The economics of roadside bear viewing

Article *in* Journal of Environmental Management · April 2014

DOI: 10.1016/j.jenvman.2014.01.051 · Source: PubMed

4 authors, including:

Leslie Richardson
National Park Service
17 PUBLICATIONS **480** CITATIONS
SEE PROFILE

Tatjana Rosen
IUCN Cat Specialist Group
22 PUBLICATIONS **86** CITATIONS
SEE PROFILE

Kerry A Gunther
Yellowstone National Park
70 PUBLICATIONS **1,122** CITATIONS
SEE PROFILE

Journal of Environmental Management 140 (2014) 102–110

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

The economics of roadside bear viewing

Leslie Richardson [a,*], Tatjana Rosen [b], Kerry Gunther [c], Chuck Schwartz [d]

[a] U.S. Geological Survey, Fort Collins Science Center, Policy Analysis & Science Assistance Branch, 2150 Centre Avenue, Bldg. C, Fort Collins, CO 80526, USA
[b] Panthera, 8 West 40th #18th Floor, New York, NY 10018, USA
[c] National Park Service, Yellowstone National Park, Bear Management Office, USA
[d] U.S. Geological Survey, Northern Rocky Mountain Science Center, Interagency Grizzly Bear Study Team, 2327 University Way, Suite 2, Bozeman, MT 59715, USA

ARTICLE INFO

Article history:
Received 5 October 2012
Received in revised form
6 January 2014
Accepted 8 January 2014
Available online 14 April 2014

Keywords:
Bears
Wildlife viewing
Economic impact analysis
Nonmarket valuation
Contingent valuation method

ABSTRACT

Viewing bears along roadside habitats is a popular recreational activity in certain national parks throughout the United States. However, safely managing visitors during traffic jams that result from this activity often requires the use of limited park resources. Using unique visitor survey data, this study quantifies economic values associated with roadside bear viewing in Yellowstone National Park, monetary values that could be used to determine whether this continued use of park resources is warranted on economic grounds. Based on visitor expenditure data and results of a contingent visitation question, it is estimated that summer Park visitation would decrease if bears were no longer allowed to stay along roadside habitats, resulting in a loss of 155 jobs in the local economy. Results from a nonmarket valuation survey question indicate that on average, visitors to Yellowstone National Park are willing to pay around $41 more in Park entrance fees to ensure that bears are allowed to remain along roads within the Park. Generalizing this value to the relevant population of visitors indicates that the economic benefits of allowing this wildlife viewing opportunity to continue could outweigh the costs of using additional resources to effectively manage these traffic jams.

Published by Elsevier Ltd.

1. Introduction

With a healthy population of black and grizzly bears, Yellowstone National Park has long been a popular destination for visitors seeking abundant and unique wildlife viewing opportunities. Observing bears while driving on the Park's 300 miles of paved roads provides a rare opportunity for visitors to get a close look at these charismatic megafauna without ever having to leave the roadside, but facilitating safe roadside bear viewing has required an evolution in bear management practices throughout the Park's history. Traffic jams on the Park's roads due to bear viewing began in the early 20th century, a time when visitors could feed panhandling bears from stagecoaches with some regularity (Schullery, 1992). Practices such as these led to an increase in the number of bear-inflicted human injuries within the Park's boundaries, averaging 48 injuries per year from the 1930's through the 1960's (Gunther and Hoekstra, 1998). With the implementation of a strictly enforced bear management program in the 1970's, this number declined dramatically, with a large portion of the decline coming from reduced black bear caused injuries on roadsides (Gunther, 1994).

Today, rather than capturing and relocating or hazing bears that forage in roadside meadows, Park management focuses on managing visitors viewing roadside bears, in an effort to promote education and appreciation for the Park's resident wildlife, as well as to allow the bears to continue using roadside habitat (Gunther and Wyman, 2008). This approach has been largely successful; while traffic jams on the Park's roads due to drivers stopping to view bears, referred to as "bear jams," have been on the rise, there have been no associated bear-inflicted human injuries (Gunther and Wyman, 2008). Nonetheless, allowing bears to use roadside habitat does not come without a price. The number of bear jams, as well as the total Park staff time required to manage bear jams, has grown exponentially over the years (Gunther and Wyman, 2008). In 2011, the year with the most recorded bear jams, Park staff spent 2542 personnel hours managing visitors at 1031 bear jams, providing traffic control and monitoring of visitor behavior to ensure safe viewing opportunities. On some days, there are such a large number of bear jams occurring simultaneously that there is not enough Park staff to respond to them all, leaving Park visitors

* Corresponding author. Tel.: +1 970 226 9181.
E-mail addresses: lrichardson@usgs.gov, leslierich18@gmail.com (L. Richardson), trosen@panthera.org (T. Rosen), Kerry_Gunther@nps.gov (K. Gunther).

http://dx.doi.org/10.1016/j.jenvman.2014.01.051
0301-4797/Published by Elsevier Ltd.

interacting with grizzly and black bears unattended (Gunther and Wyman, 2008).

Visitation to Yellowstone National Park is on the rise, with annual visitation from 2009 to 2013 ranking among the highest visitation years on record. Correspondingly, the number of bear jams that occur each year will likely continue to trend upward. When evaluating future management decisions involving bear viewing and the amount of limited Park resources to allocate towards the management of bear jams, the economic values associated with the recreational activity of roadside bear viewing can provide one important piece of information to guide decision-making. For instance, if the economic benefits of retaining the option for visitors to view bears along roadsides within Yellowstone is greater than the personnel costs necessary to provide this viewing opportunity in a safe manner, this management decision is justified on economic grounds.

Two types of economic analyses that can help inform tradeoffs in the use of scarce public resources are regional economic impact analysis and benefit-cost analysis. Regional economic impact analysis, often required under federal regulations and regularly included in National Park Service planning, can be used to capture the income and employment generated in the local economy due to visitation to public lands. These impacts result from the amount of money non-local visitors spend in the local economy on their trips, which provides a measure of the significance of a regional resource such as Yellowstone (Duffield et al., 2006). For instance, in 2012, non-local visitors to Yellowstone National Park spent over $398 million, supporting 5,594 jobs in the local economy and generating more than $164 million in labor income (Cullinane Thomas et al., 2014). Impact analysis differs greatly from benefit-cost analysis, which takes a national perspective and compares the social benefits and costs of a given action to help inform social decision-making. This is the recommended technique for formal economic analyses of government programs or projects (OMB Circular A-94) and can be used to determine whether a management action promotes an efficient use of society's scarce resources. In the case of resource uses which do not have a market price that reflects their value to society, such as recreational wildlife viewing opportunities, economic benefits can be estimated through nonmarket valuation methods. These methods capture the public's willingness-to-pay, the same measure used to establish market clearing prices in competitive markets for private goods. Willingness-to-pay in excess of current costs, i.e. consumer surplus, is the accepted benefit measure used in benefit-cost analyses performed by federal agencies.

