120	0.1	50.5	19.9	3.6	3.8	2.7	2.3
2500	120	0.0	49.7	18.4	4.2	4.5	3.8	3.5
3150	120	0.7	48.9	17.3	5.6	5.8	5.3	5.1
4000	120	1.9	48.3	17.2	7.3	7.5	7.1	6.9
5000	120	3.4	48.4	18.5	9.3	9.5	9.1	9.0
6300	120	4.3	48.2	19.8	11.1	11.3	10.9	10.7
8000	120	5.7	51.6	21.6	12.8	13.0	12.7	12.5
10000	120	7.4	52.2	23.0	14.5	14.6	14.4	14.2
12500	120	9.2	51.5	23.2	15.5	15.6	15.4	15.3
16000	120	11.1	50.5	22.1	16.8	16.9	16.8	16.7
20000	120	12.7	50.1	20.3	19.5	19.6	19.5	19.4

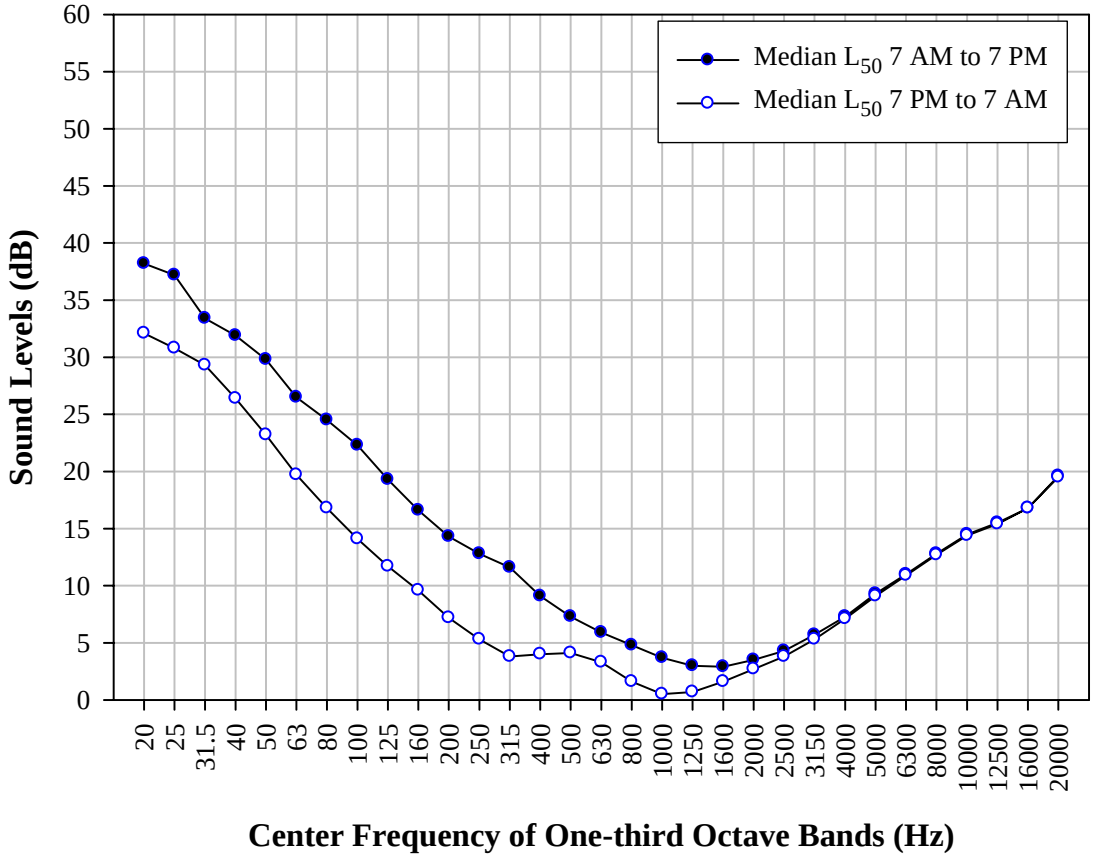

Figure I-64. L_{50} for one-third octave bands (20-20k Hz, un-weighted) 7 AM to 7 PM and 7 PM to 7 AM, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), 12-04-2007 to 12-14-2007.

Appendix II. Audibility of Sounds in GCNP Frontcountry Areas.

Table II-1. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Saturday, 6-23-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	3.9	5.6	2.2
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.3	0.6	0.0
2 Vehicle	78.9	83.6	74.2
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.7	1.4	0.0
6 Motor Sounds	7.9	15.3	0.6
7 Grounds Care	3.8	6.1	1.4
8 People	53.9	54.4	53.3
9 Domestic animal	1.9	1.7	2.2
10 Building Sounds	20.6	5.6	35.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	40.1	64.2	16.1
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	8.1	0.0	16.1
25 Bird	59.4	86.7	32.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	13.6	0.6	26.7
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.1	0.0	0.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	4.2	6.1	2.2
Total Road Vehicles	78.9	83.6	74.2
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	98.8	98.3	99.2
Total Natural	87.4	96.4	78.3
Total Artifacts	0.1	0.0	0.3

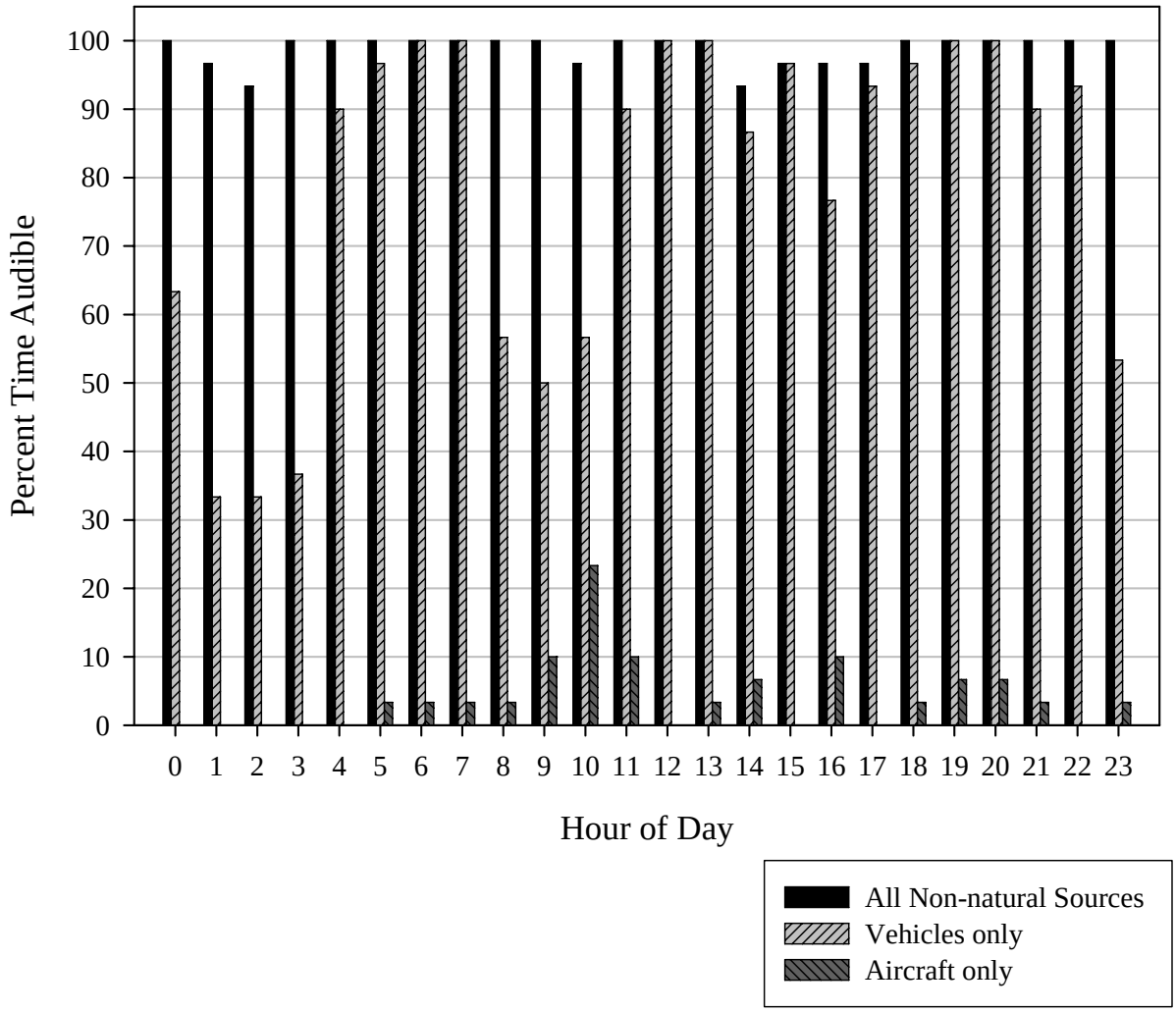

Figure II-1. Percent Time All Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Saturday, 6-23-2007.

Table II-2. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Tuesday, 6-26-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.1	0.0	0.3
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	4.0	1.7	6.4
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	3.6	6.9	0.3
2 Vehicle	82.2	85.8	78.6
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.3	0.6	0.0
6 Motor Sounds	2.6	2.8	2.5
7 Grounds Care	1.7	1.9	1.4
8 People	41.7	45.6	37.8
9 Domestic animal	5.6	3.3	7.8
10 Building Sounds	15.8	2.5	29.2
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.3	0.6	0.0
20 Non-natural Unknown	0.6	0.8	0.3
21 Wind	44.4	76.1	12.8
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	14.4	0.0	28.9
25 Bird	57.8	87.5	28.1
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	9.9	0.6	19.2
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	7.9	9.2	6.7
Total Road Vehicles	82.2	85.8	78.6
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	97.1	96.7	97.5
Total Natural	88.5	97.5	79.4
Total Artifacts	0.0	0.0	0.0

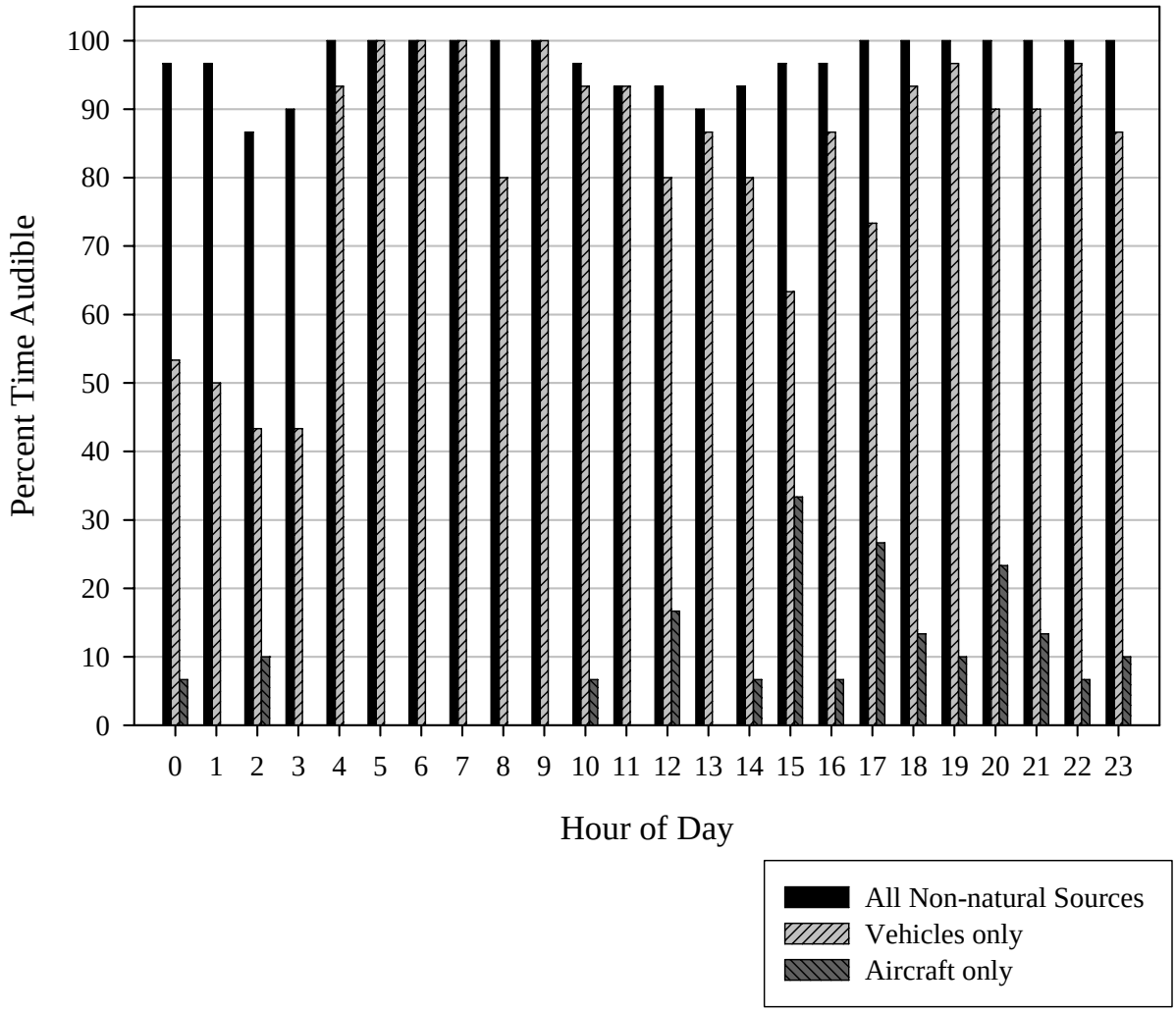

Figure II-2. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Tuesday,
6-26-2007.

Table II-3. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Thursday, 12-20-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.4	0.8	0.0
1.1 Jet Aircraft	11.0	14.4	7.5
1.2 Propeller Aircraft	0.4	0.8	0.0
1.3 Helicopter	5.4	10.8	0.0
2 Vehicle	52.6	66.7	38.6
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.4	0.8	0.0
6 Motor Sounds	1.3	1.1	1.4
7 Grounds Care	0.0	0.0	0.0
8 People	0.3	0.3	0.3
9 Domestic animal	3.2	3.3	3.1
10 Building Sounds	18.6	2.2	35.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	2.5	0.3	4.7
21 Wind	76.7	97.2	56.1
22 Water (rain, snow)	12.6	0.0	25.3
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	12.5	18.9	6.1
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.3	0.3	0.3
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	16.7	25.8	7.5
Total Road Vehicles	52.6	66.7	38.6
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	79.4	88.9	70.0
Total Natural	77.9	99.2	56.7
Total Artifacts	0.0	0.0	0.0

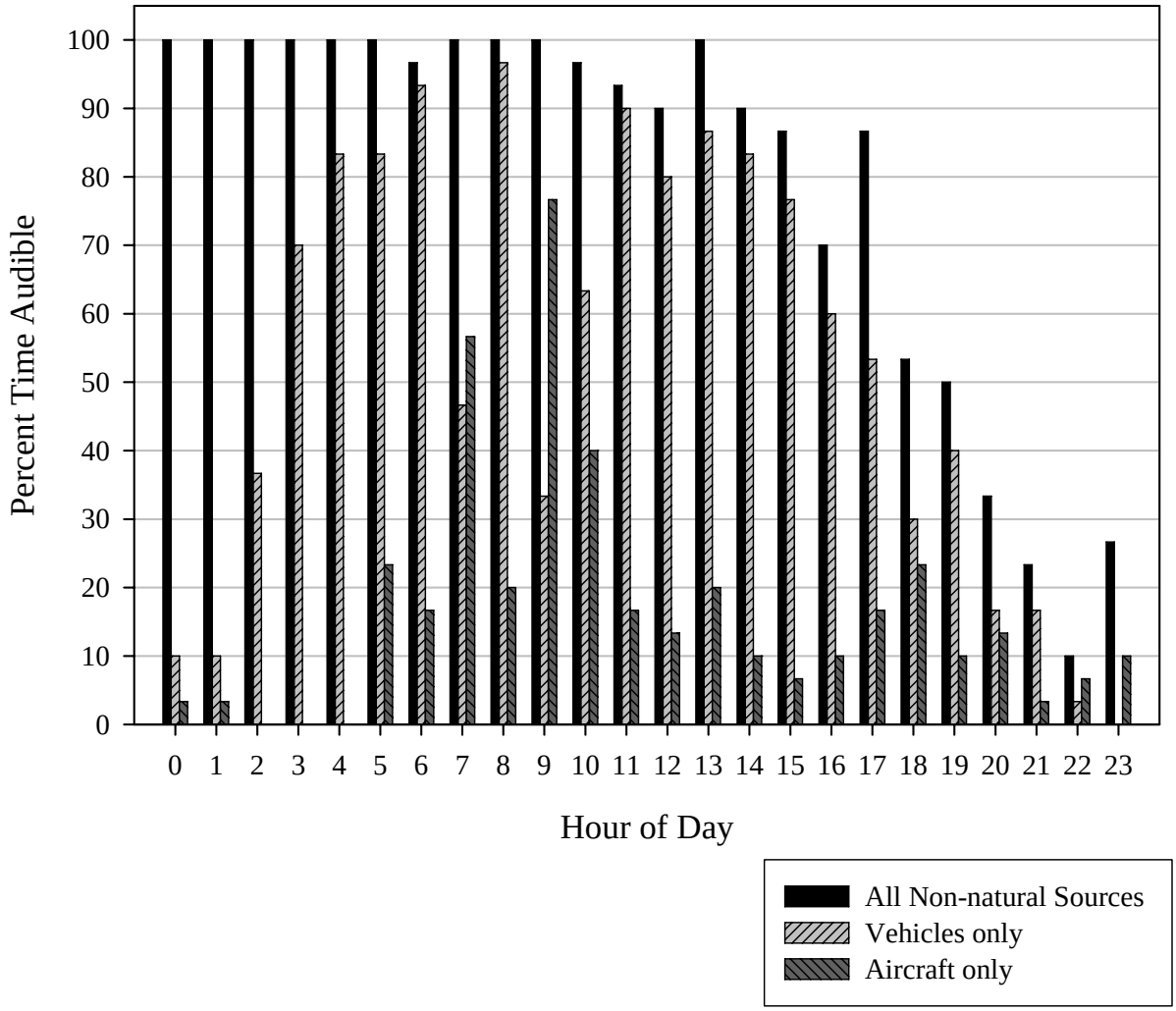

Figure II-3. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Thursday, 12-20-2007.

Table II-4. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Friday, 12-21-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	26.5	31.1	21.9
1.2 Propeller Aircraft	0.3	0.6	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	65.1	80.0	50.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.6	1.1	0.0
6 Motor Sounds	1.0	1.1	0.8
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	16.7	31.1	2.2
10 Building Sounds	9.3	1.1	17.5
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	1.0	0.0	1.9
21 Wind	77.9	90.3	65.6
22 Water (rain, snow)	13.1	20.8	5.3
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	21.9	35.0	8.9
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.7	1.4	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.6	0.0	1.1
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	26.9	31.9	21.9
Total Road Vehicles	65.1	80.0	50.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	87.5	96.4	78.6
Total Natural	83.1	96.7	69.4
Total Artifacts	0.0	0.0	0.0

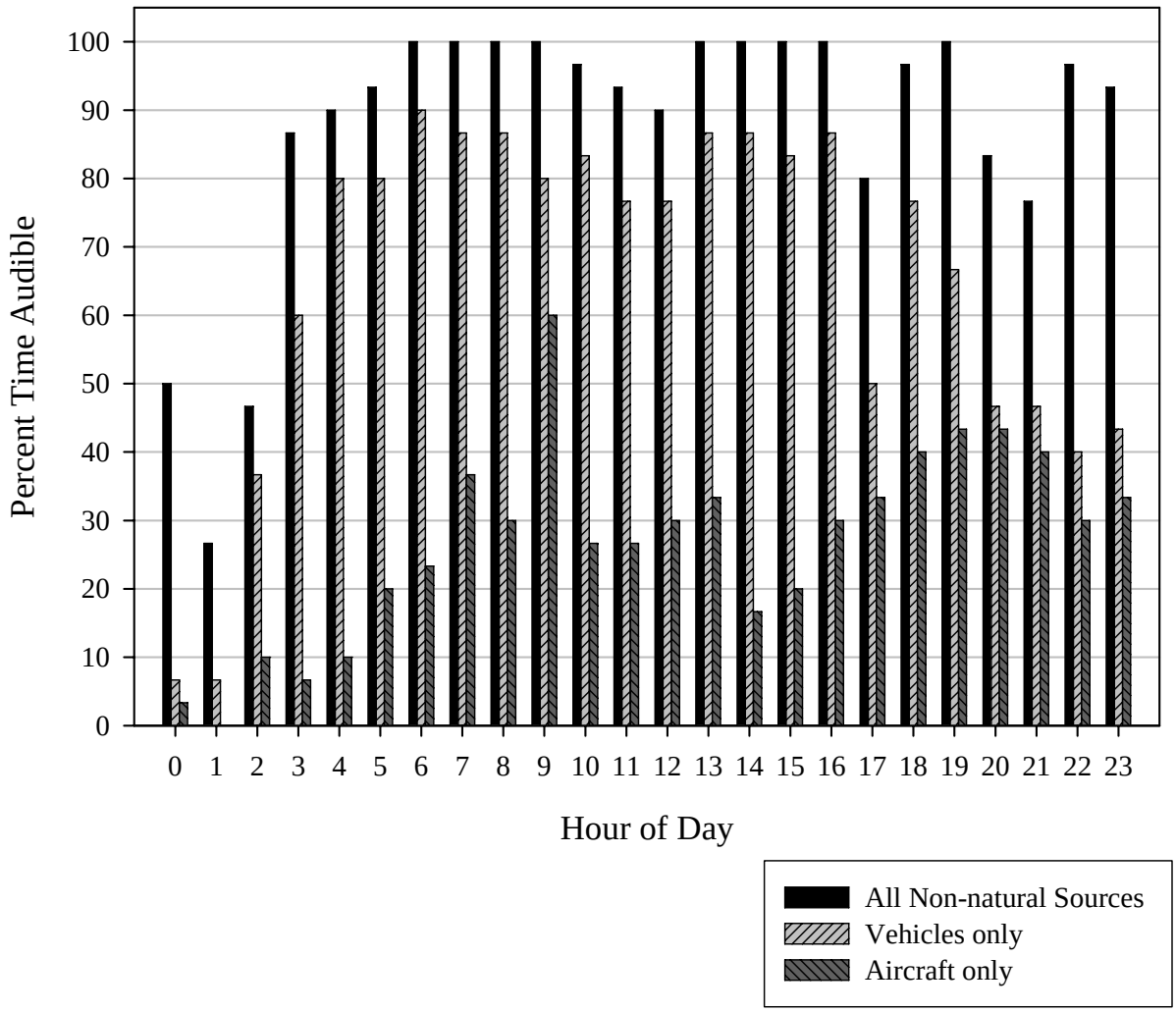

Figure II-4. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Campground (GRCA035), Friday,
12-21-2007.

Table II-5. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Saturday, 6-30-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	0.3	0.6	0.0
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.1	0.3	0.0
2 Vehicle	77.4	96.9	57.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	1.1	2.2	0.0
6 Motor Sounds	0.1	0.0	0.3
7 Grounds Care	0.3	0.0	0.6
8 People	47.1	63.6	30.6
9 Domestic animal	1.3	1.7	0.8
10 Building Sounds	11.7	0.8	22.5
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	1.7	3.3	0.0
21 Wind	32.9	6.7	59.2
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.6	0.0	1.1
25 Bird	32.6	44.7	20.6
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	29.6	0.0	59.2
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	3.1	5.8	0.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	0.6	1.1	0.0
Total Road Vehicles	77.4	96.9	57.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	91.3	100.0	82.5
Total Natural	65.7	47.8	83.6
Total Artifacts	3.1	5.8	0.3

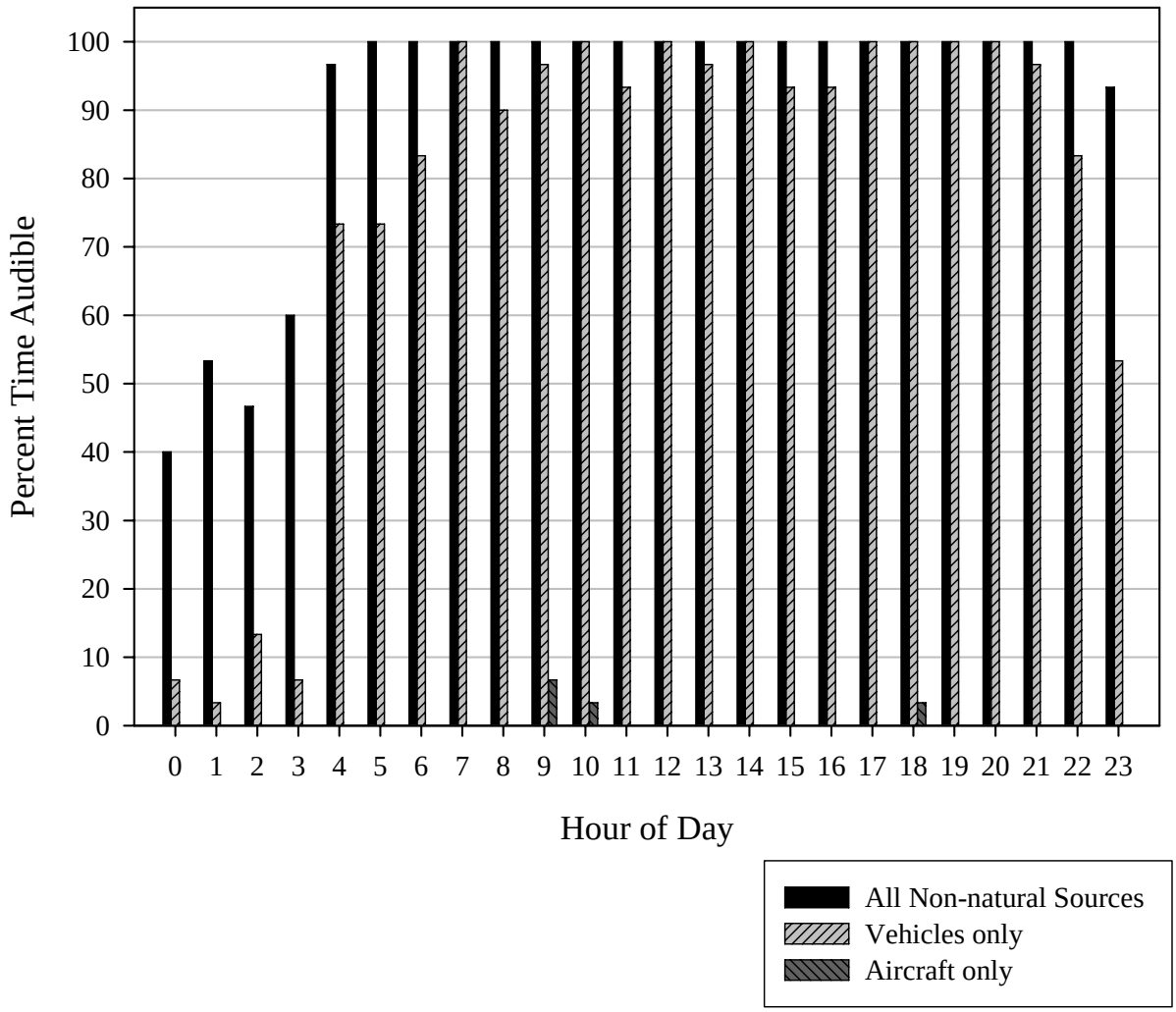

Figure II-5. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Saturday, 6-30-2007.

Table II-6. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Wednesday, 7-04-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	0.7	0.0	1.4
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	81.5	98.1	65.0
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.8	1.7	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.6	0.6	0.6
8 People	48.2	62.5	33.9
9 Domestic animal	1.0	1.7	0.3
10 Building Sounds	18.9	0.3	37.5
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	3.1	6.1	0.0
21 Wind	12.5	0.0	25.0
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	1.5	0.0	3.1
24 Mammal	12.1	0.0	24.2
25 Bird	28.1	39.7	16.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	30.7	0.0	61.4
29 Animal	0.4	0.0	0.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	0.7	0.0	1.4
Total Road Vehicles	81.5	98.1	65.0
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	96.8	100.0	93.6
Total Natural	60.0	39.7	80.3
Total Artifacts	0.0	0.0	0.0

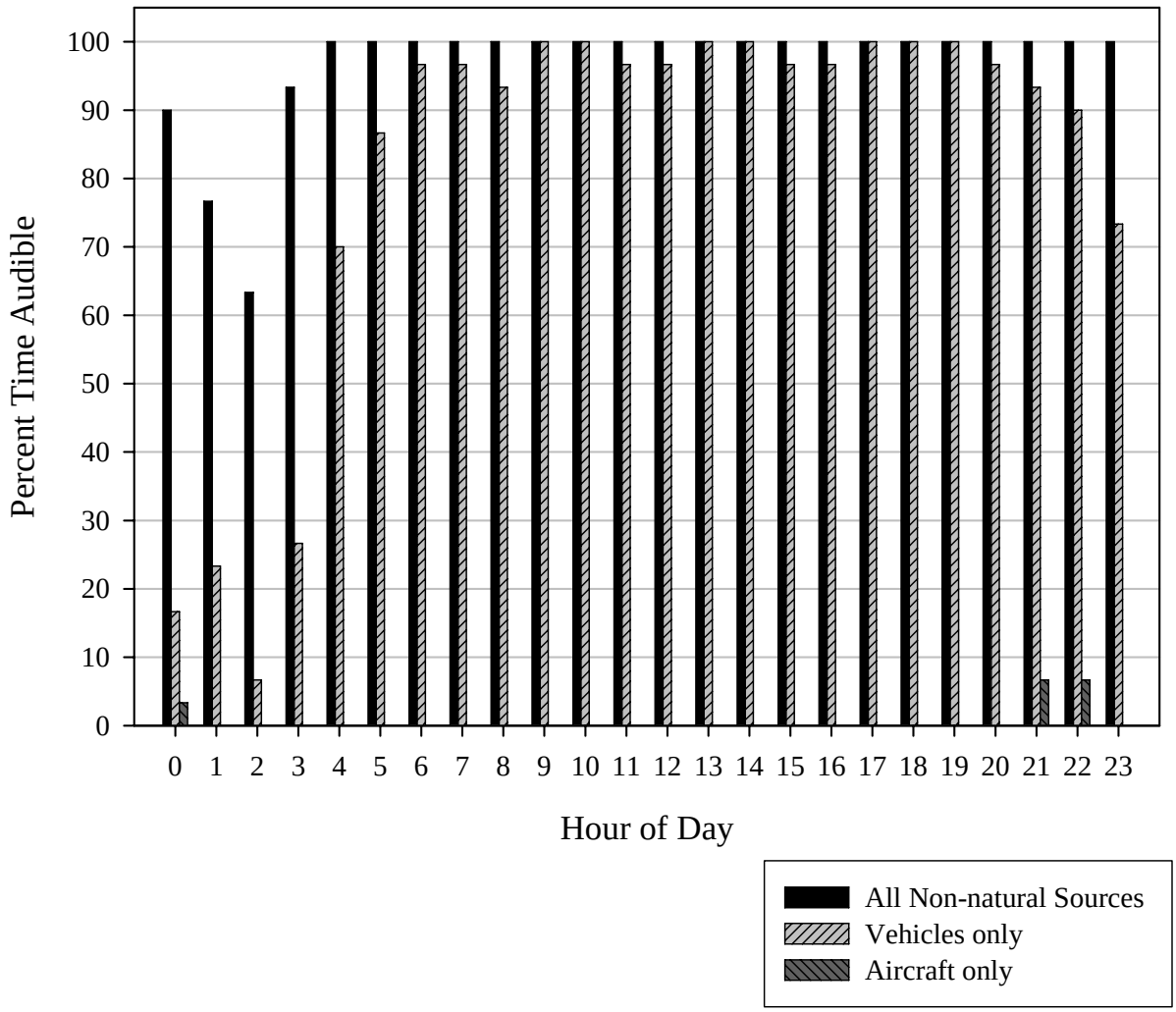

Figure II-6. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Wednesday, 7-04-2007.

Table II-7. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Saturday, 12-29-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	3.3	1.7	5.0
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	78.3	98.6	58.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	1.8	3.6	0.0
6 Motor Sounds	0.1	0.0	0.3
7 Grounds Care	0.1	0.3	0.0
8 People	26.4	39.2	13.6
9 Domestic animal	1.4	1.1	1.7
10 Building Sounds	31.7	1.1	62.2
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	2.5	0.8	4.2
21 Wind	11.9	0.0	23.9
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	4.9	9.7	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.8	0.0	1.7
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	3.3	1.7	5.0
Total Road Vehicles	78.3	98.6	58.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	98.6	100.0	97.2
Total Natural	17.9	9.7	26.1
Total Artifacts	0.0	0.0	0.0

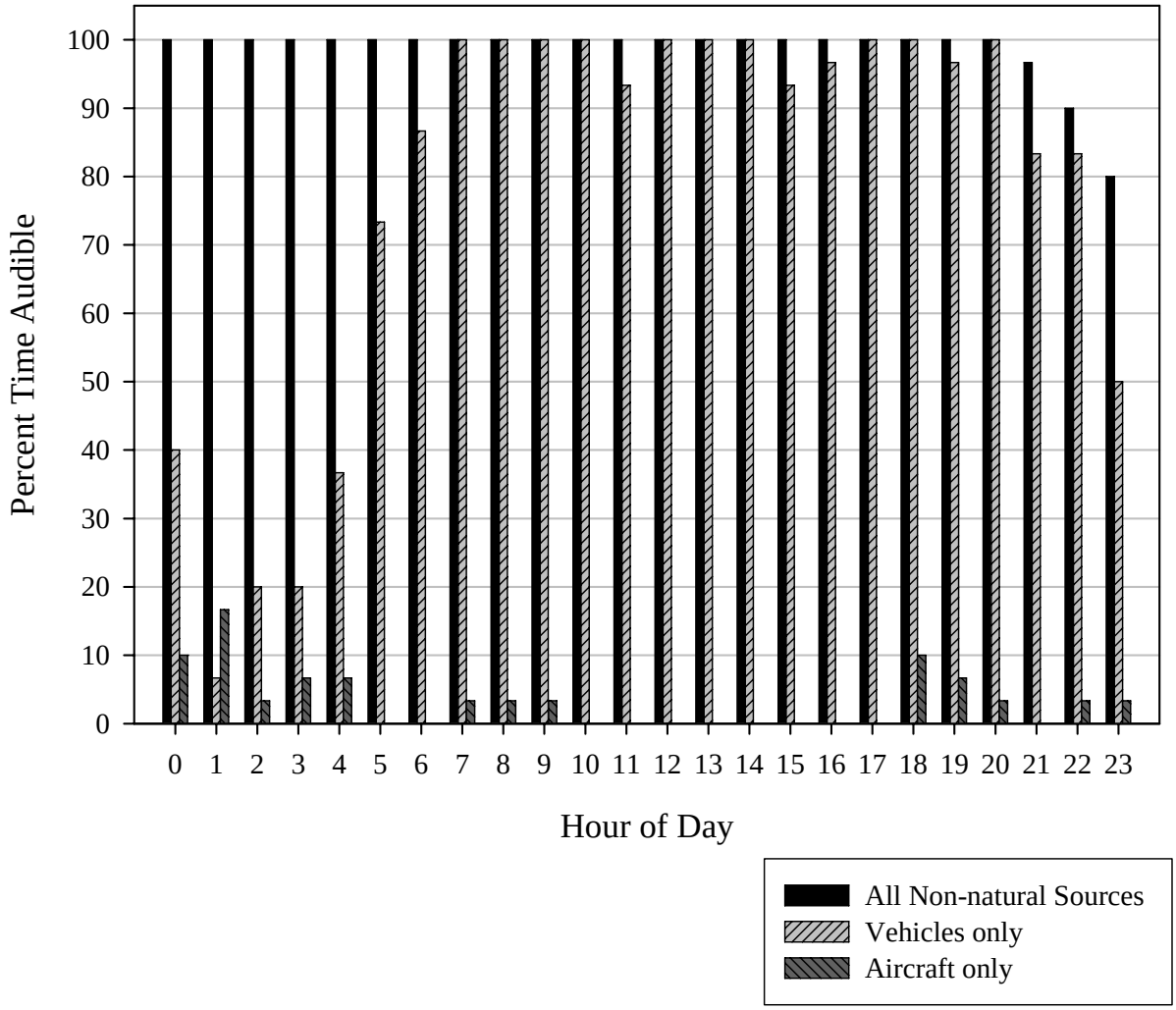

Figure II-7. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Saturday,
12-29-2007.

