



Coastal Area Visitation Patterns at Cabrillo National Monument

2011–2020 Visitation Data Summary and Analysis

Natural Resource Report NPS/CABR/NRR—2022/2417



ON THE COVER

Sunset over Coast View Parking and a section of the Coastal Trail at Cabrillo National Monument.
NPS / LINH ANH CAT

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Lauren L. M. Pandori & Linh Anh Cat

National Park Service
Cabrillo National Monument
1800 Cabrillo Memorial Drive
San Diego, CA 92106

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Abstract

Cabrillo National Monument (San Diego, CA, USA) is a pint-sized unit of the National Park System (0.65 terrestrial km²) that attracts an average of 850,720 visitors annually (IRMA, SRSS Reports, mean visitation 2011–2020). The coastal area of the park contains well-preserved and sensitive natural resources, including sea cliffs, maritime sage scrub, and rocky intertidal habitat.

Understanding small-scale visitor use patterns to this area can guide management decisions such as congestion planning and allocation of recreation fee project money toward staffing the area. Infrared trail counters (TrailMaster™ 1550, USA) were deployed adjacent to two entrances to the Coastal Trail at the Tidepool Parking and Coast View Parking areas to capture visitation patterns 2011–2020. While total visitation to the park has fluctuated over time, visitation to the coastal area has increased steadily during the study period (2011–2020). Visitation on weekend days was 110% higher (i.e., more than double) the number of midweek visitors. Additionally, holidays and some fee-free days attract additional visitors to the area. Despite the tidepools being a popular and desired visitor experience, tide level was not correlated with coastal area visitation. These findings indicate that peak staffing of Volunteers-in-Parks (VIPs) and park staff should occur on weekends and holidays, regardless of tide level. Results of this study can be incorporated into park congestion management planning and staff scheduling funded by recreation fee project money.

Acknowledgments

This project started at Cabrillo National Monument in late 2010. Throughout the decade of data collection, many park staff, Volunteers-in-Parks (VIPs), and partner staff have contributed to the operation and maintenance of the trail counters. We thank everyone who contributed new ideas, methods, and inspiration for this project. We hope to collect another decade of data!

Introduction

Cabrillo National Monument (CABR) is a unit of the National Park System located at the southern tip of the Point Loma peninsula in San Diego, CA, USA. Since three sides of the park are surrounded by water and the fourth abuts a Navy base, the park acts as an “urban island”, providing habitat for unique algal, plant and animal species in an area of increasing development and urbanization. Further, the Coastal Trail area of the park contains fragile maritime succulent scrub habitat, a subdivision of coastal sage scrub habitat. The coastal area of the park also leads to the rocky intertidal zone, which is regarded as the best conserved rocky intertidal shoreline in mainland southern California. Despite its small size (0.65 terrestrial km²), the monument attracts an average of 850,720 annual visitors (IRMA, SRSS Reports, mean visitation 2011–2020). Due to its value as both a habitat refuge and public resource, it is critical to monitor visitor use of this area.

Understanding small-scale visitor use patterns can guide park management decisions. Most directly, information about times of day, seasons, and places in the tide cycle when visitation is highest can aid in appropriately scheduling staff, including those funded by recreation fee project money. While more staff offering visitor services are scheduled to work weekend days, the magnitude of visitation increase on weekends, holidays, and other days of significance is often unknown by park management. Knowledge about visitation patterns can also enrich visitor experiences through targeted interpretive contacts. Additionally, increasing visitor popularity of a sensitive natural resources, such as the maritime succulent scrub, rocky intertidal, and sandstone cliff habitats present in the coastal area of CABR, may warrant social media campaigns and educational contacts to help visitors reduce their impact. Collectively, visitation information can increase operational efficiency of park units and enrich visitor experiences.

The first visitation monitoring instruments in the coastal area of the park were deployed in November 2010 by Phillips et al. (2013). The goal of the project was to get an accurate assessment of the number of visitors in the coastal area of the park in 2011. Further, they investigated whether use patterns were correlated with weather and tide conditions and calculated how many visitors entered the park while it is closed. Their initial investigation concluded that there were 214,000 visitors to the coastal area of the park in 2011 (Phillips et al. 2013). Visitation patterns were driven by seasons, but not by low tide events (Phillips et al. 2013). Summer months attracted the most visitors, and there were relatively few visitors before or after park hours (Phillips et al. 2013). While these patterns are robust in their original analyses, the trail counters have now been collecting data 2011–2020, providing a much larger sample size to test past hypotheses. Data are available for complete years, allowing for comparisons to IRMA total park visitation data (IRMA, SRSS Reports).

In this study, we examine factors influencing visitation pressure on the coastal area of CABR using trail counters at two entrances to the coastal area. More specifically, we aim to answer the following questions:

1. How many people visit the coastal area of CABR each year?
2. Does visitation differ across days of the week?
3. Is visitation significantly higher on days with low tides, defined as < 0.7 ft below mean lower low water (MLLW), during park hours?
4. Is visitation significantly higher on holidays?
5. Is visitation significantly higher on fee-free days?

We hypothesize that visitation to the coastal area of the park has increased over time, while entrance station visitors have decreased slightly. We also predict our findings will parallel those of the Phillips et al. report, in that the number of visitors will be higher on weekends than weekdays, and that visitation will not be affected by tide levels (Phillips et al. 2013). Additionally, we anticipate visitation is higher on holidays and fee-free days.

Methods

Field Instrument Deployment

TrailMaster™ 1550 infrared trail counters at the north and south entrances to the Coastal Trail at Cabrillo National Monument (CABR) counted visitors from November 2010 thru December 2020. The north entrance to the Coastal Trail is located at the Coast View Parking lot, while the south entrance is located at the Tidepool Parking lot (Figure 1). The Coastal Trail is an out-and-back trail that stretches 0.8 km (one-way) along the CABR coastline, with sections that are maintained as Class 3 or Class 5 trail. Visitors entering the intertidal or “tidepool” area of the park must pass either trail counter and hike a section of the Coastal Trail to reach the single tidepool area entrance. The Tidepool Parking lot, with 44 parking spots, is much larger than the Coast View Parking lot, with 13 parking spots, and the Tidepool Parking lot is considerably closer to the tidepool entrance than the Coast View Parking lot. Thus, most visitors park in the Tidepool Parking lot to visit the tidepool area. Trail counter locations were chosen to capture all visitors to the Coastal Trail and were positioned at narrow points in the trail to increase counter accuracy.

TrailMaster™ 1550 counters are made up of transmitting and receiving units, positioned on either side of the trail. The transmitting unit emits a beam of infrared light that is registered by the receiving unit. Each time a visitor walks by, the infrared beam is broken, and the time of the “event” is registered. The units do not account for travel direction, so visitors will trigger two “events”: one as they enter and one as they leave the Coastal Trail. The units can store up to 16,000 “events”, and batteries last for approximately three weeks. Every two weeks throughout the sampling period, data were transferred to a TrailMaster collector unit, and batteries were changed. Eventually, solar panels were installed to allow for longer periods between battery exchanges. Data were transferred to office computers using StatPack Software (TrailMaster, USA) and stored as Comma Separated Values (CSV) files.