For the first time, this study will quantify various components of economic value associated with roadside bear viewing in Yellowstone National Park, utilizing primary data collected in 2009 through a survey of Park visitors. First, background on the methodologies used, relevant literature, and data collection methods is presented. Next, demographics and statistics associated with bear viewing are summarized. The economic impacts of a hypothetical management decision to no longer allow bears to stay along roadside habitats are then presented, based on actual non-local visitor spending from a sample of survey respondents. In addition, some of the economic benefits associated with roadside bear viewing in Yellowstone National Park are monetized using results from a nonmarket valuation willingness-to-pay survey question. Finally, implications for Park management are discussed.

2. Methodology and literature

2.1. Regional economic impact analysis

Economic impact analysis can be used to estimate employment and income effects on a local economy due to market transactions associated with a particular resource use, such as visitation to Yellowstone National Park. The flow of non-local visitor expenditures can be tracked as it moves throughout various sectors of a particular regional economy, which is typically comprised of a county or set of counties directly affected by this spending. Because economic activity in one sector spurs economic activity in other sectors, economic input–output models are frequently used to determine how these sectors will be affected by changes in spending. Three categories of effects are captured through input–output models; direct, indirect and induced effects. Indirect and induced effects are referred to as secondary effects of visitor spending, and the sum of direct and secondary effects capture the total impacts of visitor spending.

Input-output models can provide important information regarding the economic impacts of a particular management decision. However, they are based on several simplifying assumptions, all of which can affect the accuracy of the resulting estimates. For instance, the regional economy being modeled is assumed to have no supply-side constraints. That is, a firm or industry can produce additional output to meet increased demand without taking resources away from other activities, when in reality they may be constrained by the availability of land, labor, or capital. These models also make the simplifying assumption that displaced labor in the regional economy will not be hired in another sector in that economy. Further, it should be noted that these models capture economic impacts at a specific point in time, assuming no further adjustments are made in response to the management action.

While there can be significant limitations to the use of input–output models, they can provide useful approximations of the economic impacts of a management decision. They are frequently used to inform land management planning, and have been used to demonstrate the economic impacts associated with wildlife viewing opportunities specifically. For instance, the U.S. Fish and Wildlife Service periodically releases a report entitled Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation, which estimates the economic impacts associated with recreational use on refuge lands. The latest report reveals that in fiscal year 2011, spending by all wildlife refuge visitors supported more than 35,000 jobs and generated nearly $793 million in employment income. About 72% of total expenditures were generated by non-consumptive refuge activities, such as wildlife observation (Carver and Caudill, 2013). It should be noted that these estimates focus solely on the economic impacts associated with refuge lands. They do not reveal any information regarding the economic impacts of alternative uses of the land and therefore, do not provide insight into the use of the land that would provide the most jobs.

Shifting to the region of focus for this study, Loomis and Caughlan (2004a) conducted a survey of visitors participating in the National Elk Refuge winter elk viewing sleigh ride in the Jackson Hole area in 2002. They estimated the job and income impacts resulting from spending by current visitors, as well as changes in impacts associated with various management alternatives on the Refuge. The authors found that current non-local sleigh ride visitation generated around 49 jobs and $1 million in labor income in the local economy and current nonresident visitation generated around 55 jobs and $956,832 in labor income in the larger regional economy. Again, these estimates do not provide any information as to the impacts that would be generated given alternative uses of the land. Turning to wildlife observation in Yellowstone National Park specifically, a series of visitor and household surveys focused on various components of economic value associated with recovered wolf populations and wolf viewing opportunities have been administered since the early 1990's. The latest visitor survey indicated that roughly 325,000 visitors saw wolves within the Park in

2005 (Duffield et al., 2006). Due to the presence of wolves, visitation was found to be about 3.7% higher than it would be in their absence. Additional non-local visitor spending attributed directly to the presence of wolves in the Park was estimated to be +$35.5 million. This estimate was not found to be statistically different from predictions of changes in visitor spending due to the presence of wolves in the Park, estimated prior to reintroduction (Duffield et al., 2006).

Input-output models provide a useful tool to approximate the change in economic impacts associated with a proposed management decision that affects visitation to Yellowstone National Park. An estimate of the change in visitation associated with the management action is needed, which can be based on professional judgment, or elicited through visitor surveys. The change in employment and income resulting from the change in visitation can be attributed to the management decision that spurs the change in visitation. Our study is the first to our knowledge to estimate the economic impacts of visitor spending attributed directly to the recreational activity of roadside bear viewing within Yellowstone National Park. Thus, it provides an important contribution to the growing body of literature focused on quantifying the regional economic impacts of wildlife viewing in particular.

2.2. Nonmarket valuation

The contingent valuation method is a survey based nonmarket valuation technique used to quantify the economic value associated with a change in the quality or quantity of a particular nonmarket good or service. See Freeman (2003) or Flores (2003) for an explanation of the conceptual framework underlying this approach. In practice, creation of a survey utilizing a contingent valuation methodology requires careful design of a realistic, yet hypothetical, market scenario. Specifically, some of the major components that enter into the design of a contingent valuation survey question include: 1) A careful and clear description of the good or service being valued; 2) An explanation of the method of provision; 3) A description of the payment vehicle, e.g., a tax or a park entrance fee; and 4) Selection of a specific response format, e.g., open-ended or dichotomous choice.

The hypothetical market is presented to the survey respondent, who is then asked about their willingness-to-pay for that good or service, taking into account their current budget constraint. Careful design of the survey question is a key input to accurate value estimates. Boyle (2003) provides a thorough description of the steps that should be considered for accurate design of a contingent valuation study. The contingent valuation method can be used to quantify the total economic value, including both use and non-use values, associated with a wide range of nonmarket goods and services. Use values are those derived from actual use of a resource, such as wildlife viewing opportunities. Non-use, or passive use, values include those individuals place on knowing that a resource exists even if they never plan to use it (existence value) and the value placed on preserving a resource for future generations (bequest value). Boyle and Bishop (1987) and Swanson et al. (1994) provide a comprehensive discussion of these various values as they relate to wildlife in general and grizzly bears in particular, respectively.

