WHITE WATER BOATERS
CONTINGENT VALUATION REPORT

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Grand Canyon white water boaters were surveyed to determine the monetary values (surplus values) they place on an actual 1985 Grand Canyon white water boating experience and on seven plausible scenarios of Grand Canyon boating experiences under a variety of flow release patterns. The primary purpose for estimating these surplus values was to examine the effect, as measured in dollar terms, of various flow release patterns from Glen Canyon Dam on white water boating experiences from Lee's Ferry to Lake Mead.

- Surplus values for commercial passengers were found to be significantly different from those for private boaters, with commercial passenger surplus values exceeding private boater values at all constant flow levels between 1,000 and 45,000 cfs.

- Commercial passenger surplus values for constant flow levels are $47 per trip at 1,000 cfs and rise to a maximum of $898 at 33,000 cfs, and then decline to $732 at 45,000 cfs. Private boater surplus values start at $21 per trip at 1,000 cfs and rise to a maximum of $688 at 29,000 cfs before declining to $376 at 45,000 cfs.

- Large daily fluctuations in flow levels significantly increased commercial passenger surplus values at a low average flow of 5,000 cfs and had no effect on private boater values. At a moderate average daily flow of 22,000 cfs, large fluctuations in the flow level significantly reduce surplus values for both commercial passengers and private boaters.

- Given the findings reported above, we would conclude that the Grand Canyon White Water Boater Contingent-Valuation Survey was quite successful. The results are internally consistent and match well with the flow preferences expressed by white water boaters in the earlier attribute survey, and those of commercial white water guides and private trip lenders collected in a separate survey. The resulting surplus values, therefore, seem to be adequate for the next stage in the analysis, the evaluation of alternative annual flow regimes.

INTRODUCTION

The Bureau of Reclamation and the National Park Service are cooperatively sponsoring the Glen Canyon Environmental Studies, a series of studies to determine the downstream impacts of various release patterns from Glen Canyon Dam. As one part of this effort, the Recreation Study was commissioned to evaluate the impacts of various water release patterns on recreational activities on the Colorado River from Glen Canyon Dam to Lake Mead. Three user groups have been identified as being potentially affected by river flows: 1) white water boaters between Lee's Ferry and Lake Mead; 2) day-use boaters between Glen Canyon Dam and Lee's Ferry; and 3) trout anglers between Glen Canyon Dam and Lee's Ferry.

The Recreation Study has two goals. The first is to identify, for each user group, the aspects or attributes of the recreational experience that are affected by water levels. This was accomplished through attribute surveys of recreationists from each user group. The second goal is to value, in monetary terms, the impacts of flows on the flow-sensitive attributes identified in the attribute survey. This is being accomplished through contingent-valuation (CV) surveys of recreationists.

This report describes the administration and results of the Grand Canyon White Water Boaters' Contingent Valuation Survey. A copy of the survey and a summary of the frequency distributions of respondents' answers to the questions in the survey are presented in Appendix A.

OBJECTIVES AND REQUIREMENTS OF THE WHITE WATER BOATERS CONTINGENT VALUATION SURVEY

1. Sample approximately 600 white water boaters who took a Grand Canyon trip during the 1985 boating season.

2. Determine the monetary values that respondents assign to their actual Grand Canyon trip and to seven plausible scenarios of Grand Canyon white water boating experiences under a variety flow release patterns from Glen Canyon Dam. This is being done to evaluate the effects of flow release patterns from Glen Canyon Dam on white water boating experiences on the Colorado River between Lee's Ferry and Lake Mead.

PROCEDURES

Sampling

The White Water Boaters' Contingent Valuation Survey was sent to a sample of 598 individuals who took a Grand Canyon trip during the 1985 rafting season (February 26 through November 6). The sample was stratified into three user groups: 1) passengers from commercial oar trips; 2) passengers from commercial motor trips; and 3) individuals who took private boat trips. Names and addresses for these individuals were obtained from National Park Service launch records and commercial outfitters.

The proposed sampling design was to select approximately equal numbers of commercial oar trip passengers, commercial motor trip passengers, and private boaters. To meet this objective, 195 commercial oar passengers and 191 commercial motor passengers were selected from names provided by the commercial outfitters. Two hundred and twelve private boaters were selected from NPS launch records.

Survey Procedures

In May, 1986, individuals in the sample were mailed an advance letter informing them of the survey. Approximately one week later, they were mailed a contingent valuation questionnaire (see Appendix A), cover letter, and a question and answer sheet. A postcard was sent five days later to thank those who had already responded and to encourage those who had not responded to do so. Nonrespondents were mailed a second copy of the questionnaire about three weeks after the first mailing and a third copy of the questionnaire was sent by certified mail about four weeks after the first mailing.

Survey Results

Overall, 508 usable questionnaires were returned (87 percent of the total sample). Eleven additional questionnaires were returned but were not used since the respondents were under 18 years old. The response rate as a percent of all deliverable and usable questionnaires was 91 percent (Table 1). The data presented in this report are based on the responses of 506 Grand Canyon boat trip passengers: 170 commercial oar passengers, 167 commercial motor passengers, and 169 private boaters.[1]

Table 1. Grand Canyon White Water Boater Contingent Valuation Survey Response Rate

	Percent of Total Surveys	Percent of Deliverable Surveys [b]
Completed surveys	87%	91%[c]
Undeliverable	4	--
Not applicable [a]	1	--
Surveys not returned	8	9
Refusals	0	0
Totals	100%	100%

[a] This includes 11 questionnaires returned but not included in the data analysis since the respondents were less than 18 years old.

[b] The percentages in this column are computed from a sample size of 560 rather than 598. The undeliverable and not applicable surveys have been excluded.

[c] Two of these surveys were returned after the data analysis was completed.

1/ Two surveys were received after the analysis for this report was completed. While these two are included in the response rates for Table 1, they are not included in the results reported in the remainder of this report.

DESCRIPTION OF TRIP

In this section we present results relating to how respondents viewed their actual white water trips. These findings provide useful background material for reviewing the valuation results. However, the White Water Boater Attribute Survey Report should be consulted for information on the general characteristics and views of the full population of white water boaters. For reporting purposes, we will not stratify the responses according to whether respondents took a commercial oar or commercial motor trip. This stratification is being ignored here because we found in the analysis of surplus values, which will be presented later in this report, that surplus values are not affected by the type of boat that an individual traveled on.

Overall Satisfaction

Both commercial passengers and private boaters gave their Grand Canyon white water trip an overall rating of "excellent," as is shown in Table 2. Passengers from commercial boat trips seemed to be slightly more satisfied with their experience than were individuals who took a private trip. Only one person, a private boater, gave their Grand Canyon white water experience a rating of "poor" or "fair."

Table 2. Overall Satisfaction With Trip

Level of Satisfaction	Commercial	Private
Poor or Fair (1,2)	0%	1%
Good or Very Good (3,4)	7	17
Excellent or Perfect (5,6)	93	82
Mean score [a]	5.3	5.0

[a] The mean score is calculated by assigning values of 1 through 6 to responses of Poor through Perfect, respectively, and computing a weighted average.

On average, respondents tended to indicate that they definitely would take the trip again, regardless of whether they were a private boater or a commercial trip passenger (Table 3).

Table 3. Willingness to Take Trip Again

Take Trip Again	Commercial	Private
Definitely not (1)	0%	1%
Probably not (2)	4	1
Probably yes (3)	20	13
Definitely yes (4)	76	85
Mean Score [a]	3.7	3.8

[a] The mean score is calculated by assigning value of 1 through 4 to response categories Definitely not through Definitely yes, respectively, and computing a weighted average.

Crowding

Respondents' perceived levels of crowding varied from "not at all crowded" to "extremely crowded" (Table 4). However, only a small percentage of the respondents felt "extremely crowded" on the river. Private boaters reported a slightly higher level of crowding than did commercial trip passengers. This difference may be due, at least in

part, to differing expectations and desires regarding a Grand Canyon white water trip. Commercial passengers, because of the type of trip they are taking, may expect to encounter other people more frequently. On the other hand, private boaters may expect and desire a more remote wilderness experience.

Table 4. Reported Crowding

Level of Crowding	Commercial	Private
Not at all crowded (1,2)	36%	33%
Slightly crowded (3,4)	37	36
Moderately crowded (5,6,7)	26	29
Extremely crowded (8,9)	1	2
Mean Score [a]	3.4	3.7

[a] The mean score was calculated by assigning values of 1 through 9 to responses of "Not at all crowded" through "Extremely crowded," respectively, and computing a weighted average.

Rapids

Rapids are a major attribute of a Grand Canyon white water trip, and the number and size of rapids varies under different flow levels. Over 50 percent of all respondents said that rapids were the "most important reason" or "one of two main reasons" for their decision to take the trip (Table 5), and large rapids were preferred by most respondents.

Table 5. Role of Rapids in Decision to Take Trip

Reason for Trip	Commercial	Private
Most important reason	12%	5%
One of two main reasons	53	50
One of many reasons	29	41
Not important reason	6	4

River Flow and Fluctuations

River flow and fluctuations are also important attributes affecting boaters' overall satisfaction with their Grand Canyon white water trips. Before reporting respondents' evaluations of these attributes, it may be helpful to review the actual flows and fluctuations experienced by respondents. This information is provided in Table 6. The flows and fluctuations experienced by private boaters were somewhat different than those experienced by commercial passengers due to an extended boating season for private groups.

Table 6. Average Daily Flows and Fluctuations Experienced by Respondents

Flow/Fluctuation Experienced	Commercial	Private
Daily flow levels (cfs)		
average high	31,600	29,200
average low	25,200	21,800
overall average	28,900	26,000
Daily fluctuations (cfs)		
high	16,400	16,600
low	0	900
overall average	6,400	7,300

Nearly all of the respondents from private trips noticed a change in the water level during their trip, while less than 60 percent of those on commercial trips noticed the water level change (Table 7). Finally, more than 70 percent of the private boaters felt that fluctuating water levels made the experience less like a natural setting, while less than half of the commercial boaters indicated that fluctuations would have this effect. In addition, a substantial number of commercial passengers (43 percent) said fluctuations would have no effect or they did not know what the effect was (Table 8).

Table 7. Respondents Awareness of Changes in Water Level

Response	Commercial	Private
Didn't notice	41%	13%
Noticed:		
Only on a few days	30	37
Almost every day	18	25
Every day	11	25

Table 8. Effect of Fluctuations on Respondents' Perceptions of a Natural Setting

Perception of Natural Setting	Commercial	Private
Much more	3%	1%
Somewhat more	7	3
No effect	25	17
Somewhat less	23	25
Much less	24	46
Don't Know	18	8

Beaches

Beaches are another important attribute of a Grand Canyon white water trip which can be affected by river flows. At high flow levels, the size and number of sand beaches are reduced. This increases the probability that a group will have to camp near other groups or possibly share a beach with other groups. In addition, some boating groups might have to camp in areas without sand. As a result, boaters may feel more crowded at high flows than they would at low flows with the same number of groups on the river. The majority of respondents indicated they never had to camp on the same beach with another group. However, private boaters were more likely than commercial passengers to have had to share a beach with another party (Table 9).

