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AN OVERVIEW OF VARIOUS IMPACTS TO GRAND CANYON RIVER EXPERIENCES, WITH A FOCUS ON INTERGROUP ENCOUNTERS, FLOW LEVELS, AND THE 2000 LOW SUMMER STEADY FLOW EXPERIMENT

Contract #00PG400250

Submitted to:

Grand Canyon Monitoring and Research Center

Grand Canyon Monitoring
and Research Center
AUG 3 0 2002
Received
Flagstaff, AZ

Submitted by:

SWCA, Inc., Environmental Consultants

August 2002

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August 2002

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EXECUTIVE SUMMARY

In this paper, it is argued that river experiences are emergent and dynamic in nature, being affected by the interaction between physical and social characteristics of the river trip, including type and length of trip, group size, background of participants, mode of propulsion, number and duration of intergroup encounters, and influence of the river guides, along with environmental factors, such as flow levels and the weather. Because of the multidimensional nature of river experiences, recreational boaters have a great tolerance for adverse impacts to many of the attributes that affect experience; however, overall user satisfaction can be negatively impacted by extreme changes in a single attribute, such as extreme fluctuations or extreme high/low flows, poor group social structure, or adverse weather conditions during the majority of the trip. After an in-depth discussion of the river experience, the effects of river flows on experience are examined. Based on previous research, flows have been found to impact the rate of travel, size and perceived safety of rapids, and the quality of camps and beaches. The specific effects of flows experienced during the 2000 Low Summer Steady Flow (LSSF) experiment are also examined. While the LSSF experiment reduced the rate of travel, decreased the size of rapids, increased safety concerns, and improved the quality of camping beaches, the overall impacts on user experience are considered minor due to the fact that: (1) 8,000 cubic feet per second (cfs) is not considered extreme low flow, and (2) the river experience is multidimensional and thus depends on many other factors that were either minimally or not affected by the LSSF experiment.

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1.0 INTRODUCTION

There is a long history of interest related to characterizing and assessing white-water rafting experiences on the Colorado River through Grand Canyon. Starting with John Wesley Powell's epic journey in 1869 in which the explorer-scientist told tales of starvation and danger in the "Great Unknown," American culture has come to know Grand Canyon river rafting as being one of the most adventurous wilderness experiences within the lower 48 states. The rapid rise in popularity of river rafting during the post-World War II decades prompted the National Park Service (NPS) to formulate river management policy, and in doing so, initiate social science research to inform their decision making. Through a series of studies in the mid-1970s, Shelby and Nielsen (1976a, b, & c) published several reports that laid the groundwork for understanding the nature of river rafting experiences in Grand Canyon National Park (GCNP). Their findings became the basis for river recreation management objectives as presented in the 1989 Colorado River Management Plan (NPS 1989).

1.1 Purpose of Current Study

Recent studies of Grand Canyon boaters found that approximately 90 percent of all recreational boaters surveyed defined their recent river experience as excellent or perfect (Hall and Shelby 2000, Stewart et al. 2000). In 1975, 84 percent of boaters surveyed also defined their experience as excellent or perfect (Shelby and Heberlein 1986). While these and similar studies (e.g., Bishop et al. 1987; Shelby and Nielsen 1976a; Shelby et al. 1992, Underhill and Borkan 1986) examine attributes of river trips that contribute to the overall experience, such as levels of perceived crowding, relative size and safety of rapids, or the quality of camping beaches, none clearly identify what attributes of a Grand Canyon river trip make recreationists consistently define their experience as excellent or perfect.

The purpose of this study is threefold: 1) to identify the physical and social-psychological attributes that contribute to Grand Canyon river experiences; 2) To identify those specific river trip attributes that are influenced by flow levels and how they are affected by various flow regimes; and, 3) to focus specifically on the impacts of the 2000 Low Summer Steady Flow (LSSF) experiment on recreational river experiences. Due to the emergent and dynamic nature of the river experience, it is hypothesized that the 2000 LSSF experiment altered some physical characteristics of the river experience but did not significantly impact the overall quality of that experience.

2.0 METHODS

Data for this study were obtained from preexisting sources, primarily through an intense review of the existing literature generated from past Grand Canyon river recreation research. Most of this literature took the form of agency publications (a.k.a., "gray literature") that resulted from recreational studies contracted by the NPS, Bureau of Reclamation (BOR), and the United States Geological Survey (USGS). Studies published in refereed journals that relate to Grand Canyon river recreation were also reviewed. A number of such journal articles were based on data gathered for the agency reports. Literature not relating directly to Grand Canyon river recreation but recreation on other western rivers, specifically as it related to experience and flow levels, was also reviewed.

3.0 THE NATURE OF RIVER EXPERIENCES

From the first studies of Grand Canyon river rafting conducted by Shelby and Nielsen (1976a, b, & c; also see Shelby and Heberlein 1986, pp. 58-59), river experiences were recognized as comprising a multitude of attributes, including the wilderness character of the experience, the

personal benefits of the experience such as learning and personal growth, and the social aspects of the experience such as the quality of the group experience and the rating of the river guides. A number of factors were also identified as potentially affecting that experience, including the impacts of density and crowding on the experience, and the effects of weather and personal preparation for the trip. Further studies explored other aspects that may contribute to or affect the river experience, including the volume and daily fluctuations of river flows (Bishop et al. 1987; Underhill and Borkan 1987), the size and number of rapids (Bishop et al. 1987; Stewart et al. 2000), and the number and quality of camping beaches (Stewart et al. 2000).

The above studies demonstrate that the river experience is a dynamic phenomenon, which emerges as a result of the interaction between the spectacular setting, the multiday nature of the trip, and the participants involved (Nielsen and Shelby 1977). Each of these is discussed separately later in this study. Together, they provide the makings of an "extraordinary" (Arnould and Price1993; Price et al. 1995; Arnould et al. 1999) or "optimal" (Beck 1987) experience, which is characterized by spontaneous and unique events that trigger intense, deep-felt emotions.

Due to their extended nature (i.e., over a period of several days), extraordinary experiences such as a Grand Canyon river trip tend to be emergent (Arnould and Price 1993; Gibson 1998), with the meanings and lived nature of the experiences unfolding through time as the experiences occur and can thus only be evaluated in terms of the overall experience. The process of evaluating the experience is also dependent upon the interaction between participants engaged in the same activities as they compare and relive the experience through narrative and public discourse (Arnould and Price 1993, Price et al. 1995).

