



Old Rag Visitor Use Monitoring Pilot Program

2022 Annual Report



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Shenandoah National Park

ON THE COVER: Park Ranger checks visitor's Old Rag Day Use tickets (NPS Photo)

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Introduction

Old Rag Mountain is a challenging yet popular hiking destination on the east side of the Blue Ridge in Shenandoah National Park. Old Rag trails are most easily accessed from the park boundary entry station and the Ridge Trail trailhead. The Ridge Trail includes a lengthy rock scramble to reach the Summit at an elevation of 3268'. A variety of rare and listed species have been located at or near the summit of Old Rag, including sensitive vegetation communities.

The majority of Old Rag Mountain is also within federally designated wilderness. The park is responsible for maintaining wilderness character in these designated areas as legislated in the 1964 Wilderness Act. Aspects of wilderness character include:

- Ecological systems that are substantially free from the effects of modern civilization
- Unhindered and free from intentional actions of modern human manipulation
- Lack of permanent improvements or the sights and sounds of modern human occupation; and
- The opportunity for solitude or a primitive and unconfined type of recreation.

Many years of intense visitor use at Old Rag Mountain has led to the Park Service completing several studies to better understand visitor use, expectations, and impacts. The most recent study was completed in 2019 to help the park better understand current visitor use patterns and experiences on Old Rag. The final report for this study is publicly available at:

<https://parkplanning.nps.gov/document.cfm?parkID=274&projectID=103975&documentID=114821>.

Recommendations from the 2019 study were used in conjunction with input from knowledgeable park staff to design a pilot ticketing and use monitoring program. In 2022, Shenandoah National Park began implementation of this pilot program in an effort to provide a highly valued and safe visitor experience on Old Rag that also ensured adequate resource protection, including wilderness character.

The pilot program implemented a day-use ticketing system from March 1 to November 30 to use the Old Rag Mountain area and trails (Figure 1). A daily limit of 800 tickets were made available to the public through Recreation.gov. The park also implemented visitor use monitoring efforts using trail counters, cameras, and field observers. This report provides a data summary of the program's first season of implementation.

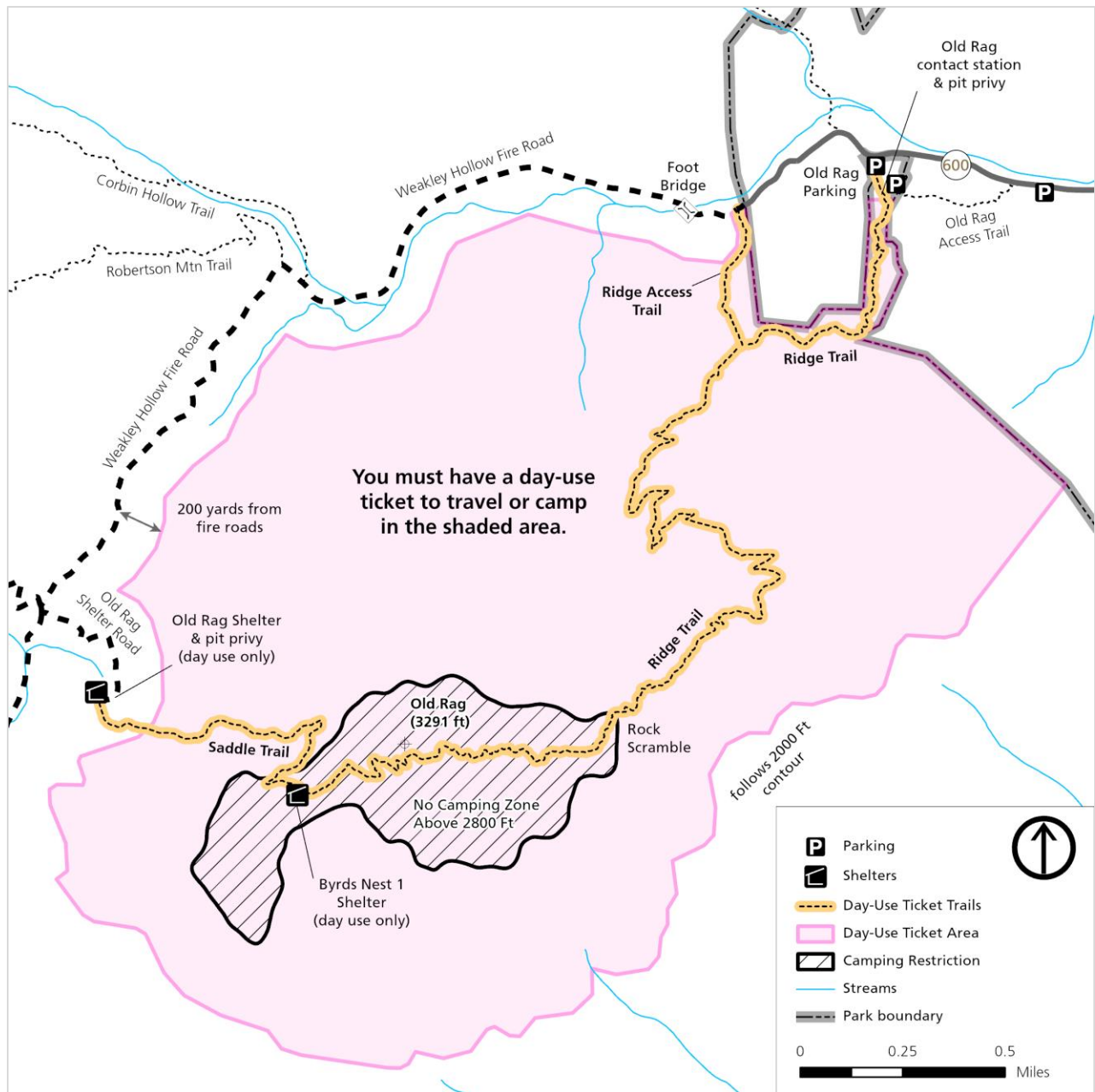


Figure 1. Map of Old Rag day-use ticketing area and trails.

Data Collection Methods Overview

A variety of data collection methods were used to describe use patterns on Old Rag. Ticket sales data from www.recreation.gov were used to summarize the demand for Old Rag hikes.

Trail counters record the number of people passing a particular location on a trail each hour. Infrared trail counters (picture top right) were installed on Old Rag trails and nearby trails in Fall 2021. Counters were calibrated using periodic one-hour field observations. These data help identify prevalent visitor use patterns.

Remote cameras (picture bottom right) were installed at the three Old Rag parking lots in the spring of 2022. These cameras photographed the number of cars in the lots each hour to help park staff understand capacity and congestion patterns.

Field observations were used to document the number of people at the Summit and at a narrow section called the Chute along the rock scramble on the Ridge Trail. Monitoring methods used similar methods as the 2019 Old Rag Visitor Use Study. Observations began in March 2022 and continued through November.

Throughout this report data are often summarized by three seasons; spring (Mar – May), summer (June – Aug), and fall (Sept– Nov).



Results and Discussion

Old Rag Trails Use

Tickets Sold

The ticketing season began on March 1 and ended November 30, lasting a total of 275 days. A total of 95,444 tickets were sold. There were 20 days in which all 800 Old Rag Day Use tickets were sold prior to the day of use (7.2%). All the sold-out days were in the spring and fall, and 19 of these days were on weekends/holidays (Table 1). There were no sold-out days in the summer season, but six days in the summer were close to selling out (790+ tickets sold).

