Chattooga National Wild and Scenic River
Upper River Use Report

Reconsidering congestion, conflict, and experience of various visitor types

by

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Cover photo: Chattooga River near Burrells Ford, Stephen Neslage (with permission)

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1. Introduction

This report contributes to an ongoing discussion of recreation in the Chattooga River Wild and Scenic River (WSR) corridor and the effectiveness of current management practices. These practices seek to mitigate predicted conflict between visitors, limit congestion, and preserve 21-miles of free-flowing river in the upper stretches of the Chattooga. The stretches of river (also called river reaches) in this WSR hold immeasurable value to different visitor types, particularly anglers, hikers, and whitewater boaters.

In 2012, the U.S. Department of Agriculture, Forest Service (Forest Service) instituted new visitor use management on the WSR that included setting new capacities for various types of visitors, indirect limits on most visitors, and direct use limits on only one user group, paddlers, that included restrictions for allowed seasons (December-April) and minimum river flow (above 350 cfs), and full prohibitions on several reaches. The new system called for monitoring and adaptive management, as is required by the 2012 Forest Planning Rule (36 CFR Part 219).

The Forest Service hired a consultant group to conduct the required monitoring, assess the efficacy of the new visitor use plan, and collect the most robust data possible on visitor use of the WSR to date. Data were collected from September 2015 to October 2017, and a final report was issued in 2019 (Berger 2019, also called "The Monitoring Report"). This report provided a wealth of data from randomly sampled point counts of visitors like anglers and hikers, but the effort suffered from a lack of public input and partner collaboration, missing significant factors influencing use and failing to address significant issues.

Specifically, the resulting Monitoring Report failed to correlate visitor use with precipitation, river levels, or fish stocking and management patterns, which are driving factors for anglers, hikers, and campers. This omission contradicts the Louis Berger Group's Literature Review Report originally submitted to the Forest Service (2007), which put forth extensive evidence showing the importance river level has on influencing congestion and visitor interactions. Case studies on other rivers show mutually exclusive river use niches that naturally regulate interactions between boaters and anglers (Whittaker et al. 2005, cited by Louis Berger Group 2007).

The Monitoring Report (2019) also neglected to analyze paddling permit data or meaningfully consider the efficacy and need of the direct limits on paddling in an adaptive management context. The random sampling methods used did not initially bring the researcher into contact with boater groups. Berger opted to compensate for this lack of data with focus groups and appendix data, but in-depth quantitative analysis on this subject remains absent from the report narrative. Focus groups provide thematic insight, but unfortunately, such data cannot be used to effectively compare scale of impact or provide measurable comparison to randomly sampled quantitative data (Bernard 2006). The choice to then omit data outside of "peak" summer months removes monitoring of boating (only allowed December-April) and leaves the influence of boaters and limits of boating up to speculation. Better understanding of why lack of contact with boaters occurred under random sampling techniques and how boater use of the Chattooga WSR relates to other visitor types is needed.

To address the missing components of the Monitoring Report, and in recognition of the importance and value of the data collected and analyzed therein, the authors of this report worked to supplement the Monitoring Report with additional analysis. The goal is 1) to paint a more accurate and comprehensive picture of visitation drivers, overlap, and management efficacy and needs, 2) to provide an improved framework for future monitoring, and 3) to more accurately assess any needs for adaptive management.

1.1 Research Questions

As the next step in this discussion, our report analyzes Berger's (2019) data in conjunction with river use data, data on local conditions (river flow, weather), and insight from the Louis Berger Group's Literature Review Report submitted to the Forest Service (2007) to answer questions about the Upper Chattooga WSR:

1. *What are the use patterns for **all users** by year and reach, and how do local conditions (rainfall, river flow) influence this use?*
2. *What are the use patterns for **boaters only** by year and reach, and how do local conditions (rainfall, river flow) influence this use?*
3. *How does boating influence overall congestion, conflict, and experiences of different user types?*
4. *How would easing boating limits influence congestion, conflict, and experiences of all users?*

1.2 Key Findings

Upper Chattooga Wild and Scenic River Reaches

- Boating accounts for 0.0008% of total use
- 1 in every 1300 groups is a group of boaters
- Paddlers use 23% of available paddling days under current limits
- Conditions self-regulate use and isolate boaters from other groups
    - Increasing rainfall: boater use increases, non-boater use decreases
    - Increasing river flow: boater use increases, non-boater use decreases
    - Boaters are not present on highly congested days
- Removing boating limits would increase boater use from 9 days/year to 17 days/year, from 16 groups/year to 30 groups per year
    - For the vast majority of the year (> 340 days), no boating will occur
- Removing boating limits would not influence highly congested days

Our findings build off of and add support to Berger's (2019) findings that boaters produced no conflict and had only minimal contact with other river users over the course of the study. Bringing together the Monitoring Report with the complementary datasets available reveals three other sets of key findings for consideration in adaptive management moving forward:

1) Boaters have a much lower presence in the Chattooga WSR corridor compared to other river users. This explains the lack of boater groups in random sampling techniques used. Boaters are likewise largely absent on days of concern: highly congested days that surpass capacity limits.

2) Analysis of Berger's (2019) year-round data suggests that congestion is not primarily seasonal. While the Monitoring Report focuses on summer "peak" months, higher levels of backcountry use occurred in those months of data omitted from the core analysis of Berger's report. The correlation between daily variation and local conditions (i.e. river flow, precipitation) far outweighs seasonal variation. Omitting these months from analysis removed all comparable data for paddling, since boaters are only allowed to use these backcountry reaches from December to April. Year-round analysis here and in future monitoring would produce more accurate and implementable results.

3) Our research problematizes the notion that removing limits on whitewater boating would produce significant conflict in the Chattooga WSR corridor. As originally noted in the consulting group's Literature Review Report, "Because optimum streamflow varies by activity, it is important for research studies to examine the relation between flow and various water-based recreational activities (Kakoyannis 2002)" (Louis Berger Group 2007, 30). Along with comparatively low use, boating on the Upper Chattooga occupies a separate river use niche that automatically staggers the presence of boaters and other user types (anglers, hikers, swimmer/wader, campers). The Upper Chattooga angling niche constitutes lower river flows and preferred lack of rain. Hikers and campers have a similar niche, with less concern for river flow, though because of their rain aversion they are correlated with flow. The Upper Chattooga boating niche constitutes high water undesirable for fishing and rain occurring on the day of and day before paddling, which produces conditions less than ideal for angling, hiking, and camping but necessary for boating in the high reaches of the watershed. These findings align with the Literature Review of other case studies: "*typically fishable ranges tend to be much lower than boating ranges on the same reaches*" (Louis Berger Group 2007, 38, emphasis in original). They likewise support the consultant group's original hypothesis: "For the Upper Chattooga, the unregulated nature of the river may provide a situation where natural processes and responsiveness to rain events naturally isolate flow preferences of anglers and boaters" (Louis Berger Group 2007, 40).

Complimenting the Louis Berger Group's Literature Review Report (2007) and Berger's Monitoring Report (2019) with these three key findings, we conclude that easing or removing direct seasonal and flow boating limits on the Upper Chattooga River will facilitate improved experiences for boaters without negatively impacting angler, hiker, or camper experience.

2. River Use Analysis

2.1 All User Patterns and Local Factors

*What are the use patterns for **all users** by year and reach, and how do local conditions (rainfall, river flow) influence this use?*

2.1.1 Key Findings

- The summer season (considered "peak season" in the Berger 2019 study) had roughly the same level of congestion (GAOT, or "groups at one time") as congestion for other months of the year in both 2016 and 2017.
- River use from all users decreases with increasing rainfall, especially above 0.25 inches.
- River use from all users decreases with increasing river flow, especially above 300 cfs and again above 600 cfs.
- Those days and river reaches above capacity limits have anglers and hikers as the most numerous users
- Days with high rainfall and high river flow do not exceed capacity limits.
- The average groups at one time for all users is roughly 5 for Chattooga Cliffs, 30 for Ellicott Rock, 16 for Rock Gorge, and 8 for Nicholson Fields.

2.1.2 Methods

We combine data from The Monitoring Report, other data collected for the Report (but omitted from their analysis to focus on the summer "peak season"), rainfall data, and river flow data. We do so to explore trends in river use throughout the year and in conjunction with local conditions. We compare GAOT data for all users in the summer months and then shift to the entire year for analysis to use a more robust set of data in determining preferred local conditions.

Daily Congestion (GAOT) for All Users

This data came from Berger's report (page 2-23). It is broken down by backcountry reach, so as to be comparable to boater use, which is separated by river reach (put-in and take-out) in permit data. Daily GAOT for all users is an underestimate of the number of groups present at those sections on those days, since it only measures one point in time. Berger averages the GAOT to get an average per day GAOT estimate per section during "peak season" (July 1- August 31). We expand this to use data collected by Berger but omitted from the 2019 report so we can provide analysis of annual trends in GAOT. We use all data from 2016-2017, choosing not to use the few days sampled at the end of 2015 to fit into two comparable annual cycles.