Figure 1. Map of Cabrillo National Monument with Coast View Parking (13 parking spaces) and Tidepool Parking (44 parking spaces) lots labeled by stars. The dashed line between the lots is the Coastal Trail, which runs 0.8 km (one-way) through the coastal area of the park. The single entrance to the tidepools is marked by the pin and is closer to the Tidepool Parking lot than the Coast View Parking lot (ESRI, NPS).

Data Assembly

Data assembly script:

https://github.com/llmpandori2/trail_counter_2011_2020/blob/main/scripts/tm_data_assembly.R

Data files generated by StatPack (TrailMaster, USA) were quality checked, then assembled using RStudio (Grolemund & Wickham 2011, Wickham & Bryan 2019, Wickham et al. 2019). The quality-checking process involves two steps: (1) reviewing each CSV file to make sure observations span the period between counter data transfers, and (2) generating a plot of visitation across hours of the day for each file to check for unusual observation patterns. These plots were visually assessed, and files with unusual observations were subsequently removed. For example, sometimes vegetation overgrowth would interfere with the infrared beam, resulting in thousands of “events” being recorded in a short period of time. Additionally, there were periods where no data were collected due to equipment malfunction. Collectively, these periods were excluded from the dataset, resulting in gaps. Only observations during daylight hours 2011–2020 were considered in analyses.

Tide Information

After data assembly, hourly and daily extreme tidal information was added to the visitation dataset. Hourly tidal prediction data (in ft above MLLW) and the timing of sunrise and sunset at the San Diego Bay Entrance station were generated using XTide prediction software (Flater, 2005). These data were joined to the visitation dataset for analysis.

Data Analysis

Data analysis script:

https://github.com/llmpandori2/trail_counter_2011_2020/blob/main/scripts/tm_data_analysis.R

Annual and monthly visitation at each counter was calculated by taking the sum of “events” recorded by the trail counter for each month or year and applying corrections for: (1) missing data, (2) counting people twice as they enter and exit the coastal area, and (3) counter error. We corrected for missing data in estimates of monthly and annual visitation by multiplying “event” sums by a correction factor equal to the proportion of time missing from an interval plus one. For example, if 20% of days in a year are missing from the dataset, the annual visitation value calculated would be multiplied by 1.2. Since each person entering the area also left the area, each visitor would register two “events” in the counter data. To correct for this, “event” sums were divided by two.

Additionally, the trail counters often undercount groups of people walking side-by-side, so visitation values are also corrected by a calibration factor specific to each counter (Phillips et al. 2013). Calibration factors were based on four observation periods ($N = 3$ for Tidepool Parking and $N = 1$ for Coast View Parking) between January and April of 2011.

We investigated whether visitation is affected by the day of week, hour of the day, holiday/fee-free day status and tide level, by calculating the number of “events” for each hour and day. These daily or hourly visitation values were divided by two to correct for double-counting and multiplied by a correction factor specific to each lot (Phillips et al. 2013). To determine if visitation differed across days of the week, we ran an ANOVA followed by a post-hoc Tukey HSD test for each counter

location. To determine if visitation was higher on holidays and fee-free days, we used paired T-tests to compare visitation values for holidays/fee-free days with paired dates fourteen days after the holiday/fee-free day. The fourteen-day delay was used to match the day of the week and have a comparable place in the tidal cycle with holidays/fee-free days. To assess whether more people visited the coastal area during tides low enough for the tidepools to be exposed, we conducted linear regressions of daily visitation against the lowest tide level between 7 AM (two hours before park opening at 9 AM) and 7 PM (two hours following park close at 5 PM) for each parking lot.

Results

When corrected for missing data and counter calibration (Phillips et al. 2013), we estimate that there were 380,920 visitors to the coastal area of Cabrillo National Monument in 2020 (Table 1).

Considering that 523,878 visitors entered the park (IRMA) in 2020, 73% of visitors to the park explored the Coastal Trail area in 2020. Total visitation to the park increased between 2011 and 2016, peaked at nearly 1 million visitors in 2017, and declined 2018 thru 2020 (Figure 2; Appendix 1, Figure S1). Visitation to the Coastal Trail adjacent to the Tidepool Parking and Coast View Parking lots in the coastal area of the park followed a similar trend, peaking around 2016, but remaining relatively high thereafter (Table 1, Figure 2). Visitation to the park in 2020 was lower than 2019. For all years at the Coast View Parking lot, and most years at the Tidepool Parking lot, trail counters collected viable data on over 75% of days (Table 1).

Visitation differed across days of the week, and differences were consistent across lots (Figure 3; Appendix 1, Tables S1-S4). Weekend days (Saturday and Sunday) had the highest visitation, with an average of 1246 visitors per day entering the Coastal Trail from the Tidepool Parking lot and 370 visitors per day from the Coast View Parking lot (Figure 3). Weekend-edge days of Monday and Friday had significantly lower visitation than weekend days, but higher visitation than midweek days, Tuesday thru Thursday (Appendix 1, Tables S2 and S4). The mean number of visitors per day on weekend edge days (Monday and Friday) was 782 at the Tidepool Parking lot and 157 at the Coast View Parking lot. Midweek days (Tuesday thru Thursday) had the lowest average number of visitors per day, with 652 and 118 visitors at Tidepool Parking and Coast View Parking lots, respectively. Overall, visitation on weekends is about twice as high as visitation midweek. Yet, trends in hourly visitation are similar across weekdays (Figure 4). Regardless of the day of week, the highest hourly visitor activity was observed as visitors enter the coastal area of the park when it opens at 9:00 AM, and as visitors leave the coastal area of the park during closing between 4:30 and 5:00 PM (Figure 4).

The magnitude of low tides is not strongly correlated with the number of daily visitors at either the Tidepool Parking (Figure 5, linear regression: $p = 0.92$, $R^2 < 0.01$) or Coast View Parking (linear regression: $p < 0.01$, $R^2 = 0.02$) lots. Similar results were obtained if comparing hourly visitors with tide level (Appendix 1, Figure S2). While there was a significant difference in visitation between low-tide days (with tide levels < 0.7 ft above Mean Lower-Low Water between 7 AM and 7 PM) and seven days following the low-tide day (paired t-test, $t = 3.50$, $df = 1653$, $p < 0.001$), the mean visitation difference was only 25 visitors.

Most holidays, or holiday-adjacent days had high visitation (Figure 6). Apart from New Year's Day, Christmas Day and Veterans Day, all holidays and holiday-adjacent days considered had significantly higher visitation than fourteen days after (paired t-test results in Appendix 1, Table S5). While there is some overlap between fee-free days and holidays, there was no strong pattern between fee-free days and visitation trends in the coastal area of Cabrillo National Monument (Appendix 1, Figure S3, Appendix 1, Table S6).

Table 1. Summing across lots, the coastal area at Cabrillo National Monument attracted over 380,000 visitors in 2020. In the table below, coverage refers to the percentage of days with available data for each of two lots in the coastal area of the park for each year 2011–2020. Visitation estimates have been corrected for missing data and counter calibration factors. Values from each lot are summed to estimate the total number of visitors to the coastal area of Cabrillo National Monument.

