



Creating Stewardship through Discovery

A Comparison among Visitors that Participated in three National Park / National Geographic BioBlitzes

Natural Resource Report NPS/NRSS/BRD/NRR—2016/1270



ON THE COVER

Images of Biscayne National Park, Saguaro National Park, and Rocky Mountain National Park.
NPS PHOTOS

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Executive Summary

- This study evaluated participants' experiences with three citizen science BioBlitzes co-sponsored by the National Park Service (NPS) and National Geographic Society (NGS) at Biscayne (BISC), Saguaro (SAGU), and Rocky Mountain (ROMO) National Parks in 2010, 2011, and 2012, respectively. Information about why the program was important and benefits accrued from this event were gathered to provide NPS and NGS with a greater understanding of their constituencies. Social outcomes related to BioBlitzes aim to enhance interest in science and stewardship within protected areas.
- BioBlitz participants engaged in a host of activities while visiting the three parks, many were involved as part of organized groups and the majority knew others at the event. Different levels of previous experience were reported. At ROMO, however, respondents had significantly more previous experience than did participants at BISC and SAGU. Across the three parks, the most important source of information for the BioBlitz was "friends, relatives and/or word of mouth."
- Respondents were involved in the BioBlitz for a variety of reasons. The most important factor that encouraged involvement was the appeal of the program; i.e., importance of the activity. The least important facet of their involvement was the idea of centrality; in that most did not organize their life around nor feel that the program was central to their lives. This is likely an artifact of the novelty and prevalence of the program and characteristics of respondents; the NPS/NGS BioBlitz is an annual event that moves around the country and respondents were causal visitors from surrounding communities.
- The impact of the BioBlitz program manifested in different ways according to survey respondents. The impact of participation on understandings of science and nature were influenced by experiencing the park in a new way and provided opportunities to learn from professionals.
- Respondents considered themselves to be natural resource stewards and at all three sites most felt their stewardship was anchored in an intrinsic appreciation of nature rather than stemming from the benefits nature provides to humans. The majority of respondents were moderately willing to engage in protectionist behaviors but did not feel responsible for the parks' protection.
- To encourage future engagement, it will be important to note that the most important reason for engaging in the program was centered on individuals' contributions to society. Opportunities to learn from others with more experience also compelled participants to engage in this event.
- Respondents felt connected to places within the three parks in different ways. Half of the respondents at ROMO and approximately one third at BISC and SAGU reported having favorite places within the parks. The levels of attachment formed between people and the parks were mostly driven by affective / emotional bonds, individual identities, and opportunities made available to associate with other people. Given the relative importance of different places, management agencies should be careful to prioritize high and low priority settings within these protected areas.

- To more effectively reach and engage with visitors that attend these events, managers should note that there were slightly more males than females. Most respondents were just over 45 years of age, the majority were well-educated (at least a four-year college degree), and over half reported earning more than \$75,000 per year. Also, at least half of the respondents were employed outside the home and the majority of those individuals were employed full time.

The majority was not Hispanic or Latino, though significantly more respondents at BISC and SAGU were of Hispanic ethnicity than at ROMO. The vast majority across all three sites was White.

- The diversity of experiences, attitudes, and behaviors reported by survey respondents at BISC, SAGU, and ROMO suggest that a “one size fits all” management approach may exclude important segments of the survey population. Research results that shed light on the varied elements that comprise visitor experiences can be used as a guide to most effectively respond to the preferences reported by BioBlitz participants.

Acknowledgments

Data collection at Rocky Mountain National Park was made possible through collaboration with staff at the park and with the assistance of students working within the Human Dimensions of Natural Resources Laboratory at Texas A&M University. This study was approved by: Texas A&M IRB2010-0832, IRB2011-0741, and IRB 2012-0493; OMB Approval #1024-0224, Expiration date: September 30, 2010 and August 31, 2014; Saguaro National Park Research Permit #SAGU-2011-SCI-0007, Expiration date: Dec 31, 2012 and Rocky Mountain National Park Research Permit #ROMO-2012-SCI-0048, Expiration date: Dec 31, 2012.