Capacity Limits

Capacity limits come from the 2012 DN in which the Forest Service "set capacity limits (for groups at one time in the frontcountry and average groups per weekday/weekend day in the backcountry) as a way to protect from overuse in the Upper Chattooga WSR" (Berger 2019, 3-1). These are the same capacity limits used by Berger (2019) to compare with GAOT, or the maximum

number of groups for a section at one time. We use these limits to compare data for the summer "peak season" and annual trends.

Influence of Local Conditions (Precipitation, River Flow)

We test the influence of local conditions through analysis of precipitation and river flow in conjunction with river use data. For precipitation, we use the USGS Burrells Ford (BF) station. We do so for two reasons: 1) it is the closest rain gauge to the most frequented river reaches of the Upper Chattooga WSR, and 2) we use the same USGS station for river flow. Another dataset exists for Highlands, NC, which nearly equidistant from the uppermost portion of the Chattooga Cliffs section, but focusing on this rain gauge would not capture the experience of most river users. It also could conflate river flow with precipitation, since Highlands is near the source of this river. For days without BF rain data (about 8 percent of days), the GAOT was not taken into consideration in Figure 2.1-1.

For river flow, we took the daily high river flow for each day, using USGS Burrells Ford station data. An alternative option would have been to select the daily average river flow. We chose daily high river since boating restrictions are based on high river flow, not average river flow. It is of note that we ran the data for both daily high river flow and daily average river flow and found nearly identical results.

2.1.3 Results

Congestion, Seasonality, and River Reaches

The summer season (considered "peak season" in the Berger study) had roughly the same GAOT ("groups at one time" data for congestion) as GAOT for all months in both 2016 and 2017. This trend is most prevalent in the more heavily congested backcountry reaches, as seen in Tables 2.1-1 and 2.1-2. Ellicott Rock, the one area not to meet indirect capacity limits for frontcountry areas and backcountry reaches (Berger 2019, 4-1), averaged a higher GAOT of 30.3 throughout the year than capacity limit of 20 groups. Ellicott Rock had a GAOT of 29.1 compared to the 20 group limit for the summer months.

Table 2.1-1: Average GAOT all users, by reach (2016-2017)

River Reach	Average GAOT 2016	Average GAOT 2017	Average GAOT 2016-2017
Chattooga Cliffs	5.3	4.4	4.8
Ellicott Rock	29.4	31.1	30.3
Rock Gorge	15.4	16.3	15.8
Nicholson Fields	7.9	7.7	7.8
All reaches	*57.9*	*59.5*	*58.7*

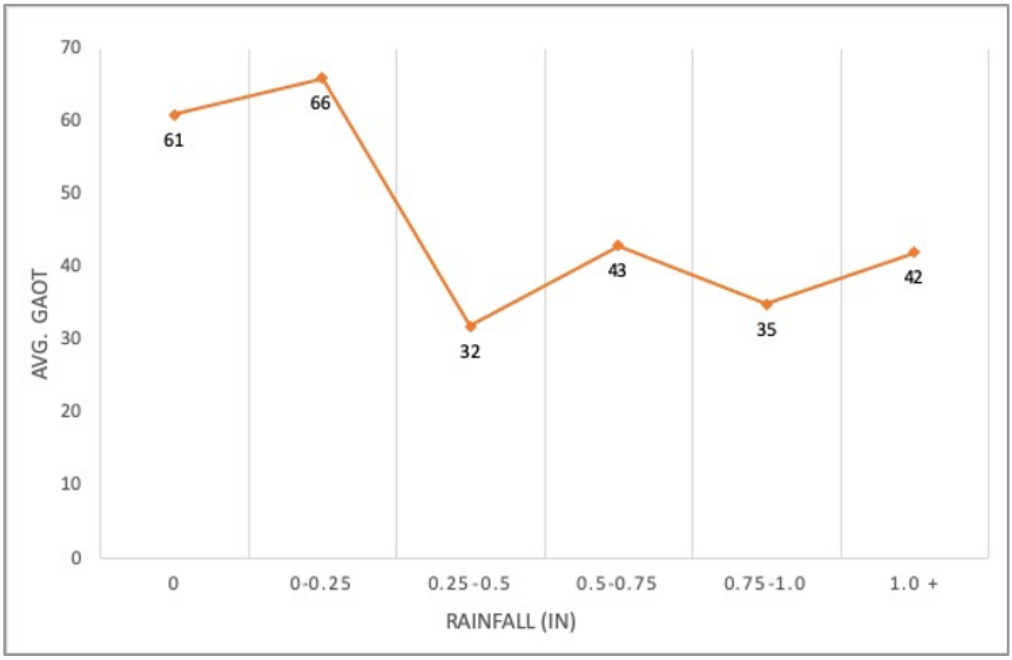
Table 2.1.-2: Average GAOT all users, by reach, Summer (June through August 2016-2017)

River Reach	Average GAOT 2016	Average GAOT 2017	Average GAOT 2016-2017
Chattooga Cliffs	6.8	6.2	6.5
Ellicott Rock	25.7	32.2	29.1
Rock Gorge	13.3	14.7	14.1
Nicholson Fields	6.2	6.4	6.3
All reaches	*51.9*	*59.5*	*55.9*

River Use, Rainfall, and River Flow

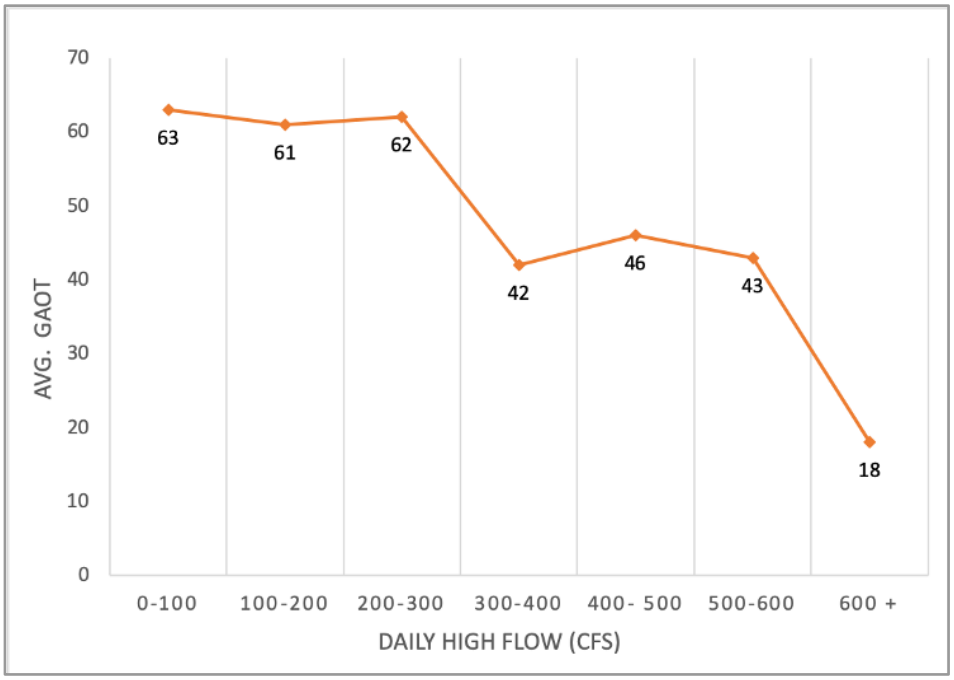
River use for all users decreases with increasing rainfall. As seen in Figure 2.1-1, a sharp use decrease occurs above 0.25 inches of rain. Matching this overall data trend with specific data for highly congested days in Berger's study and precipitation shows that, on average, days with more than 0.25 inches of rain are not of concern for capacity limits and congestion.

Figure 2.1-1: Average GAOT all users, all reaches vs. rainfall (2016-2017)



River use from all users decreases with increasing river flow. As seen in Figure 2.1-2, a sharp use decrease occurs above 300 cfs and a second sharp decrease above 600 cfs. On average, days with river flow above 300 cfs are not of concern for capacity limits and congestion. We chose to lump together all data points above 600 cfs because Berger (2019) only had 5 data points for days above 600 cfs. Future monitoring with cluster sampling to obtain data for GAOT of all users in each flow range between 600 and 1000 cfs could produce a more robust and comparable data set with which to compare to use by specific group types, like boaters.

Figure 2.1-2: Average GAOT all users, all reaches vs. river flow (2016-2017)



2.1.4 Discussion

Section 2.1 contributes to The Monitoring Report's thorough analysis of visitor presence (groups at one time, GAOT) during the summer months and expands it with additional analysis of data collected by their group for other months, which did not make it into the report's core analysis or narrative. We likewise contribute findings on how GAOT relates to local conditions like rainfall and river flow. The most immediately apparent findings are that GAOT for all users decreases with rainfall and river flow increase. This is especially apparent when thresholds of 0.25 inches of rain and 300 cfs are met and the trend intensifies after 600 cfs. Such trends of aversion to high river flows match trends for similar analysis with other rivers (cited by Louis Berger Group 2007) and the Louis Berger Group's original predictions for the Upper Chattooga (2007). In depth discussion of these trends did not occur in the group's most recent Monitoring Report (2019).