The contingent valuation method has been applied to quantify the economic benefits associated with a wide range of wildlife species. See Richardson and Loomis (2009) for a summary of studies applying this method to quantify the total economic value of threatened, rare, and endangered species. Regarding wildlife viewing opportunities specifically, this method has been applied to value general wildlife viewing nationwide (Aiken and La Rouche, 2003), wildlife viewing in the state of Pennsylvania (Shafer et al., 1993), and viewing of flamingos in Kenya's Lake Nakuru National Park (Navrud and Mungatana, 1994). This method has also been applied to value bear viewing specifically, but this application is limited to a unique viewing opportunity of Alaskan brown bears in the McNeil River game sanctuary (Clayton and Mendelsohn, 1993). While past studies quantifying the economic value of wildlife viewing opportunities indicate that there is substantial economic value associated with this recreational activity, their presence in the literature remains fairly limited compared to the abundance of studies valuing consumptive uses of wildlife such as fishing and hunting. This study contributes to the literature by quantifying, for the first time to our knowledge, the net economic value associated with roadside bear viewing in one of the most iconic national parks in the continental United States.

3. Sampling design and data collection

To gather the necessary data to quantify the economic impacts and benefits of roadside bear viewing in Yellowstone National Park, a visitor survey was developed in the summer of 2008. Regarding sampling sites, it was initially discussed with National Park Service staff and U.S. Geological Survey scientists whether visitors would be intercepted at entrance stations or at various locations within the Park. Since the Park tracks the number of visitors coming into each Park entrance, sampling at entrance stations has the considerable advantage of allowing the analyst to weight survey responses to represent the actual distribution of visitation across entrances, as shown in Duffield et al. (2006). However, when selecting sampling sites for a visitor survey conducted in neighboring Grand Teton National Park, Loomis and Caughlan (2004a) found that park personnel have had problems capturing active park users with past entrance station intercept surveys. This is partly due to the fact that Yellowstone and Grand Teton National Parks share entrance stations. In selecting their sampling sites, Loomis and Caughlan (2004a) selected intercept locations within the Park in order to capture visitors who spend a considerable amount of time in the Park, and avoid Yellowstone National Park visitors who were just driving through Grand Teton on their way to Yellowstone. Following this approach, we worked with Yellowstone National Park staff to identify various types of visitor intercept locations that would capture the variety of visitor types to Yellowstone. These included visitor centers, restaurants, trailheads, and road pullouts. Approximately 60% of surveys for this study were distributed at visitor centers and restaurants, and 40% at trailheads or road pullouts, in an attempt to obtain a sample proportional to estimated visitor use in these locations. Specific intercept sites included Canyon Visitor Center, the "old" Old Faithful Visitor Center, Tower Fall restaurant, Albright Visitor Center at Mammoth, Hayden Valley road pullouts and trailheads, Fishing Bridge road pullouts and trailheads, and Lamar Valley road pullouts and trailheads.

Surveys were administered over a five month period, from May through September of 2009, in order to capture the Park's primary bear viewing season. Sampling occurred over twenty days, including twelve weekdays and eight weekend sampling days. The twelve weekdays were balanced across the days of the week, and the eight weekend days across Saturday and Sunday. At each survey location, every third visitor, 18 years and older, was intercepted while exiting. Visitors who agreed to participate were asked their name, contact information, and a few simple questions to check for non-response bias. A mail-back survey method was employed; potential participants were handed a cover letter, the survey packet, and a postage paid return envelope. Overall, 70 visitors refused to take the survey, 978 visitors agreed to take the survey and received a copy, and 663 visitors mailed the survey back, for an overall response rate of 63.3% when taking the initial refusals into

account, and a response rate of 67.8% to the mail survey. This is a high participation rate considering the length of the survey (8 pages), the detailed questions asked, and the lack of an incentive to complete the survey, such as a gift or promise of a gift for completing the survey.

Survey questions were designed based on discussions with biologists and economists at Yellowstone National Park's Bear Management Office, the U.S. Geological Survey's Interagency Grizzly Bear Study Team, and the U.S. Geological Survey's Fort Collins Science Center. To gather the necessary data to estimate the regional economic impacts associated with roadside bear viewing, survey respondents were asked to report the amount of money they spent on various categories of trip expenses within 60 miles of Yellowstone National Park. They were also asked a series of questions regarding the nature of their trip, such as the amount of time spent within the Park and the local area, group size, activities participated in, and whether visitation to Yellowstone in particular was the primary purpose of their trip. Finally, after querying visitors on the number of trips made to Yellowstone National Park in the last year, they were presented with the following question:

> *Would your decision to visit Yellowstone National Park change if bears were no longer allowed to stay along roadside habitats?*

If they responded that it would, they were asked to report the number of additional or fewer annual trips they would take. This approach, referred to as contingent visitation, or contingent behavior, has been employed in past studies to estimate the percentage of Yellowstone National Park visitation attributable to wolves (Duffield et al., 2006), as well as to estimate changes in visitation associated with various elk and bison management strategies in Grand Teton National Park and the National Elk Refuge (Loomis and Caughlan, 2004a, 2004b). Rather than relying on professional judgment to determine how visitation might change with a particular management decision, this approach allows agencies to replace such judgment calls with actual visitor responses (Loomis and Caughlan, 2004b). However, this approach assumes that respondents think carefully about the question, answer truthfully, and would actually change their behavior consistent with how they say they would. These assumptions may not always hold, in which case the accuracy of the predicted changes in visitation could be impacted.

Table 1
Survey respondent demographics.

Demographic statistic	Percentage of respondents	Demographic statistic	Percentage of respondents
Gender ($n = 658$)		Education ($n = 659$)	
Male	51%	Some high school	1%
Female	49%	High school diploma/GED	4%
Age ($n = 660$)		Some college	30%
18–20 years	2%	Bachelor's degree	30%
21–35 years	20%	Graduate degree	35%
36–50 years	31%	Household income ($n = 645$)	
51–65 years	35%	Less than $25,000	7%
65 years and above	12%	$25,000–$49,999	16%
Employment status ($n = 657$)		$50,000–$99,999	29%
Employed (full-time or part-time)	77%	$100,000–$149,999	28%
Retired	20%	$150,000 or greater	20%
Unemployed	3%		
Residence ($n = 660$)			
United States	97%		
Other	3%		

To capture the nonmarket benefits of roadside bear viewing, all survey respondents were asked the following dichotomous choice contingent valuation question:

> *Ensuring that Park managers allow bears to stay along roads in Yellowstone National Park may require extra costs (in the form of hiring more personnel to manage "bear jams"); if the Yellowstone National Park entry fee was $_____ **higher** to cover these additional "bear jam" costs, would you have made this trip to Yellowstone National Park?*

One of 15 bid amounts ranging from $1 to $50 USD was randomly filled in the blank for each survey, and respondents were instructed to respond 'yes' or 'no' to the question. Bid amounts were chosen based on past visitor surveys and conversations with Park staff. A dichotomous choice question format was used due to its desirable incentive compatibility properties (Haab and McConnell, 2002; Boyle, 2003). This question does not specifically state what would happen if the respondent answers 'no' but implies that bears may no longer be allowed to stay along Park roads.