Table 1. Sold out days during the 2022 season (Mar – Nov). 800 tickets were available each day.

Season	Weekday	Weekend/Holiday	Total
Spring	0	6	6
Summer	0	0	0
Fall	1	13	14

As expected, there was a strong correlation between number of tickets sold and number of hikers recorded on Old Rag trails (Figure 2). Many days showed fewer hikers than tickets sold. This seems to have occurred mostly on days of inclement weather which resulted in “unused tickets”. Some ticket purchasers also appeared to have bought tickets for multiple days, typically consecutive, but only hiked on one of those days, leaving the other tickets unused. Days where hikers outnumbered tickets sold possibly indicates that some hikers did not comply with the new ticket requirement.

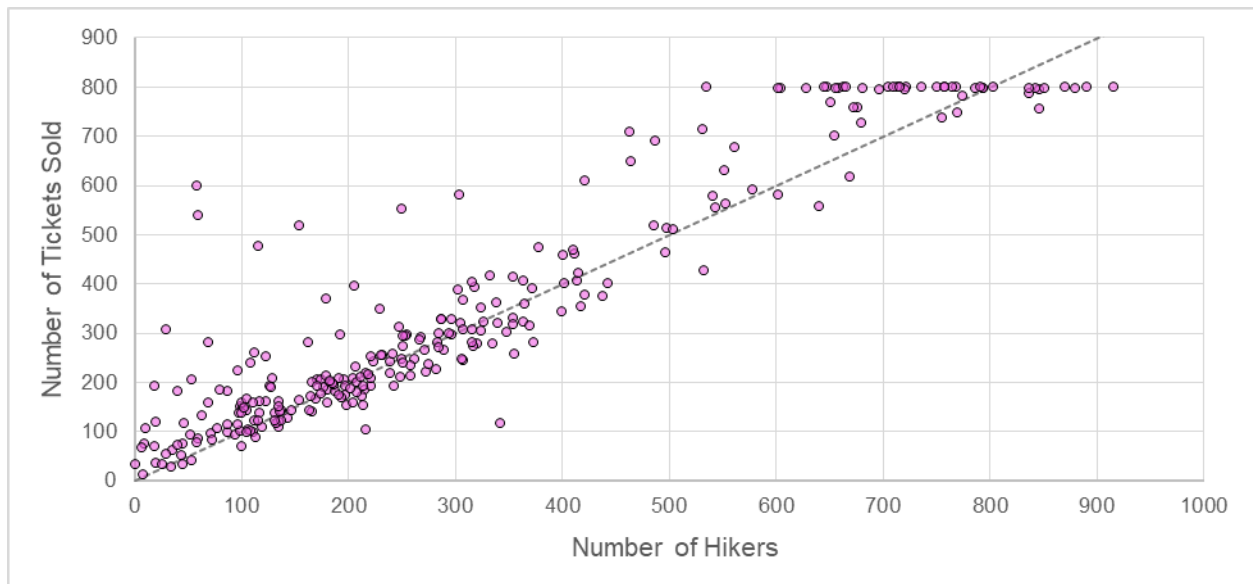
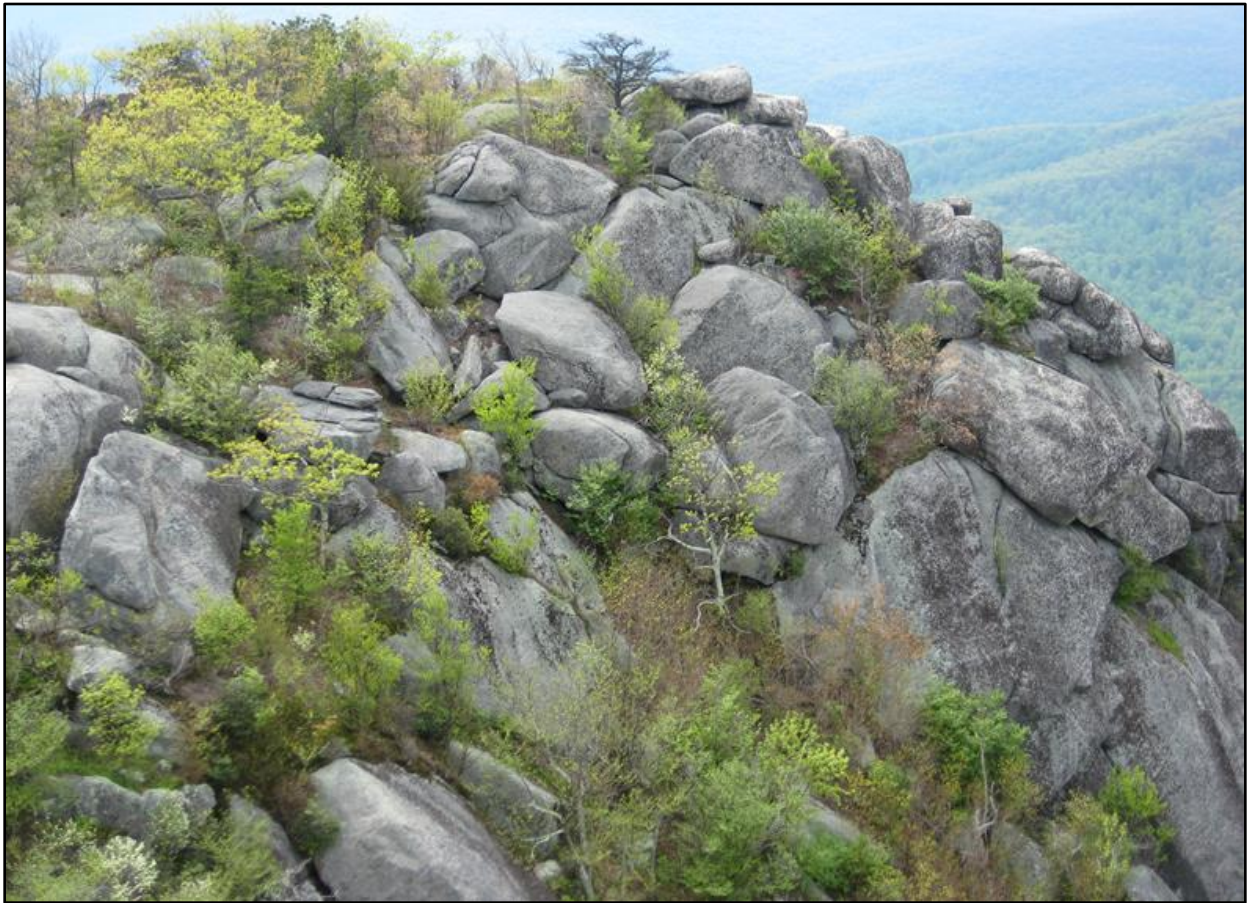


Figure 2. Daily tickets sold compared with daily number of hikers recorded by trail counters on Old Rag. The dotted line indicates a 1:1 ratio.

Trail Use by Season

Figure 3 shows the number of Old Rag hikers recorded each day and the number of daily tickets sold throughout the nine months of data collection. Weekend/holiday ticket sales and use well exceeded weekday use and sales consistently for all three seasons. Weekend and holiday days frequently had more than double the use seen on weekdays. Fall was the busiest season, averaging 360 people per day, followed by summer (295 hikers/day) and spring (288 hikers/day).