Data on GAOT of all users supports findings that most reaches meet indirect capacity limits but that Ellicott Rock is the area of most concern for congestion (Berger 2019, 4-1). If this crowding is not of concern, the capacities could be reconsidered. It is likely that recreational drivers, such delayed harvest, influence congestion between anglers and hikers, the two groups in highest numbers on days above Forest Service capacity limits. Though outside the scope of this analysis, this could be incorporated into future adaptive management to better manage angler/hiker relations, and we provide initial insight on this in Appendix A. In that initial insight, we find that daily variation due to local conditions is more influential than seasonal variation.

Data for distribution of congestion in Berger's 2019 study questions the focus on summer alone for future analysis of river use. In particular, the area of most concern for congestion, Ellicott Rock, exceeds capacity limits in its annual daily average in both the summer and annual calculations. The focus on the summer "peak" season resulted in the omission of data collected for the months without seasonal boating limits (December-April). When introducing the consultant group's study, they also discuss an expansion of sampling days to include winter and days on which flows would be adequate for boating (Berger 2019, 1-15). Yet, their sections that followed refer only to the summer "peak" season and do not include quantitative comparison of groups at one time of boaters and other visitors, only a stand-alone summary of boating permit data.

Berger uses qualitative methods (focus groups) to account for what they interpret as a lack of data on boating use (2019, 1-14). They conclude that boaters did not experience any negative interactions with other users and that it was "very uncommon" for boaters to see other people in the reach of highest congestion: Ellicott Rock (Berger 2019, 4-6). The focus group data contributes complementary thematic information for the study, but this method falls short in comparing quantitative data, like GAOT (Bernard 2006, 233).

Comparative quantitative analysis of boater permit data (briefly mentioned but not thoroughly analyzed by the Berger team (2019, 4-3)) helps understand proportions of users and the extent of an influence boaters have on the experience of other types of visitors. The next two sections of this report more deeply analyze quantitative boating data as compared to local conditions and use by other visitors to better understand contributors to congestion and relationships among river users.

2.2 Boating Use Patterns

*What are the basic use patterns for **boaters only** by year and reach, and how do local conditions (rainfall, river flow) influence this use?*

2.2.1 Key Findings

- On average, 16 groups of boaters used the Upper Chattooga WSR each year between 2014 and 2019.
- River use by boaters increases with increasing rainfall, especially above 0.25 inches (nearly identical to the inverse trend for all users in Section 2.1).
- River use by boaters increases with increasing river flow, especially above 400 cfs and again above 600 cfs (nearly identical to the inverse trend for all users in Section 2.1).
- River reaches and days above capacity limits generally have no boaters present.
- Boaters are most prevalent in days with high rainfall and high river flow, when capacity limits are not exceeded.
- Even though they are restricted to 5 months of eligible boating, boaters use a small percentage of days that reached the minimum flow requirements:
    - Chattooga Cliffs Reach: 5% of eligible days used
    - Ellicott Rock Reach: 18% of eligible days used
    - Rock Gorge Reach: 10% of eligible days used
- The average GAOT for boaters is 0.09 (compared to 59 for other user types).

2.2.2 Methods

Boating Permit Records

Boating permit records from 2014-2019 give specific use information for all boaters in the Upper Chattooga WSR. Data from these records provide valuable information for accurately depicting boating use patterns by year and reach. This type of self-reporting is not performed by all users (including hikers, anglers, etc.).

Each boating permit includes the following information: date, put-in, take-out, number of people, type of watercraft, launch time, and administrative data (permit #, code for river user type). We used put-in (or starting point) and take-out (or ending point) locations to note which river reaches are paddled by the group. After putting in at one location, groups can and sometimes do continue through multiple river reaches. In this manner, the sum total of group numbers for all river reaches may be higher than the actual number of groups.

Overall Congestion (GAOT)

We developed our methods in order to compare the two different types of Upper Chattooga river use datasets available. For all users combined, we continue using Berger's (2019) Groups at One Time (GAOT) metric. This metric uses randomly sampled observations of vehicles at access points for the different river reaches to count groups at one point in time. For boaters, we have a complete set of permits from groups putting on different reaches of river.

The problem in comparing the two datasets is that GAOT is an underestimate of the number of groups that day (that is, it only counts groups present when the researcher arrived for observation), while boating permit records are an actual count that includes the entirety of the day. This means that boating use numbers will be falsely inflated compared to GAOT, skewing the data to show boaters as more of a congestion problem then they are.

Originally, we intended to find a means to account for this skew that overestimates boater presence. After initial tests, we found that the magnitudes of difference between the low number of boaters compared to high numbers for other users meant that comparing the GAOT for all users with the actual number of boaters produced compelling results in and of themselves within the most conservative of assumptions. We present our method for converting and comparing data in the table below:

Table 2.2-1: Groups at One Time (GAOT) Methods and Influence of Methods Choices

Group	Source	Conversion to GAOT	Influence of GAOT Conversion
All Users	Randomly sampled point observations by Berger from late 2015-2017. Few points in 2015 cut to produce comparable full years of data (2016, 2017).	Converted to GAOT as a 1-to-1 ration by Berger.	**Same.** Berger Group counted vehicles at one time (VAOT) and used this as a one-to-one ratio for groups at one time (GAOT).
Boaters	Required boating permits at point of entry for 6 years (2014-2019), which shows point of entry to river and point of exit.	The total number of groups that moved through a stretch of river on any day are added to form our Boater GAOT	**Overestimates boater GAOT.** This is for two reasons: 1) boaters sometimes moved through multiple reaches, being counted multiple times when compared to All User GAOT, which focused on where the vehicle was parked 2) we count each group as being present for all times throughout the day instead of just during the time the researcher visited the site (as with All User GAOT), since we do not know when the randomly sampled time would have been
			Net result: Boater GAOT overestimated compared to observed All User GAOT

Boater Contribution to Congestion (GAOT for Boaters)

This data came from boating permits by groups of boaters as they entered the river at each reach. We looked at the put in and take out of each group, including all reaches paddled. Since one group could (and sometimes did) use multiple reaches per river use, one group can show up

multiple times, further inflating the boater number. Boaters travel quickly through front country area and through the river reaches and out again. We chose to leave it as is, given the magnitudes of difference. Even though this overestimates boater presence, it produces confident conclusions in terms of the minimal presence and impact of boaters on the experience of others.

Following Berger's methods, we found averages for the GAOT per day, per section during the season boating is allowed (January 1-April 30, December 1-31). The number of days in the boating season is different from the GAOT All Users, but this did not alter results, since both metrics are averages per day, per section.

In order to account for Berger's (2019) concern that boaters were not present during the 2016 season in normal numbers, we use the complete set of boating permits from 2014-2019 to obtain more accurate daily use averages that limit this concern.

Percentage of Potential Boating Days Used

We calculated the percentage of potential boating days that boater groups used under current limits. Boaters are only allowed to use the river on days when the river has reached 350 cfs. We used the USGS Burrells Ford gauge for river flow data and found the highest flow for each day from 2014-2019. Boaters are also only allowed to use the river between December 1 and April 30. For those days that met both criteria, we labelled them "allowed days" or "potential boating days." We compared these datasets to determine the percentage of potential boating days under current limits used across different river reaches.

Influence of Local Conditions (Precipitation, River Flow): See 2.1.2 Methods Section

2.2.3 Results

Current Use

Unlike for other river users, we have data on the actual total number of boating groups using the Upper Chattooga WSR. This number varies per year between 4 and 33 groups annually, averaging 16 groups per year between 2014 and 2019. Since the average GAOT for all users at any one point in time (59) is more than three times the total *annual* number of boater groups, the value produced for boater GAOT are quite low.

Table 2.2-2: Total groups (TG) of boaters, by reach (2014-2019)

River Reach	2014	2015	2016	2017	2018	2019	Average
Chattooga Cliffs	1	0	2	1	5	1	*2*
Ellicott Rock	3	9	12	2	20	14	*10*
Rock Gorge	0	8	4	2	8	5	*5*
Nicholson Fields	0	0	0	0	0	0	*0*
All reaches	*4*	*17*	*18*	*5*	*33*	*20*	*16**

**column does not add due to rounding*

Average GAOT for boaters is an overestimate, but even with this overestimation (explained in above methods section), the average GAOT values per reach are mostly "0" when rounded to the nearest tenth (to compare with Berger (2019) data rounding).

