Arches Reservation System

Impact on

Moab-Grand County, Utah

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Summary

Reservation system has operated for 3 years

1. A mandatory, timed-entry reservation system was introduced at Arches National Park in **April 2022**
2. The system has operated for **3-years** during **the summer tourism season** under a **pilot program**
3. Reservations have been required from **April to October**, between the hours of **7am and 4pm**

Visitation has fallen dramatically

1. Arches has experienced a **significant and protracted decline in visitation** following the reservation system's introduction
2. Visitation **during the reservation months** has declined by approximately **20%** from pre-reservation years
3. The decline in visitation is the **largest of Utah's national parks, and among the largest in the region and the country**

Large cost to the local economy

1. The fall in summer season visitation is **costing approximately $45 million annually** in lost visitor spending, or a total **$130 million** over the 3-year period since the reservation system began
2. Annual **direct visitor spending** in Grand County **declined $97 million from 2021 to 2023**, according to The Kem C. Gardner Policy Institute
3. Grand County has now recorded the **lowest real growth in direct visitor spending of any county in Utah over the 5-year period from 2018 to 2023**

Moab-Grand County depends on travel and tourism more than any other county in Utah

58%

Almost 60% of the local workforce is **employed directly or indirectly in travel & tourism.** This is the **highest rate in the state,** and much higher than the **state average of ~9%**[1]

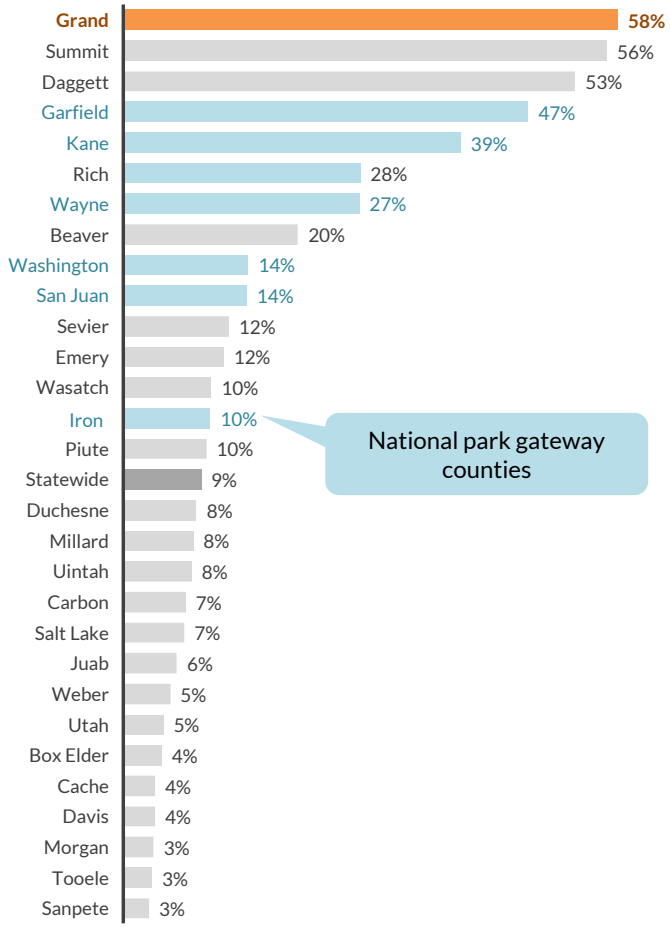
83%

Over 80% of **local government sales tax revenue comes from visitor spending.** This is also the **highest rate in the state**, and much higher than the **state average of ~20%**[1]

With most of its eggs in one basket, even **small declines in travel & tourism can have big impacts** on Moab-Grand County's economic welfare

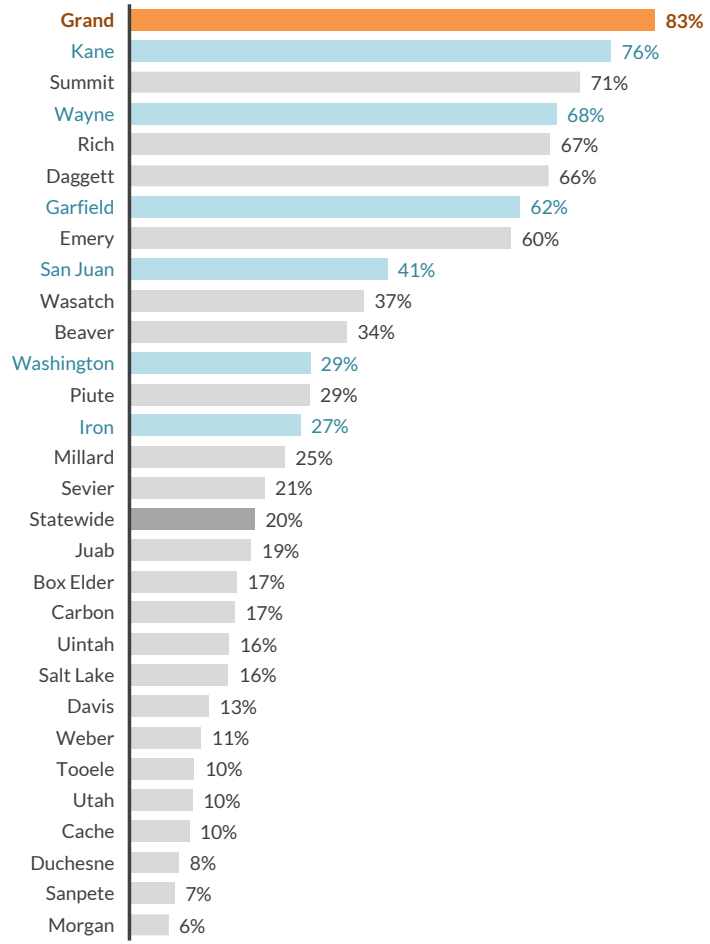
Jobs

Workforce Employed Directly & Indirectly in Tourism
2023



Local Tax Revenue

Visitor Contribution to Local Sales Tax Revenues
2023



Sources: 1. 2024 Travel & Tourism County Profiles, Kem Gardner Policy Institute, University of Utah; 2. Utah Department of Workforce Services

Arches National Park is the single biggest reason people visit Moab-Grand County

77% Almost **80% of** Grand County **visitors explore Arches National Park**[1]

74% Exploring Arches NP is the **primary reason ~75%** of Park visitors travel to the local area[2]

99% **Exploring Arches** is **one of two** or more **equally important reasons 99% of Park visitors travel to the local area**[2]

Travel and tourism in Grand County **relies heavily** on visitors' ability to explore **Arches National Park**

"Arches National Park was the single biggest draw"[1]

Sources: 1. Better Solutions LLC & RCC Associates (2024), *Trail to Tomorrow* Research Report, Grand County Dept. of Economic Development, p. 12
2. Otak (2023), *2022 Arches National Park Visitor Spending and Experience Study*, Figures 6 & 7, p. 24-25

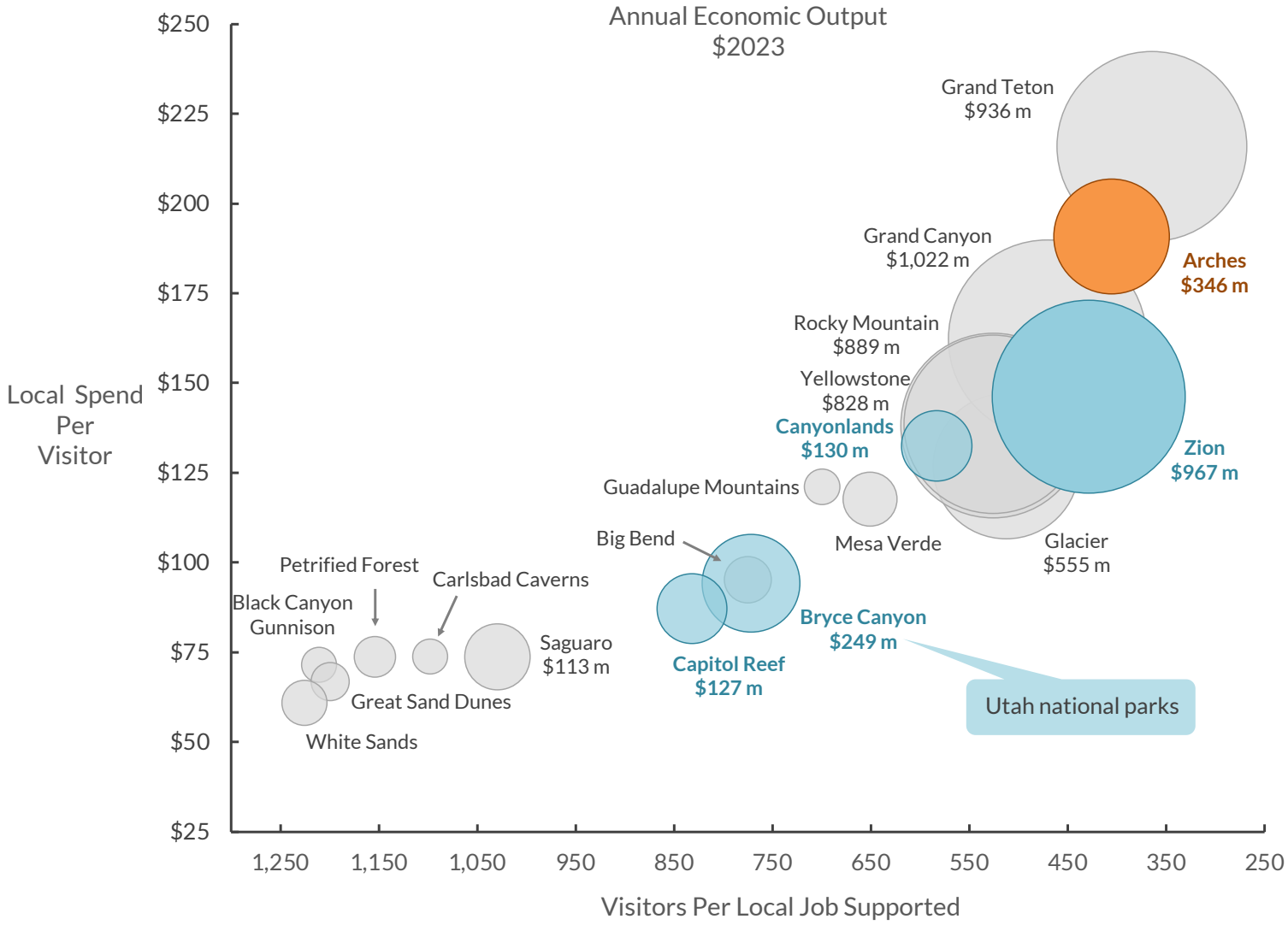
Arches National Park visitors are big spenders and local job supporters

1. **Arches** National Park **presently generates approximately $350 million in annual economic output**[1]

2. Of **Utah's** national parks, Arches makes the **2nd biggest economic contribution** to the state, behind Zion[1]

3. Arches visitors are relatively big spenders and job supporters, compared against visitors to Utah's other national parks, and visitors to other national parks in the Intermountain West

As a result, **declines in visitation at Arches have the potential to create bigger economic impacts**

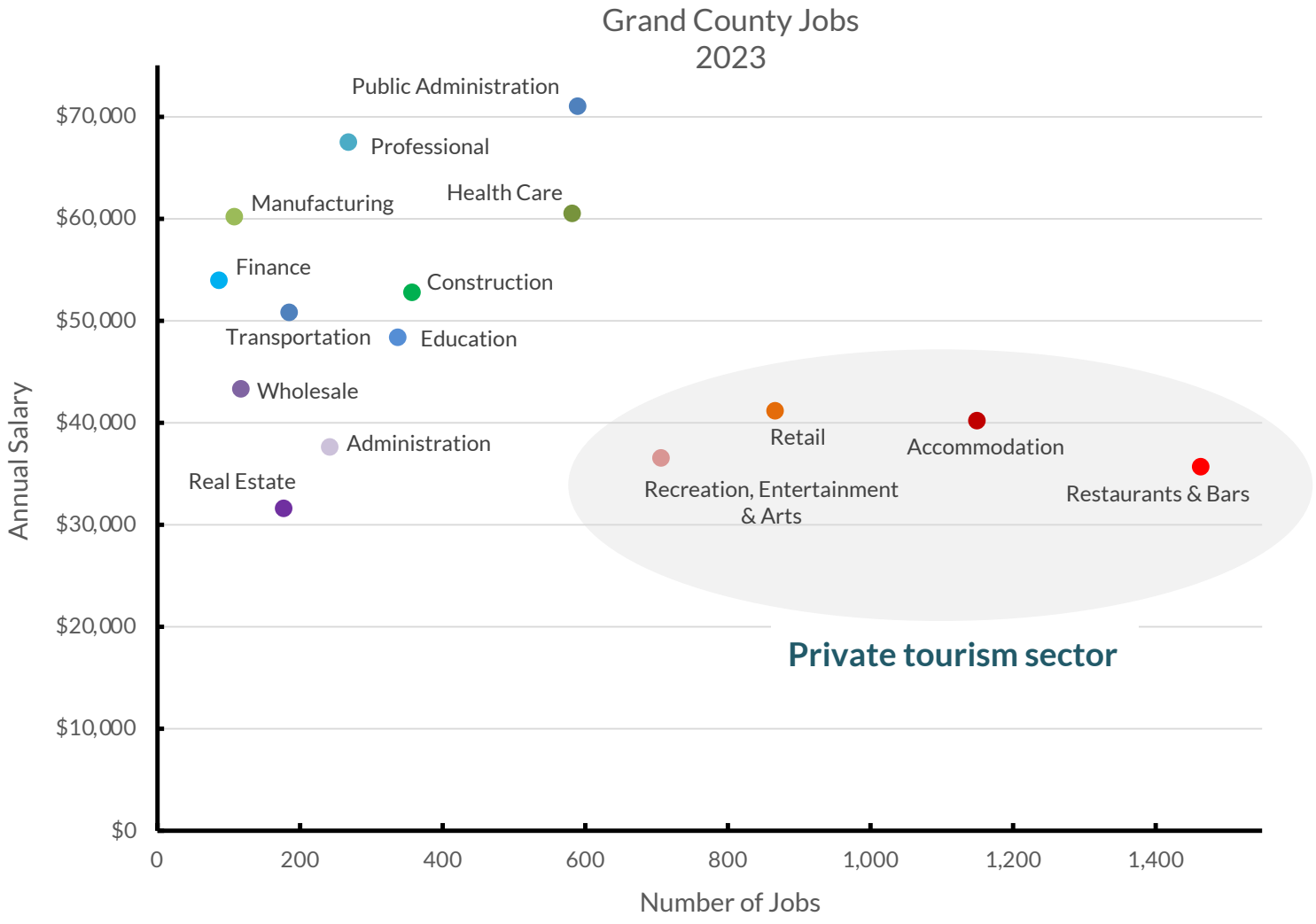


Source: 1. Flyr and Koontz (2024), *Visitors Spending Effects - 2023 Visitor Spending Effects - Economic Contributions to Local Communities, States, and the Nation*, National Park Service, Table 5, p. 20

Grand County's tourism workers are especially vulnerable to tourism downturns

Unlike people employed in most other sectors,
Grand County's many tourism workers…

1. Are **lower paid**
2. **Part-time**, with no guaranteed income
3. **Seasonal**, relying on a strong, **summer tourism season** to get through the quieter winter months
4. Enjoy **few to no benefits**, including health care, paid leave and retirement



Source: Utah Department of Workforce Services

Arches NP visitation has fallen sharply since the reservation system was introduced in April 2022

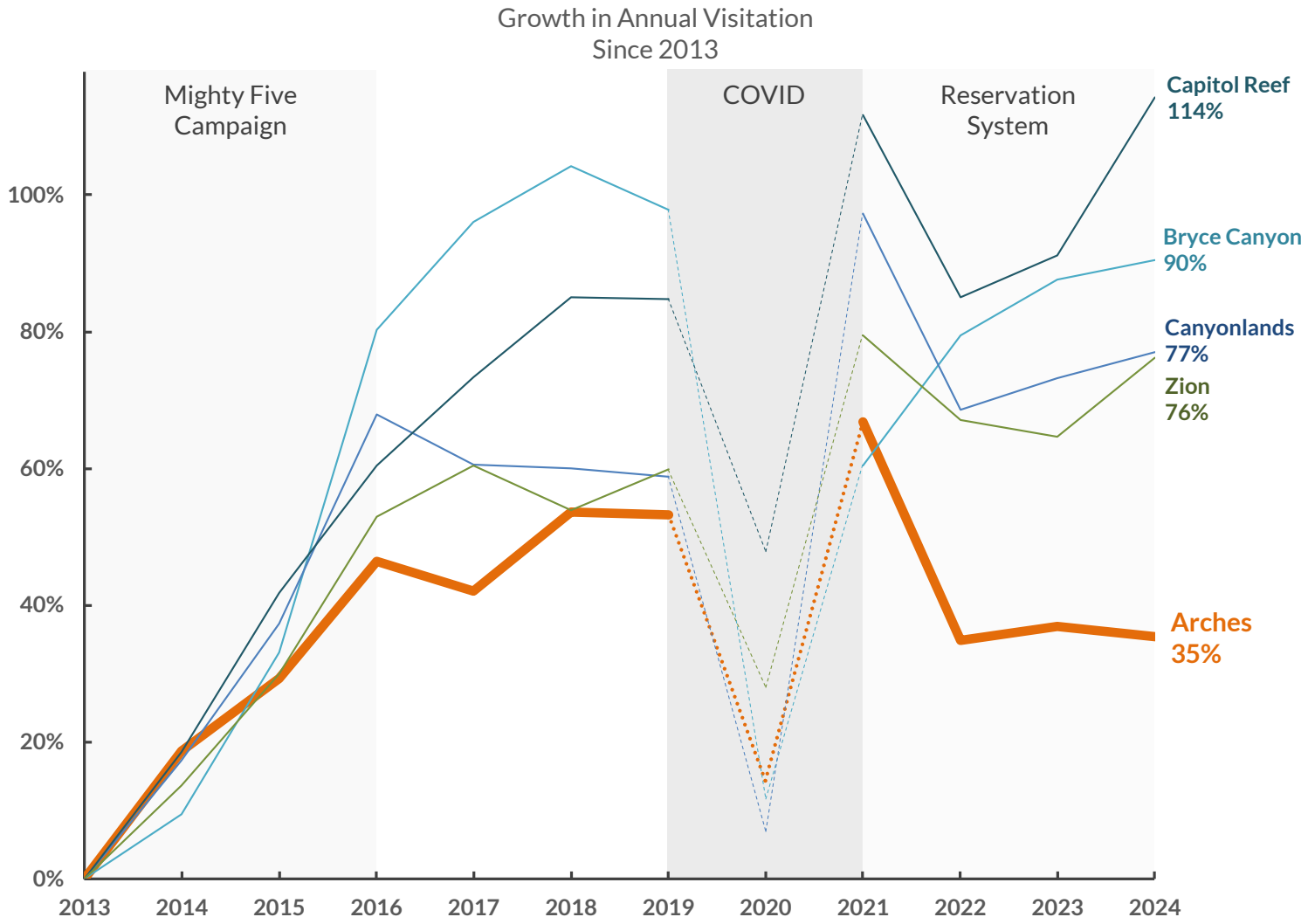
1. All Utah national parks experienced **strong visitation growth during the Mighty Five** national advertising campaign, which extended from **2013 to 2016**

2. Except for Arches, visitation at **Utah's other national parks has continued to grow** since this period

3. For example, **Zion** National Park recorded its **2nd highest annual visitation on record in 2024** - at **just under 5 million visitors**

4. Conversely, **Arches has experienced a sharp and protracted decline in visitation** since the reservation system's introduction in 2022

5. Over the last 3 years **under the reservation system**, Arches **annual visitation has reverted to 2015 levels**, at just under 1.5 million visitors



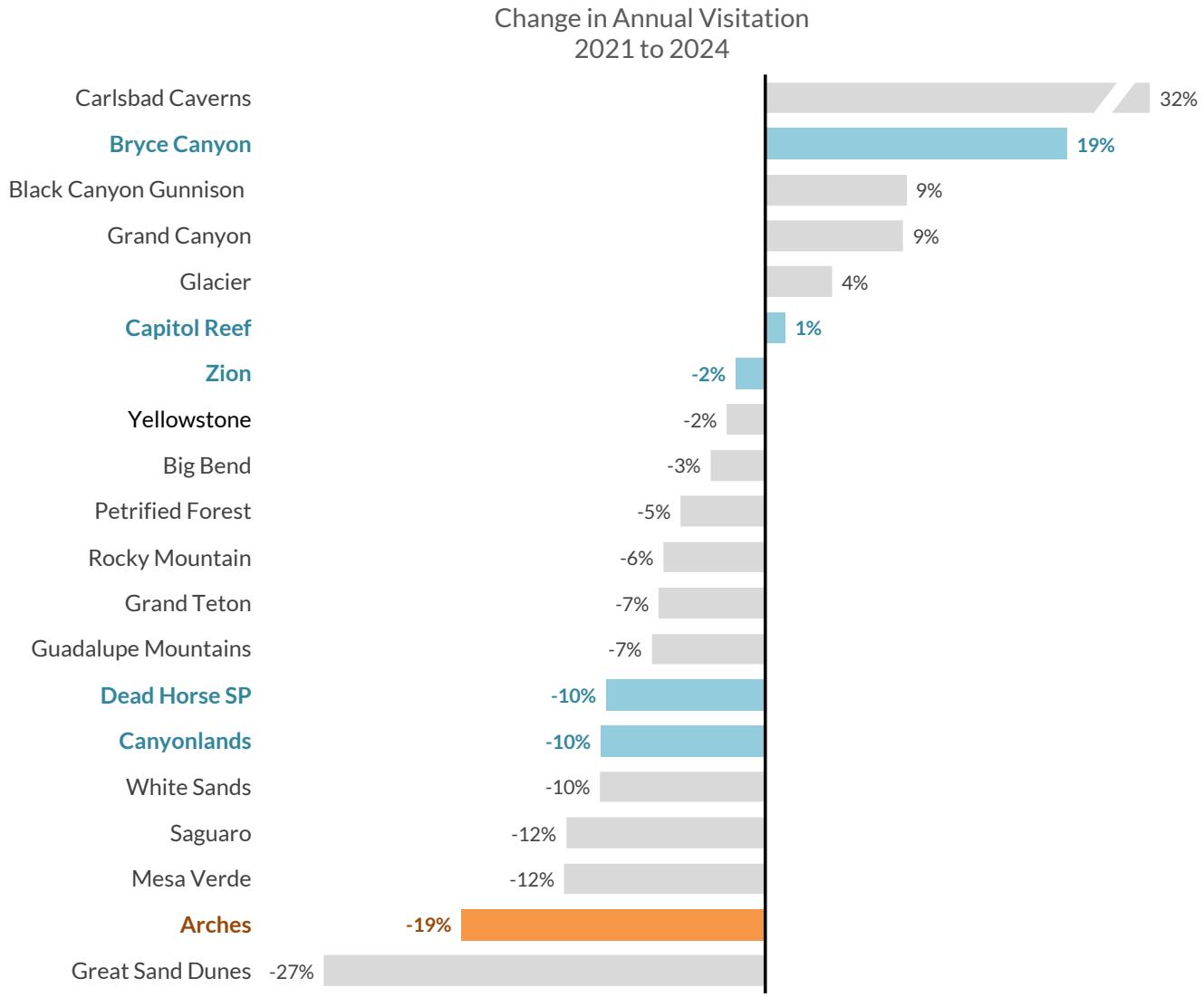
Source: National Park Service, https://irma.nps.gov/Stats/