The West Summit of Old Rag viewed from the Main Summit (NPS/Wendy Cass)

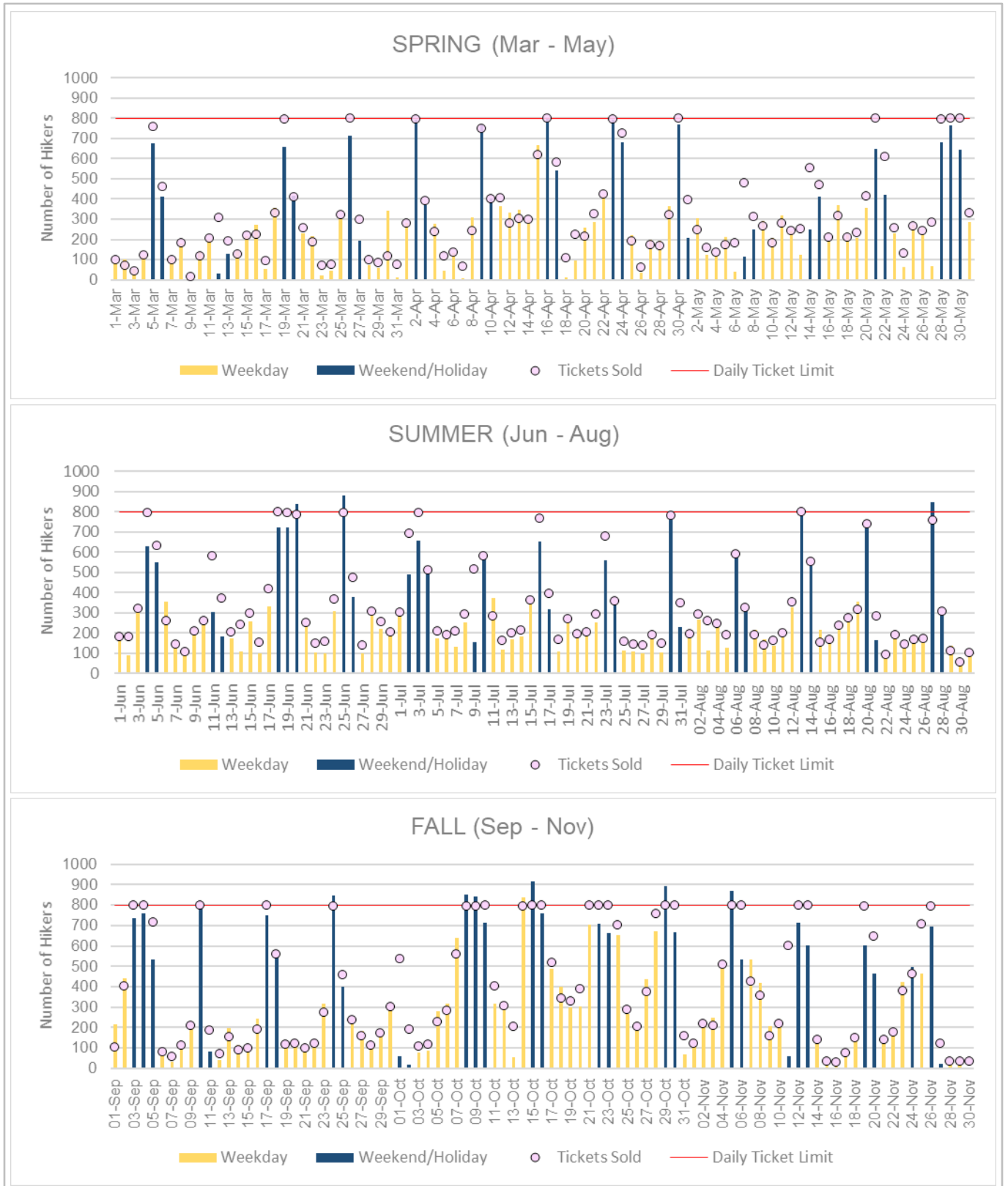


Figure 3. Daily tickets sold and number of hikers on Old Rag Mountain by season in 2022. The blue bars represent weekends and holidays while yellow bars depict weekdays. Dots represent daily tickets sold. The horizontal red line represents the daily 800 ticket limit.

October was the busiest month, averaging 468 hikers/day. March saw the least amount of use, averaging 211 hikers/day (Figure 4). Both of these averages were extremes when compared to the other months. October had 22% more daily hikers on average than April, the second busiest month, while March had 24% fewer daily hikers on average than August, the month with the second lowest hikers per day.

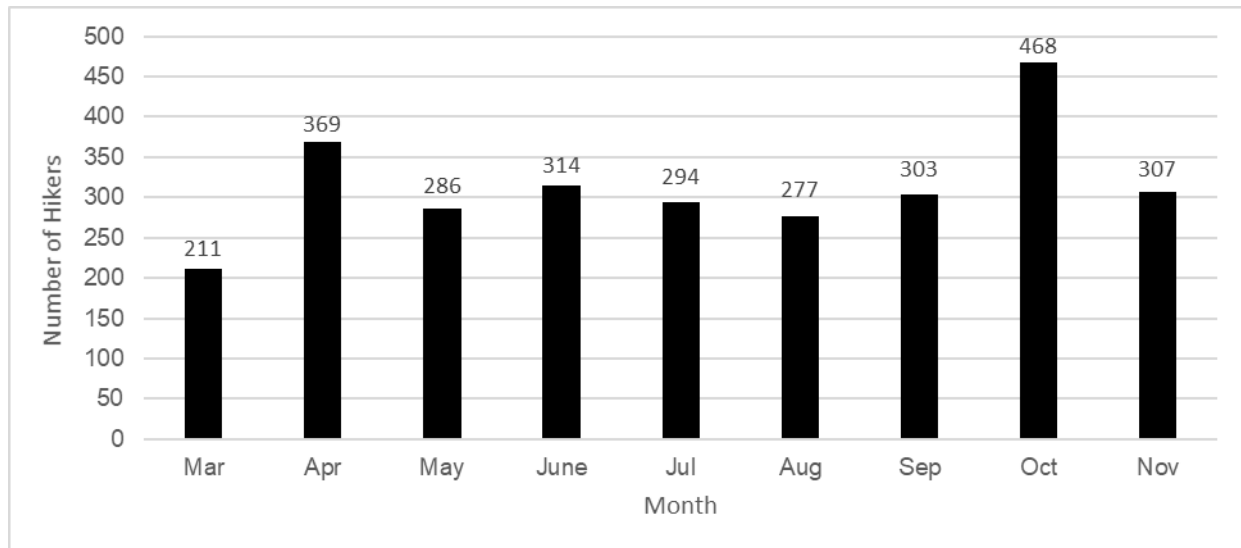


Figure 4. Average daily number of hikers by month on Old Rag Mountain in 2022.

Trail Use by Day of Week

Use was almost split equally between weekdays and weekends for all three seasons (Table 2). This indicates how daily use is more concentrated into the two weekend days than the five weekdays.

Table 2. Use by season and day of the week. Data do not take into account holidays.

