AN EVALUATION OF TICKETING PREFERENCES AND THE EFFECTS OF A FEE INCREASE AT TIMPANOGOS CAVE NATIONAL MONUMENT

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Jennifer Chaffin

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Major Professor: Dr. Kelly Wendland

Authorization to Submit Thesis

This thesis of Jennifer Chaffin, submitted for the degree of Master of Science with a major in Natural Resources and titled "An Evaluation of Ticketing Preferences and the Effects of a Fee Increase at Timpanogos Cave National Monument," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor:	_____ Kelly Wendland, Ph.D.	Date:	_____
Committee Members:	_____ Lena Le, Ph.D.	Date:	_____
	_____ Steven Shook, Ph.D.	Date:	_____
Department Administrator:	_____ Troy Hall, Ph.D.	Date:	_____
Discipline's College Dean:	_____ Kurt Pregitzer, Ph.D.	Date:	_____

Final Approval and Acceptance

Dean of the College of Graduate Studies:	_____ Jie Chen, Ph.D.	Date:	_____

Abstract

While the National Park Service has expanded since creation in land area and services provided, budgets have not kept up, threatening the integrity of the visitor experience. In this study, I evaluate willingness to pay (WTP) and potential impacts of a fee increase on demand and park revenue at Timpanogos Cave national Monument (TICA) in central Utah. In July 2013, I conducted a survey of 348 TICA visitors. Logistic regression, factor analysis, and elasticity calculations were used to identify demand factors that affect WTP. I also examined how WTP response varied with the numerical presentation of a fee increase. I found that WTP decreases significantly with each successive level of fee increase and that visitor satisfaction is a key demand factor at TICA. While demand is inelastic, any fee increase would need to be small in order to maintain revenue. In addition, WTP responses were significantly different based on numerical presentation of a fee increase.

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also to Brian and Jenni Chaffin for helping me see the importance of following through and for helping me become the person that I am today.

Dedication

This thesis is dedicated to my family and friends for their unending support of all my pursuits.

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Chapter 1: Introduction

Each year hundreds of millions of people visit one or more of the 401 National Park Service (NPS) sites scattered throughout the United States. As the Ken Burns series proclaims, the national parks are "America's best idea." Yet, the national parks suffer from long-standing financial issues. The establishment of the NPS in 1916 created and secured funding for a cohesive body to oversee and protect the parks. Unfortunately, maintenance and the provision of public services became increasingly expensive as the system expanded (Duncan, 2009). In 1996 the Recreational Fee Demonstration Program (RFDP) was enacted. This legislation authorized the NPS, along with three other federal agencies, to charge entrance and use fees at select sites to better maintain sites and improve the overall visitor experience. The goals of the RFDP were to be creative in developing new fee structures and collection practices while coordinating multiple or overlapping fees to avoid visitor confusion. Evaluations of the RFDP by the Government Accountability Office (GAO) found that "opportunities remained for the agencies [involved] to be more innovative and cooperative in designing, setting, collecting, and coordinating fees" (Government Accountability Office, 2006, p. 2). Other concerns included visitor confusion over the types of fees and passes required as well as the amount of revenue from fees retained for use at fee sites. Near the end of the demonstration period (December 2004), the RFDP was repealed by new legislation designed to address concerns with the RFDP.

The Federal Lands Recreation Enhancement Act (FLREA) replaced the RFDP in 2004, allowing the federal agencies previously involved in the RFDP to continue provisioning for the improvement of maintenance and the visitor experience via better-defined entrance and use/amenity fees (Government Accountability Office, 2006). In

accordance with the Federal Lands Recreation Enhancement Act (2012), fees generated at a particular unit or area of a Federal land management agency are immediately available for expenditure at that particular unit or area. Additionally, at least 80% of the fees generated at a particular unit or area must be used for expenditures at that particular unit or area. In other words, fees are a key source of operational funding for NPS and other Federal land management agency sites. Anything that could modify or jeopardize this stream of revenue has the potential to affect the future vitality of individual sites and thereby requires investigation.

The dual nature of the NPS mission and the manner in which individual sites decide to address this dual nature is a potential threat to site revenue. The mission of the NPS is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. § 1, 2012). Each NPS site must decide how to protect its natural and cultural resources both for and from the public. As the popularity of the national parks grows, resource management decisions become increasingly difficult. While resources suffer from visitor use and overuse, sites benefit from the entrance and use fees associated with that visitor use. Individual NPS sites must find ways to balance resource protection, visitor use, and revenue. Similar to many NPS sites, Timpanogos Cave National Monument (TICA) in central Utah faces increasing demand for visitation but cannot increase access to the site due to ecological carrying capacity. In this situation, resource protection imposes a limit on visitor use. Consequently, TICA must find a way to balance limited visitor use and revenue. Increasing cave tour fees may be one way to achieve this balance.

The purpose of this study is to examine willingness to pay (WTP) and potential impacts of increases in entrance fees on visitation rates and park revenue at TICA. WTP is the value an individual places on a good or service. Although WTP is not necessarily backed by an ability to pay (purchasing power), it can be used as a proxy for purchasing power in situations where it is difficult to measure both (Field, 2008; Ward, 2006). Some of the factors that can affect WTP include ticketing alternatives, demographics, information regarding what recreational services are funded by fees, market segmentation, visitation frequency, visitor satisfaction, and perceived substitutes. In this thesis, I examine these factors to determine which, if any, would affect WTP for cave tours at TICA. I then use the concept of elasticity of demand to determine whether a fee increase would increase or at least maintain park revenue given the maximum number of visitors the park admits in a season (ecological capacity limit). I also examine how the numerical presentation of the WTP question impacts response. Additionally, I explore public ticketing preferences to inform park management about which ticketing system to employ as a replacement to its current system. The results of this study are informative to 1) TICA park management for choosing a new, more efficient ticketing system and balancing resource protection with visitor use and revenue, and 2) social science tourism research to assess the factors that affect WTP and how the numerical presentation of WTP questions impacts survey research results.

The content of this thesis is as follows. Following this introduction, I introduce the study site and specific TICA context and provide an overview of data collection, including sampling design, the survey instrument, and response rate, which is pertinent for both of my research chapters. The specific research questions, and the theory and methods that accompany them, are written in manuscript style as two separate chapters. The bulk of the

analysis is included in the first manuscript (Chapter 2), which analyzes the questions of visitor ticketing preferences and WTP with an emphasis on which factors – such as the visitor experience – impact WTP. The second manuscript (Chapter 3) is written as a research note, and focuses specifically on how the numerical presentation of survey questions about WTP affect stated responses. In Chapter 4, I discuss limitations and provide a brief summary of the overall lessons learned from this study. Suggestions for measuring WTP and visitor experiences at other NPS sites are also included in Chapter 4.

1.1 Study Site

TICA is one of the NPS's select fee sites. It is a small site (250 acres) located about 40 miles southeast of Salt Lake City, Utah, in the Wasatch Mountain Range. It is situated on the west side of the Uinta National Forest and can be accessed via American Fork Canyon. Since the site is in the mountains, it is only open/accessible during certain months of the year, typically May through October. Despite the short season, average annual attendance is upwards of 114,000 visitors. More than one-half of these visitors (71,800) pay to take a tour of the site's main attraction, which is a series of three caves, the largest being Timpanogos Cave (National Park Service, 2013). In order to reach the caves, visitors must hike 1.5 miles up steep terrain, gaining about 1,100 feet in elevation on their journey. Once inside the cave, visitors are provided with a ranger-led tour lasting approximately 45-60 minutes. In order to preserve the health of the cave ecosystem, visitors are only allowed to enter the cave on ranger-led tours (Jasper, 2005; National Park Service, 2013).

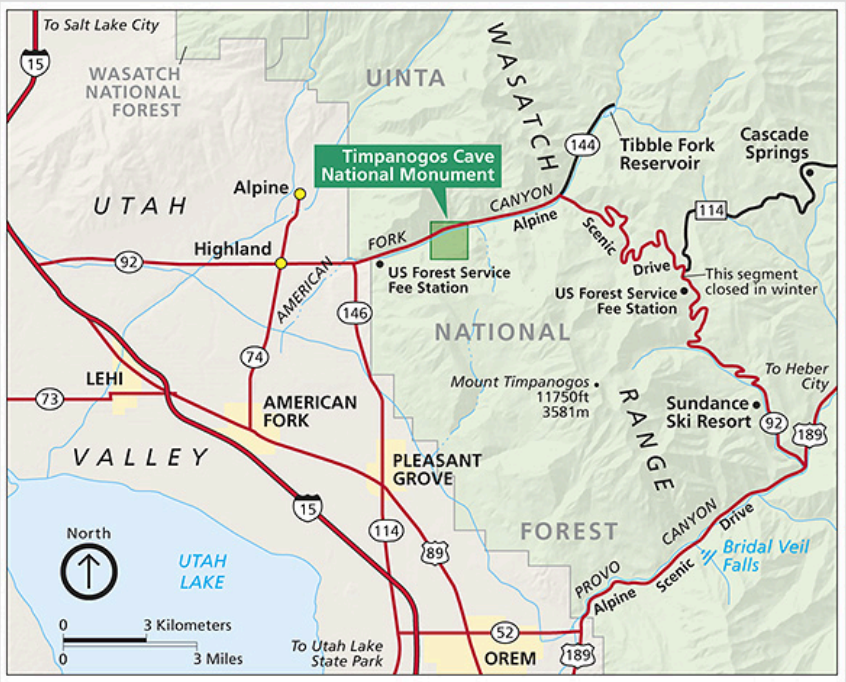

Figure 1.1. A map of the area directly around Timpanogos Cave National Monument (http://www.nps.gov/tica/planyourvisit/directions.htm).

Concerns about the ecological impact of cave visitors led to a recent survey of climate change within the cave system. The survey found that the artificial airflow created by the manmade tunnels connecting the three separate caves, alters the natural microclimate of each cave. Airlock doors have partially restored natural microclimates, but degradation of the doors and frequent openings to permit visitors during the open season have contributed to temperature increases and humidity fluctuations in each cave. Latent heat from the bodies of visitors and cave lighting has further increased cave temperatures, which affect both the health of cave organisms and the growth of cave features (Armstrong, 2010). To reduce these negative ecological impacts, tour capacity was recently limited to 16 people for general cave tours and five people for introduction to caving tours. This number was chosen on the basis of international building code standards for an empty room (five square feet of floor area per person for a standing assembly of people) and the floor area of the smallest tour stop

(International Code Council, 2009). The choice of tour capacity was intended to provide relatively unfamiliar visitors carrying various items (mainly backpacks) with enough space to move around without disturbing cave features.

1.2 Justification of a WTP study

Although the decision to limit tour capacity was imposed to maintain the health of cave ecosystems by reducing human-induced climate change, it has created other problems for the park. By limiting tour capacity, managers inadvertently decreased park revenue and exacerbated the pre-existing condition of excess demand. One possible solution to maintain revenue and mitigate excess demand would be to extend the open season to accommodate more visitors over a longer period of time. However, this is not a viable option given public safety concerns associated with the steep climb to the cave entrance. Furthermore, it could contribute to climate fluctuations within the caves given the contrast of temperatures inside and outside of the caves during the winter months. Consequently, the NPS must find other solutions. Park managers are interested in solutions that maintain revenue under the new capacity limit.

As per the FLREA (2012), the majority of revenue from cave tour tickets is directed toward park management costs. With limited revenue to work with, TICA managers are forced to limit expenditures by seeking out and correcting inefficiencies. Ticketing is one area of inefficient expenditure. The current ticketing system is labor intensive. Tickets are currently available up to 30 days in advance of a visit via an in-house phone reservation system. Advance and day-of tickets are also available for purchase on a first-come, first-served basis at the visitor center approximately 1.5 miles from the cave entrance. Managers would like to investigate other, more efficient ticketing options. Specifically, managers

would like to investigate online reservation systems like Recreation.gov that operate remotely and require fewer on-site personnel.

Adopting an online reservation system would require an increase in ticket prices to offset external management fees. Increased user fees may change visitor expectations of the services provided by the park. TICA managers have expressed an interest in diversifying tour programs by offering special topic tours. This may be a good way to meet public expectations stemming from a fee increase while also maintaining visitor numbers and thereby maintaining revenue. In order to achieve this desired outcome, visitor preferences must be examined.

1.3 Data Collection

To investigate visitor ticketing preferences and the effects of a fee increase on visitor WTP, I developed a survey instrument for TICA visitors. The survey instrument consisted of 26 questions, most of which provided pre-developed options for respondents to choose from (see **Appendix A**). All of the questions on the survey were variations of questions from the NPS pool of known questions. They were chosen and refined in order to answer my specific research questions. There were four versions of the survey instrument based on variations in the proposed fee increase presented in the WTP question. The proposed fee increase was presented as a dichotomous choice question (yes or no) for which WTP was elicited at three different levels of increase: $3, $5, and $7. These price levels were determined based on a review of the maximum tour fees charged at other NPS cave sites for ranger led tours of comparable size and length. Each of three versions of the survey presented the WTP question at a single level of increase. A fourth version presented the $3 proposed fee increase as a percentage increase, equivalent to a $3 increase, from the current fee. Marketing research has

shown that purchasing behavior varies with numerical presentation of price discounts (Rao, 2009). I was interested to see if WTP responses differ significantly based on numerical presentation of a price increase. Details regarding the fourth version of the survey and numerical presentation effects are covered in **Chapter 3**

All questions remained the same on each of the four versions of the survey instrument except for question 13, which was the primary question of interest in **Chapter 2** and **Chapter 3**. Question 13 was the dichotomous choice question that elicited WTP increased tour fees to cover management costs associated with better maintaining the site and enhancing the visitor experience. Outside of question 13, several of the survey questions acted as controls for different variables. For example, questions 7 and 8 were used to control for any effect of the ranger leading the tour. Likewise, question 14 was intended to control for any effect of the National Forest entrance fee. However, the National Forest entrance fee was rescinded for TICA visitors during the 2013 season. The entrance fee was not assessed to those visitors seeking only to visit TICA and not to venture beyond TICA farther into the Uinta National Forest. Consequently, this question was dropped from the analysis. Questions 11 and 13 served as checks of internal validity. Question 11 asked about the appropriateness of the fee paid, whether too low, too high, or about right. Question 13 subsequently asked whether respondents would be willing to pay a specified fee increase per ticket in order to better maintain the site and enhance the visitor experience. Logically, if a respondent answers that he or she feels the current fee is too high in question 11, he or she should answer no to question 13 and vice versa.

The survey instrument was pilot tested for clarity, understanding, and burden hour calculations in the fall of 2012. This initial pilot group was a convenience sample of 14

students enrolled in a research methods course at the University of Idaho. The initial pilot test was conducted prior to the addition of the non-approved questions. Once the non-approved questions were integrated into the survey, it was reviewed and pilot tested by a group of 17 students enrolled in an upper-level marketing research course at the University of Idaho. To view the survey instrument, please see **Appendix A** at the end of this document.

1.4 Sample Population and Sample Methods

I used TICA visitors as the sample population. The University of Idaho's Park Studies Unit conducted a survey at TICA in 2005. This survey collected visitor demographics for respondents and each member of a respondent's personal group. According to the information collected, the majority (62%) of TICA visitors reside in locations throughout Utah. The remaining visitors are primarily United States citizens with international visitors accounting for approximately four percent of the entire sample population. Visitors come with a variety of groups including commercial, educational, religious, and personal. The majority of visitors come with a personal group, and of these, most are family groups (Manni, Le, & Hollenhorst, 2006). These population attributes were taken into account during survey development.

The goal in choosing a sampling approach for this study was to be able to describe the population at large based on a small sample. This can be achieved through probability sampling in which each individual in the population has a known chance of being selected (Riddick & Russell, 2008; Vaske, 2008). Although information about the TICA visitor population is available from the NPS, the visitor population is not static. In other words, there is no established pool of known visitors from which to select participants at random. Therefore, I attempted to achieve probability sampling by administering the survey via

systematic random sampling. Participants were selected at approximately equal intervals from a random start. Based on statistical methods and the population size (# of visitors per year who pay to take the cave tour; i.e., 71,800), I needed a sample size of 62 visitors for each of the four versions of the survey in order to generalize to the population at a 90% confidence level with a ±10% margin of sampling error (Vaske, 2008).

Eq. 1

$$N_s = \frac{(N_p)(p)(1-p)}{(N_p-1)(B/C)^2 + (p)(1-p)}$$

N_s = completed sample size needed (notation often used is *n*)

N_p = size of population (notation often used is *N*)

p = proportion expected to answer a certain way (50% or 0.5 is most conservative)

B = acceptable level of sampling error (0.10 = ±10%; 0.05 = ±5%; 0.03 = ±3%)

C = *Z* statistic associated with confidence interval (1.645 = 90% confidence level; 1.960 = 95% confidence level; 2.576 = 99% confidence level)

Given that there were four versions of the survey, I needed a total sample of 248. Although a similar cave study in Great Basin National Park had a response rate of 82% (Lange, 2012), I chose to be more conservative in my estimate of response rate. I assumed a response rate of approximately 50%. Based on my assumed response rate and the possibility of tours not being filled completely, I tripled my total sample size for my interval calculations. Using this new target sample size (744) and the average number of cave tour tickets available each day (590), the sample interval was calculated through a series of

equations, shown below. Based on the calculations, I needed to sample every 5th visitor in order to achieve the desired sample size.

Eq. 2 $$\left(\frac{Sample\ size}{Survey\ days}\right) = Surveys\ per\ day \quad \rightarrow \quad \left(\frac{744}{7}\right) = 107$$

Eq. 3 $$\left(\frac{Tickets\ available\ per\ day}{Surveys\ per\ day}\right) = Sample\ interval \quad \rightarrow \quad \left(\frac{590}{107}\right) = 5$$

For logistical reasons, surveys were administered upon completion of the cave tour before visitors reached their respective transportation. Only adults (ages 18 +) having taken the cave tour were asked to complete the survey. Children were not used as respondents because they are typically not responsible for monetary transactions such as the payment of tour fees. However, children were included in the sample interval count. If the respondent determined by the sample interval was ineligible to respond (under 18), I simply asked the next individual to respond and so on until a respondent was found. Once a respondent was found, the sample interval count began anew. If an individual was eligible to participate but chose not to respond (non-respondent), their demographic information was recorded and the interval count restarted. In order to accurately represent the population, international visitors were included as respondents regardless of their language proficiency and how informed they may or may not have been about the fees paid. However, those traveling with organized groups (commercial, educational, etc.) were not included in the survey. A survey log was used to record basic demographic information from respondents and non-respondents.

