

APPENDIX G: VISITOR USE AND EXPERIENCE

The impact analysis for visitor use and experience in Chapter 4 in the *Draft Environmental Impact Statement* assesses an array of alternatives that produce different, distinct opportunities. This appendix provides additional detail about impact measures, relevant literature, assumptions used in conducting the analysis, and research findings relevant to the visitor use and experience impact analysis. Much of the information contained in this appendix was provided by Doug Whittaker and Bo Shelby (Confluence Research & Consulting) in draft text submitted under contract to the National Park Service for this *Draft Environmental Impact Statement*.

Fundamental Principles

Several recreation management and planning concepts guide the visitor experience impacts analysis. First, there is a range of recreation opportunities available in Grand Canyon, even on the primitive end of the spectrum. The Recreation Opportunity Spectrum (ROS) concept, institutionalized by many federal and state agencies, recommends specifying types of trips when assessing the quality or quantity of opportunities (Driver et al. 1987; Manning 1999).

Second, recreation quality is related to many variables, and several recreation planning frameworks help specify those relationships (e.g., CCAP [Shelby and Heberlein 1986]; VIM [Graefe, Kuss, and Vaske 1990]; VERP [NPS 1997]; LAC [Stankey, Lucas, Petersen, and Frissell 1985]). As recommended by these frameworks, this analysis focuses on social indicators, standards, and management actions to reduce impacts when they exceed standards.

Third, there are trade-offs between the quantity and quality of recreation opportunities. Higher use levels produce higher social impacts, which may affect the quality or type of opportunities. However, lower use levels mean that fewer people can take river trips, have high quality experiences, and have the opportunity to understand the values of the canyon or similar wilderness-like areas.

River Encounters

Generally, river encounters result in direct, short-term, localized, adverse or beneficial impacts on visitor experience.

- Encounters are important to many river users, particularly in lower use, wilderness-like settings (Vaske et al., 1986; Shelby et al., 1996).
- As encounters increase, perceived crowding increases (Vaske & Donnelly, 2002).
- Measuring actual encounters is challenging (Shelby and Colvin, 1982). Few studies measure actual encounters, and most rely on user reports (“perceived” encounters). Numbers of encounters reported by visitors are generally lower than actual encounters

recorded by trained field technicians. When encounters are over five per day, reported encounters may underestimate actual encounters by about half.

- Measuring encounter standards is also challenging (Manning et al., 2002; Hall & Roggenbuck, 2002). Encounter preferences are generally lower than tolerances for a given type of experience (Manning et al., 2002).
- Not all encounters have equal effects on quality (Cole, 2001; Cole & Stewart, 2002). There may be differences for encounters that occur at different times and locations or with different types of groups.
- The effect of encounters varies for different users. Some are more solitude-seeking and sensitive to encounters while others are more gregarious, even in wilderness-like settings (Patterson & Hammitt, 1990; Jonas & Stewart, 2002). Information about the likely level of encounters for a setting may influence expectations, which interact with preferences and actual encounters to influence effects on trips (Shelby et al., 1983).
- Even with stable use levels, the number of encounters will vary by day or by trip, so it makes sense to focus on average encounter levels and reasonable ranges.
- Studies in wilderness and backcountry settings show agreement that encounter levels should be low (Vaske et al., 1986). In general, wilderness preferences are for fewer than 2 or 3 encounters per day (with many users preferring no encounters), while tolerances are slightly higher, about 4 or 5 per day. For less primitive backcountry experiences encounter tolerances are higher, but usually less than 10 encounters per day.

There is considerable specific information about river encounters in Grand Canyon from the 1975 and 1998 studies; the quality of encounter information is generally better than for any other river in the country (including actual encounter measurement as well as surveys of encounter preferences). Key findings and implications include the following:

- River encounters are important to Grand Canyon river runners. Over 96% of 1998 oar users (commercial + noncommercial) and 85% of motor passengers reported that river encounters were important, which indicates a high norm “prevalence” (Donnelly et al., 2000). Similarly, less than 10% of all visitors “would have enjoyed meeting more other groups” during their trips.
- Grand Canyon users prefer low levels of river encounters; nearly half prefer to see no other groups, and 75% prefer to see fewer than 2 (oar users) or 4 (motor passengers) per day.
- Overall, encounter tolerances in peak season are about 3 to 5 reported river encounters per day (with higher tolerances for commercial motor passengers, lower tolerances for noncommercial users, and commercial oar passengers in the middle). Tolerances in the shoulder and winter seasons are probably lower.
- The current 1989 *Colorado River Management Plan* encounter standard is “80% probability of 7 or less river encounters” in the summer. Although aspects of this standard are unclear, encounter levels of most current trips are probably within this standard (Hall & Shelby, 2000).

- During recent years, about 40% of all encounters are “repeat encounters” with a group seen previously that day (Hall & Shelby, 2000). This suggests many encounters are related to “leap-frogging” by groups on similar schedules. Repeat encounters are exacerbated by the current uneven, weekly use patterns that often launch many similar trips on the same days (See Chapter 2 for current uneven launch schedule graph). Patterns that spread out different types of trips will probably reduce repeat and overall encounter rates. All new alternatives have more even launch patterns.
- Daily encounter analyses suggest that higher averages can be caused by a few exceptionally high encounter days associated with exchanges or high use at attraction sites. These may also be exacerbated by uneven launch schedules (which are eliminated in new alternatives).
- Motor trips generally have more river encounters per day because they travel faster and farther. Analyses show encounter rates separately for motor vs. oar trips.
- Although river encounters vary by day and trip, average daily encounters for specific use levels are predictable. Encounter impacts are expressed as ranges to reflect the appropriate level of precision and are efficient for this analysis.
- In Grand Canyon (1975 data), almost half of the variation in river encounters is explained by use levels, which is remarkably high given the variation in trip schedules and the size of the area.

River Encounters and Use Levels

Grand Canyon studies show encounters are related to 1) launch levels and 2) use density as measured by trips at one time. Figures 1 and 2 show those relationships and form the basis for analyses of specific alternatives. They are based on 1998 data with consideration from the 1975 study and river launch simulator results. Relationships are most reliable between 4 and 6 launches per day or between 40 and 60 trips at one time (the most common ranges during the 1998 study).

Figure G-1 shows that encounters increase as more trips are launched per day. The arrows indicate that encounters would shift upward at any given launch level with higher trips at one time (if trips stayed in the canyon longer), or if launch patterns were more uneven.

Figure G-2 shows a similar relationship between trips at one time and encounters. Here the arrows indicate that encounters would shift upward at any given trips at one time with more launches (of shorter trips) or more uneven launch patterns.

