



Bartlett River Trail Use

Glacier Bay National Park 2012-2015

Natural Resource Report NPS/GLBA/NRR—2018/1597





ON THIS PAGE

Boardwalk on the Bartlett River Trail
(NPS)

ON THE COVER

Spring Lupine Bloom along the Bartlett River
(NPS/CRAIG MURDOCH)

Bartlett River Trail Use

Glacier Bay National Park 2012-2015

Natural Resource Report NPS/GLBA/NRR—2018/1597

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Abstract

The Bartlett River Trail (BRT) is currently one of 6 designated trails in Glacier Bay National Park. Visiting anglers and non-anglers use the BRT to access a productive recreational salmon fishery and for wildlife viewing or other recreational purposes.

It is widely recognized that accurate trail use information is critical in making informed planning and management decisions (Loomis 2000). Alaska state ferry service to Gustavus was initiated in 2011 and park managers anticipated potentially increased use of the BRT as a consequence of this service. Trail use monitoring on the BRT was established in 2012 to quantify baseline use patterns for future planning. No full summer season estimates of trail use exist prior to 2012.

We used an Ivan Technologies active infrared trail counter to quantify seasonal trail use during the 2012 through 2015 visitor use seasons (June-September). Management of this trail will benefit from periodic evaluations of use.

We estimate that 1,466 to 2,104 hikers used the BRT seasonally between June and September of 2012-2015. The mean daily number of hikers over this four month period during 2012-2015 ranged from 12-19. We documented an increase in hiker peak numbers ranging from 30-75 hikers on select days over the period of record. July is typically the busiest month followed by August. The majority of hikers traveled the trail between 9 am and 6 pm with distinctive peaks evident between 9 am and 11 am where groups as large as 50 hikers used the trail during 2013 through 2015. Given these established baseline results and the potential for future increasing use, we recommend that park staff periodically (*i.e.*, every 5-10 years) assess trail use and conduct trail condition surveys in order to quantify use levels and evaluate trail segment remediation needs.

Acknowledgments

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Introduction

The Bartlett River Trail (BRT) is one of six designated trails in Glacier Bay National Park. Hiking the BRT is a very popular activity for park visitors spending time in Bartlett Cove. The trail affords visitors the opportunity to experience remnant glacial features, old growth forest, rich estuary habitat, a bountiful salmon stream, and abundant wildlife.

From the trail head in Bartlett Cove, the BRT extends through the temperate hemlock and spruce rainforest along the terminal moraine left behind by the Glacier Bay ice sheet approximately 250 years ago. The trail enters designated wilderness approximately 0.7 miles from the trail head (Fig. 1). The trail emerges from the forest along the Bartlett River Estuary after a rather challenging 1.6 km (0.7 mi) hike through the forest. After the trail ends at the mouth of the Bartlett River, an unmaintained wildlife/social trail continues along the river for 1.6 km (1.0 mi).