Table 9. Respondents Sharing a Beach Where They Camped

Shared a Beach	Commercial	Private
Never	78%	55%
One night	16	23
Two nights	4	13
Three nights	2	7
Four or more nights	0	2

Time for Hiking and Attraction Sites

The amount of time available for stops along the river to hike and visit attraction sites is also related to flow levels. At high flows, the river is moving faster and boaters are able to spend more time at attraction sites than is possible at lower flows where the current is slower. Nearly all of the commercial passengers indicated that they had enough time for hiking and stopping at attraction sites (Table 10). In contrast, almost one half of the private boaters felt that they did not have enough time for stopping along the river.

Table 10. Amount of Time for Hiking and Attraction Sites

Response	Commercial	Private
There was enough time	83%	53%
There was not enough time	16	46
There was too much time	1	1

These differences can be easily explained. About half of the respondents from commercial trips took a motorized raft trip which move faster than the other types of boats used on the river and, as a result, groups taking this type of trip would have more time for stopping along the river. Private boaters, on the other hand, move slower, have more experience with the river, and may be more aware of the attraction sites they are passing up to make a specific destination in a given amount of time.

CONTINGENT VALUATION RESULTS

In this section we report the monetary values respondents assigned to their actual Grand Canyon white water trip and to seven plausible scenarios of alternative Grand Canyon white water trips. Six of the trip scenarios entail different river flows and average daily fluctuations. The seventh scenario describes a situation where the number of sand beaches available for camping would be substantially reduced. Although the size and number of beaches is related to long-run flow levels, this scenario was not anchored at any specific river flow.

The descriptions for each of the scenarios are based on the findings presented in the "Grand Canyon White Water Rafters' Attribute Survey Report" and the "Grand Canyon White Water Boating Guides Survey," as well as the judgment of National Park Service personnel who are knowledgeable about Grand Canyon boating. In the remainder of this section we will present the estimated values for respondents' actual trip and the seven scenarios.

Actual Trip

Respondents spent a relatively large amount of money, on average, for their Grand Canyon white water trip. Total average expenditures ranged from about $557 for individuals on private trips to roughly $1,406 for passengers on commercial trips. These differences in total expenditures are primarily due to payments to commercial rafting companies and greater expenditures for transportation to the Grand Canyon on the part of commercial trip passengers.

Not only did respondents spend a large amount of money on their Grand Canyon white water trips, they also placed a substantial monetary value on their actual trip, above and beyond their actual expenditures. In the remainder of this report we will refer to these values, which are above and beyond actual expenditures, as surplus values.

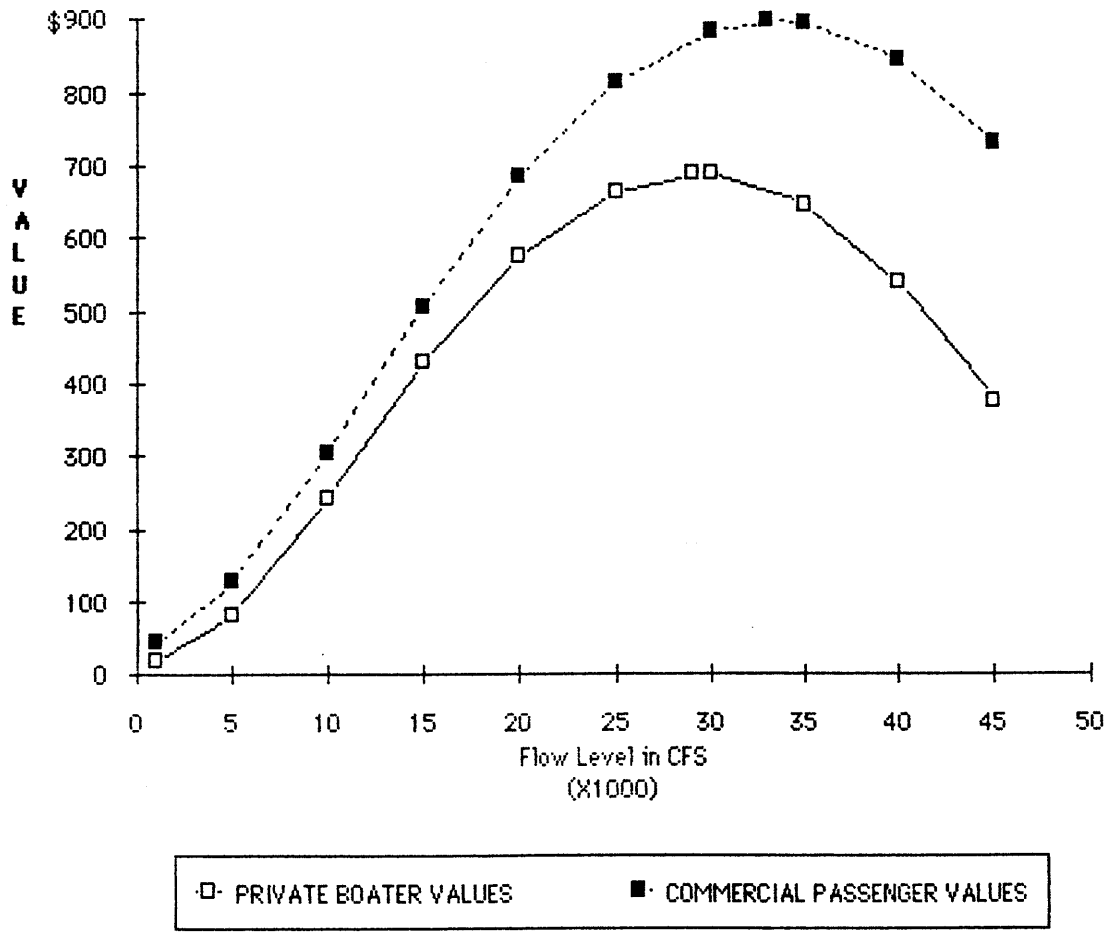
We found that surplus values varied with the average flow level experienced as well as trip type (commercial or private).[2] Commercial passenger constant flow surplus values follow a similar pattern, rising from $47 per trip at 1,000 cfs to a maximum of $898 at 33,000 cfs, and then declining to $732 at 45,000 cfs. For private boaters, constant flow surplus values are $21 per trip at an average flow of 1,000 cfs and rise to a maximum of $688 at 29,000 cfs, and then decline to $376 at 45,000 cfs. Thus, surplus values of commercial passengers are higher than those for private passengers at all flow levels (Figure 1).[3] It is illustrative to note that the magnitude of the difference between private boater and commercial passenger surplus values increases from $26 at 1,000 cfs to $356 at an average flow of 45,000 cfs.

2/ The statistical results from the analysis of each of the contingent-valuation questions (for the actual trip and the seven scenarios) are reported in Appendix B.

3/ The values plotted in Figure 1 and summarized above can be thought of as surplus values associated with constant flow levels. The average daily fluctuation experienced by respondents was 6,700 cfs which is probably not readily noticeable to most white water boaters. Only 12 percent of the respondents experiencing daily fluctuations in excess of 10,000 cfs, so we did not have a sufficient number of these types of observations to make any inferences about fluctuating flow surplus values from the actual trip data.

Figure 1

Flow Specific Surplus Values for Respondents' Actual Trips



The optimum flow level for commercial passengers (33,000 cfs), as indicated by surplus values, is 4,000 cfs higher than the optimum flow level for private boaters (29,000 cfs). It is also important to note that private boater surplus values decline faster at flow levels above their optimum than do those for commercial passengers. These results may be due to the fact that commercial passengers have a professional guide who is familiar with the river and, as a result, they can enjoy the larger "roller coaster" ride through rapids at high flow levels without the concerns of handling a boat. Private boaters, on the other hand, may have to give more consideration to maneuvering their rafts through rapids at higher flows and they do not have the experience with Grand Canyon boating that commercial guides do.

Several other types of variables were also examined to determine if they significantly affected actual trip surplus values. The type of boat used (motor raft, oar raft, paddle raft, kayak, or dory) did not affect surplus values. Private boater surplus values, however, were significantly reduced if they had to share a beach for camping or felt crowded with other boaters on the river. These variables did not significantly affect surplus values for commercial passengers. This result could be due to differing expectations between these two groups of respondents. As noted previously, private boaters may desire more of a wilderness experience and commercial passengers, in contrast, may expect to meet other people because of the type of trip they are taking.

Commercial passengers' surplus values were significantly reduced if the water level they experienced was lower than they desired, although this variable did not significantly affect private boaters' surplus

values. This result may arise for the same reason we suggested that the optimum flow levels for these two groups are different. For a full discussion of the variables analyzed in conjunction with the actual trip valuation question, the reader should refer to Appendix B.

In addition to their actual trip, respondents were also asked to evaluate seven scenarios describing Grand Canyon white water raft trips under different conditions. Six of the scenarios described trips under different flow release patterns, and the seventh described a longer range scenario where the size and number of beaches available for camping is reduced from present levels. To evaluate each scenario, respondents surplus values, over and above their actual trip expenditures were calculated.

Case 1 - Constant Flow of 5,000 cfs

The first scenario that respondents were asked to evaluate was a constant flow of 5,000 cfs. This flow was described in the survey as follows:

> **At a constant flow of 5,000 cfs, the speed of the river is relatively slow, reducing time for side canyon visits and other attractions. Boaters must break camp early to stay on schedule. Although rapids are present at this low water level, the waves are smaller and do not produce the big "roller coaster" ride created by higher flows. Due to exposed rocks, some rapids may be so difficult that it is likely passengers would have to walk around them. However, camping opportunities are abundant with many large sandy beaches exposed.**

Over 90 percent of all respondents felt that this scenario represented a trip that would be worse than the one that they actually experienced (Table 11). This feeling is represented by the surplus values of $233

and $176 per trip that private boaters and commercial passengers, respectively, assigned to this scenario. These values are substantially less than the optimum surplus values for these two groups derived from the actual trip data.