FIGURE G-1: GENERAL RELATIONSHIP BETWEEN LAUNCHES AND AVERAGE RIVER ENCOUNTERS PER DAY

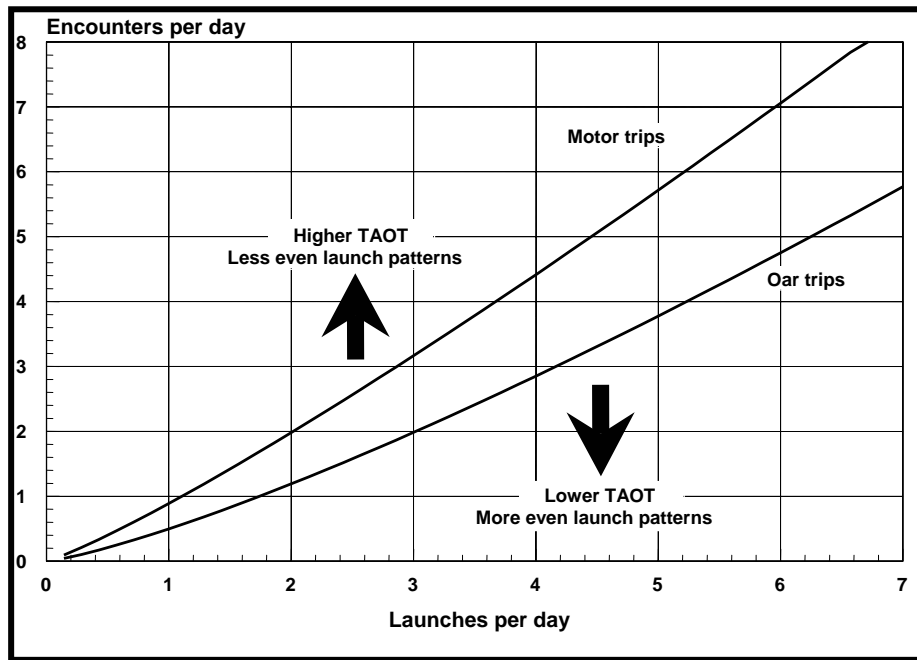
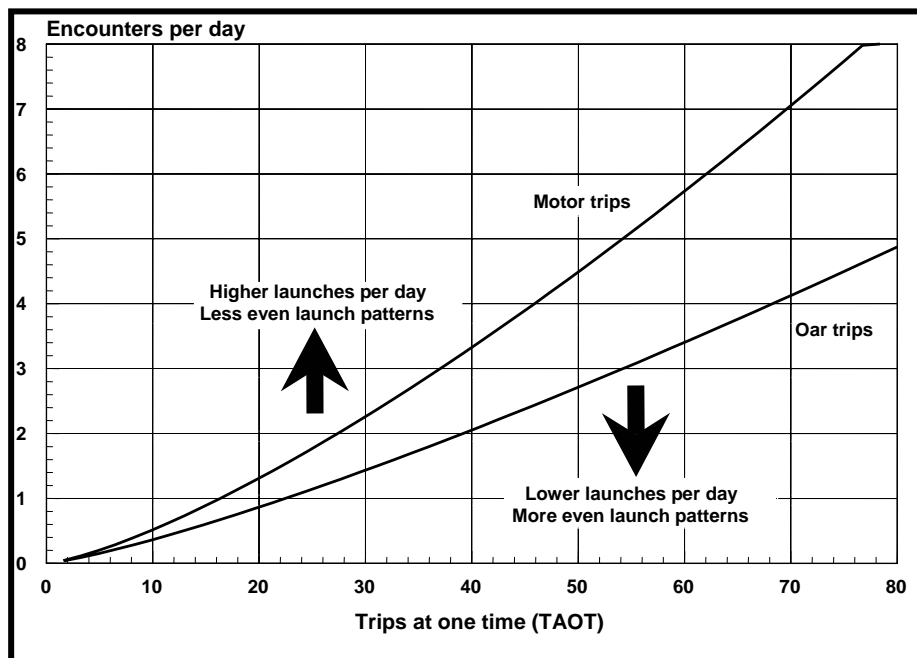


FIGURE G-2: GENERAL RELATIONSHIP BETWEEN TRIPS AT ONE TIME AND AVERAGE RIVER ENCOUNTERS PER DAY



Time in Sight

Time in sight refers to the amount of time (in minutes) that groups are in view during river encounters, which was measured during the 1975 and 1998 studies. Both Grand Canyon studies show time in sight tolerances for wilderness at 15% or less. NPS has established standards for time in sight in the current 1989 *Colorado River Management Plan* at 90 minutes per day, although it is unclear whether this refers to time in sight on the river, at attraction sites, in camp, or all three combined. Assumptions used for time in sight include:

- Applied to a five hour “on-the-water” period, 15% is about 45 minutes per day for in sight on the river.
- Applied to a 12-hour day, 15% equals about 1.75 hours when combined with in sight on the river, at attraction sites, and in camp.

Attraction Site Encounters

Attraction sites refer to places where river users stop to explore an area more extensively. They include side canyons, waterfalls, or archeological sites; at some sites users may also stop for lunch or camp. Attraction sites are important destinations that may be the focus of a day’s activities. There are about 100 sites that receive at least occasional use; of these, about 30 to 40 are regularly used, and five are “must see” sites visited by almost all trips. Two indicators (used in both the 1975 and 1998 studies) are helpful for understanding attraction site impacts. The probability of meeting another group reflects the opportunity to find solitude at attraction sites and is relevant for both lower and higher use sites. At sites with multiple groups (which is more likely at the five higher use sites), the question becomes “how many people is too many?” as measured by the average number of people observed. Generally, attraction site encounters result in direct, short-term, localized, adverse or beneficial impacts to visitor experience.

Based on the 1975 and 1998 Grand Canyon studies measuring attraction site encounters, assumptions used for attraction site encounters include:

- Most boaters prefer visiting attraction sites by themselves or to share them with few other people.
- Most boaters know (or soon learn) that encounters are likely at high use sites and possible at lower use sites.
- Commercial passengers are generally less sensitive to attraction site encounters than noncommercial users.
- On average, boaters will probably tolerate encounters at about 50% of the lower use attraction sites during summer trips, but off-season users probably prefer lower probabilities.
- Most boaters expect and will tolerate encounters at 80% of the five higher use sites in summer (e.g., on average, they will get to visit at least one with no encounters). In the non-summer season, most would prefer lower probabilities (about 60% or the probability to visit two of the five sites without other groups present).

- Acceptable densities at high use sites in summer are probably less than about 30 people (not in the same group). This is more likely to occur at Redwall and Elves Chasm than Little Colorado River, Deer Creek, and Havasu.
- Many boaters recognize that they have some ability to avoid high densities at the higher use sites by hiking farther; 86% of noncommercial users, 64% of commercial oar passengers, and 45% of motor passengers reported a willingness to do this.

Attraction Site Encounters and Use Levels

Compared to river encounters, attraction site encounters are less correlated with use levels because the geography and popularity of individual attraction sites play a larger role. The distribution of launch patterns through the week also appears to influence these impacts. Probabilities and densities vary considerably across sites, days, and trips; both indicators are affected by the sites visited and the way that stops are scheduled. Assumptions used for attraction site encounters and use levels include:

- Data from 1998 suggest that medium and high use levels (trips at one time between 50 and 65) produce similar probabilities of attraction encounters (about 85% at the five high use sites and 45% at the lower use sites). One possible explanation is that boaters may communicate and adjust their behavior more often at higher use levels. When trips at one time drop below 50, encounter probabilities drop to 55% at the five high use sites and 35% at the lower use sites. No data are available for TAOT levels below 35.
- The number of people seen at attraction sites appears to follow use levels more closely (based on 1998 data). At the five high use sites, the median number of people encountered was 30 during high use times, 23 during medium use times, and 6 during low use times. Even during high use periods most trips saw less than 55 other people, although a few trips saw over 100 in medium and high use periods.

Camp Encounters

There is no relationship between launch levels and camp encounters in Grand Canyon; 1998 data show there are similar rates of camp encounters at low, medium, and high use times. Camp encounters are related to geographical factors and trip scheduling. Groups have camp encounters in Grand Canyon when they stay at desirable camps that are in sight or sound of other desirable camps, especially near popular attraction sites or exchange points. Camp encounters may have direct, short-term, localized, adverse or beneficial impacts to visitor experience.

Table G-1 lists sites where camp encounters are most likely to occur, based on 1998 data. The sites are characterized by multiple camps (or a camp that can be shared), good hiking, and logistical value (because they set-up or are just downstream from an attraction sites or exchange point). The table includes a “use frequency index,” which suggests how often a site gets used (a function of the number of nights a site was used by the 1998 study trips). Groups that want to avoid camp encounters could avoid using these sites. The table includes

information about the attraction site or exchange point that appears to attract use to these camps.