Table 2.2-3: Average GAOT boaters only, by reach (boating season 2014-2019)

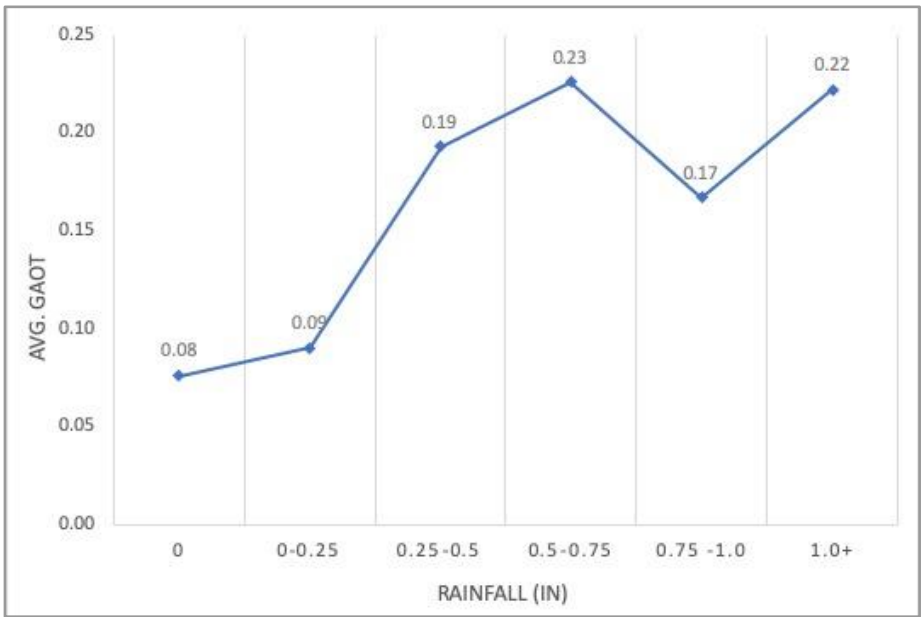
River Reach	2014	2015	2016	2017	2018	2019	Average
Chattooga Cliffs	0.01*	0.00*	0.01*	0.01*	0.03*	0.01*	0.01*
Ellicott Rock	0.02*	0.05	0.07	0.01*	0.11	0.08	0.05
Rock Gorge	0.00*	0.04*	0.02*	0.01*	0.04*	0.03*	0.02*
Nicholson Fields	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
All reaches	*0.02**	*0.09*	*0.10*	*0.03**	*0.18*	*0.11*	*0.09*

**after rounding to match Berger (2019) methods, GAOT=0*

River Use, Rainfall, and River Flow

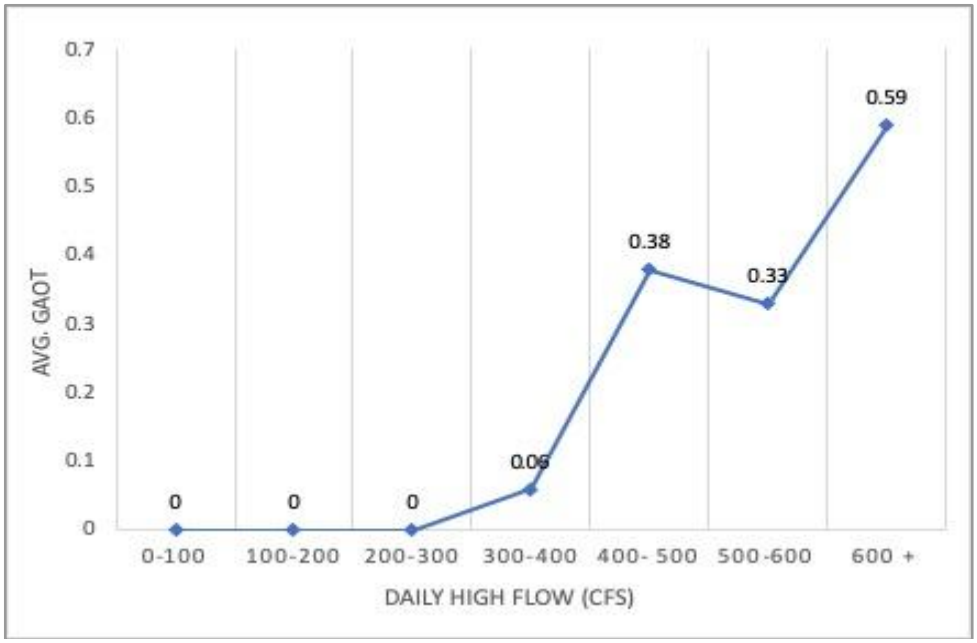
River use for boaters increases with increasing rainfall. As seen in Figure 2.2-1, a sharp use increase occurs above 0.25 inches of rain. Comparing this data trend with data for highly congested days shows that boaters are generally not present on days that surpassed capacity limits or days with high congestion.

Figure 2.2-1: Average GAOT boater only, all reaches vs. rainfall (2014-2019)



River use from boaters increases with increasing river flow. As seen in Figure 2.2-2, a sharp use increase occurs above 400 cfs and a second sharp increase above 600 cfs. On average, days with river flow above 400 cfs are not of concern for capacity limits and congestion. We chose to lump together all data points above 600 cfs because Berger (2019) only had 5 data points for days above 600 cfs. Future monitoring with cluster sampling to obtain data for GAOT of all users in each flow range between 600 and 1000 cfs could produce a more robust and comparable data set with which to compare to use by specific group types, like boaters.

Figure 2.2-2: Average GAOT boaters only, all reaches vs. river flow (2014-2019)



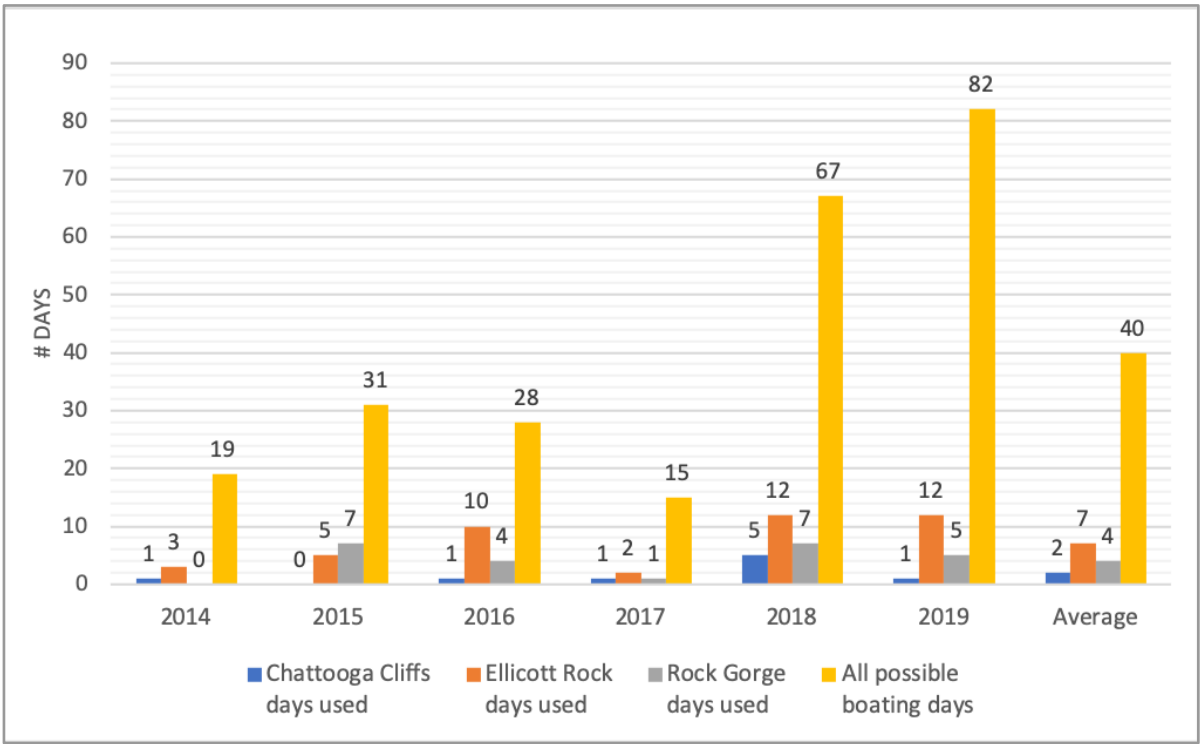
Possible Days Used

Table 2.2-4: Percent of potential days used, by reach and by year (2014-2019)

	2014	2015	2016	2017	2018	2019	Avg.	%use for section
Potential days	19	31	28	15	67	82	40	-
Chattooga Cliffs days used	1	0	1	1	5	1	2	5%
Ellicott Rock days used	3	5	10	2	12	12	7	18%
Rock Gorge days used	0	7	4	1	7	5	4	10%
Any section days used	3	9	11	2	15	16	9	23%
% days used in season	16%	29%	39%	13%	22%	20%	23%	-

A limited number of the possible boating days in the six years from 2014 to 2019 were actually used. The average number of days that fit within the boating limits (December to April and more than 350 cfs river flow) was 40 annually between 2014 and 2019. Yet, boaters used an average of 2 available days in the Chattooga Cliffs reach, 7 in the Ellicott Rock reach, 4 in the Rock Gorge reach, and zero in the Nicholson Fields reach, where boating is not allowed. Per year, only 9 out of 40 potential boating days or 23% are used. Figure 2.2-3 visually demonstrates the yearly use of days within the boating limits, broken down by stretch.

Figure 2.2-3: Days actually used by boaters compared to all possible boating days (December-April, >350 cfs)



2.2.4 Discussion

Boating permits provide valuable data on actual river use, requiring little data management to analyze. Data with actual use numbers was only partially analyzed in previous reports (Berger 2019, 4-3 to 4-5). Berger did not produce estimated numbers of boater use to compare to use by all visitors. This omission of data leaves a void in understanding use of the Upper Chattooga WSR. Focus groups provided thematic insight into the low presence of boaters when other groups are present, but they did not provide quantitatively comparable data.