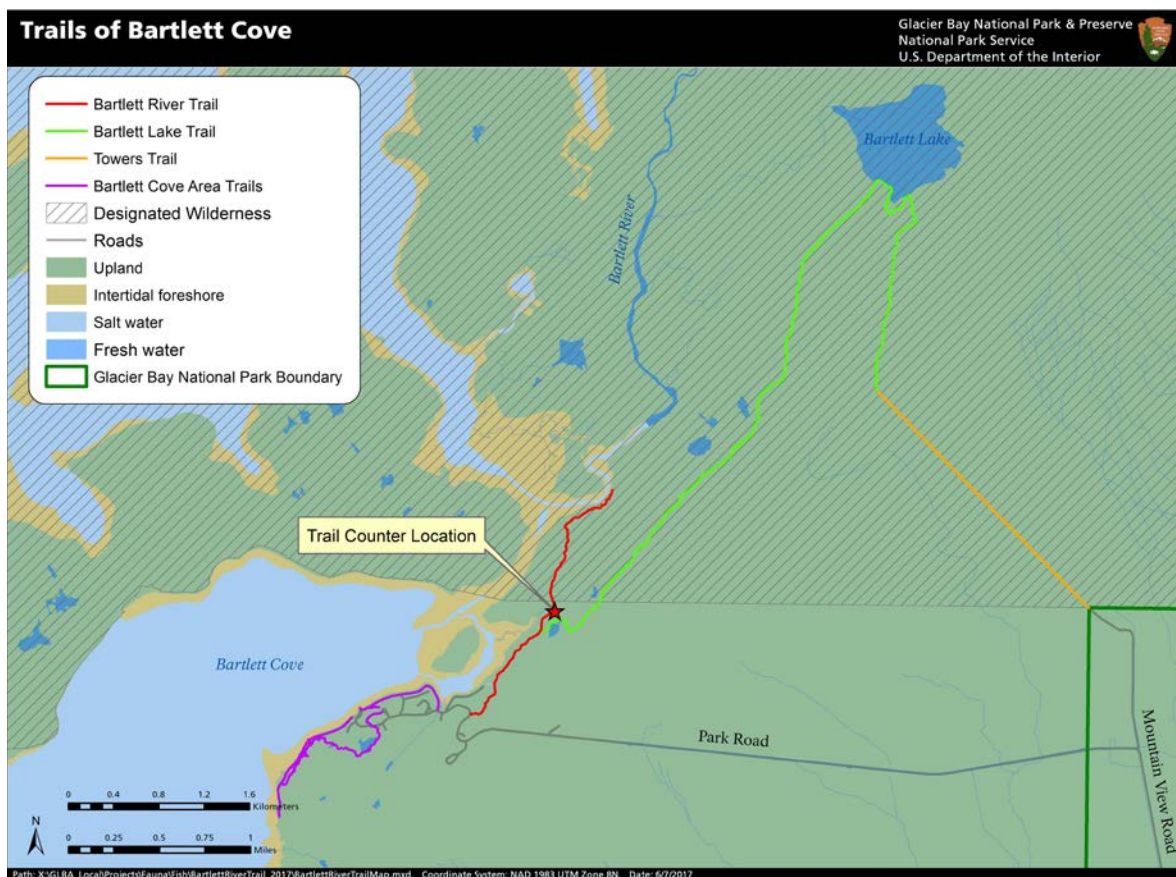


Figure 1. Bartlett River and Lake Trails map displaying the location of the trail counter site.

The trail, with the exception of braided sections, is largely a single track trail. Annual trail maintenance is light with pre-season removal of downed trees impinging on the trail. The trail surface is heavily rooted and sparsely studded with morainal boulders and cobbles within the forest. Trail conditions along short wet sections have been improved with planking, boardwalk or surfaced

logs. Trail conditions can vary widely with the amount of use and precipitation (Fig. 2). Conditions are typically most degraded during high precipitation periods in the fall when fishermen frequently use the trail in pursuit of coho salmon. The non-designated social trail along the river is mostly free of roots and rocks, but is often muddy.



Figure 2. Typical Bartlett River trail conditions.

Trail use monitoring was first initiated in 2012 when park fisheries biologists began reassessing presumed increased angling activity on the Bartlett River. Creel surveys were first conducted in 1996-98 and subsequent angler counts over the following decade indicated increased fishing effort. Additionally, managers were interested in quantifying baseline trail use levels due to Alaska State ferry service between Juneau and Gustavus established in 2011. Anecdotal information suggested ferry service increased visitors and recreational use in Bartlett Cove. Our Bartlett River summer season trail use monitoring was rolled out in 2012 and continued through 2015.

The objective of this report is to describe general patterns in BRT use over the June through September visitor use season in 2012 through 2015. We also provide recommendations to improve management of this important and well-used trail feature.

Methods

We selected an Ivan Technologies active infrared trail traffic counter because of its high degree of accuracy and ability to discriminate between actual events (i.e., hikers) and false counts. This model was the most accurate of more than a dozen trail counters tested by the US Forest Service (Gasvoda 1999). The trail counter consists of a receiver and transmitter unit (Fig. 3). The transmitter emits a beam of infrared light that must be interrupted to register a count. Count events are displayed on a six-digit LCD. Specially designed circuitry helps eliminate false counts from rain, snow, leaves or moving appendages.



Figure 3. Ivan Technologies, Inc. trail traffic counter receiver (left) and transmitter (right).

We positioned the transmitter and receiver so that the beam transects the trail at a vertical elevation of approximately 1.35 m (53 inches) in order to avoid imaging wolves and black bears transiting the trail (Fig. 4). When a hiker breaks the infrared beam between the transmitter and receiver (single event count) the date and time of the event are instantly associated with the event and recorded on a Hobo logger integrated into the trail counter. An Onset Hobo Shuttle was used to download the data on a biweekly basis during routine site visits.



Figure 4. Ivan Technologies infrared trail event counter receiver installation.

We deployed the trail counter seasonally between mid-May and mid-June and retrieved it in October or November over four consecutive seasons (2012-2015). We located this instrumentation approximately 100 m outside the wilderness boundary and beyond the Bartlett Lake Trail junction, (Fig. 1) on a section of trail that requires hikers travel single file, to eliminate the possibility of omitting hikers walking side-by-side (Fig. 5). Moreover, the infrared beam intersected the trail at a location requiring hikers to pay close attention to their footing while traversing a large (ca. 1 m diameter), embedded boulder (Fig. 5) further distracting hikers and preventing visual detection of our installation. The distance between the trail counter receiver and transmitter was 106 feet, with the transmitter being 21.6 m (71 feet) on one side of the trail and the receiver being 10.7 m (35 feet) on the other side of the trail. Each unit was camouflaged to minimize the chance of discovery and reduce the impact on a visitor's experience (Fig. 6). The infrared beam emitted by the trail counter cannot be seen by the human eye and emits no audible sound.