TABLE G-1: EXAMPLE CAMPSITES WITH THE HIGHER RATES OF CAMP ENCOUNTERS

	River Mile	Percentage of Nights with Encounters	Use Frequency Index*	Comments
Saddle Canyon	47	50	26	Two sites. Hiking. Set-up for LCR.
Nevills	75	50	9	Two sites. Set-up for Upper Gorge rapids.
North Canyon	20	45	24	Two sites. Hiking. First night option.
Cremation	87	44	19	Camp sharing. Set-up for Phantom exchange.
Nankoweap	52	42	41	Multiple sites. Cultural site, hiking, layovers.
Mile 220	220	41	36	Multiple sites. Set up for Diamond takeout.
Poncho's camps	136	33	13	Multiple sites. Across from Deer Creek.
Tapeats	134	29	15	Multiple sites. Layovers, hiking.
National Canyon	166	23	28	Two sites. Hiking. Below Havasu.
Ledges	151	22	19	Camp sharing. Set-up for Havasu.
Average for these sites		36		
Average for all sites		21		

* Use frequency index from 1998 trip data = (# of nights used ÷ # nights on all trips) x average nights per trip. It roughly indicates the percentage likelihood that any particular trip would use a site.

Camp Competition

Camp competition is different from camp encounters. It can be measured by campsite occupancy level (number of occupied camps divided by the total number of camps), which is presumably related to the density of trips (trips at one time per mile).

A few studies have examined camp competition impacts and standards, although there has been less research on this indicator than river and camp encounters (and it has not been examined in Grand Canyon). Studies on ten rivers in Alaska asked boaters to specify the proportion of camps they wanted to use but could not because the camps were occupied, and then compared those with a parallel question about campsite competition tolerances (Whittaker et al., 1990; Whittaker, 1996; Whittaker et al., 2000).

Results suggest boaters are willing to pass up about 10 to 20% of camps on wilderness-like rivers and 30 to 50% on less primitive rivers. These camp competition percentages are theoretically similar to campsite occupancy rates (although studies have not specifically attempted to link them).

For this DEIS, camp competition analysis focuses on trips at one time and related campsite occupancy rates in Grand Canyon as an indicator, which also allows comparisons with other rivers. Table G-2 shows trip densities (average miles between trips) during high use periods on several multi-day rivers in North America and are intended to be illustrative rather than comprehensive.

Results suggest that Grand Canyon, even during current high use periods, has lower densities of trips than many other rivers during their peaks. Many of the “classic” multi-day trips

**TABLE G-2: COMPARISON OF THE LEES FERRY TO DIAMOND CREEK SECTION OF THE COLORADO RIVER TO OTHER MULTI-DAY RIVERS IN NORTH AMERICA
(Ordered by Average Miles between Trips)**

Grand Canyon Compared to Other Multi-day River Trips	River Length	Average Trip Length	Launches per Day	Trips at One Time	Average Miles between Trips
Tatshenshini, Canada & AK	140.0	12.0	0.5	6.0	23.0
Selway, ID (wild section)	47.0	5.0	1.0	5.0	9.4
Birch Creek, AK	126.0	7.0	2.0	14.0	9.0
Grand Canyon (current shoulder average)	226.0	14.3	2.0	24.0	9.4
Middle Owyhee, OR	35.0	3.0	2.0	6.0	5.8
Grand Canyon (current shoulder peak)	226.0	22	7.0	54.0	4.2
Cataract, UT	112.0	5.0	5.0	25.0	4.5
Lower Owyhee, OR	60.0	5.0	3.0	15.0	4.0
John Day, OR (Service Ck to Clarno)	47.0	4.0	3.0	12.0	3.9
Grand Canyon (current summer average)	226.0	10.1	5.5	55.0	4.1
Rio Chama, NM (lower use periods)	32.0	2.0	4.5	9.0	3.6
Yampa in Dinosaur NP	71.0	4.0	5.0	20.0	3.6
Forks of the Kern River, CA	14.0	2.0	2.0	4.0	3.5
John Day, OR (Clarno to Cottonwood)	69.0	5.0	4.0	20.0	3.5
Dolores, CO (Slickrock to Bedrock)	50.0	3.0	5.0	15.0	3.3
Grand Canyon (current summer peak)	226.0	18	9.0	70.0	3.2
San Juan, UT (Mex. Hat to Lake Powell)	57.0	4.0	5.0	20.0	2.9
Upper Gulkana, AK (Pax.-Sourdough)	47.0	4.0	5.0	20.0	2.4
Middle Fork Salmon, ID	97.0	6.0	7.0	42.0	2.3
Gray/Desolation on Green River, UT	84.0	6.0	6.5	39.0	2.2
Hells Canyon, OR/ID (dam to Pittsburg)	32.0	3.0	5.0	15.0	2.1
Rio Chama, NM (weekends, July + Aug)	32.0	2.0	8.0	16.0	2.0
Main Salmon, ID (wild section)	79.0	5.0	8.0	40.0	2.0
Dolores, CO (Bradfield to Slickrock)	47.0	3.0	8.0	24.0	2.0
San Juan, UT (Sand Is. to Mexican Hat)	27.0	2.0	7.0	14.0	1.9
Lower Salmon, ID (avg. in high season)	74.0	4.7	8.4	39.5	1.9
Smith, MT	59.0	4.4	8.0	35.2	1.7
Deschutes, OR (Warm Springs to L. Gate)	41.0	3.0	10.0	30.0	1.4
Tuolumne, CA	16.0	2.0	6.0	12.0	1.3
Lower Salmon, ID (peak periods)	74.0	5.0	15.0	75.0	1.0
Rogue, OR (wild section)	34.0	3.0	12.0	36.0	0.9
Median (without Grand Canyon)			5.0		2.3

average two to three miles between trips, while the current Grand Canyon summer average is closer to four. While Grand Canyon has higher densities than the Tatshenshini or Selway (both with very low launch levels), it has lower densities than the Middle Fork Salmon, Main Salmon, Green through Desolation, Hells Canyon, Rogue, and Lower Salmon. A comparison of campsite frequency on thirteen of these rivers (not all provided camp information) shows they average 0.7 to 1.3 camps per mile, which is similar to Grand Canyon (at 1.0 per mile). Overall, these findings suggest that Grand Canyon is likely to have similar or lower campsite occupancy rates and camp competition than most comparable rivers; albeit, these general comparisons simplify camp competition issues in Grand Canyon.