Year	Tidepool Parking		Coast View Parking		Total coastal area visitors
	Coverage	Visitors	Coverage	Visitors	
2011	78%	247,881	77%	50,790	298,671
2012	92%	276,524	96%	54,921	331,445
2013	90%	288,502	96%	51,035	339,537
2014	58%	265,721	84%	50,181	315,902
2015	88%	324,783	98%	69,715	394,498
2016	77%	334,844	92%	109,121	443,965
2017	65%	318,879	91%	95,215	414,094
2018	91%	334,039	95%	73,526	407,565
2019	80%	303,285	88%	76,218	375,503
2020	77%	286,579	85%	94,341	380,920

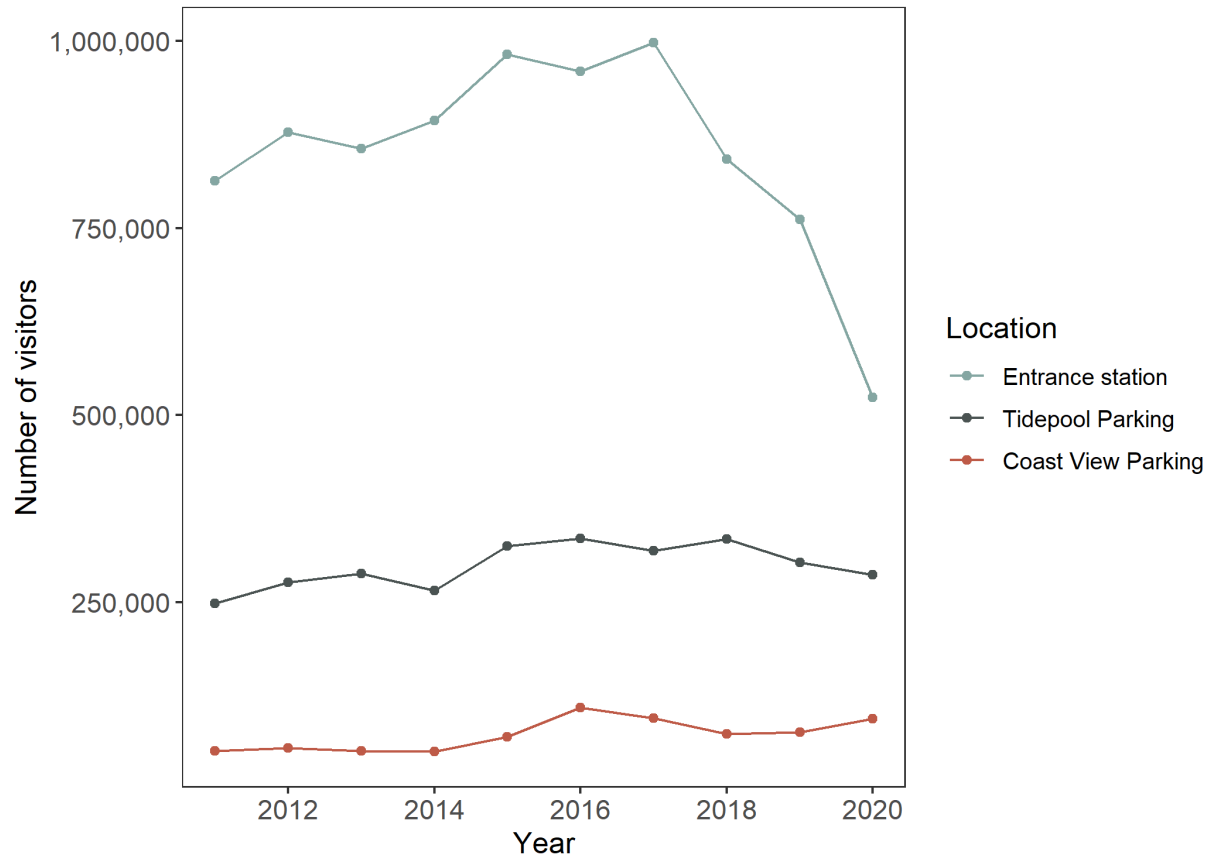


Figure 2. While visitation at the entrance station declined between 2017 and 2020, the number of visitors passing trail counters at the Tidepool Parking and Coast View Parking lots in the coastal area of Cabrillo National Monument increased slightly over the study period (2011–2020). Data are total visitation to the entrance station (IRMA), and corrected visitation estimates from infrared trail counters deployed nearby two parking lots at either side of the Coastal Trail.