This section of our report adds to the missing component of boater use of the Upper Chattooga WSR. The average number of boater groups seen in the Upper Chattooga river reaches, even at the optimal boating levels, fall well within what fishermen and wilderness visitors consider Acceptable Encounter Levels in case studies such as those on waterways like the Boundary Waters Canoe Areas (Stankey 1973), Bois Brule River (Vaske 1977), New River Gorge (Roggenbuck and Bange 1983), Deshutes River (Whittaker and Shelby 1988), and Gulkana River (Whittaker et al. 2000)(note: all citations from Louis Berger Group 2007).

The numbers in our Figure 2.2-3 ("Chattooga Cliffs days used," "Ellicott Rock days used," and "Rock Gorge days used") equate to the number of possible days in a year that other types of visitors could possibly come in contact with a boating group. Given the aforementioned factors of boating use patterns vs. water flow and rainfall, these boating use days occurred most often on days with few other visitors. As put forth in the Louis Berger Group's original Literature Review report, a wealth of case studies supports this trend (Whittaker et al. 2005 cited by Louis Berger Group 2007).

The river use trends leading to boater isolation along the Upper Chattooga are magnified by the speed with which boaters tend to move through a reach of a river and out of the backcountry when compared to other visitors. The combination of these influencing factors further decreases the likelihood that boaters and other users would come into contact on backcountry stretches of the Chattooga WSR. Berger's (2019) focus group data complements this theme of low likelihood of boater contact with other groups. Likewise, out of the study-reported conflict between visitors from 2016-2017, none involved boaters (Berger 2019, 4-3).

The sections below combine data on local conditions and use Berger's insights on use trends by all visitors to paint a more nuanced picture of Upper Chattooga WSR corridor use and analyze predicted effects of easing boating limits.

2.3 Current overlap of boating and non-boating use

How does boating influence overall congestion, conflict, and experiences of different user types?

2.3.1 Key Findings

1. Boater groups account for 0.001% or less of groups in each of the Upper Chattooga river reaches.
2. Boaters make up 1 out of every 850 user groups in the Chattooga Cliffs section, 1 in every 1100 user groups for the Ellicott Rock section, and 1 in every 1200 user groups for the Rock Gorge section. Boaters are not allowed on the Nicholson Fields reach.
3. The small presence of boaters is not spread evenly, with flow and precipitation preference differences across user types leaving little chance of boater interaction with other groups.
4. Boaters do not use the Upper Chattooga WSR on highly congested days within the allowed season.
5. The average precipitation on days when boaters used the Upper Chattooga WSR is far higher than precipitation for days commonly used by other visitor types and more than 4 times the precipitation of congested days.
6. The average river high flow on days when boaters used the Upper Chattooga WSR is far higher than the flow for days commonly used by other visitor types and more than 5 times the flow of congested days.

2.3.2 Methods

Total Groups (TG) All Users/Boaters

(also see Methods sections 2.1.2 and 2.2.2 for data types not new to this section)

We combine boating data from Forest Service river permits and data from Berger's study (discussed in previous section). For the "all users" group, we use data for those days where Berger collected data, since these were the only days where we have data on visitor presence. We used Berger's data for all months, not just the summer "peak season."

We were able to use 143 days of Berger's available data rather than the 56 days for the "peak season" narrowed in Berger's study from June 1 to August 31. We did so for two reasons: 1) 143 days of data provides a much more robust analysis of trends between river use and local conditions, and 2) this opens comparison of boating and other river use, since boating is not allowed during the summer months that Berger chose to focus on. For the "boaters only" group, we had the benefit of knowing all days that users were present across the 182 day boating season.

As with Table 2.2-1, we needed to find means to compare different user types in the Chattooga WSR Corridor when considering total groups present. Since boaters are the only type of user subjected to direct limits needing monitoring for adaptive management, it is most important to analyze the comparative influence of boaters and other river users. We used the below method

(Table 2.3-1), since it would provide comparable data while likewise providing the least contested dataset, which is an exact number for boater use (the subject of direct limits) while underestimating use by all other visitor types (the experience of whom boating limits are designed to protect).

Table 2.3-1: Total Groups (TG) Methods and Influence of Methods Choices

Group	Source	Conversion to TG	Influence of TG Conversion
All Users	Randomly sampled point observations by Berger from late 2015-2017. Few points in 2015 cut to produce comparable full years of data (2016, 2017).	Average GAOT for a reach is multiplied by the number of days in question to achieve our number of Total Groups present in that time frame.	**Underestimates All User Total Groups.** All User GAOT observes groups present at one time. In our analysis, we assume these are the only groups present that day, even though groups come and go.
Boaters	Required boating permits at point of entry for 6 years (2014-2019), which shows point of entry to river and point of exit.	Required boating permits at point of entry for 6 years (2014-2019), which shows point of entry to river and point of exit, giving exact number of groups.	**Same.** Exact number of groups from required boating permits.
			Net result: All User Total Groups underestimated compared to Boater Total Groups

The Total Groups (TG) for all users was found by simply multiplying the average annual GAOT of each section by the number of days in the year (365). This is an underestimate, since more groups than those present at time of observation are likely to come throughout the day as other groups leave. TG for boaters was found using boating permit records, giving the actual number of groups.

2.3.3 Results

Capacity Limits and Use

Even when underestimating the number of groups from all users, the number of boaters is orders of magnitude smaller than the number of all users. This holds true across all sections.

Table 2.3-2: Average groups at observation time (GAOT), by reach

River Reach	Capacity Limits	GAOT All Users	GAOT Boaters
Chattooga Cliffs	10	4.8	0.01*
Ellicott Rock	20	30.3	0.05
Rock Gorge	30	15.8	0.02*
Nicholson Fields	30	7.8	0.00*
All reaches	90	58.7	*0.09*

**after rounding to match Berger (2019) methods, GAOT=0*

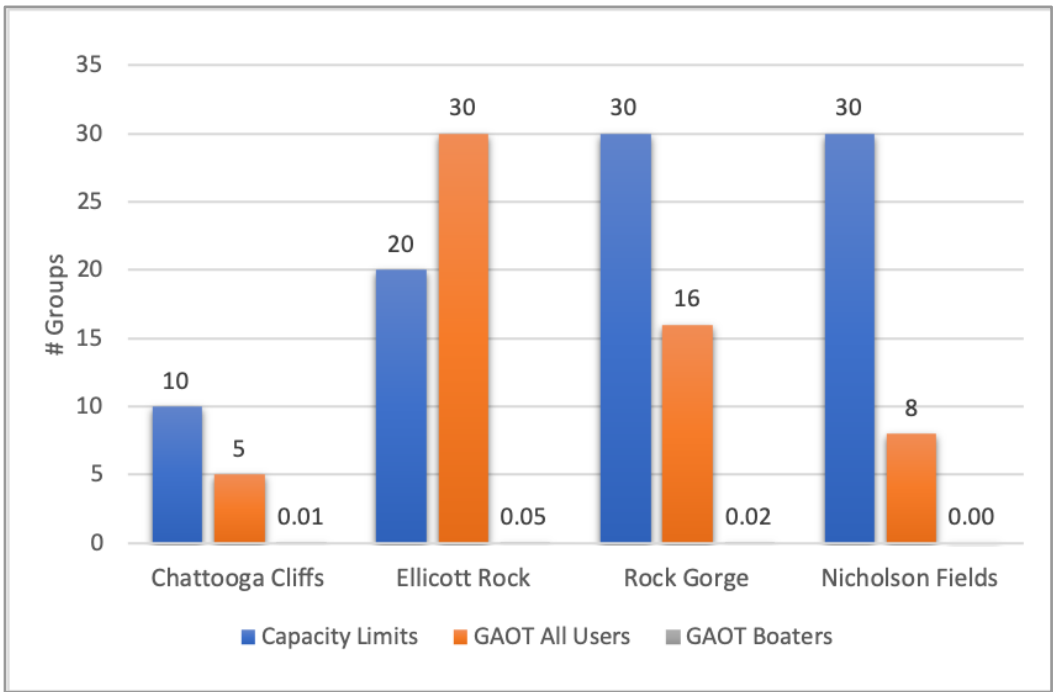
Table 2.3-3: Estimated total groups (TG) per year

River Reach	TG All Users, Summer (92 days)	TG All Users, Annual	TG Boaters, Annual
Chattooga Cliffs	400	1,700	2
Ellicott Rock	2,800	11,000	10
Rock Gorge	1,500	5,800	5
Nicholson Fields	700	2,900	0
All reaches	5,400	21,400	16

The average number of boating groups per section, per season is sometimes less than one, since not every section sees multiple user groups per year. For the year, boaters account for a remarkably small percentage of the user groups in the Upper Chattooga WSR:

- On average, 1 out of every 1300 groups is a boater group, or 0.0008%.
- By reach, on average boater groups occur in the following frequency:
    a. Chattooga Cliffs: 1 in 850, or 0.001%
    b. Ellicott Rock: 1 in 1100, or 0.0009%
    c. Rock Gorge: 1 in 1200, or 0.0008%
    d. Boaters are not allowed on the Nicholson Fields reach.