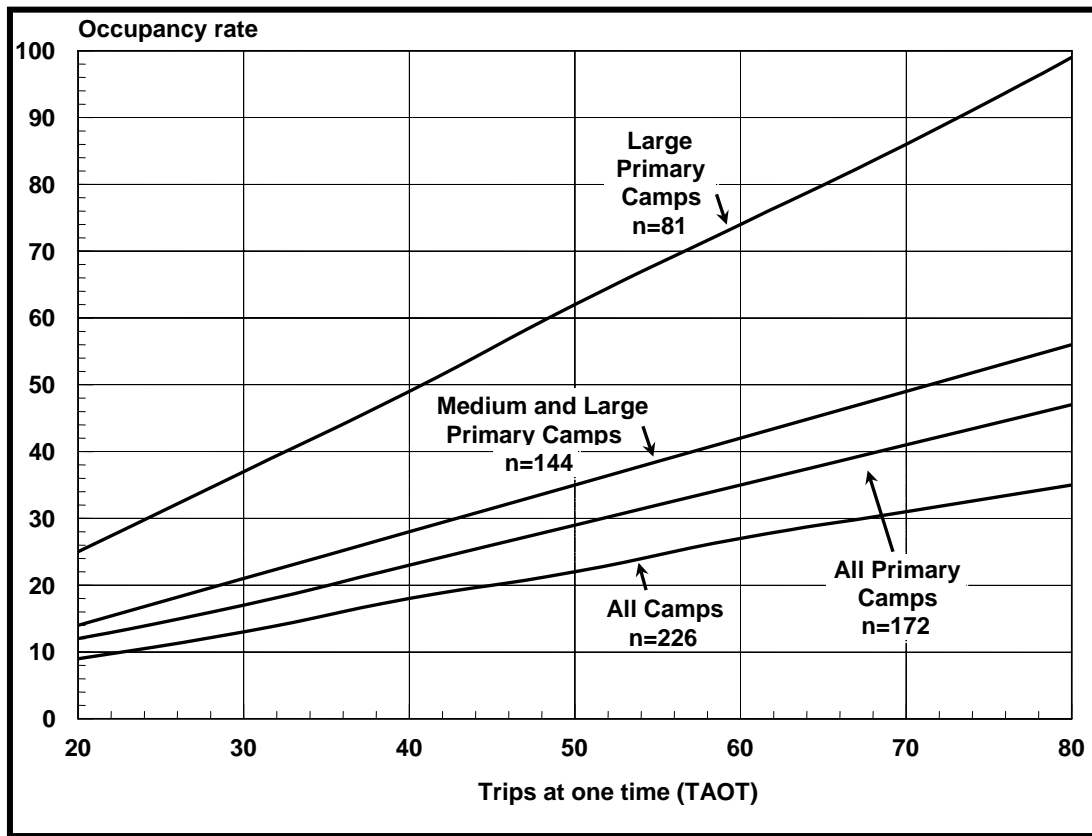
Higher trip densities (and fewer camps) occur in “bottleneck” areas near attraction sites or exchange points. In addition, some Grand Canyon trips can only use large sites with good access for large boats, which affects the “usable” campsite density. With some beaches getting smaller due to Glen Canyon Dam, camp competition may increase over time

regardless of alternative (see “Camps and Beaches” section in Chapter 3 under “Visitor Use and Experience”). Camp competition may have direct or indirect short- or long-term, localized, adverse or beneficial impacts to visitor experience.

Camp Competition and Use Levels

Figure G-3 partially addresses these issues, showing the relationship between trips at one time and camp occupancy rates in Grand Canyon for different categories of camps (assuming all “more desirable” camps are occupied first). Occupancy levels of 100% would mean every camp was being used. The number of camps in each category is based on inventory data from 1991; since that time, other studies (but not full inventories) suggest the number and size of camps has decreased.

FIGURE G-3: RELATIONSHIP BETWEEN TRIPS AT ONE TIME AND CAMPSITE OCCUPANCY RATES



Note: For different categories of camps based on 1991 inventory). Low water camps excluded

Results show that nearly all the large primary camps and about half of the medium and large primary camps would be occupied if trips at one time approached 70 (current summer peaks). At typical current summer levels, 55 trips at one time would produce occupancy rates of about 70% of large primary camps, and 40% of medium and large primary camps, but only about 25% of all camps. Table G-3 shows current TAOT density in all seasons.

**TABLE G-3: NUMBER OF TRIPS AT ONE TIME
IN SUMMER, FALL, WINTER, AND SPRING**

	Current Situation
Summer (June average)	57
Summer (peaks)	70
Spring (March average)	16
Spring (April average)	31
Fall (Sept. average)	54
Fall (October average)	38
Winter (Jan. average)	10

One implication from these findings is that somewhat smaller group sizes are likely to substantially reduce camp competition impacts. If all groups were small enough to occupy medium-sized camps (13 to 24 people), campsite occupancy rates would be cut nearly in half compared to having all groups competing for large camps. About 40% of the camps in Grand Canyon are medium-sized.

In contrast, dramatic reductions in group sizes are not likely to substantially reduce camp competition further. Less than 20% of camps in Grand Canyon are considered “small” (12 or fewer people), so even if all trips were able to use these, gains in occupancy rates are marginal. Several new alternatives provide access for small group noncommercial trips (< 8 people) that would be required to use small and medium sites (and thus not exacerbate competition for larger sites). These data also suggest that small site capacity is relatively limited; to avoid competition problems for these small sites, “small group trips at one time” should probably not exceed 20 to 30% of total trips at one time (about 1 launch per day).

Launch and Takeout Congestion

Launch and take-out congestion refers to the quantity of people, boats, and gear at put-in or take-out sites, and the way it affects efficient use of launch facilities (e.g., boat ramps, parking, and education and interpretation programs). While people and boats contribute to launch congestion, the number of people is probably the key indicator and the focus of analysis in this DEIS. In Grand Canyon, the critical launch areas are Lees Ferry, Diamond Creek, and Lake Mead (previously Pearce Ferry; currently South Cove). Launch and take-out congestion may have direct or indirect, short-term, localized, adverse or beneficial impacts on visitor experience.

Launch and take-out congestion has been examined in some river studies, but it appears less important than river encounters or camp competition, particularly on multi-day trips (Whittaker 1993). Users are probably interested in efficient facilities that can handle the expected volume of use, but a small proportion of the trip is spent at launches, so some short-lived congestion is probably tolerable and has only minor effects on overall experiences.

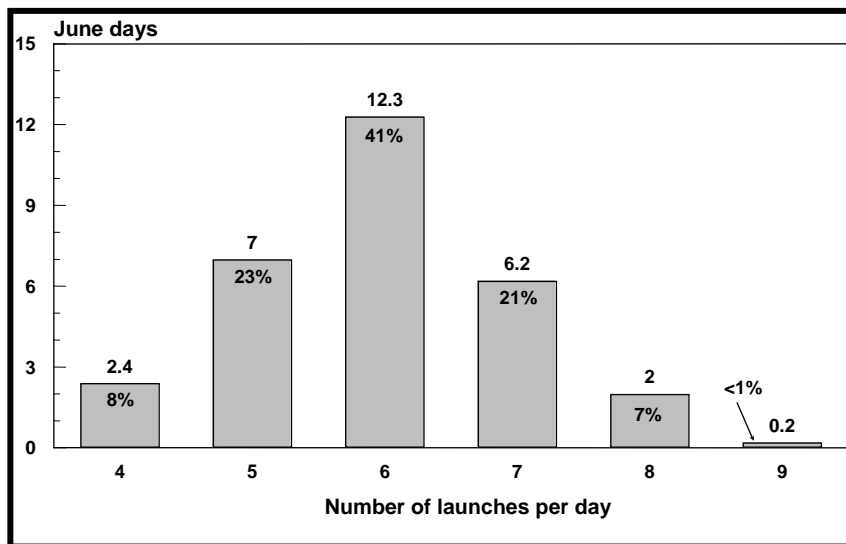
There is little specific comparative data on launch levels, but a cursory review of peak season launch rates on several multi-day use rivers (including several that are in designated Wilderness) is instructive. In general, the current number of people launching at Lees Ferry in summer is much higher than some multi-day rivers (e.g., Selway, Tatshashini-Elsek), slightly higher than others (Hells Canyon, Cataract Canyon, Desolation/Gray, the San Juan, or the

Yampa), but comparable to the Middle Fork Salmon, Main Salmon, Rogue, and Lower Salmon.

Use patterns generally have a direct relationship with launch congestion, although facility size and design are also important. In addition, the timing of trip put-ins and take-outs can create substantial congestion for a few hours even if overall daily launch levels are acceptable. Factors that can exacerbate congestion are the number of people and boats, the efficiency of users, and the efficiency of their equipment. In Grand Canyon, oar trips are probably less efficient than motor trips and noncommercial trips are less efficient than commercial trips.