	SPRING		SUMMER		FALL	
	Avg # Hikers	%	Avg # Hikers	%	Avg # Hikers	%
Monday	238	11.8%	260	12.5%	292	11.6%
Tuesday	166	8.2%	180	8.7%	187	7.4%
Wednesday	201	9.9%	162	7.8%	180	7.1%
Thursday	151	7.5%	172	8.3%	223	8.8%
Friday	276	13.7%	263	12.7%	425	16.8%
TOTAL WEEKDAYS	1032	51.0%	1038	50.0%	1307	51.8%
Saturday	593	29.3%	625	30.1%	726	28.8%
Sunday	399	19.7%	411	19.8%	489	19.4%
TOTAL WEEKENDS	992	49.0%	1036	50.0%	1215	48.2%
WEEKLY TOTALS	2024	100.0%	2074	100.0%	2522	100.0%

Weekly use patterns were similar across all three seasons, with use volumes the lowest mid-week and then increasing as days got closer to the weekend (Figure 5). Saturdays showed the highest use, accounting for approximately 30% of total use.

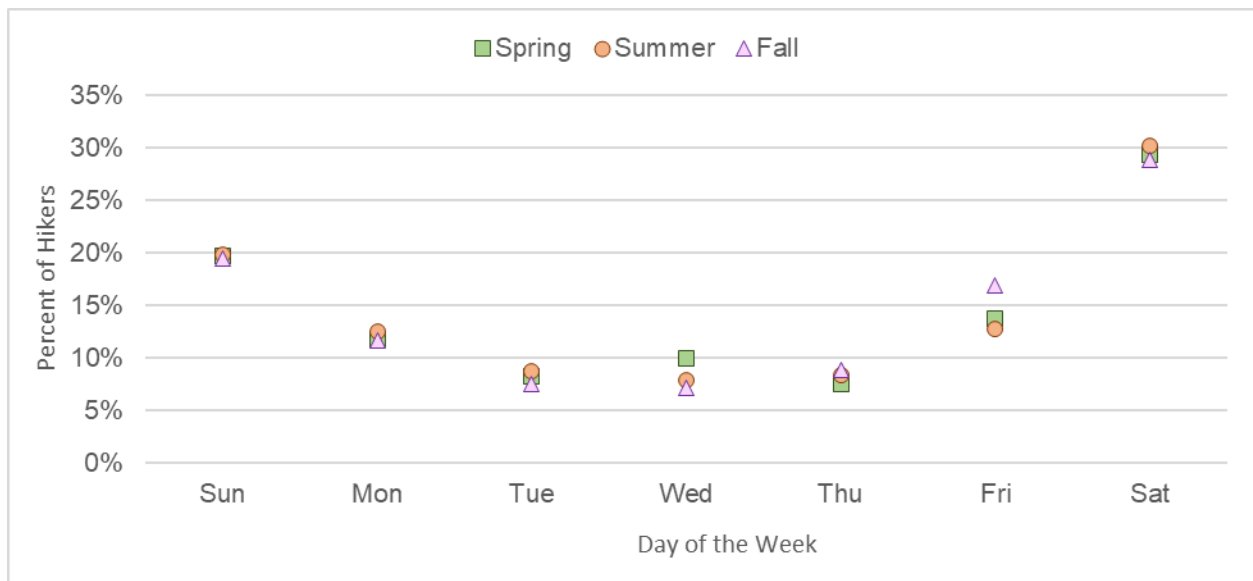


Figure 5. Percent of total hikers on Old Rag Mountain that took place on each day of the week by season.

Trail Use by Time of Day

Temporal daily pattern of trail use on Old Rag was consistent across all three seasons (Figure 6). There was some dispersal of peak use on both the Saddle and Ridge trails during the summer possibly because of the longer periods of daylight during June, July, and August.

Peak use on the Ridge Trail occurred approximately between 0900-1000 while peak use on the Saddle Trail was observed occurring between 1400-1500. This pattern shows that most visitors complete their hike in a clockwise circuit route, beginning on the Ridge Trail in the morning and reaching the Saddle Trail in the afternoon.

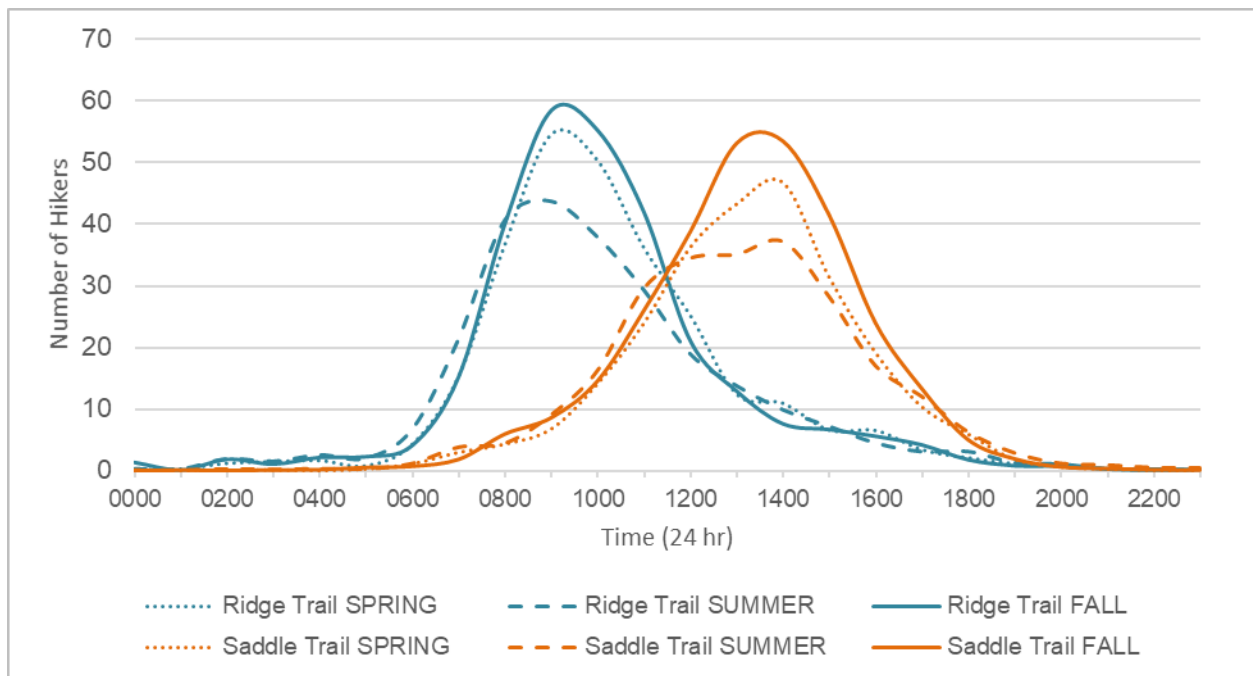


Figure 6. Average overall use by time of day for each season.

The fall season had the highest peak use for both trails. Figure 7 shows the difference between weekday and weekend/holiday use volumes during the fall months. Average use of the Ridge Trail on weekends/holidays surpassed 100 people between the hours of 0900 and 1000.