Over the last 3 years, the percentage fall in visitation at Arches National Park has been the 2nd largest among national parks in the Intermountain West

1. While many national parks have experienced visitation declines following the 'post-COVID bump', the **fall in visitation at Arches has been especially acute** over the 3-years during which the reservation system has operated

2. **Other Utah parks have not experienced comparable falls**, including nearby Canyonlands National Park and Dead Horse Point State Park

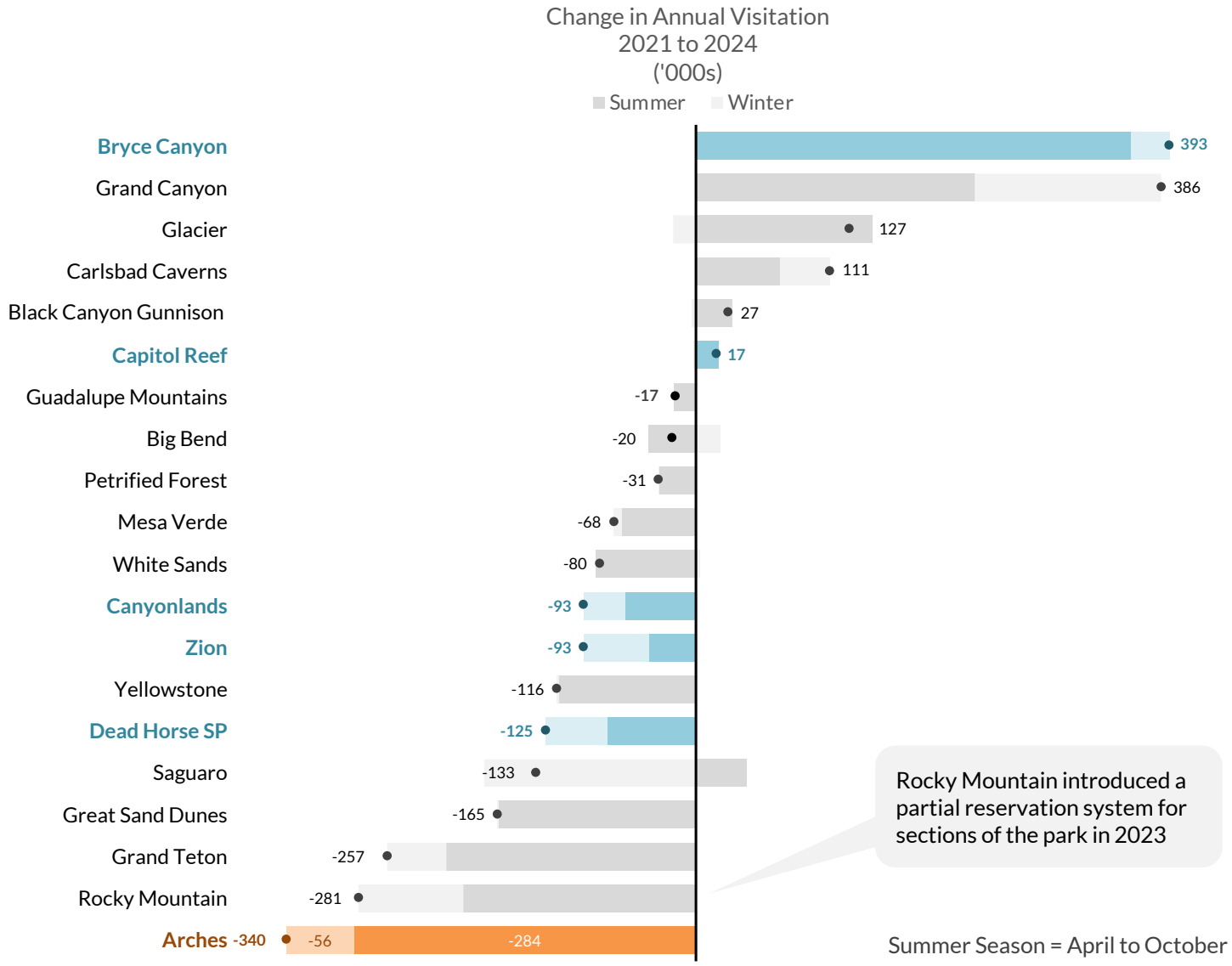
3. This lends considerable support to the claim that park specific factors, such as the reservation system, are uniquely and adversely impacting visitation at Arches National Park



Source: National Park Service, https://irma.nps.gov/Stats/

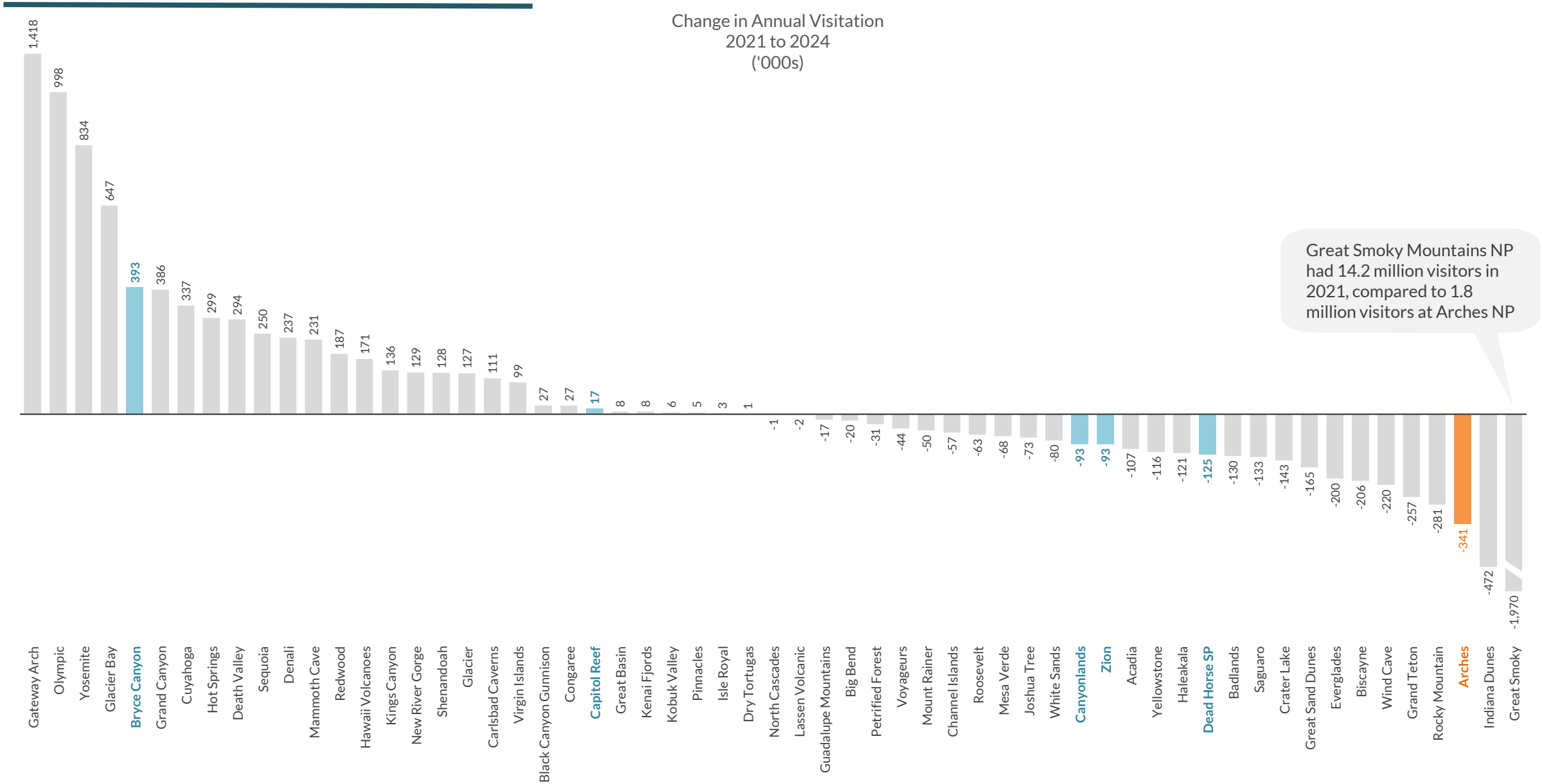
Additionally, the fall in total visitation at Arches National Park is the largest of Intermountain West national parks

The **decline in Arches visitation during the summer tourism season of April through October, when reservations are required**, has been **especially pronounced** when compared against changes in visitation at other national parks in the region over the same period



Source: National Park Service, https://irma.nps.gov/Stats/

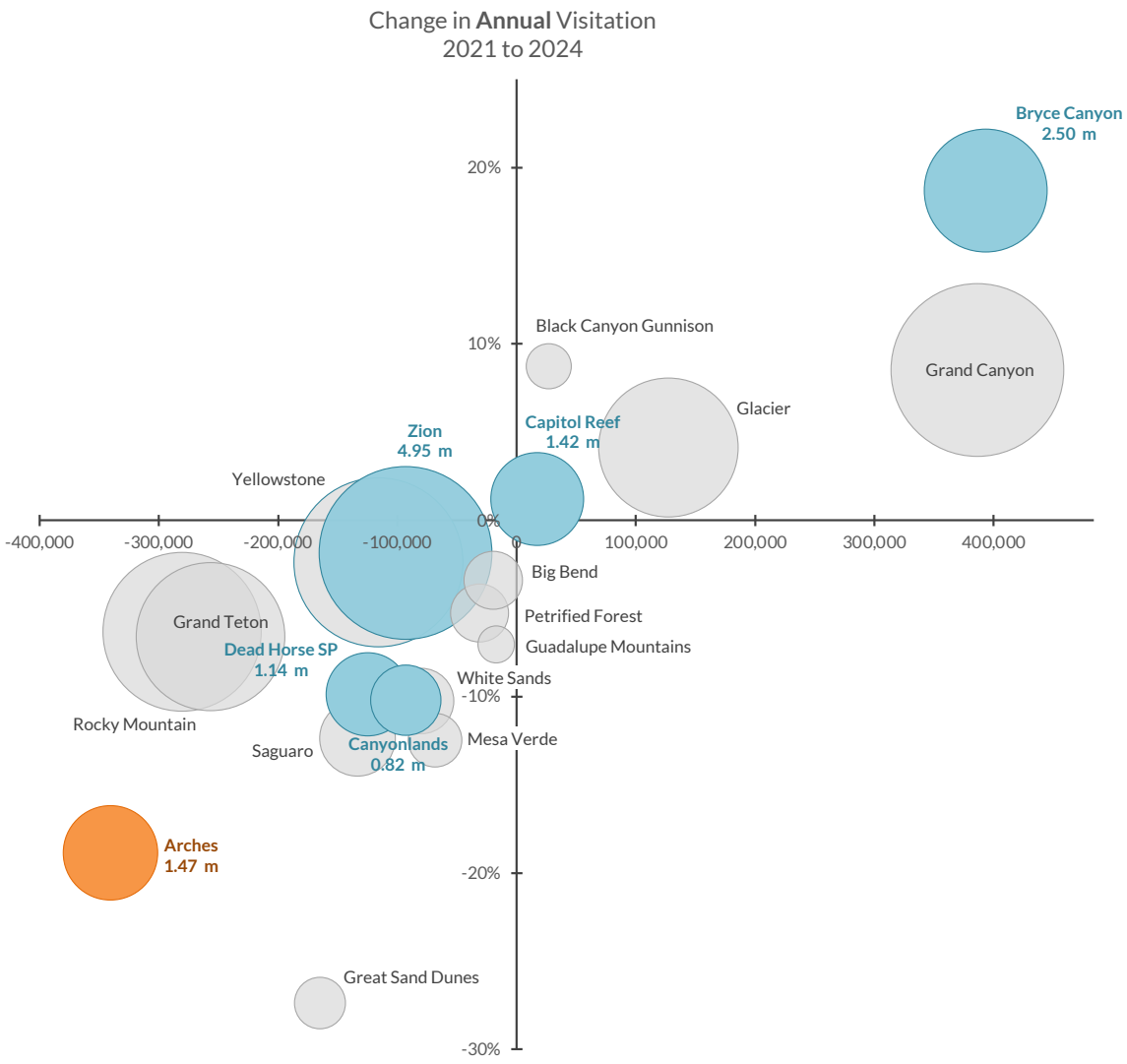
In fact, the fall in Arches visitation over the last 3 years is the 3rd largest of all parks in the country

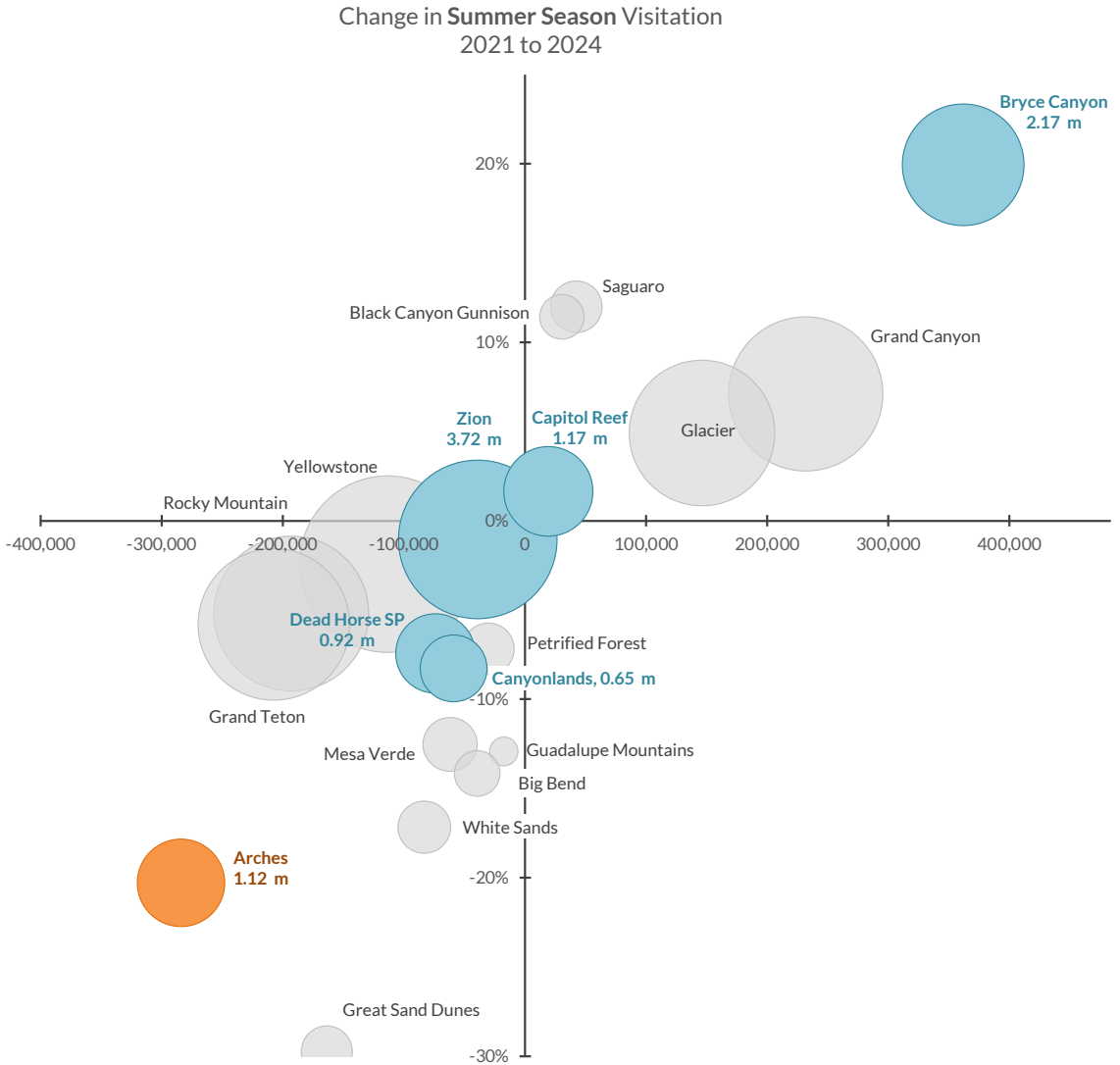


Source: National Park Service, https://irma.nps.gov/Stats/

Note: Five national parks with fewer than 100,000 annual visitors have been removed from the graph for clarity

The fall in Arches visitation over the last 3 years has been comparatively large, especially during the summer tourism season when the reservation system has operated





Summer Season = April to October

Source: National Park Service, https://irma.nps.gov/Stats/

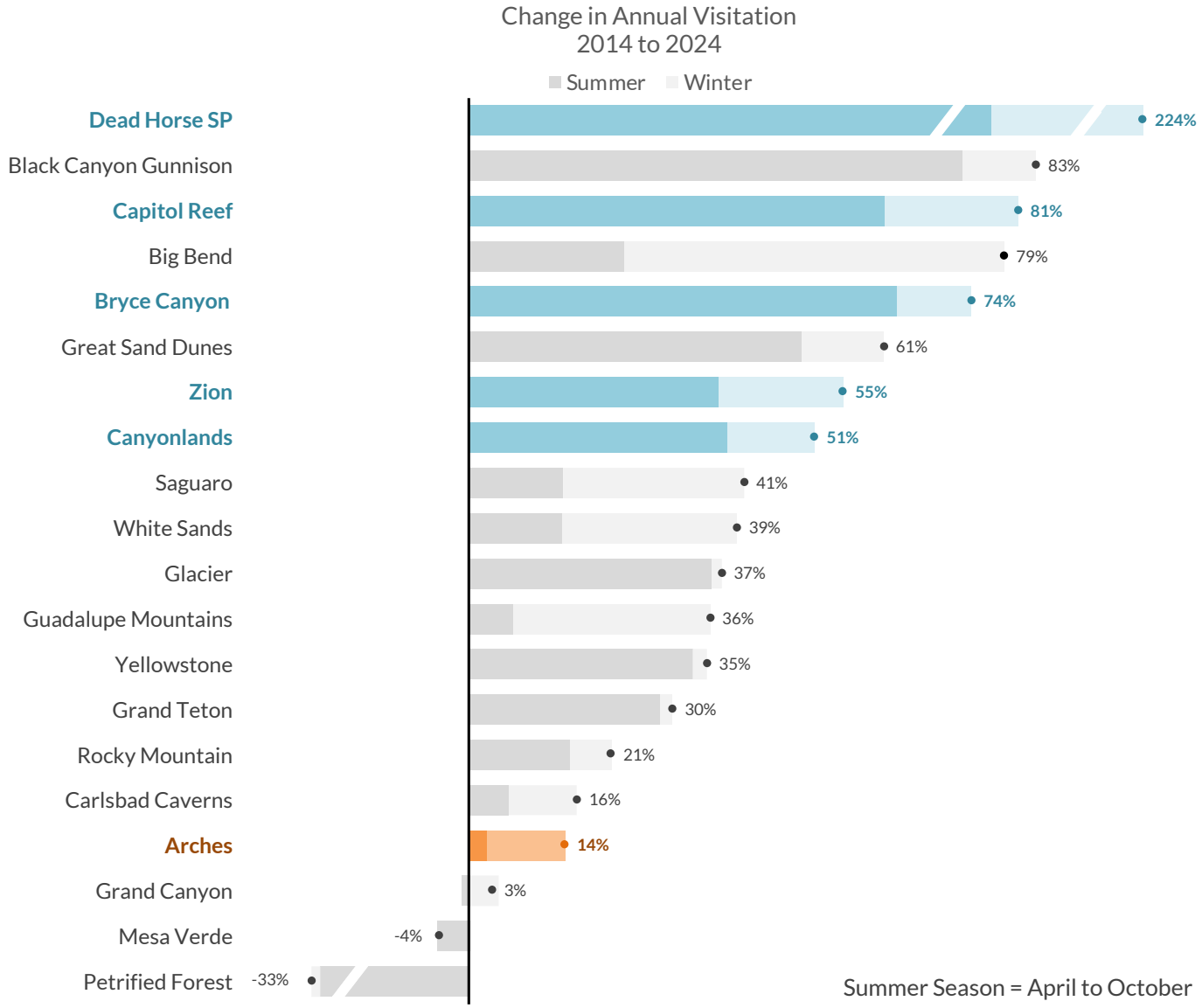
Flowing from large recent declines, Arches has seen little change in annual visitation over the last decade