Table II-8. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Monday, 12-31-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.7	1.4	0.0
1.1 Jet Aircraft	1.0	0.3	1.7
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	66.3	96.1	36.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	8.8	17.5	0.0
6 Motor Sounds	0.1	0.0	0.3
7 Grounds Care	0.0	0.0	0.0
8 People	26.4	39.4	13.3
9 Domestic animal	0.6	1.1	0.0
10 Building Sounds	20.3	2.2	38.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.1	0.3	0.0
20 Non-natural Unknown	1.5	1.4	1.7
21 Wind	42.4	0.6	84.2
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.1	0.0	0.3
25 Bird	8.2	16.4	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	2.8	0.0	5.6
99 Unknown	0.0	0.0	0.0
Total Aircraft	1.7	1.7	1.7
Total Road Vehicles	66.3	96.1	36.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	87.8	100.0	75.6
Total Natural	50.6	16.9	84.2
Total Artifacts	2.8	0.0	5.6

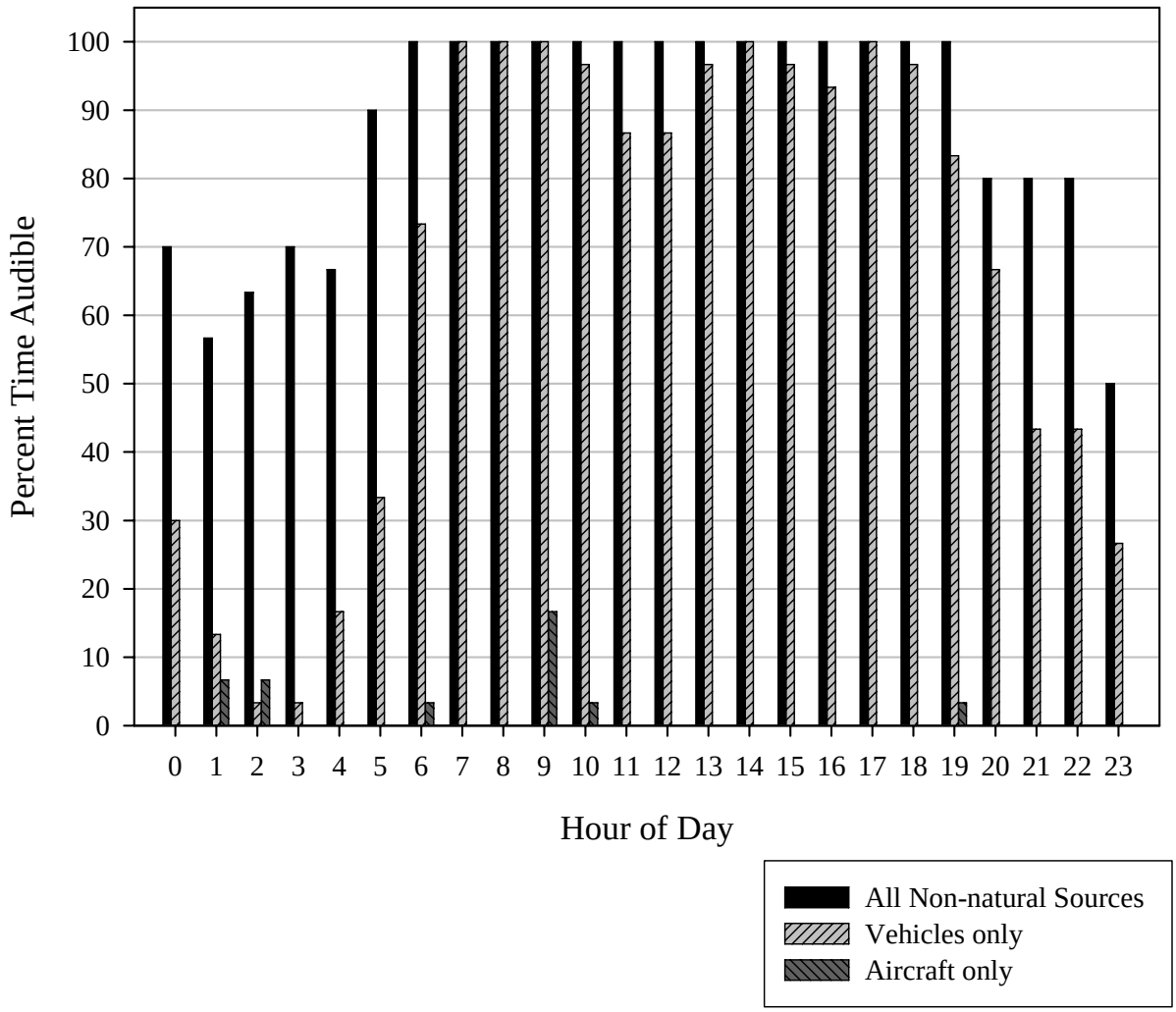

Figure II-8. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trailhead (GRCA036), Monday, 12-31-2007.

Table II-9. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Wednesday, 6-20-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.3	0.0	0.6
1 Aircraft	3.2	6.4	0.0
1.1 Jet Aircraft	8.2	3.3	13.1
1.2 Propeller Aircraft	0.4	0.8	0.0
1.3 Helicopter	4.9	9.7	0.0
2 Vehicle	87.4	97.8	76.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	2.4	0.0	4.7
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	3.5	0.0	6.9
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	13.3	24.2	2.5
22 Water (rain, snow)	15.8	7.2	24.4
23 Thunder	0.1	0.3	0.0
24 Mammal	1.3	0.0	2.5
25 Bird	47.2	62.2	32.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.3	0.0	0.6
29 Animal	1.4	0.6	2.2
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	1.5	0.0	3.1
41 Artifact	0.7	1.4	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	16.7	20.3	13.1
Total Road Vehicles	87.4	97.8	76.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	95.4	99.7	91.1
Total Natural	68.8	74.2	63.3
Total Artifacts	0.7	1.4	0.0

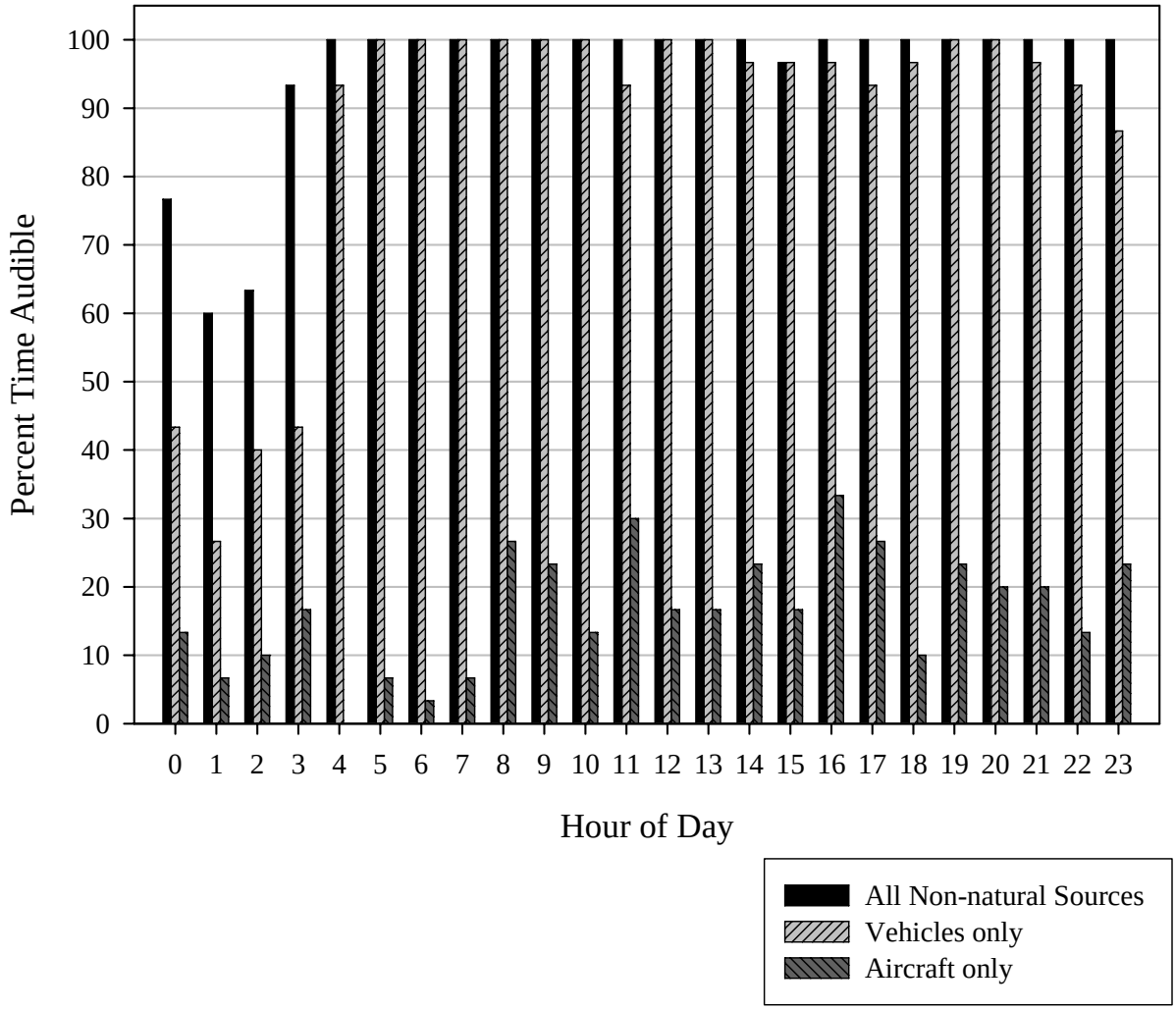

Figure II-9. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Wednesday, 6-20-2007.

Table II-10. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Saturday, 6-23-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	2.5	1.9	3.1
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	6.1	12.2	0.0
2 Vehicle	85.8	98.6	73.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.3	0.0	0.6
7 Grounds Care	0.0	0.0	0.0
8 People	0.4	0.3	0.6
9 Domestic animal	0.6	0.0	1.1
10 Building Sounds	10.8	0.0	21.7
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.3	0.0	0.6
21 Wind	11.3	20.6	1.9
22 Water (rain, snow)	6.0	0.0	11.9
23 Thunder	0.0	0.0	0.0
24 Mammal	2.9	0.3	5.6
25 Bird	50.3	71.1	29.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	1.5	2.5	0.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	2.2	0.0	4.4
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	8.9	14.7	3.1
Total Road Vehicles	85.8	98.6	73.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	98.3	98.9	97.8
Total Natural	64.0	77.2	50.8
Total Artifacts	0.1	0.3	0.0

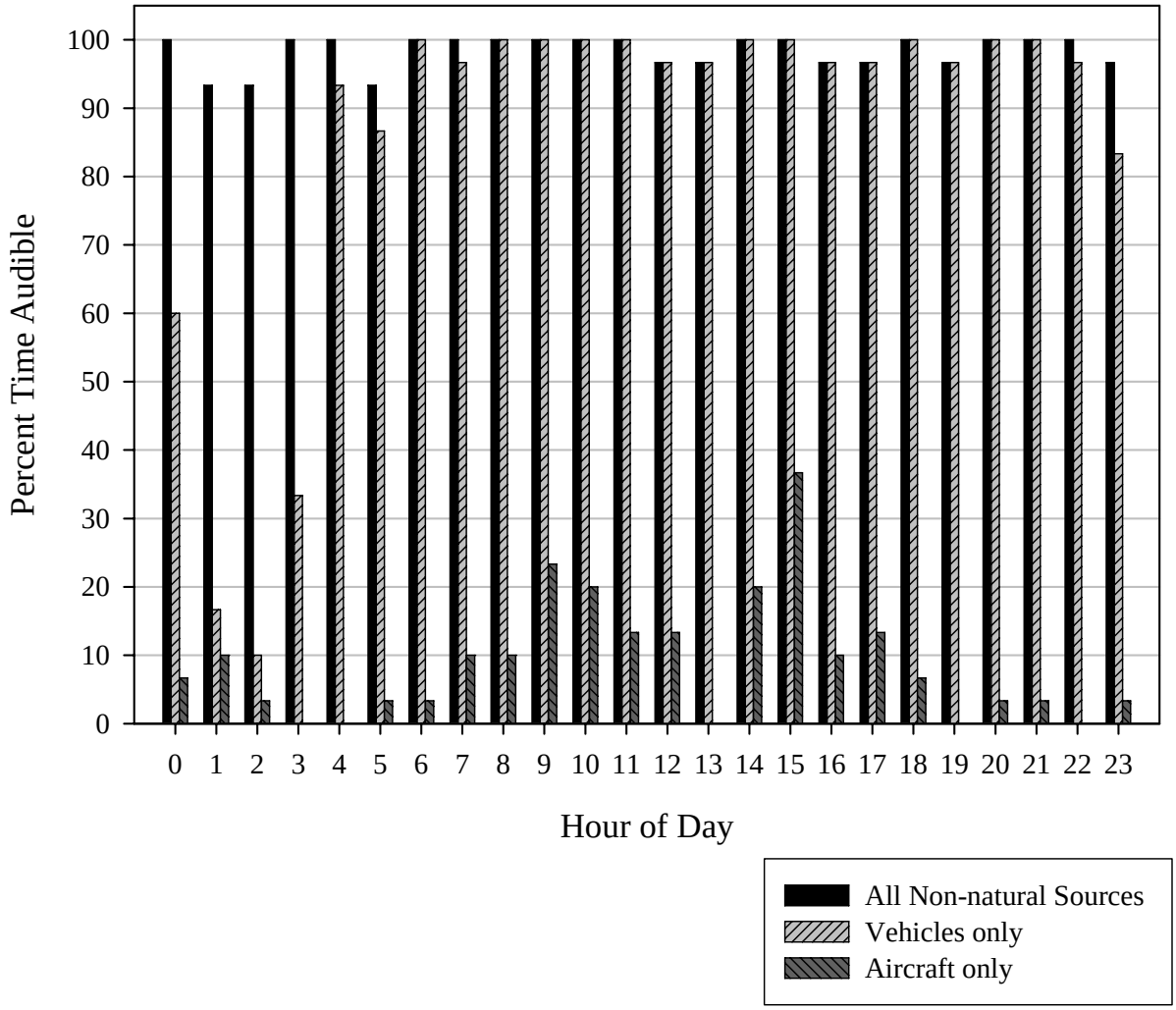

Figure II-10. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Saturday, 6-23-2007.

Table II-11. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Friday, 12-07-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	6.8	5.3	8.3
1.2 Propeller Aircraft	0.3	0.0	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	41.7	61.4	21.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.4	0.3	0.6
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.6	0.0	1.1
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	97.6	98.6	96.7
22 Water (rain, snow)	20.8	33.3	8.3
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	0.3	0.6	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.3	0.0	0.6
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	7.1	5.3	8.9
Total Road Vehicles	41.7	61.4	21.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	47.8	65.0	30.6
Total Natural	97.6	98.6	96.7
Total Artifacts	0.0	0.0	0.0

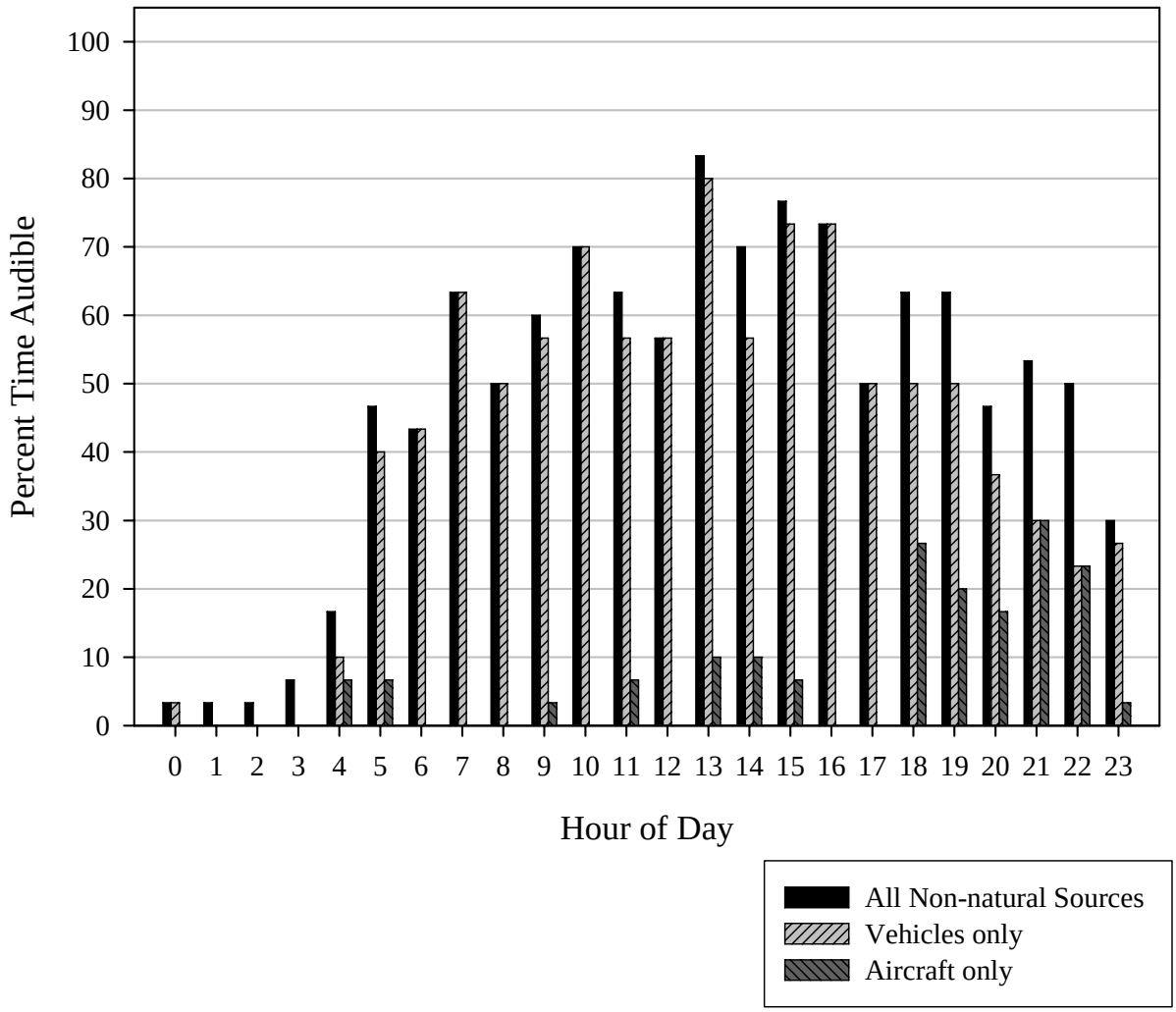

Figure II-11. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Friday, 12-07-2007.

Table II-12. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Saturday, 12-08-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	2.6	0.0	5.3
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	13.3	14.4	12.2
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.8	1.7	0.0
2 Vehicle	56.7	82.8	30.6
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.3	0.6	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	2.2	0.3	4.2
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	67.2	56.4	78.1
22 Water (rain, snow)	10.3	12.5	8.1
23 Thunder	0.0	0.0	0.0
24 Mammal	1.0	0.0	1.9
25 Bird	1.7	3.3	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.3	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.7	0.3	1.1
41 Artifact	0.3	0.6	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	14.3	16.4	12.2
Total Road Vehicles	56.7	82.8	30.6
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	66.7	88.3	45.0
Total Natural	70.7	60.6	80.8
Total Artifacts	0.3	0.6	0.0

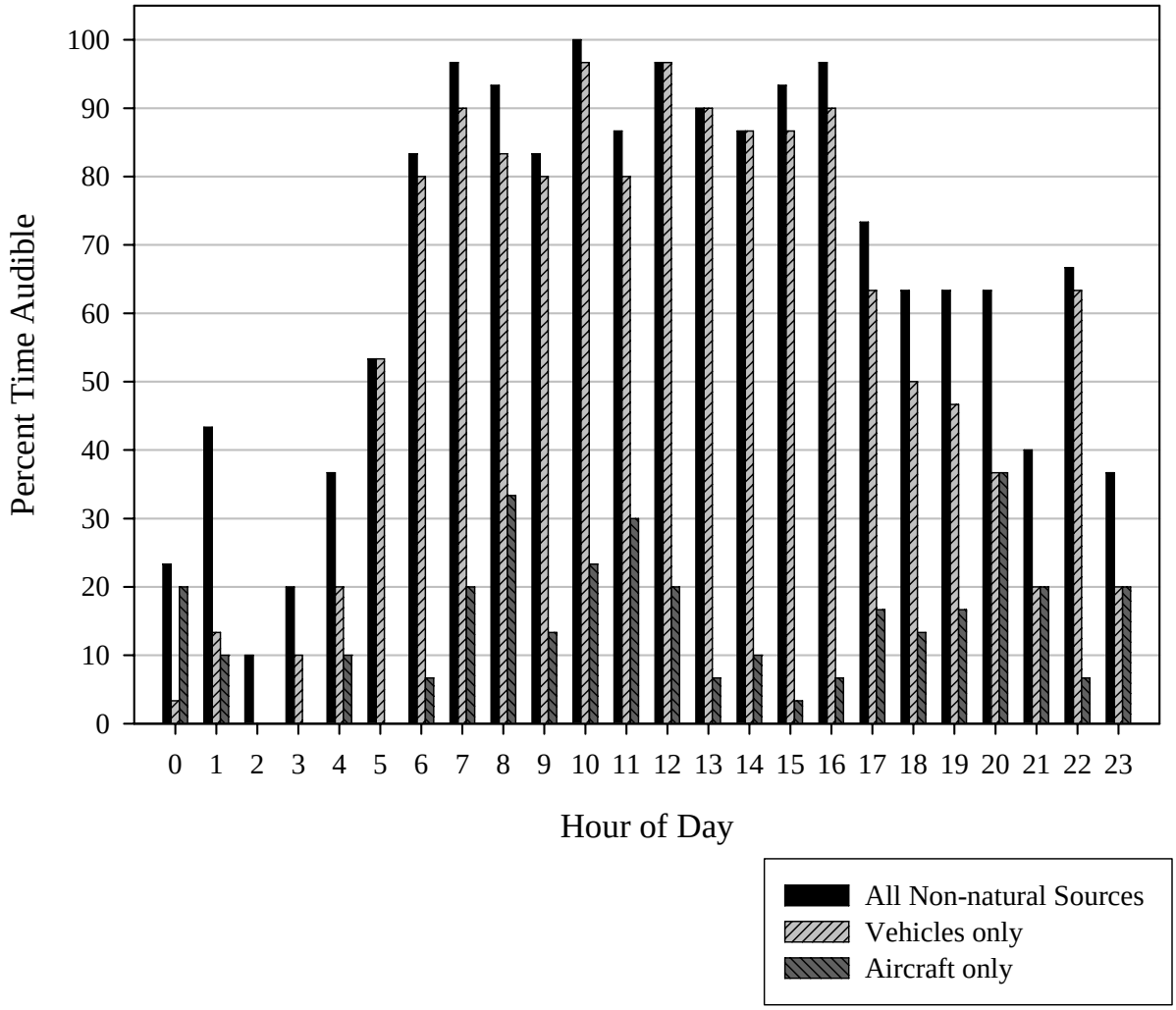

Figure II-12. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Entrance Road (GRCA037), Saturday, 12-08-2007.

Table II-13. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Saturday, 6-16-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.6	1.1	0.0
1.1 Jet Aircraft	8.8	12.8	4.7
1.2 Propeller Aircraft	1.1	2.2	0.0
1.3 Helicopter	0.3	0.6	0.0
2 Vehicle	51.4	48.9	53.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.4	0.8	0.0
7 Grounds Care	0.8	1.7	0.0
8 People	14.6	14.7	14.4
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	19.9	1.7	38.1
11 Construction	0.4	0.8	0.0
19 Non-natural Other	6.1	8.1	4.2
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	31.3	56.9	5.6
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	8.2	0.0	16.4
25 Bird	59.6	87.5	31.7
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	12.1	1.9	22.2
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.3	0.6	0.0
99 Unknown	0.1	0.0	0.3
Total Aircraft	10.7	16.7	4.7
Total Road Vehicles	51.4	48.9	53.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	84.6	73.6	95.6
Total Natural	80.6	94.4	66.7
Total Artifacts	0.3	0.6	0.0

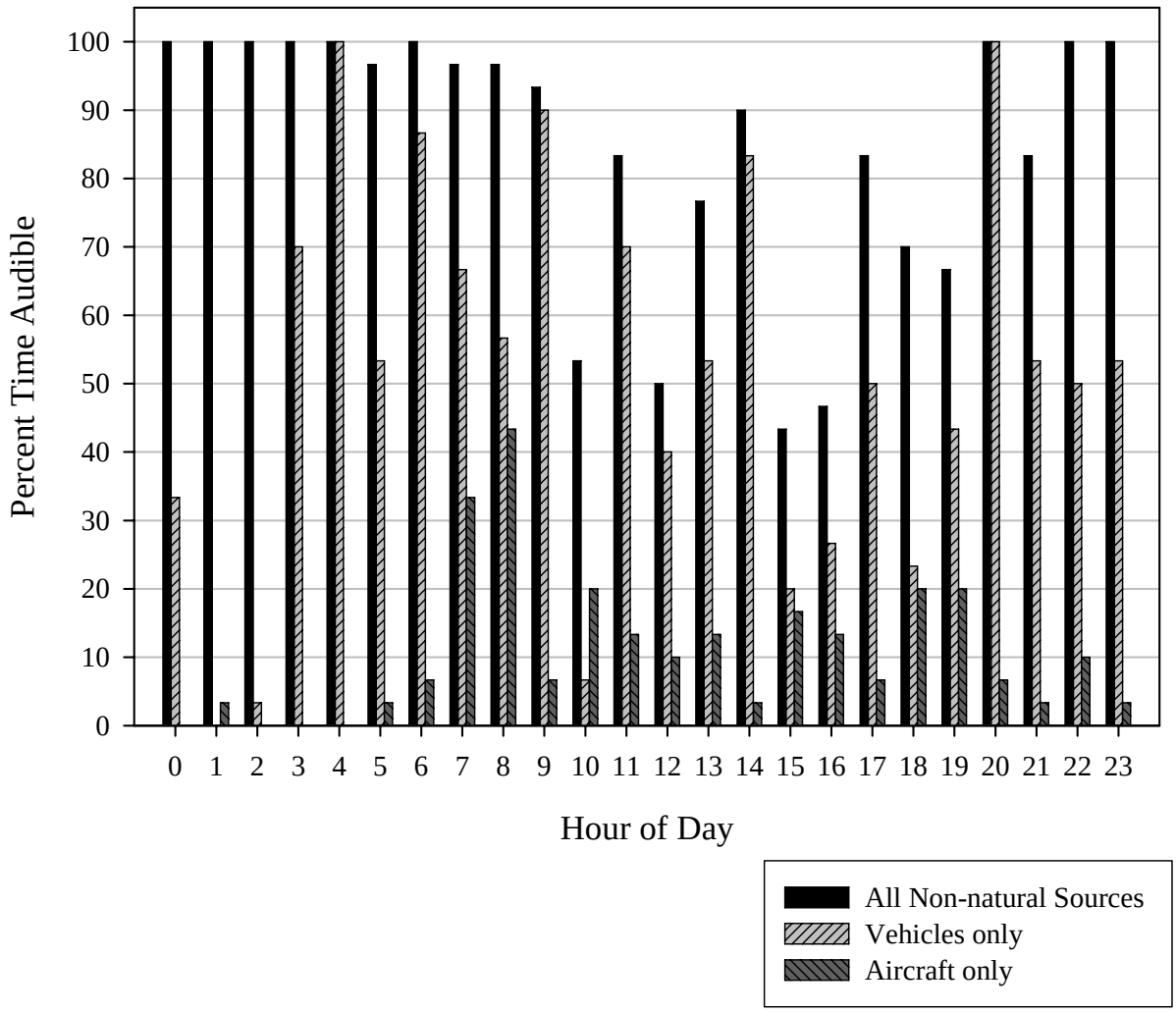

Figure II-13. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Saturday, 6-16-2007.

Table II-14. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Monday, 6-18-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.7	1.1	0.3
1.1 Jet Aircraft	8.1	10.3	5.8
1.2 Propeller Aircraft	0.3	0.6	0.0
1.3 Helicopter	13.2	18.6	7.8
2 Vehicle	58.3	61.4	55.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	2.9	3.3	2.5
7 Grounds Care	1.5	2.8	0.3
8 People	12.6	11.7	13.6
9 Domestic animal	0.1	0.3	0.0
10 Building Sounds	18.3	1.1	35.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	7.4	5.6	9.2
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	15.6	26.4	4.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	2.2	0.0	4.4
25 Bird	62.4	91.1	33.6
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	7.2	2.8	11.7
29 Animal	0.1	0.3	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.1	0.3	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	22.2	30.6	13.9
Total Road Vehicles	58.3	61.4	55.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	93.9	88.9	98.9
Total Natural	71.9	92.2	51.7
Total Artifacts	0.0	0.0	0.0

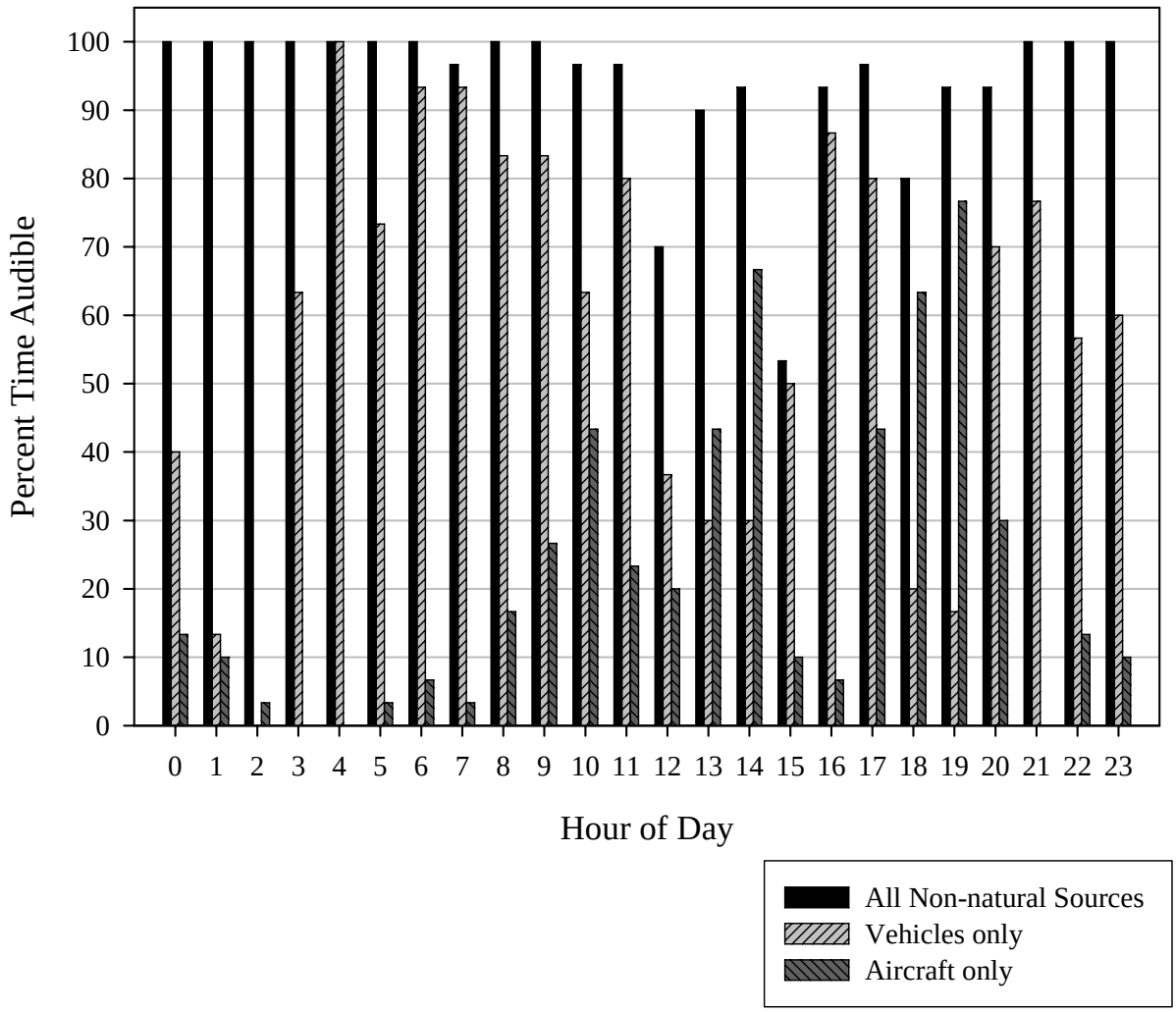

Figure II-14. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Monday, 6-18-2007.

Table II-15. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Wednesday, 12-19-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	20.7	20.6	20.8
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	73.8	91.1	56.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.4	0.8	0.0
6 Motor Sounds	18.8	5.8	31.7
7 Grounds Care	0.0	0.0	0.0
8 People	3.2	4.7	1.7
9 Domestic animal	0.1	0.0	0.3
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	8.3	13.6	3.1
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	8.2	5.8	10.6
22 Water (rain, snow)	5.7	8.9	2.5
23 Thunder	0.0	0.0	0.0
24 Mammal	0.6	0.0	1.1
25 Bird	16.5	31.7	1.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	2.9	0.3	5.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.4	0.0	0.8
Total Aircraft	20.8	20.8	20.8
Total Road Vehicles	73.8	91.1	56.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	95.7	98.9	92.5
Total Natural	30.1	42.5	17.8
Total Artifacts	0.0	0.0	0.0

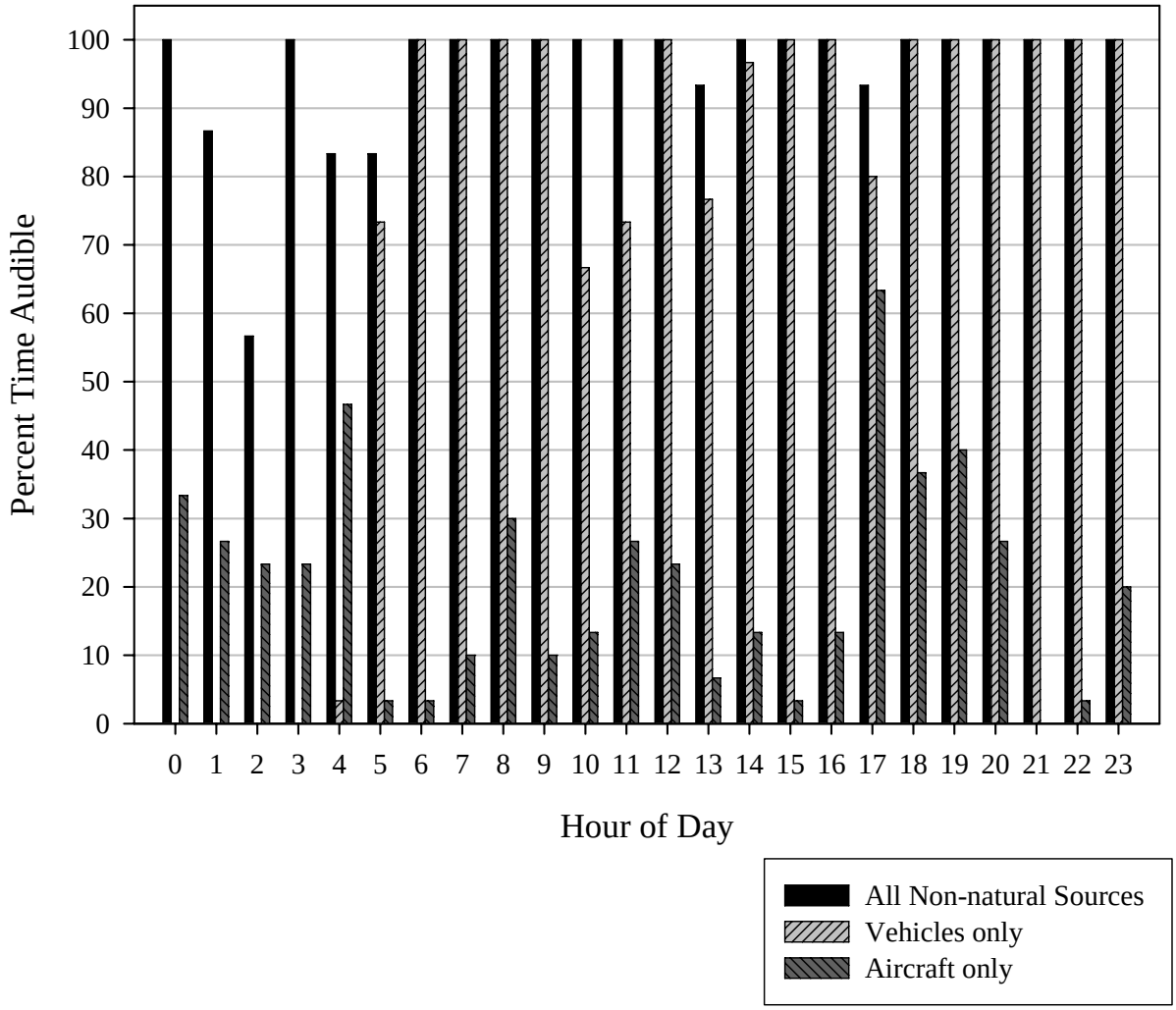

Figure II-15. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Wednesday, 12-19-2007.