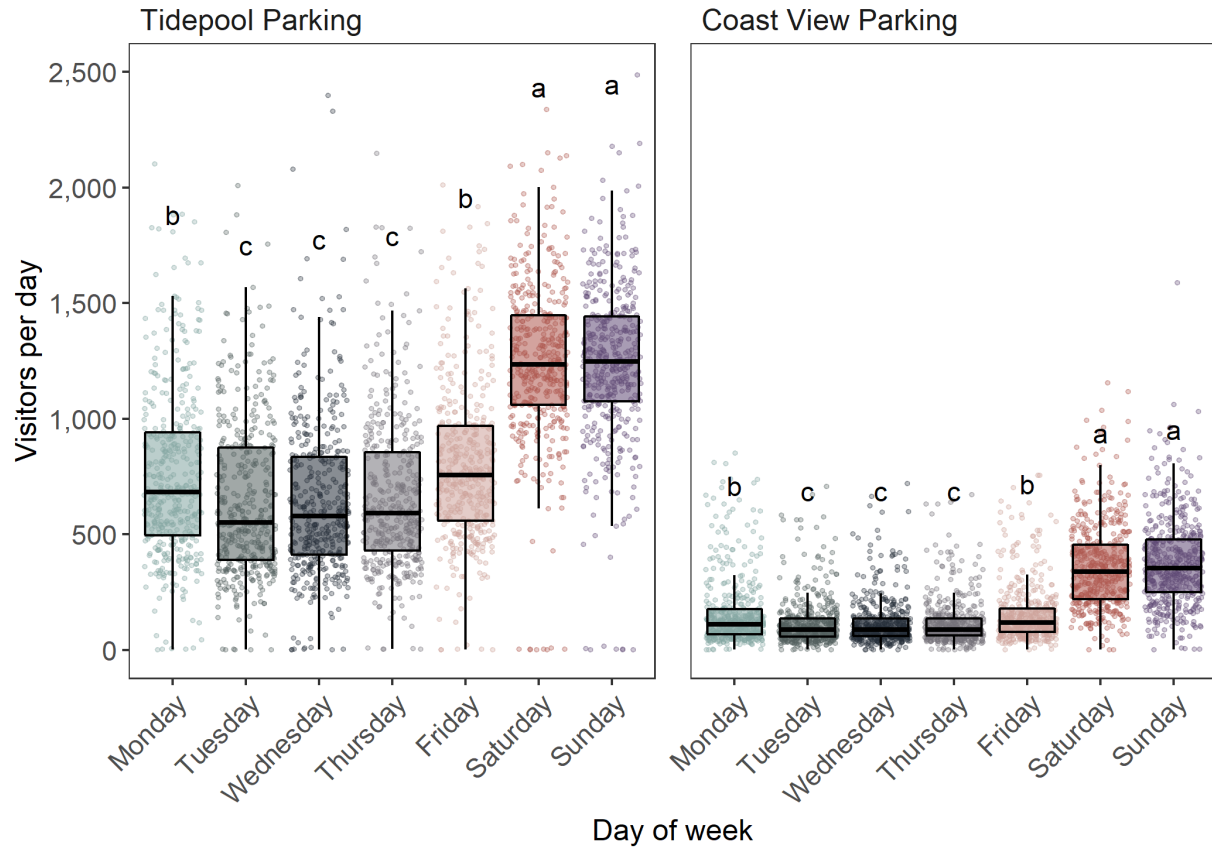


Figure 3. Visitation differs across the days of the week at both the Tidepool Parking (ANOVA, $DF = 6$, $F = 249.2$, $P < 0.01$) and Coast View Parking (ANOVA, $DF = 6$, $F = 308.3$, $P < 0.01$) lots. At both lots, weekends receive significantly higher visitation than days mid-week (Tuesday thru Thursday) and weekend edge days (Monday and Friday) (Tukey HSD, $P < 0.05$). Weekend edge days receive higher visitation than midweek days, but not as much as weekend days (Tukey HSD, $P < 0.05$). Each point is the number of visitors on a single day 2011–2020, and letters indicate significant differences between day of week groups (ANOVA with Tukey HSD).

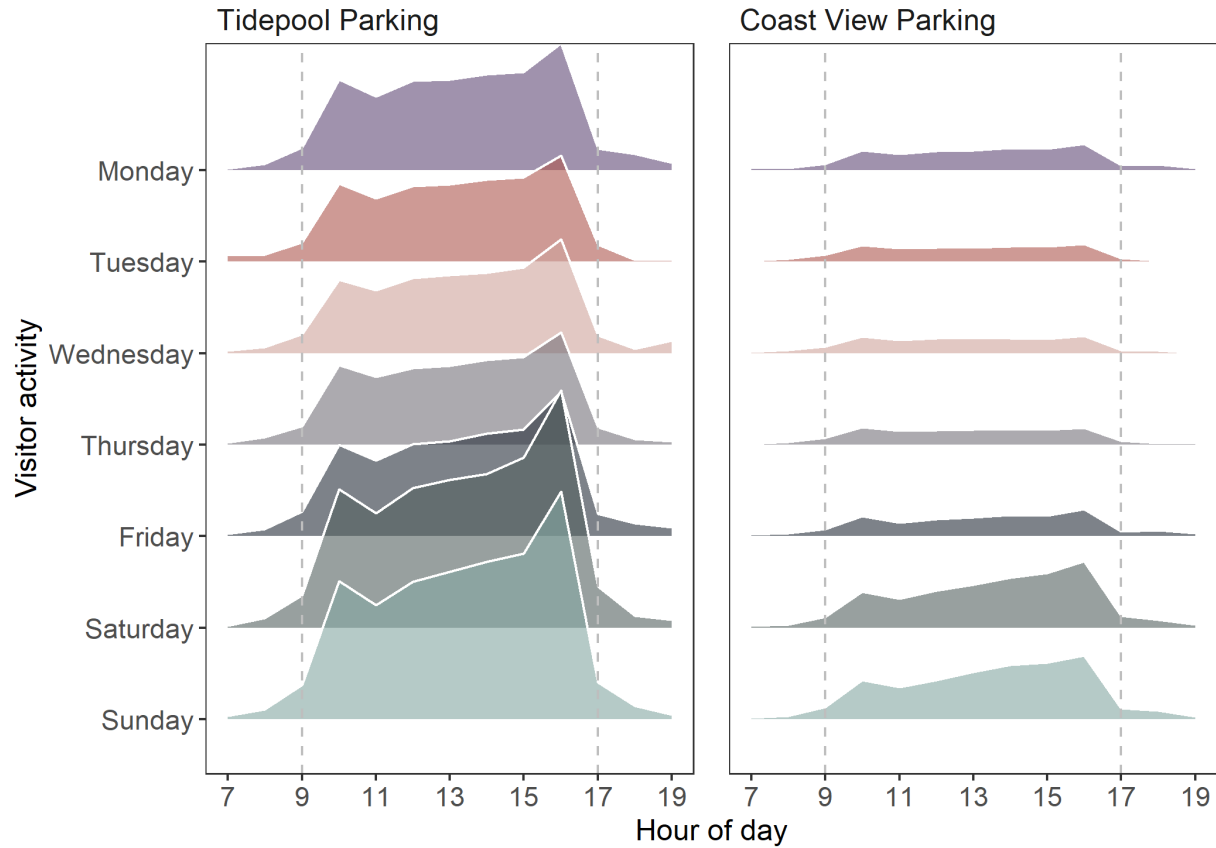


Figure 4. Peak visitor activity (in relative volume of visitors per hour) occurs near park opening at 9:00 AM and closing at 5:00 PM (indicated by dashed gray vertical lines on each figure panel). Ridgeline plots show the relative number of visitors per hour at trail counters at the Tidepool Parking and Coast View Parking lot entrances to the Coastal Trail at Cabrillo National Monument, separated by days of the week.

