

Boats, Beaches, and River Banks: Visitor evaluations of recreation on the Merced River in Yosemite Valley



Final Study Report

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Abstract

This study measured visitors' perceptions of use levels, crowding, resource conditions, and management actions related to the Merced River corridor in Yosemite Valley. Data help identify evaluations of boating and shore-based recreation use, and identify support for management actions that might be used to address impact problems. Data were collected through on-site surveys given to users throughout the 2011 high use season. Data were integrated with counts of visitor use (described in a separate NPS report). Findings show that visitors feel more crowded when using the Valley's transportation system than when they recreate on the river, but crowding and impact evaluations indicate there are times and locations where use levels are higher than visitors prefer, accept, or want NPS to manage for. Visitors support some reductions in commercial boating use, but oppose substantial reductions of commercial boating use, eliminating all boating, or reductions in Valley day or overnight use to reduce shore use crowding. Visitors support education actions that might redistribute use from crowded shore use areas or sensitive riparian areas.



Executive Summary

The Merced Wild and Scenic River corridor in Yosemite National Park has experienced increased visitation in recent years. Higher use may affect the quality of visitor experiences. This study was designed to describe characteristics of river visitors, identify important aspects of river experiences, describe visitors' tolerances and preferences for impact levels, establish correlations between use levels and impacts, and assess the acceptability of management actions that address impacts.

Methods

The study surveyed Merced River visitors in Yosemite Valley on 15 days during the high use season in July 2011. Sampling had roving and stratified elements to represent the diversity of river locations and users. A total of 806 individuals completed surveys (92% of eligible groups approached); it included samples of private boaters, commercial raft renters, and shore users. Survey results were integrated with use information (collected by NPS) to assess differences at higher and lower use locations and times.

A single on-site questionnaire included questions about visitor and trip characteristics, perceived crowding during different parts of their trips, evaluations of boating and beach use densities via photo simulations, and support for several management actions (including commercial rafting levels, non-commercial boating use limit systems, open boating segments, development and education programs to re-distribute use, and split-rail fencing or boardwalk networks to protect sensitive riparian areas).

Visitor and trip characteristics

River visitors are more likely to have visited the park in previous years (69%) or live in California (72%) than general park visitors (from other studies). A higher proportion (56%) of river users spend at least one night in the Valley compared to about one-third of general visitors. Most river users (85%) spend two or more days in the park. First-time visitors, non-Californians, and people who spend nights outside Yosemite Valley probably have less time for beach or boating activities.

Visitors who spend the night in the Valley campgrounds or at Housekeeping Camp appear to use the river at a higher rate than those from other Valley accommodations. Most river users plan to spend the better part of a day in Yosemite Valley, and In-Valley overnight visitors stay longer. About 67% spend less than 4 hours on the river, and the average was about 3 hours.

Most (76%) Out-of-Valley users travel to the river by private vehicle, while most In-Valley overnight visitors (77%) get to the river by trails. Changing the numbers of In- vs. Out-of-Valley visitors (by changing the number of campsites, lodging units, or day use parking spaces) will have different effects on parking, traffic circulation, and social impacts at river sites.

The most common river activity was relaxing (76%), but many visitors reported swimming (58%), picnicking (48%), and hiking (44%). Fewer reported boating (29%) and biking (27%), although higher proportions of return visitors reported these activities on earlier trips. Relatively few river visitors fish.



River users have slightly larger group sizes (averaging 3.9 adults and 1.4 children, or 5.3 total) compared to general park visitors. The largest groups were private boaters and picnickers.

NPS boater counts suggest about 60% of all boats were rental rafts, but they accounted for 66% of all boaters (rental rafts average more people per boat). Rental groups averaged 1.6 rafts per group compared to 3.5 for privates, but rental groups averaged more people per boat (3.3 versus 2.0).

Perceived crowding

Crowding is a negative evaluation of density; it involves a value judgment that the specified number is “too many.” Researchers have developed a simple crowding question that has been used in over 200 studies and over 600 evaluation contexts; a meta-analysis has identified capacity “rules of thumb” based on the percent reporting some degree of crowding (3-9 on the 9-point scale). While not intended to be a substitute for more detailed information from the study, the crowding scores are useful as an overall indication of a settings situation. River users feel the most crowded when they are using the Valley’s motorized transportation system (driving roads, finding parking, or riding shuttles), and these elements are most likely to be in the “over capacity” category. Trail networks (hiking and biking trails) are also relatively crowded, and may also be approaching or “over capacity.”

Fewer visitors feel crowded during river activities such as boating or relaxing in shore areas, which are in the “high normal” category. Even fewer visitors feel crowded when swimming, which fits in the “low normal” category.

Additional crowding analyses compared river visitors’ scores to those from other studies in Yosemite and other National Parks. Transportation-related crowding was generally higher than crowding at attraction sites (e.g., Yosemite Falls, Bridalveil Falls), while river-activity crowding was generally lower. Out-of-Valley visitors generally felt more crowded during on-river activities than those who spent the night in the Valley. Crowding also varied by time of day; visitors before 1 pm reported less crowding than those who use the river later in the day.

Boating issues

Respondents were asked to evaluate the acceptability of photos with 4, 8, 16, and 24 boats in a 0.14 mile “generic reach” viewshed as well as identify the photo that showed:

- ...the level of boating use they **prefer to see** (“preference”)
- ...the highest boating use level the **Park Service should allow** (“NPS action”)
- ...the highest boating use level that would **cause them to no longer visit** (“displacement”)
- ...the highest number of **boats they saw today** (“reported highest”)

Results showed visitors preferred about 6 boats per viewscope, while acceptability and the “NPS action” evaluations were similar at about 13 to 14 boats, and “displacement” was about 22 boats. Of those who reported the “highest number seen,” 82% saw 8 or less. Direct comparisons of the reported “highest seen” with evaluations showed 41% reported seeing more than they prefer, but only 9% saw more than what they think NPS should allow.



Based on NPS and concessionaire boat counts, the highest use days in 2011 were about 200 commercial boats and 130 private boats per day (total of 330), but average boatable days were about 140 rentals and 90 private boats per day (total of 230). In general, these translate to average “at one time” boating levels that are closer to visitors’ “preferences” (about 8 per photo, 60 per mile, or 140 on the entire segment) than their “acceptability” or “NPS action” standards (14 per photo, 100 per mile, and 240 per segment).

Respondents were asked to evaluate management actions that might be used to address boating issues on a support/oppose scale. There was majority support for only one action, requiring boaters to wear life jackets or PFDs,” but there was more support than opposition for opening new segments of the Merced to boating and allowing short distance floating along the Pines campgrounds.

Respondents were divided over reducing commercial raft rentals. There was more support than opposition for a 25% raft rental reduction but more opposition than support for a 50% raft. This is consistent with evaluations of existing boating use, where many visitors (although not a majority) prefer slightly lower levels. Based on current proportions of commercial and private use, a 25% raft rental reduction would produce about 15% less boats on the river.

Most opposed eliminating raft rentals in the Valley (80% oppose) and eliminating all boating in the Valley (86% oppose). This level of opposition is rare in recreation surveys. There was more opposition than support for limiting private boating use; current private boating use is unlimited in the open segment.

Shore use issues

Respondents were asked to evaluate the acceptability of photos with 10, 30, 60, and 100 shore users in a 180 foot “generic beachfront” viewshed, and identify which photo corresponds to their “preference,” “NPS action,” or “displacement” evaluations to compare with the “highest shore use density seen.”

Results showed visitors preferred about 19 people per viewscape (about 10 feet of beachfront per person), while acceptability and the “NPS action” evaluations were similar at about 52 to 54 people (about 3 feet of beachfront per person), and “displacement” was about 86 people (about 2 feet of beachfront per person). Of those who reported the “highest number seen,” 81% saw 30 or less (about 6 feet of beachfront per person). Direct comparisons of the reported “highest seen” with evaluations showed 43% reported seeing more than they prefer, but only 7% saw more than what they think NPS should allow.

NPS shore use counts show considerable variability across the season, within-a-day, and by location. There are a few high use beaches, but densities vary because they are of different sizes. Counts at the higher use beaches in relation to their size help “standardize” use information and allow comparisons to visitor evaluations. The highest beach counts at one time did not exceed NPS action/acceptability densities except on rare occasions at Stoneman Bridge and Sentinel Beach, and average counts were usually closer to preferences than acceptability evaluations. Few 2011 visitors experienced use levels depicted in the highest use photo (100 people in the viewscape, about 2 feet of beachfront per person), and those who did had alternative beaches with much lower densities nearby.



Respondents were asked to evaluate of management actions that might be used to address shore use crowding or impacts. There was majority support for actions (trails and maps to lower use beaches) designed to spread out shore use, but more opposition than support for all three “day use” management actions to address shore use crowding (about 40% oppose reducing parking near the river, limiting Valley day use, and limiting private vehicles in the Valley versus about 30% support). There was strong opposition to reducing campsites (69%) or lodging (65%) in the Valley to address river crowding.

Other management actions

Respondents were asked to evaluate the acceptability of an impacted river bank along the Merced; while most biologists would recognize several impacts, only 11% of respondents reported them unacceptable and 76% rated them acceptable. Results illustrate challenges to make the public aware of riparian impact problems and develop workable solutions.

Respondents were shown example photos of “split rail fencing” and “boardwalk and stairs,” actions that could be used to reduce bank trampling. Majorities found all these actions to be acceptable, although the two lower development options (“short split rail fencing” and “occasional boardwalks and stairs”) were more acceptable than longer split rail fencing or boardwalk networks. There was also majority support for education efforts (81%), closing user-created trails (73%), and prohibiting off-trail/off-beach use in sensitive areas (62%) to protect the river’s ecological values.



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I. Introduction

The Merced Wild and Scenic River corridor through Yosemite Valley in Yosemite National Park has experienced increased visitation over the past decade. Higher use may affect the quality of visitor experiences or the condition of ecological or cultural resources. Addressing these issues has become one focus in a new Merced Wild and Scenic River Plan (MRP). As the plan is being developed, it is helpful to understand visitors' behaviors, attitudes, and support for management actions.

Social science research to support park planning and management is mandated in NPS Management Policies (Section 8.11.1, "Social Science Studies"). Social science studies support the NPS mission to protect resources and enhance the enjoyment of present and future generations (National Park Service Act of 1916) and NPS policy indicates that social science research will be used to understand park visitors, the non-visiting public, gateway communities and regions, and human interactions with park resources. Such studies help provide a scientific basis for park planning, development, operations, management, education, and interpretive activities.

Study objectives

The overall purpose of the study is to examine recreation along the Merced River in Yosemite Valley and assess visitors' evaluations of recreation use and impacts. This includes measuring visitors' tolerances and preferences for crowding and use densities, exploring relationships between use and densities; and assessing the acceptability of management actions that might address impacts. Specific objectives of the evaluative component of this study are listed below. A separate component, which measures distribution of river use, was conducted and reported separately by NPS.

- Describe individual and trip characteristics of river visitors.
- Describe levels of perceived crowding for different parts of visitors' trips (getting to the river, engaging in different river-related activities) and for different times and locations.
- Describe reported shore and boating density levels at different times and locations; compare these with observer counts and other actual use level measures (from NPS-conducted descriptive component).
- Describe visitor preferences and tolerances for shore and boating density levels, and assess if those differ by types of users, experience levels, or location.
- Assess acceptability of riparian erosion impacts.
- Compare reported impacts with tolerances to determine if there are locations and times with "impact problems."
- Develop statistical relationships between reported densities, actual densities, and other visitation indicators (e.g., inbound vehicles to Yosemite Valley).
- Assess river visitor support/opposition for management actions that might be used to address impact problems or manage shore and boating use levels. Information will be organized by user group and location.
- Summarize "study year" flows, weather, or other potential factors that may have influenced visitation or visitor evaluations to provide context for study findings.



II. Methods

To achieve these objectives, the study surveyed visitors to the Merced River in Yosemite Valley during the high use season in July 2011. Survey results were also integrated with on-site use information and broader visitation information (collected by NPS) to assess differences at higher and lower use locations and times. The following sections briefly describe survey development, sampling, survey administration, and coding/analysis protocols used in the study; additional details are provided in appendices. More specific information about survey items and analysis are provided as results are presented in subsequent chapters.

Survey development

A single on-site questionnaire was used in the study. The survey (see separate attachment, Appendix A) was developed largely from recreation and visitor experience research traditions developed over the past three decades (see Manning, 2011 for an overview). Most survey items were developed from those used in previous river studies, with adaptations for specific conditions on the Merced River through Yosemite Valley.

Visitor and trip characteristics questions

The survey included several standard questions about user, group, and trip characteristics. These “profile” variables were used to analyze sub-groups, a common social science practice (Vaske, 2008). Specific items were adapted from those in common use by the National Park Service and similar agencies. When possible, exact wordings from items previously submitted by NPS for expedited approval by the Office of Management and Budget (OMB) were used. Key visitor and trip characteristics include:

- Visitor residence (state or country) as assessed by zip code.
- Where visitors are staying overnight during their visit (to distinguish visitors staying in valley campgrounds, valley overnight lodging, areas outside the valley, and those visiting for the day).
- Experience visiting Yosemite and the Merced River.
- Time spent on the river (on the day they were visiting).
- How visitors traveled to the river.
- Activity participation on the day of visit and on previous trips.
- Number of locations they visited along the river.

Perceived crowding

Crowding is a negative evaluation of use; the term *perceived crowding* is often used to emphasize the subjective or evaluative nature of the concept. Researchers have developed a simple measure of perceived crowding (“how crowded did you feel today?”) with responses given on a 9-point scale (Heberlein & Vaske, 1977; Shelby et al., 1989; Vaske & Shelby, 2008). Following recent studies, visitors were asked about perceived crowding during different parts of their trips (e.g., while getting to the river, traveling along it, or while swimming, boating, relaxing).



Evaluations of shore and boating use

Normative questions measured evaluations of boating and beach use densities via photo simulations. The technique has been used in previous studies, including several in Yosemite National Park (Shelby et al., 1996; Manning, 1999; Jacobi, et al., 1999; Wang and Manning, 1999; Manning et al., 2005; Manning, 2007; Manning, 2009).

For this study, visitors rated acceptability of boating and beach density photos. The photos represented a “generic” segment of river or beach designed to evoke a “typical” Merced River setting (analogous to recent transportation studies in Yosemite). The photos were developed from fieldwork pictures of actual users on the Merced River in 2009 and 2010, with “higher than actual” densities created by adding users or boats to the scene with Photoshop. The boating scene was taken from Swinging Bridge facing upstream; the beach scene was taken from the Housekeeping Foot Bridge facing the beach that is upstream on river right (north bank).

To reduce response burden, visitors were asked about four photos each for shore and boating settings (eight photos total). Use densities ranged from low (10 people on a beach; four boats on a river segment) to higher than current peak levels (about 100 users on the beach and 24 boats on the river segment).

Specific formats for these questions followed from those used in recent Yosemite studies, with some minor adjustments to reduce response burden.

- **“Acceptability”** was measured for each photo using a 9-point Likert acceptability scale (as in previous studies).
- **“Preference”** was measured by asking respondents to “indicate the photo that shows the level of use they prefer,” with additional response options of “lower than photo A” and “I don’t have a preference.”
- **“Management action”** was measured by asking respondents to “indicate the photo that shows the highest level of shore use the Park Service should allow,” with additional response options of “higher than photo D,” and “numbers should not be restricted.”
- **“Displacement”** was measured by asking respondents to “indicate the photo that shows the level of use that would cause you to no longer visit,” with additional response options of “higher than photo D,” and “use level doesn’t matter to me.”
- **“Reported peak use level”** was measured by asking respondents to “indicate the photo that shows the highest level of (river or beach) use that you saw today,” with additional response options of “lower than photo A,” “higher than photo D,” and “I don’t know.” This variable is different from the “reported ‘typical’ use level” examined in previous photo evaluation studies in Yosemite. Those studies examined attraction sites where individual use generally occurs for a relatively short period of time (e.g., a 20 minute visit to Yosemite Falls) but where collective use levels were likely to be stable throughout their visit. Most river use involves longer individual visits (multiple hour trips for floating or to relax on a beach, etc.) but where use levels may vary through the day and make a “typical” level more challenging to report.



Evaluations of human-caused riparian erosion

Respondents were asked to evaluate a single photo of human-caused riparian erosion (bank trampling). Other studies have evaluated these impacts from an ecological perspective, but the goal here was to assess how visitors perceive them. The question asked respondents to rate acceptability from an aesthetic perspective (“how they look to you”). A similar technique was employed in a study on Alaska’s Delta River related to four-wheeler or ATV impacts, documenting differences between river users that helped explain support for related management strategies (Whittaker and Shelby, 2006).

Acceptability of management actions

Acceptability of management actions was measured on common five-point Likert-type scales from “strongly support” to “strongly oppose.” Target issues will be addressed in the Merced River Plan, including commercial rafting levels, non-commercial boating use limit systems, open boating segments, development and education programs to re-distribute use, and split-rail fencing and boardwalks to protect sensitive riparian areas.

Additional open-ended comments

Respondents were also invited to provide additional open-ended comments about river management issues. Responses were organized by content areas such as parking, transportation, boating, and shore use and have been provided to NPS in a separate electronic file.

Sampling

This study employed a cross-sectional sample design with roving and stratified data collection elements. The goal was to represent the diversity of locations and users along the river in East Yosemite Valley (Clark’s Bridge to El Capitan Bridge).

Sample size and response rate

The survey population of interest included adult visitors (ages 18 and older) engaged in river-related recreation along the Merced River between Clark’s Bridge and El Capitan Bridge during July 13-31, 2011. The sampling target was 750 visitor contacts (groups) and 600 completed surveys; the study exceeded these goals (see details in Table 1). In total, **913 groups were approached and 806 completed surveys** (a 92% response rate). This provided sufficient samples of boaters and shore users to assess the parameters of interest at the appropriate precision for planning purposes.



Table 1. Overall survey sample and response rate.

Total groups approached	913
Total ineligible (see explanation below)	39
Total in eligible sample	874
Total refused (see explanation below)	68
Total completed surveys	806
Response rate (total eligible / total completed)	92%
Ineligible groups approached:	
Under 18	1
Surveyed previously	18
Language barrier	20
Total ineligible groups	39
Refusal reasons:	
In a hurry	29
Not interested	38
Opposed to study/NPS	1
Total refusals	68

Study timing

The sampling period was designed to include 15 days during the river’s primary use period (typically June and July) when floating and shore-based activities are both popular. This period is influenced by flows and weather; due to unusually snowfall and associated high flows in 2011, the study was conducted from July 13 (after stage levels were below 6.5 on the Sentinel Bridge staff gage and boating was allowed) through July 31.



Study weather, flows, and water temperatures

Survey technicians tracked weather during the study. Nearly all study days provided good weather, and 91% of the completed surveys occurred on days that were sunny and warm, with 9% on days with some mixed cooler or cloudy weather. Only one day and 1% of the completed surveys came from a day with significant rain.

Flows during the study ranged from 1,570 cfs to 708 cubic feet per second (cfs), generally declining over the study (with the exception of high flows from a rainstorm on the last day of sampling). These were considerably higher than average mid-summer flows (in red in Figure 1), and were even above the “80% flow” (in light blue). This may have produced lower use levels than in typical recent years, particularly at the start of the study when flows were over 1,000 cfs. At these higher flows, the 2.4 mile boating trip is less leisurely and some areas are too swift for “family swimming.”

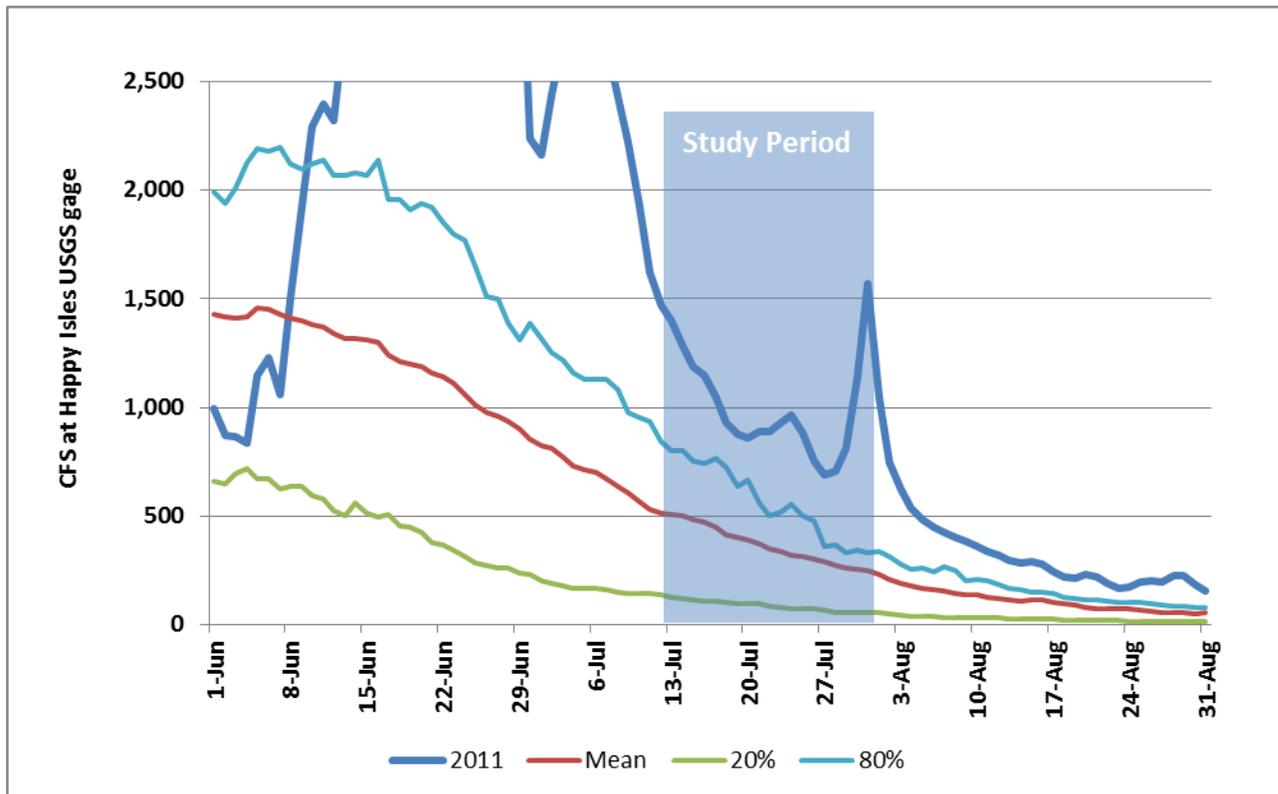


Figure 1. Flows at USGS Happy Isles gage during the study (compared to historical levels).

Higher flows also created cooler water temperatures during the study. Water temperatures during the study ranged from 52 to 54 degrees Fahrenheit in 2011, which was 2 to 10 degrees cooler than similar periods in other recent years (e.g., 54 to 63 F in 2008; 59 to 64 F in 2009; 57 to 61 F in 2010). This may also have dampened boating or swimming use.



Sampling locations

The survey was administered to visitors at ten locations along the river (Figure 2):

- Clark’s Bridge area
- Stoneman Bridge area (start of open boating reach and concession rafting put-in)
- Housekeeping Footbridge area (hereafter referred to as Housekeeping East)
- “Housekeeping West” beach
- Sentinel Bridge/Superintendent’s Footbridge area
- Swinging Bridge area
- Sentinel Beach (end of open boating reach and concession rafting take-out)
- Cathedral Beach
- Devil’s Elbow beaches
- El Capitan Bridge area

These locations include a mix of moderate and higher use beaches, riparian areas, and boating segments that are the focus of the survey questions. Maps in Appendix B show greater detail of the individual surveyed areas and NPS descriptive component “polygons.”

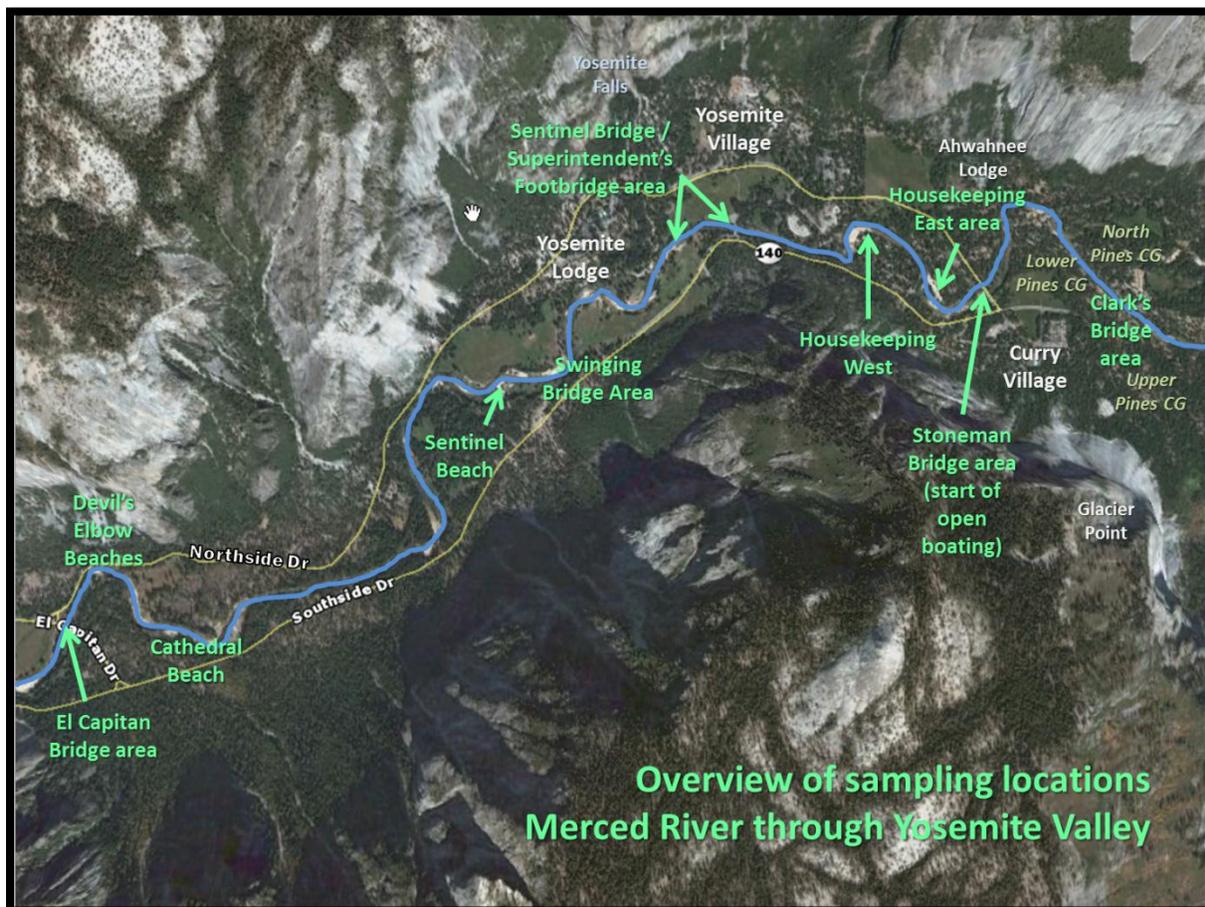


Figure 2. Overview of sampling locations.



Sampling schedule

Sampling was conducted on 15 days, with each site visited for a portion of each day. The days were spread over three weekends, with 42% sampled on the six weekend days and 58% on nine weekdays (see schedule in Appendix B). Refusals were distributed evenly across each type of day.

Sampling occurred for eight hours per day between 9 am and 7 pm, with start times varying from 9 to 11 am. On average, 61 groups were approached per day at a rate of about 7.6 per hour. The highest sampling day was Saturday July 30 (102); the lowest was July 31 (7) due to rain storms that reduced river use. On average, about 54 surveys were completed each day at a rate of 6.8 per hour.

For any given day, longer (2 hour) sampling periods occurred at the most common boating take-out (every day) and two other locations (one-third of the days). Otherwise, sampling occurred for approximately one hour per day per location. The start time and location for each day varied systematically, and the order of locations (traveling upstream vs. downstream) was alternated.

Sampling protocol

For each day, surveyors had a schedule that identified locations and times for sampling. For each location (except the boating take-out; see below), the surveyor had a general “route” through the area (generally less than a half mile in length). The surveyor approached the visitor groups encountered along the route and asked them to participate. If they agreed, the eligible person in the group with the next birthday was asked to complete the questionnaire (ensuring randomness within the group). Groups with five or more were asked to have two members complete the survey (using the next birthday to randomize the second participant). The surveyor then moved on to the next group. Surveyors attempted to contact all shore and boating groups along their routes, with the exception of boaters traveling on the river (they were reached at take-outs or when they had stopped on shore).

Visitors were asked to complete the on-site questionnaire in the presence of the surveyor, who answered questions and collected the surveys. Screening identified those who did not understand English (for these groups, survey technicians inquired in both English and Spanish if there was a group member who could complete the survey in English; just 2% of all groups approached had no English speakers). No one was surveyed more than once. The surveyors maintained a log of interviewee’s activities, location where contacted, craft type, and group size (see Appendix B). These variables were integrated with survey responses in the database.

After log information was recorded for a group, the interviewer greeted a member of the group and asked them to participate. If they agreed, the interviewee was given the survey attached to a clipboard. The questionnaire was self-administered, but the surveyor was available to provide assistance about question format and response options, or specific meanings of question content if asked. If respondents refused to participate, the interviewer recorded the reason.



Sample sizes by location

Figure 3 shows the distribution of respondents by location. The highest percentages came from Housekeeping Camp, Swinging Bridge, and the take-out at Sentinel Beach.

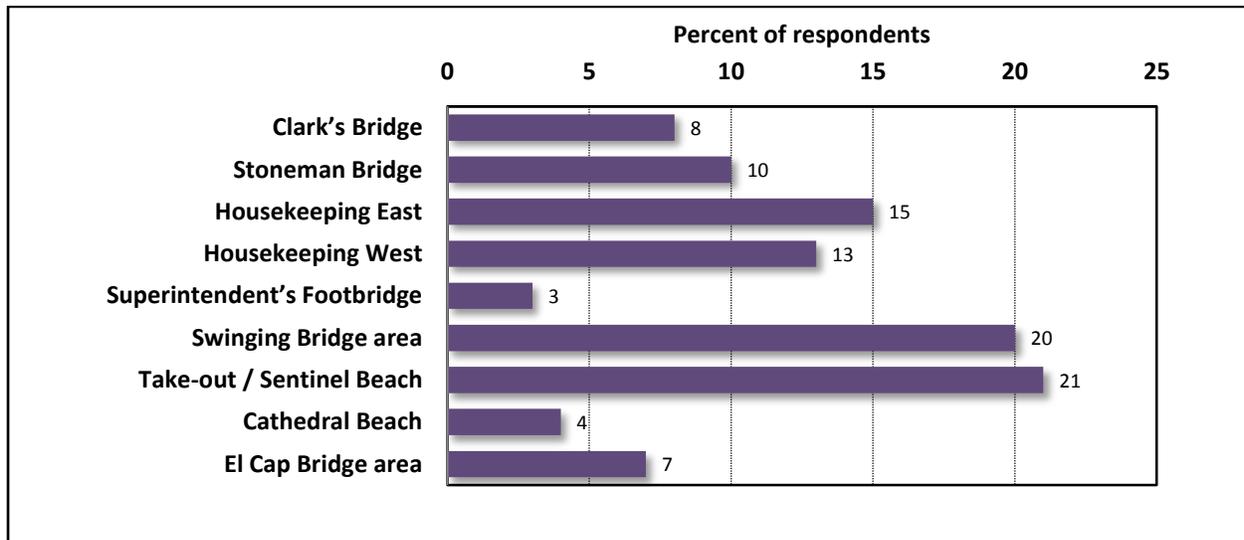


Figure 3. Percent of respondents surveyed at different locations.

Sample sizes by time of day

Figure 4 shows the distribution of respondents by time of day, which was related to both the sampling schedule and level of use. In general, there was considerably lower use before 11 am and after 5 pm, with the peak use levels (and survey completions) about 3 to 4 pm.

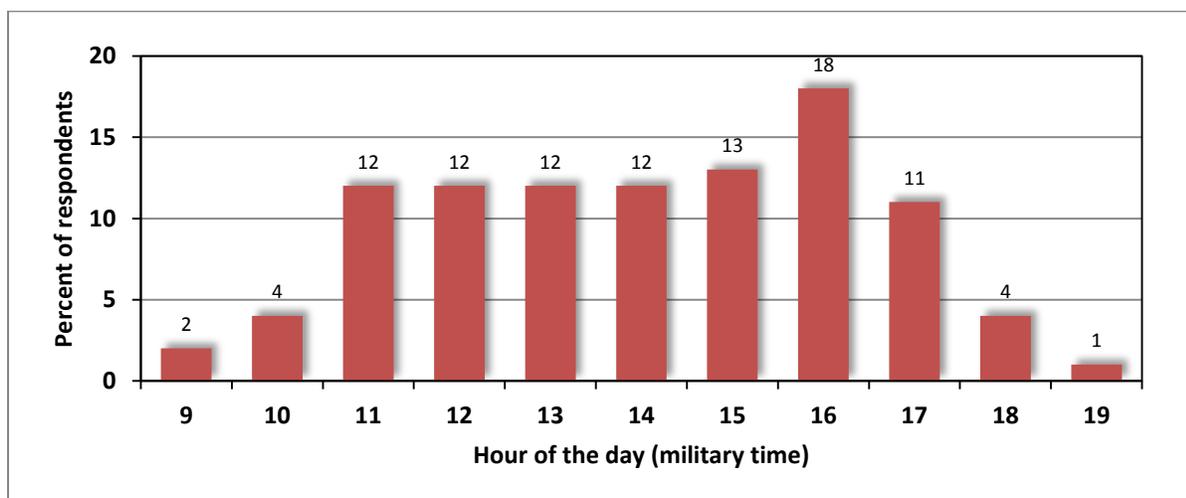


Figure 4. Percent of respondents by time of day surveyed.



Sample sizes by observed type of activity

Technicians observed the primary activity of the group when surveyed; choices included private boaters, commercial boaters (rented a raft from the concessionaire), and shore users who were primarily relaxing, picnicking, swimming, hiking, or biking. There were more shore users than boating users (although we sampled over 150 boaters), and most shore users were relaxing or picnicking. It was challenging to survey hikers or bikers who had not stopped at a shore use area (surveyors did not to flag down moving cyclists).

The study purposefully sampled more frequently at areas where boaters congregate (take-out on Sentinel Beach) to ensure a sufficient sub-group sample for that group. The goal was to have representative samples within those strata.

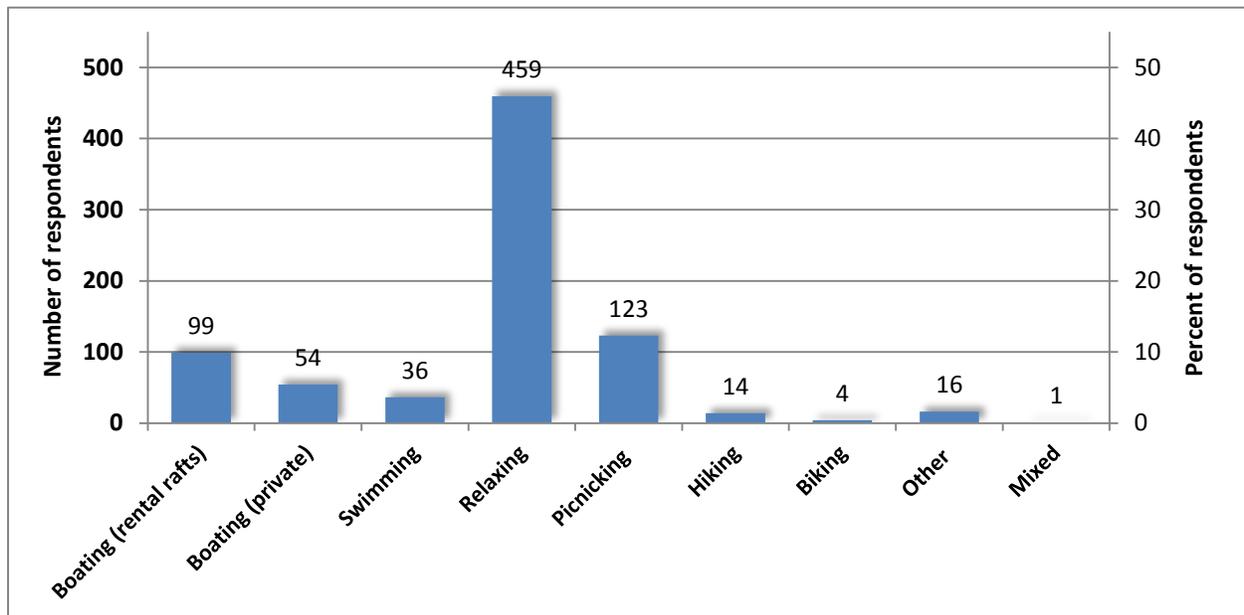


Figure 5. Number and percent of respondents by observed activity.



Other survey questions asked about visitors' river activities on previous days of their current (or previous) trips, which allowed analysis of larger samples of boaters, hikers, bikers, or other sub-groups. We were particularly interested in differences between visitors who boated on any trip versus those who had never boated. Figure 6 shows the percentages of three types of boaters and non-boaters.

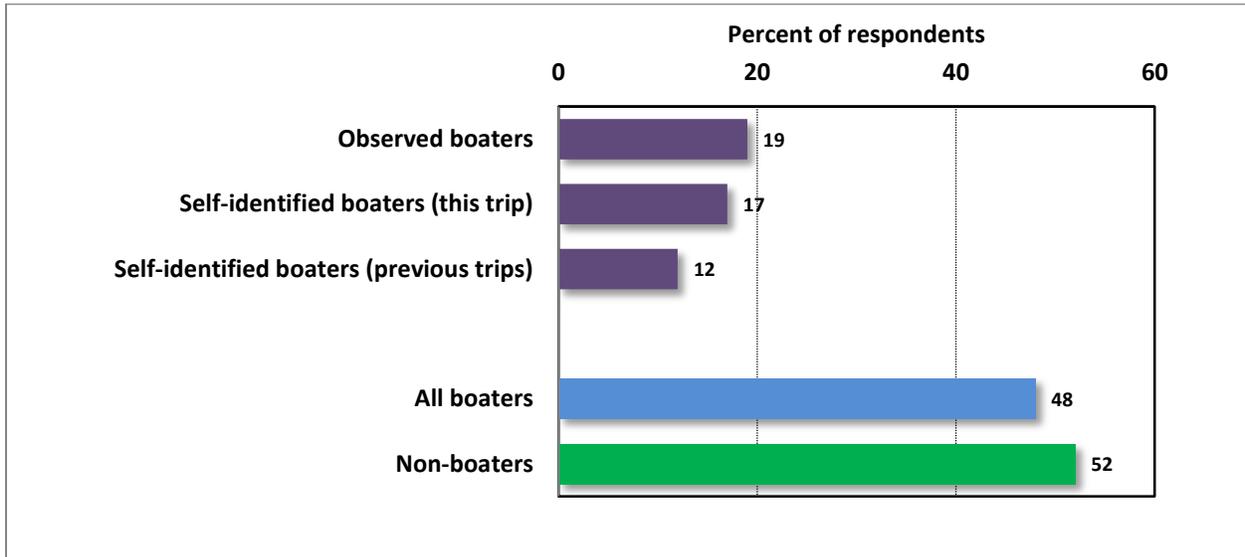


Figure 6. Percent of respondents who were observed or reported boating.