Table II-16. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Sunday, 12-23-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.8	1.7	0.0
1.1 Jet Aircraft	16.1	11.7	20.6
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	5.4	10.8	0.0
2 Vehicle	54.0	77.5	30.6
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.7	1.4	0.0
6 Motor Sounds	38.6	5.8	71.4
7 Grounds Care	0.0	0.0	0.0
8 People	5.3	8.1	2.5
9 Domestic animal	0.1	0.3	0.0
10 Building Sounds	0.1	0.0	0.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	6.0	8.3	3.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	0.6	1.1	0.0
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	9.4	18.6	0.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.8	0.0	1.7
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	22.5	24.4	20.6
Total Road Vehicles	54.0	77.5	30.6
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	99.7	99.4	100.0
Total Natural	10.8	19.7	1.9
Total Artifacts	0.0	0.0	0.0

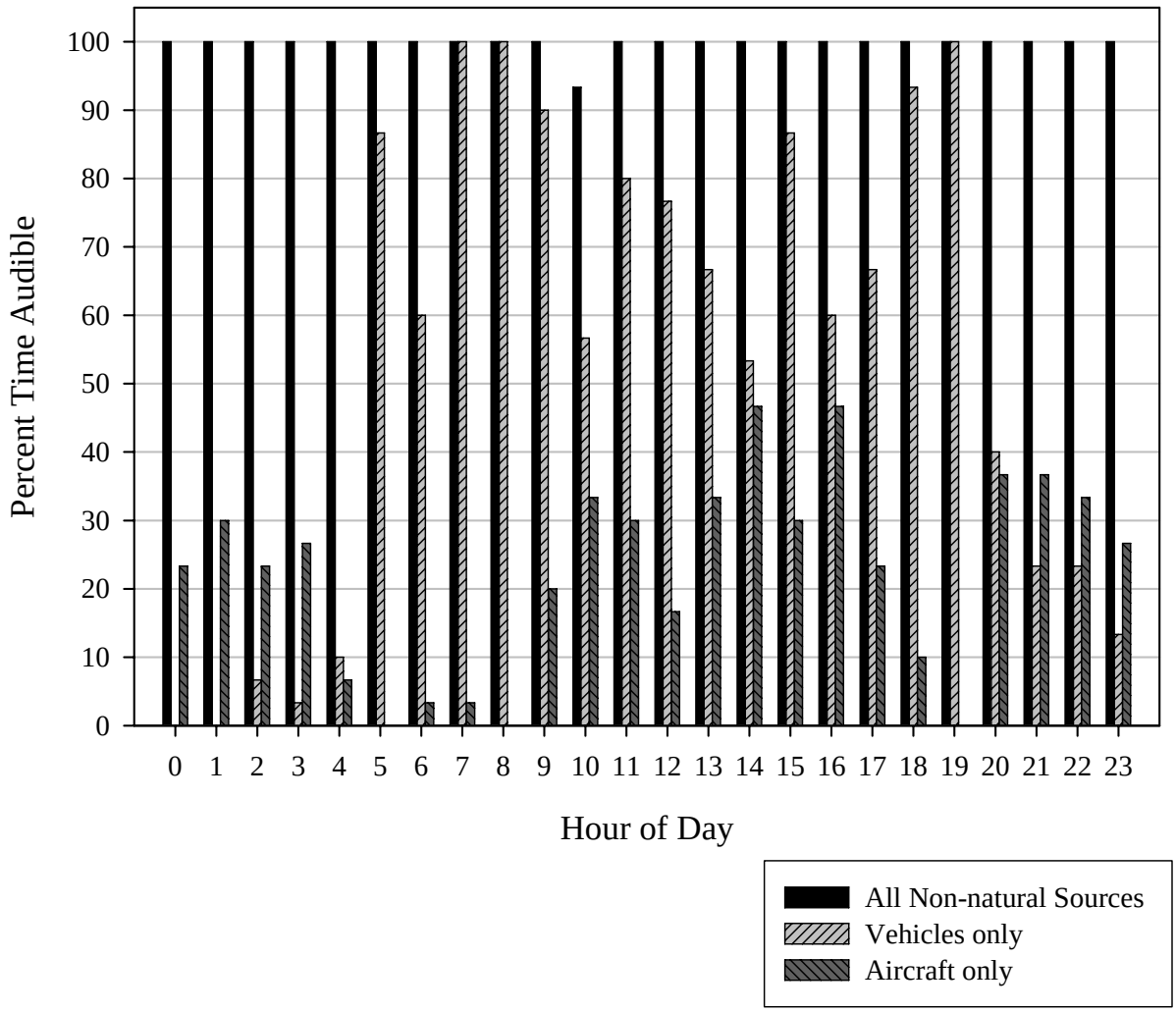

Figure II-16. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Maintenance Area (GRCA038), Sunday, 12-23-2007.

Table II-17. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Saturday, 6-16-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.7	0.8	0.6
1.1 Jet Aircraft	6.7	10.0	3.3
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.4	0.8	0.0
2 Vehicle	53.8	75.8	31.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.8	1.4	0.3
7 Grounds Care	0.1	0.3	0.0
8 People	26.8	41.1	12.5
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	1.7	3.3	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	72.2	61.4	83.1
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	3.8	0.0	7.5
25 Bird	27.9	40.0	15.8
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	43.8	25.3	62.2
29 Animal	1.8	0.3	3.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	7.9	11.9	3.9
Total Road Vehicles	53.8	75.8	31.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	65.6	94.2	36.9
Total Natural	91.3	88.1	94.4
Total Artifacts	0.0	0.0	0.0

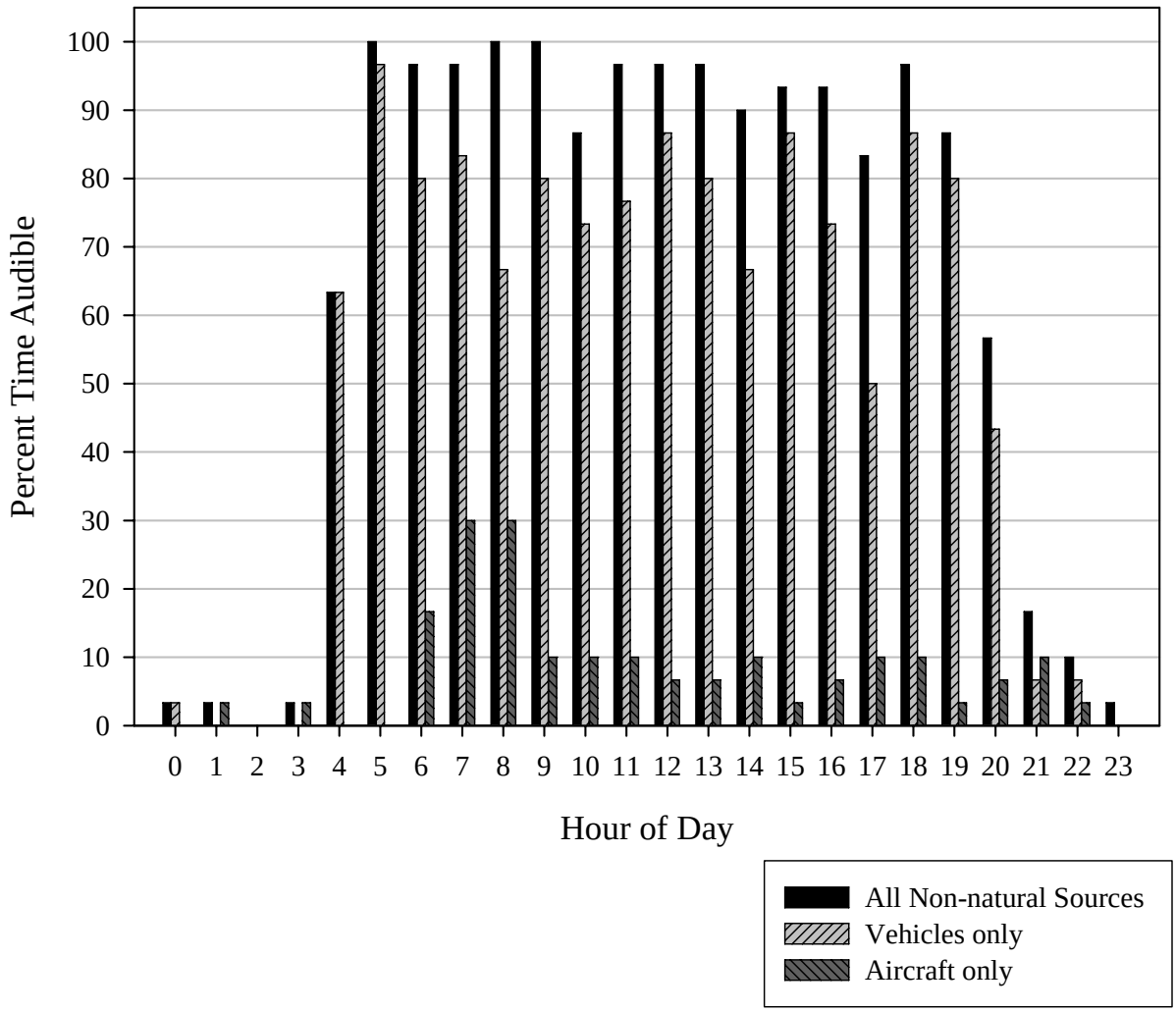

Figure II-17. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Saturday, 6-16-2007.

Table II-18. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Tuesday, 6-19-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	5.4	6.1	4.7
1.2 Propeller Aircraft	0.6	1.1	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	63.5	86.1	40.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.3	0.6	0.0
6 Motor Sounds	0.1	0.3	0.0
7 Grounds Care	1.7	2.8	0.6
8 People	30.3	51.7	8.9
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	1.4	2.5	0.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.1	0.3	0.0
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	67.9	46.1	89.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	8.6	0.0	17.2
25 Bird	30.8	49.4	12.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	46.1	24.4	67.8
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	0.3	0.6	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	6.1	7.5	4.7
Total Road Vehicles	63.5	86.1	40.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	71.5	96.7	46.4
Total Natural	88.9	81.9	95.8
Total Artifacts	0.3	0.6	0.0

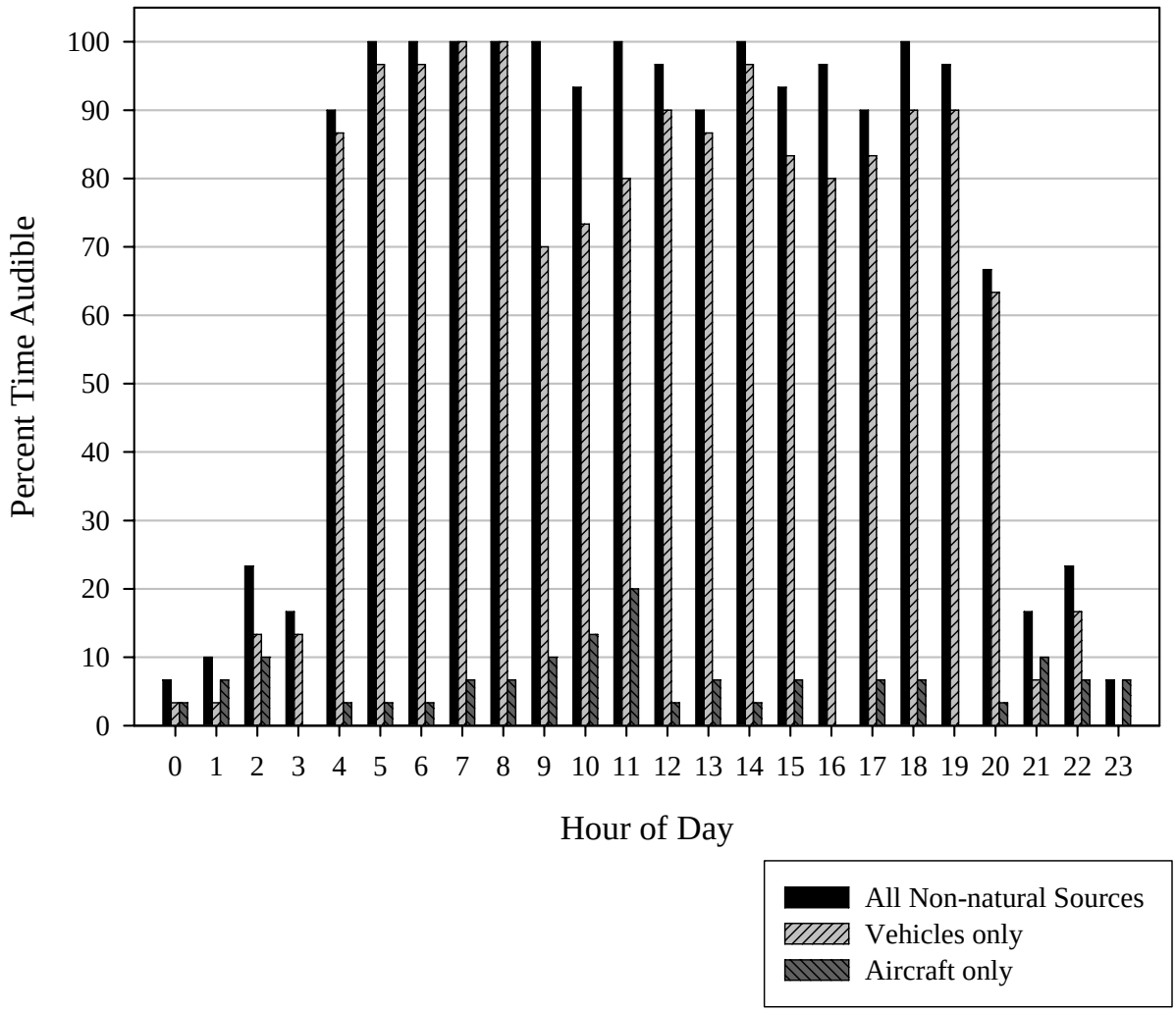

Figure II-18. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Tuesday, 6-19-2007.

Table II-19. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Saturday, 12-08-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	13.8	18.3	9.2
1.2 Propeller Aircraft	0.3	0.6	0.0
1.3 Helicopter	0.4	0.8	0.0
2 Vehicle	36.9	59.2	14.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.1	0.3	0.0
6 Motor Sounds	0.4	0.6	0.3
7 Grounds Care	0.1	0.3	0.0
8 People	3.9	7.8	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.7	1.4	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.3	0.0	0.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	94.9	90.3	99.4
22 Water (rain, snow)	2.5	3.1	1.9
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	11.4	22.5	0.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	1.3	0.3	2.2
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	4.2	0.6	7.8
40 Natural Unknown	9.4	3.6	15.3
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	14.4	19.7	9.2
Total Road Vehicles	36.9	59.2	14.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	48.6	72.5	24.7
Total Natural	96.8	94.2	99.4
Total Artifacts	0.1	0.3	0.0

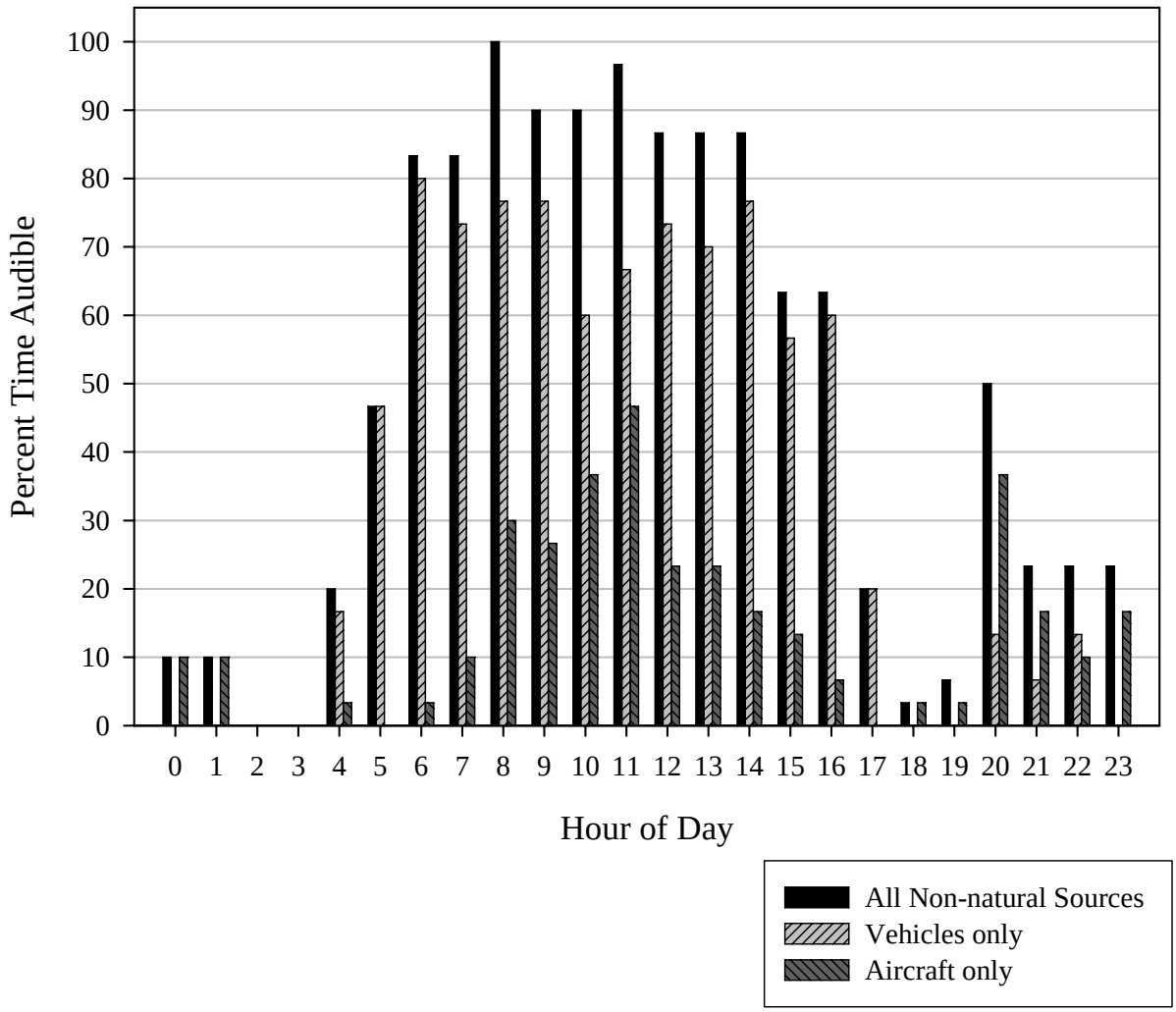

Figure II-19. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Saturday, 12-08-2007.

Table II-20. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Tuesday, 12-11-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	40.3	16.7	63.9
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	33.2	42.8	23.6
1.2 Propeller Aircraft	0.4	0.3	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	20.3	34.7	5.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.1	0.3	0.0
6 Motor Sounds	1.7	1.1	2.2
7 Grounds Care	0.0	0.0	0.0
8 People	2.9	5.8	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.1	0.3	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	2.9	4.2	1.7
22 Water (rain, snow)	5.7	9.7	1.7
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	1.5	2.5	0.6
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.3	0.6	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	33.6	43.1	24.2
Total Road Vehicles	20.3	34.7	5.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	54.6	77.2	31.9
Total Natural	10.1	16.1	4.2
Total Artifacts	0.0	0.0	0.0

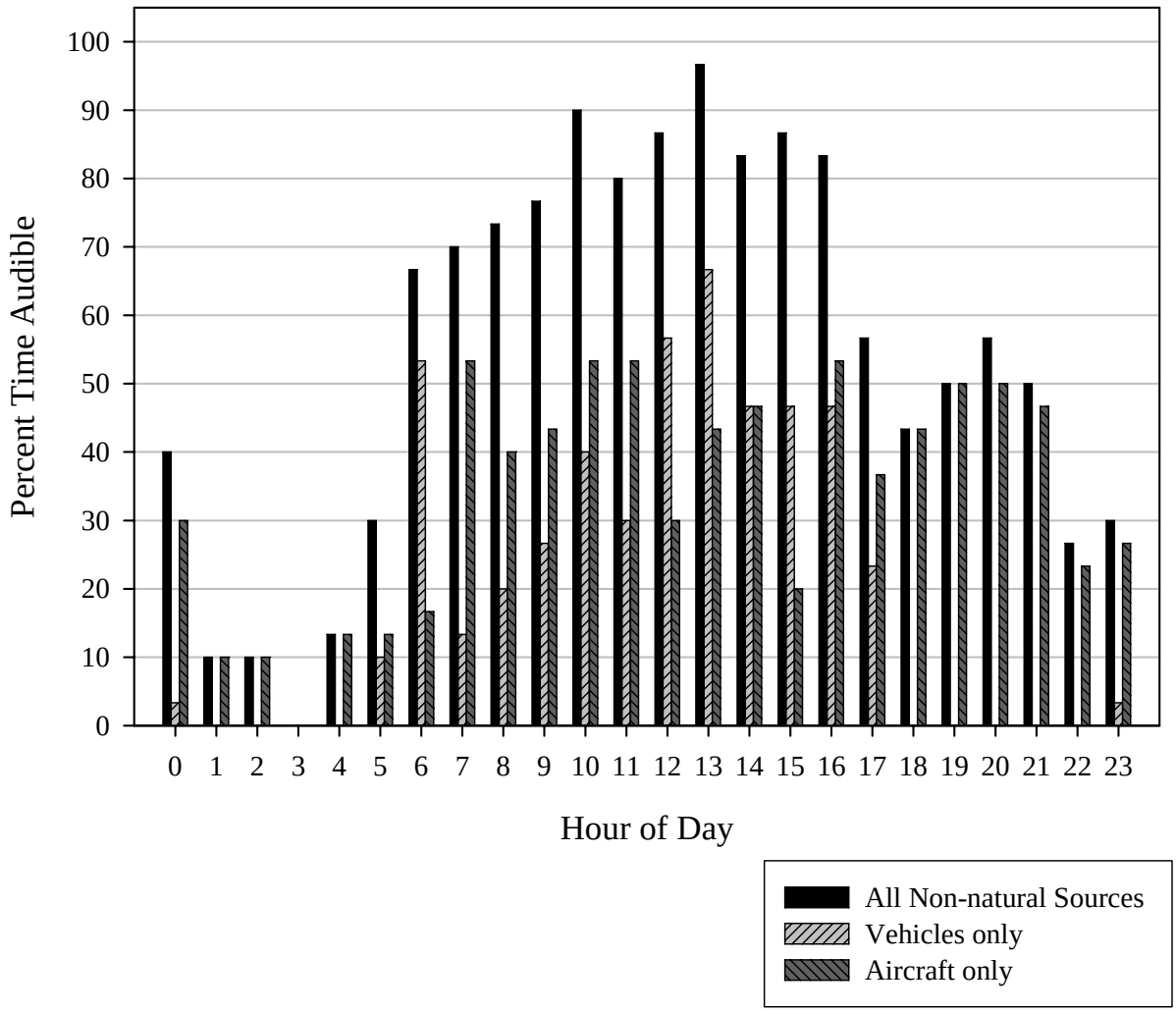

Figure II-20. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Yaki Point (GRCA039), Tuesday, 12-11-2007.

Table II-21. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Thursday, 6-21-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.7	1.4	0.0
1.1 Jet Aircraft	10.6	11.9	9.2
1.2 Propeller Aircraft	0.4	0.6	0.3
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	65.3	91.4	39.2
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.7	0.6	0.8
7 Grounds Care	0.1	0.3	0.0
8 People	20.3	31.4	9.2
9 Domestic animal	0.8	0.0	1.7
10 Building Sounds	4.6	1.1	8.1
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	9.7	3.6	15.8
21 Wind	70.8	67.5	74.2
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	17.2	0.0	34.4
25 Bird	34.3	51.4	17.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	43.5	11.9	75.0
29 Animal	0.3	0.0	0.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	1.9	0.6	3.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	11.7	13.9	9.4
Total Road Vehicles	65.3	91.4	39.2
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	79.6	98.3	60.8
Total Natural	96.3	93.3	99.2
Total Artifacts	1.9	0.6	3.3

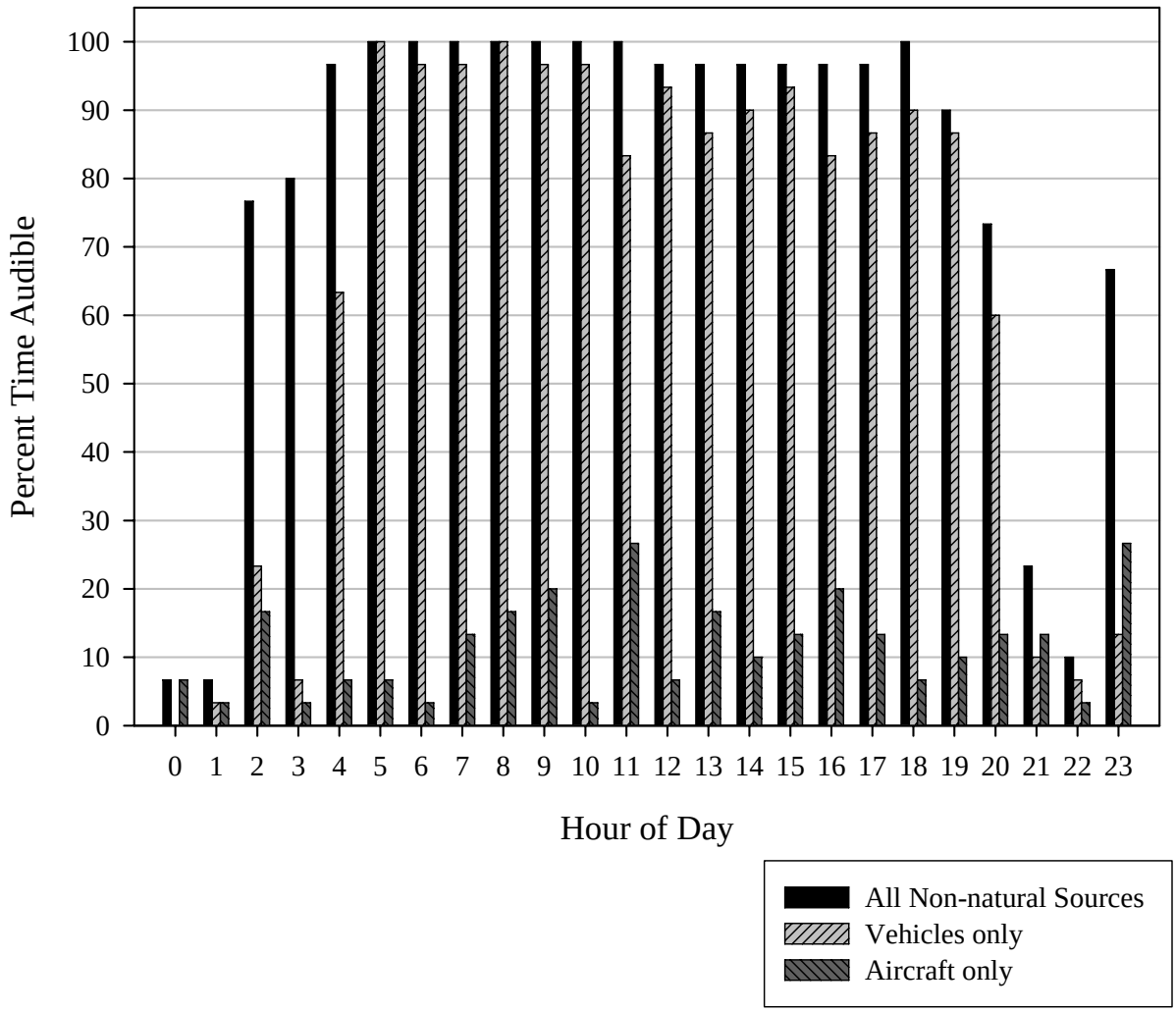

Figure II-21. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Thursday, 6-21-2007.

Table II-22. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Saturday, 6-23-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	1.8	3.6	0.0
1.1 Jet Aircraft	2.2	3.9	0.6
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.4	0.8	0.0
2 Vehicle	62.9	93.1	32.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.1	0.0	0.3
7 Grounds Care	0.3	0.6	0.0
8 People	21.8	40.6	3.1
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	2.6	3.6	1.7
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	2.2	1.9	2.5
21 Wind	85.6	72.5	98.6
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	28.9	0.0	57.8
25 Bird	35.0	60.8	9.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	41.3	12.5	70.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	6.5	1.4	11.7
99 Unknown	0.0	0.0	0.0
Total Aircraft	4.6	8.6	0.6
Total Road Vehicles	62.9	93.1	32.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	66.4	98.3	34.4
Total Natural	95.8	92.8	98.9
Total Artifacts	6.5	1.4	11.7

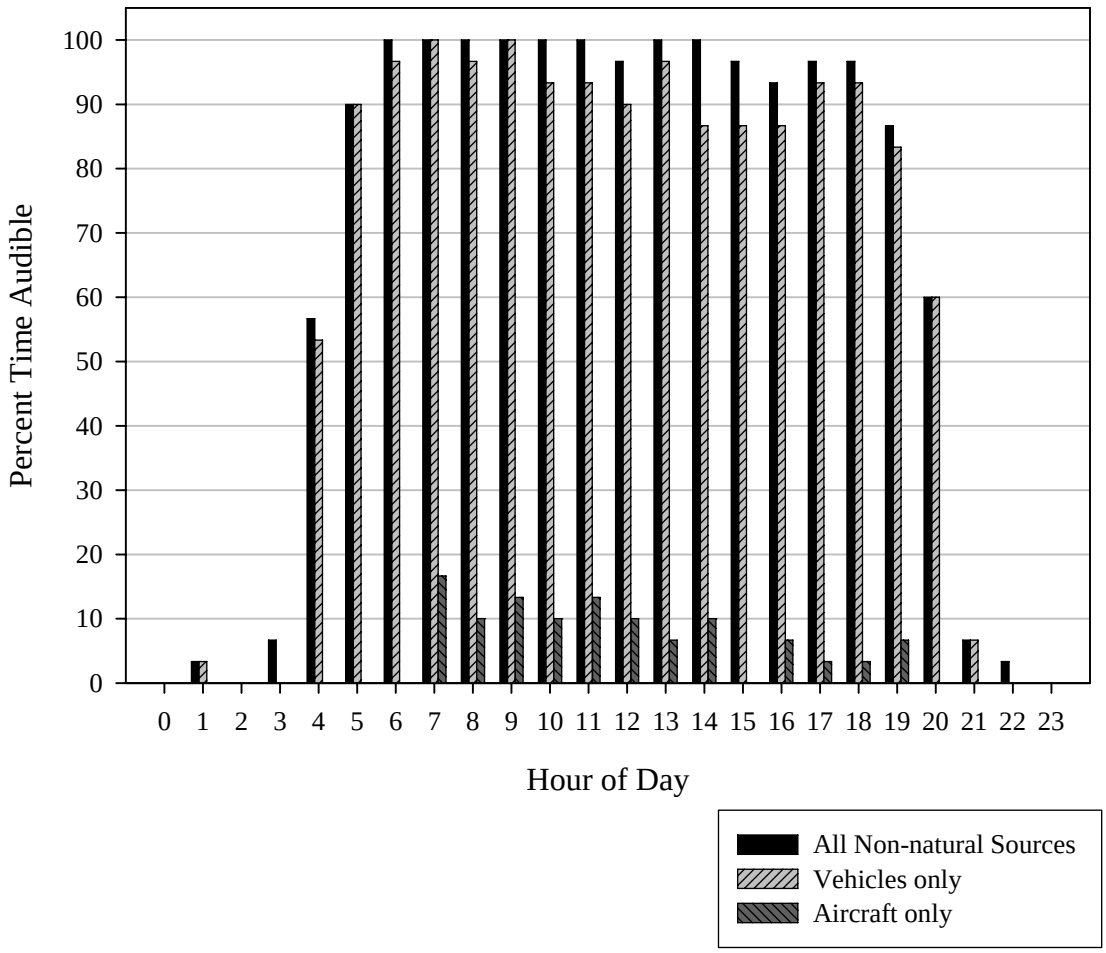

Figure II-22. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Saturday, 6-23-2007.

Table II-23. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Saturday, 12-08-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	1.1	2.2	0.0
1.1 Jet Aircraft	14.3	17.8	10.8
1.2 Propeller Aircraft	0.3	0.6	0.0
1.3 Helicopter	0.4	0.8	0.0
2 Vehicle	48.9	83.1	14.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	1.3	0.0	2.5
7 Grounds Care	0.1	0.3	0.0
8 People	5.8	11.7	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	5.7	1.4	10.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	4.2	1.4	6.9
21 Wind	90.3	81.9	98.6
22 Water (rain, snow)	11.3	12.5	10.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	14.9	29.4	0.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.4	0.3	0.6
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	16.1	21.4	10.8
Total Road Vehicles	48.9	83.1	14.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	65.6	91.1	40.0
Total Natural	94.2	89.7	98.6
Total Artifacts	0.1	0.3	0.0

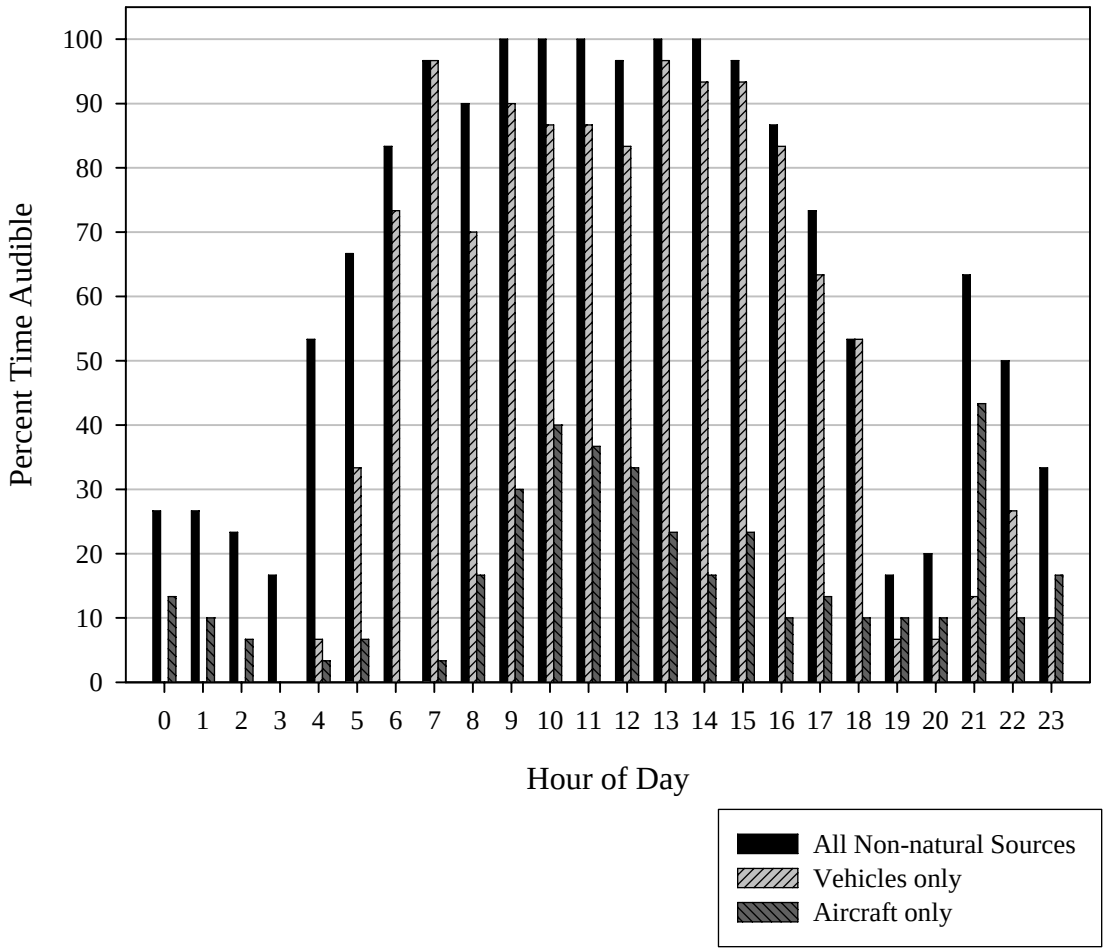

Figure II-23. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Saturday, 12-08-2007.