Figure 5. The Bartlett River trail is bisected by an active infrared trail counter beam at the embedded morainal boulder. Hikers must pass single file and carefully watch their footing at this location.



Figure 6. Camouflaged receiver (left) and transmitter (right) along the Bartlett River Trail.

We verified trail counter accuracy on four separate occasions in 2013 over a total of seven hours. We used linear regression analysis with no constant term to evaluate the relationship between visually observed hiker counts against trail count events.

We binned total number of event counts each day in order to estimate daily hiker activity along the trail. As the Bartlett River Trail is an out and back trail, the number of event counts per day were divided by two and rounded to the nearest whole number to approximate the total number of hikers per day. The correction factor determined from correlating visual trail counts to trail counter events was not applied to the event count data when evaluating hourly usage.

We were unable to quantitatively evaluate patterns or variability in hiking group size, although count events were often clustered in time. Generally, from past visual observations, we anticipated that most hiking groups accessing the Bartlett River were small (i.e., 5 or fewer members). However, tour vessels with Bartlett Cove as a port of call have the potential to contribute relatively large groups (i.e., dozens) of visitors, though group size on this wilderness trail is supposed to be limited to twelve or less. Occasionally they are able to disembark for relatively short (2.5-3 h), shore-based excursions.

Because the majority of visitor use was previously observed to occur during the summer visitor use season, we focused our analyses on the June 1 through September 30 period unless otherwise noted.

Results and Discussion

We successfully deployed the Bartlett River Trail counter each season during 2012-2015 for a 111-122 day duration (Table 1). No detectable human interaction or tampering occurred with either the transmitter or receiver. In fact, there was no indication our installation was ever discovered by wildlife or hikers. This is most likely the result of a strategic installation location as well as careful concealment (*i.e.*, camouflage) of the instrumentation. However, we did discover an issue where anomalous count events were logged during October of 2012 when thousands of additional events were recorded. Subsequent investigation indicated this event logging anomaly to be the result of sunlight reflection on vegetation between the transmitter and receiver that registered as anomalous counts only on sunny days.

Table 1. Summary statistics by year for the Bartlett River Trail event counter. Cumulative events are unadjusted for out/back hiker double counts. Estimates of the number of average daily hikers and associated variability (SE = standard error) are presented over the June through September period, as indicated for the 2012-2015 seasons.

Year	Monitoring Dates	Duration (Days)	Cumulative Events (#)	Avg Daily Hikers/ d (events*0.5)	Associated Variability (SE)
2012	6/1-9/30	122	2,933	12	0.8
2013	6/10-9/30	113	4,209	19	1.4
2014	6/3-9/30	120	3,771	16	1.3
2015	6/12-9/30	111	4,038	18	1.4

We observed a very close relationship ($R^2 = 0.995$) between the number of visually observed and event counter detected hikers (Fig. 7). A total of 105 hikers were visually observed passing the trail counter during seven validation periods. The trail counter detected 212 events (106 hikers). This discrepancy is attributed to two hikers pausing in the trail at the infrared counter beam to take pictures. We also validated the accuracy of the counts each time we installed and downloaded the counter (data not included here). Wolff and Fitzhugh (2011) also found similar results when validating the accuracy of the same trail counter. Additional empirical evaluation of counter accuracy should ideally occur periodically each season to better evaluate counter accuracy and detect anomalous counts.

