Wolf Recovery in Yellowstone: Park Visitor Attitudes, Expenditures, and Economic Impacts

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Introduction

In 1995, the U.S. Fish and Wildlife Service began reintroducing wolves to the Greater Yellowstone ecosystem and to the Central Idaho area in an attempt to restore the endangered gray wolf to the Rocky Mountains. The restoration of wolves to Yellowstone National Park has become one of the most successful wildlife conservation programs in the history of endangered species conservation. Yellowstone is now considered one of the best places in the world to watch wild wolves. Visibility of the wolves within the park, and public interest in wolves and wolf-based education programs, have far exceeded initial expectations.

During the preparation of the environmental impact statement (EIS; US Fish and Wildlife Service 1994) that was completed by the National Park Service (NPS) prior to wolf restoration, more than 170,000 public comments were reviewed to determine the public's key concerns. One of the main issues identified during this process was the concern about the possible economic effects of wolf restoration. Among the concerns of opponents were the expenditure of public federal funds for the restoration effort and the potential for negative economic effects on the regional economy. These assumed negative effects included the costs of wolf depredation on livestock, reduced big-game populations resulting in lower economic returns to agencies and businesses that derive revenue from big-game hunting, and an expected drop in visitation to Yellowstone and the surrounding ecosystem. Proponents, on the other hand, predicted increased visitation and positive regional net economic impacts caused by the presence of wolves.

Prior to reintroduction of wolves into the Yellowstone ecosystem, an EIS analysis presented predictions of a wide spectrum of impacts, including economic impacts, that would result from wolf recovery (U.S. Fish and Wildlife Service 1994). This study provides an *ex post facto* (after the fact) analysis of wolf-related social and economic impacts for comparison with the EIS predictions.

This paper focuses on two primary results from the Yellowstone National Park 2005 visitor survey: preferences for wildlife viewing among Yellowstone visitors, and regional economic impacts attributable to wolf presence in the park.

Data collection

The park's 2005 visitor survey was designed to collect a broad spectrum of information and opinions. The survey instrument was divided into four sections,

each addressing one general aspect of the visitors' trip or their attitudes and characteristics. For purposes of the regional economic analysis, information was collected on visitor attitudes toward wolf recovery and wildlife, and data were collected on expenditures.

Original data were gathered from a random survey of Yellowstone National Park visitors between December 2004 and February 2006. The survey targeted two samples: all park visitors (sampled at park entrances) and Lamar Valley visitors (sampled randomly at parking locations throughout the valley). Throughout the sampling period, a total of 2,992 surveys were distributed and 1,943 were completed and returned, for an overall response rate of 66.4%. Respondents from the Lamar sample had higher response rates (74.2%) than did respondents from the entrance station sample (64.4%).

The survey was designed as a random sample of the entire population of park visitors. Park visitors in spring, summer, and fall were contacted at park entrance stations. Winter visitors traveling by car were also contacted at the North Entrance station. Over-snow visitors were sampled through guide and outfitter lists. The resulting random sample was weighted appropriately to reflect the actual distribution of 2005 park visitation by entrance and season. A separate sample of visitors was contacted in the Lamar Valley to provide additional data on visitor wildlife viewing. The survey procedure followed a standard Dillman (2000) mail survey methodology using initial contact and repeat follow-ups.

Visitor wildlife viewing preferences

Visitors were asked about their preferences for seeing different animals on their trips. Specifically, visitors were asked to choose the three species of animals they would most like to see while in the park from a list of 16 species (Table 1). It is interesting to note that the "charismatic megafauna," including large carnivores and ungulates, rank highest on the lists. Four of the top five species are consistently the large carnivores. The consistency in ranking across years (aside from wolves) is remarkable. A similar consistency is observed between resident and nonresident visitors. Table 1 shows a comparison of preferences for seeing different species across the three independent visitor surveys conducted in 1991, 1999, and 2005. The data presented in Table 1 is for the summer season 2005 results, in order to be comparable with the 1991 and 1999 results, which were estimated from summer visitor samples.

In a 1991 study, 15% of park visitors listed wolves as a species they would most like to see, even though at that time wolves were not present in the park. This percentage ranks the species as number eight. Eight years later in the 1999 survey, and following the introduction of wolves in 1994, the number of visitors who stated they would like to see wolves had increased to 36%, and the species was rated second only to grizzly bears. Based on the 2005 study, 44% of visitors listed wolves as a species they would most like to see on their Yellowstone trip, and wolves are second only to grizzlies as a preferred species to see.