Introduction

Overview of Biodiversity Discovery and the National Park Service

The national park system contains some of the most biologically rich ecosystems in the United States. Although vertebrates and vascular plants are often well documented, biodiversity of national parks remains relatively unknown considering the vast number of undocumented invertebrates, non-vascular plants, fungi, and bacteria remaining to be discovered. Management and protection is hindered by few surveys for these lesser-known taxa. The result is that invasive species from these groups can go undetected, and distribution and abundance of rare, threatened and endangered species remain unknown. Greater knowledge of extant species from a full taxonomic array is crucial in order to improve a park's ability to protect its natural resources. All-taxa biodiversity inventories (ATBIs) and BioBlitzes help to assess and document the variety of species within a given area.

National parks also have a large number and rich diversity of visitors; they come to experience, learn about, discover, and explore a park's natural and cultural resources. Visitors generally are limited in their ability to learn about and discover the invertebrate and other unique lifeforms in parks due to the lack of opportunities and expertise. In addition to increasing NPS knowledge of the diversity of life found in parks, ATBIs and BioBlitzes provide safe learning environments for visitors to participate in a new non-traditional park experience. Engaging citizen scientists in supervised biological surveys increases visitor investment and can lead to greater interest in park advocacy and preserving park resources. Utilizing citizen scientists to help document the biodiversity of a park that may harbor tens of thousands of species may seem daunting, but this task is feasible using an ATBI approach that includes BioBlitzes.

The NPS and NGS have been co-sponsoring a large-scale BioBlitz in a park near a large urban area annually since 2006. These BioBlitzes are compressed 24-hour events where teams of volunteer scientists, families, students, teachers, and other community members work together to find and identify as many species of plants, animals, microbes, fungi, and other organisms as possible. There is also a public component to these BioBlitzes, with goals of getting the public interested in biodiversity, science, and park stewardship. NPS-NGS BioBlitzes will be conducted in a different national park each year during the decade leading up to the NPS centennial in 2016. The purpose of this study was to learn more about the type of people who participate in BioBlitzes and examine the social benefits of the NPS-NGS BioBlitz program.

Specifically, the following elements of the BioBlitz experience were examined:

- Participation in the BioBlitz and NPS program
- Experiences with the parks that host BioBlitz programs
- Commitment to and involvement in BioBlitzes
- Motives for engaging in BioBlitz programs
- Impacts and implications that emerge from participation
- Feelings about the natural environment
- Attachment to places within these parks
- Stewardship and attitudes toward resource protection
- Socio-demographic characteristics

Methods

Data Collection

On-site and mailback surveys were completed during three BioBlitz programs following Dillman, Smyth and Christian's (2008) protocols for the administration of mixed mode surveys. For the on-site surveys, email addresses, names and postal addresses were collected. For the web-based survey, respondents were sent an email one week after the BioBlitz inviting their participation and directing them to a website where they could complete the survey. At the end of the web-based survey, respondents were sent an automated thank you note for their participation and assistance. Over the following three weeks, non-respondents were sent additional email reminders (one each week, $n=3$) encouraging their participation and feedback.

For the mail surveys, two weeks following the BioBlitz respondents were sent hard copies of the survey. The survey packet contained: (a) a cover letter thanking respondents for their participation and a brief description of the survey; (b) a survey questionnaire; and (c) a stamped, self-addressed return envelope. One week following the initial mailing, a reminder, thank you post card was sent to non-respondents. Two weeks following the initial mailing, another survey packet was sent to non-respondents. A final survey packet was sent to non-respondents one month following the initial mailing. The survey took approximately 25 minutes to complete. It was divided into five sections including questions about: 1) past BioBlitz participation; 2) experiences with NPS - NGS BioBlitzes; 3) experience with the individual parks; 4) feelings about the natural environment; and 5) socio-demographic information.

