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Human Response to Aviation Noise: Development of Dose-Response Relationships for Backcountry Visitors
Rainbow Bridge National Monument

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The Federal Aviation Administration and National Park Service conducted joint research to better understand the effects of noise due to commercial air tour operations over units of the National Park System. To evaluate the relationship between aircraft noise exposure and the quality of National Park visitor experience, research was conducted at backcountry sites providing day- and overnight-hiking opportunities. Data were collected at Rainbow Bridge National Monument during June 2014 to add to the backcountry dataset collected at four National Parks during 2011. Visits to Rainbow Bridge are of shorter length than previously studied and the site is valued for both scenic and cultural/historic aspects, further expanding the dose-response dataset. This report describes the study methods, visitor surveys and data collected at Rainbow Bridge. Dose-response relationships were developed for the complete backcountry dataset inclusive of the 2014 Rainbow Bridge data.   The models developed can be used as a tool for evaluating potential effects of air tours on visitors to National Parks.

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Executive Summary

This document summarizes the results of a dose-response study conducted at Rainbow Bridge National Monument (Rainbow Bridge). The dose-response data, collected during June 2014, include 177 completed visitor experience surveys and continuous sound level measurements collected over a period of three days. These dose-response data were collected with the goal of expanding the existing backcountry dataset to include sites with hikes of shorter length and cultural/historic as well as scenic aspects. The existing backcountry dataset consists of over 4600 surveys and associated sound level measurements collected during the year 2011 at seven backcountry sites and one frontcountry cultural/historic site in Bryce Canyon, Glacier, Grand Canyon, and Zion National Parks.

The research at Rainbow Bridge was conducted by the John A. Volpe National Transportation Systems Center (Volpe Center). It is part of a research program sponsored by the Federal Aviation Administration (FAA) Western Pacific Region, Office of Special Programs, the FAA Office of Environment and Energy, and the National Park Service (NPS) Natural Sounds and Night Skies Division to further the understanding of human response to aviation noise in protected natural areas. The research entails the collection and analysis of aviation noise-exposure dose and corresponding visitor response data in National Parks. These data are used to understand and quantify human response to aviation noise through mathematical relationships between the noise exposure 'dose' and people's stated judgments about the effect of the exposure on the quality of their experiences, measured through survey instruments (i.e., a dose-response relationship).   This research approach has been widely accepted and used for many years within federal transportation noise regulations to determine noise impacts in residential environments.

Rainbow Bridge National Monument is located within the Glen Canyon National Recreation Area. Nearly all visitors arrive by boat on Lake Powell. At the time of data collection, visitors were required to dock at a point 1.25 miles from the Bridge, making the round-trip hike to view Rainbow Bridge 2.5 miles in length. The average visitor spent 58 minutes hiking to, and viewing, Rainbow Bridge. Surveys were administered as visitors exited the trail, on their return to the boat docking area. A single acoustical monitor was deployed nearby Rainbow Bridge (but out-of-sight for visitors) to monitor sound levels throughout the duration of the study.

Survey responses were used for general comparisons of visitor populations among sites and site types. In relationships developed previously from both backcountry and frontcountry dose-response data, numerous visit and visitor characteristics were found to affect visitor response to noise. The survey data indicate that there are small differences in visitor population characteristics and expectations between Rainbow Bridge visitors and those at the other sites studied. Rainbow Bridge visitors are more likely to be repeat visitors and participate in interpretive talks, and thus are predicted to be more sensitive to aircraft noise. However, Rainbow Bridge visitors are also less likely to be in adult-only groups and to participate in bird watching, traits that result in a lower predicted sensitivity to aircraft noise. As a result, the visitor population at Rainbow Bridge is predicted to rate aircraft noise similarly to visitor populations with similar noise exposures at other sites. Indeed, the predicted average ratings of

'annoyance' and 'interference with natural quiet' for the population of Rainbow Bridge visitors were similar to the observed average ratings.

The aircraft noise exposure 'dose' for the surveyed Rainbow Bridge visitors was the result of overflights of propeller-driven aircraft and high-altitude jets. The magnitude of aircraft noise exposure at the time of data collection was similar to other locations studied such as Fairyland at Bryce Canyon and Taylor Creek at Zion National Park. Visitor sound exposure levels ranged from 52 to 79 dBA and averaged 66 dBA; percent time audible ranged from 10 to 49% and averaged 24%. Ambient sound levels at Rainbow Bridge were among the quietest of the dose-response study. The median natural ambient (L_{50}) ranged from 20 to 27 dBA and averaged 23 dBA.

For the previously reported analysis of the backcountry (2011) data, the dose-response relationships presented were based on data for backcountry 'dayhike' (> 60 minutes) visitors only. In this analysis, updated 'hike' dose-response models were developed from the combined 2011 'dayhike' and 'shorthike' backcountry data, to predict visitor responses at Rainbow Bridge where the average visit length was < 60 minutes. Complete backcountry dose-response models were developed from the combined dataset following the same process used in prior analyses. The best combination of dose variables were first identified, then the mediator variables were tested sequentially and retained if they improved the fit of the model to the data. The best models were defined as those which minimize information loss based on the Akaike Information Criteria (AIC). Dose-response models were identified that best fit the 'Annoyance' and 'Interference with natural quiet' responses for three dichotomizations of visitor responses (noted as Slightly or More, Moderately or More, and Very or More). The models include dose variables of sound exposure level, percent time audible, and energy percentages due to helicopters and fixed-wing propeller aircraft. Mediator variables identified include visitor ratings of the 'importance of natural quiet', attributes of adults-only in group, first visit to the site, and participation in activities of watching birds and listening to an interpretive talk. During the model fitting process, the effects of visit duration on visitor responses were extensively tested with the 'hike' dataset; a significant relationship was not found.

The best regression model identified to predict the probability that a visitor will respond as annoyed or interfered by a given level of aircraft noise is given according to the following equation:

$$z = C_0 + C_1(L_{AE}) + C_2(\%TAud) + C_3(P_{EnHelos}) + C_4(P_{EnProps}) + C_5(S_{HR1}) + C_6(S_{HR2})$$
$$+ C_7(M_{ImpNQ}) + C_8(M_{SiteVisitBefore}) + C_9(M_{AdultsOnly}) + C_{10}(M_{WatchBirds})$$
$$+ C_{11}(M_{Talk})$$

$$R = \frac{1}{1+e^{-z}}$$

Where S = 1 if the given survey instrument was received and S=0 if a different survey instrument was received.

Mediator (M) variables are defined as:

M_{ImpNQ}: Respondent rated natural quiet as a very or extremely important aspect of the visit.

$M_{SiteVisitBefore}$: Respondent had visited the site before.

$M_{AdultsOnly}$: Respondent's personal group consisted of only adults (no children under the age of 16).

$M_{WatchBirds}$: Respondent had participated in bird watching during the visit.

M_{Talk}: Respondent had participated in an interpretive talk or presentation during the visit.

Where M = 1 for Yes responses and M=0 for No responses.

Dose variables L_{AE}, %TAud, $P_{EnHelos}$, and $P_{EnProps}$ are calculated according to:

$$L_{AE} = 10 * \log10 (\Sigma 10^{(LAeq,1s/10)})$$

$$\%TAud = 100 * (\text{Duration of aircraft sounds } (T_{AC}) / \text{Duration of visit } (T_{resp}))$$

$$P_{EnHelos} = 100 * \left(10^{L_{AE}Helos/10}/10^{L_{AE}/10}\right)$$

$$P_{en,Props} = 100 * \left(10^{L_{AE}Props/10}/10^{L_{AE}/10}\right)$$

The data collected at Rainbow Bridge National Monument provide additional information and expand the database on backcountry visitor responses to aircraft noise in National Parks. Although the survey data indicate that there are small differences in visitor population characteristics and expectations between Rainbow Bridge visitors and those at the other sites studied, the visitors at Rainbow Bridge rated aircraft noise similarly to visitors with similar noise exposures at other sites.   Other study sites with visitor noise exposure due to aircraft similar to Rainbow Bridge include Fairyland Trail at Bryce Canyon National Park and Taylor Creek Trail at Zion National Park. The combined dataset from eight backcountry locations collected in 2011 and 2014 provides a strong basis for dose-response analyses for visitors on backcountry hikes. The dataset also complements the prior dataset from the 1990's encompassing frontcountry overlook and short-hike visitors. Together, the relationships developed can be used to examine the effects of aviation noise on visitor experience.

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1.0 Introduction

The National Park Service (NPS), Natural Sounds and Night Skies Division Federal Aviation Administration (FAA) Western Pacific Region, Office of Special Programs, and the FAA Office of Environment and Energy, and have sponsored a research program to further the understanding of human response to aviation noise in protected natural areas. The foundation of the research program is the collection and analysis of aviation noise dose and corresponding visitor response data in National Parks. This approach is used to understand and quantify human response to aviation noise through mathematical relationships between the noise exposure 'dose' and people's stated judgments about the effect of the exposure on the quality of their experiences, measured through survey instruments (i.e., a dose-response relationship). This research approach has been widely accepted and used for many years within federal transportation noise regulations to determine noise impacts in residential environments (FAA 1985; FRA 2005; FTA 2006; Schultz 1978). In particular, transportation noise dose-response relationships form the basis for FAA guidelines. However, it is recognized that park visitor impacts from transportation sources cannot be based on the dose-response relationships cited by FAA guidelines, as impacts on park visitors are likely different from those in residential areas.

Spurred by the National Parks Overflights Act of 1987 a number of federal agencies including the National Park Service (NPS), Federal Aviation Administration (FAA), and United States Air Force (USAF) initiated studies to collect data and examine the relationship between aircraft overflight noise and park visitor response in frontcountry areas in four National Parks. These studies resulted in the accumulation of a large database of frontcountry (short hike and overlook) noise exposure dose and related visitor response measurements, and dose-response relationships were developed for these data (Anderson 1993; Fleming 1998; Miller 1999).

Beginning in 2008, under a joint research program sponsored by FAA and NPS, a panel of researchers in the areas of acoustics, recreation management, psychology, and social science provided input into a detailed analysis of these frontcountry data. The analysis and resulting dose-response relationships showed differences between overlook and short-hike visitor evaluations of overflight noise and that evaluations were further mediated by the source aircraft type(s), and visitor ratings of the importance of natural quiet, whether they have visited the site before, and whether they visited with children (Anderson 2011).

The panel of researchers also recommended the study of additional sites; specifically backcountry sites with day and overnight use as the highest priority for data needs (Rapoza 2009). During the year 2011, over 4600 visitor surveys and calibrated sound level measurements were collected at seven backcountry sites and one frontcountry cultural/historic site in four National Parks. These data were collected with the goal of understanding response from visitors on hikes in more remote (backcountry) areas, and dose-response relationships for these visitors were developed (Rapoza 2015). Also identified as a research need were sites where the preservation of cultural resources or historic character is of concern. During the 2011 season, only limited amounts of data were collected at cultural/historic sites. In 2014, dose-response data were collected at an additional backcountry hike site with cultural/historic aspects, Rainbow Bridge National Monument (Rainbow Bridge).

This document summarizes the results of the dose-response study conducted at Rainbow Bridge during June 2014. The data collected at Rainbow Bridge are intended to expand the database of information available for backcountry hikes and locations with cultural/historic aspects using the most recent survey instruments and methods. Provided are summaries of the dose measurements and visitor survey information collected. Additionally, these Rainbow Bridge data were combined with the backcountry data collected in 2011 to provide updated dose-response relationships for National Park backcountry visitors on single-day hikes. Together with similar relationships developed for frontcountry sites from data collected in the 1990's, these relationships will help to inform evaluations of aviation noise effects on visitor experience.

2.0   Study Site

Previous dose-response work in the National Parks has shown that visitor response to noise varies depending on the type of site visited and the activities at that site. For example, visitors who stop at scenic overlooks or viewpoints (with associated parking lots, human activity and noise) have different responses to aircraft noise than do visitors who spend 15-45 minutes hiking down a trail away from a trailhead (Anderson 2011). The exact number of 'categories' of visitor response is yet unknown. Researchers have thus far used a number of visit and site characteristics to define a finite set of general categories (referred to as site-types) that may be used to represent the possible range of actual sites. In other words, a site where visitors are hiking in a remote (un-crowded) location with an overnight stay would be one site-type: backcountry overnight hiking/camping. A single location often has attributes which fit into more than one category (short- day- and overnight-hikes can all occur at the same location). Potential site-types may include:

- Viewpoint (Overlook): Locations where average visits are less than 30 minutes. Activities may include viewing scenery or other natural features of interest and participating in interpretive events.
- Short hike: Locations where hikes are 1 mile or less and average visits are generally less than one hour. Activities may include hiking, viewing the natural scenery and participating in interpretive events.
- Frontcountry cultural/historic: Locations where average visits are less than one hour. Activities may include viewing cultural and/or historic points of interest, walking, and participating in interpretive events.
- Day hike: Locations where hikes are greater than 1 mile and average visits are generally between one and eight hours. Activities may include hiking, viewing the natural scenery and participating in interpretive talks.
- Hike: A combination of the short hike and day hike site-types, designating single-day hiking visits of any length.
- Frontcountry overnight: Frontcountry campground visits with overnight stay. Activities may include short hiking, viewing the natural scenery, and camping.
- Backcountry overnight: Locations where average visits are greater than eight hours with an overnight stay at a remote location. Activities may include hiking, viewing the natural scenery, and camping.

The goal of the data collection presented herein was to provide additional information to expand the backcountry data collected in 2011 and to include locations with cultural/historic aspects in order to better understand how the context of a visitor's experience mediates his or her response to aircraft noise.

Rainbow Bridge National Monument is located within the Glen Canyon National Recreation Area (Figure 1), and is accessible by boat on Lake Powell or via a strenuous 13-mile hike from the nearest roadway. Nearly all visitors to Rainbow Bridge arrive by boat on Lake Powell. At the time of data collection (June 28-30, 2014), visitors travelling by boat were required to dock at a point 1.25 miles from the viewing area for Rainbow Bridge, thereby making the round-trip

hike 2.5 miles in length. Because access to the Bridge requires a hike – as opposed to direct access by boat, boat noise from the lake does not reach the Bridge, making it a very quiet location.

Rainbow Bridge is one of the world's largest known natural bridges. In addition to its natural and scenic value, the neighboring American Indian tribes consider Rainbow Bridge sacred. Thus, this site has both scenic and cultural/historic aspects. NPS personnel are available throughout the day to present interpretive talks.
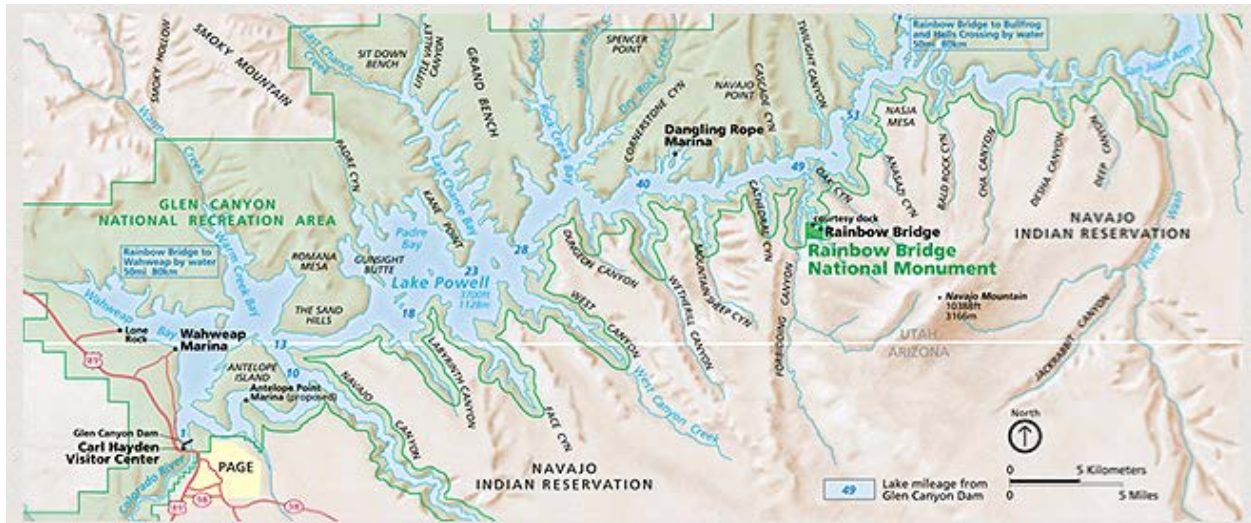
Figure 1. Map showing Glen Canyon National Recreation Area and Rainbow Bridge National Monument.

Survey and acoustic data were collected at Rainbow Bridge during June 28-30, 2014. A single acoustical monitoring system was deployed at Rainbow Bridge, located northeast of the bridge (Figure 2). A team of two experienced sound source loggers was deployed near the system during each measurement day to document the source(s) of audible sounds.

Figure 2. Location of acoustic monitoring system at Rainbow Bridge.

A team of four survey administrators was deployed along the trail leading to the viewing area. On June 28, survey personnel were located approximately halfway along the trail from the boat dock to the viewing area. This site was chosen as it afforded a quiet location to administer surveys away from potential visitor activity noise at the boat dock. However, the extreme heat and lack of sufficient shade ultimately made this location undesirable for survey administration. As a result, visitor surveys were administered in a shaded area at the end of the boat dock on June 29 and 30. This location was approximately 0.25-miles from the boat-tie up area and still some distance from the majority of visitor activity.

Figure 3. Visitor survey area: June 28, 2014.

Figure 4. Visitor survey area: June 29 and June 30, 2014.

3.0   Visitor Surveys

This section describes the visitor survey instruments and survey administration component of the data collection. Survey administration involved a visitor intercept at the start of the visit, tracking of the duration and timing of their visit, and a post-visit intercept to take part in the survey. Time synchronization is crucial in this type of study to accurately correlate noise dose with response data. All sound level measurements, sound source logs, and visitor survey logs were time stamped in synchrony with a master timepiece.

3.1 Survey Instruments

Two visitor survey instruments were utilized at Rainbow Bridge. They are modified versions of dose-response and soundscape study instruments used previously by FAA and NPS, designed to evaluate promising research strategies, while maintaining comparability with past studies. The surveys each contain identical introductory, trip and demographic information sections. They differ in the 'core' sounds section which contains questions on aircraft and non-aircraft sounds and their effect on visitor experiences. While similar in intent, these questions differ in format, phrasing, and the emphasis placed on aircraft noise. These survey instruments are included in Appendix A. The Office of Management and Budget (OMB) approved the information collection request (ICR) (Control #2120-0744) and the survey instruments for this study.

The 'Human response to aviation noise survey version 1' (HR1) is an adaptation of the NPS/FAA/USAF 'Aircraft Overflight Studies Visitor Survey' used in the 1990's frontcountry dose-response research (Anderson 1993; Fleming 1998). It is designed to provide understanding of the effects of aircraft noise on the visitor experience. Respondent ratings of 'annoyance' and 'interference with natural quiet and natural sounds' are collected on a five-point scale (not at all, slightly, moderately, very, extremely).

The 'Human response to aviation noise survey version 2' (HR2) is an adaptation of the NPS 'Understanding and Managing Soundscapes in National Parks: Visitor Use Survey'. It is designed to understand the sounds heard and the visitors' response to these sounds. Respondents are asked to identify the sounds heard during their visit from a list that includes both anthropogenic and natural sources and evaluate these sounds on a nine-point Likert-type scale of pleasing to annoying and acceptable to unacceptable. To provide data directly comparable to the HR1 survey instrument, the HR2 survey includes a question identical to that in the HR1 survey regarding interference with natural quiet and the sounds of nature.

Each survey is designed to assess visitor evaluations of aircraft sounds/noise by different methods, while utilizing three main evaluative dimensions: annoyance, interference with particular visit aspects, and acceptability. The questions are as follows:

> **Annoyance**:
> *During your time at <site>, how much did noise from airplanes, jets, helicopters, or other aircraft bother, disturb, or annoy you?*

Evaluations of annoyance due to aircraft noise are the most widely used measure of aircraft noise impact in most environmental noise studies. The question format is based on recommendations from the International Standards Organization (ISO 15666: 2003).   It is directly comparable to questions in studies performed in the 1990s. This question is included in all surveys, but within-survey placement and rating scales differ between surveys. The HR1 survey uses a five-point scale ranging from 'not at all annoyed' to 'extremely annoyed', while HR2 uses a nine-point scale ranging from 'extremely annoying' to 'extremely pleasing'.

> **Interference with… :**
> *How much did the sounds from aircraft interfere with each of the following aspects of your visit at <site>?*
> - *Enjoyment of the site*
> - *Appreciation of the natural quiet and sounds of nature at the site*
> - *Appreciation of the historical and cultural significance of the site*
> - *Experiencing a feeling of calmness, peace, or tranquility*
> - *Experiencing a sense of adventure or challenge*
> - *Hearing something said during a ranger talk, campfire program, or other ranger-led activity*
> - *Hearing any other performance, talk, or group presentation*

This series of questions measures visitors' subjective impression of the extent to which the sound affected their experiences. The questions use unipolar, negative scales because this is consistent with the general finding that noise interferes with these types of experiences. The questions rely on the visitor's ability to make a causal judgment about the extent to which the noise interferes with an experience. The first three aspects are directly comparable to queries used in the studies performed in the 1990's, while the others are new to this study and intended to address additional visit aspects which are directly related to the cultural/historic site-types within this study.

> **Acceptability**:
> *How acceptable or unacceptable was the sound from aircraft that you heard during your time at <site>?*

Evaluations of the acceptability of aircraft sound are widely used in the normative evaluation framework. Respondents are asked to make judgments using a nine-point response scale ranging from 'very unacceptable' to 'very acceptable'. The positive-negative aspects can help identify a point where conditions turn from acceptable to unacceptable; this point often provides an impact threshold within a normative framework. This question is included in all surveys, but within-survey placement differs.

3.2 Survey Administration Procedures
The survey team consisted of four members who rotated among duties of pre-intercepting visitors at the start of their visit and intercepting visitors at the conclusion of their visit to administer the survey. On June 28, visitors were pre-intercepted and surveyed at the half-way point between the boat dock and the bridge. On June 29 and 30, visitors were pre-intercepted and surveyed at the beginning of the trail /end of the boat dock. Survey administration occurred between the hours of 9 am and 3 pm. However, few visitors arrived before 10 am or after 2 pm. All visitors were pre-intercepted, and those who were at least 18 years old and with whom the interviewers could reasonably communicate in English were invited to participate. At the conclusion of their visit, respondents were provided paper surveys to complete. Survey

personnel rotated through the two survey instruments so that each instrument was administered to an equal number of respondents; visitors within the same group generally received different surveys. Intercept scripts, documented in Appendix C, were prepared and followed to minimize potential surveyor bias.

The survey pre-intercept served two purposes. First, survey personnel were able to recruit survey participants in advance, and accurately note their entry times into the study area. Numbered tickets were given to all participating visitors to ensure that each respondent's visit start and end times were accurately recorded. At the completion of the hike, as the survey team retrieved the numbered tickets from each group, each hiker's ticket number was entered into the survey administration log sheet along with the time. In this way, the log sheets recorded the start and end times of each hiker's visit to the study area (i.e. the period of potential aircraft noise exposure). In addition, each respondent's ticket number was noted on the survey at the beginning of the survey administration, tying the survey data to the respondent's start time and end time.

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4.0 Acoustical Monitoring

Accurate representation of the sound environment experienced by each individual survey respondent is essential to the success of a dose-response study. This was accomplished using a specialized acoustical and meteorological data collection system. A single acoustical monitoring system was deployed at Rainbow Bridge, located to the northeast of the bridge structure and out of sight of visitors. This location was chosen to be representative of the environment experienced by hikers in the area, but out of direct view of visitors hiking along the trail, and in an area free of localized noise sources and/or reflective surfaces. Trained personnel deployed the monitoring system prior to the start of survey administration. Data collection commenced immediately after the deployment of the monitors, and continued without interruption for the entire duration of the study.

This section describes the following:

- Acoustical monitoring system (Section 4.1), which collected:
  - Continuous, one-second, A-weighted sound levels and their associated one-third octave-band un-weighted spectrum from 20 to 20,000 Hz;
  - Continuous digital audio recordings
  - Meteorological: Continuous, one-second wind speed and direction data
- Sound Source identification (Section 4.2)

4.1 Acoustical Monitoring Equipment
The acoustical monitoring systems used are robust, portable, and designed to run outdoors, unattended, continuously for many days without system maintenance. The system can collect continuous one-third-octave band noise measurements and synchronous, full-spectrum digital audio recordings in low-sound-level, outdoor environments.

4.1.1 Microphone System
The G.R.A.S. Model 40AQ pre-polarized microphones used in this study are electret condenser microphones. Being pre-polarized, the microphone functions as a closed system with regard to humidity, thus eliminating the potential for condensation in high humidity situations. Additionally, Larson Davis™ (LD) Model PRM831 preamplifiers were employed at each site. The cable to preamplifier connection is protected by plastic housing, which can contain desiccant cartridges to minimize humidity.

The microphone is protected from precipitation and birds with a LD Model EPS2108 environmental shroud, which consists of a special acoustic foam windscreen outfitted with bird-spikes and a shroud housing desiccant cartridges to provide temperature/ humidity stability. The use of a windscreen also reduces the effects of wind-generated noise at the microphone diaphragm. Such reduction can improve the signal-to-noise ratio of sound measurements.

4.1.2 Sound Level Meter
The microphone system was connected to a LD Model 831 sound level meter / real-time analyzer. The Model 831 SLM was set up with slow exponential time-weighting to continuously measure the overall A-weighted equivalent sound level for each 1-second sample, as well as the Z-weighted (flat or un-weighted) equivalent sound level in each 1/3-octave-band from 12.5 Hz to 20 kHz.

4.1.3 Audio Recorder
Continuous digital audio recordings were collected using a Roland R-05 audio recorder. The AC output of the LD 831 SLM was connected directly to the input of the recorder. WAV format audio files were saved on an SDHC card.

4.1.4 Ultrasonic Weather Sensor
A Vaisala Weather Transmitter Model WXT520 outfitted with bird-spikes was used to measure barometric pressure, humidity, precipitation, temperature, and wind speed and direction. The sensor was set up to sample wind speed and direction at a rate of 4 samples per second and 1-second averaged output. The output of this unit is sent to the LD831.

4.1.5 Other Instrumentation
Three additional pieces of acoustic-support instrumentation were used to support the data collection effort:

- Sound level calibrator - A B&K Model 4231 sound level calibrator was used in the field for establishing and checking the sensitivity of the entire acoustical instrumentation system (i.e., microphone, preamplifier, cables, and SLM). The Model 4231 produces a user-selectable 94-dB sound pressure level at a frequency of 1 kHz.
- Microphone simulator - A microphone simulator was used to establish the electronic noise floor of the entire electrical system absent of the microphone.
- GPS unit - A GPS unit was used to document the exact site location.

4.2 Sound Source Identification
The purpose of sound source identification and logging is to maintain a continuous, timed record of sound source audibility during survey administration to correlate with the measured sound level data. Observers logging in the field can closely match the experience of park visitors. Field observers can take full advantage of human binaural hearing capabilities and identify sound source origin, simultaneous sound sources, and directionality. During survey administration time periods, a team of observers continuously documented all audible sound sources in the vicinity of the acoustical monitoring systems, whether a single source (e.g., wind-in-trees), or multiple, simultaneous sources (e.g., vehicles and aircraft). In this manner, a timed record of audible sounds is created.

Each field observer used a tablet PC running custom-developed software that provided a touch-screen interface to enable simple, rapid input for sound sources and durations. Sounds are categorized in three primary acoustical states: aircraft, human, and natural. Aircraft intrusions include air tour, commercial jet, general aviation, military, and other aircraft sounds. Human sounds can include surface vehicles (roadway vehicles, watercraft, etc.) and voices. Natural sounds can include wind-induced noises, animals and insects. Sounds may also be sub-categorized; sub-categories of aircraft sounds can include, helicopter, fixed-wing propeller aircraft, or commercial jet.

5.0 Data Processing

Three sets of data were collected during each measurement trip: survey, acoustic, and visit time. Each of these datasets required cleaning and pre-processing prior to computation of the noise exposure dose for each respondent and assembly of the final dose-response database.

The survey data consist of:

- The survey response data collected via paper questionnaires.
- The pre-intercept and survey-intercept log sheets. The pre-intercept log sheets contain the visit start time and ticket numbers, number of adults and children in the visitor group, refusals, and any hand-written notes. The survey log sheets contain visit end time and ticket numbers.

The acoustic data consist of:

- Continuous, one-second, A-weighted sound levels and their associated one-third octave-band, un-weighted spectra from 20 to 20,000 Hz.
- Continuous digital audio recordings.
- Meteorological data in the form of continuous, one-second wind speed and direction data.
- Observer Logs from field observers. These files contain a second-by-second record of audible sound sources.

5.1 Survey Data

Park visitor survey data collected via paper surveys were coded and merged into a master survey database. All surveys were checked for completeness and survey notes were inspected to determine if any respondents were noted as invalid (i.e., under the age of 18, worked for NPS, wearing personal audio device during hike, etc.), or of any other inconsistencies were observed (i.e., talking to others during surveys, bad weather, wind, thunder, or other loud noises). Twenty-two of the 177 respondents from the Rainbow Bridge survey effort were identified as invalid and removed from the final dataset.

For each visitor, the pre-intercept date and time, destination, group size, survey date and time and other hand-noted information from the survey intercept logs were entered into the survey database. This information was assigned to the correct visitor by cross-correlating the ticket numbers noted both in the survey logs and on the paper surveys.

5.2 Acoustic Data

Raw sound level monitor data from the LD831 contain both acoustical and meteorological data. These files were translated into ASCII text files; each line of the text file represents a 1-second data sample containing the date, time, equipment ID, battery voltage, internal temperature, 1-second averaged wind speed and wind direction, Z-weighted (flat or no weighting) L_{eq}, A-weighted L_{eq}, and Z-weighted spectral data (12.5 – 20,000 Hz).

The text files containing the sound level monitor data were examined for errors and cleaned. Prior to detailed data reduction and analysis, several quality assurance filters, checks, and adjustments were applied to the acoustic data to ensure that any questionable data were

identified and that only 'good' data were analyzed. The list of filters used to identify 'bad' or questionable data include the following:

- Data collected during potential system malfunction (battery problems, temperature limits, anemometer error, etc.);
- Data with associated 1-second average wind speeds greater than 5 m/s, indicating measurement system noise resulting from high-wind conditions;[*]
- Data with associated 1-second Z-weighted sound levels exceeding the LD Model 831 SLM's instrumentation noise "ceiling level" for the gain setting of the instrument ;
- Data with associated ⅓-octave frequency band data that do not deviate by at least one standard deviation (dB) across all 33 bands, typically represented by no variations in sound levels within the bands, which indicates a problem with the LD831 sample;
- Data that were measured during time periods that may be potentially contaminated by field personnel handling instrumentation during the calibration process, observer logging, and/or entering/leaving the site area.

The adjustments applied to the acoustic data include:

- Calibration. These adjustments accounted for calibration drift as determined by measuring a calibration signal at the start and end of each data collection period.
- Microphone frequency response. These adjustments accounted for frequency response biases of the microphone and were provided by a microphone calibration facility.
- Windscreen frequency response. These adjustments accounted for frequency response effects of the windscreen.
- Noise floor. These adjustments accounted for contamination effects of the system noise floor. Application of the adjustments provide for more accurate estimation of the true ambient sound levels without being limited by the equipment's electrical noise floor.

The one-second sound level time history data resulting from this process for each monitor are used as input to the noise exposure dose computation software described in Section 5.4.