Because river experiences are spontaneous and dynamic, consumer expectations (including beliefs, evaluative criteria, attitudes, and activity sequences) tend to be vague. This is especially true for the 81 percent of commercial passengers in 1998 who were on their first river trip and thus had no frame of reference to compare trips (Hall and Shelby 2000). Consequently, measuring satisfaction with extraordinary experiences tends to be difficult, as satisfaction is typically measured though comparing expectations with outcomes. Furthermore, the extended nature of river trips allows more time for revaluation and interpretation of certain aspects of the experience during the trip, and even after participants depart from the trip. Consequently, a number of situations can occur on a river trip that would, singularly, be defined as unenjoyable by a boater, such as bad weather, lack of privacy, or excessive sand in one's food, but overall satisfaction with the trip remains high. This is because satisfaction is not "embodied in attributes of the experience such as amount of time spent freezing in wet clothes, uncomfortable toilet facilities, bad food, or any summary index of specific attributes of the trip" (Arnould and Price 1993, p. 25). Instead, such negative experiences are reinterpreted and become part of the overall narrative of the river trip, which tends to be positive as indicated by the 90 percent of river rafters defining their experience as excellent or perfect. As Arnould and Price (1993) further stress,

> A prevailing view is that satisfaction can be described with a summary index of a product or service's performance on various attributes. In contrast, satisfaction with extraordinary experience is emergent across the temporal frame of the experience...[which] leads to emphatic positive re-evaluation of all the negatives that might otherwise dominate evaluation of the experience....the evaluation of the experience evolves within the context of the overall story (Arnould and Price 1993, p. 26).

Consequently, it becomes ineffectual to isolate a single attribute of the river experience and identify factors directly related to that experience in an attempt to assess overall trip satisfaction based on

those factors. There are exceptions, however, to this premise. In extreme cases, a single factor can impact a multitude of trip attributes and, as a result, have a direct impact on overall trip satisfaction. For instance, severe weather conditions during the entire length of the trip or radically fluctuating flows can result in an overall feeling of dissatisfaction. The rating of trip satisfaction, however, remains dependent upon how such extreme factors are interpreted and evaluated in terms of the overall trip experience. Instead of leading to interpretations of an undesirable experience, they could also to lead to a more positive evaluation of the experience, such as the trip being interpreted as an adventure.

To understand the nature of the river experience and the factors that influence that experience, it is important to understand the multidimensional and emergent nature of that experience. Instead of merely focusing on one factor that influences the experience, a host of factors and how they relate to each other must be examined. While the study of extraordinary experiences focuses on spontaneity (i.e., anything can happen), the structured nature of river trips, especially commercial trips, does provide some consistency among river experiences. In addition, even the most novice outdoor enthusiasts have some idea of what to expect on their first river trip based on river outfitter brochures, television, and the Internet. Some of these vague expectations are met while others are not. The resultant experiences are more dependent upon the interaction between the physical and social attributes of river trips (i.e., group structure, the mode of travel, time spent in the canyon, and river guides).

3.1 Physical and Social Attributes of River Trips

As discussed briefly above, certain physical and social characteristics of a river trip influence the outcome of the nature of the experience. There is not a singular Grand Canyon experience due to

the fact that not all river trips are the same in terms of participant makeup, section of river floated, boat type, trip length (in days), and river guides. Variations in such characteristics of the river trips influence the river experience in different fashions. While much of the description below may seem "obvious," to fully understand the river experience, we must first identify the variables that influence boaters to evaluate certain aspects of their river trips differently, while evaluating other aspects similarly.

3.1.1 People

Most studies of river recreation divide boaters into two main groups, commercial and private, based on the make-up of the participants (Hall and Shelby 2000; Shelby and Nielsen 1976c; Stewart et al. 2000). Commercial trips are organized by commercial outfitters with licensed, paid river guides who are in charge of on-river activities, such as boat operation, camping decisions, food preparation, and the like. Private trips are organized by a group of individuals who take it upon themselves to organize the trip, gather equipment and food, and run the trip, with expenses being shared equally among those on the trip. Each commercial outfitter is allocated a number of user days per year, while one person (the trip leader) from each private trip must obtain an individual use permit from the NPS.

Commercial passengers and private boaters were found to be similar in terms of age, with both groups averaging 43 years of age; marital status; and education (Hall and Shelby 2000). The two groups differed in terms of gender and income. While more men, in general, participate on Grand Canyon river trips, a more equal proportion of women go on commercial trips than on private trips, although the difference in the gender makeup between the two groups declined during the last two decades. In 1975, women made up 48 percent of commercial passengers but only 23 percent of

private boaters (Shelby and Nielsen 1976a), while in 1998, 43 percent of commercial passengers were women compared to 33 percent of private boaters (Hall and Shelby 2000). In terms of income, commercial passengers tend to have higher household incomes than private boaters, with the most striking difference occurring at the upper levels. While the proportion of private boaters with household incomes greater than $100,000 was similar to the national average in 1998 (11 percent compared to the national average of 12 percent), nearly four times as many commercial passengers (47 percent) had household incomes greater than $100,000 (Stewart et al. 2000).

Probably the most significant difference between commercial passengers and private boaters as it relates to the lived experience on the river is the amount of previous river experience. While only 20 percent of commercial passengers in 1998 had prior rafting experience in Grand Canyon and 33 percent had prior rafting experience on other rivers, 39 percent of private boaters had prior rafting experience in Grand Canyon and 94 percent had prior rafting experience on other rivers (Hall and Shelby 2000). In general, recreationists with more experience tend to have more defined expectations, and are more likely to interpret their experiences based on such expectations (Kuentzel and McDonald 1992). For example, experienced outdoor recreationists tend to be "purists" and are more likely to hold well-defined personal norms for such things as the number of acceptable encounters in the backcountry setting than those less experienced (Nielsen and Endo 1977). As a result, the two groups can interpret experiences differently when exposed to the same circumstances in an outdoor setting. For example, private boaters tend to have more defined notions of "wilderness," are less likely to call the Grand Canyon a wilderness, more likely to state that the Grand Canyon river corridor is negatively impacted by overuse, and have well-defined "encounter norms" (Hall and Shelby 2000). More experienced recreationists are also more likely to exert their

expertise on other, less experienced recreationists, influencing their perceptions (Cockrell et al. 1984).