Data Analysis

Completed and usable survey data were coded and entered into a database for analysis using Statistical Package for the Social Sciences (SPSS) Version 20.0. For various response categories, frequency distributions and valid percentages (i.e., percentages excluding missing values) were estimated. Descriptive statistics were also calculated to illustrate mean values (i.e., averages) and standard deviations. Figures were created for selected variables to guide interpretation of the study findings.



Figure 1. Texas A&M graduate student surveys visitors at National Park Service BioBlitz.

Results

This report compared results from BioBlitz participants at Biscayne (BISC), Saguaro (SAGU), and Rocky Mountain (ROMO) National Parks. The tables and graphs below show the similarities and differences among respondents across these three national parks.

Past BioBlitz Involvement

Previous Participation in BioBlitzes

Most respondents reported that they had not previously participated in BioBlitz programs (Table 1) (Figure 2). Specifically, 7% from BISC, 3.8% from SAGU and 4.7% from ROMO had attended past events.

Table 1. Previous participation in BioBlitzes for respondents at three national parks

Previous Participation ¹	Yes
Biscayne	7.0%
Saguaro	3.8%
Rocky Mt.	4.7%

¹Pearson $\chi^2(2) = 295.1, p = .000^{***}$

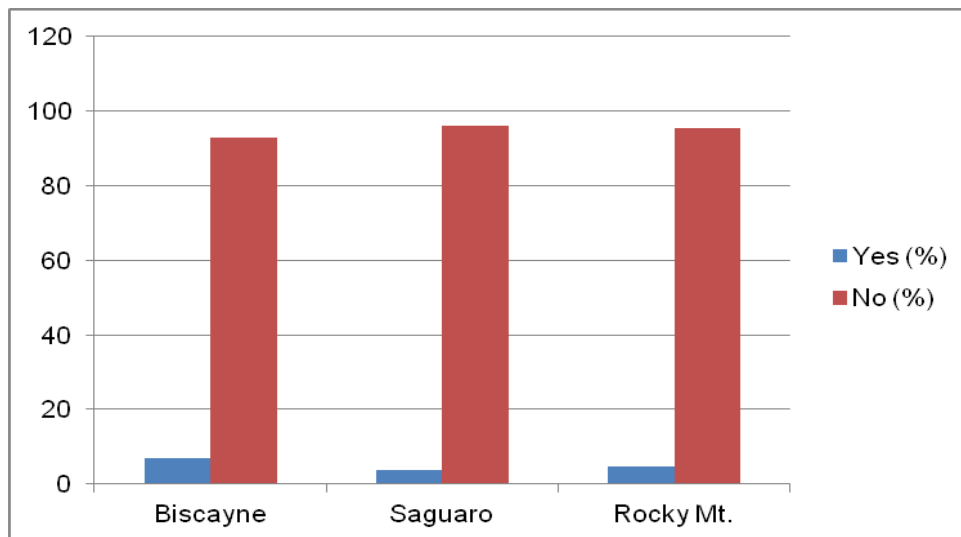


Figure 2. Comparison among reported levels of previous participation in BioBlitzes.

Experiences over the last 12 months

When asked how many BioBlitzes respondents had participated in over the last 12 months, BISC and SAGU respondents reported attending an average of two, whereas ROMO respondents had attended one including the event at which they were initially surveyed (Table 2). On average, BISC respondents spent 7.2 hours per month engaged in BioBlitz activities, 2.8 hours were spent by SAGU respondents, and 0.8 hours by ROMO respondents (Figure 3). There were no statistically significant differences across the three groups for these two measures (Table 3).

Table 2. Previous experiences over the last 12 months.