5.3 Sound Source Data

Observers continuously documented *all* audible sound sources, whether a single source (e.g., wind-in-trees), or multiple, simultaneous sources (e.g., wind-in-trees, people talking, and an aircraft overflight). As a result, at any given time, numerous sound sources could have been recorded, all of which contributed to the overall sound level at that time. The sound source logs were converted to a hierarchical structure for comparability with previous studies. In the hierarchy, helicopter overflights are given the highest priority, followed by propeller-driven aircraft overflights, commercial jet overflights, non-aircraft human sounds (i.e., autos or voices), and lastly natural sounds. The hierarchal sound source logs are used as input to the noise exposure dose computation software described in Section 5.4.

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[*] Available data (HighWindCutoff) suggests that there is a high probability of microphone-induced distortion above this wind speed threshold.

5.4 Noise Exposure Dose Computation

Specially-developed computer software was used to read the 1-second A-weighted sound-level records ($L_{Aeq,1s}$), 1-second one-third octave band sound level records, and 1-second sound-source designation, combined with visit time information to compute the corresponding aircraft noise exposure doses.

The initial step in this process was to synchronize the sound level time history data with the sound source logs to form a second-by-second database of sound levels and associated sound source. For each visit period, the software then computes several basic pieces of duration and aircraft noise exposure information, from which numerous acoustical descriptors can be computed to describe the noise exposure dose. This basic information includes:

1) T_{resp}: The duration of the respondent's visit in the study area;

2) T_{AudAC}: The duration during which aircraft sounds were audible (i.e., the total number of 1-second records which were identified with an aircraft source);

3) T_{AC}: The number of 1-second records of 'good' aircraft sound data (i.e., data not removed due to the various filters including high winds);

4) $L_{AE,}$: The sound exposure level due to aircraft sounds, computed using only 'good' data, where

$$L_{AE,} = 10 * \log 10 \ (\Sigma 10^{(LAeq,1s/10)}); \text{ and}$$

5) L_{ASmxC}: The maximum A-weighted sound level (1-second record) from aircraft during the visit.

This information was computed in aggregate for all aircraft (regardless of type), and also in aircraft-type components of helicopters, fixed-wing propeller aircraft, and high-altitude jet aircraft. These aircraft-type components are both informative and necessary for computation of metrics in the dose-response regression model.

Similarly, basic sound level metrics for non-aircraft sounds were computed for each visit period:

1) $L_{AE,Hum}$: The sound exposure level due to non-aircraft human sounds;

2) T_{Hum}: The total duration of human sounds[†];

3) $L_{AE,Nat,}$: The total sound energy of natural sounds;

4) T_{Nat}: The total duration of natural sounds[‡];

[†] This corresponds to time periods when non-aircraft human sounds are audible. Due to the sound source hierarchy, natural sounds are likely present during these periods.
[‡] This corresponds to time periods when only natural sounds are audible, excluding all human and mechanical sounds.

5) *Natural Ambient L$_{50}$*: The 50-percentile exceeded sound level of natural ambient sounds. A statistical descriptor describing the sound level exceed 50 percent of a specific time period; and

6) *Natural Ambient L$_{90}$*: The 90-percentile exceeded sound level of natural ambient sounds. A statistical descriptor describing the sound level exceeded 90 percent of a specific time period.

Additional diagnostic information was also summarized and reported for each visit period: number of records which were filtered (removed) due to high winds and number of records where corresponding sound source information was not available. Respondents where more than 50% of the available data were removed due to any combination of these issues are not included in the final dose-response pool. No data exceed this limit at Rainbow Bridge.

These basic dose components were used within analysis software to compute additional noise exposure dose metrics of interest:

- *L$_{Aeq,Tresp}$*: The equivalent sound level due to aircraft, normalized to the respondent's visit duration

- $L_{Aeq,Tresp} = L_{AE} - 10 * \log_{10}(T_{resp})$

- *L$_{Aeq,TAC}$*: The equivalent sound level due to aircraft, normalized to the duration during which aircraft sounds were audible

- *%TAud:* Percent time aircraft are audible

- $\%TAud_{AC} = 100 * (T_{AC} / T_{resp})$

- %Energy$_{Heli}$ (P$_{EnHelos}$): The portion of the sound energy forming the basis for L$_{Aeq,Tresp}$ which is contributed by helicopters

- %Energy$_{Prop}$ (P$_{en,Props}$): The portion of the sound energy forming the basis for L$_{Aeq,Tresp}$ which is contributed by propeller aircraft.

6.0 Summary of Survey and Visit Data Collected

The result of the data cleaning pre-processing is a master database of noise exposure and survey response information, with one record for each respondent. In total, 177 surveys were collected at Rainbow Bridge. These data add to the database of over 4,600 completed visitor surveys and associated acoustic dose measurements collected in 2011. This database is the foundation for the results and analyses presented in Sections 7 and 8. Table 1 summarizes the data collection locations, their site-type classification and the number of completed surveys at each location. Note that at Rainbow Bridge, the 177 surveys were split among two survey-types, while at all other sites the surveys were split among three survey-types.

Table 1. Summary of 2011/2014 survey data collected

Park	Site	Hike	Overnight Hike	View-point	Total
Rainbow Bridge	Rainbow Bridge	177			177
Grand Canyon	Hermit Trail	449	135		584
Grand Canyon	Grandview Trail	291	126		417
Grand Canyon	Tusayan Ruins			374	374
Zion	Taylor Creek	453			453
Zion	West Rim Trail	182	127		309
Bryce Canyon	Fairyland Trail	1102			1102
Glacier	Hidden Lake Trail	516			516
Glacier	Sperry Trail	540	345		885
	Total	2793	345	374	4817

Section 6.1 presents summary results for the survey collection and comparisons among sites of select survey questions. Section 6.2 summarizes the visit information obtained from survey logs. Statistical summaries for all survey items by study site are presented in Appendix C.

6.1 Survey Response Data Summary

Each survey contained a number of key questions which have previously been shown to be important predictors within the dose-response relationships of both frontcountry and backcountry visitors (Anderson 2011; Rapoza 2015). Summaries of responses to these questions can provide understanding of some of the variation in visitor response which may occur due to differences in population characteristics among sites and between site types. This variation in response can be accounted for through the inclusion of these characteristics as mediator variables within the dose-response models developed. The responses to the key questions that have been shown to influence visitor response to noise are summarized below. This summary of the survey responses includes data from all of the available surveys, sites and site-types.

Personal expectations, motivations and past experiences regarding noise,[§] sounds and the soundscape can affect visitor response to noise (Tarrant 1995). In relationships developed from both the backcountry and frontcountry dose-response data, these values were at least partially captured in ratings of the *importance of natural quiet* and/or *importance of calmness, peace or tranquility*.[**] Visitors who rate these values as very or extremely important also report *annoyance* and/or *interference with natural quiet* due to aircraft noise in greater numbers than those who place less value on these factors. An additional question, intended to capture the values that drive interest in cultural and historic sites, asked about the *importance of history and cultural significance.*

Table 2 and Figure 5 summarize responses to these questions: Table 2 summarizes the average ratings by site-type for the 1990's, 2011 and 2014 datasets, while Figure 5 shows ratings by site for the 2011 and 2014 data. In this figure and throughout much of this document, sites and site-types are color-coded according to the following scheme: blue designates sites with day-and overnight hike options, green for sites with only dayhike options, and purple for cultural/historic sites. The data in Table 2 indicate that fewer visitors at Rainbow Bridge rate *natural quiet* very or extremely important than the visitors surveyed in 2011, but similar proportions rate *calmness, peace or tranquility* very or extremely important. Additionally, the majority of (76%) Rainbow Bridge visitors rate the *history and cultural* aspects of the location very or extremely important.

[§] Noise is defined as an unwanted or extraneous sound. In the majority of contexts in this document, sounds from aircraft are referred to as "noise."

[**] Shortened references to survey questions (response and mediator variables) are noted in italics throughout this report.

Table 2. Percentage of respondents rating certain visit aspects very or extremely important. Percentages are shown by site-type.

Visit aspect	Rainbow Bridge (2014)	Backcountry (day- and overnight hikes) (2011[††])	Frontcountry Viewpoint (cultural /historic) (2011[‡‡])	Frontcountry Short Hikes (1990's[§§])	Frontcountry Viewpoints (Scenic) (1990's[***])
Natural quiet	73%	84%	61%	64%	63%
Calmness, peace and tranquility	75%	79%	56%	NA	NA
History and cultural significance	76%	38%	82%	53%	47%

[††] Seven sites at four parks

[‡‡] One site at one park

[§§] Four sites at four parks

[***] Six sites at two parks
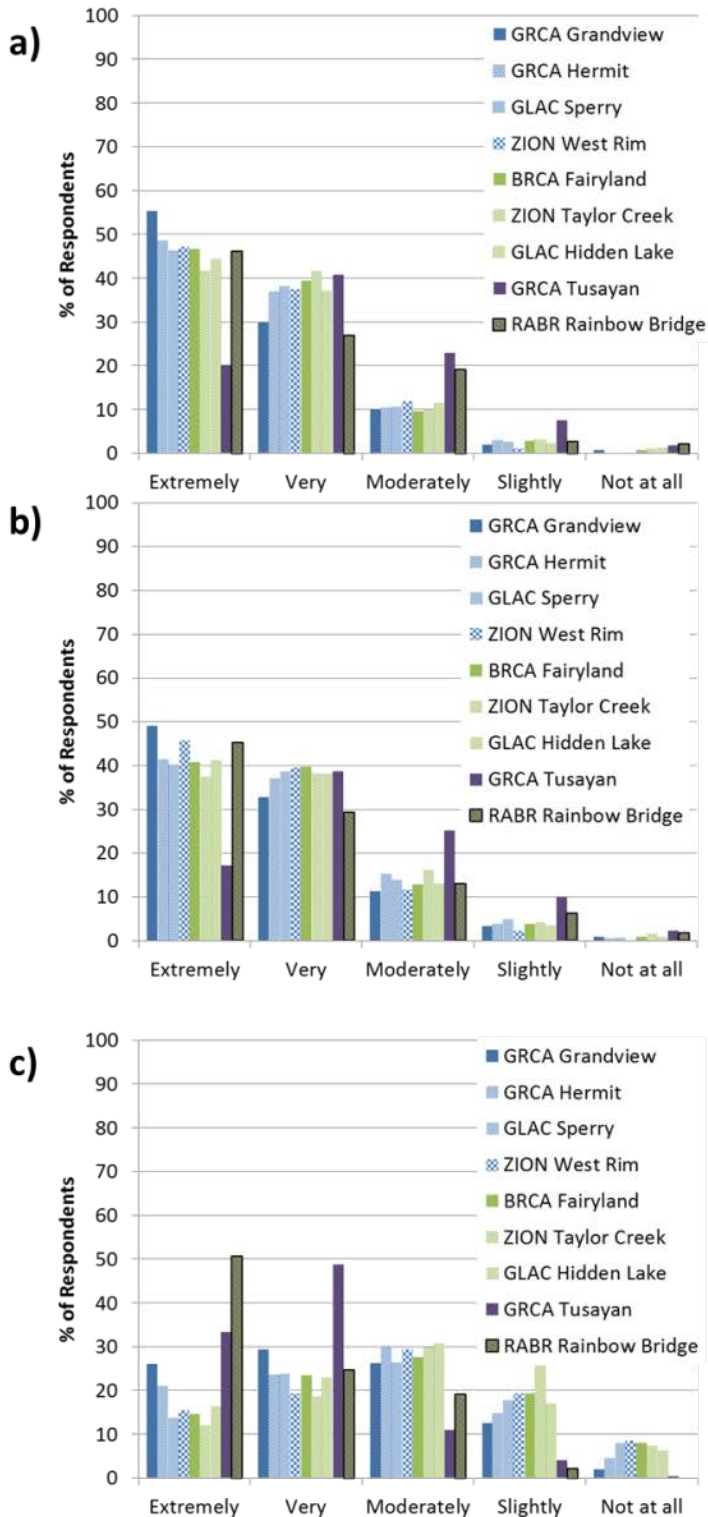
In these graphics (left) and throughout much of this document, sites and site-types are color-coded according to the following scheme: blue designates sites with day-and overnight hike options, green for sites with only dayhike options, and purple for cultural/historic sites.

Figure 5. Percentage of respondents providing a given answer to: 'How important was it that this visit to <site> provide you with the opportunity to a) enjoy the natural quiet and sounds of nature? b) experience a feeling of calmness, peace, or tranquility? and c) to appreciate the history and cultural significance of the site?'

Previous analyses also showed that the visitor's familiarity with the site can affect visitor response to noise exposure, as those who had previously visited a location were more sensitive to aircraft noise (Anderson 2011; Rapoza 2015). At Rainbow Bridge 46% were repeat visitors to the site, compared to the 13% who were repeat visitors within the 2011 dataset (Figure 6a).

The presence of children in the visitor's group can affect visitor response to noise exposure; in previous backcountry and frontcountry analyses, visitors without children reported greater annoyance and/or interference due to aircraft noise than those with children (Anderson 2011; Rapoza 2015). At Rainbow Bridge, 56% of visitor groups contained children, compared to the 19% of visitor groups containing children within the 2011 dataset (Figure 6b).

Lastly, participation in specific activities can affect response; in the previous backcountry analyses, visitors participating in bird-watching or attending an interpretive talk were more sensitive to aircraft noise (Rapoza 2015). At Rainbow Bridge, 17% of visitors reported watching birds and 43% attended an interpretive talk, compared to the 36% of visitors who reported watching birds and 3% who attended an interpretive talk within the 2011 dataset.

Relationships developed from both the backcountry and frontcountry datasets show that these visitor characteristics play a role in explaining a portion of the variability among individual visitors' responses to noise exposure. The survey data indicate that there are small differences in visitor population characteristics and expectations between Rainbow Bridge visitors and those at the sites studied in 2011. The population at Rainbow Bridge had greater numbers of repeat visitors and visitors who participated in interpretive talks, both of which would lead to predictions of increased sensitivity to aircraft noise compared to those at the 2011 sites. However, the population at Rainbow Bridge also had fewer adult-only groups and visitors who participated in bird watching, traits which would lead to predictions of decreased sensitivity to aircraft noise compared to those at the 2011 sites. As a result, the visitor population at Rainbow Bridge is predicted to rate aircraft noise similarly to visitor populations with similar noise exposures at other backcountry sites.
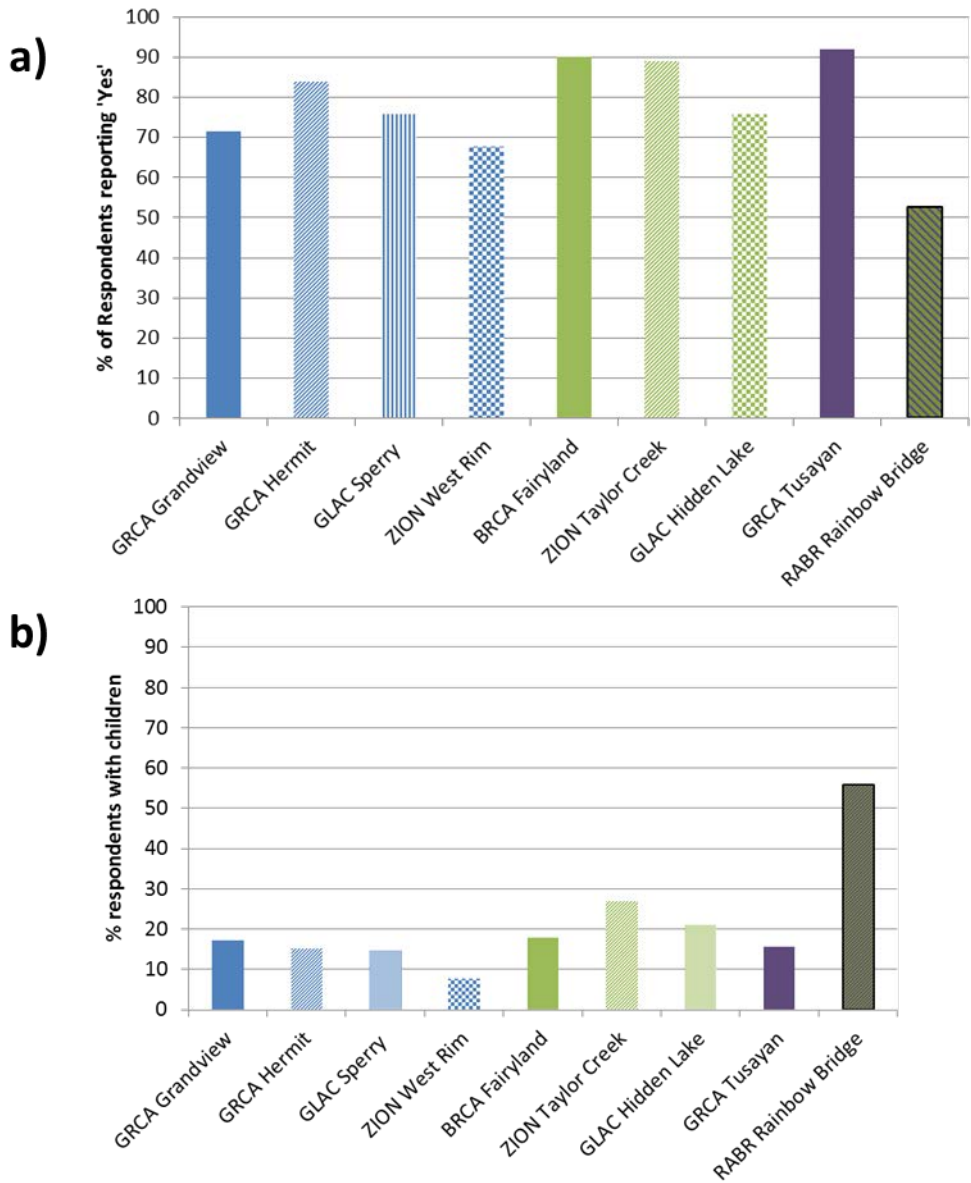
Figure 6. Percentage of respondents providing a positive response to: a) Is this your first visit to <site>? and b) How many children are in your personal group (spouse, family, friends) on this visit to <site>? Responses converted to yes/no children present.
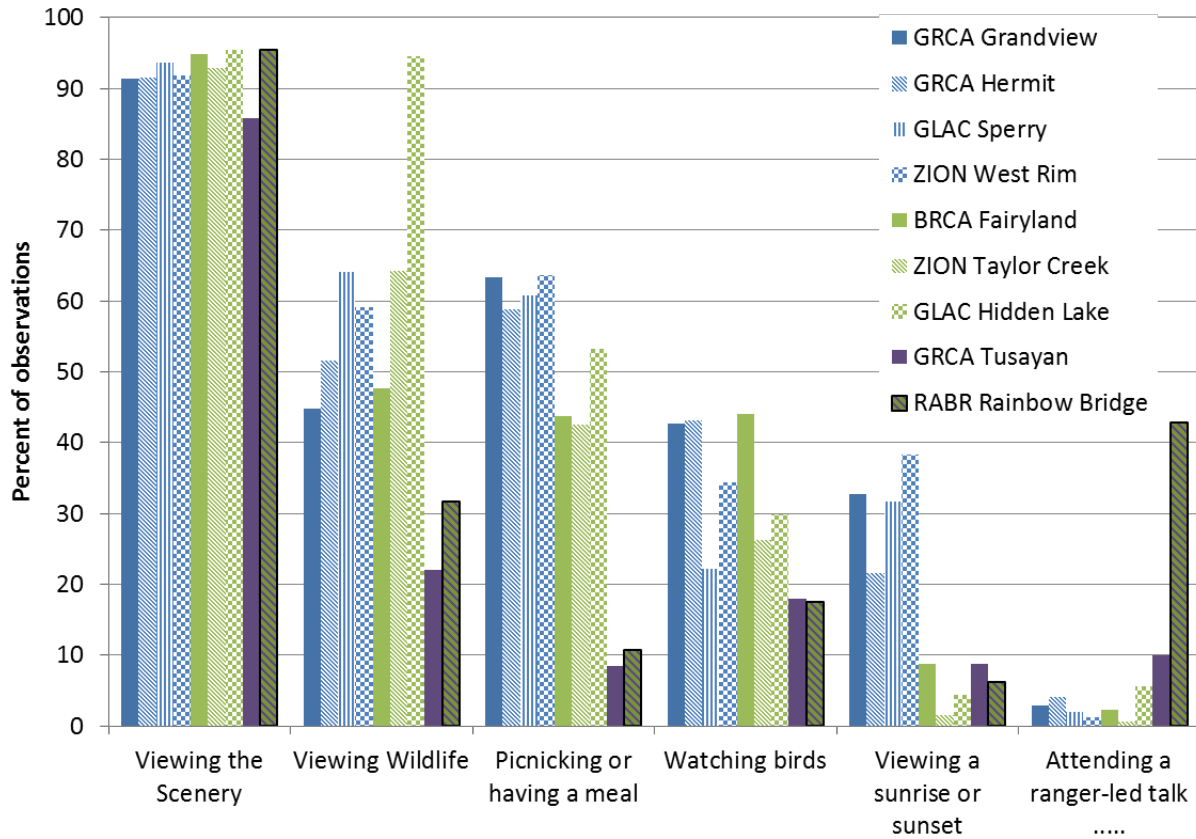
Figure 7. Percentage of respondents reporting participation in specific activities during the visit.

6.2 Visit Data Summary

Calculation of an accurate noise exposure dose for each visitor requires knowledge of the temporal (visit start and end times) and spatial characteristics of each visit. The duration of each visit is also used to define the "site-type" categorical variable. Table 3 shows the average visit duration at each trail. At Rainbow Bridge, the average visit duration was 58 minutes.

Table 3. Visit duration statistics

Site	Site Type	Average Duration	Minimum Duration	Maximum Duration
Rainbow Bridge	Short and Day Hike	1 hour	12 minutes	1.7 Hours
Grand Canyon – Hermit	Short and Day Hike	3.7 Hours	20 minutes	9.2 Hours
Grand Canyon - Grandview	Short and Day Hike	3.5 Hours	7 minutes	8.8 Hours
Bryce Canyon - Fairyland	Short and Day Hike	2.4 Hours	16 minutes	9.2 Hours
Zion - West Rim	Short and Day Hike	3.6 Hours	49 minutes	8.2 Hours
Zion - Taylor Creek	Short and Day Hike	3.1 Hours	42 minutes	5.8 Hours
Glacier - Sperry	Short and Day Hike	3.7 Hours	35 minutes	8.4 Hours
Glacier - Hidden Lake	Short and Day Hike	2.6 Hours	40 minutes	11.0 Hours
Grand Canyon – Hermit	Overnight	2.5 Days	1.0 Day	4.4 Days
Grand Canyon - Grandview	Overnight	2.3 Days	0.9 Days	4.2 Days
Zion - West Rim	Overnight	1.2 Days	0.7 Days	3.3 Days
Glacier - Sperry	Overnight	1.7 Days	0.7 Days	4.2 Days

Note that for the 2011 analysis of the backcountry survey data, the dose-response relationships developed were based on data for backcountry 'dayhike' (> 60 minutes) visitors only, as limited observations were available for short and overnight hikes. For the updated analysis presented is this report, data from sites categorized as backcountry 'shorthike' and 'dayhike' site-types were combined into a single site-type designated as backcountry 'hike'. This approach is supported by results from the prior analyses showing that visit duration did not affect visitor response within the backcountry dayhike category. Furthermore, the effects of visit duration on visitor responses with the combined 'hike' dataset were extensively tested and significant relationships were not found.