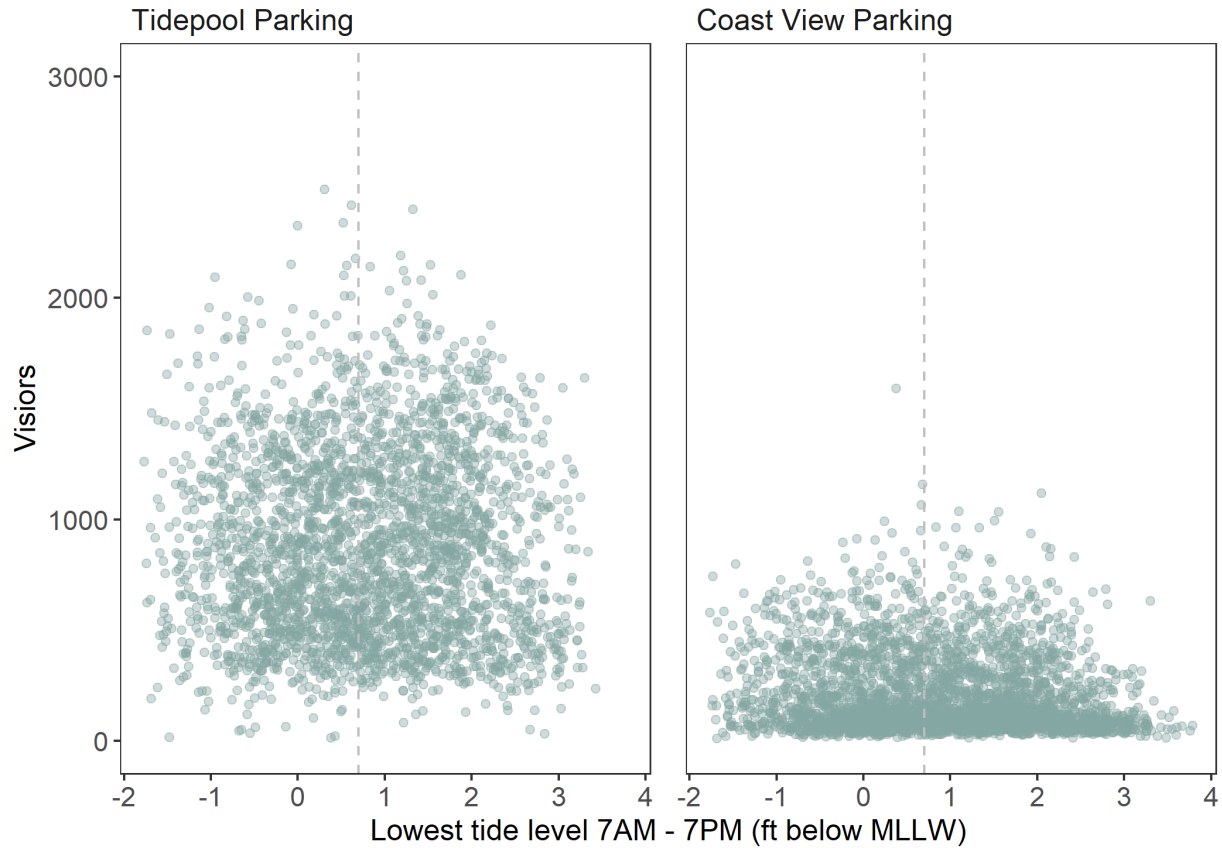


Figure 5. The magnitude of low tides is not strongly correlated with the number of daily visitors at either the Tidepool Parking (linear regression: $p = 0.92$, $R^2 < 0.01$) or Coast View Parking (linear regression: $p < 0.01$, $R^2 = 0.02$). The lowest tide level between 7 AM (two hours before park opening at 7 AM) and 7 PM (two hours following park close at 5 PM), and the corrected number of visitors to the Tidepool Parking and Coast View Parking entrances to the Coastal Trail at Cabrillo National Monument 2011–2020. The vertical dashed line at 0.7 ft above mean lower-low water (MLLW) indicates the tide level below which tidepools at the park are visible and accessible.

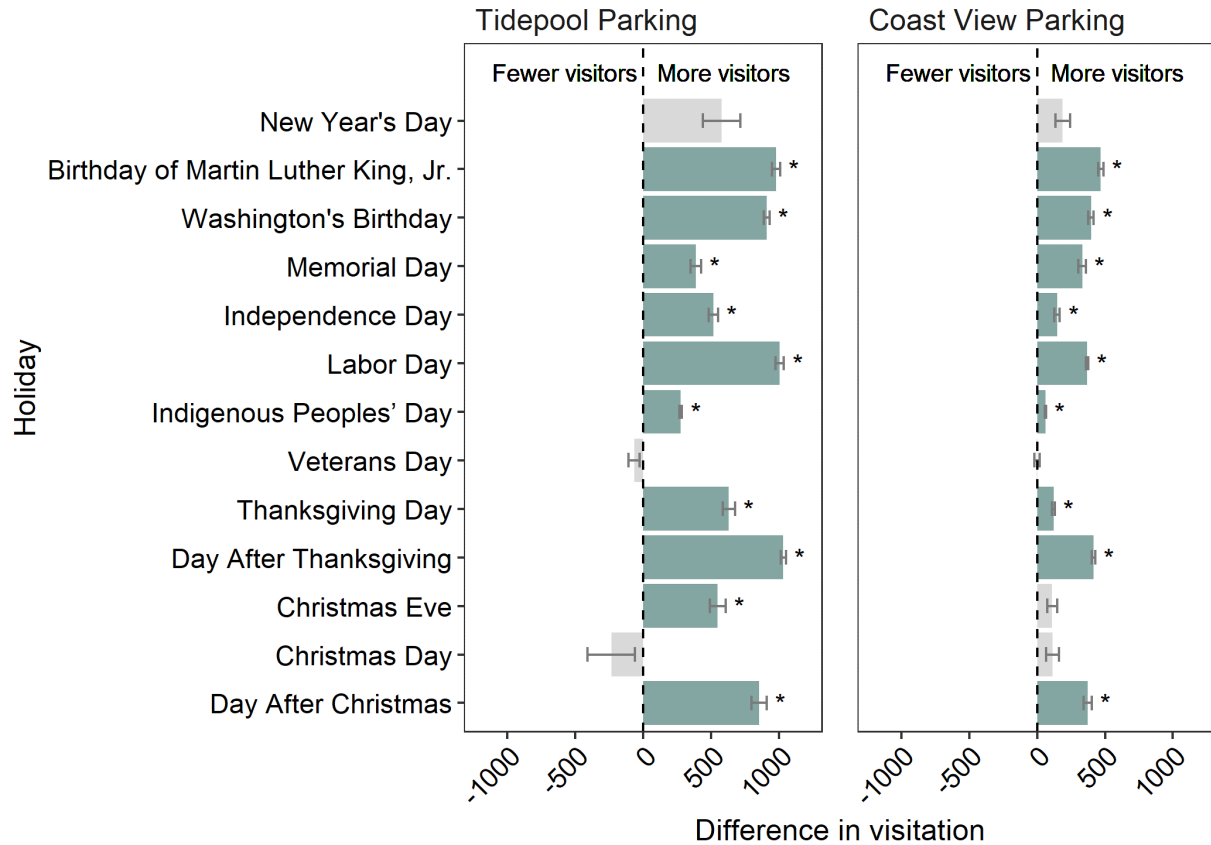


Figure 6. There are more visitors to the coastal area of the park on holidays than on non-holiday dates 14 days after (to match day of week and tidal cycle). Values presented are the mean ($\pm$ standard error) difference in visitation between holidays and paired dates fourteen days post-holiday. Dark blue bars indicate significant differences between holidays and paired non-holidays (t-test, difference is significantly different than 0, $p < 0.05$), while light gray bars indicate non-significant differences between holidays and paired non-holidays (t-test, difference in visitation not significantly different than 0, $p > 0.05$).

Discussion

Visitation information can provide trend insights, increase operational efficiency of park units, and enrich visitor experiences. Entrance station visitation trends, including increasing visitation 2011–2017 and declining visitation 2018–2020, can likely be explained by changes in park policy and social media presence. The increase and subsequent peak in visitation 2016–2017 are likely explained by the National Park Service Centennial celebration. The campaign was widely publicized on social media and led to increases in visitation across the National Park System. The following decrease in visitation could be attributed to increasing costs of park entry in June of 2018, and the start of the COVID-19 Pandemic in early spring 2020. While visitation to the entrance station fluctuates over time, visitation to the coastal area followed a similar upward trend 2011–2017 and remaining relatively high thereafter (Figure 2). Higher visitor counts at the Tidepool Parking lot area of the Coastal Trail, when compared to the Coast View Parking section, is a consequence of parking lot size and proximity to the tidepool area—the Tidepool Parking lot contains 44 parking spaces and is much closer to the tidepool area, while the Coast View Parking has 13 spaces. Most visitors to the park explore the Coastal Trail area during their visit to Cabrillo National Monument.