1. Except for Arches, annual **visitation at Utah's national parks has increased by more than 50% over the last decade**

2. **In start contrast**, annual visitation at **Arches** national park **has increased only 14%** over the same period

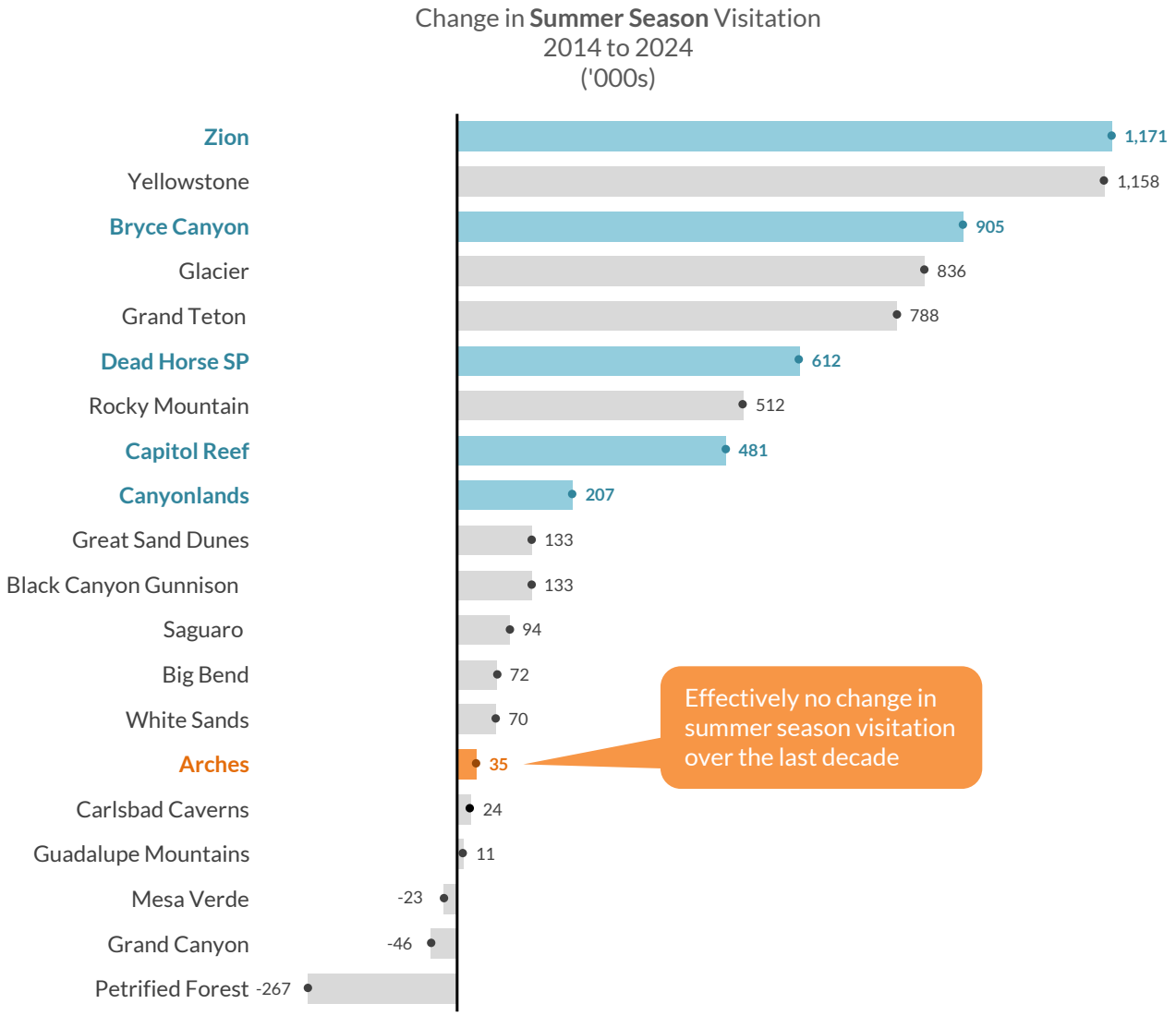
3. This modest increase comes overwhelmingly from an **increase in winter, not summer season visitation**

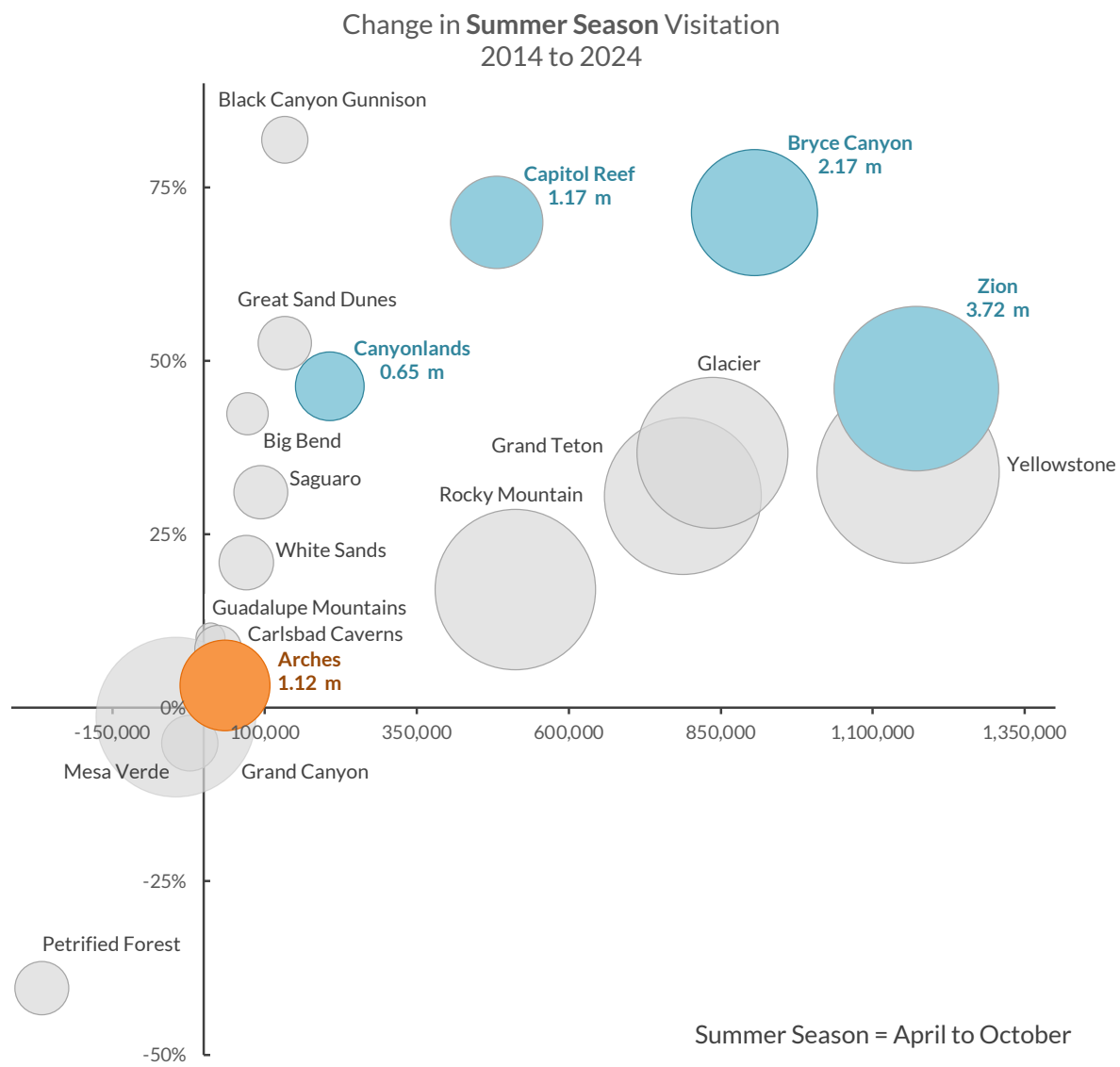
4. **Capitol Reef now welcomes more visitors during the summer tourism season** than Arches



Source: National Park Service, https://irma.nps.gov/Stats/

Over the last decade, Zion National Park has welcomed an additional 1.2 million visitors annually during the summer tourism season. In stark contrast, Arches has welcomed fewer than 35,000.





Source: National Park Service, https://irma.nps.gov/Stats/

The fall in visitation at Arches National Park during the reservation months is statistically significant[1]. It is costing the local economy approximately $45 million annually in lost visitor spending.

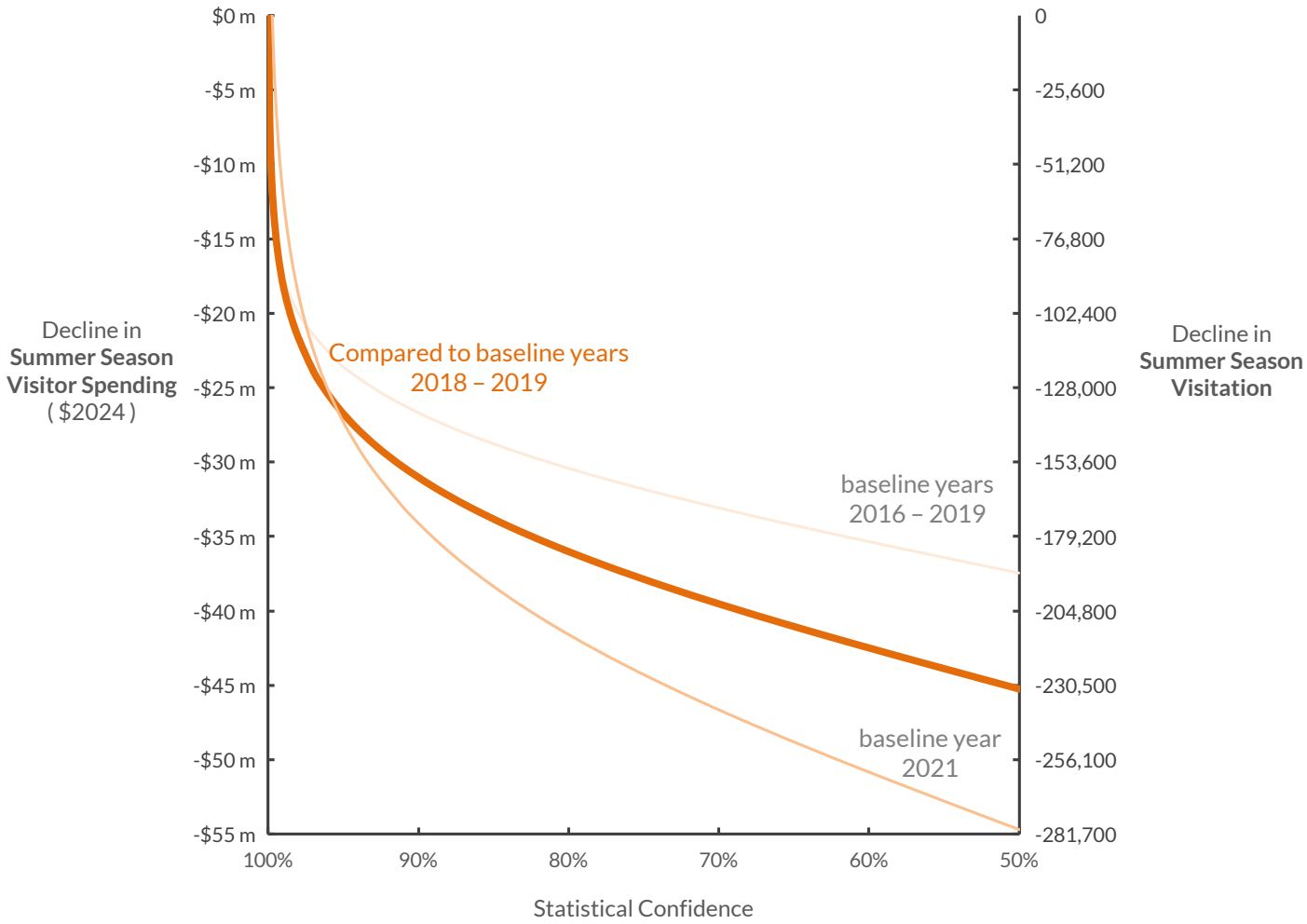
1. Statistical analysis indicates that **summer season visitation** at Arches National Park **has fallen by between 140,000 visitors** (95% confidence) **and 230,000 visitors** (50% confidence) annually since the reservation system was introduced in 2022; compared to average summer season visitation over the period 2018 through 2019

2. This has come at an **annual cost** of **between $27 million** (95% confidence) and **$45 million** (50% confidence**) in lost direct visitor spending** in the local economy

3. The total **cost of the reservation system over the 3-years pilot period** is estimated to be between **$80 million to $135 million** in lost visitor spending

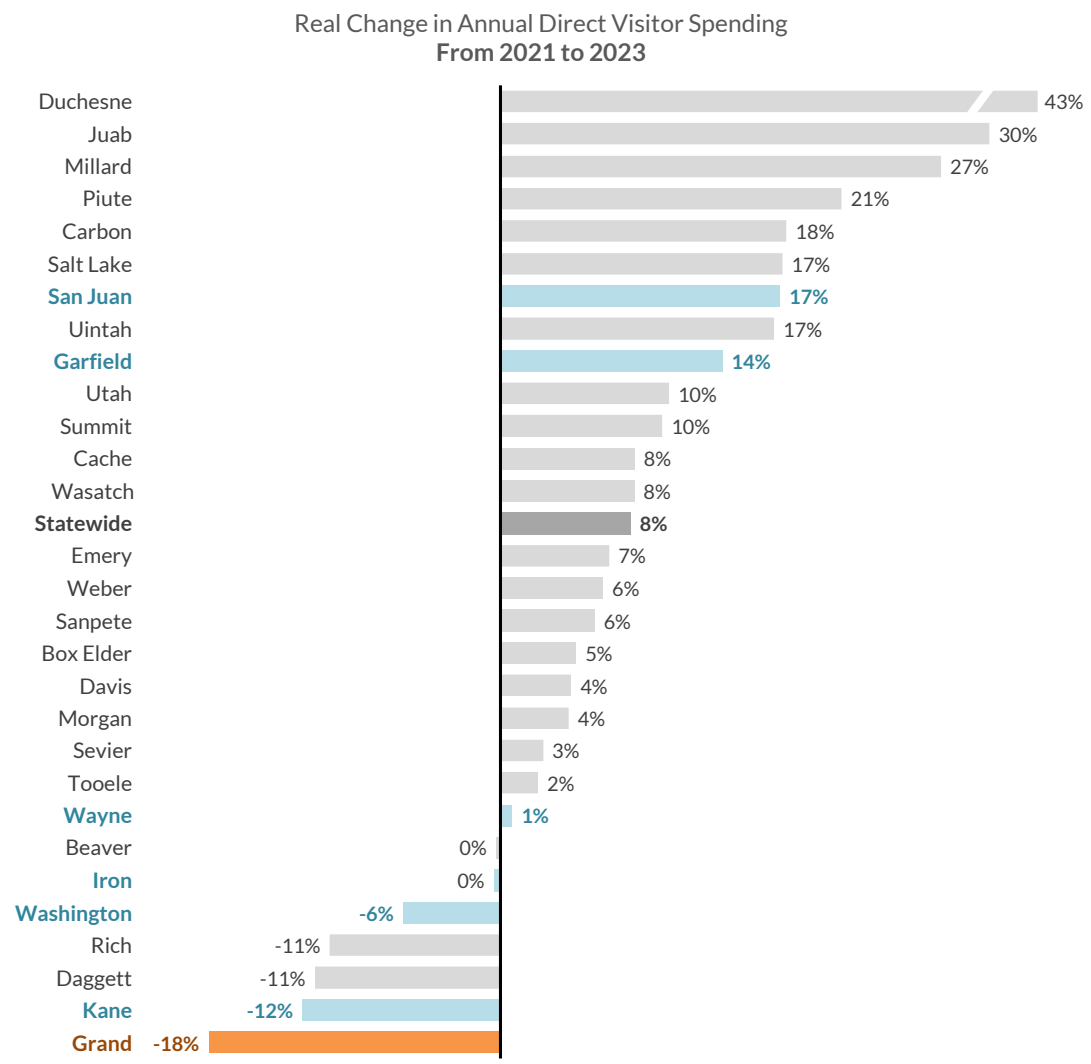
4. The **total economic impact is likely to be substantially greater due to secondary spending effects and economic multipliers**

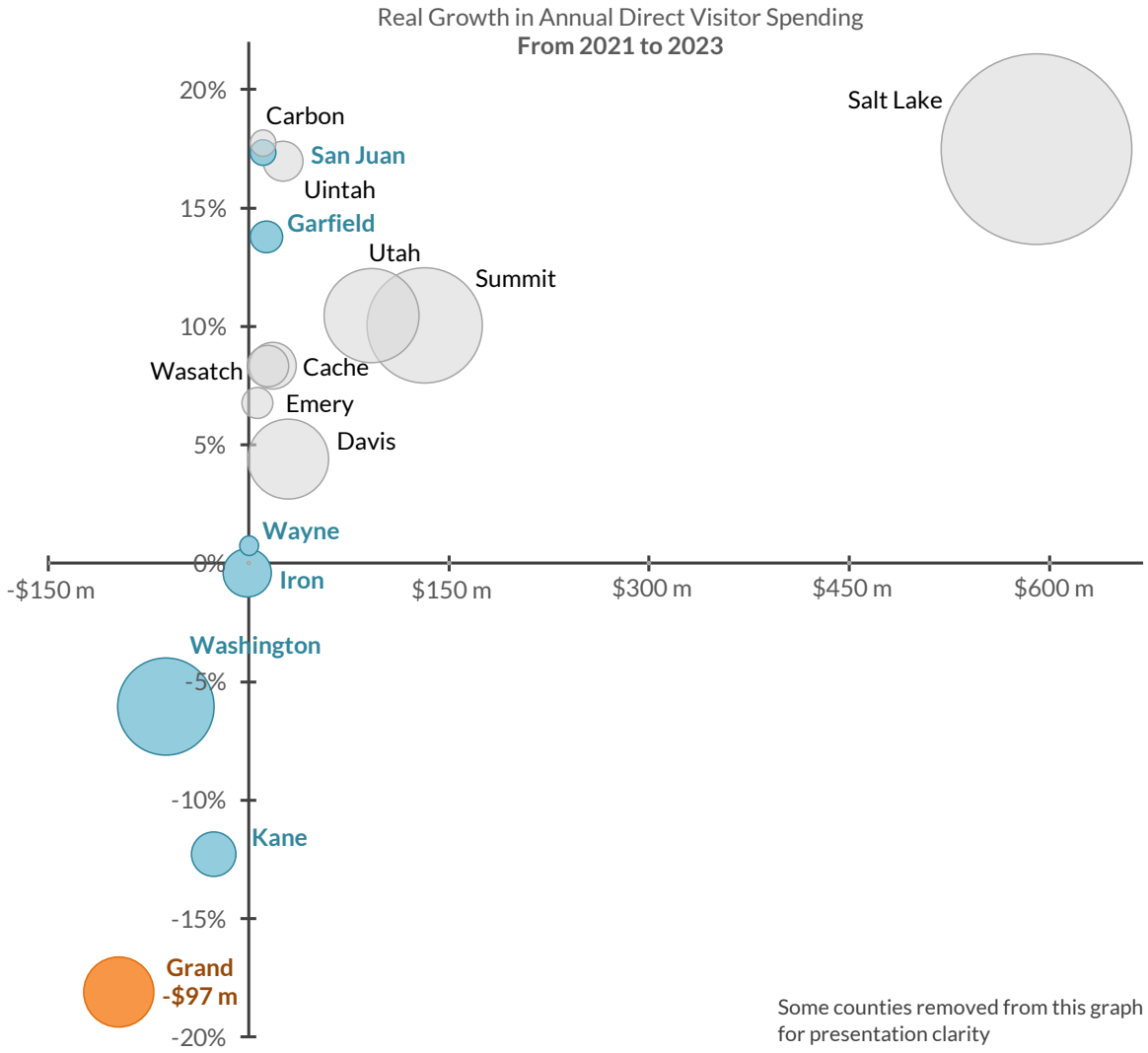
5. There has been **no statistically significant increase in Arches winter season visitation over the same period**. Refer Appendices 4 & 10.