7.0 Summary of Acoustic Data Collected

Select noise exposure dose and ambient sound level information (derived from in-situ sound level measurements) for each survey respondent is summarized in this section. Summaries are presented by site to highlight differences in noise exposure and soundscape conditions between these locations, with the Rainbow Bridge data presented at the top. Graphics depict aggregated, summary statistics for all surveyed visitors in the dose-response pool. In general, the sound exposure due to aircraft (L_{AE}, Figure 8) at Rainbow Bridge was similar to other locations such as Fairyland, Taylor Creek and Sperry Trails and the Tusayan Ruins site. The sound exposure level due to aircraft at Rainbow Bridge ranged from 52.0 to 78.9 dBA and averaged 65.7 dBA. Compared to other dose-response measures, the maximum sound levels (L_{Asmx}, Figure 9) experienced by park visitors had the greatest variation within and among sites. The maximum sound levels at Rainbow Bridge ranged from 36.6 to 63.8 dBA, averaging 51.3 dBA for the surveyed visitors. The percent of time that aircraft were audible (%TAud, Figure 10) at Rainbow Bridge ranged from 10.2 to 48.7%, averaging 23.8%. This is similar to the Hidden Lake, Fairyland, and Taylor Creek sites. The median A-weighted natural ambient sound levels (L_{50}, Figure 13) show variation both within and between sites. At Rainbow Bridge, the median level of ambient sounds for respondents are among the quietest of the entire study, averaging 22.7 dBA and ranging from 20.6 to 27.1 dBA. These levels are similar to other sites without nearby water and vegetation such as those in Grand Canyon and Zion National Parks. The natural ambient sound levels at sites nearby streams and waterfalls, such as those at Glacier, are higher.
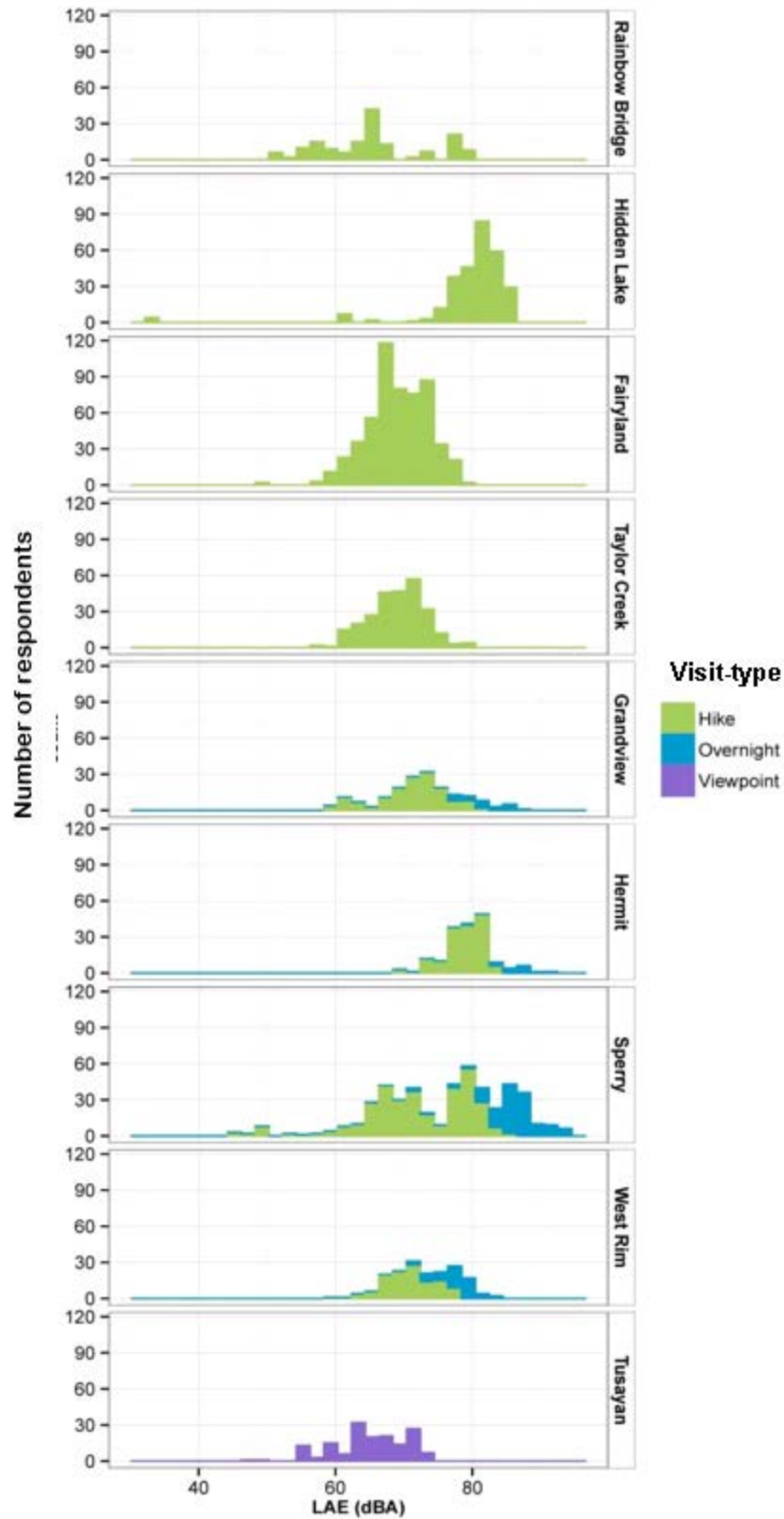
Figure 8. Sound exposure level due to aircraft (L$_{AE}$) over the visit duration
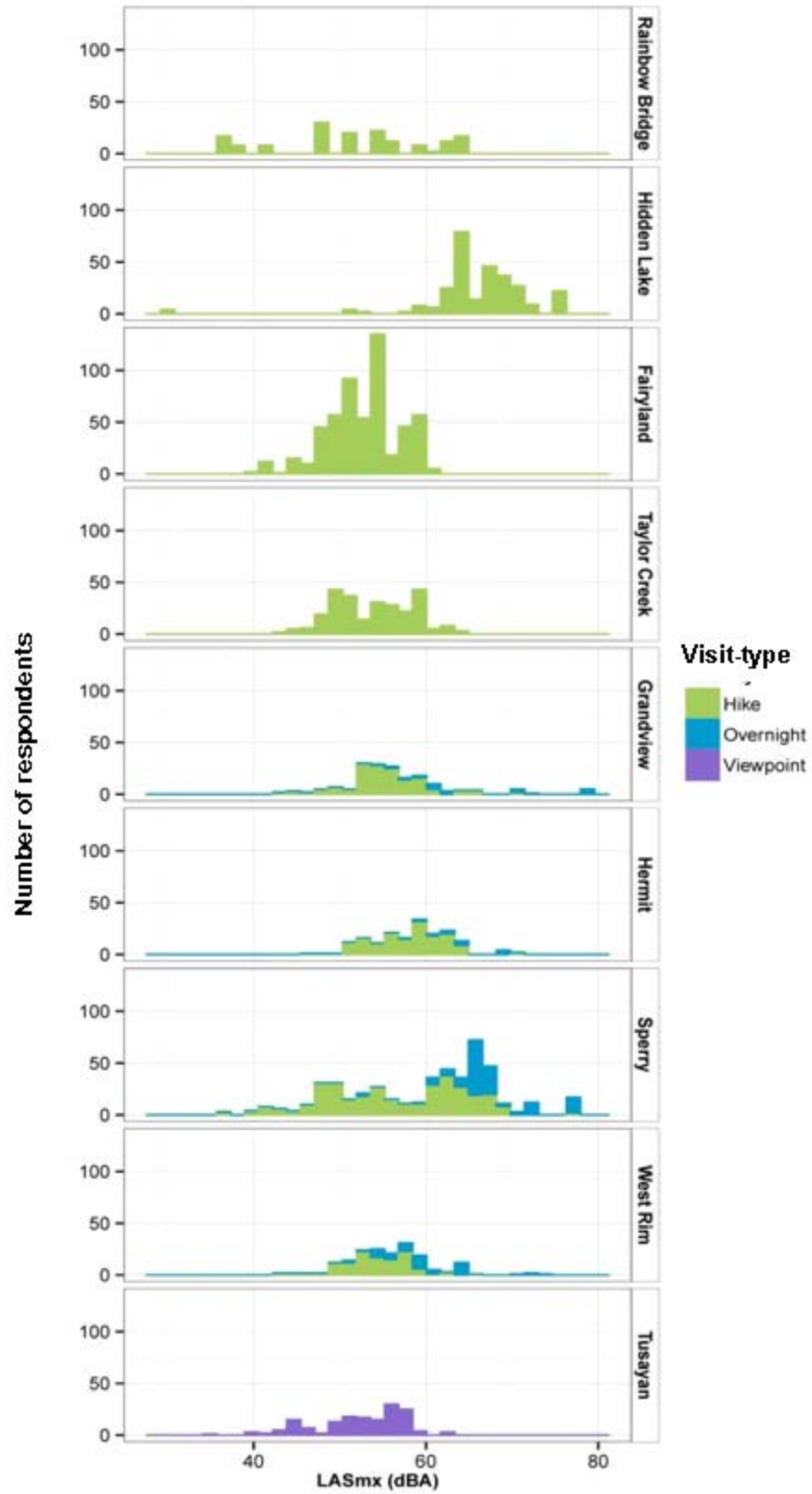
Figure 9. Maximum sound level (L$_{Asmx}$) over the visit duration
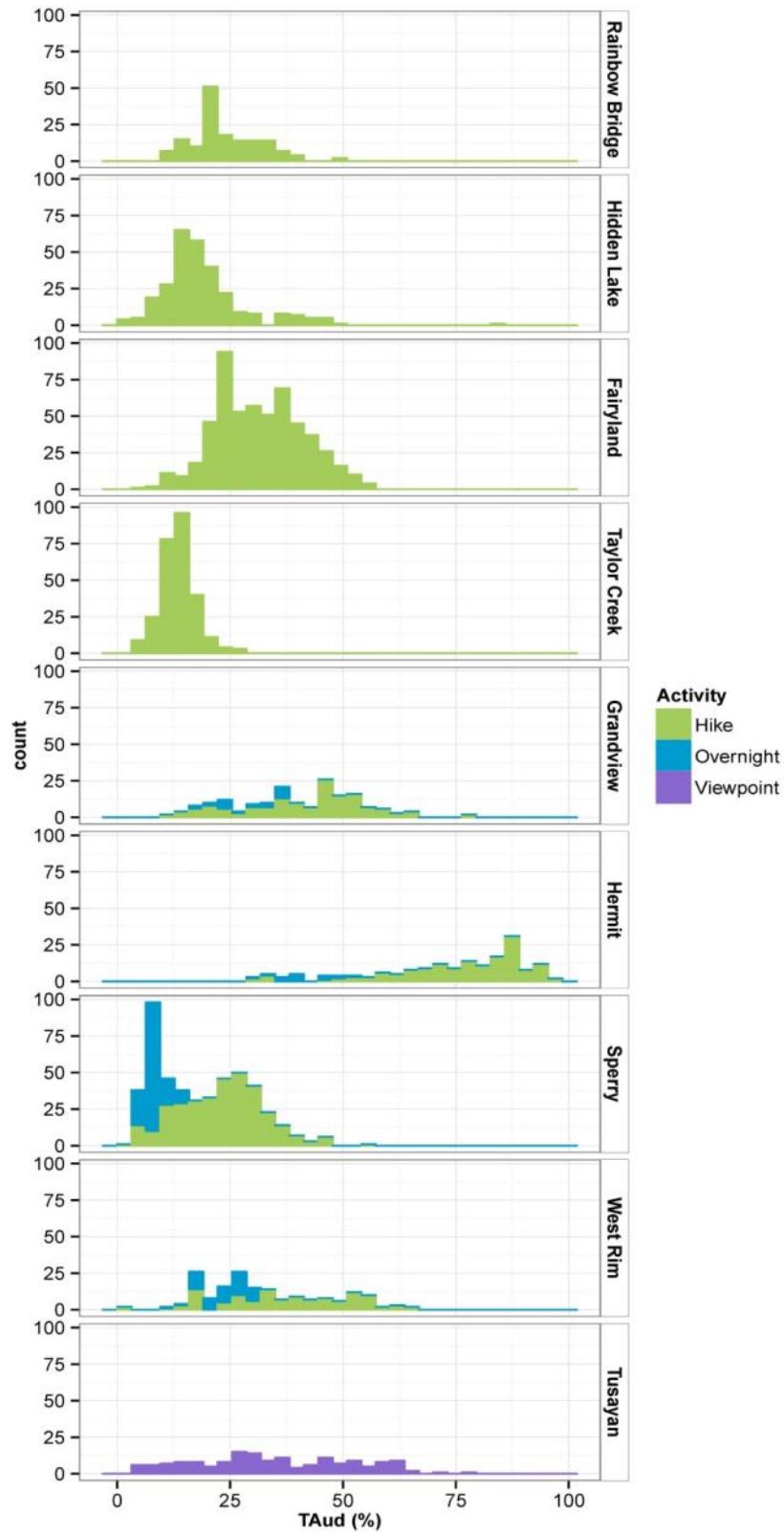
Figure 10. Percent time that aircraft are audible (%TAud) over the visit duration
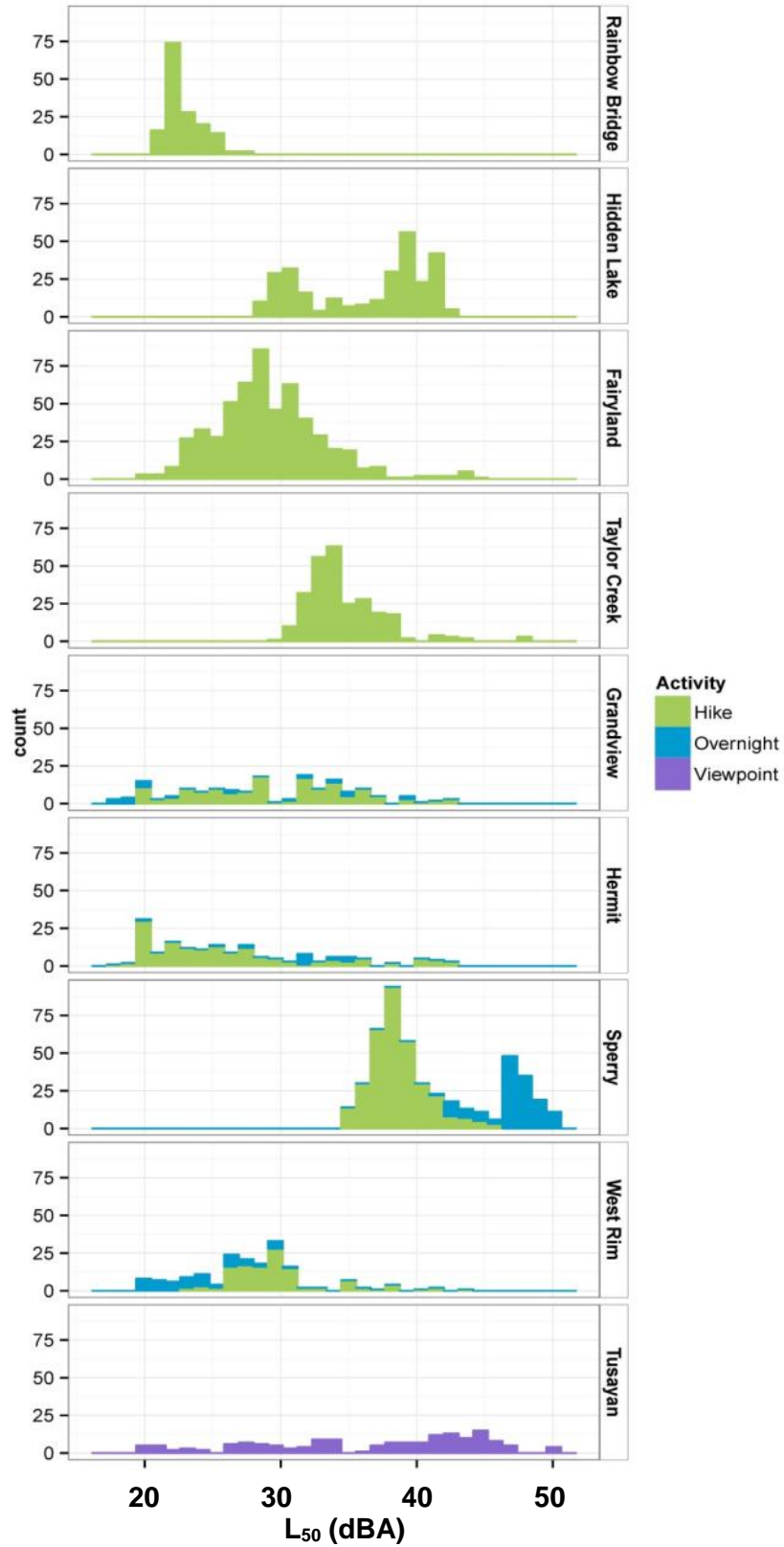
Figure 11. Histogram of Natural Ambient (L_{50}) over the visit duration

Presented next are summaries of the aircraft-type specific A-weighted noise exposure dose components calculated for each visitor, with visitors grouped according to both site and site-type. A-weighted noise exposure is shown separately for helicopters (helos), propeller aircraft (props) and high-altitude jets (jets). Aircraft-type A-weighted noise exposure metric include sound exposure level due to aircraft (L_{AE}, Figure 12), percent time audible (%TAud, Figure 13), and maximum sound level ($L_{ASmx,}$ Figure 14). These graphics show that the noise exposures at Rainbow Bridge, Fairyland Trail, Taylor Creek Trail, and West Rim Trail sites include contributions from both propeller aircraft and high-altitude jets, while the Hermit Trail, Sperry Trail, Hidden Lake Trail, Grandview Trail, and Tusayan Ruins sites also included significant contributions from helicopters
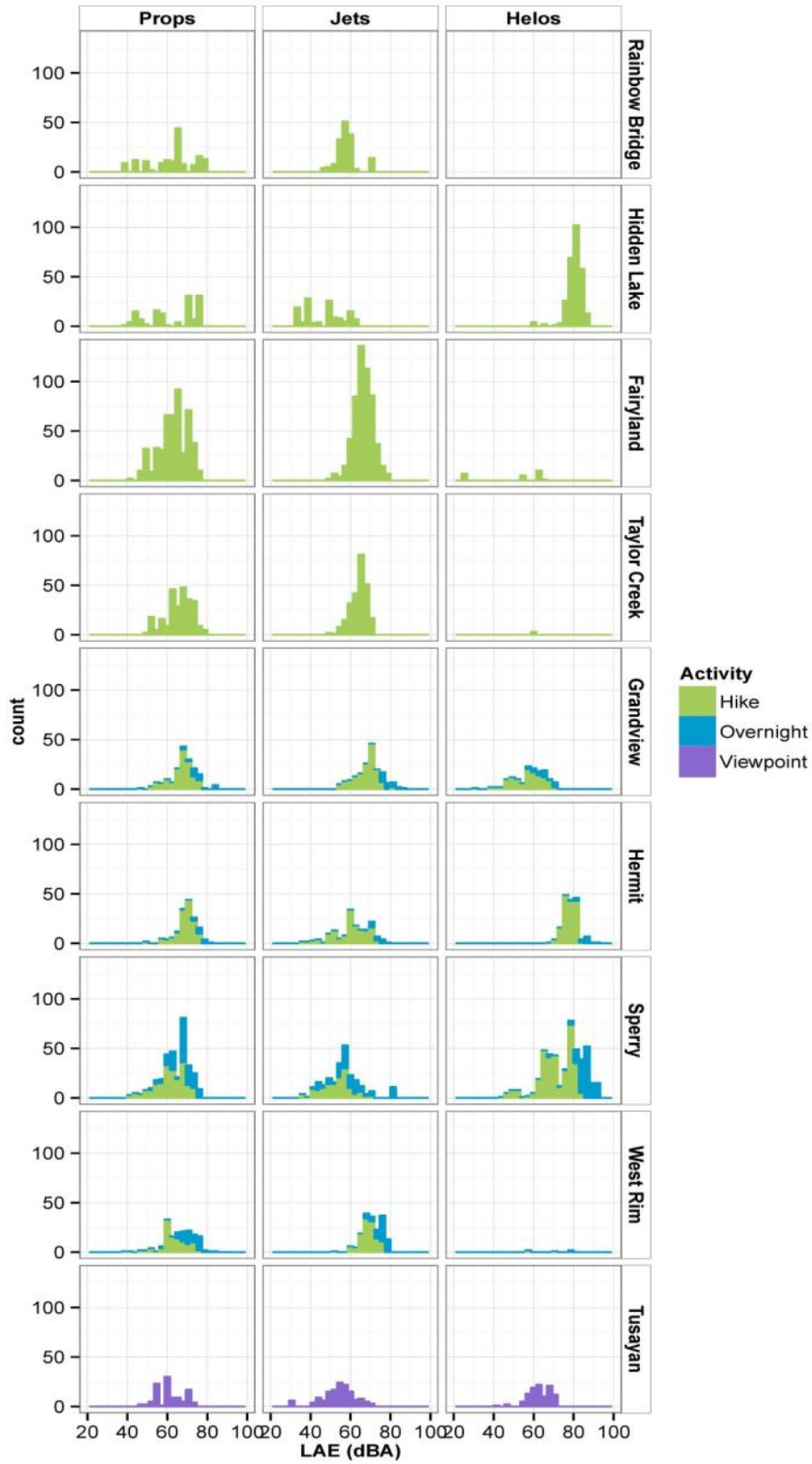
Figure 12. Histogram of sound exposure level (L$_{AE}$) over the visit duration, grouped by aircraft type.
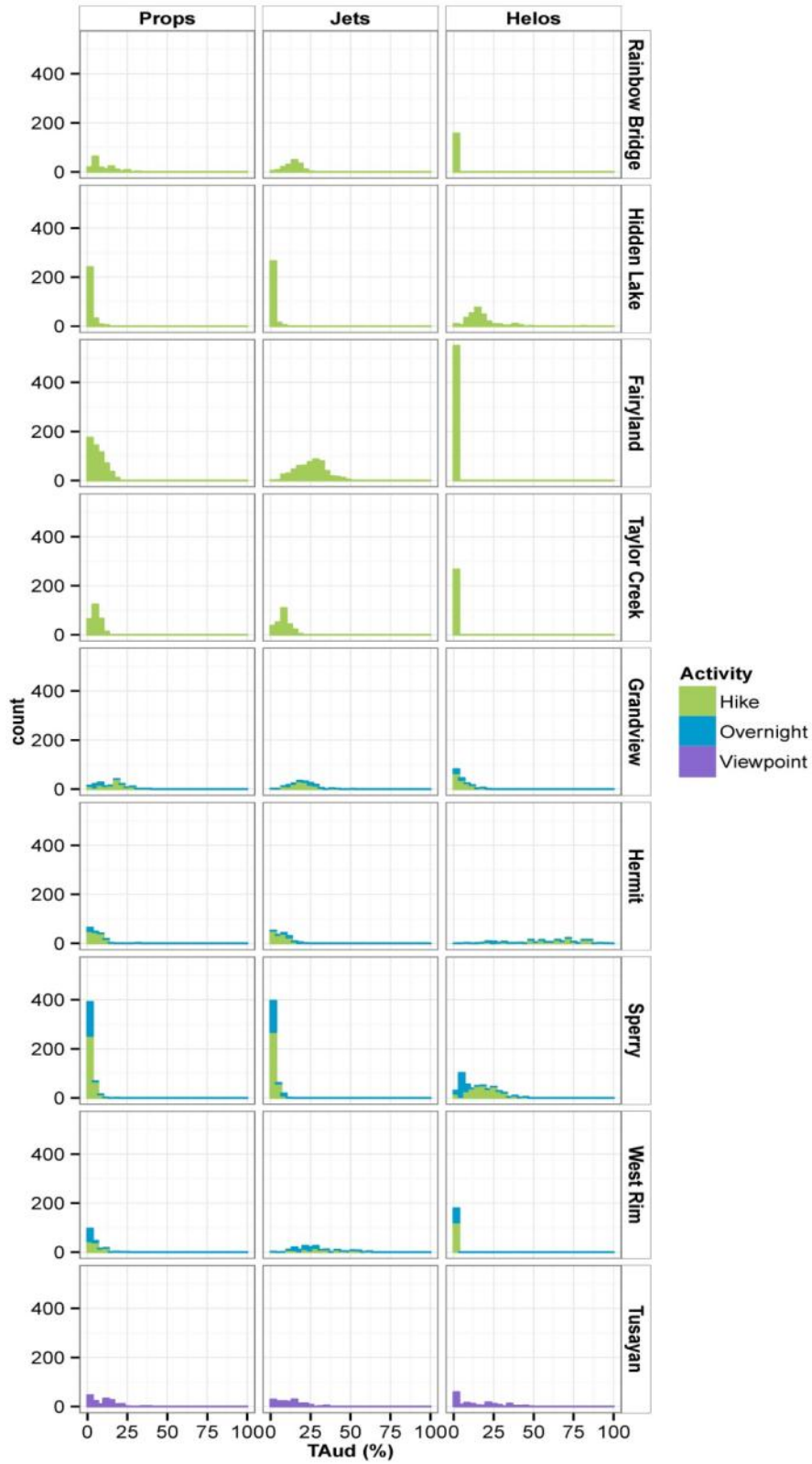
Figure 13. Histogram of percent time audible of each aircraft type (%TAud) over the visit duration
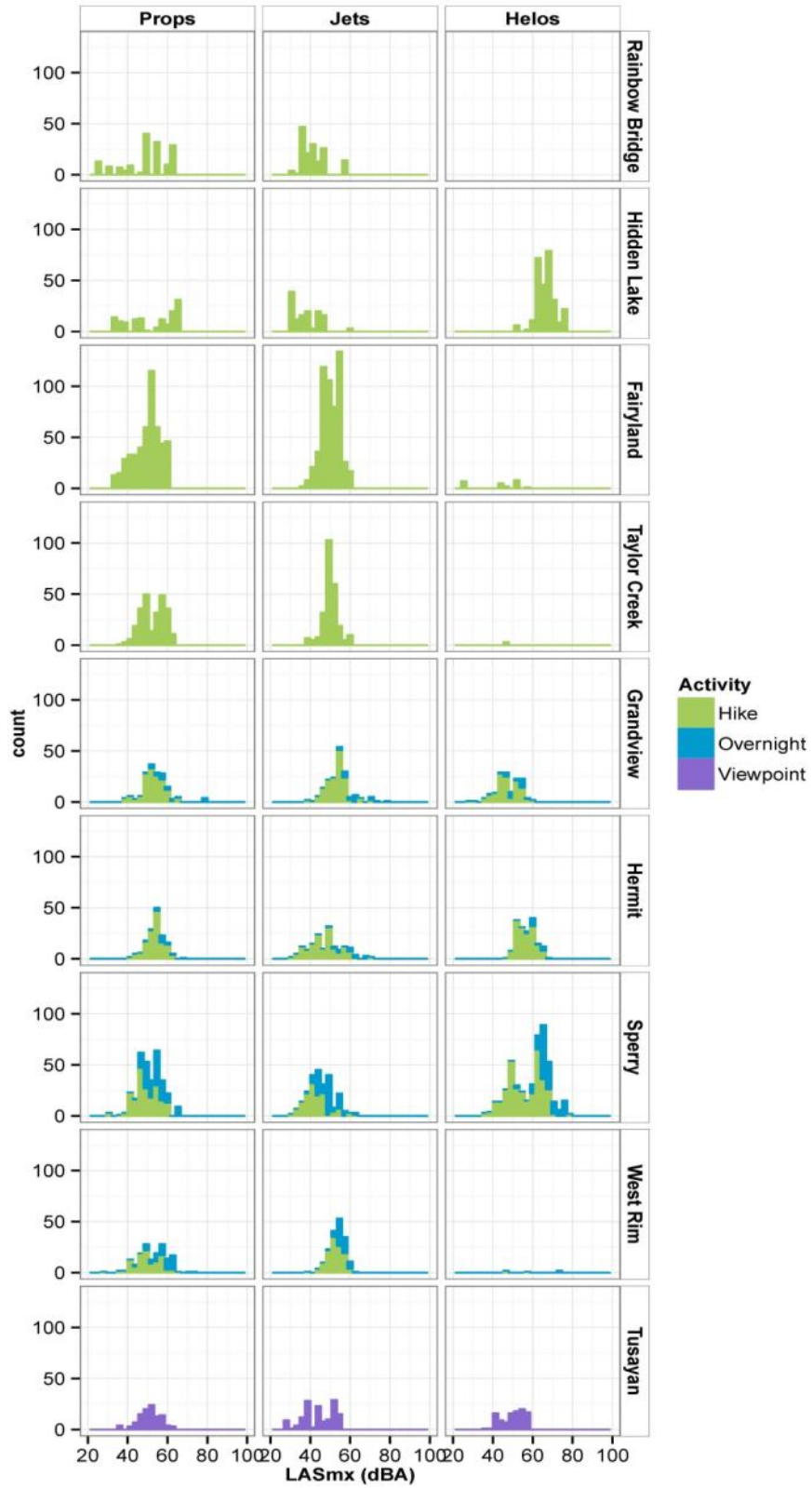
Figure 14. Histogram of maximum sound level of each aircraft type (L$_{ASmx}$) over the visit duration.

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8.0 Analysis

The following section presents the methods and results for the analysis of visitor response data collected at Rainbow Bridge in 2014. As the average visit length at Rainbow Bridge was less than 60 minutes, the criteria used to define the 'dayhike' site-type thus far would not apply to the majority of the Rainbow Bridge data. Therefore, for analyses of these data, the 'dayhike' and 'shorthike' backcountry data collected in 2011 were combined to create a single 'hike' site-type, defined as all single-day backcountry visits of any length. This 'hike' dataset from 2011 includes 222 'shorthike' surveys which were previously excluded from the 'dayhike' analysis (Rapoza 2015). Analysis of the 'hike' dataset also excluded the audio clip (AC) survey data, as the AC survey instrument was not used at Rainbow Bridge. Dose-response models were fit to the data, following protocols developed for the analysis of 2011 'dayhike' data and described below. The updated backcountry 'hike' models were used to predict the response of visitors to aircraft noise at Rainbow Bridge for each dichotomization of the *annoy* and *interfere* responses (Section 8.1). The 2014 Rainbow Bridge data were then combined with the 2011 'hike' data (single-day backcountry visits of any length), and dose-response models were fit to the combined 2011/2014 data (Section 8.2). The analysis process used to identify the best dose-response models for the complete 2011 and 2014 'hike' data is described in detail in section 8.2.

The two response variables that were used to develop the prior frontcountry and backcountry models were selected for analysis:

1. Annoyance (*Annoy*): (HR1 and audio clip) During your time at [site], how much did noise from airplanes, jets, helicopters, or other aircraft bother, disturb, or annoy you? (5-point response scale of: Not at all, slightly, moderately, very or extremely)

2. Annoyance (HR2): How much did these sounds please or annoy you during your time at [site]? (9-point response scale of: extremely annoy, very annoy, moderately annoy, slightly annoy, neutral, slightly please, moderately please, very please, extremely please)

3. Interference with natural quiet (*Interfere*): How much did the sound from aircraft interfere with your appreciation of the natural quiet and sounds of nature at [site]? (5-point response scale of: Not at all, slightly, moderately, very, or extremely)

The response data were converted to three dichotomized variables for analysis, representing visitors who did (1) or did not (0) experience "Slightly or more" (SorMore), "Moderately or more" (MorMore), or "Very or more" (VorMore) annoyance or interference with natural quiet from aircraft noise during their visit (Table). Responses for the nine-point scale survey (HR2) were converted with an additional step to convert categories indicating that aircraft sounds were neutral or pleasing to visitors (*neutral, slightly please, moderately please, very please, extremely please*) to a"Not at all" response. The conversion to a "Not at all" response represented the lack of negative response from visitors due to aircraft noise. Three of the four possible

dichotomizations were evaluated,[†††] as any or all may provide useful information and ultimately be considered when developing impact criteria.

Table 4. Response dichotomizations

Level	'Yes' Responses	'No' Responses
Very or more (VorMore)	Extremely Very	Moderately Slightly Not at all Did not hear aircraft
Moderately or more (MorMore)	Extremely Very Moderately	Slightly Not at all Did not hear aircraft
Slightly or more (SorMore)	Extremely Very Moderately Slightly	Not at all Did not hear aircraft

Multilevel logistic regression methods were used to model relationships between visitor responses and aircraft dose metrics, with the resulting dose-response curves constrained between zero and 100%. The models of the *Annoy* and *Interfere* responses included "Site" as a random component, plus additional dose and mediator variables for each visitor:

$$\Pr(y_i = 1) = logit^{-1}\left(\alpha_{j[i]} + \beta_0 + \sum_{d=1}^{M} \beta_d x_{id}\right), \text{ for } i = 1,\ldots,n. \tag{1}$$

where *j*[*i*] indexes the site (from 1 to 8) corresponding to visitor *i*, and x_{id} is the value of predictor *d* for visitor *i* in a model with M predictor variables. Site was analyzed as the "random" component of the multilevel regression:

$$\alpha_j^{site} \sim N\left(0, \sigma_{site}^2\right), \text{ for } j = 1,\ldots,8. \tag{2}$$

In the stepwise selection procedure, the models of *Annoy* and *Interfere* responses were evaluated separately. Models for the three different dichotomizations of the visitor responses (SorMore, MorMore, and VorMore) were fit for each combination of dose and mediator predictor variables for a total of six variations of each regression model. For this analysis, the best models were defined as those that minimized information loss based on the Akaike Information Criteria (AIC). For each response dichotomization, all models statistically similar to the model with the lowest AIC value were considered as candidate 'best' models.

8.1   Predictions with Updated 2011 Backcountry 'Hike' Models

In order to predict visitor responses to aircraft noise at Rainbow Bridge, the analysis of the 2011 backcountry data was first updated to include all single-day backcountry visits of any length ('hike' data). The prior analysis of the 'dayhike' data had excluded visit durations of less than 60 minutes, meant to distinguish any differences between 'shorthike' and 'dayhike' site-types. However, the effects of visit duration on visitor responses with the combined 'hike' dataset were

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[†††] The 'extremely or more' dichotomization was not evaluated as very few 'yes' responses exist in this category, and regressions utilizing this dichotomization do not have a significant correlation with sound level (i.e., the relationships are essentially horizontal).

extensively tested and significant relationships were not found. As the average visit duration at Rainbow Bridge was under an hour, the model was updated to include the 2011 designated as 'shorthike'. For the updated analysis, the Audio Clip (AC) survey data were also eliminated, as the AC survey was not used at Rainbow Bridge. The same model fitting procedure used for the analysis of the 2011 'dayhike' data was followed (Rapoza 2015).

The best models identified in the prior 'dayhike' analysis and the updated 'hike' analysis for the 2011 survey data were very similar. This was expected, given the significant amount of overlap between the 'dayhike' and the 'hike' datasets (both contain the data for visit lengths over 60 minutes and for the HR1 and the HR2 survey instruments). Table 5 summarizes the estimated values of the regression coefficients, their standard uncertainties and p-values for the best overall model for the three dichotomizations for the annoy/interfere responses.

Table 5. Updated analysis of the 2011 'hike' data (Rainbow Bridge data were not included in the analysis). Coefficient estimates for each predictor, the associated standard uncertainty (SU) and significance (p-value) for the best overall models identified for the Annoy and Interfere responses.

a) Slightly or More Dichotomization

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-5.64	0.76	0.00	-6.85	0.78	0.00
L_{AE}	0.04	0.01	0.00	0.06	0.01	0.00
%TAud	0.02	0.00	0.00	0.02	0.00	0.00
$P_{EnHelos}$	0.02	0.00	0.00	0.02	0.00	0.00
$P_{EnProps}$	0.00	0.00	0.15	0.00	0.00	0.11
Survey HR2	-0.76	0.11	0.00	0.07	0.11	0.52
Imp nat quiet	0.42	0.17	0.01	0.51	0.16	0.00
Visit before	0.37	0.15	0.01	0.18	0.15	0.25
Adults only	0.44	0.15	0.00	0.26	0.14	0.07
Watch birds	0.29	0.12	0.02	0.26	0.12	0.03
Talk	0.65	0.29	0.03	0.48	0.29	0.10

b) Moderately or More Dichotomization

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-9.71	1.10	0.00	-5.96	0.91	0.00
L_{AE}	0.07	0.02	0.00	0.04	0.01	0.00
%TAud	0.02	0.00	0.00	0.01	0.01	0.10
$P_{EnHelos}$	0.02	0.00	0.00	0.02	0.00	0.00
$P_{EnProps}$	0.01	0.00	0.00	0.00	0.00	0.60
Survey HR2	-0.51	0.14	0.00	0.11	0.12	0.38
Imp nat quiet	0.49	0.23	0.03	0.46	0.19	0.01
Visit before	0.30	0.18	0.11	0.13	0.17	0.44
Adults only	0.36	0.20	0.07	0.21	0.16	0.20
Watch birds	0.22	0.15	0.15	0.14	0.13	0.29
Talk	0.19	0.35	0.60	0.33	0.30	0.27

c) Very or More Dichotomization

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-9.86	1.62	0.00	-7.13	1.21	0.00
L_{AE}	0.05	0.02	0.02	0.04	0.02	0.03
%TAud	0.02	0.00	0.00	0.02	0.01	0.03
$P_{EnHelos}$	0.02	0.00	0.00	0.02	0.00	0.00
$P_{EnProps}$	0.02	0.01	0.01	0.01	0.00	0.06
Survey HR2	-0.13	0.21	0.52	-0.01	0.16	0.93
Imp nat quiet	0.42	0.34	0.22	0.67	0.27	0.01
Visit before	0.52	0.25	0.04	0.21	0.21	0.31
Adults only	0.65	0.34	0.05	-0.04	0.21	0.85
Watch birds	0.18	0.21	0.39	0.25	0.17	0.13
Talk	0.62	0.44	0.16	0.81	0.33	0.01

The updated 'hike' models were used to calculate the predicted probability of each Rainbow Bridge visitor being annoyed/interfered for each dichotomization of the *annoy* and *interfere* response variables, according to equation 1. The regression coefficients estimated for the 2011 backcountry 'hike' data (Table 5), correspond in order to the regression coefficients C_0-C_{11} in equation 1. To calculate the percentage of visitors at Rainbow Bridge predicted to be annoyed/interfered, the predicted probabilities of each visitor being annoyed/interfered were averaged and the result was multiplied by 100. The predicted values were compared to the observed percentage of visitors that reported being annoyed/interfered by aircraft noise during their visit to Rainbow Bridge (Table 6).

Equation 1:

$$z = C_0 + C_1(L_{AE}) + C_2(\%TAud) + C_3(P_{EnHelos}) + C_4(P_{EnProps}) + C_5(S_{HR2}) + C_6(M_{ImpNQ})$$
$$+ C_7(M_{SiteVisitBefore}) + C_8(M_{AdultsOnly}) + C_9(M_{WatchBirds}) + C_{10}(M_{Talk})$$

$$R = \frac{1}{1+e^{-z}}$$

Where S = 1 if the given survey instrument was HR2 and S=0 if the given survey instrument was HR1.

Mediator (M) variables are defined as:

M_{ImpNQ}: Respondent rated natural quiet as a very or extremely important aspect of the visit.

$M_{SiteVisitBefore}$: Respondent had visited the site before.

$M_{AdultsOnly}$: Respondent's personal group consisted of only adults (no children under the age of 16).

$M_{WatchBirds}$: Respondent had participated in bird watching during the visit.

M_{Talk}: Respondent had participated in an interpretive talk or presentation during the visit.