Commercial and private trips also differ in number of participants, with commercial trips having an average of 27 people on a trip in 1998, compared to an average of 13 people on private trips (Hall and Shelby 2000). Heywood (1987) found that the type of experiences sought by river recreationists is partially influenced by the size of the group, with the smallest groups seeking an experience that involves quiet and escape, while larger groups are more likely to seek group adventure. Similarly, Hall and Shelby (1996) found that smaller groups of recreationists are probably more focused on the wilderness aspect of their experience and thus have more concrete norms for the number of acceptable encounters with others, while larger groups tend to seek a more social form of recreation and thus have less salient encounter norms. As suggested earlier, commercial passengers and private river runners also differ in their perceptions of wilderness qualities in the Grand Canyon, with 90 percent of all commercial passengers compared to 56 percent of private passengers who consider the Grand Canyon a wilderness (Hall and Shelby 2000).

3.1.2 Place

A Grand Canyon river trip takes place on the Colorado River through Grand Canyon National Park; however, many boaters do not travel through the entire length of the river corridor. The Colorado River through Grand Canyon begins at Lees Ferry (River Mile 0) and terminates at Grand Wash Cliffs (River Mile 278). While some boaters traverse the entire length, others begin and/or end their trips at various points along the way. All boats for Grand Canyon river trips are launched from Lees Ferry, with the exception of those boats launched from Diamond Creek (River Mile 225) for short, "weekend" trips, that take out at Pearce Ferry on Lake Mead (River Mile 280). Boaters,

however, can enter or leave the trip at a number of points, with the most popular being Phantom Ranch (River Mile 88), Whitmore Wash (River Mile 187, via helicopter), and Diamond Creek. In general, most commercial passengers do not complete a "full canyon" trip (from Lees Ferry to Diamond Creek or Lake Mead), but end or begin their trips at Phantom Ranch or Whitmore Wash. In 1998, only 27 percent of commercial passengers compared to 85 percent of private boaters completed a full canyon trip (Hall and Shelby 2000).

While not examined specifically, whether a boater travels the entire length of the river or only a particular section can impact his or her overall river experience. For example, the lower section of the Canyon (Phantom Ranch downstream to Whitmore Wash or beyond) is known for larger rapids that provide more thrilling rides than the section from Lees Ferry to Phantom Ranch.

3.1.3 Boats

Boats vary from single-person kayaks, canoes, and inflatable kayaks (duckies); 14- to 18-foot rubber rafts that hold two to four people; wooden or metal dories; to pontoon boats (22-foot snouts to 37-foot J-riggs) that can hold up to 20 people. In general, the smaller boats (kayaks, canoes, rafts, cater-rafts, and dories) are paddle or oar powered, while the larger, pontoon boats are motor powered. With few exceptions, private trips use paddle/oar-powered boats while commercial trips use both motor- and paddle/oar-powered boats. The majority of commercial trips use motor-powered boats, with 76 percent of all commercial trips using motor-powered boats in 1998 (Hall and Shelby 2000). While the average number of people per boat is greater for commercial trips using motor-powered boats compared to oar-powered boats (16 people per boat compared to 5 people per boat) the total number of people per trip for commercial motor versus commercial oar trips is about the same (27 people per trip) because commercial oar trips use about three times more boats than do

commercial motor trips (six oar-powered boats per trip compared to two motor-powered boats) to get more passengers on the trip (Hall and Shelby 2000).

The studies conducted by both Shelby and Nielsen (1976b) and Hall and Shelby (2000) compared the difference in river experiences had by motor- and oar-powered commercial trips and found that passengers who were given the opportunity to travel on both types of rafts reported different river experiences based on boat type. In general, commercial passengers preferred the oar-powered trips over motorized trips, perceiving them to be more quiet and natural, more akin to a "wilderness" experience, and with more friendly and intimate social dynamics, while motor trips were seen as fast and noisy, with less intimate social groups. While the difference in experiences is partially the result of the mode of transportation, other factors, including the number of passengers per boat and the average length of the trip, also contribute to the difference in river experiences and preferences. For example, roughly three times more passengers ride on a motor-powered raft compared to a oar-powered raft, resulting in a lower guide-to-passenger ratio; those on motorized trips encounter almost twice as many other trips and people each day; and those on oar-powered trips spend almost twice as much time in the Canyon, visit more attraction sites, and spend about four times longer when visiting each attraction site than those on motor-powered trips (Hall and Shelby 2000).

While Shelby and Nielsen (1976b) showed that more commercial passengers preferred the experience they gained on oar-powered boats compared to motor-powered boats, 75 percent of commercial passengers take motor-powered trips (Stewart et al. 2000). This may be explained merely by availability; commercial companies mainly offer motor-powered trips, making them easier to purchase. This is partly supported by the data gathered by McCulley (1999), who found that

commercial companies offering both types of trips booked oar-powered trips faster than motorized trips. Although the demand for oar-powered trips exceeds the availability, commercial companies do not seem to be motivated to meet this demand at the cost of reducing the number of the more profitable motorized trips. While commercial companies do not fill their reservations for motorized trips as quickly as reservations for oar-powered trips, they are still able to sell such trips, even to people who would otherwise prefer oar-powered trips.

Motorized trips do have some benefits over oar-powered trips. Their shorter length and lower cost makes them more appealing to many individuals who may have only a few days to a week of vacation to spend on a river trip. Hall and Shelby (2000) found that the most frequently cited reason for choosing motor-powered trips by passengers on such trips was their perceived safeness and efficiency, and being able to see the "whole" Canyon, or more of it, in less time.

3.1.4 Time

Since the river experience is emergent and evolves with time, the amount of time an individual spends on the river influences the nature of the experience. As suggested above, the amount of time a boater spends on the river is dependent upon a variety of factors, including whether the trip is commercial or private; whether the boater travels the entire length of the river through Grand Canyon or only a section of it; and the type of boat (motorized or oar powered) that the boater chooses. Although the average commercial trip using motorized boats is eight days, passengers are on those trips for an average of only five out of the eight days because most do not complete full canyon trips (Hall and Shelby 2000). The average commercial trip using oar-powered boats is 14 days, with passengers being on such trips for an average of six days. The amount of time private boaters spend on the river far surpasses that of all commercial boaters. The average private trip is 17

days and most private boaters complete full canyon trips, with the average private boater being on the river for 16 days (Hall and Shelby 2000).