1.5 Response Rate

The survey was conducted at TICA over a period of seven days in July 2013. Approximately 68 people per day were contacted at an attempted interval of one survey per five visitors. The actual interval was closer to six (6.31) given the amount of children in each group. Over the seven days of sampling, 475 people were contacted to complete a survey. Of these, 348 agreed to complete the survey or 73%. However, only 318 surveys were returned and only 282 were completed to the degree that they were usable for data analysis. This resulted in an effective useable response rate of 59%.

The characteristics of the survey population were very similar to those found by the 2005 visitor survey at TICA. Based on all contacts (both respondents and non-respondents), most visitors came with family (78%) in groups ranging from one to 27 individuals. Average group size was approximately seven (6.54) individuals. The mean age of each contact was 40 (39.63) years with an age range of 18 to 82. Contacts were 48% male and 52% female. The majority of contacts were from nearby areas of Utah, but included people from all over the United States and 14 other countries. TICA was the primary destination for 76% of contacts and one of several destinations for 22% of contacts. These figures were very similar for respondents, indicating limited nonresponse bias. Most respondents (80%) traveled with family in groups ranging from one to 30 individuals. Average group size for respondents was six (6.336). The mean age of respondents was 41 (40.543) years with an age range of 18 to 74. Respondents were 43.5% male and 56.5% female. Respondents were mainly from nearby areas of Utah, but included people from all over the United States and 12 other countries. TICA was the primary destination for 62% of respondents and one of several destinations for 33% of respondents. See **Appendix B** for a complete overview of survey summary statistics.

Table 1.1. Statistical summary of sampling and respondent demographics by survey version.

	Survey version			
	$3 fee increase	$5 fee increase	$7 fee increase	$3 fee increase as percentage increase
Surveys handed out	87	86	87	88
Surveys returned	81	78	81	78
Response rate	93.10%	90.70%	93.10%	89.66%
Surveys usable	71	66	76	69
Effective response rate	81.61%	76.74%	87.36%	78.41%
Mean age	41.06	43.71	38.00	39.85
Mean group size	5.62	7.29	6.27	6.24
Percent male	42.86%	32.76%	51.47%	45.45%
Family groups	82.54%	74.14%	84.06%	78.79%
Travel plans: primary destination	68.12%	63.64%	49.33%	69.57%
Travel plans: one of several destinations	27.54%	31.82%	46.67%	24.64%
Travel plans: not a planned destination	4.35%	4.55%	4.00%	5.80%

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Chapter 2: Willingness to Pay Study

Title: Budget Constraints: Maintaining Revenue Under Ecological Capacity Limits

Co-Authors: Dr. Kelly Wendland, Dr. Lena Le, and Dr. Steven Shook

Journal: Journal of Park and Recreation Administration

Executive summary: Many public agencies, including the National Park Service, struggle with budgetary constraints. While fees can help cover management costs, ecological management objectives may compromise some portion of fees. It is possible for management agencies to use pricing as a means to balance ecological and economic objectives. This study examined willingness to pay (WTP) increased tour fees at Timpanogos Cave National Monument (TICA) in Utah where ecological constraints have compromised a portion of fee revenue. A survey was conducted on-site in July 2013. Survey data was used to calculate elasticity conditions and identify demand factors in play at the site. Based on elasticity calculations and current conditions of excess demand for cave tour tickets, it is feasible that TICA could recover revenue lost to ecological constraints by charging higher tour fees. Regression analysis shows that visitor WTP is positively correlated with satisfaction. Additionally, visitors frequently agree that they are willing to pay increased tour fees should those fees be directed toward various services, primarily ecological preservation. Thus, to ensure that a fee increase leads to a revenue increase, the site should work to maintain high quality interpretive programs and provide information to visitors about ecological preservation projects funded by fees. While TICA is unique site, it is possible that similar methods could be applied elsewhere to determine whether pricing is a feasible management strategy to maintain revenue under ancillary constraints, such as ecological preservation.

Key Words: Willingness to pay, recreation, fees, management, public lands

2.1 Introduction

Managing public lands is a balancing act: managers seek to balance ecological, economic, and equity outcomes. Striking such a balance would achieve agency missions, equilibrate revenue with cost, and satisfy the public. Although all three outcomes are critically important for public lands management, taken together, all three are beyond the scope of this study. This study focuses primarily on the economic outcomes associated with public lands management. Specifically, the focus is on ticketing alternatives, WTP, and the impacts of increasing use fees.

In general, public land management agencies use a variety of management strategies to mitigate harm to ecological resources from overuse. Imposing use limits is often a last resort management strategy due to its ethical and political implications of inequity (Dustin & McAvoy, 1980; Manning & Anderson, 2012). Yet, limiting use may be the only way to truly protect ecological resources and maintain ecological integrity. TICA managers sought primarily to protect ecological resources by imposing a capacity (use) limit on cave tours. Thus, the TICA use limit was primarily designed to achieve ecological outcomes. Subsequent management decisions can address and help balance ecological outcomes with economic and equity outcomes.

One of these subsequent decisions is which management practice or combination of management practices to employ to ration and allocate recreation use. In this study I examine some of these management practices by evaluating visitor preferences for ticketing options, visitor WTP increased tour fees, and the factors that affect WTP. Additionally, I evaluate how changes in WTP would affect park revenue. Specific research questions include:

RQ1. Which ticketing alternative do TICA visitors prefer?

- What reasons do visitors cite for having this preference?

RQ2. How does visitor WTP tour fees at TICA vary based on the factors identified in the literature?

- How does visitor WTP vary based on demographic/socioeconomic factors?
- How does visitor WTP vary based on the degree of market segmentation?
- How does visitor WTP vary based on the frequency of visitation?
- How does visitor WTP vary based on the degree of visitor satisfaction?
- What are visitors' perceived substitutes for visiting TICA?
- In the event of a fee increase, what services would visitors agree to pay to augment with fee revenue?

RQ3. Using the elasticity of demand (WTP), how does park revenue change as tour fees increase?

2.2 Theory and Literature Review

2.2.1 Rationing use

McLean and Johnson (1997) define the rationing of public sector recreation services as "a planned allocation of resources, services and opportunities in response to a limited resource base" such as ecological resources (McLean & Johnson, 1997, p. 78). The method of allocation chosen by a particular agency will depend on its mission(s): resource protection, social values, or personal enrichment (McLean & Johnson, 1997). Under the mission of resource protection, there are five basic NPS management practices that can be employed to

ration and allocate recreation use: (1) reservation systems; (2) lotteries; (3) first-come, first-served or queuing; (4) pricing; and (5) merit (Manning & Anderson, 2012). Reservation systems require visitors to reserve tickets in advance of a visit. Lotteries allocate tickets in a random fashion. First-come, first-served or queuing systems require visitors to queue up and wait for tickets based on their position in the queue. Pricing systems require a fee for entrance and/or use. This fee may discourage use by people who are unable or unwilling to pay. Merit systems require visitors to earn the right to use by demonstrating a certain level of knowledge or skill (Manning & Anderson, 2012). These management practices provide the basis for the ticketing alternatives available to the park. Although each alternative serves to enforce the ecologically beneficial tour capacity limit, each has its economic and equity advantages and disadvantages.

The main equity argument against the various types of rationing strategies is that they favor different groups of people. For instance, reservation systems favor people who plan ahead while first-come, first-served or queuing systems favor people who are willing to wait. Similarly, pricing favors those with the ability to pay increased fees and puts those without the ability to pay increased fees at a disadvantage. Merit systems discriminate in essentially the same manner as pricing systems, except they discriminate based on skill level rather than ability to pay (Manning & Anderson, 2012; McLean & Johnson, 1997).

One of the cruxes of limiting use in leisure and recreation contexts is that public agencies like the NPS may not want to take any action that would negatively affect the visitor experience, relationships with users, or the overall image of the agency (Groff, 1998). In other words, any action taken to limit use must hold all else constant. Although conceptually simple, this is not so simple in practice, which is one reason why agencies adopt lottery

allocation. Lottery allocation promotes equal opportunity despite the fact that it may not be the most efficient means of rationing use (Kerr, 1995; Manning & Anderson, 2012; McLean & Johnson, 1997). In lottery allocation, resource users are randomly selected from the total pool of potential resource users rather than being selected from those potential users who are willing to pay the most. Consequently, lottery allocation merely prolongs condition of excess demand where those conditions already exist and does not necessarily result in the greatest net social benefit (Kerr, 1995).

Kerr (1995) argues that price allocation is the most socially efficient means of rationing use (results in greatest net social benefit) even though it may exacerbate distribution inequalities (e.g., more opportunities for the rich and fewer opportunities for the poor). His findings suggest that it is feasible to mix lottery and price allocation strategies to achieve a level of efficiency and equity somewhere between that of the two allocation strategies by themselves. This can be done in one of two ways: by charging a participation fee to enter a lottery or by charging a success fee to those who win the lottery. Kerr (1995) suggests that mixing the two strategies can help achieve desired outcomes and management goals such as obtaining a desired level of revenue. Although TICA's current first-come, first-served, capacity-limited system is not a true lottery allocation method, it is similar in that it imposes a capacity limit. Thus, it may be feasible to combine TICA's current lottery-like allocation strategy with price allocation to strike a balance between efficiency and equity while simultaneously reducing demand and maintaining revenue.

Kerr's (1995) study dealt with two forms of lottery-price allocation in which a single fee (tariff) was charged to consumers. It is also possible to combine these two forms of lottery-price allocation into a two-part tariff in which one fee is fixed (participation fee) and

the other varies (success fee) depending on the quantity and type of good purchased (Shy, 2008). The two-part model is generally superior to the one-part model. Assuming that participation and success fees are the same for both models, the two-part model will generate more revenue by collecting both types of fees as long as the same number of people enter the lottery in each model. Under conditions of excess demand, it is likely that enough people will enter the lottery for each model to at least reach the capacity limit. Yet, even under conditions of overall excess demand, it is possible that demand is not distributed evenly over time. In other words, there may be visitors far in excess of the capacity limit in the summer and fewer visitors than the capacity limit in the spring and fall. Peak load pricing models make up for this by charging higher fees during peak times and lower fees outside of peak times (Shy, 2008). In this way, peak load pricing models maximize revenue by collecting fees from the greatest number of visitors across all seasons. They also mitigate excess demand via higher fees charged during peak times.

Although peak load pricing schemes may achieve revenue goals, Federal agencies cannot modify fees unless necessary to maintain ecological integrity and/or cover management costs. Furthermore, varying fees throughout the season may alter relationships between the agency and users in an undesirable manner due to users' perceived inequity of peak load pricing schemes. Two-part tariffs are a better pricing method to increase revenue and still maintain positive relationships between the agency and users. Ultimately, the allocation method chosen for TICA will depend on visitor preferences. The current pricing strategy at TICA is a combination of a single tariff and an integrated advanced booking system with a fixed cancellation fee (Shy, 2008). Since advanced booking systems are convenient, visitors will likely prefer to retain some components of the current advanced

booking system. If this is the case, managers will need to consider whether or not it is appropriate to modify the current return policy in a manner that increases revenue to cover management costs associated with the booking system.

These allocation and pricing strategies all tie back to ecological outcomes achieved by limiting use (i.e., reducing quantity demanded). Demand is an economic principle that illustrates desire for a particular good or service. Demand has two facets: desire for a good or service and ability to pay the value placed on a good or service. The ability to pay is sometimes called purchasing power, while the value an individual places on a good or service indicates WTP. In order for demand to exist, an individual must have both desire for a good or service and the ability to pay the value he/she places on that good or service (Field, 2008; Ward, 2006). However, WTP can be used as a proxy for demand when it is not possible to determine purchasing power.

2.2.2 Demand and Price Elasticity

There is a well-established relationship between the price of a good or service and the quantity demanded, known as the law of demand. The law of demand states: "all else being equal, as price falls, the quantity demanded by consumers will rise, and as price increases, the quantity demanded will fall" (Ward, 2006, p. 37). For a graphical representation of this relationship, see **Figure 2.1**. As shown in the graphs of **Figure 2.1**, the relationship between price and quantity demanded is generally negative (i.e., downward sloping), but not always linear. In fact, the shape and curvature of each demand curve can vary widely.

The degree to which quantity demanded changes in response to a change in price is known as the price elasticity of demand (E_p) or price responsiveness. There are three different types of price elasticity: unitary elasticity, elastic demand, and inelastic demand.

Unitary elasticity simply indicates that the percentage change in quantity demanded is the same as the percentage change in price. This result is economically uninteresting because revenue (price x quantity) remains the same. On the other hand, elastic demand and inelastic demand are more interesting because both affect revenue.

Elastic demand occurs when the percentage change in quantity demanded is greater than the percentage change in price. In other words, a change in price has a large effect on the quantity demanded. In cases of elastic demand, revenue goes up following a price decrease and revenue goes down following a price increase. Inelastic demand occurs when the percentage change in quantity demanded is less than the percentage change in price. In other words, a change in price has little effect on quantity demanded. In cases of inelastic demand, revenue goes up following a price increase and revenue goes down following a price decrease (Field, 2008; Tribe, 2011). Demand for services, such as cave tours, tends to be inelastic (Hoffman & Bateson, 2011). Some other factors that commonly lead to inelastic demand situations include high necessity, lack of substitutes, monopolistic rights like patents or trademarks, high addictiveness, low price relative to usefulness, and lack of consumer knowledge (Tribe, 2011). In recreation contexts, factors that often lead to inelastic demand situations include lack of comparable substitutes, superior resource/product quality, specialized use, relatively low proportion of income spent on the good, and frequent purchase of the good (Loomis & Walsh, 1997).

It is assumed that managers at TICA would prefer a price increase that would simultaneously reduce the quantity of tour tickets demanded (i.e., meet the capacity limit) and increase or at least maintain current revenue. In other words, managers would prefer to have a case of inelastic demand or at least unitary elasticity. It is possible for this outcome to

be achieved by modifying the services provided to meet the characteristics of common inelastic demand situations, such as offering a variety of special topic tours to create a situation of specialized use and/or superior product quality. Decreasing the costs and/or increasing the values associated with services can also achieve inelastic demand. Common costs associated with services include monetary cost, time costs, energy costs, and psychic costs. Common values associated with services include product value, service value, personnel value, and image value (Hoffman & Bateson, 2011).

2.2.3 Factors That Affect WTP

WTP and the elasticity of demand are not solely dependent on price. There are other factors that affect the value people place on a particular good or service (WTP). These factors include ticketing alternatives, demographics, information about what recreational services are funded by fees, market segmentation, visitation frequency, visitor satisfaction, and perceived substitutes.

WTP is directly related to the reasons why people choose various ticketing alternatives. David Scott (1993) suggests that time scarcity has a direct effect on leisure behavior. People seeking leisure will choose the option for which they can get the most out of their limited time. Therefore, any leisure delivery system that saves the user time will be preferred over those that do not save time. A study of World War II Valor found that one strength of online reservation systems is that they save the user time (Le, Holmes, & Holenhorst, 2011). So, if TICA visitors consider time as the most important element in choosing a ticketing alternative, they will likely prefer an online reservation system.

Visitor preferences and WTP also depend on demographics. For instance, older, less Internet savvy visitors may prefer and be willing to pay more for a ticketing alternative that

does not involve an online reservation system. Bowker, Cordell, and Johnson (1999) found that support for user fees varies significantly with demographic factors like education, age, ethnicity, and income. Their findings suggest that education and income are positively correlated with support for user fees while age and ethnicity are negatively correlated with support for user fees (Bowker, Cordell, & Johnson 1999). Similarly, Bowker and Leeworthy (1998) found that the price responsiveness of Hispanic visitors was significantly different from that of Caucasian visitors. Hispanic visitors were more responsive to a change in price than Caucasian visitors.

In the Bowker et al. (1999) study, researchers also found that support for use fees varied based on which recreation services were supported by those use fees. Overall, people are more supportive of use fees for specialized recreation activities than amenity services such as picnic areas and restrooms (Bowker et al., 1999). Kerr and Manfredo (1991) found that past experience with fees affects visitor response to fees. In other words, visitors may only be willing to pay for recreation services for which they have paid a fee in the past. Public and private entities do not typically charge for amenity services outside of campgrounds. Thus, few people are likely to have experience with fees for amenities services and will be less willing to pay for these services as compared to other services with which they have associated fee experience.

Markets are made up of various user groups or segments that have certain characteristics in common. These characteristics can range from preferences for a particular recreation activity such as birding (Lee & Scott, 2004), angling (Oh, Ditton, Anderson, Scott, & Stoll, 2005), and off-highway vehicle use (Smith, Burr, & Reiter, 2010) to attitude toward natural resource management (Lai, Sorice, Nepal, & Cheng, 2009). Markets may be further

segmented by level of specialization within a particular recreational activity (Oh et al., 2005; Smith et al., 2010). TICA was designated for its cave system and is one of the only cave systems in the greater Rocky Mountain area. As such, TICA may attract visitors who enjoy touring cave systems or have a particular interest in cave ecology. Visitors in this market segment may be willing to pay more to visit TICA and/or preserve the cave ecosystem than those with little or no interest in caves.

Visitation frequency could influence WTP in either direction. Loomis and Walsh (1997) suggest that visitation frequency could increase WTP if visitation is so frequent that it becomes routine. However, utility models suggest that with each subsequent visit, visitors derive less and less utility. This decreasing marginal utility will lead to decreased WTP for subsequent visits (Field, 2008; Ward, 2006).

Lindberg (2001) suggests that a change in fees could change the nature of the visitor experience, "making it more structured and commercialized" (p. 9). This could increase the expectation of visitors for an entertaining experience provided through interpretation and education. Visitors may only be willing to pay more if their experience is enhanced in some way. Measures of visitor satisfaction may indicate areas where the visitor experience could be improved to encourage higher visitor WTP.

Another factor that affects visitor WTP is presence or absence of perceived substitutes. If substitutes are perceived to exist for a particular good or service and the price goes up for that good or service, consumers will seek out substitutes. If no substitutes are perceived to exist, demand for the good or service will likely be inelastic (Field, 2008; Loomis & Walsh, 1997; Tribe, 2011; Ward, 2006).