Where M = 1 for Yes responses and M=0 for No responses.

Dose variables L_{AE}, %TAud, $P_{EnHelos}$, and $P_{EnProps}$ are calculated according to:

L_{AE} = 10 * log10 ($\Sigma 10^{(LAeq,1s/10)}$),

%TAud = 100 * (Duration of aircraft sounds (T_{AC}) / Duration of visit (T_{resp})),

$P_{EnHelos}$ = $100 * \left(10^{L_{AE}Helos/10}/10^{L_{AE}/10}\right)$,

$P_{en,Props}$ = $100 * \left(10^{L_{AE}Props/10}/10^{L_{AE}/10}\right)$.

Table 6. Predicted (mean ± modeled prediction uncertainties) and observed visitor responses to aircraft noise at Rainbow Bridge.

Response and rating	Predicted	Observed
Annoyance, Slightly or more	15.0 ± 2.5%	14.1%
Annoyance, Moderately or more	5.9% ± 2.0%	9.6%
Annoyance, Very or more	2.3% ± 1.0%	2.5%
Interference with natural quiet, Slightly or more	16.7% ± 2.5%	16.7%
Interference with natural quiet, Moderately or more	8.6% ± 2.0%	9.6%
Interference with natural quiet, Very or more	5.4% ± 1.0%	3.8%

With the exception of the *annoy* response at the moderately or more level, the dose-response model fit to the 2011 'hike' data predicted the average population response of visitors to Rainbow Bridge (within the 95% confidence intervals).

8.2   Complete Backcountry 'Hike' Models: 2011 and 2014 data

Dose-response models for the complete backcountry 'hike' dataset (including Rainbow Bridge data) were developed according to protocols developed for the 2011 analysis of the 'dayhike' data (Rapoza 2015). First identified were the dose variable combinations that, along with the *Importance of natural quiet* or the *Importance of calm/peace* mediators, best predicted visitor *Annoyance* and *Interference* in response to measured sounds levels. Additional mediator variables were tested in a step-wise procedure to see if they improved the models, based on the Akaike Information Criteria (AIC values).

8.2.1 Complete Backcountry 'Hike' Models: dose metrics

The dose metrics were evaluated within each dataset singly and in combination based on their validity and goodness-of-fit in prior analyses of both frontcountry and backcountry datasets. The alternate dose models evaluated included mediators of *Survey type* and visitor ratings of the *Importance of natural quiet* or the *Importance of calm/peace*, as these mediators were previously found to strongly influence visitor response to a given dose. Aircraft-type components ($P_{EnHelos}$, $P_{En,Props}$) were included in the models where appropriate.[‡‡‡]

Table 7 illustrates the correlations between the noise exposure dose metrics. A value of 1.00 indicates a perfect relationship, while other values can be compared to determine the relative relationships.   The level-based dose descriptors (L_{ASmx}, L_{AE}, $L_{Aeq,Tac}$, $L_{Aeq,Tresp}$) are all highly

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[‡‡‡] As the component variables apportion the total aircraft sound exposure into individual aircraft-type components, they are only appropriate to include with doses that measure A-weighted total exposure (i.e., $L_{Aeq,Tac}$, L_{AE}).

correlated, and are expected to perform similarly in the regression models. The time-based descriptor (%TAud) does not show correlation with any of the level-based metrics, as expected.

Table 7. Noise exposure dose metric correlations

	L_{ASmx}	L_{AE}	%TAud	$L_{Aeq,Tresp}$	$L_{Aeq,Tac}$
L_{ASmx}	1.00				
L_{AE}	0.90	1.00			
%TAud	-0.06	0.09	1.00		
$L_{Aeq,Tresp}$	0.80	0.80	0.25	1.00	
$L_{Aeq,Tac}$	0.84	0.79	-0.18	0.89	1.00

Two additional metrics were included in the tests of alternative dose combinations. Related to dose, the median ambient sound level excluding anthropogenic sounds (natural ambient L_{50}) is of particular interest, as the audibility of aircraft is logically dependent on the presence or absence of other natural and anthropogenic sounds in the listening environment. It is a non-visitor-based characteristic which may help to distinguish between sites and site-types. Visit duration was also of particular interest and was tested for inclusion as a continuous variable.

Table 8 summarizes the model-fitting statistics for the group of candidate best models for the *Annoy* response. The 'best' combination of dose variables for this *Annoy* response (i.e., the model for which the relative likelihood compared to the model with the lowest AIC value was greater than or equal to 0.05 for all three modeled responses (SorMore, MorMore, and VorMore)) included metrics of A-weighted sound exposure level (L_{AE}), percent time audible (%TAud), and percent aircraft energy ($P_{EnHelos}$, $P_{EnProps}$). Both of the best models for the *Annoy* responses included the L_{AE} dose variable plus %TAud, $P_{EnHelos}$, $P_{EnProps}$, *Survey type*, and either *Importance of calm/peace* or *Importance of natural quiet*. Table 8 summarizes the model-fitting statistics for the group of candidate best models. These results are consistent with results from the prior analysis of the backcountry 'dayhike' dataset.

Table 8. Results indicating the best dose metrics for use in Annoy dose-response models for the complete 2011 and 2014 'hike' data, based on AIC values. The relative probability (Rel Prob) represents the relative likelihood of the model compared to the model with the lowest AIC value. A value of 1.00 indicates the model with the lowest AIC value.

Dose Variables	Mediator(s)	Slightly or More AIC	Slightly or More Rel Prob	Moderately or More AIC	Moderately or More Rel. Prob	Very or More AIC	Very or More Rel Prob
L_{AE} %TAud $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of calm/peace	2126.0	0.11	1408.6	1	774.3	0.43
L_{AE} %TAud $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of natural quiet	2121.5	1	1411.4	0.25	778.2	0.06
L_{AE} log10(%TAud) $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2126.7	0.07	1411.4	0.25	779.8	0.03
L_{AE} log10(%TAud) $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2122.2	0.70	1414.5	0.05	783.9	0.00
$L_{eqTresp}$ %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2127.1	0.06	1416.9	0.02	781.8	0.00
$L_{eqTresp}$ Visit Duration (minutes)	Importance of natural quiet	2135	0.00	1410.6	0.37	779.7	0.03
L_{AE} $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of calm/peace	2136.1	0.00	1411.2	0.27	779.4	0.03
L_{AE} Visit Duration (minutes) $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of calm/peace	2136.6	0.00	1413.1	0.11	780.2	0.02
L_{AE} $P_{EnHelos}$ $P_{EnProps}$	Importance of natural quiet	2131.8	0.01	1414.2	0.06	783.5	0.00
L_{AE} %TAud $P_{EnHelos}$ $P_{EnProps}$	Importance of calm/peace	2169.0	0.00	1420.4	0.00	772.6	1.00
L_{AE} %TAud $P_{EnHelos}$ $P_{EnProps}$	Importance of natural quiet	2164.1	0.00	1422.5	0.00	776.5	0.14
L_{AE} %TAud $P_{EnHelos}$ $P_{EnProps}$	Importance of viewing scenery	2170.6	0.00	1430.8	0.00	777.1	0.11
$L_{eqTresp}$ %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2132.0	0.01	1414.7	0.05	777.8	0.07

* Shading indicates the models for which the relative likelihood compared to the model with the lowest AIC values is ≥ 0.05 for all three modeled response dichotomizations (SorMore, MorMore, VorMore).

Table 9 summarizes the model-fitting statistics for the group of candidate best models for the *Interfere* response. The dose variables included in the best models for this response were similar to those for the *Annoy* response; one of the three best models did not include the *Survey type* mediator, and the other included $L_{Aeq,Tresp}$ instead of L_{AE}.

Table 9. Results indicating the best dose metrics for use in Interfere dose-response models for the complete 2011 and 2014 'hike' data, based on AIC values. The relative probability (Rel Prob) represents the relative likelihood of the model compared to the model with the lowest AIC value. A value of 1.00 indicates the model with the lowest AIC value.

Dose Variables	Mediator	Slightly or More AIC	Slightly or More Rel Prob	Moderately or More AIC	Moderately or More Rel. Prob	Very or More AIC	Very or More Rel Prob
L_{AE} %TAud $P_{EnHelos}$ $P_{en,Props}$	Importance of natural quiet	2161.5	1.00	1799.2	0.47	1212.1	0.70
L_{AE} %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2162.8	0.52	1800.4	0.26	1214.1	0.26
$L_{Aeq,Tresp}$ %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2166.7	0.07	1802.6	0.09	1215.7	0.12
L_{AE} %TAud $P_{EnHelos}$ $P_{en,Props}$	Importance of calm/peace	2170.7	0.01	1797.7	1.00	1211.4	1.00
L_{AE} %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2172	0.01	1799	0.52	1213.4	0.37
$L_{Aeq,Tresp}$ %TAud $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2176.8	0.00	1801.3	0.17	1215.3	0.14
$L_{Aeq,Tresp}$ L_{50} Nat Quiet $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2182.9	0.00	1801.7	0.14	1218.7	0.03
$L_{Aeq,Tresp}$ $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2186.8	0.00	1801.9	0.12	1219.4	0.00
L_{AE} log10(%TAud) $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of calm/peace	2179.9	0.00	1802.3	0.10	1215.7	0.12
$L_{Aeq,Tresp}$ L_{50} Nat Quiet $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2172.4	0.00	1802.5	0.09	1218.7	0.03
L_{AE} $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of calm/peace	2186.4	0.00	1802.5	0.09	1220.6	0.00
L_{AE} Visit Duration (minutes) $P_{EnHelos}$ $P_{EnProps}$	Survey Importance of calm/peace	2185.1	0.00	1802.9	0.07	1220.5	0.00
$L_{Aeq,Tresp}$ $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2176.8	0.00	1803.2	0.06	1220.1	0.00
L_{AE} log10(%TAud) $P_{EnHelos}$ $P_{en,Props}$	Survey Importance of natural quiet	2170.5	0.01	1803.9	0.05	1216.8	0.07

* Shading indicates the models for which the relative likelihood compared to the model with the lowest AIC values is ≥0.05 for all three modeled response dichotomizations (SorMore, MorMore, VorMore).

Consistent with the prior analysis of the backcountry 'dayhike' dataset and the frontcountry model form, the percent aircraft-type energy variables ($P_{EnHelos}$, $P_{enProps}$) were significant in all

models. Also consistent with prior analysis, neither visit duration nor ambient sound level were significant. Visit duration was further tested as a categorical variable (binned into visits of less than/greater than 60 minutes, less than/greater than 120 minutes, and less than/greater than 180 minutes) and was not found to be significant.

8.2.2 Complete Backcountry 'Hike' Models: mediator variables

The 'best' dose-response models identified in step one were used to test whether the inclusion of a select group of additional survey and visit-based mediators (Table 10) resulted in models with significantly lower AIC values. Mediator variables were added individually and in combination to the candidate *Annoy* and *Interfere* response models. Mediators that resulted in lower average AIC values for the three models of *Annoy* and *Interfere* responses and had significant regression coefficients in one or more models were retained.

Table 10. Mediator variables listed in the order tested

Variable Short Name	Definition / Survey Basis
Survey Type	Was the visitor administered the HR1 or the HR2 survey type?
Importance of…	"How important was it that your time on the _____ trail provide you with the opportunity to…. Choices: Not at all, slightly, moderately, very or extremely Response dichotomy: Very or extremely responses coded "yes"; not at all, slightly, moderately responses coded "no".
Importance of view scenery	View the natural scenery?"
Importance of natural quiet	a. Enjoy the natural quiet and sounds of nature
Importance of history	b. Appreciate the history and cultural significance of the site
Importance of calm/peace	c. experience a feeling of calmness, peace, or tranquility
Importance of adventure/challenge	d. Experience a sense of adventure or challenge
Visited site before	"Is this your first visit to _____ trail?" (Yes, visited site before OR No, first visit)
Adults only	Indicates the presence of children under the age of 16 in the visit group, based on interviewer observations. (Yes, only adults, OR No, group includes children)
Never air tour	Have you ever taken a scenic air tour over <park> or any other park? (Yes, Never taken air tour, OR No, Never taken air tour)
Activity	Which of the following activities did you take part in during your time <"on the" (day/multi-day hike trail) / "at" (Overlook/Cultural Resource Study Site)> <site>?
View scenery	Viewing the scenery
Watch birds	a. Watching birds
View a sunrise/ sunset	b. Viewing a sunrise or sunset
Picnic / meal	c. Picnicking or having a meal

Variable Short Name	Definition / Survey Basis
Talk	d. Attending a ranger-led talk, walk, or campfire program OR e. Attending some other demonstration, talk, or organized activity or performance
View wildlife	f. Viewing wildlife (other than birds)
Duration visit	Duration of Visit, described as continuous variable in minutes and log10(minutes)

The addition of select mediator variables to the preferred dose-response models identified in step one resulted in models with reduced AIC values. In many cases, adding an additional mediator variable resulted in models with similar AIC values and a relative probability higher than 0.05 compared to the reference model. Additional mediators were only retained in the model if the average AIC values for the three response dichotomizations decreased and at least one of the coefficient estimates for the mediator was significant. To compare the best models identified by the model selection process, the relative probabilities of each model compared to the model with the lowest AIC value for each dichotomization were calculated. A relative probability greater than 0.05 indicates the information loss of the model is not significantly different than that of the model with the lowest AIC value. Using this process, models with relative probabilities greater than 0.05 for all three dichotomizations were identified for each response (Table 11 and Table 12). Models that include the use of either the *Importance of natural quiet* OR the *Importance of calm/peace* mediator were retained in the set of final models, as the *Importance of natural quiet* mediator has lower AIC values and significant regression coefficients for the SorMore response, while *Importance of calm/peace* has lower AIC values and significant regression coefficients for the MorMore and VorMore responses. The *Importance* variables were not included together in any final model as they describe a similar visitor valuation, and thus are closely correlated.

In a final step, the best models identified for the *Annoy* responses were fit to the *Interfere* response data, and vise-versa, with the goal of identifying a model that was a sufficiently good fit to the data for both response variables. A single model that resulted in a relative probability ≥0.05 for all three dichotomizations of the Annoy and the Interfere responses was identified (with unique coefficient estimates for each dichotomization). This response variables included L_{AE}, *%TAud*, $P_{EnHelos}$ and $P_{EnProps}$, *Survey, Importance of natural quiet, Site visit before, Adults only, Watch birds, and Talk*. Note that many models with different combinations of mediator variables had similar AIC values, thus alternative model selection criteria may identify different models as the best fit to the data.

Table 11. AIC values and relative probabilities for the best Annoy response models of the 2011 and 2014 'hike' data, identified during the step-wise mediator selection process. Lower AIC values indicate models that better predict the data. The relative probability (Rel Prob) represents the relative likelihood of the model compared to the model with the lowest AIC value. A value of 1.00 indicates the model with the lowest AIC value (shown in bold). All models included in the mediator selection step included L_{AE}, %TAud, $P_{EnHelos}$ and $P_{EnProps}$, and Importance of natural quiet OR Importance of calm/peace. The shading indicates the single model that resulted in a relative probability ≥ 0.05 for all three dichotomizations of the Annoy and the Interfere (Table 12) responses.

Step 1 Mediators	Additional Mediators	Slightly or More AIC	Slightly or More Rel Prob	Moderately or More AIC	Moderately of More Rel Prob	Very or More AIC	Very or More Rel Prob
Survey Natural Quiet	Visit Before Adults Only Watch Birds Talk	**2102.8**	**1.00**	1409.5	0.10	771.8	0.10
Survey Natural Quiet	Visit Before Adults Only Watch Birds	2105.5	0.26	1408.3	0.17	772.5	0.07
Survey Calm/Peace	Visit Before Adults Only Watch Birds Talk	2106.2	0.18	1406.7	0.39	767.9	0.70
Survey Calm/Peace	Visit Before Adults Only Watch Birds	2108.8	0.05	1405.4	0.74	768.5	0.52
Survey Natural Quiet	Visit Before Adults Only	2109.4	0.04	1407.6	0.25	771.2	0.14
Survey Calm/Peace	Visit Before Adults Only	2113.3	0.01	**1404.8**	**1.00**	**767.2**	**1.00**
Survey Natural Quiet	Visit Before	2119.3	0.00	1409.2	0.11	775.1	0.02
Survey Calm/Peace	Visit Before	2124.2	0.00	1406.8	0.37	771.4	0.12

Table 12. AIC values and relative probabilities for the best interfere response models of the 2011 and 2014 'hike' data, identified during the step-wise mediator selection process. Lower AIC values indicate models that better predict the data. The relative probability (Rel Prob) represents the relative likelihood of the model compared to the model with the lowest AIC value. A value of 1.00 indicates the model with the lowest AIC value (shown in bold). All models included in the mediator selection step included L_{AE}, %TAud, $P_{EnHelos}$ and $P_{enProps}$, and Importance of natural quiet OR Importance of calm/peace. The shading indicates the single model that resulted in a relative probability ≥ 0.05 for all three dichotomizations of the Annoy and the Interfere (Table 9) responses.

Step 1 Mediators	Additional Mediators	Slightly or More AIC	Slightly or More Rel Prob	Moderately or More AIC	Moderately or More Rel Prob	Very or More AIC	Very or More Rel Prob
Natural Quiet	Adults Only Watch Birds Talk	**2154.5**	**1.00**	1798.8	0.37	1210.8	0.61
Survey Natural Quiet	Adults Only Watch Birds Talk	2155.9	0.50	1800.1	0.19	1212.8	0.22
Natural Quiet	Adults Only Watch Birds	2156.3	0.41	1799.8	0.22	1213	0.20
Survey Natural Quiet	Visit Before Adults Only Watch Birds Talk	2157.3	0.25	1801.2	0.11	1214.1	0.12
Natural Quiet	Adults Only	2159.4	0.09	1798.9	0.35	1214	0.12
Calm/Peace	Adults Only Watch Birds Talk	2161.9	0.02	**1796.8**	**1.00**	**1209.8**	**1.00**

8.2.3 Complete Backcountry 'Hike' Models: Overall best-fit

A single set of predictor variables resulting in models with a relative probability greater than 0.05 for all three dichotomizations of both response variables was identified in the model selection process. Table 14 summarizes the values of the regression coefficients, their standard uncertainties and p-values for the best overall model. The model predicts the probability that a visitor experiences annoyance from given levels of aircraft noise according to the following equation:

$$z = C_0 + C_1(L_{AE}) + C_2(\%TAud) + C_3(P_{EnHelos}) + C_4(P_{EnProps}) + C_5(S_{HR1}) + C_6(S_{HR2}) + C_7(M_{ImpNQ}) + C_8(M_{SiteVisitBefore}) + C_9(M_{AdultsOnly}) + C_{10}(M_{WatchBirds}) + C_{11}(M_{Talk})$$

$$R = \frac{1}{1+e^{-z}}$$

Where S = 1 if the given survey instrument was received and S=0 if a different survey instrument was received.

Mediator (M) variables are defined as:

M_{ImpNQ}: Respondent rated natural quiet as a very or extremely important aspect of the visit.

$M_{SiteVisitBefore}$: Respondent had visited the site before.

$M_{AdultsOnly}$: Respondent's personal group consisted of only adults (no children under the age of 16).

$M_{WatchBirds}$: Respondent had participated in bird watching during the visit.

M_{Talk}: Respondent had participated in an interpretive talk or presentation during the visit.

Where M = 1 for Yes responses and M=0 for No responses.

Dose variables L_{AE}, %TAud, $P_{EnHelos}$, and $P_{EnProps}$ are calculated according to:

$$L_{AE} = 10 * \log 10\ (\Sigma 10^{(LAeq,1s/10)}),$$

$$\%TAud = 100 * (\text{Duration of aircraft sounds } (T_{AC}) / \text{Duration of visit } (T_{resp})),$$

$$P_{EnHelos} = 100 * \left(10^{L_{AE}Helos/10}/10^{L_{AE}/10}\right),$$

$$P_{en,Props} = 100 * \left(10^{L_{AE}Props/10}/10^{L_{AE}/10}\right).$$

Figure 15 depicts the dose-response curves summarizing the relationships between increases in noise exposure and visitor response for the dose variable L_{AE} for both the *Annoy* and *Interfere* responses. In these plots, the L_{AE} dose variable is explicitly visualized, while the effects of the %TAud, $P_{EnHelos}$, and $P_{EnProps}$ doses on visitor response are represented using a function[§§§] relating each to L_{AE}. Thus, the shapes of the does-response curves are adjusted to include the effects of additional dose variables on visitor response through their relationships with the primary dose variable. The three individual curves (solid lines) in the plots represent each of the three dichotomizations of visitor response (SorMore, MorMore, and VorMore); dashed lines represent the 95% confidence intervals. Values of the survey-based mediator variables were held constant at the average values for the 'hike' survey data (Table 13). The data points (green dots represent the 2011 data, purple dots represent the 2014 Rainbow Bridge data) are jittered to aid in visualization and represent the SorMore dichotomization.

[§§§] %TAud is represented with a linear function, while the percent aircraft energy variables (e.g., $P_{EnHelos}$, $P_{EnProps}$) are represented with a logistic function. The logistic function was chosen to constrain the percent aircraft energy to values between 0 and 100. These functions are only utilized for visualizing the dose-response relationships, and do not affect the regression coefficients of the models.

Table 13. Values of mediators for respondent population by site and overall.

	Rainbow Bridge (Rainbow Bridge)	Fairyland (BRCA)	Taylor Creek (ZION)	West Rim (ZION)	Grand-view (GRCA)	Hermit (GRCA)	Sperry (GLAC)	Hidden Lake (GLAC)	Overall
Average % Time Audible	24	32	14	35	42	77	23	19	31
Average % Heli energy	0	0	0	0	6	80	86	96	31
Average % Prop energy	66	36	55	30	39	12	11	4	30
% Adults only	44	81	71	87	79	89	83	79	77
% Importance of calm, peace	75	86	84	89	86	87	83	84	79
% Visited site before	46	9	11	28	18	13	16	22	17
%Watch birds	17	44	26	30	38	41	27	28	32
% Talk / presentation	43	3	1	2	5	6	6	6	4

Table 14. Coefficient estimates for each predictor, the associated standard uncertainty (SU) and significance (p-value) for the best overall model identified for the Annoy and Interfere responses. Significant p-values are noted in boldface type.

a) **Slightly or More Dichotomization**

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-5.945	0.718	**0.000**	-7.195	0.743	**0.000**
L_{AE}	0.045	0.010	**0.000**	0.064	0.011	**0.000**
%TAud	0.016	0.003	**0.000**	0.017	0.004	**0.000**
$P_{EnHelos}$	0.016	0.002	**0.000**	0.017	0.003	**0.000**
$P_{EnProps}$	0.004	0.002	0.133	0.003	0.002	0.136
Survey HR2	-0.747	0.111	**0.000**	0.080	0.106	0.453
Importance of natural quiet	0.460	0.161	**0.004**	0.480	0.158	**0.002**
Visited site before	0.298	0.144	**0.039**	0.118	0.145	0.417
Adults only	0.464	0.142	**0.001**	0.250	0.134	0.063
Watch birds	0.286	0.120	**0.018**	0.257	0.118	**0.030**
Talk	0.587	0.266	**0.027**	0.529	0.269	**0.049**

b) **Moderately or More Dichotomization**

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-9.726	1.037	**0.000**	-6.456	0.867	**0.000**
L_{AE}	0.074	0.014	**0.000**	0.046	**0.012**	**0.000**
%TAud	0.018	0.003	**0.000**	0.011	**0.006**	0.057
$P_{EnHelos}$	0.018	0.003	**0.000**	0.015	**0.004**	**0.000**
$P_{EnProps}$	0.013	0.004	**0.000**	0.002	**0.003**	0.582
Survey HR2	-0.521	0.140	**0.000**	0.099	0.119	0.406
Importance of natural quiet	0.632	0.224	**0.005**	0.523	0.186	**0.005**
Visited site before	0.366	0.172	**0.034**	0.152	0.160	0.341
Adults only	0.332	0.187	0.076	0.226	0.157	0.150
Watch birds	0.166	0.148	0.262	0.123	0.131	0.346
Talk	0.293	0.329	0.373	0.499	0.277	0.071

c) Very or More Dichotomization

Predictor	Annoy Coefficient Estimate	Annoy SU	Annoy p-value	Interfere Coefficient Estimate	Interfere SU	Interfere p-value
Intercept	-9.356	1.506	**0.000**	-7.715	1.145	**0.000**
L_{AE}	0.042	0.021	**0.041**	0.042	0.016	**0.008**
%TAud	0.023	0.004	**0.000**	0.024	0.009	**0.006**
$P_{EnHelos}$	0.020	0.005	**0.000**	0.015	0.004	**0.000**
$P_{EnProps}$	0.014	0.006	**0.020**	0.007	0.004	0.066
Survey HR2	-0.128	0.202	0.526	0.026	0.153	0.867
Importance of	0.517	0.338	0.126	0.717	0.265	**0.007**
Visited site before	0.583	0.242	**0.016**	0.173	0.208	0.405
Adults only	0.725	0.323	**0.025**	0.063	0.203	0.757
Watch birds	0.174	0.211	0.411	0.276	0.181	0.127
Talk	0.718	0.411	0.080	0.696	0.322	**0.031**

Annoy: Hike
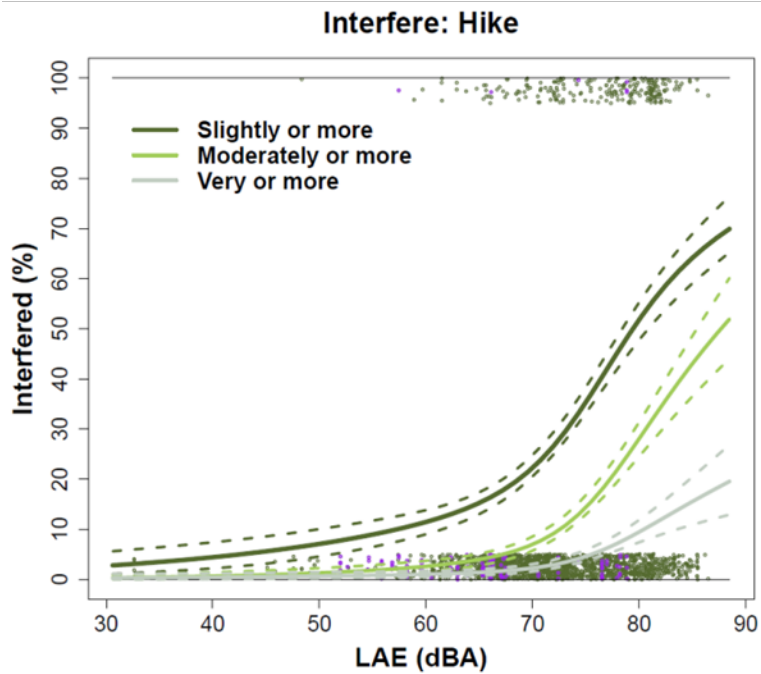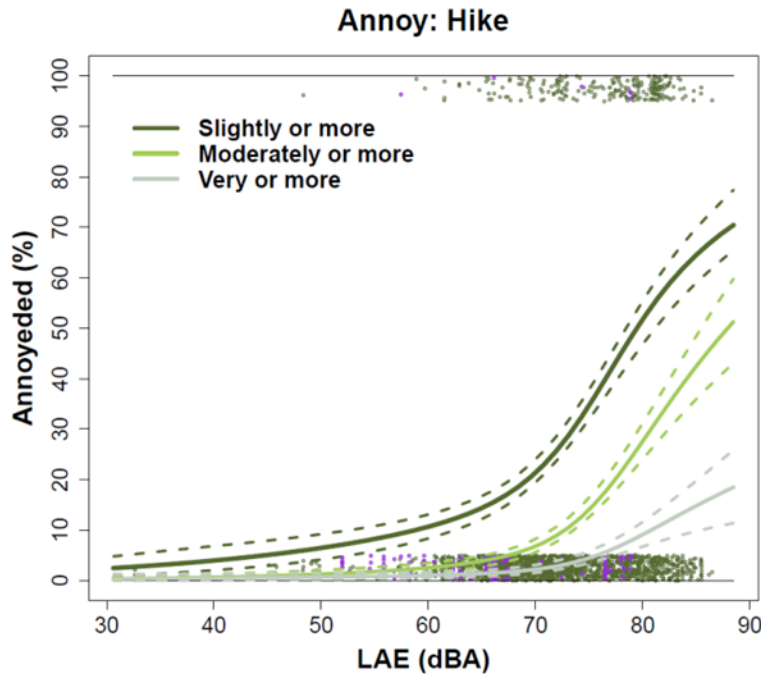
Interfere: Hike

Figure 15. Dose response models of the complete 2011 and 2014 Rainbow Bridge 'hike' data for the Annoy (top) and Interfere (bottom) responses.

8.3   Model Fitting Summary

The data collected at Rainbow Bridge in 2014 strengthen the models developed for the backcountry dataset. The model selection process identified a single set of predictor variables that resulted in similar fits to the data for all three dichotomizations of both response variables (*Annoy and Interfere)* for the complete 2011 and 2014 'hike' dataset. The models identified for each response and dichotomization of the 'hike' dataset are similar to those identified in the

prior analysis of the 'dayhike' dataset. The dose and mediator variables are nearly identical and the coefficient values are similar. In the models for the complete 'hike' dataset, the only mediator variable included in the 'dayhike' models that was no longer significant for the 'hike' models was *Taken an air tour.*

9.0 Summary

The goal for the dose-response data collection and analysis at Rainbow Bridge was to expand the information available from backcountry locations. The Rainbow Bridge data strengthens the backcountry dataset with information on shorter-length hikes and sites with cultural/historic as well as scenic aspects. In total, 177 surveys were collected at Rainbow Bridge, adding to the database of over 4,600 completed visitor surveys collected in 2011.

The aircraft noise exposure 'dose' for the surveyed Rainbow Bridge visitors was the result of overflights of propeller-driven aircraft and high-altitude jets. The magnitude of aircraft noise exposure at the time of data collection was similar to other locations studied such as Fairyland at Bryce Canyon and Taylor Creek at Zion National Park. Visitor sound exposure levels ranged from 52 to 79 dBA and averaged 66 dBA; percent time audible ranged from 10 to 49% and averaged 24%. Ambient sound levels at Rainbow Bridge were among the quietest of the dose-response study. The median natural ambient (L50) ranged from 20 to 27 dBA and averaged 23 dBA.

Dose-response models fit to the 2011 backcountry 'hike' data were used to predict visitor responses to aircraft noise at Rainbow Bridge. Although there were some differences in visitor population characteristics between Rainbow Bridge visitors and those at the other sites studied, visitors to Rainbow Bridge were not predicted to rate aircraft noise differently than visitors at other sites with similar noise exposures. Indeed, predictions of the proportion of Rainbow Bridge visitors reporting 'annoyance' and 'interference with natural quiet' were similar to the observed proportions.

The 2014 Rainbow Bridge data were combined with the 2011 backcountry 'hike' data and used to identify the best dose-response relationships for visitors on backcountry hikes, based on the complete set of available data for single-day hikes. The development of the dose-response model for the combined 2011 and 2014 'hike' data involved model fitting to identify the combination of dose and mediator variables that resulted in the best models of visitor response to aircraft noise. The best models were defined as those which minimize information loss based on the Akaike Information Criteria (AIC). Dose-response models were identified which best fit the *Annoyance* and *Interference with natural quiet* responses for three dichotomizations of visitor responses (noted as Slightly or More, Moderately or More, and Very or More). The models include dose variables of sound exposure level, percent time audible, and energy percentages due to helicopters and fixed-wing propeller aircraft. Mediator variables identified include *survey type*, visitor ratings of the *importance of natural quiet*, attributes of *adults only* in group, *first visit* to the site, and participation in activities of *watching birds* and listening to an interpretive *talk*. The dose-response relationships developed can be used to estimate the effects of aviation noise on visitor experience in National Park settings.