Table II-24. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Friday, 12-14-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	1.9	3.9	0.0
1.1 Jet Aircraft	23.8	23.9	23.6
1.2 Propeller Aircraft	0.8	1.1	0.6
1.3 Helicopter	2.1	4.2	0.0
2 Vehicle	48.6	76.1	21.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.1	0.3	0.0
6 Motor Sounds	1.4	0.6	2.2
7 Grounds Care	0.0	0.0	0.0
8 People	12.1	23.9	0.3
9 Domestic animal	1.5	0.6	2.5
10 Building Sounds	4.4	0.6	8.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	2.6	1.9	3.3
21 Wind	70.3	64.7	75.8
22 Water (rain, snow)	66.4	85.3	47.5
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	10.1	20.3	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.6	0.0	1.1
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	28.6	33.1	24.2
Total Road Vehicles	48.6	76.1	21.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	76.1	95.6	56.7
Total Natural	96.9	98.6	95.3
Total Artifacts	0.0	0.0	0.0

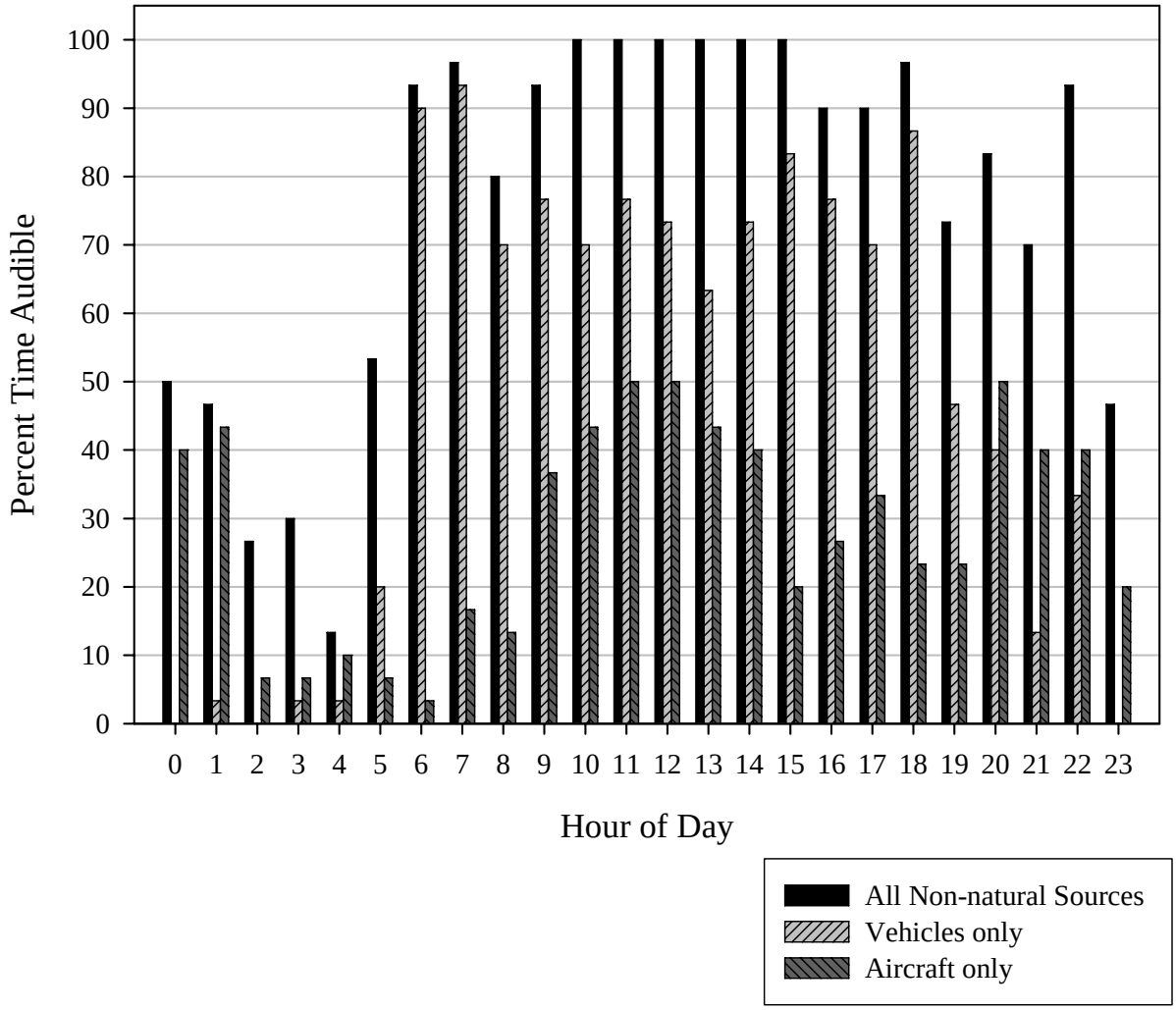

Figure II-24. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, South Kaibab Trailhead (GRCA040), Friday, 12-14-2007.

Table II-25. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Monday, 6-25-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	0.0	0.0	0.0
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	83.6	99.7	67.5
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.8	1.1	0.6
8 People	47.6	67.8	27.5
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	38.2	20.0	56.4
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	7.6	8.1	7.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	23.5	2.8	44.2
29 Animal	0.4	0.0	0.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	9.6	0.0	19.2
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	7.9	9.2	6.7
99 Unknown	0.0	0.0	0.0
Total Aircraft	0.1	0.3	0.0
Total Road Vehicles	83.6	99.7	67.5
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	83.8	100.0	67.5
Total Natural	48.5	29.2	67.8
Total Artifacts	7.9	9.2	6.7

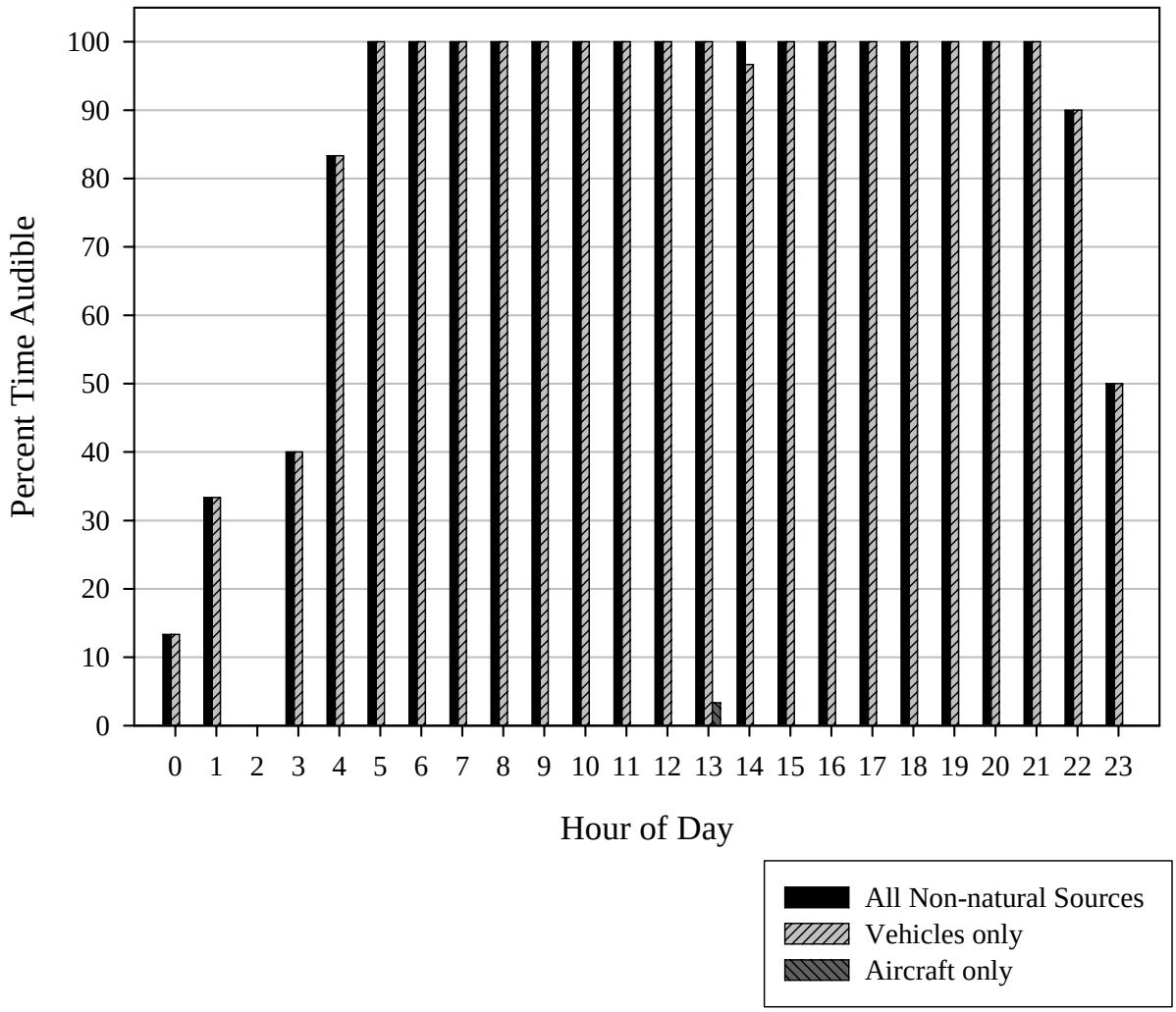

Figure II-25. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Monday, 6-25-2007.

Table II-26. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Wednesday, 6-27-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	1.3	0.3	2.2
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	80.8	100.0	61.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.6	0.0	1.1
7 Grounds Care	2.1	3.3	0.8
8 People	51.0	67.2	34.7
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	28.9	3.6	54.2
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	2.4	0.0	4.7
25 Bird	10.6	11.1	10.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	25.6	0.0	51.1
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	2.1	0.0	4.2
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	1.8	1.7	1.9
99 Unknown	0.0	0.0	0.0
Total Aircraft	1.3	0.3	2.2
Total Road Vehicles	80.8	100.0	61.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	83.8	100.0	67.5
Total Natural	42.2	14.7	69.7
Total Artifacts	1.8	1.7	1.9

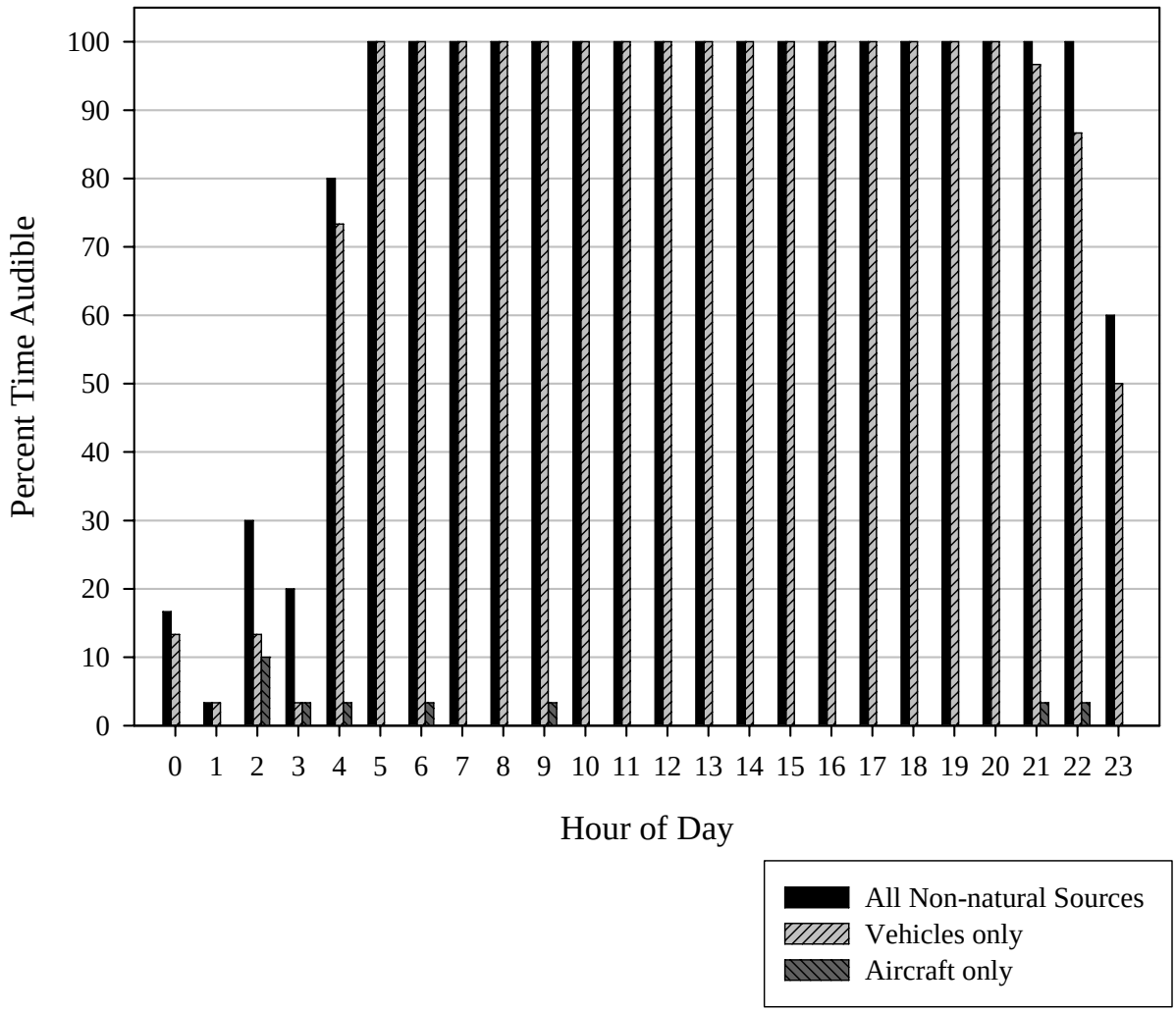

Figure II-26. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Wednesday, 6-27-2007.

Table II-27. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Saturday, 12-15-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	14.9	3.1	26.7
1.2 Propeller Aircraft	0.3	0.6	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	63.3	100.0	26.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.3	0.0	0.6
7 Grounds Care	0.7	1.4	0.0
8 People	38.5	74.2	2.8
9 Domestic animal	2.1	1.1	3.1
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	28.2	0.0	56.4
22 Water (rain, snow)	11.9	0.0	23.9
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	7.6	15.3	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	1.4	0.0	2.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.1	0.0	0.3
40 Natural Unknown	1.5	0.0	3.1
41 Artifact	0.4	0.0	0.8
99 Unknown	0.0	0.0	0.0
Total Aircraft	15.1	3.6	26.7
Total Road Vehicles	63.3	100.0	26.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	75.0	100.0	50.0
Total Natural	40.3	15.3	65.3
Total Artifacts	0.4	0.0	0.8

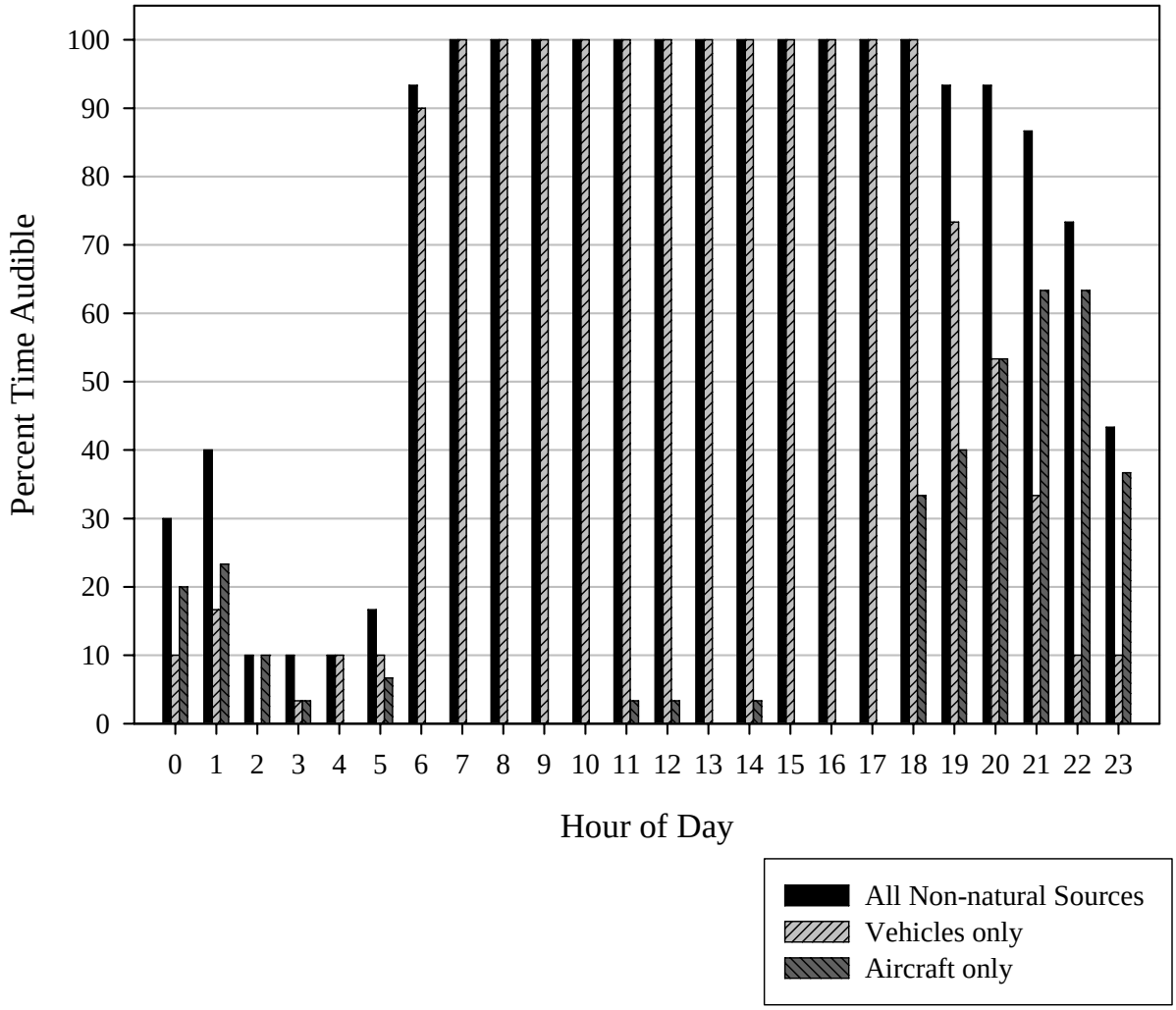

Figure II-27. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Saturday, 12-15-2007.

Table II-28. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Wednesday, 12-19-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	8.3	1.4	15.3
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	65.8	99.7	31.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	1.3	2.2	0.3
8 People	33.3	63.1	3.6
9 Domestic animal	0.7	0.3	1.1
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	2.4	0.0	4.7
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	48.2	10.0	86.4
22 Water (rain, snow)	9.6	6.7	12.5
23 Thunder	0.0	0.0	0.0
24 Mammal	0.1	0.0	0.3
25 Bird	7.2	14.4	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	1.5	0.0	3.1
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	8.3	1.4	15.3
Total Road Vehicles	65.8	99.7	31.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	75.0	100.0	50.0
Total Natural	57.6	27.8	87.5
Total Artifacts	0.0	0.0	0.0

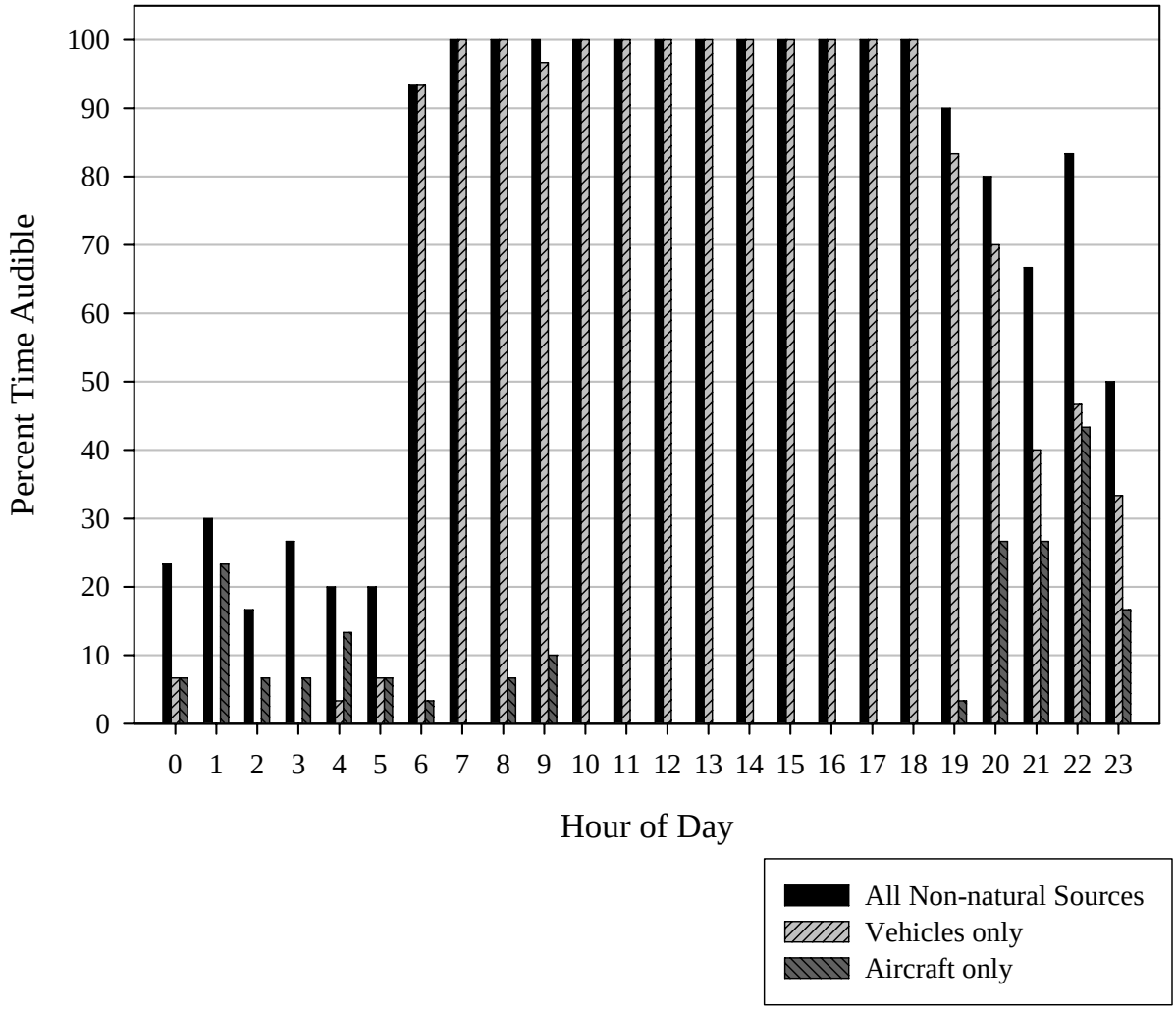

Figure II-28. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Mather Point Parking Lot (GRCA041), Wednesday, 12-19-2007.

Table II-29. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Friday, 6-22-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	9.2	0.0	18.3
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	17.6	19.2	16.1
1.2 Propeller Aircraft	1.4	1.9	0.8
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	52.1	81.7	22.5
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.1	0.3	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	17.9	2.5	33.3
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.7	0.0	1.4
25 Bird	61.4	87.5	35.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	23.9	19.2	28.6
29 Animal	0.1	0.0	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	1.3	0.0	2.5
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	19.2	21.4	16.9
Total Road Vehicles	52.1	81.7	22.5
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	64.3	92.8	35.8
Total Natural	83.5	90.0	76.9
Total Artifacts	0.0	0.0	0.0

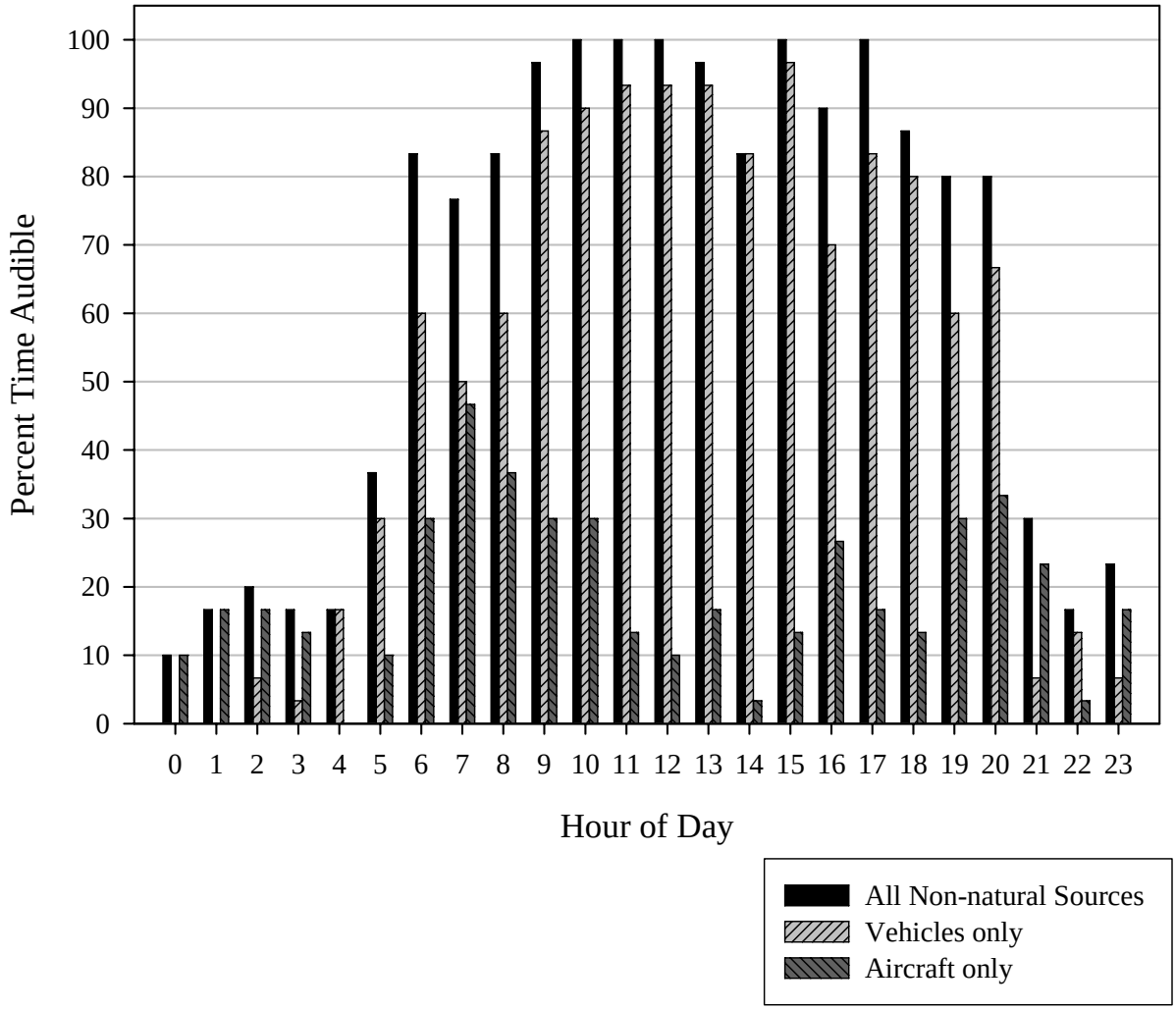

Figure II-29. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Friday, 6-22-2007.

Table II-30. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Sunday, 6-24-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	6.5	4.2	8.9
1.2 Propeller Aircraft	1.5	2.5	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	39.2	60.6	17.8
3 Watercraft	0.1	0.3	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.4	0.3	0.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	98.9	100.0	97.8
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.4	0.0	0.8
25 Bird	60.4	89.4	31.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	20.6	2.2	38.9
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.8	0.3	1.4
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.8	1.1	0.6
Total Aircraft	8.2	6.9	9.4
Total Road Vehicles	39.2	60.6	17.8
Total Watercraft	0.1	0.3	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	46.1	65.8	26.4
Total Natural	99.6	100.0	99.2
Total Artifacts	0.0	0.0	0.0

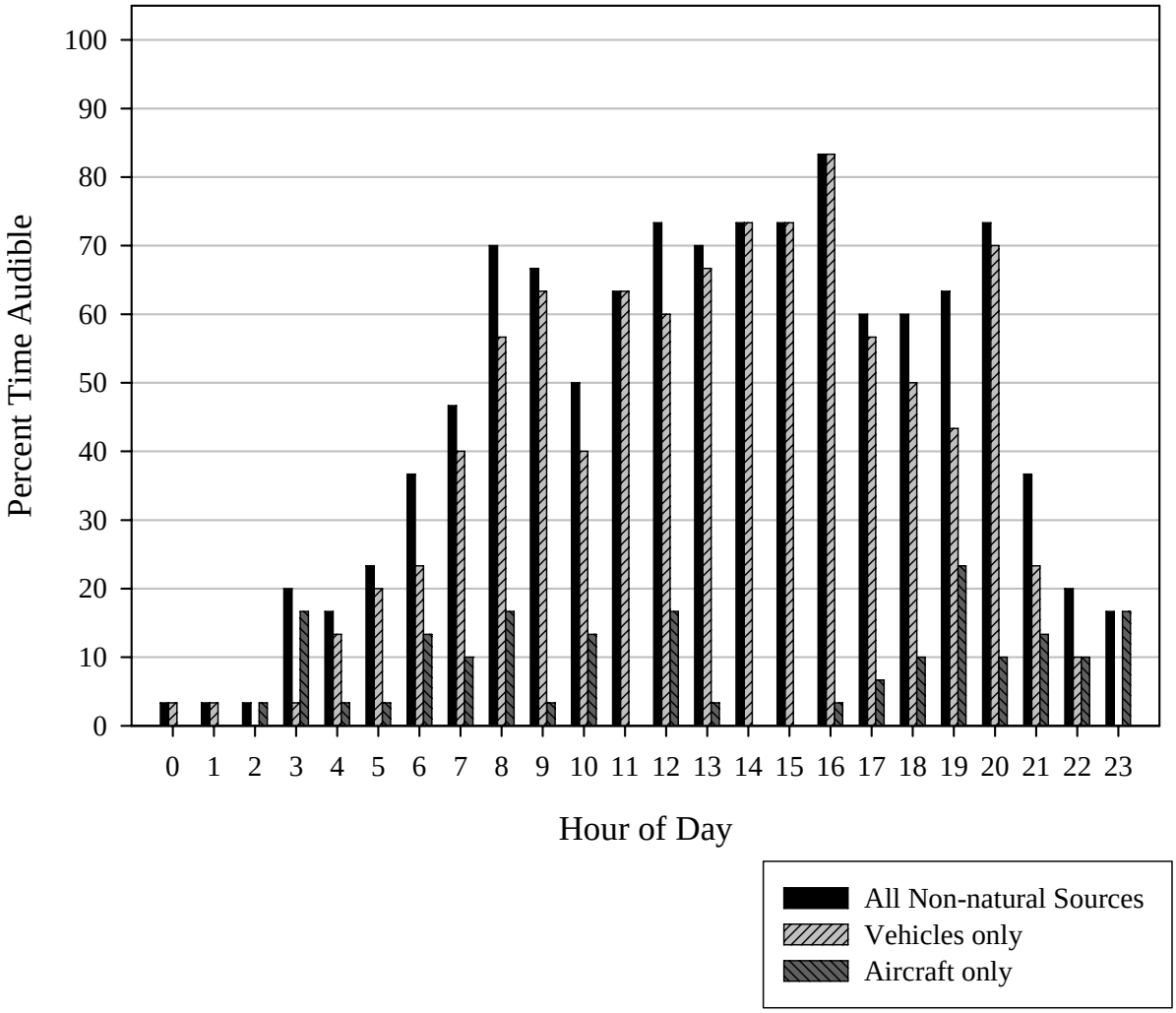

Figure II-30. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Sunday, 6-24-2007.

Table II-31. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Sunday, 12-09-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	18.2	3.3	33.1
1 Aircraft	1.7	3.1	0.3
1.1 Jet Aircraft	28.5	30.6	26.4
1.2 Propeller Aircraft	0.8	1.7	0.0
1.3 Helicopter	1.0	1.9	0.0
2 Vehicle	21.0	40.6	1.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	64.7	66.9	62.5
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	5.8	11.1	0.6
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	1.7	0.6	2.8
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	31.9	37.2	26.7
Total Road Vehicles	21.0	40.6	1.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	50.6	73.1	28.1
Total Natural	70.3	77.5	63.1
Total Artifacts	0.0	0.0	0.0

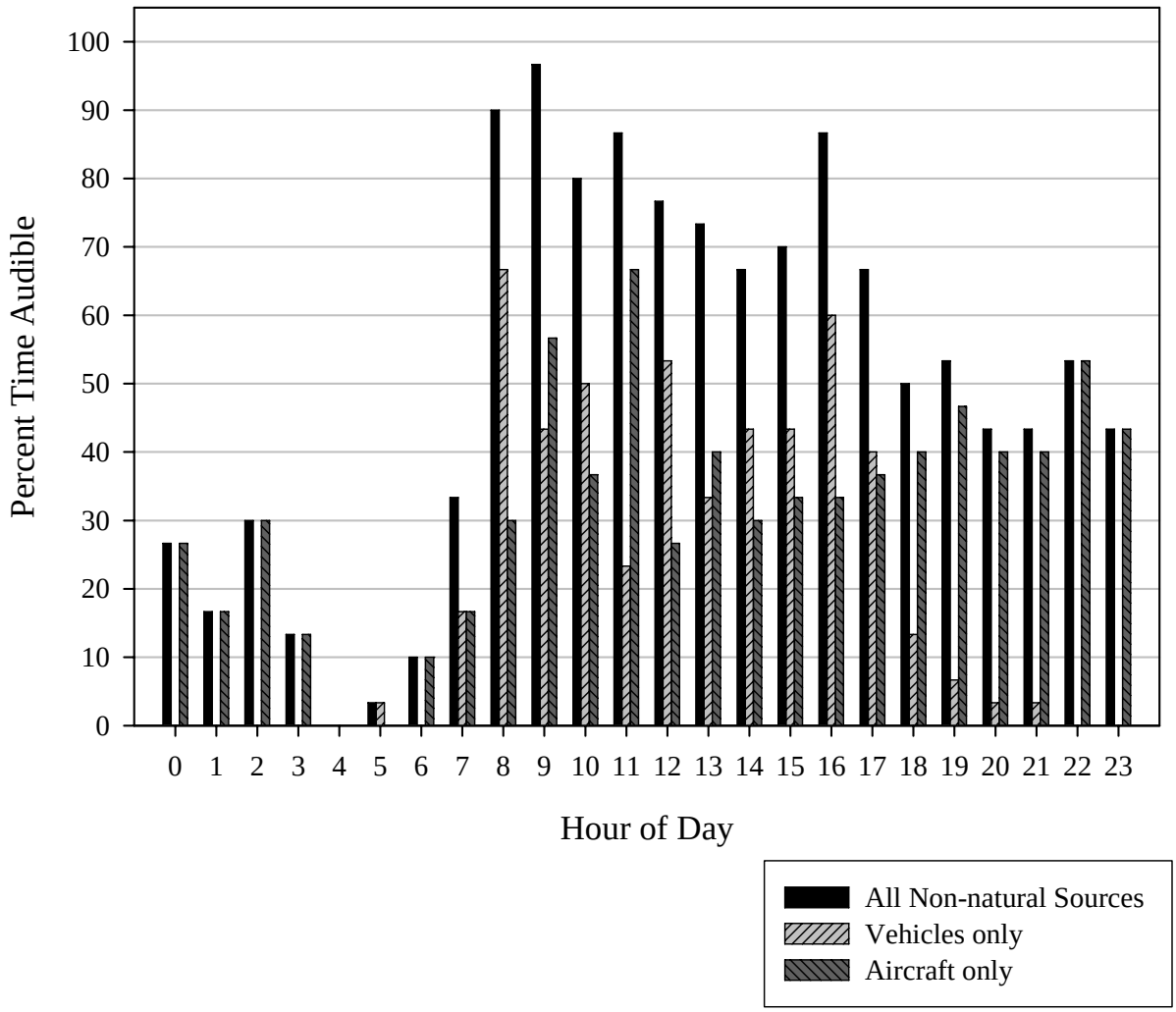

Figure II-31. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Sunday, 12-09-2007.

Table II-32. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Wednesday, 12-12-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	24.2	4.7	43.6
1 Aircraft	1.0	1.9	0.0
1.1 Jet Aircraft	30.8	32.5	29.2
1.2 Propeller Aircraft	0.4	0.3	0.6
1.3 Helicopter	3.5	5.8	1.1
2 Vehicle	28.8	53.6	3.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	0.0	0.0	0.0
22 Water (rain, snow)	57.1	72.8	41.4
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	8.6	17.2	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.3	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.7	0.8	0.6
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	35.7	40.6	30.8
Total Road Vehicles	28.8	53.6	3.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	61.0	87.5	34.4
Total Natural	60.4	79.2	41.7
Total Artifacts	0.0	0.0	0.0

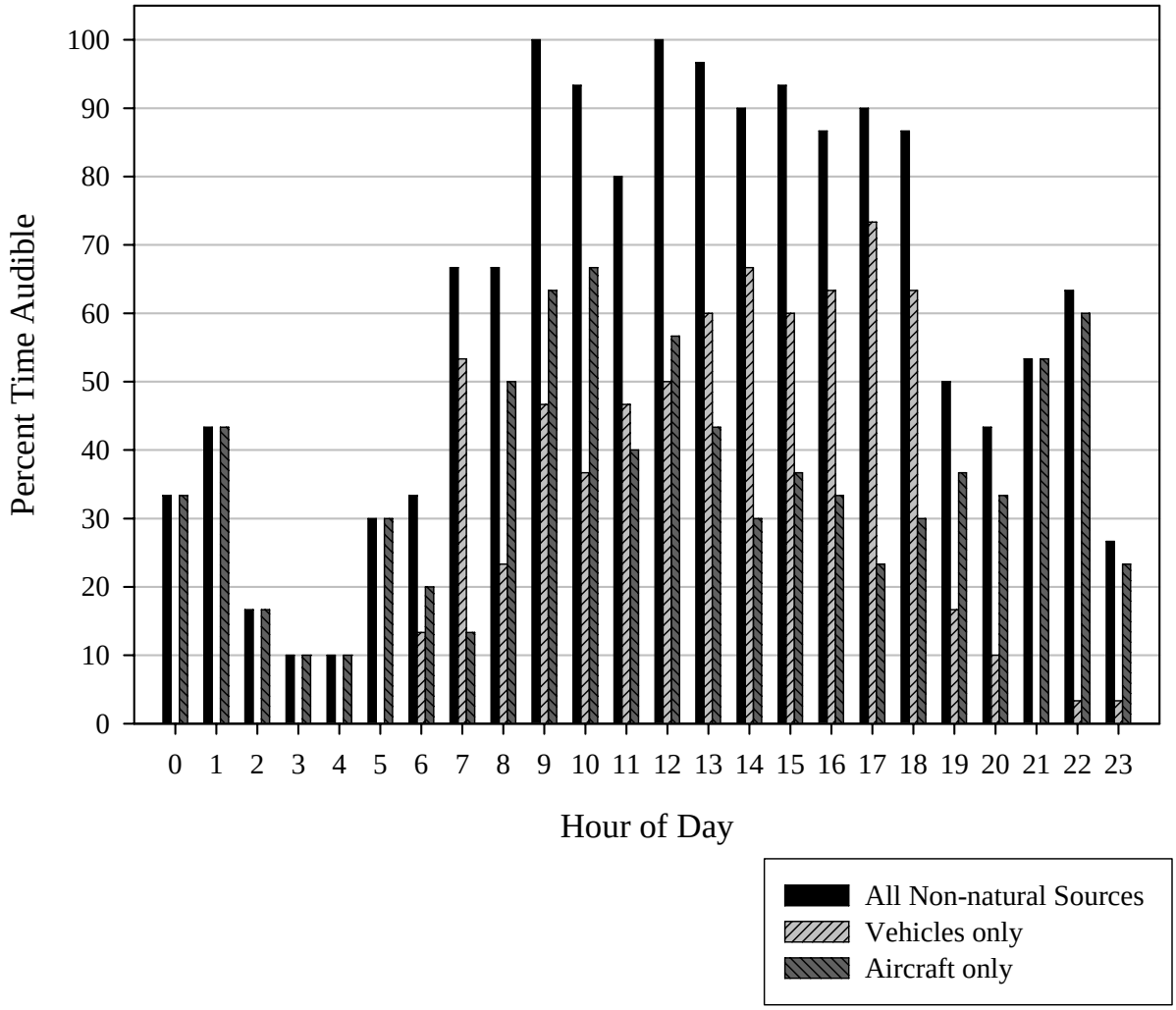

Figure II-32. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, East Rim Road, Mile 251 (GRCA042), Wednesday, 12-12-2007.