Understanding the timing of peak visitation to the coastal area can guide management decisions on project selection and staffing. More specifically, visitation patterns can aid in allocating recreation fee funding—which is collected by the entrance station to fund projects with a direct impact on visitation. The number of weekend visitors to the coastal area is 110% higher (more than double) the number of midweek visitors. On average, holidays and holiday-adjacent days considered in this analysis attract more than 800 additional visitors to the coastal area! Visitation was not correlated with tide level. These findings indicate that, despite the tidepools being a popular and desired visitor experience, it is critical the park maintains high staffing and volunteer docent presence in the coastal area during holidays, weekends, and holiday-adjacent days, regardless of the tide level.

Moving forward, the park continues to monitor coastal area visitation patterns using updated equipment. EcoCounter PYRO trail counters were installed in February 2021. These new counters use thermal differences to detect visitors and can differentiate ingoing and outgoing trail traffic. The sensors on the new counters use passive-infrared, pyroelectric technology to detect two people that are slightly staggered. Testing in the field confirmed that two adult individuals walking next to each other only have to be staggered by a couple inches and that the counter is able to avoid counting dogs, even if they are relatively large, but may not count very small children (personal observation, L. A. Cat). Additionally, the counter installed on the section of the Coastal Trail adjacent to the Tidepool Parking is equipped with an induction loop that can detect bicycles, which are currently not permitted on the Coastal Trail. The new counters address potential limitations of the Phillips et al. (2013) method because the old calibration technique assumes that visitation patterns are identical to the test periods, which has not been observed. The TrailMaster counters used in this analysis were retired in April 2021, with two months of overlap to allow for direct comparison of data between trail counter systems. Moving forward, we recommend a seasonal calibration with the new EcoCounter PYRO trail counters because the sensors require a temperature differential between individuals and the background, which may be masked by thick coats and jackets. The weather at Cabrillo National

Monument is moderate year round, but this may result in undercounting during extremely cold days when visitation will likely be much lower. Cabrillo National Monument is also in the process of completing a Congestion Management Plan that involves several strategies to manage and reduce congestion and visitation in the coastal area that can be guided by the data in this report.

Trail counters are an important monitoring tool to understand visitation at national park units to carry out the NPS mission. “The National Park Service preserves unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations.” Meeting the NPS mission requires balancing access to visitors with preserving the ecosystems they enjoy visiting. This ranges from habitat quality, to staffing sensitive areas like the tidepools with staff or docents that can educate visitors on how to sustainably visit the rocky intertidal.

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Appendix 1: Statistical Tests and Supplementary Figures

Coastal Area Visitation by Month 2011–2020

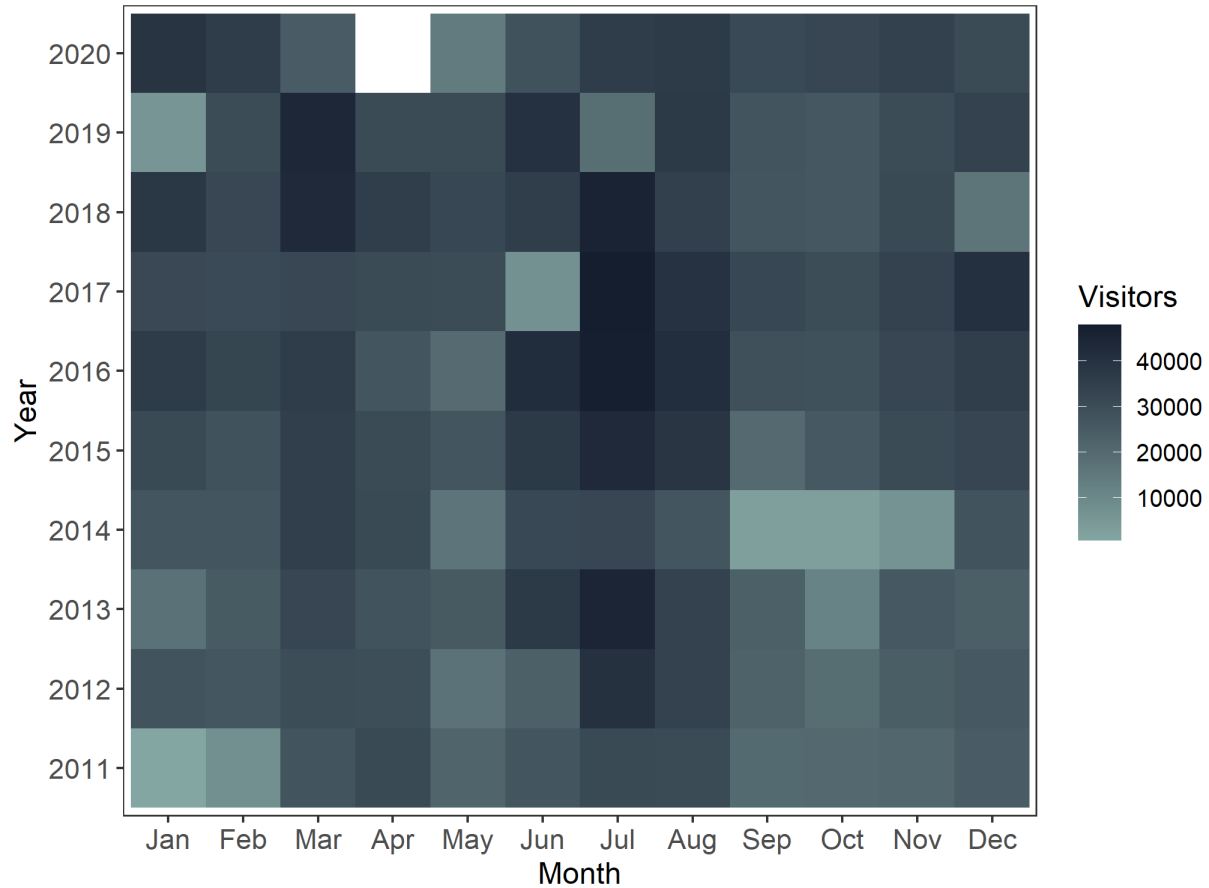


Figure S1. There are more visitors in summer months than spring or fall seasons. Values presented are the sum of Tidepool Parking and Coast View Parking trail counter visitation counts across months and years 2011–2020 to the coastal area of Cabrillo National Monument.

Visitation across Days of the Week

Table S1. ANOVA results for Tidepool Parking.

Factor	Degrees of Freedom	F-value	P-value
Day of Week	6	249.2	< 0.001
Residuals	2895	—	—

Table S2. Tukey HSD results for Tidepool Parking.