Table 11. Rating of Case 1 Relative to Actual Trip

Rating	Commercial	Private
Better	0%	4%
About the Same	4	3
Worse	96	93

Case 2 - Flow of 5,000 cfs with Fluctuations

In this scenario respondents were asked to evaluate an average daily flow of 5,000 cfs with large fluctuations from a low of 1,000 cfs to a high of 17,000 cfs within a 24 hour period. The scenario description was as follows:

> **With flows fluctuating daily from 1,000 to 17,000 cfs, around an average daily flow of 5,000 cfs, most people are aware of changes in the water level. Trip speed is relatively slow, reducing time for side canyon visits, and boaters must break camp early to stay on schedule. Large sandy beaches are generally abundant, but boatmen must take care selecting mooring sites. Occasionally, due to low water in the morning, gear will have to be carried a long ways (perhaps across slippery rocks) to be loaded on the boats. Boatmen may have to wait above certain rapids for the water to rise, or hurry to get to a rapid before the water falls. Due to exposed rocks, some rapids may be so difficult that it is likely passengers would have to walk around them. At other rapids, however, higher flows may produce large waves and a bigger "roller coaster" ride than at a low constant flow.**

Respondents were first asked whether they would prefer a trip with low water and large daily fluctuations, as described above, or low water with small daily fluctuations. Given these two alternatives, private boaters were more likely to prefer low water with small fluctuations, while commercial passengers indicated a preference for low water with large fluctuations (Table 12). These findings appear to be consistent with the type of trips each group experienced. Commercial passengers do not need to be concerned with the management of a boat so that they may enjoy the large fluctuations at a low flow level because they can get a bigger "roller coaster" ride through rapids at the high end of the fluctuation. On the other hand, private boaters must consider the effect that fluctuations have on their trip schedule and the care of their boat(s).

Table 12. Respondents' Preferences for Fluctuations at Low Flow Levels

Preference	Commercial	Private
Low water/small fluctuations	30%	49%
Low water/large fluctuations	60	42
Makes no difference	10	9

Commercial passengers' preference for low water with large daily fluctuations relative to low water with small daily fluctuations is supported by the surplus value they assigned to this scenario. The surplus value commercial passengers assigned to this scenario is $226 per trip, which is significantly different from the value of $176 that they placed on the 5,000 cfs constant flow scenario. The surplus value for private boaters is $241 per trip which is not

statistically different from the comparable surplus value reported for the 5,000 cfs constant flow scenario of $233 per trip.[4]

Case 3 - Constant Flow of 13,000 cfs

In this scenario respondents evaluated a moderate constant flow level of 13,000 cfs. The scenario description is:

> **At moderate water levels (around 13,000 cfs), the pace of the river is slightly faster than at low flows, leaving a little more time for hiking in side canyons and stops at attractions. Most boating groups will not have a problem staying on schedule. Rapids tend to have larger waves and provide a little more of a "roller coaster" ride than at low water. Passengers may have to walk around only a few rapids. Campsites are still large and plentiful.**

Most respondents indicated that this trip would be about the same or worse than their actual trip (Table 13). This result is not surprising given that an average flow of 13,000 cfs is still considerably below the flow level most respondents experienced as well as the optimum flow levels derived from the actual trip valuation data.

The surplus values assigned to this scenario are $504 per trip for private boaters and $488 per trip for commercial passengers. These values are both significantly larger than the respective surplus values reported for the 5,000 cfs constant flow scenario.[5]

4/ The χ^2 statistics for these tests are 7.46 and 0.08, respectively, with two degrees of freedom. These statistics indicate that the null hypothesis of no difference can be rejected at the 0.10 level for commercial passengers, but cannot be rejected for private boaters.

5/ The χ^2 statistics for these tests are 88.42 for commercial passengers and 31.60 for private boater's with two degrees of freedom, indicating that the null hypothesis can be rejected at the 0.10 level.

Table 13. Rating of Case 3 Relative to Actual Trip

Rating	Commercial	Private
Better	15%	25%
About the Same	32	36
Worse	53	39

Case 4 - Constant Flow of 22,000 cfs

Case 4 is another constant flow scenario for which respondents were asked to evaluate a moderately high flow of 22,000 cfs. The scenario was described as follows:

> **At moderately high water levels (around 22,000 cfs), the pace of the river is faster than at lower flows, leaving more time for side canyons and stops at attractions. Boating groups do not have a problem staying on schedule. Rapids have larger waves and provide a bigger "roller coaster" ride than at moderate water. Only a few passengers choose to walk around some of the bigger rapids for their safety. Some potential campsites are under water in some areas of the canyon, but generally campsites are plentiful although a bit smaller in size.**

A majority of the respondents from each trip type felt that this description was about the same as the trip they actually experienced (Table 14). This result is not surprising since this scenario comes the closest to describing the actual flow levels experienced by most of the respondents. Overall, private boaters assigned a surplus value of $525 per trip to this scenario, while the surplus value for commercial passengers is $602 per trip. The surplus value for commercial passengers is statistically larger than the respective value reported for the 13,000 cfs constant flow scenario of $488. The same comparison for private boaters resulted in the conclusion

that a significant difference did not exist between the 13,000 cfs and 22,000 cfs constant flow scenario values.[6]

Table 14. Rating of Case 4 Relative to Actual Trip

Rating	Commercial	Private
Better	22%	30%
About the Same	67	66
Worse	11	4

Case 5 - Flow of 22,000 cfs With Fluctuations

Case 5 is similar to Case 4 except that respondents were asked to evaluate an average flow of 22,000 cfs with daily fluctuations from a low of 10,000 cfs to a high of 34,000 cfs. This scenario was described in the following manner:

> **With large daily fluctuations from 10,000 cfs - 31,500 cfs, around an average daily flow of 22,000 cfs, most people are aware of water level changes. The boatmen will have to take more care in selecting mooring and camping sites. Due to low water levels in the morning, gear may have to be carried (perhaps across rocky areas) to be loaded on the boats. Boatmen may decide to wait above certain rapids for the water level to rise or may have to hurry to get to a certain rapid before the water level falls. In addition, some rapids may be difficult due to exposed rocks at low water levels and other rapids might be quite large at high water levels, and it is likely that passengers may have to walk around a few rapids. When the water is high or rising, however, the standing waves in some of the major rapids become larger, resulting in a bigger "roller coaster" ride.**

6/ The χ^2 statistics for these tests are 8.08 and 0.90, respectively, with two degrees of freedom. These statistics indicate that the null hypothesis of no difference can be rejected at the 0.10 level for commercial passengers and cannot be rejected for private boaters.

The majority of respondents, regardless of trip type, said they would prefer to experience moderately high water with small fluctuations rather than moderately high water with large fluctuations (Table 15).

Table 15. Respondents' Preferences for Fluctuations at Moderately High Flow Levels

Rating	Commercial	Private
Moderately high water/ small fluctuations	81%	89%
Moderately high water/ large fluctuations	11	7
Makes no difference	8	4

The surplus values for this scenario are $384 per trip for private boaters and $467 for commercial passengers. These values are both significantly lower than the respective surplus values reported for the 22,000 cfs constant flow scenario.[7]

Case 6 - Constant Flow of 40,000 cfs

Case 6 is the final flow specific scenario respondents were asked to evaluate and was described in the following manner:

> **At high water levels (around 40,000 cfs), the current is fast. Trips are able to stop at additional side canyons and spend additional time at attraction sites. Fewer rapids are present, as some of the smaller rapids are "washed out." In other rapids, however, the waves are very large and some passengers, especially those on oar powered trips, face an increased likelihood of having to walk around one or more of the major rapids for their safety. Campsites become more scarce as sandbars and shore areas are flooded, and campsites are much smaller. In some areas of the Canyon, there is an increased chance of camping with or near other groups.**

7/ The χ^2 statistics for these tests are 7.59 for private boaters and 12.21 for commercial passengers, with 2 degrees of freedom, indicating that the null hypothesis of no difference can be rejected at the 0.10 level.

Most respondents felt that this scenario described a trip that would be about the same or worse than their actual experience (Table 16). This result appears to be consistent with the previously reported findings in that 40,000 cfs is a higher flow level than most respondents experienced and it is also higher than the optimum flows derived from the actual trip valuation data.

Table 16. Rating of Case 6 Relative to Actual Trip

Rating	Commercial	Private
Better	7%	8%
About the Same	27	36
Worse	66	56

The surplus values respondents assigned to this scenario reflect these feelings, $434 per trip for private boaters and $439 for commercial passengers. The value for commercial passengers is significantly lower than the respective surplus value reported for the 22,000 cfs constant flow scenario. However, a statistically significant difference does not exist between the 22,000 and 40,000 cfs constant flow scenario values for private boaters.[8]

8/ The χ^2 statistics for these tests are 21.62 and 3.21, respectively, with 2 degrees of freedom. These results indicate that the null hypothesis of no difference can be rejected at the 0.10 level for commercial passengers and cannot be rejected for private boaters.

Case 7 - Beaches Reduced

This scenario is not anchored at a particular flow level. Rather, respondents were asked to evaluate a scenario where the number of sand beaches available for camping are substantially reduced. The scenario description is as follows:

> **There are indications that certain types of flow patterns in the long run may reduce the number of sandy beaches in the Grand Canyon. At present, the area between Hance Rapids and Havasu has fewer beaches than other parts of the canyon. Trip leaders must plan schedules very closely to ensure a good campsite in this area. As beaches disappear, this careful planning would have to be extended to other parts of the canyon.**
>
> **This planning might mean missing some attraction sites to get to camp early or longer stops at some attraction sites. Fewer beaches would increase the likelihood of camping near other parties and perhaps sharing a beach with other parties. Some camps might have to be made in areas without any sand.**

Although the scenario is not developed in conjunction with a specific flow regime, it is important to remember that the size and number of sand beaches is directly related to river flows, i.e., at high flow levels the number and size of beaches is reduced. Private boaters placed a surplus value of $377 per trip on this scenario and the value for commercial passengers is $413 per trip, indicating that a reduction in the number of beaches would substantially decrease the surplus value that boaters place on their Grand Canyon white water trips. Only the constant flow and fluctuating flow scenarios at 5,000 cfs have lower surplus values.

Summary

The optimum constant flow levels, according to the analysis of the actual trip data, occur at average flows of 29,000 and 33,000 cfs for private boaters and commercial passengers, respectively. The highest scenario surplus values, however, occur at a constant flow of 22,000 cfs. We believe this difference is simply due to the fact that we did not anchor a scenario in the flow range from 29,000 to 33,000 cfs. If we had selected a scenario which was anchored, say at an average flow of 31,000 cfs, we strongly suspect that this would have been the scenario which resulted in the highest surplus value across all scenarios.

Despite the fact that we did not select a scenario that was anchored at a moderately high flow, the surplus values for constant flow scenarios do show a great deal of consistency when plotted against the actual trip surplus values. This comparison is done for commercial passengers in Figure 2 and for private boaters in Figure 3. The scenario values, for both groups of respondents, are somewhat higher than the actual trip values at flows below 15,000 to 20,000 cfs. At higher flows the direction of the difference is reversed. Given these graphic representations of the relationships between average flow levels and surplus values, one can see why we believe that a scenario anchored at a constant flow of 31,000 cfs may have resulted in the highest surplus value across all scenarios.