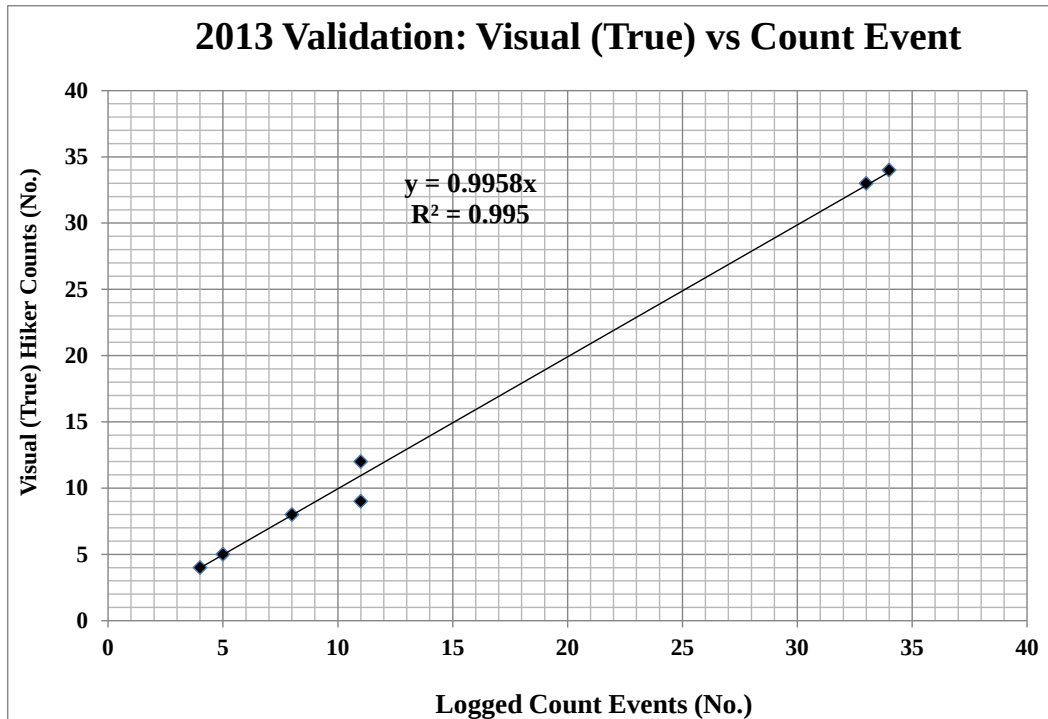


Figure 7. Relationship between visually observed numbers of hikers and logged count events over 7 hours of visual observation during 2013.

A comparison of hiker use along the Bartlett River Trail suggests a cyclical seasonal pattern where increasing numbers of hikers are detected throughout early June through July with decreasing numbers of hikers observed through the end of September (Fig. 8). Unfortunately, periods of missing data occurred during the first half of June in 2013 and 2015. The majority of trail use occurs during the June, July through August period with ten to thirty hikers more generally detected on a daily basis.

We observed a stark difference between the number of days with more than 20 hikers between 2012 and 2013-15. Where the total number of days with 20 or more hikers was 29 in 2012, it was two to three times this number of days in 2013-2015 (Table 2). Evaluation of these periodically higher trail use counts (i.e., 30-73 hikers per day) in conjunction with direct staff field observations, tour vessel schedules, and interpretive ranger logs indicates tour vessel passengers engaged in shore-based excursions typically account for this pattern.