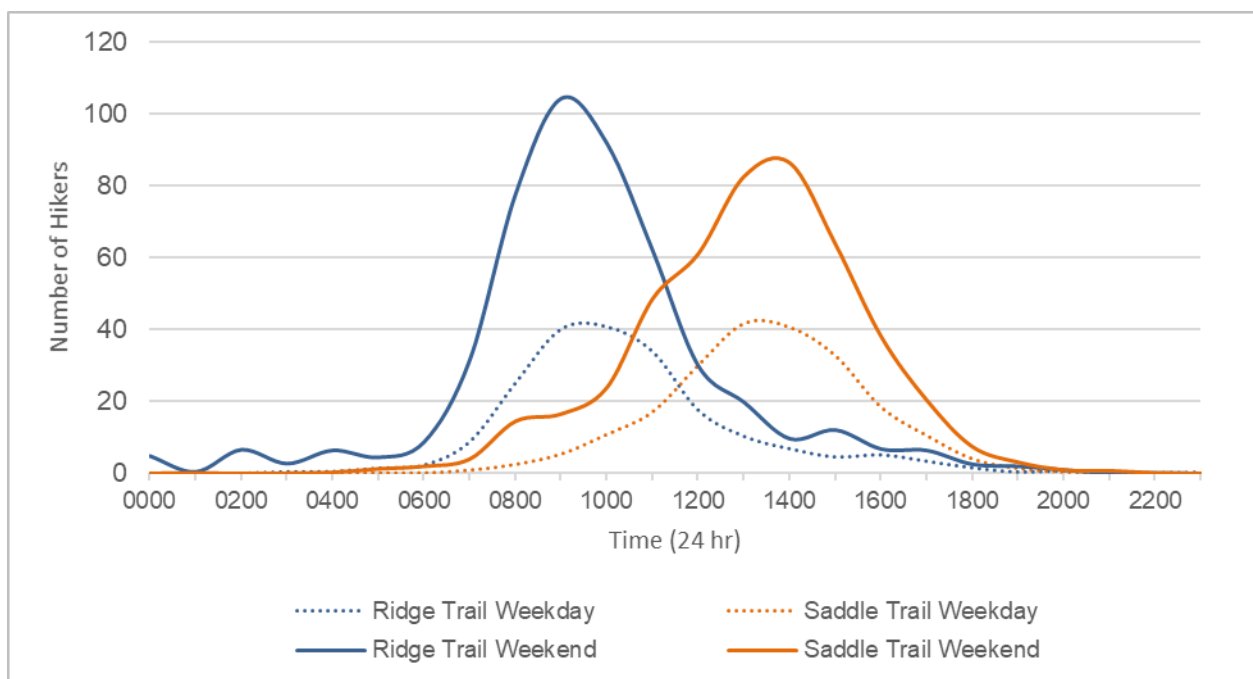


Figure 7. Average number of hikers by time of day during the fall season (Sep – Nov), the busiest season. Weekdays and weekends/holidays are shown.

Hikers using Berry Hollow Trail to access Old Rag was minimal and is not shown in the above figures. Use of Berry Hollow Trail was consistent for all three seasons, with a maximum hourly average of 2.9 hikers in Spring (0900-1000), 3.0 hikers in summer (1100-1200), and 3.3 hikers in fall (0900-1000, 1300-1400, and 1400-1500). A summary of Berry Hollow Trail is available in Figure 13.



Hikers waiting to proceed through the Chute on the Ridge Trail. (NPS Photo)

People at One Time (PAOT) Counts

Field staff collected people at one time (PAOT) data for two areas of the trail that are known to experience high concentrations of hikers, the Chute and the Summit. Monitoring efforts are summarized in Table 3.

Table 3. People at one time monitoring efforts for the 2022 ticketing season where one or both sample areas were monitored.

Season	WEEKDAY			WEEKEND/HOLIDAY			Total Days Sampled
	Days Sampled	Total Possible Days	% of Total Days Sampled	Days Sampled	Total Possible Days	% of Total Days Sampled	
Spring	8	65	12.3%	7	27	25.9%	15
Summer	16	64	25.0%	8	28	28.6%	24
Fall	19	61	31.1%	10	30	33.3%	29
Total	43	190	22.6%	25	85	29.4%	68

Chute

The Chute is a narrow section of the rock scramble along the Ridge Trail that requires visitors to travel single file. The 2019 Old Rag Visitor Use Study identified that 49 people at one time in the Chute “might be an appropriate crowding-related threshold for monitoring and managing use on the Old Rag Mountain Trail.” People at one time monitoring was conducted using methods similar to those used in the 2019 visitor use study. Two observers, one stationed at the bottom of the Chute and one at the top, would record the number of people departing and arriving during ten-minute intervals.

In 2022, the identified threshold of 49 people at one time was observed to be reached or surpassed three times during the monitoring season. All these exceedances occurred on a single day in the fall; however, monitors regularly reported visitors voicing frustration about the line and wait time when approximately 20 or more people were observed in the Chute at one time.

Figure 8 shows people at one time counts for each season by time of day. The highest number of people were typically observed between 1100 and 1300; however, during the summer season, 0900 to 1100 hours averaged the greatest number of people. One assumption may be that people began their hike earlier in the summer months due to earlier sunrise times and anticipated hotter afternoon temperatures.

The three high outliers (99, 78, 67) shown in the fall season between 1100 and 1300 hours were due, in part, to a visitor becoming ill in the Chute, causing a total stop in hiker movement for approximately two minutes. Short temporary holdups, including visitor illness/injury, periods of rest, and hikers traveling down the Chute opposite the direction of most hikers, were observed to quickly increase the number of people in the Chute.