Previous Experience	Park Unit	Mean	SD
Number of BioBlitzes attended over the last 12 months	Biscayne	2.0	1.3
	Saguaro	1.7	1.2
	Rocky Mt.	0.8	0.8
Monthly hours committed	Biscayne	7.2	10.5
	Saguaro	2.8	2.2
	Rocky Mt.	0.8	1.1

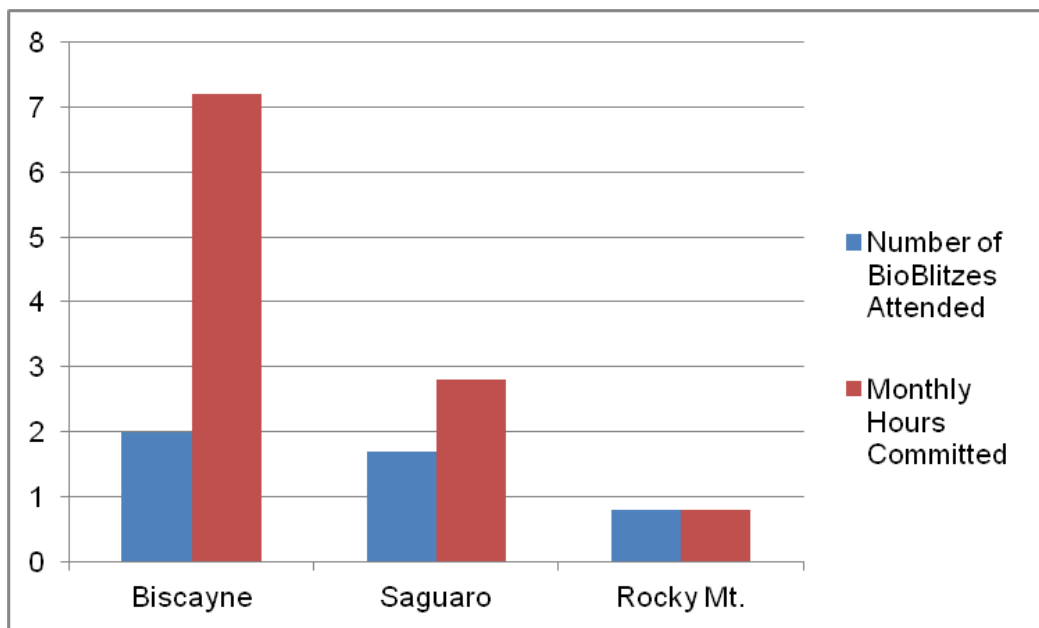


Figure 3. Comparison among previous experiences across three national parks.

Table 3. Analysis of variance test of average time committed to BioBlitzes in previous month.

Commitment Category	Commitment Group	Sum of squares	df	Mean Square	F	Sig.
Number of BioBlitzes attended over the last 12 months	Between Groups	4.783	2	2.392	1.834	.190
	Within Groups	22.167	17	1.304	N/A	N/A
	Total	26.950	1	N/A	N/A	N/A
Monthly hours committed	Between Groups	1320.796	2	660.398	1.206	.327
	Within Groups	8215.763	15	547.718	N/A	N/A
	Total	9536.559	17	N/A	N/A	N/A

Participation in Other NPS Programs

Respondents at BISC (17.0%), SAGU (34.0%), and ROMO (31.0%) participated in NPS programs outside of the ATBI/BioBlitz (Table 24) (Figure 4). When asked about the average time spent per month, respondents reported spending 5.5 hours at BISC, 5.4 hours at SAGU, and 14.7 hours at ROMO engaged with other NPS programs outside of the BioBlitz. There were no statistically significant differences among BISC, SAGU, and ROMO respondents in terms of monthly hours committed (Table 5).

Table 4. Participation in other NPS programs.