One objective of the 2005 survey was to obtain an estimate of the number of Yellowstone National Park visitors who actually see wolves in the park throughout the year. One survey question asked respondents to indicate which species they actually saw on their trip to the park. As expected, nearly all visitors report seeing bison (93%

Rank	1991 Study		1999 Summer Study		2005 Summer Study	
	Species	Percent	Species	Percent	Species	Percent
1	Grizzly	0.550	Grizzly	0.58	Grizzly	0.55
2	Black Bear	0.332	**Wolf**	**0.36**	**Wolf**	**0.44**
3	Moose	0.332	Moose	0.35	Moose	0.41
4	Elk	0.239	Lion	0.31	Black Bear	0.26
5	Lion	0.229	Black Bear	0.29	Lion	0.25
6	Sheep	0.219	Sheep	0.23	Sheep	0.21
7	Eagle	0.187	Eagle	0.21	Eagle	0.21
8	Bison	0.160	Bison	0.19	Bison	0.21
9	**Wolf**	**0.154**	Elk	0.14	Elk	0.14
10	Wolverine	0.047	Wolverine	0.06	Wolverine	0.06

For the 2005 study, the remaining preferences to see species were Trumpeter swan (3%), Deer (2%), Fox (1.8%), Coyote (0.6%), Antelope (0.3%), and Goose (0.1%).

Table 1. Comparison of Yellowstone National Park visitor ratings of the animals they most would like to see on their trips to Yellowstone.

to 98%), and a large share report seeing elk (85% to 92%). Also, as expected, very few visitors report seeing two rarely viewed species, mountain lions and wolverines (1.8% or less across seasons).

Table 2 shows the percentage of respondents from the entrance-station sample who reported seeing wolves on their trips. The table also reports the percentage who said they saw coyotes and the percentage who reported seeing *both* wolves and coyotes on their trip. For purposes of conservatively estimating the number of Yellowstone National Park visitors who see wolves in a year, we use the percentage of visitors who reported seeing both coyotes and wolves. This conservative estimate is used to reduce the chance of counting visitors who misidentified coyotes as wolves.

Table 3 shows that in the period of spring through fall, between 9% and 19% of visitors reported seeing both wolves and coyotes. In the winter season, about 37% of North Entrance visitors reported seeing wolves and coyotes. Applying these percentages to the actual 2005 recreational visitation levels reported by the NPS yields an estimated 326,000 visitors who saw wolves in 2005. This is conservative, for it excludes winter visitors who enter through the West, East, and South entrances on over-snow vehicles. This is substantially higher than previous estimates of the number of visitors seeing wolves in the park. For example, Smith (2005) reports, based on field counts by Yellowstone National Park personnel, that about 20,000 park visitors per year view wolves. The latter estimate was based on occasions where park field personnel were able to observe visitors observing wolves. Given the size of Yellowstone National Park, the widespread distribution

Statistic	Spring N=495	Summer N=477	Fall N=322	Winter N=221
% seeing wolves	25.4%	15.2%	18.5%	42.4%
% seeing coyotes	45.3%	38.9%	40.4%	71.2%
% seeing both	19.2%	9.1%	12.8%	36.7%
Recreational visitation (2005)	382,598	1,819,798	547,777	43,933
Number of visitors seeing wolves	73,382	166,330	70,335	16,123
Total estimated visitors sighting wolves (spring-fall)	**310,046 (95% C.I. 257,210 to 362,882)**			
Total estimated visitors sighting wolves and coyotes (year-round)	**326,170 (95% C.I. 273,277 to 379,097)**			
Note: winter and year-round estimate includes only North Entrance visitation.				

Table 2. Estimated number of Yellowstone visitors seeing wolves and coyotes in the park in 2005.

Season / residency	Amount spent in GYA	Amount spent in three-states	Total trip spending	Sample size
Spring – nonresident	$220.55	$320.24	$673.21	374
Spring – GYA resident	$72.87	$74.99	$105.66	70
Summer – nonresident	$187.85	$349.58	$709.33	369
Summer – GYA resident	$63.67	—	$117.28	22
Fall – nonresident	$279.56	$387.78	$762.19	241
Fall – GYA resident	$112.99	$150.03	$208.94	47
Note: winter results are only representative of wheeled access and are not presented.				

Table 3. Comparison of visitor spending, by season and residency for the 17-county GYA analysis area.

of wolves (Smith 2005), and the limited presence of park personnel in the field, it is possible that this method may be understating estimates by more than an order of magnitude.

Yellowstone visitor trip expenditures

Recreational travel to Yellowstone National Park includes spending by park visitors. A key measure of the significance of a regional resource such as Yellowstone to the area's economy is the amount of money visitors from outside of the local area spend in the area on their trips. For the sake of measuring local area spending, visitors were asked to list the amount of money they spent on their trips in total, as well as the amount they spent in the three states of Montana, Idaho, and Wyoming, and the amount they spent in the local Greater Yellowstone area (GYA). Table 4 shows reported average trip spending by season and residency for each of the geographic areas. As would be expected, park visitors resident in the GYA spend less on their trips to the park than do nonresident visitors. This pattern is consistent across seasons.