Sources:
1. Refer Appendix 9
2. National Park Service, https://irma.nps.gov/Stats/
3. Flyr and Koontz (2023), *Visitors Spending Effects - 2023 Visitor Spending Effects - Economic Contributions to Local Communities, States, and the Nation*, National Park Service, Table 5, p. 20

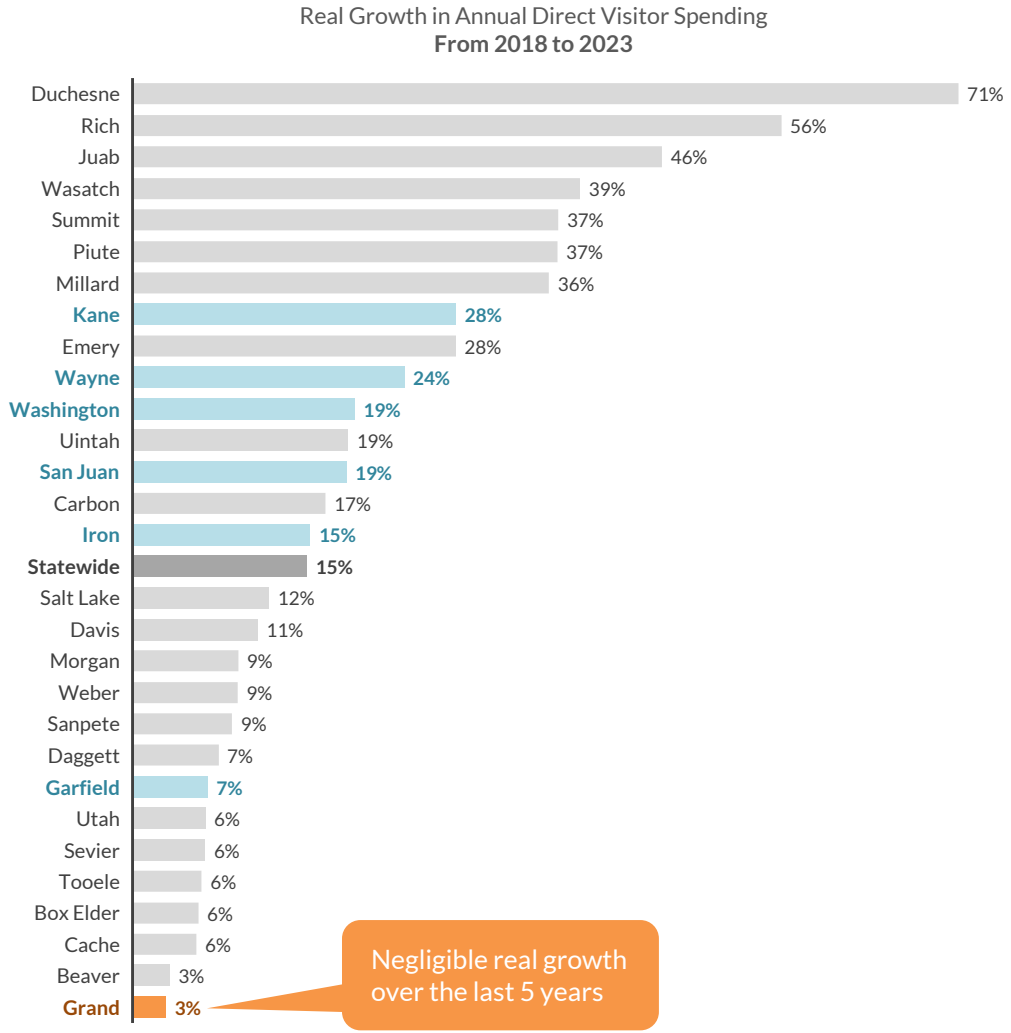
Of Utah's counties, Grand County recorded the largest decline ($97 million) in annual direct visitor spending over the 2-year period from 2021 to 2023; as measured by the Kem C. Gardner Policy Institute

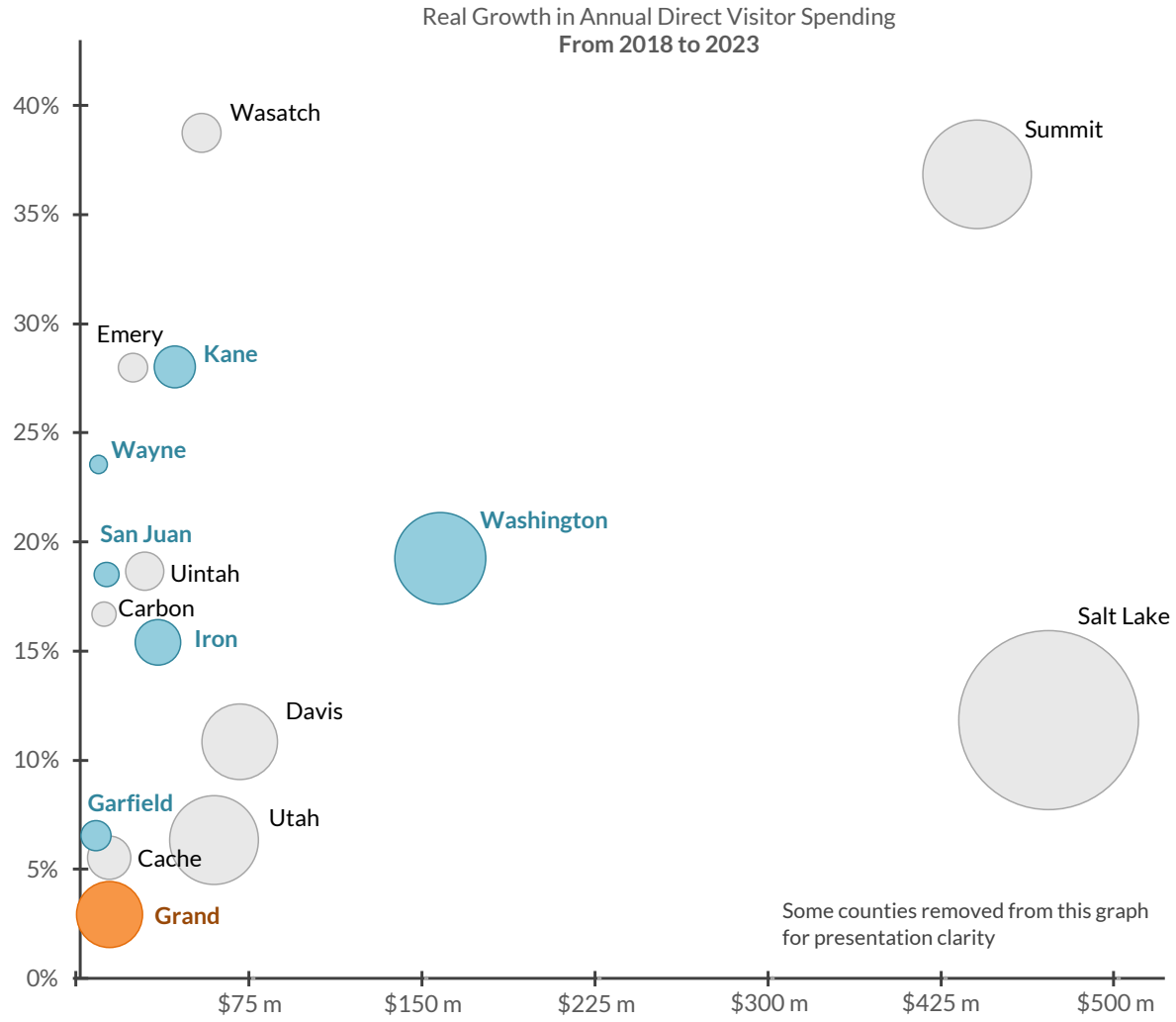




Source: Kem C. Gardner Policy Institute (September 2024), *2023 Travel and Tourism County Profiles*, University of Utah
https://d36oiwf74r1rap.cloudfront.net/wp-content/uploads/2025/01/CouProfiles-2023-Sept2024.pdf

Additionally, Grand County recorded the lowest real growth in direct visitor spending of any county in the state of Utah over the 5-year period from 2018 to 2023; as measured by the Kem Gardner Institute[1]





Source: 1. Kem C. Gardner Policy Institute (September 2024), *2023 Travel and Tourism County Profiles*, University of Utah https://d36oiwf74r1rap.cloudfront.net/wp-content/uploads/2025/01/CouProfiles-2023-Sept2024.pdf

Most visitors reported a positive experience at Arches BEFORE the reservation system was introduced

1. Visitors were surveyed in **May and June 2021**, before the reservation system was introduced. This was the **busiest period at Arches on record**, with an average of over 230,000 monthly visitors.

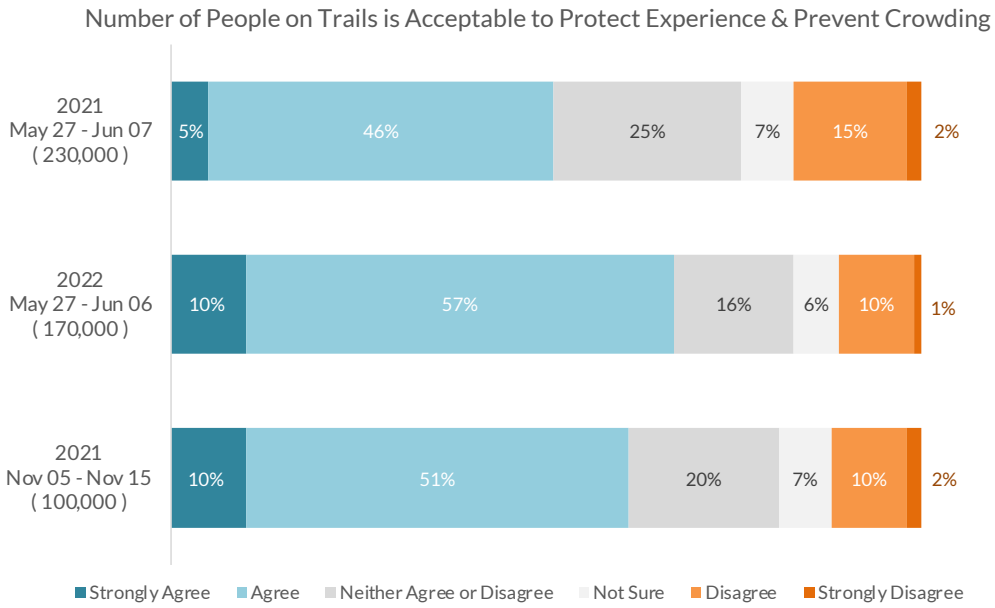
2. During this period, **most visitors agreed outright that the number of people on trails was acceptable to protect the experience and prevent crowding (51%)**, while a **minority agreed outright that the Park was too crowded in general (41%)**[1].

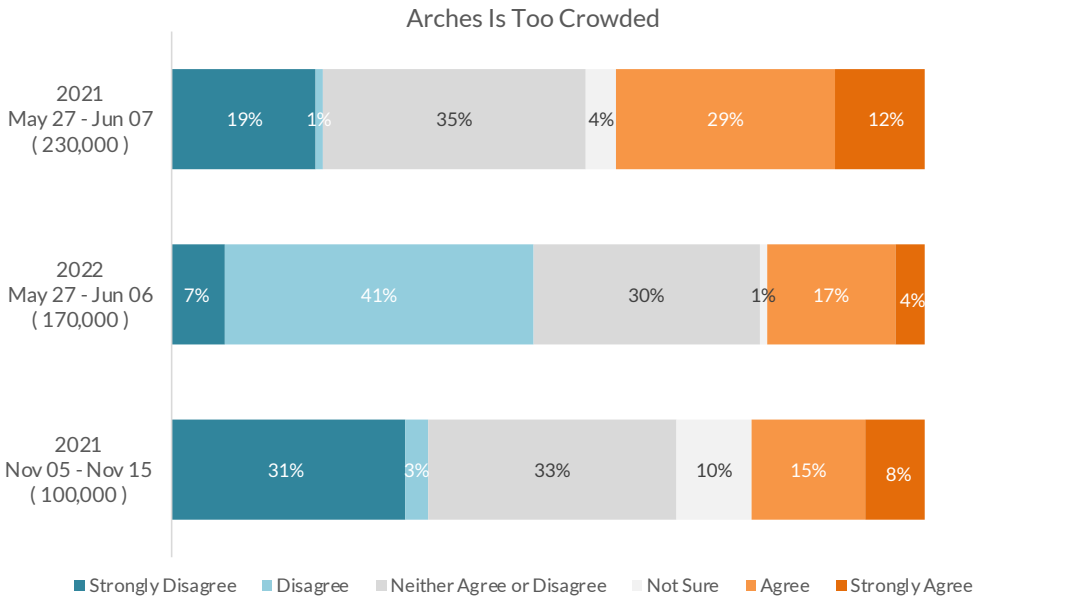
3. **Only 17% disagreed that that number of people on trails was acceptable**, while **19% strongly disagreed that the park was too crowded**[1].

4. The survey was repeated during the same months the following year **under the reservation system. While perceptions of crowdedness improved, 25% fewer people entered the Park**[1,3].

5. Also of note, fewer people disagreed that Arches was too crowded in November 2021 (34%) than disagreed in the spring of 2022 (48%), despite Arches being objectively busier in the spring, welcoming 70,000 or 70% more monthly visitors[1,2]

6. This lends considerable support to the belief that crowd tolerance varies across seasons, and that individual, subjective **perceptions of crowdedness are relative** and **influenced by expectations**





Sources: 1. Otak (2022), *2021 Arches National Park Visitor Spending and Experience Study*, National Park Service
2. Otak (2023), *2022 Arches National Park Visitor Spending and Experience Study*, National Park Service
3. National Park Service, ,https://irma.nps.gov/Stats

Appendices

Appendix 1a. Visitor experiences reflect on-going performance problems with the reservation system…

1. On **Sunday, September 15, 2024,** the author (who is a Moab local), visited Arches National Park with a visiting friend

2. **Advanced** timed-entry reservations **had been sold-out for weeks in advance**. This contributed to an **expectation** that **the Park would be busy**

3. A limited, day-before, timed-entry reservation ticket was purchased at 7:00pm online, the night before visiting the Park

4. The author waited approximately 10 minutes at the entrance to enter the Park, and observed that several proceeding vehicles were turned away at the entrance gate

5. However, upon arrival in the Park, the author was surprised to find the **Delicate Arch carpark approximately two-thirds empty. At Delicate Arch** itself, there were **approximately 15 other people**

6. The **weather and temperature were perfect** for hiking

7. Visitation data for September 2024, together with anecdotes from other visitors, indicate that this experience was not anomalous

Delicate Arch, Sunday, September 15, 2024
12:19pm, 79F

Delicate Arch Carpark, Sunday, September 15, 2024
11:35am, 79F

Appendix 1b. …that are not isolated…

1. The following week, on **Wednesday, September 19, 2024,** another Moab local visited Arches National Park with visiting friends

2. **Likewise, advanced** timed-entry **reservations had been sold-out for weeks in advance**. A limited, day-before, timed-entry reservation was purchased at 7:00pm online, the night before visiting the Park

3. The visitors also waited approximately 10 minutes at the entrance before entering the Park, and witnessed that several proceeding vehicles were turned away at the entrance gate

4. Upon arrival in the Park, the visitors were also surprised to find the **Delicate Arch carpark three-quarters empty,** with very few people at the arch itself

5. Again, the **weather and temperature were perfect** for hiking

6. Visitation data for the month indicate that these experiences were not anomalous


Delicate Arch, Wednesday, September 19, 2024
12:22pm, 79F


Delicate Arch Carpark
Wednesday, September 19, 2024
13:20pm, 79F

Appendix 1c. …especially during the later half of the summer tourism season

1. **Approximately 30% fewer people** visited Arches National Park **in September 2024 than in September 2018 & 2019,** before the reservation system's introduction

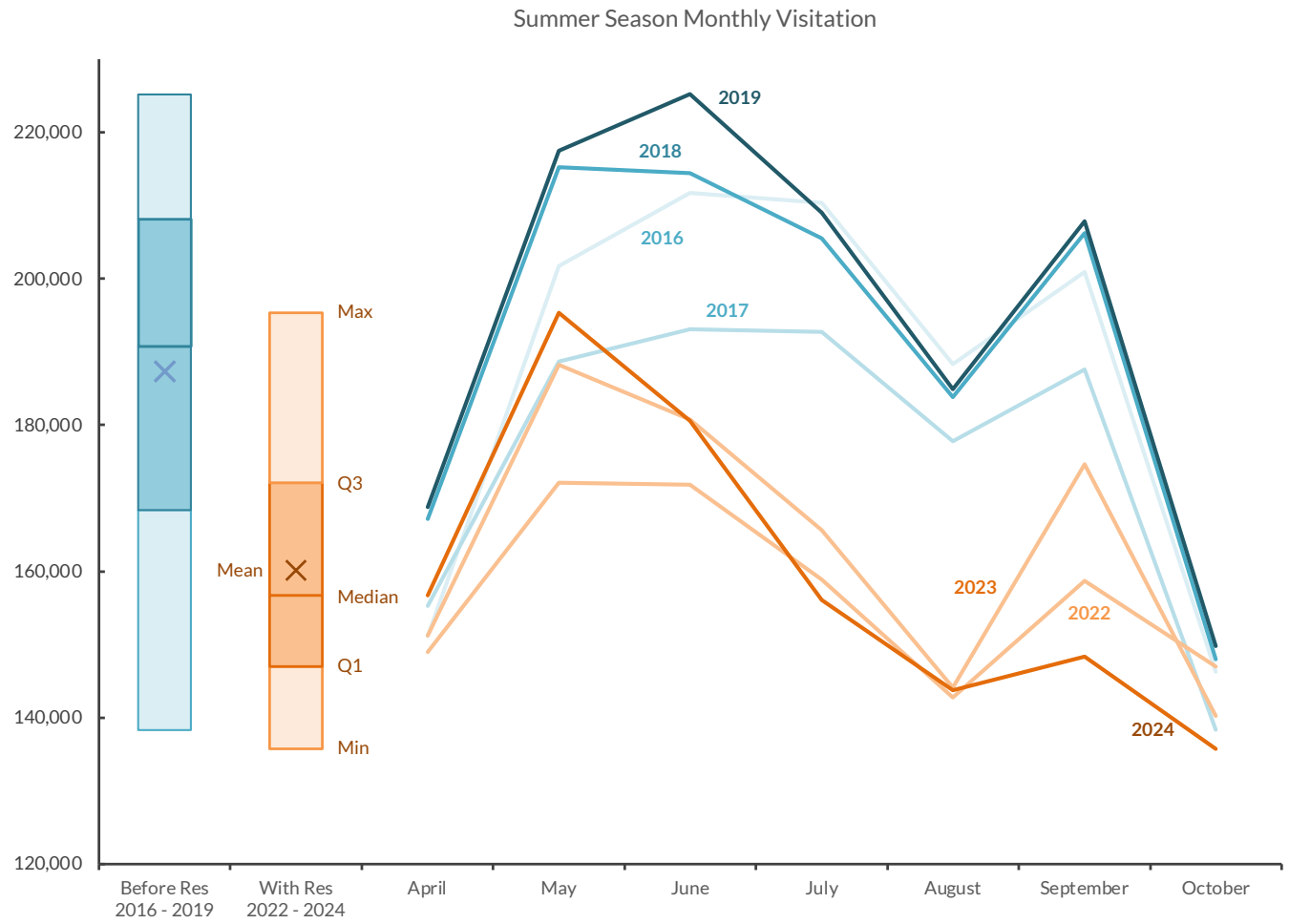
2. **Visitation in September 2024** was the **lowest September** visitation **since 2013**

3. **In 2023, the reservation system was extended to include the month of October**

4. **It is unclear why this extension was required** given historic October visitation levels

5. **In 2025**, the NPS announced **reservations would not be required in 2025 for most of July and August**

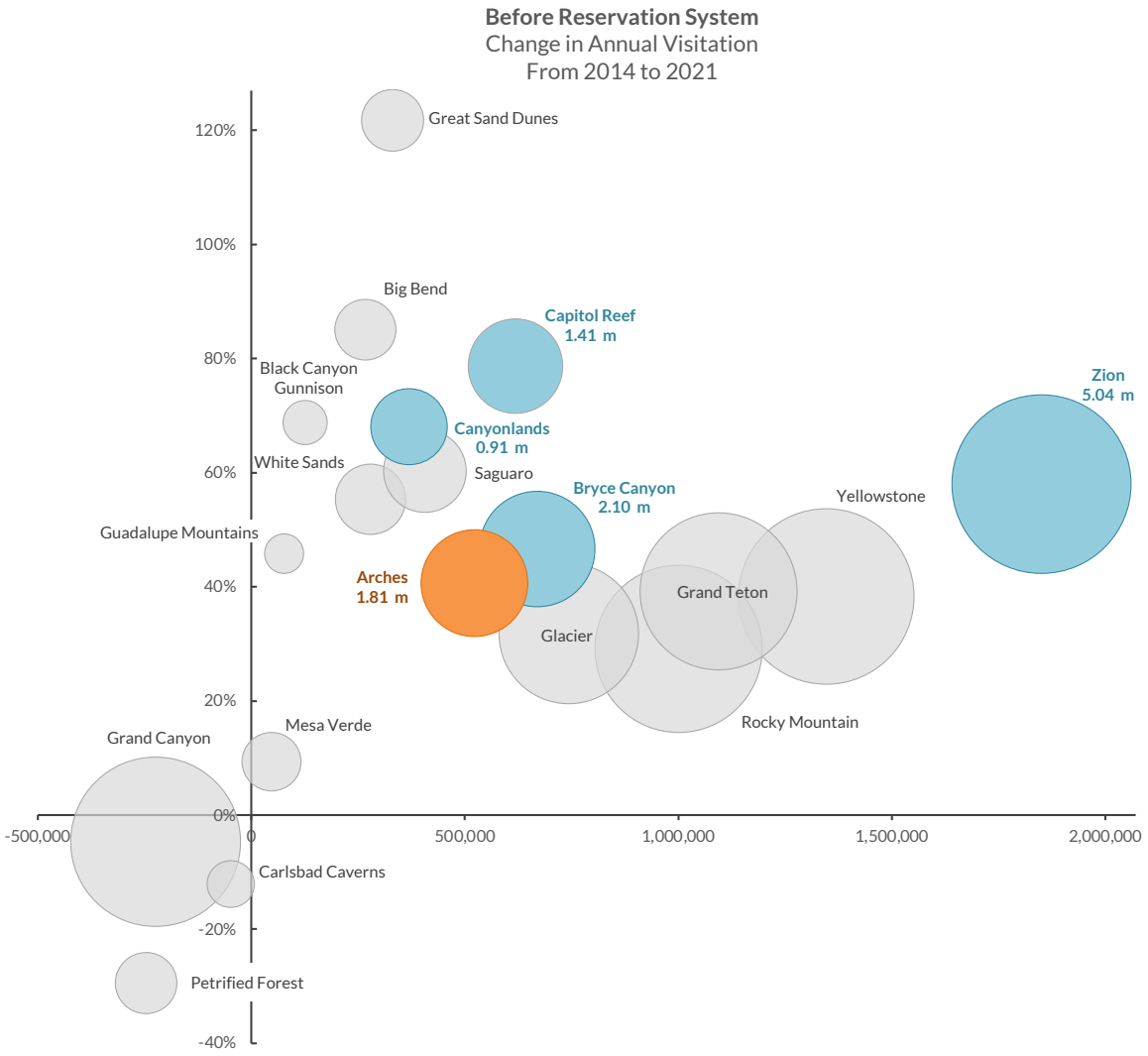
6. However, reservations will **still be required for September and October, even though October has always seen fewer visitors than July**, and September has seen fewer visitors than July over 2 of the last 3 years