Another major influence on launch and take-out congestion in Grand Canyon is the distribution of launches through the week. Under current management, there are limits on the number of people launching per day, but no limits on launches because it is a user-day based system. The resulting uneven launch patterns are shown in Figure G-4, based on June data from 1998-2002. This figure shows that nearly 30% of days had seven or more launches, while a similar percentage had five or fewer launches. Congestion impacts are more maintaining the same overall use level.

FIGURE G-4: UNEVEN LAUNCH PATTERNS: LAUNCHES PER DAY IN JUNE 1998–2002



Group Size

Group size refers to the total people on a trip (including commercial crew) and is an important component of river trips. The size on one’s own group and the size of groups one encounters affect opportunities for solitude and the character of wilderness trips, as well as logistics and dynamics within the group. People spend 24 hours a day with their own group, so “own group size” is arguably more important than occasional encounters with large groups. In either case, group size limits can directly manage these impacts. Group size has direct, short- or long-term, regional, adverse or beneficial impacts on visitor experience.

A review of group size limits on 25 multi-day river systems in the west (River Management Society, 2003) shows that one-third have limits at 16 and three-quarters have limits of 26 or less. Only five rivers (parts of the Rio Grande in Big Bend, Klamath, Lower-Salmon, Main Salmon, and commercial groups on the Middle Fork Salmon) have limits at 30, and only one (Cataract Canyon) has a limit of 40. In Grand Canyon, commercial group size is 36 passengers or up to 46 with crew.

Data from the 1998 boater survey offers compelling evidence that Grand Canyon River users prefer to be part of and meet smaller rather than larger groups (Hall & Shelby, 2000). The following summarizes findings based on questions that asked about being in small (0-20), medium (21-30), or large (31-40) groups and form the list of assumptions used for group size:

- Among commercial motorized passengers, 83% prefer to be in small or medium groups (with 56% preferring to be in small groups). Less than 4% prefer to be in large groups and only 13% report it makes no difference.
- Among commercial oar passengers, 98% prefer to be in small or medium groups (81% prefer to be in small groups).
- Private boaters unanimously prefer to be in small groups.
- Among guides, 88% prefer to be in small or medium groups (66% prefer small groups).
- Even among people who were in large groups themselves, 83% prefer to be in small or medium groups (48% prefer to be in small groups). Only 6% preferred to be in large groups and 11% reported that it makes no difference.
- The 1998 boater survey asked boaters about preferences for meeting other groups of different sizes. Results were similar to the “own group preferences” above.
- The 1998 survey also asked boaters specifically about their opinions of group size limits and results are consistent with their preferences for own groups size or meeting other groups. Preferences for group size limits are summarized in Table G-4 for different user groups.

TABLE G-4: PREFERENCES FOR GROUP SIZE LIMITS

Group Size Preference	Commercial Motor	Commercial Oar	Noncommercial	Guides
Group size should be 20 or less (%)	31	37	74	17
Group size should be 30 or less (%)	69	88	98	75
Group size should be 31 or higher (%)	31	12	2	25
Preferred group size limit (average)	28.8	25.5	20.0	28.5

Source: 1998 study.

Assuming standard passenger-to-crew ratios on commercial trips and group size categories, the percentages of trips in different size categories under current management are given in Table G-5. In general, about one fifth of all current trips have a large (31 to 40) or very large (over 40) group size. Data show that most Grand Canyon boaters do not want to be part of or meet these large groups.

TABLE G-5: PERCENTAGE OF LAUNCHES OF DIFFERENT SIZES (INCLUDING CREW) IN 2002

Group Size Percents	Commercial Motor	Commercial Oar	Noncommercial	All trips
Very small groups (10 or less)	2	1	23	8
Small groups (11 to 20)	34	12	77	42
Medium groups (21-30)	27	80	0	29
Large groups (31-40)	35	7	0	20
Very large groups (41 or more)	2	0	0	1

Trip Length

Trip length refers to regulations on maximum trip lengths; it has major effects on trips. Longer trips allow greater opportunities to explore the canyon, hike, visit attraction sites, or have an “unhurried” trip. Shorter trips provide less time in the canyon, although this may fit with some users’ limited vacation time or preferences for shorter trips. The quality of either trip can be high, but the nature of each may be fundamentally different. Trip length has direct or indirect, long-term, regional, adverse or beneficial impacts on visitor experience.

For many users, a long trip appears to be important and a distinguishing feature of the Grand Canyon. Boaters were asked to rate Grand Canyon trips on 12 general attributes compared to other rivers, and the “length of time traveling through an undisturbed environment” was the third highest ranked (just behind geology and scenery; just ahead of whitewater as indicated in the “Recreation Values” section of Chapter 3 under “Visitor Use and Experience”). Nearly one-third of commercial passengers and 51% of noncommercial users felt their trip was too short. Most noncommercial boaters prefer trip lengths of 16 to 18 days from Lees Ferry to Diamond Creek (18 is the current summer trip length limit and most trips are close to that limit). It is likely that many noncommercial users would take longer trips if allowed and some choose trips during shoulder or winter seasons because longer trips are allowed then.

Most commercial passengers have no previous experience in Grand Canyon, relying on options and information from outfitters when choosing trip lengths. Most motor trips are six to eight days and most oar trips are 12 to 14 days; however, commercial motorized trips far out-number commercial non-motorized trips. Under a user-day based limit system, there is a general incentive for outfitters to offer shorter commercial trips, but some longer trip options remain available from some outfitters. Longer trips allow more time in the canyon, but increased impacts related to trips at one time related and decreased access. Shortening trip lengths is one way to produce higher numbers of trips while reducing “at one time” impacts.

Discretionary Time, Exploration Impacts, and Personal Benefits

Discretionary time refers to the free time on Grand Canyon river trips that is not spent on logistics (e.g., packing, rigging, preparing meals, etc.), sleep, or travel on the river. Although it is related to trip length, discretionary time is also influenced by other factors, such as daylight hours (which change by season) and type of trip.

Because discretionary time is a new tool developed for this DEIS, it is potentially important in two ways. First, it may help suggest relationships between use levels and certain biophysical or cultural impacts (see natural and cultural resource sections for impact analyses). Second, discretionary time is a useful indicator of trip quality. Researchers have catalogued a long list of psychological benefits from outdoor recreation experiences (Driver, Brown & Peterson, 1991; Crystal & Harris, 1995), several of which are probably related to the time people have for exploration activities different from down-river travel and logistics. More discretionary time may translate into improved opportunities to appreciate nature or cultural resources; experience a sense of freedom or adventure; develop new skills, self-reliance, and competence; or engage in personal or spiritual growth.

The NPS model integrates trip types, use patterns, and trip length information with the number of daylight hours (9.5 in winter to 14.5 in summer), while making assumptions about the amount of time different trip types spend on the river, sleeping, or doing logistical activities. Variables used in the model are listed below; specific information about the model and additional adjustments made during calculations are documented in Appendix XX (NPS, 2004):

Per trip time (subtracted from total trip length):

- Put-in (varies by commercial and noncommercial)
- Takeout (varies by commercial and noncommercial)
- On river (varies by commercial motor, commercial oar, and noncommercial)
- Scouting rapids (varies by commercial motor, commercial oar, and noncommercial)

Per day time (subtracted per day over total trip length):

- Loading and unloading
- Meals
- Camp set-up
- Hygiene

Albeit a new tool to be used for relative comparisons between groups or alternatives, in general the discretionary time model suggests several hypotheses about people's free time on river trips that form the basis of assumptions used for visitor experience.

- Noncommercial trips may be less efficient at daily and per trip logistical tasks because they generally view their trip as leisure time and often conduct logistics in a more leisurely pace.
- The number of daylight hours affects the amount of time groups can spend exploring the canyon.
- If trip lengths were equal, more efficient commercial trips would have more discretionary time than noncommercial trips; because most commercial trips are substantially shorter, there are smaller differences between the two.