3.1.5 Guides

Passengers on commercial trips have cited that river guides are important in creating a "perfect" trip (Bishop et al. 1987; Stewart et al. 2000). The influence of river guides over their passengers' experience has been studied by a number of researchers (cf., Arnould and Price 1993; Arnould et al. 1999; Cockrell et al. 1984; Gibson 1998; Holyfield 1997, 1999; Jonas 1997, 1999; Price et al. 1995) who recognize river guides as fundamental in facilitating or orchestrating the passenger's experience, or at least as exerting normative influence (Cockrell et al. 1984) over the evaluation of the experience. As Price et al. (1995) suggest, this is part of the guide's role in providing a service to their customers, the passengers:

> [River guides] must orchestrate mutual understanding to produce service satisfaction. By orchestrating mutual understanding, we mean the [river guide] must oversee the emergence of shared customer-provider scripts. [Guides] must interpret service episodes, explain unexpected events to crystallize customer expectations, and then provide evidence that expectations are being met (Price et al. 1995, p. 85).

Guides are thus involved in assisting passengers on how to interpret their experience in a positive fashion, even when such experiences would, by themselves, be considered negative. Gibson (1998; also see Holyfield 1999) also came to this conclusion when be observed the river guides' role in assisting passengers to transform a potentially terrifying incident (falling out of a raft) into part of an overall, positive experience:

> ...when a client falls from a raft in the middle of a rapid and is forced to swim a potentially life-threatening white water rapid, the client most often appears not to be satisfied with the situation. By afterwards processing the experience with the client, the guide potentially has the ability to transfer the incident into a positive experience for the client. In other words, white water rafting has unforeseen, uncontrollable

> risks inherent in the activity, and feeling temporarily unsatisfied may not influence client benefits, but may actually increase the potential for benefits to be realized later as the client processes and distills the experience by reflection. Hence, river guides should attempt to explore the possibilities of taking a bad experience and processing it with the client to search for meanings that may have a positive influence. (Gibson 1998, p. 274-275.)

The above is not meant to suggest that river guides are in full control of the passenger's experience. The point is merely that in order to understand the river experience, we need to take into consideration the guide's role, along with other factors, in interpreting that experience, which again emphasizes the dynamic and lived nature of the experience.

3.2 Past and Ongoing Studies of the River Experience

Studies that examine river running generally attempt to capture the river experience through a checklist of attributes contributing to the quality of the experience that the respondent chooses from or is asked to rate in terms of importance to the overall experience. In some instances, respondents are asked to list aspects of their most recent river trip that contributed to their overall river experience. Such attributes used in surveys include the size and number of rapids, quality of scenery, sense of remoteness from civilization, feeling of naturalness, feeling of solitude, quality of food, skill and approachability of the river guides, presence of wildlife, importance of visits to attraction sites, opportunity to learn about the natural and historical aspects of the Grand Canyon, type of weather, nature of the social interaction, pace of the trip, perception of the wilderness experience, and the quality of the camping beaches (Bishop et al. 1987; Hall and Shelby 2000; Shelby and Nielsen 1976a; Stewart et al. 2000).

Stewart et al. (2000) and Bishop et al. (1987) asked Grand Canyon boaters to list the attributes that created a perfect trip. Both studies found that the top attributes for commercial

passengers were good guides, good weather, and good social interaction, while the top rankings for private boaters were good social interaction, good weather, and no crowding. Such attributes by themselves, however, do not capture the overall nature of the river experience. That phenomenon is a result of a combination of all the various trip attributes listed above, plus some additional ones, that are both interpreted at the situational level and evaluated as part of the overall river experience. Consequently, it becomes difficult to isolate and study a single attribute of river trips and relate it back to its impact on overall river experiences; however, most river studies have effectively done so. One of the most intensely studied attributes affecting river experiences is the number and duration of intergroup encounters. The popularity of studying such attributes arises from the influence of the crowding literature (see Shelby and Herberlien 1986) as well as the fact that user density and the number and duration of intergroup encounters is one aspect of the river experience that can be readily manipulated through management practices.

3.2.1 Intergroup Encounters

The Colorado River Management Plan (NPS 1989) suggests that the river should be managed to provide opportunities for solitude, quiet, and the ability to avoid crowded sites. Based on research conducted by Shelby and Nielsen (1976a; also see Hall and Shelby 2000), the Management Plan identifies several factors that influence experience quality, including the number of river encounters per day, the amount of time in sight of other boaters, and the number of encounters at attraction sites, and provides standards to regulate the nature of such encounters as a means to manage the river experience. The underlying assumption is that the quality of the river experience, measurable in terms of user satisfaction, is inversely proportional to the number of encounters.

Hall and Shelby's (2000) recent boater study found that the standards set by the Management Plan for intergroup encounters were generally being met, with infractions being minor. For instance, commercial motor trips appear slightly out of compliance with management standards for the number of daily encounters and the number of encounters on a per-trip basis, while commercial oar and private trips are within standards. All three groups were slightly out of compliance with the management standards for camp encounters but in compliance with the number and duration of encounters at attraction sites. Although this may seem to partially explain the high levels of user satisfaction reported by boaters, further examination yielded little or no support for the assumption that increases in use levels or encounters have a negative effect on user satisfaction or other measures of social well being (Nielsen 1976; Shelby and Heberlein 1986; Stewart et al., in press).

River runners, both in GCNP and elsewhere, go on river trips for a variety of reasons, including escaping routines of everyday life, seeking privacy, experiencing challenge, and learning new skills (Knopf et al. 1983). River users can thus be satisfied or dissatisfied with the river experience as a result of a variety of factors, with encounters being only one in a multitude of factors by which users rate their experience. According to Shelby and Heberlein (1986), who base their conclusions on data gathered by Shelby and Nielsen (1976a), encounters with other boaters in GCNP (including river contacts, people seen on the river, time in sight of other people on the river, percent of attraction sites with contacts, and number of people seen at attraction sites) accounted for less than 1.5 percent of the variance in user satisfaction among commercial passengers and private boaters. Other aspects of the experience that explained a greater percentage of the variance in user satisfaction included personal benefits such as learning and personal growth (11 percent); social aspects of the trip such as positive group experience and a good river guide (25 percent); importance

and perceived quality of the "wilderness" experience (30 percent); and the weather and users' preparedness for the trip (32 percent).