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Appendix A Survey Instruments

This appendix contains the surveys that were administered at Rainbow Bridge National Monument. Details regarding each of the surveys are described in detail in Section 2.

- The human response to aviation noise - visitor survey, version 1 (HR1)
- The human response to aviation noise - visitor survey, version 2 (HR2)

The instruments were administered evenly among visitors, and within a group every attempt was made to get responses to each survey.

Rainbow Bridge National Monument

RAINBOW BRIDGE TRAIL VISITOR SURVEY

Thank you for agreeing to participate in this survey. Your participation in the survey is voluntary, and the answers you provide will remain anonymous.

This questionnaire asks about your experiences during your time at Rainbow Bridge National Monument.

1. Is this your first visit to Rainbow Bridge Trail or had you visited here before?

First visit ....☐ ➜ *Skip to question 2.*

Visited before ....☐ **Answer a**

   a. Approximately how many times have you visited this trail before?

     (Please enter a number **or** select a checkbox.)

     Times before   _____ (approximate)

     or check one of the following:

     Visited this trail 100 or more times ....☐

     Don't know /not sure ....☐

2. Did you take part or not take part in each of the following activities during your time on Rainbow Bridge Trail?

	Take part ▼	Not take part ▼
a. Viewing the scenery	☐	☐
b. Viewing a sunrise or sunset	☐	☐
c. Picnicking or having a meal	☐	☐
d. Watching birds	☐	☐
e. Viewing wildlife (other than birds)	☐	☐
f. Hiking or walking	☐	☐
g. Attending a ranger-led talk, walk, or campfire program	☐	☐
h. Attending some other demonstration, talk or other organized activity or performance [Please describe.]	☐	

    └➜   [   ]

i. Other activity [What activity?] ....

    └➜   [   ]

3. How important was it that your time on Rainbow Bridge Trail provides you with the opportunity to… *(Mark "Not relevant" if an experience was not relevant for this visit.)*

	Not relevant ▼	----------------------- Importance -----------------------				
		Not at all important ▼	**Slightly important** ▼	**Moderately important** ▼	**Very important** ▼	**Extremely important** ▼
a. View the natural scenery	☐	☐	☐	☐	☐	☐
b. Enjoy the natural quiet and sounds of nature	☐	☐	☐	☐	☐	☐
c. Appreciate the history and cultural significance of the site	☐	☐	☐	☐	☐	☐
d. Experience a feeling of calmness, peace or tranquility	☐	☐	☐	☐	☐	☐
e. Experience a sense of adventure or challenge...	☐	☐	☐	☐	☐	☐

4. During your time on Rainbow Bridge Trail, how much did you…

(Mark "Not relevant" if an experience was not relevant for this visit.)

	Not relevant ▼	----------------- How much did you…? -----------------				
		Not at all ▼	**Slightly** ▼	**Moderately** ▼	**Very** ▼	**Extremely** ▼
a. Appreciate the natural scenery	☐	☐	☐	☐	☐	☐
b. Enjoy the natural quiet and sounds of nature	☐	☐	☐	☐	☐	☐
c. Appreciate the history and cultural significance of the site	☐	☐	☐	☐	☐	☐
d. Experience a feeling of calmness, peace or tranquility	☐	☐	☐	☐	☐	☐
e. Experience a sense of adventure or challenge	☐	☐	☐	☐	☐	☐

5. Did you HEAR airplanes, jets, helicopters, or any other aircraft during your time on Rainbow Bridge Trail?

Yes - heard .... ☐

No - did not hear ... ☐ ➜ *Skip to question 10.*

6. During your time on Rainbow Bridge Trail, how much did noise from airplanes, jets, helicopters or other aircraft bother, disturb or annoy you?

Not at all.. ☐

Slightly .... ☐

Moderately .... ☐

Very .... ☐

Extremely.. ☐

7. How much did the sounds from aircraft interfere with each of the following aspects of your visit on Rainbow Bridge Trail? *(Mark "Not relevant" if an aspect was not relevant for this visit.)*

	Not relevant ▼	**Not at all** ▼	**Slightly** ▼	**Moderately** ▼	**Very** ▼	**Extremely** ▼
a. Enjoyment of the site	☐	☐	☐	☐	☐	☐
b. Appreciation of the natural quiet and sounds of nature at the site	☐	☐	☐	☐	☐	☐
c. Appreciation of the historical and cultural significance of the site	☐	☐	☐	☐	☐	☐

8. How much did the sounds from aircraft interfere with each of the following aspects of your visit on Rainbow Bridge Trail? *(Mark "Not relevant" if an aspect was not relevant for this visit.)*

	Not relevant ▼	-------------- Aircraft sound interfered --------------				
		Not at all ▼	Slightly ▼	Moderately ▼	Very ▼	Extremely ▼
History and Culture						
a. Experiencing a sense of connection to the history, events or people commemorated here	☐	☐	☐	☐	☐	☐
Nature						
b. Experiencing a sense of connection with nature	☐	☐	☐	☐	☐	☐
c. Appreciating scenic beauty	☐	☐	☐	☐	☐	☐
Other feelings						
d. Experiencing a feeling of calmness, peace or tranquility	☐	☐	☐	☐	☐	☐
e. Experiencing a sense of adventure or challenges	☐	☐	☐	☐	☐	☐
Listening to a presentation						
f. Hearing something said during a ranger talk, campfire program, or other ranger-led activity	☐	☐	☐	☐	☐	☐
g. Hearing any other performance, talk or group presentation	☐	☐	☐	☐	☐	☐

9. How acceptable or unacceptable were the sounds from aircraft that you heard during your time on Rainbow Bridge Trail?

------ Unacceptable ------				Neutral	------ Acceptable ------			
Extremely	**Very**	**Moderately**	**Slightly**	**Neutral**	**Slightly**	**Moderately**	**Very**	**Extremely**
▼	▼	▼	▼	▼	▼	▼	▼	▼
☐	☐	☐	☐	☐	☐	☐	☐	☐

Earlier: Q.5 asked: **Did you** hear **aircraft?**

Next: Q.10 asks: **Did you** see **aircraft?**

10. Did you SEE airplanes, jets, helicopters, or any other aircraft during your time on Rainbow Bridge Trail?

No - Did not see .... ☐ ➜ *Skip to question 11.*

Yes - Did see .... ☐ ➜ *Answer a*

    a.   **During your time on this Rainbow Bridge Trail, did seeing aircraft bother, disturb or annoy you?**

Not at all .... ☐

Slightly .... ☐

Moderately .... ☐

Very .... ☐

Extremely .... ☐

11. Have you ever taken a scenic air tour over this or any other park?

(Please check all that apply.)

Yes, I have taken a scenic air tour over Lake Powell / Rainbow Bridge ☐

Yes, I have taken a scenic air tour over another national park .... ☐

No, I have never taken a scenic air tour over a park........................... ☐

12. Would you take a sightseeing air tour over this park, even if visitors on this trail could hear the aircraft during their visit?

Yes.............................. ☐
No .... ☐
Don't know/not sure ..... ☐

Background Information

13. How many adults and children were in your personal group (spouse, family, friends) on this visit to this trail?

Adults   (age 16 or older)   _____ Number

Children (age 15 or younger)   _____ Number

14. Were you or your personal group part of some larger commercial, educational, or other organized group of visitors?

Yes........................ ☐

No .... ☐

15. What is your gender?

Male .... ☐

Female .... ☐

16. In what year were you born?

Year

1	9		

17. Where do you live?

United States...... ☐ ➜ **What is your Zip code?**   ➜ | | | | | |

Another country.. ☐ ➜ **What country do you live in?** ➜

18. What is the highest level of formal education you have completed? (Check one.)

Some high school .... ☐

High school graduate or GED _____ ☐

Some college, business or trade school _____ ☐

College, business or trade school graduate ☐

Some graduate school _____ ☐

Master's, doctoral or professional degree .... ☐

19. Are you Hispanic or Latino? (Check <u>one</u>.)

Yes.......................☐

No ....☐

20. What is your race? (Check all that apply.)

American Indian or Alaska Native...............☐

Asian..☐

Black or African American...........................☐

Native Hawaiian ....☐

Pacific Islander other than Native Hawaiian.☐

White...☐

Please give your questionnaire to the survey administrator.

Thank you for taking the time to complete this survey!

OMB control number: 2120-0744

__/__/__ HR2

_____
(YY/MM/DD)

_____

Ticket number:

Survey time:

Thank you for agreeing to participate in this survey. Your participation in the survey is voluntary, and the answers you provide will remain anonymous.

This questionnaire asks about your experiences during your time at Rainbow Bridge National Monument.

NATIONAL PARK SERVICE

RAINBOW BRIDGE NATIONAL MONUMENT VISITOR SURVEY

1. Is this your first visit to Rainbow Bridge Trail or had you visited here before?

First visit ....☐ ➔ *Skip to question 2.*

Visited before ....☐ **Answer a**

a. Approximately how many times have you visited Rainbow Bridge Trail before?

(Please enter a number **or** select a checkbox.)

Times before _____ (approximate)

or check one of the following:

Visited this trail 100 or more times ....☐

Don't know /not sure ....☐

2. Did you take part or not take part in each of the following activities during your time on Rainbow Bridge Trail?

	Take part ▼	Not take part ▼
j. Viewing the scenery	☐	☐
k. Viewing a sunrise or sunset	☐	☐
l. Picnicking or having a meal	☐	☐
m. Watching birds	☐	☐
n. Viewing wildlife (other than birds)	☐	☐
o. Hiking or walking	☐	☐
p. Attending a ranger-led talk, walk, or campfire program	☐	☐
q. Attending some other demonstration, talk or other organized activity or performance [Please describe.]	☐	

└➔ [   ]

r. Other activity [What activity?] ☐

└➔ [   ]

3. How important was it that your time on Rainbow Bridge Trail provide you with the opportunity to… *(Mark "Not relevant" if an experience was not relevant for this visit.)*

	Not relevant ▼	---------------------- **Importance** ----------------------				
		Not at all important ▼	Slightly important ▼	Moderately important ▼	Very important ▼	Extremely important ▼
f. View the natural scenery	☐	☐	☐	☐	☐	☐
g. Enjoy the natural quiet and sounds of nature	☐	☐	☐	☐	☐	☐
h. Appreciate the history and cultural significance of the site	☐	☐	☐	☐	☐	☐
i. Experience a feeling of calmness, peace or tranquility	☐	☐	☐	☐	☐	☐
j. Experience a sense of adventure or challenge...	☐	☐	☐	☐	☐	☐

4. During your time on Rainbow Bridge Trail, how much did you…
(Mark "Not relevant" if an experience was not relevant for this visit.)

	Not relevant ▼	----------------- **How much did you…?** -----------------				
		Not at all ▼	Slightly ▼	Moderately ▼	Very ▼	Extremely ▼
f. Appreciate the natural scenery	☐	☐	☐	☐	☐	☐
g. Enjoy the natural quiet and sounds of nature	☐	☐	☐	☐	☐	☐
h. Appreciate the history and cultural significance of the site	☐	☐	☐	☐	☐	☐
i. Experience a feeling of calmness, peace or tranquility	☐	☐	☐	☐	☐	☐
j. Experience a sense of adventure or challenge	☐	☐	☐	☐	☐	☐

5. Answer Question A, B, and C about each of the sounds you heard during your time on Rainbow Bridge Trail. *(Mark "Did not hear" if sound not present.)*

A. How acceptable or unacceptable were these sounds during your time on this trail?

B. How much did these sounds please or annoy you during your time on this trail?

C. How much did these sounds positively add to or negatively detract from your experience during your time on this trail?

SOUNDS	Did Not hear	A. --Unacceptable-- → --Acceptable-- (Extremely, Very, Moderately, Slightly, Neutral, Slightly, Moderately, Very, Extremely)	B. --Annoy-- → --Please-- (Extremely, Very, Moderately, Slightly, Neutral, Slightly, Moderately, Very, Extremely)	C. Negatively detract → Positively add (Extremely, Very, Moderately, Slightly, Neutral, Slightly, Moderately, Very, Extremely)
a. Insect Sounds	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
b. Bird or animal sounds	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
c. Waterfalls, running water, or waves	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
d. Wind, rain, or thunder	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
e. Group of people talking	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
f. Someone's radio, TV, IPod, or other audio device	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
g. Cars or trucks in a parking lot	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
h. Cars or trucks on a road or highway	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
i. Airplanes, jets, helicopters, or other aircraft	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
j. Motorboats or motorized watercraft	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

6. Did you HEAR airplanes, jets, helicopters, or any other aircraft during your time on Rainbow Bridge Trail?

Yes - heard .... ☐
No - did not hear .. ☐ ➜ ***Skip to question 8.***

7. How much did the sounds from aircraft interfere with each of the following aspects of your visit on Rainbow Bridge Trail?

	Not relevant	**--------------- Aircraft sound interfered ---------------**				
		Not at all	**Slightly**	**Moderately**	**Very**	**Extremely**
	▼	▼	▼	▼	▼	▼
d. Enjoyment of the site	☐	☐	☐	☐	☐	☐
e. Appreciation of the natural quiet and sounds of nature at the site	☐	☐	☐	☐	☐	☐
f. Appreciation of the historical and cultural significance of the site	☐	☐	☐	☐	☐	☐

9. To what extent would you support or oppose each of the following potential actions at Rainbow Bridge National Monument?

	Strongly Support ▼	Support ▼	Neither Support nor Oppose ▼	Oppose ▼	Strongly Oppose ▼	Don't Know/ Not Sure ▼
Reduce the number of sightseeing tour aircraft allowed to fly over the park	☐	☐	☐	☐	☐	☐
Maintain the number of sightseeing tour aircraft allowed to fly over the park at the current level	☐	☐	☐	☐	☐	☐
Increase the number of sightseeing tour aircraft allowed to fly over the park	☐	☐	☐	☐	☐	☐
Allow sightseeing tour aircraft to be flown over the park only during specially designated dates and times	☐	☐	☐	☐	☐	☐
Allow sightseeing tour aircraft to use designated flight paths over limited areas of the park	☐	☐	☐	☐	☐	☐
Prohibit sightseeing tour aircraft from flying over the park	☐	☐	☐	☐	☐	☐

10. Have you ever taken a scenic air tour over this or any other park?

(Please check all that apply.)

Yes, I have taken a scenic air tour over Lake Powell / Rainbow Bridge ☐

Yes, I have taken a scenic air tour over another national park .... ☐

No, I have never taken a scenic air tour over a park............................ ☐

11. Would you take a sightseeing air tour over this park, even if visitors on this trail could hear the aircraft during their visit?

Yes............................. ☐

No .... ☐

Don't know/not sure ..... ☐

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<u>Background Information</u>

12. How many adults and children were in your personal group (spouse, family, friends) on this visit to this trail?

    Adults   (age 16 or older)   _____Number

    Children (age 15 or younger)   _____Number

13. Were you or your personal group part of some larger commercial, educational, or other organized group of visitors?

    Yes......................☐

    No ....☐

14. What is your gender?

    Male ....☐

    Female.................☐

15. In what year were you born?

Year

1	9		

16. Where do you live?

    United States......☐➜ **What is your Zip code?** ➜ | | | | | |

    Another country..☐➜ **What country do you live in?**➜

17. What is the highest level of formal education you have completed?

    Some high school ....☐

    High school graduate or GED _____☐

    Some college, business or trade school _____☐

    College, business or trade school graduate ____☐

    Some graduate school _____☐

    Master's, doctoral or professional degree ....☐

18. Are you Hispanic or Latino?

Yes.......................☐
No ....☐

19. What is your race? (Check all that apply.)

American Indian or Alaska Native................☐
Asian...☐
Black or African American............................☐
Native Hawaiian..☐
Pacific Islander other than Native Hawaiian.☐
White...☐

Please give your questionnaire to the interviewer.

Thank you for completing the survey!

OMB control number: 2120-0744

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Appendix B Intercept Scripts

B.1 Dose Response Initial Intercept Protocol & Script

Initial Survey Station Set Up

- Complete the information at the top of the *Initial Intercept Log*. This includes GPS coordinate information from the Garmin GPS unit.

- TURN CELL PHONES TO SILENT, or OFF

- Set up tables and folding chairs

  NOTE: If possible, the survey administration area should be set up so that it is not visible to hikers when they first arrive at the trailhead and are pre-intercepted. At a minimum, the survey administration area should be spatially separated from the pre-intercept area.

- Set out the following on the table(s):

  – Numbered tickets

  – Initial Intercept Log Sheets on clipboards.

Interception

- At the start of sampling, intercept the first arriving visitor group.

- Use the following intercept script (Remember to smile):

  "Good morning. We are doing research with the National Park Service.   After you visit Rainbow Bridge, could help us out by taking a brief survey about your experiences in the park?"

  > **IF NO:** "No problem.   Enjoy your visit. "
  >
  > > Circle *Decline* in the *Non-Response Status* column of the *Initial Intercept Log*, and enter time, group size, number of children, overnight or not, and any notes.
  >
  > **IF YES:** "Great. The survey is anonymous, and will take only 10-15 minutes. We'll give each of you a ticket, so we can identify you as participants when you finish your visit to the Bridge. When you take the survey, we will collect you ticket."
  >
  > > Tear off the appropriate number of tickets, write the ticket number(s) in the *Initial Intercept Log* (last 4 digits of each number), and distribute the tickets to the members of the group.
  >
  > > Enter start time, group size, number of children, and any notes in the *Initial Intercept Log.*

Non-intercepts:

For any hikers that are not intercepted (e.g., the survey team members are all busy with other hikers), on the *Initial Intercept Log* fill in the time, group size, number of children, and circle NI in

the *Non-Response Status* column. This may be difficult to do in high-use areas. Do the best you can.

NOTE – Stop the initial intercept at least ½ - 1 hour prior to the end of your sampling day, to allow time for respondents to visit site.

Filling out *Initial Intercept Log*

- Make sure to fill out all of the information on the top of the log sheet.
- Make sure to write down group number (consecutive throughout the day), and all ticket numbers (last 4 digits)

Note Start Time, Group Size, # of Children, and any other notes of relevance (e.g., reason for decline)

B.2 Dose Response Survey Intercept

- Fill in the information on the top of the *Survey Intercept Log* sheet. This includes GPS coordinate information from the Garmin GPS unit.

- As each park visitor or group nears the intercept location, note the time, and approach them. Smile, and use the following script:

"Hello. Have we already talked to you about taking a survey? "

IF NOT PREVIOUSLY INTERCEPTED: "That's OK. If you are interested, I can tell you about the survey, and we'd love to have you participate."

> **IF VISITOR IS INTERESTED IN LEARNING MORE:** "This is a survey about your experience at Rainbow Bridge and on this trail today. The answers are anonymous, and the survey will take about 15 minutes. Would you like to participate?"
>
> > **IF YES:** "Great. Please step over here, have a seat and we'll get you started."
> >
> > - Record intercept time, group size, overnight or not, and number of children (in Notes column) in *Survey Intercept Log*
> >
> > - *Since these respondents were not previously intercepted, they will not have tickets. Start a new ID number sequence – for example, R1001, R1002, etc. If more than one person is doing survey intercept, each person should start a unique sequence – for example, the second person would use R2001, R2002, etc.*
> >
> > - If multiple respondents in group, ask them not to discuss surveys. You can tell them they have different surveys.
> >
> > - Provide respondent(s) with paper survey.
> >
> > > - Be sure to write the respondent's "ticket" number (e.g., R1001) and the time on the survey form. Also, complete the survey ID number at the top left of the survey form, by filling in the date.
> >
> > - Note any "Events affecting survey quality" in Notes Column.
> >
> > **IF NO:** "OK. Thanks for your time."

IF PREVIOUSLY INTERCEPTED: "Great. Are you ready to take the survey?"

> > **IF YES**: "OK. Please step over here, have a seat and we'll get you started."
> >
> > - Collect ticket(s)
> >
> > - Record ticket number(s) and instrument(s) administered on appropriate row of *Survey Intercept Log*.
> >
> > - Provide respondent(s) with paper survey.
> >
> > > - Be sure to write the respondent's "ticket" number (e.g., R1001) and the time on the survey form. Also, complete the survey ID number at the top left of the survey form, by filling in the date.

- If multiple respondents in group, ask them not to discuss surveys. You can tell them they have different versions of the survey.

- Note any "Events affecting survey quality" in Notes Column.

- When respondent has completed the survey, click "Administrator," then "Accept" or "Accept with comment".

IF NO: "No Problem. Just let me collect your ticket(s). Is there any particular reason why you decided not to participate?"

- Record ticket in *Survey Intercept log*, and circle *Declined* in Status column. If respondent provides reason, record that also.

- Make sure to fill in all information on the appropriate log sheets (*Survey Intercept Log* and the *Survey Completes Tally Log*).

Appendix C Summary of Survey Responses

This appendix reports descriptive statistics for responses to all questions contained in the survey questionnaires by sampling site within each park. Reported sample sizes reflect the number of respondents presented with each question. Response data for questions that appear in all three questionnaires are aggregated.

Table C-1. Was your hike a day-hike or a multi-day, overnight hike on this visit?

Location	Sample Size	Day-Hike	Multi-Day, Overnight Hike
RABR Rainbow Bridge	**177**	**100.0%**	**0.0%**
GRCA Grandview	415	70.1%	29.9%
GRCA Hermit	583	77.0%	23.0%
GRCA Tusayan Ruins	400	100.0%	0.0%
BRCA Fairyland	1079	100.0%	0.0%
ZION West Rim	308	58.8%	41.2%
ZION Taylor Creek	453	100.0%	0.0%
GLAC Sperry	912	59.2%	40.8%
GLAC Hidden Lake	516	100.0%	0.0%

Table C-2. Is this your first visit to <site>?

Location	Sample Size	Yes	No	No Response
RABR Rainbow Bridge	**177**	**52.6%**	**46.3%**	**1.1%**
GRCA Grandview	415	71.6%	28.2%	0.2%
GRCA Hermit	583	83.7%	16.0%	0.3%
GRCA Tusayan Ruins	400	92.0%	7.0%	1.0%
BRCA Fairyland	1079	90.0%	9.9%	0.1%
ZION West Rim	308	67.5%	32.5%	0.0%
ZION Taylor Creek	453	89.0%	11.0%	0.0%
GLAC Sperry	912	75.8%	23.9%	0.3%
GLAC Hidden Lake	516	75.6%	24.0%	0.4%

Table C-3. Approximately how many times [before] have you visited <site>?

Location	Sample Size	1 Previous Visit	2 to 5 Previous Visits	6 or More Previous Visits	No Response
RABR Rainbow Bridge	**177**	**8.5%**	**19.8%**	**18.1%**	**53.7%**
GRCA Grandview	415	7.0%	13.7%	7.5%	71.8%
GRCA Hermit	583	4.1%	6.5%	5.1%	84.2%
GRCA Tusayan Ruins	400	4.0%	3.0%	0.0%	93.0%
BRCA Fairyland	1079	4.5%	3.8%	1.3%	90.4%
ZION West Rim	308	5.2%	10.1%	1.6%	83.1%
ZION Taylor Creek	453	4.0%	4.2%	2.4%	89.4%
GLAC Sperry	912	7.7%	8.3%	2.9%	81.1%
GLAC Hidden Lake	516	7.4%	8.9%	6.8%	76.9%

Table C-4. Which of the following activities did you take part in during this visit to <site>?

a) Viewing the scenery

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**95.5%**	**4.5%**
GRCA Grandview	415	91.3%	8.7%
GRCA Hermit	583	91.6%	8.4%
GRCA Tusayan Ruins	400	85.8%	14.3%
BRCA Fairyland	1079	94.9%	5.1%
ZION West Rim	308	91.9%	8.1%
ZION Taylor Creek	453	92.9%	7.1%
GLAC Sperry	912	93.6%	6.4%
GLAC Hidden Lake	516	95.5%	4.5%

b) Viewing a sunrise or sunset

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**6.2%**	**93.8%**
GRCA Grandview	415	32.8%	67.2%
GRCA Hermit	583	21.6%	78.4%
GRCA Tusayan Ruins	400	8.8%	91.3%
BRCA Fairyland	1079	8.9%	91.1%
ZION West Rim	308	38.3%	61.7%
ZION Taylor Creek	453	1.5%	98.5%
GLAC Sperry	912	31.7%	68.3%
GLAC Hidden Lake	516	4.5%	95.5%

c) Picnicking or having a meal

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**10.7%**	**89.3%**
GRCA Grandview	415	63.4%	36.6%
GRCA Hermit	583	58.8%	41.2%
GRCA Tusayan Ruins	400	8.5%	91.5%
BRCA Fairyland	1079	43.4%	56.6%
ZION West Rim	308	63.6%	36.4%
ZION Taylor Creek	453	42.6%	57.4%
GLAC Sperry	912	60.7%	39.3%
GLAC Hidden Lake	516	53.3%	46.7%

d) Watching Birds

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**17.5%**	**82.5%**
GRCA Grandview	415	42.7%	57.3%
GRCA Hermit	583	43.2%	56.8%
GRCA Tusayan Ruins	400	18.0%	82.0%
BRCA Fairyland	1079	44.1%	55.9%
ZION West Rim	308	34.4%	65.6%
ZION Taylor Creek	453	26.3%	73.7%
GLAC Sperry	912	22.1%	77.9%
GLAC Hidden Lake	516	29.8%	70.2%

e) Viewing wildlife (other than birds)

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**31.6%**	**68.4%**
GRCA Grandview	415	44.8%	55.2%
GRCA Hermit	583	51.6%	48.4%
GRCA Tusayan Ruins	400	22.0%	78.0%
BRCA Fairyland	1079	47.7%	52.3%
ZION West Rim	308	59.1%	40.9%
ZION Taylor Creek	453	64.2%	35.8%
GLAC Sperry	912	64.1%	35.9%
GLAC Hidden Lake	516	94.6%	5.4%

f) Hiking or walking

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	96.0%	4.0%
GRCA Grandview	415	97.6%	2.4%
GRCA Hermit	583	96.9%	3.1%
GRCA Tusayan Ruins	400	76.3%	23.8%
BRCA Fairyland	1079	98.4%	1.6%
ZION West Rim	308	98.1%	1.9%
ZION Taylor Creek	453	98.5%	1.5%
GLAC Sperry	912	97.9%	2.1%
GLAC Hidden Lake	516	96.7%	3.3%

g) Camping

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	NA	NA
GRCA Grandview	415	32.3%	67.7%
GRCA Hermit	583	25.4%	74.6%
GRCA Tusayan Ruins	400	3.3%	96.8%
BRCA Fairyland	1079	1.8%	98.2%
ZION West Rim	308	39.9%	60.1%
ZION Taylor Creek	453	NA	NA
GLAC Sperry	912	13.0%	87.0%
GLAC Hidden Lake	516	1.0%	99.0%

h) Entering a visitor center, lodge, store, or other building

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**2.3%**	**97.7%**
GRCA Grandview	415	22.2%	77.8%
GRCA Hermit	583	29.0%	71.0%
GRCA Tusayan Ruins	400	76.3%	23.8%
BRCA Fairyland	1079	25.8%	74.2%
ZION West Rim	308	21.4%	78.6%
ZION Taylor Creek	453	48.6%	51.4%
GLAC Sperry	912	41.0%	59.0%
GLAC Hidden Lake	516	53.5%	46.5%

i) Attending a ranger-led talk, walk, or campfire program

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**42.9%**	**57.1%**
GRCA Grandview	415	2.9%	97.1%
GRCA Hermit	583	4.1%	95.9%
GRCA Tusayan Ruins	400	10.0%	90.0%
BRCA Fairyland	1079	2.3%	97.7%
ZION West Rim	308	1.3%	98.7%
ZION Taylor Creek	453	0.7%	99.3%
GLAC Sperry	912	2.1%	97.9%
GLAC Hidden Lake	516	5.6%	94.4%

j) Attending some other demonstration, talk, or organized activity

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**13.6%**	**86.4%**
GRCA Grandview	415	1.7%	98.3%
GRCA Hermit	583	1.7%	98.3%
GRCA Tusayan Ruins	400	1.0%	99.0%
BRCA Fairyland	1079	1.2%	98.8%
ZION West Rim	308	0.6%	99.4%
ZION Taylor Creek	453	0.9%	99.1%
GLAC Sperry	912	3.1%	96.9%
GLAC Hidden Lake	516	2.7%	97.3%

k) Other

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**7.3%**	**92.7%**
GRCA Grandview	415	6.3%	93.7%
GRCA Hermit	583	7.2%	92.8%
GRCA Tusayan Ruins	400	3.3%	96.8%
BRCA Fairyland	1079	0.0%	92.2%
ZION West Rim	308	6.8%	93.2%
ZION Taylor Creek	453	5.5%	94.5%
GLAC Sperry	912	0.0%	91.7%
GLAC Hidden Lake	516	0.0%	90.1%

l) None of the above

Location	Sample Size	Yes	No
RABR Rainbow Bridge	**177**	**0.0%**	**100.0%**
GRCA Grandview	415	0.0%	100.0%
GRCA Hermit	583	0.5%	99.5%
GRCA Tusayan Ruins	400	0.7%	99.3%
BRCA Fairyland	1079	0.5%	99.5%
ZION West Rim	308	0.0%	100.0%
ZION Taylor Creek	453	0.4%	99.6%
GLAC Sperry	912	0.3%	99.7%
GLAC Hidden Lake	516	0.4%	99.6%

Table C-5. How important was it that this visit to <site> provide you with the opportunity to …

a) View the natural scenery?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**0.0%**	**0.0%**	**6.2%**	**31.1%**	**45.2%**	**0.6%**	**1.7%**
GRCA Grandview	415	0.2%	0.0%	2.4%	21.2%	74.7%	0.2%	1.2%
GRCA Hermit	583	0.0%	0.5%	3.4%	28.3%	67.1%	0.2%	0.5%
GRCA Tusayan Ruins	400	0.0%	2.8%	23.5%	38.5%	31.3%	1.8%	2.3%
BRCA Fairyland	1079	0.1%	0.4%	2.8%	27.1%	68.6%	0.2%	0.9%
ZION West Rim	308	0.0%	0.3%	4.2%	26.9%	67.2%	0.0%	1.3%
ZION Taylor Creek	453	0.2%	0.7%	6.8%	25.2%	65.6%	0.4%	1.1%
GLAC Sperry	912	0.2%	0.5%	5.5%	34.4%	58.1%	0.2%	1.0%
GLAC Hidden Lake	516	0.0%	0.4%	1.9%	23.6%	72.9%	0.0%	1.2%

b) Enjoy the natural quiet and sounds of nature?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**2.3%**	**2.8%**	**19.2%**	**27.1%**	**46.3%**	**1.1%**	**1.1%**
GRCA Grandview	415	0.7%	1.9%	10.1%	29.9%	55.4%	0.2%	1.7%
GRCA Hermit	583	0.2%	3.1%	10.6%	37.0%	48.7%	0.2%	0.2%
GRCA Tusayan Ruins	400	1.8%	7.5%	23.0%	40.8%	20.3%	3.8%	3.0%
BRCA Fairyland	1079	0.7%	2.9%	9.6%	39.1%	46.8%	0.3%	0.6%
ZION West Rim	308	0.6%	1.3%	12.0%	37.7%	47.4%	0.0%	1.0%
ZION Taylor Creek	453	1.3%	3.3%	10.2%	41.7%	41.7%	0.7%	1.1%
GLAC Sperry	912	0.3%	2.9%	10.7%	38.4%	46.5%	0.4%	0.8%
GLAC Hidden Lake	516	1.4%	2.5%	11.6%	37.2%	44.6%	1.2%	1.6%

c) Appreciate the history and cultural significance of the site?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**0.0%**	**2.3%**	**19.2%**	**24.9%**	**50.8%**	**1.7%**	**1.1%**
GRCA Grandview	415	1.9%	12.5%	26.3%	29.4%	26.0%	2.7%	1.2%
GRCA Hermit	583	4.6%	14.9%	30.0%	23.8%	21.1%	3.6%	1.9%
GRCA Tusayan Ruins	400	0.5%	4.0%	11.0%	48.8%	33.3%	1.5%	1.0%
BRCA Fairyland	1079	8.0%	19.4%	27.2%	23.4%	14.8%	5.8%	1.4%
ZION West Rim	308	8.8%	19.5%	29.5%	19.5%	15.6%	5.8%	1.3%
ZION Taylor Creek	453	7.5%	25.8%	30.0%	18.8%	12.1%	4.6%	1.1%
GLAC Sperry	912	8.1%	17.9%	26.5%	23.9%	13.8%	8.4%	1.3%
GLAC Hidden Lake	516	6.4%	17.2%	30.8%	23.1%	16.5%	4.1%	1.9%