Figure 2

Commercial Boater Surplus Values for Flow Specific Scenarios and Respondents' Actual Trip

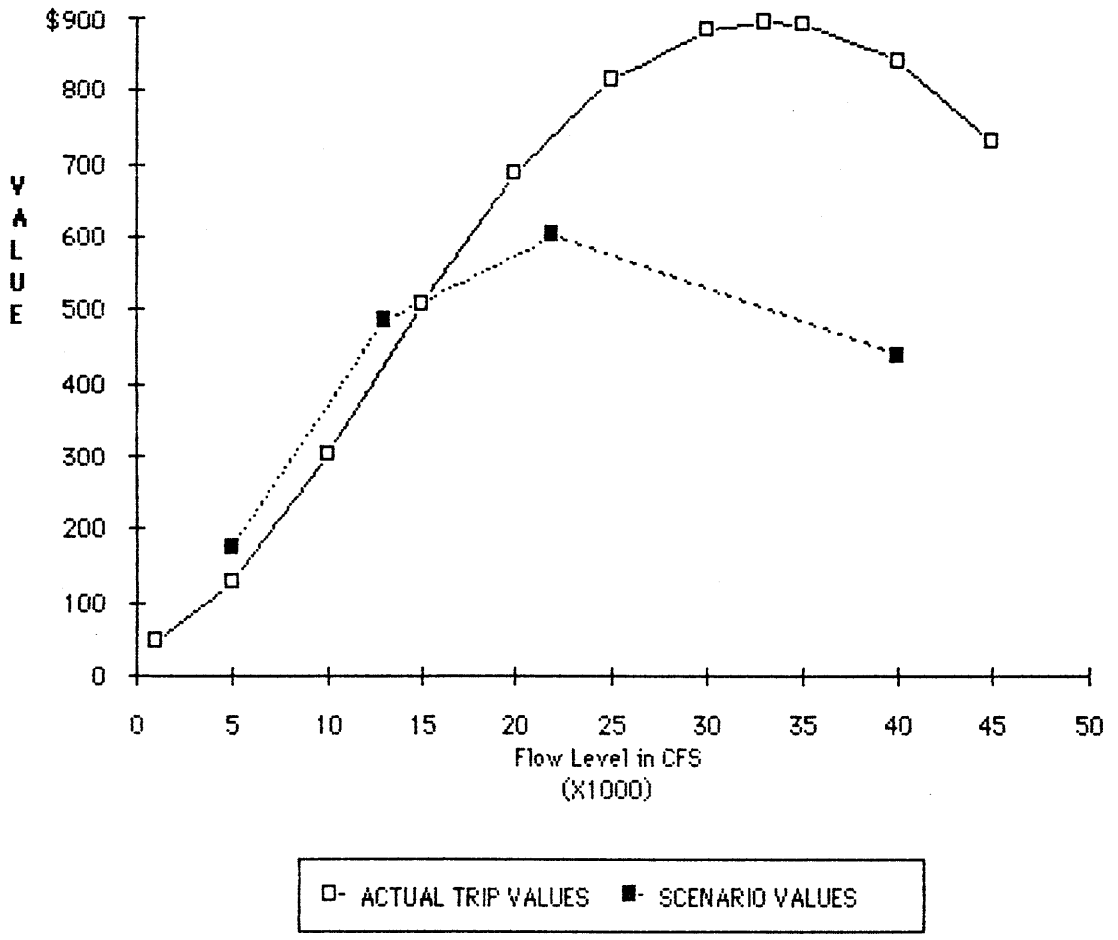
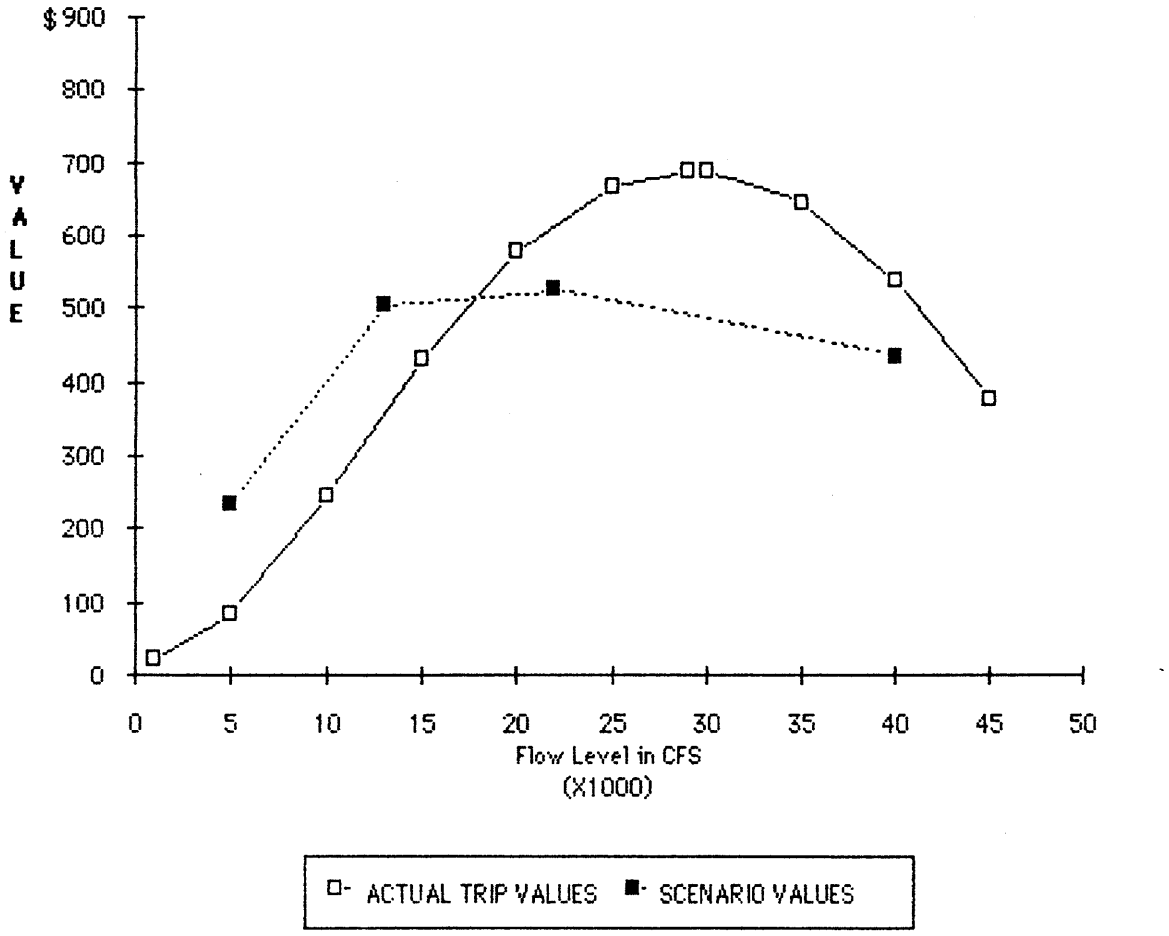


Figure 3

Private Boater Surplus Values for Flow Specific Scenarios and Respondents' Actual Trip



The surplus values for each of the scenarios are summarized in Table 17. For low flows, large fluctuations around an average flow of 5,000 cfs significantly increased surplus values, relative to a constant flow, for commercial passengers, but did not affect private boater values. At a moderate flow of 22,000 cfs, large daily fluctuations significantly reduced surplus values for both groups of respondents. A high constant flow of 40,000 cfs produced lower surplus values than moderate constant flows of 13,000 and 22,000 cfs, but were higher than those for a low constant flow of 5,000 cfs. Finally, a substantial reduction in the number of sand beaches for camping would substantially reduce surplus values, and only the 5,000 cfs scenarios recorded lower surplus values.

Table 17. Estimated Scenario Surplus Values ($ PER TRIP)

Scenario	Commercial Passengers	Private Boaters
5,000 cfs	$176	$233
5,000 cfs with fluctuations	226	241
13,000 cfs	488	504
22,000 cfs	602	525
22,000 cfs with fluctuations	467	384
40,000 cfs	439	434
Beaches reduced	413	377

CONCLUSIONS

Sampled commercial passengers and private boaters were quite willing to participate in the survey and completed questionnaires were received from 87 percent of those selected in the sample. In addition, respondents did not seem to have any major problems evaluating the scenarios and none of the associated valuation questions had an item nonresponse problem.

The optimum constant flow level for private boaters, as indicated by surplus values, is 29,000 cfs, while the optimum constant flow level for commercial passengers is 33,000. These optimum flows were calculated from the analyses of the valuation question associated with respondents' actual trips. The surplus values for the constant flow scenarios correspond quite well with the relationship developed between average flows and surplus values for respondents' actual trips. This result indicates that respondents were consistent in their responses to the actual trip valuation question and the responses to the valuation questions for each of the constant flow scenarios.

Only 12 percent of the respondents experienced daily fluctuations in flow levels in excess of 10,000 cfs. Thus, we did not have enough observations to draw any inferences about fluctuating flow surplus values from the actual trip data. The potential for this type of problem was anticipated in the study design and the scenarios were developed to describe Grand Canyon boating experiences under a wide range of flow regimes. From the analyses of respondents' answers to the scenario valuation questions, we found that fluctuations in daily flows significantly increase commercial passenger surplus values at a

low average flow of 5,000 cfs. In contrast, private boater surplus values were unaffected by fluctuations around an average daily flow of 5,000 cfs. At a moderate flow of 22,000 cfs, however, fluctuations in daily flow levels significantly reduce surplus values for both commercial passengers and private boaters.

Given the findings reported above, we would conclude that the Grand Canyon White Water Boater Contingent-Valuation Survey was quite successful. The results are internally consistent and match well with the preferences expressed by white water boaters in the earlier attribute survey, and the flow preferences of the commercial white water guides and private trip leaders collected in a separate survey. The resulting surplus values, therefore, seem to be adequate for the next stage in the analysis, the evaluation of alternative annual flow regimes.

APPENDIX A. WHITE WATER BOATERS' CONTINGENT-VALUATION SURVEY: FREQUENCY DISTRIBUTIONS OF RESPONSES

In this first section, we are interested in finding out about your white water trip in the Grand Canyon and how much you enjoyed it.