2.3 Methods

The term "methods" is often used to refer to various stages in the research process from planning to data collection and analysis. For the purposes of this study, I define each of these stages using different terms. The methodological approach or just approach is the overall framework of the study. This is chosen based upon the nature of the topic, the worldview of the inquirer, and the worldview of the audience (Creswell, 2009). The study design is secondary to the approach. It is the specific strategy used to guide the procedures of a study. Secondary to both the approach and study design are the methods. The methods are the specific procedures for data collection, analysis, and interpretation. Data collection for this chapter is described in **Chapter 1**.

2.3.1 Methodological Approach and Study Design

This study takes a quantitative approach. This choice was guided in part by the nature of the topic and the worldviews of both the inquirer and the audience. The topic, economics, is well defined with established theories that are often tested and applied to various contexts. This fits with the tenets of the quantitative approach including "testing theories deductively, building in protection against bias, controlling for alternative explanations, and being able to generalize and replicate the findings" (Creswell, 2009, p. 4). In terms of worldviews, economists apply one of two worldviews in their studies: positive or normative. Guba and Lincoln (1994) describe "worldview" as a basic set of beliefs that define the nature of the world, an individual's place in that world, and the nature of relationships an individual can have to the world and its parts (p. 107). The worldview of positive economics emphasizes objectivity while the worldview of normative economics is subjective in nature. Positive economists objectively examine how things are or came to be via factual analysis while

normative economists are more apt to make value judgments (Field, 2008, pp. 34-35). Although I tend to view the world in a more objective manner in which everything happens for a reason and that reason can be determined via inquiry, I also think that inquiry can identify areas in need of improvement. Thus, this study uses positive economics to examine ticketing and fees at TICA on the basis of current economic theory. The study then uses normative economics to make management suggestions based on the findings. This semi-objective approach coupled with deductive use of theory is characteristic of the postpositivist worldview, which is often applied in quantitative approaches (Creswell, 2009).

Under the quantitative approach there are many study designs to choose from. These designs fall broadly into two categories: experimental and non-experimental. Experimental designs offer the highest degree of control to the inquirer. This control provides the inquirer the ability to ascertain causal relationships from the data. Although ascertaining causal relationships is desired, there is a tradeoff between control and complexity. With increased control comes increased design complexity. In fact, price experiments often involve multiple treatment groups and pre- or post-test designs that require a large number of respondents and that actions be taken to hold all extraneous variables constant (Riddick & Russell, 2008). From these price modifications (treatments), one can measure demand curves and the elasticity of demand. Harrison and List (2004) describe three types of economic "field experiments": artefactual, framed, and natural; each designed to deal with different issues associated with experimental inquiry.

Artefactual field experiments are simply lab experiments that use subjects relevant to the question under investigation rather than the typical student subjects (Harrison & List, 2004; List, 2011). In this manner, artefactual field experiments retain control over the

variables in the experiment. Yet, the artificial environment of the lab is not altogether reflective of reality. Framed field experiments seek to deal with this issue by carrying out experiments in the environment in which the situations therein would normally occur (Harrison & List, 2004; List, 2011). Those participating in framed field experiments are aware that they are being studied. This awareness could bias or skew responses from reality. When conditions are right, researchers can examine a population of subjects undertaking tasks of interest without the population being aware of their participation in an experiment (Harrison & List, 2004; List, 2011). This type of experiment is known as a natural field experiment. It reflects reality while also maintaining the randomization necessary for experimental design (Harrison & List, 2004; Riddick & Russell, 2008; List, 2011). One caveat to this design is that naturally occurring situations may not reflect researcher interests. In fact, finding a situation that mimics individual research questions can be difficult. The conditions of this study do not allow for the use of a natural field experiment or an artefactual field experiment. As a result, this study is best classified as a framed field experiment. Although the results obtained in this experiment will provide an accurate representation of reality, they will also have some degree of bias.

One issue with using an experimental design in this study is that the price of services on public lands cannot be modified unless modifications are to maintain ecological integrity and/or cover management costs. This constraint rules out true experimental design as a viable option. However, it is still possible to approximate an experiment by hypothetically modifying fees using stated preference methods to elicit WTP. Employing stated preference methods to elicit WTP still allows for the generation of demand curves and measurement of the elasticity of demand, but it does not allow the inquirer to ascertain causal relationships.

Rather, the inquirer can measure correlations between several factors of interest and WTP. Correlations are relationships between variables that can be measured in terms of strength and direction (Graziano & Raulin, 2010). Although correlations are not equivalent to causation, with sufficient sample size, they still provide important information in which to inform policy circumstances. Correlational design is the most suitable methodology for this project because there is no way to modify the price of tour tickets and measure the resulting demand.

To derive the demand function and subsequently determine price elasticity of demand, economic studies of non-marketed goods elicit individual WTP through valuation methods. Common valuation methods include revealed preference and stated preference methods (Bateman et al., 2002; Ward, 2006). Revealed preference methods assume that an individual's market decisions reveal something about how that individual values a particular non-market good or service while stated preference methods assume an individual's market decisions reveal nothing about how that individual values a particular non-market good or service. Revealed preference methods are often used for goods or services that influence existing markets for some other good or service. For instance, the non-market good requires the purchase of related goods that have a direct market value (like backpacking equipment and travel costs for backcountry trips) or depends on the characteristics of other goods. When none of these conditions exist, stated preference methods must be used to elicit WTP. Stated preference methods involve asking people directly how much they are willing to pay for a good or service (benefit) using survey- and/or experiment-based techniques. In this manner, stated preference methods create a hypothetical market for the good in question.

Stated preference methods include contingent valuation (CV) and choice modeling (CM). CV involves simply asking people what they are willing to pay for a good or service. CM is starting to replace CV in some contexts. CM infers WTP from rankings/ratings of various alternatives in which different combinations of attributes and attribute levels are presented. Based on individual choices, the inquirer can estimate how different characteristics of a good or service influence an individual's WTP. Generally, CM is preferred when values are necessary for individual attributes of a good or service as opposed to a value for the good or service as a whole (Bateman et al., 2002).

To date, no changes have been made to the ticketing options or prices at TICA and there are no markets directly influenced by or related to cave tour fees. As a result, it would not be possible to observe behaviors or use previous data or data from other sites to derive demand through revealed preference methods. Therefore, I used a stated preference method to determine visitor WTP at TICA. Of the stated preference methods, CV was used to value tour fees as I wanted to value the service as a whole, rather than a set of separately valued attributes.

There are several strategies for eliciting visitor WTP under the stated preference method of CV. These include open-ended valuation, closed-ended valuation, and dichotomous choice (Ward, 2006). Open-ended valuation involves asking people to state the maximum amount they would be willing to pay for a defined good or service. This method is relatively straightforward. It does not provide a reference price upon which people can base their answer, thereby avoiding anchoring bias. However, the exercise is foreign to most people and the hypothetical nature of the question can lead to low response rates, protest answers, zero answers, and high-end outliers. Closed-ended valuation seeks to avoid some of

the issues associated with open-ended valuation via a “bidding game”. Respondents are asked whether they would pay a particular amount for the good in question. A yes answer results in the question being repeated at an incremental increase until the respondent says no. Unfortunately, this method cannot be employed in self-administered questionnaires and responses often vary depending upon the starting price or reference value, which results in anchoring bias. Like open-ended valuation, closed-ended valuation can also yield a large number of outliers given its hypothetical nature (Bateman et al., 2002; Ward, 2006).

Another elicitation strategy is dichotomous choice. Dichotomous, meaning division or contrast between two things, implies that respondents must choose between two options. Under the dichotomous choice strategy, the inquirer selects a range of predetermined prices that includes estimated maximum WTP values. Each respondent is then randomly presented with a single price to which they can respond yes or no in terms of whether or not they would be willing to pay that price. This strategy presents less of a cognitive burden to respondents than other methods and takes a relatively short amount of time. It has been found to minimize non-response and avoid outliers. It was even endorsed by the National Oceanic and Atmospheric Administration panel on CV. Yet, it too has pitfalls. Dichotomous choice provides less information to the inquirer than other methods. Like the other CV strategies, the hypothetical nature of the question in dichotomous choice can cause respondents to answer questions in a manner that does not reflect reality (Bateman et al., 2002; Ward, 2006). Dichotomous choice was used in this study to limit public burden and minimize various biases.

There are specific standards and procedures that must be followed when investigating policies at the federal level. In accordance with the Paperwork Reduction Act (PRA) of 1995,

approval must be obtained from the Office of Management and Budget (OMB) for any federally sponsored data collection. The purpose of this approval process is to limit the public burden from federally sponsored data collections. Thus, data collection instruments need to be short and to the point in order to reduce public burden hours. In line with this, collection instruments should only include questions that have a direct utility for the agency requesting clearance and should limit the number of identical questions. Consequently, well-established methods for investigating WTP are not entirely acceptable under federal standards. In many cases it is more a matter of the time required for the public to complete WTP instruments as opposed to the acceptability of a particular method. This is another reason for employing the dichotomous choice CV strategy. Using dichotomous choice, WTP can be elicited at several different predetermined price levels thereby limiting public burden hours.

2.3.2 Data Analysis

To explore the impact of the identified demand factors on WTP, I performed regression analysis using WTP as the dependent variable and the specific proxy variables for each demand factor as independent variables. Given that the dependent variable (WTP) is a binomial variable, it violates the assumption of a linear relationship between independent and dependent variables that is integral to linear regression models. Non-linear regression methods circumvent this issue by transforming the data such that the resultant relationship between dependent and independent variables is expressed in a linear fashion (Hair, Black, Babin, & Anderson, 2010; Field, 2009). There are two non-linear regression methods commonly used to examine binomial dependent variables: probit and logit models. While both models assume a binary dependent variable for which the outcomes are mutually

exclusive, they differ in the link function used to redefine the dependent variable as a continuous variable. Probit models redefine the dependent variable as a probability (ranging from 0 to 1) while logit models redefine the dependent variable as the log of the odds ratio for each outcome (ranging from $-\infty$ to ∞). Typically, both models produce very similar results. I chose to use the logit model for the purposes of this analysis.

I used STATA 12.1 to perform logistic regression with WTP (WTP_{type}) as my dependent variable and age (AGE), gender (GEND), race (RACE), ethnicity (ETHN), income (INC), personal group size (GRPSIZE), cave familiarity (FAM), frequency of visitation (FREQ), satisfaction with ranger who led tour (SATIS), value for fee paid ($VALUE_{type}$), and questionnaire version (VERSION) as my independent variables. I ran separate regressions for each fee type (adult, junior, senior/access pass, and child) beginning with the full model that included all of the independent variables. I then progressively winnowed down the full model via backward elimination to get the most parsimonious model. In backward elimination, you start with the full model and remove variables lacking significance one at a time, checking to see the effect of the removal on the likelihood ratio statistic. If there is little difference in the likelihood ratio statistic following the removal of a variable, it is rejected from the model and so on until further deletions significantly affect the likelihood ratio statistic (Field, 2009).

Output tables from regression analysis include statistics used to make inferences about the fit of the model and about the relationship of the independent variables to the dependent variable. Reported statistics for the fit of the model include number of observations, log likelihood, likelihood ratio chi-square statistic (LR chi2) with degrees of freedom in parentheses, probability of obtaining the chi-square statistic (Prob > chi2) if there

is no effect of the full set of independent variables on the dependent variable (i.e., the null hypothesis is true), and percent of cases correctly predicted by the model (PCP). Reported statistics for the relationship of the independent variables to the dependent variable include marginal effects (dy/dx), standard error (std. err.), and p-value (P > |z|). The p-value is used to determine the outcome of the null hypothesis test that each independent variable has no effect on the dependent variable. Any effect would be a marginal effect; meaning that for a one-unit increase in the independent variable, the likelihood of a particular outcome in the dependent variable changes by the probability indicated by dy/dx.

While regression analysis examined the relationship between identified demand factors and WTP, it did not examine the price elasticity of demand associated with WTP. In order to determine the price elasticity of demand, respondents were asked to indicate which types of tickets were obtained for their personal group during their visit. Respondents were also asked whether they would be willing to pay a fee increase for each type of tour ticket. These two responses were matched such that WTP was conditional on the types of tour tickets obtained. In other words, WTP responses for child tour tickets were only counted for visitors who actually obtained child tour tickets during their visit. Using the original and conditional values, price elasticity of demand and resultant revenue were calculated. Price elasticity of demand was calculated using the following equation:

$$E_p = \frac{Percentage\ change\ in\ quantity\ demanded}{Percentage\ change\ in\ price}$$

Information on the different types of price elasticity and their effect on revenue is summarized in **Table 2.2**.

In the event of a fee increase, visitors may expect improvement in particular services provided in order to be willing to pay increased fees. To determine which services visitors prefer to augment in the event of a fee increase, various services were identified and 2-4 survey items generated based on each service. Respondents were asked to rate each item on an attitude scale (strongly agree to strongly disagree) in regard to whether they would be willing to pay increased tour fees should those fees be directed toward that item (see question 6 on the survey instrument in **Appendix A**). Although services were identified via collaboration with park management, the identified services may or may not be viewed by visitors in the same way that we view them. For instance, visitors might view safety barriers on the trail as separate from safety services provided at the visitor center due to the geographic separation of the provision of those services. As such, it was important to determine how visitors grouped survey items into different service categories.

Factor analysis is one method used to reduce large datasets. Principal component analysis (PCA) is a factor analysis technique used to reduce data into components (a group or clump of related variables) for further analysis. The goal of PCA is to find the smallest number of components that can be used to best represent the interrelationships between items while accounting for the majority of the variance in those items. The first step toward achieving this goal is to determine the number of components. The number of components is based on eigenvalues (only components with values greater than or equal to 1 should be considered), percent of variance accounted for, scree plot, and parallel analysis. The next step is to use rotation to discriminate between factors. Oblique rotation assumes factors are correlated while orthogonal rotation assumes factors are not correlated. I used PCA to reduce the observed items down to four components. I followed up with orthogonal rotation to

discriminate between components. Items that cross-loaded were dropped from the analysis in order to get the clearest factor loadings.

Once components were established, further analysis was conducted to determine which services visitors would prefer to augment in the event of a fee increase. Due to the central tendency of the responses, the original likert-type attitude scale (1 - strongly disagree, 2 - disagree, 3 - neutral, 4 - agree, 5 - strongly agree) was condensed to differentiate between disagreement (1), neutrality (2), and agreement (3). Based on the condensed scale, items making up each component were scanned for agreement on a per respondent basis. If a respondent expressed agreement for any item within a particular component, a value of "1" was returned for that respondent on that component. Frequency of agreement was then calculated by counting the cases of agreement for each factor.

2.4 Results and Discussion

2.4.1 Visitor Preferred Ticketing Alternatives

Respondents were presented with five ticketing alternatives chosen by park management. These options included: (1) tickets available for purchase on-site, on a first-come-first-serve basis only, (2) tickets available for advance reservation through a phone reservation system only with a non-refundable transaction fee of $0.50 per ticket, (3) tickets available for advance reservation through an online reservation system only with a non-refundable transaction fee of $3 per ticket, (4) a combination of options (1) and (2), and (5) a combination of options (2) and (3). It is clear from the results that preferences for ticketing alternatives vary widely (**Table 2.2**). Although most people chose option (5), options (2), (3), and (4) received similar levels of support. Option (1) was the least preferred of all the alternatives.

Respondents were also asked to choose from a list of reasons why they preferred a particular ticketing alternative. Reasons included: price, convenience, assurance of securing a ticket in general (no particular date or time), assurance of obtaining a ticket for a particular tour date and time, fairness of obtaining a ticket, or some other reason. Convenience was cited most often as the reason for preferring a particular ticketing alternative, followed by assurance of obtaining a ticket for a particular date and time (**Table 2.3**). Price and assurance of securing a ticket in general were also frequently cited as reasons for preferring a particular ticketing alternative.

2.4.2 Data Preparation and Descriptive Statistics

Preparation of the independent variables for regression analysis involved examining the descriptive statistics of each variable to determine whether any variable categories should be collapsed to avoid issues associated with collinearity. AGE, GEND, GRPSIZE, and VERSION were the only variables that did not require modification. Due to the low percentage (5% or less) of people in each RACE category outside of white, RACE was recoded as a dummy variable for white (1 for white and 0 for not white, i.e. American Indian or Alaska Native, Asian, Black, African American, Native Hawaiian or other Pacific Islander, or multiracial). Similarly, the two lowest INC categories contained very few respondents (5% or less) and were combined such that the lowest INC category changed from $24,999 or less annually to $34,999 or less annually. For FAM, respondents were almost evenly split between the first two categories (not at all familiar and slightly familiar) and the last three categories (moderately, very, and extremely familiar). This seemed to indicate a natural break between the not familiar and the familiar. Thus, cave familiarity was recoded as a dummy variable combining the last three categories as familiar (coded as 1) and

the first two categories as not familiar (coded as 0). For FREQ, the descriptive statistics showed that only about 2% of visitors visit more frequently than once a year. As such, these frequent visitors were lumped in with the once a year visitors, cutting the categories down to two: (1) this is my first visit and (2) once a year, more or less. Satisfaction with the ranger who led the tour was overwhelmingly positive with 83.5% of visitors responding that they were "very satisfied." The remaining categories were lumped together and the variable was recoded as a dummy variable for very satisfied (1 for very satisfied and 0 for not very satisfied). The variable $VALUE_{type}$ was a little tricky because it was dependent on the type of tour fees paid by respondents. Responses for adult and junior tour fees were distributed differently than responses for senior and child tour fees. The original categories were (0) not applicable, (1) very poor, (2) poor, (3) average, (4) good, and (5) very good. For adult and junior tour fees no respondents chose category (1) and very few respondents chose categories (2) and (3). Thus, category (1) was dropped and categories (2) and (3) combined. For senior and child tour fees, there were too few observations to avoid collinearity issues. Thus, $VALUE_{type}$ was dropped from the senior and child regression models. Likewise, appropriateness of the fee paid indicated that very few visitors viewed tour fees as too high or too low. Consequently, $APPROP_{type}$ was dropped from all regression models. **Table 2.4** contains descriptive statistics for the modified variables.

2.4.3 Demand Factors and WTP

As previously discussed, demand factors (outside of price) can affect WTP. Some of the demand factors that may affect WTP at TICA include demographic/socioeconomic characteristics, degree of market segmentation, frequency of visitation, and visitor satisfaction. The specific demographic/socioeconomic characteristics measured were age,

gender, race, ethnicity, income, and personal group size. Degree of market segmentation was measured as degree of familiarity with cave ecosystems prior to visiting TICA. Visitor satisfaction was measured as satisfaction with the ranger leading the tour and value for the fee paid. Variables based on these demand factors were used as independent variables in logistics regression.