Figure 2.3-1: Average GAOT, by reach, for all users and boaters only



*GAOT Boaters for Chattooga Cliffs and Rock Gorge round to 0 when using Berger (2019) rounding method

2.3.4 Discussion

From combining Berger's study with boating permit records, we now know that the average number of non-boater groups visiting the Upper Chattooga WSR at one moment during an average day is more than 3 times the total of number of boating groups visiting the WSR *throughout the entire year*.

Berger (2019) did not see boaters during his preliminary study because the level of boater presence was below the needed threshold for the GAOT methods used. This does not mean a sampling error occurred. Instead, it demonstrates an important finding: the average GAOT for boaters using Berger's methods is 0. Using Berger's sampling strategy, during an average day, within the allowed boating season for any year between 2014 and 2019, it would take an average of 17 *full days of observation* before finding a boating group (152 days in season, average of 9 days used per season). This problem was not experienced with other groups, since they were present during the randomly sampled times of randomly sampled days (average GAOT all users=58.7, average GAOT for boaters=0.09*)(*note: this number is an overestimate, and average boater GAOT drops to "0" under Berger (2019) sampling methods).

The key finding is then that boating does not provide a noticeable influence on congestion in any section of the Upper Chattooga. On average, one in every 1300 groups is a group of boaters.

Moreover, this small amount of boating is not evenly spread across days. The most congested days for the Upper Chattooga are simultaneously the days with no boater presence. River flow and precipitation are directly proportional to boater use but inversely proportional to use by other river users. This may explain why boaters interviewed about the Ellicott Rock section in the Monitoring Report said it was "very uncommon to see other people in or next to this reach" (Berger 2019, 4-6), despite this reach averaging a higher year-round GAOT (30) than the capacity limit (20) (see Section 2.1). Boaters likewise had no negative experiences with other user groups (Berger 2019, 4-6). This supports Berger's original hypothesis: "For the Upper Chattooga, the unregulated nature of the river may provide a situation where natural processes and responsiveness to rain events naturally isolate flow preferences of anglers and boaters" (Louis Berger Group 2007, 40). Local conditions in these reaches, high in the watershed and free flowing in nature, change on a daily scale. This produces more variation in use patterns and congestion from day to day than across seasons, putting into question the need for seasonal boating limits.

The high use levels and similarity in preferred use conditions bring other, non-boating visitors, like hikers, anglers, swimmers, and campers, to the same stretch at the same time. This is what Berger's (2019) data shows, specifically for Ellicott Rock. In the most congested areas and on the most congested says, anglers are the most common, followed by hikers, with boaters not present.

2.4 Impact of Easing Direct Boating Limits

How would easing boating limits influence congestion, conflict, and experiences of all users?

2.4.1 Key Findings

- Extrapolating river use data to include predicted potential boating use days with a lift in direct boating limits demonstrates only a minor increase in boater use of the river.
- Removing both direct flow and seasonal limits would not increase conflict or congestion, since boaters do not use the Upper Chattooga WSR on highly congested days.
- After removing boating limits, the average number of boater groups present lies well below what fishermen and wilderness visitors consider Acceptable Encounter Levels, shown in numerous case studies (Louis Berger Group 2007).
- Total boater groups per section, after removing direct limits:
    - Chattooga Cliffs: 3 boater groups/year (+1/year from current)
    - Ellicott Rock: 20 boater groups/year (+10/year from current)
    - Rock Gorge: 8 boater groups/year (+3/year from current)
- Currently, boaters use one or more of these stretches on only 9 days out of the year, which is predicted to rise to 17 days per year after lifting limits.
- For the vast majority of the year (more than 340 days), no boating will occur on the Upper Chattooga, and the days used will have few other visitors present.

2.4.2 Methods

We analyzed Burrells Ford USGS Gauge data from 2014-2019 to match boating permit data. We marked each day of the year with a peak river flow above 350 cfs as a "potential boating day," as per current flow limits on boating in all Upper Chattooga WSR reaches. We then broke analysis down by river reach for a place-based comparison.

For each river reach, we multiplied the "potential boating days" added without direct limits by the percentage of days currently used by boaters for each river reach, since boaters use different reaches at different frequencies (see Table 2.2-4, this report).

It is of note that we treat all seasons the same, predicting a constant rate of use across all seasons. We do so for two reasons:

1) No available data exists for the summer months, since boating is not allowed in these reaches outside of December to April.
2) Berger's (2019) report data shows that Chattooga WSR backcountry use is influenced far more from daily conditions than seasonal conditions (see Section 2.1 and Appendix B, this report).

2.4.3 Results

Change in Possible Boating Days and Days Used

Using data from 2014 to 2019, the average possible boating days added (those days upon which river levels reach 350 cfs in the currently limited months) is 34/year. Adding this brings the average total possible boating days to 74 out of 365. Yet, since boaters use between 5 and 18% of possible boating days, depending on river reach (see Table 2.2-4, this report), the actual days used by boaters will be much lower.

Table 2.4-1: Change in possible boating days with lift of direct seasonal limits (2014-2019)

	2014	2015	2016	2017	2018	2019	Annual
Potential boating days (current)	19	31	28	15	67	82	40
Added without direct limits	21	28	10	38	75	31	34
Total possible boating days	*40*	*59*	*38*	*53*	*142*	*113*	74

Without limits, use of Chattooga Cliffs by boaters is estimated to increase from the current 2 days per year to 3 days per year. Use of Ellicott Rock by boaters is estimated to increase from the current 7 days per year to 14 days per year. Use of Rock Gorge by boaters is estimated to increase from the current 4 days used per year to 7 days used per year.

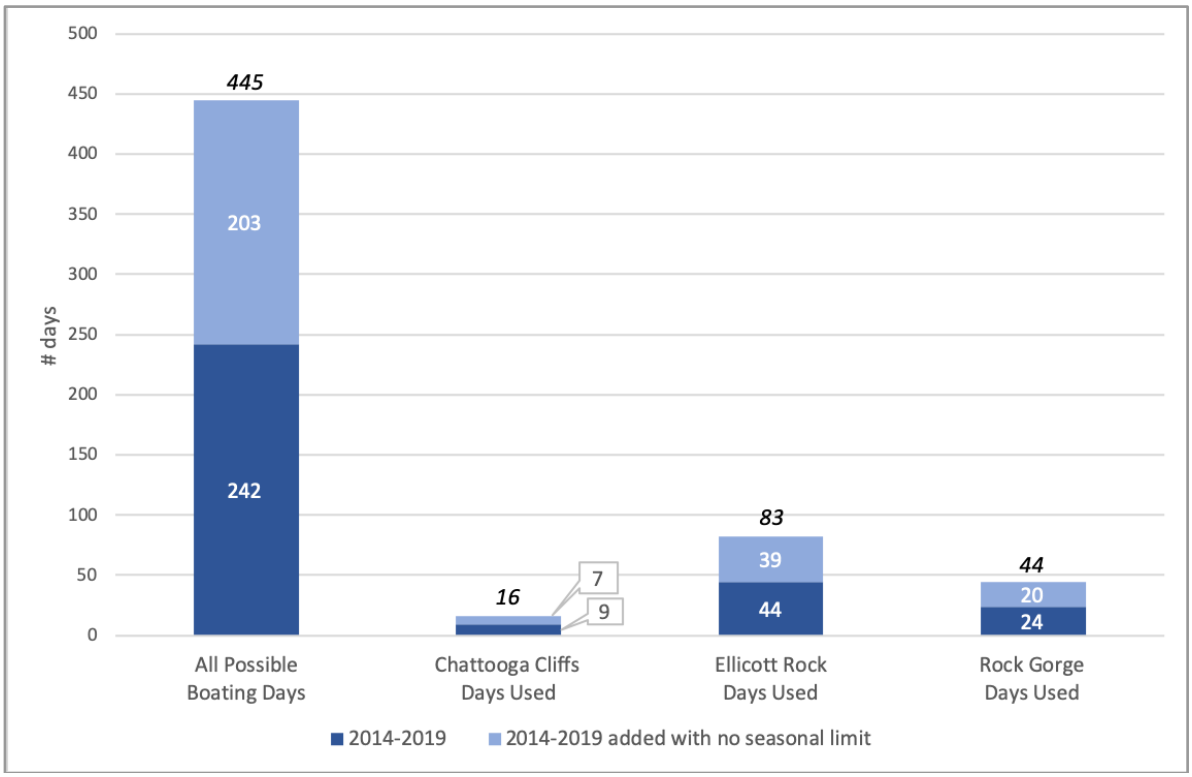
Currently, boaters are only present on any stretch of the Upper Chattooga River for 9 days per year. This number is predicted to rise to 17 days. For the vast majority of the year (more than 340 days), no boating will occur on the Upper Chattooga, and the days used will have few other visitors present (see Section 2.2 and 2.3, this report).