A1. Overall, how would you rate your white water trip? (CIRCLE ONE NUMBER)

0%	POOR
1	FAIR, it just didn't work out very well
2	GOOD, but a number of things could have been different
9	VERY GOOD, but could have been better
54	EXCELLENT, only minor problems
34	PERFECT

A2. Where did you put-in (start trip)? (CIRCLE ONE NUMBER)

94%	LEE'S FERRY
6	PHANTOM RANCH

A3. Where did you take-out (end trip)? (CIRCLE ONE NUMBER)

13%	PHANTOM RANCH
1	HAVASU
9	WHITMORE WASH
4	LAVA FALLS
42	DIAMOND CREEK
31	LAKE MEAD

A4. How long was your trip? 11 (ave.) DAYS

A5. What type of boat were you on? (CIRCLE ONE NUMBER)

33%	MOTOR POWERED RAFT
44	OAR POWERED RAFT
6	DORY
8	KAYAK
9	PADDLE RAFT

A6. Was your Grand Canyon white water trip: (CIRCLE ONE NUMBER)

67% RUN BY A COMMERCIAL OUTFITTER

33 A PRIVATE TRIP-->Were you primarily responsible for operating a boat on this trip?

55% YES

45 NO

A7. How many times have you taken a white water trip on the Colorado River below Lee's Ferry, including this trip?

___2___ TIMES (ave.)

A8. If you had the opportunity, would you take a Grand Canyon white water trip again? (CIRCLE ONE NUMBER)

1% DEFINITELY NOT

3 PROBABLY NOT

17 PROBABLY YES

79 DEFINITELY YES

A9. On average, how crowded did you feel the river was while you were floating? (Circle the number on the scale best representing your feelings.)

14%	21%	25%	11%	11%	10%	6%	1%	1%
1	2	3	4	5	6	7	8	9
not at all crowded		slightly crowded		moderately crowded			extremely crowded	

Rapids are an important part of the Grand Canyon trip for many people. In this next section, we would like to get your expectations and feelings about the rapids.

A10. What role did rapids play in your decision to take this trip? (CIRCLE ONE NUMBER)

- 9% RAPIDS WERE THE MOST IMPORTANT REASON FOR TAKING THE TRIP
- 52 RAPIDS WERE ONE OF THE TWO OR THREE MOST IMPORTANT REASONS FOR
- 33 TAKING THE TRIP
- 6 RAPIDS WERE ONLY ONE OF MANY IMPORTANT REASONS FOR TAKING THE TRIP
- 0 RAPIDS WERE NOT AN IMPORTANT REASON FOR TAKING THE TRIP

A11. Did you have to walk around any rapids?

- 84% NO
- 16 YES---->Which rapids? **Crystal, Duebendorff, Hance, Lava**

A12. In general, which type of rapid did you enjoy most on this trip: (CHOOSE ONE)

- 53% BIG RAPIDS
- 16 MEDIUM RAPIDS
- 1 SMALL RAPIDS
- 29 LIKED ALL TYPES OF RAPIDS EQUALLY
- 1 DON'T LIKE RAPIDS

Besides rapids, the water level on the river may also affect a person's trip. In this next section, we are interested in your feelings about the water level during your trip.

A13. If you had the choice, would you have preferred the overall water level to be: (CIRCLE ONE NUMBER)

12% LOWER

57 ABOUT THE SAME

13 HIGHER

18 DON'T KNOW OR DOESN'T MATTER

A14. Did you notice whether the water level changed during your trip?

31% NO

69 YES----->How often did you notice it changing? (CIRCLE ONE)

23% EVERY DAY

30 ALMOST EVERY DAY

47 ONLY ON A FEW DAYS

----->What made you aware of the water level change?

Most frequent responses: beached boats, change in shoreline, water lines on rocks, water level different at night, size of beaches

A15. Do you think that daily fluctuations in the water level would make you feel more or less like you were in a natural setting? (CIRCLE ONE NUMBER)

3% MUCH MORE LIKE A NATURAL SETTING

6 SOMEWHAT MORE LIKE A NATURAL SETTING

22 NATURAL SETTING REGARDLESS OF FLUCTUATIONS

24 SOMEWHAT LESS LIKE A NATURAL SETTING

31 MUCH LESS LIKE A NATURAL SETTING

14 DON'T KNOW

A16. If you had a choice, would you have preferred a trip with daily fluctuations in the water level or one with a constant water level? (CIRCLE ONE NUMBER)

10% I WOULD PREFER A TRIP WITH DAILY FLUCTUATIONS

57 I WOULD PREFER A TRIP WITH CONSTANT WATER LEVELS

33 MAKES NO DIFFERENCE TO ME

A17. On your trip, did you feel you had enough time to hike the side canyons and see other attractions? (CIRCLE ONE NUMBER)

73% YES, THERE WAS ENOUGH TIME FOR HIKING

26 NO, THERE WAS NOT ENOUGH TIME FOR HIKING

1 THERE WAS TOO MUCH TIME FOR HIKING

A18. Did you ever have to share the beach where you were camping with other groups during your trip? (CIRCLE ONE NUMBER)

70% NO

30 YES----->How many nights did this happen? (CIRCLE ONE NUMBER)

61% ONE NIGHT

24 TWO NIGHTS

12 THREE NIGHTS

3 FOUR OR MORE NIGHTS

A19. Could you see the camps of other groups from any of your campsites during your last trip? (CIRCLE ONE NUMBER)

38% NO

62 YES----->Were these groups sharing the beach with your group or did they have a separate beach? (CIRCLE ONE)

20% WE SHARED THE BEACH

77 THEY WERE ON A SEPARATE BEACH

3 BOTH

A20. If you had a choice, would you prefer a campsite: (CIRCLE ONE)

1% ON THE SAME BEACH AS ANOTHER PARTY

3 WHERE YOU MIGHT BE ABLE TO SEE OR HEAR ANOTHER PARTY

96 OUT OF SIGHT AND HEARING OF OTHERS

In this next section we would like to find out how you traveled to the Grand Canyon and what types of items you purchased for your white water trip. This information will help us to compare your responses with those of other people.

A21. How would you best describe your reason(s) for taking your Grand Canyon white water boat trip? (CIRCLE ONE NUMBER)

33% THE WHITE WATER BOAT TRIP WAS THE ONLY REASON FOR MAKING THE TRIP

30 THE WHITE WATER BOAT TRIP WAS THE MOST IMPORTANT REASON FOR MAKING THE TRIP

36 THE WHITE WATER BOAT TRIP WAS ONE OF SEVERAL EQUALLY IMPORTANT REASONS FOR TAKING THE TRIP

1 THE WHITE WATER BOAT TRIP WAS NOT AN IMPORTANT REASON FOR MAKING THE TRIP

A22. Was any part of your trip to the Grand Canyon by airplane? (CIRCLE ONE NUMBER)

48% YES----->How much time did it take to fly one way?

__4__ TOTAL HOURS OF FLYING **(ave.)**

52 NO

A23. Did you drive at least part of the way to the Grand Canyon for your white water trip?

79% YES----->How much time did you spend driving one way?

__1.7__ DAY(S) DRIVING **(ave.)** __14.1__ TOTAL HOURS OF DRIVING **(ave.)**

21 NO----->Skip to **question A26, next page**

A24. What type of vehicle did you use to get to the Grand Canyon? (CIRCLE ONE NUMBER)

11% FULL SIZED AUTOMOBILE

11 INTERMEDIATE SIZED AUTOMOBILE

14 COMPACT AUTOMOBILE

14 SMALL TRUCK (Toyota, Chevy S10, Bronco II, etc.)

36 R.V., FULL SIZE TRUCK, VAN

13 BUS

1 MOTORCYCLE

A25. How many people travelled with you (in the same vehicle) to the Grand Canyon?

MYSELF AND __5__ OTHER PEOPLE **(ave.)**

A26. Please estimate how much your trip cost (COSTS FOR YOU INDIVIDUALLY, EITHER PAID BY YOURSELF OR BY OTHERS). Include only money spent on items specifically for this trip. If a certain item was not purchased for this trip, please put $0.

	Commercial (ave.)	Private (ave.)
Payment to Rafting Company	$ 900	$ --
Gas and Oil for vehicle	$ 40	$ 68
Airfare	$ 182	$ 42
Car Rental	$ 23	$ 4
Food and Beverages	$ 76	$ 162
Personal gear (suntan lotion, sun glasses, film for camera)	$ 78	$ 59
Lodging, Camping (before and after white water trip)	$ 83	$ 24
Boat Gear (oars, lines, etc.)	$ --	$ 93
Equipment rental	$ --	$ 25
Take out at Diamond Creek	$ --	$ 7
Vehicle shuttle	$ --	$ 28
Tow across Lake Mead	$ --	$ 6
Other (please specify) _____	$ 42	$ 74
TOTAL AMOUNT TRIP COST (Please add all payments and fill in the total on this line)	$ 1406*	$ 557*

A27. Would you still have gone on the Grand Canyon white water trip if your costs had been $_____ **more** than the total you just calculated in Question A26? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

***Items do not add exactly to total due to rounding and respondent computational errors.**

PLEASE READ CAREFULLY

Many factors influence the quality of Grand Canyon white water trips. For example, in a recent survey white water boaters told us that things like good weather, good social interaction, good guides and trip leaders, the number of layovers at attraction sites, running rapids, good food, and many other things would contribute to an excellent or perfect trip. The present survey, however, is focusing specifically on those aspects of the trip that are affected by water flows in the Colorado River.

Water flows in a river like the Colorado are often measured in cubic feet per second (cfs) passing a given point. For our study, water flows are being described in terms of four categories: low flows (5,000 cfs), moderate flows (13,000 cfs), moderately high flows (22,000 cfs), and high flows (40,000 cfs) as measured by releases at Glen Canyon Dam, the last dam above the Grand Canyon. These flow levels are only a few of the many alternative flows that are possible given legal restrictions on releases from Glen Canyon Dam and they are being used here to find out about your preference for various Colorado River flows through the Grand Canyon.

The amount of water being released from Glen Canyon Dam can also vary from time to time within any one day. These daily fluctuations, when they occur, typically follow a regular pattern. Flow releases from the Dam increase during the morning to provide high water during the afternoon, and decrease in the late afternoon and evening, resulting in low water at night and in the early morning hours.

In the case descriptions that follow, we will describe the effects of each of these types of flow patterns. For each type of flow we would like you to tell us how it would affect the quality of a Grand Canyon white water trip for you. A previous study of boating in the Grand Canyon shows that white water boaters tend to give a high rating to their trip regardless of the flow they actually experienced. However, most boaters were able to indicate a preference for one type of flow over others. Information from this previous survey is presented as an aid in your evaluation of different river conditions and represents the general opinion of boaters in our previous study. Your opinion about water levels, however, may be different. For each type of condition, we would like you to tell us how the river flow would affect the quality of your white water trip.

Your white water trip in the Grand Canyon started on _____. Records show that during your trip the average water level was about _____ cfs, with daily changes ranging from an average daily low of _____ cfs to an average daily high flow of _____cfs.