The output from the full logistic regression models (**Table 2.5**) suggests that there is an effect of the independent variables (taken together) on the dependent variable for adult and junior tour fees but not for senior and child tour fees. Thus, for senior and child tour fees, we fail to reject the null hypothesis that the independent variables (taken together) have any effect on the dependent variable. That is not to say that a particular variable in the model does not affect WTP, just that all the variables together do not have an effect on WTP. In fact, version two ($5 fee increase) of the questionnaire is significantly different from zero for child tour fees (dydx = -0.435, p-value = 0.000) even though the model is not significant. The marginal effect here indicates that the probability of a "yes" WTP response decreases by approximately 44% from the base $3 fee increase (**Table 2.5**). INC 4 (dydx = -0.348, p-value = 0.049) is also significant for child tour fees. FREQ (dydx = 0.305, p-value = 0.019) differs significantly from zero for senior tour fees. VERSION 2 ($5 fee increase; dydx = -0.213, p-value = 0.049) and VERSION 3 ($7 fee increase; dydx = -0.334, p-value = 0.002) of the questionnaire are significantly different from zero for junior tour fees as well as VALUE 3 (dydx = 0.293, p-value = 0.028), SATIS (dydx = 0.253, p-value = 0.022), and GEND (dydx = -0.200, p-value = 0.029). Adult tour fees exhibit similar significance. VERSION 2 ($5 fee increase; dydx = -0.219, p-value = 0.015) and VERSION 3 ($7 fee increase; dydx = -0.303, p-value = 0.001) of the questionnaire are significantly different from zero for adult tour fees

as well as VALUE 2 (dydx = 0.293, p-value = 0.019), VALUE 3 (dydx = 0.332, p-value = 0.005), SATIS (dydx = 0.236, p-value = 0.028), INC 7 (dydx = 0.448, p-value = 0.001) and GRPSIZE (dydx = -0.018, p-value = 0.019).

Working backwards from the full models, I was unable to find a significant model for senior tour fees. However, I did find significant models for adult, junior, and child tour fees. The parsimonious model for adult tour fees includes all of the variables from the full model except ETHNICITY and FREQ. The parsimonious model for junior tour fees includes AGE, GEND, SATIS, VALUE, and VERSION. The parsimonious model for child tour fees includes FREQ, SATIS, and VERSION. Visitor satisfaction and questionnaire version were common to all of the parsimonious models. This suggests that outside of price (VERSION), visitor satisfaction is a demand factor affecting WTP at TICA. Although SATIS does not differ significantly from zero in all parsimonious models (adult – dydx = 0.233, p-value = 0.030; junior – dydx = 0.239, p-value = 0.012; child – dydx = 0.171, p-value = 0.164), that it is still included in all of the parsimonious models suggests that it affects WTP in some way, whether directly or indirectly.

2.4.4 Preferred Service Augmentation With a Fee Increase

Due to similar loadings on multiple factors, I dropped certain items from the PCA. These items were WTP for additional features/exhibits on the cave tour, additional tour times after 4:30pm, ecological restoration of bat habitat within the cave, law enforcement presence, and restroom improvements. After dropping the confounding items, five components accounted for 67% of the variance in the observed items (**Table 2.7**). The five components seem to be clearly related to particular services offered by the park. Component one relates to ticketing system. Component two relates to facilities services associated with both the visitor

center and the trail to the cave. Component three relates parking and traffic services. Component four relates to ecological preservation of the caves. Component five relates to tours and tour characteristics.

Using a condensed attitude scale, I scanned the original items in each factor for agreement to see how many respondents would be WTP increased tour fees if the fee were put toward a particular component. I then averaged agreement across the items in each factor. Average respondent agreement to pay increased tour fees for each component is as follows: 105 (37% of respondents) for ticketing, 86 (30%) for facilities, 59 (21%) for parking, 197 (70%) for ecological preservation, and 93 (33%) for tour/visitor experience (**Table 2.8**). Based on these results, visitors are more likely to be willing to pay increased tour fees should those fees be directed toward preserving the ecosystem. Visitors may also be inclined to pay increased tour fees to implement a different type of ticketing system. There is about equal support for increased fees being put toward tour/visitor experience and facilities and although there is some support for increased fees being put toward parking, this service category received the least support.

2.4.5 Revenue and the Elasticity of Demand

Price elasticity of demand was inelastic ($0 < E_p < -1$) for all types of tour tickets across all levels of fee increase (**Table 2.9**). In general, inelastic demand under a fee increase leads to an increase in revenue. However, in this study, revenue change was calculated based on survey response. During peak season, many visitors are unable to take cave tours because tickets sell out. Therefore, there is a larger body of visitors who would potentially purchase tour tickets outside of those people who were surveyed. Without information from the larger pool of visitors, there is no way to accurately calculate revenue change with a price increase.

Yet, given the conditions of excess demand and inelastic demand, it is likely that revenue would increase with a price increase. In order to avoid confusion, I have excluded revenue calculations from the results.

2.5 Summary

While there is variation in the results presented above, there are some overall trends. In terms of visitor preferred ticketing alternatives, visitors prefer a variety of options but tend toward options involving an online reservation system. This was slightly surprising given the online reservation option was accompanied by a $3 non-refundable transaction fee per ticket. However, technology is constantly improving and the internet is readily available on phones, tablets, and a variety of other devices. Consequently, internet reservations are likely seen as convenient and visitors are willing to pay more for that convenience factor because it minimizes costs (time and psychic) and maximizes values (productive, service, and image value). With online reservation systems, there is little or no wait time and visitors have the ability to pick the date, time, and number of tickets desired with minimal error. While online reservation systems may be good for those who plan ahead, they do not leave any tickets available for those deciding to visit at the last minute. This may be why visitors prefer a combination of tickets available on-site and for advance reservation online.

While the price of tickets obtained via an online reservation system did not seem to have a significant impact on preferred ticketing alternatives, it did impact WTP. The different versions of the questionnaire were significant in the regression models. This was expected based on the law of demand (the higher the price, the lower the demand/WTP). More interesting, are the demand factors in addition to price that affect WTP. Based on the results of both the full and parsimonious regression models, an income of $200,000 or more led to a

significant difference in WTP for adult tour fees. People at higher income levels have a greater ability to pay and will generally have a higher WTP as a result. People at lower income levels have lower WTP due to income constraints. The results also indicate that visitor satisfaction impacts WTP, since it appears in all of the parsimonious regression models despite the fact that its marginal effects are only significant for adult and junior tour fees. Some of the demand factors that do not seem to have an effect on WTP include race, ethnicity, familiarity with cave ecosystems, and frequency of visitation. Due to the nature of the visitor population, there is not much racial or ethnic representation. This is likely the reason for the lack of an effect on WTP from race and ethnicity. Likewise the geology of the area does not make it a hotspot for caves and the TICA cave system is very small. As such, TICA is not likely to attract visitors who specialize in cave tours or spelunking. Frequency of visitation did not seem to have a clear impact on WTP. Very few visitors (~2%) visit more than once a year. Thus, only a small portion of the visitor population has formed a place attachment to the site or routine that could foster greater WTP. Since this portion of the population is so small, no effect appears in the regression analysis.

In the event of a fee increase, it is likely that visitor expectations will change. Repeat visitors, familiar with the tour and other services offered, may expect more from those services in the event of a fee increase. According to the results, the highest number of respondents expressed agreement to pay increased tour fees should those fees be directed toward ecological preservation. Direct exposure to the cave ecosystem and information about the length of time it takes cave formations to grow compared to the short amount of time it takes to damage them may evoke concern from visitors about the preservation of cave ecosystems. People having experienced the ecosystem are much more likely to pay to

preserve it than people who have never experienced it. The ticketing system received the second highest agreement for WTP increased tour fees. The current ticketing system is antiquated and may need to be replaced by something more modern and efficient. Visitors seem to be willing to monetarily support this change. Facilities and tour/visitor experience received about equal agreement, lower than that of both ecological preservation and ticketing. Even so, given that the tour is the main attraction at TICA, it may need to be augmented in some way to offset the decreasing utility visitors derive from each subsequent visit. Parking received the lowest level of agreement. Visitors are not likely as familiar with having to pay for amenities like facilities and parking on public lands. Thus, visitors are not likely to agree to pay more for those services. Fees with which visitors have experience, like tour fees, are more likely to be supported but with different expectations.

In order to meet visitor expectations associated with a fee increase, the fee increase needs to provide the means to do so. In other words, a fee increase needs to generate revenue. The elasticity of demand results indicate conditions of inelastic demand across all levels of fee increase. However, accurate revenue calculations could not be performed without information on the larger pool of visitors. Given conditions of inelastic and excess demand, it is likely that revenue will increase with a price increase but it is uncertain by how much. With each successive level of price increase, fewer and fewer visitors indicated that they would be willing to pay to take a cave tour. This could be indicative of an anchoring effect stemming from the already established fee (i.e., reference price) for tour tickets. Given the potential anchoring effect of the established fee, it may be wise to keep any proposed fee increase as small as possible in order to achieve the management goal of maintaining revenue under an ecological capacity limit.

It would also be interesting to explore the possibility of implementing a peak-load pricing scheme. During peak times, people usually travel to the site from a greater distance and there are more visitors due to children being off school, weather conditions, etc. Raising ticket prices at this time of the season could simultaneously limit excess demand and increase revenue. At the same time, keeping prices as they currently are during the off-season could raise demand from local users who have the ability to come at different times of the year when demand is lower than the capacity limit. This would serve to even out demand across all seasons. Peak-load pricing schemes raise equity concerns because higher ticket prices limit the number of users who can take the cave tour. Adopting a peak-load pricing scheme could be risky for the image and reputation of a federal agency like the National Park Service given equity concerns, but it could also be beneficial. While there may be discontent among visitor groups should a peak-load pricing scheme be implemented. However, the scheme also has the potential to foster positive relationships with local users who can come in the off-season for a more intimate and affordable experience.

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2.7 Tables

Table 2.1. Summary of the different types of price elasticity and their effect on revenue.

In cases of inelastic demand ($-1 < Ep < 0$), revenue increases with a price increase. In cases of unitary elasticity ($Ep = -1$), there is no change in revenue with a price increase. In cases of elastic demand ($Ep < -1$), revenue decreases with a price increase (Field, 2008, pp. 341-342).

	Inelastic Demand	**Unitary Elasticity**	**Elastic Demand**
Price elasticity (Ep)	$-1 < Ep < 0$	$Ep = -1$	$Ep < -1$
Relationship between %ΔQd and %ΔP	%ΔQd < %ΔP	%ΔQd = %ΔP	%ΔQd > %ΔP
Revenue change with price increase	revenue increases	no change	revenue decreases
Revenue change with price decrease	revenue decreases	no change	revenue increases

Table 2.2. Summary of the visitor preferences for the various ticketing alternatives offered by park management.

Response	**Frequency**	**% of total**
(1) Tickets available for purchase **on-site**, on a **first-come-first-serve** basis only	22	9
(2) Tickets available for advance reservation through a **phone reservation system** only (which would include a non-refundable transaction fee of $0.50 per ticket)	48	20
(3) Tickets available for advance reservation through an **online reservation system** only (which would include a non-refundable transaction fee of $3 per ticket)	57	23
(4) A combination of options (1) and (2)	55	22
(5) A combination of options (1) and (3)	64	26

Table 2.3. Summary of the reasons visitors cited for preferring a particular ticketing alternative.

Response	**Frequency**
Price	62
Convenience	169
Assurance of securing a ticket in general (no particular date or time)	61
Assurance of obtaining a ticket for a particular tour date and time	89
Fairness of method for obtaining a ticket	48
Other	7

Table 2.4. Descriptive statistics for the independent variables used in regression analysis.

All variables are categorical except AGE and GRPSIZE. Reported statistics include variable name, description (including levels for categorical variables), number of observations, mean, standard deviation, minimum, and maximum.

Variable	Description	Obs.	Mean	St. Dev.	Min	Max
AGE	Age: continuous	188	40.79	11.22	18	74
GEND	Gender: 0 = male, 1 = female	189	0.57	0.50	0	1
RACE	Race: 0 = not white, 1 = white	189	0.87	0.33	0	1
ETHN	Ethnicity: 0 = not Hispanic or Latino, 1 = Hispanic or Latino	183	0.08	0.27	0	1
INC	Annual household income: 1 = $34,999 or less 2 = $35,000-$49,999 3 = $50,000-$74,999 4 = $75,000-$99,999 5 = $100,000-$149,999 6 = $150,000-$199,999 7 = $200,000 or more	159	4.07	1.85	1	7
GRPSIZE	Size of personal group: continuous	187	6.37	4.47	1	30
FAM	Cave familiarity prior to visit: 0 = not familiar, 1 = familiar	210	0.51	0.50	0	1
FREQ	Frequency of visitation: 1 = first visit, 2 = once a year (more or less)	189	1.57	0.50	1	2
SATIS	Satisfaction with the ranger who led the cave tour: 0 = not very satisfied, 1 = very satisfied	206	0.83	0.37	0	1
$VALUE_{ADULT}$	Value for the fee paid: 1 = poor to	194	2.45	0.68	1	3
$VALUE_{JUNIOR}$	average, 2 = good, 3 = very good	144	2.43	0.71	1	3
VERSION	Questionnaire version: 1 = $3 proposed fee increase 2 = $5 proposed fee increase 3 = $7 proposed fee increase	213	2.02	0.83	1	3

Table 2.5. Regression output for each of the four full models.

Adult and junior tour fee models are significant while senior and child tour fee models are not significant. Significant marginal effects are highlighted within each model.

		Adult			Junior			Senior/Access Pass			Child		
		Number of obs		139	Number of obs		104	Number of obs		56	Number of obs		73
		Log Liklihood		-71.196698	Log Liklihood		-55.479337	Log Liklihood		-31.517772	Log Liklihood		-37.284077
		LR chi2		48.22 (18)	LR chi2		32.25 (18)	LR chi2		14.53 (15)	LR chi2		23.53 (16)
		Prob > chi2		0.0001	Prob > chi2		0.0205	Prob > chi2		0.4861	Prob > chi2		0.1004
		PCP		73.38%	PCP		68.27%	PCP		75.00%	PCP		72.60%
		dy/dx	Std. Err.	P>|z|	dy/dx	Std. Err.	P>|z|	dy/dx	Std. Err.	P>|z|	dy/dx	Std. Err.	P>|z|
AGE		0.002	0.004	0.594	0.005	0.006	0.429	0.002	0.006	0.751	0.008	0.006	0.174
GEND		-0.125	0.077	0.105	-0.200	0.092	0.029	-0.157	0.134	0.242	-0.137	0.114	0.228
RACE		0.181	0.114	0.113	-0.054	0.135	0.689	0.019	0.171	0.912	-0.093	0.168	0.577
ETHNICITY		-0.067	0.148	0.654	0.003	0.201	0.988	-	-	-	0.020	0.297	0.946
INC	2	0.042	0.169	0.802	0.014	0.213	0.947	0.084	0.287	0.770	0.012	0.231	0.959
	3	0.074	0.156	0.633	0.028	0.197	0.886	0.055	0.269	0.837	0.079	0.208	0.705
	4	0.057	0.154	0.711	0.058	0.186	0.754	-0.251	0.245	0.307	-0.348	0.177	0.049
	5	0.103	0.155	0.506	0.169	0.204	0.407	-0.120	0.275	0.663	-0.196	0.214	0.360
	6	0.171	0.187	0.359	0.089	0.233	0.701	0.116	0.311	0.709	-0.368	0.220	0.094
	7	0.448	0.138	0.001	0.343	0.193	0.075	0.326	0.245	0.185	-0.041	0.231	0.860
GRPSIZE		-0.018	0.008	0.019	-0.010	0.009	0.281	-0.009	0.013	0.484	0.001	0.011	0.942
FAM		-0.036	0.079	0.648	0.034	0.096	0.722	0.047	0.137	0.732	-0.044	0.102	0.664
FREQ		-0.019	0.080	0.811	0.001	0.095	0.991	0.305	0.130	0.019	0.157	0.108	0.148
SATIS		0.236	0.108	0.028	0.253	0.111	0.022	0.070	0.221	0.750	0.184	0.145	0.202
VALUE	2	0.293	0.124	0.019	0.207	0.142	0.144	-	-	-	-	-	-
	3	0.332	0.118	0.005	0.293	0.133	0.028	-	-	-	-	-	-
VERSION	2	-0.219	0.091	0.015	-0.213	0.108	0.049	-0.161	0.179	0.367	-0.435	0.110	0.000
	3	-0.303	0.094	0.001	-0.334	0.108	0.002	-0.065	0.178	0.715	-0.135	0.147	0.358

Table 2.6. Regression output for the three parsimonious models.

All parsimonious models include visitor satisfaction (SATIS) and questionnaire version (VERSION) as contributing to WTP. No significant model was found for senior tour fees.

		Adult			Junior			Child		
		Number of obs		143	Number of obs		130	Number of obs		91
		Log Liklihood		-73.466693	Log Liklihood		-74.607578	Log Liklihood		-55.199043
		LR chi2		49.80	LR chi2		30.97	LR chi2		13.27
		Prob > chi2		0.0000	Prob > chi2		0.0001	Prob > chi2		0.0100
		PCP		74.83%	PCP		71.54%	PCP		67.03%
		dy/dx	Std. Err.	P>|z|	dy/dx	Std. Err.	P>|z|	dy/dx	Std. Err.	P>|z|
AGE		0.002	0.004	0.629	0.003	0.004	0.411	-	-	-
GEND		-0.113	0.074	0.128	-0.234	0.081	0.004	-	-	-
RACE		0.184	0.112	0.099	-	-	-	-	-	-
ETHNICITY		-	-	-	-	-	-	-	-	-
INC	2	0.054	0.165	0.744	-	-	-	-	-	-
	3	0.081	0.156	0.603	-	-	-	-	-	-
	4	0.085	0.150	0.573	-	-	-	-	-	-
	5	0.096	0.153	0.531	-	-	-	-	-	-
	6	0.206	0.181	0.253	-	-	-	-	-	-
	7	0.465	0.141	0.001	-	-	-	-	-	-
GRPSIZE		-0.018	0.007	0.013						
FAM		-0.051	0.076	0.499	-	-	-	-	-	-
FREQ		-	-	-	-	-	-	0.173	0.099	0.080
SATIS		0.233	0.107	0.030	0.239	0.095	0.012	0.171	0.123	0.164
VALUE	2	0.295	0.123	0.016	0.130	0.125	0.295	-	-	-
	3	0.333	0.116	0.004	0.283	0.117	0.016	-	-	-
VERSION	2	-0.223	0.090	0.013	-0.249	0.094	0.008	-0.366	0.114	0.001
	3	-0.340	0.090	0.000	-0.320	0.091	0.000	-0.241	0.119	0.043

Table 2.7. Principal Component Analysis – Pattern Matrix[a]

Principal component analysis was used to analyze how visitors group services offered by the park to which a portion of fees might be directed in the event of a fee increase. After dropping several confounding items, five components accounted for 67% of the variance in the observed variables. The resulting components seem to be related to specific services such as ticketing system, facilities services, parking, ecological preservation, and tour characteristics.