- Noncommercial trips are longer and spend more time at attraction sites and camps (Hall & Shelby, 1998).

Aggregate discretionary time is given in each Lees Ferry Alternative and shows how discretionary time varies considerably by alternative, and the differences are not necessarily driven by user-day total (e.g., all of the alternatives have similar number of commercial user-days, but some produce substantially more discretionary hours in the commercial sectors). In this analysis, discretionary time has a direct or indirect, long-term, regional, adverse or beneficial impact on visitor experience.

Discretionary time can be a useful model for this social impact analysis; however, at least three substantial information gaps limit its value.

First, the relationship between trip length and discretionary time is unknown. While people on longer trips obviously have more total time in the canyon, it is unknown how this translates into the amount of discretionary time. For example, people on longer trips may spend more time on logistics (cooking more elaborate meals, taking more time to scout rapids, or set up camps).

Second, people's activities during discretionary time are unknown. More discretionary time provides the opportunity to hike trails or swim in tributaries, but some people may use that time to relax in camp, prepare gourmet meals, or socialize. Each of these pursuits may provide different personal benefits and have different impacts.

Third, the relationship between discretionary time activities and adverse impacts or personal benefits is unknown. A group that spends more time hiking does not necessarily cause more "exploration impacts." For example, a long hike employing Leave No Trace ethics (e.g., staying on the trail, avoiding wildlife disturbance, and not disturbing cultural sites) may have less impact than a short hike that is less careful and is supported in much of the biophysical impact literature (Cole, 1994; Cole, 2000).

Non-Motorized Opportunities

Conflicts about motorized and non-motorized use are a major planning issue. Although several variables may be relevant (see below), the fundamental decisions in this DEIS focus on the length of non-motorized use periods for the alternatives. The relevant indicators are the numbers and percent of probable trips (and people who get to take them) in those non-motorized periods. Non-motorized opportunities may have direct or indirect, short- or long-term, regional, adverse or beneficial impacts on visitor experience.

Conflicts between motorized and non-motorized use are well-documented in the recreation literature (Lucas, 1964; Jacob & Schreyer, 1980; Shelby, 1980; Adelman et al., 1982; Jackson & Wong, 1982; Kuss et al., 1990). Research shows antipathy from non-motorized users toward motorized use in many settings, particularly wilderness-like settings. This antipathy is often one-sided, and it may have a value-based component that is independent of actual encounters with motorized users (i.e., social conflict; see Vaske et al., 1995). The central issue of the conflict between motorized and non-motorized use is the nature of contrasting

experiences (Shelby, 1980). Motorized use has been an issue in Grand Canyon since the exponential growth in use in the 1960s (see Chapter 1 – Purpose & Need of this DEIS for background).

In 1975, a group of commercial passengers took experimental Grand Canyon “combination” motor-oar trips. Most participants preferred oar travel because they perceived a slower, more relaxed pace; smaller more comfortable social groupings; and enhanced sensitivity to the natural environment. These perceptions related to objective differences (such as trip length, party size, and boat configuration) between oar and motor trips. Overall, 92% reported that oar trips better enabled them to “experience the Grand Canyon environment;” this is among the most compelling findings in the recreation research literature on conflicts or social impacts.

When asked about preferences for meeting motor or oar trips, 84% of commercial oar and 93% of noncommercial users prefer to encounter oar trips and only 1% preferred to meet motor trips (the remainder said it made no difference to them). In contrast, 13% of motor passengers prefer to meet oar trips, 6% prefer to meet other motor trips, but 81% said it “makes no difference.” This type of “asymmetric antipathy” is common in use conflicts, particularly those involving motorized use.

The asymmetry is further illustrated in results from a trade-off question. About 80% of motor users said they would prefer to meet one trip of 35 people on 2 motorboats that passes quickly, compared to a trip of 35 people on 8 oar boats that goes by more slowly. Among oar users the finding was reversed, with 80% preferring the longer contact with the multi-boat oar trip.

Without linking the motorized use issue to legal definitions of wilderness, 1998 data also show that most oar users (85% of noncommercial users and 74% of commercial oar passengers) believe the canyon would be “more of a wilderness if motor travel were banned.” Less than half the guides (46%) and only a quarter of motorized users felt the same. Wilderness concepts are multi-faceted and defy simple characterizations (Nash, 1982; Oelschlaeger, 1991); the motor/non-motor issue often-times is viewed with a social values perspective and thereby, cannot be resolved in this DEIS.

Whitmore Helicopter Activity

Nearly 11,000 commercial passengers per year currently put-in or take-out at the Whitmore helipad (RM187) via helicopter exchanges from the rim; noncommercial boaters hardly ever use this access point. Shuttles affect the people who use them and the trips that encounter them. This use also may be part of a more profound social values conflict about the appropriateness of helicopters in the Canyon, regardless of how many people encounter them.

Under current management, uneven launch patterns create distinct patterns of helicopter use at Whitmore, with the greatest use in the summer and on certain days of the week. Figure G-5 shows the number of days per month with Whitmore helicopter activity, along with the number of river trips involved per day. Figure G-6 shows the average number of river trips participating in shuttles by day of the week (from June and July 2002 data).

FIGURE G-5: WHITMORE HELICOPTER ACTIVITY, 2002
Days per Month and Number of Trips per Day

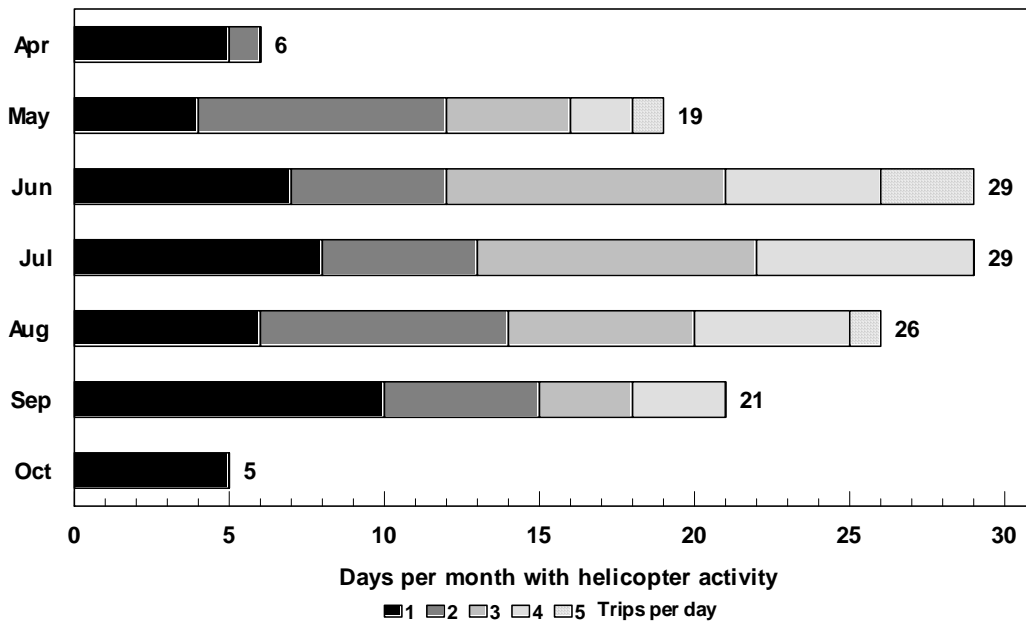
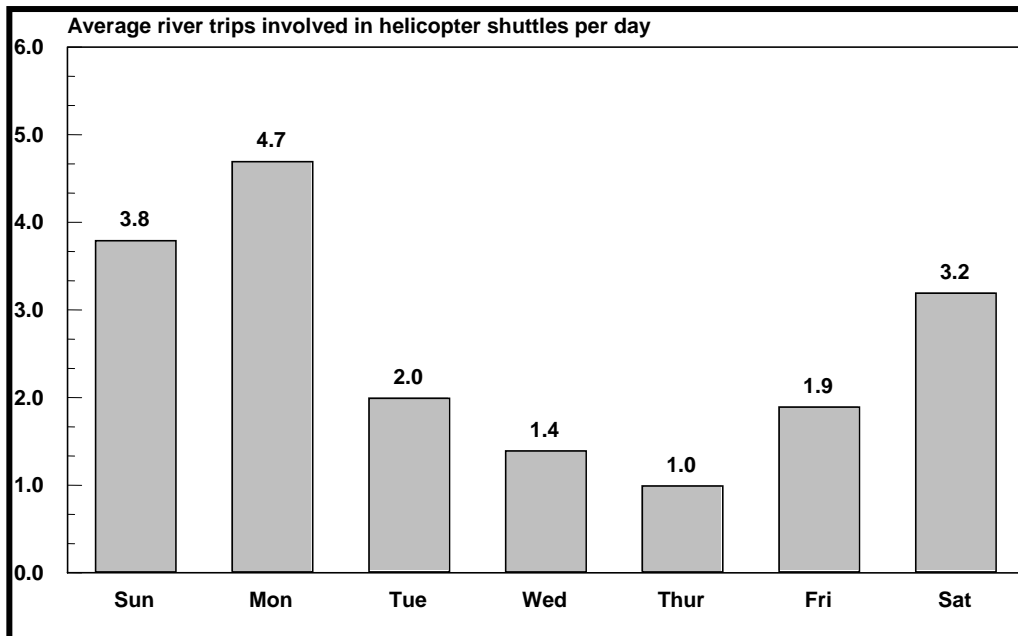