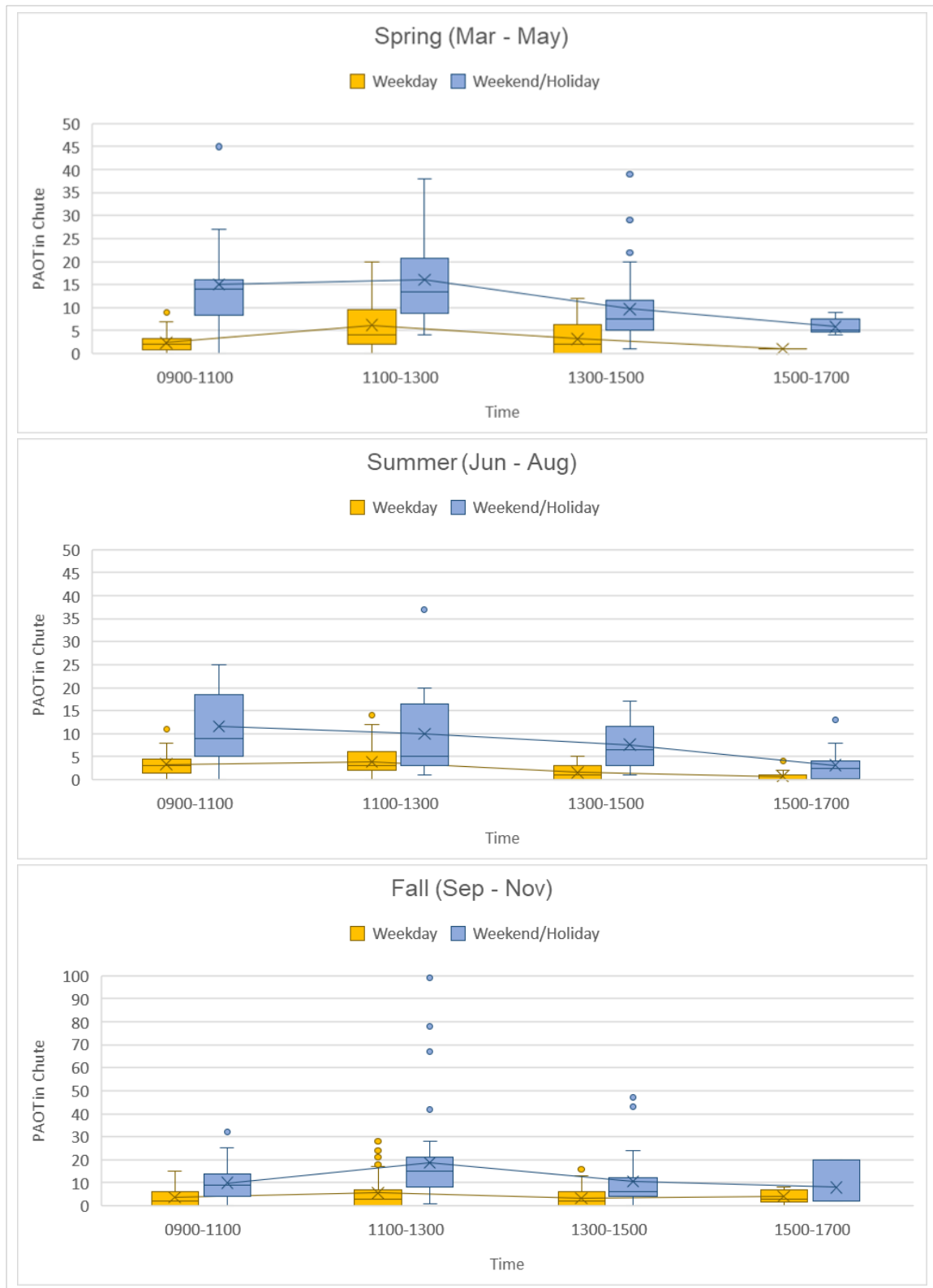


Figure 8. People at one time in the Chute. Note the varied y-axis scales. Each colored box shows the range of values that include 50% of all values. The middle line in each box represents the median. The “whisker” lines at the top and bottom of each box represent the upper and lower quartiles (25%). Dots outside of the box and whisker lines are outliers. The line connecting the boxes passes through an “X” which represents the mean value for that time period.

Summit

Viewscape

The Summit is the primary destination for most hikers of the Old Rag Mountain loop trail system. It is spread out into several vista areas separated by scattered boulders and vegetation. One of these vistas was referred to as the “viewscape” and was examined in the 2019 visitor use study for people’s perceptions of crowding (Figure 9). The study’s findings suggest that “20 PAOT in the Summit viewscape may be an appropriate crowding-related threshold for monitoring and managing visitor use on the Old Rag Mountain Trail.”



Figure 9. The Old Rag Summit viewscape. Photos were taken from the same spot every ten minutes to capture how many people at one time were present within the viewscape limits.

People at one time counts for the Summit viewscape were conducted using photograph methods like those used in the 2019 study (Figure 10). The number of people in the Summit viewscape surpassed the suggested threshold of 20 on five weekend days and two weekdays during the 2022 season. People at one time in the viewscape was more temporally dispersed during the summer season, again possibly because of earlier sunrise and later sunset times.

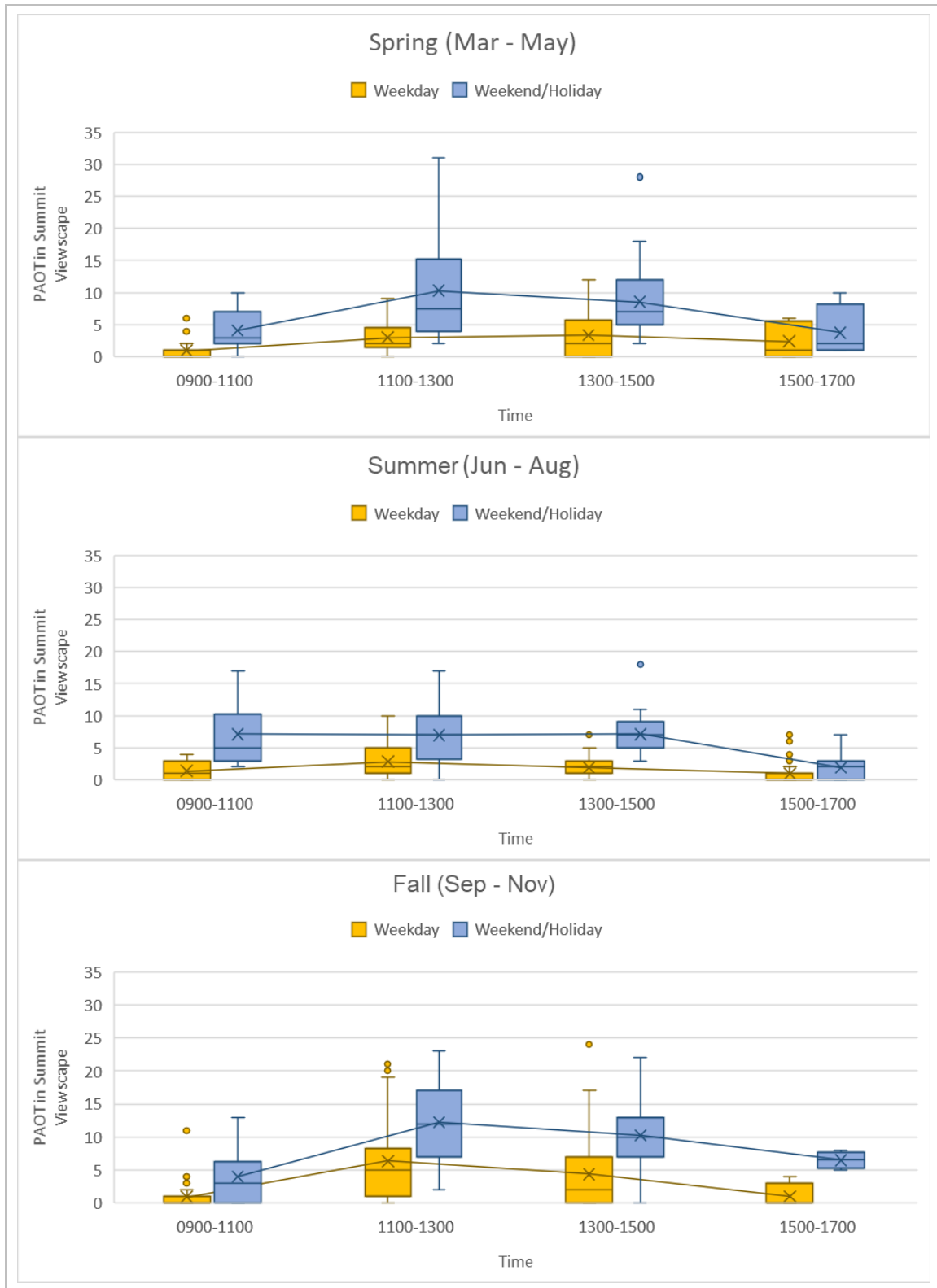


Figure 10. PAOT in the Summit viewscape by season. Each colored box shows the range of values that include 50% of all values. The middle line in each box represents the median. The “whisker” lines at the top and bottom of each box represent the upper and lower quartiles (25%). Dots outside of the box and whisker lines are outliers. The line connecting the boxes passes through an “X” which represents the mean value for that time period.

Entire Summit

People at one time counts were also collected for the entire Summit using two observers. One observer counted the number of people already present at the Summit by doing a counterclockwise sweep while the other observer subtracts any new arrivals that likely crossed paths with the first observer. Once a baseline number was calculated, one observer then counted the number of people who departed and arrived at the summit in ten-minute intervals to estimate the number of people at one time.

In the 2022 season the maximum number of people estimated on the Summit was 80 people on a weekend (4/23, 1100-1300 hrs) and 57 on a weekday (10/7, 1100-1300 hrs) (Figure 11). The 2019 study did not identify a people at one time threshold for the entire summit of Old Rag; however, repeated observations from NPS field observers provided an indication that approximately 50 or more people created similarly crowded conditions as defined in the 2019 study on this wilderness summit.