WTP increased tour fees if the fees were put toward . . .	Component				
	1	2	3	4	5
A system to procure last minute tickets, on-site	.774				
Internet reservation system	.755				
Phone reservation system	.730				
Better directional signage		.668			
Building improvements		.806			
Decreasing wait time for tickets		.575			
Grounds maintenance		.713			
Emergency services		.630			
Safety barriers		.603			
Limiting parking and traffic congestion			.859		
Parking lot improvements			.805		
Preserving cave ecosystems				.884	
Preserving cave features				.893	
Age-specific tours					.765
Child-free tours					.685
Longer tours					.575
Smaller tours					.678
Special topic tours					.726

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Coefficients of .400 or less suppressed.
a. Rotation converged in 6 iterations.

Table 2.8. Frequency of agreement for WTP increased tour fees for particular service categories identified by PCA.

More respondents agreed that they would pay increased fees to support ecological preservation than any other service category. Ticketing had the second most frequent agreement. Facilities and tour/visitor experience received about equal agreement and parking received the least agreement.

WTP increased tour fees if the fees were put toward . . .	# of agree responses	Service category	Average agreement (% of respondents)
A system to procure last minute tickets, on-site	108	Ticketing	105 (37%)
Internet reservation system	152		
Phone reservation system	56		
Better directional signage	115	Facilities	86 (30%)
Building improvements	65		
Decreasing wait time for tickets	71		
Grounds maintenance	62		
Emergency services	81		
Safety barriers	119		
Limiting parking and traffic congestion	60	Parking	59 (21%)
Parking lot improvements	58		
Preserving cave ecosystems	190	Ecological preservation	197 (70%)
Preserving cave features	203		
Age-specific tours	90	Tour/visitor experience	93 (33%)
Child-free tours	55		
Longer tours	115		
Smaller tours	106		
Special topic tours	98		

Table 2.9. Elasticity of demand at each of the three levels of proposed fee increase.

Demand was inelastic in all cases ($0 < E_p < -1$), which generally leads to an increase in revenue with a price increase. However, revenue decreased in most cases. Although demand is inelastic, the price levels may be at too high increments for revenue to increase.

Elasticity of Demand for $3 Fee Increase

	Q_d Before	Q_d After	P Before	P After	% Change in Q_d	% Change in P	E_p	Elasticity condition
Adult	67	43	7	10	-0.36	0.43	-0.84	Inelastic
Junior	48	30	5	8	-0.38	0.6	-0.63	Inelastic
Senior/ Access Pass	6	3	3.5	6.5	-0.5	0.86	-0.58	Inelastic
Child	20	10	3	6	-0.5	1	-0.5	Inelastic

Elasticity of Demand for $5 Fee Increase

	Q_d Before	Q_d After	P Before	P After	% Change in Q_d	% Change in P	E_p	Elasticity condition
Adult	63	28	7	12	-0.56	0.71	-0.78	Inelastic
Junior	49	19	5	10	-0.61	1	-0.61	Inelastic
Senior/ Access Pass	10	4	3.5	8.5	-0.6	1.43	-0.42	Inelastic
Child	20	7	3	8	-0.65	1.67	-0.39	Inelastic

Elasticity of Demand for $7 Fee Increase

	Q_d Before	Q_d After	P Before	P After	% Change in Q_d	% Change in P	E_p	Elasticity condition
Adult	73	27	7	14	-0.63	1	-0.63	Inelastic
Junior	53	18	5	12	-0.66	1.4	-0.47	Inelastic
Senior/ Access Pass	10	4	3.5	10.5	-0.6	2	-0.3	Inelastic
Child	18	4	3	10	-0.78	2.33	-0.33	Inelastic

2.8 Figures

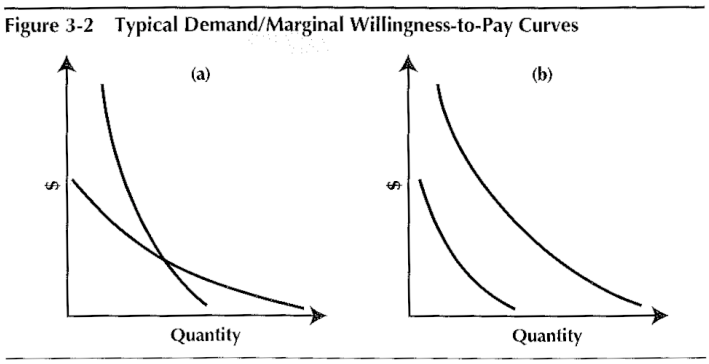

Figure 2.1. Graphical representation of demand and how it varies (Field, 2008, p. 44).

Chapter 3: WTP and the Numerical Presentation of a Fee Increase

Title: Differential Willingness to Pay Response Based on the Numerical Presentation of a Fee Increase

Co-Authors: Dr. Kelly Wendland, Dr. Lena Le, and Dr. Steven Shook

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Abstract: While neoclassical economic theory views individuals as rational economic actors with unlimited cognitive resources, this is not reflective of reality. In seeking to predict actual behavior, behavioral economists re-conceptualized economic decisions as bounded. In order to simplify decisions under bounds, economic actors rely on heuristics. These heuristics can trigger certain responses and have implications for the presentation of survey questions. This study examined the numerical presentation of a survey question eliciting willingness to pay (WTP) for cave tour tickets at Timpanogos Cave National Monument in Utah. Results indicate that WTP response differs significantly based on the numerical presentation (nominal vs. percentage) of a fee increase. Despite the equivalent nature of the fee increase, WTP was lower for the percentage fee increase. The greater the percentage increase, the higher the perceived price. Consequently, WTP survey questions should be presented in a simple format that is easy to evaluate and respond to.

Key Words: Bounded rationality, survey research, willingness to pay, numerosity, fees

3.1 Theory and Literature Review

We are constantly bombarded with decision-making tasks in our everyday lives. For many of these tasks, we have limited information with which to work. Without complete information, we must rely on other things to aid in our decisions, such as presentation and

context. Equivalent information, presented in different forms, may evoke different decisions for the same decision task. In other words, decisions may vary based on the presentation of equivalent information. This phenomenon and others like it are often the focus of studies in behavioral economics. Behavioral economics is an interdisciplinary field focused on investigating the validity of neoclassical models of behavior. Behavioral economists and consumer behaviorists seek a better understanding of individual and group economic decisions in cases where neoclassical models fail to explain behavior (Simon 1997).

In order to understand individual economic decisions, it is important to first understand the individual. Individual economic actors are viewed by both neoclassical and behavioral economics as taking purposeful, goal-oriented action (Sontheimer 2006). Thus, neoclassical and behavioral economists conclude that individual decisions are not arbitrary; they are directed. However, purposeful actions may not necessarily be rational or consistent. In neoclassical economics, individuals are assumed to take purposeful action *and* be rational actors (Sontheimer 2006). Assuming individuals are rational actors who take purposeful action implies that individual actions are both consistent and predictable.

The rational information-processing model aligns well with the assumptions of neoclassical economics. In fact, the rational information-processing model is the foundation of neoclassical economics. The rational information-processing model assumes that individuals have unlimited capacity to consider and elaborate on all relevant information in order to obtain the most optimal outcome (Lord and Maher 1990; Sontheimer 2006). Likewise, neoclassical economists assume that individuals make decisions on the basis of utility maximization. In other words, individual preferences – expressed as a continuous utility function comparing all possible alternatives – serve as the basis for individual

decision-making. Rational economic actors are assumed to be utility maximizers, and thus, always choose the alternative that yields the highest utility (Dowling and Chin-Fang 2007). Yet, the assumptions of neoclassical economics are not altogether reflective of reality. In reality, it is not possible to derive a utility function for all possible alternatives, nor is it straightforward for people to make consistent, predictable decisions under conditions of uncertainty.

Studies in psychology and behavioral decision research suggest that individual actors change their preferences under certain conditions such as risk and uncertainty. Kahneman and Tversky (1979) found that people making decisions under conditions of risk tend to underweight probable outcomes in favor of definitive outcomes and people tend to ignore attributes that are consistent among options. Both of these tendencies lead to inconsistent preferences (Kahneman and Tversky 1979). Changes in the description of choice options and/or the method of elicitation can also lead to inconsistent preferences. Although Tversky and Kahneman (1986) assert that preferences should not change with the description of options or the method of elicitation (principle of invariance), Payne, Bettman, and Johnson (1992) found otherwise. In cases where preferences should have been predictable based on the task, context, and individual difference factors, inconsistent preferences occurred with small changes in how options were presented (descriptive invariance) or how questions were asked (procedural invariance) (Payne, Bettman, and Johnson 1992). This violates Tversky and Kahneman's (1986) principle of invariance. Payne et al. (1992) suggest conflicting values of relative attributes, task complexity, and uncertainty as probable causes of the inconsistent preferences found in their study. It is clear from these studies that the neoclassical conceptualization of the rational economic actor is not descriptively accurate.

Given the limited ability of neoclassical economic theory to accurately describe individual economic actions under conditions of risk or uncertainty, some economists turned to psychology and other related fields for answers. These economists eventually developed the discipline of behavioral economics. One of the forerunners of behavioral economics was Herbert Simon. In 1955, Simon developed an alternative information-processing model to the rational information-processing model that is more reflective of reality. Simon's information-processing model is known as bounded rationality. It is a limited capacity information-processing model. As such, the model assumes that individual capacity to process information is limited or bounded in some way and therefore, individuals must simplify information processing in order to achieve optimal outcomes (Lord and Maher 1990). Specifically, bounded rationality proposes that how we ultimately choose among decision options depends on the context and complexity of a decision task; time pressure; and our innate ability to process (Simon 1955; Simon 1956). These proposed bounds are inextricably linked to one another. Simon later described the internal bounds ("computational capabilities of the actor") and external bounds ("structure of the task environment") as the two blades of a pair of scissors that must fit together in order for rationality to cut (Simon 1990, p. 7).

Over the years, there have been various conceptualizations of bounded rationality related to internal and external bounds. These conceptualizations include: heuristics and biases, fast and frugal heuristics, and the adaptive toolbox. The heuristics and biases conceptualization embraces the notion of the rational actor and views behavior deviating from the rational as a function of our limited cognitive system. Systematic departures from rational behavior are seen as evidence of irrationality and cognitive illusions (biases and fallacies) that need to be corrected. Although, correcting "irrational" or "biased" decision

strategies may lead to more rational decisions, it may also discourage decision strategies that are well adapted to environmental bounds (Rieskamp, Hertwig, and Todd 2006; Todd and Gigerenzer 2003). Thus, the heuristics and biases conceptualization focuses mainly on internal bounds while disregarding external bounds. The fast and frugal heuristics conceptualization is less prescriptive and more descriptive than the heuristics and biases conceptualization. Under the fast and frugal heuristics conceptualization, decision strategies are seen as cognitive mechanisms specifically adapted to perform well in certain environments (optimization under constraints) regardless of whether or not they follow norms of rationality (Rieskamp, Hertwig, and Todd 2006; Todd and Gigerenzer 2003). Again, the fast and frugal heuristics conceptualization focuses solely on external bounds while disregarding internal bounds.

A relatively new conceptualization of bounded rationality that accounts for both external and internal bounds is the adaptive toolbox. The adaptive toolbox is a framework for bounded rationality that eschews optimization and irrationality. It is based on three premises: psychological plausibility, domain specificity, and ecological rationality. Thus, the adaptive toolbox seeks to understand actual human behavior rather than an idealized view of human behavior. This is done using a collection of specialized, domain-specific heuristics, the success of which lies in their degree of adaptation to the structure of physical and social environments (Gigerenzer 2002; Todd and Gigerenzer 2003). Proponents of the adaptive toolbox see previous conceptualizations of bounded rationality as flawed. For instance, the fast and frugal heuristics conceptualization is sometimes viewed as optimization under constraints. However, optimization necessarily implies “unbounded rationality” and to equate bounded rationality with unbounded rationality is a misnomer (Gigerenzer 2002; Gigerenzer

and Selten 2002; Todd and Gigerenzer 2003). Likewise, the heuristics and biases conceptualization is flawed for using current norms of rationality rather than rethinking norms in terms of actual behavior and the structure of environments (Gigerenzer and Selten 2002). The adaptive toolbox attempts to redirect errant research directions and re-conceptualize bounded rationality in a more descriptively accurate manner.

The adaptive toolbox framework is essentially a collection of heuristics. These heuristics are "building blocks" with three functions: they provide search rules, stop rules, and decision rules (Gigerenzer 2002). The building blocks aid individuals at each step of the decision process. During the search, search rules aid in two types of searching: the search for alternatives (satisficing) and the search for cues (fast and frugal heuristics) (Gigerenzer 2002). Since the search is bounded, decision-makers must simplify the choices available to them and choose whichever option is most satisfactory. This is known as "satisficing" (Simon 1955; Simon 1956). Satisficing is essentially the process of narrowing down the choice set and then choosing the best option. The search for cues is slightly different in that it is a search for tools to evaluate the alternatives within a choice set. Stopping rules terminate both search types and a final decision is made based on simple decision rules (Gigerenzer 2002). Studying the heuristics within the adaptive toolbox can help researchers gain a better understanding of the cognitive mechanisms underlying decision strategies and ultimately aid economists in more accurately describing and predicting individual behavior.

Economists often study hypothetical situations for which it would be advantageous to be able to predict the behavior of individual economic actors. For instance, non-market valuation studies aim to place a value on a good or service for which there is no established market (Field 2008; Ward 2006). Decisions based on non-market valuation studies could

potentially result in policy changes. Thus, it is critically important to be able to predict behavior from such studies. Yet, the methods used to conduct non-market valuation studies may skew our ability to predict behavior by cuing a particular response.

One common non-market valuation metric, WTP, is typically assessed via survey. Survey research methodologists have established that the manner in which questions are asked affects how they are answered. While it is commonly understood that the wording (verbal language/message content) of questions can affect responses, more recent findings in survey methodology have shown that non-verbal communication within surveys can affect responses as well (Dillman and Christian 2002; Redline and Dillman 2002; Smith 1993). There are three forms of non-verbal communication that can influence survey responses. These non-verbal forms of communication include symbolic language (the use of symbols that hold shared cultural meaning), numeric language (the use of numbers), and graphical language (the use of various design features such as font size, brightness, color, and spacing). Smith (1993) and Dillman and Christian (2002) clearly illustrate how graphical language, like directional cues and arrangement of scales, can affect survey response. However, there is a paucity of research in the field of survey methodology that examines the effects of varying numerical language on survey responses.

Economic studies of preference reversals yield evidence that varying numerical language can affect survey responses. Johnson, Payne, and Bettman (1988) found that displaying gambles in a simpler numerical format (decimals as opposed to hard fractions) reduced the number of preference reversals. The values in each of the gambles were equivalent but presented in different numerical language formats. Similarly, presenting or framing attribute information with different number sizes (large or small) can lead to

preference reversals. Smaller numbers seem to increase the perceived difference between attributes (Wong and Kwong 2005). Expanding the scale of an attribute can also lead to preference reversals: people perceive attributes differently on a 5-point scale than they would on a 100-point scale (Burson, Larrick, and Lynch 2009). Thus, the differential presentation of equivalent numerical language can lead to preference reversals. Yet, it is unclear what the underlying cognitive mechanism is behind these preference reversals. I speculate that both internal and external bounds associated with numerical choices may cause individuals to resort to different heuristics that lead to different decisions and thereby, preference reversals.

Varying the numerical presentation of a WTP survey question may trigger different search, stop, and/or decision rules that lead to different responses. For instance, numeracy may affect search rules. Numeracy is the ability to process basic probability and numerical concepts (Peters et al. 2006). Decision-making studies suggest that high-numeracy adults are more likely than low-numeracy adults to retrieve and use appropriate numerical principles to transform numbers presented in one frame to a different frame (modify the choice set). In other words, high numeracy adults have a greater ability to discern identical information presented in various forms as compared to low-numeracy adults (Peters et al. 2006). Low-numeracy adults may resort to satisficing strategies to compare numerical information due to their limited ability and the amount of effort required by the choice. Thus, numerical format manipulations that change the mental effort required by a decision task may result in strategy shifts (Johnson and Payne 1985). One strategy to avoid transforming numerical data is the numerosity heuristic. The numerosity heuristic simply equates numerosity with quantity. However, numerosity and quantity are different things. Numerosity is the number of units into which a stimulus is divided and is not necessarily indicative of quantity, or the total

amount of a stimulus. Consequently, individuals using the numerosity heuristic, tend to over infer quantity (Pelham, Sumarta, and Myaskovsky 1994, p. 104). Based on the numerosity heuristic, an individual comparing two large pizzas of equivalent size – one cut into 16 slices and the other cut into eight slices – would view the two pizzas as different sizes. The pizza cut into 16 slices would likely be viewed as larger than the pizza cut into eight slices, despite their size equivalence.

The numerosity heuristic seems to explain why preferences and valuation change with expanded attribute scales in studies of preference reversals. Based on the numerosity heuristic, people perceive expanded attribute scales as larger in quantity. Taking numeracy into account, this may limit the search for alternatives and provide a cue for choosing amongst the presented alternatives (satisficing). In terms of a fee increase on a WTP survey, this may mean choosing what is perceived as the least costly option based on the information presented. As such, expanding the attribute scale of a WTP question may lead to differential response among equivalent alternatives. For instance, WTP may differ with the presentation of a fee increase as a nominal dollar increase from the original fee as opposed to a percentage increase from the original fee

3.2 Methods

3.2.1 Data collection

To answer my research question "Does visitor WTP vary significantly with the numerical presentation of a fee increase (dollar value vs. percentage)?", the questionnaire elicited visitor WTP for increased tour fees. This elicitation was achieved using dichotomous choice contingent valuation as described in **Chapter 2**.