Integration with NPS “descriptive component”

The evaluative component of this study (survey findings) has been integrated with an NPS “descriptive component,” which collected use information. Key elements of the descriptive component relevant to this study are summarized below.

- NPS provided technicians for about 11 weeks of observational counts from June 11 through August 25. They counted visitors by specific locations and activities on approximately five days per week during that period and every day when surveys were being collected.
- **“Time of interview counts.”** On 15 days when the survey was conducted, one technician “shadowed” the Confluence survey technician to conduct “time of interview counts” at each survey location (see Appendix B for observation stations and polygons). These provided accurate “at-one-time” (AOT) use counts for the locations and times when users were surveyed, as well as recorded other observation information.
- **“Twice-a-day counts.”** These involved two daily visits to each observation station at the same time each day, providing basic indices of daily river use. These counts proceeded from downstream to upstream to avoid “double counting” boating use. Appendix B identifies count locations and times when they occurred.
- **“Full day counts.”** These measured use at a single location over the course of an 8 hour day to document hourly variation. They were conducted at two moderate and two higher use areas as identified in Appendix B. These profiles include AOT counts every 30 minutes through the period.
- **Commercial boating use.** NPS also collected information about commercial use from the concessionaire during the boating season, including the number of boats rented and people who rented them.
- **Broader daily use information.** NPS also provided inbound vehicle totals for the DSC Chapel counter, an accurate estimate of total use in the East end of Yosemite Valley (the study area).
- Data from the descriptive component was coded into an Excel database and organized by location, date, time, and count variables.

Analysis

Results from the survey are presented in this summary report to the NPS, focusing on measures of central tendency (means and medians), dispersion (standard deviations and ranges), and frequency distributions. When appropriate, results have been presented in graphs for easy use. Some analysis included tests for differences among sub-groups, as well as correlations between evaluations and use levels. Analyses generally followed standard methods for survey research in parks and recreation settings (Vaske, 2008) and are explained as results are presented.



III. Findings: Visitor and Trip Characteristics

This chapter reviews visitor and trip characteristics for different groups. Questions asked about visitors' park and Yosemite Valley experience, residency, where they stayed overnight during their trip, how they travelled to the river, hours spent along the river, and activities on this and previous trips. Findings describe the different types of Merced River visitors and allow additional analysis by disaggregated groups (when those are shown to be different).

Experience in Yosemite National Park

Respondents were asked to report the years they have been visiting Yosemite National Park (Figure 7).

- Over two-thirds (69%) of river users had visited the park in previous years, but 31% were visiting for the first time in the study year (hereafter referred as “first-timers”).
- The proportion of first-timers (31%) was smaller than the 48% reported for a 2005 general visitor survey (Littlejohn et al., 2006) or the 57% reported in the 2009 general visitor survey (Blotkamp et al., 2010). First-time visitors were less likely to know about river-related boating and shore use opportunities, and probably spend more of their time seeing the iconic attractions in the Valley (e.g., Yosemite Falls, Bridalveil Falls, and Vernal Falls).
- Boaters were also much more likely to have been visiting the park for more years (average 17.1 years; median 12) than non-boaters (average 8.3; median 2). Similarly, only 15% of boaters but 46% of non-boaters were visiting in their first year. The number of years was also much higher for private boaters (average 18.3, median 15.5) than those who rent rafts from the concessioner (average 10.7, median 3).

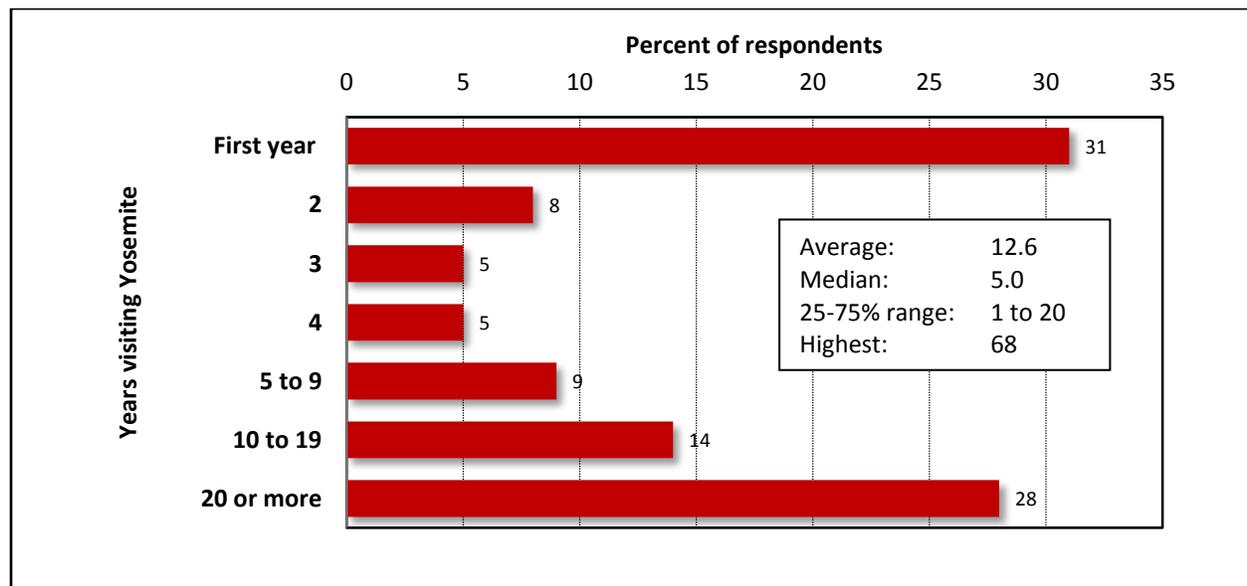


Figure 7. Number of years visiting Yosemite National Park.



Residency

Respondents were asked where they live (by zip code for the US; by country otherwise). Results are given in Figure 8; more detailed information is provided in Appendix C.

- Nearly three-quarters (72%) of river users were from California compared to 50% and 61% Californians in the 1999 studies for Bridalveil and Glacier Point (Manning et al, 1999), 57% for general visitors in the 2005 survey (Littlejohn et al., 2006), and 47% in the 2009 general visitor survey (Blotcamp et al., 2010). Analysis suggests differences between boaters and non-boaters may explain much of this difference (83% of boaters were from California compared to 64% for non-boaters). It appears that Californians (who can visit more often) tend to spend less time at immediately road-accessible “sights” (Bridalveil and Glacier Point) and more time doing more intensive activities.
- Similarly, the river study shows lower proportions of “out of state” and “foreign country” compared to the general visitor population.
- Roughly equal proportions of California river users come from populous areas such as Los Angeles (17%), the Bay Area (17%), Sacramento and the Central Valley (16%), and San Diego (14%). Only 8% visit from Fresno, Bakersfield, and regional locations near the park. About 2% live in Yosemite Valley (all were concession employees) and another 2% live in Mariposa/El Portal or other gateway communities.
- Among non-Californian visitors, 5% were from the Midwest, 4% from the South, 3% from the Northwest, and 2% each from New England and the Rocky Mountain West. Among foreign visitors, the highest proportions were from the Netherlands (3%), UK and Ireland (2%), Germany, Canada, and Switzerland (1% each). All other countries were under 1%.

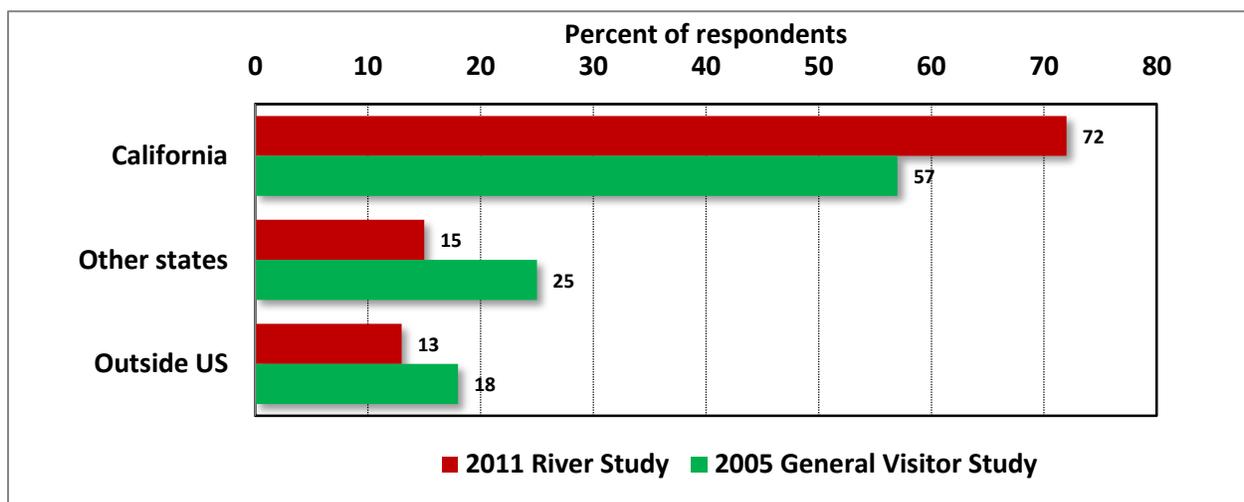


Figure 8. Residency of respondents to 2011 River Study and 2005 General Visitor Survey.



Overnight Use

Respondents were asked where they were staying overnight on their trip to Yosemite, or to identify themselves as a “day user” (someone who travelled to and from their home on the day they were surveyed). Figure 9 summarizes the In-Valley vs. Out-of-Valley results. Table 2 shows proportions for specific Valley, Park and Gateway facilities. Appendix C provides additional information.

- A higher proportion (56%) of river users spend at least one night in the Valley compared to 35% of general Valley visitors (as estimated by MRP parking and traffic modeling). Several overnight facilities and campgrounds are located close to the river, and overnight visitors generally have more time to visit it.
- In contrast, Out-of-Valley visitors appear to use the river less (44%) compared to the 65% of general Valley visitors who come from outside the Valley each day, probably because they spend more time traveling to the Valley and have less time for boating or beach activities.
- Valley overnighers who stay in the campgrounds or Housekeeping Camp appear to use the river at a higher rate. For example, about 13% of overnight Valley visitors stay in Housekeeping, but they are 36% of the river use In-Valley overnight sample. Similarly, only about 26% of Valley overnighers are campers compared to 39% in the study Valley overnigher sample. Proximity to the river’s more popular attractions (rafting and large beaches) is probably the best explanation.

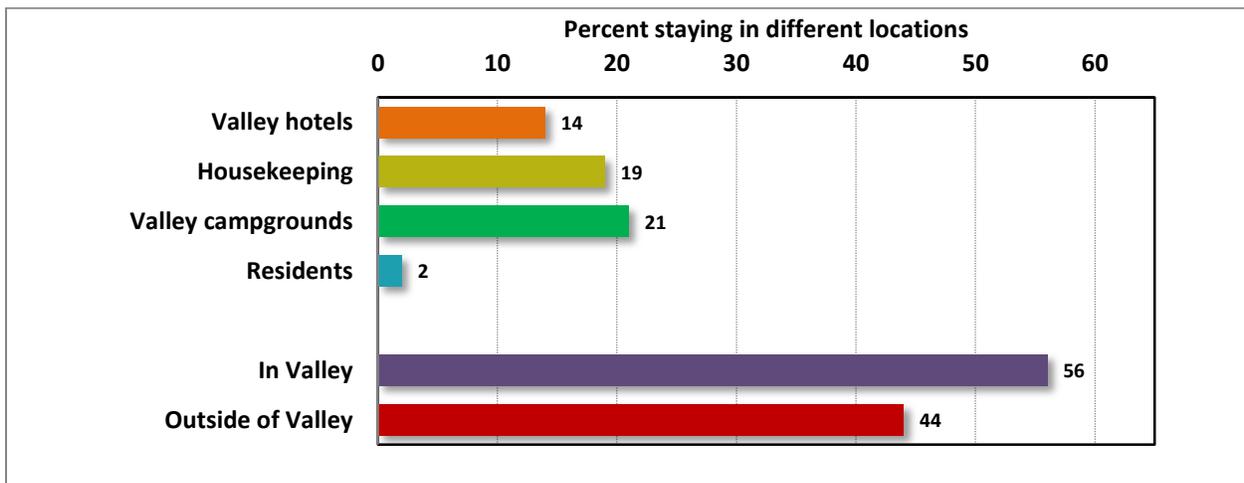


Figure 9. Percent of respondents staying overnight inside vs. outside Yosemite Valley during their trips.



Table 2. Percent of respondents staying overnight in various locations on their trips.

In Valley	n	% of all visitors	% within Valley	Outside Valley	n	% of all visitors
Valley campgrounds	166	20	36	Other campgrounds*	106	13
Housekeeping	156	19	34	Other location lodging*	70	8
Curry Village	80	10	17	Day users (no overnight)	55	7
Yosemite Lodge	31	4	7	El Portal	28	3
Valley residents	18	2	4	Groveland	28	3
Ahwahnee Lodge	7	1	2	Mariposa	23	3
Total In Valley	458	56	100	Oakhurst	21	3
				Yosemite West	17	2
				Wawona	11	1
				Fresno	10	1
				Foresta	3	<1
				Total Outside Valley	372	44

* Includes areas in the park but outside of Yosemite Valley, on adjacent public lands, or in gateway communities.



Length of visit (days in Yosemite National Park)

Respondents were asked how many days they planned to stay in the park on this visit; results are given in Figure 10.

- Most river users (85%) spend two or more days in the park. Single day visits may not provide enough time for river activities.
- About 24% of river users stay in the park for 6 days or longer, compared to 13% and 17% reported in the 2005 and 2009 general visitor surveys, respectively. This may be a methods effect: multi-day visitors are more likely to be included in an on-site sample compared to the “entrance gate” sampling method in the general visitor surveys.
- On average, boaters spend more days on trips (5.1 days) compared to non-boaters (3.2 days).
- In-Valley users average 5.0 days in the park compared to 2.6 days for day or Out-of-the-Valley users.

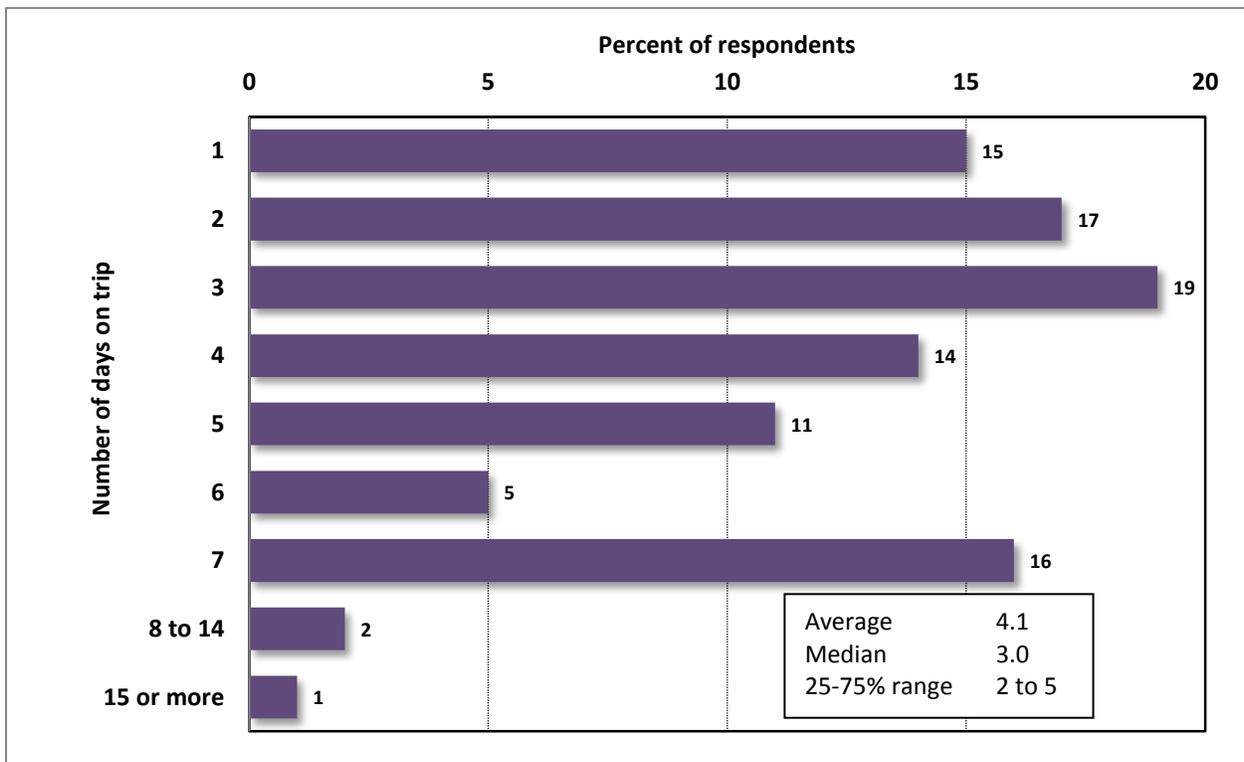


Figure 10. Percent of respondents reporting days in the park on their trips.



Hours in Yosemite Valley and on the river today

Respondents were asked how many hours they expected to spend in Yosemite Valley on the day they were surveyed; results are summarized in Table 3.

- Most river users plan to spend the better part of a day in Yosemite Valley, and In-Valley overnight visitors obviously stay longer. Only about 11% stayed less than 2 hours in the Valley. The 2005 and 2009 general visitor surveys reported about 22% to 23% of day users (those spending less than 24 hours in the park) spend 3 hours or less in the park (which is equal to about 2 hours in the Valley, because it takes at least a half hour to get to and from the entrance gates).
- There were few differences between boaters and non-boaters or In and Out-of-Valley visitors (differences were not statistically significant).
- About 67% spend less than 4 hours on the river, and the average was about 3 hours. It appears that boating or relaxing on the beach is one of several activities over the course of their day.

Table 3. Reported hours spent in Yosemite Valley and on the Merced River today.

	All respondents	Boaters	Non-boaters	Out-of-Valley visitors	In-Valley visitors
Hours in Yosemite Valley					
Average	6:48	6:48	6:54	6:48	6:36
Median	7:00	6:36	7:00	7:00	6:00
25-75% range	4 to 8:30	4:18 to 8	4 to 9	5 to 8	3 to 9
n	478	168	310	315	142
Percent answering	59%*	44%*	74%*	95%	32%*
Hours on the river					
Average	3:18	3:43	2:58	2:42	3:45
Median	3:00	3:00	2:00	2:00	3.0
25-75% range	2 to 4	2 to 5	1:24 to 4	1:30 to 3:30	2 to 5

* Many reported 24 hours because they were residents or were staying in the valley for multiple days; these were removed from the analysis.



Travel to the river

Respondents were asked how they traveled to the river on the day they were surveyed. The most common method was private vehicle (46%), although 43% walk and another 11% used a bicycle (taken together, 54% used trails). Only 9% used the shuttle system. The 2005 general user survey reported 48% of visitors to the park (not just the Valley) use shuttle bus services.

Only 1% of river users arrived by tour bus compared to the estimated 4% of all visitors (from MRP use estimates). Tour buses are probably more likely to focus on iconic viewpoints and developed areas for meals and interpretive programs.

Most (76%) Out-of-Valley users travel to the river by private vehicle, while 22% use trails. Conversely, 23% of those spending nights in the Valley arrive by private vehicle, and 77% arrive by trails. Changing the numbers of overnight vs. day visitors would probably have different effects on parking, traffic circulation, and social impacts at river sites (see discussion in Chapter IX).

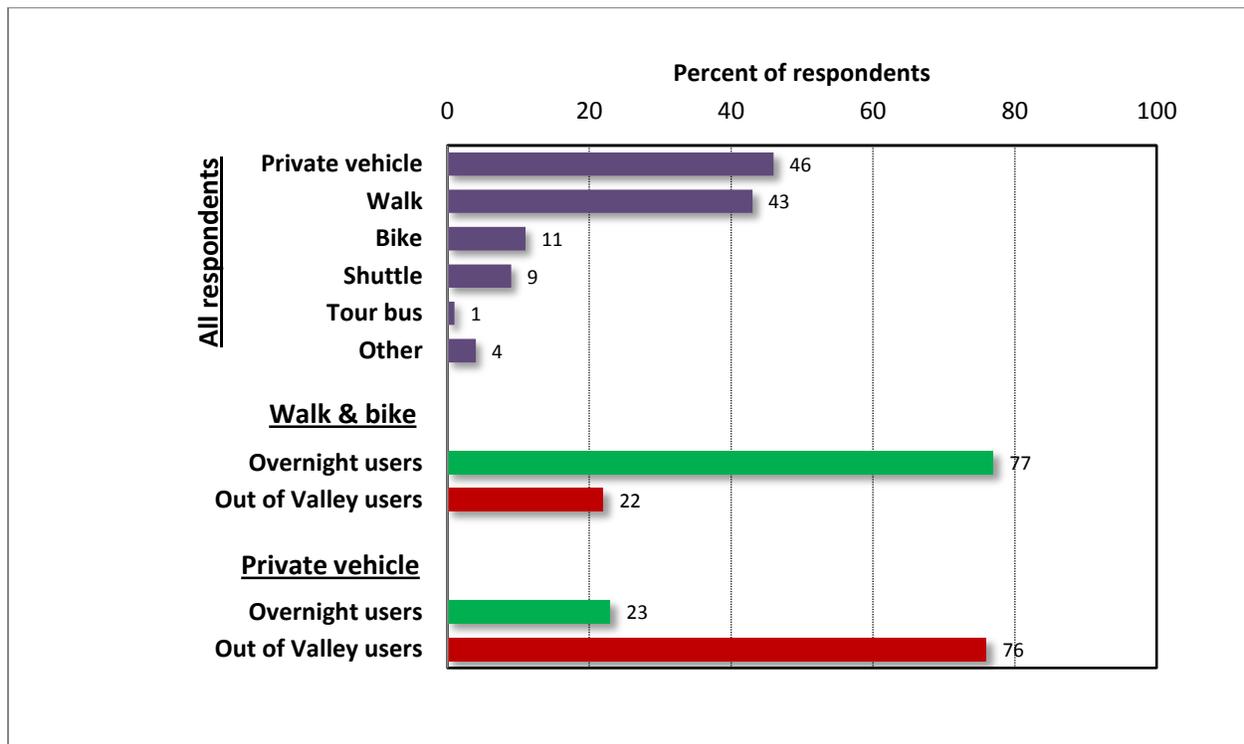


Figure 11. Percent of respondents travelling to the river via different modes.



Riverside locations visited

River users were asked how many riverside locations they visited on the day they were surveyed. Most (57%) visited just the location where they were surveyed, 36% “two or three locations,” and 8% “four or more.” “Observed boaters” (those identified by survey technicians; a subset of all boaters) reported higher proportions than others: 48% visited two to three locations and 15% visited four or more. When boaters are on their trips, most (63%) stop multiple times along the river.

Activities on this and previous trips

Respondents were asked to report all activities done on “this trip” and “previous trips” (Figure 12). Reported activities are not the same as “primary activities” observed and reported by survey technicians (see Figure 1). Findings include:

- The most common river activity on this trip was relaxing on the shore (76%), but many visitors reported swimming (58%), picnicking (48%), and hiking (44%). Some reported boating (29%) and biking (27%) on this trip (with higher proportions among return visitors reporting this for earlier trips). Relatively few river visitors fish (5% on this trip).
- Participation rates on previous trips tended to be substantially lower than for “this trip.” This may be a methods effect (the two questions may have seemed redundant to some respondents who did not complete the “previous trip” part), or reflect visitors’ actual history of use. Some users may participate in fewer activities on earlier trips, then discover new things to do.
- The difference in boating and swimming participation on “this” and “previous trips” is surprising; more river users report both on this trip, despite high water, and anecdotal reports suggesting boating and swimming use was slightly lower in 2011 compared to recent years.
- Most (90%) of In-Valley visitors reported “relaxing” on the river compared to only 18% of Out-of-Valley visitors; this fits with the “not enough time” theory for visitors that have to travel to the river from outside the Valley. Similarly, In-Valley visitors were more likely to report boating (58% versus 22%) and picnicking (48 versus 34%).
- Among In-Valley visitors, 96% of Housekeeping visitors report relaxing by the river in comparison to 86% for campers and hotel visitors, who travel farther to the best sand beaches. Housekeeping visitors also reported higher rates of hiking (57%) and biking (49%).
- “Other” (write-in) activities reported by multiple respondents included reading/writing, backpacking, sightseeing, photography, wading, drinking, and tubing. A full list is provided in Appendix C.
- The list of activities provided to river users was not the same as those provided in the general visitor survey conducted in 2005 and 2009. However, it is notable that of the “overlap” activities, river users were more likely to picnic (48% vs. 33%) and bicycle (27% vs. 12%), but less likely to go hiking (44% vs. 54%). The highest participation for river users was relaxing (76%) and swimming (58%) compared to viewing scenery (93%) and taking a scenic drive (64%).

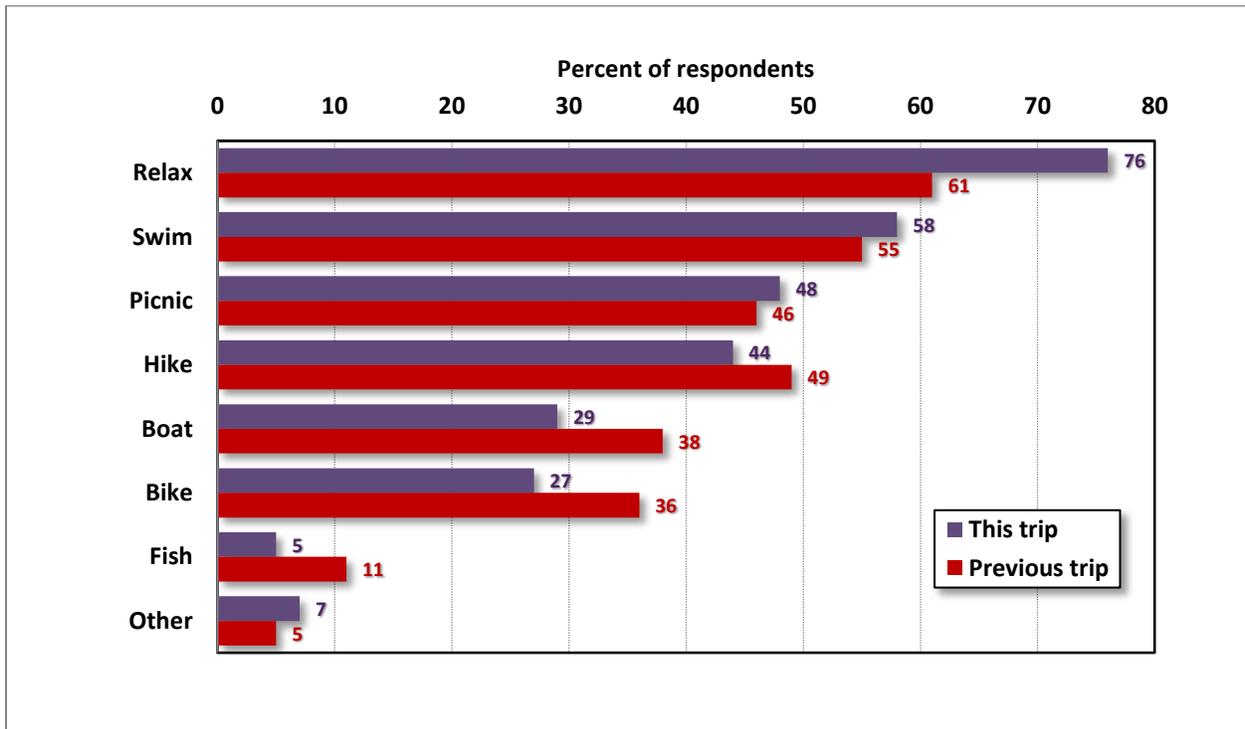


Figure 12. Activities reported for this and previous trips.



Group sizes

Study technicians counted the number of adults and children in each group as they handed out surveys. Table 4 summarizes group sizes for all groups approached (includes those who refused surveys). Findings include:

- River users have slightly larger group sizes compared to general park visitors. The 2005 general visitor survey reported 81% came in groups of 5 or less, compared to 69% for river users. About 10% of river user groups are larger than 10.
- The largest groups were private boaters and picnickers. Both tend to be comprised of many large family (or multi-family) groups with a mix of adults and children.
- Swimming groups tended to have more children. Biking groups had less children, although the sample size for this activity was small (bikers were not stopped for the study).

Table 4. Average group sizes for observed groups by type of primary activity.

	Adults	Children	Total
All observed groups	3.9	1.4	5.3
Percent 5 or less			69%
Percent 10 or less			90%
Sub-groups			
Boaters – raft rentals	4.1	1.2	5.3
Boaters – private on long trip	5.2	1.7	6.9
Boaters – private on short float	2.0	1.0	3.0
Swimming groups	3.4	2.2	5.6
Relaxing groups	3.4	1.4	4.8
Picnicking groups	5.8	1.4	7.1
Hiking groups	2.7	1.2	3.8
Biking groups	2.5	0.3	2.8
Other or mixed groups	2.8	0.6	3.3
All boaters / water toy groups	4.5	1.3	5.8
All shore use groups	3.9	1.4	5.2
All hikers / bikers	2.6	1.0	3.6



Craft types and people per boat among boating groups

For observed boating groups, survey technicians recorded type of craft and number of people per boat (Table 5). These counts suggest about 66% of all boating groups use commercial raft rentals. NPS counts that occurred over a longer period indicate that 60% of all boats on the river were rental rafts, but they accounted for 66% of all boaters (because rental rafts average have more people per boat). Few groups use canoes, kayaks, inflatable kayaks, or tubes, although all these craft were observed by study or NPS technicians. Many “water toys” are also used on the river (NPS counts suggest they comprise about 16% of all floating craft observed), but few were included in the study sample because most are used by children (not eligible for the survey).

Table 5. Percent of craft types among observed boating groups.

	n	%
Rental raft	108	66
Private raft	50	31
Kayak	3	2
Tube	1	<1
Water toy	2	1

Based on study observations, the average number of craft per group was 2.3 (median of 2.0), but 20% of groups had more than three and 5% had six or more. Large “flotillas” of rafts may have impacts beyond the sheer number of boats they add to the viewscape, as such groups may tend to “take-over” beaches where they stop. Rental groups averaged 1.6 rafts per group compared to 3.5 for privates, but rental groups averaged more people per boat (3.3 versus 2.0). Taken together, private boaters have slightly larger group sizes (6.9 versus 5.2 people per group; $t=2.6$, $p<.012$). NPS count data showed similar people per boat estimates: 3.1 people per commercial raft, 2.4 per private raft, and 1.6 per other private boats.



IV. Findings: Perceived Crowding

This chapter focuses on how crowded respondents felt during their visits to the river. Results show how different parts of trips have crowding impacts, allow comparisons between the Merced and other resources that have used the crowding item, and helps analyze use-crowding relationships.

Most researchers recognize a difference between use density and crowding (Shelby et al., 1989). Density is a descriptive term that refers to the number of people per unit area (and it can be determined objectively). Crowding is a negative evaluation of density; it involves a value judgment that the specified number is too many. The term *perceived crowding* is used to emphasize the subjective or evaluative nature of the concept. Researchers have developed a simple measure that asks how crowded they feel during their visit (first developed by Heberlein & Vaske, 1977). Responses are given on a 9-point scale:

1	2	3	4	5	6	7	8	9
Not at all Crowded		Slightly Crowded			Moderately Crowded		Extremely Crowded	

Results can be analyzed in several ways. The traditional analysis collapses the scale into a dichotomous variable. This provides a conceptually meaningful break point between those who labeled the situation as “not at all crowded” (scale points 1 and 2, a positive evaluation), and those who labeled the situation as slightly, moderately, or extremely crowded (scale points 3 through 9, a negative evaluation). While other analyses of central tendency have been proposed, a comparison showed correlations of .90 to .95 with the traditional scale (Vaske and Shelby, 2011), suggesting few differences among these choices.

Since 1975, this single item measure has been used in over 200 studies conducted across the United States (e.g., Alaska, Arizona, California, Colorado, Michigan, Minnesota, Nevada, New Hampshire, Oregon, Pennsylvania, West Virginia, Wisconsin), Canada (British Columbia, Alberta), New Zealand, Australia, and Korea resulting in crowding ratings for over 600 different settings/activities (Vaske & Shelby, 2008). The activities included hiking, backpacking, wildlife viewing, wildlife photography, hunting of many types, fishing of many types, rafting, canoeing, tubing, motor boating, rock climbing, sailing, and driving for pleasure. The areas represented considerable diversity, with some showing extremely high density and use impact problems, others illustrating low densities and no problems, and still others actively utilizing management strategies to control densities and use impacts.

A meta-analysis of 35 studies (Shelby, et al., 1989) identified five “rule of thumb” capacity categories (see Table 6) when the scale was collapsed in the manner described above. The paper carefully warns against using these categorizations as a “substitute for the information about use levels, impacts, and standards, that a more complete capacity study can provide” (p. 287), but notes that the measure provides “useful comparative data that allow managers to understand better the carrying capacity challenges that face them and give investigators an idea about what kinds of studies would be most useful.” (p. 288). Their inclusion here is intended to allow those comparisons, not direct attention to specific category labels that may have other specific meanings in planning contexts.



Table 6. “Rule of thumb” capacity judgments based on levels of perceived crowding (from Shelby et al., 1989).

% Feeling Crowded	Capacity “rule of thumb” judgment	1989 paper recommendations regarding management or research
0-35%	Uncrowded	Crowding usually limited by management or situational factors (remote location, difficult access), or refers to low use areas.
35-50%	Low normal	Problem situation does not exist at this time.
50-65%	High normal	Should be studied if increased use is expected, allowing management to anticipate problems.
65-80%	Over capacity	Studies & management necessary to preserve experiences.
80-100%	Greatly over capacity	Manage for high-density recreation.

For Yosemite, Figure 13 shows the percent feeling crowded (3-9 on the scale) for the activities asked on the survey, with the five “capacity rule of thumb” categories superimposed.

- River users feel the most crowded when they are using the Valley’s motorized transportation system (driving roads, finding parking, or riding shuttles), and these elements are most likely to be in the “over capacity” category.
- Trail networks (hiking and biking trails) are also relatively crowded, and may also be approaching or over capacity.
- Fewer visitors feel crowded during river activities such as boating or relaxing in shore areas, which are in the “high normal” category. Even fewer visitors feel crowded when swimming, which fits in the “low normal” category.
- Overall crowding ratings appear to reflect influences from transportation ratings. This helps illustrate the importance of an efficient and uncrowded transportation system for visitors’ overall experiences.



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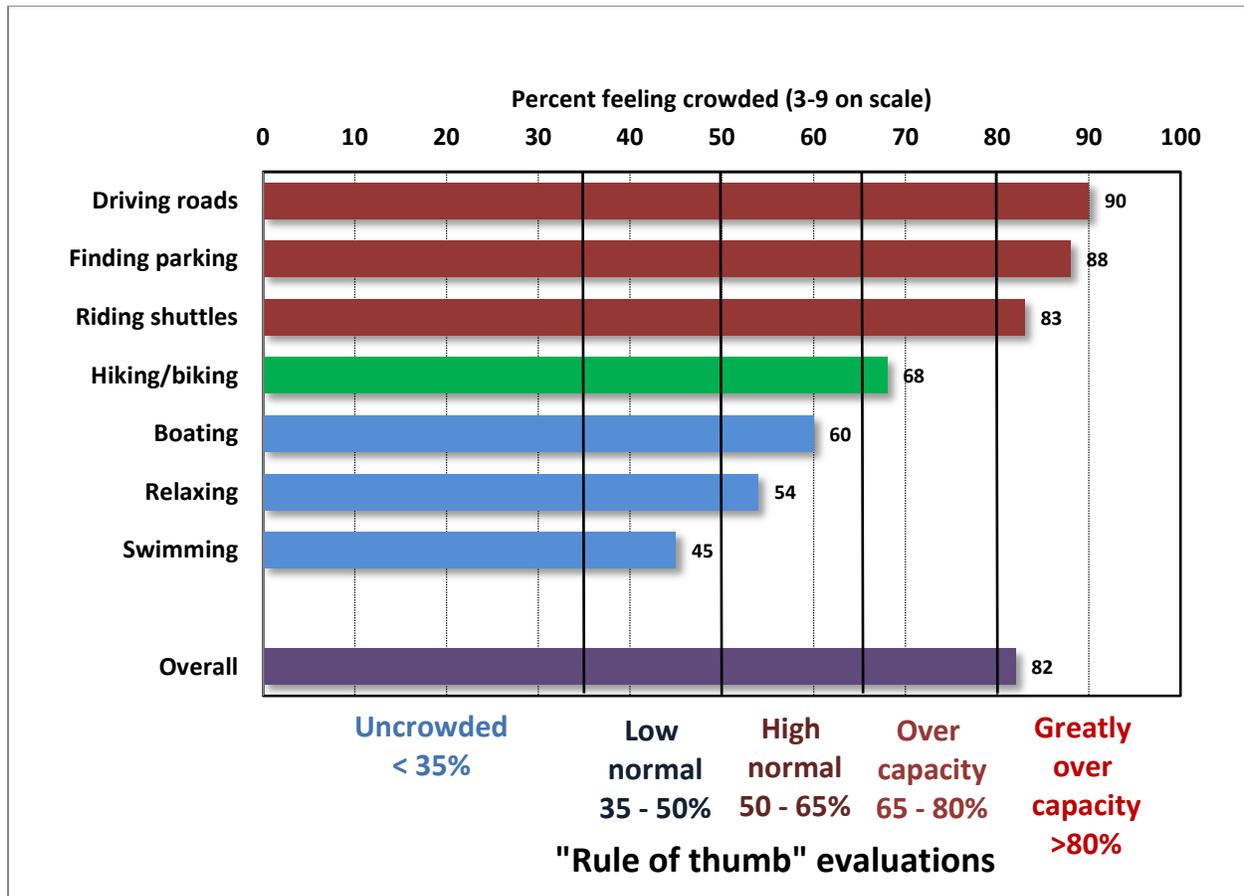


Figure 13. Percent feeling crowded during different activities on visitors' trips.