Table C-5 (continued). How important was it that this visit to <site> provide you with the opportunity to …

d) Experience a feeling of calmness, peace, or tranquility?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**1.7%**	**6.2%**	**13.0%**	**29.4%**	**45.2%**	**2.8%**	**1.7%**
GRCA Grandview	415	1.0%	3.4%	11.3%	32.8%	49.2%	0.7%	1.7%
GRCA Hermit	583	0.5%	3.8%	15.3%	37.0%	41.5%	1.7%	0.2%
GRCA Tusayan Ruins	400	2.3%	10.0%	25.3%	38.8%	17.3%	3.8%	2.8%
BRCA Fairyland	1079	0.8%	3.7%	13.3%	39.7%	40.8%	0.7%	1.0%
ZION West Rim	308	0.0%	2.3%	11.7%	39.6%	45.8%	0.3%	0.3%
ZION Taylor Creek	453	1.5%	4.2%	16.1%	38.2%	37.5%	1.3%	1.1%
GLAC Sperry	912	0.7%	4.8%	13.9%	38.7%	40.2%	0.7%	1.0%
GLAC Hidden Lake	516	1.0%	3.5%	13.0%	38.2%	41.3%	1.2%	1.0%

e) Experience a sense of adventure or challenge

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**12.4%**	**11.9%**	**19.8%**	**24.3%**	**27.1%**	**3.4%**	**1.1%**
GRCA Grandview	415	0.7%	2.9%	14.5%	32.3%	48.2%	0.5%	1.0%
GRCA Hermit	583	0.9%	5.3%	19.0%	35.0%	39.1%	0.3%	0.3%
GRCA Tusayan Ruins	400	14.0%	19.3%	26.5%	17.8%	9.0%	9.3%	4.3%
BRCA Fairyland	1079	3.0%	9.5%	24.7%	34.0%	26.6%	1.4%	0.8%
ZION West Rim	308	1.3%	4.2%	17.9%	36.7%	39.0%	0.3%	0.6%
ZION Taylor Creek	453	3.3%	10.2%	32.2%	29.8%	22.5%	0.9%	1.1%
GLAC Sperry	912	1.9%	8.6%	21.8%	37.3%	28.7%	0.8%	1.0%
GLAC Hidden Lake	516	3.3%	8.1%	22.7%	33.3%	28.7%	1.7%	2.1%

Table C-6. During this visit to <site>, how much did you …

a) Appreciate the natural scenery?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**0.0%**	**0.6%**	**6.8%**	**25.4%**	**65.5%**	**0.0%**	**1.7%**
GRCA Grandview	415	0.2%	0.2%	2.7%	24.1%	69.9%	0.2%	2.7%
GRCA Hermit	583	0.3%	0.3%	4.3%	27.8%	64.8%	0.2%	2.2%
GRCA Tusayan Ruins	400	0.0%	3.8%	20.0%	43.5%	24.0%	1.0%	7.8%
BRCA Fairyland	1079	0.1%	0.2%	3.0%	26.1%	69.0%	0.1%	1.5%
ZION West Rim	308	0.3%	0.6%	3.9%	25.3%	67.9%	0.0%	1.9%
ZION Taylor Creek	453	0.2%	0.0%	3.8%	34.4%	59.4%	0.0%	2.2%
GLAC Sperry	912	0.1%	0.9%	8.2%	34.0%	54.7%	0.2%	1.9%
GLAC Hidden Lake	516	0.0%	0.0%	1.4%	23.3%	72.9%	0.2%	2.3%

b) Enjoy the natural quiet and sounds of nature?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**1.7%**	**6.2%**	**17.5%**	**27.1%**	**44.1%**	**1.1%**	**2.3%**
GRCA Grandview	415	0.5%	5.1%	12.0%	31.8%	47.7%	0.2%	2.7%
GRCA Hermit	583	0.9%	6.7%	19.4%	35.2%	35.5%	0.0%	2.4%
GRCA Tusayan Ruins	400	0.8%	9.5%	22.0%	39.3%	18.3%	2.3%	8.0%
BRCA Fairyland	1079	0.6%	1.2%	9.8%	42.4%	44.3%	0.3%	1.4%
ZION West Rim	308	0.0%	1.6%	10.7%	39.9%	45.5%	0.0%	2.3%
ZION Taylor Creek	453	0.2%	2.4%	13.0%	43.0%	39.1%	0.2%	2.0%
GLAC Sperry	912	0.4%	2.2%	13.4%	44.0%	37.7%	0.5%	1.8%
GLAC Hidden Lake	516	1.6%	5.2%	18.2%	35.5%	37.2%	0.4%	1.9%

c) Appreciate the history and cultural significance of the site?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**1.7%**	**3.4%**	**16.4%**	**27.1%**	**47.5%**	**2.3%**	**1.7%**
GRCA Grandview	415	3.6%	13.3%	26.0%	25.1%	25.5%	2.7%	3.9%
GRCA Hermit	583	6.9%	16.8%	29.5%	21.8%	19.4%	2.9%	2.7%
GRCA Tusayan Ruins	400	0.8%	3.3%	13.8%	44.0%	29.8%	1.0%	7.5%
BRCA Fairyland	1079	10.7%	18.7%	27.5%	19.7%	12.8%	8.1%	2.5%
ZION West Rim	308	12.0%	17.5%	24.7%	21.4%	14.3%	7.8%	2.3%
ZION Taylor Creek	453	9.5%	24.3%	31.1%	18.8%	10.8%	3.1%	2.4%
GLAC Sperry	912	12.9%	19.8%	22.8%	19.3%	11.8%	11.5%	1.8%
GLAC Hidden Lake	516	10.7%	22.3%	26.6%	18.2%	13.8%	5.2%	3.3%

Table C-6 (continued). During this visit to <site>, how much did you …

d) Experience a feeling of calmness, peace, or tranquility?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**2.3%**	**7.3%**	**24.9%**	**22.0%**	**39.5%**	**2.3%**	**2.8%**
GRCA Grandview	415	0.5%	4.6%	14.5%	32.8%	44.3%	0.2%	3.1%
GRCA Hermit	583	0.9%	5.5%	18.9%	36.7%	34.6%	0.9%	2.6%
GRCA Tusayan Ruins	400	1.5%	7.8%	24.3%	40.5%	15.0%	2.5%	8.5%
BRCA Fairyland	1079	0.5%	2.8%	13.1%	42.7%	38.6%	0.6%	1.8%
ZION West Rim	308	0.0%	1.0%	13.0%	41.2%	42.9%	0.0%	1.9%
ZION Taylor Creek	453	0.2%	5.5%	17.0%	38.9%	35.5%	0.7%	2.2%
GLAC Sperry	912	0.9%	3.7%	16.7%	41.3%	35.4%	0.2%	1.8%
GLAC Hidden Lake	516	1.4%	5.8%	18.0%	34.7%	36.8%	1.0%	2.3%

e) Experience a sense of adventure or challenge

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**177**	**11.9%**	**18.1%**	**14.1%**	**21.5%**	**31.1%**	**1.1%**	**2.3%**
GRCA Grandview	415	0.5%	2.9%	16.4%	34.0%	43.4%	0.2%	2.7%
GRCA Hermit	583	1.2%	4.3%	18.5%	35.2%	38.3%	0.2%	2.4%
GRCA Tusayan Ruins	400	18.0%	16.5%	24.5%	15.8%	8.8%	8.3%	8.3%
BRCA Fairyland	1079	3.2%	10.8%	27.3%	33.2%	22.5%	1.3%	1.7%
ZION West Rim	308	1.0%	5.8%	19.8%	36.0%	34.7%	0.3%	2.3%
ZION Taylor Creek	453	2.9%	13.5%	35.3%	26.3%	19.2%	0.7%	2.2%
GLAC Sperry	912	2.0%	10.2%	23.7%	34.0%	27.4%	0.9%	1.9%
GLAC Hidden Lake	516	2.3%	9.9%	23.8%	34.3%	25.4%	2.1%	2.1%

Table C-7. Did you HEAR airplanes, jets, helicopters, or any other aircraft during this visit to <site>?

Location	Sample Size	Yes	No	No Response
Rainbow Bridge	**177**	**38.4%**	**59.9%**	**1.7%**
GRCA Grandview	415	53.3%	46.3%	0.5%
GRCA Hermit	583	84.9%	14.9%	0.2%
GRCA Tusayan Ruins	400	38.8%	61.3%	0.0%
BRCA Fairyland	1079	42.2%	56.2%	1.4%
ZION West Rim	308	48.1%	51.0%	1.0%
ZION Taylor Creek	453	28.5%	71.3%	0.2%
GLAC Sperry	912	79.1%	19.8%	1.1%
GLAC Hidden Lake	516	80.6%	19.0%	0.4%

Table C-8. During this visit to <site>, how much did noise from airplanes, jets, helicopters, or other aircraft bother, disturb, or annoy you?[*]

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	No Response
Rainbow Bridge	**25**	**40.0%**	**16.0%**	**32.0%**	**8.0%**	**0.0%**	**4.0%**
GRCA Grandview	221	23.5%	29.9%	18.6%	8.6%	6.8%	12.7%
GRCA Hermit	495	14.5%	23.8%	25.1%	17.4%	13.1%	6.1%
GRCA Tusayan Ruins	155	41.3%	33.5%	18.1%	6.5%	0.6%	0.0%
BRCA Fairyland	455	43.5%	37.6%	11.9%	3.5%	1.5%	2.0%
ZION West Rim	148	45.3%	31.8%	16.2%	6.1%	0.7%	0.0%
ZION Taylor Creek	129	51.9%	27.9%	13.2%	3.9%	1.6%	1.6%
GLAC Sperry	193	37.8%	33.2%	15.0%	4.7%	9.3%	0.0%
GLAC Hidden Lake	113	43.4%	28.3%	18.6%	5.3%	4.4%	0.0%

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[*] This question appeared only for those visitors who reported hearing aircraft.

Table C-9. How much did the sounds from aircraft interfere with each of the following aspects of this visit to <site>?[†]

a) Enjoyment of the site

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**68**	**39.7%**	**16.2%**	**11.8%**	**1.5%**	**4.4%**	**20.6%**	**5.9%**
GRCA Grandview	153	26.1%	22.2%	11.8%	13.1%	6.5%	1.3%	19.0%
GRCA Hermit	332	18.4%	25.6%	22.3%	15.4%	8.1%	3.6%	6.6%
GRCA Tusayan Ruins	86	44.2%	22.1%	10.5%	5.8%	4.7%	11.6%	1.2%
BRCA Fairyland	310	37.4%	28.4%	14.8%	6.8%	3.9%	3.9%	4.8%
ZION West Rim	98	45.9%	26.5%	9.2%	3.1%	4.1%	11.2%	0.0%
ZION Taylor Creek	89	51.7%	25.8%	10.1%	3.4%	2.2%	3.4%	3.4%
GLAC Sperry	498	41.0%	26.1%	18.1%	5.4%	5.8%	3.6%	0.0%
GLAC Hidden Lake	273	34.4%	30.4%	19.4%	4.8%	5.1%	4.8%	1.1%

b) Appreciation of the natural quiet and sounds of nature at the site?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**68**	**30.9%**	**19.1%**	**13.2%**	**4.4%**	**5.9%**	**20.6%**	**5.9%**
GRCA Grandview	153	16.3%	31.4%	14.4%	11.8%	13.7%	0.7%	11.8%
GRCA Hermit	332	9.0%	19.6%	19.6%	22.0%	23.2%	2.1%	4.5%
GRCA Tusayan Ruins	86	32.6%	25.6%	17.4%	11.6%	3.5%	9.3%	0.0%
BRCA Fairyland	310	26.1%	29.4%	19.7%	12.6%	5.2%	2.3%	4.8%
ZION West Rim	98	36.7%	26.5%	15.3%	6.1%	6.1%	9.2%	0.0%
ZION Taylor Creek	89	37.1%	31.5%	12.4%	7.9%	3.4%	4.5%	3.4%
GLAC Sperry	498	24.3%	27.1%	23.9%	10.8%	11.4%	2.4%	0.0%
GLAC Hidden Lake	273	20.5%	34.4%	19.8%	10.3%	10.3%	4.4%	0.4%

c) Appreciation of the historical and cultural significance of the site?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**68**	**42.6%**	**16.2%**	**5.9%**	**4.4%**	**4.4%**	**20.6%**	**5.9%**
GRCA Grandview	153	28.8%	19.0%	11.8%	5.2%	3.9%	6.5%	24.8%
GRCA Hermit	332	28.3%	16.9%	16.9%	9.6%	6.0%	10.5%	11.7%
GRCA Tusayan Ruins	86	50.0%	17.4%	10.5%	5.8%	2.3%	14.0%	0.0%
BRCA Fairyland	310	45.2%	23.5%	8.7%	5.5%	2.3%	9.7%	5.2%
ZION West Rim	98	53.1%	13.3%	10.2%	3.1%	2.0%	18.4%	0.0%
ZION Taylor Creek	89	58.4%	18.0%	5.6%	4.5%	1.1%	9.0%	3.4%
GLAC Sperry	498	48.4%	16.9%	9.6%	3.8%	3.8%	16.9%	0.6%
GLAC Hidden Lake	273	49.1%	16.5%	9.5%	4.4%	4.0%	16.1%	0.4%

[†] This question was presented only to those visitors who reported hearing aircraft in the HR1 and HR2 surveys. Options d through l were presented only in the HR1 survey.

Table C-9 (continued). How much did the sounds from aircraft interfere with each of the following aspects of this visit to <site>?

d) Experiencing a sense of connection to the history, events, or people commemorated here?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**48.0%**	**24.0%**	**12.0%**	**0.0%**	**8.0%**	**4.0%**	**4.0%**
GRCA Grandview	77	26.0%	23.4%	9.1%	3.9%	6.5%	11.7%	19.5%
GRCA Hermit	172	24.4%	18.0%	20.3%	8.7%	4.1%	12.2%	12.2%
GRCA Tusayan Ruins	42	50.0%	21.4%	9.5%	4.8%	2.4%	9.5%	2.4%
BRCA Fairyland	160	53.1%	15.6%	6.3%	3.1%	0.6%	21.3%	0.0%
ZION West Rim	47	63.8%	10.6%	8.5%	2.1%	0.0%	14.9%	0.0%
ZION Taylor Creek	51	54.9%	13.7%	9.8%	3.9%	0.0%	17.6%	0.0%
GLAC Sperry	282	47.5%	18.4%	9.2%	2.5%	3.5%	17.7%	1.1%
GLAC Hidden Lake	144	45.1%	18.1%	9.0%	2.8%	1.4%	21.5%	2.1%

e) Experiencing a sense of connection with nature?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**52.0%**	**16.0%**	**16.0%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**
GRCA Grandview	77	26.0%	28.6%	6.5%	9.1%	15.6%	1.3%	13.0%
GRCA Hermit	172	15.7%	18.6%	21.5%	17.4%	18.6%	4.1%	4.1%
GRCA Tusayan Ruins	42	38.1%	23.8%	14.3%	11.9%	2.4%	7.1%	2.4%
BRCA Fairyland	160	45.6%	23.8%	13.8%	7.5%	4.4%	5.0%	0.0%
ZION West Rim	47	51.1%	23.4%	10.6%	6.4%	2.1%	2.1%	4.3%
ZION Taylor Creek	51	45.1%	19.6%	19.6%	7.8%	2.0%	5.9%	0.0%
GLAC Sperry	282	29.8%	29.4%	18.8%	12.1%	7.8%	1.1%	1.1%
GLAC Hidden Lake	144	31.9%	22.2%	18.8%	15.3%	6.3%	3.5%	2.1%

f) Appreciating scenic beauty?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**44.0%**	**28.0%**	**16.0%**	**0.0%**	**4.0%**	**4.0%**	**4.0%**
GRCA Grandview	77	32.5%	18.2%	9.1%	9.1%	11.7%	1.3%	18.2%
GRCA Hermit	172	24.4%	22.7%	18.6%	13.4%	8.7%	4.1%	8.1%
GRCA Tusayan Ruins	42	52.4%	11.9%	11.9%	11.9%	0.0%	9.5%	2.4%
BRCA Fairyland	160	62.5%	18.1%	8.1%	3.8%	3.1%	4.4%	0.0%
ZION West Rim	47	66.0%	10.6%	10.6%	4.3%	2.1%	6.4%	0.0%
ZION Taylor Creek	51	49.0%	23.5%	17.6%	2.0%	2.0%	3.9%	2.0%
GLAC Sperry	282	48.2%	22.7%	13.5%	6.7%	6.4%	1.4%	1.1%
GLAC Hidden Lake	144	44.4%	22.9%	13.9%	9.7%	4.2%	3.5%	1.4%

Table C-9 (continued). How much did the sounds from aircraft interfere with each of the following aspects of this visit to <site>?

g) Experiencing a feeling of calmness, peace, or tranquility?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**36.0%**	**28.0%**	**16.0%**	**4.0%**	**8.0%**	**4.0%**	**4.0%**
GRCA Grandview	77	19.5%	26.0%	13.0%	9.1%	16.9%	1.3%	14.3%
GRCA Hermit	172	11.0%	18.6%	27.3%	16.9%	18.0%	4.1%	4.1%
GRCA Tusayan Ruins	42	35.7%	26.2%	7.1%	19.0%	0.0%	9.5%	2.4%
BRCA Fairyland	160	38.8%	33.1%	15.6%	5.6%	3.8%	3.1%	0.0%
ZION West Rim	47	51.1%	25.5%	12.8%	6.4%	0.0%	4.3%	0.0%
ZION Taylor Creek	51	41.2%	25.5%	15.7%	9.8%	2.0%	3.9%	2.0%
GLAC Sperry	282	31.2%	28.0%	16.7%	12.4%	8.5%	1.8%	1.4%
GLAC Hidden Lake	144	26.4%	27.8%	17.4%	16.0%	6.9%	3.5%	2.1%

h) Experiencing a sense of adventure or challenge?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**52.0%**	**24.0%**	**8.0%**	**0.0%**	**8.0%**	**4.0%**	**4.0%**
GRCA Grandview	77	36.4%	18.2%	10.4%	6.5%	6.5%	1.3%	20.8%
GRCA Hermit	172	30.8%	19.2%	19.2%	11.0%	3.5%	6.4%	9.9%
GRCA Tusayan Ruins	42	47.6%	14.3%	16.7%	2.4%	0.0%	16.7%	2.4%
BRCA Fairyland	160	65.0%	11.9%	8.8%	3.1%	1.3%	9.4%	0.6%
ZION West Rim	47	66.0%	8.5%	12.8%	4.3%	0.0%	6.4%	2.1%
ZION Taylor Creek	51	56.9%	15.7%	11.8%	5.9%	0.0%	9.8%	0.0%
GLAC Sperry	282	60.3%	12.8%	12.1%	4.3%	4.3%	5.7%	0.7%
GLAC Hidden Lake	144	52.1%	18.1%	11.8%	6.3%	2.1%	8.3%	1.4%

i) Hearing something said during a ranger talk, campfire program, or other ranger-led activity?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**44.0%**	**28.0%**	**8.0%**	**4.0%**	**0.0%**	**12.0%**	**4.0%**
GRCA Grandview	77	14.3%	5.2%	2.6%	0.0%	2.6%	37.7%	37.7%
GRCA Hermit	172	13.4%	2.9%	4.1%	1.2%	0.6%	55.2%	22.7%
GRCA Tusayan Ruins	42	42.9%	4.8%	4.8%	2.4%	0.0%	40.5%	4.8%
BRCA Fairyland	160	28.8%	1.3%	1.3%	0.6%	0.0%	68.1%	0.0%
ZION West Rim	47	34.0%	2.1%	4.3%	0.0%	0.0%	59.6%	0.0%
ZION Taylor Creek	51	21.6%	5.9%	0.0%	0.0%	0.0%	72.5%	0.0%
GLAC Sperry	282	26.6%	2.5%	2.5%	0.7%	2.5%	64.2%	1.1%
GLAC Hidden Lake	144	19.4%	4.2%	0.0%	1.4%	0.7%	70.1%	4.2%

Table C-9 (continued). How much did the sounds from aircraft interfere with each of the following aspects of this visit to <site>?

j) **Hearing any other performance, talk, or group presentation?**

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**25**	**36.0%**	**28.0%**	**4.0%**	**8.0%**	**0.0%**	**16.0%**	**8.0%**
GRCA Grandview	77	13.0%	5.2%	3.9%	0.0%	2.6%	36.4%	39.0%
GRCA Hermit	172	13.4%	3.5%	4.1%	2.3%	1.7%	52.9%	22.1%
GRCA Tusayan Ruins	42	35.7%	7.1%	4.8%	0.0%	0.0%	45.2%	7.1%
BRCA Fairyland	160	29.4%	3.1%	2.5%	0.6%	0.0%	64.4%	0.0%
ZION West Rim	47	36.2%	2.1%	2.1%	0.0%	0.0%	59.6%	0.0%
ZION Taylor Creek	51	29.4%	2.0%	0.0%	0.0%	0.0%	68.6%	0.0%
GLAC Sperry	282	28.0%	2.8%	2.5%	0.7%	1.8%	62.8%	1.4%
GLAC Hidden Lake	144	20.1%	2.8%	0.0%	1.4%	0.7%	70.8%	4.2%

k) **Appreciating natural sounds at night?**

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**NA**							
GRCA Grandview	34	0.0%	20.6%	5.9%	5.9%	14.7%	0.0%	52.9%
GRCA Hermit	44	0.0%	9.1%	11.4%	6.8%	4.5%	0.0%	68.2%
GRCA Tusayan Ruins	NA							
BRCA Fairyland	NA							
ZION West Rim	27	55.6%	11.1%	11.1%	11.1%	0.0%	11.1%	0.0%
ZION Taylor Creek	NA							
GLAC Sperry	141	64.5%	11.3%	5.7%	4.3%	5.0%	9.2%	0.0%
GLAC Hidden Lake	NA							

l) **Sleeping at night?**

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	Not Relevant	No Resp
Rainbow Bridge	**NA**							
GRCA Grandview	34	0.0%	5.9%	0.0%	0.0%	0.0%	0.0%	94.1%
GRCA Hermit	44	0.0%	11.4%	0.0%	0.0%	0.0%	0.0%	88.6%
GRCA Tusayan Ruins	NA							
BRCA Fairyland	NA							
ZION West Rim	27	74.1%	7.4%	0.0%	0.0%	0.0%	7.4%	11.1%
ZION Taylor Creek	NA							
GLAC Sperry	141	78.0%	5.0%	0.0%	0.0%	0.0%	8.5%	8.5%
GLAC Hidden Lake	NA							

Table C-10. How acceptable or unacceptable was the sound from aircraft that you heard during this visit to <site>?[*]

Location	Sample Size	Extremely unaccept-able	Very unaccept-able	Moderately unaccept-able	Slightly unaccept-able	Neutral	Slightly acceptable	Moderately acceptable	Very acceptable	Extremely acceptable	No resp
Rainbow Bridge	**68**	**2.9%**	**0.0%**	**4.4%**	**13.2%**	**36.8%**	**10.3%**	**10.3%**	**10.3%**	**7.4%**	**4.4%**
GRCA Grandview	153	11.8%	7.2%	11.8%	15.7%	20.3%	8.5%	15.0%	7.2%	2.0%	0.7%
GRCA Hermit	332	15.4%	16.0%	17.2%	12.7%	16.0%	7.2%	6.0%	7.2%	2.4%	0.0%
GRCA Tusayan Ruins	86	0.0%	5.8%	9.3%	17.4%	25.6%	9.3%	11.6%	14.0%	4.7%	2.3%
BRCA Fairyland	310	3.2%	2.9%	8.7%	12.3%	29.0%	9.7%	13.2%	15.5%	5.2%	0.3%
ZION West Rim	98	0.0%	5.1%	11.2%	13.3%	29.6%	4.1%	15.3%	17.3%	4.1%	0.0%
ZION Taylor Creek	89	3.4%	4.5%	7.9%	23.6%	29.2%	4.5%	7.9%	10.1%	7.9%	1.1%
GLAC Sperry	498	7.8%	7.6%	13.1%	17.7%	22.3%	7.2%	10.6%	8.4%	4.4%	0.8%
GLAC Hidden Lake	273	6.6%	7.0%	15.4%	17.6%	20.9%	8.1%	13.9%	6.2%	2.9%	1.5%

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[*] This question was presented to only those visitors who reported hearing aircraft in the HR1 and HR2 surveys.

Table C-11. Did you SEE airplanes, jets, helicopters, or any other aircraft during this visit to <site>?

Location	Sample Size	Yes	No	No Response
Rainbow Bridge	**93**	**18.3%**	**79.6%**	**2.1%**
GRCA Grandview	139	48.2%	50.4%	0.7%
GRCA Hermit	205	83.4%	16.1%	0.5%
GRCA Tusayan Ruins	129	12.4%	86.0%	1.6%
BRCA Fairyland	357	46.8%	51.8%	0.3%
ZION West Rim	103	47.6%	51.5%	2.9%
ZION Taylor Creek	163	23.9%	74.2%	1.8%
GLAC Sperry	336	57.4%	42.0%	0.6%
GLAC Hidden Lake	172	65.7%	33.1%	1.2%

Table C-12. During this visit to <site> did seeing aircraft bother, disturb or annoy you?

Location	Sample Size	Not At All	Slightly	Moderately	Very	Extremely	No Response
Rainbow Bridge	**17**	**47.1%**	**29.4%**	**11.8%**	**0.0%**	**11.8%**	**0.0%**
GRCA Grandview	67	25.4%	23.9%	9.0%	9.0%	10.4%	22.4%
GRCA Hermit	171	28.1%	21.6%	19.9%	12.3%	10.5%	7.6%
GRCA Tusayan Ruins	16	43.8%	31.3%	25.0%	0.0%	0.0%	0.0%
BRCA Fairyland	167	71.3%	18.0%	7.2%	3.0%	1.2%	0.0%
ZION West Rim	49	65.3%	28.6%	4.1%	0.0%	0.0%	2.0%
ZION Taylor Creek	39	79.5%	10.3%	7.7%	0.0%	2.6%	0.0%
GLAC Sperry	193	37.8%	33.2%	15.0%	4.7%	9.3%	0.0%
GLAC Hidden Lake	113	43.4%	28.3%	18.6%	5.3%	4.4%	0.0%

Table C-13. Which of the following sounds did you hear during this visit to <site>?

a) Insect sounds

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**65.5%**	**34.5%**
GRCA Grandview	150	74.0%	26.0%
GRCA Hermit	182	56.6%	43.4%
GRCA Tusayan Ruins	128	9.4%	90.6%
BRCA Fairyland	374	63.4%	36.4%
ZION West Rim	100	84.0%	16.0%
ZION Taylor Creek	156	82.1%	17.9%
GLAC Sperry	291	72.5%	27.5%
GLAC Hidden Lake	166	54.2%	45.8%

b) Bird or animal sounds

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**75.0%**	**25.0%**
GRCA Grandview	150	94.7%	5.3%
GRCA Hermit	182	90.7%	9.3%
GRCA Tusayan Ruins	128	62.5%	37.5%
BRCA Fairyland	374	90.9%	9.1%
ZION West Rim	100	92.0%	8.0%
ZION Taylor Creek	156	96.2%	3.8%
GLAC Sperry	291	85.9%	14.1%
GLAC Hidden Lake	166	80.7%	19.3%

c) Waterfalls, running water, or waves

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**50.0%**	**50.0%**
GRCA Grandview	150	30.7%	69.3%
GRCA Hermit	182	44.5%	55.5%
GRCA Tusayan Ruins	128	5.5%	94.5%
BRCA Fairyland	374	19.0%	81.0%
ZION West Rim	100	77.0%	23.0%
ZION Taylor Creek	156	95.5%	4.5%
GLAC Sperry	291	97.9%	2.1%
GLAC Hidden Lake	166	94.0%	6.0%

d) Wind, rain, or thunder

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**46.4%**	**53.6%**
GRCA Grandview	150	71.3%	28.7%
GRCA Hermit	182	74.7%	25.3%
GRCA Tusayan Ruins	128	55.5%	44.5%
BRCA Fairyland	374	72.7%	27.3%
ZION West Rim	100	71.0%	29.0%
ZION Taylor Creek	156	54.5%	45.5%
GLAC Sperry	291	52.6%	47.4%
GLAC Hidden Lake	166	56.6%	43.4%

e) Group of people talking

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**90.5%**	**9.5%**
GRCA Grandview	150	86.7%	13.3%
GRCA Hermit	182	78.6%	21.4%
GRCA Tusayan Ruins	128	78.9%	21.1%
BRCA Fairyland	374	74.3%	25.7%
ZION West Rim	100	65.0%	35.0%
ZION Taylor Creek	156	80.1%	19.9%
GLAC Sperry	291	75.6%	24.4%
GLAC Hidden Lake	166	83.1%	16.9%

f) Someone's radio, TV, iPod, or other audio device

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**29.8%**	**70.2%**
GRCA Grandview	150	3.3%	96.7%
GRCA Hermit	182	8.8%	91.2%
GRCA Tusayan Ruins	128	3.1%	96.9%
BRCA Fairyland	374	9.1%	90.9%
ZION West Rim	100	3.0%	97.0%
ZION Taylor Creek	156	3.8%	96.2%
GLAC Sperry	291	7.2%	92.8%
GLAC Hidden Lake	166	12.0%	88.0%

g) Cars or trucks in a parking lot

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**23.8%**	**76.2%**
GRCA Grandview	150	11.3%	88.7%
GRCA Hermit	182	4.9%	95.1%
GRCA Tusayan Ruins	128	47.7%	52.3%
BRCA Fairyland	374	12.0%	88.0%
ZION West Rim	100	7.0%	93.0%
ZION Taylor Creek	156	3.2%	96.8%
GLAC Sperry	291	6.5%	93.5%
GLAC Hidden Lake	166	32.5%	67.5%

h) Cars or trucks on a road or highway

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**22.6%**	**77.4%**
GRCA Grandview	150	4.7%	95.3%
GRCA Hermit	182	3.3%	96.7%
GRCA Tusayan Ruins	128	46.9%	53.1%
BRCA Fairyland	374	10.7%	89.3%
ZION West Rim	100	16.0%	84.0%
ZION Taylor Creek	156	5.8%	94.2%
GLAC Sperry	291	11.0%	89.0%
GLAC Hidden Lake	166	22.3%	77.7%

i) Airplanes, jets, helicopters, or other aircraft

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**51.2%**	**48.8%**
GRCA Grandview	150	51.3%	48.7%
GRCA Hermit	182	84.6%	15.4%
GRCA Tusayan Ruins	128	34.4%	65.6%
BRCA Fairyland	374	40.1%	59.4%
ZION West Rim	100	51.0%	49.0%
ZION Taylor Creek	156	24.4%	75.6%
GLAC Sperry	291	74.2%	25.8%
GLAC Hidden Lake	166	77.7%	22.3%

j) Motorboats or motorized watercraft

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**44.0%**	**56.0%**
GRCA Grandview	150	2.7%	97.3%
GRCA Hermit	182	2.7%	97.3%
GRCA Tusayan Ruins	128	0.8%	99.2%
BRCA Fairyland	374	5.3%	94.7%
ZION West Rim	100	1.0%	99.0%
ZION Taylor Creek	156	2.6%	97.4%
GLAC Sperry	291	3.1%	96.9%
GLAC Hidden Lake	166	1.2%	98.8%

k) None of the above

Location	Sample Size	Percent	No Response
Rainbow Bridge	**84**	**1.2%**	**98.8%**
GRCA Grandview	150	0.7%	99.3%
GRCA Hermit	182	0.0%	100.0%
GRCA Tusayan Ruins	128	0.8%	99.2%
BRCA Fairyland	374	0.8%	99.2%
ZION West Rim	100	0.0%	100.0%
ZION Taylor Creek	156	0.0%	100.0%
GLAC Sperry	291	0.0%	100.0%
GLAC Hidden Lake	166	0.0%	100.0%