To determine whether the numerical presentation of a price increase affects visitor WTP, the numerical presentation of the $3 price increase was modified on one version of the questionnaire. Rather than being presented as a nominal fee increase of $3 per fee type, the fee increase was presented as a percentage increase from the current fee. All other parts of the question were held constant including formatting and wording. See **Figure 3.1** and **Figure 3.2** for the differential presentation of the $3 fee increase.

3.2.2 Data Analysis

Responses to the WTP question were evaluated using IBM SPSS Statistics Version 22. For each fee type, a two-way contingency table was generated comparing WTP response for each version of the questionnaire. Due to the categorical nature of the data, chi-square analysis and Fisher's exact test (for a 2x2 table) were performed to determine whether a relationship exists between WTP responses and the version of the questionnaire received. Each fee type was examined separately. Infant fees were excluded because they did not change.

While chi-square analysis and Fisher's exact test determine whether relationships exist between categorical variables, these tests do not indicate the strength or nature of those relationships. I conducted further analysis to determine the nature of the relationship between WTP responses and the version of the questionnaire received. I first calculated phi to determine the strength and direction of the association between WTP and questionnaire version. Going one step further, I generated contingency tables comparing WTP for each fee type with questionnaire version. I then ran a z-test comparing the column proportions to determine the nature of the indicated relationship between WTP increased tour fees and questionnaire version. I looked specifically for where there was a significant difference in

WTP based on the numerical presentation (nominal vs. percentage) of a fee increase on two versions of the questionnaire.

3.3 Results

Chi-square analysis for the various fee types suggests a relationship between WTP and the different versions of the questionnaire based on Pearson chi-square and Fisher's exact test. Values for Pearson chi-square and Fisher's exact test are significant (asymp. sig. < 0.05) for senior and child fee types (**Table 3.1**). For instance, we can conclude that the Pearson chi-square for senior tour fees (value = 9.269, p-value = 0.002) indicates a significant relationship between WTP and questionnaire version for that fee type because the asymptotic significance is less than 0.05 (**Table 3.1**). Likewise, the Fisher's exact test for senior tour fees (p-value = 0.003) also indicates a significant relationship (**Table 3.1**) Although Pearson chi-square does not work well for small sample sizes, none of the expected cell counts were below five, which is the minimum level necessary for Pearson chi-square to work well. Thus, Pearson chi-square can be trusted to the same degree as Fisher's exact test in this study.

While chi-square analysis does not indicate the strength of the relationship between WTP and version, the values for phi indicate both the strength and direction of the relationship between WTP and version. The phi values (adult = -.144, junior = -.187, senior/access pass = -.411, and child = -.370) indicate a weak negative relationship that is not significant (p-values: adult = 0.100, junior = 0.057) between the two variables for adult and junior tour fees and a moderate negative relationship that is significant (senior/access pass = 0.002, child = 0.001) between the two variables for senior and child tour fees (**Table 3.2**). To determine the nature of the relationship indicated by phi, a z-test of column proportions was

run on the contingency tables. The results of the z-test appear in the combined contingency tables as subscripts (**Table 3.3**). Columns with different subscripts differ significantly. For example, the subscript "a" for WTP senior tour fees at the $3 fee increase is different from subscript "b" for WTP senior tour fees at the $3 fee increase presented as a percentage increase, indicating that those two versions of the questionnaire differ significantly in terms of WTP increased tour fees for the senior tour fee type (**Table 3.3**). For the adult and junior fee types, WTP did not differ significantly based on the numerical presentation of a $3 fee increase. For the senior/access pass holder and child fee types, WTP differed significantly based on the numerical presentation of a $3 fee increase.

3.4 Summary

The results indicate a relationship between WTP and questionnaire version. Although chi-square analysis was inconclusive in regard to the strength and nature of this relationship, phi indicates no significant relationship for adult and child tour fees and a significant negative relationship of moderate strength for senior and child tour fees. Further tests confirm a significant difference between the $3 fee increase and the $3 fee increase presented as a percentage increase for senior and child fee types.

For the numerical presentation of a fee increase, the finding that there was only a statistical difference in senior and child tickets only partially supports my hypothesis that WTP will vary significantly with the numerical presentation of a fee increase. Looking closely at the $3 fee increase presented as a percentage increase, you can see that the percentage increase from the current fee is highest for the senior/access pass holder and child fee types (86% and 100%, respectively). This may have had an effect on WTP responses. Individuals faced with choosing an option based on the percentage increase may struggle

with the decision task due to its complexity and structure. These bounds may lead individuals to resort to simple heuristics in order to make a decision rather than putting the time or effort into transforming the data into a form that is easier to understand. Since percentage is a different and more inferential scale than dollars, a higher percentage may seem to imply a much higher fee increase than what is actually being indicated. Individuals resorting to a satisficing strategy like the numerosity heuristic might infer a higher quantity from the numerosity of the expanded attribute scale of the percentage increase. This would result in an inverse relationship between WTP and percentage fee increase regardless of the fee increase being a fixed dollar amount for each fee type.

Like the numerosity heuristic, the collection of heuristics in the adaptive toolbox is adept at describing and predicting behavior of individual economic actors. We cannot rely on rational information-processing models to predict behavior accurately because they are built on assumptions that are not descriptive of reality, like unlimited cognitive resources. As a limited capacity information-processing model, bounded rationality is a more accurate model of reality that takes into account our internal and external limitations. While some of the conceptualizations of bounded rationality are flawed in their descriptions of behavior, the adaptive toolbox seeks to correct for these flaws and describe human behavior as it is. The heuristics within the adaptive toolbox are the cognitive mechanisms underlying human decisions. They act as building blocks guiding individuals through each step of the decision process from search to stop to decision. Understanding how and when these heuristics guide the decision process is key to predicting actual behavior and making informed policy decisions.

Policy decisions based on skewed survey responses are not necessarily the best policy decisions. When conducting survey research that could potentially influence policy decisions, it is important to represent information in a manner that is easy for individuals to understand and process. Due to the bounds placed on our rationality from our innate cognitive ability and the structure of the environment in which we make decisions, individuals tend not to transform presented data into forms that are easier to understand. Instead, individuals resort to alternative strategies to make decisions. The numerical presentation of a fee increase is just one of many triggers that may lead people to resort to alternative decision strategies and thereby alter survey responses. Thus, keeping survey items simple and as contextually relevant as possible is advisable in order to garner responses that accurately reflect reality and can be used to predict behavior.

3.5 References

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3.6 Tables

Table 3.1. Tests of Independence Between WTP and Version for Each Type of Tour Fee.

	Adult		Junior		Senior/Access Pass		Child	
	Value	Asymp. Sig. (2-sided)	Value	Asymp. Sig. (2-sided)	Value	Asymp. Sig. (2-sided)	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.713[a,b]	.100	3.619[a,c]	.057	9.269[a,d]	.002	10.277[a,e]	.001
Fisher's Exact Test		.110		.075		.003		.002
N of Valid Cases	130		104		55		75	

a. 0 cells (0.0%) have expected count less than 5.
b. The minimum expected count is 25.60.
c. The minimum expected count is 21.20.
d. The minimum expected count is 10.45.
e. The minimum expected count is 14.80.

Table 3.2. Strength of Relationship Between WTP and Version for Each Fee Type

	Adult		Junior		Senior/Access Pass		Child	
	Value	Approx. Sig.	Value	Approx. Sig.	Value	Approx. Sig.	Value	Approx. Sig.
Phi	-.144	.100	-.187	.057	-.411	.002	-.370	.001
N of Valid Cases	130		104		55		75	

Table 3.3. Contingency Table Comparing WTP Increased Tour Fees and Questionnaire Version

				VERSION		
				$3 fee increase	$3 fee increase as percentage	Total
WTP Increased Tour Fees	Adult	Yes	Count	43_a	35_a	78
			Expected Count	38.4	39.6	
		No	Count	21_a	31_a	52
			Expected Count	25.6	26.4	
	Junior	Yes	Count	36_a	23_a	59
			Expected Count	31.2	27.8	
		No	Count	19_a	26_a	45
			Expected Count	23.8	21.2	
	Senior/Access Pass	Yes	Count	16_a	7_b	23
			Expected Count	10.5	12.5	
		No	Count	9_a	23_b	32
			Expected Count	14.5	17.5	
	Child	Yes	Count	22_a	8_b	30
			Expected Count	15.2	14.8	
		No	Count	16_a	29_b	45
			Expected Count	22.8	22.2	

Each subscript letter denotes a subset of VERSION categories whose column proportions do not differ significantly from each other at the .05 level.

3.7 Figures

Park managers are considering a $3 fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay $3 more per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?	
Fee type	Current fee	Proposed fee	Yes, likely	No, unlikely
Adult (age 16 and older)	$7.00	$10.00	O	O
Junior (age 6-15)	$5.00	$8.00	O	O
Senior/Access pass holder	$3.50	$6.50	O	O
Child (age 3-5)	$3.00	$6.00	O	O
Infant (age 0-2)	Free	Free	O	O

Figure 3.1. The dichotomous choice WTP question presented as a nominal $3 fee increase per fee type.

Park managers are considering a percentage fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay the percentage increase per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?	
Fee type	Current fee	Percentage increase	Yes, likely	No, unlikely
Adult (age 16 and older)	$7.00	43%	O	O
Junior (age 6-15)	$5.00	60%	O	O
Senior/Access pass holder	$3.50	86%	O	O
Child (age 3-5)	$3.00	100%	O	O
Infant (age 0-2)	Free	0%	O	O

Figure 3.2. The dichotomous choice WTP question presented as a percentage increase from the current fee equivalent to a $3 increase per fee type.

Chapter 4: Lessons Learned

Achieving a balance between ecological, economic, and equity outcomes is not an easy task, especially when there are constraints placed on the task. The ecological capacity limit at TICA placed constraints on both economic and equity outcomes. My exploration of WTP at TICA suggests that the potential exists to balance at least ecological and economic outcomes. Although WTP decreased significantly with a proposed fee increase, demand for cave tours is inelastic. Under conditions of excess and inelastic demand, a fee increase would likely result in a revenue increase. However, this could not be determined based on the data collected. It may be advantageous to keep any fee increase small in order to mitigate anchoring bias and have the best chance of increasing revenue. Visitor satisfaction seems to play a significant role in visitor WTP. Augmenting experiential services associated with the tour could increase visitor satisfaction and WTP. While these results suggest that the potential exists to balance ecological and economic outcomes, the results do not take into account equity implications of any actions taken. Any fee change is likely to have equity implications that would be important to TICA managers.

4.1 Limitations

There are limitations inherent in any WTP study. For this study in particular, TICA visitors were asked how much they would be willing to pay for an additional unit of a good provided on a subsequent visit or visits. In other words, the study elicited marginal WTP from TICA visitors. According to the law of demand, marginal WTP decreases as quantity increases. Customers are willing to pay less for each additional unit of a good because they derive less and less satisfaction (utility) from each additional unit (Field, 2008; Ward, 2006).

Essentially, the novelty of an item or service wears off as an individual gets more and more of it. As a result, the WTP elicited underestimates the value of the good in question.

Further issues stem from the validity of WTP methods. The hypothetical nature of WTP studies does not always provide respondents with a true sense of how much they would actually pay were they forced to do so. Whether or not respondents have the incentive to report this true WTP is also questionable. It may be the case that respondents purposely provide a value higher than their true WTP if they are in support of a policy action and a value lower than their true WTP if they are opposed to a policy action (Loomis & Walsh, 1997). In addition, available reference prices, such as established tour fees, may bias visitor WTP estimates (Bateman et al., 2002). Having just taken a cave tour for a given price, visitors will likely not provide WTP estimates that differ significantly from current tour fees.

Due to the time and budget allotted to this study, there is one further limitation. That limitation is not being able to use a choice modeling technique such as a choice experiment. Choice modeling techniques can help value attributes of a good such as length or type of tour. Knowledge of how attributes of the cave tour affect visitor WTP could be extremely helpful for park managers. Choice modeling techniques also tend to eliminate the over-/underestimate issues associated with WTP studies (Bateman et al., 2002). Despite the rigorous nature of choice experiments, it was beyond the scope of this study to develop and administer a choice experiment.

4.2 Recommendations

The results of this study have implications for public agencies regarding ticketing and fees. In the current age of economic uncertainty, the threat of budget cuts drives park management to rely increasingly on visitor use fees to fund park operations. Yet, the dual

mission of the NPS tends to pit visitor use against resource protection. In cases where resource protection wins, fee revenue may decrease such that maintenance and the provision of the visitor experience suffer.

Although TICA was designated for its unique ecosystem, it is in much the same situation as many other public sites in terms of having fee revenue inadvertently reduced due to actions taken to protect its unique natural resources. While it is possible for a fee increase to make up for lost revenue at TICA, this may not be the case elsewhere. Certain factors make TICA a candidate for a fee increase. First, there are no real substitutes for the experience visitors receive at TICA. While visitors can hike many places in the Uinta National Forest and surrounding areas, they cannot visit another nearby cave because they don't exist. Shopping and going to the local water park are fun, but do not provide the same distinctive experience as walking in a cool, damp cave viewing stalactites, stalagmites, helicites, and the other cave formations. The absence of comparable substitutes for the TICA experience suggests that demand for tour tickets should be inelastic and inelastic demand generally leads to a revenue increase with a fee increase. Elasticity of demand calculations confirm that demand for tour tickets is in fact, inelastic. Unfortunately, information collected was not sufficient to determine revenue changes stemming from a price increase, but the general trend was that WTP decreased with each successive level of fee increase. This is likely due to strong anchoring bias and the nature of WTP studies. In situations where there is an established fee for a good or service, it would be wise to keep any fee increase small and proportional to the established fee. Raising a relatively small fee ($7) by increments of $2-3 was likely too much unless associated with a certain characteristic of a good or service.

Although WTP decreased at each successive level of hypothetical fee increase,

visitors still preferred the ticketing alternative with the highest non-refundable transaction fee per ticket ($3 vs. $0.50 per ticket). While some respondents expressed to me that a $3 transaction fee was wildly outrageous for an online service that supposedly requires little work to maintain, most respondents still chose it as their preferred ticketing option. This suggests that the transaction fee was fundamentally different than the hypothetical fee increase. Visitors likely chose to pay the fee because they were choosing to pay for the convenience – both in terms of time saved and ease of execution – associated with the reservation system. Internet reservation systems also provide visitors with the assurance of being able to secure a ticket for a particular date and time. Since the Internet is so widely available now, we tend to turn to it as a primary resource. This has clear implications for park management. Parks with antiquated and inefficient ticketing systems may consider transitioning to a ticketing system that includes an advance online reservation system. I recommend an online reservation system as part of a larger ticketing scheme because online reservation systems cater just to visitors who plan ahead. To be more equitable, it is best to offer multiple ticketing options that cater to multiple types of visitors.

Outside of convenience, the demand factors at TICA may or may not mirror those at other sites. There is not much racial or ethnic variation in the TICA visitor population and visits are infrequent (once a year or less). In general, there is not enough variation in the population to see a difference in WTP among certain groups. However, the demand of the population as a whole is influenced to some degree by visitor satisfaction, specifically satisfaction with the ranger leading the cave tour. For sites whose main attraction is some type of interpretation, it is important that rangers are both knowledgeable and personable. Having worked in an interpretation capacity before, the best way to achieve this goal is to

hire the right people and to rotate interpretation personnel through different tasks so that they do not get bored and lose energy and enthusiasm.

In the event of a fee increase, visitor expectations may change. Visitors may have higher expectations for the services provided. For instance, utility theory suggests that visitors derive less and less utility from subsequent amounts of a good or service. Utility and WTP are negatively correlated: as one decreases, so does the other. Services, for which a site is well known, like cave tours, may need to be augmented in order for visitors to be willing to pay increased fees associated with those services. In this study, visitors expressed agreement to pay increased tour fees most frequently for ecological preservation. Ticketing received the second most frequent agreement, with facilities and tour/visitor experience receiving about equal and lesser agreement, and parking receiving the lowest agreement. Visitors having seen the cave are WTP to preserve it. Direct experience with and information about the cave may foster some sort of environmental consciousness or place attachment in visitors that increases the likelihood of agreement to pay increased tour fees to protect it. Visitors are also more likely to agree to pay increased tour fees for services that they already associate with fees. Tours generally require some sort of fee and payment for ecological preservation is becoming increasingly common. However, fees for facilities services, ticketing systems, ad parking, especially on public lands, are less common. While ticketing, facilities services, and parking may be in need of funding, it may be best to direct at least a portion of fees to services that the public has experience with. Stating the percentage of tour fees that are directed toward particular services or the particular projects funded by fees may help garner support for and agreement to pay increased tour fees.

Additionally, this study has implications for conducting surveys. Surveys are a common method of data collection for many agencies because they are relatively inexpensive and require less time and personnel than other data collection methods. However, if survey data is not reflective of reality, it is not worth the time and effort to conduct a survey. As such, it is critical to structure and present surveys in a manner that they are easy to understand and respond to. While survey methodologists suggest consistency in verbal, graphical, and symbolic language, my findings suggest that consistency in numerical language is also important. We have limited cognitive resources and in order to conserve those resources, we use contextual clues and heuristics to simplify our decisions. The numerosity heuristic is one decision-making tool that we tend to fall back on when presented with numerical scales that are cumbersome to translate into more understandable terms. Consequently, we mistakenly infer greater quantity from greater numerosity leading to differential response. Therefore, numerical scales should be presented in a manner that does not require translation from one form to another. If a scale is referencing something valued in dollars, the scale should be in dollars. First-time survey designers may be ambitious in their expectations and design. However, it is not advantageous to create an overly complicated survey, especially if it garners differential response. It is best to stick to established methods while keeping questions and response scales simple and consistent.

4.3 References

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Loomis, J. B. & Walsh, R. G. (1997). *Recreation economic decisions: Comparing benefits and costs* (2nd ed.). State College, PA: Venture Publishing.

Ward, F. A. (2006). *Environmental and natural resource economics*. Upper Saddle River, NJ: Pearson Education.