Average perceived crowding scores and statistical differences

An analysis of *average* perceived crowding scores in Table 7 shows a rank-order similar to Figure 13. These averages also allow statistical comparisons (via paired t-tests) as summarized. The only pairs of crowding scores that were *not* statistically different were driving and parking (5.94 vs. 5.93) and relaxing and boating (3.27 vs. 3.33); all others were significantly different at the $p < .001$ level.

Table 7. “Rule of thumb” capacity judgments based on levels of perceived crowding (from Shelby et al., 1989).

	% Feeling Crowded (3-9 on scale)	Average crowding (9 point scale)
Driving roads	90	5.9 ^a
Finding parking	88	5.9 ^a
Using shuttles	83	5.5 ^b
Hiking/biking on trails	68	4.0 ^c
Relaxing by the river	60	3.3 ^d
Boating	54	3.3 ^d
Swimming	45	2.7 ^e
Overall	82	4.4 ^f

Note: averages with different superscripts are statistically different at $p < .001$.

Perceived crowding differences between groups

For *boaters and non-boaters* the rank-order of activities remained the same, and differences were small. For *In-Valley and Out-of-Valley visitors*, Out-of-Valley visitors felt more crowded on trails (74% to 64%), while boating (68% to 57%), relaxing (60% to 50%), and swimming (52 to 41%). Because their day includes travel time, Out-of-Valley visitors are more likely to use trails and the river at higher use times in the middle of the day. In-Valley visitors may also have greater knowledge or experience finding areas that are uncrowded because they stay longer and profile characteristics show that they also have longer average histories in Yosemite.

Comparing Yosemite perceived crowding to other resources

Perceived crowding scores from this study and several other comparable resources are given in Table 7. These have been chosen from a “master list” assembled by Jerry Vaske from nearly 200 studies (available at http://warnercnr.colostate.edu/~jerryv/CROWDING/Vaske_Crowding.htm). The list includes several river and national park units with higher use levels. It also includes several other Yosemite locations (Manning et al., 1998, Manning et al, 1999, and Newman, et al., 2001) shown in bold italics, along with river study results in bold. These results provide context and “face validity” for the perceived crowding concept and method of analysis.



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Table 8. Percent feeling some degree of crowding at various resources.*

% Feeling Crowded	Resource	Population/Comments
Greatly over capacity: <i>Should be managed for high densities; might be described as sacrifice area</i>		
100	Deschutes River, Or	Boaters on weekends
100	Kenai River, Ak	Upper river bank anglers on high use days
95	Nantahala River, NC	Canoers about other users (includes rafters and kayakers)
94	Brooks River, Katmai NP, Ak	Bear viewers at mouth of river (September)
94	Colorado River, Az	Anglers at Thanksgiving
92	Alcatraz Island NP, Ca	Prison cell house
92	Kenai River, Ak	Lower river powerboaters on high use days
90	Yosemite Valley, Yosemite NP, Ca	River users about driving roads in Valley
90	Yosemite Valley, Yosemite NP, Ca	River users about finding parking in Valley
88	Deschutes River, Or	Boaters on weekdays
87	Oregon Caves National Monument, Or	All visitors
85	Arches National Park, Ut	Mountain bikers on Slick Rock trail
Over capacity: <i>Studies and management likely needed to preserve quality</i>		
84	Bridalveil Falls, Yosemite NP (1999)	Bridalveil Falls visitors evaluating the entire Yosemite Valley
83	Columbia Icefield, Banff-Jasper NP	Snocoach tourists
83	Yosemite Valley, Yosemite NP, Ca	River users about riding shuttles in Valley
82	Yosemite Valley, Yosemite NP, Ca	All river users taken together – Overall evaluation for river
81	Bridalveil Falls, Yosemite NP (1999)	Falls visitors at base of falls
80	Vernal Falls, Yosemite NP (1998)	Falls visitors at base of falls and for entire Yosemite Valley
78	Kenai River, Ak	Middle River powerboaters on high use days
76	Bridalveil Falls, Yosemite NP (1999)	Bridalveil Falls visitors evaluating the trail to the falls
74	Acadia NP, Me	Thunder Hole visitors
74	Columbia Icefield, Banff-Jasper NP	Visitor Center visitors
74	Rocky Mountain NP, Co	Visitor Center visitors
73	Boundary Waters, Mn	Canoers/boaters
72	Muir Woods NM, Ca	Visitors in the gift shop
72	Grand Canyon, Az	Rafters
71	Glacier Point, Yosemite NP (1999)	Glacier Point visitors evaluating entire Yosemite Valley
70	Abel Tasman NP, NZ	Hikers evaluating other visitors
70	Mount McKinley, Denali NP, Ak	Climbers
69	Glacier Point, Yosemite NP (1999)	Glacier Point visitors evaluating viewing areas
69	Rocky Mountain NP, Co	Longs Peak hikers
68	Yosemite Valley, Yosemite NP, Ca	River users about hiking and biking on trails in Valley
67	Mesa Verde NP, Co	Visitors overall
High Normal: <i>Should be studied if use increases expected; managers might anticipate problems</i>		
63	Gulkana River, Ak	All users – Lower Main Stem
61	Yosemite Falls, Yosemite NP, Ca	Falls visitors on trail and at base of falls
60	Yosemite Valley, Yosemite NP, Ca	River users about boating on Merced River
58	Arches NP, Ut	Visitors to Delicate Arch
54	Yosemite Valley, Yosemite NP, Ca	River users about relaxing along Merced River
53	Grand Canyon, Az	Rafters in winter
53	Snake River in Hells Canyon, Or/Id	Rafters
51	Yosemite NP, Ca (2001)	Frontcountry users along trails
51	Upper Youghiogheny, Pa	Kayakers (daily scheduling and use limit system)
Low Normal: <i>Unlikely to be a problem; may offer unique low density experiences</i>		
45	Yosemite Valley, Yosemite NP, Ca	River users about swimming in Merced River
45	Acadia NP, Me	Visitors on Carriage Roads
43	Brule River, Wi	Tubers
41	Kenai River, Ak	Lower river powerboaters during catch/release
38	Klamath River, Ca	Floaters
36	Yosemite NP, Ca (2001)	Remote wilderness hikers
Uncrowded: <i>no problem; may offer unique low-density experiences</i>		
35	Upper Youghiogheny, Pa	Rafters (daily scheduling and use limit system)
33	Gulkana River, Ak	All users – on low use Middle Fork
26	Illinois River, Or	Rafters
25	Delta River, Ak	Canoers and rafters
23	Yosemite NP, Ca (2001)	Wilderness “transition” users on trails
23	Kenai Fjords NP, Ak	Visitors to Exit Glacier
23	Acadia NP, Me	Isle au Haut hikers
21	Hawaii Volcanoes NP, Hi	Visitors at Thurston lava tube
14-19	Gwaii Haanas, BC	Touring kayakers at various areas
1-9	Athabasca-Sunwapta Rivers, Al	Whitewater rafters at various areas

*Selections from table assembled by Jerry Vaske; available on-line at: wamerncr.colostate.edu/~jerryv/CROWDING/Vaske_Crowding.htm
River study findings in bold. Other Yosemite findings in *bold italics*.



Perceived crowding variation through the day

Perceived crowding varied by the time when visitors were surveyed. Both boating and shore use are substantially lower in the morning and build through the afternoon, and crowding scores for different river activities are correlated with time of day ($r = 0.12$ to 0.23). The starkest differences were evident with a “breakpoint” at 1 pm (Table 9).

Afternoon crowding is about 15 percent higher than in the morning for the three main on-river activities (swimming, boating, or relaxing), and moves them from “low normal” to “high normal” by the capacity “rules of thumb.” Slightly smaller increases are evident for shuttle use (moving it from “high normal” to “over capacity”) and hiking / biking (although it remains “high normal”). Visitors willing to spend time at the river, ride shuttles, or use trails before 1 pm are likely to feel noticeably less crowded.

In contrast, differences in crowding before and after 1 pm are smaller for driving roads and finding parking in Yosemite Valley (5 and 7 points), and both remain in the “greatly over capacity” category. Transportation issues for those with private vehicles remain a problem throughout the day. The transportation system may have a longer period of higher use and crowding in comparison to river activities, which are often concentrated in the hotter part of the day (especially for activities that involve contact with the relatively cool Merced waters).

Table 9. Perceived crowding before and after 1 pm.

Type of crowding	Percent feeling crowded		t	p
	Before 1 pm	After 1 pm		
Swimming or wading in the river	31	51	4.3	.001
Boating on the river	49	66	2.4	.017
Relaxing or picnicking along the river	45	58	3.9	.001
Riding or waiting for shuttle buses	73	87	2.7	.006
Walking / hiking / biking on trails	60	72	2.9	.003
Driving roads in Yosemite Valley	85	92	4.0	.001
Finding parking in Yosemite Valley	85	90	3.3	.001
Overall (all day)	77	84	3.7	.001



Perceived crowding vs. daily use measures

A broad measure of daily Valley use (inbound vehicles past the Chapel counter) was weakly correlated with crowding while driving and crowding while finding parking ($r = 0.23$ and 0.10 , respectively), but not for other transportation or river-related activities. Road transportation system crowding is apparently more sensitive to changes in Valley vehicle counts than crowding on shuttles, trails, or while swimming, boating, or relaxing on the river. Limited variance in daily vehicle counts during the study is one likely explanation; inbound Valley vehicle counts only ranged between 5,800 and 6,800 in the study, while a typical May to September season ranges from 3,500 to 7,000. Transportation modeling (Byrne et al, 2011) for Yosemite Valley suggests that transportation impacts (e.g., long travel times, intersection queues, parking availability) diminish substantially at low and medium use levels (e.g., 3,500 to 6,000 vehicles), and crowding measured through this range is likely to correlate much more strongly.

Other analysis examined direct relationships between crowding and other daily use measures, finding only one that was statistically significant: daily boating counts at all locations (from systematic counts) was related to “crowding while boating” ($r = 0.20$). A relatively small range of use levels during the study period is again a possible explanation, but daily use measures may also fail to reflect use levels and associated crowding that may vary substantially within a day or by individual locations.

Relationships between crowding and at-a-location use measures were also reviewed. In nearly all cases, relationships were not statistically significant. The notable exception was for daily use at Swinging Bridge (from systematic counts), which was moderately related ($r = 0.31$) to “crowding while relaxing.” This site is the most likely to be busy throughout the day, so the daily locational use measure may have been more likely to reflect the conditions that visitors experienced.

For individual locations, a stronger predictor of perceived crowding was “reported highest use levels” in relation to a series of shore and boating use photos depicting various densities (the focus of the next two chapters). At most locations, crowding scores for that location (while relaxing, boating, or swimming) were moderately correlated with reported highest shore and boating use (correlations ranged from 0.3 to 0.4).

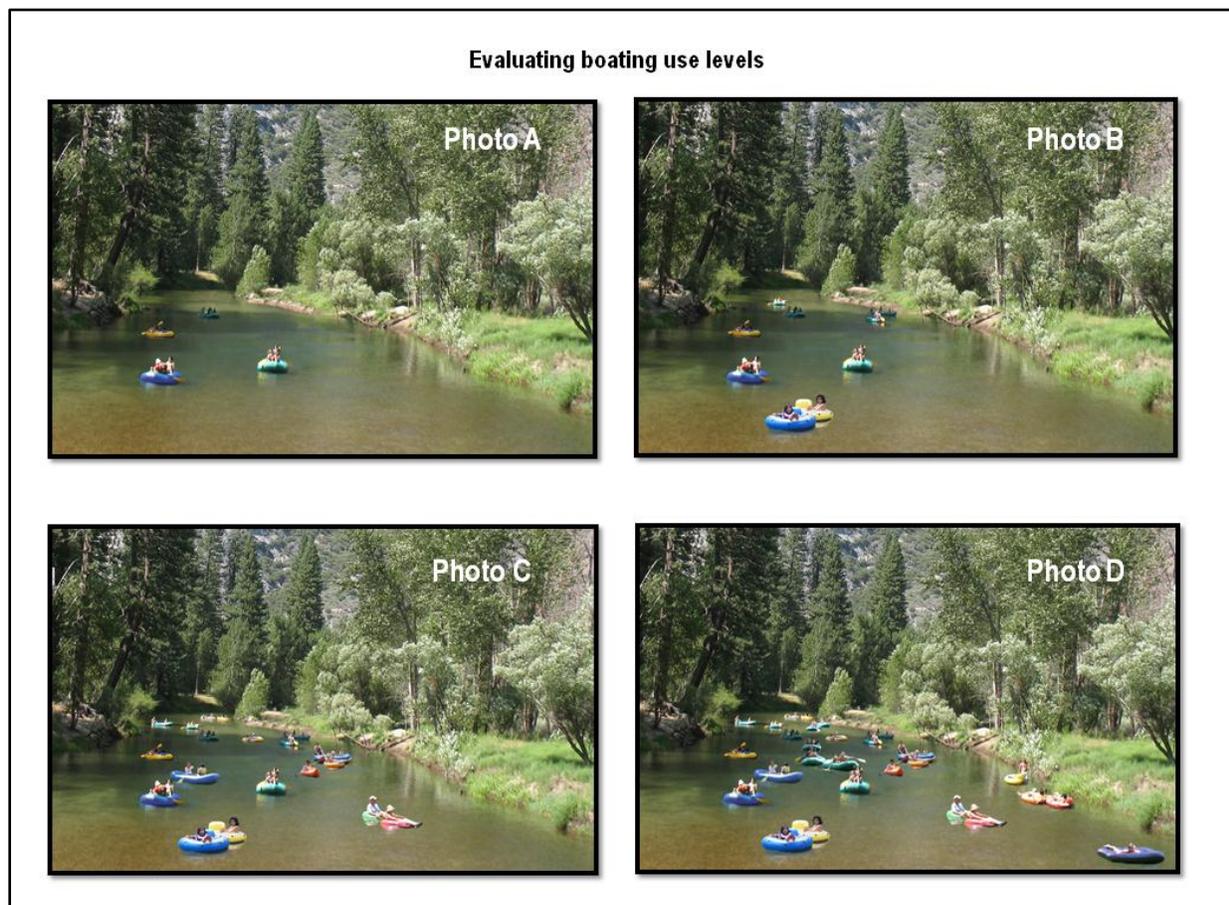


V. Findings: Boating Issues

This section of the report examines evaluations of boating densities (as represented in photos) and compares them to use levels in 2011. It also reviews support for management actions related to boating, including reductions of commercial boating, limiting private use, or opening other segments of the river.

Evaluations of boating use

Respondents were shown four photos of boating use levels on the Merced River. The photo background was a “generic reach” of the river (actually taken from Swinging Bridge looking upstream) and covered 746 feet or 0.14 miles). The photos depicted 4, 8, 16, and 24 boats in the viewshed; the clusters of boats were “photo-shopped” from actual photos taken from the bridge and included a mix of private and commercial boats (roughly half and half). The page from the landscape format survey is shown below:



On the facing page of the survey, respondents were asked to evaluate each photo on a 9-point acceptability scale (identical to those in similar ITCA studies) and then identify the photo that showed:

- ...the level of boating use you *prefer to see* (hereafter called “preference”)
- ...the highest boating use level the *Park Service should allow* (“NPS action”)
- ...the highest boating use level that would *cause you to no longer visit* (“displacement”)
- ...the highest number of *boats you saw today* (“reported highest”)



Acceptability

Figure 14 shows average acceptability evaluations of the four photos for all respondents. River users rated fewer boats as more acceptable, with the difference between acceptable and unacceptable (where the evaluation curve crosses the marginal line) at about 14 boats at one time (BAOT). Differences between each of the photos are statistically significant at the $p < .001$ level. Ratings by boaters versus shore users were not statistically different. More detail is provided in Appendix E.

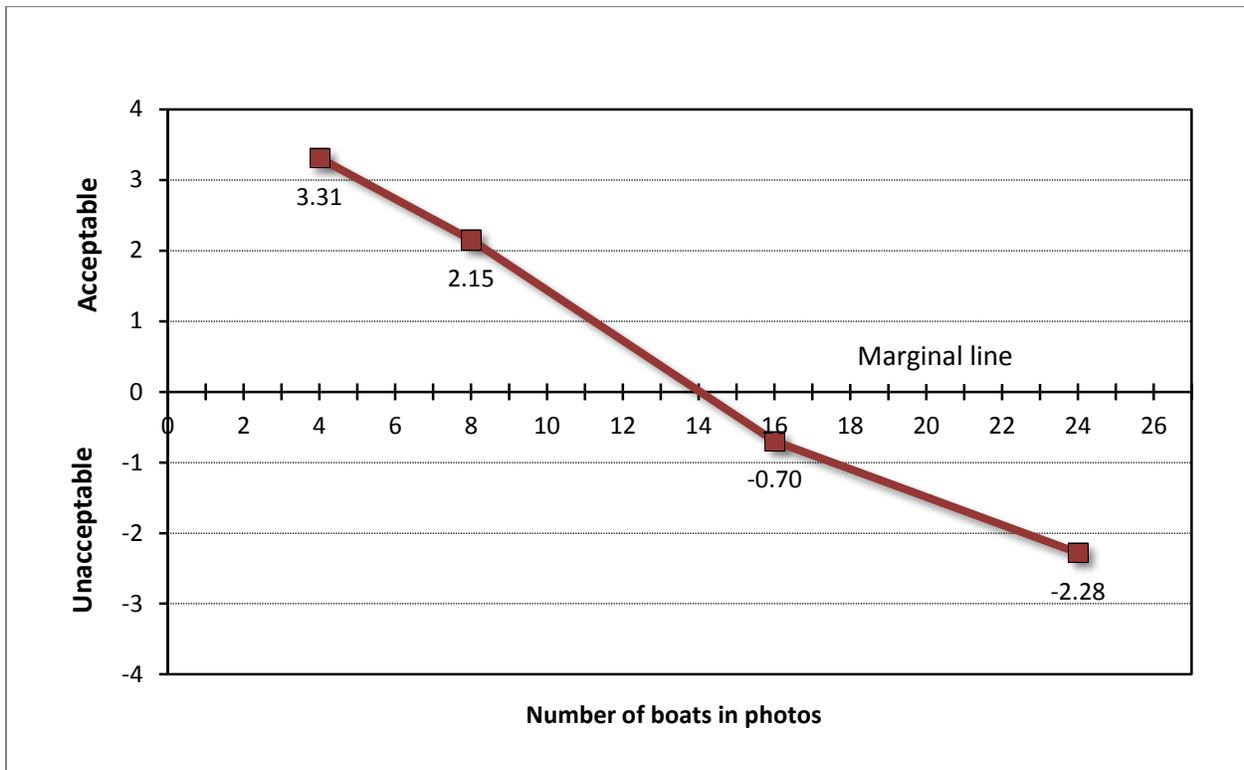


Figure 14. Average acceptability evaluations of photos depicting 4, 8, 16, and 24 boats in a “generic reach.”



Specified photos: Preferences

Figure 15 shows river users' preferences for use levels, and most chose the 4 or 8-boat photos. After removing those who indicated "no preference" (9% of the sample), 56% preferred 4 or less and only 6% preferred the two higher use levels. There were differences in preferences for boating and shore users; among those with a preference, 49% of boaters but 62% of shore users preferred 4 or less. Additional analysis detail is provided in Appendix E.

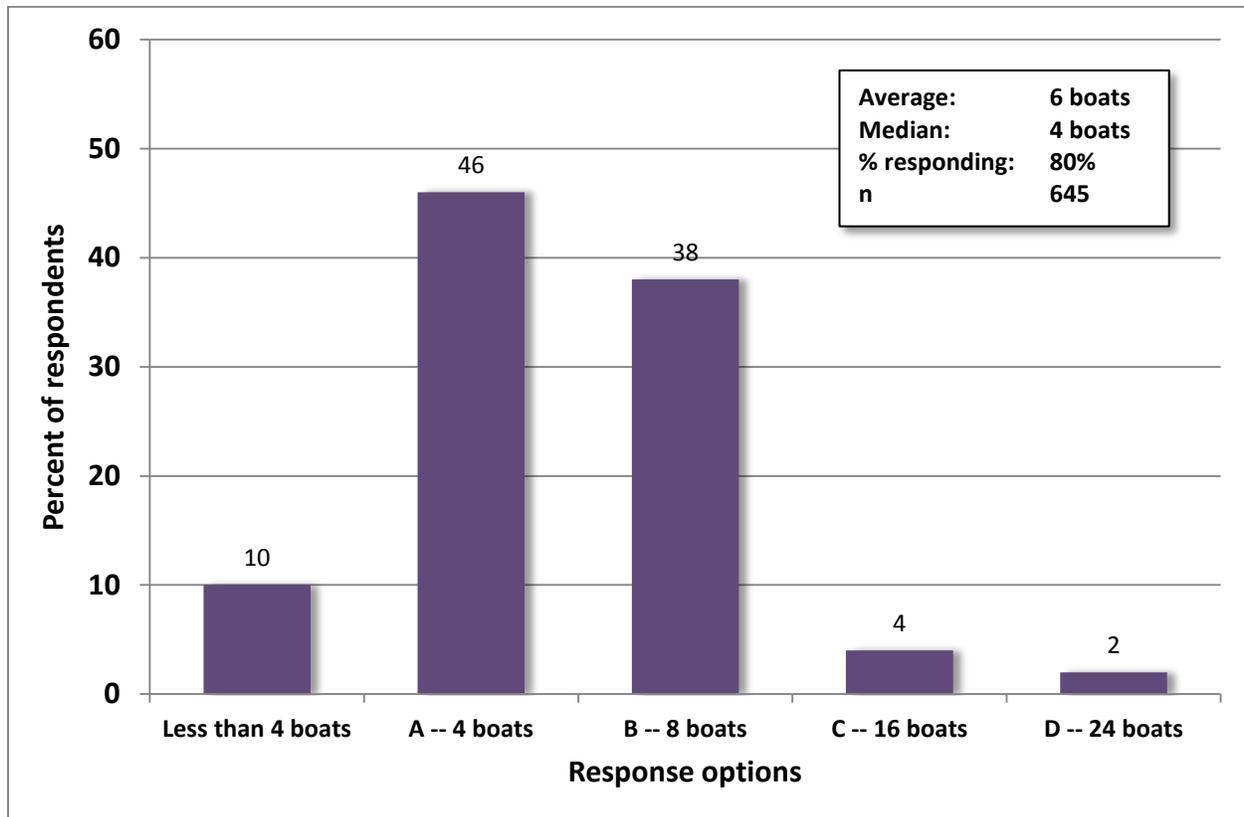


Figure 15. Percent reporting their preferred boating use level (mean and median for percent specifying a preference).



Specified photos: NPS action

Figure 16 shows river users' responses regarding the highest boating levels the Park Service should allow. The two "medium density" photos (8 and 16 boats) were chosen most often. After removing those who reported "numbers should not be restricted," 9%), 89% chose 16 or less, and 48% said 8 or less. As in other studies using similar questions, preferences were lower than "acceptability" and "NPS action" evaluations (which are similar to each other).

There were differences for these evaluations for boaters and shore users, with the latter choosing slightly lower use levels. Among those specifying evaluations, 44% of boaters but 53% of shore users chose 8 or less. Additional details are provided in Appendix E.

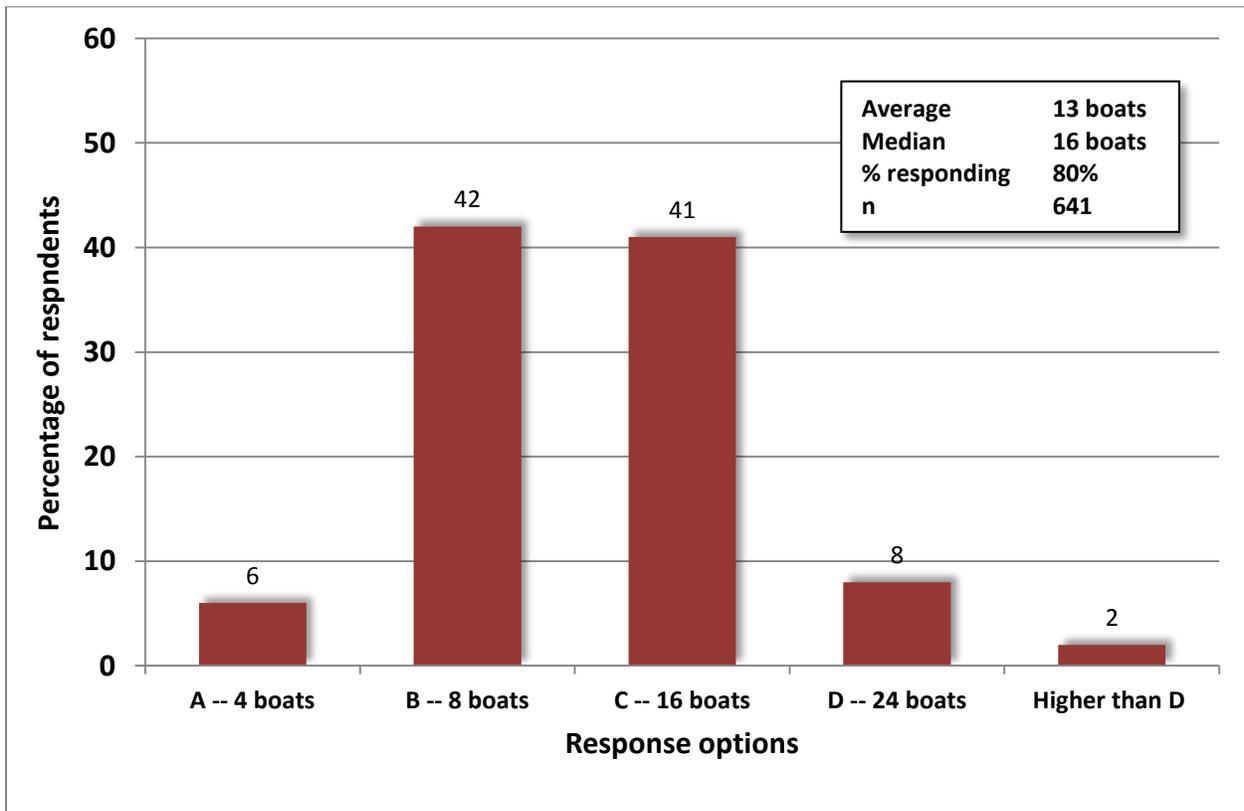


Figure 16. Percent reporting the highest boating use level NPS should allow (mean and median for percent specifying a use level).



Specified photos: Displacement

Figure 17 shows the highest boating level that would cause river users to no longer visit. Most identified the two highest use photos (or something higher still), and an additional 18% reported “use level doesn’t matter to me.” After removing the latter from the analysis, 71% chose the two highest use level photos (16 and 24 boats). There were small differences between boaters and shore users. Among those specifying a photo, 28% of boaters but 42% of shore users reported 16 or less. Additional analysis details are provided in Appendix E.

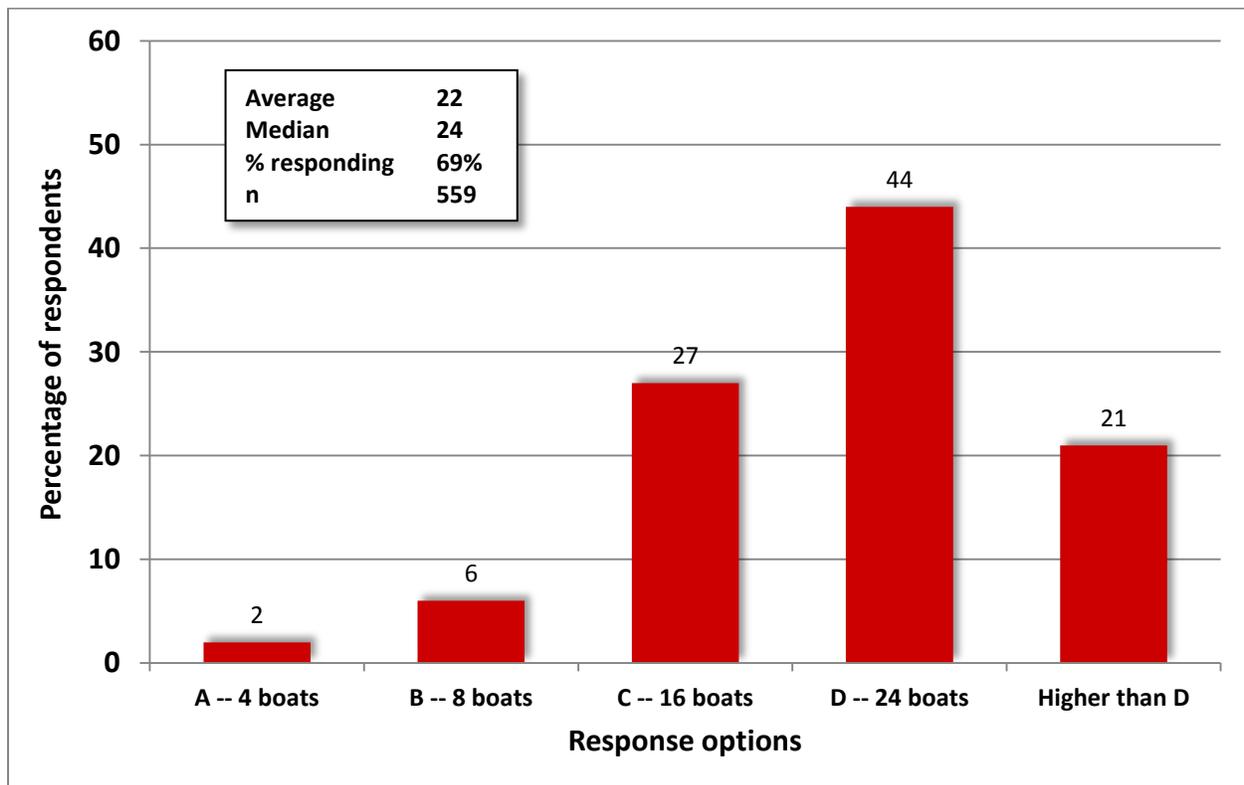


Figure 17. Percent reporting the highest boating use level that would cause them to no longer visit (mean and median for percent specifying a use level).



Specified photos: Highest reported use

Figure 18 shows the highest boating level river users reported for the day they were surveyed. Most reported 8 boats or less; after removing those who said “I don’t know” (5% of the sample), 82% reported 8 or less boats. There were some differences between boaters and shore users. Among those specifying a use level, 26% of boaters but 45% of shore users reported a highest use level of 4 or less. This makes sense because some shore users were sampled at times or on segments where boating use is prohibited. Additional analysis details are provided in Appendix E.

Other analysis examined correlations between the highest reported use and daily use measures. In general, these relationships were statistically significant but weak (r between .13 and .15 for different use measures). As with the relationships between crowding and daily use levels, within-a-day and location use variation is a likely confounding factor.

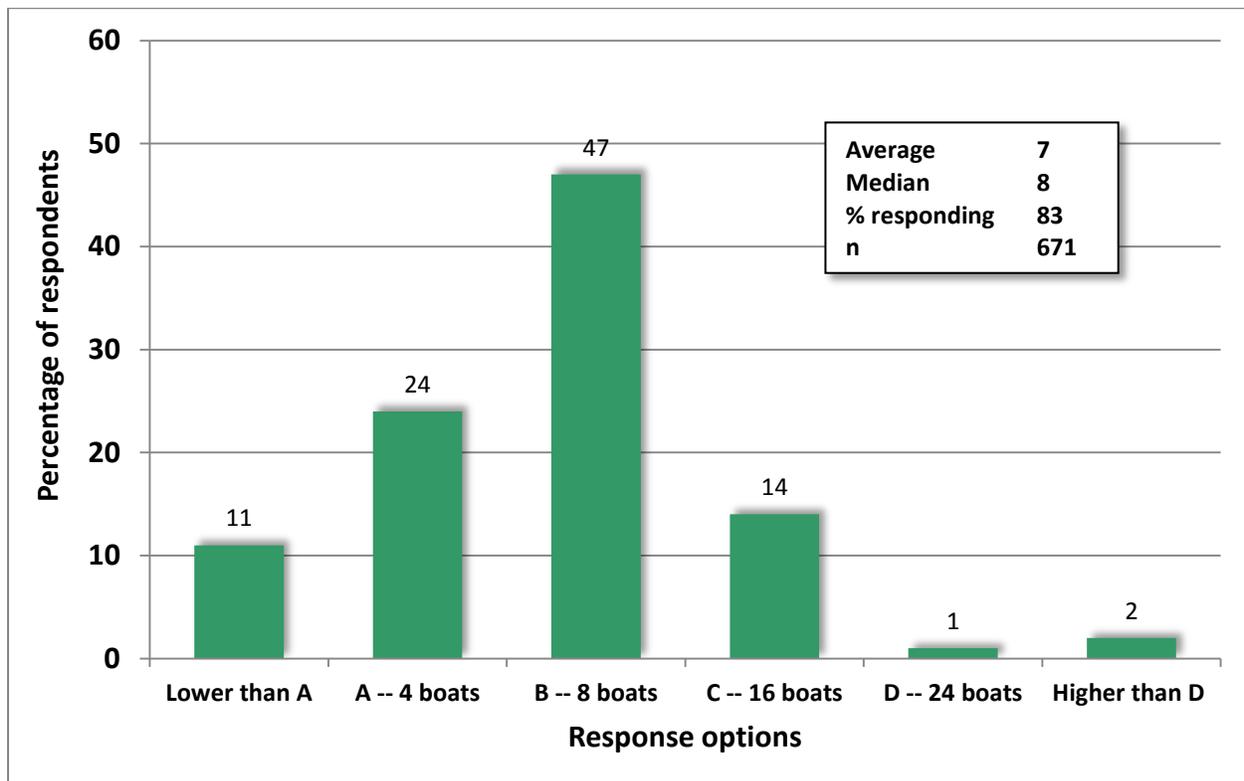


Figure 18. Percent reporting the highest boating use level that they saw on survey day (mean and median for percent specifying a use level)



Comparing “highest seen” to preferences and NPS action

Analyses compared respondents’ “highest seen” boating use level with their preference and NPS action evaluation. Results estimate the proportion who “saw more than they prefer/tolerate;” “saw about what they prefer/tolerate;” or “saw less than they prefer/tolerate” (Figure 19). Although 41% reported seeing more than they prefer, only 9% saw more than what they think NPS should allow, similar to “acceptability.”

In the middle of the scale, 39% and 31% report that the highest use level seen equaled their preference or NPS action standard, respectively. For these respondents, there may be little margin for increased boating levels without violating their evaluations. At the other end of the scale, most (60%) said that the highest level seen was less than they want NPS to allow, while 20% saw less than their preference. Differences between boating and shore users were small but statistically significant for the NPS action comparison ($t=-2.4, p<.013$).

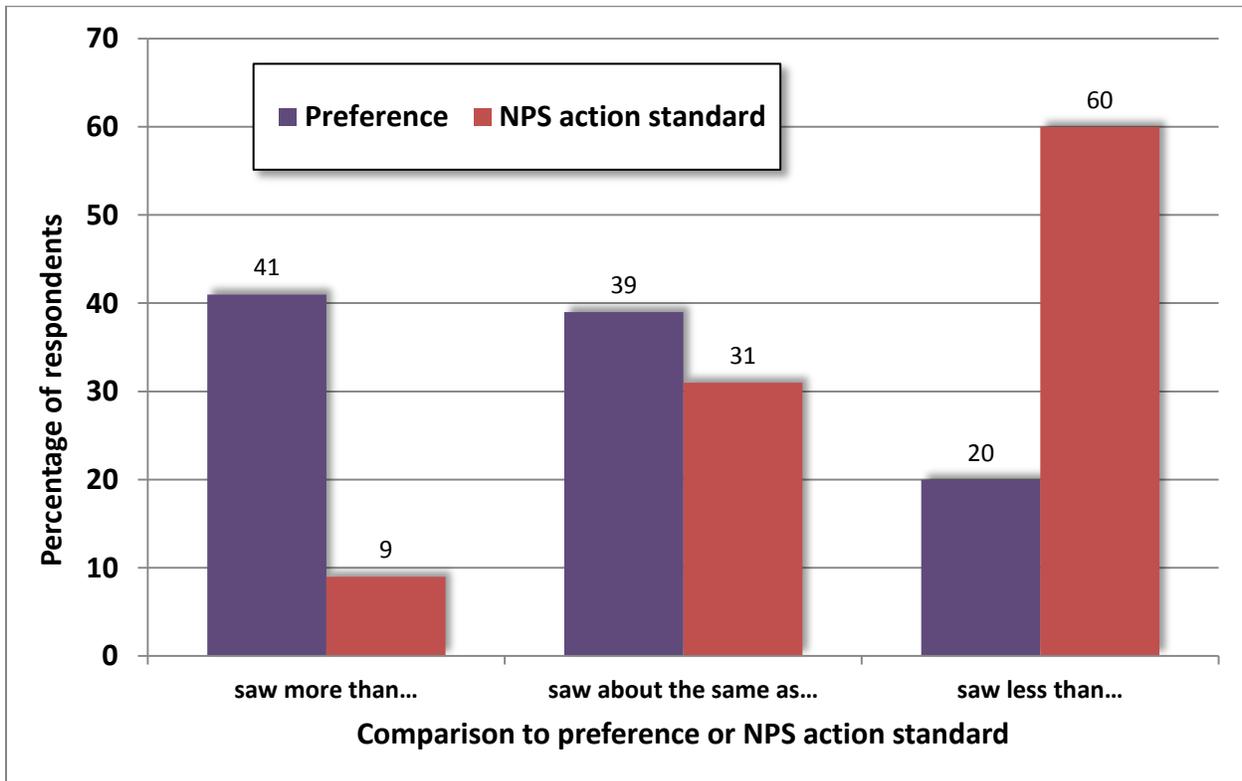


Figure 19. Percentage reporting the “highest boating use seen” was more, the same, or less than their preference or NPS action standard.



Summary of boating evaluations

Table 10 summarizes results from acceptability, preference, NPS action, and displacement evaluations, and “converts” them into densities for the photo viewshed, per mile, and the 2.4 mile reach where boating is currently allowed. Results help estimate the highest number of boats at one time on the segment that correspond to different visitor evaluations.