Participation	Park Unit	Percent	Mean	SD
Percent Engaged in Other Activities ¹	Biscayne	17.0%	N/A	N/A
	Saguaro	34.0%	N/A	N/A
	Rocky Mt.	31.0%	N/A	N/A
Hours Committed	Biscayne	N/A	2.9	4.6
	Saguaro	N/A	3.6	7.0
	Rocky Mt.	N/A	14.7	45.0

¹ Pearson $\chi^2 = 9.315$, $p = .009^{**}$

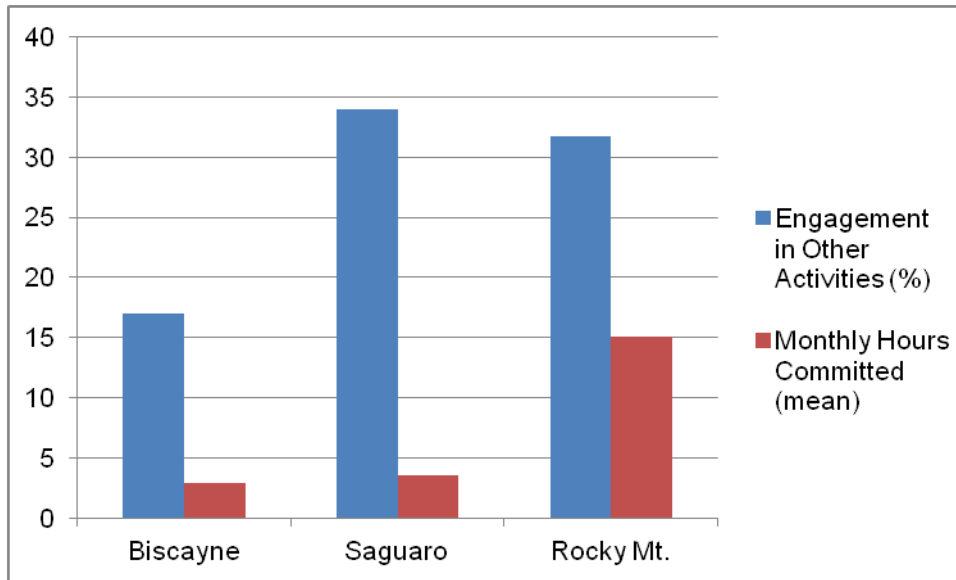


Figure 4. Comparison forms of participation in other NPS programs among three groups of BioBlitz participants.

Table 5. Analysis of variance test of average time committed in previous month to NPS programs outside of the BioBlitz.

Time Commitment Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	2953.017	2	1476.508	1.743	.181
Within Groups	77091.790	91	847.163	N/A	N/A
Total	80044.806	93	N/A	N/A	N/A

Experience with the BioBlitz Program

Information Sources

Across the three sites, the most frequent information source for the BioBlitz program was “friends/relatives/word of mouth”: BISC (31.4%), SAGU (33.5%), and ROMO (36.4%) (Table 6) (Figure 5).

Note: Respondents checked all that apply (Table 6) (Figure 5).

Previous BioBlitz: Pearson $\chi^2(2) = 81.708, p=.000^{***}$

Previous visit to the park: $\chi^2(2) = 63.099, p=.000^{***}$

Friends/relatives/word of mouth: $\chi^2(2) = 82.557, p=.000^{***}$

Videos/TV/Radio: $\chi^2(2) = 60.337, p=.000^{***}$

Newspaper/Magazine article: $\chi^2(2) = 77.584, p=.000^{***}$

Internet – Park homepage: $\chi^2(2) = 119.3, p=.000^{***}$

Internet – Other sites: $\chi^2(2) = 96.003, p=.000^{***}$

Convention Visitors’ Bureau: $\chi^2(2) = 151.0, p=.000^{***}$

** $p<.01$, *** $p<.001$

Table 6. Information sources for BioBlitz program.