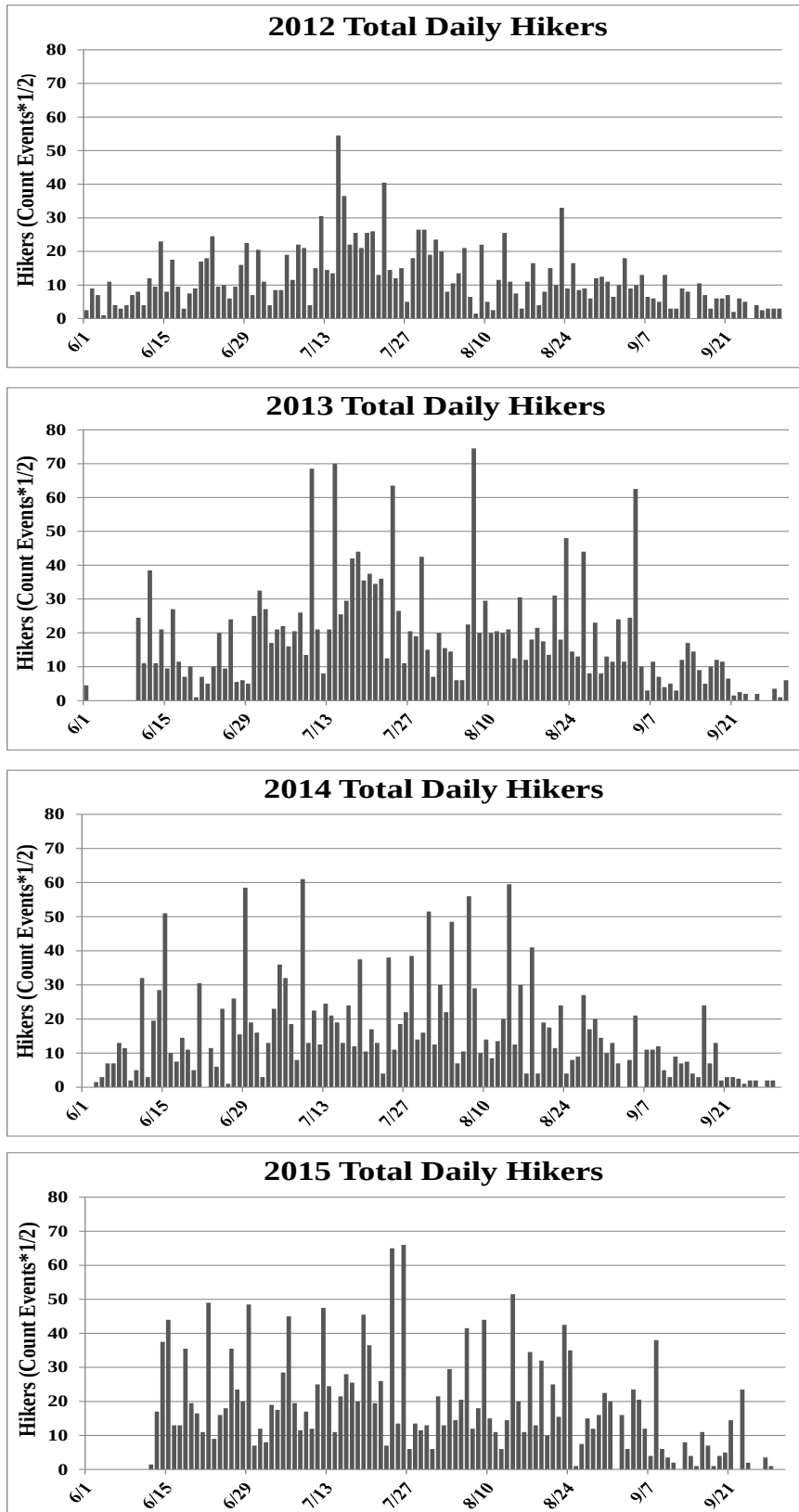


Figure 8. Estimated sum of daily BRT hikers from June 1 through September 30 over five seasons. Daily count events were adjusted by 0.5 in order to account for “out” and “back” travel.

Table 2. Number of days where more than 20, 30, 40 and 50 hikers were counted per day on the Bartlett River Trail each June 1 –September 30 season for the years 2012 -2015.

Year	Days >20 Hikers	Days >30 Hikers	Days >40 Hikers	Days >50 Hikers	Days >60 Hikers	Total
2012	22	5	1	1	0	29
2013	42	18	10	5	5	80
2014	32	15	8	6	1	62
2015	36	20	12	3	1	72

Across season comparison (June–September) of the estimated number of mean daily hikers suggests much reduced trail use during 2012 in comparison with later seasons (Fig. 9). However, there appears to be little difference in the number of mean daily hikers across the season during successive years from 2013-2015. The number of mean daily hikers was highest in July, declining seasonally through September. Anecdotal information from fisheries staff conducting creel surveys indicate that anglers targetting sockeye in July and coho salmon in September constitute a substantial component of trail users during these time periods.

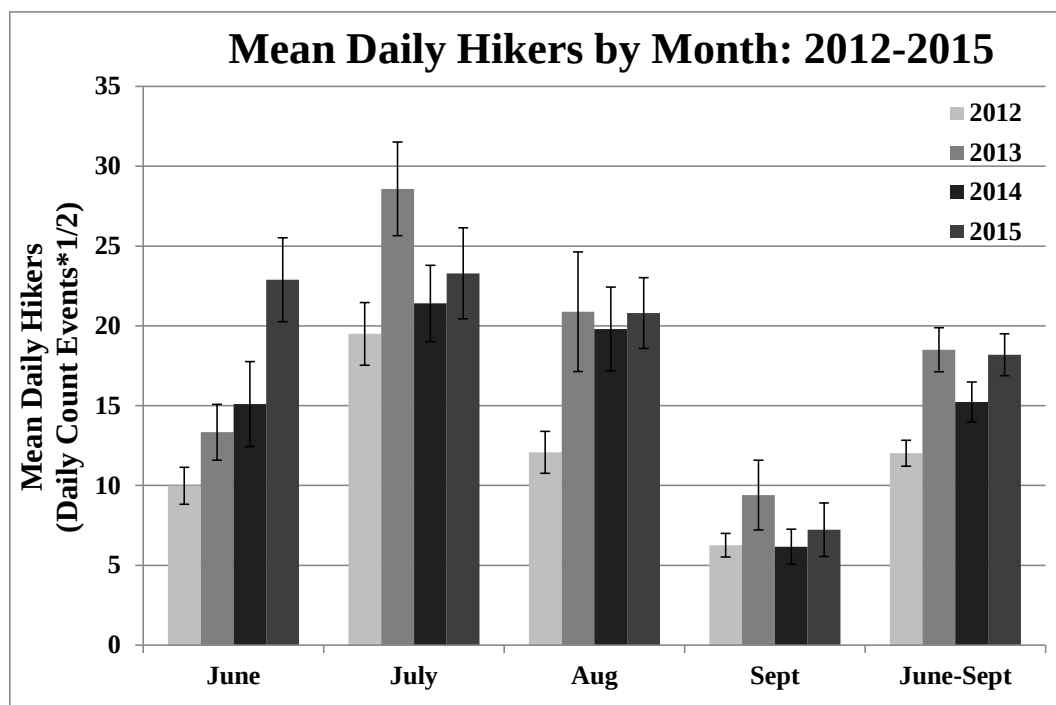


Figure 9. Estimated mean daily number of hikers (daily count events*0.5) by month for the June through September period (2012-2015). Error bars represent one standard error around mean values.

We evaluated Bartlett River Trail use according to the number of count events recorded within each respective hour (Fig. 10). Very few events were recorded outside the twelve hour period from 8 a.m.

(0800 h) to 8 p.m. (2000 h). In fact, the majority (> 90%) of trail use activity, indicated by count events, was documented to occur between the hours of 9 a.m. and 6 p.m. (1800 h) (Table 3).