The calculations first assume even distributions of boats throughout the 2.4 mile reach, but we also present alternative estimates assuming uneven distributions. These calculations assume that high use clusters reach respondents’ evaluation levels, but with average “at one time” estimates reduced by half. Actual count data (discussed below) suggests that boating use clusters in time and space may vary by a factor of two or three consistent with this assumption, but it was beyond the scope of the study to model specific boating distributions.

Table 10. Summary of boating use evaluations (among all respondents) with conversions to densities.

	Boats in photo (0.14 mile reach in viewshed)	Boats per mile (rounded, with even distributions) ¹	Boats per 2.4 miles (rounded, with even distributions) ²	Boats per 2.4 miles (assuming “clustering”) ³
Photo A	4	30	70	35
Photo B	8	60	140	70
Photo C	16	110	270	140
Photo D	24	170	410	200
Preference	6	40	100	50
Acceptability	14	100	240	120
NPS action	13	90	220	110
Displacement	22	160	380	190

1. Rounded to nearest 10; assumes even distributions through one mile reach.
2. Assumes even distributions of boats through the entire reach.
3. Assumes uneven distributions – total at-one-time use is half of even distributions; evaluations refer to highest use clusters.



Comparing 2011 boating use to visitor evaluations

The NPS descriptive component of this study provides additional information about boating use. We have summarized key findings regarding temporal and spatial distributions to compare with boating density evaluations presented above.

Seasonal variation

Figure 20 shows daily use patterns across the season based on two indices of boating use: (1) reported concessioner raft rentals per day from July 14 through Sep 18 (the days of operation in 2011); and (2) twice-a-day counts at all locations on most days from June 19 through Aug 28. Findings include:

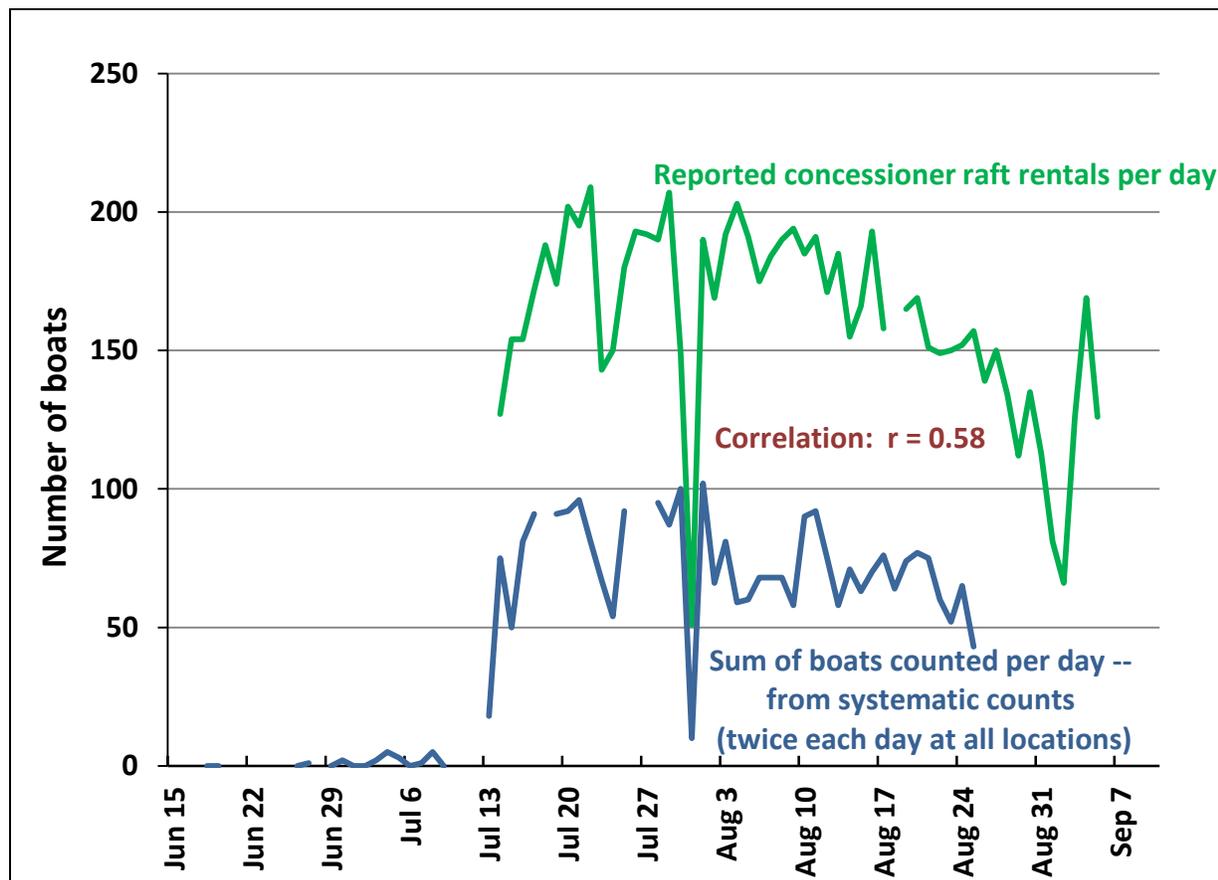


Figure 20. Seasonal boating use patterns based on concessioner raft rentals per day and systematic afternoon counts at all locations

- Use in 2011 varied dramatically through the season and very little boating occurred in June and early July because of high flows. The river was officially opened on July 12 (although a few private boaters were on the river prior to this date), and commercial boating began July 14. Based on anecdotal information, “normal year” summer boating runs from early May through mid-July (a 75 day season), although high water may close the river for a week during that period (usually in late May or early June). 2011 was the rare year when boating extended into September.



- A few high use days were attributable to holidays (e.g., the spike over Labor Day weekend in the concessioner counts), a few low use days to weather (e.g., a cool day on July 15, thunderstorms on July 31).
- The concessioner rental counts are considered a census of commercial use. Because commercial use makes up 60% of total boating use (across all locations from all types of counts), total daily boating use can be estimated from the concessioner daily rental rate (multiply by 1.66). Based on this “rule of thumb,” the highest use days in 2011 were about 200 commercial boats and 130 private boats for a total of about 330 per day. Similarly, average boating use in 2011 was about 140 rentals and 90 private boats for a total of 230 boats per day.
- These “rule of thumb” estimates are slightly higher than the averages reported from near-census observations conducted by Colorado State University researchers in 2007 (Pettebone et al., 2008). In that year (which had commercial boating for a 52 day season, with observations conducted between May 31 and June 24), the average number of total boats ranged from 193 (Stoneman Bridge counts) to 205 (Sentinel Beach counts). The 2007 counts may have missed some private boats used for short trips (e.g., Housekeeping to Swinging Bridge) by counting only at the put-in and take-out, or private boating use may have increased slightly. It is unlikely that commercial use has increased substantially because NPS boats-at-one-time limits constrain total daily use.
- Systematic counts of all boats (twice a day at all locations) in 2011 were moderately correlated with concessioner daily counts ($r = 0.58$). Systematic counts are not a census because they miss considerable use as field techs travel to and from observation locations, but they are a reasonable index of daily boating use.
- Over the entire summer, systematic counts never exceeded 102 boats in a day, averaged 51, and typically ranged between 5 and 77 (the interquartile or 25% and 75% counts). In the study period, the maximum count was similar (100), but the average (74) and the typical range (64 to 92) was higher. The study generally corresponded with the peak boating use period for the summer.
- Over all counts, 60% of total boats counted were commercial rafts, but the share of commercial boats was even higher on higher use days (exceeding 70% on some days). In general, private boating use averaged 28 but sometimes exceeded 40 boats observed per day during systematic counts, while commercial rafts averaged 44 and sometimes exceeded 50 boats during those same systematic counts.
- Concessioner rentals reached a maximum of 209 boats per day, averaged 137, and typically ranged from 112 to 185 over the whole commercial season. During the study period, concessioner rentals were higher, averaging 168 with a typical range from 151 to 193.
- 2007 monitoring suggested that weekends (defined in their report as Fridays, Saturdays, and Sundays; 157 to 177) had lower boating use levels than weekdays (219 to 226), and a similar pattern is evident in 2011 data. Unlike Saturday peaks for daily traffic counts into the Valley, higher boating use usually occurred Wednesdays through Fridays. A higher proportion of overnight users boat the river, and their visits last about a week. Saturday traffic circulation may constrain commercial rafting because concessioner’s shuttle operation becomes less efficient.



Within-a-day variation

In addition to seasonal and weekly variation, boating use also varies within a day. An example illustration (Figure 21) comes from a “full day count” at Stoneman Bridge (the rafting put-in) on Sunday August 7. Based on concessioner raft rental counts, this was a reasonably high use day (184 boats), although systematic counts showed that private use was relatively lower.

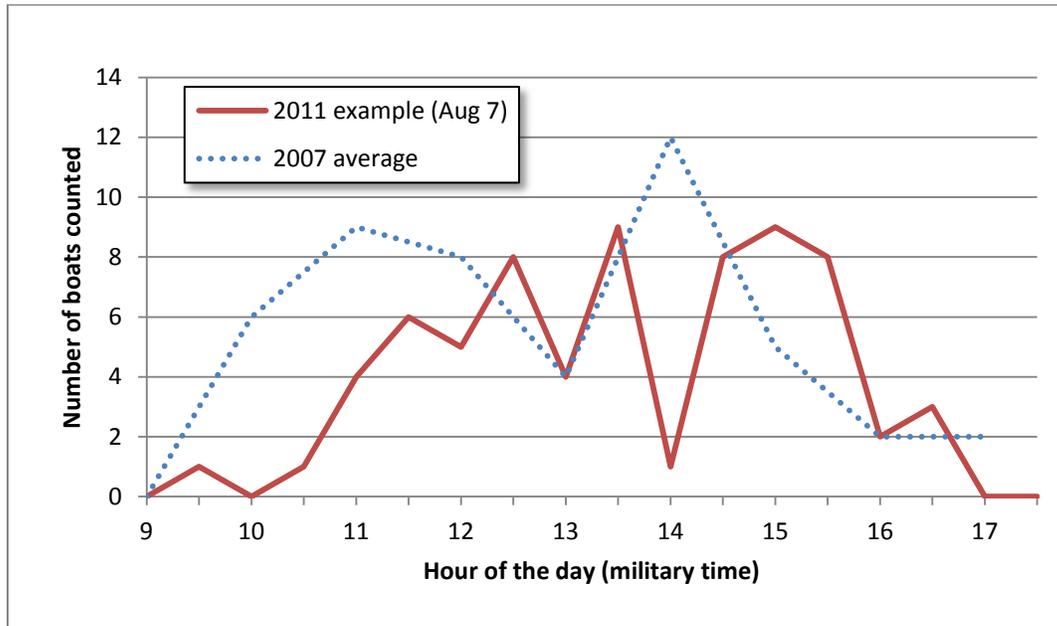


Figure 21. Example “full day” boat counts (Stoneman Bridge put-in on Aug. 7) with comparison to 2007 study average for same location.

Boating use tends to build in the morning and peaks in mid-afternoon. Because Stoneman Bridge is at the start of the boating segment, it may have earlier use than other locations. Use may be uneven in the higher user part of the day (also evident in 2007 river use monitoring, even though it reported an average for the entire study). The mid-afternoon “dips” in use may reflect lunch breaks, or be a consequence of the 100 rental boats at-one-time limit (prospective renters have to wait until boats return).

Location variation

Boating data also illustrate that boaters spend more time at some locations than others (see Figure 22). Boaters congregate at Swinging Bridge, Superintendent Footbridge, and Housekeeping West – all of which have large beaches. Swinging Bridge has the additional attraction of a bridge (sometimes used for jumping, despite rules to the contrary), and it is the last large beach where boaters can prolong their time on the river before the takeout.

The lowest use locations include 1) Sentinel Beach (the boating take-out, where few boaters appear to linger); 2) the rafting put-in at Stoneman Bridge (a congested location with no real beach on river right where the boats put-in); and 3) Housekeeping East (which has large beaches, but comes shortly after the put-in and may be “too soon” for a stop).

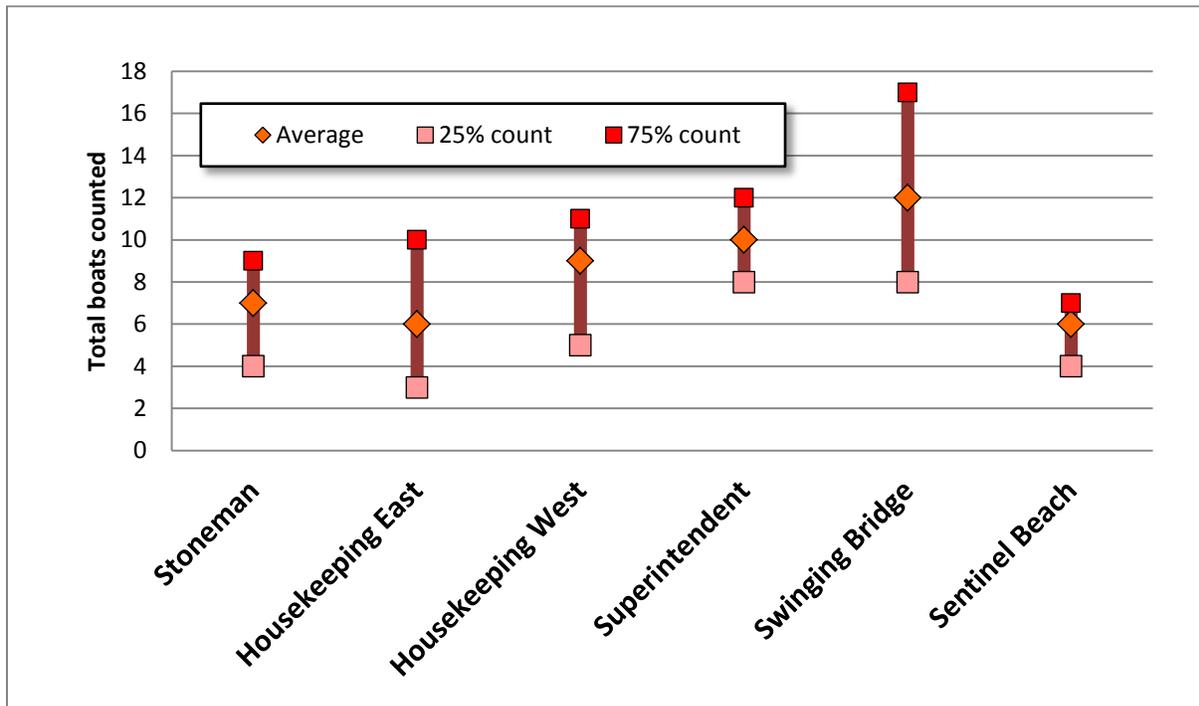


Figure 22. Afternoon systematic counts of boats at various locations (entire rafting season).

Figure 22 also provides rough information about the number of boats within a viewshed at these locations. While total counts for any given location are higher than “boats in view” from a single vantage point (because observers look both upstream and downstream during their counts), total counts for a location represent an upper bound on how many boats may be visible at one time. In a review of sight distances from the center of the nine bridges in the study area, the average river reach has a line of sight of about 0.16 miles both upstream and downstream.

The highest boat counts at one time and location exceeded 20 on only eight occasions – once at Stoneman Bridge put-in just after noon, and on seven occasions at Swinging Bridge. The highest boating count was 28 on Saturday July 30 at Swinging Bridge.

Combined with the interquartile range information shown in Figure 22, these counts suggest few if any 2011 visitors experienced use levels depicted in the highest use photo (Photo D – 24 boats in view). This is consistent with respondent’s reported highest use levels (only 3% reported they saw use levels at or higher than Photo D). In general, these use levels provide boating densities closer to visitors’ “preferences” (about 8 per photo, 60 per mile, or 140 at one time on the entire segment) than their “acceptability” or “management action” standards (about 14 per photo, 100 per mile, and 240 at one time on the entire segment).



Support/opposition for management actions

Respondents were asked to evaluate potential management actions that might be used to address boating and related management issues. A preamble summarized existing management and asked respondents to indicate their support or opposition on a 5 point scale.

The National Park Service currently allows boating on 2 ½ miles (out of 7) of the Merced River through Yosemite Valley. The number of rental rafts is limited (100 on the river at one time), but private boats are unlimited. Please tell us if you support or oppose the following actions.

The management actions included the following. The percentages of support and opposition for all respondents are given in Figure 23; percentages do not sum to 100 because of “neutral” responses.

- Require boaters to wear life jackets (PFDs)
- Reduce raft rentals by 25% (no more than 75 at one time)
- Reduce raft rentals by 50% (no more than 50 at one time)
- Eliminate raft rentals in Yosemite Valley
- Limit the number of private boats per day through a permit system
- Eliminate all boating in Yosemite Valley
- Allow unlimited short-distance boating along the Pines campgrounds (this is currently closed to boating)
- Allow boating on other currently “closed” segments, but keep use low by limiting boats per day through a permit system

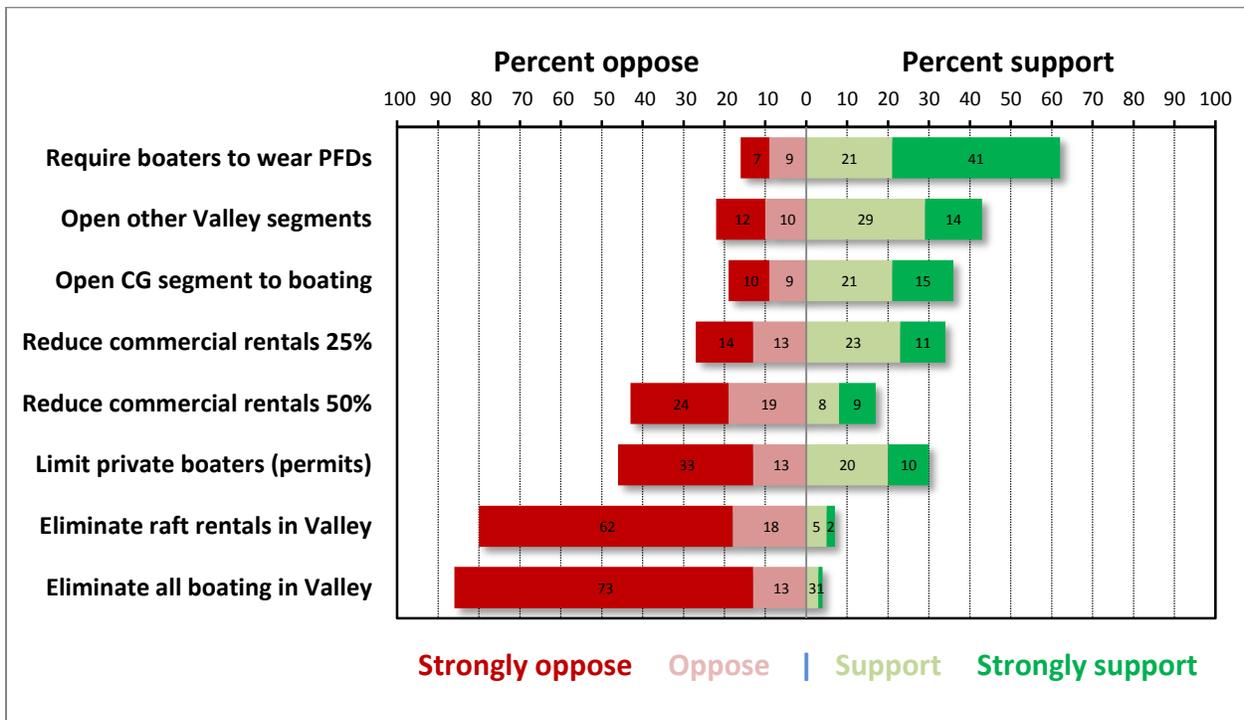


Figure 23. Percent of all respondents who support/oppose potential boating management actions.



- There was majority support (62%) for only one action, **requiring boaters to wear life jackets** or PFDs.” Current California law requires boaters to have PFDs available in their boats, but they are not required to wear them.
- There was more support than opposition for **opening new segments of the Merced to boating**, (43 support to 22 oppose) and **allowing short distance floating along the Pines campgrounds** (36 support to 19 oppose). Potential benefits included reducing densities on the currently open 2.4 mile segment and providing additional boating opportunities in the valley. About 35-45% were neutral on these issues.
- Respondents were divided over **reducing commercial raft rentals**. There was more support than opposition for a 25% raft rental reduction (34% support, 27% oppose, 39% neutral or indifferent), but more opposition than support for a 50% raft reduction (43% oppose, 17% support, 40% neutral). This is consistent with evaluations of existing boating use, where many visitors (although not a majority) prefer slightly lower levels. Based on current proportions of commercial and private use, a 25% raft rental reduction would produce about 15% less boats on the river (because private use would not be affected).
- Most opposed **eliminating raft rentals in the Valley** (80% oppose, 7% support, 13% neutral) and **eliminating all boating in the Valley** (86% oppose, 4% support, 10% neutral). This level of opposition to a management action is rare in recreation surveys.
- There was more opposition than support for **limiting private boating use** (46% oppose, 30% support, 24% neutral); current private boating use is unlimited in the open segment.



Differences between groups for management actions

There were statistically significant differences between boaters and non-boaters for all the boating management actions, but most were differences in degree (rather than polarized opinions). Figure 24 shows differences graphically; tests for average differences are given in the appendix. For example, non-boaters were more likely to support wearing PFDs (79% support vs. 54%; $t=4.2, p<.001$), reduce raft rentals 25% (37% support vs. 30%; $t=4.1, p<.001$), and less likely to oppose raft reductions of 50% (32% oppose vs. 55% oppose; $t=6.6, p<.001$).

The only action where the two groups held substantively different opinions was limiting private boats. Most boaters opposed this action (59% oppose, 22% support), while more non-boaters support than oppose it (40% support, 34% oppose), with a significant mean difference ($t=7.5, p<.001$). It is obviously easier for non-boaters to support a permit system that might improve conditions on the river but wouldn't affect them (because they don't boat).

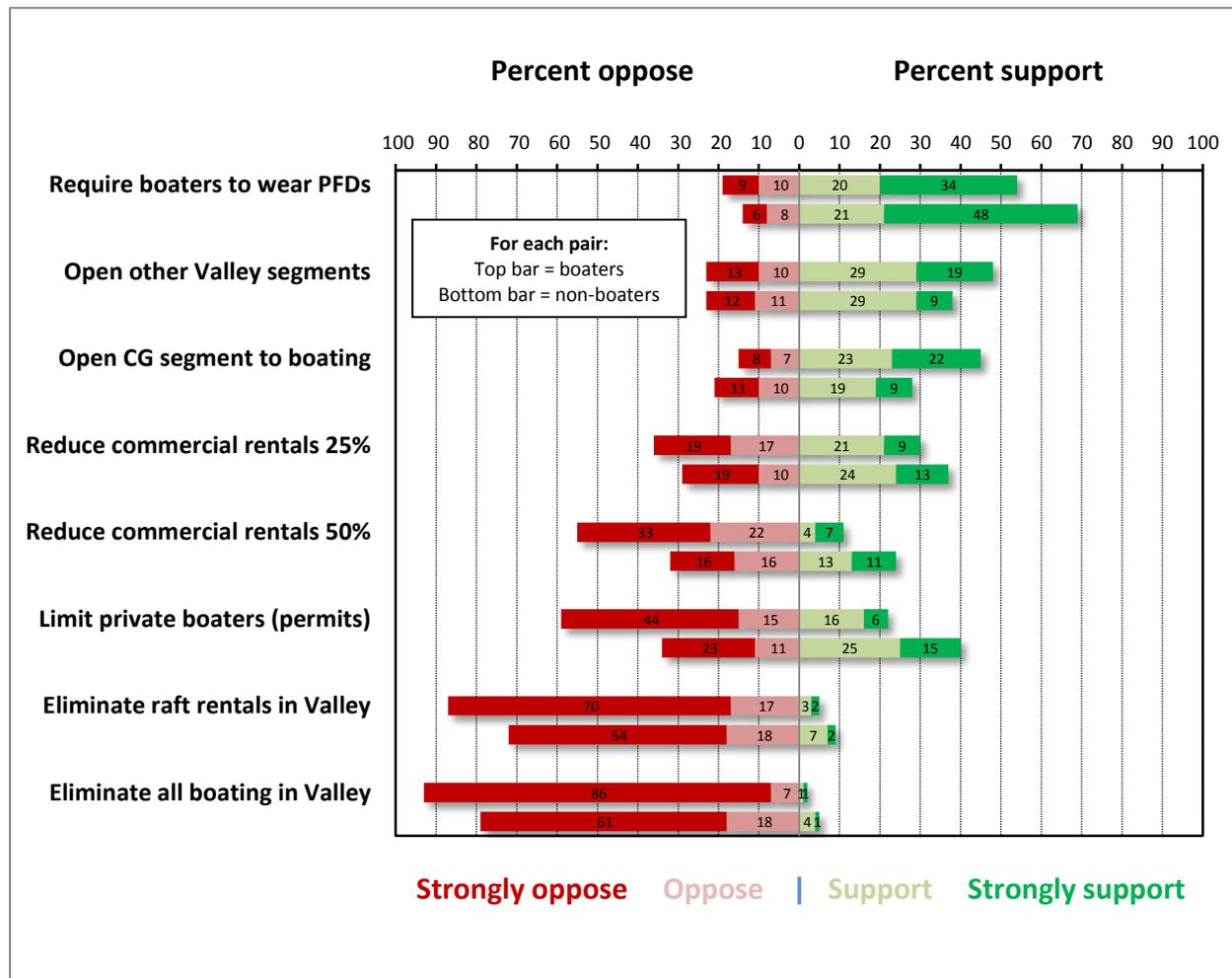


Figure 24. Percent support/oppose for boating management actions (among boaters and non-boaters).



Additional boating considerations

In summary, results from the study suggest boating use rarely exceeds median acceptable or “NPS action” thresholds, indicating that boating use is probably not “too high” for most visitors. Although “clustering” of boats might produce higher densities at some times and places, most mid-summer visitors experience lower densities and there more opposition than support for large use commercial use reductions or any limits on private boating use.

Existing use limits on commercial raft rentals are one likely explanation. Even with limits, concession raft rentals are related to day use as measured by traffic into the Valley; if those constraints were not applied, total boating use would probably increase even more, possibly to consensus unacceptable levels described in this report.

Although there are no similar limits on private boating use, that use is somewhat constrained by relatively static overnight use because most private boaters spend a night in the Valley hotels or campgrounds. Unless overnight accommodations and campgrounds are expanded (increasing overnight use levels), private boating use is likely to remain relatively stable. Private use monitoring can help track this situation, either through systematic counts (as conducted during this summer’s study) or through a self-registration program (a common practice on higher use rivers across the country). An unlimited but mandatory self-registration system, in combination with the concession rental count program, could provide a census of boating use and allow managers to be certain when boating use is approaching unacceptable levels assessed in this study.

Study data show that there are very few river users who support the elimination of boating in Yosemite valley (probably less than 5% of non-boaters, and less than 4% of all river users). One possible explanation is that sensitive non-boaters may recognize that boating only occurs for a portion of the year (typically less than 75 days, which is 20% of the entire year although about 50% of the May-September season). In addition, current regulations only allow boating on the 2.4 mile reach from Stoneman Bridge to Sentinel Beach.

Regarding new boating opportunities in other segments in the Valley, current river users show more support than opposition for these management options. These actions would restore some historically available boating opportunities, but they are not without management challenges (e.g., judicious management of ecologically-important large wood to reduce boating or swimming hazards, search and rescue needs if relatively unskilled boaters use higher challenge (Class I-III, or IV) reaches, and congestion and parking availability issues at potential new boating access areas).



VI. Findings: Shore Use Issues

This section reports evaluations of shore use densities (as represented in photos) and compares them to actual use levels in 2011. It also reviews support for related management actions, including redistributing shore use through education efforts or parking changes, limiting private vehicles in the Valley, or reducing overnight use.

Evaluations of shore use

Respondents were shown four photos of shore use levels on the Merced River. The photo background was a “generic beach” (actually taken from Housekeeping Footbridge looking upstream covering about 180 feet of beach front). The photos depicted 10, 30, 60, and 100 people in the viewshed; with clusters of shore users “photo-shopped” into the scene from actual photos taken from the bridge. The page from the landscape format survey is shown below:



On the facing page, respondents were asked to evaluate each photo on a 9-point acceptability scale (identical to those in similar ITCA studies) and then identify the photo that shows...

- ...the level of shore use you *prefer to see* (hereafter called “preference”)
- ...the highest shore use level the *Park Service should allow* (“NPS action”)
- ...the highest shore use level that would *cause you to no longer visit* (“displacement”)
- ...the highest level of shore use *you saw today* (“reported highest”)



Acceptability

Figure 25 shows average acceptability evaluations of the four photos for all respondents taken together. River users rate fewer boats more acceptable, and the curve crosses the marginal line (goes from acceptable to unacceptable) about 54 people at one time (PAOT). Differences between each of the photos were statistically significant at the $p < .001$ level). Additional analysis showed no significant differences between boaters and shore users. Frequency distributions and other statistics are in Appendix F.

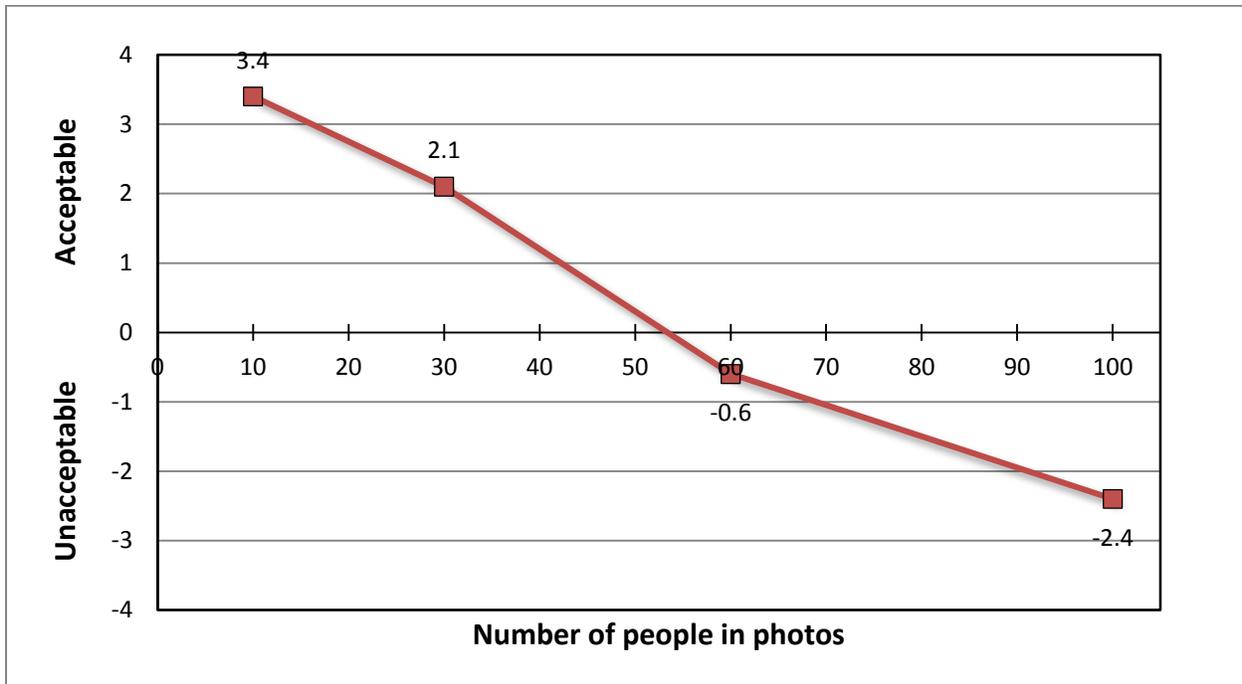


Figure 25. Average acceptability evaluations of photos depicting 10, 30, 60, and 100 people on a “generic beach.”



Specified photos: Preferences

Figure 26 shows preferences for shore use levels depicted in photos. Among those with a preference 60% preferred 10 or fewer and only 7% preferred 60 or 100 people (7% had no preference). Additional analysis showed small differences between boaters and shore users (See appendix F).

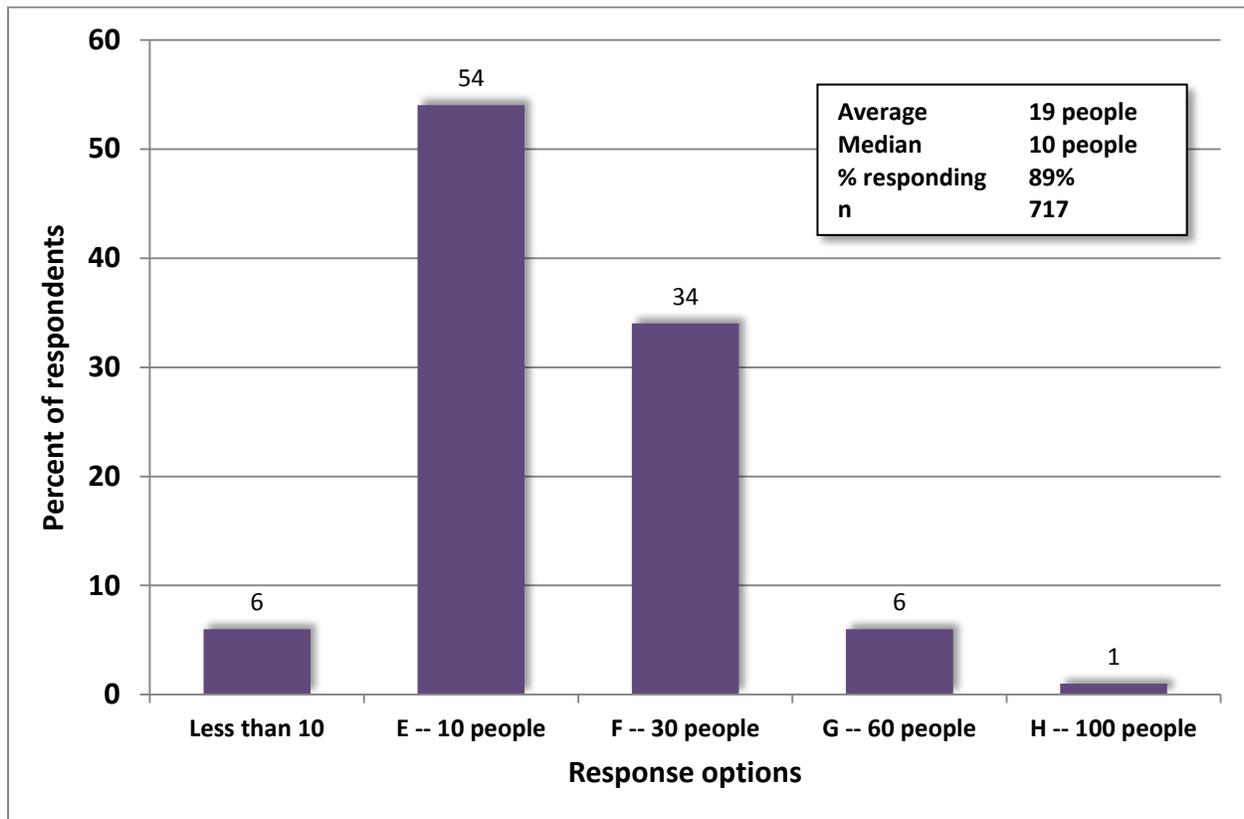


Figure 26. Percent reporting their preferred shore use level (mean and median for percent specifying a preference).



Specified photos: NPS action

Figure 27 shows the shore use levels that were the “highest the Park Service should allow.” Among those who gave an answer, 87% reported 60 or fewer. Another 13% said shore use “numbers should not be restricted.” While river users preferred lower use levels, most did not want NPS to limit use until about 50 to 60 people per viewscape. This is about the same number indicated from the “acceptability” results (52 people; Figure 25). There were no substantive differences between boaters and non-boaters.

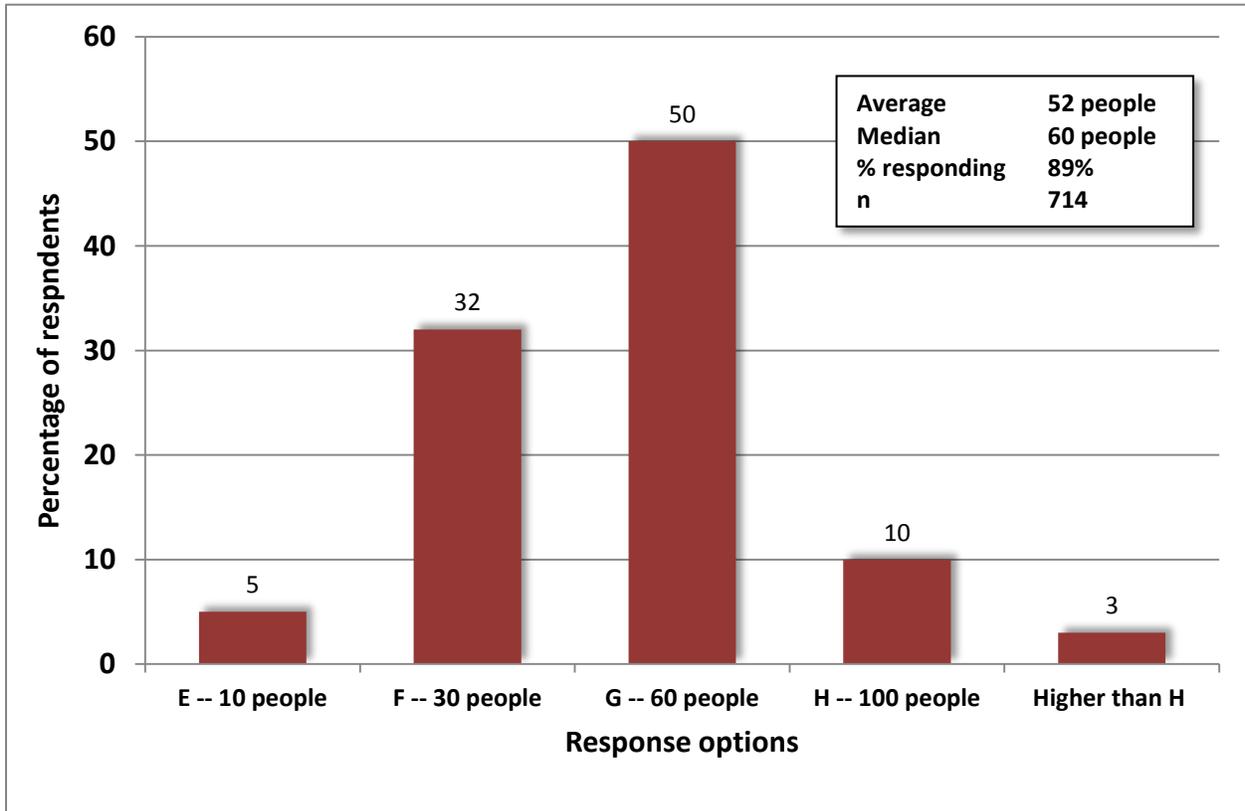


Figure 27. Percent reporting the highest shore use level NPS should allow (mean and median for percent specifying a use level).