Table II-33. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Tuesday, 6-26-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	6.8	11.1	2.5
1.1 Jet Aircraft	21.5	28.1	15.0
1.2 Propeller Aircraft	3.8	5.3	2.2
1.3 Helicopter	0.6	1.1	0.0
2 Vehicle	0.1	0.0	0.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.3	0.6	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	19.7	31.7	7.8
9 Domestic animal	1.5	3.1	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	77.8	76.9	78.6
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.6	0.8	0.3
25 Bird	53.2	61.4	45.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	61.3	34.2	88.3
29 Animal	1.8	0.0	3.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	8.9	11.7	6.1
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	6.1	6.4	5.8
99 Unknown	0.0	0.0	0.0
Total Aircraft	32.6	45.6	19.7
Total Road Vehicles	0.1	0.0	0.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	44.0	62.2	25.8
Total Natural	99.4	98.9	100.0
Total Artifacts	6.1	6.4	5.8

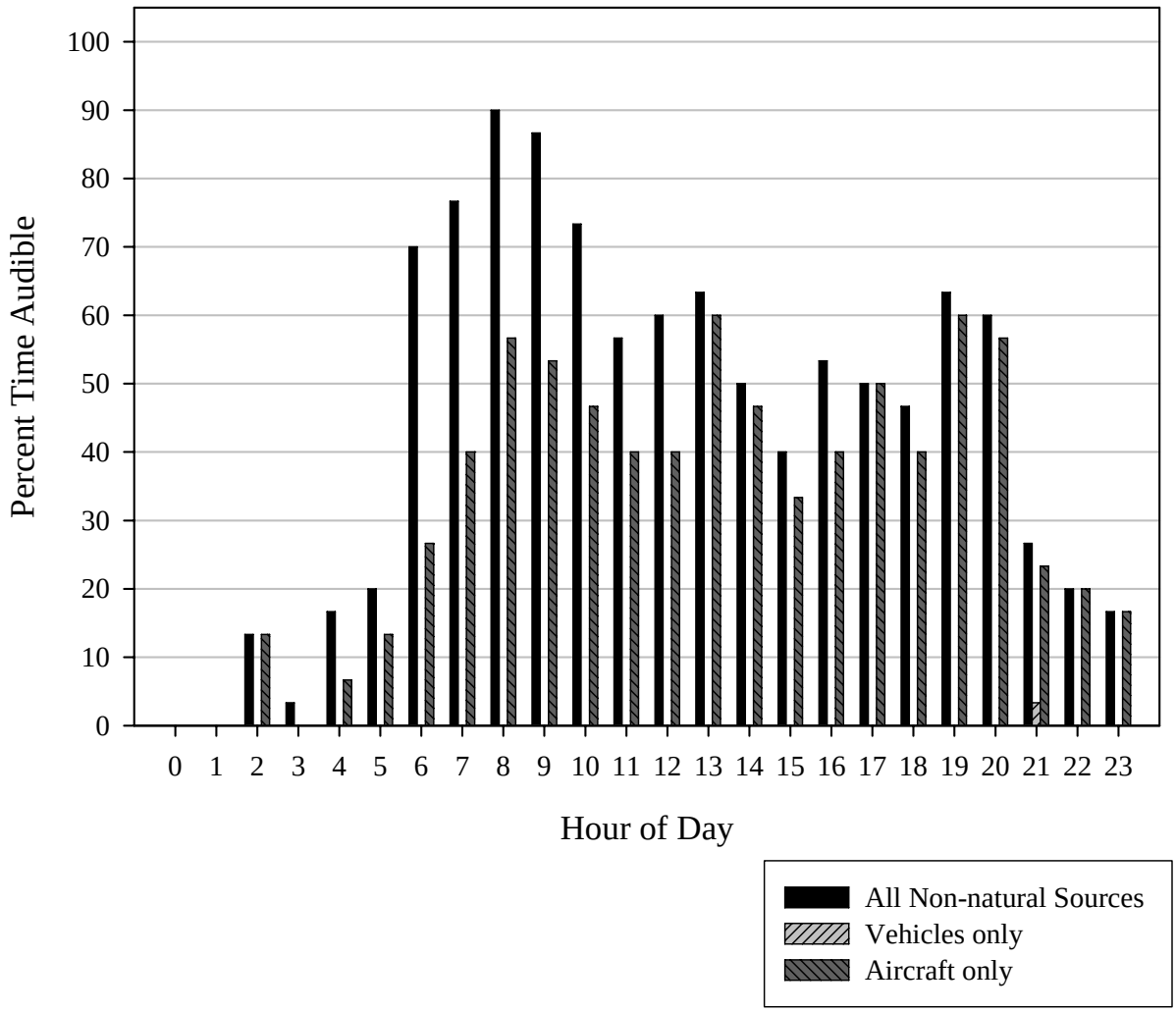

Figure II-33. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Tuesday, 6-26-2007.

Table II-34. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Saturday, 6-30-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	4.4	6.7	2.2
1.1 Jet Aircraft	17.5	25.8	9.2
1.2 Propeller Aircraft	5.8	8.1	3.6
1.3 Helicopter	0.1	0.3	0.0
2 Vehicle	0.1	0.0	0.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	2.1	1.4	2.8
7 Grounds Care	0.0	0.0	0.0
8 People	25.0	41.1	8.9
9 Domestic animal	1.3	2.5	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	82.8	76.4	89.2
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.4	0.0	0.8
25 Bird	57.8	71.4	44.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	71.7	52.8	90.6
29 Animal	1.8	0.6	3.1
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	15.4	12.2	18.6
40 Natural Unknown	0.1	0.3	0.0
41 Artifact	8.1	2.2	13.9
99 Unknown	0.0	0.0	0.0
Total Aircraft	27.9	40.8	15.0
Total Road Vehicles	0.1	0.0	0.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	45.8	67.2	24.4
Total Natural	99.4	99.2	99.7
Total Artifacts	8.1	2.2	13.9

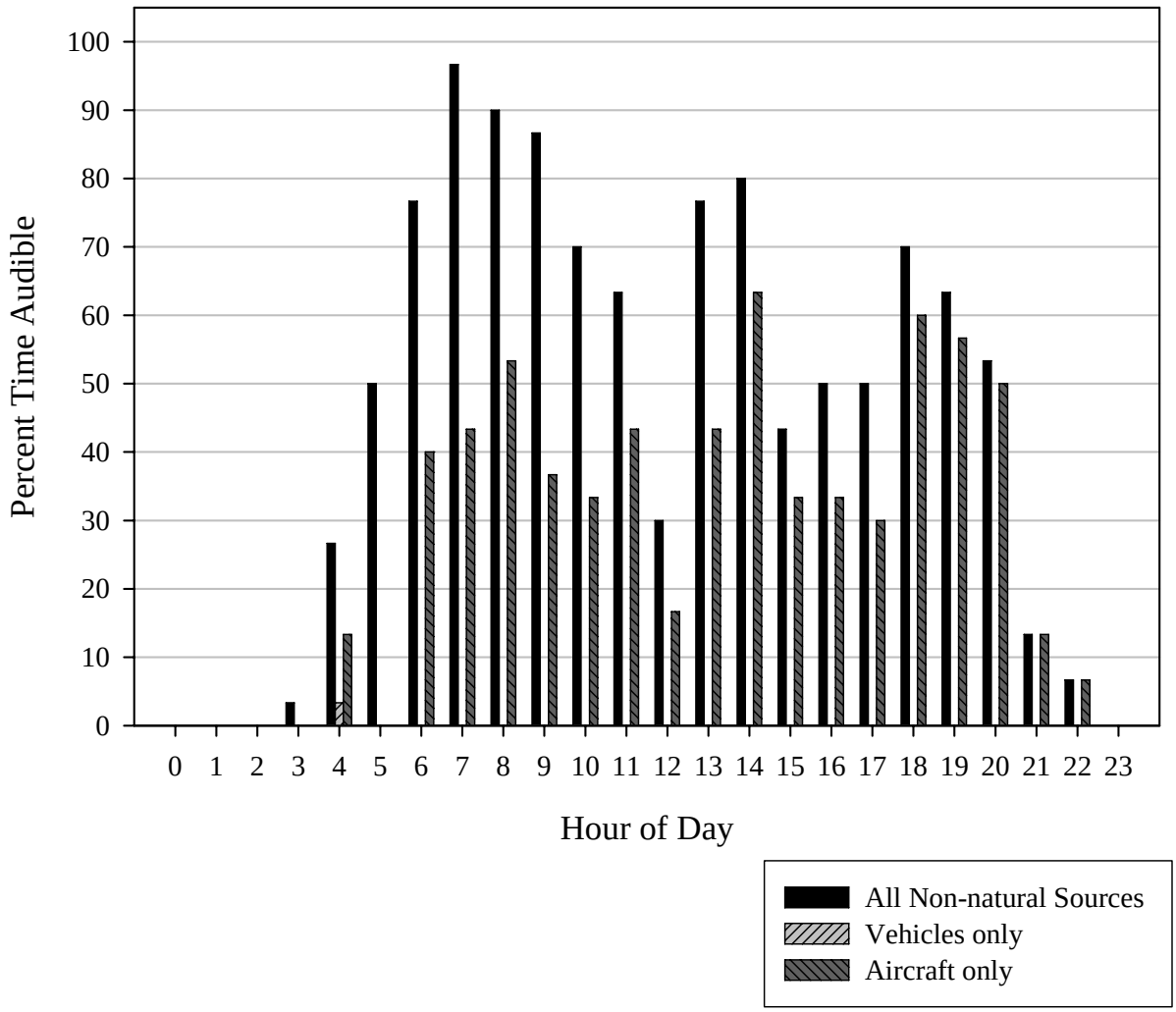

Figure II-34. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Saturday, 6-30-2007.

Table II-35. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Tuesday, 3-04-2008.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	8.3	10.8	5.8
1 Aircraft	0.8	1.7	0.0
1.1 Jet Aircraft	20.8	32.2	9.4
1.2 Propeller Aircraft	0.6	0.8	0.3
1.3 Helicopter	0.4	0.8	0.0
2 Vehicle	0.0	0.0	0.0
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.4	0.8	0.0
6 Motor Sounds	0.6	1.1	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	8.1	16.1	0.0
9 Domestic animal	0.7	1.4	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	71.3	48.9	93.6
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	10.4	16.4	4.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.6	1.1	0.0
29 Animal	0.7	1.1	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.1	0.3	0.0
Total Aircraft	22.6	35.6	9.7
Total Road Vehicles	0.0	0.0	0.0
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	29.0	48.3	9.7
Total Natural	76.9	60.3	93.6
Total Artifacts	0.0	0.0	0.0

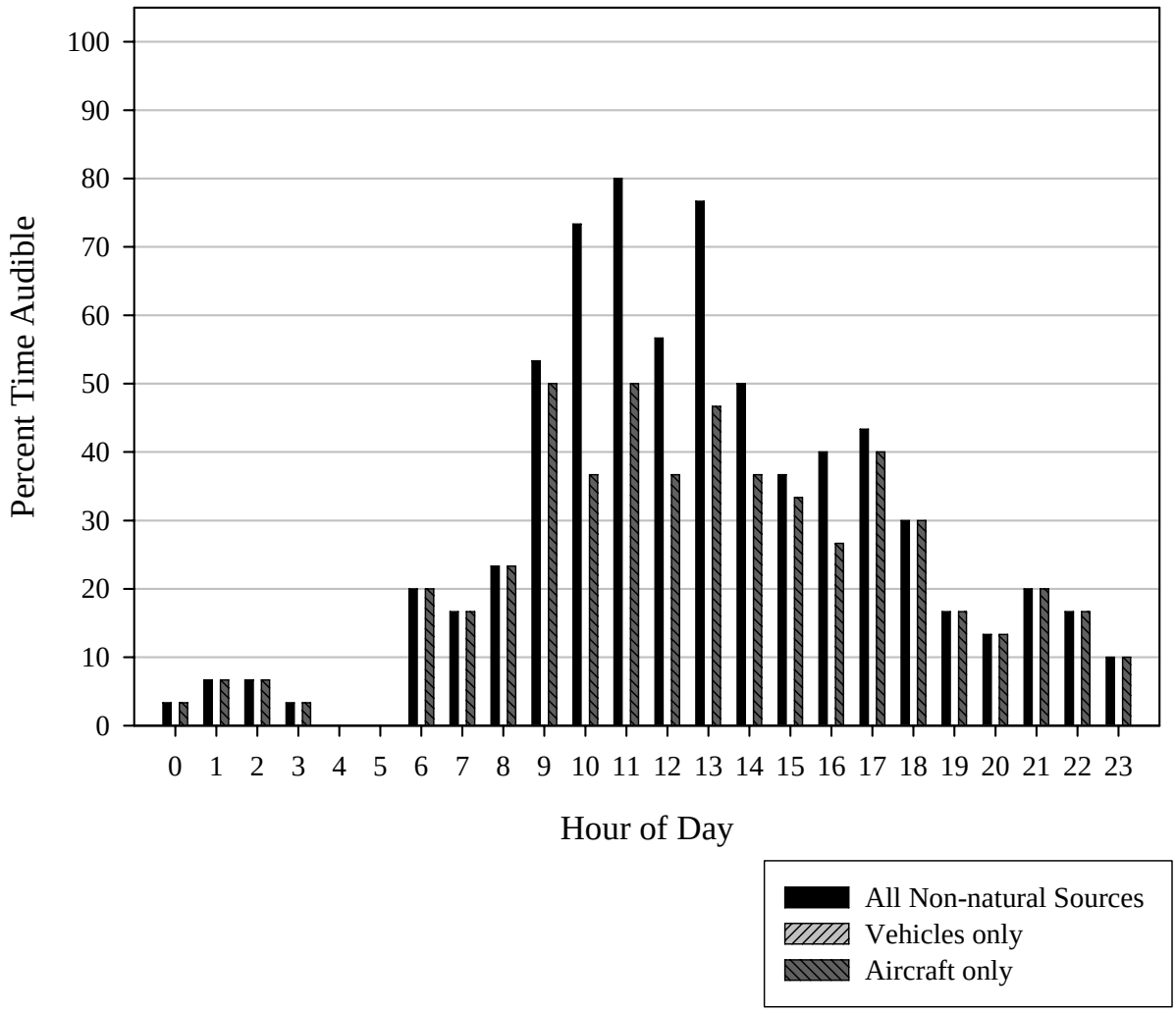

Figure II-35. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Tuesday, 3-04-2008.

Table II-36. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Friday, 3-07-2008.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	41.1	23.9	58.3
1 Aircraft	0.6	0.8	0.3
1.1 Jet Aircraft	25.8	35.3	16.4
1.2 Propeller Aircraft	1.3	2.5	0.0
1.3 Helicopter	1.8	3.6	0.0
2 Vehicle	0.0	0.0	0.0
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.4	0.3	0.6
7 Grounds Care	0.0	0.0	0.0
8 People	10.8	21.7	0.0
9 Domestic animal	0.8	1.7	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	15.1	12.8	17.5
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	11.8	16.4	7.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	1.0	1.9	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	0.0	0.0	0.0
99 Unknown	0.1	0.3	0.0
Total Aircraft	29.4	42.2	16.7
Total Road Vehicles	0.0	0.0	0.0
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	36.7	56.1	17.2
Total Natural	27.4	29.7	25.0
Total Artifacts	0.0	0.0	0.0

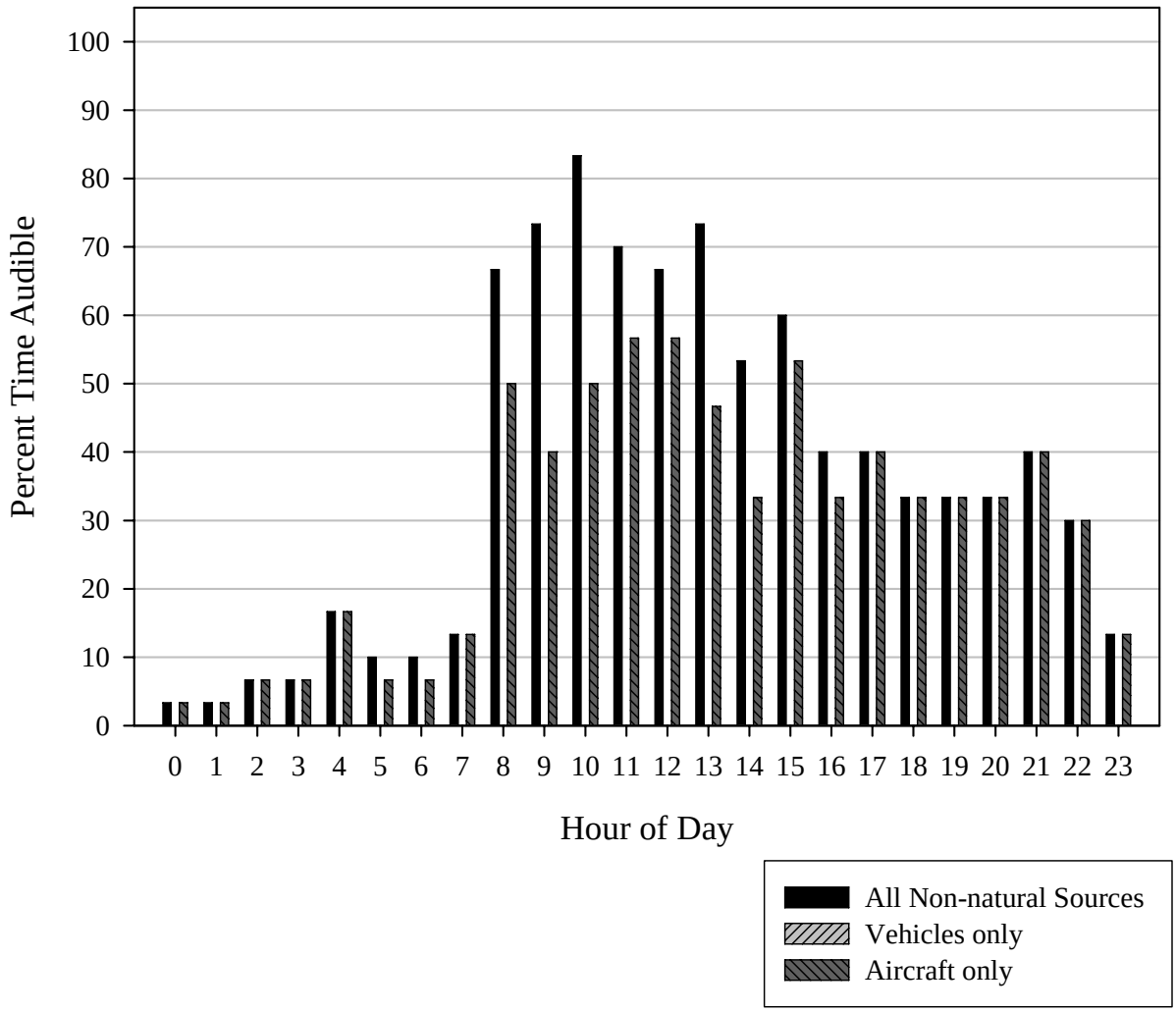

Figure II-36. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Bright Angel Trail, 3.7 Mile (GRCA043), Friday, 3-07-2008.

Table II-37. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Thursday, 6-28-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	2.9	0.6	5.3
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	72.9	94.7	51.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.1	0.3	0.0
7 Grounds Care	1.8	2.5	1.1
8 People	44.3	64.2	24.4
9 Domestic animal	0.3	0.3	0.3
10 Building Sounds	25.7	2.2	49.2
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.6	0.6	0.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	41.7	33.6	49.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	21.1	0.0	42.2
25 Bird	41.3	58.1	24.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	33.2	1.4	65.0
29 Animal	0.3	0.0	0.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	18.9	26.9	10.8
99 Unknown	0.0	0.0	0.0
Total Aircraft	3.1	0.8	5.3
Total Road Vehicles	72.9	94.7	51.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	94.0	98.1	90.0
Total Natural	86.1	77.8	94.4
Total Artifacts	18.9	26.9	10.8

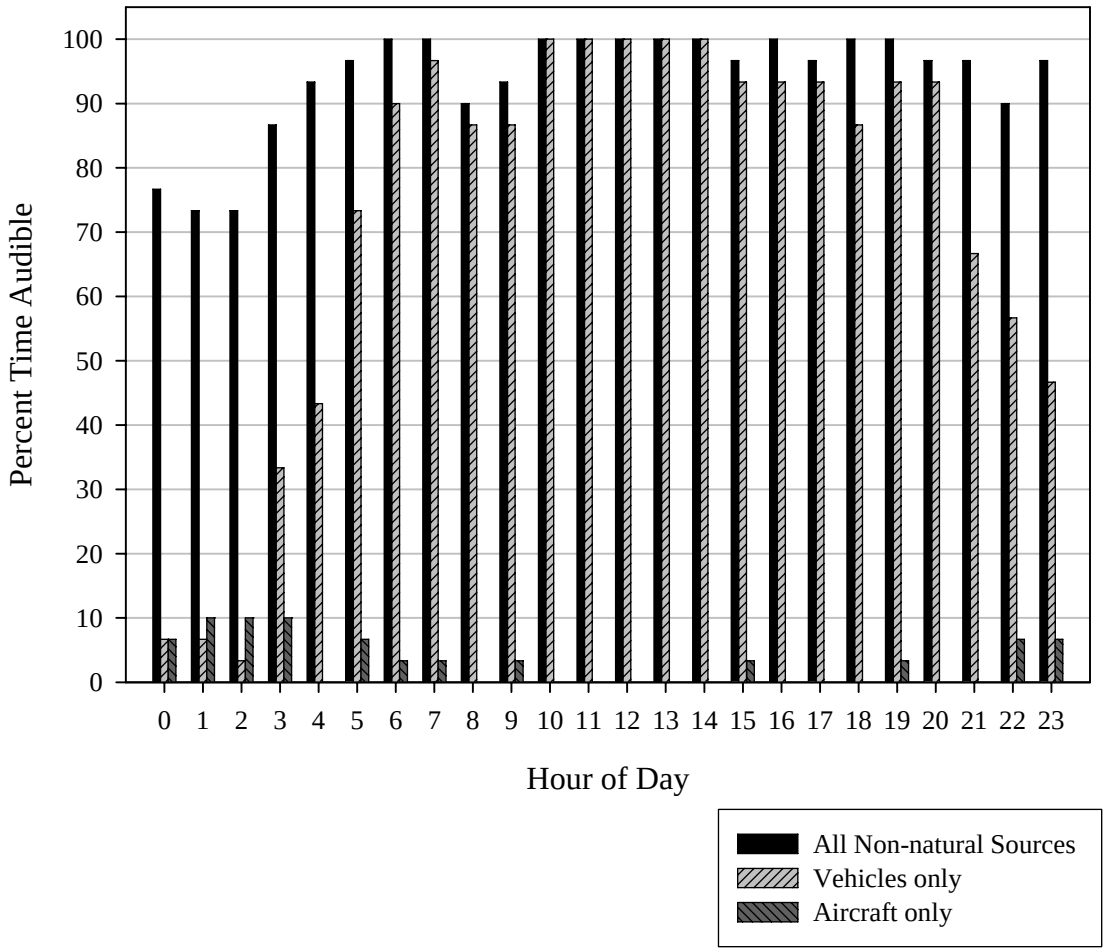

Figure II-37. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Thursday, 6-28-2007.

Table II-38. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Saturday, 6-30-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.3	0.6	0.0
1.1 Jet Aircraft	0.8	0.6	1.1
1.2 Propeller Aircraft	0.8	1.4	0.3
1.3 Helicopter	0.1	0.3	0.0
2 Vehicle	68.8	97.8	39.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	4.6	1.4	7.8
7 Grounds Care	2.9	5.8	0.0
8 People	46.7	70.3	23.1
9 Domestic animal	0.4	0.6	0.3
10 Building Sounds	14.2	0.6	27.8
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.7	0.8	0.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	33.6	7.8	59.4
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	21.4	0.0	42.8
25 Bird	38.5	55.6	21.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	31.7	0.0	63.3
29 Animal	0.6	0.0	1.1
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	20.1	12.2	28.1
99 Unknown	0.0	0.0	0.0
Total Aircraft	2.1	2.8	1.4
Total Road Vehicles	68.8	97.8	39.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	84.2	99.4	68.9
Total Natural	75.6	59.2	91.9
Total Artifacts	20.1	12.2	28.1

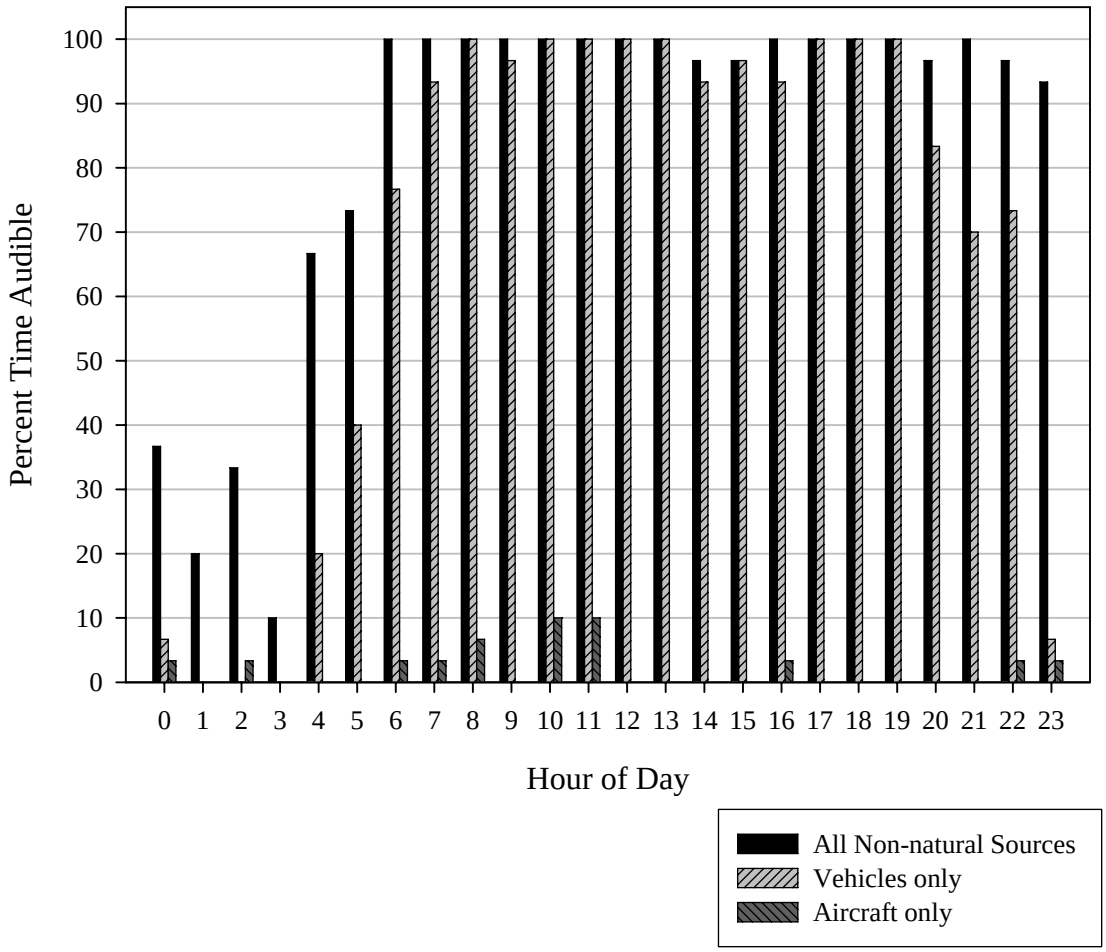

Figure II-38. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Saturday, 6-30-2007.

Table II-39. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Saturday, 12-08-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	13.8	18.9	8.6
1.2 Propeller Aircraft	0.0	0.0	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	39.0	73.3	4.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.8	1.7	0.0
8 People	8.5	16.7	0.3
9 Domestic animal	0.1	0.3	0.0
10 Building Sounds	5.6	3.9	7.2
11 Construction	0.0	0.0	0.0
19 Non-natural Other	11.3	2.2	20.3
20 Non-natural Unknown	6.1	0.0	12.2
21 Wind	84.4	70.6	98.3
22 Water (rain, snow)	20.7	12.5	28.9
23 Thunder	0.0	0.0	0.0
24 Mammal	1.4	2.5	0.3
25 Bird	14.0	28.1	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	1.4	2.5	0.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	13.8	18.9	8.6
Total Road Vehicles	39.0	73.3	4.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	63.5	83.6	43.3
Total Natural	92.1	85.3	98.9
Total Artifacts	1.4	2.5	0.3

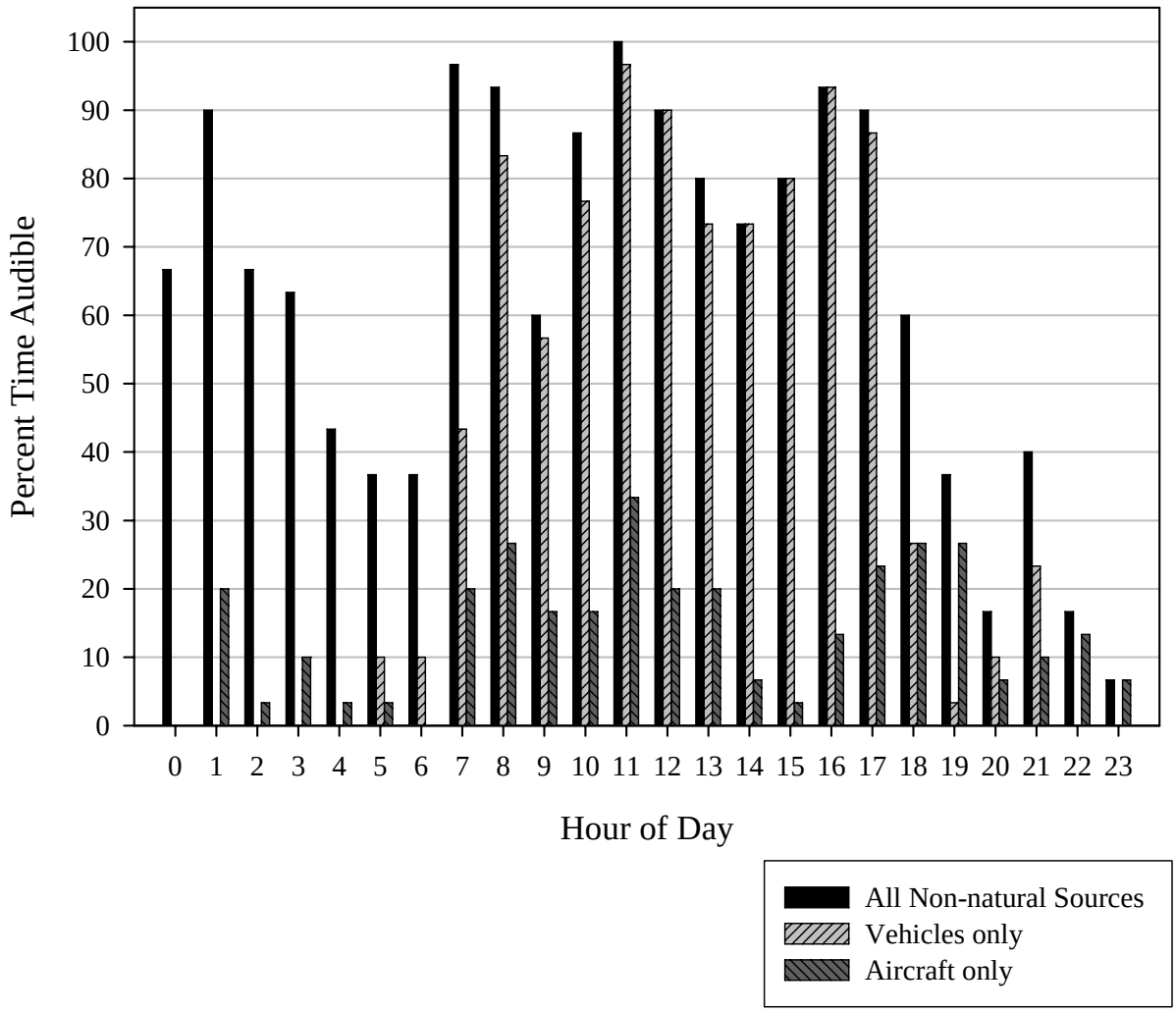

Figure II-39. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Saturday, 12-08-2007.

Table II-40. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Wednesday, 12-12-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	1.0	0.0	1.9
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	16.8	12.5	21.1
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.7	1.4	0.0
2 Vehicle	51.9	90.8	13.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.4	0.3	0.6
7 Grounds Care	1.0	1.9	0.0
8 People	15.6	28.6	2.5
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	28.9	0.8	56.9
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.3	0.6	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	2.6	1.9	3.3
22 Water (rain, snow)	10.7	0.6	20.8
23 Thunder	0.0	0.0	0.0
24 Mammal	1.5	0.0	3.1
25 Bird	17.2	34.4	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.6	0.0	1.1
41 Artifact	3.1	4.2	1.9
99 Unknown	0.0	0.0	0.0
Total Aircraft	17.6	14.2	21.1
Total Road Vehicles	51.9	90.8	13.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	93.8	98.1	89.4
Total Natural	31.1	36.7	25.6
Total Artifacts	3.1	4.2	1.9

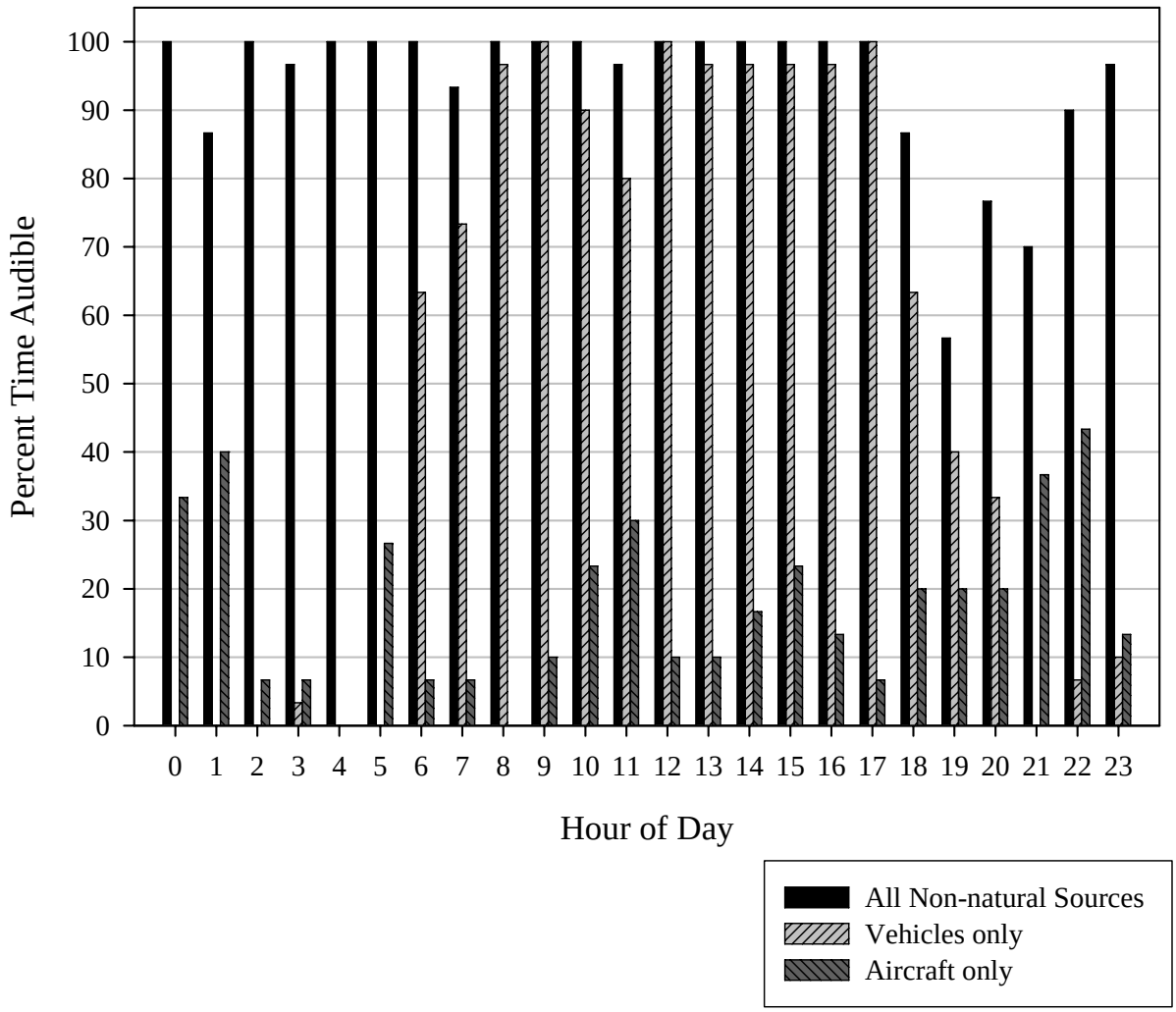

Figure II-40. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Desert View Parking Lot (GRCA044), Wednesday, 12-12-2007.