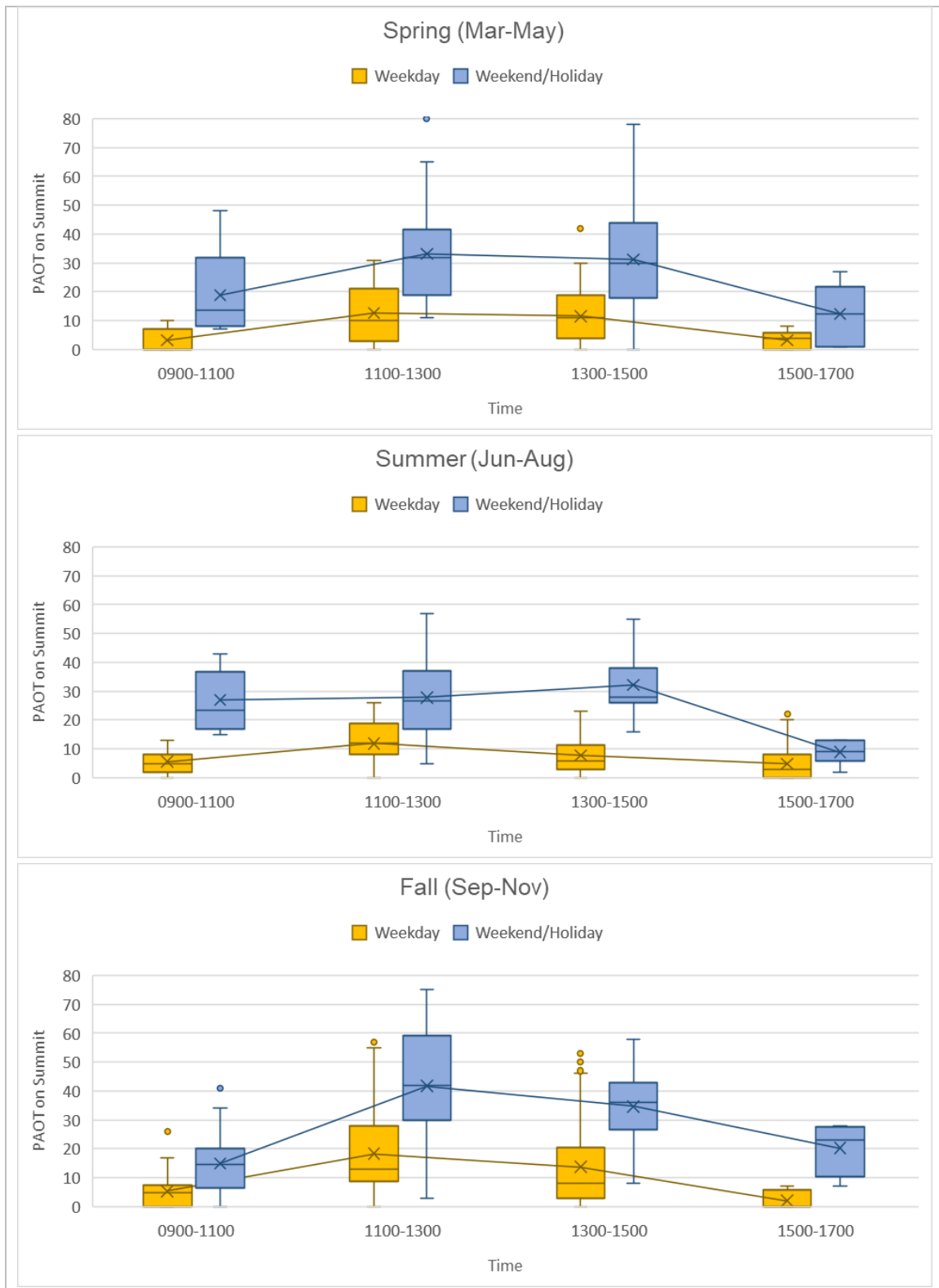


Figure 11. People at one time on the whole Old Rag Summit by season. Each colored box shows the range of values that include 50% of all values. The middle line in each box represents the median. The “whisker” lines at the top and bottom of each box represent the upper and lower quartiles (25%). Dots outside of the box and whisker lines are outliers. The line connecting the boxes passes through an “X” which represents the mean value for that time period.

Old Rag Parking

There are three parking lots used to access the Old Rag area. The estimated capacity of the three lots is 92 vehicles in the main lot (Lot #1), 50 vehicles in the adjacent lot (Lot #2), and 150 vehicles in the overflow lot (Lot #3). Hourly images and physical counts were used to monitor daily use. Due to camera issues, data were collected for 243 of the 275 days during the season.

Figure 12 shows the total number of vehicles in the Old Rag parking lots. The red line indicates the point at which Lots #1 and #2 are full and the overflow lot (Lot #3) must be opened. During the 2022 season the overflow lot was needed on 47 days (n=243). 41 of these days (87%) were on a weekend or holiday. The remaining six days occurred on Fridays.

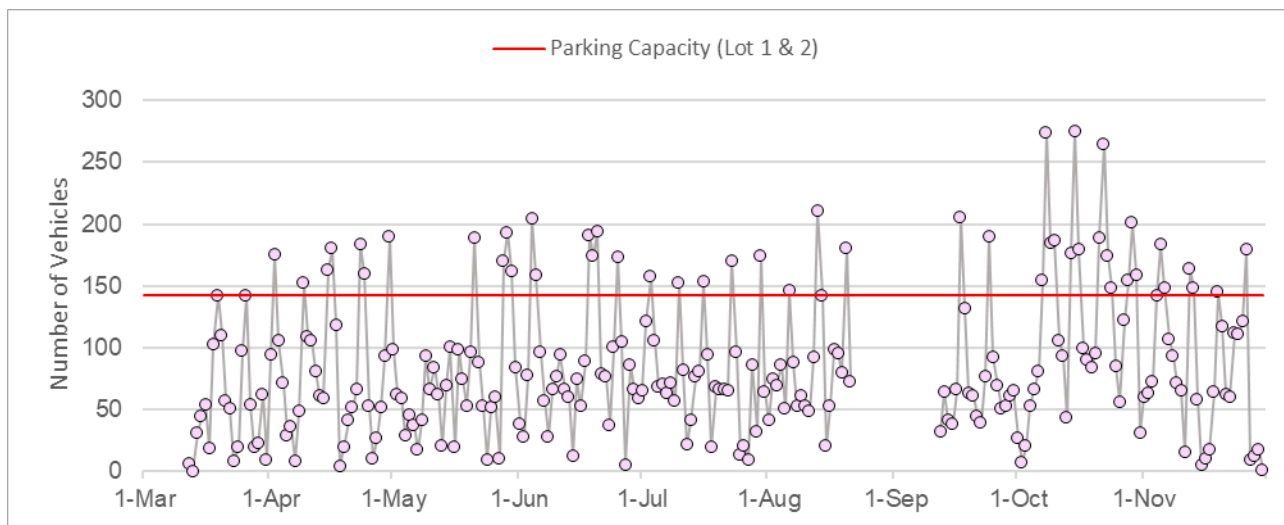


Figure 12. Daily vehicle maximum counts.

Data on the daily number of hikers and number of cars were used to calculate an estimate of approximately four hikers per vehicle for weekend/holiday days and weekdays, with greater variability on weekdays (Figure 13).