FIGURE G-6: RIVER TRIPS INVOLVED IN HELICOPTER SHUTTLES BY DAY OF THE WEEK



SOURCE: June and July, 2002 data.

Table G-6 provides additional statistics about the percent of days with Whitmore helicopter use and the percent that involve three or more trips per day. In summer months, 84% of days have some helicopter activity and 42% have three or more river trips participating per day. In June and July, 94% of days have some activity and 52% have three or more trips. Spring helicopter activity levels are lower, with no activity in March and 20% of days in April (most involving only one trip per day). In fall, about 40% of days have some helicopter activity.

TABLE G-6: WHITMORE HELICOPTER ACTIVITY, 2002

Months and Seasons of Helicopter Activity	Percentage of Days (any activity)	Percentage of Days (3 or more trips)	Average Number of River Trips Involved per Day
March	0	0	0.0
April	20	0	0.2
May	61	23	1.5
June	97	57	2.7
July	94	52	2.4
August	84	39	2.1
September	70	20	1.4
October	16	0	0.2
Spring	10	0	0.1
Summer	84	42	2.1
Fall	43	10	0.8

Whitmore helicopter shuttles have several potential impacts on trips. Although more localized than impacts from motorized rafting use or aircraft overflights in general, low altitude helicopters using Whitmore are louder and contrast sharply with other components of Grand Canyon River experiences. Perceived adverse impacts from helicopters may include:

- Noise
- Physical impacts (downwash from rotors may blow sand or gear around)
- Visual impacts (seeing mechanized use after a week or more of being in a primitive and undeveloped setting)
- Congestion at Whitmore helipad (particularly for trip passengers waiting for helicopter exchanges to be completed)
- Perceived safety risks from low flying aircraft
- Camp competition for sites near the helipad or “trip scheduling” changes to use or avoid helicopters
- Creation of an “artificial” end to the trip, 39 miles upstream of Diamond Creek

As with motorized/non-motorized conflicts in general, antipathy regarding helicopter use is probably asymmetrical, with those not using helicopters being the sensitive group. Most people participating in helicopter shuttles probably view them as a “feature” of their trips, and data suggest that most users who take scenic helicopter trips enjoy the views of the canyon they provide (NPS 1995).

As with motorized boating, conflict over helicopter use is likely to have a strong “value-based” component. Based on public comments, some people feel helicopters are inappropriate

for the Grand Canyon even if few people encounter them or noise impacts are limited by improved technologies or temporal zoning.

Helicopter shuttles may provide some beneficial impacts, including in-canyon “flight-seeing” opportunities for helicopter passengers, decreased congestion at other take-outs, and a variety of economic benefits to commercial outfitters; aircraft concessions, Bar-10 Ranch, and the Hualapai Nation (see Soundscapes and Socioeconomic sections for specific impact analyses).

Many studies have examined noise impacts from aircraft, although few have focused on backcountry settings (Gramann, 1999). Several studies are specific to Grand Canyon, although they focus on general overflight impacts, not Whitmore. In general, aircraft noise impact studies use three different approaches (Gramann, 1999). Psychological approaches focus on visitor evaluations without considering physical sound measurements; acoustical approaches quantify physical sound levels relative to ambient sound; and psycho-acoustical approaches combine non-site evaluations with physical measurements (see Natural Soundscape sections of this DEIS for further information). Assumptions used for assessing aircraft noise impacts on visitor experience include:

- Visitor characteristics affect evaluations of aircraft noise. There is great sensitivity to aircraft noise by backcountry vs. front country users, repeat vs. first-time users, and small vs. larger groups (HBRS/HMMR, 1993; Anderson et al., 1994; NPS, 1995). Additional characteristics are likely to distinguish more and less sensitive visitors.
- Among river users, sensitivity to aircraft noise is greater for oar vs. motor users (HBRS/HMMR, 1993). Possible explanations focus on desired experiences, higher noise levels from raft motors, and higher “self-noise” at land sites (because motor groups tend to be larger).
- In Grand Canyon, 88% of oar and 74% of motor river users reported hearing aircraft in general (not specific to Whitmore use). Among oar users, 52% thought aircraft noise interfered with “natural quiet,” and 38% reported noise levels were moderately to extremely annoying. Among motor users, 22% felt noise interfered with natural quiet and 14% reported it was annoying (HBRS/HMMR, 1993).
- There is strong support among river users for management actions to reduce or eliminate aircraft noise impacts, with about 70% supporting defined aircraft use areas, about 66% supporting time of day restrictions, and about half supporting day of the week restrictions (HBRS/HMMR, 1993). Among oar users, 56% support seasonal restrictions; among motor users, 43% support seasonal restrictions. For all the other actions, there was less support among motor passengers than oar passengers.
- Noise levels may be more objectionable at specific locations (e.g., attraction sites, reaches of the river without rapids, or similar places with low ambient sound) and at different times of the day (e.g., at night while sleeping, in early morning).

Specific impacts from Whitmore helicopter activity are characterized in the following categories in the “Visitor Use and Experience” section of this document:

- *Close Encounters* — These are low-altitude encounters with helicopters as they land or take-off at the river or while they are active at the helipad. Noise levels are

substantially higher than distant encounters with scenic overflights or high altitude commercial aircraft, and majorities would probably rate them “moderately annoying” or worse. These encounters are also probably responsible for occasional physical impacts and perceptions of safety risks (as described in some public comments).

Despite their potential impact, close encounters occur less frequently than distant encounters. For close encounters to occur, a river trip must be near the helipad during active periods. Under current management, active helicopter use is generally under five hours per day in peak summer months, and often less. Some river trips may also avoid these encounters by scheduling to pass the helipad in late afternoon or on lower use days. Close encounters have direct, short-term, localized, adverse impacts on visitor experience.