Table C-14. How acceptable or unacceptable were these sounds during this visit to <site>?

a) **Insect Sounds**

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**55**	**1.8%**	**1.8%**	**0.0%**	**0.0%**	**23.6%**	**5.5%**	**18.2%**	**25.5%**	**23.6%**	**0.0%**
GRCA Grandview	111	0.9%	0.0%	0.9%	2.7%	9.9%	7.2%	14.4%	29.7%	33.3%	0.9%
GRCA Hermit	108	0.0%	0.0%	0.0%	1.9%	11.1%	2.8%	13.9%	31.5%	38.9%	0.0%
GRCA Tusayan Ruins	12	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%	25.0%	33.3%	33.3%	0.0%
BRCA Fairyland	237	0.0%	0.4%	0.8%	0.8%	12.7%	3.0%	19.8%	35.4%	25.3%	1.7%
ZION West Rim	84	0.0%	2.4%	3.6%	2.4%	16.7%	7.1%	6.0%	32.1%	25.0%	4.8%
ZION Taylor Creek	128	0.0%	3.1%	1.6%	2.3%	12.5%	2.3%	14.1%	33.6%	29.7%	0.8%
GLAC Sperry	211	1.9%	2.4%	4.3%	6.6%	13.3%	8.1%	13.3%	28.4%	19.9%	1.9%
GLAC Hidden Lake	90	1.1%	0.0%	1.1%	3.3%	23.3%	8.9%	18.9%	18.9%	22.2%	2.2%

b) **Bird or animal sounds**

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**63**	**3.2%**	**0.0%**	**1.6%**	**1.6%**	**23.8%**	**6.3%**	**9.5%**	**22.2%**	**27.0%**	**4.8%**
GRCA Grandview	142	0.0%	0.0%	0.0%	0.7%	4.2%	2.1%	9.2%	27.5%	56.3%	0.0%
GRCA Hermit	173	0.0%	0.6%	0.0%	0.0%	2.9%	0.6%	8.1%	30.6%	57.2%	0.0%
GRCA Tusayan Ruins	81	1.2%	1.2%	0.0%	1.2%	2.5%	2.5%	8.6%	42.0%	39.5%	1.2%
BRCA Fairyland	340	0.9%	0.9%	0.0%	0.3%	1.5%	1.5%	7.9%	35.3%	47.1%	4.7%
ZION West Rim	92	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	8.7%	34.8%	53.3%	1.1%
ZION Taylor Creek	150	0.0%	0.0%	0.0%	0.0%	2.0%	0.7%	4.0%	34.7%	58.0%	0.7%
GLAC Sperry	250	0.4%	0.4%	0.4%	0.4%	2.0%	1.6%	7.6%	31.6%	52.4%	3.2%
GLAC Hidden Lake	134	0.7%	0.7%	0.0%	0.7%	6.7%	3.0%	8.2%	27.6%	49.3%	3.0%

Table C-14 (continued). How acceptable or unacceptable were these sounds during this visit to <site>?

c) Waterfalls, running water, or waves

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**42**	**0.0%**	**0.0%**	**0.0%**	**7.1%**	**28.6%**	**2.4%**	**7.1%**	**31.0%**	**23.8%**	**0.0%**
GRCA Grandview	45	0.0%	2.2%	2.2%	0.0%	2.2%	0.0%	4.4%	22.2%	64.4%	2.2%
GRCA Hermit	87	1.1%	1.1%	0.0%	0.0%	1.1%	2.3%	8.0%	27.6%	58.6%	0.0%
GRCA Tusayan Ruins	7	0.0%	0.0%	0.0%	0.0%	28.6%	0.0%	28.6%	14.3%	28.6%	0.0%
BRCA Fairyland	71	1.4%	0.0%	0.0%	0.0%	11.3%	4.2%	9.9%	26.8%	40.8%	5.6%
ZION West Rim	77	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	5.2%	32.5%	55.8%	3.9%
ZION Taylor Creek	149	0.0%	0.0%	0.7%	0.0%	0.7%	0.0%	2.0%	22.1%	72.5%	2.0%
GLAC Sperry	285	0.7%	0.4%	0.0%	0.0%	0.4%	0.4%	3.2%	26.7%	67.7%	0.7%
GLAC Hidden Lake	156	1.9%	0.0%	0.6%	0.0%	1.3%	1.3%	4.5%	28.2%	60.3%	1.9%

d) Wind, rain, or thunder

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**39**	**0.0%**	**0.0%**	**2.6%**	**5.1%**	**33.3%**	**2.6%**	**20.5%**	**0.0%**	**15.4%**	**20.5%**
GRCA Grandview	106	0.9%	0.0%	1.9%	0.0%	7.5%	2.8%	17.0%	42.5%	26.4%	0.9%
GRCA Hermit	140	0.7%	0.0%	0.7%	2.1%	5.0%	3.6%	11.4%	36.4%	39.3%	0.7%
GRCA Tusayan Ruins	71	1.4%	0.0%	1.4%	1.4%	11.3%	0.0%	11.3%	40.8%	32.4%	0.0%
BRCA Fairyland	272	0.4%	0.0%	0.0%	0.4%	5.1%	2.2%	11.0%	38.2%	37.9%	4.8%
ZION West Rim	71	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	9.9%	33.8%	47.9%	2.8%
ZION Taylor Creek	85	0.0%	0.0%	0.0%	0.0%	2.4%	3.5%	4.7%	34.1%	52.9%	2.4%
GLAC Sperry	153	0.7%	1.3%	0.7%	0.0%	7.8%	1.3%	9.2%	34.6%	43.8%	0.7%
GLAC Hidden Lake	94	1.1%	1.1%	0.0%	2.1%	6.4%	4.3%	16.0%	28.7%	35.1%	5.3%

Table C-14 (continued). How acceptable or unacceptable were these sounds during this visit to <site>?

e) Group of people talking

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**76**	**3.9%**	**1.3%**	**5.3%**	**9.2%**	**26.3%**	**6.6%**	**19.7%**	**15.8%**	**7.9%**	**3.9%**
GRCA Grandview	129	0.8%	1.6%	2.3%	10.1%	27.1%	7.8%	17.8%	23.3%	9.3%	0.0%
GRCA Hermit	151	0.7%	0.0%	2.0%	6.0%	33.1%	6.6%	18.5%	24.5%	8.6%	0.0%
GRCA Tusayan Ruins	101	0.0%	1.0%	2.0%	6.9%	27.7%	9.9%	25.7%	21.8%	4.0%	1.0%
BRCA Fairyland	278	1.1%	1.4%	2.5%	7.9%	24.1%	10.4%	22.7%	23.7%	4.0%	2.2%
ZION West Rim	65	0.0%	0.0%	4.6%	7.7%	41.5%	6.2%	12.3%	16.9%	7.7%	3.1%
ZION Taylor Creek	125	0.8%	0.8%	1.6%	4.8%	27.2%	8.0%	24.0%	23.2%	6.4%	3.2%
GLAC Sperry	220	0.9%	0.9%	0.9%	1.4%	27.7%	8.2%	28.6%	25.9%	4.1%	1.4%
GLAC Hidden Lake	138	0.7%	3.6%	7.2%	10.9%	26.1%	8.0%	16.7%	18.8%	5.1%	2.9%

f) Someone's radio, TV, iPod, or other audio device

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**25**	**8.0%**	**0.0%**	**8.0%**	**20.0%**	**36.0%**	**4.0%**	**12.0%**	**8.0%**	**4.0%**	**0.0%**
GRCA Grandview	5	0.0%	0.0%	0.0%	20.0%	20.0%	0.0%	20.0%	20.0%	0.0%	20.0%
GRCA Hermit	16	12.5%	12.5%	6.3%	12.5%	12.5%	6.3%	12.5%	6.3%	0.0%	18.8%
GRCA Tusayan Ruins	4	0.0%	0.0%	0.0%	0.0%	75.0%	0.0%	0.0%	25.0%	0.0%	0.0%
BRCA Fairyland	34	20.6%	8.8%	2.9%	0.0%	32.4%	2.9%	5.9%	2.9%	14.7%	8.8%
ZION West Rim	3	0.0%	0.0%	0.0%	0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	33.3%
ZION Taylor Creek	6	16.7%	0.0%	16.7%	33.3%	16.7%	0.0%	0.0%	0.0%	16.7%	0.0%
GLAC Sperry	21	4.8%	9.5%	19.0%	33.3%	19.0%	0.0%	9.5%	0.0%	0.0%	4.8%
GLAC Hidden Lake	20	30.0%	10.0%	5.0%	15.0%	15.0%	10.0%	0.0%	0.0%	15.0%	0.0%

Table C-14 (continued). How acceptable or unacceptable were these sounds during this visit to <site>?

g) Cars or trucks in a parking lot

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**20**	**0.0%**	**0.0%**	**5.0%**	**15.0%**	**45.0%**	**0.0%**	**10.0%**	**5.0%**	**15.0%**	**5.0%**
GRCA Grandview	17	5.9%	17.6%	17.6%	29.4%	5.9%	5.9%	17.6%	0.0%	0.0%	0.0%
GRCA Hermit	9	0.0%	0.0%	11.1%	22.2%	33.3%	22.2%	11.1%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	61	0.0%	3.3%	11.5%	16.4%	36.1%	11.5%	16.4%	3.3%	0.0%	1.6%
BRCA Fairyland	45	4.4%	2.2%	4.4%	13.3%	40.0%	4.4%	11.1%	8.9%	6.7%	4.4%
ZION West Rim	7	0.0%	0.0%	14.3%	14.3%	57.1%	14.3%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	5	0.0%	20.0%	0.0%	0.0%	40.0%	0.0%	0.0%	0.0%	20.0%	20.0%
GLAC Sperry	19	0.0%	10.5%	10.5%	21.1%	42.1%	0.0%	5.3%	10.5%	0.0%	0.0%
GLAC Hidden Lake	54	7.4%	3.7%	7.4%	11.1%	42.6%	7.4%	13.0%	3.7%	3.7%	0.0%

h) Cars or trucks on a road or highway

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**19**	**0.0%**	**0.0%**	**5.3%**	**15.8%**	**42.1%**	**0.0%**	**10.5%**	**5.3%**	**15.8%**	**5.3%**
GRCA Grandview	7	14.3%	0.0%	28.6%	14.3%	14.3%	0.0%	14.3%	0.0%	14.3%	0.0%
GRCA Hermit	6	0.0%	0.0%	16.7%	16.7%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	59	1.7%	1.7%	8.5%	16.9%	37.3%	10.2%	15.3%	5.1%	0.0%	3.4%
BRCA Fairyland	40	7.5%	0.0%	10.0%	5.0%	35.0%	5.0%	20.0%	7.5%	5.0%	5.0%
ZION West Rim	16	6.3%	0.0%	12.5%	18.8%	18.8%	6.3%	31.3%	6.3%	0.0%	0.0%
ZION Taylor Creek	9	0.0%	0.0%	0.0%	33.3%	44.4%	11.1%	0.0%	0.0%	11.1%	0.0%
GLAC Sperry	32	0.0%	3.1%	25.0%	25.0%	31.3%	6.3%	3.1%	3.1%	0.0%	3.1%
GLAC Hidden Lake	37	2.7%	10.8%	16.2%	0.0%	43.2%	8.1%	10.8%	0.0%	8.1%	0.0%

Table C-14 (continued). How acceptable or unacceptable were these sounds during this visit to <site>?

i) **Airplanes, jets, helicopters, or other aircraft**

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**43**	**2.3%**	**0.0%**	**7.0%**	**14.0%**	**44.2%**	**7.0%**	**7.0%**	**9.3%**	**4.7%**	**4.7%**
GRCA Grandview	76	9.2%	9.2%	18.4%	13.2%	21.1%	6.6%	14.5%	6.6%	0.0%	1.3%
GRCA Hermit	160	11.9%	20.6%	16.9%	14.4%	15.6%	9.4%	5.6%	3.8%	1.9%	0.0%
GRCA Tusayan Ruins	44	0.0%	6.8%	9.1%	18.2%	31.8%	13.6%	13.6%	4.5%	0.0%	2.3%
BRCA Fairyland	150	4.7%	2.7%	8.7%	11.3%	34.0%	10.0%	13.3%	9.3%	5.3%	0.7%
ZION West Rim	51	0.0%	5.9%	13.7%	9.8%	29.4%	3.9%	19.6%	17.6%	0.0%	0.0%
ZION Taylor Creek	38	5.3%	2.6%	7.9%	23.7%	36.8%	7.9%	7.9%	2.6%	2.6%	2.6%
GLAC Sperry	216	9.3%	7.4%	13.9%	19.0%	24.5%	6.9%	9.3%	6.5%	1.9%	1.4%
GLAC Hidden Lake	129	7.0%	7.8%	16.3%	17.1%	19.4%	8.5%	15.5%	4.7%	2.3%	1.6%

j) **Motorboats or motorized watercraft**

Location	Sample Size	Extremely Unaccept-able	Very Unaccept-able	Moderately Unaccept-able	Slightly Unaccept-able	Neutral	Slightly Acceptable	Moderately acceptable	Very Accept-able	Extremely Acceptable	No Resp
Rainbow Bridge	**37**	**0.0%**	**2.7%**	**2.7%**	**13.5%**	**35.1%**	**10.8%**	**13.5%**	**10.8%**	**8.1%**	**2.7%**
GRCA Grandview	4	0.0%	25.0%	0.0%	50.0%	0.0%	0.0%	25.0%	0.0%	0.0%	0.0%
GRCA Hermit	5	0.0%	0.0%	0.0%	0.0%	40.0%	40.0%	0.0%	0.0%	20.0%	0.0%
GRCA Tusayan Ruins	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BRCA Fairyland	20	20.0%	0.0%	0.0%	0.0%	50.0%	5.0%	0.0%	5.0%	15.0%	5.0%
ZION West Rim	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	4	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	25.0%	25.0%	0.0%
GLAC Sperry	9	0.0%	11.1%	11.1%	0.0%	44.4%	11.1%	0.0%	0.0%	0.0%	22.2%
GLAC Hidden Lake	2	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%

Table C-15. How much did these sounds please or annoy you during this visit to < site >?

a) Insect Sounds

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**55**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**25.5%**	**7.3%**	**20.0%**	**18.2%**	**20.0%**	**9.1%**
GRCA Grandview	111	1.8%	0.9%	2.7%	9.0%	23.4%	4.5%	19.8%	18.9%	18.0%	0.9%
GRCA Hermit	108	0.0%	0.0%	0.0%	7.4%	17.6%	8.3%	20.4%	21.3%	25.0%	0.0%
GRCA Tusayan Ruins	12	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	33.3%	16.7%	33.3%	0.0%
BRCA Fairyland	237	0.4%	1.3%	2.1%	3.4%	19.4%	5.9%	18.1%	30.0%	14.3%	5.1%
ZION West Rim	84	0.0%	7.1%	9.5%	6.0%	23.8%	4.8%	9.5%	20.2%	15.5%	3.6%
ZION Taylor Creek	128	3.1%	1.6%	3.9%	7.0%	23.4%	6.3%	10.2%	21.9%	19.5%	3.1%
GLAC Sperry	211	2.4%	4.7%	6.6%	17.1%	17.5%	6.6%	13.3%	16.1%	14.2%	1.4%
GLAC Hidden Lake	90	0.0%	0.0%	2.2%	10.0%	31.1%	8.9%	7.8%	17.8%	15.6%	6.7%

b) Bird or animal sounds

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**63**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**27.0%**	**7.9%**	**11.1%**	**19.0%**	**23.8%**	**11.1%**
GRCA Grandview	142	0.0%	0.0%	0.0%	0.0%	7.7%	2.1%	11.3%	29.6%	48.6%	0.7%
GRCA Hermit	173	0.0%	0.0%	0.0%	0.6%	6.4%	1.7%	11.0%	35.3%	45.1%	0.0%
GRCA Tusayan Ruins	81	1.2%	0.0%	0.0%	0.0%	9.9%	8.6%	9.9%	38.3%	30.9%	1.2%
BRCA Fairyland	340	0.0%	0.3%	0.0%	0.3%	3.2%	3.8%	11.2%	34.7%	39.7%	6.8%
ZION West Rim	92	0.0%	0.0%	0.0%	1.1%	6.5%	1.1%	12.0%	31.5%	46.7%	1.1%
ZION Taylor Creek	150	0.0%	0.0%	0.0%	0.0%	2.7%	2.7%	12.0%	37.3%	42.0%	3.3%
GLAC Sperry	250	0.0%	0.4%	0.4%	0.4%	4.0%	2.8%	9.6%	30.4%	48.8%	3.2%
GLAC Hidden Lake	134	0.0%	0.0%	0.0%	0.0%	6.7%	0.7%	13.4%	28.4%	44.0%	6.7%

Table C-15 (continued). How much did these sounds please or annoy you during this visit to < site >?

c) Waterfalls, running water, or waves

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**42**	**0.0%**	**0.0%**	**0.0%**	**2.4%**	**38.1%**	**11.9%**	**7.1%**	**19.0%**	**14.3%**	**7.1%**
GRCA Grandview	45	0.0%	2.2%	4.4%	0.0%	2.2%	0.0%	4.4%	24.4%	60.0%	2.2%
GRCA Hermit	87	0.0%	1.1%	0.0%	0.0%	3.4%	1.1%	6.9%	36.8%	50.6%	0.0%
GRCA Tusayan Ruins	7	0.0%	0.0%	0.0%	0.0%	28.6%	14.3%	0.0%	28.6%	28.6%	0.0%
BRCA Fairyland	71	0.0%	0.0%	0.0%	0.0%	15.5%	1.4%	12.7%	23.9%	35.2%	11.3%
ZION West Rim	77	0.0%	0.0%	0.0%	0.0%	3.9%	0.0%	9.1%	31.2%	53.2%	2.6%
ZION Taylor Creek	149	0.0%	0.7%	0.0%	0.0%	2.7%	1.3%	2.7%	22.8%	65.1%	4.7%
GLAC Sperry	285	0.4%	0.0%	0.0%	0.7%	2.5%	0.7%	3.5%	29.1%	60.4%	2.8%
GLAC Hidden Lake	156	0.0%	0.0%	0.6%	0.0%	3.8%	0.6%	3.2%	26.9%	59.0%	5.8%

d) Wind, rain, or thunder

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**39**	**0.0%**	**0.0%**	**0.0%**	**2.6%**	**48.7%**	**7.7%**	**10.3%**	**10.3%**	**12.8%**	**7.7%**
GRCA Grandview	106	0.9%	0.0%	3.8%	3.8%	17.0%	2.8%	14.2%	38.7%	17.0%	1.9%
GRCA Hermit	140	0.7%	1.4%	0.0%	5.0%	16.4%	7.1%	18.6%	20.0%	30.0%	0.7%
GRCA Tusayan Ruins	71	0.0%	1.4%	1.4%	2.8%	22.5%	8.5%	14.1%	23.9%	25.4%	0.0%
BRCA Fairyland	272	0.0%	0.0%	0.4%	1.5%	12.9%	2.2%	15.4%	30.5%	29.8%	7.4%
ZION West Rim	71	0.0%	0.0%	0.0%	0.0%	7.0%	8.5%	18.3%	26.8%	38.0%	1.4%
ZION Taylor Creek	85	0.0%	0.0%	0.0%	0.0%	9.4%	1.2%	12.9%	27.1%	45.9%	3.5%
GLAC Sperry	153	0.7%	0.0%	0.7%	0.7%	13.7%	3.3%	13.7%	28.8%	36.6%	2.0%
GLAC Hidden Lake	94	0.0%	1.1%	0.0%	1.1%	16.0%	3.2%	13.8%	27.7%	30.9%	6.4%

Table C-15 (continued). How much did these sounds please or annoy you during this visit to < site >?

e) Group of people talking

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**76**	1.3%	0.0%	7.9%	15.8%	40.8%	9.2%	5.3%	3.9%	3.9%	11.8%
GRCA Grandview	129	0.8%	0.8%	4.7%	14.7%	51.9%	7.8%	10.1%	4.7%	4.7%	0.0%
GRCA Hermit	151	1.3%	0.0%	2.0%	12.6%	55.6%	9.3%	9.9%	5.3%	4.0%	0.0%
GRCA Tusayan Ruins	101	0.0%	1.0%	5.0%	11.9%	51.5%	7.9%	18.8%	2.0%	2.0%	0.0%
BRCA Fairyland	278	0.7%	2.5%	2.5%	13.7%	50.0%	6.1%	12.2%	5.4%	0.4%	6.5%
ZION West Rim	65	0.0%	1.5%	3.1%	20.0%	56.9%	4.6%	6.2%	1.5%	4.6%	1.5%
ZION Taylor Creek	125	0.8%	0.0%	4.0%	12.8%	51.2%	4.0%	13.6%	6.4%	3.2%	4.0%
GLAC Sperry	220	0.9%	0.5%	1.4%	5.0%	56.4%	5.5%	17.7%	6.8%	2.3%	3.6%
GLAC Hidden Lake	138	3.6%	1.4%	5.1%	16.7%	52.2%	5.8%	4.3%	4.3%	1.4%	5.1%

f) Someone's radio, TV, iPod, or other audio device

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**25**	**8.0%**	**0.0%**	**12.0%**	**4.0%**	**48.0%**	**12.0%**	**0.0%**	**4.0%**	**4.0%**	**8.0%**
GRCA Grandview	5	0.0%	0.0%	0.0%	20.0%	40.0%	0.0%	40.0%	0.0%	0.0%	0.0%
GRCA Hermit	16	12.5%	18.8%	6.3%	18.8%	18.8%	6.3%	6.3%	6.3%	0.0%	6.3%
GRCA Tusayan Ruins	4	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BRCA Fairyland	34	11.8%	5.9%	2.9%	5.9%	44.1%	0.0%	5.9%	0.0%	2.9%	20.6%
ZION West Rim	3	0.0%	0.0%	33.3%	0.0%	33.3%	0.0%	33.3%	0.0%	0.0%	0.0%
ZION Taylor Creek	6	0.0%	0.0%	0.0%	50.0%	33.3%	0.0%	0.0%	0.0%	0.0%	16.7%
GLAC Sperry	21	4.8%	9.5%	14.3%	19.0%	42.9%	4.8%	0.0%	0.0%	0.0%	4.8%
GLAC Hidden Lake	20	15.0%	5.0%	0.0%	15.0%	40.0%	0.0%	0.0%	0.0%	5.0%	20.0%

Table C-15 (continued). How much did these sounds please or annoy you during this visit to < site >?

g) Cars or trucks in a parking lot

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**20**	**5.0%**	**0.0%**	**5.0%**	**10.0%**	**60.0%**	**10.0%**	**0.0%**	**5.0%**	**5.0%**	**0.0%**
GRCA Grandview	17	0.0%	29.4%	5.9%	29.4%	17.6%	5.9%	5.9%	0.0%	0.0%	5.9%
GRCA Hermit	9	0.0%	0.0%	11.1%	44.4%	33.3%	0.0%	11.1%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	61	0.0%	4.9%	11.5%	21.3%	49.2%	1.6%	6.6%	3.3%	0.0%	1.6%
BRCA Fairyland	45	0.0%	4.4%	6.7%	15.6%	44.4%	2.2%	4.4%	2.2%	2.2%	17.8%
ZION West Rim	7	0.0%	0.0%	14.3%	14.3%	71.4%	0.0%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	5	20.0%	0.0%	0.0%	0.0%	40.0%	0.0%	0.0%	0.0%	0.0%	40.0%
GLAC Sperry	19	5.3%	5.3%	5.3%	15.8%	52.6%	5.3%	5.3%	0.0%	0.0%	5.3%
GLAC Hidden Lake	54	3.7%	1.9%	7.4%	13.0%	53.7%	1.9%	5.6%	0.0%	1.9%	11.1%

h) Cars or trucks on a road or highway

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**19**	**5.3%**	**0.0%**	**5.3%**	**10.5%**	**63.2%**	**5.3%**	**0.0%**	**5.3%**	**5.3%**	**0.0%**
GRCA Grandview	7	14.3%	28.6%	0.0%	14.3%	28.6%	0.0%	14.3%	0.0%	0.0%	0.0%
GRCA Hermit	6	0.0%	16.7%	16.7%	50.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	59	0.0%	1.7%	6.8%	25.4%	52.5%	6.8%	3.4%	0.0%	0.0%	3.4%
BRCA Fairyland	40	0.0%	2.5%	10.0%	17.5%	42.5%	5.0%	5.0%	0.0%	2.5%	15.0%
ZION West Rim	16	6.3%	0.0%	12.5%	25.0%	43.8%	0.0%	6.3%	6.3%	0.0%	0.0%
ZION Taylor Creek	9	0.0%	0.0%	0.0%	22.2%	66.7%	0.0%	0.0%	0.0%	0.0%	11.1%
GLAC Sperry	32	0.0%	3.1%	25.0%	31.3%	28.1%	6.3%	0.0%	0.0%	0.0%	6.3%
GLAC Hidden Lake	37	2.7%	2.7%	18.9%	10.8%	48.6%	0.0%	5.4%	0.0%	0.0%	10.8%

Table C-15 (continued). How much did these sounds please or annoy you during this visit to < site >?

i) Airplanes, jets, helicopters, or other aircraft

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**43**	**2.3%**	**2.3%**	**7.0%**	**9.3%**	**60.5%**	**2.3%**	**0.0%**	**2.3%**	**2.3%**	**11.6%**
GRCA Grandview	76	7.9%	7.9%	22.4%	14.5%	38.2%	3.9%	5.3%	0.0%	0.0%	0.0%
GRCA Hermit	160	13.8%	16.3%	18.1%	20.6%	22.5%	2.5%	3.8%	1.9%	0.6%	0.0%
GRCA Tusayan Ruins	44	0.0%	6.8%	9.1%	20.5%	54.5%	2.3%	6.8%	0.0%	0.0%	0.0%
BRCA Fairyland	150	2.0%	5.3%	4.7%	24.0%	43.3%	6.7%	6.0%	2.0%	0.7%	5.3%
ZION West Rim	51	0.0%	9.8%	9.8%	17.6%	49.0%	2.0%	7.8%	2.0%	2.0%	0.0%
ZION Taylor Creek	38	2.6%	0.0%	5.3%	28.9%	50.0%	5.3%	2.6%	0.0%	0.0%	5.3%
GLAC Sperry	216	9.3%	6.5%	16.2%	23.6%	34.3%	3.2%	1.9%	1.4%	1.4%	2.3%
GLAC Hidden Lake	129	7.8%	3.1%	13.2%	28.7%	30.2%	3.1%	4.7%	2.3%	1.6%	5.4%

j) Motorboats or motorized watercraft

Location	Sample Size	Extremely Annoying	Very Annoying	Moderately Annoying	Slightly Annoying	Neutral	Slightly Pleasing	Moderately Pleasing	Very Pleasing	Extremely Pleasing	No Resp
Rainbow Bridge	**37**	**2.7%**	**5.4%**	**2.7%**	**10.8%**	**51.4%**	**8.1%**	**2.7%**	**0.0%**	**2.7%**	**13.5%**
GRCA Grandview	4	0.0%	25.0%	0.0%	50.0%	0.0%	25.0%	0.0%	0.0%	0.0%	0.0%
GRCA Hermit	5	0.0%	0.0%	0.0%	20.0%	40.0%	20.0%	0.0%	0.0%	20.0%	0.0%
GRCA Tusayan Ruins	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BRCA Fairyland	20	10.0%	0.0%	0.0%	5.0%	45.0%	0.0%	10.0%	0.0%	5.0%	25.0%
ZION West Rim	1	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	4	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	25.0%	0.0%	25.0%
GLAC Sperry	9	0.0%	11.1%	11.1%	11.1%	22.2%	11.1%	0.0%	0.0%	0.0%	33.3%
GLAC Hidden Lake	2	50.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table C-16. How much did these sounds positively add to or negatively detract from your experience during this visit to <site>?

a) Insect Sounds

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	**55**	**0.0%**	**0.0%**	**0.0%**	**1.8%**	**23.6%**	**7.3%**	**12.7%**	**20.0%**	**18.2%**	**16.4%**
GRCA Grandview	111	0.9%	0.0%	1.8%	5.4%	27.9%	6.3%	27.0%	11.7%	18.9%	0.0%
GRCA Hermit	108	0.0%	0.0%	0.0%	1.9%	19.4%	11.1%	18.5%	22.2%	25.9%	0.9%
GRCA Tusayan Ruins	12	0.0%	0.0%	0.0%	0.0%	16.7%	8.3%	33.3%	8.3%	33.3%	0.0%
BRCA Fairyland	237	0.0%	0.0%	2.5%	0.8%	24.1%	8.0%	16.5%	28.3%	15.6%	4.2%
ZION West Rim	84	0.0%	1.2%	6.0%	15.5%	25.0%	7.1%	7.1%	20.2%	13.1%	4.8%
ZION Taylor Creek	128	0.8%	1.6%	3.9%	6.3%	28.9%	4.7%	11.7%	18.8%	21.9%	1.6%
GLAC Sperry	211	1.4%	2.8%	6.2%	12.3%	25.6%	7.6%	11.8%	16.6%	13.3%	2.4%
GLAC Hidden Lake	90	0.0%	0.0%	0.0%	7.8%	36.7%	11.1%	8.9%	10.0%	18.9%	6.7%

b) Bird or animal sounds

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	**63**	**0.0%**	**1.6%**	**0.0%**	**0.0%**	**22.2%**	**9.5%**	**12.7%**	**11.1%**	**20.6%**	**22.2%**
GRCA Grandview	142	0.0%	0.0%	0.7%	0.0%	7.0%	2.8%	15.5%	28.9%	44.4%	0.7%
GRCA Hermit	173	0.0%	0.0%	0.6%	0.0%	5.8%	2.9%	13.9%	36.4%	39.3%	1.2%
GRCA Tusayan Ruins	81	0.0%	0.0%	0.0%	0.0%	9.9%	9.9%	16.0%	27.2%	35.8%	1.2%
BRCA Fairyland	340	0.0%	0.3%	0.3%	1.2%	4.1%	3.2%	13.2%	33.5%	37.4%	6.8%
ZION West Rim	92	0.0%	0.0%	1.1%	0.0%	2.2%	2.2%	13.0%	33.7%	45.7%	2.2%
ZION Taylor Creek	150	0.0%	0.0%	0.0%	0.0%	5.3%	0.0%	15.3%	38.0%	39.3%	2.0%
GLAC Sperry	250	0.0%	0.8%	0.4%	0.0%	4.0%	3.6%	9.2%	32.4%	46.4%	3.2%
GLAC Hidden Lake	134	0.0%	0.0%	0.0%	0.0%	5.2%	1.5%	10.4%	32.8%	42.5%	7.5%