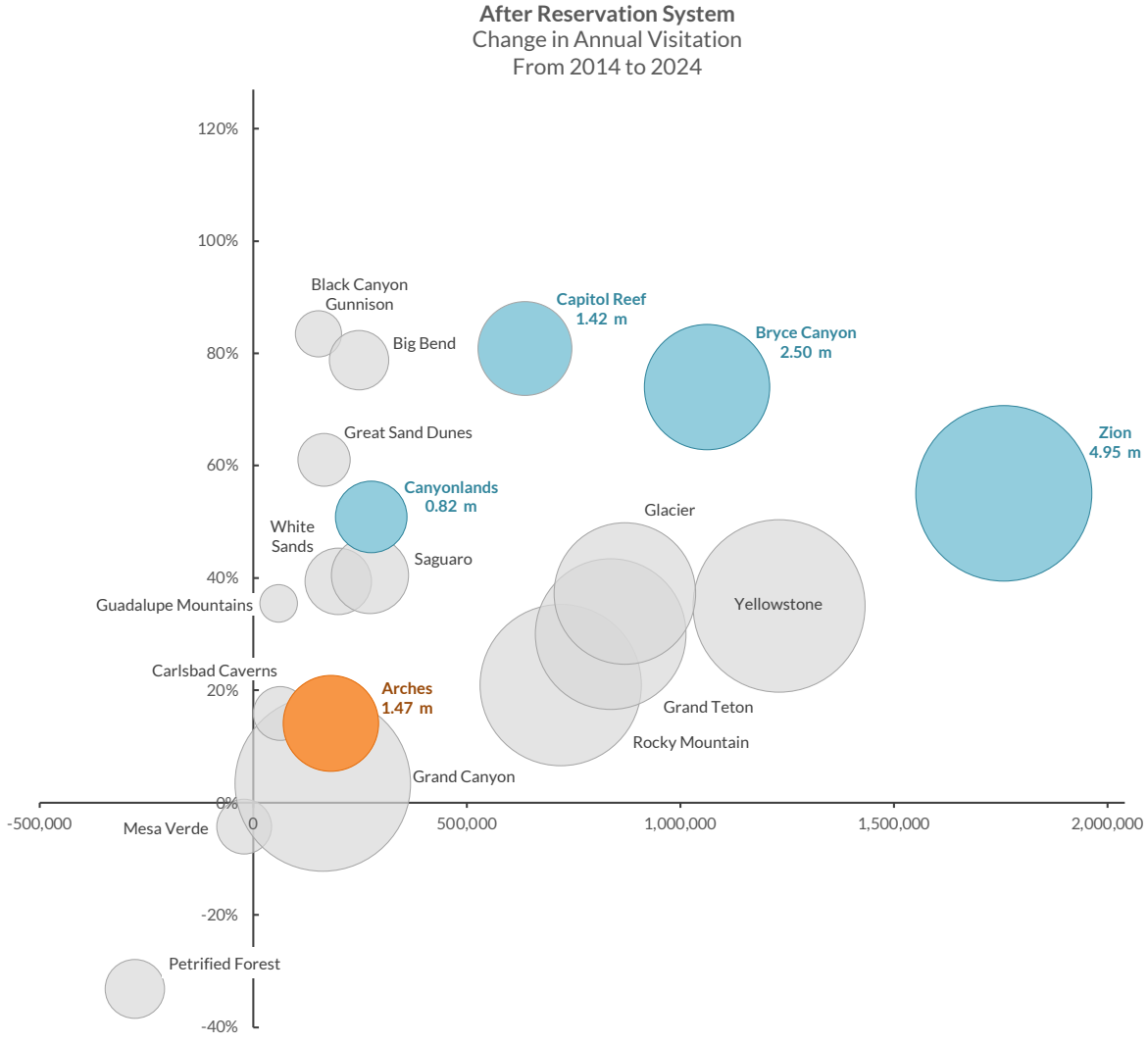
Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 2. The increase in Arches visitation before the reservation system's introduction was consistent with increases at most other regional parks

Arches visitation fell from 1.81 million people in 2021…



…to 1.47 million people in 2024.



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 3. The correlation between summer season visitation at Arches and Utah's other national parks has fallen significantly since the reservation system's introduction

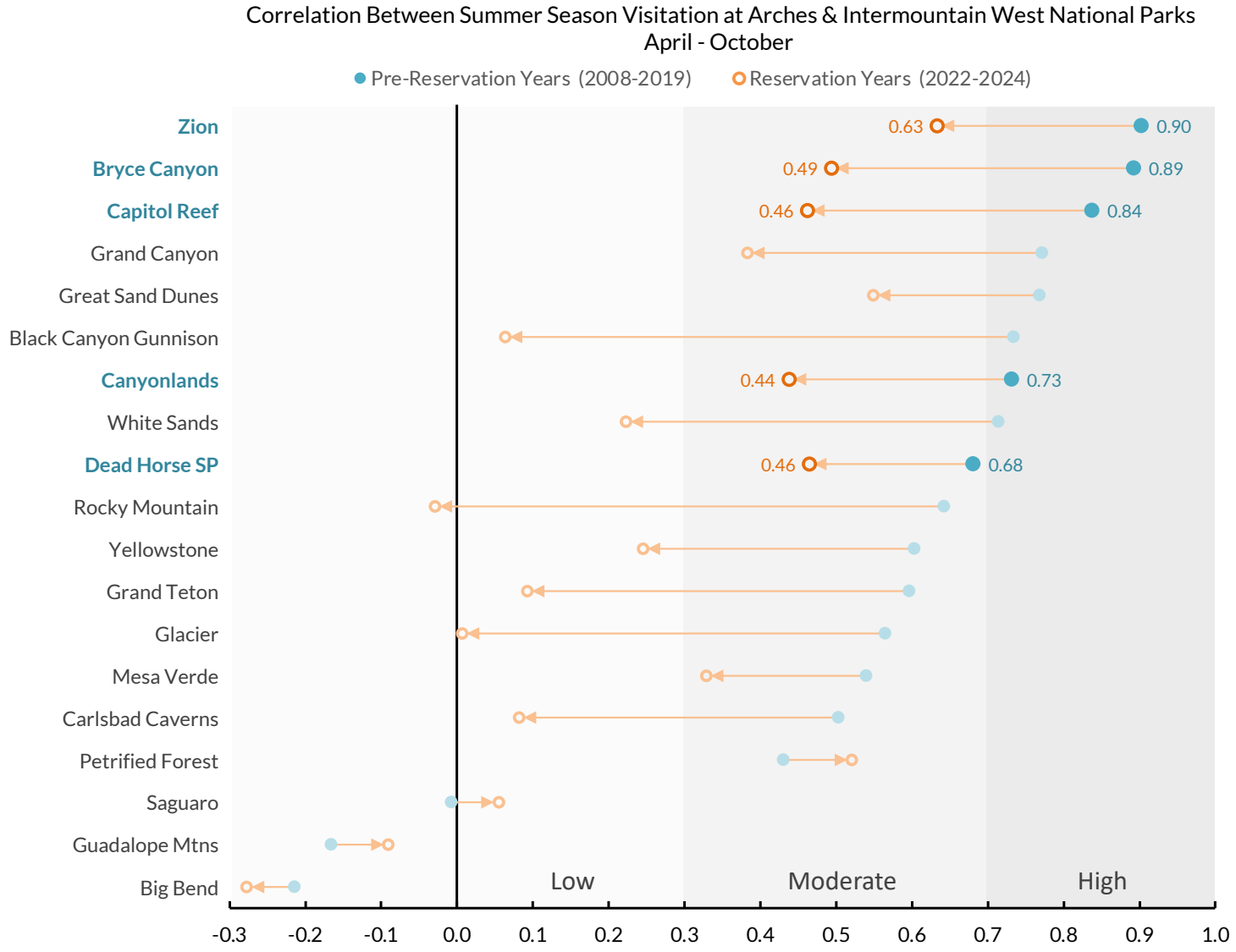
1. In **2021, over 50% of Arches visitors also visited Zion and Bryce Canyon** national parks on the same trip[2]. 33% visited the Grand Canyon[2].

2. **Historically**, there has been a **strong relationship between** summer season visitation at **Arches and Utah's other national parks**

3. This once close relationship has **declined significantly** following the introduction of the Arches reservation system

4. The relationship between summer season visitation at Arches and nearby Canyonlands National Park and Dead Horse Point State Park has also declined markedly

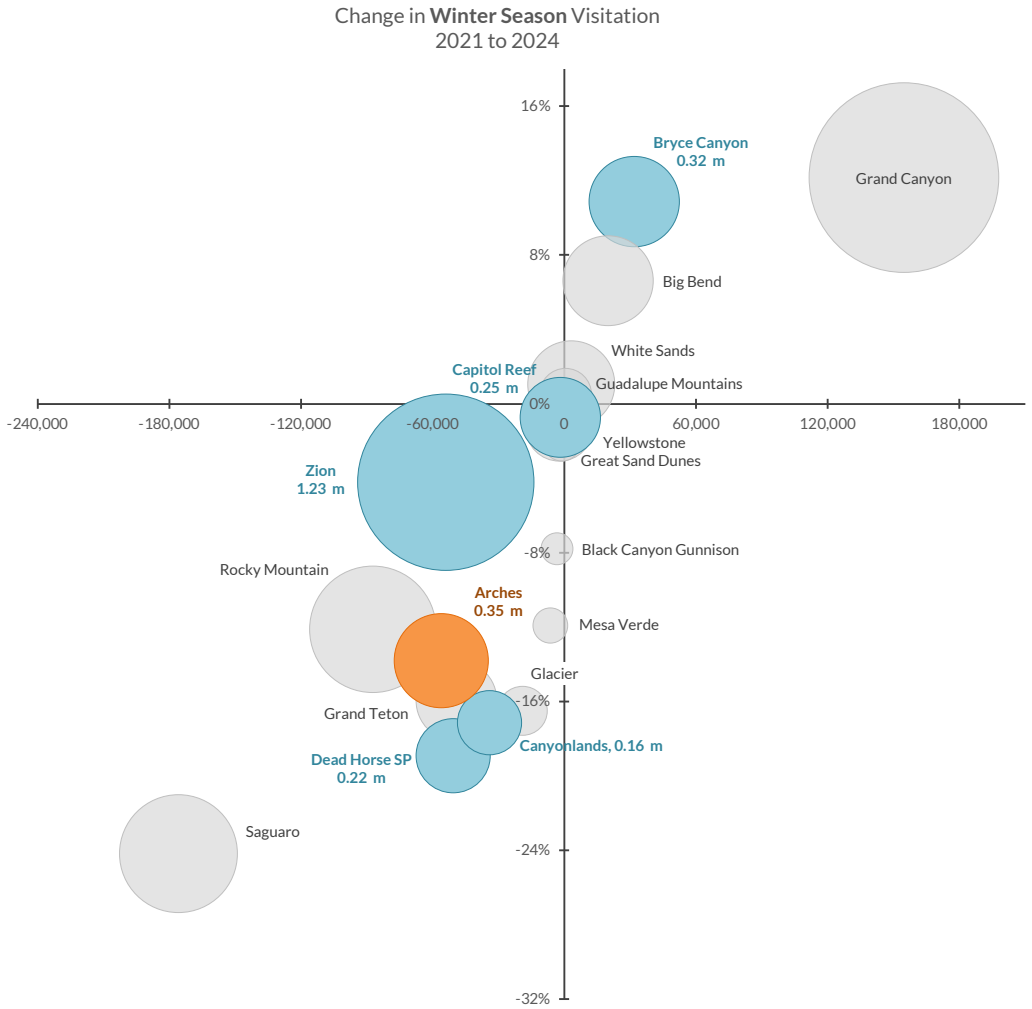
5. Except for the Grand Canyon, the correlation between visitation at Arches and other Southwest national parks, including those with busier winter seasons, remains relatively low.

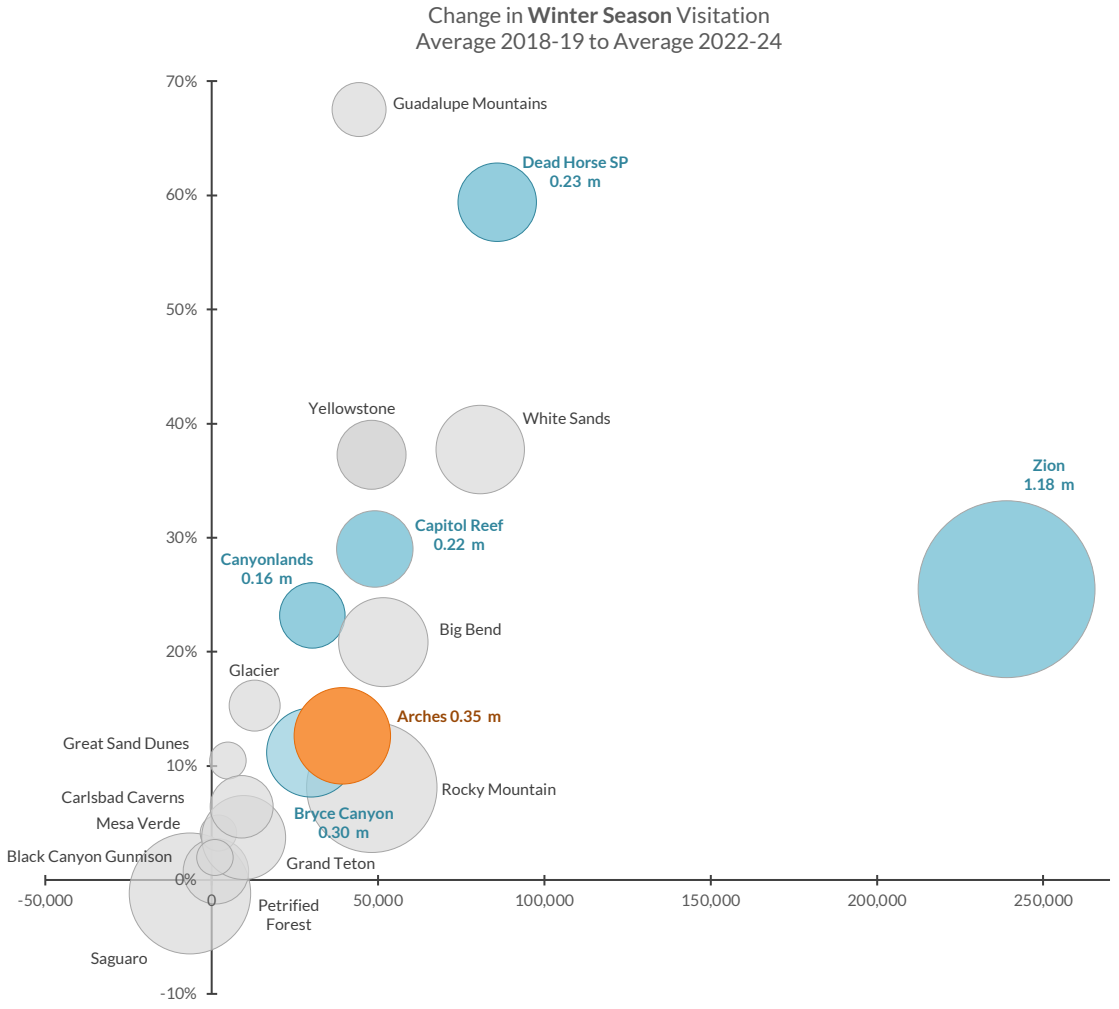


Sources: 1. National Park Service, https://irma.nps.gov/Stats/
2. Otak (2022), *2021 Arches National Park Visitor Spending and Experience Study*, Summer Sample Period May 27–June 07, National Park Service

Appendix 4. Consistent with most other regional parks, Arches has experienced modest falls in winter season visitation since 2021, and modest gains since 2018-19. These changes are not statistically significant[1].

There is no compelling evidence that the reservation system has materially increased Arches winter visitation because most other other regional parks have also experienced visitation increases of a similar or greater magnitude since 2018-19.

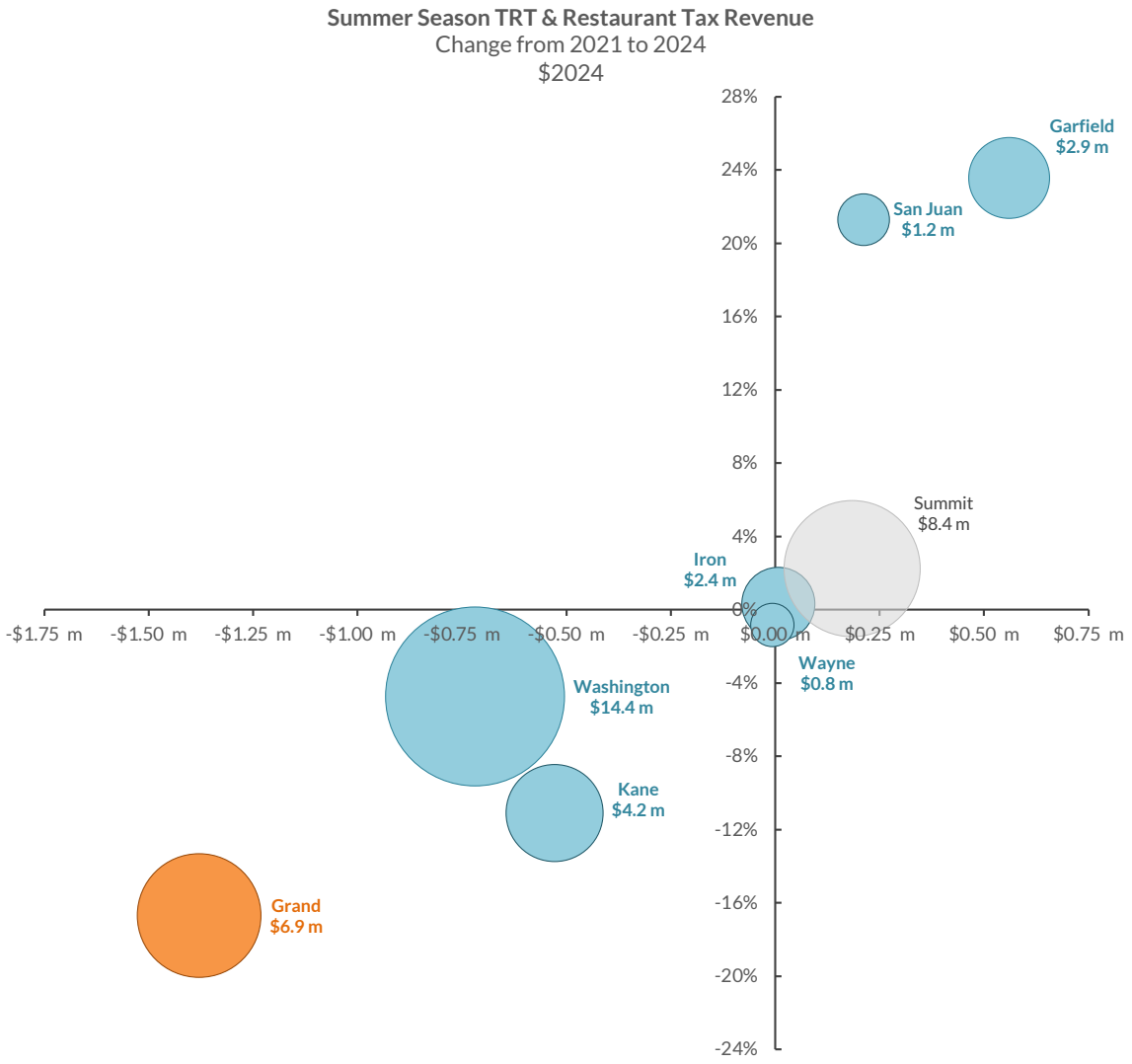


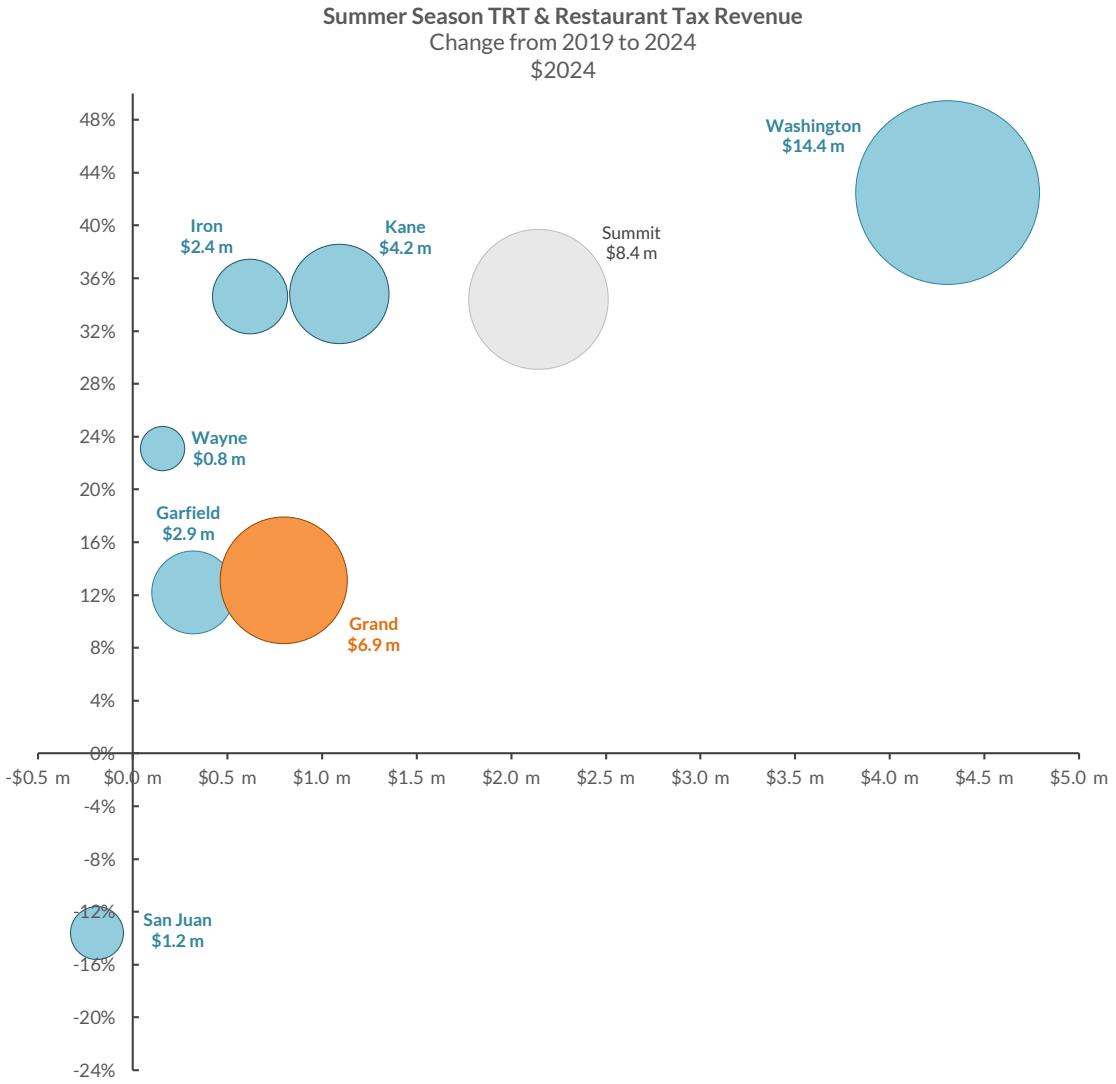


Sources: 1. Refer Appendix 10; National Park Service, https://irma.nps.gov/Stats/