Specified photos: Displacement

Figure 28 shows the highest shore use level that would cause river users to no longer visit. Among those who gave an answer, 75% chose 60 or 100 and 18% more chose higher than 100 people. River users preferred lower use levels, and supported NPS action at higher use levels, but most would not be displaced until 85 to 100 people in the viewscape.

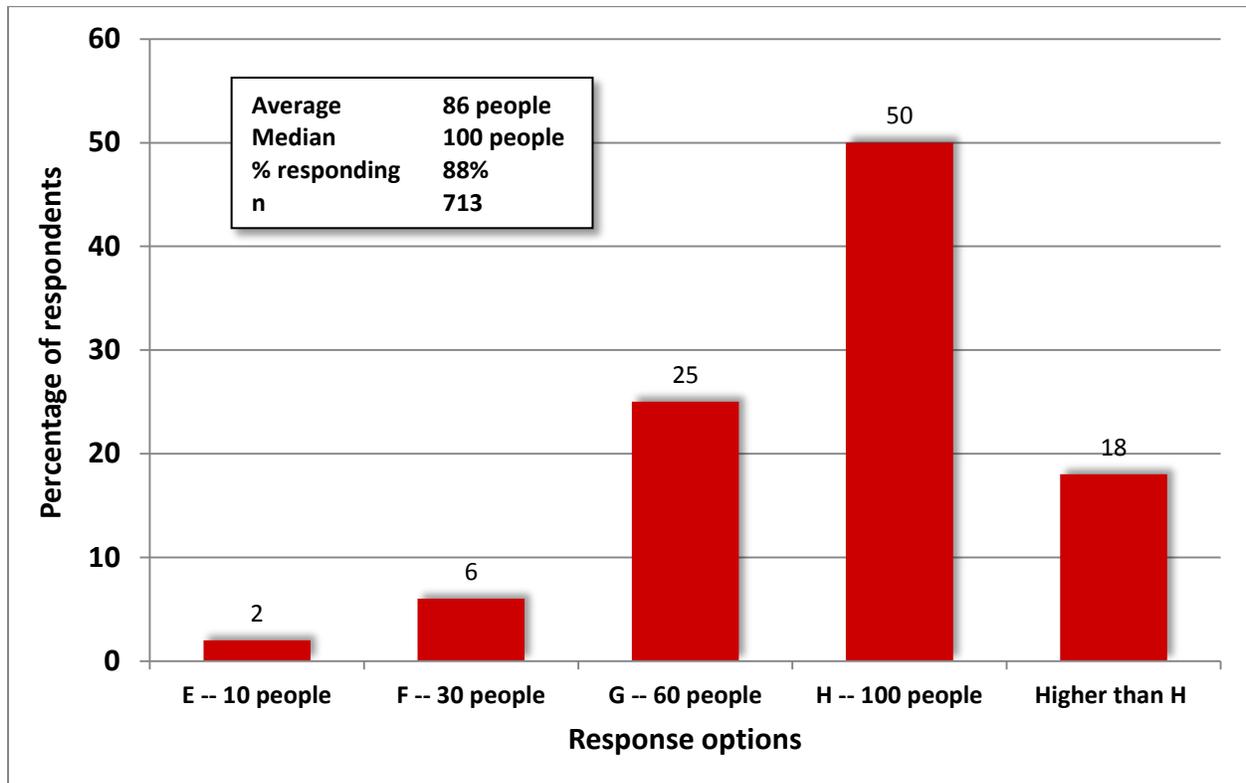


Figure 28. Percent reporting the highest shore use level that would cause them to no longer visit (mean and median for percent specifying a use level).



Specified photos: Highest reported use

Figure 29 shows the highest shore use level river users reported for the day they were surveyed. Among those who identified a use level, 81% reported 30 or less at one time. Most did not experience the high use levels depicted in Photos G and H (60 and 100 people); the average reported about 26 to 30 people at one time. Only 5% could not identify the highest use level they had seen.

Additional analysis explored relationships between highest reported shore use and actual use (from systematic counts). In general, these were weak but statistically significant, with correlations ranging from .09 to .15.

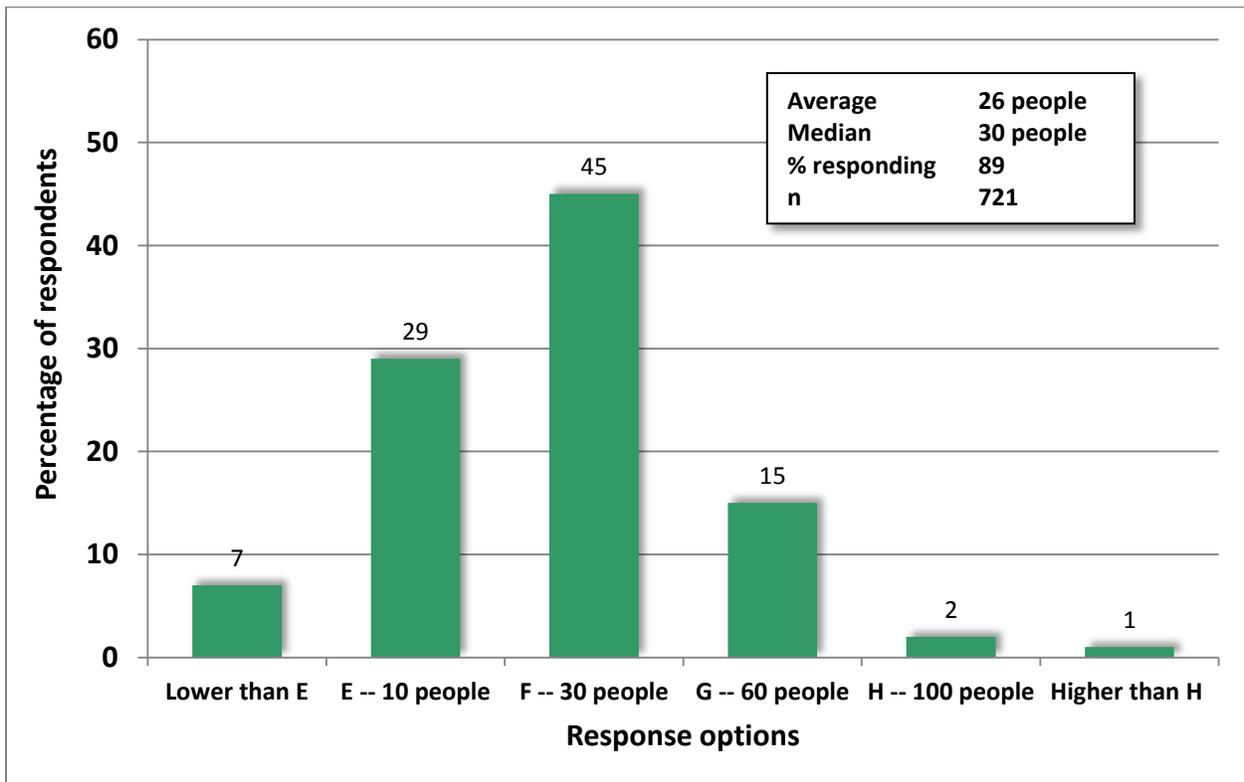


Figure 29. Percent reporting the highest shore use level that they saw on survey day (mean and median for percent specifying a use level)



Comparing “highest seen” to preferences and NPS action

Figure 30 compares respondents’ “highest use level seen” with their preference and NPS action evaluation. Results show that although 43% reported a “highest level” greater than they preferred, only 7% saw more than what they thought NPS should allow.

At the other end of the spectrum, most respondents (76%) reported that the “highest level seen” was less than they want NPS to allow, and 22% saw less than their preference. For these respondents, there is more “margin for increased use” before their preferences or management action standard are threatened. In the middle, 35% said the highest level seen was the same as their preference, and 17% said it was the same as their NPS action standard.

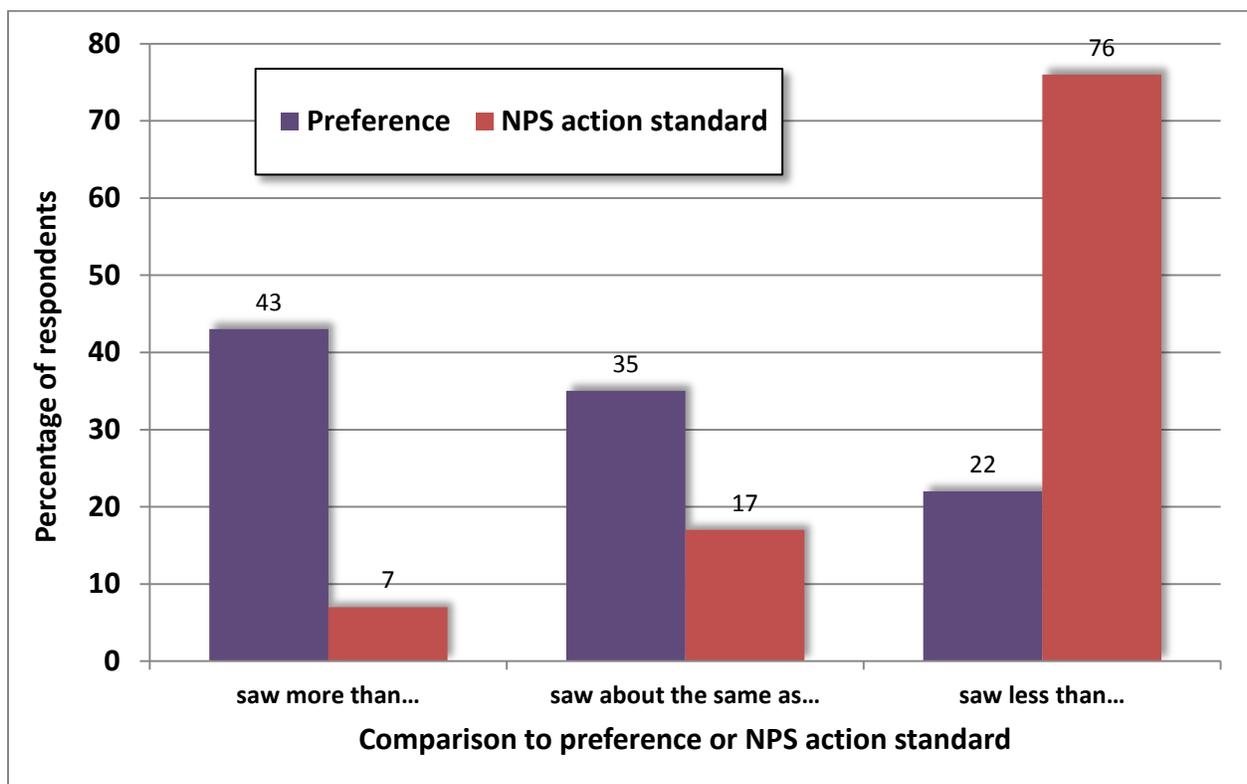


Figure 30. Percentage reporting the “highest shore use seen” was more, the same, or less than their preference or NPS action standard.



Summary of shore use evaluations

Table 11 and Figure 31 summarize acceptability, preference, NPS action, and displacement evaluations, and “convert” them into people per photo viewshed, and linear feet of beachfront per person. Results help predict the highest number of people at one time on a “generic beach” at one time that would meet these different evaluations.

Table 11. Summary of shore use evaluations (among all respondents) with conversions to “beachfront” densities (feet of beachfront per person).

	People in photo (180 feet of beach front)	Beachfront (feet) per person	Rounded beachfront (feet) per person
Photo A	10	18.0	18
Photo B	30	6.0	6
Photo C	60	3.0	3
Photo D	100	1.8	2
Preference	19	9.5	10
Acceptability	54	3.3	3
NPS action	52	3.4	3
Displacement	86	2.1	2

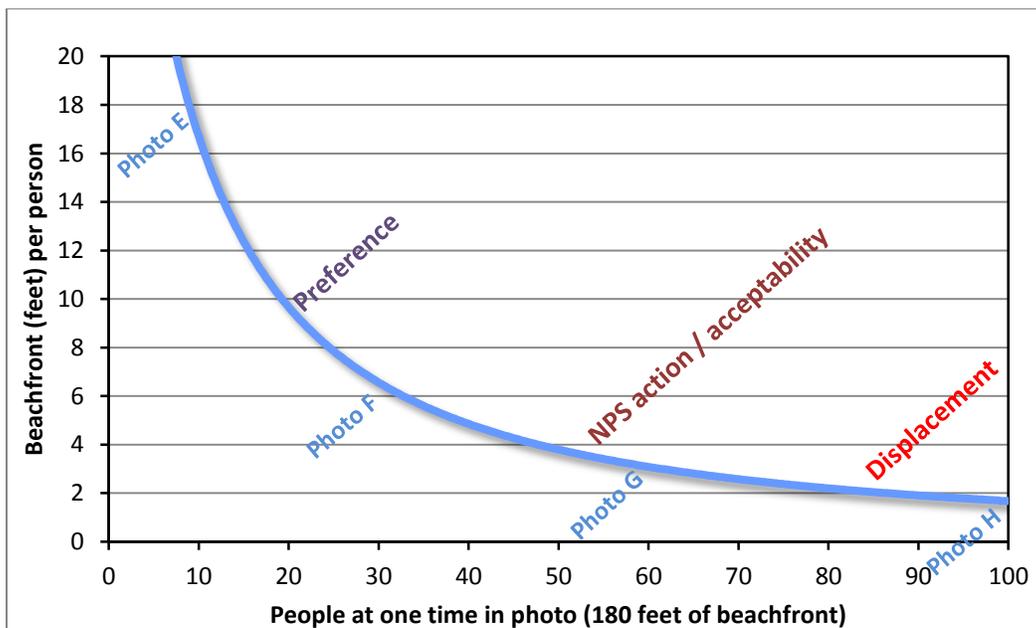


Figure 31. Relationship between people per photo and beachfront per person with preference, NPS action/acceptability, and displacement evaluations.



Comparing 2011 shore use to evaluations

The NPS descriptive component of this study provides additional information about shore use. We have summarized key findings to compare with boating density evaluations presented above, focusing on variation across the season or time of day and differences between specific beaches.

Seasonal variation

Figure 32 shows daily use patterns through the season based on averaging counts from eight high use beaches (one from each location) during afternoons. Results illustrate several important characteristics of use.

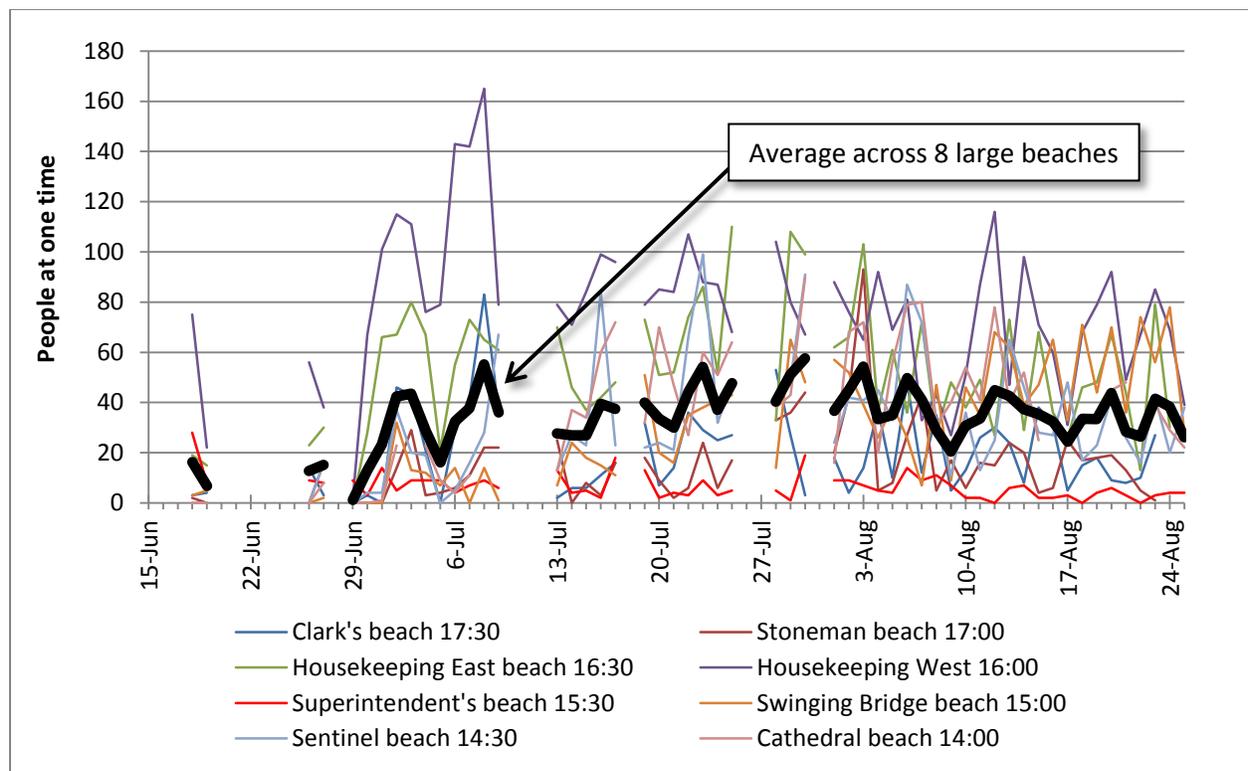


Figure 32. Seasonal shore use patterns – Example total use at key locations from afternoon systematic counts (time of count shown for each location).

- Shore use was affected by early summer high flows, with lower use evident in June. Several beaches were mostly underwater during this period (e.g., Swinging Bridge, Sentinel Beach, and Cathedral Beach) and others were considerably smaller. High water was also colder and more turbid.
- The highest use peaks in Figure 31 were on weekends before and after the Fourth of July (which was on a Monday in 2011).
- There is considerable variation in use of individual beaches, with same-time counts changing substantially from day to day. When total use on a beach is small (e.g., 5 to 10), it takes only one



large group (e.g., a family reunion) to multiply use by three or four. However, even higher use beaches such as Housekeeping East had afternoon counts that tripled over a three day period (from 33 to 108 and 109 on Thursday-Saturday, July 21-23, even though all three days had similar weather). At the main Stoneman Bridge beach (river right), counts at 5 pm varied from 10 to 93.

- Despite considerable variation, individual beaches rarely have counts over 100, and most of these occur at Housekeeping East and West. These are close to overnight accommodations at Curry, Housekeeping, and the campgrounds, as well as the main day use parking lot at Camp 6.
- The average from systematic counts across all eight beaches was 34 people with a typical range (25% and 75% counts) from 27 to 42; this reflects overall use stability for large beaches taken together. Given that over 15,000 people cycle through Yosemite Valley during a typical peak season day, only a small proportion use these eight popular beaches *at one time*, even during the higher use part of the day (eight beaches x 42 per beach = 336 people or about 2%).
- The average afternoon counts across these eight beaches was correlated but relatively weak ($r = 0.28$ with vehicles arriving in East Valley). Day use is less likely to affect beach visitation because a majority of river users are associated with In-Valley overnight visitation (which is stable throughout the summer season, because most campgrounds and hotels are full). Additional discussion of this issue is provided below.
- Average shore use on these eight beaches is slightly higher on Fridays and Saturdays (39 and 42 people, respectively) compared to other days (28 to 31 people), but this difference is smaller than in Valley traffic counts.

Within-a-day variation

Shore use varies more substantially within a day than across a week or season. Examples are provided from “full day counts” at Housekeeping East and West. At Housekeeping West (Figure 33) counts show that use is low before noon, but builds through the afternoon to a peak between 3:30 and 5 pm. Use dropped substantially by 5:30 pm, and peak use lasted less than an hour. This pattern fits with the rise in temperatures through a day and offshore users’ activities (e.g., swimming and relaxing).

At Housekeeping East (Figure 34), use also builds after noon, but the peak occurs by 2:30 pm and remains relatively high until 5 pm. “Secondary” shore use areas (the small beach next to the bridge, the beach farther upstream, and the riprap shore area adjacent to Housekeeping units) generally do not show high use or substantial peaks in mid-afternoon (although the footbridge itself sees more activity from 3:30 to 4:30).

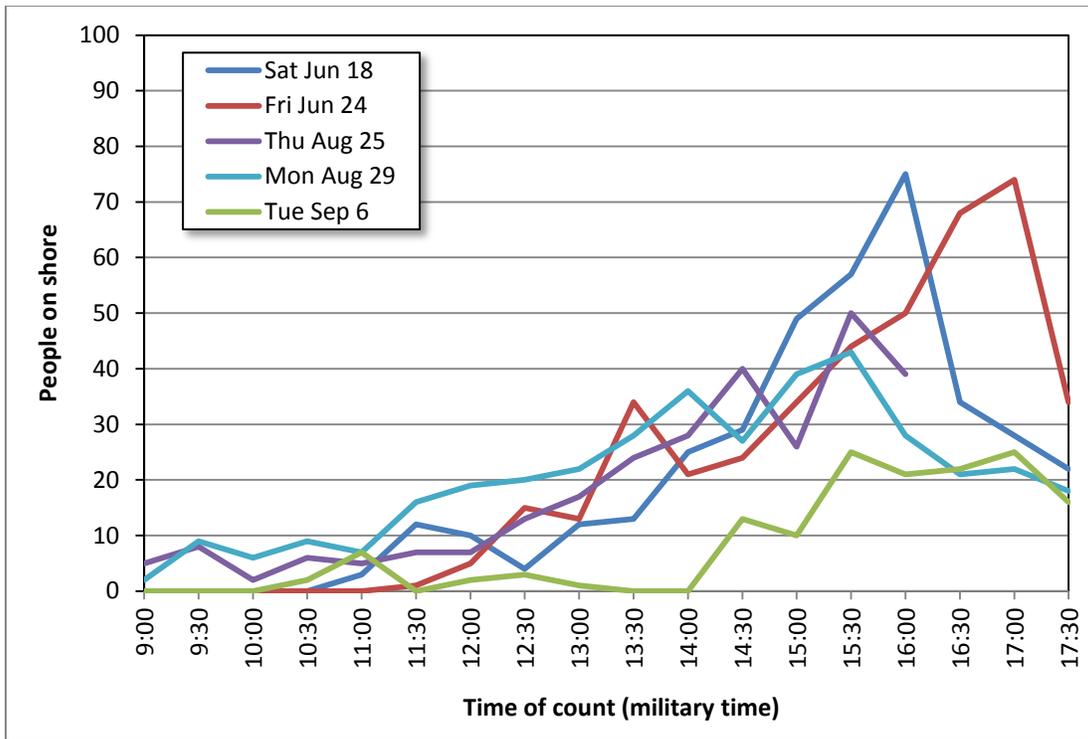


Figure 33. Example “full day” counts at Housekeeping West Beach.

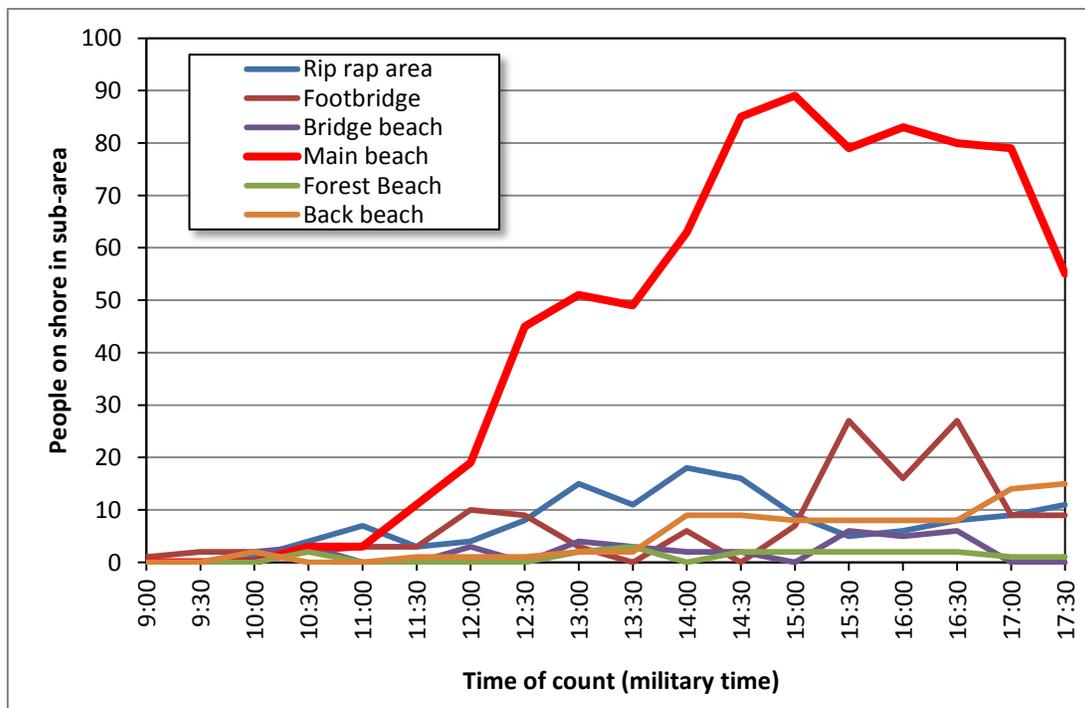


Figure 34. Example “full day” count at Housekeeping East area (Sunday, July 3).



Locational variation

Other use data helps illustrate differences between use levels at different beaches or shore use areas. Figure 35 shows the average and typical range (25% to 75% counts) for afternoons (higher use times) at several locations. These systematic counts occurred from mid-June through the end of August.

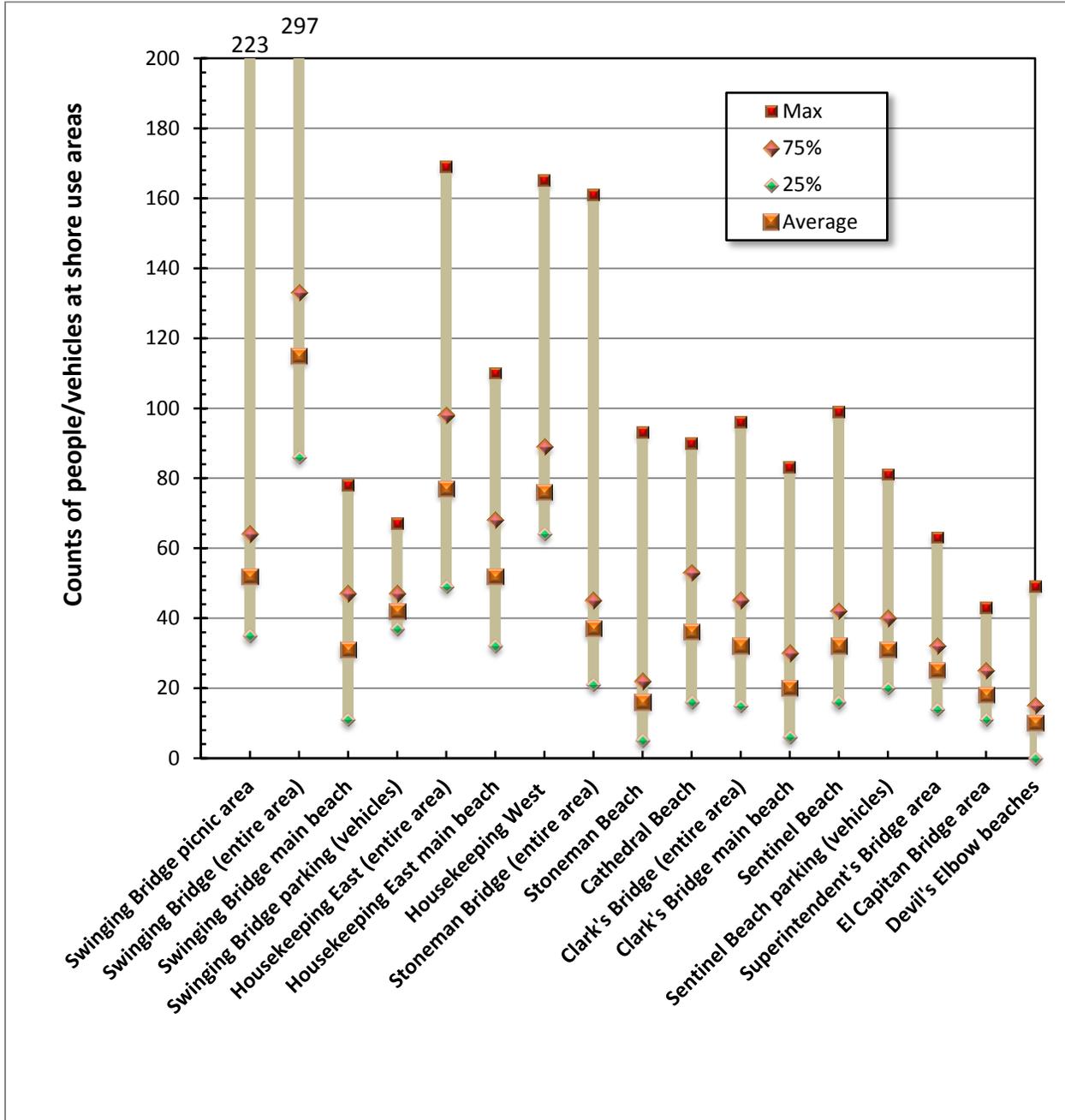


Figure 35. Afternoon systematic counts various locations and sub areas (entire season).



Results for different locations suggest several findings:

- Peak counts (maximums) for most locations are at least twice of average counts, showing variability similar to the eight large beaches discussed earlier.
- With the exception of the entire Swinging Bridge area (which includes the upland picnic area), average counts were always less than 80 people at one time, and 75% counts were less than 100.
- Swinging Bridge, Housekeeping East, and Housekeeping West have higher maximum counts than other locations, but some sub-areas in those locations have lower use (e.g., Swinging Bridge's main beach) or more space for users to spread-out (e.g., Housekeeping West). This makes density the more relevant variable (see separate analysis below of people per linear foot of beachfront).
- A few of the lower use areas (e.g., Superintendent's Bridge, El Capitan Bridge, Devil's Elbow) offer lower density experiences, with average and 75% counts between 10 and 30 people at one time.
- Counts for parking areas adjacent to Swinging Bridge and Sentinel Beach can be compared to their estimated facility capacities.
 - At Swinging Bridge, NPS has marked spaces on pavement for 39 vehicles, but the site is so heavily used that it averages 42, the 75% count was 47, and the maximum was 67 – reflecting regular parking in striped “no parking” areas or on adjacent road shoulders.
 - At Sentinel Beach, with an unpaved surface and no curbing, NPS estimates space for 30 vehicles. But the site averages 32, the 75% count was 40, and the maximum was 81, indicating that parking often expands beyond “authorized” areas.
- The counts for Swinging Bridge picnic area can be compared with estimated facility capacity. NPS estimates 26 picnic tables at the site, with each table designed for approximately 8 people (a total of 208 people, if each table was filled). While the maximum count of 223 is higher than that estimate, the 75% count of 64 and the average of 52 at one time were far lower. However, the area's social capacity is probably reached when individual groups occupy each table, causing additional arrivals to spill into adjacent areas such as the riprap along the shore, the bridge, or the beaches across the river (places some picnickers use in any case). It is difficult to consider the beaches, other shore areas, picnic area, or the area's trail system in isolation because the juxtaposition of these attractions is partly responsible for congestion at the site.



Specific beach “densities”

Counts at the higher use beaches in relation to their size help “standardize” use information and allow comparisons to visitor evaluations presented earlier in this chapter. While a beach’s surface area is one choice, it varies substantially at different flows and can be challenging to calculate. A useful density measure is based on beachfront per person in linear feet; this is less likely to change dramatically at different flows (with some notable exceptions), and is simple to estimate with measurements from aerial photos on Google Earth (Appendix F provides additional details about beach size). Observations show that most visitors array themselves along the shore or where shade is abundant and the middle of many beaches is rarely used.

Figure 36 shows how beachfront per person (a density measure) changes for specific beaches and how those counts compare to potential standards (preference, NPS action/acceptability, or displacement; from Table 10 and Figure 30).

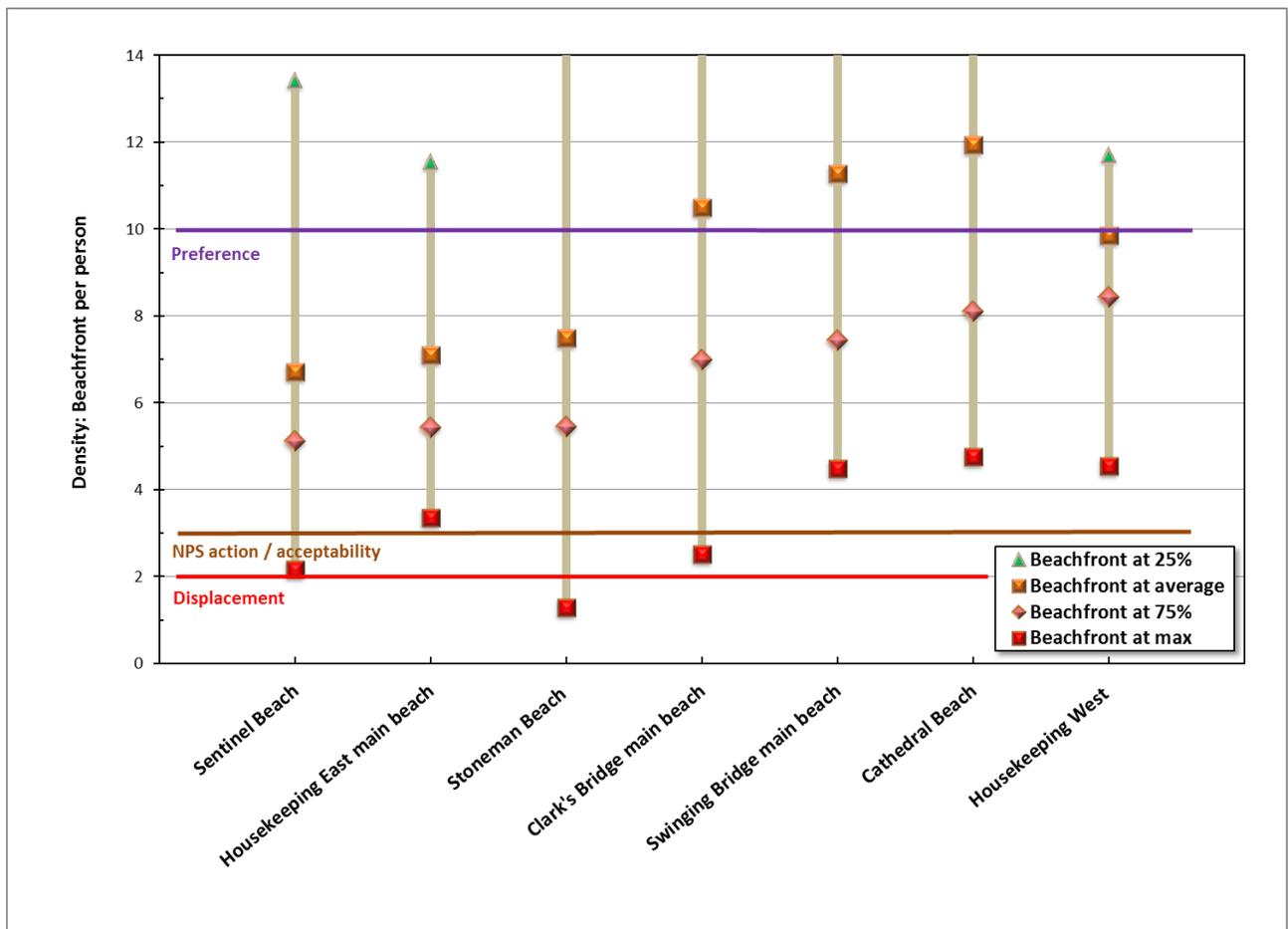


Figure 36. Beachfront per person at average, maximum, and typical range count levels at high use beaches compared with potential evaluation standards (preference, acceptability/NPS action, and displacement).



- Maximum counts at three beaches approach or exceed “displacement” evaluations of 2 feet of beachfront per person (the density depicted in Photo H, with 100 people in view), but the 75% counts were always lower. The majority of afternoon counts show densities better than this displacement evaluation at all but the highest density beach (downstream on river right at Stoneman Bridge).
- With the exception of Stoneman Bridge beach, 75% counts produce densities better than 5 feet per person, substantially better than the “NPS action/acceptability” evaluation of about 3 feet per person (the density depicted in Photo G, with 60 people in view). Average counts provide better than 6 feet per person (the density depicted in Photo F, with 30 people in view). Average counts at Housekeeping West, Cathedral Beach, Swinging Bridge beach, and Clark’s Bridge beach are near to or lower density than preference evaluations of about 10 feet per person, a little higher than the conditions depicted in lowest-density photo E, with 10 people in view.
- Densities at the 25% counts in afternoons were always better than preference evaluations, and before noon even peak levels on popular beaches are usually better than preferences. Visitors who seek lower densities can reliably find those conditions in the mornings, even on the most popular beaches.
- Distinctly higher density conditions occur at the small beach adjacent to Stoneman Bridge (river right, downstream). About 120 feet long at medium water levels, this is the first sand beach accessible from roads or multiuse trails leading from the campgrounds and Curry Village. A full day count on Sunday August 7 captured one of these high use periods (with counts between 60 and 80 at 3:30 and 4:30, densities about 1.5 feet of beachfront per person). The high use period lasted under an hour, and counts before and after were in the low 40s, about 3 feet of beachfront per person. In addition, other shore use areas are close by (e.g., the “forest beach” upstream of Housekeeping East is just 200 yards, and the main Housekeeping East Beach is 350 yards). Of the 290 counts made at Stoneman Bridge, only 9 (3%) were higher-density than the NPS action/acceptability evaluation.
- A few parallel counts that showed higher densities than the NPS action/acceptability evaluation at Sentinel Beach. These were on a Saturday and Sunday in late July about 2:30 pm, and may have been related to shuttle problems due to road congestion (rafters using the beach while waiting for the shuttle).

Taking all the systematic, parallel, and full counts together, the highest beach counts at one time did not exceed NPS action/acceptability densities except on rare occasions at Stoneman Bridge and Sentinel. These counts indicate few 2011 visitors experienced use levels depicted in the highest use photo (Photo H – 100 people in view), and those that did had alternative beaches with much lower densities a few hundred yards away. This is consistent with respondent’s survey responses (only 3% reported they saw use levels at or higher than Photo H).