Table 2.4-2: Estimated change in actually used boating days with lift of direct seasonal limits, by section

	2014	2015	2016	2017	2018	2019	Annual
Chattooga Cliffs days used	1	0	1	1	5	1	2
Added days	1	1	0	1	3	1	1
Total used days	2	1	1	2	8	2	3
Ellicott Rock used	3	5	10	2	12	12	7
Added days	4	5	2	7	14	6	6
Total used days	7	10	12	9	26	18	14
Rock Gorge days used	0	7	4	1	7	5	4
Added days	2	3	1	4	8	3	3
Total used days	2	10	5	5	15	8	7

Figure 2.4-1 visually demonstrates changes in the total number of days used by boater groups for the 6-year span of 2014-2019. Across the 6 years of boating permit data, 242 total days were possible given current boating limits. This number increases to 445 total possible days, if seasonal limits were lifted. Despite opening up so many more days, the predicted number of days that would have been used by boaters remains quite low. Across 6 years (more than 2,000 days), Chattooga Cliffs river reach was used by boaters on only 9 days. Without limits, it is estimated that this number would increase to 16. For Ellicott Rock, the most heavily used reach, boaters only used the stretch 44 days in 6 years. This number is estimated to increase to 83 days in 6 years without limits. For Rock Gorge, 24 days out of 6 years were used. This number is estimated to increase to 44 days in 6 years without direct limits on boating.

Figure 2.4-1: Total days used by reach (2014-2019) compared to all possible boating days and predicted additional days with no seasonal limits



Change in Total Groups

After removing boating limits, the estimated total boater groups per year remains quite low across all sections. For Chattooga Cliffs, we predict 3 boater groups would use the stretch each year, only one more group/year than current. For Ellicott Rock 20 boater groups would use the reach per year, 10 more than the current level. For Rock Gorge 8 boater groups would use the reach per year, 3 more than the current level. These numbers are thousands of times less than then number of groups from other visitor types.

Table 2.4-1: Estimated total groups (TG) per year with no seasonal boating limit

River Reach	TG All Users, Annual	TG Boaters, Annual	TG Boaters, Annual, no limit
Chattooga Cliffs	1,700	2	3
Ellicott Rock	11,000	10	20
Rock Gorge	5,800	5	8
Nicholson Fields	2,900	0	0
All reaches	21,400	16	30

2.4.4 Discussion

The average number of boater groups seen in all stretches of the Upper Chattooga, even at the optimal boating levels, fall well within what fishermen and wilderness visitors consider Acceptable Encounter Levels in case studies such as those on waterways like the Boundary Waters Canoe Areas (Stankey 1973), Bois Brule River (Vaske 1977), New River Gorge (Roggenbuck and Bange 1983), Deshutes River (Whittaker and Shelby 1988), and Gulkana River (Whittaker et al. 2000)(note: all citations from Louis Berger Group 2007). After removing direct limits on boating, the number of boaters present per day will remain well below the Acceptable Encounter Level in each of the case studies the Louis Berger Group (2007) presents.

The influence of boaters on congestion is imperceptible in comparison to use by other visitor types. Across each river reach, there are thousands of times more non-boaters than there are boaters. The number of boater groups encountered by other users drops much lower when considering the characteristics of the Upper Chattooga that produce natural separation of boaters and anglers. The Louis Berger Group predicted this naturally occurring regulation in 2007, citing a wealth of literature in the 20 years leading up to their literature review (page 28-40). We demonstrate this natural regulation for the Upper Chattooga in the above sections of this report.

3.0 Conclusions: Adaptive Management is Merited

In terms of conflict, the Monitoring Report says it best: “Conflicts are deemed a non-issue for visitors to the Upper Chattooga Backcountry” (2-42). Moreover, “anglers did not report any negative encounters with other groups” (5-1), and “boaters did not report any negative interactions with other user groups” (4-6). This is supported by our demonstration of separate river use niches for these two groups and 20 years of case studies (cited by Louis Berger Group 2007). Monitoring Report data and our analysis show an absence of the predicted conflict between boaters and anglers/hikers/campers in the Upper Chattooga WSR. The current relationship is self-stabilizing and requires no regulation.

In terms of congestion, the concern cannot focus on boater groups, who demonstrate no perceptible contribution to congestion. Firstly, use by non-boater groups is one thousand times more than use by boater groups. Secondly, boaters do not use congested stretches when congested. The one stretch commonly above capacity is Ellicott Rock (Berger 2019, 2-1). At conditions when used by boaters, they report “it is very uncommon to see other people in or next to this reach” (4-6). On average, 30 non-boater groups use the Ellicott Rock reach at any *one point in time*, compared to 10 boater groups over the course of a *full year.* Easing boating limits will therefore not cause congestion over the Forest Service capacity limits.

One concern from Berger’s (2019) report is that the “average use levels are above capacities at the Ellicott Rock backcountry reach” (5-1), where anglers are in the majority at 35 percent, followed by hikers at 30 percent (2-32). If worry for this issue is eased by the low levels of conflict and minimal complaints for congestion in Berger’s (2019) study, the capacities could be reconsidered for Ellicott Rock.

Automatic self-regulation of boaters through their unique river use niche (high water, rain preferable), separates them from the more closely tied use niches of anglers, hikers, campers, and swimmers/waders. The Louis Berger Group predicted this in 2007, and we demonstrate it in our report. This self-regulation makes boater and non-boater conflict a non-issue, given the Monitoring Report’s assessment that, “for conflict to exist, encounters and competition for resources among recreation users must be present” (Berger 2019, 4-2). A large volume of studies provide cautionary tales for using unnecessary regulation in an otherwise self-regulated system and instead highlight the importance of focusing regulation through data-supported adaptation (Walker and Salt 2006; Meadows and Wright 2008; Sutherland et al. 2009). After conclusive monitoring by the Berger group (2019) and our supplementary analysis, removing direct seasonal and flow limits for boating groups will therefore prevent unforeseen negative impacts on the system without increasing conflict or congestion.

4.0 References

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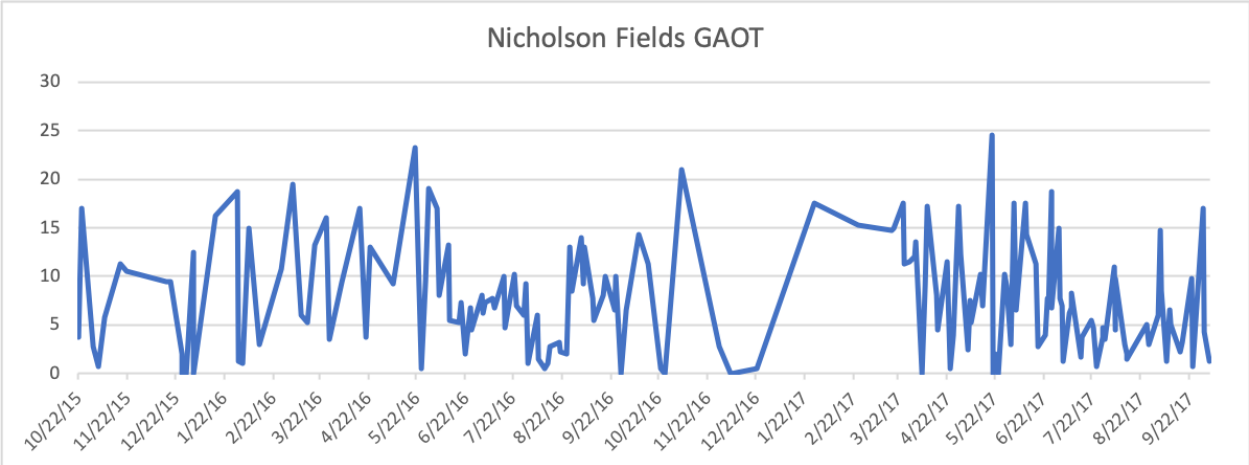
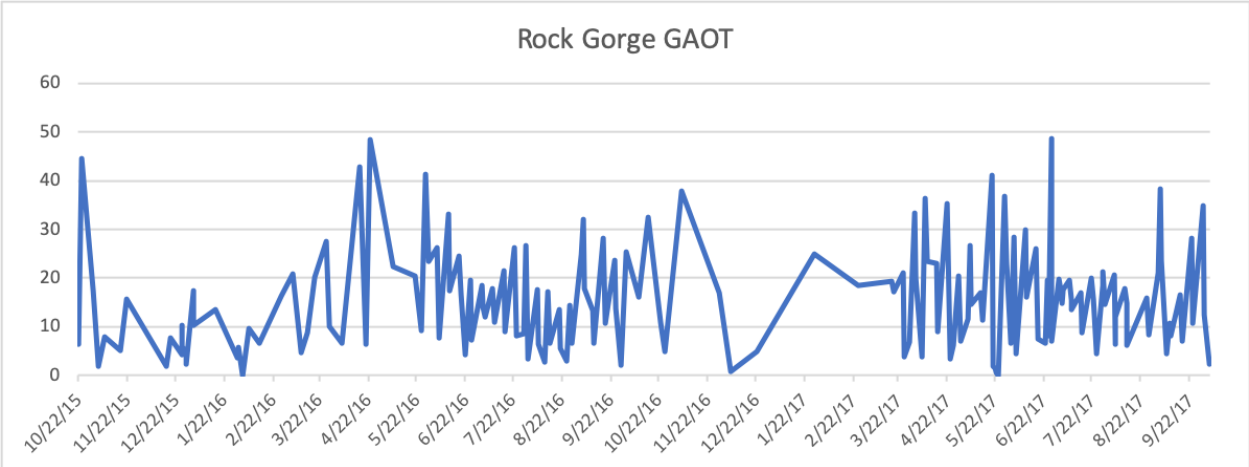
Appendix A: GAOT by reach, in presence or absence of delayed harvest restrictions