Winter Season = January to March & November to December

Appendix 5. Of Utah's national park gateway counties, Grand County recorded the largest decline in summer season Transient Room and Restaurant Tax revenue over the 3 years between 2021 and 2024

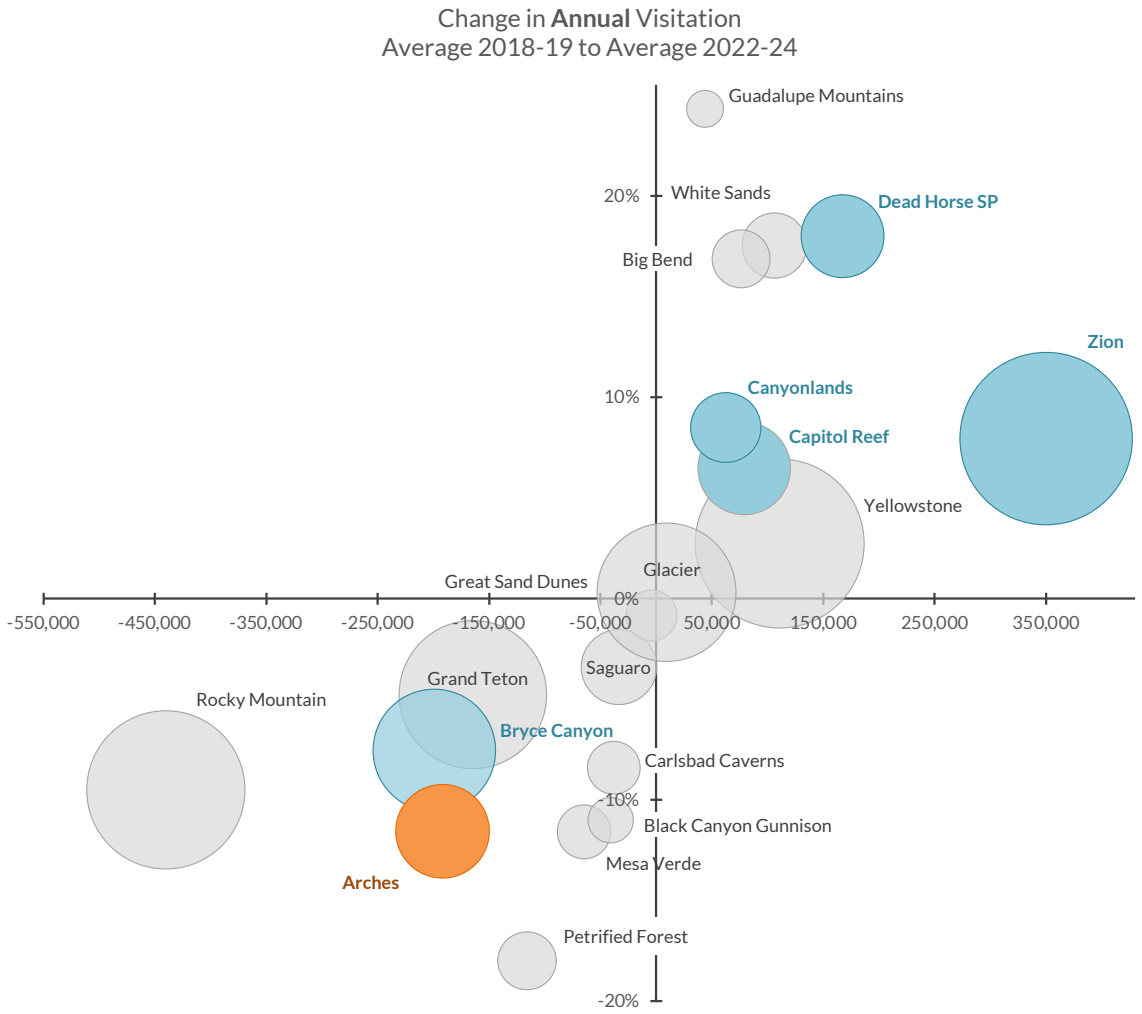




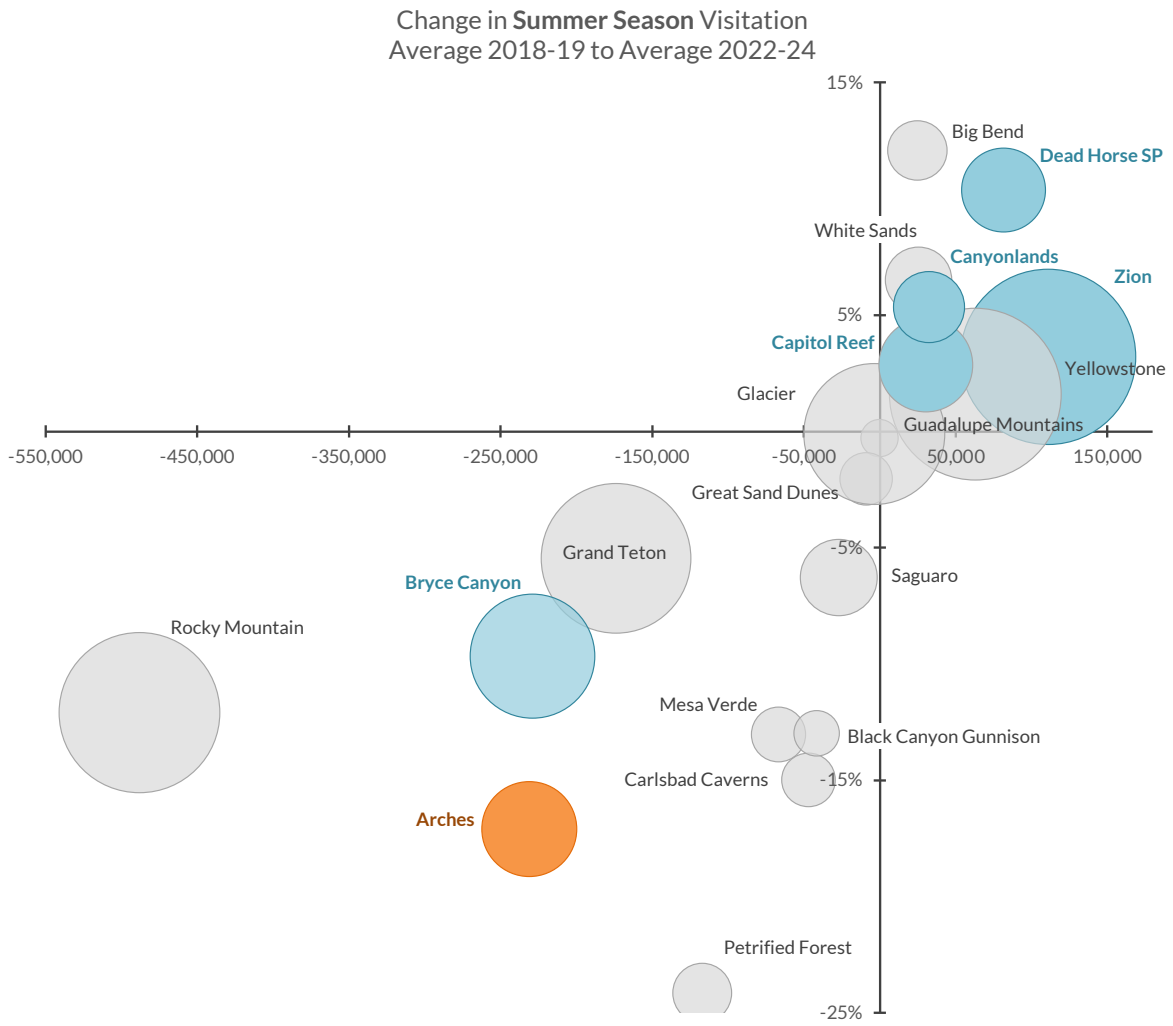
Summer Season = April to October

Source: Utah State Tax Commission

Appendix 6a. The change in average visitation over the reservation years 2022 to 2024, compared to average pre-reservation visitation during the years 2018 to 2019



For clarity, excludes Grand Canyon which declined 1.4 million visitors and 22%

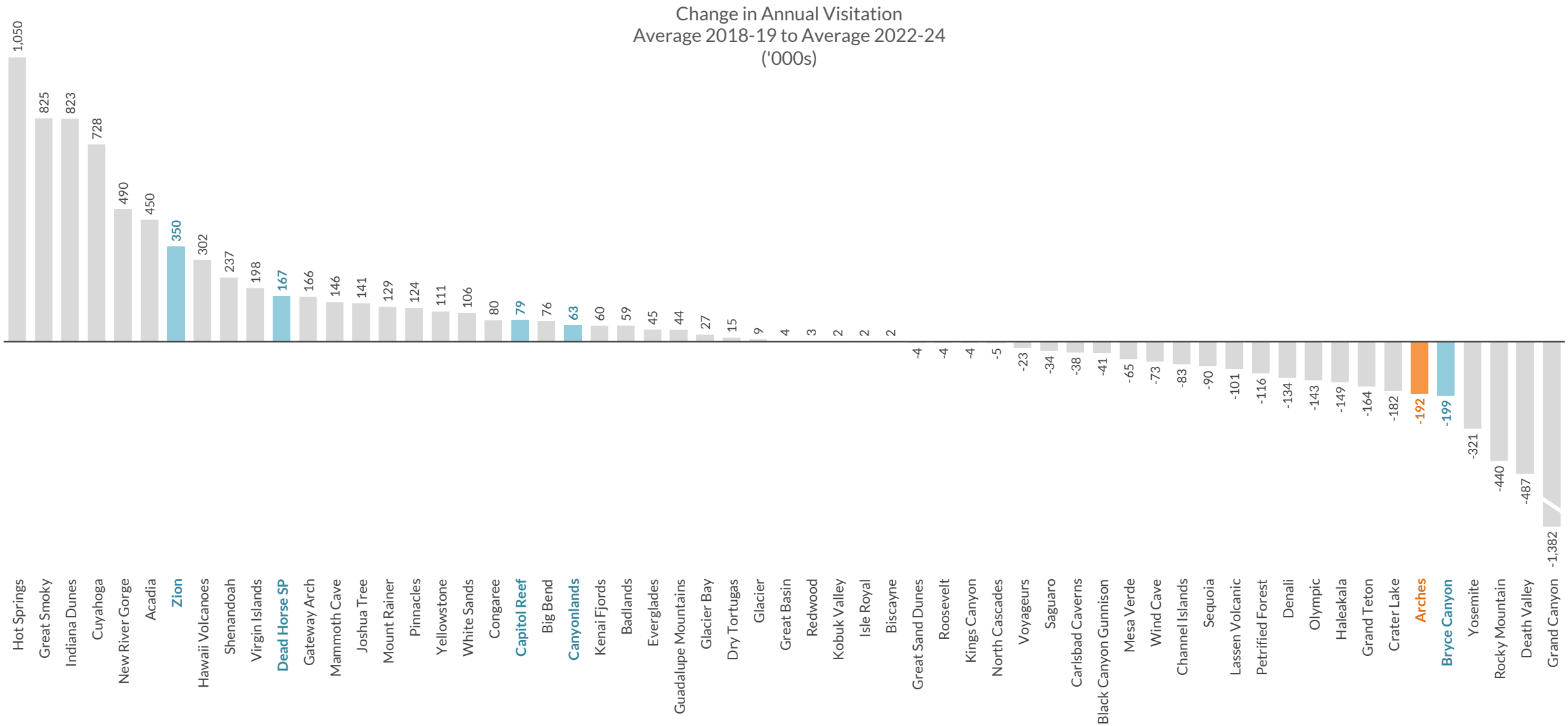


For clarity, excludes Grand Canyon which declined 1.0 million visitors and 23%

Summer Season = April to October

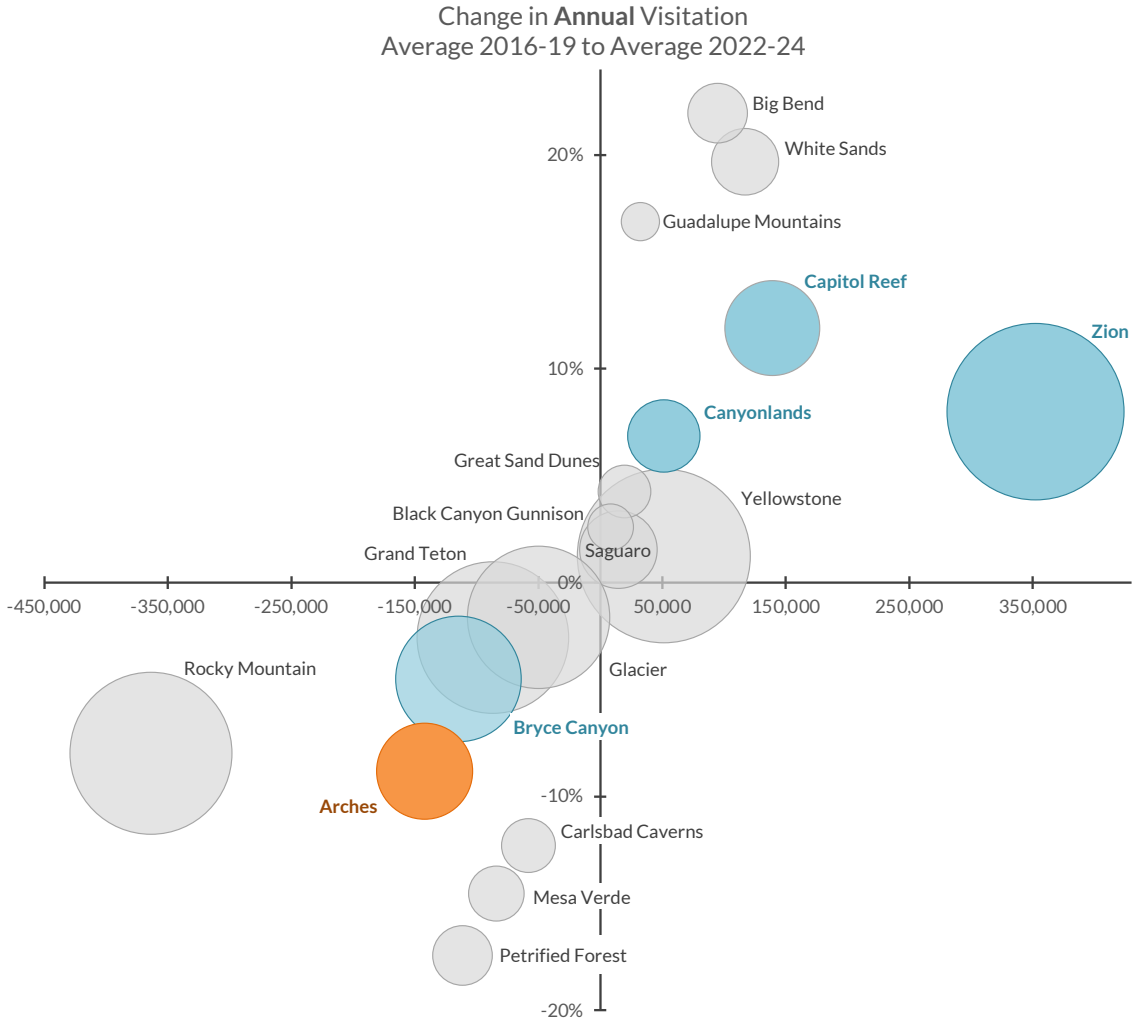
Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 6b. The change in average visitation over the reservation years 2022 to 2024, compared to average pre-reservation visitation during the years 2018 to 2019

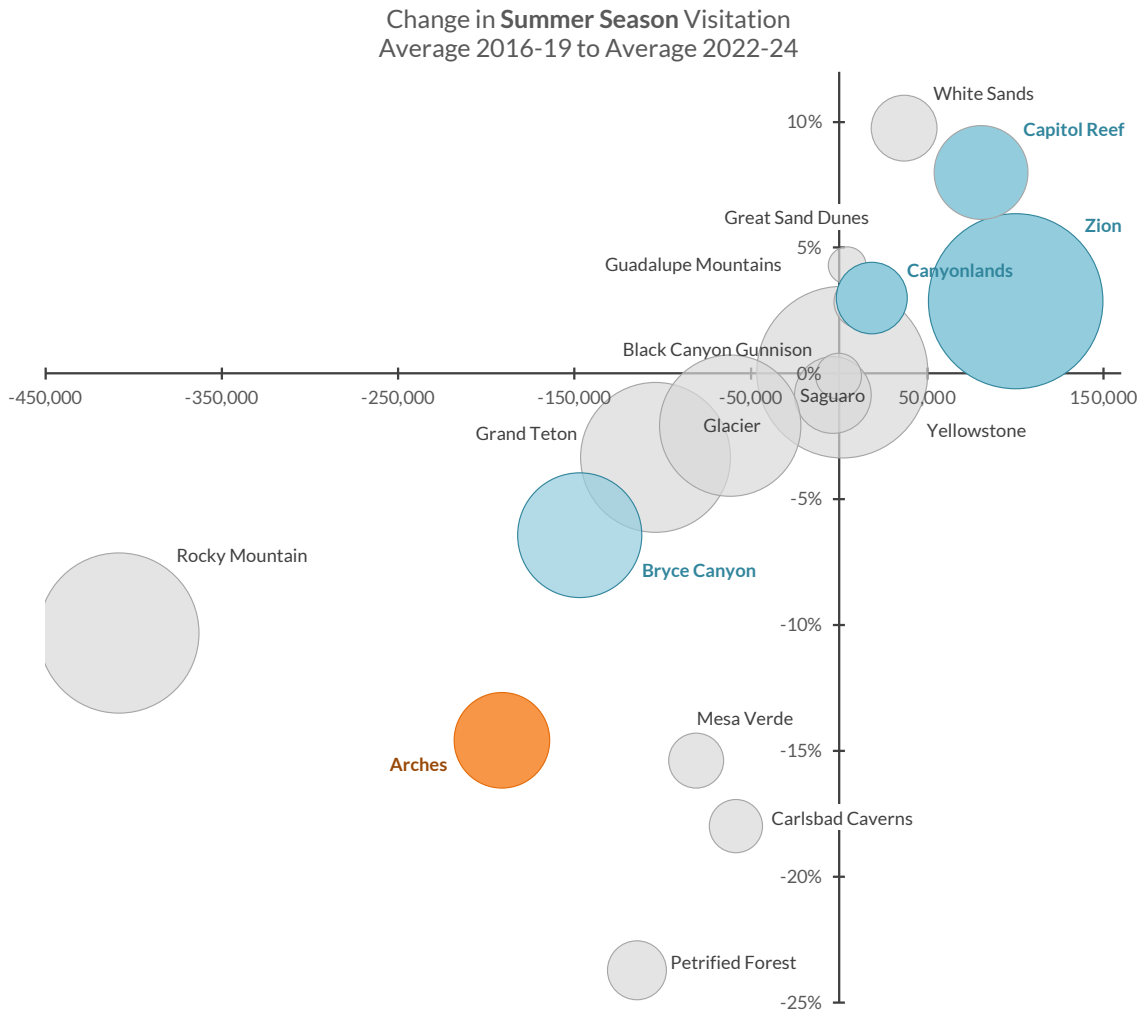


Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 7a. The change in average visitation over the reservation years 2022 to 2024, compared to average pre-reservation visitation during the years 2016 to 2019