Even when encounters were compared to one aspect of the user experience that seems more directly related to contact with other users–the feeling of solitude–the relationship is weak because of the multidimensional nature of solitude. While seeking solitude seems to be dependent on avoiding contact with other groups, this may not necessarily be the case as solitude can also refer to remoteness, primitiveness, non-confinement, cognitive freedom, and autonomy, with many of these other aspects of solitude appearing more important than being alone (Patterson and Hammitt 1990).

Several explanations have been provided for the weak correlation with intergroup encounters and user satisfaction (Shelby and Heberlein 1986), including self selection (recreationists select experiences they will enjoy); product shifts (recreationists will re-evaluate/re-define the experience based on what they find); displacement (dissatisfied users leave the area); rationalization (recreationists will have a good time no matter what); and multiple sources of satisfaction (other factors contribute to the overall definition of the situation). The latter deserves special focus due to the multidimensional nature of the river experience, which would naturally result in multiple sources of satisfaction, some of which overshadow any adverse effect that may occur due to perceptions of crowding. As Nielsen and Shelby (1977) observed:

> ...there is the effect of the Canyon itself to consider. The Canyon is a spectacular natural phenomenon, and seeing it from the river is in many respects a unique experience. It may be that this singularity overshadows the effect of other trip features (e.g., contact with other groups) and makes them seem trivial or minor in comparison. (Nielsen and Shelby 1977, p. 7)

The above explanations for the lack of relationship between encounters and satisfaction are still based on the notion that encounters are negative, and that somehow, users rationalize their

occurrences or are not bothered by them because the negative effect of encounters are outweighed by other, more positive aspect of the experience. A contrasting explanation for the weak relationship between the number of intergroup contacts and user experience is that encountering other groups during a Grand Canyon river trip does not necessarily adversely affect the river experience; that is, some encounters actually have a positive impact on satisfaction. As Hall and Shelby (2000) found, 40 percent of commercial motor passengers stated that they actually preferred to see two to three groups each day, while about 25 percent preferred to meet four or more groups, possibly because they recognized that such encounters increased the overall quality of their experience.

The meanings of encounters are interpreted at the interaction level, that is, as they occur between various groups of river runners (Jonas et al. 2000). The circumstances surrounding the encounters affect the meanings attributed to the interaction, resulting in encounters being interpreted as either pleasant or unpleasant. Under this assumption, an otherwise similar encounter (i.e., two commercial groups meeting at an attraction site or a private and commercial group passing each other on the water) could actually enhance the overall experience if the resultant interaction is positive in nature. As Nielsen (1976) concluded, "Density seems to have little or no effect on the overall rating of one's experience, but other variables like... those relating to the kind and quality of the social interaction do" (Nielsen 1976, p. 255).

This is not to say that the number of people on the river does not adversely impact user experience. All studies have been conduced when there were limitations on user numbers on the water at one time; if such limitations were lifted and the number of people on the water was to significantly increase, adverse impacts would be more apparent. Furthermore, some types of encounters often times adversely impact experience, specifically, those that involve competition over

some limited resource such as competing over a campsite in an area of the canyon with few available campsites, or competing for space to land at a popular campsite. The current limit on user days and set schedule of launch days seems to limit such conflicts among groups to an acceptable level, or at least to a tolerable level that does not impact overall user satisfaction.

A final point about the impact of encounters on user experience deals with boater expectations. Since many boaters are new to the experience, especially commercial passengers, they come with few preconceived notions of how to interpret the meaning of encounters on river trips. River guides play a central role in facilitating such interpretations. Thus, just as river guides are known to make adjustments in their scheduling to reduce the numbers of encounters (Nielsen 1976; Nielsen and Shelby 1977), river guides also make adjustments during unavoidable encounters to enhance their passengers' experiences by influencing them to interpret the encounter as either pleasant or enjoyable. For instance, when different groups come into contact, they oftentimes engage in such river play as water fights; barter for food, alcohol, or ice; exchange stories; or assist each other or stand as an audience during the running of rapids, occasionally taking the other group's pictures as a favor. The result is a positive impact to the overall experience.

4.0 FLOW LEVELS AND THE RIVER EXPERIENCE

Much of the above discussion on what contributes to the river experience is not directly related to flow levels. For instance, the number and duration of intergroup encounters were determined not to be significantly influenced by river flows, but more greatly impacted by the schedule of launches at Lees Ferry (Underhill and Borkan 1986). Trip attributes that are more directly related to flow levels that are consequential for the river experience include the speed of the

trip and trip scheduling, quality and safety of rapids, and the quality of the camping beaches (Bishop et al. 1987; Brown and Hahn 1987; Shelby et al. 1992; Stewart et al. 2000; Underhill and Borkan 1986).

4.1 Flows and Rate of Travel

As one would expect, the higher the river flow, the faster the speed of travel and the less need for boaters to row or run their motors to keep up with their trip schedules. When boaters were asked to indicate the low flows levels at which they had to row or run the motor longer to make up time and meet their schedule, they responded that flows below 10,000 cfs required them to make such adjustments, while flows above 35,000 cfs resulted in them rowing less or turning off their motor and floating because they were ahead of schedule (Shelby et al. 1992). Lost time due to low flows would result in less available time for attraction site visits (Underhill and Borkan 1986), while increased time would be spent at scheduled and additional attraction sites. Commercial oar guides and private trip leaders also indicated that they would also spend a layover day at a campsite if they were ahead of time due to high flows, while commercial motor guides would use the time to turn off the motor and float (Shelby et al. 1992).