Appendix A

Integrated Survey Instrument

U.S. Department of the Interior
National Park Service

Social Science Program

Visitor Services Project

Timpanogos Cave National Monument

Visitor Study

OMB Control Number: 1024-0224
Current Expiration Date: 8-31-2014

United States Department of the Interior

NATIONAL PARK SERVICE
Timpanogos Cave National Monument
R.R. 3 Box 200
American Fork, Utah 84003

July 2013

Dear Visitor,

Thank you for participating in this important study. We want to learn about the expectations, opinions, and interests of visitors regarding Timpanogos Cave National Monument. This information will help us improve our management of this site and better serve you, the visitor.

This questionnaire will be given to a select number of people, so your participation is highly appreciated. It should only take about 10 minutes to complete. Your responses are anonymous.

Please complete this questionnaire and return it to the survey technician or place it in the drop box located at the survey tent.

If you have any questions, please contact Jennifer Chaffin, Graduate Student, University of Idaho College of Natural Resources, Department of Conservation Social Sciences, 875 Perimeter Drive MS 1139, Moscow, Idaho 83844-1139, phone: 208-885-7911, email: chaf8019@vandals.uidaho.edu.

We appreciate your help and are looking forward to hearing your opinions.

Sincerely,

Jim Ireland
Superintendent

DIRECTIONS

1. Please have the selected individual (at least 18 years old) complete this questionnaire.
2. Read the questions carefully since each question is different.
3. For questions that use circles (O), please mark your answer by filling in the circle with ***black or blue ink***. Please do not use pencil.

   Like this: ● Not like this: ✔ ✘ ∅ ⊙

4. Return your completed questionnaire to the survey technician or place in the drop box located at the survey tent.

Paperwork Reduction Act Statement: The National Park Service is authorized by 16 U.S.C. 1a-7 to collect this information. This information will be used to evaluate visitor experiences at Timpanogos Cave National Monument. Your response to this request is voluntary. Please do not put your name or contact information on the questionnaire. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement: We estimate that it will take 10 minutes to complete this questionnaire. You may direct any comments regarding the burden estimate or any other aspect of this questionnaire to Lena Le, NPS Visitor Services Project Director, Park Studies Unit, College of Natural Resources, University of Idaho, 875 Perimeter Drive MS 1139, Moscow, ID, 83844-1139; lenale@uidaho.edu (email).

1. a) **Prior to your visit today**, how familiar were you with cave systems? Please fill in **only one circle**.

Not at all familiar	Slightly familiar	Moderately familiar	Very familiar	Extremely familiar
O	O	O	O	O

b) **After your visit today**, which of the following statements best describes your knowledge of cave systems? Please fill in **only one circle**.

- O I **did not learn anything new** about cave systems during my visit today.
- O I learned **one new fact** about cave systems during my visit today.
- O I learned **several new facts** about cave systems during my visit today.

2. What is your primary reason for visiting Timpanogos Cave National Monument today?

_____

3. Prior to your visit today, how did you find out about Timpanogos Cave National Monument? Please fill in **all circles that apply**.

- O Friends/family
- O School program
- O Previous visits
- O Television show
- O Social media web site (such as Facebook, Twitter, etc.)
- O Timpanogos Cave National Monument web site (www.nps.gov/tica)
- O Other (Please specify) _____

4. How did this visit to Timpanogos Cave National Monument (TICA) fit into your travel plans? Please fill in **only one circle**.

- O TICA was the primary destination
- O TICA was one of several destinations
- O TICA was not a planned destination

5. a) On this trip, if you had not chosen to visit Timpanogos Cave National Monument, what other recreation site would you have visited instead?

   O None or Name of site _____

   b) If you answered "None" above, in what activity would you have participated instead?

   O None or Activity _____

6. Please indicate your level of agreement with each of the following statements concerning your willingness to pay more for a cave tour ticket, depending on how the increase would be used. Please fill in **only one circle for each statement**.

I would be willing to pay more for a tour ticket *if the increase were put toward*…	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
…a system to reserve tickets by phone	O	O	O	O	O
…a system to reserve tickets via the Internet	O	O	O	O	O
…a system to procure a last-minute ticket, on-site	O	O	O	O	O
…additional features/exhibits of the cave tour program	O	O	O	O	O
…additional tour times after 4:30 pm	O	O	O	O	O
…better directional signage	O	O	O	O	O
…building improvements	O	O	O	O	O
…decreased wait time to obtain tour tickets	O	O	O	O	O
…ecological restoration of bat habitat within the cave	O	O	O	O	O
…increased grounds maintenance	O	O	O	O	O
…increased availability of emergency services	O	O	O	O	O

I would be willing to pay more for a tour ticket *if the increase were put toward*…	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
…law enforcement presence	O	O	O	O	O
…limiting traffic and parking congestion	O	O	O	O	O
…parking lot improvements	O	O	O	O	O
…preservation of cave ecosystems	O	O	O	O	O
…preservation of natural cave features	O	O	O	O	O
…providing a longer tour	O	O	O	O	O
…providing age-specific tours	O	O	O	O	O
…providing child-free tours	O	O	O	O	O
…restroom improvements	O	O	O	O	O
…safety barriers/ improvements along the trail to the cave	O	O	O	O	O
…smaller tour group size so I can see and hear better	O	O	O	O	O
…special topic tours	O	O	O	O	O

7. Overall, how satisfied were you with the ranger who led your cave tour today at Timpanogos Cave National Monument? Please fill in **only one circle**.

Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied
O	O	O	O	O

8. Which cave tour did you attend on your visit today?

a) Date of tour _____ b) Time of tour _____

9. For you visit today, which type(s) of cave tour ticket(s) were purchased for you and your personal group, and how many of each type? (Your personal group is anyone with whom you are visiting the park, and does not include a larger group you might be travelling with, such as a guided tour, church, school, scouts group, etc.) Please fill in **all circles that apply** and write the number of tickets purchased on the line provided.

Fee Type		**Amount**	**Number of tickets obtained**
O	Adult (age 16 and older)	$7.00	_____
O	Junior (age 6-15)	$5.00	_____
O	Senior and Access Pass holder	$3.50	_____
O	Child (age 3-5)	$3.00	_____
O	Infant (age 0-2)	Free	_____

10. For each type of cave tour fee **that you paid** on this visit, how would you rate the tour's value for the fee paid? Please fill in **only one circle for each fee type**. If you did not pay any cave tour fee, please go to Question 12.

		Value for fee paid					
Fee type	**Amount**	Very poor	Poor	Average	Good	Very good	n/a
Adult (age 16 and older)	$7.00	O	O	O	O	O	O
Junior (age 6-15)	$5.00	O	O	O	O	O	O
Senior/Access pass holder	$3.50	O	O	O	O	O	O
Child (age 3-5)	$3.00	O	O	O	O	O	O
Infant (age 0-2)	Free	O	O	O	O	O	O

11. For each type of cave tour fee **that you paid** on this visit, in your opinion, how appropriate is the fee amount? Please fill in **only one circle for each fee type**. If you did not pay any cave tour fee, please go to Question 12.

		Appropriateness of fee			
Fee type		Too low	About right	Too high	n/a
Adult (age 16 and older)	$7.00	O	O	O	O
Junior (age 6-15)	$5.00	O	O	O	O
Senior/Access pass holder	$3.50	O	O	O	O
Child (age 3-5)	$3.00	O	O	O	O
Infant (age 0-2)	Free	O	O	O	O

12. a) If special topic cave tours were offered, which topic(s) would interest you? Please fill in **all circles that apply**.

O None ➔ **Please go to Question 13**

O Cave ecology

O History

O Photography

O Other _____

b) If you were interested in any of the special topic tours above, would you be willing to pay a higher fee for that tour than for the general tour?

O Yes O No

c) What is the maximum dollar amount you would be willing to pay for a special topic tour of interest to you?

$_____

13. Park managers are considering a $3 fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay $3 more per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?	
Fee type	Current fee	Proposed fee	Yes, likely	No, unlikely
Adult (age 16 and older)	$7.00	$10.00	O	O
Junior (age 6-15)	$5.00	$8.00	O	O
Senior/Access pass holder	$3.50	$6.50	O	O
Child (age 3-5)	$3.00	$6.00	O	O
Infant (age 0-2)	Free	Free	O	O

14. In order to reach Timpanogos Cave National Monument, you had to pay a fee to enter the Uinta National Forest. Please indicate the degree to which your willingness to pay the proposed fee increase (Question 13 above) was affected by having to pay the Uinta National Forest entrance fee. Please fill in **only one circle**.

Not at all affected	Slightly affected	Moderately affected	Very affected	Extremely affected
O	O	O	O	O

15. a) Of the following cave tour ticketing options, please indicate the option you would most prefer. Please fill in **only one circle**.

- O (1) Tickets available for purchase **on-site**, on a **first-come-first-serve** basis only.
- O (2) Tickets available for advance reservation through a **phone reservation system** only (which would include a non-refundable transaction fee of $0.50 per ticket).
- O (3) Tickets available for advance reservation through an **online reservation system** only (which would include a non-refundable transaction fee of $3 per ticket).
- O (4) A combination of options (1) and (2).
- O (5) A combination of options (1) and (3).

b) Which of the following best describes the reason(s) you selected your most preferred option above? Please fill in **all circles that apply**.

- O Price
- O Convenience
- O Assurance of securing a ticket in general (no particular day or time)
- O Assurance of obtaining a ticket for a particular tour day and time
- O Fairness of method for obtaining a ticket
- O Other (Please specify) _____

16. Regarding obtaining cave tour tickets, which of the following statements best describes your situation on **this visit**? Please fill in **only one circle**.

- O As long as I can secure tickets for my entire group to go on the same tour, tour times and crowding are not a problem.
- O As long as I can secure tickets for my entire group, I am willing for my group to be separated into different tours.
- O Being able to secure a ticket for a specific day and time is most important to me.
- O I am willing to wait for a tour (provided at a later date or time) in order to have a quality experience (e.g., less crowded, more intimate, better conveyance of information from ranger).

17. How often do you visit Timpanogos Cave National Monument? Please fill in **only one circle**.

O This is my first visit
O Once a year or less often
O Several times a year
O Once a month
O Several times a month

18. On this visit, what kind of personal group were you with? (Your personal group is anyone with whom you are visiting the park, and does not include a larger group you might be travelling with, such as a guided tour, church, school, scouts group, etc.) Please fill in **only one circle**.

O Alone
O Family
O Other (Please specify) _____
O Friends
O Family and friends

19. On this visit, how many people were in your personal group, including yourself?

_____ Number of people in personal group

20. a) On this visit, were you with an organized group (such as tour, school, church, scouts, etc.)?

O Yes O No

b) If you answered "Yes" above, what type of organized group were you with?

_____

21. a) What is your zip code? _____

b) If you are not from the U.S., what country are you from? _____

22. What is your age (in years)? _____

23. What is your gender?

O Male O Female

24. Which of these categories best indicates your race? Answer only for yourself. Please fill in **all circles that apply**.

O	American Indian or Alaska Native	O	Native Hawaiian or other Pacific Islander
O	Asian	O	White
O	Black or African American	O	Other

25. Are you Hispanic or Latino? Answer only for yourself.

O Yes O No

26. Which category best represents your annual household income? Please fill in **only one circle**.

O	$24,999 or less	O	$100,000 to $149,999
O	$25,000 to $34,999	O	$150,000 to $199,999
O	$35,000 to $49,999	O	$200,000 or more
O	$50,000 to $74,999	O	Do not wish to answer
O	$75,000 to $99,999		

You have reached the end of this questionnaire. Please return it to the survey technician or place it in the drop box located under the survey tent.

Thank you for taking the time to complete this questionnaire. Your responses are highly appreciated and will help us better serve you and other visitors in the future.

Appendix B

Survey Statistics

Survey Statistics

Over 7 days of sampling, 475 people were contacted to complete a survey. Of these, 348 agreed to complete the survey for a response rate of 73.26%. However, only 318 surveys were returned with only 282 usable for data analysis. This resulted in an effective response rate of 59.37%. Over the seven days of sampling, approximately 68 people per day were contacted at an attempted interval of five. The actual interval was closer to six (6.31) given the amount of children in each group. Below is a table of contacts per survey day. Wednesday's contacts are so low because of a weekly staff meeting that eliminated two hours of cave tours.

Contacts Per Survey Day		
Date	**Contacts**	**% of total contacts**
Sunday - July 14, 2013	72	15.16
Monday - July 15, 2013	73	15.37
Tuesday - July 16, 2013	63	13.26
Wednesday - July 17, 2013	52	10.95
Thursday - July 18, 2013	68	14.32
Friday - July 19, 2013	76	16.00
Saturday - July 20, 2013	71	14.95

Other statistics recorded during sampling include travel plans, personal group type, personal group size, age, gender, race, ethnicity, and zip code. Most people came with family in groups ranging from one to 27 individuals. Average group size was approximately seven (6.54) individuals. The mean age of each contact was 40 (39.63) years with an age range of 18 to 82. Contacts were 48% male and 52% female. The majority of contacts were from nearby areas of Utah, but included people from all over the United States and 14 other countries.

Travel plans	**Frequency**	**% of total**
Primary destination	259	76.18
One of several destinations	75	22.06
Not a planned destination	6	1.76

Personal group type	**Frequency**	**% of total**
Alone	5	1.47
Family	267	78.30
Friends	29	8.50
Family and friends	40	11.73

Race	**Frequency**	**% of total**
American Indian or Alaska Native	2	0.42
Asian	18	3.80
Black or African American	0	0.00
Native Hawaiian or other Pacific Islander	3	0.63
White	451	95.15
Other	0	0.00

Ethnicity	Frequency	% of total
Hispanic	18	3.79
Not Hispanic	457	96.21

The following statistics are frequency tabulations of the responses for each of the questions on the survey instrument.

1. a) **Prior to your visit today**, how familiar were you with cave systems? Please fill in **only one circle**.

Response	Frequency	% of total
Not at all familiar	54	19.4
Slightly familiar	84	30.1
Moderately familiar	100	35.8
Very familiar	33	11.8
Extremely familiar	8	2.9

b) **After your visit today**, which of the following statements best describes your knowledge of cave systems? Please fill in **only one circle**.

Response	Frequency	% of total
I **did not learn anything new** about cave systems during my visit today	5	1.8
I learned **one new fact** about cave systems during my visit today	21	7.5
I learned **several new facts** about cave systems during my visit today	253	90.7

2. What is your primary reason for visiting Timpanogos Cave National Monument today?

Common responses included family, recreation/hiking, and to enjoy nature/cave

3. Prior to your visit today, how did you find out about Timpanogos Cave National Monument? Please fill in **all circles that apply**.

Response	Frequency
Friends/family	144
Previous visits	138
Social media web site (such as Facebook, Twitter, etc.)	6
Timpanogos Cave National Monument web site (www.nps.gov/tica)	55
School program	4
Television show	1
Other	28

Other responses included living in the area, driving by, tourism materials, and National Park Pass information

4. How did this visit to Timpanogos Cave National Monument (TICA) fit into your travel plans? Please fill in **only one circle**.

Response	Frequency	% of total
TICA was the primary destination	174	62.4
TICA was one of several destinations	92	33.0
TICA was not a planned destination	13	4.7

5. a) On this trip, if you had not chosen to visit Timpanogos Cave National Monument, what other recreation site would you have visited instead?

Response	Frequency	% of total
None	192	68.8
Name of site	87	31.2

Other Response	Frequency
Alpine Loop	1
American Forks	1
Amusement Park	1
Antelope Island	3
Arches National Park	2
Bridal Veil Falls	2
Bryce Canyon National Park	3
Camping in upper meadow	1
Cascade Springs	9
City of Rocks	1
Crystal Springs	1
Donut Falls	1
golf	1
hike in Uintas	1
hike to the Y	1
hiking trails - waterfall	1
Lagoon	2
Lake Mary hike	1
Morman Church	1
Mount Olympus	1
Ogden trails	1
other states	1
Park City	1
Payson Lakes	1
Pineview Reservoir	1
Provo (Canyon, Rec Center)	3
Salamander Flats	1
Salt Flats	1
Salt Lake	2

Scout Falls	1
Seven Peaks	1
Silver Lake Flat	1
some other beautiful place	1
somewhere else in the canyon	1
Stewart Falls	3
Strawberry Reservoir, fishing	1
Summit Timpanogos	1
Sundance	4
swam in our pool	1
the lake	1
Tibble Fork	2
Tibble Fork or Silver Lake	1
Tibble Fork, Cascade Springs	1
Timpanogos Mountain Trail	1
Tracy Aviary	1
Uinta Indian Reservation	1
water park	3
Y @ BYU	1
Zions National Park	3
Not sure/don't know	3

b) If you answered "None" above, in what activity would you have participated instead?

Response	**Frequency**	**% of total**
None	217	77.8
Activity	62	22.2

Other Response	**Frequency**
Alpine Slide	1
Amusement Park	1
Aspen Grove family camp	1
Birthday stuff	1
Boating	1
Camping	2
Cycling	2
Don't know	1
Drive around til found something interesting	1
Drive through Uintas	1
Eating	1
Family times (games, reunion)	4
Fishing	2
Fishing the Provo River	1
Fishing/hanging out	1
Gardening	1
Golfing	1
Great Basin	1
Great Salt Lake, Antelope Island	1
Hiking	18
Hiking in Park City	1
Hiking/fishing	1
Hiking/rock climbing	1

Horse trail ride	1
House hunting	1
Laser tag	1
Laundry	1
Living aquarium	1
Mountain biking	1
Movie	1
Not sure	3
Park City	2
Picnic	2
Picnic/hiking	1
Ranger circles @ canyon, etc.	1
Relaxing	1
River rafting	1
School work	1
Seven Peaks Waterpark	2
Shopping	4
Sight seeing	1
Sleep in	1
Snowbird recreation	1
Splash pad	1
Sports	1
Stay home (w/ family)	3
Study & exercise	1
Swimming	5
Swimming or park city	1
Swimming/water park	1
Utah Natural History Museum	1
Visit lake	1
Visit w/ Family	1
Water Parks	2
Water skiing	1
Waterfall hike	1
Work	1
Yard work	2
Zoo	2

6. Please indicate your level of agreement with each of the following statements concerning your willingness to pay more for a cave tour ticket, depending on how the increase would be used. Please fill in **only one circle for each statement**.