For clarity, excludes Grand Canyon which declined 1.4 million visitors and 22%

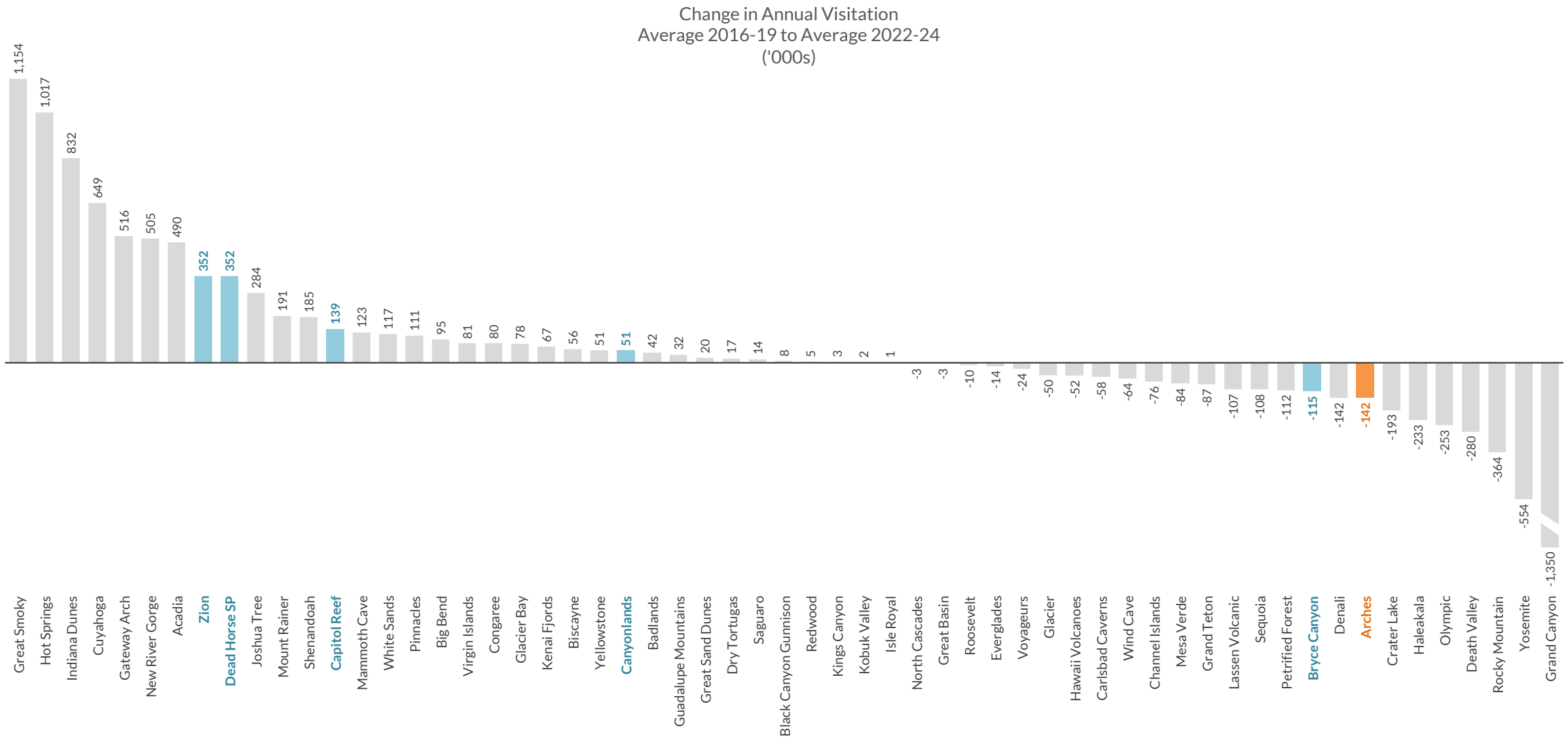


For clarity, excludes Grand Canyon which declined 1.1 million visitors and 23%

Summer Season = April to October

Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 7b. The change in average visitation over the reservation years 2022 to 2024, compared to average pre-reservation visitation during the years 2016 to 2019



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 8. Arches Full Year Visitation: Statistical Significance - Years 2022-2024 versus 2021

Statements that claim that the 9-19% declines in full-year visitation at Arches National Park are not statistically significant fail to account for the large seasonal variation in visitation at Arches National Park. This large seasonal variation significantly dilutes the power of statistical testing and obscures the large and significant drop in summer season and annual visitation since the reservation system was introduced.

Normality

Kolmogorov-Smirnov tests: CAN REJECT null hypothesis that monthly visitation data for the full year are not normally distributed, with 95% confidence for both time periods

F-Test Two-Sample for Variances

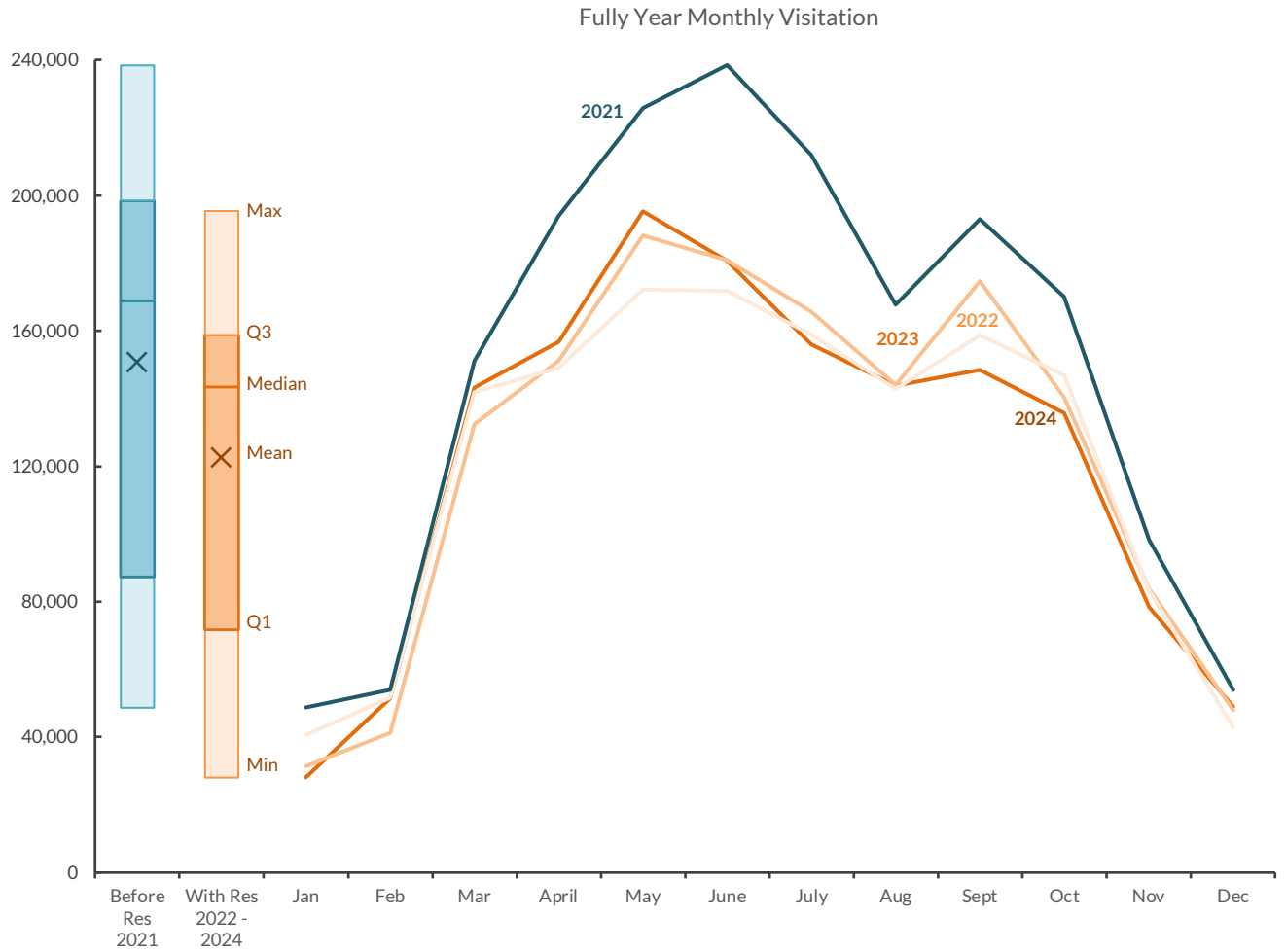
CANNOT REJECT null-hypothesis that variances are equal; with more than 88.8% confidence

	2021	2022 - 2024
Mean	150,572	122,478
Variance	4,842,945,257	2,834,319,775
F	1.709	
P(F<=f) one-tail	0.112	**88.78%**
F Critical one-tail	2.075	

t-Test: Two-Sample Assuming Equal Variances

CANNOT REJECT null-hypothesis that mean monthy visitation during 2022-2024 is less than mean monthly visitation during 2021; with more than 92.5% confidence

	2021	2022 - 2024
Mean	150,572	122,478
Variance	4,842,945,257	2,834,319,775
Hypothesized Mean Difference	**0**	
df	46	
t Stat	1.46	
P(T<=t) one-tail	0.08	**92.50%**
t Critical one-tail	1.68	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 9a. Arches Summer Season Visitation: Statistical Significance - Years 2022-2024 versus 2021

Normality

Kolmogorov-Smirnov tests: Can REJECT null hypothesis that monthly summer season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test: Two-Sample for Variances

Can REJECT null-hypothesis that variances are equal with 94.27% confidence

	2021	2022 - 2024
Mean	200,114	160,090
Variance	720,109,556	288,307,267
F	2.498	
P(F<=f) one-tail	0.057	**94.27%**
F Critical one-tail	2.599	

t-Test: Two-Sample Assuming Unequal Variances

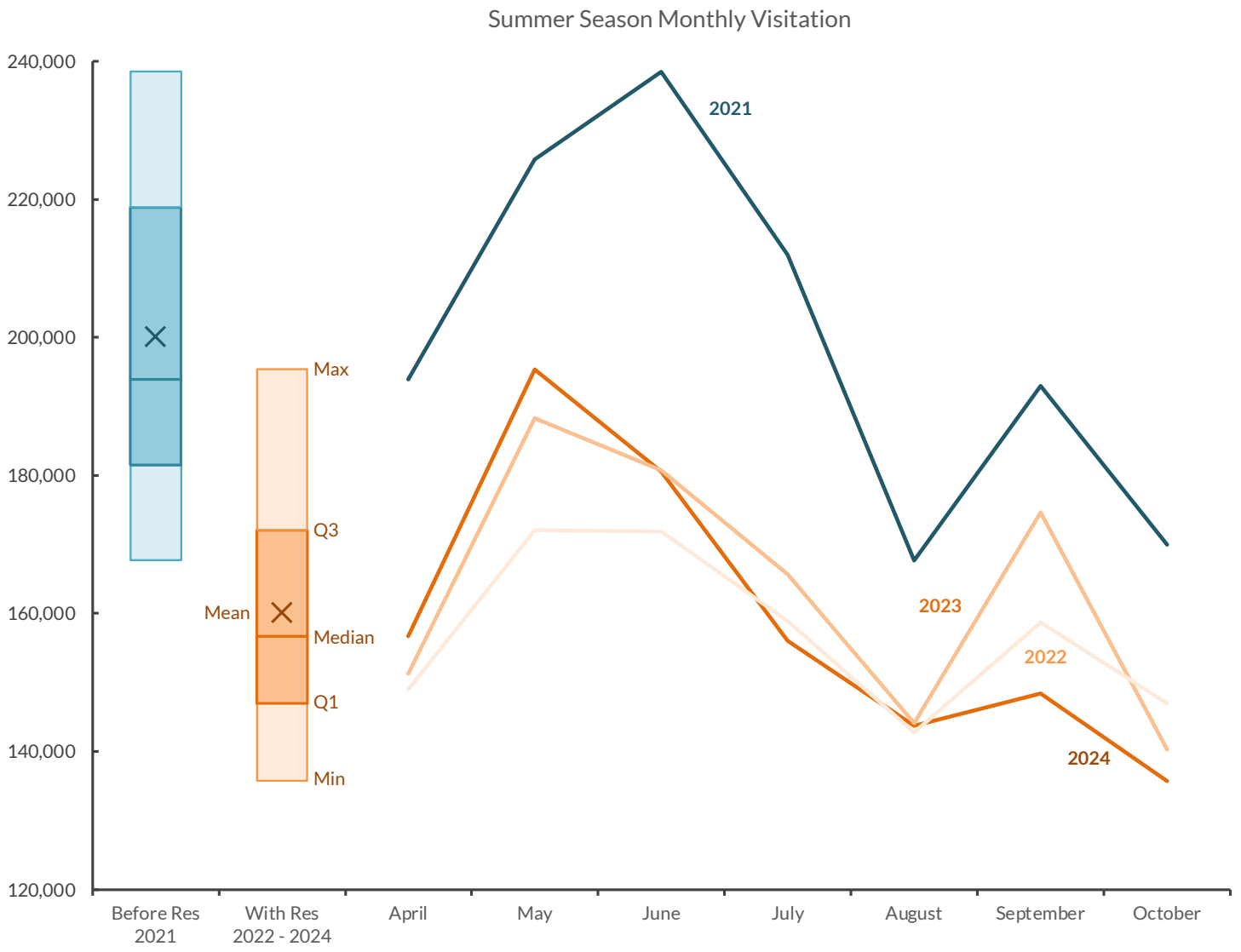
Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is NOT less than monthly visitation during 2021, with 99.7% confidence

	2021	2022 - 2024
Mean	200,114	160,090
Variance	720,109,556	288,307,267
Hypothesized Mean Difference	**0**	
df	8	
t Stat	3.71	
P(T<=t) one-tail	0.00	**99.70%**
t Critical one-tail	1.86	

t-Test: Two-Sample Assuming Unequal Variances

Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is less than the mean monthly visitation during 2021 by 19,950 or fewer people, with 95% confidence

	2021	2022 - 2024
Mean	200,114	160,090
Variance	720,109,556	288,307,267
Hypothesized Mean Difference	**19,950**	
df	8	
t Stat	1.86	
P(T<=t) one-tail	0.05	**95.00%**
t Critical one-tail	1.86	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 9b. Arches Summer Season Visitation: Statistical Significance - Years 2022-2024 versus 2018-2019

Normality

Kolmogorov-Smirnov tests: Can REJECT null hypothesis that monthly summer season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test: Two-Sample for Variances

Can REJECT null-hypothesis that variances are equal with 95.6% confidence

	2018 - 2019	2022 - 2024
Mean	193,101	160,090
Variance	669,075,811	288,307,267
F	2.321	
P(F<=f) one-tail	0.044	**95.61%**
F Critical one-tail	2.250	

t-Test: Two-Sample Assuming Unequal Variances

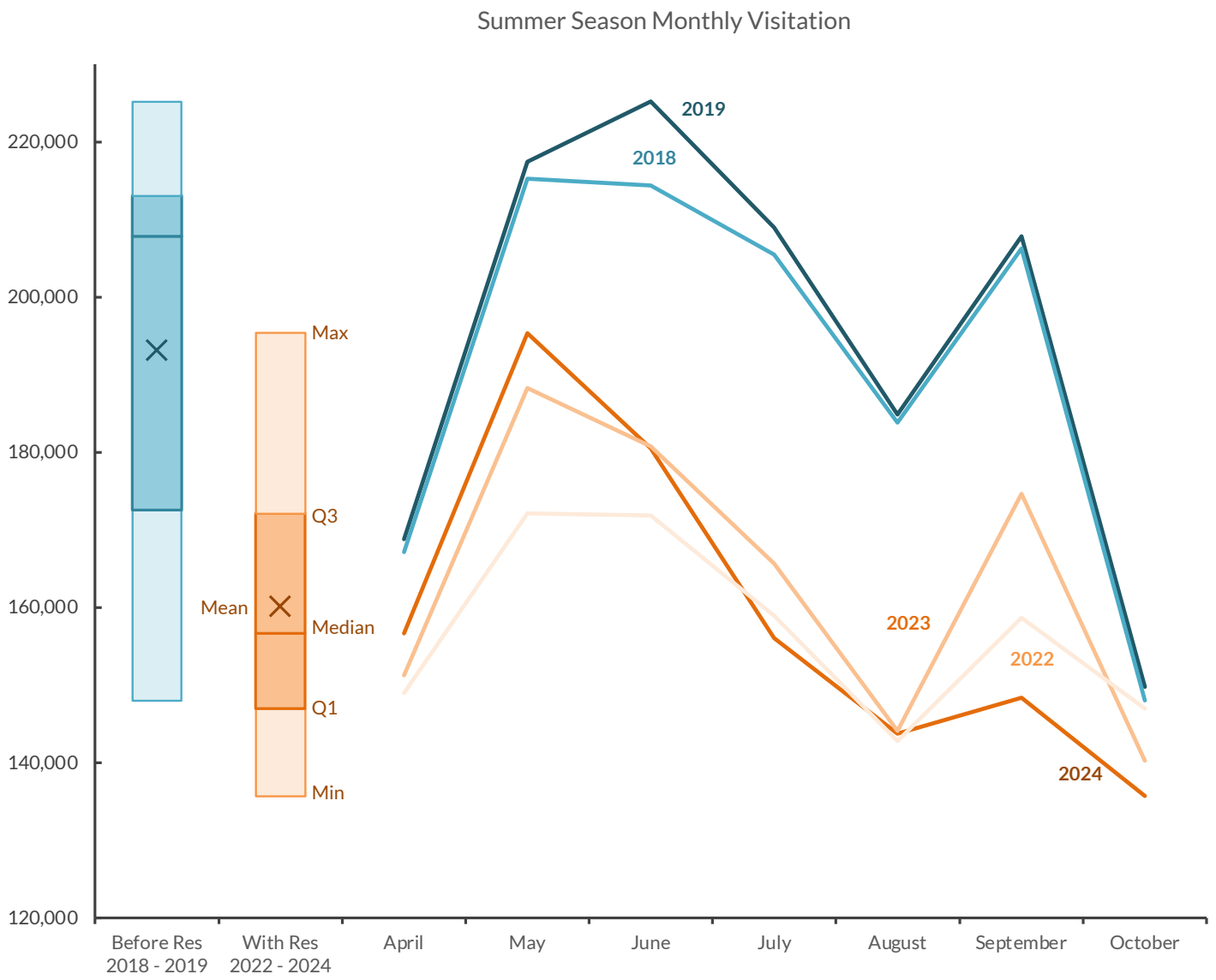
Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is NOT less than monthly visitation during 2018-2019, with 99.98% confidence

	2018 - 2019	2022 - 2024
Mean	193,101	160,090
Variance	669,075,811	288,307,267
Hypothesized Mean Difference	**0**	
df	20	
t Stat	4.21	
P(T<=t) one-tail	0.00	**99.98%**
t Critical one-tail	1.72	

t-Test: Two-Sample Assuming Unequal Variances

Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is less than the mean monthly visitation during 2018-2019 by 19,485 or fewer people, with 95% confidence

	2018 - 2019	2022 - 2024
Mean	193,101	160,090
Variance	669,075,811	288,307,267
Hypothesized Mean Difference	**19,485**	
df	20	
t Stat	1.72	
P(T<=t) one-tail	0.05	**95.00%**
t Critical one-tail	1.72	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 9c. Arches Summer Season Visitation: Statistical Significance - Years 2022-2024 versus 2016-2019

Normality

Kolmogorov-Smirnov tests: Can REJECT null hypothesis that monthly summer season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test: Two-Sample for Variances

Can REJECT null-hypothesis that variances are equal with 96.48% confidence

	2016 - 2019	2022 - 2024
Mean	187,405	160,090
Variance	639,424,272	288,307,267
F	2.218	
P(F<=f) one-tail	0.035	**96.48%**
F Critical one-tail	2.059	

t-Test: Two-Sample Assuming Unequal Variances

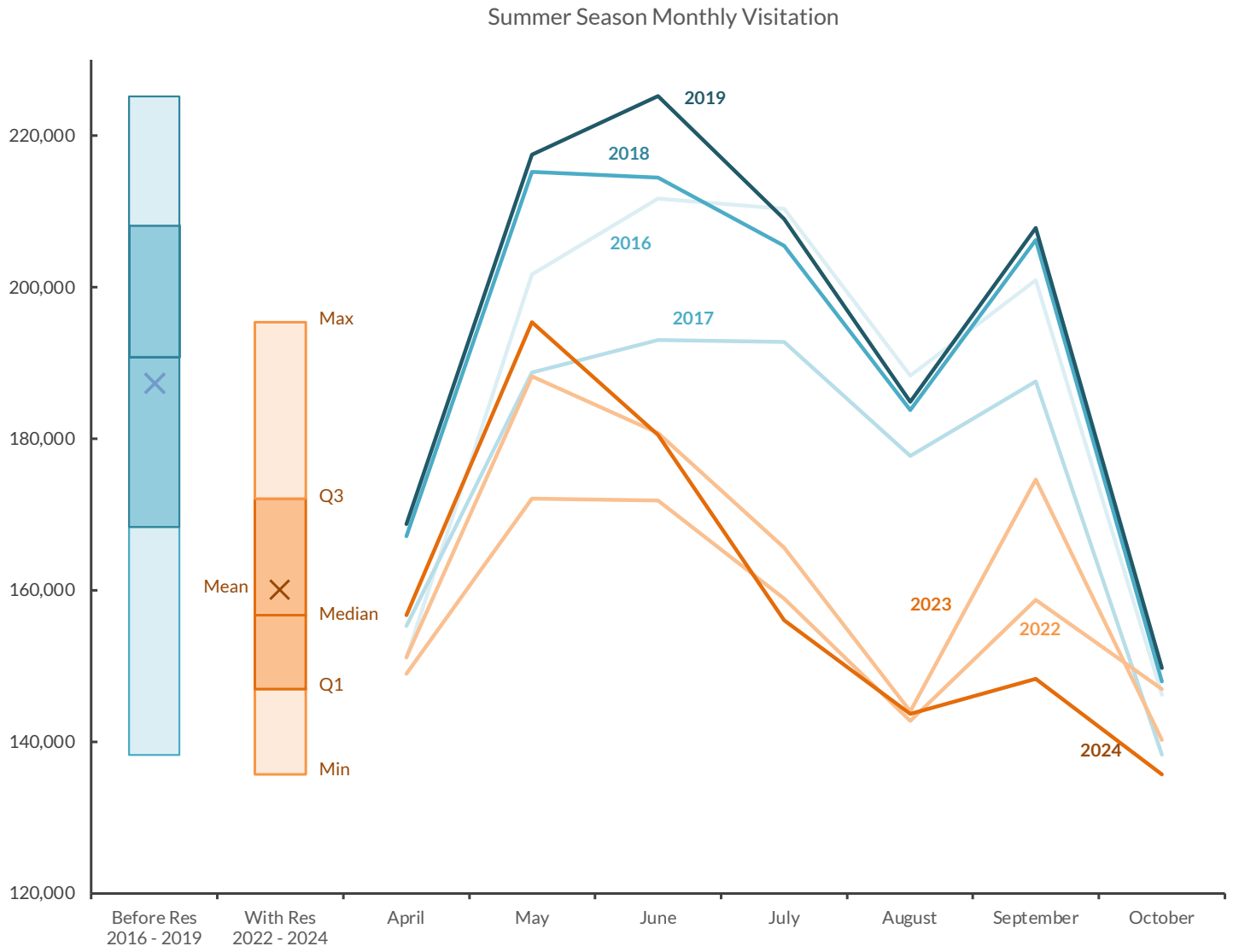
Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is NOT less than monthly visitation during 2016-2019, with 99.998% confidence