Information Source	Biscayne	Saguaro	Rocky Mt.
Previous BioBlitz	3.3%	2.8%	1.6%
Previous visit to this park	5.8%	7.3%	2.3%
Friends/relatives/word of mouth	31.4%	33.5%	36.4%
Vides/TV/Radio	0.8%	3.4%	2.3%
Newspaper/Magazine articles	0.8%	16.2%	24.0%
Internet – Park homepage	8.3%	6.7%	17.1%
Internet – Other	5.8%	6.1%	8.6%
Convention Visitors' Bureau	0.8%	1.7%	0.8%

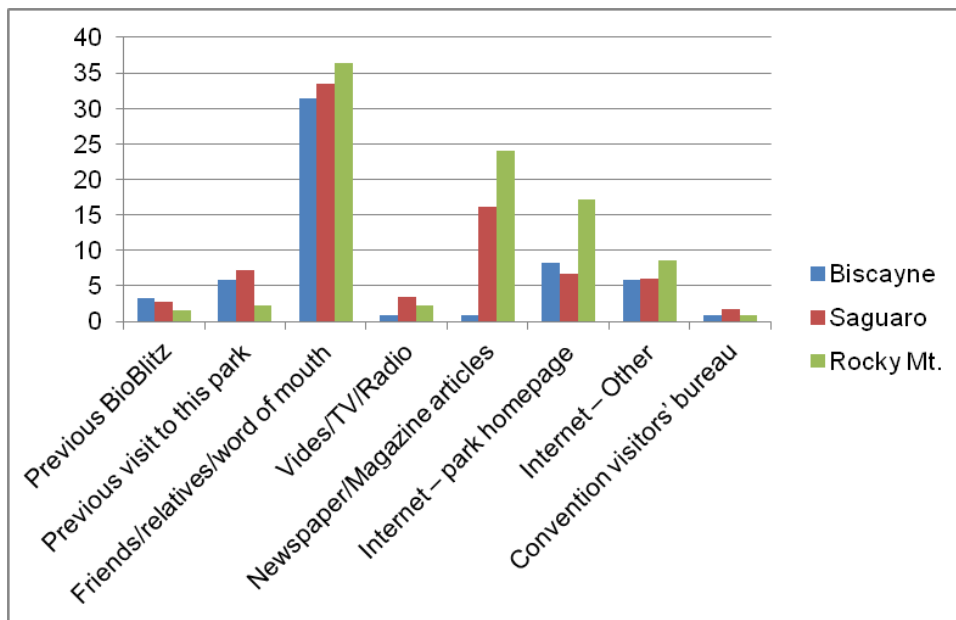


Figure 5. Comparison among information sources across three national parks.

Participated in the BioBlitz as a Part of an Organization

Across the three sites, some respondents participated in the BioBlitz as a part of an organization: BISC (39.6%), SAGU (60.4%), and ROMO (23.6%) (Table 7) (Figure 6).

Table 7. Participation in a BioBlitz with an organization.