CASE 1

At a constant flow of 5,000 cfs, the speed of the river is relatively slow, reducing time for side canyon visits and other attractions. Boaters must break camp early to stay on schedule. Although rapids are present at this low water level, the waves are smaller and do not produce the big "roller coaster" ride created by higher flows. Due to exposed rocks, some rapids may be so difficult that it is likely passengers would have to walk around them. However, camping opportunities are abundant with many large sandy beaches exposed.

B1. Do you think a Grand Canyon white water trip under the conditions described for Case 1 above would be better or worse than your last Grand Canyon white water trip? (CIRCLE ONE NUMBER)

1% MUCH BETTER
1 SOMEWHAT BETTER
3 ABOUT THE SAME
32 SOMEWHAT WORSE
63 MUCH WORSE

We would now like you to imagine that you are presently deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your last trip (e.g., the same people, same food, etc.) with <u>two exceptions</u>:

The water level would be constant at 5,000 cfs (see Case 1 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

B2. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP
NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 2

With flows fluctuating daily from 1,000 to 17,000 cfs, around an average daily flow of 5,000 cfs, most people are aware of changes in the water level. Trip speed is relatively slow, reducing time for side canyon visits, and boaters must break camp early to stay on schedule. Large sandy beaches are generally abundant, but boatmen must take care selecting mooring sites. Occasionally, due to low water in the morning, gear will have to be carried a long ways (perhaps across slippery rocks) to be loaded on the boats. Boatmen may have to wait above certain rapids for the water to rise, or hurry to get to a rapid before the water falls. Due to exposed rocks, some rapids may be so difficult that it is likely passengers would have to walk around them. At other rapids, however, higher flows may produce large waves and a bigger "roller coaster" ride than at a low constant flow.

B3. If you had to choose, which would you prefer: low water with small or no fluctuations or low water with large daily fluctuations? (CIRCLE ONE NUMBER)

36% LOW WATER WITH SMALL OR NO FLUCTUATIONS

54 LOW WATER WITH LARGE DAILY FLUCTUATIONS

10 MAKES NO DIFFERENCE TO ME

Now imagine that you are deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your last trip (e.g., the people, food, etc.) with <u>two exceptions</u>:

There would be large daily fluctuations from a low flow of 1,000 cfs to a high flow of 17,000 cfs around an average of 5,000 cfs (see description for Case 2 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

B4. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 3

At moderate water levels (around 13,000 cfs), the pace of the river is slightly faster than at low flows, leaving a little more time for hiking in side canyons and stops at attractions. Most boating groups will not have a problem staying on schedule. Rapids tend to have larger waves and provide a little more of a "roller coaster" ride than at low water. Passengers may have to walk around only a few rapids. Campsites are still large and plentiful.

C1. Do you think a Grand Canyon white water trip under the conditions described for Case 3 above would be better or worse than your last Grand Canyon white water trip? (CIRCLE ONE NUMBER)

4% MUCH BETTER
15 SOMEWHAT BETTER
33 ABOUT THE SAME
38 SOMEWHAT WORSE
10 MUCH WORSE

We would now like you to imagine that you are presently deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your trip (e.g., the same people, same food, etc.) with <u>two exceptions</u>:

The water level would be constant at 13,000 cfs (see description for Case 3 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

C2. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 4

At moderately high water levels (around 22,000 cfs), the pace of the river is faster than at lower flows, leaving more time for side canyons and stops at attractions. Boating groups do not have a problem staying on schedule. Rapids have larger waves and provide a bigger "roller coaster" ride than at moderate water. Only a few passengers choose to walk around some of the bigger rapids for their safety. Some potential campsites are under water in some areas of the canyon, but generally campsites are plentiful although a bit smaller in size.

D1. Do you think a Grand Canyon white water trip under these conditions (Case 4 above) would be better or worse than your last Grand Canyon white water trip? (CIRCLE ONE NUMBER)

8%	MUCH BETTER
16	SOMEWHAT BETTER
67	ABOUT THE SAME
8	SOMEWHAT WORSE
1	MUCH WORSE

We would now like you to imagine that you are presently deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your last trip (e.g., the people, food, etc.) with <u>two exceptions</u>:

The water level would be constant at 22,000 cfs (see description for Case 4 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

D2. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 5

With large daily fluctuations from 10,000 cfs - 31,500 cfs, around an average daily flow of 22,000 cfs, most people are aware of water level changes. The boatmen will have to take more care in selecting mooring and camping sites. Due to low water levels in the morning, gear may have to be carried (perhaps across rocky areas) to be loaded on the boats. Boatmen may decide to wait above certain rapids for the water level to rise or may have to hurry to get to a certain rapid before the water level falls. In addition, some rapids may be difficult due to exposed rocks at low water levels and other rapids might be quite large at high water levels, and it is likely that passengers may have to walk around a few rapids. When the water is high or rising, however, the standing waves in some of the major rapids become larger, resulting in a bigger "roller coaster" ride.

D3. If you had to choose, which would you prefer: moderately high water with small or no fluctuations or moderately high water with large daily fluctuations? (CIRCLE ONE NUMBER)

84% MODERATELY HIGH WATER WITH SMALL OR NO FLUCTUATIONS

9 MODERATELY HIGH WATER WITH LARGE DAILY FLUCTUATIONS

7 MAKES NO DIFFERENCE TO ME

Now imagine that you are deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your last trip (e.g., the people, food, etc.) with <u>two exceptions</u>:

There would be large daily fluctuations from a low flow of 10,000 cfs to a high flow of 31,500 cfs around an average of 22,000 cfs (see description for Case 5 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

D4. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 6

At high water levels (around 40,000 cfs), the current is fast. Trips are able to stop at additional side canyons and spend additional time at attraction sites. Fewer rapids are present, as some of the smaller rapids are "washed out." In other rapids, however, the waves are very large and some passengers, especially those on oar powered trips, face an increased likelihood of having to walk around one or more of the major rapids for their safety. Campsites become more scarce as sandbars and shore areas are flooded, and campsites are much smaller. In some areas of the Canyon, there is an increased chance of camping with or near other groups.

E1. Do you think a Grand Canyon white water trip under the conditions described above for Case 6 would be better or worse than your last Grand Canyon white water trip?

3% MUCH BETTER
5 SOMEWHAT BETTER
30 ABOUT THE SAME
37 SOMEWHAT WORSE
25 MUCH WORSE

We would now like you to imagine that you are presently deciding whether or not to go on a Grand Canyon white water trip. Imagine that the trip would be the same as your last trip (e.g., the people, food, etc.) with <u>two exceptions</u>:

The water level would be constant at 40,000 cfs (see Case 6 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

E2. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

CASE 7

There are indications that certain types of flow patterns in the long run may reduce the number of sandy beaches in the Grand Canyon. At present, the area between Hance Rapids and Havasu has fewer beaches than other parts of the canyon. Trip leaders must plan schedules very closely to ensure a good campsite in this area. As beaches disappear, this careful planning would have to be extended to other parts of the canyon.

This planning might mean missing some attraction sites to get to camp early or longer stops at some attraction sites. Fewer beaches would increase the likelihood of camping near other parties and perhaps sharing a beach with other parties. Some camps might have to be made in areas without any sand.

F1. If the number of beaches in the Grand Canyon were substantially reduced, the effects described above would become much more likely. We would like you to imagine that you are presently deciding whether or not to go on a Grand Canyon white water trip. All of the details of this trip would be the same as your last trip <u>with two exceptions</u>:

The number of beaches was substantially reduced (see Case 7 above)

AND

<u>Your individual</u> costs for the trip increased by $_____ (over the total cost you calculated on page 8, question A26)

F2. Would you go on this trip? (CIRCLE ONE NUMBER)

YES, I WOULD PAY THIS AMOUNT TO TAKE THE TRIP

NO, I WOULD NOT PAY THIS AMOUNT TO TAKE THE TRIP

In the previous case descriptions there were a number of different questions where we asked whether you would still take the white water trip if your expenses increased by a certain dollar amount.

To help us better understand your responses, we would like to know the extent to which various factors affected your answers. Please tell us whether the following statements were true or not for you when answering those questions. (CIRCLE ONE RESPONSE FOR EACH STATEMENT)

	Definitely True	Probably True	Probably False	Definitely False
G1. My main concern was that the Park Service might start charging a fee for <u>private</u> Grand Canyon white water trips.	14%	19%	18%	49%
G2. My main concern was that <u>rafting companies</u> might increase the price of commercial Grand Canyon white water trips.	15	28	21	36
G3. My responses reflected my best guess as to whether I would pay the specified amounts for the Grand Canyon white water trip.	66	29	2	3
G4. My responses reflected the fact that I feel the Grand Canyon white water boating experience should be maintained for all people to enjoy.	61	24	9	6
G5. I just don't know how much more I would really pay for a Grand Canyon white water trip regardless of the conditions.	21	39	23	17
G6. I just don't want to have to pay more for a Grand Canyon white water trip regardless of what the conditions would be.	23	25	27	25

G7. Other, please describe: **Most frequent response: concerned about quality of the experience**

PRIVATE BOATERS ONLY ANSWERED H1 AND H2

In this section we would like to know how you evaluate the chance of a boat flipping in specific rapids at specific flow levels.

H1. It has been suggested that the flow level in the river might affect the likelihood of boating accidents in the rapids. We would like your judgment as to the risk of flipping a boat (the type of boat **you** used for your 1985 Grand Canyon white water trip) in two specific rapids, under four different flow conditions.

Imagine that 100 boats of your type were run, by "average" boaters, through Crystal rapid at flows in the range of 3,000 to 9,000 cfs. How many of these boats do you think would flip? You would answer "zero" if you felt that none of these boats would flip in Crystal at these flows, and "100" if you feel that all of these boats would flip at these flows. Answering "50", for example, would indicate you believe that roughly half of the boats like yours would flip in Crystal at these flows. Please give us your best judgment (between 0 and 100) of the chance of flipping in these two rapids at the four flow conditions shown below. (PLEASE FILL IN THE BLANK FOR EACH CATEGORY)

(ave.)

HANCE RAPID:

11 boats out of every 100 would flip at daily flows between **3,000 and 9,000 cfs**

11 boats out of every 100 would flip at daily flows between **10,000 and 15,000 cfs**

14 boats out of every 100 would flip at daily flows between **16,000 and 31,000 cfs**

20 boats out of every 100 would flip at daily flows greater **than 32,000 cfs**

(ave.)

CRYSTAL RAPID:

15 boats out of every 100 would flip at daily flows between **3,000 and 9,000 cfs**

17 boats out of every 100 would flip at daily flows between **10,000 and 15,000 cfs**

23 boats out of every 100 would flip at daily flows between **16,000 and 31,000 cfs**

33 boats out of every 100 would flip at daily flows greater **than 32,000 cfs**

H2. For question **H1** you filled in eight numbers describing how many boats like yours might flip under various conditions. We would now like to know, in your judgment, if any of the numbers you reported in question **H1** are so high that you would have serious concerns about running the rapid(s) under those conditions. Please indicate whether the chances <u>you</u> reported of flipping are acceptable or unacceptable. (CIRCLE ONE NUMBER FOR EACH CATEGORY).