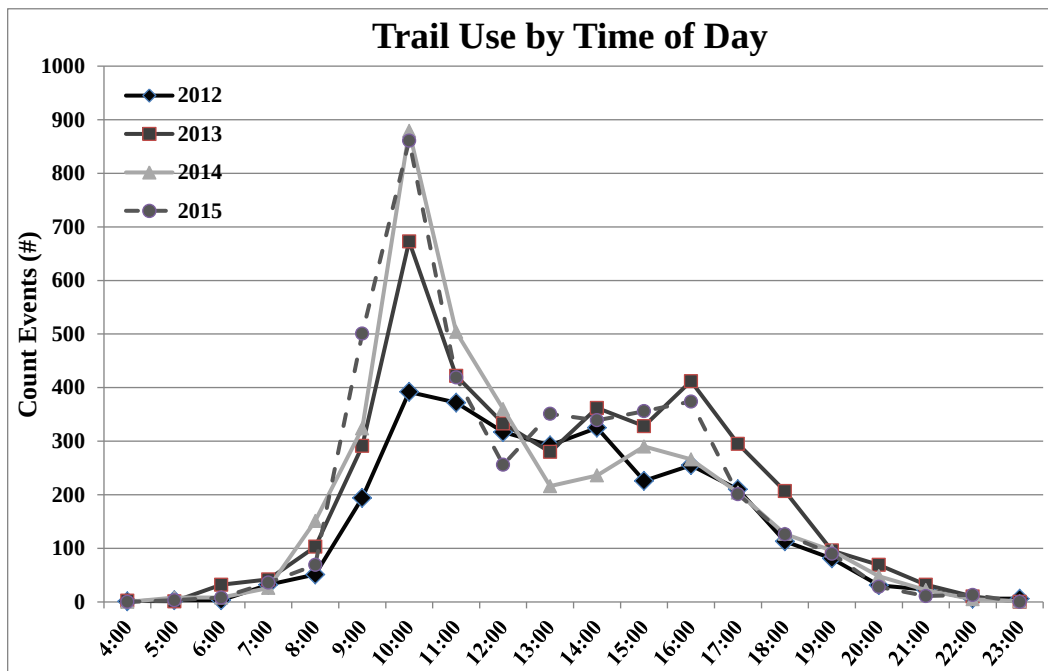


Figure 10. Number of uncorrected count events by hour of occurrence recorded at the Bartlett River Trail counter over the June through September time period from 2012 to 2015.

Table 3. Percent of daily hiker activity grouped by time of day over four years (2012-2015) during June through September of Bartlett River trail counter deployment. Time interval groupings were determined by grouping counts in hours representing the majority of use in all years (0900-1800), and periods of lower use.

Time (h)	2012 (%)	2013 (%)	2014 (%)	2015 (%)
0400 to 0900	3.1	4.5	5.1	2.9
0900 to 1800	91.9	90.3	90.3	93.6
1800 to 2300	5.0	5.2	4.6	3.5

With the exception of 2012, we documented a consistent peak in count events during the 0900 to 1100 h period (Fig. 10). As previously noted, tour vessel passengers participating in shore-based excursions are responsible for this peak in 2013-2015. In 2015 for example, 18 of 21 hours with count events 30 or higher occurred in the 9 or 10am hour. All 21 of these hours align with interpretive ranger logs that indicate tour boats were engaged in shore excursions in Bartlett Cove. Additionally in 2015, the median number of count events between 9am and 11am was 6.5 (n=82, S.E.=0.63, max=34) for days where interpretive ranger logs did not indicate tour boats operating shore excursions in Bartlett Cove, while for the same time period when tour boats were likely

conducting shore excursions in Bartlett Cove, the median was 56.5 (n=22, S.E=4.87, max=105) counter events (Fig. 11).