Participation ¹	Yes
Biscayne	39.6%
Saguaro	60.4%
Rocky Mt.	24.8%

¹ Pearson $\chi^2(2)=13.690, p=.001^{**}$

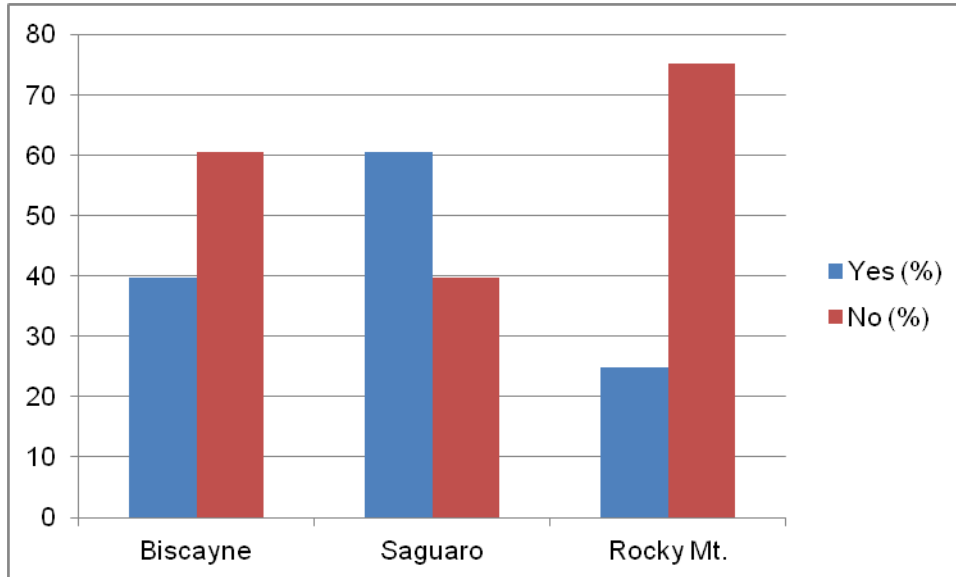


Figure 6. Comparison among proportion of respondents that participated in a BioBlitz as part of an organization.

Friends/Family/Colleagues Participating in the BioBlitz

The majority of the respondents from BISC (78.8%), SAGU (74.8%) and ROMO (62.6%) had friends/family/colleagues participating in the BioBlitz program (Table 8) (Figure 7).

Table 8. Knew others participating in the BioBlitz.

Others' Participation ¹	Yes
Biscayne	78.8%
Saguaro	74.8%
Rocky Mt.	62.6%

¹ Pearson $\chi^2(2)=8.273, p=.016^*$

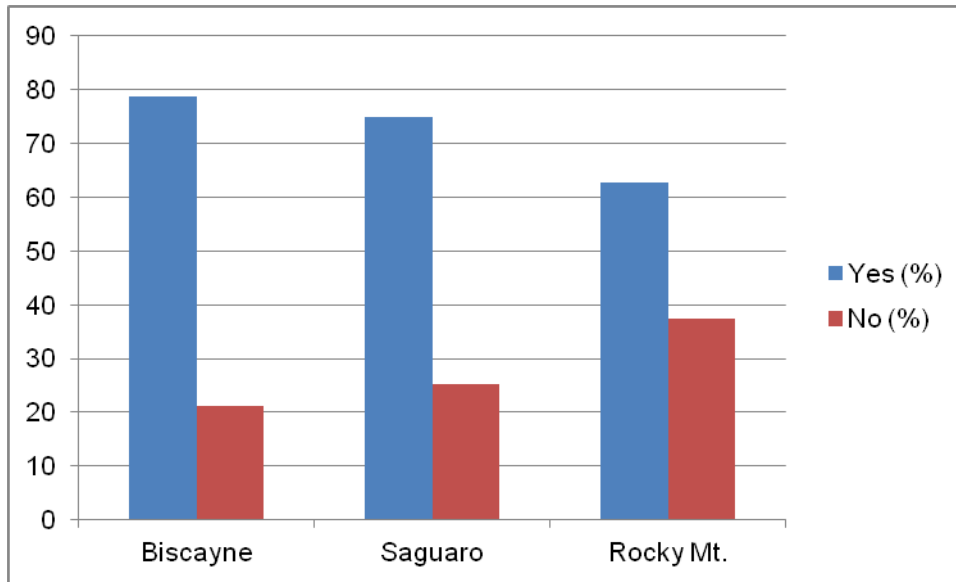


Figure 7. Comparison among proportion of respondents that had friends, family, and/or colleagues participating in BioBlitz programs.

Motivation

The survey measured motivation through four dimensions: learning, self-improvement, contribution to society, and solitude (5-point Likert scale) (Table 9). Individual survey items that were associated with each factor are listed in Tables 12a-d. For respondents, the most important motivation was centered on the idea of “contributions to society” at BISC (M=3.7, SD=0.8), SAGU (M=4.0, SD=0.9), and ROMO (M=4.0, SD=0.8). A comparison was conducted using the common items measured across the three parks (Figure 8). There was a statistically significant difference in the means of the “self-improvement” (Table 10) and “solitude” dimensions of motivation (Table 11).

Table 9. Average scores for four kinds of motivations that compelled visitors to participate in BioBlitz program.