Table II-41. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Sunday, 7-08-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	2.2	3.1	1.4
1.1 Jet Aircraft	23.6	32.5	14.7
1.2 Propeller Aircraft	0.8	1.7	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	24.7	23.1	26.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.8	1.7	0.0
6 Motor Sounds	33.5	11.4	55.6
7 Grounds Care	0.8	1.7	0.0
8 People	5.7	2.2	9.2
9 Domestic animal	7.6	5.3	10.0
10 Building Sounds	0.7	0.8	0.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	6.4	6.4	6.4
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	32.1	41.4	22.8
22 Water (rain, snow)	7.1	1.1	13.1
23 Thunder	0.1	0.0	0.3
24 Mammal	0.3	0.0	0.6
25 Bird	66.7	100.0	33.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	11.4	18.1	4.7
29 Animal	1.4	0.0	2.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	26.7	37.2	16.1
Total Road Vehicles	24.7	23.1	26.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	87.2	78.1	96.4
Total Natural	83.9	100.0	67.8
Total Artifacts	0.1	0.3	0.0

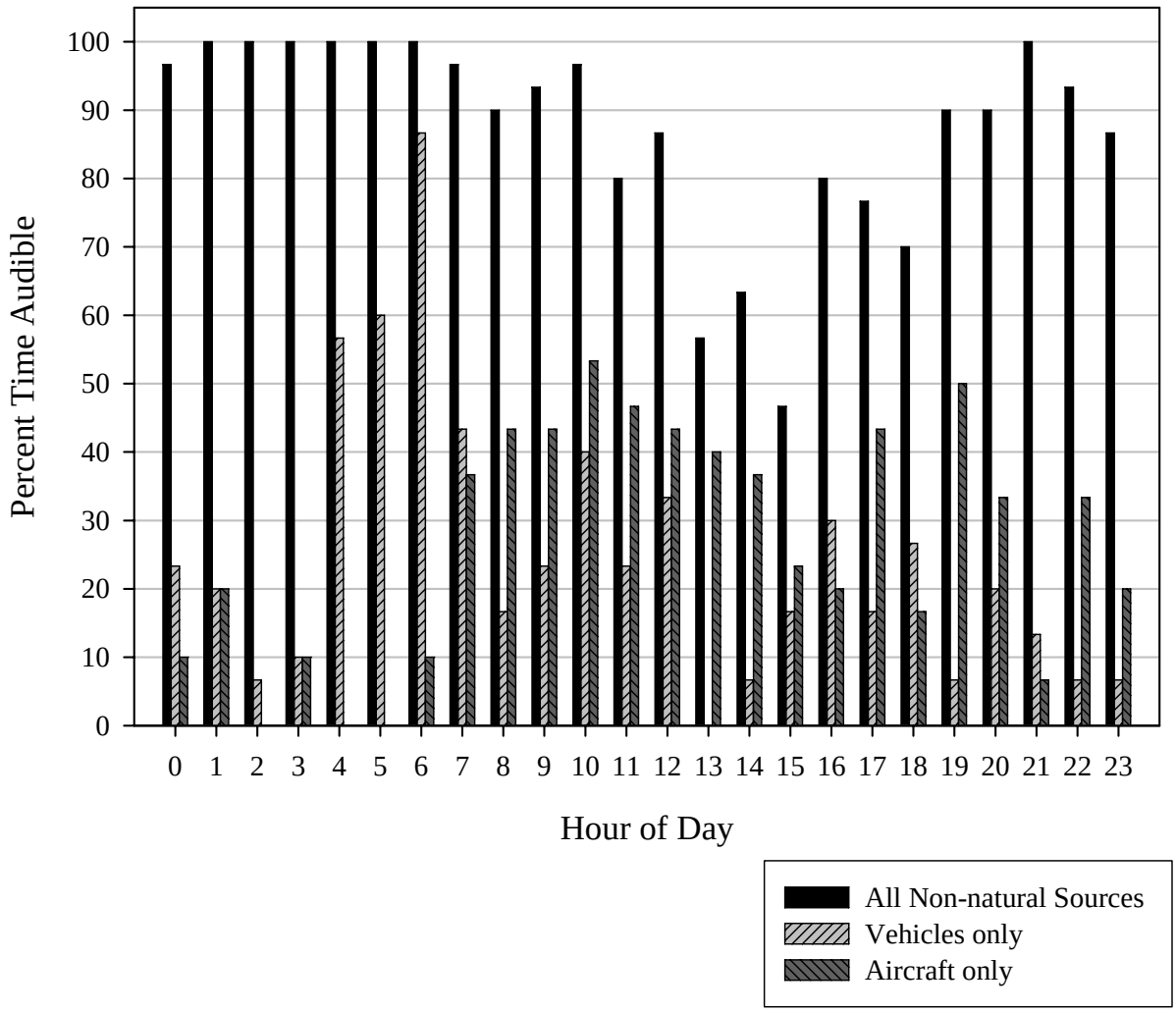

Figure II-41. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Sunday, 7-08-2007.

Table II-42. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Wednesday, 7-18-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.6	1.1	0.0
1.1 Jet Aircraft	16.9	18.3	15.6
1.2 Propeller Aircraft	0.4	0.8	0.0
1.3 Helicopter	0.3	0.6	0.0
2 Vehicle	48.9	54.2	43.6
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	1.5	3.1	0.0
6 Motor Sounds	23.1	4.7	41.4
7 Grounds Care	1.1	2.2	0.0
8 People	6.1	7.2	5.0
9 Domestic animal	9.9	11.1	8.6
10 Building Sounds	0.4	0.6	0.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	4.0	4.7	3.3
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	27.8	39.4	16.1
22 Water (rain, snow)	13.3	1.9	24.7
23 Thunder	2.1	4.2	0.0
24 Mammal	0.1	0.0	0.3
25 Bird	63.5	100.0	26.9
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	5.7	6.9	4.4
29 Animal	1.3	0.0	2.5
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.1	0.0	0.3
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.1	0.0	0.3
Total Aircraft	18.2	20.8	15.6
Total Road Vehicles	48.9	54.2	43.6
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	91.4	85.8	96.9
Total Natural	82.4	100.0	64.7
Total Artifacts	0.0	0.0	0.0

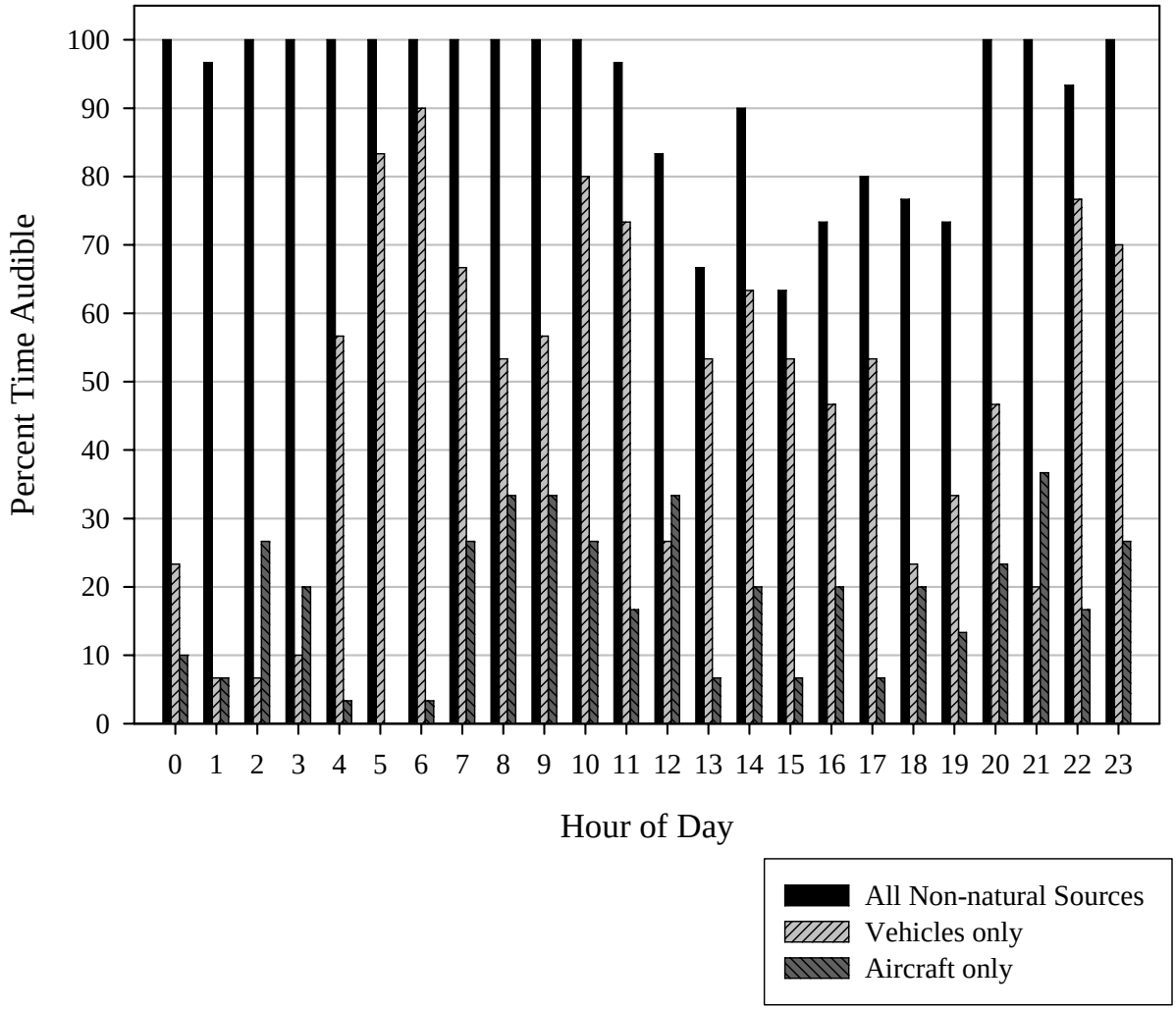

Figure II-42. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Wednesday, 7-18-2007.

Table II-43. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Wednesday, 12-19-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.3	0.6	0.0
1.1 Jet Aircraft	21.4	20.8	21.9
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	42.6	58.9	26.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	1.0	1.9	0.0
6 Motor Sounds	44.0	22.2	65.8
7 Grounds Care	0.0	0.0	0.0
8 People	4.6	6.7	2.5
9 Domestic animal	8.5	11.4	5.6
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	11.3	8.9	13.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	10.1	6.7	13.6
22 Water (rain, snow)	13.1	20.6	5.6
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	40.3	80.3	0.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.3	0.6	0.0
Total Aircraft	21.8	21.7	21.9
Total Road Vehicles	42.6	58.9	26.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	97.8	97.5	98.1
Total Natural	56.5	93.9	19.2
Total Artifacts	0.0	0.0	0.0

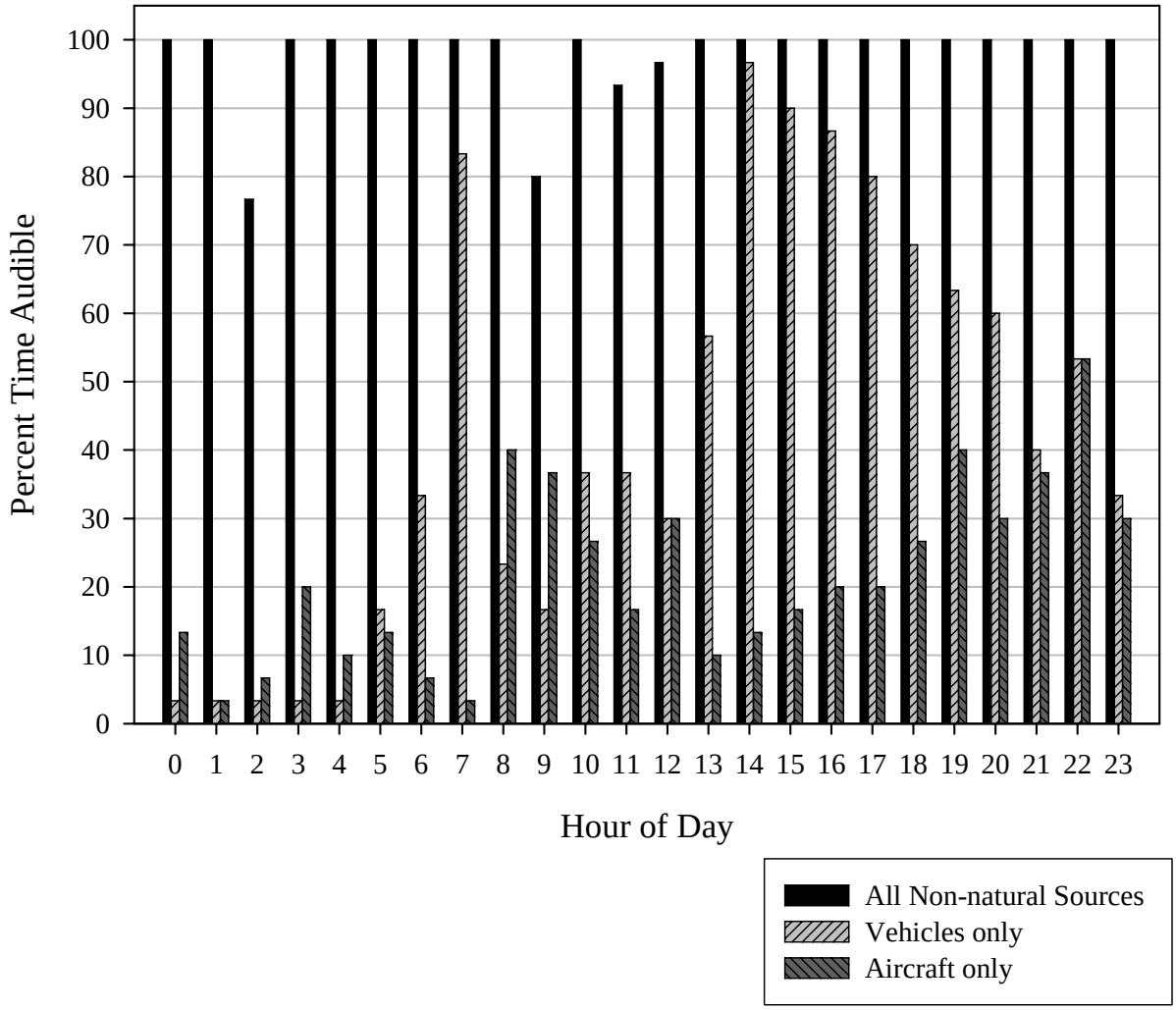

Figure II-43. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Wednesday, 12-19-2007.

Table II-44. Percent Time All Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Saturday, 12-22-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	17.8	11.1	24.4
1.2 Propeller Aircraft	0.1	0.3	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	56.7	65.0	48.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.7	1.4	0.0
6 Motor Sounds	32.9	18.9	46.9
7 Grounds Care	0.0	0.0	0.0
8 People	4.4	7.2	1.7
9 Domestic animal	12.6	16.9	8.3
10 Building Sounds	0.6	1.1	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	10.4	12.2	8.6
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	2.6	5.0	0.3
22 Water (rain, snow)	12.1	24.2	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	40.0	80.0	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.1	0.3	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.4	0.0	0.8
Total Aircraft	17.9	11.4	24.4
Total Road Vehicles	56.7	65.0	48.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	99.3	98.6	100.0
Total Natural	40.6	80.8	0.3
Total Artifacts	0.0	0.0	0.0

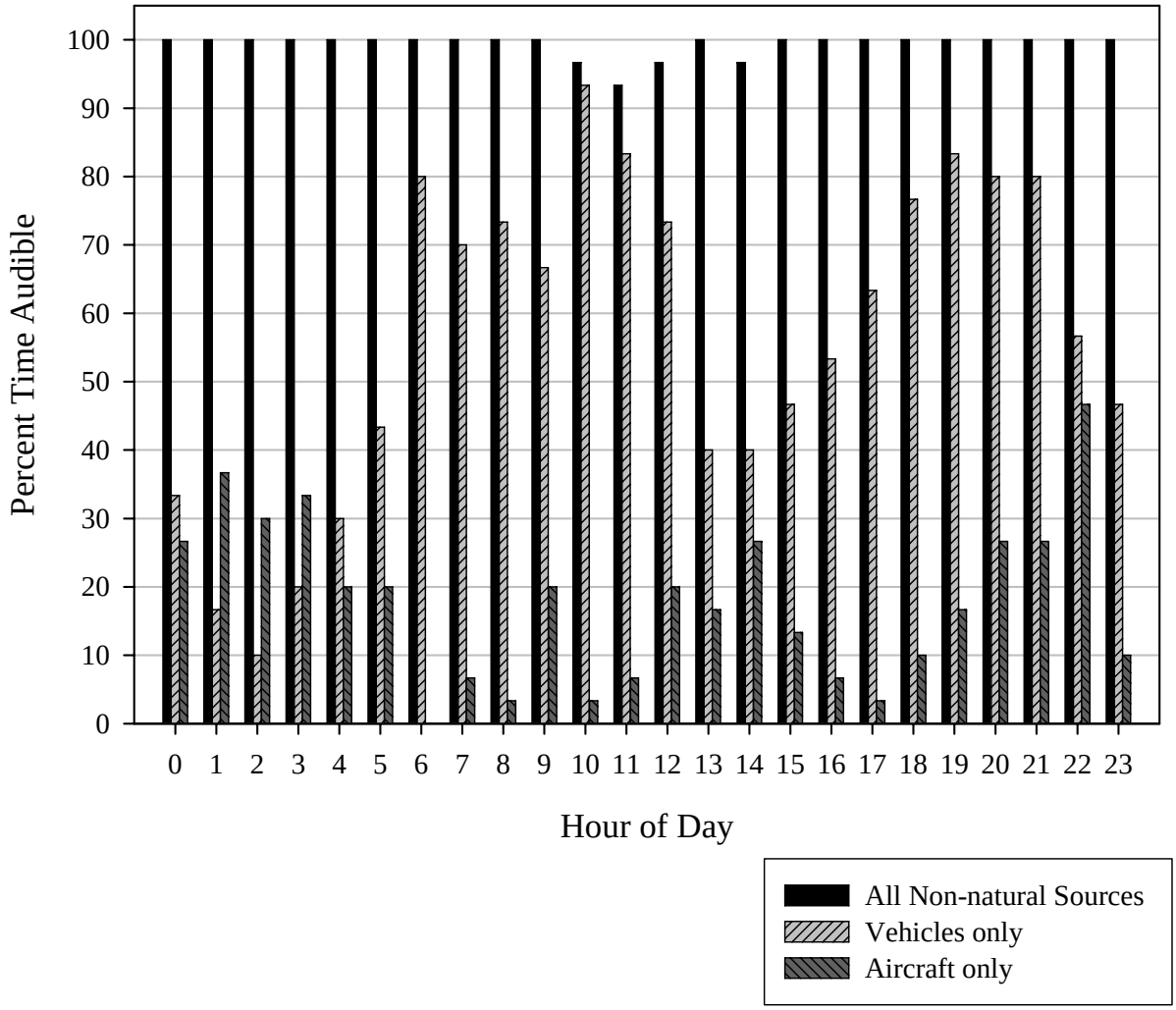

Figure II-44. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, South Rim, Residential Area (GRCA045), Saturday, 12-22-2007.

Table II-45. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), Monday, 7-16-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.3	0.0	0.6
1 Aircraft	0.6	0.6	0.6
1.1 Jet Aircraft	8.3	5.3	11.4
1.2 Propeller Aircraft	0.4	0.8	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	55.6	87.2	23.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	34.6	48.1	21.1
9 Domestic animal	3.3	6.7	0.0
10 Building Sounds	0.3	0.6	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	2.4	4.4	0.3
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	35.6	7.2	63.9
22 Water (rain, snow)	1.8	3.6	0.0
23 Thunder	2.2	4.4	0.0
24 Mammal	1.5	0.0	3.1
25 Bird	44.6	69.7	19.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.7	1.4	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	9.3	6.7	11.9
Total Road Vehicles	55.6	87.2	23.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	70.8	96.4	45.3
Total Natural	78.2	71.9	84.4
Total Artifacts	0.0	0.0	0.0

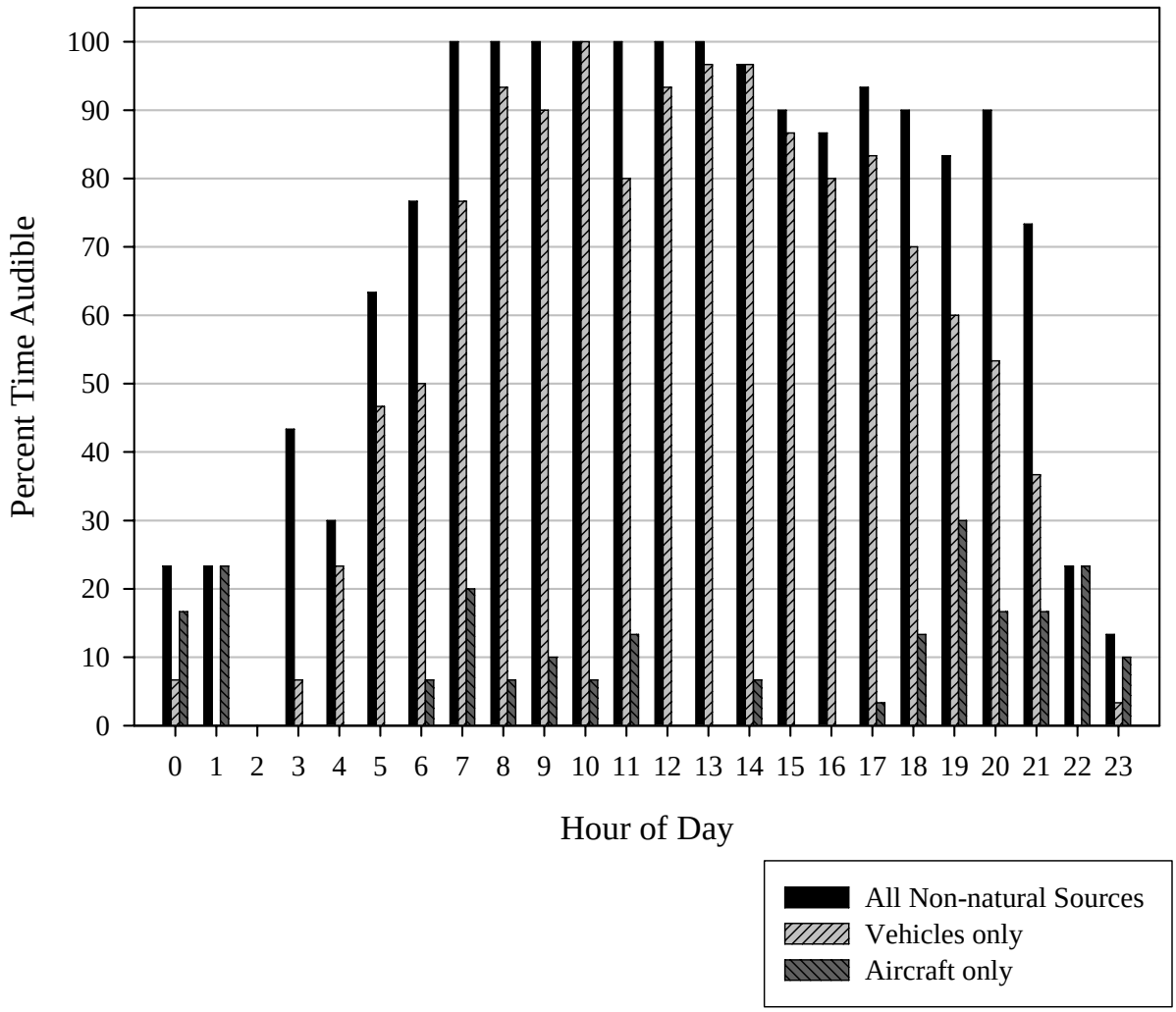

Figure II-45. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), Monday, 7-16-2007.

Table II-46. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), Tuesday, 7-17-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	3.6	0.0	7.2
1 Aircraft	0.1	0.0	0.3
1.1 Jet Aircraft	8.6	2.8	14.4
1.2 Propeller Aircraft	1.4	1.7	1.1
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	54.7	79.2	30.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	24.2	39.4	8.9
9 Domestic animal	2.6	3.9	1.4
10 Building Sounds	1.0	1.4	0.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	3.3	4.4	2.2
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	33.5	15.0	51.9
22 Water (rain, snow)	15.0	12.5	17.5
23 Thunder	5.1	10.3	0.0
24 Mammal	2.8	0.0	5.6
25 Bird	42.5	62.5	22.5
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.1	0.3	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	10.1	4.4	15.8
Total Road Vehicles	54.7	79.2	30.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	68.5	88.6	48.3
Total Natural	76.1	72.5	79.7
Total Artifacts	0.0	0.0	0.0

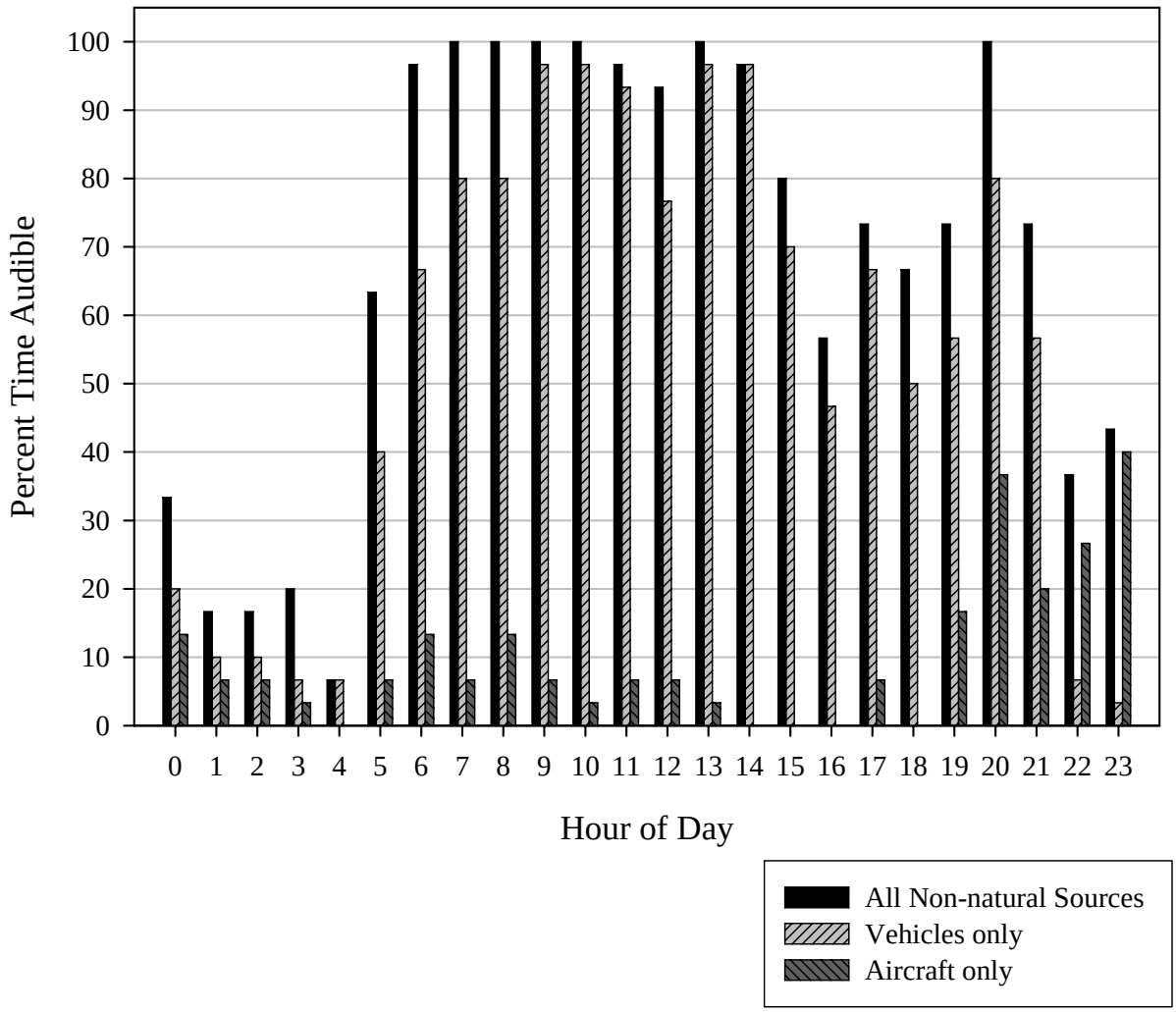

Figure II-46. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Kaibab Trailhead (GRCA046), Tuesday, 7-17-2007.

Table II-47. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), Sunday, 7-15-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	1.8	0.0	3.6
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	5.3	2.8	7.8
1.2 Propeller Aircraft	0.4	0.8	0.0
1.3 Helicopter	0.1	0.3	0.0
2 Vehicle	74.6	97.5	51.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.6	0.8	0.3
8 People	53.2	76.4	30.0
9 Domestic animal	2.2	3.6	0.8
10 Building Sounds	19.0	1.7	36.4
11 Construction	0.0	0.0	0.0
19 Non-natural Other	7.4	8.3	6.4
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	7.1	0.3	13.9
22 Water (rain, snow)	0.4	0.8	0.0
23 Thunder	0.4	0.8	0.0
24 Mammal	20.1	0.0	40.3
25 Bird	40.7	60.0	21.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	3.5	2.2	4.7
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	6.0	4.2	7.8
Total Road Vehicles	74.6	97.5	51.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	96.9	100.0	93.9
Total Natural	64.0	61.7	66.4
Total Artifacts	0.0	0.0	0.0

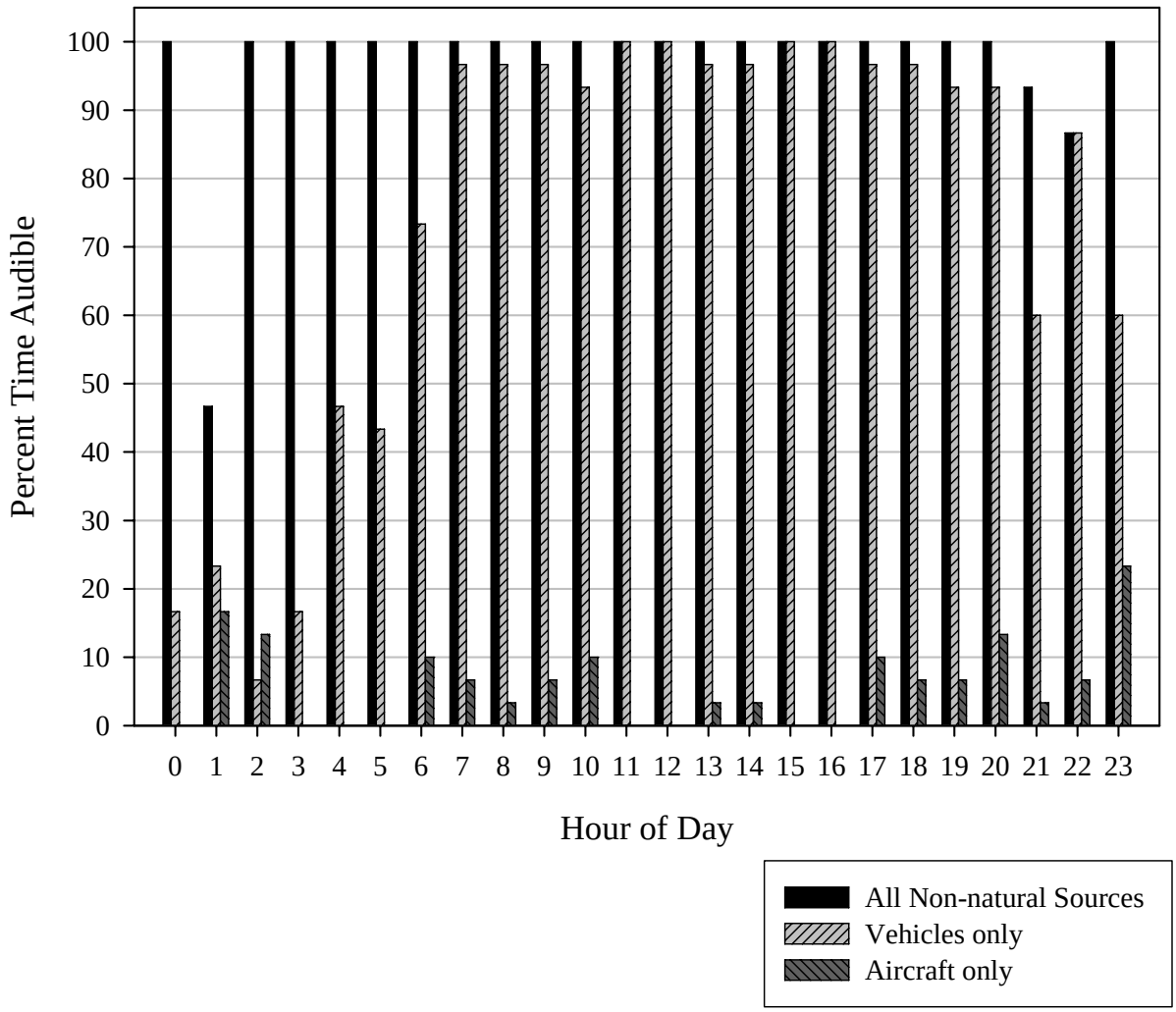

Figure II-47. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), Sunday, 7-15-2007.

Table II-48. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), Tuesday, 7-17-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.3	0.3	0.3
1.1 Jet Aircraft	5.6	1.7	9.4
1.2 Propeller Aircraft	0.7	0.3	1.1
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	68.8	93.6	43.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	4.0	8.1	0.0
8 People	57.9	80.8	35.0
9 Domestic animal	1.1	1.9	0.3
10 Building Sounds	18.8	0.0	37.5
11 Construction	0.0	0.0	0.0
19 Non-natural Other	7.2	9.7	4.7
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	12.1	0.3	23.9
22 Water (rain, snow)	11.1	10.6	11.7
23 Thunder	4.7	6.7	2.8
24 Mammal	22.2	0.0	44.4
25 Bird	38.3	57.5	19.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	1.3	0.0	2.5
29 Animal	0.4	0.0	0.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	6.5	2.2	10.8
Total Road Vehicles	68.8	93.6	43.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	95.1	98.9	91.4
Total Natural	73.5	67.8	79.2
Total Artifacts	0.0	0.0	0.0

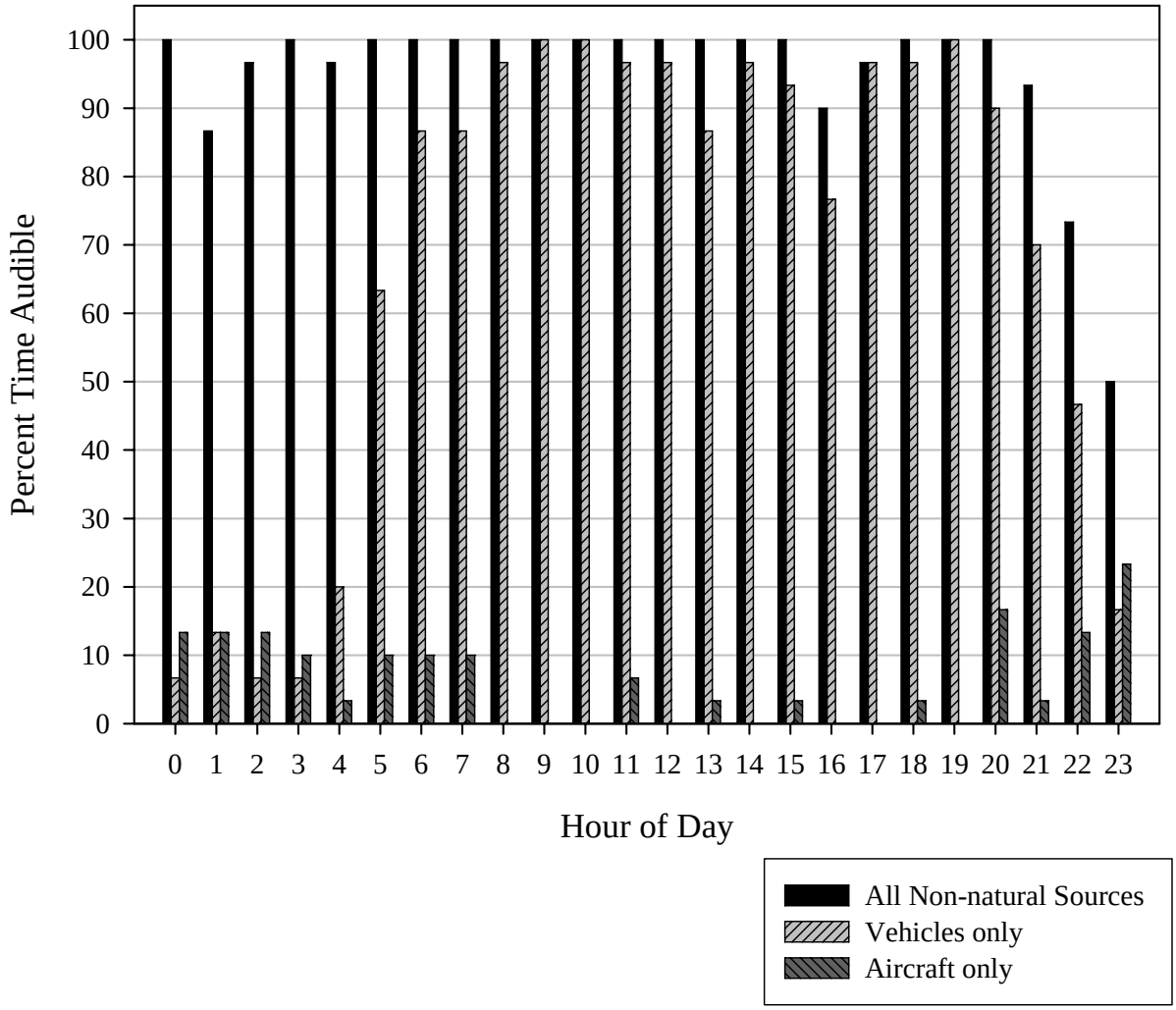

Figure II-48. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Visitor Center Parking Lot (GRCA047), Tuesday, 7-17-2007.