4. Data analysis and results

4.1. Demographics and bear viewing statistics

Table 1 summarizes various demographic statistics for the survey respondents. The number of respondents who provided responses for each statistic is listed in parentheses next to its title. Regarding education, it is somewhat surprising that 95% of survey respondents had at least some college education. However, this is consistent with findings from similar visitor surveys. For instance, a 2002–2003 survey conducted in the winter season found that 88.5% of Yellowstone National Park visitors and 98% of visitors surveyed at Grand Teton National Park's Taggart Lake had at least some college education (Mansfield et al., 2005).

Of the 663 survey respondents, 81% participated in wildlife viewing on their most recent trip to Yellowstone and 55% participated in bear viewing specifically. When asked to list the top five animals they would most like to see on their trip, 81% of respondents listed bears as one of them. Duffield et al. (2006) compare the results of Yellowstone National Park visitor surveys conducted in 1991, 1999, and 2005 for the top three species visitors surveyed in the summer indicated they would most like to see on their trips to the Park. The authors note the surprising consistency in ranking over the years; charismatic megafauna, such as large carnivores and ungulates, steadily ranked the highest. Wolves were the notable exception, ranking in the top three for 15% of the 1991 survey respondents, even though wolves were not present in the Park at that time, and climbing to 36% of the 1999 summer survey respondents, and 44% of the 2005 summer survey respondents. This trend has notably continued; results from our 2009 survey show that wolves rank second highest in terms of the percentage of respondents who list them as one of the top five mammals they would most like to see, followed by moose at 66%. Table 2 shows the percentage of survey respondents choosing each of twenty-one mammals and birds they were presented with as one of the top five they would most like to see on their trip to Yellowstone National Park.

When presented with the option to see a black or grizzly bear, 35% of all respondents indicated that they would prefer to see a grizzly bear, 5% would prefer to see a black bear, and 60% had no preference between the two. Nearly all respondents, 99%, indicated that they had expected to see a bear on their visit to Yellowstone National Park, and 67% actually did see a bear on their most recent visit. Although the Park does not track the percentage of total

Table 2
Percentage of respondents selecting each mammal or bird as one of the top five they would most like to see on their trip to Yellowstone National Park.

Mammal/bird	Percentage of respondents	Mammal/bird	Percentage of respondents
Bear	81%	Trumpeter swan	11%
Wolf	68%	Sandhill crane	11%
Moose	66%	Coyote	9%
Bison	49%	Canada goose	9%
Big horn sheep	38%	Antelope	8%
Elk	38%	Fox	5%
Bald eagle	32%	Owl	4%
Mountain lion	24%	Deer	3%
Wolverine	16%	Osprey	3%
Otter	12%	Pelican	3%
Mountain goat	12%		

visitors who see bears on their trips to Yellowstone, this seems like a high percentage. One possible explanation could be related to the sites where visitors were intercepted; there is the possibility that some of the intercept locations, such as road pullouts, may have captured a higher proportion of visitors focused on wildlife viewing in the Park specifically. Of the remaining 216 visitors who did not see a bear on their most recent trip, 65% were disappointed. Survey respondents were also asked about the importance of bear viewing in their decision to take trips to Yellowstone National Park throughout the year, the results of which can be seen in Fig. 1.

4.2. Regional economic impact analysis

When quantifying the economic impacts of visitor spending on the local economy, only spending by non-local visitors is considered. This is due to the fact that visitors living outside of the local impact area bring new money into the economy, whereas it is assumed that if local residents visit Yellowstone National Park more or less as a result of management changes, they will simply shift their spending elsewhere in the local economy, resulting in no net effect on the local impact area. For the purposes of this analysis, the local impact area is defined as those counties within a 60 mile radius of Yellowstone National Park, including Park and Teton counties in Wyoming, Park and Gallatin counties in Montana, and Fremont County in Idaho. Of the 663 survey respondents, four lived in the local area and 25 did not respond to survey questions asking about their travel distance to the Park or their home zip code. For the purposes of this study, there remain 634 survey respondents that could definitively be considered non-local visitors whose spending could be included in the regional economic impact analysis.

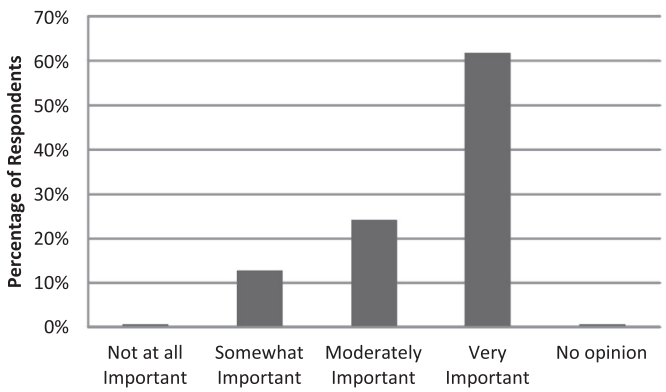

Fig. 1. Importance of bear viewing in the respondents' decision to take trips to Yellowstone National Park.

Table 3
Trip characteristics by 'type of stay' segment.

	Day trips	Hotel	Camp in	Camp out	Other
Segment share	20.5%	57.2%	4.5%	3.4%	14.5%
Average party size	3.78	3.15	4.19	3.90	2.84
Length of stay (days)	1.00	4.27	5.79	6.95	3.49
Re-entry rate[a]	1.45	2.53	2.00	3.20	2.84
Percent primary purpose trips	95%	82%	68%	57%	87%

Stynes includes an additional split in segments for those visitors staying at a motel/hotel inside the Park and those staying outside of the Park. Here we use the average of those for the hotel re-entry rate.