4.2 Size and Perceived Safety of Rapids

The perceived impacts of river flow on the quality of rapids have remained relatively constant over the past twenty years (Bishop et al. 1987; Stewart et al. 2000). Numerous and long rapids with large waves and those that provide a "roller coaster" ride are seen as the best rapids for enhancing the river experience, while the enjoyment of the trip decreases if boaters need to wait at rapids for other trips to run them, passengers are required to walk around the rapids, the rapids are in a condition that causes concern about damage to personal equipment, and if rocks are sticking out of the water

(Stewart et al. 2000). When commercial guides, for both oar-powered and motor-powered trips, and private boaters were asked to evaluate their satisfaction with constant flow levels between 2,000 and 80,000 cfs, in terms of how such flow levels provide the best ride for passengers, allow for ease of maintaining trip schedules, and provide an acceptable level of safety, they responded that their peak levels of satisfaction occur during flow levels between 20,000 and 26,000 cfs (Bishop et al. 1987; Shelby et al. 1992; Stewart et al. 2000). When asked for the minimum flow level for running the river safely with passengers, commercial motor guides tend to respond with lower flows on average (7,850 - 8,405 cfs; Stewart et al. 2000 and Bishop et al. 1987, respectively) compared to commercial oar guides (8,162 - 9,198 cfs; Stewart et al. 2000 and Bishop et al. 1987, respectively) and private trip leaders (9,025 cfs; Shelby et al. 1992). Commercial motor guides also provided higher mean maximum flow for running rapids safely with passengers (51,250 - 59,014 cfs; Stewart et al. 2000 and Bishop et al. 1987, respectively) than commercial oar guides (45,881 - 54, 910 cfs; Stewart et al. 2000 and Bishop et al. 1987, respectively) and private trip leaders (47,210 cfs; Shelby et al. 1992). Interestingly, average flow rates for both minimum and maximum safe levels were consistently lower in the late 1990s than in the mid-1980s, probably due to river users being more accustomed to the more steady flows in the 1990s that produced higher minimum and lower maximum flows.

4.3 Camps and Beaches

An oftentimes-neglected aspect of river trips are the camps, although a significant amount of time is spent in camp, more than on the water or visiting attraction sites. Consequently, the experience at camp is a significant factor influencing boaters' overall river experience. One factor that can impact the camping experience and is related to flow levels is the quality of beaches (Brunson and Shelby 1990). Stewart et al. (2000) found that river users preferred large beaches with

shade from trees. While high flows can affect beach size by either removing or adding sand to the shoreline, depending upon the amount of sediment in the system, they inundate large portions of beaches and even completely submerge some smaller beaches. The mean constant flow level above which campsites are limited ranges between 41,107 to 44,500 cfs (Shelby et al. 1992). In comparison, low flows generally expose more beach area that can be used for camping.

4.4 Fluctuating and Steady Flows

Researchers also examined river rafters' perceptions of fluctuating flows versus steady flows, and asked respondents to state what they think are the best flows in terms of overall quality of their river experience. Much of the study conducted by Bishop et al. (1987) was aimed at examining user preferences related to flows that fluctuated more than 10,000 cfs within a 24-hour period. During the 1980s, when the study was conducted, such fluctuating flows were common and were determined to be the cause of much discontent by river users. However, the 1990s saw a different flow regime that drastically reduced daily fluctuations, which minimized the adverse impacts to boaters' river experiences to a point that the daily fluctuations were no longer considered important (Stewart et al. 2000).

In terms of preferred steady flow levels, Stewart et al. (2000) and Bishop et al. (1987) found that both private trip leaders and commercial river guides perceived steady flows below 5,000 cfs as very unsatisfactory, and flows ranging between 20,000 and 25,000 cfs as providing the peak levels of satisfaction. The flow levels rated as above the midpoint in terms of satisfaction were 10,000 - 40,000 cfs for private trip leaders, and 10,000 - 50,000 cfs for commercial guides.

5.0 EFFECTS OF THE LSSF EXPERIMENT ON RIVER EXPERIENCES

Boaters who rafted down the Colorado River through Grand Canyon during the 2000 river season saw steady flows of 8,000 cfs from June to September, with a four-day spike flow of 31,000 cfs in early September. Those on the river during the early part of the season experienced releases of 17,000-19,000 cfs in April and May, with a four-day spike flow of 31,000 cfs in early May. Only the potential effects of the steady 8,000 cfs on boater experiences are discussed in this section. Based upon the studies discussed in section 4.0, it can be extrapolated that such flows would impact boaters' river experiences by decreasing the size of rapids and increasing safety concerns, decreasing the speed of travel of boats on the water, and improving the size of beaches. These assumed impacts are discussed below.

5.1 Size of Rapids and Safety Issues

At a constant 8,000 cfs, the size of waves and length of rapids would be reduced, decreasing the "thrill" of the ride for many boaters. Several rapids would be more "dangerous" due to exposed rocks. As indicated above, 8,000 cfs is below or close to the minimum flow level reported by boaters to run the river safely with passengers (Bishop et al. 1987; Shelby et al. 1992; Stewart et al. 2000). Commercial motor trips would likely feel the effects less than private trips since they reported that the river would tend to become unsafe at flows averaging 7,850 cfs (Stewart et al. 2000), while private trips reported that the river would become unsafe at flows below 9,025 cfs (Shelby et al. 1992). Perceptions that flows below 8,000 cfs are unsafe seem to be supported by preliminary data reported by Jalbert (2001) who observed that accident variables such as striking rocks and equipment damage are directly related to low flows of 5,000 to 8,000 cfs, with the NPS data showing a 100 percent increase in the number of reported incidents compared to higher flows.

Interesting, although motor trips reported that flows of 8,000 cfs were within their comfort level in terms of safety, Jalbert (2001) found that motorized rafts experienced much higher accident rates during the LSSF experiment compared to oar-powered boats.

5.2 Rate of Travel

Steady flows of 8,000 cfs compared to the higher flow regime during the past few years would result in slower floating speeds, requiring more time spent rowing and motoring. This, in turn, would result in lost time at attraction sites and potentially fewer lay-over days. As Shelby et al. (1992) found, boaters reported that flows below 10,000 cfs would require more adjustments to make up for lost time. This would be a greater impact to oar-powered boats as motor-powered boats could more easily travel at faster speeds to make up for time lost. However, it would mean less time floating for motor boats, with the passengers feeling as if the trip is more rushed, which is already perceived as a negative aspect of motorized trips (Hall and Shelby 2000; Shelby and Nielsen 1976c).