The most frequently reported “highest use level” was depicted in Photo F (30 people in view, 6 feet of beachfront per person). This is a higher density than the average seen at all beaches, about mid-way between visitors’ preferences and their NPS action/acceptability evaluations. At current use levels, shore use densities do not approach unacceptable levels for most visitors.



Support/opposition for shore use management actions

Respondents were asked to evaluate of management actions that might be used to address shore use crowding or impacts. Support/opposition (from a 5-point scale) is shown in Figure 37; percentages do not add to 100 because a “neutral” response was also available. Management actions are listed below.

- Develop trails to less-used beaches to spread out use.
- Create maps that show people how to reach less-used beaches to spread out use.
- Reduce parking in areas close to the river to discourage concentrations of use.
- Limit the number of day users in Yosemite Valley (overnight use is already limited by the number of hotel rooms and campsites).
- Limit the number of private vehicles in Yosemite Valley at one time.
- Reduce the number of campsites in Yosemite Valley.
- Reduce the amount of lodging in Yosemite Valley.

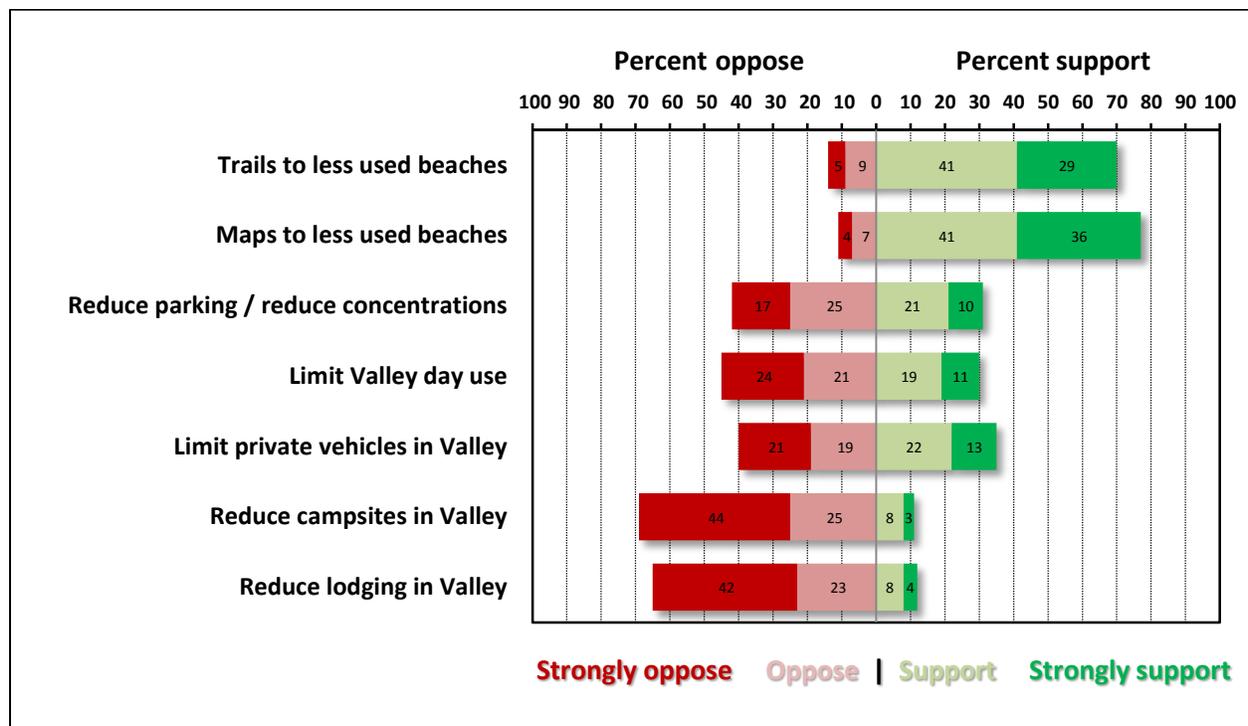


Figure 37. Percent of all respondents who support/oppose potential shore use management actions.



Merced River in Yosemite Valley • Visitor evaluations of recreation

- Most favored actions are designed to spread out shore use. Over three quarters (77%) support maps showing how to get to other shore use areas, and 70% support developing trails to those areas. These actions may help visitors find the conditions they prefer.
- There was more opposition than support for all three “day use” management actions. About 40% oppose reducing parking near the river, limiting Valley day use, and limiting private vehicles in the Valley, versus about 30% support. Given that most respondents did not experience substantial crowding on the river (particularly in comparison to crowding on roads, shuttles, or while parking), it is not surprising to find opposition to changes in access to the Valley.
- There was strong opposition to reducing campsites or lodging in the Valley to address river crowding. This is consistent with density-evaluation comparisons showing good conditions and the majority of river users staying overnight In-Valley.



Other shore use management considerations

Shore use rarely exceeds median acceptable or NPS action standards, indicating that few Yosemite visitors feel that current shore use is “too high.” Although very high densities occur from time to time, most beaches have more moderate densities that current users appear accustomed to (acceptability evaluations were typically not higher than the highest use visitors report seeing).

Existing limits on overnight use and transportation limitations for the Valley overall are probably responsible for this situation. Overnight use in recent years has been stable or declining (due to increased knowledge about rockfall hazards), while many day users are focused on non-river attractions (e.g., the falls) and might be constrained by traffic congestion and a lack of parking near river sites on high use days. Adding campgrounds or parking within easy walking distance of the higher density beaches (e.g., near the old Rivers campgrounds) could increase use at shore areas at some times.

If higher use in some shore areas occurs more frequently, managers could respond by encouraging some visitors to use other low or moderate use beaches (which are often nearby). These options were strongly supported in the study, and they may be successful if integrated with trail and shuttle system access improvements (e.g., a coordinated set of maps, on-site kiosks, and longitudinal trail systems following the Merced). A few beaches have become higher use because they are centrally located and more visible from the road or accommodation centers. By encouraging a proportion of those users to find other beaches, managers can help better match visitor expectations with experiences.



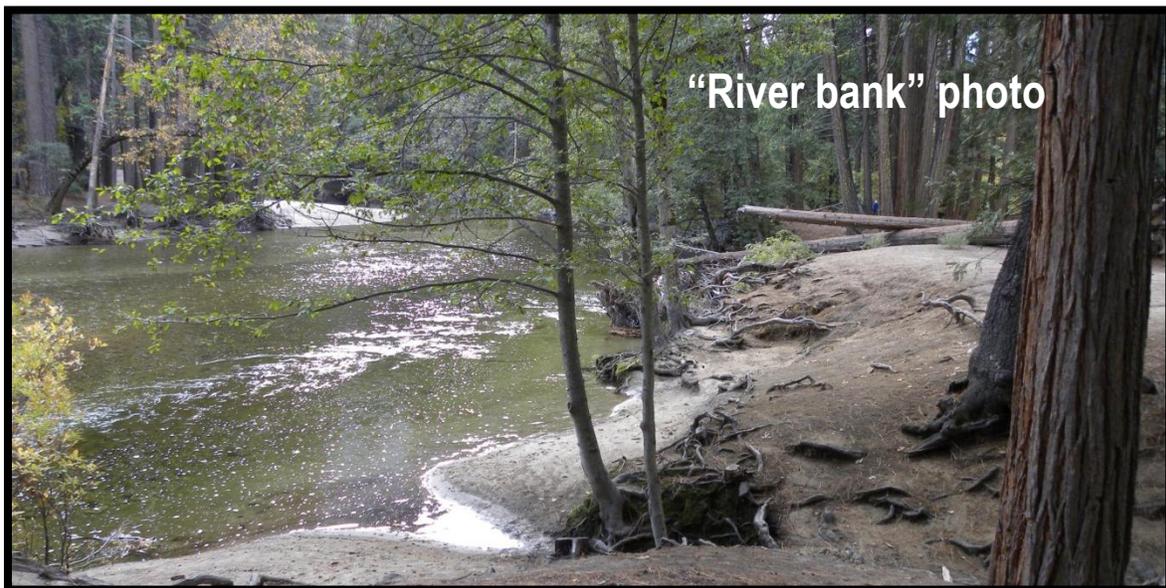
VII. Findings: Other Management Actions to Reduce Impacts

This chapter reviews questions about riparian conditions, educational programs, and other management actions (e.g., boardwalks and split rail fencing to keep users from sensitive areas) that might be used to address them.

Acceptability of riverbank conditions

Respondents were shown a photo of an impacted river bank along the Merced River, then asked to evaluate conditions on a 9-point acceptability scale. The question was designed to be “value-free” and did not call out the presence of impacts; the photo and question are given below:

The “river bank” photo shows an area used by park visitors along the Merced. National Park Service scientists evaluate river banks from an ecological perspective, but we are interested in how visitors perceive them. Please rate the acceptability of this river bank from your perspective.



Results are given in Figure 38. Most biologists would recognize several impacts in this photo (e.g., compacted soils, lack of understory vegetation, exposed tree roots, which increase susceptibility to erosion at higher flows). However, only 11% of river users reported them unacceptable and 76% rate them acceptable. Observations suggest river users may be attracted to places like this, which have “recreation habitat” features such as a convenient location, sand beach, good places to sit, views of the river, and shade.

Without judging the extent of the ecological impacts depicted in the photos (or visitor’s responses to them), results illustrate challenges for NPS. In order to reduce riparian condition impacts, the Park needs to make the public aware of the problems and develop workable solutions. Additional questions in the survey measured visitor support for a “technical fix” using boardwalks and fencing to direct visitors away from sensitive areas, or for education and regulation-based approaches to achieve the same ends.

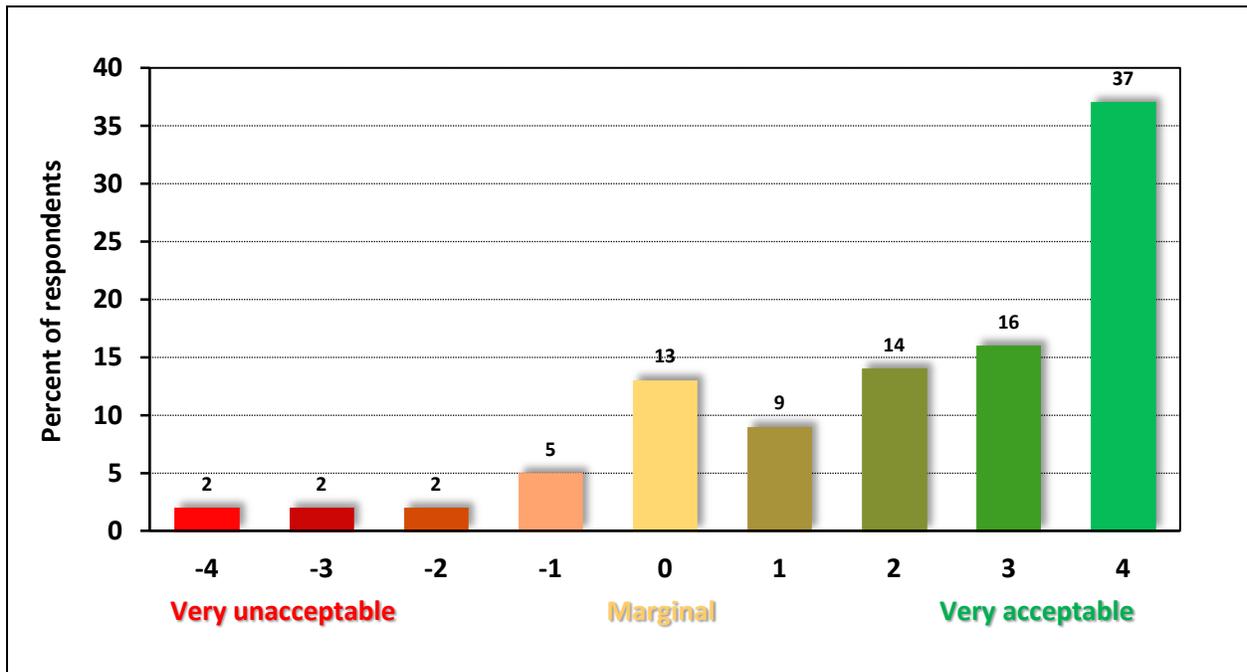


Figure 38. Percent of respondents rating the acceptability of riverbank conditions in a photo.



Evaluating boardwalks and fencing

Respondents were shown example photos of “split rail fencing” and “boardwalk and stairs,” actions that could be used to reduce bank and meadow trampling. Follow-up questions described reasons for these actions and possible consequences, and then asked visitors to rate the acceptability on a 9-point scale. The photos and question are given below.



To reduce bank and meadow trampling along the river, the Park Service could close sensitive areas (see “split rail fencing” photo) and direct people toward areas that can withstand use (see “boardwalk and stairs” photo). However, these actions may decrease “naturalness,” prevent access to some areas, or lead to congestion in other areas. Please rate the acceptability of the following actions.

- **Longer split rail fences** (over 200 feet) to protect **large areas** from trampling, with short openings for river access.
- **Shorter split rail fences** (under 50 feet) to restore **small sites** with heavy trampling.
- **Occasional boardwalks and stairs** through meadows and sensitive areas to provide access to areas like beaches.
- Trail networks with **many boardwalks & stairs** directing use to less sensitive areas and discouraging off-trail use.

Figure 39 shows 53-72% acceptability ratings for the four fencing and boardwalk options, and even the lowest rated option (trail networks with many boardwalks and stairs) was unacceptable for only 27%. However, the two lower development options (“short split rail fencing” and “occasional boardwalks and stairs”) were more acceptable (72% and 66%, respectively).

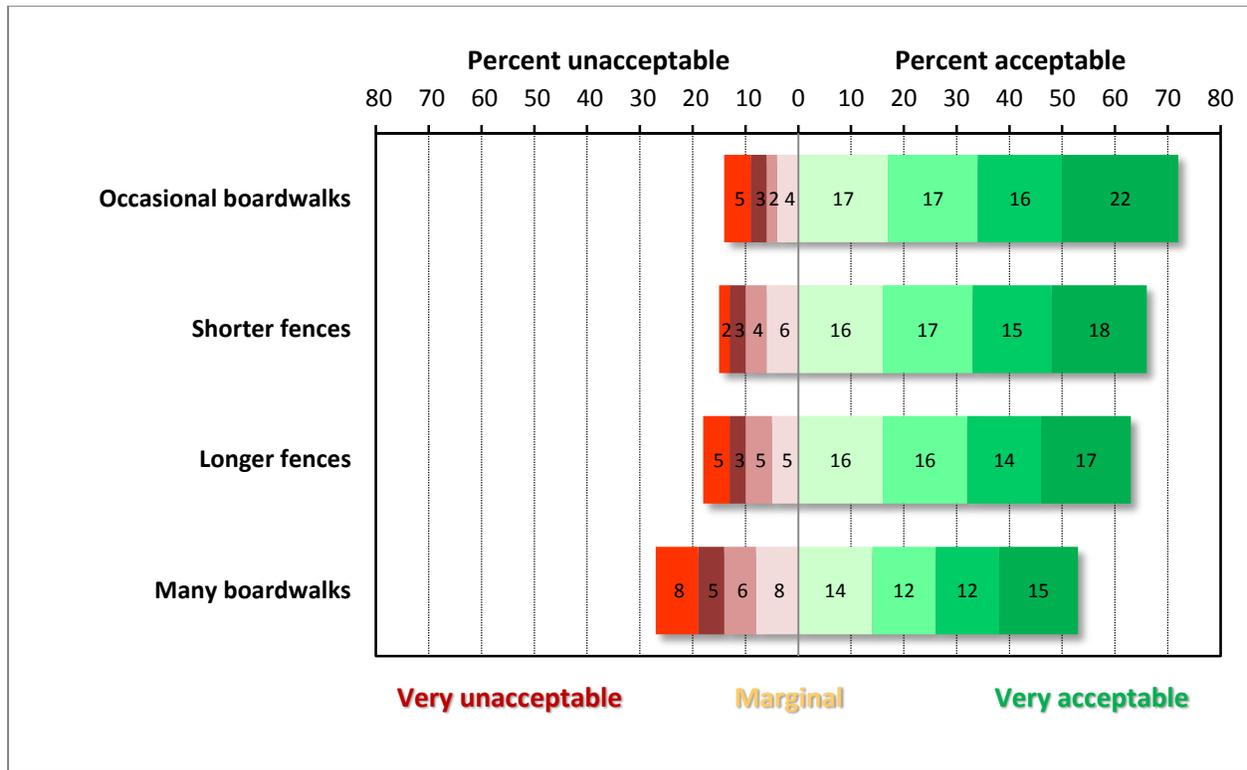


Figure 39. Percent of respondents reporting the acceptability of different levels of fencing and boardwalks.



Evaluating education and regulation to address river bank impacts

Respondents were asked to evaluate general education and regulation solutions to addressing river bank impacts on a five point support-oppose scale. The three approaches were described as:

- Education efforts that teach visitors to avoid sensitive areas.
- Close user-created trails that lead into sensitive areas.
- Prohibit off-trail or off-beach use in sensitive areas.

Figure 40 shows widespread support for such actions to protect ecological or aesthetic values along the river. There was 81% support for education, 73% support for closing user-created trails, and 62% support for prohibiting off-trail/off-beach use in sensitive areas.

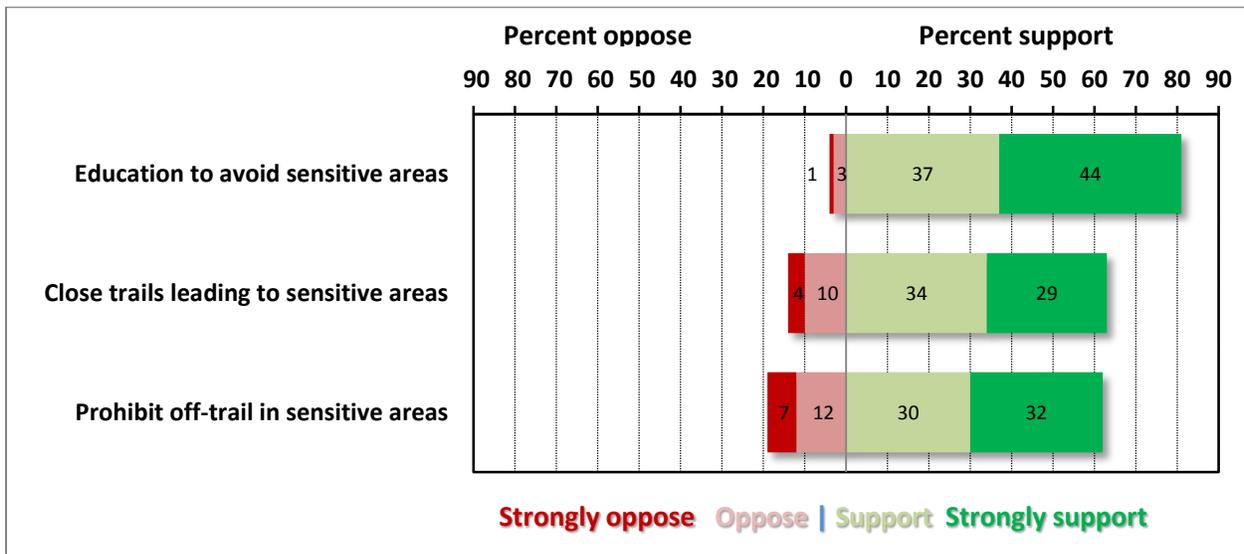


Figure 40. Support/opposition for education and regulation approaches to addressing river bank conditions.

Other management considerations regarding bank use impacts

Data from the study suggest river users do not commonly recognize riparian impacts and may not avoid using good recreation habitat next to rivers, where these impacts can occur. The main way to manage these impacts will be through education and cueing people via trails, boardwalks, and split-rail fences to avoid sensitive areas. If the NPS doesn't provide access to places where people want to go, there may be substantial enforcement challenges keeping them out of good "recreation habitat." However, there was strong support for these infrastructure cues, especially if minimized or used judiciously.

A final issue focuses on how users disperse themselves around beaches and the tendency to spend time under and on the roots of trees. This is another "recreation habitat" problem – it is the best place to be when the sun is hot – but could have impacts on ecological resources (not a focus of this study). Fencing and regulations/enforcement might reduce some of this use, but it would likely require a substantial operations effort.



VIII. Findings: Open Ended Comments

Respondents were invited to provide additional written comments about “ways the Park Service can improve the river and river experiences,” with prompts given for “parking issues,” “traffic / transportation issues,” “boating issues,” and “shore use issues.”

Open-ended comments can be misleading because a self-selected group provides them, the prompts are vague, and there are no uniform response categories. That said, comments can be interesting, and a simple analysis is provided below (Table 12), with tallies of frequent typical responses given.

In total, 298 (37%) out of 806 respondents provided open-ended comment. Of those who provided comments, 61% said something about traffic and transportation, 56% about parking, 25% about boating, and 22% about shore use (percentages do not add to 100 because respondents could answer in more than one category). NPS has been provided the verbatim comments in a separate file.



Table 12. Summary of comments by broad topic area.

	Number of comments	Percent of entire sample (n=806)	Percent of those who provided comments (n=298)
Traffic and transportation			
All comments	183	23	61
General complaints/descriptions of poor transportation		5	12
Shuttle system suggestions/ complaints		4	10
No transportation problems or positive description		3	7
Limit use as a solution to transportation problems		3	6
Specific suggestions/complaints about traffic management		3	6
Expand transportation system		1	3
Parking			
All comments	166	21	56
Expand parking as a solution to parking scarcity		4	12
Limit vehicles/use as a solution to parking scarcity		3	8
Complaint or description of poor parking availability		3	7
No parking problems (mix of different reasons)		2	5
Boating issues			
All comments	74	9	25
Few boating problems or a positive description of boating		3	7
Reduce or eliminate boating (or some type of boating)		2	4
Safety / boating management / enforcement		<1	1
Shore use issues			
All comments	65	8	22
Few shore use problems or positive description		3	7
Litter or maintenance complaint		1	3
Crowding or high use complaint		1	3
Other issues	128	16	42



IX. Conclusion

This study provides information about Merced River visitors, their trips, and their evaluations of crowding, boating use levels, shore use levels, riparian conditions, and related management options. Results provide information for future planning, management, and monitoring.

Data from this survey suggests there are diverse recreation opportunities available in the Merced River corridor. Different segments and types of use provide opportunities for different experiences and users may recognize and take advantage of them. Different use densities, types of users, and levels of impacts are associated with each of these opportunities, and visitors have developed tolerance levels that fit with those impact levels. Managing agencies can recognize this diversity through proactive management, which means identifying (1) a range of opportunities to be provided; (2) defining “high quality” opportunities in terms of specific desired conditions; and (3) choosing appropriate management actions to ensure those conditions are provided.



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Appendices

[Provided in separate file]

A. Survey instrument

B. Other methods information

Survey log

Sampling schedule

Survey locations and observation count polygons

Additional methods tables

Additional use information during the study

C. Additional visitor characteristics results

D. Additional perceived crowding results

E. Additional boating results

F. Additional shore use results

Boats, Beaches, and River Banks: Visitor evaluations of recreation on the Merced River in Yosemite Valley



Appendices for Final Study Report

Contract number P2030100050 • OMB Control Number: 1024-0224

Doug Whittaker, Ph.D. and Bo Shelby, Ph.D.
Confluence Research and Consulting • July 2012

Appendices

This document provides additional information about the 2011 River Use Study on the Merced River through Yosemite Valley. It is available as a separate electronic file, but continues page numbers from the main report (starting at page 75). Appendices are listed below.

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Appendix A: Survey Instrument

OMB# 1024-0224 Expiration 7/31/2011

ID #: _____ **River Use Study • Merced River through Yosemite Valley • Yosemite National Park**

1. Where do you live? (Circle one letter) A. United States (Specify zip code) _____ B. Other country: _____
2. During this visit to Yosemite National Park, where are you staying overnight? (Check any that apply below or here if you will travel to/from home today).
 Yosemite Lodge Curry Village Housekeeping Ahwahnee Campground in Yosemite Valley Other campground: _____
 El Portal Mariposa Yosemite West Wawona Oakhurst Fresno Foresta Groveland Other: _____
3. How many **years** have you been visiting **Yosemite National Park**? (if this is your first visit, write "1")

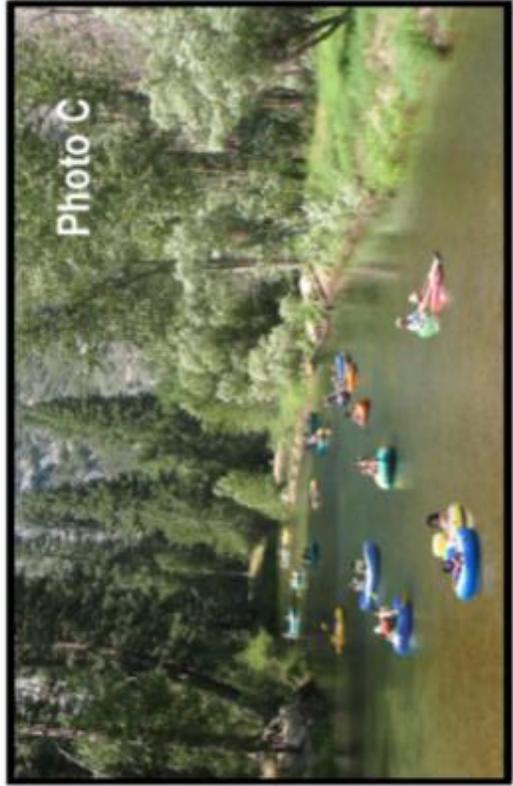
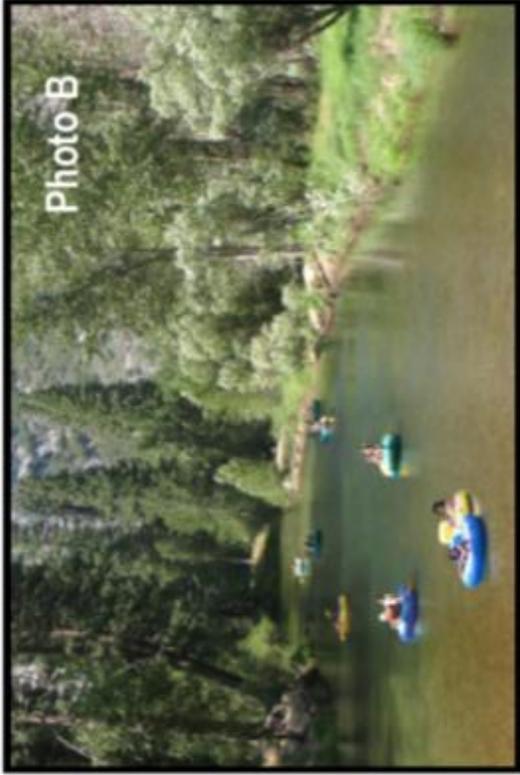
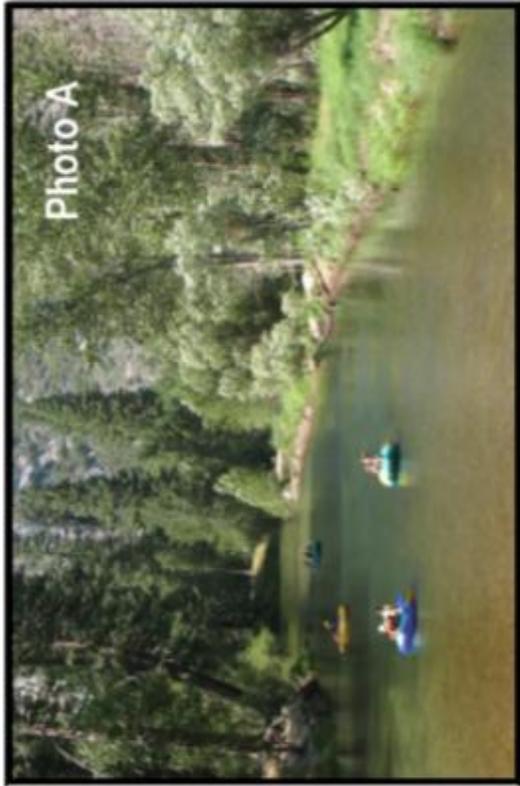
	year(s)
	day(s)
	hours
	hours
4. How many **days** will you spend in **Yosemite National Park** during this visit?
5. How many **hours** will you spend in **Yosemite Valley** today? (Please list partial hours as ¼, ½, or ¾)
6. How many **hours** will you spend **on or along the river** today? (Please list partial hours as ¼, ½, or ¾)
7. How did you travel to the river today? (Check all that apply) Walk Bicycle Shuttle bus Tour bus Private vehicle Motorcycle Other _____
8. Please check the boxes of **all activities** you have done on or along the Merced River in Yosemite Valley ...
 ...on this trip (including today): Swimming Boating Relaxing Picnicking Fishing Hiking Biking Other: _____
 ...on any previous trip: Swimming Boating Relaxing Picnicking Fishing Hiking Biking Other: _____

9. How many riverside locations have you visited today? (Circle one.) 1. This location only 2. Two to three others 3. Four or more locations

10. How crowded did you feel **today**? (Circle one number for each activity/location. If you did not do an activity today, check the box in that row)

	I did not do this today	Not at all crowded	Slightly crowded	Moderately crowded	Extremely crowded				
Boating on the river	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Swimming or wading in the river	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Relaxing or picnicking along the river	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Walking / hiking / biking on trails	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Driving roads in Yosemite Valley	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Finding parking in Yosemite Valley	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Riding or waiting for shuttle buses	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9
Overall (entire day)	<input type="checkbox"/> 1	2	3	4	5	6	7	8	9

Evaluating boating use levels



Evaluating boating use levels

11. The four photos above show different boating use levels on the Merced River. For the segments of the river you visited today, please rate the acceptability of the use levels shown.

Photo	Very unacceptable	Marginal				Very acceptable			
A	-4	-3	-2	-1	0	+1	+2	+3	+4
B	-4	-3	-2	-1	0	+1	+2	+3	+4
C	-4	-3	-2	-1	0	+1	+2	+3	+4
D	-4	-3	-2	-1	0	+1	+2	+3	+4

12. For the segments of the river you visited today, please indicate which photo shows... (For each row, circle one letter OR check a box)

...the level of boating use you prefer to see.	A	B	C	D	<input type="checkbox"/> Lower than A	<input type="checkbox"/> I don't have a preference.
...the highest boating use level the Park Service should allow.	A	B	C	D	<input type="checkbox"/> Higher than D	<input type="checkbox"/> Numbers should not be restricted.
...the highest boating use level that would cause you to no longer visit.	A	B	C	D	<input type="checkbox"/> Higher than D	<input type="checkbox"/> Use level doesn't matter to me.
...the highest number of boats you saw today.	A	B	C	D	<input type="checkbox"/> Lower than A	<input type="checkbox"/> Higher than D <input type="checkbox"/> I don't know

13. The National Park Service currently allows boating on 2 1/2 miles (out of 7) of the Merced River through Yosemite Valley. The number of rental rafts is limited (100 on the river at one time), but private boats are unlimited. Please tell us if you support or oppose the following actions.

	Strongly oppose	Oppose	Neutral	Support	Strongly support
Require boaters to wear life jackets (PFDs)	-2	-1	0	+1	+2
Reduce raft rentals by 25% (no more than 75 at one time)	-2	-1	0	+1	+2
Reduce raft rentals by 50% (no more than 50 at one time)	-2	-1	0	+1	+2
Eliminate raft rentals in Yosemite Valley	-2	-1	0	+1	+2
Limit the number of private boats per day through a permit system	-2	-1	0	+1	+2
Eliminate all boating in Yosemite Valley	-2	-1	0	+1	+2
Allow unlimited short-distance boating along the Pines campgrounds (this is currently closed to boating)	-2	-1	0	+1	+2
Allow boating on other currently closed segments, but keep use low through a permit system	-2	-1	0	+1	+2

Evaluating shore use levels



Evaluating shore use levels

14. The four photos above show different shore use levels on the Merced River. For **beaches you visited today**, please rate the acceptability of use levels shown:

Photo	Very unacceptable	Marginal	Very acceptable						
E	-4	-3	-2	-1	0	+1	+2	+3	+4
F	-4	-3	-2	-1	0	+1	+2	+3	+4
G	-4	-3	-2	-1	0	+1	+2	+3	+4
H	-4	-3	-2	-1	0	+1	+2	+3	+4

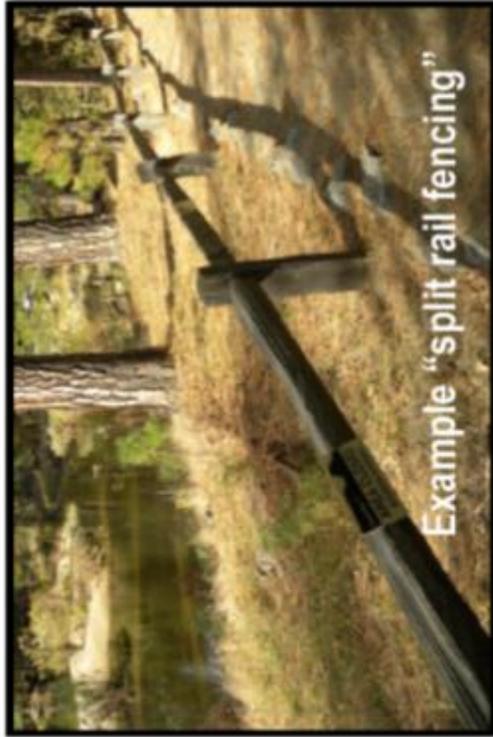
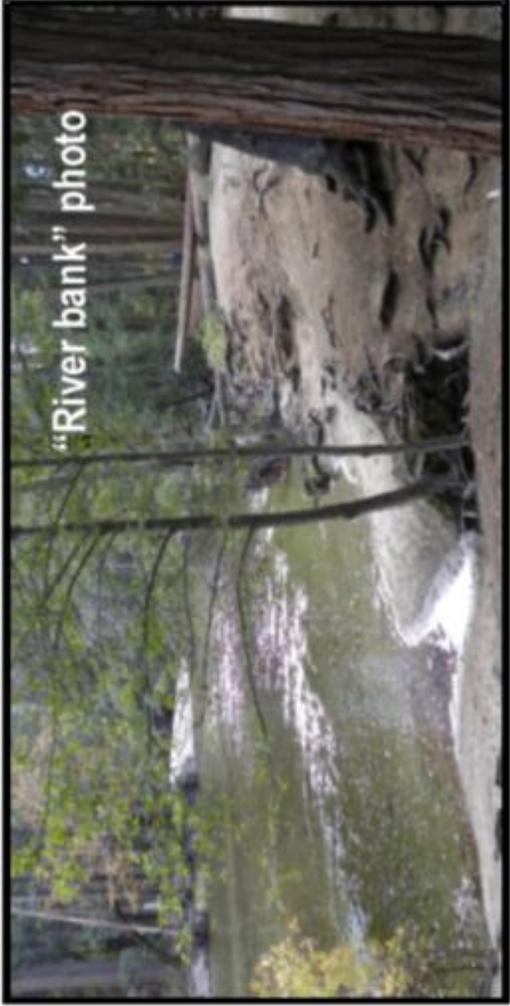
15. For the **beaches you visited today**, please indicate which photo shows... (For each row, circle one letter **OR** check a box)

Photo	Very unacceptable	Marginal	Very acceptable				
...the level of shore use you prefer to see .	E	F	G	H	<input type="checkbox"/> Lower than E	<input type="checkbox"/> I don't have a preference.	
...the highest level of shore use the Park Service should allow .	E	F	G	H	<input type="checkbox"/> Higher than H	<input type="checkbox"/> Numbers should not be restricted.	
...the highest level of use that would cause you to no longer visit .	E	F	G	H	<input type="checkbox"/> Higher than H	<input type="checkbox"/> Use level doesn't matter to me.	
...the highest number of shore users you saw today .	E	F	G	H	<input type="checkbox"/> Lower than E	<input type="checkbox"/> Higher than H	<input type="checkbox"/> I don't know

16. People have suggested other ways to manage shore use to reduce crowding or impacts. Please tell us if you support or oppose the following actions.

	Strongly oppose	Oppose	Neutral	Support	Strongly support
Develop trails to less-used beaches to spread out use.	-2	-1	0	+1	+2
Create maps that show people how to reach less-used beaches to spread out use.	-2	-1	0	+1	+2
Reduce parking in areas close to the river to discourage concentrations of use.	-2	-1	0	+1	+2
Limit the number of day users in Yosemite Valley (overnight use is already limited by the number of hotel rooms and campsites).	-2	-1	0	+1	+2
Limit the number of private vehicles in Yosemite Valley at one time.	-2	-1	0	+1	+2
Reduce the number of campsites in Yosemite Valley.	-2	-1	0	+1	+2
Reduce the amount of lodging in Yosemite Valley.	-2	-1	0	+1	+2

Management actions to reduce impacts



Management actions to reduce impacts

17. The "river bank" photo shows an area used by park visitors along the Merced. National Park Service scientists evaluate river banks from an ecological perspective, but we are interested in how visitors perceive them. Please rate the acceptability of this river bank from your perspective.

Very unacceptable	Marginal			Very acceptable				
-4	-3	-2	-1	0	+1	+2	+3	+4

18. To reduce bank and meadow trampling along the river, the Park Service could close sensitive areas (see "split rail fencing" photo) and direct people toward areas that can withstand use (see "boardwalk and stairs" photo). However, these actions may decrease "naturalness," prevent access to some areas, or lead to congestion in other areas. Please rate the acceptability of the following actions.

Very unacceptable	Marginal			Very acceptable				
-4	-3	-2	-1	0	+1	+2	+3	+4
Longer split rail fences (over 200 feet) to protect large areas from trampling, with short openings for river access.								
-4	-3	-2	-1	0	+1	+2	+3	+4
Shorter split rail fences (under 50 feet) to restore small sites with heavy trampling.								
-4	-3	-2	-1	0	+1	+2	+3	+4
Occasional boardwalks and stairs through meadows and sensitive areas to provide access to areas like beaches.								
-4	-3	-2	-1	0	+1	+2	+3	+4
Trail networks with many boardwalks & stairs directing use to less sensitive areas and discouraging off-trail use.								

19. People have suggested other ways to manage visitor impacts along the river. Please tell us if you support or oppose the following actions.

Strongly oppose	Oppose	Neutral	Support	Strongly support
-2	-1	0	+1	+2
Education efforts that teach visitors to avoid sensitive areas.				
-2	-1	0	+1	+2
Close user-created trails that lead into sensitive areas.				
-2	-1	0	+1	+2
Prohibit off-trail or off-beach use in sensitive areas.				