- *Distant Encounters* — These involve more distant visual or noise impacts from helicopters flying from the helipad to the rim, rather than close encounters near the landing site. Impacts are likely to vary depending on flight patterns, wind, terrain, or other factors that affect the distance between boaters and helicopters. At a down-river speed of 5 mph, an oar trip is probably within the “distant encounter zone” of Whitmore helicopters for less than two hours (assuming they camp more than 3 or 4 miles away from the helipad). Motor trips are probably within the distant encounter zone for half that time, because self-noise levels are higher and they travel faster.

Distant encounters are likely to have smaller impacts on passing boaters than close encounters, but they have greater impacts than overflights or commercial aircraft. These impacts are incompatible with the concept of “natural quiet” (see Natural Soundscape section) or a “wilderness-like” experience. Distant encounters have indirect, short-term, localized, adverse impacts on visitor experience.

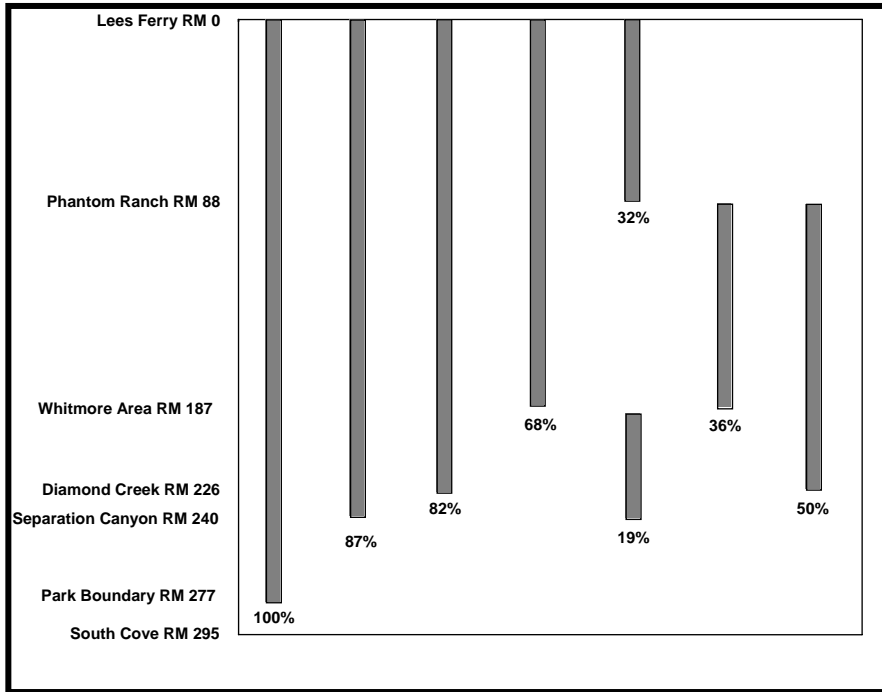
- *Contrasting Experience Effects for Helicopter Exchange Passengers* — A third impact may occur for users involved in helicopter exchanges. Helicopter use is advertised as a trip feature that provides views of the canyon different from those on the river, and a study of scenic overflight passengers suggests that most enjoy them and would recommend them to others (NPS, 1995). But helicopter exchanges are a substantial contrast to being on the river and they may have effects on overall experiences.

The contrast is probably greatest for passengers on long oar trips (although only about 11% of oar trips are involved in Whitmore exchanges), and smallest for those on short (5 day) motor trips (particularly those who joined short trips at Phantom Ranch). It is likely to be exacerbated by congestion at the helipad, which varies by season and day of the week under current management.

- *“Shortening” the Grand Canyon River Trip Experience* — The Colorado River in Grand Canyon provides one of the longest river trips in the Lower 48 states. Geologically and historically, the Grand Canyon starts at Lees Ferry and ends at Grand Cliffs (the current Grand Canyon National Park boundary). For passengers boating from Lees Ferry to Whitmore, the river trip is only 187 miles long, about 32% shorter than the entire canyon (see Figure G-7). The effects are compounded for passengers who start their trips at Phantom Ranch after hiking in.

For passengers who put-in at Whitmore, trips include just 53 miles on the river (Whitmore to Separation Canyon). Many of these trips conclude with a jetboat component, their river trip is 81% shorter than a trip through the entire canyon.

FIGURE G-7: COMMON TRIP LENGTHS AND THE “SHORTENING” OF GRAND CANYON (Percentages of Total Length)



- Sensitive groups** — Helicopter exchange impacts are likely to be more objectionable to noncommercial vs. commercial oar users, and more objectionable to oar users vs. motor users. The longer a person has been on a trip or away from close contact with mechanized sound, the more intrusive helicopter impacts are likely to be. Noncommercial users may be particularly sensitive to these impacts because they are associated with commercial user, which may interact with their evaluations of motorized rafts and access issues.

Under current management, even peak season trips experience helicopter exchange impacts for a relatively small proportion of their total time in the canyon (probably about 1 to 2% of the total hours). However, the length, frequency, or duration of these encounters may not be as important as the simple fact of their occurrence, particularly for those who have a value-based objection to helicopter use in backcountry settings. The contrast between helicopter use and other components of the Grand Canyon river trip experience is so great that a single encounter may have substantial effects on many users’ experiences.

Encounters between River Users and Hikers

From a river runner perspective, encounters between river users and hikers happen relatively infrequently. On average, river users only see a hiking group about one day out of four (Hall & Shelby, 2000). More importantly, hikers and river users have these encounters at specific locations, and river users can limit these encounters by spending less time at those attraction sites or camps. Hiker-river encounters occur most often near Phantom Ranch; they occur occasionally at points where less-used trails reach the river (e.g., Deer Creek, Hance, Granite, Tapeats, and Hermit).

From a hiker perspective, encounters may be more common and obtrusive. A hiker who camps or spends time along the river in the summer may see 5 to 7 river groups per day, which is probably more than the number of other hiking groups they encounter (except in the Bright Angel / Kaibab corridor). Perhaps more importantly, hikers may arrive at the river late in the day seeking a beach camp only to find it is already occupied by a river party (especially at Hance, Granite, Tapeats, or Hermit). Under current management, the problem is relatively small because the prime hiking seasons are in spring and fall, while the primary river season is in the summer. Generally, encounters between river users and hikers may have direct or indirect, short-term, localized, adverse or beneficial impacts on visitor experience.

Phantom Ranch Exchanges

Under current management, 2,071 users leave trips at Phantom Ranch and 1,981 replace them after hiking in (see Chapter 3, “Visitor Use and Experience”). Most of these exchanges occur on commercial oar trips (about 1,400 and over half of all exchanges), although they are also common on motor trips (about 800 exchanges and about one third of all exchanges). Fewer than 300 exchanges currently occur on noncommercial trips (just over 10% of all exchanges).

The social dynamics of having some proportion of users leave or join a trip are not trivial. Those taking the longer trip may not invest effort in meeting or getting to know passengers that are leaving sooner, and the effort involved in meeting and dealing with new arrivals is also substantial. For new arrivals, they face integration into a social group that may have already formed friendships and have some shared history. For guides, educational and interpretive information must be conveyed to the new set of passengers, which may be repetitive to the original passengers and diminishes opportunities for more in-depth information.

A more important management issue focuses on the hiking challenges for Phantom exchange passengers. The relative difficulty of the hike depends on individual fitness, skill, and experience levels, and outfitters probably try to discourage the obviously unqualified. However, it is not known how rigorously outfitters screen exchange passengers or the degree to which they provide accurate information about the difficulty of the hike. While many outfitters encourage their passengers to take the hike seriously, under current regulations guides and outfitters are generally not responsible for their passengers when they are not on the river trip, which can potentially be a health and safety risk to their passengers. Phantom Ranch Exchanges may have direct or indirect, short-term, localized adverse or beneficial impacts on visitor experience.