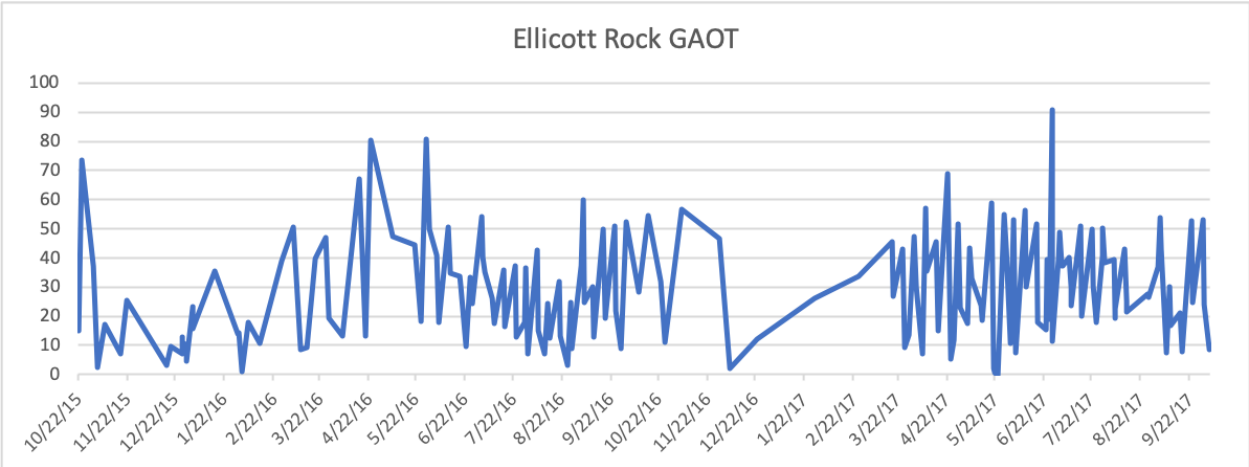
Reach	With Delayed Harvest Restrictions	No Delayed Harvest Restrictions
Chattooga Cliffs	3.0	5.5
Ellicott Rock	25.6	30.9
Rock Gorge	14.1	16.0
Nicholson Fields	8.6	7.0
All reaches	*51.3*	*59.3*

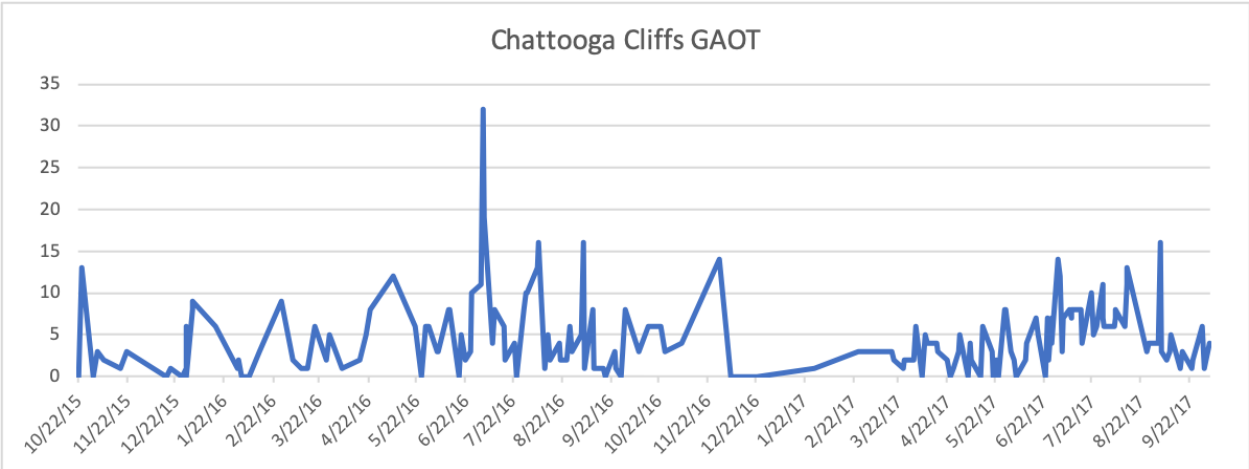
Considering the Appendix A table and the graphs in Appendix B, delayed harvest might have an effect on river use, but the day to day level of visitors present is largely subject to daily variation. Number of groups present is closely related to local conditions on a given day. Lifting seasonal limits on boating would then not increase congestion in part because use is primarily influenced by daily rainfall and river flow. Daily rainfall and river flow naturally isolate boaters from other users. There may still be an effect of delayed harvest, but that is outside our scope of analysis and less influential than daily fluctuations.

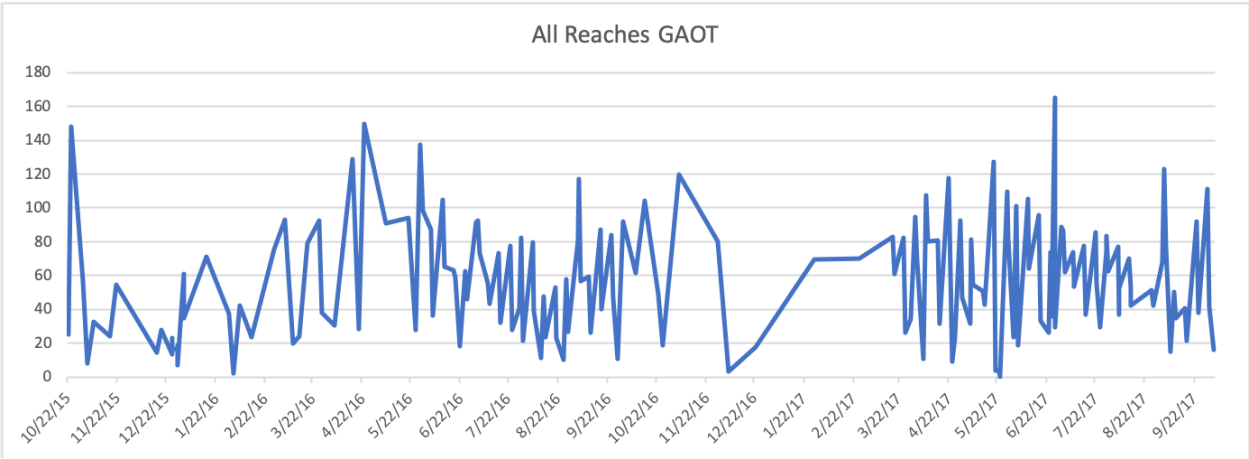
Appendix B: Daily variation vs. seasonal variation, seen through GAOT by date, by reach











Level of use is primarily a day-to-day fluctuation and not a seasonal trend. Level of use is closely tied to local conditions on a given day. Lifting seasonal limits on boating would then not increase congestion, since visitor presence is not about seasons but about the daily rainfall and river flow. Daily rainfall and river flow naturally isolate boaters from other users.

Appendix C: Average GAOT boaters only, by reach (when river flow >350 cfs and boating season 2014-2019)

River Reach	2014	2015	2016	2017	2018	2019	Average
Chattooga Cliffs	0.05	0	0.07	0.07	0.07	0.01	**0.05*
Ellicott Rock	0.16	0.29	0.43	0.13	0.3	0.17	**0.25*
Rock Gorge	0	0.26	0.14	0.13	0.12	0.06	**0.12*
Nicholson Fields	0	0	0	0	0	0	**0.0*
All reaches	*0.21*	*0.55*	*0.64*	*0.33*	*0.49*	*0.24*	**0.41*

**after rounding, all average GAOT values are <1*

A possible initial critique could be that we chose to use all days in a boating season to calculate the average GAOT for boaters only instead of those days that have both 350 cfs and fit within the boating season. We do not feel this is a critique that can be upheld, since the measurement is groups at one time and the goal of this portion of study is to estimate boater contribution to congestion. This critique must consider two factors: 1) if groups are not present because of too low of a flow, this still amounts to a "0" for number of groups present, and 2) boaters use the river under different conditions than other users, and focusing only on times when the river is high will produce numbers of boater groups present during times when other groups are not in high numbers. Still, for transparency sake and to produce further conversation, we contribute this table of how the GAOT would look if the only days selected were those days out of the year (40) when the river is above 350 cfs and it is between December and April. The average GAOT across all reaches is 0.41. An alternative approach would be to calculate the average GAOT for the entire year, even with the current direct limits in place. This would shift the average GAOT for boaters across all stretches from 0.09 to 0.04. Both systems of measurement produce small numbers compared to the average GAOT of 58 for non-boater groups. Note: The Total Groups (TG) is unaffected by this change, since total groups of boaters it is a directly measured amount. Total annual groups would remain 21,400 for non-boater groups and 16 for boater groups.