If you have additional comments about ways the Park Service can improve the river and river experiences, please provide them below.

Parking issues: _____

Traffic / transportation issues: _____

Boating issues: _____

Shore use issues: _____

Other issues: _____

PRIVACY ACT and PAPERWORK REDUCTION ACT STATEMENT:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Please do not put your name or that of any member of your group on the questionnaire. All data will be anonymous. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB number. OMB control number: OMB #1024-0224. Expiration Date: July 31, 2011.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 15 minutes per response. Direct comment regarding the burden estimate or any other aspect of this form to: Robert_Gordon @nps.gov.

Appendix B: Additional Methods Information

Maps of individual survey locations and descriptive component “polygons.”



Overview of Sampling Schedule

Location code →			1	2	3 & 4	5	6	7	8.6 and 9	
Length of time →			30-45	50-70	90-120	30-45	50-70	90-120	50-70	
Date	Day	Time and direction	Clark's	Stoneman	House-keeping	Footbridge	Swinging	Take-out	Cathedral, El Cap, Devil's	
12	Tu	9-17	Training							
13	We	9-17 Dn	16:15 •	9:00 →	10:00 →	11:30 →	12:15 →	13:15 →	15:15 →	
14	Th	11-19 Dn	17:15 →	18:15 •	11:00 →	12:30 →	13:15 →	14:15 →	16:15 →	
15	Fr	10-18 Dn	15:45 →	16:30 →	17:30 •	11:00 →	11:45 →	12:45 →	14:45 →	
16	Sa	11-19 Dn	10:00 →	10:45 →	11:45 →	13:15 →	14:00 →	15:00 →	17:00 •	
17	Su	9-17 Up	← 12:15	← 11:15	← 9:45	← 9:00	16:00 •	← 14:00	← 13:00	
18 and 19 • Monday and Tuesday • Days off										
20	We	11-19 Up	18:15 •	← 17:15	← 15:45	← 15:00	← 14:00	← 12:00	← 11:00	
21	Th	10-18 Up	← 14:15	← 13:15	← 11:45	← 11:00	← 10:00	16:00 •	← 15:00	
22	Fr	10-18 Up	← 13:15	← 12:15	← 10:45	← 10:00	17:00 •	← 15:00	← 14:00	
23	Sa	10-18 Up	17:15 •	← 16:15	← 14:45	← 14:00	← 13:00	← 11:00	← 10:00	
24	Su	9-17 Dn	9:00 →	9:45 →	10:45 →	12:15 →	13:00 →	14:00 →	16:00 •	
25	Mo	11-19 Up	← 13:30	← 12:30	← 11:00	18:15 •	← 17:15	← 15:15	← 14:15	
26 and 27 • Tuesday and Wednesday • Days off										
28	Th	10-18 Dn	10:00 →	10:45 →	11:45 →	13:15 →	14:00 →	15:00 →	17:00 •	
29	Fr	10-18 Dn	14:45 →	15:30 →	16:30 •	10:00 →	10:45 →	11:45 →	13:45 →	
30	Sa	10-18 Up	← 14:15	← 13:15	← 11:45	← 11:00	← 10:00	16:00 •	15:00	
31	Su	9-17 Dn	15:15 →	16:00 •	9:00 →	10:30 →	11:15 →	12:15 →	14:15 →	

Green = start location
Red = stop location

Overall Yosemite Valley Use During Study

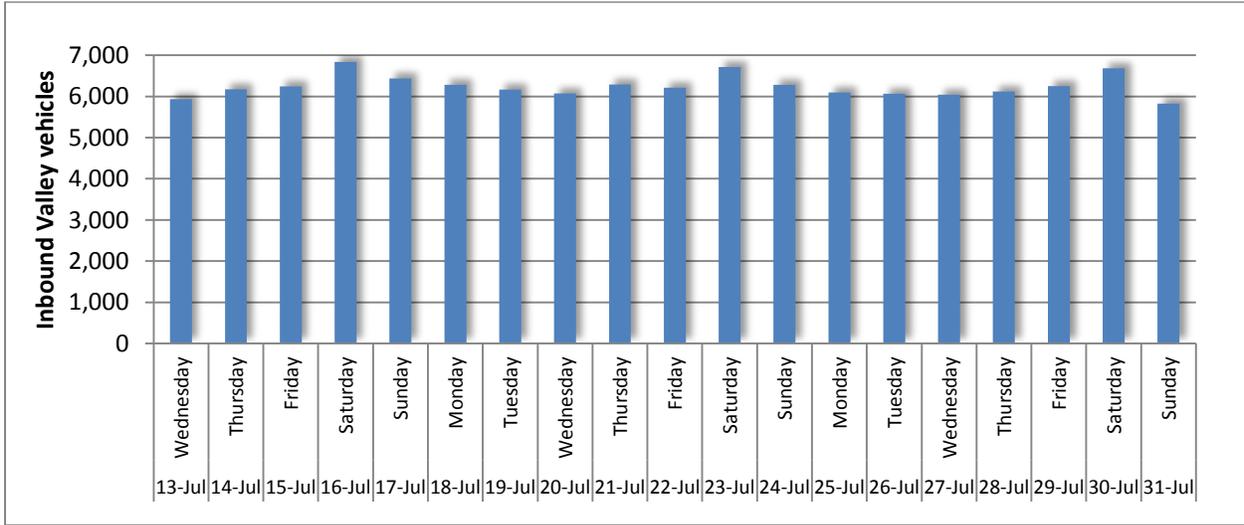


Figure 1. Inbound Valley vehicles (vehicles past the DSC counter at the Chapel) during the study period.

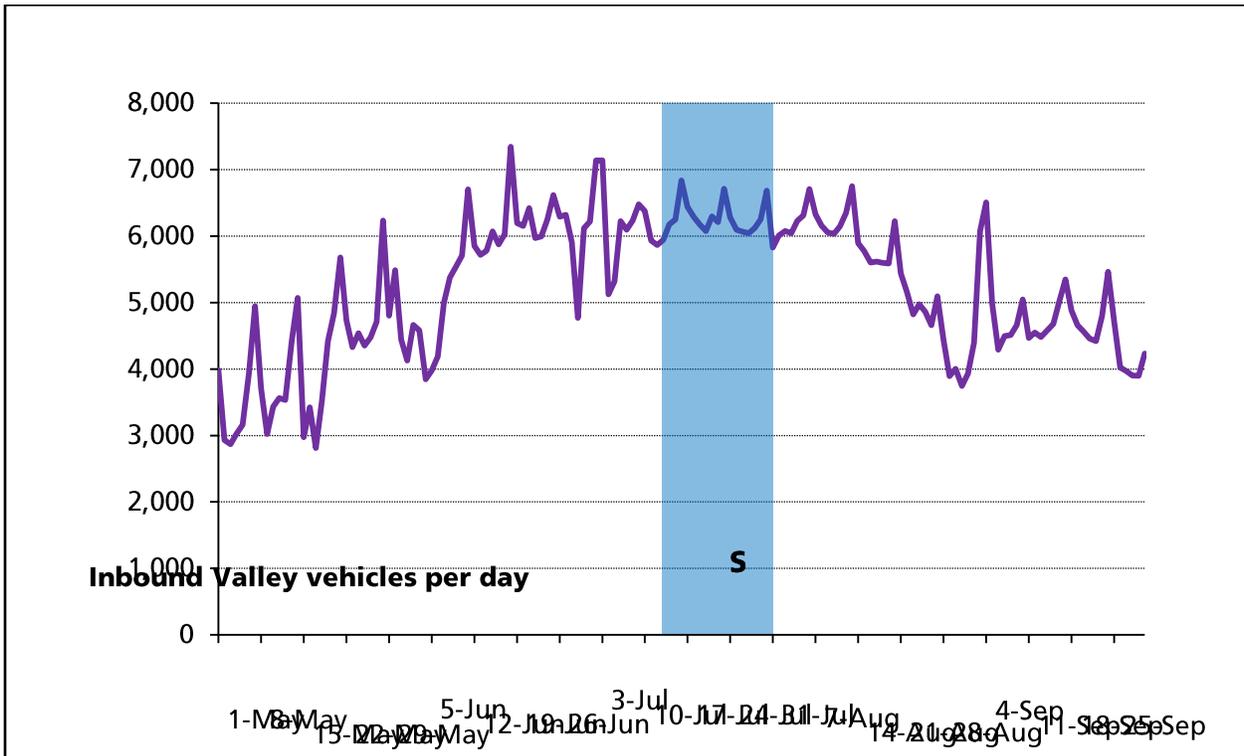


Figure 2. Inbound Valley vehicles (vehicles past the DSC counter at the Chapel) for summer 2011.

Other Methods Information

Table 1. Number and percent of on-site contacts and their disposition.

	n	%
Under 18*	1	1
Surveyed previously*	18	17
Language barrier*	20	19
In a hurry	29	27
Not interested or other reason	38	36
Opposed to study/NPS	1	1
Total who did not complete survey for any reason	107	
Removed from sample frame (*)	39	
Refused	71	
Total approached	913	
Total removed (not in sample frame)	39	
Total eligible in sample frame	874	
Total refused	68	
Total completed surveys	806	
Response rate (total eligible / total completed)	92%	

Table 2. Number and percent of contacts by day of week.

	All groups		Surveyed groups		Refused	
	n	%	n	%	n	%
Monday	68	7	66	8	2	2
Tuesday	0	0	0	0	0	0
Wednesday	106	12	92	11	14	13
Thursday	185	20	159	20	25	24
Friday	173	19	153	19	20	19
Saturday	230	25	206	26	24	23
Sunday	151	17	130	16	21	20
Total	913	100	806		107	

Table 3. Number of groups approached per day.

	n			
Highest day	102	Jul 30	Sat	
Lowest day	7	Jul 31	Sun	Rain shortened
Average day	61	7.6 per hour		
Median day	51	6.3 per hour		
25% day	45			
75% day	75			

Table 4. Number of surveys completed per day.

	n			
Highest day	91	Jul 30	Sat	
Lowest day	6	Jul 31	Sun	Rain shortened
Average day	54	6.8 per hour		
Median day	44	5.5 per hour		
25% day	40			
75% day	76			

Table 5. Number and percent of contacts/surveys by different locations.

	Location number	All groups		Surveyed groups	
		n	%	n	%
Clark's Bridge area	1	72	8	62	8
Stoneman Bridge area	2	89	10	81	10
Housekeeping East, bridge, and riprap	3	135	15	118	15
Housekeeping West	4	125	14	108	13
Superintendent's Footbridge area	5	29	3	27	3
Swinging Bridge area	6	185	20	161	20
Take-out / Sentinel Beach area	7	185	21	165	21
El Cap Bridge area (also Devil's Elbow)	8	58	6	52	7
Cathedral Beach	8.6	35	4	32	4
Total		913		806	

Table 6. Number and percent on contacts/surveys by time of day.

Time of day (military time)	All groups		Surveyed groups	
	n	%	n	%
9	20	2	17	2
10	49	5	35	4
11	112	12	94	12
12	110	12	100	12
13	107	12	93	12
14	108	12	96	12
15	120	16	104	13
16	150	16	143	18
17	97	11	86	11
18	37	4	35	4
19	2	<1	2	<1
	913		806	

Appendix C: Additional Results about User and Trip Characteristics

Table 7. Percent of groups engaging in different “primary activities.”

	All groups		Surveyed groups	
	n	%	n	%
1 Rental floating (Stoneman-Sentinel)	108	12	99	12
2 Private floating (Stoneman-Sentinel)	56	6	52	7
3 Short float (e.g, Housekeeping reach only)	2	<1	2	<1
4 Stationary water toys	0	0	0	0
5 Swimming	42	5	36	5
6 Relaxing	529	58	459	57
7 Picnicking	136	15	123	15
8 Hiking	17	2	14	2
9 Biking	4	<1	4	<1
10 Other	17	2	16	2
11 Mix	2	<1	1	<1
	913		806	

Table 8. Percent of observed groups using different craft.

	All observed groups		Surveyed groups	
	n	%	n	%
1 Rental raft	108	66	99	64
2 Private raft	51	31	51	33
3 Canoe	0	0	0	0
4 Kayak	3	2	2	1
5 IK	0	0	0	0
6 Tube	1	<1	1	1
7 Water toy	2	1	2	1
	164	100	155	100

Table 9. Percent of groups with different numbers of boats.

	Surveyed groups		All groups	
	n	%	n	%
1	76	50	84	51
2	27	18	28	17
3	19	12	20	12
4	18	12	19	11
5	5	3	6	4
6 or more	8	5	9	5
Total	153		166	
Average	2.3		2.3	
Median	2.0		1.0	
Interquartile range	1 to 3		1 to 3	

Table 10. Frequency distribution of adults and children in observed groups.

	Adults		Children	
	n	%	n	%
1	120	13	434	48
2	370	41	137	15
3	110	12	156	17
4	91	10	86	9
5	41	4	46	5
6	65	7	16	2
7	37	4	15	2
8	13	1	12	1
9	20	2	5	<1
10	9	1	6	<1
11-15	20	2	0	0
16-20	2	1	0	0
Over 20	15	2	0	0
Average	3.9		1.4	
Median	2.0		1.0	
IQ range	2 to 4		0 to 2	

Table 11. Frequency distribution of total group sizes (observed groups).

All groups			
	n	%	
1	57	6	
2	209	23	
3	117	13	
4	162	18	
5	85	9	69% are 5 or less
6	71	8	
7	49	6	
8	30	3	
9	21	2	
10	20	2	90% are 10 or less
11	26	3	
12	12	1	
13	14	1	
14-15	11	1	
16-19	11	1	
20-24	6	<1	
25 or more	12	1	
Highest	40		
Average	5.3		
Median	4.0		
IQ range	2 to 6		

Table 12. Comparing mean group characteristics among observed private and rental boaters.

All groups			
	n	average	
Number of rafts			
Average rental rafts	107	1.6	t=-5.9 p<.001, unequal var.
Average for private rafts	55	3.5	
Number of adults			
Average rental rafts	107	4.1	not significant, equal variances
Average for private rafts	55	5.2	
Number of kids			
Average rental rafts	107	1.2	not significant, unequal var.
Average for private rafts	55	1.7	
Number of people total			
Average rental rafts	108	5.2	t=-2.6 p<.012, unequal varia.
Average for private rafts	50	6.9	
Gender (percent males)			
Average rental rafts	105	47%	not significant
Average for private rafts	53	45%	

Table 13. Group sizes and gender of respondent by activity.

	n	Adults	Kids	Total	Percent male of respondent
1 Rental floating long	107	4.1	1.2	5.3	47
2 Private long floating	55	5.2	1.7	6.9	45
3 Short float	2	2.0	1.0	3.0	100
4 Stationary water toys	1	7.0	1.0	8.0	100
5 Swimming	42	3.4	2.2	5.6	48
6 Relaxing	530	3.4	1.4	4.8	44
7 Picnicking	136	5.8	1.4	7.1	47
8 Hiking	17	2.7	1.2	3.8	53
9 Biking	4	2.5	0.3	2.8	25
10 Other or mixed	19	2.8	0.6	3.3	41
All	913	3.9	1.4	5.3	45
All boaters	165	4.5	1.3	5.8	47
All beach users	727	3.9	1.4	5.2	45
All hikers/bikers	21	2.6	1.0	3.6	48

Note: Gender is random person within group and may not represent true mix of groups.

Table 14. Sample sizes of different types of observed users by location.

<u>Sample sizes</u>	Floaters	Shore Users	Hikers/Bikers
Clark's Bridge	0	62	0
Sentinel Bridge	7	71	3
Housekeeping bridge area	16	99	3
Housekeeping West	24	84	0
Superintendent's Footbridge	12	15	0
Swinging Bridge area	20	135	6
Take-out / Sentinel Beach	72	93	0
El Cap Bridge area	0	46	6
Cathedral Beach	3*	29	0
	154	634	18
Percentages			
Clark's Bridge	0	10	0
Sentinel Bridge	5	11	17
Housekeeping bridge area	10	16	17
Housekeeping West	16	13	0
Superintendent's Footbridge	8	2	0
Swinging Bridge area	13	21	33
Take-out / Sentinel Beach	47	15	0
El Cap Bridge area	0	7	33
Cathedral Beach	2	5	0
	100	100	100

Table 15. Sample sizes of various boating respondents (used in subsequent analyses).

<u>For all groups approached</u>	n	%
Observed boaters	165	18
Self-identified boaters this trip	134	15
Self-identified boaters previous trips	97	11
Boaters via crowding question	54	6
All potential boaters	450	49
Non-boaters	463	51
Total approached	913	
For survey respondents:		
Observed boaters	154	19
Self-identified boaters this trip	134	17
Self-identified boaters previous trips	97	12
Boaters via crowding question	54	7
All potential boaters	439	54.5
Non-boaters	367	45.5
Total respondents	806	

Table 16. Number of respondents by state (except California, see Table 17).

State	n	
Mass	3	
NJ	3	
New York	7	
PA	3	16 from NE – 2%
VA	8	
MD	1	
NC	4	
SC	1	
GA	3	
FL	3	
AL	1	
TN	2	
KY	1	24 from South – 4%
OH	3	
IN	2	
MI	1	
IA	2	
WI	2	
MN	3	
IL	5	
MO	1	
NB	1	
OK	1	
TX	9	Midwest = 30 – 5%
CO	2	
UT	3	
AZ	5	
NM	1	
NV	5	Rocky Mt West = 16 – 2%
OR	11	
WA	6	
AK	3	
HI	2	NW and AK = 22 – 3%

Table 17. Number and percent of respondents from California and foreign countries.

Zip Code or country	n	%	Comments
CA – 96xxx	9	<1	Northern CA
CA – 95xxx	120	16	Sacramento and Central Valley
CA – 94xxx	129	17	Bay Area
CA – 93xxx	61	8	Fresno, Bakersfield, some other Central Valley zip codes
CA – 92xxx	107	14	SD and Eastern LA and Mojave zip codes
CA – 90xxx – 91xxx	131	17	LA and suburb zip codes
Total CA	557	72	
Netherlands	23	3	
UK and Ireland	12	2	
Germany	11	1	
Canada	10	1	
Switzerland	8	1	
France	7	<1	
Denmark	5	<1	
Australia/NZ	3	<1	
Mexico	3	<1	
Sweden	2	<1	
Spain	2	<1	
Other Europe	5	<1	Belgium, Cyprus, Italy, Norway, Poland
So / Central America	3	<1	Argentina, Columbia, Guatemala
Other Asia	3	<1	Israel, China, Hong Kong
Total foreign visitors	97	13	
All Europe	78	10	
Most frequent zipcodes	16	2	Yosemite Valley
	12	2	Mariposa / El Portal etc.
	21	3	San Jose
	88	12	East Bay
	41	5	San Francisco and southern suburbs
	15	2	Fresno / Salinas
	46	6	Southern Sierra to Coast includes Bakersfield, Santa Barbara
Total US visitors	665	87	total US visitors – 82% in summer 2005 survey
Total foreign visitors	97	13	total foreign visitors – 18% in summer 2005 survey
Total provided residency	762		95% of 806 who completed surveys
California	557	72	57% of total visitors in summer 2005 survey
Other states	108	15	25% in summer 2005 survey
Outside US	97	13	18% in summer 2005 survey

Table 18. Residency by boaters and non-boaters.

	Boaters		Non-boaters		All respondents	
	n	%	n	%	n	%
California	303	83	254	64	557	73
Western states	20	5	18	5	38	5
Other states	19	5	51	13	70	9
Foreign	25	7	72	18	97	13
Total	367	100	395	100	762	100

Table 19. Percent staying in different overnight locations.

	Everyone		
	n	%	
No overnight specified	26	3	Did not answer this series...
Total overnight sample	780	97	Answered the series. 50 or 6% gave 2+ responses.
Out-of-Valley visitors			Percent is out of 780....
Other YNP CGs	106	13	See list
Other location lodging	70	8	See list
Day users	55	7	Went to and from home...
El Portal	28	3	
Groveland	28	3	
Mariposa	23	3	
Oakhurst	21	3	
Yosemite West	17	2	
Wawona	11	1	
Fresno	10	1	
Foresta	3	<1	
	372	44	
In-Valley			
Housekeeping	156	19	
Valley CGs	166	20	
Curry	80	10	
Lodge	31	4	
Residents	18	2	
Ahwahnee	7	<1	
	458	56	

Table 20. Percent staying in overnight locations (boaters vs. non-boaters).

	All respondents		Boaters		Non-boaters	
	n	%	n	%	n	%
Total overnight sample	780		378		402	
Valley hotels	109	14	57	15	52	13
Housekeeping	155	20	104	27	51	13
Valley campgrounds	165	21	101	27	64	16
Residents	18	2	10	3	8	2
Outside of Valley	333	43	106	28	227	56

Table 21. List of “other” overnight locations provided by respondents.

Other overnight locations mentioned	n	Other campground locations mentioned	
Unspecified (but checked)	16	Unspecified (but checked)	38
Merced	8	Crane Flat	17
Don't know yet	4	Hodgden Meadows	11
Mammoth	4	Bridalveil	9
Unspecified car camping	3	Indian Flat	5
Camp Mathers	3	KOA Mid Pines	6
Along the road	2	Tuolumne Meadows	3
Backcountry / wilderness	2	Yosemite Lakes, Groveland	2
Crane Flat	2	Big Bend near Lee Vining	1
Friend's house unspecified	2	Diamond Circle	1
Stockton	2	Groveland CG	1
Tenaya Lodge	2	Lake Miterton	1
Tracy	2	Lee Vining Mono Vista	1
Angel's Camp	1	Oak Flat	1
Bass Lake	1	Pine Mountain	1
Coarsegold	1	Redwood Camp	1
Coulterville	1	Reversed Creek	1
Fish Camp	1	San Jose Family Camp	1
Sonora	1	Sawmill Creek	1
Lodi	1	Summerdale	1
June Lakes	1	Sweetwater CG	1
Juniper Springs	1	Tamarack	1
KOA cabins	1	Yosemite Creek	1
Lillaskag Lodge	1	Total other campgrounds	106
Madera	1		
Modesto	1		
Motel 6	1		
Scenic Wonders	1		
Sunset Inn	1		
Virginia Lakes	1		
Yosemite Pines Resort	1		
Total other lodging	70		

Table 22. Reported years visiting Yosemite National Park.

	All respondents		Boaters		Non-boaters	
	n	%	n	%	n	%
1	245	31	56	15	189	46
2	65	8	29	8	36	9
3	42	5	17	4	25	6
4	36	5	16	4	20	5
5 to 9	75	9	47	12	26	6
10 to 19	112	14	69	18	43	10
20 or more	221	28	148	39	75	18
	796	100	382	100	414	100
Average	12.6		17.1		8.3	
Median	5.0		12		2	
IQ range	1 to 20		3 to 30		1 to 10	
Highest	68		64		68	

Table 23. Reported days in Yosemite on this visit.

	All respondents		Boaters		Non-boaters	
	n	%	n	%	n	%
1	119	15	24	7	95	23
2	132	17	34	9	98	24
3	145	19	64	18	81	20
4	108	14	64	18	44	11
5	83	11	41	11	42	10
6	41	5	27	7	14	3
7	121	16	92	25	29	7
8 to 14	18	2	15	4	4	1
15 or more	4	1	3	1	1	<1
60 or more	17	2				Valley residents. 96% of sample
	772		364		408	
Average	4.1		5.1		3.2	
Median	3.0		4.0		3.0	
IQ range	2 to 5		3 to 7		2 to 4	
Highest*	60					60+ removed (not visitors)
Percent answering	96		95		97	

Table 24. Comparison of In-Valley vs. Out-of-Valley users for reported days in the park.

	Day users	Valley overnighters
Average	2.6	5.0
Median	2.0	5.0
IQ range	1 to 3	3 to 7
n	322	425

Statistically significant.

Table 25. Reported hours in the valley today.

	All respondents	Boaters	Non-boaters	Day users	Overnight users*
Average	6.8	6.8	6.9	6.8	6.6
Median	7.0	6.6	7.0	7.0	6.0
IQ range	4 to 8.5	4.3 to 8.0	4 to 9	5 to 8	3 to 9
n	478	168	310	315	142
Possible n	806	385	421	333	447
Percent answering	59%	44%	74%	95%	32%
Frequencies					
	%				
<1	5				
1 thru 2	6				
3 thru 4	16				
5 thru 6	21				
7 thru 8	27				
9 thru 10	12				
11 thru 12	9				
13 thru 15	2				
16 or more	2				

*Most reported 24 hours, but some were on their first or last day (or were planning to go to other locations outside the valley, and may have provided accurate time in the valley for that day).

Table 26. Reported hours on the river today.

	All respondents	Boaters	Non-boaters	Out-of-Valley users	In-Valley users
Average	3:18	3:43	2:58	2:42	3:45
Median	3:00	3:00	2:00	2:00	3.0
IQ range	2 to 4	2 to 5	1.4 to 4	1.5 to 3.5	2 to 5
n	782	372	410	326	433
Possible n	806	385	421	333	447
Percent answering	97	97	97	98	97
Frequencies					
	%				
<1	8				
1	14				
2	23				
3	22				
4	12				
5	7				
6	6				
7 thru 8	6				
9 thru 10	1				
11 or more	1				

Table 27. Reported mode of transport to the river today (percentages).

	All respondents	Boaters only	Valley campers only	Housekeeping only	Valley hotels only	In Valley overnights	Out of Valley visitors
Walk	43	36	39	87	61	61	18
Bike	11	8	22	8	21	16	4
Shuttle	9	12	8	3	19	9	10
Tour bus	1	1	0	<1	1	<1	<1
Private vehicle	46	42	39	9	17	23	76
Motorcycle	<1	0	0	0	0	0	<1
Other	4	12	5	3	3	4	2
n	806	154	165	155	109	429	333

Table 28. Reported activities on this and previous trips (percentages).

	This trip	Previous trip*
Relax	86	73
Boat	33	45
Swim	65	65
Picnic	55	55
Hike	50	58
Bike	30	43
Fish	6	13
Other	7	5
n	806	562

* Does not include visitors reporting this was their first year in park.

Table 29. Reported locations on river visited today (percentages).

	All visitors	Boaters only	Valley campers only	House keeping only	Valley hotels only	In-Valley overnight visitors	Out of Valley visitors
1	57	61	55	56	54	56	57
2-3	36	33	32	35	44	35	36
4 or more	8	6	13	9	2	8	7
n	714	580	152	139	96	404	289
Possible n	806	652	165	155	109	429	333

Appendix D: Additional Perceived Crowding Results

Table 30. Perceived crowding statistics for all visitors.

	% feeling crowded (3-9 on scale)	mean	n	% extremely crowded (8 or 9)
Driving roads	90	5.9	658	33
Finding parking	88	5.9	631	34
Riding shuttles	83	5.4	343	28
Hiking/biking	68	4.0	615	8
Boating	60	3.2	309	3
Relaxing	54	3.2	725	5
Swimming	45	2.7	633	1
Overall	82	4.4	734	7
91% answered overall				

Table 31. Perceived crowding statistics for boaters and non-boaters.

	Observed shore users n = 652			Observed boaters n = 154			Observed + self-ID boaters 385		
	% feeling crowded	mean	n	% feeling crowded	mean	n	% feeling crowded	mean	n
Driving roads	89	5.8	528	91	6.2	130	90	6.1	309
Finding parking	88	5.9	507	89	5.9	124	87	5.9	289
Riding shuttles	84	5.5	242	81	5.4	101	84	5.4	209
Hiking/biking	68	3.9	500	71	4.4	115	69	4.1	305
Boating	59	3.3	163	62	3.2	146	61	3.2	255
Relaxing	53	3.1	595	60	3.2	130	56	3.2	342
Swimming	45	2.7	497	47	2.8	136	46	2.7	332
Overall	81	4.3	595	83	4.5	139	82	4.4	352
91% answered overall			90% answered overall			91% answered overall			

Table 32. Perceived crowding statistics for Valley overnighters and Out-of-Valley visitors.

	Valley overnighters = 447			Out-of-Valley visitors = 333		
	% feeling crowded	mean	n	% feeling crowded	mean	n
Driving roads	88	5.9	325	92	5.9	310
Finding parking	86	5.8	303	90	6.0	305
Riding shuttles	84	5.5	218	81	5.4	115
Hiking/biking	64	3.7	351	74	4.2	246
Boating	57	3.0	205	68	3.8	237
Relaxing	50	2.9	397	60	3.5	306
Swimming	41	2.6	371	52	3.0	243
Overall	77	4.1	404	87	4.7	307
90% answered overall			92% answered overall			

Note: 3% didn't specify overnight vs. day use...

Table 33. Frequency distribution (percentages) for perceived crowding questions (all visitors).

	Driving	Parking	Shuttles	Hike/bike	Boating	Relaxing	Swim	Overall
1	5	7	7	15	24	29	35	6
2	6	5	10	16	15	17	20	12
3	11	10	12	16	25	19	17	20
4	11	11	13	14	12	13	11	18
5	10	7	7	11	6	7	5	14
6	13	13	10	12	10	7	7	14
7	13	14	14	7	4	4	4	9
8	11	13	10	4	1	2	1	4
9	22	21	18	4	2	2	1	3

Table 34. Correlations between overall perceived crowding and selected variables (all visitors).

	r	p	n	
Acceptability of Photo A	--			
Acceptability of Photo B	-.19	.001	639	More crowded = lower ratings for high boating densities
Acceptability of Photo C	-.25	.001	631	
Acceptability of Photo D	-.22	.001	630	
PFD	--			
25% reduction	.17	.001	668	More crowded = more support for reductions...
50% reduction	.11	.005	656	
No commercial	.08	.02	719	
Limit privates	.10	.01	673	
No boating	--			
Short segments	--			
Open new segs.	--			
Acceptability of Photo E	--			
Acceptability of Photo F	-.16	.001	661	More crowded = lower ratings for higher shore densities
Acceptability of Photo G	-.21	.001	652	
Acceptability of Photo H	-.21	.001	657	
Trails to beaches	--			
Maps to beaches	--			
Reduce parking	.08	.02	682	More crowded, more support for limits/reductions
Limit day users	.15	.001	683	
Reduce camping	.10	.013	681	
Reduce lodging	.13	.001	683	

-- Means not statistically significant correlation.

Table 35. Correlation between use measures and perceived crowding scores (all visitors).

Use measure	Type of crowding	r	p
Vehicles into East Valley	Crowding while driving	.23	.001
Vehicles into East Valley	Overall crowding	.13	.001
Daily boating use (systematic – all locations)	Crowding while boating	.20	.001
Daily “water toys” counted (systematic – all)	Overall crowding	.12	.001
Daily boating use (systematic – all)	Crowding while swimming	.09	.03
Daily boating use (systematic – all)	Overall crowding	.08	.04
Daily boating use (systematic – all)	Crowding while relaxing	--	ns
Daily use at 8 beaches (systematic)	Overall crowding (all respondents)	.12	.001
Daily use at 8 beaches (systematic)	Crowding while boating (all)	.14	.001
Daily use at 8 beaches (systematic)	Crowding while relaxing, swimming (all)	--	ns
Daily use at Swinging Bridge (systematic)	Crowding while relaxing (Swinging Bridge visitors)	.31	.001
Daily use at Swinging Bridge (systematic)	Crowding while swimming, boating	--	ns
Daily use at Clarks Bridge, Stoneman Bridge, Housekeeping East, Housekeeping West, Superintendent’s Bridge, Sentinel Beach, and Cathedral Beach	All crowding measures at those locations	--	ns

Appendix E: Additional Boating Issue Results

Table 36. Acceptability of boating density photos (with additional statistics for boaters and non-boaters).

	-4	-3	-2	-1	1	2	3	4	mean	med	se mean	n
Photo A (4)	2	1	1	1	3	6	12	73	3.31	4.0	.058	720
Photo B (8)	2	1	2	2	11	18	22	29	2.15	3.0	.070	696
Photo C (16)	11	15	18	13	9	8	5	7	-0.70	-1.0	.089	687
Photo D (24)	48	17	8	6	5	3	3	5	-2.28	-3.0	.091	687
	high 95%	low 95%	mean	se x 1.96	Observed boaters only		Observed and self-identified boaters		Non-boaters			
Photo A (4)	3.42	3.20	3.31	.114	3.38	130	3.38	349	3.24	371		
Photo B (8)	2.29	2.01	2.15	.137	2.17	127	2.33	340	1.97	356		
Photo C (16)	-0.52	-0.87	-0.70	.174	-0.42	121	-0.52	332	-0.87	355		
Photo D (24)	-2.10	-2.46	-2.28	.178	-2.02	123	-2.19	333	-2.37	354		

Table 37. Preferences for boating densities (with additional statistics for boaters and non-boaters).

	All respondents			Boaters		Non-boaters	
	n	raw %	valid %	n	valid %	n	valid %
Lower than A	65	8	10	22	7	43	13
Photo A (4)	295	37	46	135	42	160	49
Photo B (8)	246	31	38	142	44	104	32
Photo C (16)	27	3	4	16	5	11	3
Photo D (24)	12	2	2	6	2	6	2
No preference	76	9	--	32	--	44	--
Total valid n	645			321		324	
total n possible	806			385		421	
Percent responding	80%			83		77	
Preference mean*	6.2			6.6		5.8	
Preference median	4.0			8.0		4.0	

* "Lower than A" was assumed to be 2 for calculating mean.

Table 38. Boating densities that "NPS should allow" (with additional statistics for boaters and non-boaters).

	All respondents			Boaters		Non-boaters	
	n	raw %	valid %	n	valid %	n	valid %
Photo A (4)	41	5	6	9	3	32	10
Photo B (8)	271	34	42	131	41	140	43
Photo C (16)	262	33	41	149	47	113	35
Photo D (24)	53	7	8	25	8	28	9
Higher than D	14	2	2	4	1	10	3
No restrictions	69	9	--	33	--	36	
Total valid n	641			318		323	
total n possible	806			385		421	
Percent responding	80			83		77	
NPS standard mean	12.8			13.2		12.2	
NPS standard med	16			16		8	

* "Higher than D" was assumed to be 32 for calculating mean.

Table 39. Boating densities that “would cause you to no longer visit.”

	All respondents			Boaters		Non-boaters	
	n	raw %	valid %	n	valid %	n	valid %
Photo A (4)	12	2	2	2	1	10	3
Photo B (8)	35	4	6	9	3	26	9
Photo C (16)	152	19	27	64	24	88	30
Photo D (24)	245	30	44	129	48	116	40
Higher than D	115	14	21	63	24	52	18
Use level doesn't matter	145	18	--	78		67	--
Total valid n	559			267		292	
total n possible	806			385		421	
Percent responding	69			69		69	
NPS standard mean*	21.9			23.3		20.8	
NPS standard med	24			24		24	

* “Higher than D” was assumed to be 32 for calculating mean.

Table 40. “Highest boating density seen today” (with additional statistics for boaters and non-boaters).

	All respondents			Boaters		Non-boaters	
	n	raw %	valid %	n	valid %	n	valid %
Lower than A	81	10	11	15	4	66	20
Photo A (4)	160	20	24	76	22	84	25
Photo B (8)	314	39	47	179	53	135	41
Photo C (16)	92	11	14	57	17	35	11
Photo D (24)	8	1	1	5	2	3	1
Higher than D	16	2	2	8	2	8	2
Don't know	43	5	--	12	--	31	--
Total valid n	671			340		331	
total n possible	806			385		421	
Percent responding	83			88		79	
NPS standard mean*	7.0			7.8		6.2	
NPS standard med	8.0			8.0		8.0	

* “Lower than A” assumed to be 2 and “Higher than D” was assumed to be 32 for calculating mean.

Table 41. Comparing “highest seen” to “preference” among boat density photos.

	All respondents		Boaters	Non-boaters
	n	%	%	%
Saw more than prefer	249	41	45	38
Saw what you prefer	234	39	39	39
Saw less than prefer	122	20	17	23
Saw 2,3, or 4 categories more than prefer	75	12	11	14
n= 605 (75% answered both)			310	295

No significant differences among mean scores for boaters and non-boaters (t=-1.3, p = .191)

Table 42. Comparing “highest seen” to “NPA action standard” among boat density photos.

	All respondents		Boaters	Non-boaters
	n	%	%	%
Saw more than standard	53	9	10	8
Saw your standard	185	31	34	28
Saw less than standard	362	60	56	64
Saw 2,3, or 4 categories more than std.	11	2		
n= 600 (74% answered both)			306	294

Small significant differences among mean scores for boaters and non-boaters (t=-2.4, p = .013)

Table 43. Correlations between perceived crowding and boating density variables.

	Highest boat density reported	Highest boat density reported compared to preference	Highest boat density reported compared to NPS action standard
Crowding while boating	.27	-.35	-.44
Crowding while relaxing	.20	-.32	-.33
Crowding while driving	.11	-.16	-.15
Crowding while parking	ns	-.15	-.18
Crowding on trails	ns	-.24	-.24
Crowding while on shuttles	ns	-.14	-.12
Crowding overall	.16	-.24	-.29

Table 44. Frequency distributions and statistics for boating management actions (all respondents).

	Oppose			Support			mean	med	sd	se mean	n	%
	-2	-1	0	1	2							
Require PFDs	7	9	22	21	41	0.8	1.0	1.3	.046	744	92	
Reduce rentals 25%	14	13	40	23	11	0.0	0	1.2	.043	726	90	
Reduce rentals 50%	24	19	40	8	9	-0.4	0	1.2	.045	713	89	
No rentals	62	18	14	5	2	-1.3	-2	1.0	.037	721	90	
Limit private use	33	13	23	20	10	-0.4	0	1.4	.052	731	91	
Eliminate boating	73	13	10	3	1	-1.5	-2	0.9	.033	732	91	
Allow campground boating	10	9	46	21	15	0.2	0	1.1	.041	731	91	
Open other boating segs.	12	10	35	29	14	0.2	0	1.2	.043	730	91	

Table 45. Comparing boaters and non-boaters on boating management actions.

	Boaters	Non-boaters	mean diff	t	p	n
Require PFDs	0.6	1.0	-0.39	-4.2	.000	362
Reduce rentals 25%	-0.1	0.2	-0.35	-4.1	.000	351
Reduce rentals 50%	-0.7	-0.1	-0.58	-6.6	.000	347
No rentals	-1.5	-1.2	-0.34	-4.7	.000	348
Limit private use	-0.8	-0.02	-0.74	-7.5	.000	354
Eliminate boating	-1.8	-1.3	-0.42	-6.7	.000	357
Allow campground boating	1.2	0.04	0.38	4.7	.000	359
Open other boating segments	0.3	0.1	0.18	2.0	.042	357

Table 46. Correlations for “highest reported vs. evaluation” variables and boating management actions.