Table II-49. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), Monday, 7-09-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.3	0.0	0.6
1.1 Jet Aircraft	11.8	14.2	9.4
1.2 Propeller Aircraft	0.3	0.3	0.3
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	50.7	73.6	27.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	1.1	0.8	1.4
7 Grounds Care	0.8	1.7	0.0
8 People	21.1	39.7	2.5
9 Domestic animal	0.1	0.3	0.0
10 Building Sounds	33.5	20.6	46.4
11 Construction	1.0	1.9	0.0
19 Non-natural Other	1.4	0.6	2.2
20 Non-natural Unknown	0.8	1.1	0.6
21 Wind	79.2	59.4	98.9
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.4	0.0	0.8
25 Bird	59.0	89.7	28.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	1.0	1.4	0.6
29 Animal	1.7	2.2	1.1
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	12.4	14.4	10.3
Total Road Vehicles	50.7	73.6	27.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	86.9	96.9	76.9
Total Natural	97.2	95.0	99.4
Total Artifacts	0.1	0.3	0.0

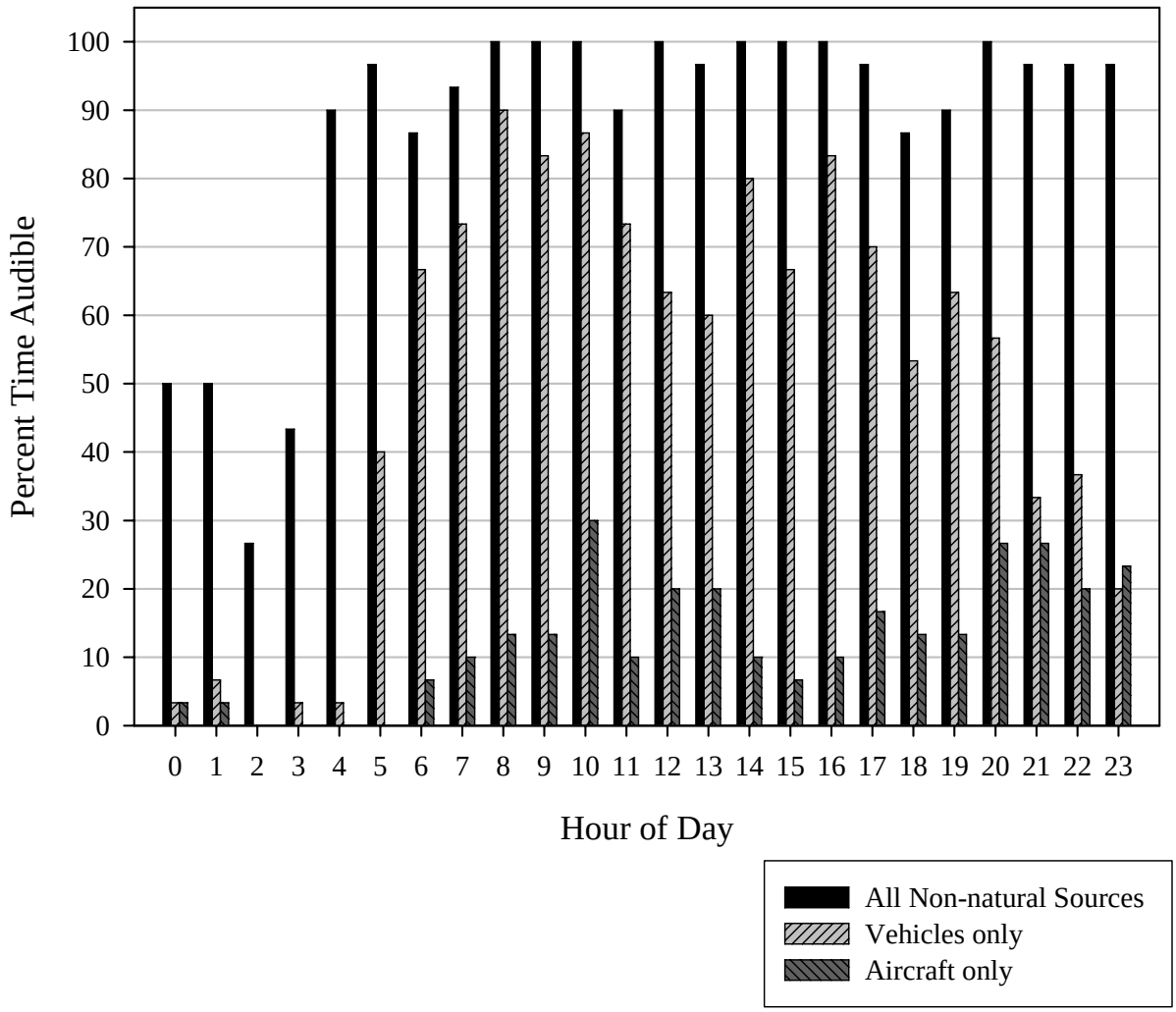

Figure II-49. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), Monday, 7-09-2007.

Table II-50. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), Saturday, 7-14-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	7.2	6.9	7.5
1.2 Propeller Aircraft	0.3	0.3	0.3
1.3 Helicopter	0.3	0.6	0.0
2 Vehicle	58.3	87.5	29.2
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	1.1	2.2	0.0
7 Grounds Care	0.4	0.8	0.0
8 People	28.3	48.1	8.6
9 Domestic animal	0.3	0.3	0.3
10 Building Sounds	47.1	25.3	68.9
11 Construction	0.3	0.0	0.6
19 Non-natural Other	17.9	0.3	35.6
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	42.8	18.6	66.9
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	2.5	0.0	5.0
25 Bird	61.4	95.8	26.9
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	2.1	4.2	0.0
29 Animal	0.8	1.7	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.8	0.3	1.4
41 Artifact	0.1	0.3	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	7.9	8.1	7.8
Total Road Vehicles	58.3	87.5	29.2
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	98.3	100.0	96.7
Total Natural	89.6	96.7	82.5
Total Artifacts	0.1	0.3	0.0

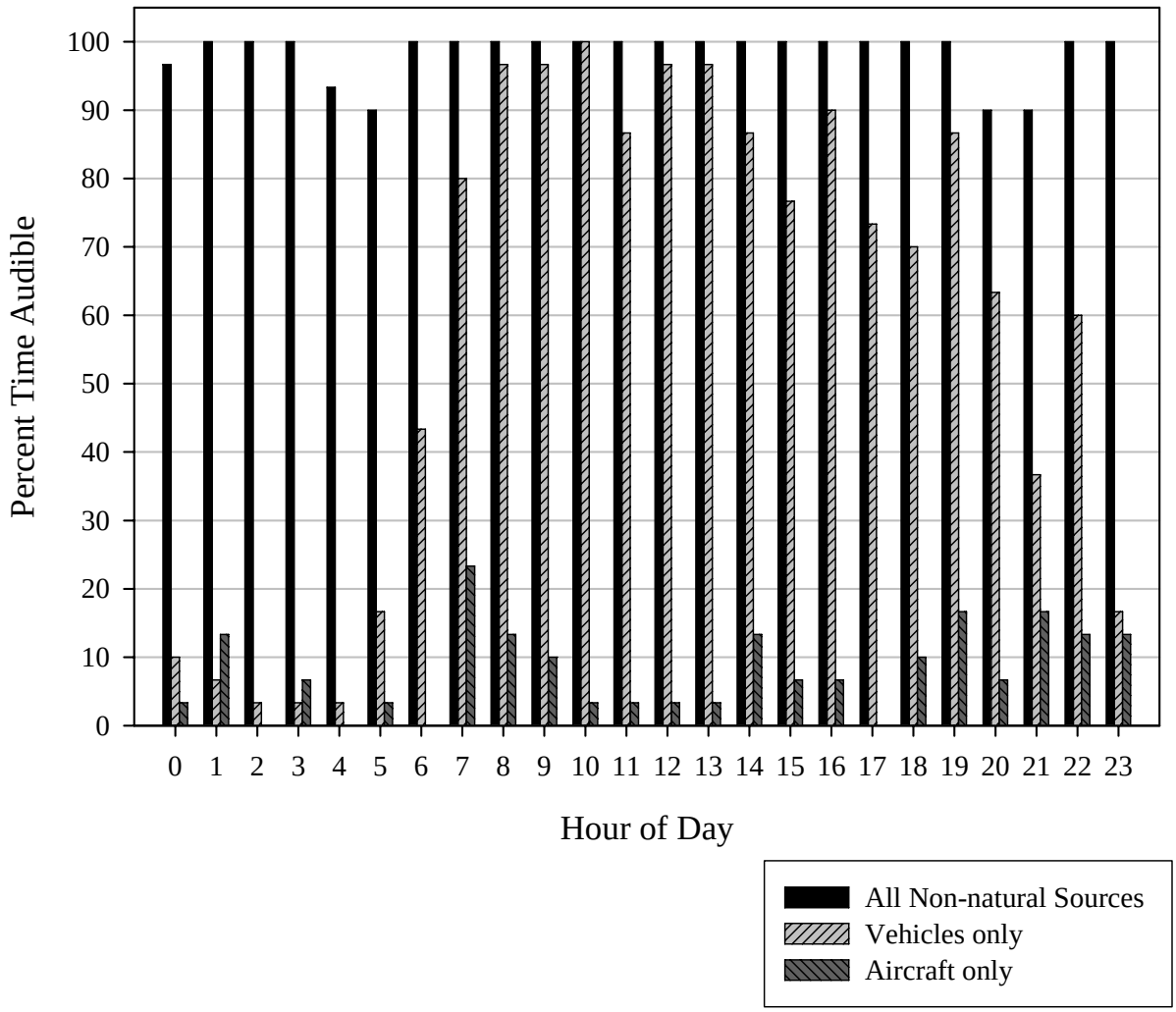

Figure II-50. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Headquarters and Residential Area (GRCA048), Saturday, 7-14-2007.

Table II-51. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), Monday, 7-09-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.3	0.6	0.0
1.1 Jet Aircraft	8.2	11.1	5.3
1.2 Propeller Aircraft	0.8	1.1	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	51.5	73.6	29.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	3.5	5.3	1.7
7 Grounds Care	2.4	4.2	0.6
8 People	58.6	82.5	34.7
9 Domestic animal	0.4	0.8	0.0
10 Building Sounds	17.4	11.4	23.3
11 Construction	0.1	0.3	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.1	0.3	0.0
21 Wind	68.3	37.5	99.2
22 Water (rain, snow)	0.6	0.8	0.3
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	57.4	89.2	25.6
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	1.0	1.7	0.3
29 Animal	1.1	0.0	2.2
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.7	0.0	1.4
41 Artifact	0.1	0.0	0.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	9.3	12.8	5.8
Total Road Vehicles	51.5	73.6	29.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	83.5	99.7	67.2
Total Natural	97.9	96.4	99.4
Total Artifacts	0.1	0.0	0.3

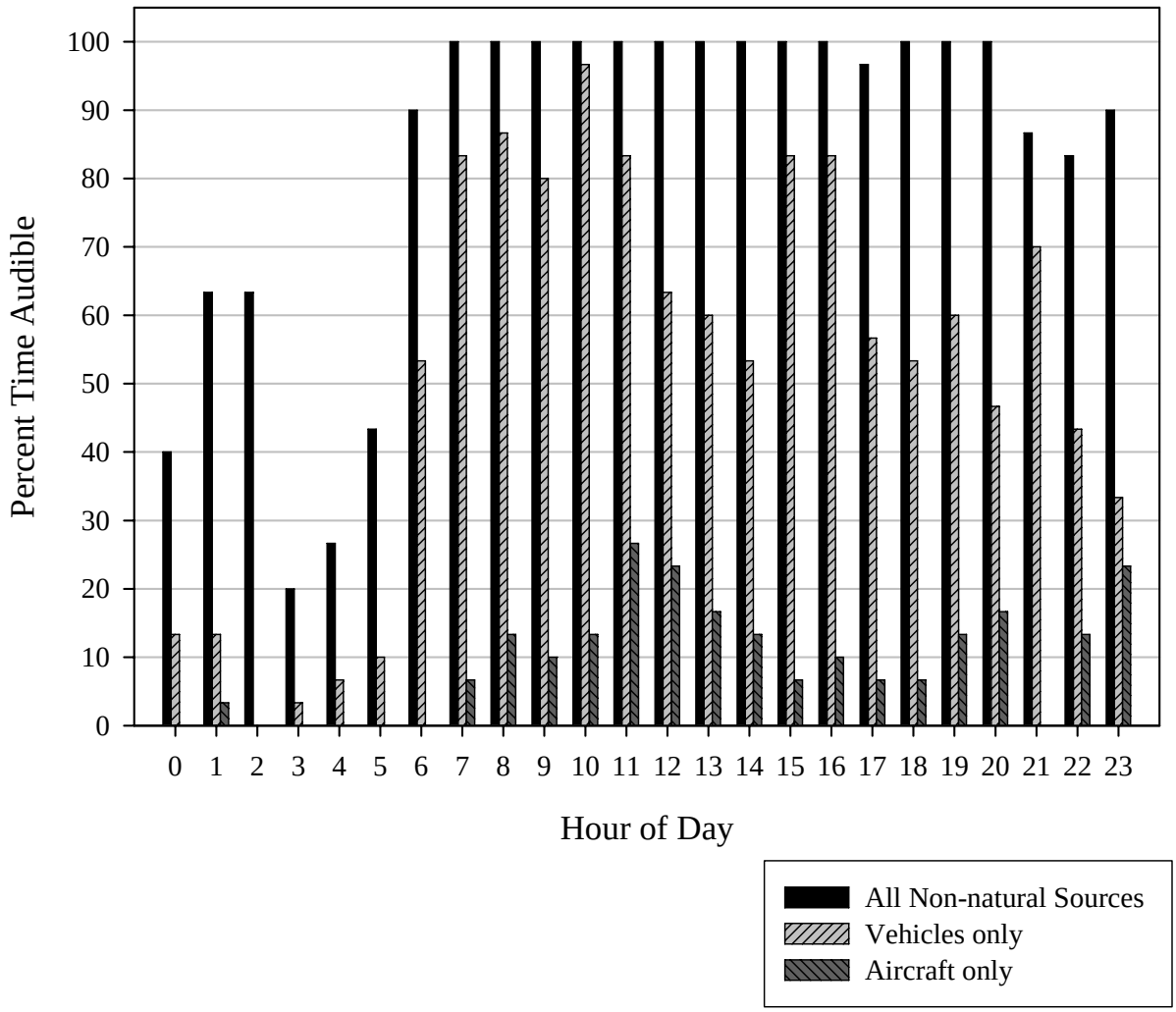

Figure II-51. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), Monday, 7-09-2007.

Table II-52. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), Saturday, 7-14-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.1	0.3	0.0
1.1 Jet Aircraft	8.5	10.0	6.9
1.2 Propeller Aircraft	1.1	1.7	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	55.4	80.0	30.8
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	4.9	4.2	5.6
7 Grounds Care	1.9	3.6	0.3
8 People	64.0	90.3	37.8
9 Domestic animal	4.3	6.1	2.5
10 Building Sounds	31.7	14.7	48.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.1	0.0	0.3
21 Wind	49.4	22.2	76.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	3.3	0.3	6.4
25 Bird	54.9	89.4	20.3
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.8	1.4	0.3
29 Animal	0.4	0.0	0.8
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.1	0.0	0.3
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	9.7	11.9	7.5
Total Road Vehicles	55.4	80.0	30.8
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	94.9	100.0	89.7
Total Natural	89.6	93.6	85.6
Total Artifacts	0.0	0.0	0.0

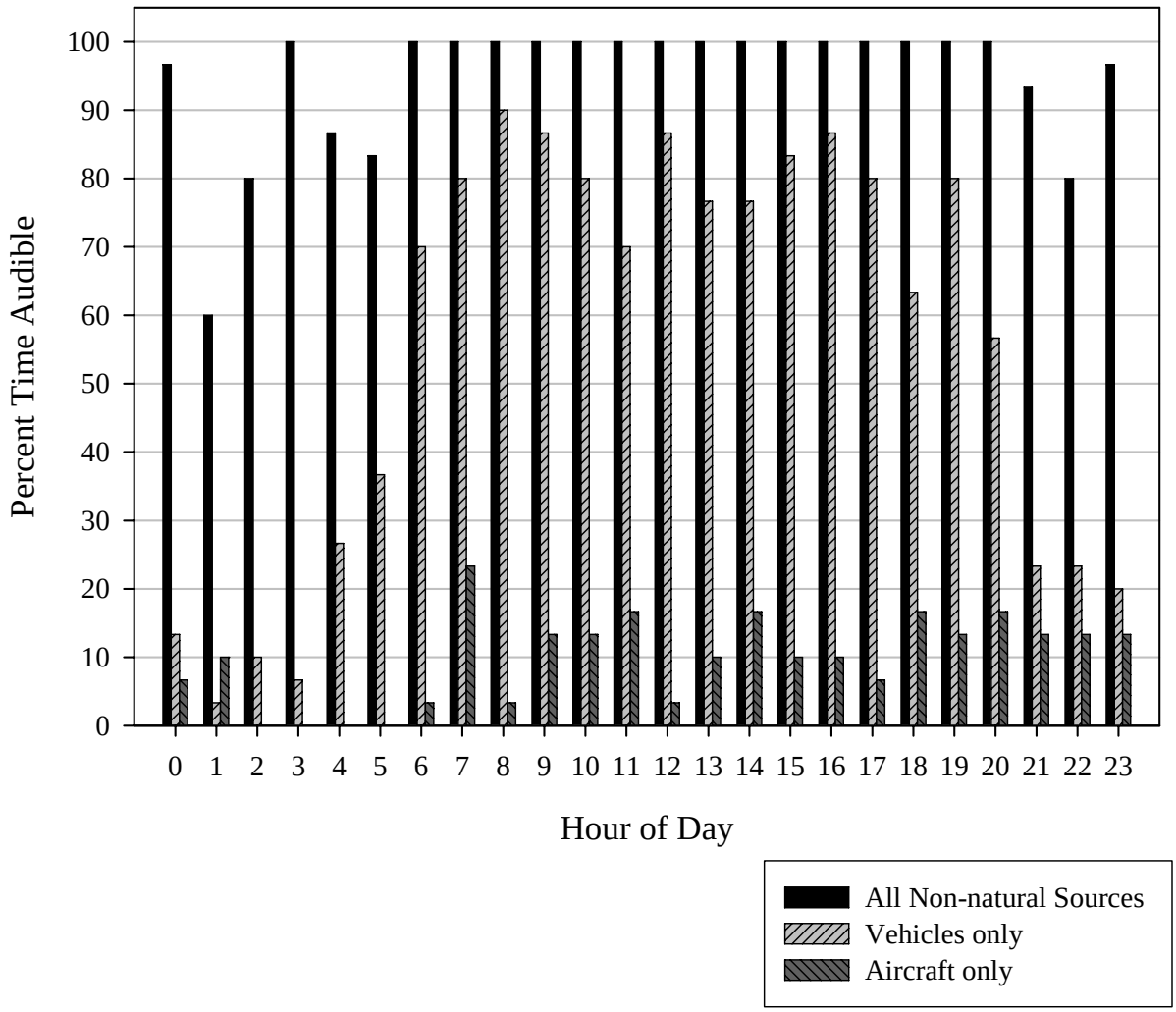

Figure II-52. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Rim Campground (GRCA049), Saturday, 7-14-2007.

Table II-53. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), Wednesday, 7-11-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	29.9	25.0	34.7
1.2 Propeller Aircraft	8.8	16.1	1.4
1.3 Helicopter	0.7	1.4	0.0
2 Vehicle	32.4	60.3	4.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	36.7	65.6	7.8
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	1.9	3.3	0.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	61.7	48.1	75.3
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	2.6	0.0	5.3
25 Bird	55.6	86.1	25.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	48.1	20.3	75.8
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.7	0.3	1.1
99 Unknown	0.0	0.0	0.0
Total Aircraft	38.8	41.7	35.8
Total Road Vehicles	32.4	60.3	4.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	66.4	92.2	40.6
Total Natural	97.1	95.6	98.6
Total Artifacts	0.7	0.3	1.1

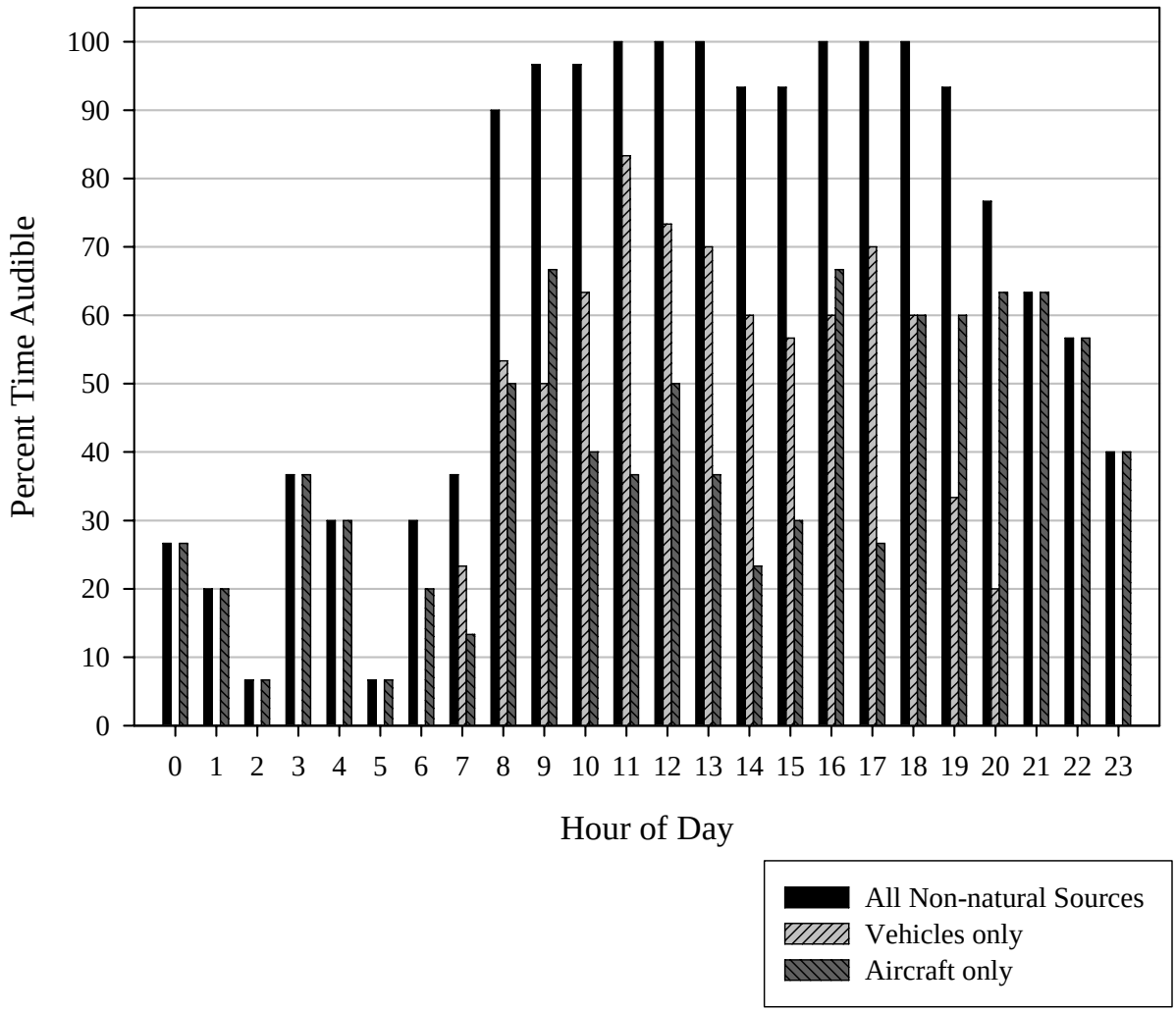

Figure II-53. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), Wednesday, 7-11-2007.

Table II-54. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), Saturday, 7-14-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	25.4	30.3	20.6
1.2 Propeller Aircraft	5.7	9.7	1.7
1.3 Helicopter	0.7	1.1	0.3
2 Vehicle	38.5	60.3	16.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	41.5	67.2	15.8
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	2.5	4.7	0.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	8.3	16.7	0.0
21 Wind	40.6	17.5	63.6
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.4	0.0	0.8
25 Bird	52.2	78.1	26.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	75.7	61.1	90.3
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.7	0.0	1.4
99 Unknown	0.0	0.0	0.0
Total Aircraft	31.0	39.4	22.5
Total Road Vehicles	38.5	60.3	16.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	69.3	98.1	40.6
Total Natural	96.5	94.4	98.6
Total Artifacts	0.7	0.0	1.4

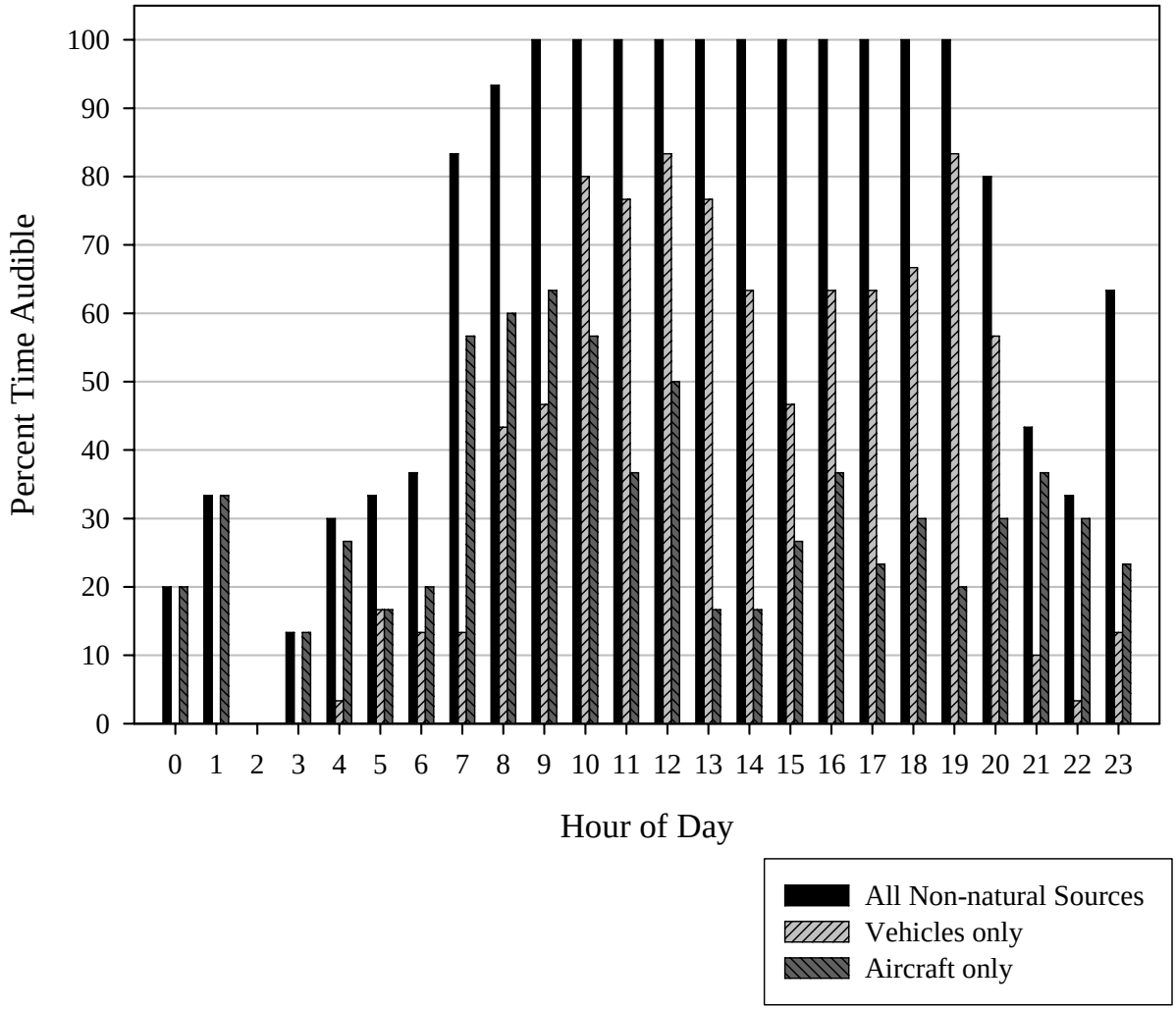

Figure II-54. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Cape Royal (GRCA050), Saturday, 7-14-2007.

Table II-55. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), Tuesday, 7-10-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	1.9	3.9	0.0
1.1 Jet Aircraft	8.3	13.3	3.3
1.2 Propeller Aircraft	1.1	1.9	0.3
1.3 Helicopter	6.0	11.9	0.0
2 Vehicle	24.7	42.5	6.9
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	2.9	5.0	0.8
7 Grounds Care	0.0	0.0	0.0
8 People	11.1	21.7	0.6
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	8.2	15.8	0.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	86.4	73.1	99.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	50.8	78.9	22.8
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	10.6	13.3	7.8
29 Animal	0.4	0.6	0.3
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.3	0.0	0.6
41 Artifact	14.4	1.4	27.5
99 Unknown	0.0	0.0	0.0
Total Aircraft	17.4	31.1	3.6
Total Road Vehicles	24.7	42.5	6.9
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	46.4	80.6	12.2
Total Natural	98.8	97.8	99.7
Total Artifacts	14.4	1.4	27.5

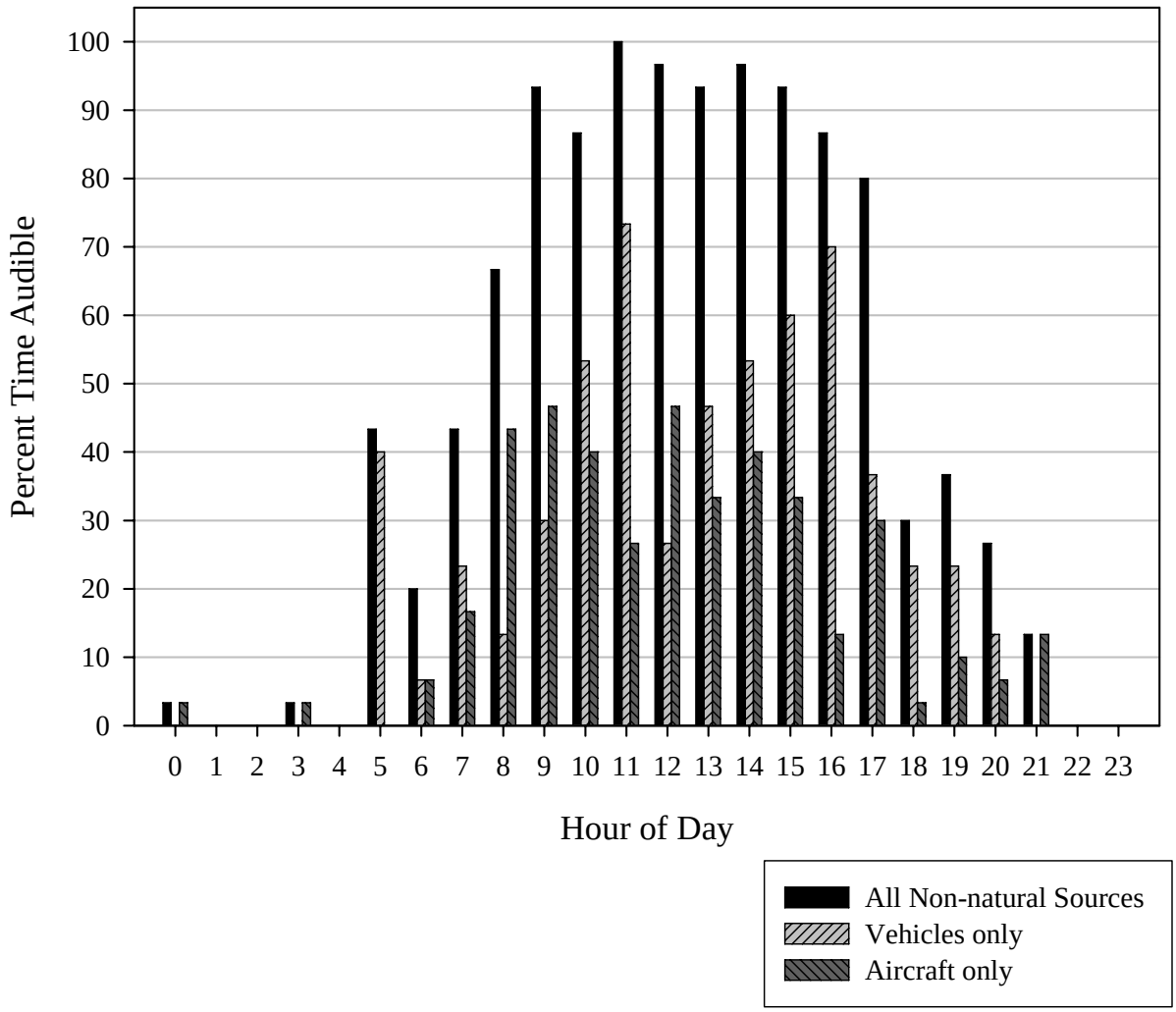

Figure II-55. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), Tuesday, 7-10-2007.

Table II-56. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), Tuesday, 7-17-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	3.3	4.4	2.2
1 Aircraft	2.4	4.2	0.6
1.1 Jet Aircraft	5.4	6.1	4.7
1.2 Propeller Aircraft	2.2	3.9	0.6
1.3 Helicopter	4.2	8.3	0.0
2 Vehicle	17.6	31.9	3.3
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	2.6	4.2	1.1
7 Grounds Care	0.0	0.0	0.0
8 People	10.7	21.1	0.3
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	2.9	5.0	0.8
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	68.6	46.4	90.8
22 Water (rain, snow)	5.0	9.2	0.8
23 Thunder	4.4	8.9	0.0
24 Mammal	0.0	0.0	0.0
25 Bird	34.0	51.7	16.4
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	1.0	1.9	0.0
29 Animal	0.6	0.6	0.6
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.6	0.6	0.6
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	14.0	22.2	5.8
Total Road Vehicles	17.6	31.9	3.3
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	36.9	62.5	11.4
Total Natural	86.8	78.9	94.7
Total Artifacts	0.0	0.0	0.0

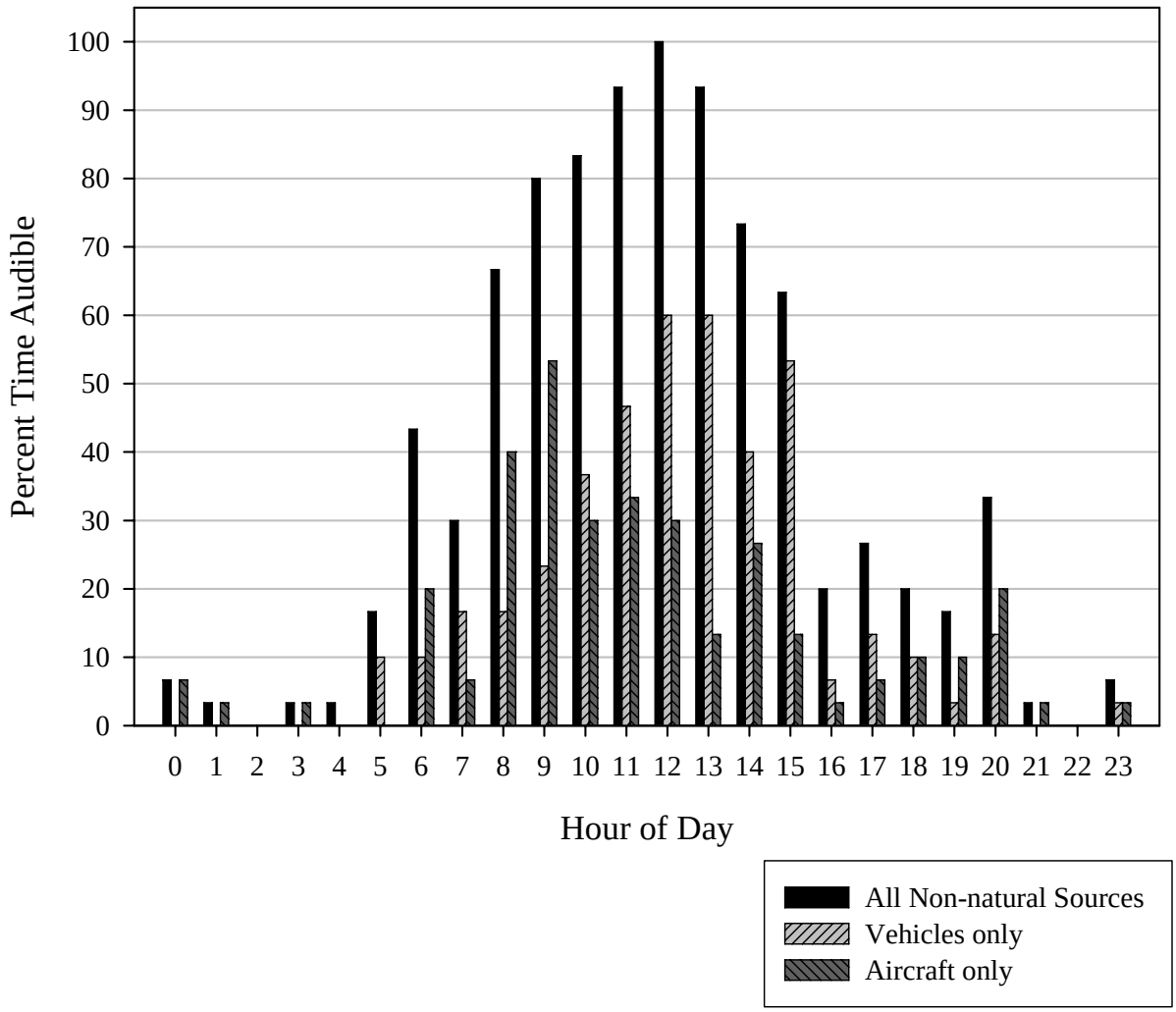

Figure II-56. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Point Imperial (GRCA051), Tuesday, 7-17-2007.