Comparison	Difference	p-value	Lower CL	Upper CL
Friday–Monday	51.538304	0.3480	20.59090	123.66751
Friday–Saturday	–443.691696	0.0000	–515.73602	–371.64737
Friday–Sunday	–433.249446	0.0000	–505.29377	–361.20512
Friday–Thursday	141.841747	0.0000	69.36579	214.31771
Friday–Tuesday	163.386782	0.0000	91.12892	235.64465
Friday–Wednesday	161.867559	0.0000	89.43559	234.29953
Monday–Saturday	–495.230001	0.0000	–566.83586	–423.62414
Monday–Sunday	–484.787751	0.0000	–556.39361	–413.18189
Monday–Thursday	90.303443	0.0041	18.26332	162.34356
Monday–Tuesday	111.848477	0.0001	40.02778	183.66918
Monday–Wednesday	110.329255	0.0001	38.33339	182.32512
Saturday–Sunday	10.442250	0.9995	–61.07811	81.96261
Saturday–Thursday	585.533443	0.0000	513.57831	657.48858
Saturday–Tuesday	607.078478	0.0000	535.34302	678.81394
Saturday–Wednesday	605.559256	0.0000	533.64843	677.47008
Sunday–Thursday	575.091193	0.0000	503.13606	647.04633
Sunday–Tuesday	596.636228	0.0000	524.90077	668.37169
Sunday–Wednesday	595.117006	0.0000	523.20618	667.02783
Thursday–Tuesday	21.545035	0.9755	–50.62391	93.71398
Thursday–Wednesday	20.025812	0.9833	–52.31745	92.36907
Tuesday–Wednesday	–1.519222	1.0000	–73.64398	70.60554

Table S3. ANOVA results for Coast View Parking.

Factor	Degrees of Freedom	F-value	P-value
Day of Week	6	308.3	< 0.001
Residuals	3287	–	–

Table S4. Tukey HSD results for Coast View Parking.

Comparison	Difference	p-value	Lower CL	Upper CL
Friday–Monday	–4.3616150	0.9993	–32.108433	23.38520
Friday–Saturday	–206.4661161	0.0000	–234.256939	–178.67529
Friday–Sunday	–223.0262866	0.0000	–250.773104	–195.27947
Friday–Thursday	35.8303871	0.0027	8.083569	63.57720
Friday–Tuesday	37.2574590	0.0015	9.525201	64.98972
Friday–Wednesday	36.7377226	0.0019	8.976291	64.49915
Monday–Saturday	–202.1045011	0.0000	–229.791651	–174.41735
Monday–Sunday	–218.6646716	0.0000	–246.307652	–191.02169
Monday–Thursday	40.1920021	0.0004	12.549022	67.83498
Monday–Tuesday	41.6190740	0.0002	13.990708	69.24744
Monday–Wednesday	41.0993376	0.0002	13.441689	68.75699
Saturday–Sunday	–16.5601705	0.5723	–44.247320	11.12698
Saturday–Thursday	242.2965032	0.0000	214.609353	269.98365
Saturday–Tuesday	243.7235751	0.0000	216.051016	271.39613
Saturday–Wednesday	243.2038387	0.0000	215.502044	270.90563
Sunday–Thursday	258.8566737	0.0000	231.213694	286.49965
Sunday–Tuesday	260.2837456	0.0000	232.655380	287.91211
Sunday–Wednesday	259.7640092	0.0000	232.106361	287.42166
Thursday–Tuesday	1.4270719	1.0000	–26.201294	29.05544
Thursday–Wednesday	0.9073355	1.0000	–26.750313	28.56498
Tuesday–Wednesday	–0.5197364	1.0000	–28.162778	27.12331

Hourly Tide Level and Visitation

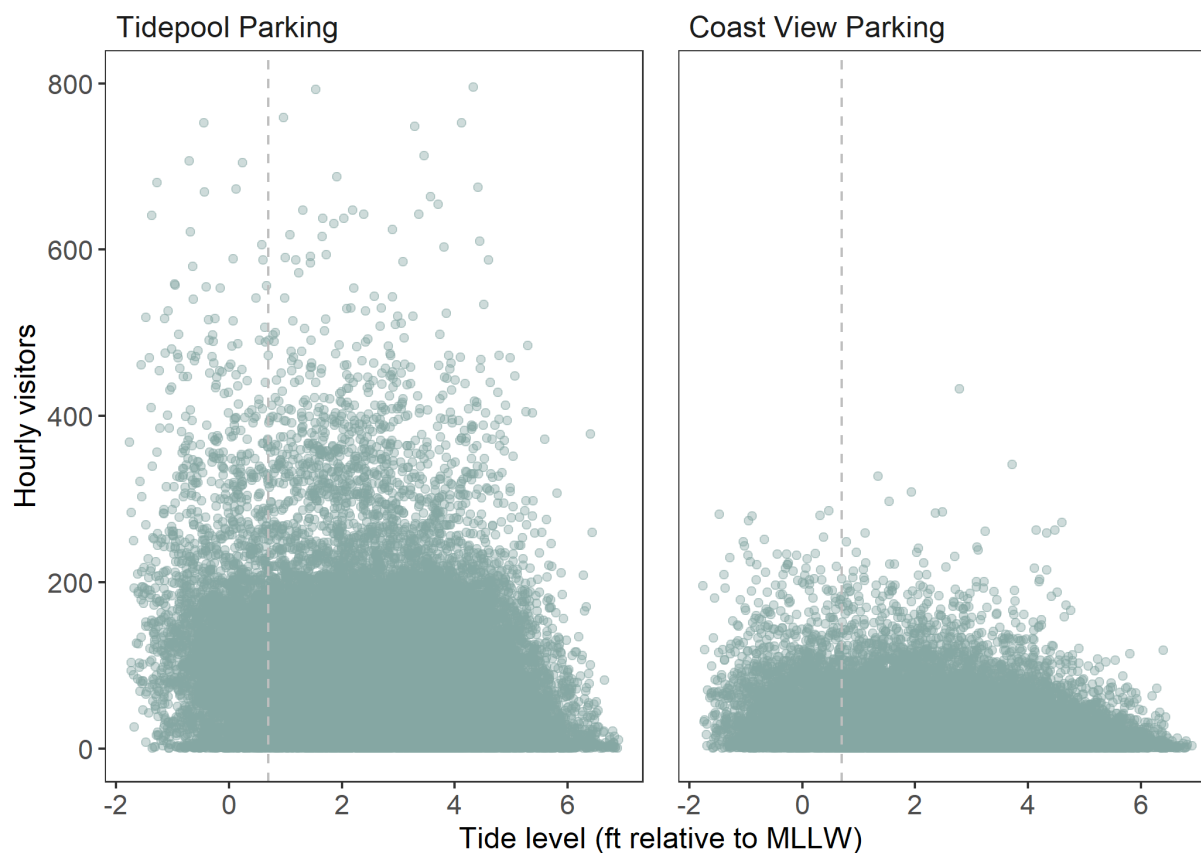


Figure S2. The magnitude of low tides is not strongly correlated with the number of hourly visitors at either the Tidepool Parking (linear regression: $p < 0.01$, $R^2 = 0.03$) or Coast View Parking (linear regression: $p < 0.01$, $R^2 = 0.04$). The tide level at the top of the hour, in feet below mean lower-low water (MLLW), is plotted against the corrected number of visitors to the Tidepool Parking and Coast View Parking entrances to the Coastal Trail at Cabrillo National Monument each hour 2011–2020.