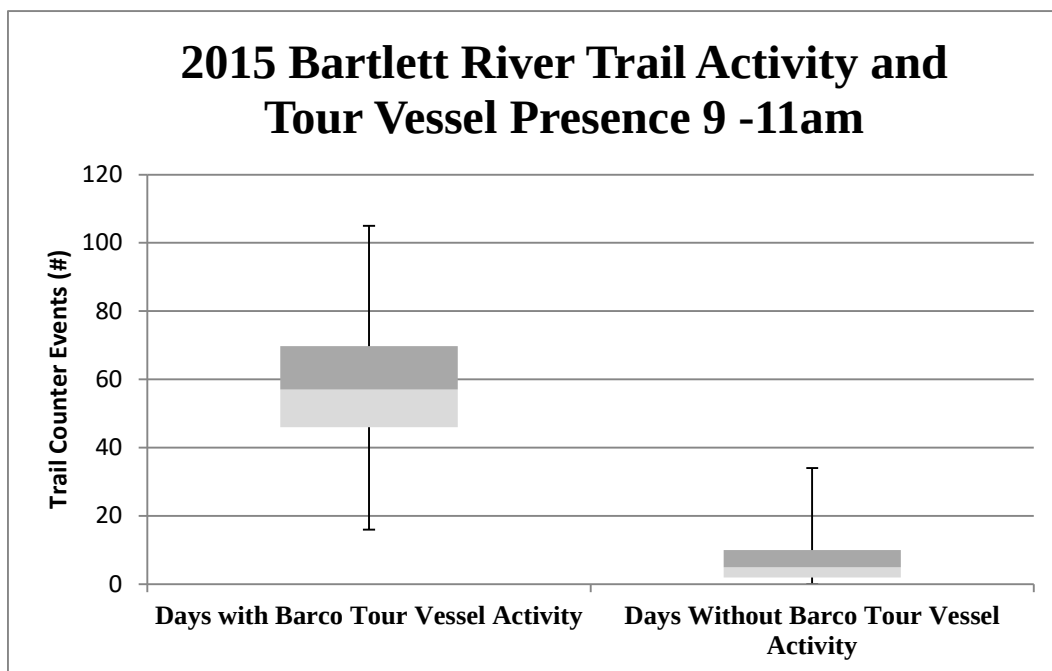


Figure 11. Box plots of Bartlett River Trail hiker events for days where interpretive ranger logs specified tour vessel excursions were likely operating in Bartlett Cove compared with days where they were not operating in Bartlett Cove for the hours between 9 -11 am. Trail events for this this time period with tour vessels (min=16,med=57, max=105) are vastly different than without tour vessels (min=0, med=5, max=34).

At times these large hiking groups can exceed 40 hikers. Figure 12 displays 41 hikers passing the trail counter in a 7 minute period and then likely the same group returning over a 7 minute period with five additional hikers. Though these large hiking groups only occur periodically (mostly between 9-11am) throughout the summer, their frequency is increasing (0, 13, 19, 21 hours respectively, 2012-2015).

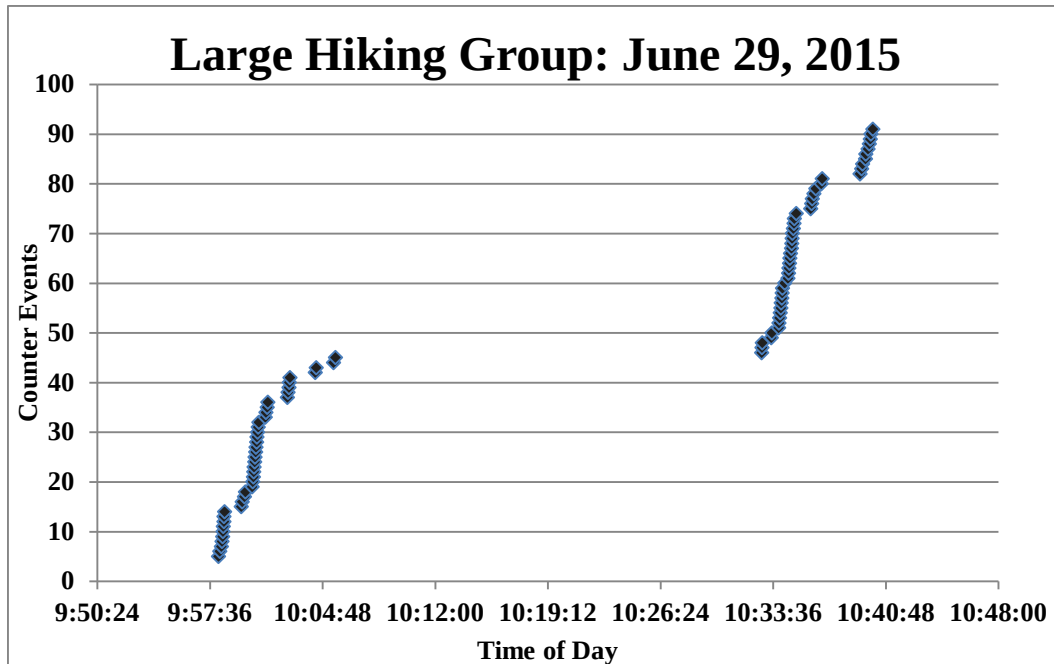


Figure 12. An example of hike events displayed over time demonstrate two groups exceeding 40 hikers passing the Bartlett River Trail counter over two 7 minute periods. The second group of events is likely the return trip, and not an additional group of 46 hikers.

Relatively large groups of hikers (as large as 50 on the BRT) may lead to more substantial trail impacts, depending on trail segments transited and inherent trail resilience. Large groups tend to have a disproportionate impact on trails and visitor experience. In particular, in areas that are relatively lightly used, large groups cause more impacts on soil and vegetation than small groups (Monz et. al 2000). Additionally, some wilderness visitors (19-29% depending on the study) generally say that encountering large groups reduces the feeling of wilderness (Stankey 1973, 1980; Towler 1977) According to Monz et. al, though approximately 75% of people are in favor of group size restrictions in wilderness, it is not clear whether encountering one large group of people has more of a negative effect to wilderness character as encountering the same number of people spread out in smaller groups

Hiking activity along the Bartlett River Trail comprises an important component of summer visitation to the Bartlett Cove area. Visitor use statistics from the NPS Integrated Resource Management Applications (IRMA) portal online source (NPS 2017) indicate tent campers exhibit the highest use in July, followed by June or August with considerably less use in September (Table 4). These results align well with the trail counts in July and September but less well for June and August. Greater trail use in July and September is at least partly attributed to sportfishing anglers accessing the river in pursuit of sockeye and coho salmon, respectively.