[a] Rates for each segment are based on those reported in Stynes (2008).

Survey respondents were specifically asked to report the amount of money their party spent on various spending categories both within Yellowstone National Park and in the surrounding gateway communities within 60 miles of the Park on their most recent visit. The average party size was 3.3 people and the average length of a trip spent both in the Park and in the local area was 3.6 days. The average surveyed visitor party spent a total of $742 on a trip to Yellowstone National Park in 2009. To calculate the economic impacts associated with this visitor spending, the approach taken by Stynes (2008) is followed. First, survey respondents are split into segments which serve to categorize them based on their type of stay on their most recent trip to Yellowstone National Park. Visitor parties in each segment may have different spending patterns, as well as different trip characteristics. These segments include[1]:

Day Trips: visitor groups staying in the Park and the surrounding area for one day or less;

Hotel: visitors staying at a hotel or motel, either inside or within 60 miles of the Park;

Camp In: visitors camping inside the Park;

Camp out: visitors camping outside but within 60 miles of the Park; and

Other: visitors reporting no lodging expenses within 60 miles of the Park;

Survey results were used to compile trip characteristics for visitor parties, including the percentage of respondents within each 'type of stay' segment, the average party size, average length of stay in days, both inside and within 60 miles of the Park, as well as the percentage of respondents indicating that for their most recent trip to Yellowstone National Park, visiting the Park was the primary or sole purpose of the trip. The average party size ranged from 2.84 to 4.19 people and the average length of stay ranged from 1 to 6.95 days. Re-entry rates for each segment are based on those reported in Stynes (2008). These indicate the average number of times visitors in each segment enter the Park on a given trip. These trip characteristics, categorized by 'type of stay' segment, are presented in Table 3.

While total recreation visits to Yellowstone National Park vary each year, some of the highest visitation numbers on record have occurred in recent years. To connect sample results from the 2009 survey to the larger population of visitors to Yellowstone National Park, annual recreation visits to the Park from the years 2005

[1] Similar to the approach taken in Stynes (2008), visitors reporting expenditures in multiple lodging categories were placed in the category with the highest lodging expense reported.

through 2009 are averaged. This five year average is used to account for variations in year to year visitation due to unusually high visitation years, weather events, etc. Only those recreation visits occurring from May through September of each year are included in the population estimate, as these were the months our survey was conducted. Based on data from the National Park Service Public Use Statistics Office, this results in an average of 2,773,685 annual recreation visits to Yellowstone National Park. However, as mentioned previously, an unexpectedly high percentage of survey respondents reported seeing a bear. It is possible that sampling at certain locations, such as road pullouts and possibly trailheads, resulted in a sample containing a higher proportion of visitors focused on wildlife viewing in particular than what is representative of the overall population of summer Park visitors. Unfortunately, there is no way to compare the proportion of visitors sampled at each location with the actual population of users at these locations, which is a limitation to sampling at locations within the Park rather than at the entrance stations. So there remains some uncertainty as to whether our sample of survey respondents is truly representative of all Park visitors. A conservative approach is to aggregate sample results to only that population of Park visitors who participated in wildlife viewing specifically. A recent survey of a random sample of summer Park visitors conducted for Yellowstone finds that 82% of visitors participated in wildlife viewing on their most recent trip (Kulesza et al., 2012). Therefore, we aggregate our results to 82% of the summer recreation visits, for a total of 2,274,422 visits.

Following Stynes (2008), annual recreation visits are split into 'type of stay' segments based on segment shares reported in Table 3. These visits are adjusted for re-entry into the park by dividing recreation visits by the associated re-entry rate for each segment to put them on a person trip basis. Person trips for each segment are then divided by the associated average group size to arrive at party trips. The results can be found in Table 4.

For each 'type of stay' segment, average visitor expenditures per party per trip are calculated. Not all visitor spending should be attributed to Park visitation if visiting the Park was not the primary purpose of their trip. Thus, visitors were asked to report whether their visit to Yellowstone National Park was: a) the primary purpose of their trip; b) one of many equally important reasons or destinations for their trip; or c) just an incidental or spur of the moment stop on a trip taken for other purposes or to other destinations. For those visitors in the first category, all of their spending was counted; for those in the second category, half of their spending was counted; for those in the third category, one quarter of their spending was counted. After making these necessary adjustments to spending, average visitor expenditures per party per trip are calculated. Total visitor spending, which provides the basis for the economic impact analysis, is calculated by multiplying average visitor spending per party per trip for each segment by the estimated number of party trips by segment.

Results of the contingent visitation survey question show that 12% of survey respondents believe that their decision to visit Yellowstone National Park throughout the year would indeed change if bears were no longer allowed to stay along roadside habitats. Two percent of respondents believe they would take more trips throughout the year, while 10% believe they would take fewer trips throughout the year. The net percentage change in annual trips resulting from this hypothetical management decision is shown in Table 5, broken out by 'type of stay' segment. These results are similar to those of a contingent visitation question asked in the previously mentioned 2005 Yellowstone National Park survey quantifying the economic value of wolf reintroduction, which found that the estimated percentage of Park visitation directly attributable to wolves ranged from about 1.5% in the spring season to nearly 5% in the fall (Duffield et al., 2006).

Table 4
Recreation visits and party trips by 'type of stay' segment.

	Recreation visits	Person trips (adjusted for re-entry)	Party trips (adjusted for party size)
Day trips	466,257	321,556	85,068
Hotel	1,300,969	514,217	163,244
Camp in	102,349	51,174	12,213
Camp out	77,330	24,166	6196
Other	329,791	116,124	40,889
Total	2,274,422	1,027,237	307,610

Table 5
Percentage change in annual trips to Yellowstone National Park if bears were no longer allowed to stay on roadside habitats.

	Percentage change
Day trips	−3.2%
Hotel	−4.5%
Camp in	−10.0%
Camp out	−7.8%
Other	−3.2%
All visitors	−4.7%

Assuming characteristics of the survey respondents' most recent trip to Yellowstone National Park, such as trip length and trip expenditures, are representative of other trips taken during the summer, this change in Park visitation would be expected to reduce annual non-local visitor spending by $10,076,135. The impact on the local economy resulting from this reduction in visitor spending is estimated using IMPLAN (Impact Analysis for Planning), a computerized database and regional input–output modeling system (MIG, Inc.[2]). Regional economic impacts from the IMPLAN model are reported for the following categories:

- *Employment* represents the change in the number of jobs generated in the region from a change in regional output.
- *Labor Income* includes employee wages and salaries, including income of sole proprietors and payroll benefits.
- *Value Added* measures contribution to Gross Domestic Product. Value added is equal to the difference between the amount an industry sells a product for and the production cost of the product.