Statistic	Spring	Summer	Fall	Winter
Total recreational visitation to Yellowstone	382,598	1,819,798	547,777	85,478
% of visitors from outside the three-state area	70.5%	83.68%	67.59%	82.2%
(A) Recreational visitors from out of the three states	269,770	1,522,807	370,242	70,289
(B) % of visitors who would not have visited without the presence of wolves	1.93%	4.78%	3.45%	3.66%
(C) Average spending per visitor within the three states by visitors from outside the area	$361.89	$369.12	$425.50	$510.84
(A) * (B) * (C) Total estimated annual three-state visitor spending attributable to wolves	$1,885,178	$26,889,668	$5,431,916	$1,314,167
Total estimated annual visitor spending in the three states attributable to wolves		$35,520,929		
95% Confidence interval		$22,404,274 to $48,637,585		

Table 4. Estimated three-state (Montana, Idaho, and Wyoming) direct expenditure impact associated with wolf presence in Yellowstone National Park.

Net impacts of wolf recovery on the regional economy

The economic analysis associated with the Yellowstone area wolf reintroduction EIS included an estimate of how many new recreational visits per year would result from reintroduction of wolves to the park. The 2005 survey included a series of questions designed to allow the estimation of the percentage of current Yellowstone National Park visitation attributable to wolf presence in the park. Survey respondents were asked the following questions:

> Was the possibility of seeing or hearing **wolves** one of the reasons for your visiting Yellowstone National Park on this trip?
>
> ❑ NO ❑ YES
>
> **IF YES,** would you still have chosen to take this trip even if **wolves** were not present in the Yellowstone National Park? (Please check one)
>
> ❑ DEFINITELY YES
> ❑ DEFINITELY NO
> ❑ NOT SURE

The estimated percentage of Yellowstone visitation attributable to wolves ranges from 1.5% in the spring season to nearly 5% in the fall. Based on the percentage of visitors who would only come if wolves are present, Table 3 shows the derivation of an estimate of impacts to the three-state region for comparison below with the estimate derived by Duffield (1992). In total, it is estimated that visitors coming from outside the three-state region, who are coming specifically to see or hear wolves in the park, spend $35.5 million annually.

Prior to reintroduction, Duffield (1992) estimated, based on park visitor survey responses, that a recovered wolf population in the park would lead to increased visitation from outside the three-state region

resulting in an additional $19.35 million in direct visitor spending within the three states. Between 1991 and 2005 the standard measure of consumer prices, the CPI-U (Consumer Price Index–All Urban Consumers, compiled monthly by the Bureau of Labor Statistics), has increased 43.4% (from 136.2 to 195.3). Adjusting the 1991 estimate for increases in prices leads to an inflation-adjusted 1991 estimate of $27.74 million per year. This estimate is below the 2005 estimate of $35.5 million, but well within the 95% confidence interval for the estimate of $22.4 to $48.6 million. It appears that the 1991 methodology and estimate correspond well to current estimates of wolf impacts on visitor spending.

Conclusions

Overall, it appears that the economic predictions made in the original EIS analysis were relatively accurate. Based on the 2005 study, 44% of visitors to Yellowstone listed wolves as a species they would most like to see on their trip, and wolves are second only to grizzlies as a preferred species to see. In terms of projections of changes in park visitation, the current estimated percentage increase due to wolf presence is somewhat lower than predicted (+3.7% estimated versus +4.93% predicted). However, the 1994 predictions were based on a survey of summer visitors to the park and the current estimate of the percentage of summer visitation due to wolf presence is +4.78%—very similar to the EIS predictions. Regarding changes in visitor spending in the local economy due to wolf presence, the current estimate of +$35.5 million (confidence interval of $22.4 to $48.6 million) is consistent with the 1994 EIS estimate of +$27.7 million (2005 dollars).

The 1994 EIS economic analysis also provided estimates of the impacts of a recovered wolf population on predation of livestock in the Yellowstone area, and on big-game populations in the area. For the issue of wolf depredation of livestock, the EIS's estimated losses, mostly for cattle and sheep, of $1,900 to $30,500 per year were based on assumptions of a recovered population of 100 wolves. Depredation loss levels during the period when wolf numbers were near predicted levels were consistently within the range of predicted losses, and averaged $11,300 during the period 1997–2000. In 2004 and 2005, when wolves numbered over 300, losses were twice the high-end estimate of losses predicted in the EIS, at $63,818 per year (Defenders of Wildlife Compensation Fund data; www.defenders.org).

Regarding the issue of impacts to big-game populations, a review of the wildlife biology literature associated with wolf impacts on the northern Yellowstone elk herd shows a divergence of views on the impact wolf predation has had depending on whether wolf predation is viewed as largely additive or largely compensatory. Two peer-reviewed papers examining impacts of wolves on northern herd elk populations (Vucetich et al. 2005; Varley and Boyce 2006), however, have shown the impact of wolves on elk numbers to be either consistent with or below the impact predicted in the EIS, which was for a long-range hunter harvest reduction of elk of between 5% and 30%.

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