Table 4. Glacier Bay National Park tent camper use statistics by year and month (NPS 2017). Numbers represent the number of tent campers present within the park during the indicated month and year.

Year	May	June	July	Aug	Sept
2012	68	197	228	116	19
2013	51	130	222	209	20
2014	60	200	327	173	4
2015	32	181	246	184	15

Trail count data may include some small number of mammals other than humans using the trail. The vertical elevation at which the counter bisects the trail (1.35 m or 53 inches) makes it unlikely that bears or wolves influenced daily count events, although any moose passing through the infrared beam would have been counted. The very low number of events ($< 0.5\%$ of seasonal totals) occurring during the evening and early morning hours of 2200 to 0500 h, when wildlife are more likely to use the trail, suggests few contributing events. Although larger non-human mammals have been infrequently observed by NPS staff along the trail and would be counted if they used the corresponding trail segment, they are unlikely to unduly influence our human use estimates.

Downed logs and vegetation along the trail (Fig. 5) prohibited aiming the trail counter lower than 1.35 m (53 inches). Thus children and small stature adults are clearly excluded from our estimates. While omission of smaller stature hikers would only incrementally reduce our estimates of hiker trail use, the inclusion of some small unknown number of wildlife would counteract this underestimate.

All trail count data reported includes administrative trail use by NPS staff. Interpretive rangers leading visitors on hikes, rangers patrolling, trail maintenance crews and fisheries staff conducting fisheries surveys all contributed to estimates of trail use. While both administrative and visitor use would similarly impact trail physical condition, park visitors may perceive Bartlett River Trail wilderness character differently when NPS staff (administrative use) are present. Whether NPS administrative presence influences the level of visitor trail use and activity, especially in regard to angler activity and fishing effort, could be explored but would require careful tracking of administrative use.

Conclusions

In summary, during the years 2012-2015, an estimated 1,466 to 2,104 hikers used the Bartlett River Trail between June and September each year. Due to missing 9 and 11 days of data collection in June 2013 and 2015, the total hiker counts for these years would be slightly higher than the reported values. The daily mean number of hikers ranged between 12 and 19. However, we documented an increase in hiker peak numbers ranging from 30-75 hikers on select days. July exhibited the heaviest trail use followed closely by August. Ninety percent or more of hikers each season were documented to travel between the hours of 9 a.m. and 6 p.m. We observed distinctive peaks in count events around the 10 a.m. time period during 2013-2015 but not during 2012, where groups as large as 50 hikers use the trail. As documented by observations, but mostly interpretive ranger logs, this activity corresponds with off vessel tour vessel activity in Bartlett Cove.

The BRT is one of only six maintained hiking trails within Glacier Bay National Park. Visitors use this trail to access the Bartlett River for wildlife viewing, recreational activity and to fish for salmon and trout. The Alaska Marine Highway system began serving the community of Gustavus in 2011 but it wasn't until 2012 that the NPS began consistently monitoring trail use. Results from this survey provide a baseline against which future change can be compared.

National Park Service Management Policies (2006) stipulate that:

Natural systems in the national park system, and the human influences upon them, will be monitored to detect change. The Service will use the results of monitoring and research to understand the detected change and to develop appropriate management actions.

Visitor impact monitoring is an essential component for periodic evaluations of current conditions to compare against standards or to evaluate the success of management actions (Marion et al. 2006). Any future management of trail use or maintenance of trails will benefit from periodic evaluations of trail use. According to the park's General Management Plan "the BRT and Forest Loop trail will continue to be maintained as necessary" (NPS 1984). Further, the park's existing Trail Management Plan states that "the trail will be 12 inch (30.5 cm) minimum width, gravel or sand base, with no hazards in the trail tread" (GLBA 1994). This is clearly not the current condition of the BRT and relatively challenging trail conditions undoubtedly prevent some visitors from exploring the area.

Trail counter data provides basic use statistics that can be an important first step in developing sound management practices. Based on the results of this preliminary information and information needs for upcoming planning efforts, it is recommended that the park continue trail use counts, conduct a trail condition survey and develop a methodology for estimating administrative trail use. Trail condition assessments in conjunction with trail use estimates could be used to prioritize trail maintenance. Large changes in visitor use of this trail may warrant trail upgrades, enforcement of group size limits or adjusting the current group size limits upward. Additionally, management of all park trails should fall under a management plan that clearly describes desired future conditions.

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