The year 2009 IMPLAN data profiles for Park and Teton counties, Wyoming, Park and Gallatin counties, Montana, and Fremont County, Idaho, were used in this study. The impacts on the local economy resulting from a hypothetical management decision to no longer allow bears to occupy roadside habitat in Yellowstone National Park are presented in Table 6 below.

This management decision is estimated to result in a loss of 155 jobs, $3,995,427 in labor income, and $7,152,572 in value added, based on 2009 visitor spending information. While this represents a small portion of the overall local economy, this difference amounts to more than a 4% reduction in total employment impacts of visitor spending directly attributed to Park visitation. Large management changes often take several years to achieve, and the economic impacts presented in Table 6 represent those that would occur after all changes in management have been implemented. These results are based on the assumption that respondents were

[2] Any us of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

truthful in their responses regarding exactly how their visitation to Yellowstone would change if bears were no longer allowed to occupy roadside habitats. Over time, there would likely be substitution effects that would take place, making this an upper bound on annual economic impacts. For instance, visitors who reported that they would take fewer trips as a result of this hypothetical management decision may eventually substitute other wildlife viewing opportunities, such as viewing wolves, rather than cancel their trips altogether.

4.3. Nonmarket valuation

All 663 survey respondents provided a response to the dichotomous choice contingent valuation question. Table 7 shows the percentage of respondents responding 'yes' to each particular bid amount. As expected, this percentage generally declines as the bid amount increases. It should be noted that even at the highest bid amount of $50, over half of all respondents would still be willing to pay this increased Park entrance fee to cover "bear jam" costs. Interestingly, 88% of respondents who did not participate in bear viewing on this most recent trip that they were surveyed on were still willing to pay a positive amount.

Given the dichotomous choice question format used, the underlying distribution of willingness-to-pay is unknown. The only known information is whether a respondent answered 'no' to a specified bid amount, in which case their true willingness-to-pay is lower than that particular bid amount, or if they answered 'yes' to a specified bid amount, in which case their true willingness-to-pay is greater than or equal to that bid amount. The unknown willingness-to-pay distribution of interest, WTP*, can be specified as follows:

$$WTP_i^* = x_i'\beta + \varepsilon_i \quad (1)$$

where x_i' represents a vector of independent variables that could influence the individual's willingness-to-pay, including the bid amount, and ε_i is the error term. Whether or not an individual is willing to pay a specified bid amount is observed, so the probability that the individual responds 'yes' to a specified bid amount 'bid_i' is equal to the probability that the random willingness-to-pay function is greater than or equal to that offered bid amount:

$$Pr\left(WTP_i^* \geq bid_i \middle| x_i'\right) = 1 - F(bid_i|x_i') \quad (2)$$

where F is the cumulative distribution function of WTP_i^*. Using the method of maximum likelihood and assuming a logistic for the underlying distribution of willingness-to-pay, the results of a logit regression modeling the determinants of willingness-to-pay are shown in Table 8. All variables refer to the respondents' most recent trip to Yellowstone National Park (YNP) unless otherwise stated.

The bid coefficient in this model is negative and statistically significant at the 1% level, indicating that the higher the bid amount, the less likely the individual is willing to pay an increased Park entrance fee, all else constant. This provides evidence of theoretical construct validity to the contingent valuation question responses. Interestingly, time spent in the Park was found to have a statistically significant and negative effect on the probability that a respondent would be willing to pay the specified bid amount. Individuals who saw a bear on their most recent trip to Yellowstone were more likely to be willing to pay than those who did not, all else constant, and this variable is significant at the 1% level. Finally, the probability that a respondent is willing to pay the specified bid amount decreases with age and increases with the number of years of education they have. Variables controlling for respondents who participated in bear viewing or other wildlife viewing on their most recent trip to Yellowstone compared to those who did not were not found to have a statistically significant effect on willingness-to-pay. Similarly, expecting to see a bear, as well as whether the respondent had seen a bear in Yellowstone on past trips, did not have a statistically significant effect on willingness-to-pay.

While the results of this model could be used to estimate a measure of central tendency for willingness-to-pay, as can be seen in Table 7, the majority of survey respondents were willing to pay at even the highest bid amounts offered. The range of the bid amounts used was simply too narrow; respondents were never presented with a bid amount high enough that a majority would not be willing to pay that amount. The result is a lack of data to characterize the full response distribution, meaning the use of a parametric model to estimate a measure of central tendency for willingness-to-pay may not be appropriate. A reasonable strategy when presented with this situation is to employ a conservative approach, such as estimating the lower bound of expected

Table 6
Change in local economic impacts due to hypothetical management decision to no longer allow bears to occupy roadside habitats, 2009

Impact type	Employment	Labor income	Value added
Direct effect	116	$2,760,788	$4,850,552
Secondary effects	39	$1,234,639	$2,302,020
Total effect	155	$3,995,427	$7,152,572

Table 7
Percentage of survey respondents responding 'yes' to each bid amount.

Bid amount	Percent yes	Bid amount	Percent yes
$1	98%	$20	79%
$3	98%	$25	92%
$5	87%	$30	86%
$7	98%	$35	85%
$10	98%	$40	79%
$13	96%	$45	68%
$15	95%	$50	64%
$17	87%		

Table 8
Logit regression of willingness-to-pay for increased Yellowstone National Park entrance fee to cover additional "bear jam" costs.

Variable	Coefficient	Std. error
Bid amount	−0.054***	0.01
Time spent in YNP	−0.139**	0.06
Group size	−0.003	0.035
Participated in bear viewing (1 if yes, 0 if no)	0.109	0.292
Participated in other wildlife viewing (1 if yes, 0 if no)	−0.096	0.305
Expected to see a bear (1 if yes, 0 if no)	1.218	0.919
Saw a bear (1 if yes, 0 if no)	1.028***	0.293
Number of trips to YNP in the past 12 months	0.021	0.11
Number of trips to YNP in past 12 months primarily for bear viewing	0.068	0.228
Seen a bear before in YNP (1 if yes, 0 if no)	0.105	0.307
Gender (1 if male, 0 if female)	−0.371	0.291
Age	−0.278*	0.154
Work (1 if full or part time, 0 if retired or unemployed)	0.399	0.309
Education	0.306**	0.151
Income	−5.70E-07	3.00E-06
Constant	1.609	1.331
$N = 619$		
Log likelihood = −176.3734		
LR chi2 (15) = 63.16	Prob > chi2 = 0.00000	

*: $p < 0.10$, **: $p < 0.05$, ***: $p < 0.01$.

willingness-to-pay from a Turnbull estimator (Haab and McConnell, 2002). The Turnbull estimator is appealing in that it satisfies the criteria for a valid measure of willingness-to-pay and relies solely on information contained in the survey responses. When calculating the Turnbull distribution-free estimator, a monotonicity restriction must be imposed to ensure that the probability of a 'no' response increases with the bid amount. Following the procedure outlined in Haab and McConnell (2002), Table 9 shows the Turnbull estimates based on the survey responses to the willingness-to-pay question, with bid amounts pooled where necessary to guarantee monotonicity.