The chances I reported of flipping in **HANCE RAPID** are:

Acceptable	Unacceptable	
91%	**9%**	at a daily flow of **3,000 to 9,000 cfs**
95	**5**	at daily flows between **10,000 and 15,000 cfs**
95	**5**	at daily flows between **16,000 and 31,000 cfs**
89	**11**	at daily flows greater than **32,000 cfs**

The chances I reported of flipping in **CRYSTAL RAPID** are:

Acceptable	Unacceptable	
87%	**13%**	at a daily flow of **3,000 to 9,000 cfs**
93	**7**	at daily flows between **10,000 and 15,000 cfs**
94	**6**	at daily flows between **16,000 and 31,000 cfs**
73	**27**	at daily flows greater than **32,000 cfs**

In this final section, we would like to ask some questions about your background which will help us compare your answers with those of other people. We stress that <u>all</u> of your answers are strictly confidential.

I1. How old are you? 39 (ave.) YEARS OLD

I2. Are you: 64% MALE

36 FEMALE

I3. How many years of school have you completed? (CIRCLE OR CHECK THE HIGHEST YEAR OR LEVEL)

											7%
1	2	3	4	5	6	7	8	9	10	11	12

23%	Some college	21%	M.A., M.S.
34%	B.A. or equivalent	15%	Advanced degree (J.D., M.D., Ph.D)

I4. Please circle the response that comes closest to your total family income before taxes. (CIRCLE ONE NUMBER)

2%	Less than $10,000	6%	$45,000 to $49,999
6	$10,000 to $14,999	10	$50,000 to $59,999
5	$15,000 to $19,999	6	$60,000 to $69,999
8	$20,000 to $24,999	7	$70,000 to $79,999
10	$25,000 to $29,999	4	$80,000 to $89,999
7	$30,000 to $34,999	2	$90,000 to $99,999
5	$35,000 to $39,999	14	$100,000 or more
8	$40,000 to $44,999		

I5. With reference to your primary occupation, are you currently (CIRCLE ONE NUMBER):

74% EMPLOYED FULL-TIME

12 EMPLOYED PART-TIME

4 FULL-TIME HOMEMAKER

3 TEMPORARILY UNEMPLOYED

2 NOT EMPLOYED, NOT LOOKING FOR WORK

3 RETIRED, NOT WORKING

2 RETIRED, WORKING PART-TIME

APPENDIX B. STATISTICAL ANALYSES OF RESPONDENTS' ANSWERS TO THE CONTINGENT-VALUATION QUESTIONS

The surplus values presented in the body of this report were derived from the analyses of respondents' answers to the seven contingent-valuation questions in the survey. The procedure used to ask these valuation questions is commonly referred to as the "dichotomous-choice" technique. The application of this technique involved asking respondents whether they would pay a specific amount (offer), above and beyond their actual trip expenses, to take their actual trip and seven scenarios of plausible Grand Canyon white water trips. A separate valuation question was used for each of the eight trips. The offers for each of these valuation questions were randomly assigned to questionnaires based on the findings from the analyses of response to comparable questions in a pretest survey.

Respondents' answers to the valuation questions were analyzed using logit models. A logit model is a special case of a general group of models, known as probabilistic models, that can be used to analyze qualitative response data. The qualitative responses here are respondents' "yes" and "no" answers to the valuation questions. The general form of a logit model can be specified as

$$Pr(YES) = [1 + \exp(f(x))]^{-1}$$

where Pr(YES) is the probability that a respondent will answer yes to a specific valuation question, exp indicates exponential notation (e), and f(x) is a function of variables, including the offer, which may influence respondents' answers to the valuation questions. A separate logit equation is estimated for each valuation question so

the number and types of variables included in the f(x) term may vary with the situation being evaluated. For the current analyses the following functional form of the f(x) term was used:

$$f(x) = b_0 + \sum_{i=1}^{n} b_i X_i$$

where b_0 and the b_i are parameters to be estimated, the X_i are variables that are hypothesized to influence respondents' answers to a valuation question, and n is the number of variables included in a specific logit equation.

The estimated logit equations are used to calculate expected surplus values. That is,

$$Pr(NO) = 1 - Pr(YES)$$

since yes and no are the only possible answers to the valuation questions and the two answer categories are mutually exclusive events. Since Pr(NO) represents a cumulative distribution function (c.d.f.), the above equation can be rewritten as

$$Pr(NO) = F(X_1 | X_j,\ j=2,3,\ldots,n)$$

where F( ) is a c.d.f., X_1 is the offer from the valuation question and the X_j are fixed levels of the other variables in the logit equation. Thus, F( ) represents the probability that a typical respondent will answer no to a valuation question with a specific offer amount, given certain levels of the other variables (X_j's).

Surplus values that are conditioned on specified levels of the X_j variables are calculated from the estimated logit equations as:

$$E(X_1|X_j,\ j=2,3,\ldots,n) = \int_0^{X_{1t}} [1 - F(\bar{X}_1|X_j,\ j=2,3,\ldots,n)]dx_1$$

$$= \int_0^{X_{1t}} Pr(YES)dx_1$$

where E( ) denotes expected value and the right-hand side of the equation is the integral of the appropriate logit equation with the estimated parameters entered in the equation [Pr(YES)] and variables other than the offer evaluated at the specified levels. An unconditional surplus value is calculated as

$$E(X_1) = \sum_{j,k} [\int_0^{X_{1t}} Pr(YES)dx_1]g_j(x_{jk})$$

where this unconditional surplus value is simply the weighted average of all of the conditional surplus values calculated in the manner outlined above, $g_j(\ )$ are the observed probability distributions of the X_j variables, and X_{jk} is the kth value of jth variable. This calculation is based on the implicit assumption that all of the X_j variables have discrete probability distributions. For the current analyses this assumption will be true.

In the remainder of this appendix we will report the estimated logit equations that were used to calculate the surplus values reported in the text. The estimation results will be briefly discussed. However, the intent of this appendix is to simply document the estimated parameters.

Actual Trip

The variables examined in the logit analysis of respondents' answers to the actual trip valuation question are outlined below. These variables are:

X_1 = OFFER = the dollar amount from the actual trip valuation question;

X_2 = EXPENSE = the amount a respondent spent to take their actual trip;

X_3 = MOTOR = 1 if a respondents' trip was in a motor raft and 0 if not;

X_4 = PADDLE = 1 if a respondents' trip was in a paddle raft and 0 if not;

X_5 = DORY = 1 if a respondents' trip was in a dory and 0 if not;

X_6 = KAYAK = 1 if a respondent used a kayak and 0 if not;

X_7 = DAYS = the number of days spent on the river;

X_8 = CROWD = an integer scale, ranging from 1 to 9, reflecting how crowded a respondent felt the river was with other boaters during his or her trip;

X_9 = WALK = 1 if a respondent had to walk around a rapid and 0 if not;

X_{10} = WATERLVL = an integer scale, ranging from -1 to 1, reflecting a respondents' preference for an optimum flow level relative to what they actually experienced (-1 lower, 0=same, and 1=higher);

X_{11} = HIKING = 1 if a respondent felt that she or he had enough time for hiking and seeing attraction sites, and 0 if not;

X_{12} = SHARBEACH = 1 if a respondent ever had to share a beach for camping and 0 if not;

X_{13} = FEE = 1 if a respondent felt his or her answers to the valuation questions would affect the cost of Grand Canyon white water trips and 0 if not;

X_{14} = CONFIDENCE = 1 if a respondent was not confident in his or her answers to the valuation questions and 0 if not;

X_{15} = FEEOFFER = FEE multiplied by OFFER;

X_{16} = CONFIDENCEOFFER = CONFIDENCE multiplied by OFFER;

X_{17} = FLOW = average flow (in cfs) experienced by a respondent divided by 1,000; and

X_{18} = FLOWSQ = FLOW squared.

Four types of variables were included in the analysis. Variable X_1 is included because it is the dollar amount respondents were asked to consider in the actual trip valuation question. The offers ranged from $4 to $1729, with an average of $670. The assignment of specific dollar amounts to the surveys was random. The second group of variables, X_2 through X_{12}, are characteristics of respondents' actual trips, each of which may affect how a respondent answered the valuation question. The expense variable (X_2) can be thought of as representing the price of a Grand Canyon white water boating trip.

Contingent-valuation data sets are typically examined to identify responses to the valuation question that are deemed to be invalid. To address this issue we included variables X_{13} through X_{16}. The purpose of these variables was to determine whether respondents concerns about costs and confidence in their answers to the valuation questions would significantly affect surplus values. If the estimated parameters for either of these variables turns out to be significant, the variable(s) will be evaluated at a value of zero in the computation of surplus values. This will be done to control for these types of effects which should not enter into the computation of surplus values.

The average daily flow levels experienced were modeled as average flow and average flow squared to account for the fact that surplus values decline after some optimum flow level. We examined several different functional specifications of the flow variables and found that the specification using flow and flow squared fit the data best. We did not model fluctuating flow levels for the actual trip because only 12 percent of the respondents experienced a daily fluctuation in excess of 10,000 cfs, and the largest fluctuation experienced was 16,600 cfs.

We found that only a few of the variables outlined above had a statistically significant effect on respondents' answers to the actual trip valuation question. The variables with significant parameters for commercial passengers were: OFFER, EXPENSES, WATERLVL, FEE, FLOW, and FLOWSQ. For private boaters, the variables with significant parameters were: OFFER, EXPENSES, CROWD, SHARBEACH, FEE, FLOW, and FLOWSQ. Logit equations which only include these variables with significant parameters are presented in Table C1. Statistical significance is denoted by an asterisk to the upper right of an estimated parameter. The constant term (b_0) is statistically different from zero for commercial passengers, but is not for private boaters. Variables with significant parameters are interpreted as having a significant effect on respondents answers to the valuation question and, consequently, will affect calculated surplus values. Variables which have insignificant parameters, on the other hand, do not have an effect. It is important, and interesting, to note that the type of boat a respondent used did <u>not</u> have a significant effect on estimated surplus values. The estimated logit questions were used to compute the actual trip surplus values for constant flow levels plotted in Figure 1 of the text.