Holiday Visitation Comparison

To test whether visitation on holidays is significantly higher than non-holidays, we looked at visitation on Office of Personnel Management (OPM) holidays, along with a few holiday-adjacent days. We took the difference in visitation on holidays and days two weeks after the holidays (to compare values with the same day of week and similar place in the tide cycle) and used a t-test for each holiday (with years as replicates) to determine if visitation is significantly higher on holidays than paired non-holidays. Each row in the table below contains results from a t-test on a given holiday for each lot.

Table S5. Holiday visitation paired t-test results.

Lot	Holiday	P-value	DF	F-Value	Mean Difference in Visitation
Tidepool Parking	Birthday of Martin Luther King, Jr.	2.08E-05	6	11.95046	976.0307
Tidepool Parking	Christmas Day	0.581285	4	-0.59927	-236.232
Tidepool Parking	Christmas Eve	0.010935	6	3.632284	547.8493
Tidepool Parking	Day After Christmas	0.001161	7	5.270018	851.9231
Tidepool Parking	Day After Thanksgiving	1.41E-06	6	18.92631	1030.564
Tidepool Parking	Independence Day	0.002467	4	6.782568	516.069
Tidepool Parking	Indigenous Peoples' Day	2.61E-05	7	9.703082	274.635
Tidepool Parking	Labor Day	9.66E-06	7	11.27257	1003.489
Tidepool Parking	Memorial Day	0.009966	4	4.608673	387.09
Tidepool Parking	New Year's Day	0.127459	3	2.092617	576.81
Tidepool Parking	Thanksgiving Day	0.001702	7	4.925783	629.0213
Tidepool Parking	Veterans Day	0.58372	7	-0.57433	-67.7025
Tidepool Parking	Washington's Birthday	1.22E-06	7	15.30572	908.6288
Coast View Parking	Birthday of Martin Luther King, Jr.	5.27E-05	7	8.711027	468.7094
Coast View Parking	Christmas Day	0.338662	4	1.085708	114.046
Coast View Parking	Christmas Eve	0.330016	7	1.046729	110.8075
Coast View Parking	Day After Christmas	0.002325	7	4.656126	372.5069
Coast View Parking	Day After Thanksgiving	2.46E-06	9	10.45745	415.3535
Coast View Parking	Independence Day	0.048007	8	2.332059	146.7556
Coast View Parking	Indigenous Peoples' Day	0.003096	8	4.176244	60.81889
Coast View Parking	Labor Day	6.49E-07	8	14.02223	367.1006
Coast View Parking	Memorial Day	0.004472	5	4.900533	331.7875
Coast View Parking	New Year's Day	0.19941	4	1.535708	189.357
Coast View Parking	Thanksgiving Day	0.005455	8	3.771405	121.7789
Coast View Parking	Veterans Day	0.99217	9	-0.01009	-0.635
Coast View Parking	Washington's Birthday	1.53E-04	8	6.70088	397.9333

Fee-Free Day Comparison

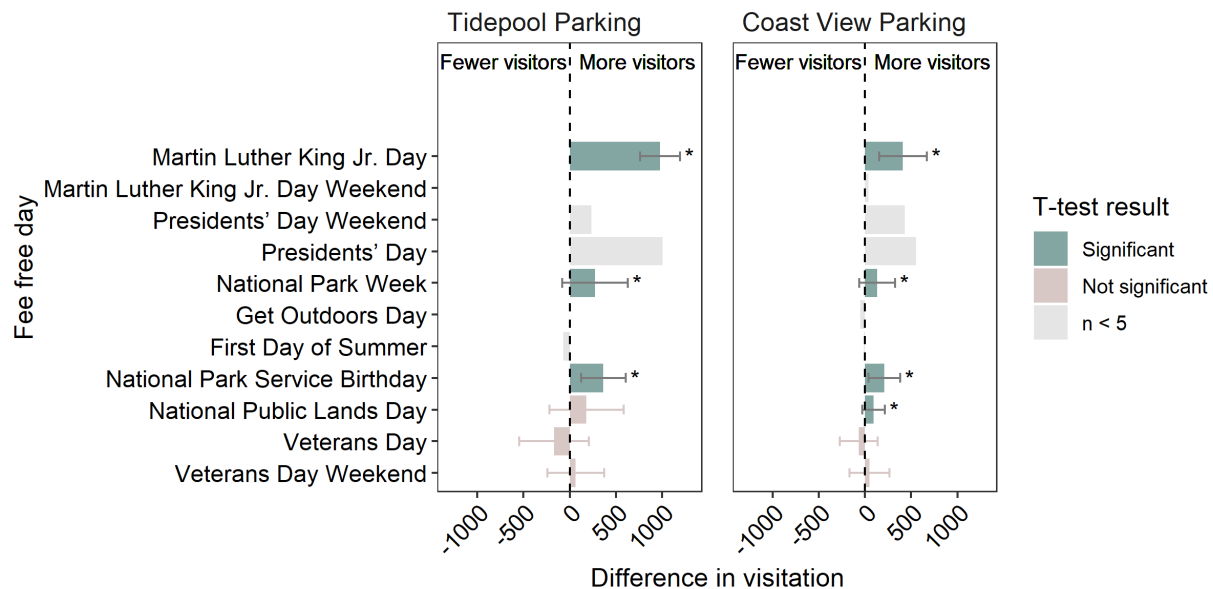


Figure S3. Most fee free days don't result in higher visitation than fee admission days 14 days after (to match day of week and tide cycle position). Martin Luther King Jr. Day, National Park Week days, and the National Park Service Birthday result in significantly higher visitation at both lots in the coastal area of Cabrillo National Monument. Values presented are the mean difference ($\pm$ SE) in visitation between fee free days and paired dates 14 days after. Bar color indicates the results of t-tests, which determine if there is a significant difference in visitation. Teal bars (darkest bars) indicate that there is a significant difference between fee-free days and non-fee free days (paired t-test, $p < 0.05$), while dusty pink bars (which are lighter in color value and have error bars) indicate no significant difference (paired t-test, $p > 0.05$). Light gray bars with no error bars indicate insufficient sample sizes for t-tests to be conducted.

Table S6. Fee-free day paired t-test results.

Lot	Fee Free Day	P-value	DF	F-value	Mean difference in visitation
Tidepool Parking	Martin Luther King Jr. Day	2.08E-05	6	11.95046	976.0307
Tidepool Parking	National Park Week	3.78E-04	27	4.0595	271.493
Tidepool Parking	National Public Lands Day	0.240947	7	1.281152	181.5919
Tidepool Parking	National Park Service Birthday	0.010631	5	3.970509	398.1825
Tidepool Parking	Veterans Day	0.246012	7	-1.26601	-168.204
Tidepool Parking	Veterans Day Weekend	0.657236	4	0.478558	65.331
Coast View Parking	Martin Luther King Jr. Day	0.002853	7	4.483976	410.5275
Coast View Parking	National Park Week	2.46E-04	35	4.082459	130.8629
Coast View Parking	National Public Lands Day	0.047002	8	2.345618	95.32056
Coast View Parking	National Park Service Birthday	0.029718	6	2.836114	192.0421
Coast View Parking	Veterans Day	0.323295	9	-1.04496	-67.437
Coast View Parking	Veterans Day Weekend	0.582021	6	0.581586	47.44357

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525