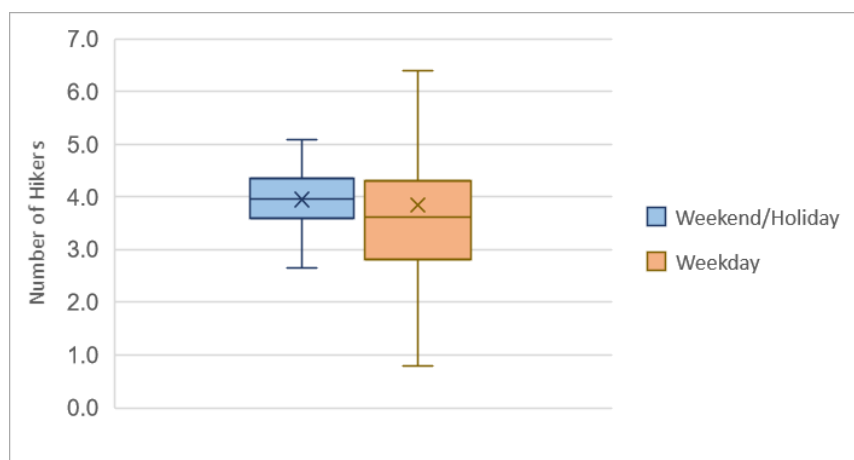


Figure 13. Estimated number of hikers per vehicle during the 2022 Old Rag ticketing season.

Other Trails Monitored

Trail counters were installed on seven other trails outside of the Old Rag Day Use area. Four of these trails (Berry Hollow, Nicholson Hollow, Robertson Mountain, and Whiteoak Canyon) are adjacent to the Old Rag area while the other three trails (Buck Hollow, Hazel River, Little Devil's Stairs) are still on the east side of the park but to the north of Old Rag Mountain. This data will help park managers better understand current trail use intensity and how the pilot ticketing program on Old Rag was impacting the use of these trails.

Average daily use on weekends and holidays was greater than weekday use for all four adjacent trails (Figure 14) as well as the three other trails (Figure 15) in every month monitored. All trails except Whiteoak Canyon typically had their highest use in the fall season. Whiteoak Canyon had its highest use during the summer season.



Trail counter mounted to tree in a protective metal box along Berry Hollow. (NPS Photo)



Figure 14. Daily averages and maximums by month for four trails adjacent to the Old Rag area. Note varied y-axis scales.

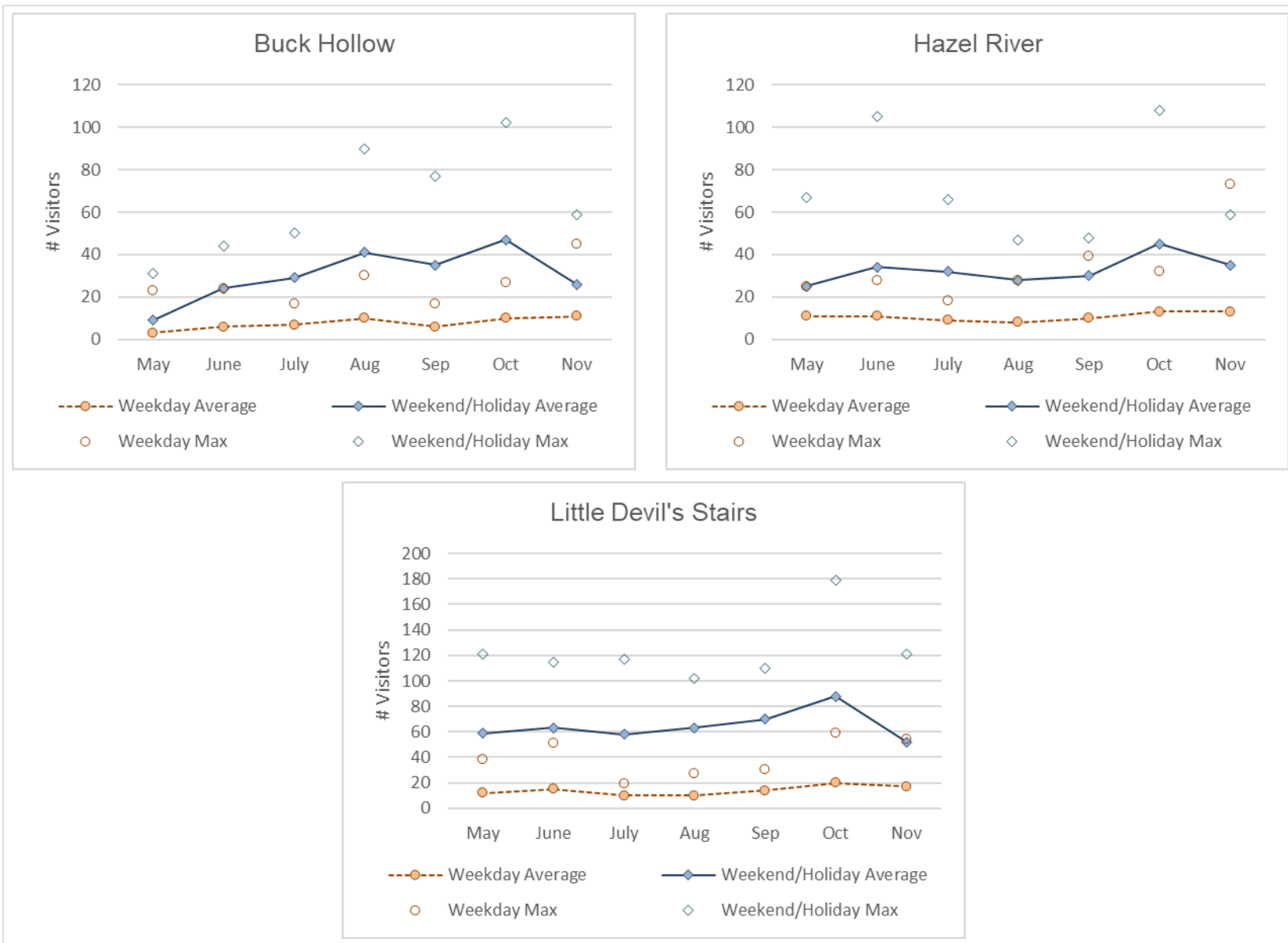


Figure 15. Daily averages and maximums by month for three trails north of the Old Rag area. Note varied y-axis scales.

Conclusion

The visitor use data collected provided some general key findings, including:

- Compared to the 2019 Visitor Use Study, it appears the ticketing system has reduced some crowding instances at the Chute and Summit. Crowding during busy weekend and holiday days still exists.
- Ticket sales often substantially differed from actual use with many days showing higher sales and lower use.
- Every month showed days of high or maximum use, mainly on weekends and holidays.
- Although weekend and holiday use on Old Rag well exceeded daily weekday use, overall weekday use represented slightly more than half of all Old Rag hikers.
- Peak use by day of week and time of day was consistent throughout the season, showing predictable concentrated use.
- There was always available parking in one of the three designated lots, even on the busiest days.

These and additional findings will be used to help inform future park decisions regarding Old Rag management. The park plans to continue data collection efforts in the coming year(s) to build a more robust dataset that can be used to inform adaptive management actions to further disperse use. Overall, a better understanding of visitor use patterns will help the park achieve its continued goal of improving the visitor experience, park resource conditions, and wilderness character.

National Park Service
U.S. Department of the Interior



Shenandoah National Park