In Table 9, t_j represents the range of bid amounts where $j = [1,\ldots,M]$, N_j is the number of 'no' responses to bid t_j, and T_j represents the total number of respondents offered bid t_j. The proportion of 'no' responses to each bid amount is represented by F_j^*, where F_0^* is 0 and F_{M+1}^* is set to 1 to ensure that no respondents have willingness-to-pay greater than the highest bid amount. This is the monotonically increasing Turnbull cumulative distribution function. Finally, f_j^* is the Turnbull probability distribution function, calculated as $F_j^* - F_{j-1}^*$, which provides consistent estimates of the probability that willingness-to-pay falls between bid $j-1$ and the next highest bid amount, j. As shown in Haab and McConnell (2002), this information can be used to calculate a consistent estimate of the lower bound on willingness-to-pay as follows:

$$E_{LB}(\text{WTP}) = \sum_{j=0}^{M^*} t_j \cdot f_{j+1}^* \tag{3}$$

Even though the true underlying distribution of willingness-to-pay is unknown, Equation (3) will always bound expected willingness-to-pay from below, as long as the true distribution is defined only over the non-negative range (Haab and McConnell, 2002). This makes it an appealing conservative measure of central tendency. Applying Equation (3) for our sample of respondents results in a mean lower bound estimate of $41.35 in 2009 dollars. Recall, this represents the average increase in Park entrance fees that respondents are willing to pay to cover the additional costs that may be required to ensure that park managers allow bears to stay along Park roads. This is a measure of consumer surplus, willingness-to-pay above and beyond Park entrance fees already paid. Given that Park entrance fees are per vehicle, it should be noted that there were, on average, about three visitors per group sharing expenses in our sample of survey respondents.

Aggregating this average to the 307,610 party trips calculated in Table 4 results in a total willingness-to-pay of $12,719,674 across all visitors who participated in wildlife viewing at Yellowstone National Park in May through September of 2009. This is likely a conservative estimate due to the fact that it is based on a lower bound estimate of willingness-to-pay and assumes that the population of visitors who did not participate in wildlife viewing would not be willing to pay any additional costs for Park staff during bear jams. However, it may not be reasonable to assume that visitors would be willing to pay this increased entrance fee in future years due to substitution in recreation activities that could occur over time. For instance, if roadside bear viewing were no longer allowed, some visitors may eventually substitute to other wildlife viewing opportunities, such as viewing wolves instead of bears. If that is the case, this estimate may be viewed as an upper bound on foregone annual economic benefits if roadside bears were no longer allowed to occupy roadside habitat in Yellowstone.

Table 9
Turnbull estimates.

t_j	N_j	T_j	F_j^*	f_j^*
0			0	
1	1	54	0.018	0.018
3	1	60	Pooled back	Pooled back
5	9	67	0.069	0.051
7	1	47	Pooled back	Pooled back
10	1	46	Pooled back	Pooled back
13	2	46	0.079	0.010
15	2	40	Pooled back	Pooled back
17	7	54	Pooled back	Pooled back
20	8	38	0.142	0.063
25	3	39	Pooled back	Pooled back
30	7	50	Pooled back	Pooled back
35	7	46	0.152	0.010
40	6	29	0.207	0.055
45	8	25	0.320	0.113
50	8	22	0.364	0.044
50+			1.000	0.636

5. Park management implications and conclusions

Visitation to Yellowstone National Park is on the rise, topping three million for the seventh straight year in 2013, and the opportunity to view the Park's unique and abundant wildlife has long been a major draw for visitors. Nonetheless, providing continued access to certain wildlife viewing opportunities such as roadside bear viewing involves considerable tradeoffs in the use of limited Park resources (Gunther and Wyman, 2008). There are currently more "bear jams" on Park roads than Park rangers to manage them, causing a strain on existing Park personnel as well as increased concern for visitor safety. Providing visitors with the opportunity to view bears along roadside habitats within the Park involves both economic benefits and costs that can be quantified and compared to better inform this management decision. This study was meant to shed light on some of the economic impacts and benefits associated with roadside bear viewing in Yellowstone National Park, providing one important component of a systematic analysis of this management practice.

Results from our visitor survey indicate that if bears were no longer allowed to stay along roadside habitats, spending in the local economy by Park visitors could decrease by about $10.1 million, resulting in a loss of 155 jobs. Results from a nonmarket valuation survey question indicate that, on average, visitors to Yellowstone National Park are willing to pay around $41 more in Park entrance fees to ensure that bears are allowed to remain along roads within the Park. It is important to note that if visitors change their behavior and substitute other wildlife viewing opportunities for roadside bear viewing over time, these estimates may represent an upper bound on annual economic impacts and benefits in future years.

Results from this study indicate that Park managers could potentially increase Park entrance fees to offset the cost of hiring additional personnel that may be required to effectively manage "bear jams." Of course, many other factors come into play when evaluating changes to park entrance fees. The important take away message, however, is that even if entrance fees are not raised, the consumer surplus that visitors receive from having the option to participate in roadside bear viewing can be compared to the cost of hiring more Park personnel to determine whether this use of taxpayer dollars is justified on economic efficiency grounds. Although monetized economic benefit estimates represent just one aspect of wildlife viewing, they contribute an important piece of information to any objective analysis of the costs and benefits of a management decision that affects this recreational opportunity.

While unique wildlife viewing opportunities in national parks represent an increasingly popular visitor activity, relatively few studies have conducted surveys to capture the associated range of values and opinions held by visitors. Surveys also provide an effective means to educate visitors, informing them of the various

management issues that Park staff has to address, as well as the tradeoffs that have to be made to provide visitors with the opportunity to participate in certain recreational activities. Future studies should continue to expand on this type of survey-based research in national parks.