	2016 - 2019	2022 - 2024
Mean	187,405	160,090
Variance	639,424,272	288,307,267
Hypothesized Mean Difference	**0**	
df	47	
t Stat	4.52	
P(T<=t) one-tail	0.00	**100.00%**
t Critical one-tail	1.68	

t-Test: Two-Sample Assuming Unequal Variances

Can REJECT null-hypothesis that mean monthy visitation during 2022-2024 is less than the mean monthly visitation during 2016-2019 by 17,170 or fewer people, with 95% confidence

	2016 - 2019	2022 - 2024
Mean	187,405	160,090
Variance	639,424,272	288,307,267
Hypothesized Mean Difference	**17,170**	
df	47	
t Stat	1.68	
P(T<=t) one-tail	0.05	**95.00%**
t Critical one-tail	1.68	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 10a. Arches Winter Season Visitation: Statistical Significance - Years 2022-2024 versus 2018-2019

Normality

Kolmogorov-Smirnov tests: Can REJECT null hypothesis that monthly winter season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test: Two-Sample for Variances

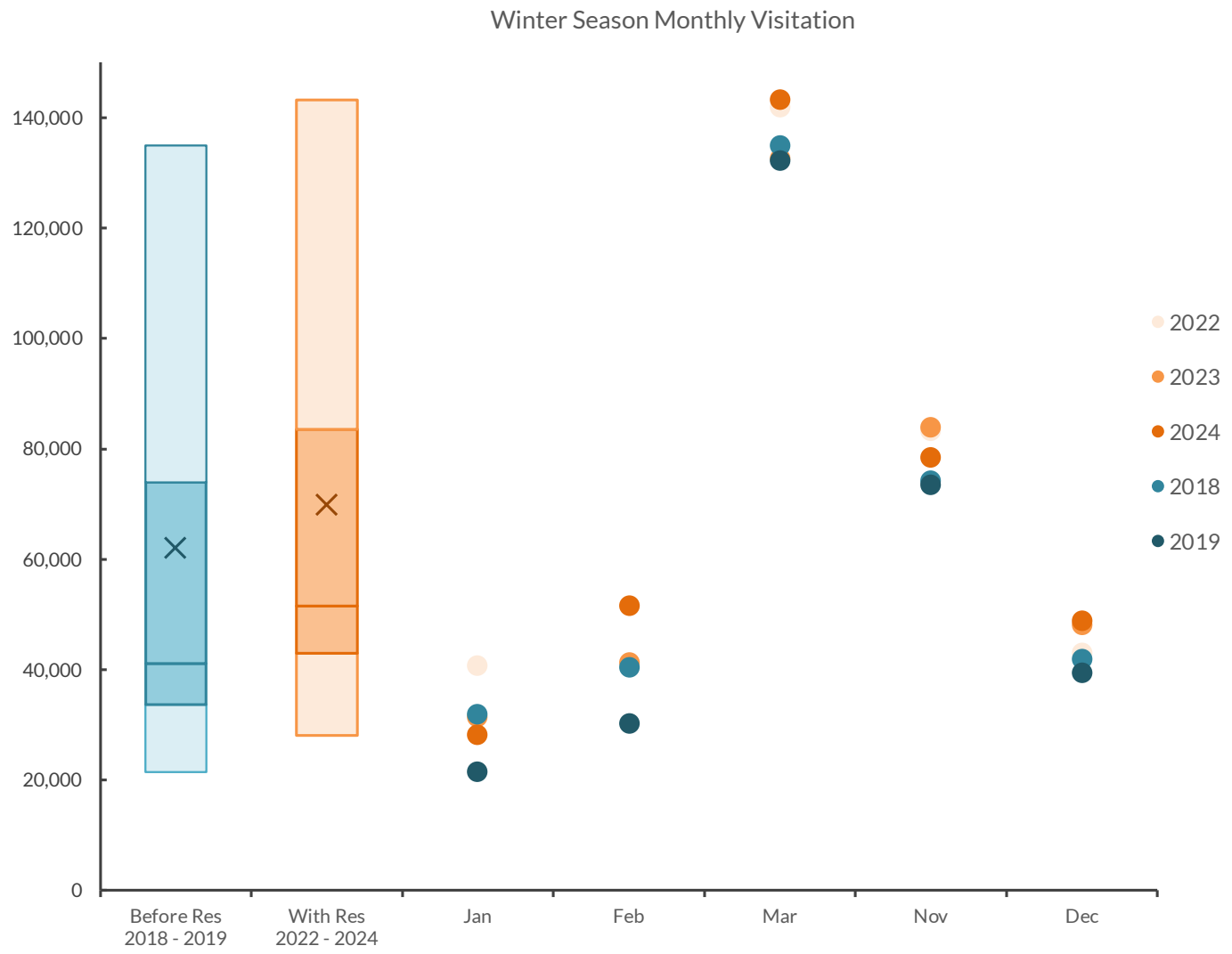
CANNOT REJECT null-hypothesis that variances are equal; with more than 57.1% confidence

	2018-2019	2022 - 2024
Mean	61,985	69,822
Variance	1,534,733,550	1,581,248,845
F	1.087	
P(F<=f) one-tail	0.429	**57.15%**
F Critical one-tail	2.646	

t-Test: Two-Sample Assuming Equal Variances

CANNOT REJECT null-hypothesis that mean monthy visitation during 2022-2024 is greater than mean monthly visitation during 2018-2019; with more than 68% confidence

	2018-2019	2022 - 2024
Mean	61,985	69,822
Variance	1,719,287,856	1,581,248,845
Hypothesized Mean Difference	**0**	
df	23	
t Stat	-0.47	
P(T<=t) one-tail	0.32	**68.03%**
t Critical one-tail	1.71	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 10b. Arches Winter Season Visitation: Statistical Significance - Years 2022-2024 versus 2016-2019

Normality

Kolmogorov-Smirnov tests: Can REJECT null hypothesis that monthly winter season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test: Two-Sample for Variances

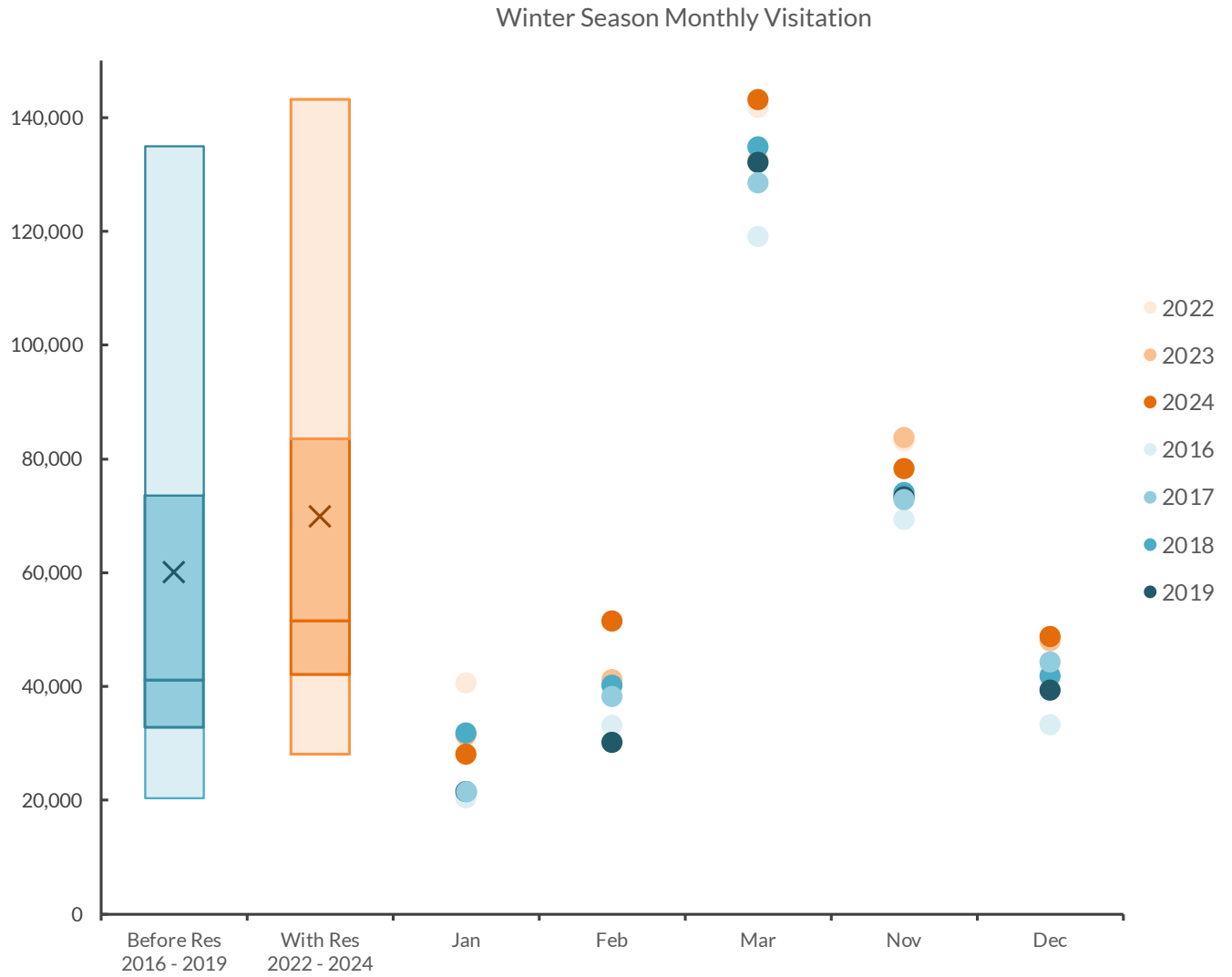
CANNOT REJECT null-hypothesis that variances are equal; with more than 53.4% confidence

	2016 - 2019	2022 - 2024
Mean	60,034	69,822
Variance	1,534,733,550	1,581,248,845
F	0.971	
P(F<=f) one-tail	0.466	**53.36%**
F Critical one-tail	0.443	

t-Test: Two-Sample Assuming Equal Variances

CANNOT REJECT null-hypothesis that mean monthy visitation during 2022-2024 is greater than monthly mean visitation during 2016-2019; with more than 76% confidence

	2016 - 2019	2022 - 2024
Mean	60,034	69,822
Variance	1,534,733,550	1,581,248,845
Hypothesized Mean Difference	**0**	
df	33	
t Stat	-0.73	
P(T<=t) one-tail	0.24	**76.38%**
t Critical one-tail	1.69	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 10c. Arches Winter Season Visitation Excluding March: Statistical Significance - Yrs 2022-2024 vs 2018-2019

Normality

Kolmogorov-Smirnov tests: CAN REJECT null hypothesis that monthly winter season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test Two-Sample for Variances

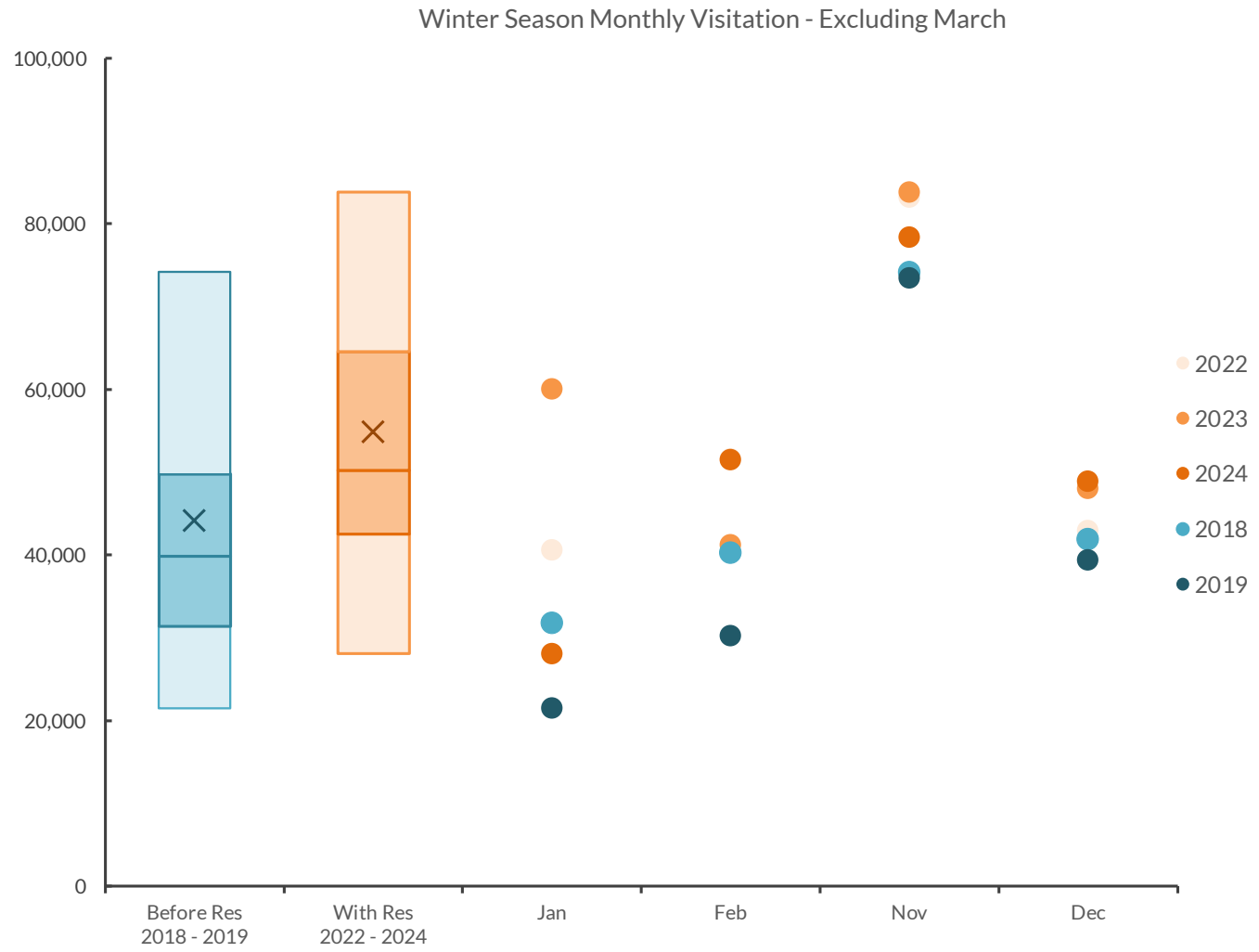
CANNOT REJECT null-hypothesis that variances are equal; with more than 54.1% confidence

	2018-2019	2022 - 2024
Mean	44,089	52,483
Variance	379,770,488	366,494,013
F	1.036	
P(F<=f) one-tail	0.459	**54.06%**
F Critical one-tail	3.012	

t-Test: Two-Sample Assuming Equal Variances

CANNOT REJECT null-hypothesis that mean monthy visitation during 2022-2024 is greater than mean monthly visitation during 2018-2019; with more than 82% confidence

	2018-2019	2022 - 2024
Mean	44,089	52,483
Variance	379,770,488	366,494,013
Hypothesized Mean Difference	**0**	
df	18	
t Stat	-0.95	
P(T<=t) one-tail	0.18	**82.36%**
t Critical one-tail	1.73	



Source: National Park Service, https://irma.nps.gov/Stats/

Appendix 10d. Arches Winter Season Visitation Excluding March: Statistical Significance - Yrs 2022-2024 vs 2016-2019

Normality

Kolmogorov-Smirnov tests: CAN REJECT null hypothesis that monthly winter season visitation data are not normally distributed, with 95% confidence for both time periods

F-Test Two-Sample for Variances

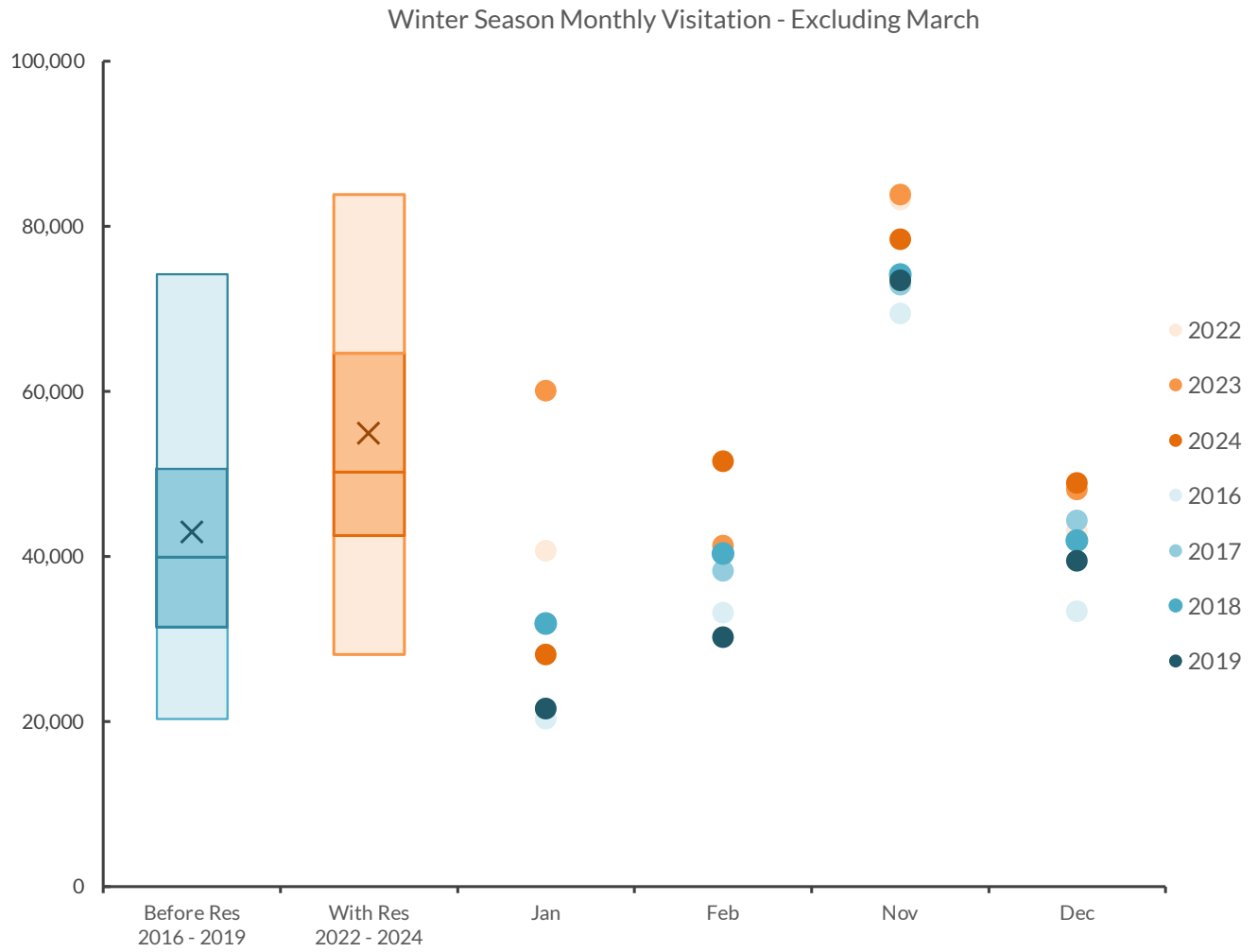
CANNOT REJECT null-hypothesis that variances are equal; with more than 51.8% confidence

	2016 - 2019	2022 - 2024
Mean	42,869	52,483
Variance	363,093,549	366,494,013
F	0.991	
P(F<=f) one-tail	0.482	**51.81%**
F Critical one-tail	0.399	

t-Test: Two-Sample Assuming Equal Variances

CANNOT REJECT null-hypothesis that mean monthy visitation during 2022-2024 is greater than mean monthly visitation during 2016-2019; with more than 90% confidence

	2016 - 2019	2022 - 2024
Mean	42,869	52,483
Variance	363,093,549	366,494,013
Hypothesized Mean Difference	**0**	
df	26	
t Stat	-1.32	
P(T<=t) one-tail	0.10	**90.06%**
t Critical one-tail	1.71	



Source: National Park Service, https://irma.nps.gov/Stats/