5.3 Quality of Beaches

Although mooring large pontoon boats may become problematic at some beaches due to shallow water resulting from low flows, in general, lower flows expose a greater portion of the beaches and improve the quality of camping opportunities. In addition, steady flows increase the amount of "usable" beach because boaters can camp near the water's edge and not be concerned about rising water levels during the night due to fluctuating flows. The ability to sleep next to the water's edge where it is cooler can be greatly appreciated by boaters during the hot summer months. As a result, the LSSF experiment should have improved the overall camping experience for boaters.

5.4 Overall Impact of the LSSF Experiment

Based on the information presented above, the LSSF probably affected certain aspects of a Grand Canyon river trip (i.e., less thrilling ride, safety concerns due to exposed rocks, reduced rate of travel and reduced time spent at attraction sites, and improved quality of beaches). When considering such impacts in light of what we know from previous studies regarding the multidimensional nature of the river experience leads us to conclude that such impacts would not greatly affect overall boater experiences; that is, the great majority of boaters would still view the experience they acquired during the LSSF experiment as excellent or perfect. Our conclusions are based on the following reasons: (1) while 8,000 cfs is considered low flow, it is not considered extreme low flow (below 5,000 cfs) and thus is not likely to significantly impact experience; (2) the trip attributes affected by low flows are only three among many that make up river experiences; and (3) the emergent nature of the river experience allows the trip attributes affected by the LSSF to be interpreted as part of the overall experience.

While the LSSF experiment did change certain attributes of the river experience (e.g., decreasing the size of waves in the rapids), such changes are reinterpreted as part of the overall narrative of the river trip, which is perceived as a high-quality experience. In addition, many boaters, especially commercial passengers, have little means to relate the impacts of low flows to their river experiences (i.e., "they don't know the difference"), and thus interpret low flows as a normal part of their experience. River guides play an important role in facilitating the interpretation of that experience, encouraging passengers to interpret any mishaps that may occur during low flows (e.g., hitting rocks in the rapids or pushing stranded boats back into the current) as part of the overall "adventure."

Even for the more experienced private river runners who often have the means to compare the low steady flows to other flow regimes, the differences may be evaluated positively as a new and different experience. Such experiences give the private boater a new story to tell and a comparison to other flow regimes, adding to the boater's level of expertise as he or she questions other boaters, "Hey, were you on the river during the low flows of 2000?" It can be compared to the high flows of 1983, which resulted in safety concerns due to increased rates of flips, including large, commercial motorized rafts; inundated campsites; and accelerated rates of speed. While these factors may seem to adversely affect the trip, both commercial and private boaters continue to reminisce about the "high flows of '83," suggesting that the emergent story is important to the overall rating of the experience (Luckner and Nadler 1995).

5.4.1 Indirect Impacts of the LSSF Experiment

While past studies have shown that, other than in extreme cases, both the impacts of flow levels on encounters and the effects of encounters on the overall river experience are minor, several observations have been made concerning encounters that are indirectly related to the LSSF experiment. While it is expected that the LSSF experiment did not significantly change the number and duration of encounters between and among commercial and private trips, it did increase the number of encounters between commercial/private trips and research trips that were in the Grand Canyon studying the impacts of the LSSF experience.

While the argument was made that, under the current user levels, encountering other groups has little effect on the overall river experience, some encounters do situationally result in negative experiences. In terms of encounters between recreational river trips and research trips, the type of

interaction that occurs determines if the encounter is perceived as positively or negatively affecting the recreational boaters' experiences. This is exemplified in the following observation:

> With encountering other groups, of course all the boatmen know all the other boatmen, and ice, Pringles, beer, etc., are exchanged; and old friends get to chat. However, the passengers are not very involved in the interaction - maybe hear some stories or exchange pleasantries, talk fish, etc. Although it doesn't seem to destroy their experience - just something to pass the day, they were treated "like they didn't exist," just staring into space waiting for the boatmen to finish their chatting and continue on down stream. I noticed that one of our volunteers really took the effort to talk to the passengers - which seemed to brighten up their day. I took her lead and also started to spend more time with the passengers and noticed the difference and how it improved the experience for them. The few times when we actually took the time to talk to the commercial groups, sometimes extensively, about our research really made a difference - with the passengers asking a lot of questions and seeming truly interested in our work. When we would later pass each other on the water, they would seem happy to see us and continue to ask more questions. (Jonas et al. in press)

In the above account of encounters between recreational and research trips, it was noted that the guides from both groups acknowledged each other and exchanged pleasantries, information, or goods. Passengers were generally left out of these exchanges, resulting in a feeling of awkwardness; however, as the above also suggests, it only takes a little effort from the research crew to initiate involvement with the passengers to transform a potentially negative encounter into a situation that increases the quality of the commercial passengers' trip. Otherwise, passengers may feel merely like part of the raft's "baggage" if they are ignored during such encounters. A river guide in the study conducted by Price et al. (1997) made a similar observation:

> There is a boat[person] culture. All these boat [persons] know each other and they work together...[Sometimes we'll] pull in and talk for a while. Clients just become faceless blobs, [we boatpersons] just focus on each other, talk quietly and all [about] gear. 'Moment out of trip.' Breaks up the flow of the trip for a few minutes,...brings up the concept of other outfitters and other trips. [Clients' realize that they are not the only experience. [We are] trying to communicate [the uniqueness of] 'just our trip'

> but this [encounter] reminds them they are just 'this week's group of clients'...they are just 'my load' when I run into another outfitter (Price et al. 1995, p. 90)

In these examples, when passengers are ignored during encounters between two commercial groups, or between a commercial and a research trip, those passengers tend to feel uncomfortable. Fortunately, such a negative experience is fleeting and probably does not greatly affect the overall river experience. In addition, as the observation made by Jonas et al. (in press) illustrates, it only takes a little effort from the river guides and/or researchers to involve the passengers in the situation or ongoing conversation. Although this seems a simple solution, it is not always implemented.

6.0 CONCLUSIONS

The major points and conclusions of this study are as follows:

1) The Grand Canyon river experience is both emergent and dynamic. This is due to the extended nature of the river trip that allows for interactions between various groups of boaters, as well as between boaters and the environment. Because of the various physical characteristics of river trips as well as differences in people participating on those trips, examining only one or a limited number of attributes that make up those experiences cannot adequately capture the nature of river experiences.