Some limitations to this study, which can be incorporated into similar future efforts, should be noted. First, the majority of survey respondents were willing to pay even the highest bid amount of $50 in the form of an increased Park entrance fee to ensure that bears are allowed to stay along roadside habitats. Future studies should include bid amounts greater than $50 and a larger number of bid amounts at the upper end of the range. Further, more information could have been presented to respondents in the contingent behavior and contingent valuation questions to reduce hypothetical bias. For instance, respondents could have been told where bears would remain and how they could still be viewed if they were no longer allowed to occupy roadside habitat, as well as reminded of other animals they could possibly still view from their car. In the contingent valuation question, respondents could have been given a 'cheap talk' script that discusses the tendency for people to exaggerate their willingness-to-pay, and a more detailed explanation as to what would happen in the case of a 'yes' or 'no' response by the majority of respondents. This could include a description of the methods that would be used to remove bears from roadside habitat or alternatively, whether a 'no' response meant they could still see bears, just in a more dangerous environment due to the lack of appropriate staff. In addition, there are often pros and cons to various survey sampling designs, but future visitor surveys conducted in national parks may benefit from surveying visitors at entrance stations, in order to weight survey responses to represent the actual distribution of visitation across entrances. Finally, this study captured preferences and values for roadside bear viewing of only those individuals who visited the Park at the time the survey was conducted. There are likely many members of society who value the option to view bears along Park roads in the future, or derive value from ensuring that future generations have the option to participate in roadside bear viewing. Household surveys can capture many of these additional economic values.

References

Aiken, R., La Rouche, G.P., 2003. Net Economic Values for Wildlife-related Recreation in 2001, pp. 2001–2003. Addendum to the 2001 national survey of fishing, hunting and wildlife-associated recreation. U.S. Fish and Wildlife Service, Report.

Boyle, K.J., 2003. Contingent Valuation in Practice. In: Champ, P.A., Boyle, K.J., Brown, T.C. (Eds.), A Primer on Nonmarket Valuation. Kluwer Academic Publishers, Boston, pp. 111–169.

Boyle, K.J., Bishop, R.C., 1987. Valuing wildlife in cost-benefit analysis: a case study involving endangered species. Water Resour. Res. 23 (5), 943–950.

Carver, E., Caudill, J., 2013. Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. Division of Economics, U.S. Fish and Wildlife Service, Washington, DC.

Clayton, C., Mendelsohn, R., 1993. The value of watchable wildlife: a case study of McNeil River. J. Environ. Manag. 39, 101–106.

Cullinane Thomas, C., Huber, C., Koontz, L., 2014. 2012 National Park Visitor Spending Effects: Economic Contributions to Local Communities, States, and the Nation. Natural Resource Report NPS/NRSS/EQD/NRR—2014/765. National Park Service, Fort Collins, Colorado.

Duffield, J., Neher, C., Patterson, D., 2006. Wolves and People in Yellowstone: Impacts on the Regional Economy. Final report prepared for Yellowstone Park Foundation. University of Montana.

Freeman, M., 2003. The Measurement of Environmental and Resource Values: Theory and Methods. Resources for the Future, Washington, DC.

Flores, N.E., 2003. Conceptual framework for nonmarket valuation. In: Champ, P.A., Boyle, K.J., Brown, T.C. (Eds.), A Primer on Nonmarket Valuation. Kluwer Academic Publishers, Boston, pp. 27–58.

Gunther, K.A., 1994. Bear management in Yellowstone National Park, 1960–93. Int. Conf. Bear. Res. Manag. 9 (1), 549–560.

Gunther, K.A., Hoekstra, H.E., 1998. Bear inflicted human injuries in Yellowstone National Park, 1970–1994. Ursus 10, 378–384.

Gunther, K.A., Wyman, T., 2008. Human habituated bears: the next challenge in bear management in Yellowstone National Park. Yellowst. Sci. 16 (2), 35–41.

Haab, T.C., McConnell, K.E., 2002. Valuing Environmental and Natural Resources. Edward Elgar Publishing, Inc., Northampton, Massachusetts.

Kulesza, C., Gramann, J., Le, Y., Hollenhorst, S.J., 2012. Yellowstone National Park Visitor Study: Summer 2011. Natural Resource Report NPS/NRSS/EQD/NRR – 2012/539. National Park Service. Natural Resource Stewardship and Science Office, Fort Collins, CO. Available at. http://psu.uidaho.edu/files/vsp/reports/250.1_YELL_rept-summer.pdf.

Loomis, J., Caughlan, L., 2004a. Economic Analysis of Alternative Bison and elk Management Practices on the National elk Refuge and Grand Teton National Park: a Comparison of Visitor and Household Responses: U.S. Geological Survey, Biological Resources Discipline, Open. File Report 2004–1305, 110 p..

Loomis, J., Caughlan, L., 2004b. Linking intended visitation to regional economic impact models of bison and elk management. Hum. Dimen. Wildl. 9, 17–33.

Mansfield, C., Johnson, R., Whitmore, R., Phaneuf, D., 2005. Winter 2002–2003 visitor survey: Yellowstone and Grand Teton National Parks. Revised Final Report. Prepared for: National Park Service Environmental Quality Division.

MIG, Inc., IMPLAN System (Data and Software), 502 2nd Street, Suite 301, Hudson, WI 54016 www.implan.com.

Navrud, S., Mungatana, E.D., 1994. Environmental valuation in developing countries: the recreational value of wildlife viewing. Ecol. Econ. 11, 135–151.

Office of Management and Budget (OMB). Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.

Richardson, L., Loomis, J., 2009. The total economic value of threatened, endangered and rare species: an updated meta-analysis. Ecol. Econ. 68 (5), 1535–1548.

Schullery, P., 1992. The Bears of Yellowstone. High Plains Publishing Company, Inc, P.O. Box 1860, Worland, Wyoming, USA, 318 pp.

Shafer, E.L., Carline, R., Guldin, R.W., Cordell, H.K., 1993. Economic amenity values of wildlife: six case studies in Pennsylvania. Environ. Manag. Tour. 17 (5), 669–682.

Stynes, D.J., 2008. Impacts of Visitor Spending on the Local Economy: Yellowstone National Park, 2006 National Park Service Social Science Program. Michigan State University.

Swanson, S.G., McCollum, D.W., Maj, M., 1994. Insights into the economic value of grizzly bears in the Yellowstone recover zone. Int. Conf. Bear. Res. Manag. 9 (1), 575–582.