	Highest boat densities reported compared to preference	Highest boat densities reported compared to NPS action standard
Reduce rentals 25%	- .19	- .19
Reduce rentals 50%	- .21	- .21
Eliminate commercial rentals	- .15	- .14
Limit private boats	- .15	- .12, .005
Eliminate boating	- .14	- .10, .017
Allow CG segment boating	ns	.08, .047
Allow other segment boating	ns	ns

All correlations significant at $p < .001$ unless noted.

Appendix F: Additional Shore Use Results

Table 47. Preferences for shore use densities (all respondents).

	n	raw %	valid %
Lower than E	36	4	6
Photo E (10)	351	38	54
Photo F (30)	222	24	34
Photo G (60)	38	4	6
Photo H (100)	8	1	1
No preference	62	7	--
Total valid n	717		
total n possible	806		
Percent responding	89		
Preference mean*	18.8		
Preference median	10.0		

* "Lower than E" assumed to be 5 when calculating mean.

Table 48. Shore use densities that "NPS should allow" (all respondents).

	n	raw %	valid %
Photo E (10)	31	5	5
Photo F (30)	190	21	32
Photo G (60)	299	33	50
Photo H (100)	57	6	10
Higher than H	19	2	3
No restrictions	119	13	--
Total valid n	714		
total n possible	806		
Percent responding	89		
NPS standard mean*	52.2		
NPS standard med	60.0		

* "Higher than H" assumed to be 120 when calculating mean.

Table 49. Shore use densities that "would cause me to no longer visit" (all respondents).

	n	raw %	valid %
E (10)	9	1	2
F (30)	35	4	6
G (60)	141	15	25
H (100)	285	31	50
Higher than H	101	11	18
Use level doesn't matter	142	16	--
Total valid n	713		
total n possible	806		
Percent responding	88		
NPS standard mean	85.6		
NPS standard med	100.0		

* "Higher than H" assumed to be 120 when calculating mean.

Table 50. Highest shore density seen” (all respondents).

	n	raw %	valid %
Lower than E	46	6	7
E (10)	201	28	29
F (30)	309	43	45
G (60)	104	14	15
H (100)	14	2	2
Higher than H	9	1	1
Don't know	38	5	--
Total valid n	721		
total n possible	806		
Percent responding	89		
mean*	26.0		
med	30.0		

* “Lower than E” assumed to be 5 and “Higher than H” assumed to be 120 when calculating mean.

Table 51. Comparing “highest seen” to “preference” among shore density photos.

	n	%
Saw more than prefer	256	43
Saw what you prefer	206	35
Saw less than prefer	131	22
Saw 2/3/4 categories more than prefer	69	12
n= 593		74%

Table 52. Comparing “highest seen” to “NPS action standard” among shore density photos.

	N	%
Saw more than standard	42	7
Saw your standard	159	17
Saw less than standard	369	76
Saw 2/3/4 categories more than standard	10	2
n= 570		71%

Table 53. Correlation between perceived crowding and shore use variables.

	Highest shore use reported	Highest shore density reported compared to preference	Highest shore density reported compared to standard
Crowding while boating	.25	-.36	-.39
Crowding while relaxing	.31	-.31	-.36
Crowding while driving	.19	-.15	-.21
Crowding while parking	.09	-.16	-.17
Crowding on trails	.13	-.20	-.22
Crowding while on shuttles	ns	-.14	-.16
Crowding overall	.19	-.25	-.28

Table 54. Correlations between “highest use vs. evaluation” variables and selected management actions to reduce river impacts or densities (all significant at p<.01).

	Reduce river parking	Limit day use in Valley	Limit private vehicles in Valley	Reduce campsites in Valley	Reduce lodging in Valley
Highest shore densities seen compared to preference	-.19	-.18	-.13	-.22	-.20
Highest shore densities seen compared to NPS standard	-.16	-.24	-.18	-.21	-.15

Note: Negative correlation means if respondent saw more than preference/standard, they were more likely to support a use reduction action.

Table 55. Frequency distributions and statistics for shore use management actions (all respondents).

	Oppose			Support		mean	med	sd	se mean	n	%
	-2	-1	0	1	2						
Trails to less used beaches	5	9	17	41	29	0.8	1.0	1.12	.041	740	92
Maps to less used beaches	4	7	13	41	36	1.0	1.0	1.06	.039	741	92
Reduce river parking	17	25	29	21	10	-0.2	0.0	1.21	.045	743	92
Limit day use	24	21	26	19	11	-0.3	0.0	1.30	.048	744	92
Limit private vehicles	21	19	25	22	13	-0.1	0.0	1.33	.049	741	92
Reduce campsites	44	25	21	8	3	-1.0	-1.0	1.10	.041	740	92
Reduce lodging	42	23	23	8	4	-0.9	-1.0	1.14	.042	743	92

Appendix G: Additional Results on Riparian Impact Issues

Table 56. Acceptability of 1) riparian impacts in example photo and 2) different infrastructure actions to direct use to non-sensitive areas (all respondents).

	Unacceptable					Acceptable				mean	med	se mean	n
	-4	-3	-2	-1	0	1	2	3	4				
Impact photo	2	2	2	5	13	9	14	16	37	2.1	3.0	.076	720
Longer split rail fencing	5	3	5	5	19	16	16	14	17	1.17	1	.079	738
Shorter split rail fencing	2	3	4	6	20	16	17	15	18	1.35	1.5	.075	730
Occasional boardwalks	5	3	2	4	15	17	17	16	22	1.47	2	.080	732
Many boardwalks	8	5	6	8	20	14	12	12	15	0.67	1	.088	731

Table 57. Percent support/opposition for riparian impact management actions (all respondents).

	Oppose			Support			mean	med	sd	se mean	n
	-2	-1	0	1	2						
Education to avoid sensitive areas	1	3	15	37	44	1.2	1.0	.89	.033	740	
Close user trails	4	10	23	34	29	0.73	1	1.10	.041	736	
Prohibit off-trail use	7	12	20	30	32	.68	1	1.23	.054	739	

Appendix H: Selected Use Level Information

The following are selected graphic representations of 2011 use information from the NPS descriptive component.

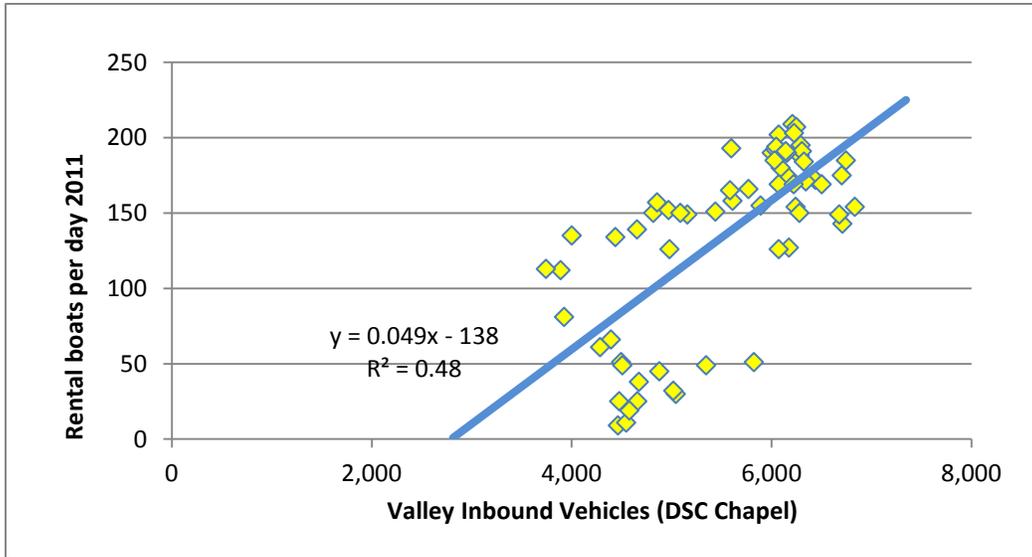


Figure 3. Relationship between Valley Inbound Vehicles (index of total Valley use) and raft rentals per day.

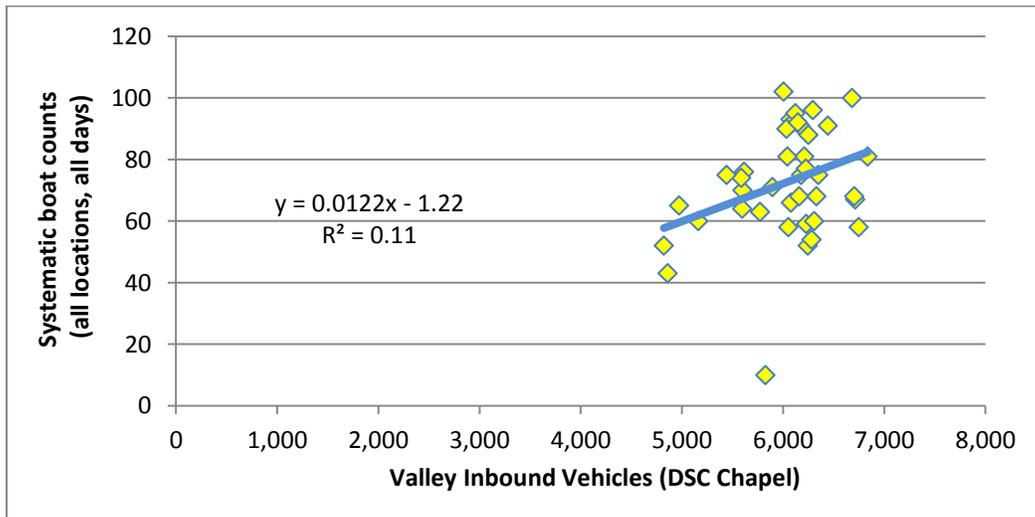


Figure 4. Relationship between Valley Inbound Vehicles and daily boat counts per day (Note: counts ended after Aug 25).

Table 58. Correlations between Daily Inbound Vehicles (DSC counter at Chapel) and various use measures.

Location	Use level measure	Correlation with Inbound Valley Vehicles	
Bridalveil Falls 2007		0.80	
Bridalveil Falls 2011		0.90	
Vernal Falls 2010	Daily visits at Valley attractions	0.49	
Vernal Falls 2011		0.34	
Yosemite Falls 2007		0.58	
Yosemite Falls 2011		0.80	
Rafting segment		Raft rentals (concession)	0.69
Rafting segment		People on raft rentals (concession)	0.74
Rafting segment – all locations	Twice-a-day boat counts	0.33	
Rafting segment – all locations	Twice-a-day boater counts	0.31	
Rafting segment – all locations	Twice-a-day counts of water toys	0.12	
Clark’s Bridge (entire area)	Early afternoon people counts	0.32	
Clark’s Bridge (entire area)	Late afternoon people counts	0.25	
Clark’s Bridge main beach	Early afternoon people counts	0.25	
Clark’s Bridge main beach	Late afternoon people counts	0.19	
Stoneman Bridge main beach	Early afternoon people counts	0.27	
Stoneman Bridge (entire area)	Early afternoon people counts	0.26	
Stoneman Bridge (entire area)	Late afternoon people counts	0.18	
Stoneman Bridge main beach	Late afternoon people counts	0.15	
Housekeeping Bridge (bridge)	Late afternoon people counts	0.41	
Housekeeping East (main beach)	Late afternoon people counts	0.25	
Housekeeping East (main beach)	Early afternoon people counts	0.17	
Housekeeping East (rip rap)	Late afternoon people counts	0.15	
Housekeeping East (rip rap)	Early afternoon people counts	0.03	
Housekeeping Bridge (bridge)	Early afternoon people counts	-0.01	
Housekeeping West beach	Late afternoon boat counts	0.04	
Housekeeping West beach	Late afternoon people counts	0.33	
Housekeeping West beach	Midday people counts	0.29	
Sentinel Bridge (on bridge)	Afternoon people counts	0.19	
Superintendent Footbridge (on bridge)	Afternoon people counts	-0.03	
Superintendent’s Footbridge beach	Afternoon people counts	0.38	
Superintendent’s/Sentinel Bridge area	Afternoon people counts	0.23	
Swinging Bridge parking area	Afternoon vehicle counts	0.63	
Swinging Bridge picnic area	Afternoon people counts	0.51	
Swinging Bridge area (entire area)	Afternoon people counts	0.34	
Swinging Bridge (on bridge)	Afternoon people counts	0.27	
Swinging Bridge main beach	Afternoon people counts	0.23	
Swinging Bridge rip rap area	Afternoon people counts	0.14	
Sentinel Beach (parking)	Afternoon vehicle counts	0.56	
Sentinel Beach (beach)	Afternoon people counts	0.31	
Sentinel Beach (picnic area)	Afternoon people counts	0.19	
Sentinel Beach	Afternoon boat counts	0.01	
Cathedral Beach (beach)	Afternoon people counts	0.22	
Devil’s Elbow area	Afternoon vehicle and people counts	-0.21	
El Cap Bridge area	Afternoon people counts	0.32	

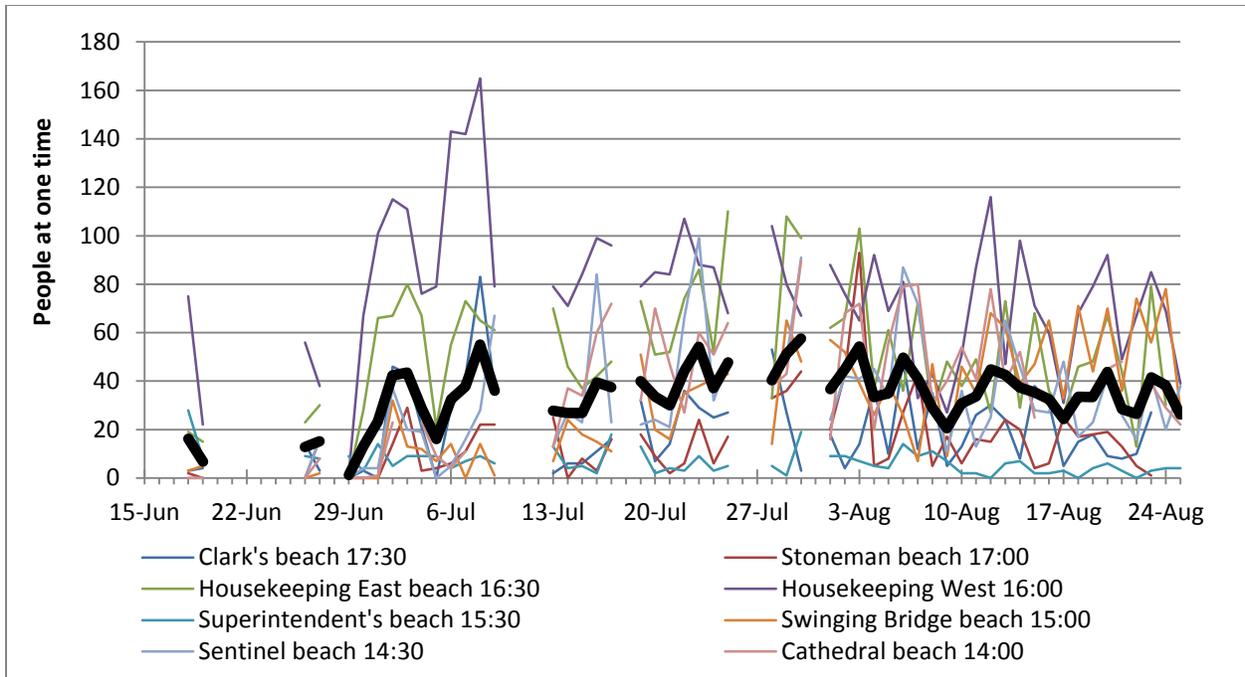


Figure 5. Afternoon counts at eight main beaches (and overall average in black) during 2011.

Example “Full Day Counts” from Selected Locations

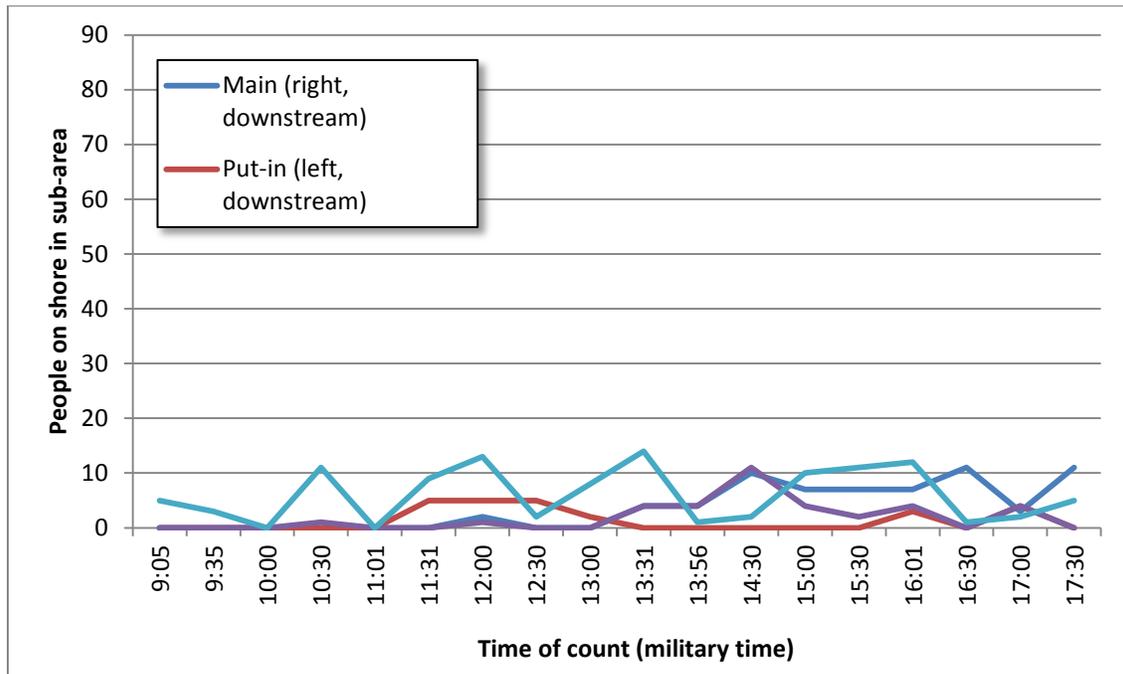


Figure 6. Counts of shore users at Stoneman Bridge sub-areas on Monday July 4, 2011.

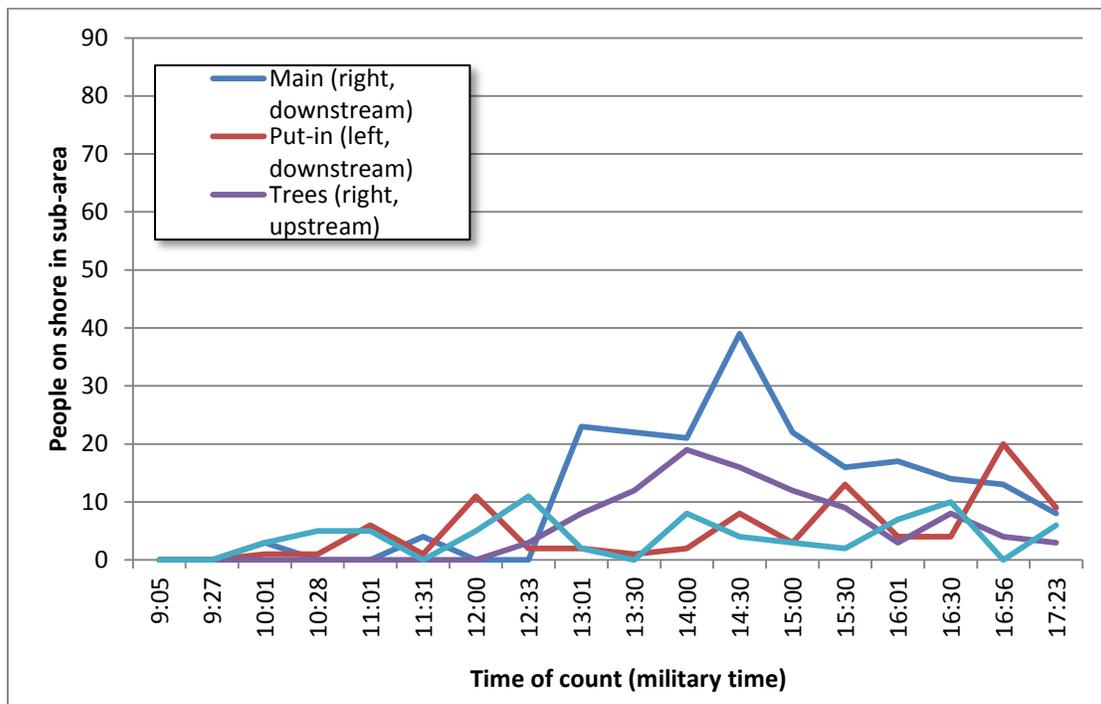


Figure 7. Counts of shore users at Stoneman Bridge sub-areas on Sunday Aug. 21, 2011.

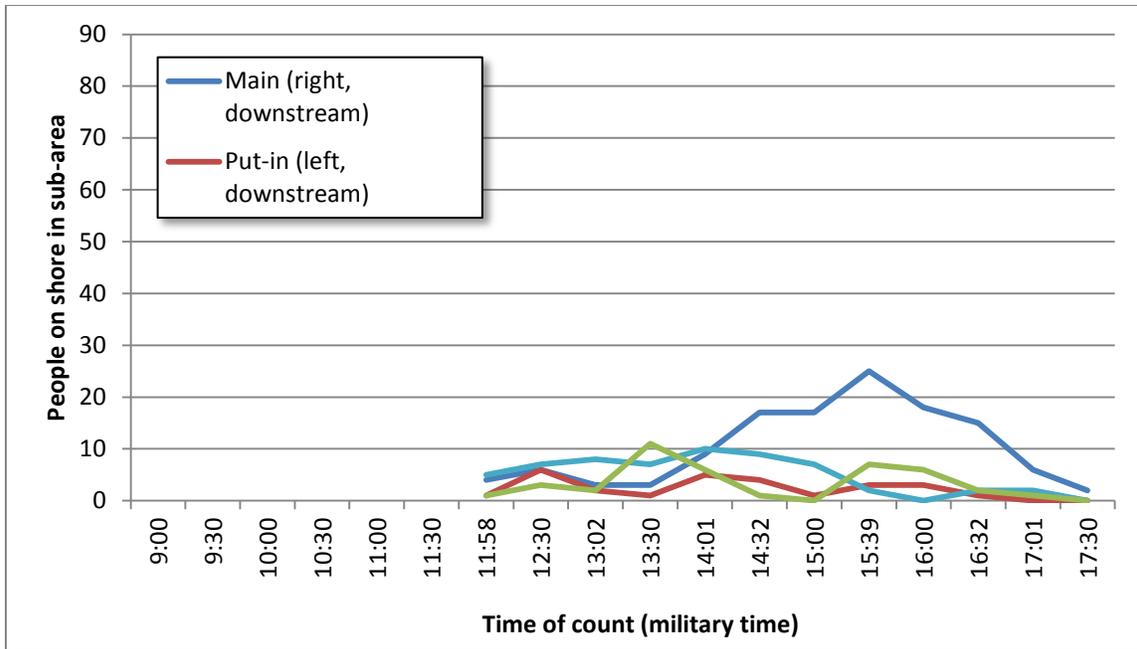


Figure 8. Counts of shore users at Stoneman Bridge sub-areas on Tuesday Aug. 30, 2011.

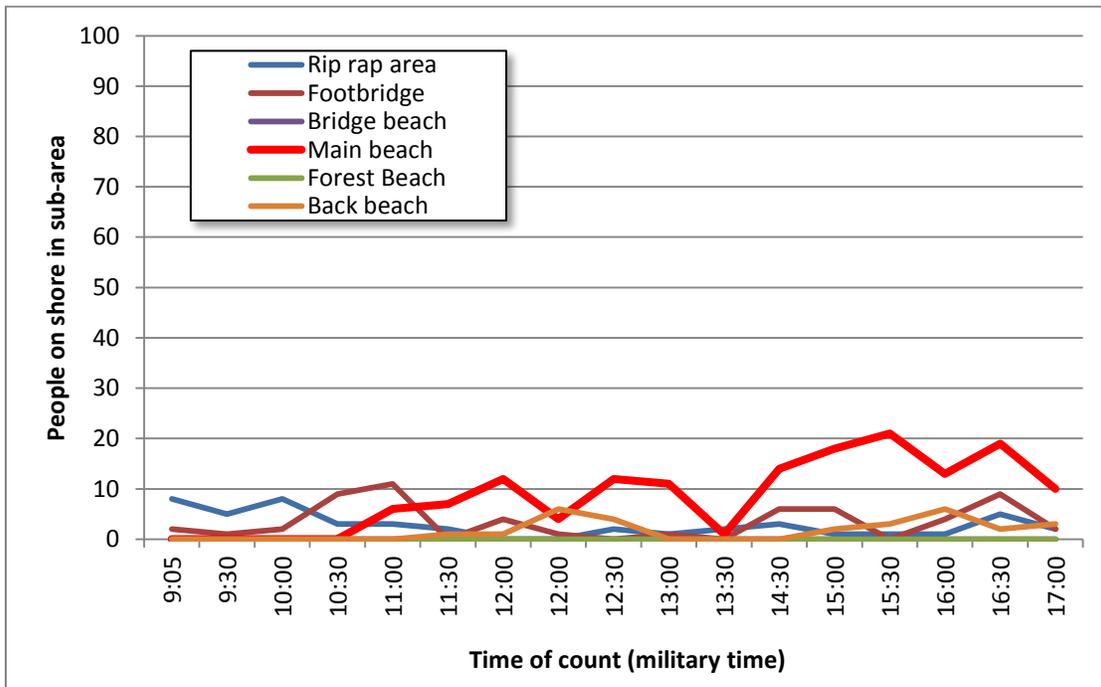


Figure 9. Counts of shore users at Housekeeping East sub-areas on Friday, June 17, 2011.

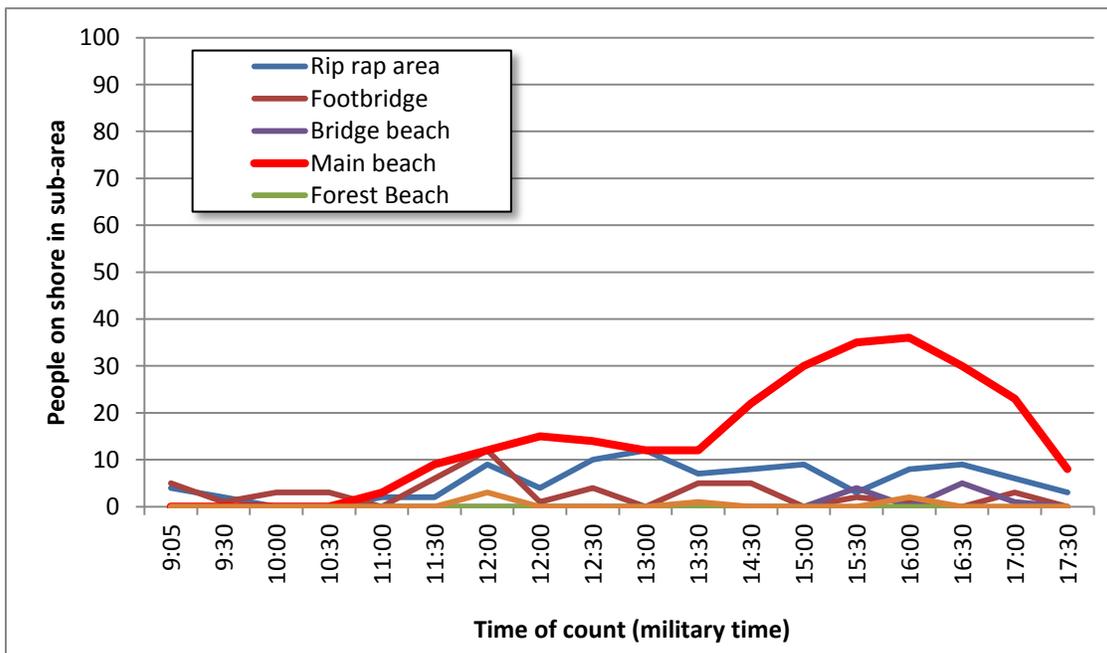


Figure 10. Counts of shore users at Housekeeping East sub-areas on Monday June 27, 2011.

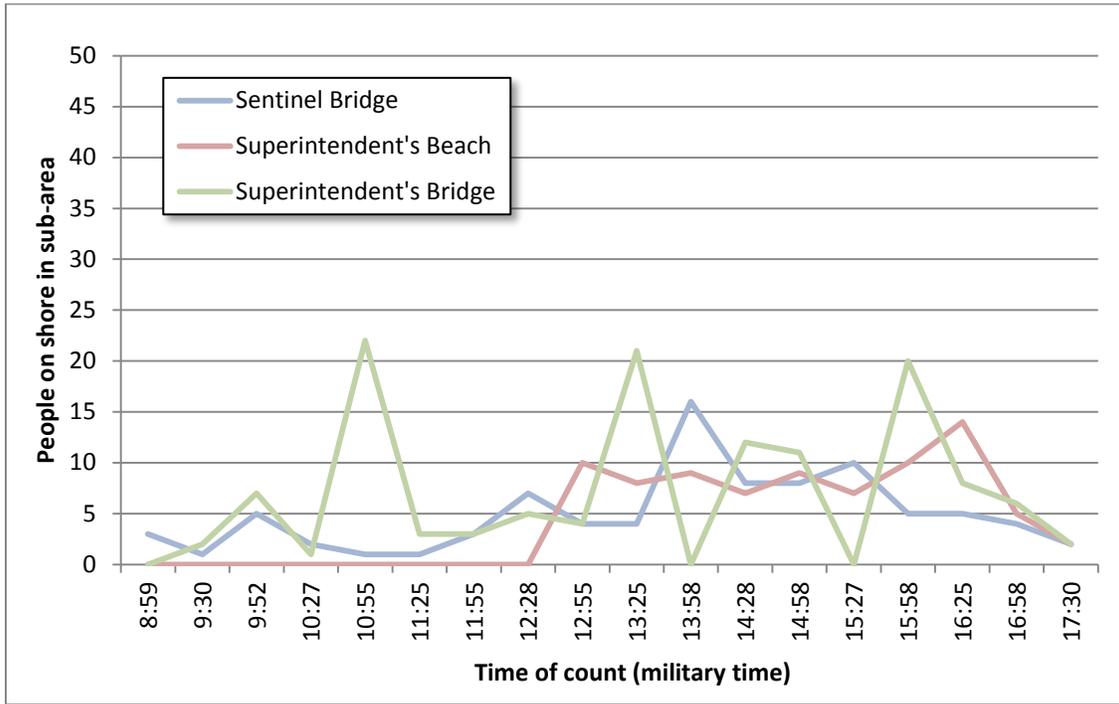


Figure 11. Counts at Sentinel Bridge / Superintendent's Bridge sub-areas on Sunday June 12, 2011.

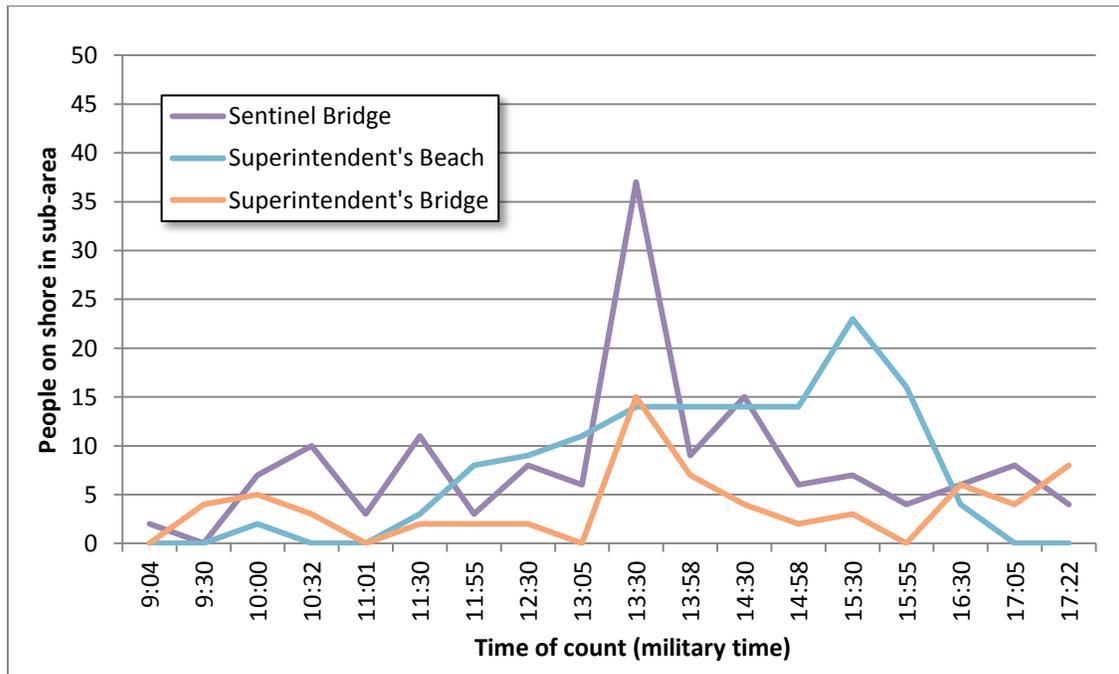


Figure 12. Counts at Sentinel Bridge / Superintendent's Bridge sub-areas on Monday Sep 5, 2011.

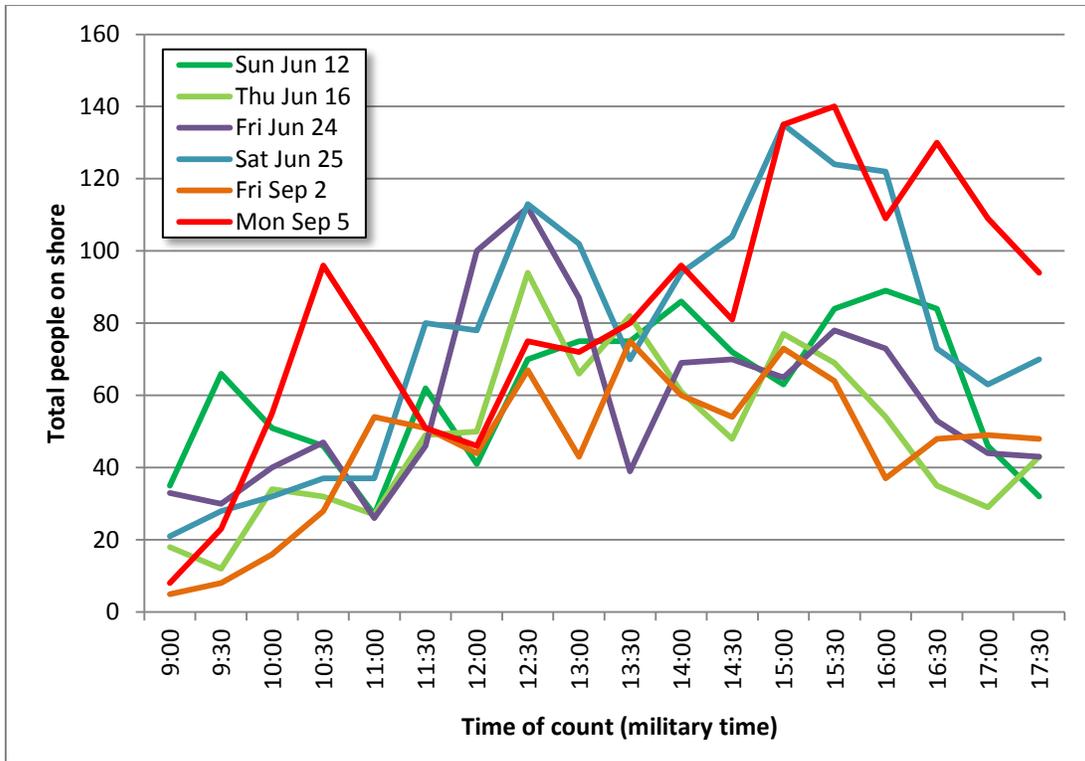


Figure 13. Counts at Swinging Bridge (all sub-areas) on multiple dates, 2011.

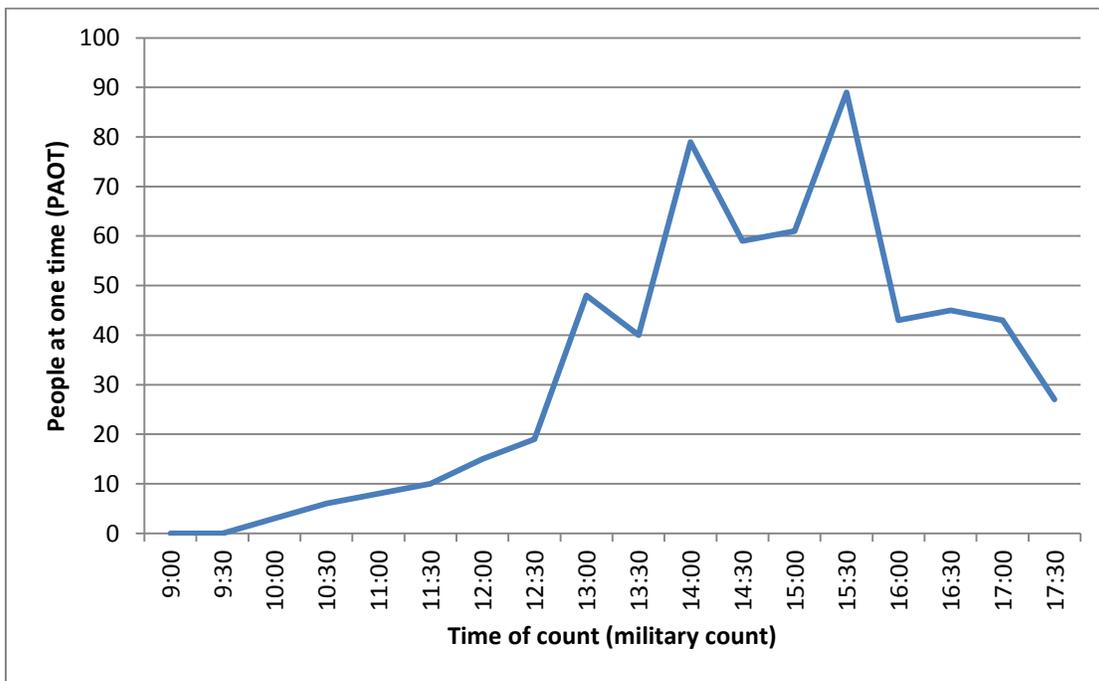


Figure 14. Counts at Cathedral Beach on Saturday August 6, 2011