2) Although the river experience is emergent and dynamic, certain factors do influence the outcome of that experience. These include river trip characteristics (e.g., type of trip, mode of transportation, number of trip participants); social factors (e.g., the quality of intragroup interactions, influence of river guides, user density levels, and the nature of intergroup encounters); and environmental factors (e.g., weather conditions, flow levels, number and quality of beaches, and the general appearance of the environment). While some of these factors can be influenced by management practices (e.g., density levels, number and duration of intergroup encounters, and river trip characteristics), others are not (e.g., weather conditions and intergroup interactions).

3) Because of the multidimensional and emergent nature of river experiences, recreational boaters have a great tolerance for adverse impacts to many of the attributes that affect experience; however, overall user satisfaction can be damaged by extreme changes in a limited number of attributes, such as extreme fluctuations or high/low flows, poor group social structure, or adverse weather during the majority of the trip.

4) Most previous studies on the river experience focus on a single factor, such as intergroup encounters, and neglect examining a number of other factors that impact the experience. Intergroup encounters have been studied under the assumption that they have an adverse impact on the river experience, although some encounters can have a positive effect.

5) One neglected factor that has an influence on the nature of the river experience that can be manipulated is the influence of the river guides over their passenger's interpretation of the experience, including intergroup encounters.

6) Flow levels, only one among many factors that influence the river experience, can impact the rate of travel, size and perceived safety of rapids, and quality of camps and beaches. Significant impacts to overall quality of experience, however, occur mainly during extreme high and low flows, or during extreme fluctuating flows.

7) The LSSF experiment affected the river experience by decreasing the rate of travel, decreasing the size of rapids and increasing safety concerns, and improving the quality of camping beaches. However, because 8,000 cfs is not considered extreme low flow, the resultant impacts on user experience can be considered minor.

8) An indirect impact of the LSSF experiment resulted from the intergroup encounters between research trips examining the LSSF experiment and recreational boaters. The situational impact of those encounters, whether they had a negative or positive impact on the river experience, depended upon the nature of the encounter. The more enduring encounters that involved researchers talking to recreational boaters and sharing their research seemed more likely to result in positive experiences than short-term encounters that did not involve interaction between researchers and recreationists.

7.0 MANAGEMENT IMPLICATIONS

One of our main goals in this study is to evaluate the effects of the LSSF experiment, specifically steady 8,000 cfs flows, on recreational users of the Colorado River in Grand Canyon. The nature of the river experience needs to first be understood, however, before impacts can be fully

assessed. As Stewart and his colleagues stressed, "without first understanding more fully the nature of river-based recreation resources and experiences, it is challenging to completely address questions related to flow releases and recreational use" (Stewart et al. 2000, p. 52). They further emphasize the need to undertake a study that "addresses basic questions about linkages between recreational experiences and resource characteristics within the river corridor," recommending that the research should "embed the research in the daily experiences of recreationists" (Stewart et al. 2000, p. 52).

The difficulty inherent in the study of the river experience reflects upon the difficulties in management decisions. Since approximately 90 percent of boaters evaluate their river experiences as excellent or perfect, it seems that the focus of management decisions should not be directed towards enhancing such experiences, but to maintain elements of those experiences to retain the high levels of boater satisfaction. As this report demonstrates, satisfaction with the river experience is embodied in a plethora of trip attributes, including personal benefits such as learning and personal growth; the social aspect of the trip, such as positive group experience and a good river guide; the perceived quality of the wilderness experience; the weather and user's preparedness for the trip; and the level of perceived crowding (Shelby and Heberlein 1986; Shelby and Nielsen 1976a). While it has been recognized that satisfaction with the river experience is a function of all of these trip attributes, a major focus of research has been on only one attribute which, alone, appears to be minimally important to satisfaction with the river experience: the number and duration of intergroup encounters. Other attributes of the river experience that explain greater variance in user satisfaction, such as the importance of a good river guide, tend to receive much less attention.

While commercial passengers acknowledge the importance of a good river guide in their overall level of satisfaction with their river experience, they probably do so without recognizing the

role that guides play in facilitating that experience. Recognizing the emergent quality of the river experience and the role of the guides in facilitating the interpretation of that experience, some researchers recommend that managers evaluate their level of involvement with outfitters and river guides to determine if they are taking full advantage of river guides' normative influence over their passengers. As Cockrell et al. (1984) suggest, "If managers and interpreters sought the compliance and support of such opinion leaders [i.e., commercial river guides], they might capitalize on the normative influence process in recreation reference goals" (Cockrell et al. 1984, p. 25). Through capitalizing upon the river guide's normative influence, managers may be able to direct how certain aspects of river trips are interpreted and experienced. Roggenbuck and his colleagues also make this suggestion:

> We see also the need for the Park Service to take an active, educational outreach program to the boaters as an integral part of the public involvement process. Currently, many boaters are developing personal norms about river use, and their primary referents are the outfitters and their guides (Cockrell et al. 1984). Boaters would have a stronger information base for personal normative decisions if the Park Service made its own philosophy, values, and resource knowledge available to them through personal contacts at the river, literature supplied to visitors, and, most importantly, through training workshops for the outfitters and their guides. (Roggenbuck et al. 1991, pp. 151-152)

For example, to reduce the level of perceived crowding on the river, an alternative to changing use levels or altering launch dates would be to influence perceived crowding by modifying user expectations and preference (Tarrant and English 1996, p. 165). An alternative to this suggestion that is more in line with the current research would be to instruct river guides to increase the quality of unavoidable intergroup encounters. Making commercial passengers or private groups more personally involved in intergroup encounters would increase the quality of that encounter and transform a potentially negative experience into a positive one. For example, when a research trip

encounters a commercial or private trip, the more effort that individuals on that research trip allocate to talking to the passengers and informing them about the nature of the research being conducted, the greater the possibility of a positive encounter, potentially enhancing the quality of the overall river experience. The problem with such a recommendation is that it would increase the length of intergroup encounters, which is in direct conflict with Colorado River Management Plan (1989) standards for the amount of time in sight of other boaters (90 minutes per day). If managers are interested in enhancing or preserving the quality of the river experience, then the basis for their current policy on encounters should be further investigated. In addition, to fully understand both the role that river guides play in facilitating the river experience for their passengers and the process by which they accomplish such a role, we recommend that an extensive qualitative study that examines the lived nature of the river experience, focusing on the interactions between river guides and their passengers, be conducted.

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