Table II-57. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Sunday, 7-15-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	16.0	16.1	15.8
1.2 Propeller Aircraft	4.4	8.1	0.8
1.3 Helicopter	1.1	1.9	0.3
2 Vehicle	42.9	64.4	21.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.1	0.3	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.3	0.0	0.6
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	1.0	1.9	0.0
21 Wind	74.6	58.6	90.6
22 Water (rain, snow)	6.0	11.7	0.3
23 Thunder	2.1	3.9	0.3
24 Mammal	5.7	1.1	10.3
25 Bird	64.7	97.2	32.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	7.5	5.3	9.7
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.1	0.0	0.3
40 Natural Unknown	3.2	0.8	5.6
41 Artifact	0.0	0.0	0.0
99 Unknown	0.0	0.0	0.0
Total Aircraft	21.3	25.6	16.9
Total Road Vehicles	42.9	64.4	21.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	56.8	78.3	35.3
Total Natural	98.3	98.6	98.1
Total Artifacts	0.0	0.0	0.0

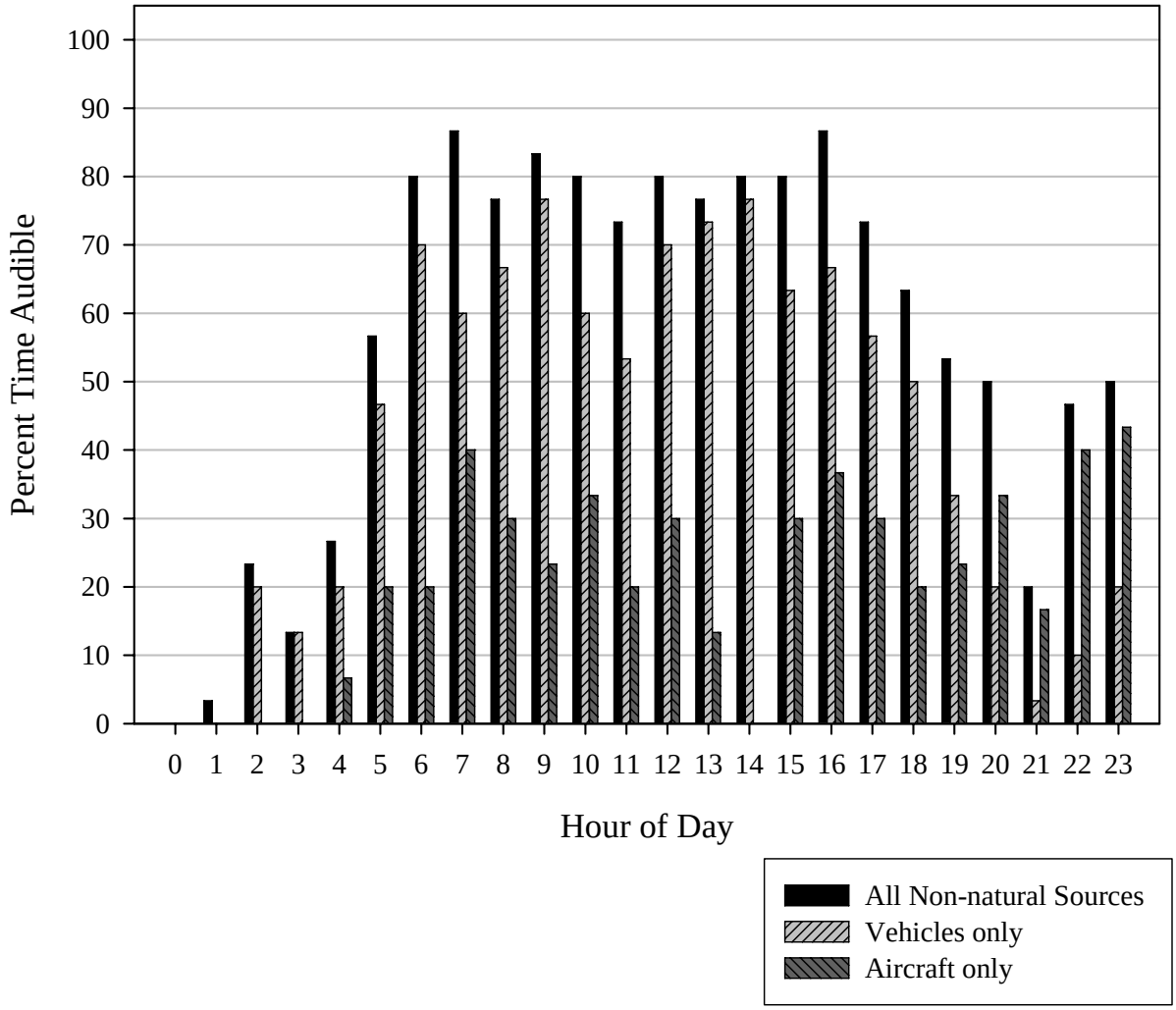

Figure II-57. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Sunday, 7-15-2007.

Table II-58. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Wednesday, 7-18-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	17.1	16.1	18.1
1.2 Propeller Aircraft	4.3	7.8	0.8
1.3 Helicopter	1.3	2.2	0.3
2 Vehicle	43.1	60.0	26.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.3	0.6	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	62.1	57.5	66.7
22 Water (rain, snow)	5.0	10.0	0.0
23 Thunder	3.6	7.2	0.0
24 Mammal	13.3	10.6	16.1
25 Bird	64.4	98.1	30.8
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	3.2	3.6	2.8
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	10.7	4.4	16.9
41 Artifact	5.3	0.3	10.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	22.1	25.0	19.2
Total Road Vehicles	43.1	60.0	26.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	59.6	76.1	43.1
Total Natural	97.1	99.4	94.7
Total Artifacts	5.3	0.3	10.3

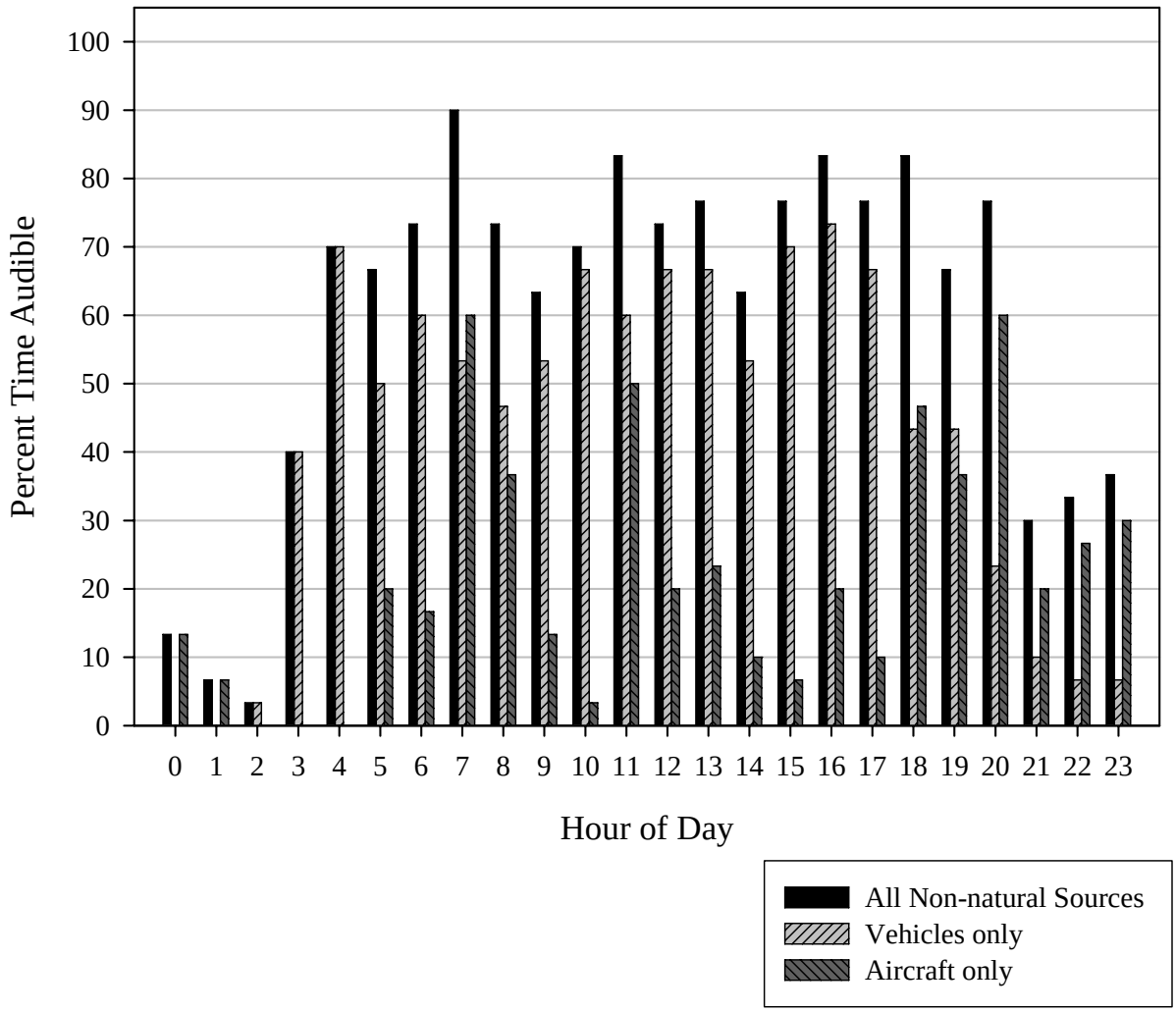

Figure II-58. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Wednesday, 7-18-2007.

Table II-59. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Wednesday, 12-05-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	3.2	0.8	5.6
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	29.0	40.8	17.2
1.2 Propeller Aircraft	5.0	9.2	0.8
1.3 Helicopter	0.7	1.4	0.0
2 Vehicle	4.0	8.1	0.0
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	82.4	73.6	91.1
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	2.5	5.0	0.0
25 Bird	9.6	19.2	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	20.0	23.6	16.4
40 Natural Unknown	9.9	15.3	4.4
41 Artifact	11.9	3.6	20.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	33.6	49.2	18.1
Total Road Vehicles	4.0	8.1	0.0
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	36.4	54.7	18.1
Total Natural	92.2	93.3	91.1
Total Artifacts	11.9	3.6	20.3

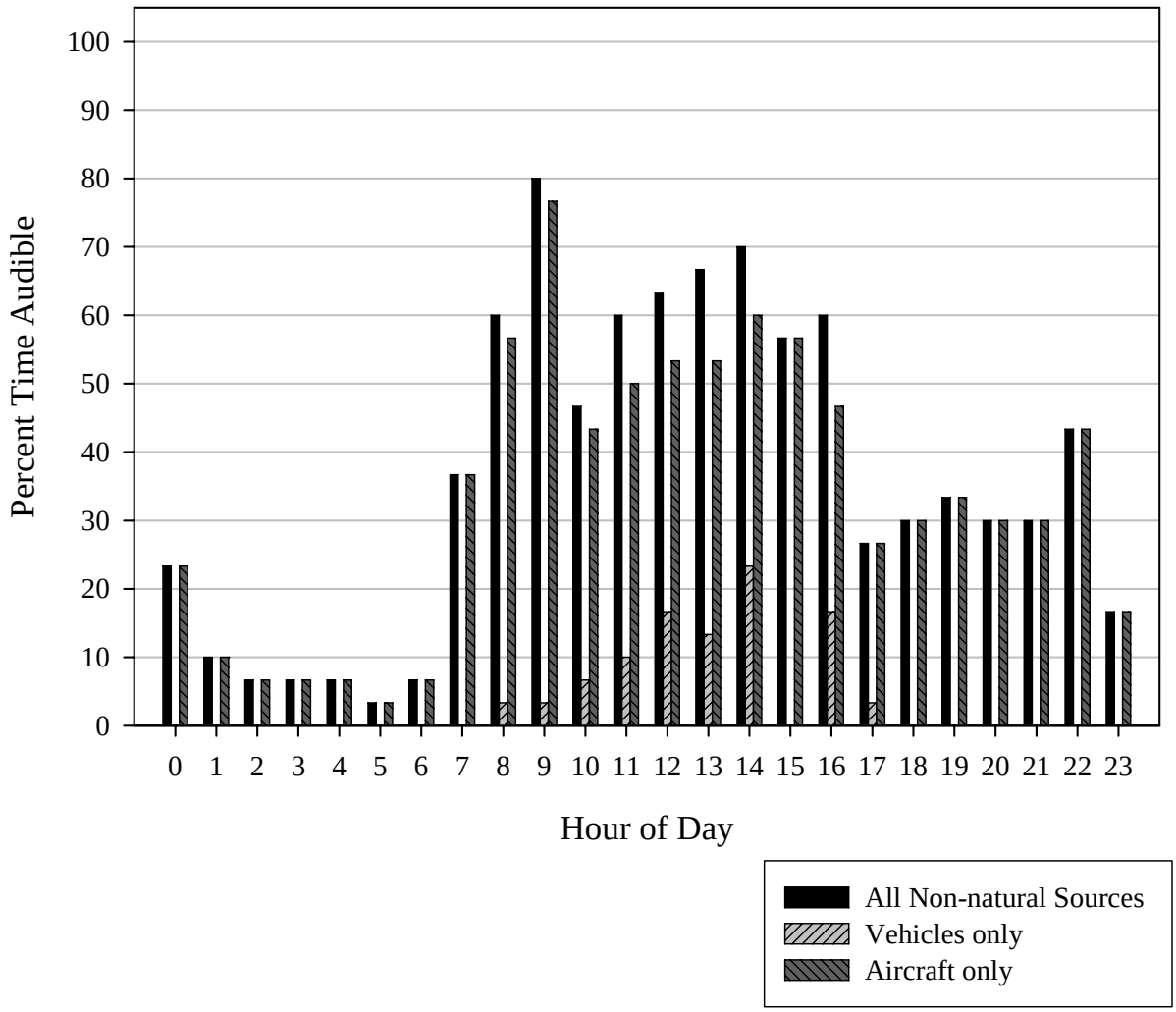

Figure II-59. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Wednesday, 12-05-2007.

Table II-60. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Friday, 12-07-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.0	0.0	0.0
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	10.7	8.9	12.5
1.2 Propeller Aircraft	1.0	1.4	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	2.9	4.4	1.4
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.0	0.0	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.0	0.0	0.0
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	99.6	99.7	99.4
22 Water (rain, snow)	79.6	97.5	61.7
23 Thunder	1.0	1.9	0.0
24 Mammal	0.1	0.0	0.3
25 Bird	0.7	1.4	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	0.0	0.0	0.0
29 Animal	0.1	0.3	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	7.1	0.8	13.3
40 Natural Unknown	1.4	0.3	2.5
41 Artifact	0.4	0.0	0.8
99 Unknown	0.0	0.0	0.0
Total Aircraft	11.7	10.3	13.1
Total Road Vehicles	2.9	4.4	1.4
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	14.4	14.7	14.2
Total Natural	99.9	100.0	99.7
Total Artifacts	0.4	0.0	0.8

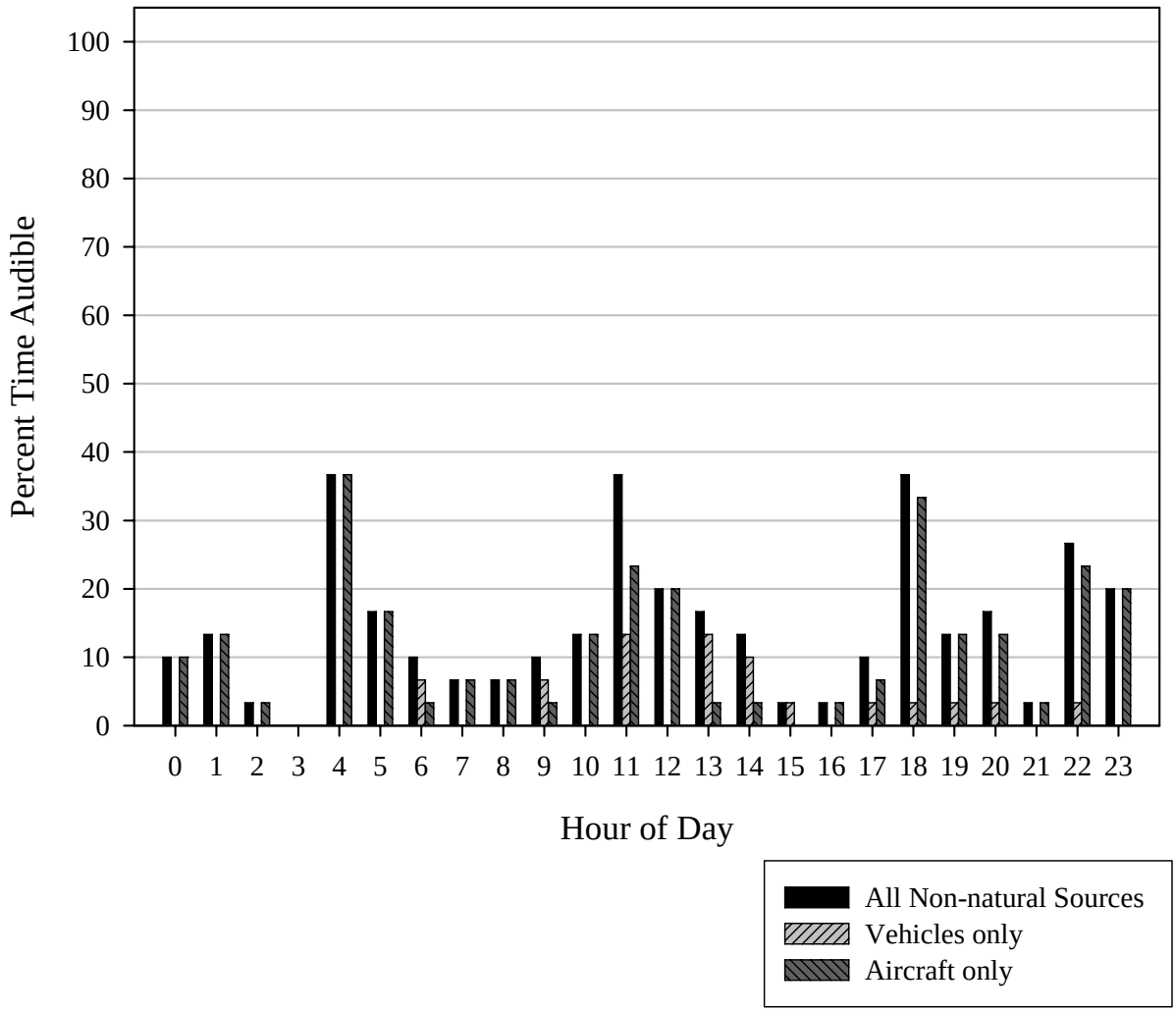

Figure II-60. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, North Entrance Road (GRCA052), Friday, 12-07-2007.

Table II-61. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Friday, 8-03-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.8	1.4	0.3
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	19.6	20.8	18.3
1.2 Propeller Aircraft	2.5	4.4	0.6
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	3.5	3.9	3.1
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	5.1	0.8	9.4
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	1.3	0.6	1.9
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	40.3	65.8	14.7
22 Water (rain, snow)	3.8	7.5	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.7	0.0	1.4
25 Bird	34.9	47.5	22.2
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	57.1	20.3	93.9
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	1.8	1.1	2.5
99 Unknown	0.0	0.0	0.0
Total Aircraft	21.9	25.0	18.9
Total Road Vehicles	3.5	3.9	3.1
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	29.9	29.2	30.6
Total Natural	95.4	92.2	98.6
Total Artifacts	1.8	1.1	2.5

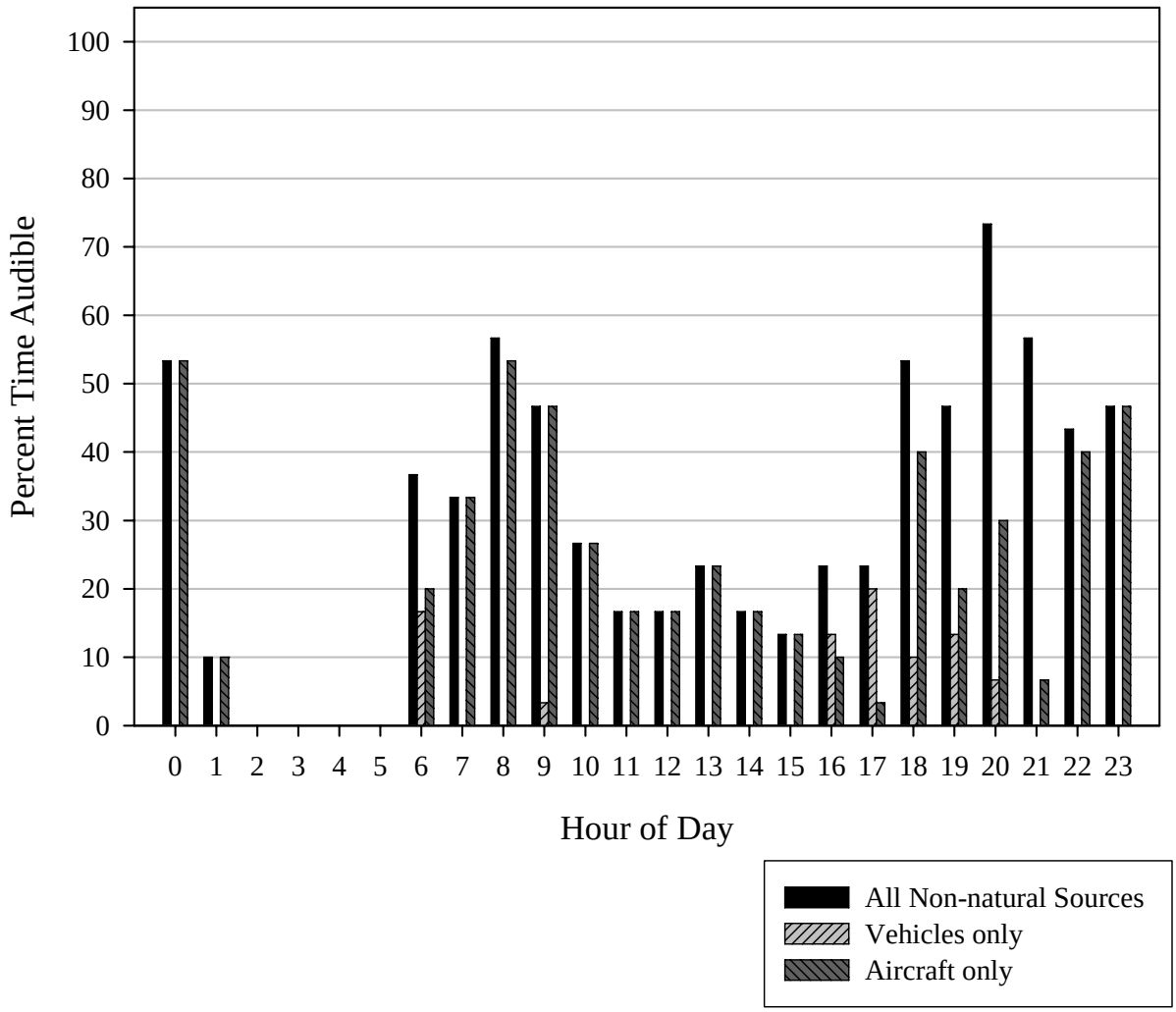

Figure II-61. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Friday, 8-03-2007.

Table II-62. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Friday, 8-10-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	0.4	0.0	0.8
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	7.4	4.2	10.6
1.2 Propeller Aircraft	3.1	5.6	0.6
1.3 Helicopter	0.3	0.0	0.6
2 Vehicle	9.4	14.2	4.7
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	36.4	43.6	29.2
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	5.0	3.9	6.1
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	50.7	79.7	21.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.3	0.0	0.6
25 Bird	23.3	30.0	16.7
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	46.8	4.7	88.9
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	0.1	0.0	0.3
99 Unknown	0.0	0.0	0.0
Total Aircraft	10.7	9.7	11.7
Total Road Vehicles	9.4	14.2	4.7
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	48.6	55.6	41.7
Total Natural	92.1	86.1	98.1
Total Artifacts	0.1	0.0	0.3

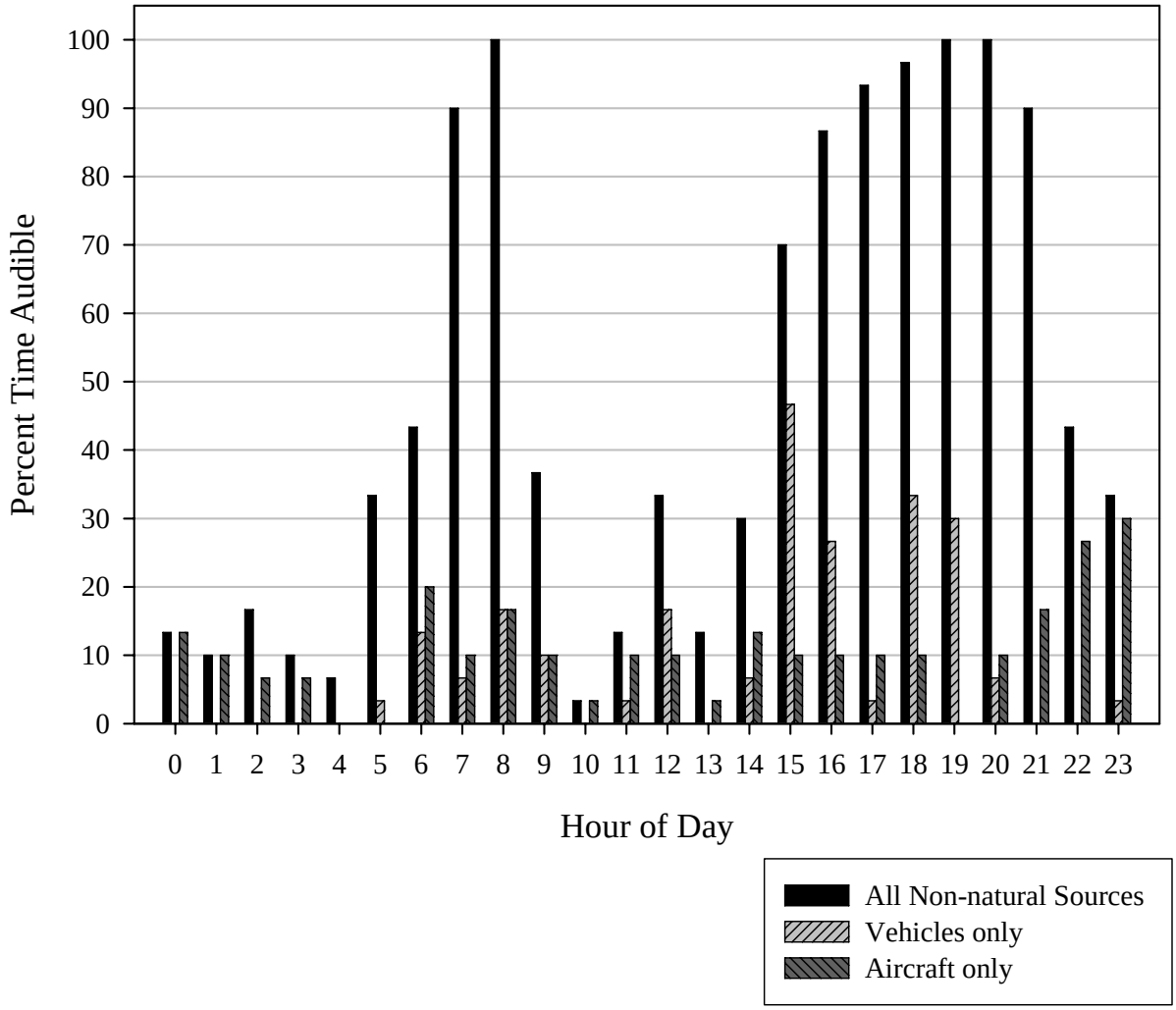

Figure II-62. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Friday, 8-10-2007.

Table II-63. Percent Time All Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Wednesday, 12-05-2007.

Audible Sound Sources	24 Hour Percent Time Audible	7 AM - 7 PM Percent Time Audible	7 PM - 7 AM Percent Time Audible
0 No Sound Audible	16.4	5.6	27.2
1 Aircraft	0.0	0.0	0.0
1.1 Jet Aircraft	23.2	29.2	17.2
1.2 Propeller Aircraft	2.2	4.4	0.0
1.3 Helicopter	0.0	0.0	0.0
2 Vehicle	1.9	3.9	0.0
3 Watercraft	0.0	0.0	0.0
4 Over-snow Vehicle	0.0	0.0	0.0
5 Train	0.0	0.0	0.0
6 Motor Sounds	0.0	0.0	0.0
7 Grounds Care	0.0	0.0	0.0
8 People	0.7	1.4	0.0
9 Domestic animal	0.0	0.0	0.0
10 Building Sounds	0.4	0.6	0.3
11 Construction	0.0	0.0	0.0
19 Non-natural Other	0.0	0.0	0.0
20 Non-natural Unknown	0.0	0.0	0.0
21 Wind	67.5	73.3	61.7
22 Water (rain, snow)	0.0	0.0	0.0
23 Thunder	0.0	0.0	0.0
24 Mammal	0.1	0.3	0.0
25 Bird	27.2	54.4	0.0
26 Reptile	0.0	0.0	0.0
27 Amphibian	0.0	0.0	0.0
28 Insect	4.0	7.2	0.8
29 Animal	0.0	0.0	0.0
30 Geothermal / Mass Movement	0.0	0.0	0.0
39 Natural Other	0.0	0.0	0.0
40 Natural Unknown	0.0	0.0	0.0
41 Artifact	6.0	5.0	6.9
99 Unknown	0.0	0.0	0.0
Total Aircraft	25.0	32.8	17.2
Total Road Vehicles	1.9	3.9	0.0
Total Watercraft	0.0	0.0	0.0
Total Over-snow Vehicle	0.0	0.0	0.0
Total Non-natural	27.8	38.1	17.5
Total Natural	72.6	83.3	61.9
Total Artifacts	6.0	5.0	6.9

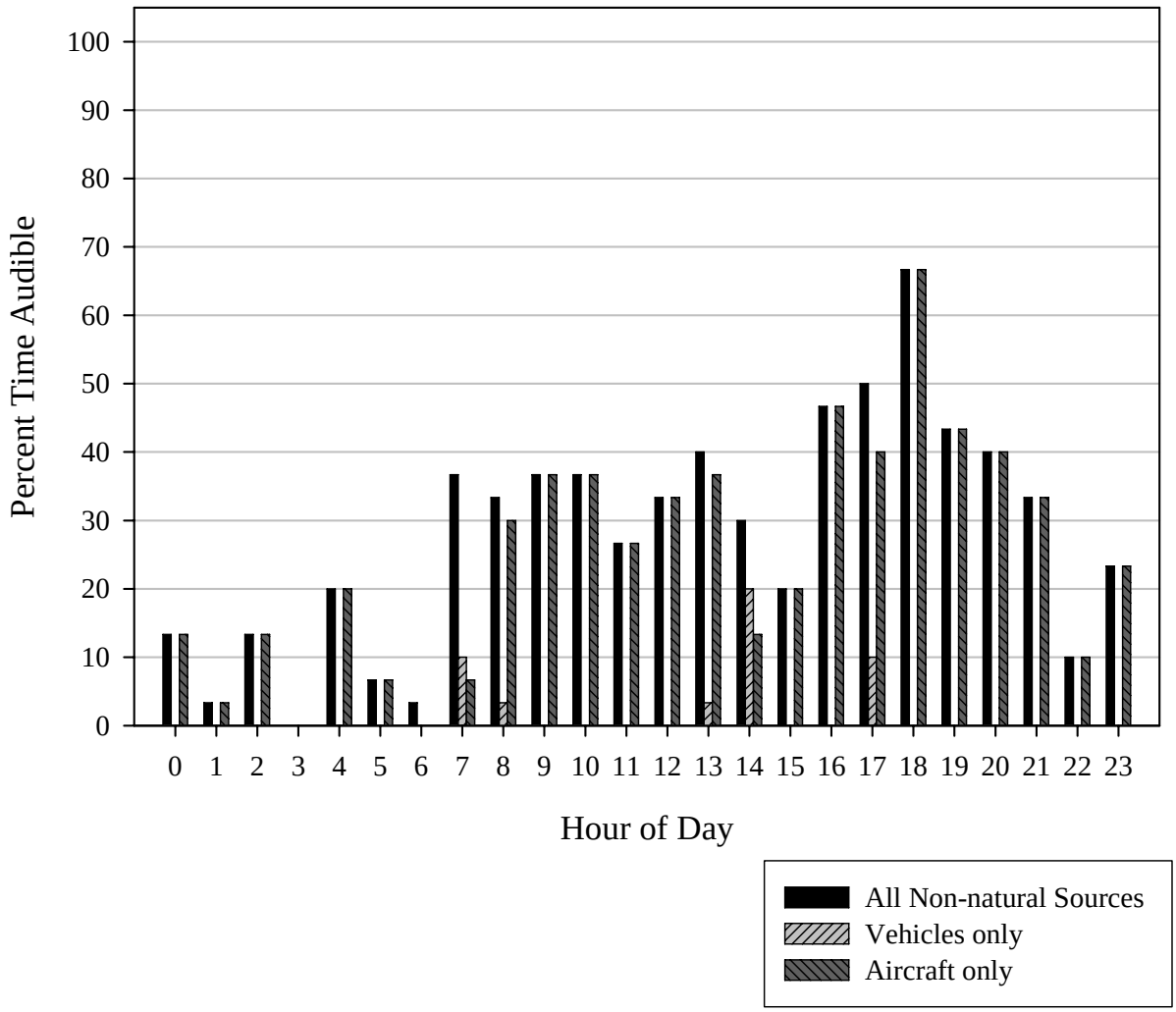

Figure II-63. Percent Time Non-natural Sounds, Vehicle Sounds, and Aircraft Sounds were Audible, Grand Canyon National Park, North Rim, Tuweep Campground (GRCA053), Wednesday, 12-05-2007.

Appendix III. Sound Levels of Common Vehicle Types.

Location, date (yyyymmdd), time (hhmmss), vehicle type, and maximum sound level (L_{max} dBA) of common vehicles, 15 m (50 feet) at approximately 25 mph, South Entrance Road, near Yavapai Point turnoff.

Figure III-3. South Entrance Road near Yavapai Point, GRCASER1_20070707_083841.
Vehicle: Automobile.
L_{max}: 59.2 dBA

Figure III-2. South Entrance Road near Yavapai Point, GRCASER1_20070707_084134.
Vehicle: Automobile.
L_{max}: 61.4 dBA

Figure III-6. South Entrance Road near Yavapai Point, GRCASER1_20070707_082822.
Vehicle: Van, small.
L_{max}: 64.4 dBA

Figure III-4. South Entrance Road near Yavapai Point, GRCASER1_20070707_080325.
Vehicle: SUV.
L_{max}: 64.5 dBA

Figure III-5. South Entrance Road near Yavapai Point, GRCASER1_20070707_084239.
Vehicle: SUV (Hummer).
L_{max}: 69.2 dBA

Figure III-7. South Entrance Road near Yavapai Point, GRCASER1_20070707_082122.
Vehicle: Bus, shuttle (natural gas).
L_{max}: 71.3 dBA

Figure III-8. South Entrance Road near Yavapai Point, GRCASER1_20070707_084730.
Vehicle: Bus, shuttle (natural gas).
L_{max}: 72.5 dBA

Figure III-9. South Entrance Rd. near Yavapai Point, GRCASER1_20070707_080242.
Vehicle: Bus, diesel.
L_{max}: 74.4 dBA

Figure III-1. South Entrance Road near Yavapai Point, GRCASER1_20070707_083244.
Vehicle: Motorcycle.
L_{max}: 80.1 dBA