Table C-16 (continued). How much did these sounds positively add to or negatively detract from your experience during this visit to <site>?

c) Waterfalls, running water, or waves

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	42	0.0%	0.0%	0.0%	0.0%	33.3%	7.1%	9.5%	16.7%	11.9%	21.4%
GRCA Grandview	45	0.0%	0.0%	2.2%	0.0%	2.2%	4.4%	6.7%	26.7%	57.8%	0.0%
GRCA Hermit	87	0.0%	1.1%	0.0%	0.0%	1.1%	1.1%	12.6%	33.3%	50.6%	0.0%
GRCA Tusayan Ruins	7	0.0%	0.0%	0.0%	0.0%	28.6%	14.3%	14.3%	14.3%	28.6%	0.0%
BRCA Fairyland	71	0.0%	0.0%	0.0%	1.4%	15.5%	9.9%	9.9%	21.1%	32.4%	9.9%
ZION West Rim	77	0.0%	0.0%	0.0%	0.0%	5.2%	2.6%	9.1%	35.1%	45.5%	2.6%
ZION Taylor Creek	149	0.0%	0.7%	0.0%	0.0%	2.7%	0.0%	6.0%	24.8%	61.1%	4.7%
GLAC Sperry	285	0.7%	0.0%	0.4%	0.0%	1.8%	0.0%	6.3%	29.8%	59.3%	1.8%
GLAC Hidden Lake	156	0.0%	0.0%	0.0%	1.3%	2.6%	1.3%	4.5%	28.2%	56.4%	5.8%

d) Wind, rain, or thunder

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	39	0.0%	0.0%	2.6%	0.0%	48.7%	5.1%	10.3%	10.3%	10.3%	12.8%
GRCA Grandview	106	0.0%	0.0%	4.7%	1.9%	17.9%	8.5%	13.2%	34.0%	17.9%	1.9%
GRCA Hermit	140	0.7%	0.0%	0.0%	5.0%	16.4%	9.3%	20.0%	20.7%	27.1%	0.7%
GRCA Tusayan Ruins	71	0.0%	0.0%	1.4%	5.6%	25.4%	7.0%	15.5%	21.1%	23.9%	0.0%
BRCA Fairyland	272	0.0%	0.0%	0.0%	2.6%	12.5%	1.8%	15.4%	32.7%	27.6%	7.4%
ZION West Rim	71	0.0%	0.0%	0.0%	0.0%	11.3%	5.6%	18.3%	25.4%	36.6%	2.8%
ZION Taylor Creek	85	0.0%	0.0%	0.0%	0.0%	8.2%	2.4%	12.9%	29.4%	44.7%	2.4%
GLAC Sperry	153	0.7%	0.0%	1.3%	0.7%	15.0%	3.3%	14.4%	27.5%	35.9%	1.3%
GLAC Hidden Lake	94	0.0%	0.0%	0.0%	1.1%	14.9%	6.4%	12.8%	25.5%	31.9%	7.4%

Table C-16 (continued). How much did these sounds positively add to or negatively detract from your experience during this visit to <site>?

e) Group of people talking

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	76	0.0%	0.0%	6.6%	0.0%	46.1%	6.6%	2.6%	3.9%	2.6%	31.6%
GRCA Grandview	129	0.8%	0.8%	2.3%	22.5%	48.1%	7.0%	10.9%	3.1%	4.7%	0.0%
GRCA Hermit	151	0.7%	1.3%	0.7%	11.3%	62.3%	7.9%	4.6%	7.3%	4.0%	0.0%
GRCA Tusayan Ruins	101	0.0%	1.0%	5.0%	15.8%	52.5%	9.9%	12.9%	1.0%	2.0%	0.0%
BRCA Fairyland	278	0.7%	1.1%	4.0%	13.3%	49.3%	2.9%	11.2%	7.6%	1.4%	8.6%
ZION West Rim	65	0.0%	1.5%	3.1%	16.9%	60.0%	4.6%	6.2%	3.1%	3.1%	1.5%
ZION Taylor Creek	125	0.8%	0.8%	3.2%	16.0%	51.2%	4.0%	12.0%	4.8%	4.0%	3.2%
GLAC Sperry	220	0.5%	1.8%	0.5%	7.3%	61.4%	9.5%	8.2%	6.4%	2.3%	2.3%
GLAC Hidden Lake	138	2.9%	2.2%	8.7%	18.1%	47.8%	4.3%	3.6%	5.1%	1.4%	5.8%

f) Someone's radio, TV, iPod, or other audio device

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	25	4.0%	0.0%	8.0%	4.0%	48.0%	4.0%	4.0%	0.0%	4.0%	24.0%
GRCA Grandview	5	0.0%	0.0%	0.0%	20.0%	40.0%	0.0%	40.0%	0.0%	0.0%	0.0%
GRCA Hermit	16	6.3%	6.3%	12.5%	25.0%	25.0%	6.3%	6.3%	6.3%	0.0%	6.3%
GRCA Tusayan Ruins	4	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BRCA Fairyland	34	11.8%	2.9%	2.9%	5.9%	47.1%	2.9%	5.9%	0.0%	2.9%	17.6%
ZION West Rim	3	0.0%	0.0%	0.0%	0.0%	33.3%	0.0%	33.3%	33.3%	0.0%	0.0%
ZION Taylor Creek	6	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GLAC Sperry	21	0.0%	9.5%	19.0%	19.0%	47.6%	0.0%	0.0%	0.0%	0.0%	4.8%
GLAC Hidden Lake	20	10.0%	10.0%	5.0%	20.0%	35.0%	5.0%	0.0%	0.0%	0.0%	15.0%

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Table C-16 (continued). How much did these sounds positively add to or negatively detract from your experience during this visit to <site>?

g) Cars or trucks in a parking lot

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	20	0.0%	0.0%	5.0%	5.0%	55.0%	5.0%	5.0%	0.0%	5.0%	**20.0%**
GRCA Grandview	17	0.0%	23.5%	17.6%	29.4%	23.5%	0.0%	5.9%	0.0%	0.0%	0.0%
GRCA Hermit	9	0.0%	0.0%	11.1%	33.3%	55.6%	0.0%	0.0%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	61	0.0%	3.3%	8.2%	23.0%	59.0%	1.6%	3.3%	0.0%	0.0%	1.6%
BRCA Fairyland	45	0.0%	4.4%	6.7%	17.8%	46.7%	2.2%	2.2%	0.0%	2.2%	17.8%
ZION West Rim	7	0.0%	0.0%	14.3%	14.3%	71.4%	0.0%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	5	20.0%	0.0%	0.0%	0.0%	60.0%	0.0%	0.0%	0.0%	0.0%	20.0%
GLAC Sperry	19	5.3%	5.3%	5.3%	10.5%	52.6%	5.3%	0.0%	5.3%	0.0%	10.5%
GLAC Hidden Lake	54	3.7%	3.7%	5.6%	24.1%	50.0%	1.9%	1.9%	0.0%	1.9%	7.4%

h) Cars or trucks on a road or highway

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	19	0.0%	0.0%	5.3%	5.3%	57.9%	0.0%	5.3%	0.0%	5.3%	**21.1%**
GRCA Grandview	7	14.3%	28.6%	0.0%	14.3%	28.6%	0.0%	14.3%	0.0%	0.0%	0.0%
GRCA Hermit	6	0.0%	0.0%	16.7%	33.3%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GRCA Tusayan Ruins	59	0.0%	3.4%	6.8%	25.4%	59.3%	0.0%	1.7%	0.0%	0.0%	3.4%
BRCA Fairyland	40	2.5%	2.5%	5.0%	17.5%	47.5%	5.0%	0.0%	0.0%	2.5%	17.5%
ZION West Rim	16	6.3%	6.3%	6.3%	18.8%	43.8%	6.3%	6.3%	6.3%	0.0%	0.0%
ZION Taylor Creek	9	0.0%	0.0%	0.0%	33.3%	66.7%	0.0%	0.0%	0.0%	0.0%	0.0%
GLAC Sperry	32	0.0%	3.1%	18.8%	34.4%	28.1%	6.3%	0.0%	0.0%	0.0%	9.4%
GLAC Hidden Lake	37	2.7%	5.4%	13.5%	21.6%	43.2%	0.0%	2.7%	0.0%	0.0%	10.8%

Table C-16 (continued). How much did these sounds positively add to or negatively detract from your experience during this visit to <site>?

i) Airplanes, jets, helicopters, or other aircraft

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	43	0.0%	0.0%	9.3%	9.3%	46.5%	0.0%	2.3%	2.3%	2.3%	**27.9 %**
GRCA Grandview	76	5.3%	10.5%	18.4%	18.4%	42.1%	2.6%	2.6%	0.0%	0.0%	0.0%
GRCA Hermit	160	13.1%	13.1%	18.1%	24.4%	24.4%	1.9%	1.9%	1.9%	0.6%	0.6%
GRCA Tusayan Ruins	44	0.0%	2.3%	13.6%	25.0%	45.5%	4.5%	9.1%	0.0%	0.0%	0.0%
BRCA Fairyland	150	2.0%	4.0%	8.0%	24.7%	48.7%	3.3%	3.3%	1.3%	0.7%	4.0%
ZION West Rim	51	0.0%	3.9%	11.8%	23.5%	47.1%	3.9%	5.9%	2.0%	2.0%	0.0%
ZION Taylor Creek	38	2.6%	5.3%	7.9%	21.1%	57.9%	0.0%	2.6%	0.0%	0.0%	2.6%
GLAC Sperry	216	8.3%	7.4%	13.0%	28.2%	33.3%	3.7%	1.4%	0.9%	1.4%	2.3%
GLAC Hidden Lake	129	5.4%	4.7%	14.0%	28.7%	32.6%	0.0%	2.3%	3.1%	2.3%	7.0%

j) Motorboats or motorized watercraft

Location	Sample Size	Extremely Negatively Detracts	Very Negatively Detracts	Moderately Negatively Detracts	Slightly Negatively Detracts	Neutral	Slightly positively Adds	Moderately positively Adds	Very positively Adds	Extremely positively Adds	No Resp
Rainbow Bridge	37	0.0%	2.7%	0.0%	10.8%	40.5%	5.4%	8.1%	0.0%	2.7%	**29.7 %**
GRCA Grandview	4	0.0%	25.0%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0 %
GRCA Hermit	5	0.0%	0.0%	0.0%	0.5%	1.0%	0.5%	0.0%	0.0%	0.5%	97.4 %
GRCA Tusayan Ruins	1	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	99.2 %
BRCA Fairyland	20	10.0%	5.0%	5.0%	5.0%	45.0%	0.0%	5.0%	0.0%	5.0%	20.0 %
ZION West Rim	1	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ZION Taylor Creek	4	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.6%	0.0%	97.4 %
GLAC Sperry	9	0.0%	11.1%	11.1%	0.0%	22.2%	22.2%	0.0%	0.0%	0.0%	33.3 %
GLAC Hidden Lake	2	0.6%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	98.8 %

Table C-17. To what extent would you support or oppose each of the following potential actions at <Park> National Park?

a) Reduce the number of sightseeing tour aircraft allowed to fly over the park

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	**84**	**9.5%**	**8.3%**	**34.5%**	**10.7%**	**14.3%**	**14.3%**	**8.3%**
GRCA Grandview	276	3.3%	3.6%	37.0%	21.7%	25.7%	6.9%	1.8%
GRCA Hermit	378	2.6%	6.3%	23.0%	32.3%	30.2%	5.3%	0.3%
GRCA Tusayan Ruins	271	3.7%	11.8%	39.9%	27.3%	10.3%	6.3%	0.7%
BRCA Fairyland	722	3.3%	5.8%	29.2%	26.6%	23.8%	9.0%	2.2%
ZION West Rim	205	4.9%	6.3%	30.7%	36.1%	18.5%	3.4%	0.0%
ZION Taylor Creek	290	2.4%	4.5%	37.6%	25.2%	19.0%	10.7%	0.7%
GLAC Sperry	576	4.5%	5.6%	30.6%	30.2%	22.6%	5.2%	1.4%
GLAC Hidden Lake	344	2.3%	7.0%	30.2%	31.4%	22.4%	4.1%	2.6%

b) Maintain the number of sightseeing tour aircraft allowed to fly over the park at the current level

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	**84**	**3.6%**	**14.3%**	**35.7%**	**14.3%**	**6.0%**	**17.9%**	**8.3%**
GRCA Grandview	276	8.3%	12.0%	34.8%	21.4%	9.1%	10.1%	4.3%
GRCA Hermit	378	9.3%	23.3%	26.5%	19.0%	5.8%	8.7%	7.4%
GRCA Tusayan Ruins	271	2.2%	11.1%	39.5%	28.4%	5.9%	11.1%	1.8%
BRCA Fairyland	722	3.5%	12.6%	36.3%	16.8%	8.7%	14.4%	7.8%
ZION West Rim	205	12.7%	10.2%	34.6%	25.9%	9.3%	7.3%	0.0%
ZION Taylor Creek	290	9.7%	9.7%	37.2%	19.3%	8.6%	14.8%	0.7%
GLAC Sperry	576	9.0%	20.1%	34.0%	17.9%	5.7%	9.2%	4.0%
GLAC Hidden Lake	344	10.2%	20.6%	36.6%	20.1%	3.5%	6.4%	2.6%

Table C-17 (continued). To what extent would you support or oppose each of the following potential actions at \<Park\> National Park?

c) Increase the number of sightseeing tour aircraft allowed to fly over the park

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	84	10.7%	21.4%	35.7%	1.2%	4.8%	15.5%	10.7%
GRCA Grandview	276	39.5%	33.7%	15.9%	2.2%	2.2%	5.4%	1.1%
GRCA Hermit	378	47.6%	29.4%	12.4%	2.1%	1.6%	4.0%	2.9%
GRCA Tusayan Ruins	271	18.5%	41.3%	24.7%	5.5%	3.3%	5.2%	1.5%
BRCA Fairyland	722	39.8%	28.0%	18.0%	3.2%	2.4%	6.9%	1.8%
ZION West Rim	205	36.1%	29.3%	22.0%	5.9%	4.4%	1.5%	1.0%
ZION Taylor Creek	290	32.4%	32.4%	23.1%	2.8%	2.4%	6.6%	0.3%
GLAC Sperry	576	39.4%	32.1%	20.0%	2.8%	1.4%	2.8%	1.6%
GLAC Hidden Lake	344	36.9%	36.9%	19.2%	1.7%	1.2%	2.6%	1.5%

d) Allow sightseeing tour aircraft to be flown over the park only during specially designated dates and times

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	84	10.7%	10.7%	28.6%	20.2%	6.0%	15.5%	8.3%
GRCA Grandview	276	12.7%	11.2%	25.4%	32.2%	12.7%	4.3%	1.4%
GRCA Hermit	378	5.6%	10.1%	22.5%	39.7%	15.9%	4.5%	1.9%
GRCA Tusayan Ruins	271	5.2%	9.6%	32.8%	37.3%	10.7%	4.1%	0.4%
BRCA Fairyland	722	15.1%	14.5%	25.9%	27.3%	9.6%	6.2%	1.4%
ZION West Rim	205	18.0%	12.2%	24.9%	36.1%	7.3%	1.5%	0.0%
ZION Taylor Creek	290	13.4%	13.1%	27.2%	31.7%	7.2%	6.9%	0.3%
GLAC Sperry	576	9.0%	12.3%	28.3%	33.2%	11.5%	4.0%	1.7%
GLAC Hidden Lake	344	8.7%	14.5%	28.8%	33.1%	9.3%	3.8%	1.7%

Table C-17 (continued). To what extent would you support or oppose each of the following potential actions at <Park> National Park?

e) **Allow sightseeing tour aircraft to use designated flight paths over limited areas of the park**

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	**84**	**14.3%**	**9.5%**	**27.4%**	**20.2%**	**4.8%**	**15.5%**	**8.3%**
GRCA Grandview	276	6.9%	8.3%	19.9%	39.5%	22.1%	2.9%	0.4%
GRCA Hermit	378	4.8%	6.6%	18.0%	40.5%	24.9%	4.0%	1.3%
GRCA Tusayan Ruins	271	4.1%	6.6%	22.9%	44.6%	17.3%	3.3%	1.1%
BRCA Fairyland	722	13.9%	15.1%	22.4%	31.4%	10.1%	6.1%	1.0%
ZION West Rim	205	16.6%	12.2%	23.4%	40.0%	7.3%	0.5%	0.0%
ZION Taylor Creek	290	12.4%	8.6%	23.1%	34.1%	13.8%	6.9%	1.0%
GLAC Sperry	576	8.2%	10.9%	22.9%	35.8%	17.2%	3.5%	1.6%
GLAC Hidden Lake	344	8.4%	13.4%	23.5%	39.5%	10.2%	3.5%	1.5%

f) **Prohibit sightseeing tour aircraft from flying over the park**

Location	Sample Size	Strongly Oppose	Oppose	Neither Support nor Oppose	Support	Strongly Support	Don't Know/ Not Sure	No Response
Rainbow Bridge	**84**	**21.4%**	**16.7%**	**27.4%**	**7.1%**	**3.6%**	**14.3%**	**9.5%**
GRCA Grandview	276	8.0%	22.1%	29.0%	17.8%	19.2%	3.6%	0.4%
GRCA Hermit	378	6.9%	27.0%	24.6%	20.1%	15.1%	4.8%	1.6%
GRCA Tusayan Ruins	271	10.0%	29.2%	37.3%	9.2%	7.0%	7.0%	0.4%
BRCA Fairyland	722	5.8%	16.9%	28.4%	18.4%	23.7%	6.0%	0.8%
ZION West Rim	205	8.3%	17.1%	29.8%	20.5%	22.9%	0.5%	1.0%
ZION Taylor Creek	290	7.9%	13.8%	39.3%	15.2%	16.6%	6.9%	0.3%
GLAC Sperry	576	10.2%	18.2%	32.1%	18.6%	15.1%	4.0%	1.7%
GLAC Hidden Lake	344	7.0%	21.8%	30.8%	18.3%	16.3%	4.4%	1.5%

Table C-18. Have you ever taken a scenic air tour over <Park> National Park or any other park?

a) Yes, I have taken a scenic air tour over <Park> National Park

Location	Sample Size	Percent
Rainbow Bridge	**177**	**2.8%**
GRCA Grandview	415	6.3%
GRCA Hermit	583	5.7%
GRCA Tusayan Ruins	400	8.0%
BRCA Fairyland	1079	0.7%
ZION West Rim	308	1.3%
ZION Taylor Creek	453	3.1%
GLAC Sperry	912	2.9%
GLAC Hidden Lake	516	1.2%

b) Yes, I have taken a scenic air tour over another park

Location	Sample Size	Percent
Rainbow Bridge	**177**	**9.6%**
GRCA Grandview	415	3.9%
GRCA Hermit	583	6.2%
GRCA Tusayan Ruins	400	6.0%
BRCA Fairyland	1079	10.5%
ZION West Rim	308	7.8%
ZION Taylor Creek	453	10.6%
GLAC Sperry	912	7.9%
GLAC Hidden Lake	516	8.9%

c) No, I have never taken a scenic air tour over a park

Location	Sample Size	Percent
Rainbow Bridge	**177**	**87.6%**
GRCA Grandview	415	89.9%
GRCA Hermit	583	88.3%
GRCA Tusayan Ruins	400	86.5%
BRCA Fairyland	1079	87.4%
ZION West Rim	308	90.3%
ZION Taylor Creek	453	85.7%
GLAC Sperry	912	88.2%
GLAC Hidden Lake	516	89.0%

Table C-19. Would you take a sightseeing air tour over \<Park\> National Park, even if visitors at \<site\> could hear the aircraft during their visit?

Location	Sample Size	Yes	No	Don't Know/ Not Sure	No response
Rainbow Bridge	**177**	**41.2%**	**33.9%**	**21.5%**	**5.6%**
GRCA Grandview	415	20.2%	52.8%	11.6%	15.4%
GRCA Hermit	583	21.6%	49.7%	14.8%	13.9%
GRCA Tusayan Ruins	400	29.5%	36.3%	32.3%	2.0%
BRCA Fairyland	1079	13.3%	63.5%	20.9%	1.9%
ZION West Rim	308	18.2%	54.5%	24.7%	2.6%
ZION Taylor Creek	453	17.9%	54.1%	25.6%	2.4%
GLAC Sperry	912	25.2%	49.2%	23.6%	2.0%
GLAC Hidden Lake	516	21.9%	49.8%	26.4%	1.9%

Table C-20. What is your gender?

Location	Sample Size	Female	Male	No response
Rainbow Bridge	**177**	**45.2%**	**48.6%**	**6.2%**
GRCA Grandview	415	34.0%	66.0%	0.0%
GRCA Hermit	583	40.1%	59.3%	0.5%
GRCA Tusayan Ruins	400	47.3%	52.8%	0.0%
BRCA Fairyland	1079	44.8%	54.1%	0.8%
ZION West Rim	308	32.5%	67.2%	0.3%
ZION Taylor Creek	453	48.6%	50.1%	1.3%
GLAC Sperry	912	46.5%	52.5%	1.0%
GLAC Hidden Lake	516	42.2%	56.0%	1.7%

Table C-21. What is the highest level of formal education you have completed?

Location	Sample Size	Some high school	High school graduate or GED	Some college, business, or trade school	College, business, or trade school graduate	Some graduate school	Master's, doctoral, or professional degree	No resp
Rainbow Bridge	**177**	5.6%	10.7%	15.8%	33.9%	5.6%	20.9%	7.3%
GRCA Grandview	415	4.6%	6.3%	8.9%	33.5%	9.9%	36.4%	0.5%
GRCA Hermit	583	5.8%	5.0%	11.5%	34.0%	7.4%	35.5%	0.9%
GRCA Tusayan Ruins	400	1.5%	5.5%	21.5%	36.0%	6.3%	28.3%	1.0%
BRCA Fairyland	1079	3.6%	5.2%	7.2%	19.9%	8.6%	41.8%	13.5%
ZION West Rim	308	4.5%	9.1%	12.0%	32.5%	8.4%	33.1%	0.3%
ZION Taylor Creek	453	5.5%	3.1%	15.2%	36.9%	6.0%	32.2%	1.1%
GLAC Sperry	912	4.1%	3.1%	10.6%	28.6%	7.0%	34.3%	12.3%
GLAC Hidden Lake	516	3.7%	3.1%	9.7%	35.1%	6.6%	40.7%	1.2%

Table C-22. Are you Hispanic or Latino?

Location	Sample Size	Yes	No	No Response
Rainbow Bridge	**177**	1.7%	89.8%	8.5%
GRCA Grandview	415	6.5%	92.8%	0.7%
GRCA Hermit	583	2.9%	96.2%	0.9%
GRCA Tusayan Ruins	400	3.0%	96.5%	0.5%
BRCA Fairyland	1079	2.5%	96.3%	0.9%
ZION West Rim	308	2.9%	95.8%	1.3%
ZION Taylor Creek	453	4.0%	94.3%	1.8%
GLAC Sperry	912	2.1%	96.7%	1.2%
GLAC Hidden Lake	516	2.3%	96.3%	1.4%

Table C-23. What is your race? (Select all that apply)

NOTE: These do not add to 100%, as some respondents selected multiple choices

a) American Indian or Alaska Native

Location	Sample Size	Percent
Rainbow Bridge	**177**	9.0%
GRCA Grandview	415	2.2%
GRCA Hermit	583	2.9%
GRCA Tusayan Ruins	400	4.3%
BRCA Fairyland	1079	0.9%
ZION West Rim	308	3.2%
ZION Taylor Creek	453	0.9%
GLAC Sperry	912	2.1%
GLAC Hidden Lake	516	1.2%

b) Asian

Location	Sample Size	Percent
Rainbow Bridge	**177**	4.5%
GRCA Grandview	415	2.2%
GRCA Hermit	583	5.8%
GRCA Tusayan Ruins	400	3.0%
BRCA Fairyland	1079	2.9%
ZION West Rim	308	3.2%
ZION Taylor Creek	453	4.4%
GLAC Sperry	912	3.4%
GLAC Hidden Lake	516	5.0%

c) Black or African American

Location	Sample Size	Percent
Rainbow Bridge	**177**	1.1%
GRCA Grandview	415	3.1%
GRCA Hermit	583	2.1%
GRCA Tusayan Ruins	400	4.8%
BRCA Fairyland	1079	1.7%
ZION West Rim	308	2.3%
ZION Taylor Creek	453	2.9%
GLAC Sperry	912	2.2%
GLAC Hidden Lake	516	1.6%

d) Native Hawaiian

Location	Sample Size	Percent
Rainbow Bridge	**177**	0.0%
GRCA Grandview	415	1.0%
GRCA Hermit	583	0.3%
GRCA Tusayan Ruins	400	0.0%
BRCA Fairyland	1079	0.0%
ZION West Rim	308	0.0%
ZION Taylor Creek	453	0.4%
GLAC Sperry	912	0.2%
GLAC Hidden Lake	516	0.0%

e) Pacific Islander other than Native Hawaiian

Location	Sample Size	Percent
Rainbow Bridge	**177**	1.1%
GRCA Grandview	415	1.4%
GRCA Hermit	583	0.9%
GRCA Tusayan Ruins	400	0.0%
BRCA Fairyland	1079	0.5%
ZION West Rim	308	0.0%
ZION Taylor Creek	453	0.2%
GLAC Sperry	912	0.3%
GLAC Hidden Lake	516	0.2%

f) White/Caucasian

Location	Sample Size	Percent
Rainbow Bridge	**177**	74.6%
GRCA Grandview	415	92.3%
GRCA Hermit	583	91.1%
GRCA Tusayan Ruins	400	92.5%
BRCA Fairyland	1079	92.6%
ZION West Rim	308	95.8%
ZION Taylor Creek	453	91.8%
GLAC Sperry	912	93.8%
GLAC Hidden Lake	516	91.5%

g) No response

Location	Sample Size	Percent
Rainbow Bridge	**177**	7.9%
GRCA Grandview	415	2.7%
GRCA Hermit	583	1.9%
GRCA Tusayan Ruins	400	2.8%
BRCA Fairyland	1079	3.7%
ZION West Rim	308	1.0%
ZION Taylor Creek	453	3.1%
GLAC Sperry	912	2.4%
GLAC Hidden Lake	516	3.1%

Table C-24. In what year were you born? (Converted to age in years)

Location	Sample Size	17 and Younger	18 to 24	25 to 34	35 to 44	45 to 54	55 to 64	65 and Older	No Resp
Rainbow Bridge	**177**	**5.6%**	**20.3%**	**15.8%**	**18.1%**	**23.2%**	**7.3%**	**4.5%**	**6.2%**
GRCA Grandview	415	2.7%	8.7%	28.7%	13.0%	19.3%	20.0%	7.2%	0.5%
GRCA Hermit	583	1.9%	11.3%	20.4%	14.9%	17.5%	17.0%	5.1%	0.3%
GRCA Tusayan Ruins	400	2.8%	3.8%	29.8%	11.3%	18.8%	25.3%	7.5%	0.5%
BRCA Fairyland	1079	1.2%	9.1%	24.7%	17.6%	23.1%	16.6%	6.4%	1.1%
ZION West Rim	308	1.9%	19.5%	29.5%	17.2%	14.9%	14.3%	2.3%	0.3%
ZION Taylor Creek	453	1.3%	11.9%	20.1%	11.5%	24.9%	20.3%	1.5%	0.2%
GLAC Sperry	912	2.2%	11.0%	18.2%	12.0%	17.8%	25.4%	12.2%	1.3%
GLAC Hidden Lake	516	3.9%	7.0%	32.2%	19.0%	21.3%	18.2%	21.5%	2.3%

Table C-25. Where do you live?

Location	Sample Size	United States	Other country	No Response
Rainbow Bridge	**177**	92.7%	1.7%	5.1%
GRCA Grandview	415	83.9%	15.7%	0.5%
GRCA Hermit	583	85.8%	13.6%	0.7%
GRCA Tusayan Ruins	400	81.8%	18.0%	0.3%
BRCA Fairyland	1079	69.1%	29.6%	1.0%
ZION West Rim	308	88.0%	12.0%	0.0%
ZION Taylor Creek	453	92.3%	6.4%	1.3%
GLAC Sperry	912	90.4%	8.4%	1.2%
GLAC Hidden Lake	516	83.1%	15.7%	1.2%

Table C-26. Were you or your personal group part of some larger commercial, educational, or other organized group of visitors?

Location	Sample Size	Yes	No	No Response
Rainbow Bridge	**177**	14.1%	80.2%	5.1%
GRCA Grandview	415	10.8%	88.4%	0.7%
GRCA Hermit	583	10.1%	89.5%	0.3%
GRCA Tusayan Ruins	400	3.5%	92.8%	3.8%
BRCA Fairyland	1079	6.4%	91.8%	1.6%
ZION West Rim	308	9.1%	89.9%	1.0%
ZION Taylor Creek	453	5.3%	92.3%	2.4%
GLAC Sperry	912	3.4%	94.8%	1.8%
GLAC Hidden Lake	516	2.5%	96.1%	1.4%

Table C-27. How many adults and children were in your personal group (spouse, family, friends) on this visit to <site>?

Location	Sample Size	1 person	2 people	3 or 4 people	5 or more people	No Response
Rainbow Bridge	**177**	**0.6%**	**10.7%**	**14.1%**	**59.9%**	**0.0%**
GRCA Grandview	415	13.0%	30.4%	33.0%	22.9%	1.0%
GRCA Hermit	583	12.3%	39.6%	26.8%	20.4%	0.9%
GRCA Tusayan Ruins	400	10.3%	54.5%	26.3%	6.8%	2.5%
BRCA Fairyland	1079	13.4%	47.3%	19.7%	18.4%	1.2%
ZION West Rim	308	14.3%	41.9%	23.1%	18.8%	2.3%
ZION Taylor Creek	453	8.6%	37.7%	27.2%	25.4%	1.1%
GLAC Sperry	912	9.4%	37.5%	34.3%	17.9%	0.9%
GLAC Hidden Lake	516	9.9%	43.8%	28.1%	16.5%	1.6%

Table C-28. How many children were in your personal group (spouse, family, friends) on this visit to <site>?

Location	Sample Size	0 children	1 child	2 children	3 or 4 children	5 or more children	No Response
Rainbow Bridge	**177**	**41.8%**	**26.6%**	**11.8%**	**17.5%**	**5.1%**	**0.0%**
GRCA Grandview	415	75%	6.0%	5.5%	3.4%	2.2%	7.7%
GRCA Hermit	583	84.0%	7.5%	4.3%	1.9%	1.4%	0.9%
GRCA Tusayan Ruins	400	84.5%	6.0%	5.8%	3.5%	0.3%	0.0%
BRCA Fairyland	1079	81%	6.5%	6.0%	4.4%	1.4%	0.8%
ZION West Rim	308	92%	3.9%	1.9%	1.6%	0.3%	0.0%
ZION Taylor Creek	453	72.8%	12.4%	7.9%	5.7%	0.9%	0.2%
GLAC Sperry	912	85%	7.9%	4.6%	1.4%	0.8%	0.3%
GLAC Hidden Lake	516	77.7%	8.1%	8.1%	3.9%	0.8%	1.4%