Item	**Response and Frequency**				
I would be willing to pay more for a tour ticket *if the increase were put toward…*	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
…a system to reserve tickets by phone	46 (17.0 %)	63 (23.3%)	105 (38.9%)	44 (16.3%)	12 (4.4%)
…a system to reserve tickets via the Internet	18 (6.6%)	31 (11.3%)	73 (26.6%)	98 (35.8%)	54 (19.7%)
…a system to procure a last- minute ticket, on-site	19 (6.7%)	38 (14.3%)	100 (37.7%)	78 (29.4%)	30 (11.3%)
…additional features/exhibits of the cave tour program	14 (5.2%)	21 (7.8%)	67 (24.9%)	124 (46.1%)	43 (16.0%)
…additional tour times after 4:30 pm	25 (9.4%)	47 (17.7%)	97 (36.5%)	76 (28.6%)	21 (7.9%)
…better directional signage	40 (15.0%)	81 (30.5%)	115 (43.2%)	24 (9.0%)	6 (2.3%)
…building improvements	29 (10.9%)	66 (24.7%)	107 (40.1%)	54 (20.2%)	11 (4.1%)
…decreased wait time to obtain tour tickets	29 (10.8%)	56 (20.8%)	113 (42.0%)	64 (23.8%)	7 (2.6%)
…ecological restoration of bat habitat within the cave	21 (7.8%)	26 (9.6%)	88 (32.6%)	95 (35.2%)	40 (14.8%)
…increased grounds maintenance	20 (7.4%)	46 (17.1%)	141 (52.4%)	51 (19.0%)	11 (4.1%)
…increased availability of emergency services	17 (6.3%)	41 (15.2%)	131 (48.5%)	65 (24.1%)	16 (5.9%)
…law enforcement presence	48 (18.0%)	82 (30.8%)	112 (42.1%)	21 (7.9%)	3 (1.1%)
…limiting traffic and parking congestion	30 (11.4%)	55 (20.8%)	119 (45.1%)	49 (18.6%)	11 (4.2%)
…parking lot improvements	29 (10.9%)	54 (20.2%)	126 (47.2%)	48 (18.0%)	10 (3.7%)
…preservation of cave ecosystems	18 (6.8%)	12 (4.5%)	46 (17.3%)	130 (48.9%)	60 (22.6%)
…preservation of natural cave features	14 (5.2%)	14 (5.2%)	39 (14.4%)	134 (49.6%)	69 (25.6%)
…providing a longer tour	23 (8.6%)	46 (17.2%)	83 (31.1%)	73 (27.3%)	42 (15.7%)

…providing age-specific tours	19 (7.1%)	47 (17.5%)	112 (41.8%)	61 (22.8%)	29 (10.8%)
…providing child-free tours	44 (16.4%)	59 (22.0%)	110 (41.0%)	36 (13.4%)	19 (7.1%)
…restroom improvements	19 (7.3%)	46 (17.6%)	94 (35.9%)	63 (24.0%)	40 (15.3%)
…safety barriers/ improvements along the trail to the cave	22 (8.2%)	37 (13.8%)	91 (33.8%)	88 (32.7%)	31 (11.5%)
…smaller tour group size so I can see and hear better	30 (11.3%)	71 (26.7%)	106 (39.8%)	44 (16.5%)	15 (5.6%)
…special topic tours	17 (6.4%)	45 (16.9%)	106 (39.8%)	66 (24.8%)	32 (12.0%)

7. Overall, how satisfied were you with the ranger who led your cave tour today at Timpanogos Cave National Monument? Please fill in **only one circle**.

Response	**Frequency**	**% of total**
Very dissatisfied	11	4.0
Somewhat dissatisfied	5	1.8
Neutral	8	2.9
Somewhat satisfied	22	8.0
Very satisfied	228	83.2

8. Which cave tour did you attend on your visit today?

a) Date of tour _____ b) Time of tour _____

9. For you visit today, which type(s) of cave tour ticket(s) were purchased for you and your personal group, and how many of each type? (Your personal group is anyone with whom you are visiting the park, and does not include a larger group you might be travelling with, such as a guided tour, church, school, scouts group, etc.) Please fill in **all circles that apply** and write the number of tickets purchased on the line provided.

Fee Type	**Amount**	**Frequency Purchased**	**Total Number of tickets obtained**
Adult (age 16 and older)	$7.00	271	897
Junior (age 6-15)	$5.00	194	616
Senior and Access Pass holder	$3.50	29	37
Child (age 3-5)	$3.00	75	109
Infant (age 0-2)	Free	22	26

10. For each type of cave tour fee **that you paid** on this visit, how would you rate the tour's value for the fee paid? Please fill in **only one circle for each fee type**. If you did not pay any cave tour fee, please go to Question 12.

		Value for fee paid					
Fee type	**Amount**	Very poor	Poor	Average	Good	Very good	n/a
Adult (age 16 and older)	$7.00	1 (0.4%)	3 (1.1%)	32 (11.9%)	83 (31.0%)	142 (53.0%)	7 (2.6%)
Junior (age 6-15)	$5.00	0 (0.0%)	2 (0.7%)	24 (8.9%)	54 (20.1%)	107 (39.8%)	82 (30.5%)
Senior/Access pass holder	$3.50	0 (0.0%)	0 (0.0%)	4 (1.5%)	6 (2.2%)	18 (6.7%)	241 (89.6%)
Child (age 3-5)	$3.00	0 (0.0%)	0 (0.0%)	13 (4.9%)	20 (7.5%)	36 (13.5%)	198 (74.2%)
Infant (age 0-2)	Free	0 (0.0%)	0 (0.0%)	3 (1.1%)	5 (1.9%)	11 (4.1%)	250 (92.9%)

11. For each type of cave tour fee **that you paid** on this visit, in your opinion, how appropriate is the fee amount? Please fill in **only one circle for each fee type**. If you did not pay any cave tour fee, please go to Question 12.

		Appropriateness of fee			
Fee type	**Amount**	Too low	About right	Too high	n/a
Adult (age 16 and older)	$7.00	14 (5.3%)	225 (85.2%)	15 (5.7%)	10 (3.8%)
Junior (age 6-15)	$5.00	7 (2.7%)	168 (63.6%)	7 (2.7%)	82 (31.1%)
Senior/Access pass holder	$3.50	1 (0.4%)	28 (10.6%)	0 (0.0%)	235 (89.0%)
Child (age 3-5)	$3.00	3 (1.1%)	60 (22.8%)	3 (1.1%)	197 (74.9%)
Infant (age 0-2)	Free	0 (0.0%)	20 (7.6%)	0 (0.0%)	264 (92.4%)

12. a) If special topic cave tours were offered, which topic(s) would interest you? Please fill in **all circles that apply**.

Response	Frequency
None	68
Cave ecology	134
History	124
Photography	97
Other	12

Other Response	Frequency
Animals/habitat	1
Bats	1
Cave repelling	1
Exploration (new caves, areas of cave off the main trail)	5
Geology	3
Halloween	1
More time	1

b) If you were interested in any of the special topic tours above, would you be willing to pay a higher fee for that tour than for the general tour?

Response	Frequency	% of total
Yes	144	70.2
No	61	29.8

c) What is the maximum dollar amount you would be willing to pay for a special topic tour of interest to you?

$7 to $150

Version 1

13. Park managers are considering a $3 fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay $3 more per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?		
Fee type	Current fee	Proposed fee	Yes, likely	No, unlikely	Total
Adult (age 16 and older)	$7.00	$10.00	43	21	63
Junior (age 6-15)	$5.00	$8.00	36	19	55
Senior/Access pass holder	$3.50	$6.50	16	9	25
Child (age 3-5)	$3.00	$6.00	22	16	38
Infant (age 0-2)	Free	Free	20	5	25

Version 2

13. Park managers are considering a $5 fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay $5 more per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?		
Fee type	Current fee	Proposed fee	Yes, likely	No, unlikely	Total
Adult (age 16 and older)	$7.00	$12.00	29	29	58
Junior (age 6-15)	$5.00	$10.00	22	28	50
Senior/Access pass holder	$3.50	$8.50	12	12	24
Child (age 3-5)	$3.00	$8.00	8	20	28
Infant (age 0-2)	Free	Free	12	5	17

Version 3

13. Park managers are considering a $7 fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay $7 more per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?		
Fee type	Current fee	Proposed fee	Yes, likely	No, unlikely	Total
Adult (age 16 and older)	$7.00	$14.00	27	39	66
Junior (age 6-15)	$5.00	$12.00	19	33	52
Senior/Access pass holder	$3.50	$10.50	13	17	30
Child (age 3-5)	$3.00	$10.00	10	19	29
Infant (age 0-2)	Free	Free	15	9	24

Version 4

13. Park managers are considering a percentage fee increase in order to better maintain the site and enhance the visitor experience at Timpanogos Cave National Monument. Would you be willing to pay the percentage increase per ticket in order to cover management costs associated with better site maintenance and enhancing the visitor experience? Please fill in **only one circle for each fee type**.

			Willing to pay increase to cover management costs?		
Fee type	Current fee	Percentage increase	Yes, likely	No, unlikely	Total
Adult (age 16 and older)	$7.00	43%	35	31	66
Junior (age 6-15)	$5.00	60%	23	26	49
Senior/Access pass holder	$3.50	86%	7	23	30
Child (age 3-5)	$3.00	100%	8	29	37
Infant (age 0-2)	Free	0%	13	13	26

14. In order to reach Timpanogos Cave National Monument, you had to pay a fee to enter the Uinta National Forest. Please indicate the degree to which your willingness to pay the proposed fee increase (Question 13 above) was affected by having to pay the Uinta National Forest entrance fee. Please fill in **only one circle**.

Response	Frequency	% of total
Not at all affected	87	36.0
Slightly affected	37	15.3
Moderately affected	73	30.2
Very affected	31	12.8
Extremely affected	14	5.8

15. a) Of the following cave tour ticketing options, please indicate the option you would most prefer. Please fill in **only one circle**. NOTE: only options 1-5 were listed on the survey.

Response	Frequency	% of total
(1) Tickets available for purchase **on-site**, on a **first-come-first-serve** basis only	22	8.9
(2) Tickets available for advance reservation through a **phone reservation system** only (which would include a non-refundable transaction fee of $0.50 per ticket)	48	19.5
(3) Tickets available for advance reservation through an **online reservation system** only (which would include a non-refundable transaction fee of $3 per ticket)	57	23.2
(4) A combination of options (1) and (2)	55	22.4
(5) A combination of options (1) and (3)	64	26.0

b) Which of the following best describes the reason(s) you selected your most preferred option above? Please fill in **all circles that apply**.

Response	Frequency
Price	62
Convenience	169
Assurance of securing a ticket in general (no particular day or time)	61
Assurance of obtaining a ticket for a particular tour day and time	89
Fairness of method for obtaining a ticket	48
Other	7

Other Response	Frequency
All of the above	1
Tickets purchased for me	1
Family suggested	1
I wouldn't pay a fee to buy the ticket	1
Internet transaction fee WAY too high	1
Online fee too high; switch phone and online fee to get everyone online	1
Why charge a fee for an automated service which requires no labor cost	1

16. Regarding obtaining cave tour tickets, which of the following statements best describes your situation on **this visit**? Please fill in **only one circle**. NOTE: only options 1-4 were listed on the survey.

Response	Frequency	% of total
(1) As long as I can secure tickets for my entire group to go on the same tour, tour times and crowding are not a problem	106	41.4
(2) As long as I can secure tickets for my entire group, I am willing for my group to be separated into different tours	24	9.4
(3) Being able to secure a ticket for a specific day and time is most important to me	95	37.1
(4) I am willing to wait for a tour (provided at a later date or time) in order to have a quality experience (e.g., less crowded, more intimate, better conveyance of information from ranger)	28	10.9
(1) and (4)	1	0.4
(3) and (4)	2	0.8

17. How often do you visit Timpanogos Cave National Monument? Please fill in **only one circle**.

Response	Frequency	% of total
This is my first visit	108	42.4
Once a year or less often	144	56.1
Several times a year	3	1.2
Once a month	0	0.0
Several times a month	1	0.4

18. On this visit, what kind of personal group were you with? (Your personal group is anyone with whom you are visiting the park, and does not include a larger group you might be travelling with, such as a guided tour, church, school, scouts group, etc.) Please fill in **only one circle**.

Response	Frequency	% of total
Alone	6	2.3
Family	205	80.1
Friends	13	5.1
Family and friends	31	12.1
Other	1	0.4

Other Response	Frequency
Co-working friends	1

19. On this visit, how many people were in your personal group, including yourself?

Min: 1
Max: 30
Mean: 6.336
Std. Deviation: 4.4035

20. a) On this visit, were you with an organized group (such as tour, school, church, scouts, etc.)?

Response	Frequency	% of total
Yes	1	0.4%
No	254	99.6%

b) If you answered "Yes" above, what type of organized group were you with?

Co-workers

21. a) What is your zip code? _____

b) If you are not from the U.S., what country are you from? _____

Zip Code	Frequency	State
00801	1	U.S. Virgin Islands
01002	1	Massachusetts
01845	1	Massachusetts
07328	1	New Jersey
11222	1	New York
14618	1	New York
18064	1	Pennsylvania
18066	1	Pennsylvania
20148	1	Washington D.C.
21769	1	Maryland
22180	2	Virginia
22302	1	Virginia
22309	1	Virginia
24073	1	Virginia
27519	1	North Carolina
28173	1	North Carolina
30519	1	Georgia
32828	1	Florida
33435	1	Florida
33483	1	Florida
34102	1	Florida
44124	1	Ohio
44446	1	Ohio
45648	1	Ohio
46038	1	Indiana
50310	1	Iowa
55103	1	Minnesota
60804	1	Illinois
66213	1	Kansas
70808	1	Louisianna
75002	1	Texas
75225	2	Texas
75409	1	Texas
76031	1	Texas
76107	1	Texas
78023	1	Texas
80015	1	Colorado
80232	1	Colorado
80904	1	Colorado
81212	1	Colorado
81501	1	Colorado
83221	1	Idaho
83440	1	Idaho
83445	1	Idaho
83616	2	Idaho
83642	1	Idaho
83646	1	Idaho
84003	7	Utah

84004	1	Utah
84015	3	Utah
84020	3	Utah
84032	2	Utah
84037	1	Utah
84040	2	Utah
84041	2	Utah
84042	1	Utah
84043	7	Utah
84044	1	Utah
84045	5	Utah
84047	4	Utah
84058	3	Utah
84062	3	Utah
84065	7	Utah
84070	2	Utah
84074	2	Utah
84075	2	Utah
84078	1	Utah
84081	4	Utah
84082	1	Utah
84084	3	Utah
84088	5	Utah
84092	4	Utah
84093	1	Utah
84094	3	Utah
84095	1	Utah
84096	6	Utah
84098	3	Utah
84102	1	Utah
84103	1	Utah
84106	1	Utah
84107	1	Utah
84115	1	Utah
84116	1	Utah
84118	1	Utah
84119	1	Utah
84120	2	Utah
84121	3	Utah
84123	3	Utah
84124	1	Utah
84128	1	Utah
84129	2	Utah
84302	2	Utah
84315	1	Utah
84319	1	Utah
84321	2	Utah
84337	1	Utah
84340	1	Utah
84341	1	Utah
84403	1	Utah
84404	2	Utah
84405	1	Utah

84414	2	Utah
84501	3	Utah
84601	3	Utah
84604	6	Utah
84606	4	Utah
84651	1	Utah
84653	1	Utah
84655	2	Utah
84660	1	Utah
84663	6	Utah
84664	1	Utah
84666	1	Utah
84721	1	Utah
84770	1	Utah
84790	2	Utah
85048	1	Arizona
85053	1	Arizona
85212	1	Arizona
85213	3	Arizona
85260	1	Arizona
85297	1	Arizona
87124	1	New Mexico
87402	1	New Mexico
89406	1	Nevada
90041	2	California
90403	1	California
91331	1	California
91748	1	California
91910	1	California
92064	1	California
92122	1	California
92509	1	California
92647	1	California
92869	1	California
92879	1	California
93311	1	California
94509	1	California
94510	1	California
94521	1	California
95630	1	California
95758	1	California
95969	1	California
97124	1	Oregon
97330	1	Oregon
97401	1	Oregon
97408	1	Oregon
97530	1	Oregon
98004	1	Washington
98045	1	Washington
98902	1	Washington
99507	1	Alaska
99516	1	Alaska

State or Country	Frequency	% of Visitor Population
Alaska	2	0.8
Arizona	8	3.1
California	19	7.3
Colorado	5	1.9
Florida	4	1.5
Idaho	7	2.7
Illinois	1	0.4
Indiana	1	0.4
Iowa	1	0.4
Kansas	1	0.4
Louisiana	1	0.4
Maryland	1	0.4
Massachusetts	2	0.8
Minnesota	1	0.4
Nevada	1	0.4
New Jersey	1	0.4
New Mexico	2	0.8
New York	2	0.8
North Carolina	2	0.8
Ohio	3	1.2
Oregon	5	1.9
Pennsylvania	2	0.8
Texas	7	2.7
Utah	158	61.0
Virginia	5	1.9
Washington	3	1.2
Washington D.C.	1	0.4
Canada	1	0.4
France	1	0.4
Germany	1	0.4
Hungary	1	0.4
Malaysia	1	0.4
Norway	1	0.4
Portugal	1	0.4
Russia	1	0.4
Saudi Arabia	1	0.4
Switzerland	1	0.4
U.S. Virgin Islands	1	0.4
United Kingdom	1	0.4

22. What is your age (in years)?

Min: 18
Max: 74
Mean: 40.543
Std. Deviation: 10.8437

23. What is your gender?

Gender	Frequency	% of total
Male	111	43.5
Female	144	56.5

24. Which of these categories best indicates your race? Answer only for yourself. Please fill in **all circles that apply**.

Response	Frequency	% of total
American Indian or Alaska Native	4	1.5
Asian	12	4.5
Black or African American	1	0.4
Native Hawaiian or other Pacific Islander	3	1.1
White	236	89.1
Other	9	3.4

25. Are you Hispanic or Latino? Answer only for yourself.

Ethnicity	Frequency	% of total
Hispanic	15	6.0
Not Hispanic	235	94.0

26. Which category best represents your annual household income? Please fill in **only one circle**.

Response	Frequency	% of total
$24,999 or less	13	5.1
$25,000 to $34,999	12	4.7
$35,000 to $49,999	18	7.0
$50,000 to $74,999	40	15.6
$75,000 to $99,999	39	15.2
$100,000 to $149,999	53	20.6
$150,000 to $199,999	18	7.0
$200,000 or more	25	9.7
Do not wish to answer	39	15.2