The omission of insignificant variables did not appear to have affected the magnitude of the estimated parameters for the included variables. The logic for estimating a logit equation that only includes variables with significant parameters is as follows. For survey data, each variable may have some missing observations associated with it since some respondents do not answer all of the questions in a survey. As a result, these missing responses censor the number of observations that can be used for estimation purposes. To make the best use of our data for

Table C1. Estimated Logit Parameters for Respondents' Actual Trip

Variable	Parameter	Equation	
		Commercial Passengers	Private Boaters
----------	b_0	3.4505*[a] (1.6913)[b]	0.4188 (2.2630)
OFFER	b_1	0.0037* (0.0005)	0.0052* (0.0013)
EXPENSES	b_2	-0.0011* (0.0003)	-0.0009* (0.0005)
CROWD	b_8	-------	0.5633* (0.1619)
WATERLVL	b_{10}	0.6691* (0.3134)	-------
SHARBEACH	b_{12}	-------	0.9737* (0.5030)
FEE	b_{13}	1.3898* (0.2909)	2.1228* (0.5300)
FLOW	b_{17}	-0.3115* (0.1117)	-0.4118* (0.1631)
FLOWSQ	b_{18}	0.0047* (0.0018)	0.0070* (0.0030)
-------	χ^2	320.95[c]	112.88
-------	N	303	150

a/ An asterisk denotes significance of the parameter at the 0.10 level.

b/ Numbers in parentheses are asymptotic standard errors.

c/ The χ^2 statistics are used to test the null hypothesis that all of the estimated parameters in an equation are zero simultaneously. The degrees of freedom are computed by subtracting one from the number of parameters estimated. The null hypothesis is rejected if the reported χ^2 statistic exceeds the table value for the appropriate degrees of freedom.

estimating the actual trip logit equation and the calculation of an actual trip surplus value, we created a data set for estimation purposes which only included the variables with statistically significant parameters and consequently were determined to have a significant effect on respondents' answers to the actual trip valuation question. Thus, there would be fewer observations censored by missing data and we could use more respondents' answers to the actual trip valuation question.

Most of the parameters in the estimated equation have the expected signs. It is important to note that due to the specific functional form of a logit equation, the signs on the parameters are reversed from what intuition might lead one to expect, based on a linear regression model. That is, one would expect the probability of a yes response to the valuation question to decline as the magnitude of the offer increases. For this result to occur in a logit equation, the parameter on the OFFER variable must have a positive sign.

An unexpected finding was that respondents' surplus values increased with the amount they spent to take their actual trip. This result contradicts what economic theory would tell us the sign on this variable should be. That is, the more an individual pays for their trip the lower should be their surplus values, all other factors equal. However, this is not the case here.

We also found that surplus values were significantly lower for respondents who felt their answers to the valuation questions would affect the cost of boating in the Grand Canyon. To control for this undesirable effect, the FEE variable was evaluated at zero for the computation of surplus values.

Finally, the optimum flow levels for both groups of respondents are computed by substituting the estimated logit parameter into the f(x) term from the logit equation and by taking the first derivative of [f(x)] with respect to the FLOW variable. This derivative when evaluated at zero can be used to solve for the optimum flow levels. The resulting flow is an optimum only if the second derivative of f(x) with respect to flow is negative.

Scenarios

A separate logit equation was estimated for each of the seven scenarios, and each of the equations included the same set of variables. The variables included in the logit equations for the scenarios are:

X_1 = OFFER;

X_2 = EXPENSE;

X_3 = FEE;

X_4 = CONFIDENCE;

X_5 = FEEOFFER; and

X_6 = CONFIDENCEOFFER.

All of these variables were defined for the actual trip logit equation so we will not repeat those definitions here. It is important to note, however, that the distribution of OFFERS varied across contingent-valuation questions for each of the scenarios.

The estimated logit equations for each of the scenarios are presented in Table C2 for commercial passengers and those for private boaters are presented in Table C3. The equations reported in Tables C2 and C3 were used to calculate the scenario surplus values reported in the text.

The reported equations do not include the FEE, FEEOFFER, CONFIDENCE, and CONFIDENCEOFFER variables as the analysis revealed that the parameters on these variables were not generally significant. So, we used the subset of variables with significant parameters for the estimated equations reported here. This is the same procedure we used for the analysis of the actual trip valuation data to make use of a larger number of respondents' answers to the valuation question.

The parameters for the OFFER variable in Tables C2 and C3 are significant in all of the equations, and the parameters on the EXPENSE variable are significant in nine of the fourteen equations. The parameter for the expense variable has the wrong sign in 13 of the 14 equations, a result we also observed in the estimates for the actual trip logit equations. For the equation where the parameter for the expense variable does have the correct sign, the parameter is insignificant.

Table C2. Estimated Logit Parameters for Scenario Equations — Commercial Passengers

Variable	Parameter	5,000 cfs Constant Flow	5,000 cfs W/Fluc	13,000 cfs Constant Flow	22,000 cfs Constant Flow	22,000 cfs W/Fluc	40,000 cfs Constant Flow	Beaches Reduced
-------	b_0	1.5982*[a] (0.5279)[b]	0.6880 (0.4499)	-0.5772 (0.4320)	-0.4373 (0.4637)	-0.7511* (0.4301)	-0.4896 (0.4333)	0.0659 (0.4094)
OFFER	b_1	0.0024* (0.0006)	0.0036* (0.0006)	0.0043* (0.0006)	0.0039* (0.0005)	0.0041* (0.0005)	0.0031* (0.0004)	0.0024* (0.0005)
EXPENSE	b_2	-0.0007* (0.0003)	-0.0007* (0.0003)	-0.0010* (0.0003)	-0.0013* (0.0003)	-0.0007* (0.0003)	-0.0004 (0.0003)	-0.0004* (0.0002)
-------	χ^2	257.15[c]	295.20	348.59	354.95	323.58	341.40	405.33
-------	N	325[d]	323	321	322	326	326	324

[a] An asterisk denotes significance of the parameter at the 0.10 level.

[b] Numbers in parentheses are asymptotic standard errors.

[c] The χ^2 statistics are used to test the null hypothesis that all of the estimated parameters in an equation are zero simultaneously. The degrees of freedom are computed by subtracting one from the number of parameters estimated. The null hypothesis is rejected if the reported χ^2 statistic exceeds the table value for the appropriate degrees of freedom.

[d] The sample sizes vary across logit equations because some of the respondents did not answer all of the valuation questions in the survey.

Table C3. Estimated Logit Parameters for Scenario Equations -- Private Boaters

Variable	Parameter	5,000 cfs Constant Flow	5,000 cfs W/Fluc	13,000 cfs Constant Flow	22,000 cfs Constant Flow	22,000 cfs W/Fluc	40,000 cfs Constant Flow	Beaches Reduced
-------	b_0	-0.3302 (0.3972)[a]	-0.2868 (0.3996)	-1.7769* (0.4553)	-1.8916* (0.5176)	-1.4730* (0.5483)	-1.7424* (0.4585)	-1.9645* (0.4693)
OFFER	b_1	0.0054*[b] (0.0011)	0.0050* (0.0010)	0.0049* (0.0008)	0.0044* (0.0008)	0.0055* (0.0009)	0.0047* (0.0008)	0.0055* (0.0010)
EXPENSE	b_2	-0.0011* (0.0004)	-0.0010* (0.0005)	-0.0011* (0.0005)	-0.0006 (0.0004)	-0.0010 (0.0007)	-0.0003 (0.0004)	0.0001 (0.0004)
-------	χ^2	134.16[c]	154.17	158.90	171.83	150.33	147.04	175.88
-------	N	166[d]	164	165	166	164	165	166

a/ Numbers in parentheses are asymptotic standard errors.

b/ An asterisk denotes significance of the parameter at the 0.10 level.

c/ The χ^2 statistics are used to test the null hypothesis that all of the estimated parameters in an equation are zero simultaneously. The degrees of freedom are computed by subtracting one from the number of parameters estimated. The null hypothesis is rejected if the reported χ^2 statistic exceeds the table value for the appropriate degrees of freedom.

d/ The sample sizes vary across logit equations because some of the respondents did not answer all of the valuation questions in the survey.

Evaluation of the Effect of Scenario Sequence on Surplus Values

Since we asked a total of eight valuation questions in the survey, we were concerned that the placement of any specific scenario in the sequence of white water boating experiences to be evaluated might have affected respondents' answers to that valuation question. For example, if the 5,000 cfs constant flow scenario was the first white water boating experience evaluated and there was a sequence effect, we might expect respondents to give different answers to the associated valuation questions than they would if this were the last experience evaluated. However, if there is not an ordering effect, respondents' answers should be the same regardless of the placement of any specific scenario within the sequence of scenarios to be evaluated.

To examine the potential for this type of problem we randomly assigned respondents to two groups and reversed the order in which these two groups evaluated the scenarios. Individuals in both groups were asked an actual trip valuation question first. The sequence in which the scenarios were presented varied between the two groups. The exact order in which the scenarios were presented is shown in Table C4. Note that a constant flow scenario always preceded the corresponding fluctuating flow scenario regardless of the overall sequence of the scenarios.

Table C4. Sequence in Which Scenarios were Evaluated

Ascending Order	Descending Order
Actual Trip	Actual Trip
5,000 cfs Constant Flow	Beaches Reduced
5,000 cfs With Fluctuations	40,000 cfs Constant Flow
13,000 cfs Constant Flow	22,000 cfs Constant Flow
22,000 cfs Constant Flow	22,000 cfs With Fluctuations
22,000 cfs With Fluctuations	13,000 cfs Constant Flow
40,000 cfs Constant Flow	5,000 cfs Constant Flow
Beaches Reduced	5,000 cfs With Fluctuations

To address the issue of whether the sequence of scenarios affected the surplus values we estimated separate logit equations for each of these groups for each of the scenarios and statistically tested for differences between the estimated logit coefficients for the Acending Order group and the comparable estimates from the Descending Order group. The χ^2 statistics for all pairwise comparisons are reported in Table C5. A statistically significant difference was identified for two of the comparisons for commercial passenger and three of the private boater scenario comparisons, i.e., the χ^2 statistics exceed 5.99 implying a significant difference at the 0.05 level. However, there does not appear to be a pattern to the occurrence of these significant differences and we would conclude that the sequence in which respondents evaluated the scenarios did not affect the calculated surplus values.

Table C5. Comparison of Logit Estimates for Ascending Order and Descending Order Groups

Scenario	χ^2 Statistics	
	Commercial Passengers	Private Boaters
5,000 cfs Constant Flow	4.19[a]	6.16*
5,000 cfs With Fluctuations	0.46	5.41*
13,000 cfs Constant Flow	5.39*[b]	11.14*
22,000 cfs Constant Flow	8.56*	8.80*
22,000 cfs With Fluctuations	5.91*	4.39
40,000 cfs Constant Flow	12.61*	2.61
Beaches Reduced	0.37	4.29

a/ The degrees of freedom corresponding to all of the χ^2 statistics are 2.

b/ An asterisk denotes a significant difference at the 0.05 level.