Park Unit	Learning M (SD) ¹	Self- improvement M (SD) ¹	Contribution to Society M (SD) ¹	Solitude M (SD) ¹
Biscayne	3.6 (1.0)	2.4 (1.1)	3.7 (0.8)	3.6 (1.0)
Saguaro	3.7 (1.1)	2.5 (1.2)	4.0 (0.9)	1.9 (1.2)
Rocky Mt.	3.8 (0.8)	2.8 (1.0)	4.0 (0.8)	2.4 (1.2)

¹ Measured along a Likert-type scale where 1= “Not important” through 5= “Extremely important”

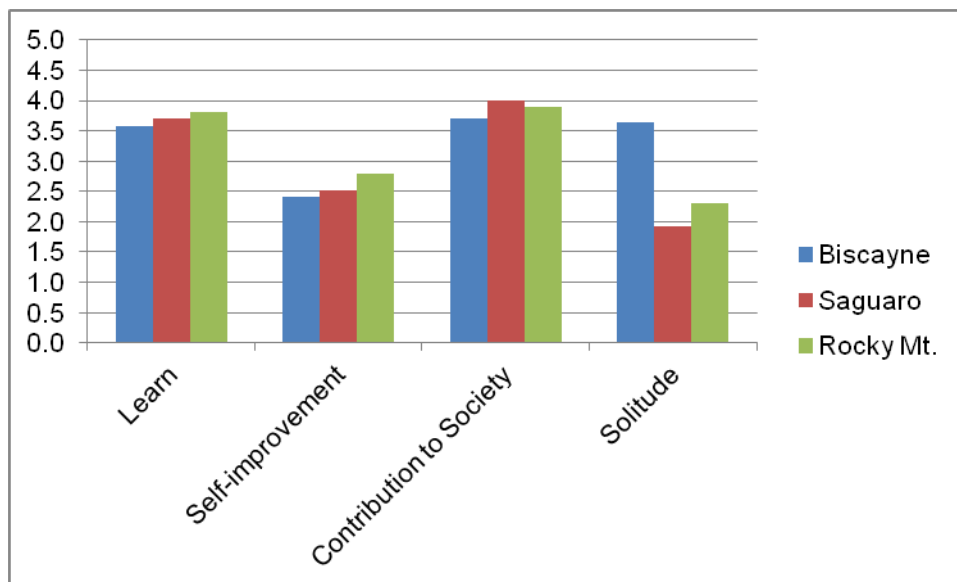


Figure 8. Comparison among mean values of four dimensions of motivation across three national parks.

Table 10. Analysis of variance test of average levels of self-improvement as a motivating factor to participate in BioBlitz programs at three national parks.

Self-improvement Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	3.183	2	1.591	1.592	.037 ¹
Within Groups	368.737	369	.999	N/A	N/A
Total	371.920	371	N/A	N/A	N/A

¹There was a statistically significant difference between groups as determined by a one-way ANOVA ($F(2, 369) = 1.592, p = .037$). A Tukey *post-hoc* test revealed that the level of self-improvement as a motivation for visiting the park was higher to a statistically significant degree among respondents from ROMO ($M=2.8, SD=1.0, p = .046$) compared to BISC ($M=2.4, SD=1.1$). There were no statistically significant differences between SAGU and BISC ($p = .843$) or between as SAGU and ROMO ($p = .089$).

Table 11. Analysis of variance test of average levels of solitude as a motivating factor to participate in BioBlitz programs at three national parks.

Motivation Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	16.094	2	8.047	6.051	.003 ¹
Within Groups	458.822	345	1.330	N/A	N/A
Total	474.916	347	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 345) = 6.051, p = .003$). A Tukey *post-hoc* test revealed that the level of solitude as a motivation for visiting the park was higher to a statistically significant degree among respondents from BISC ($M=3.6, SD=1.0, p = .021$) and ROMO ($M=2.4, SD=1.2, p = .007$) compared to SAGU ($M=1.9, SD=1.2$). There was no statistically significant difference between BISC and ROMO respondents ($p = .931$).

Table 12a. Comparisons among survey items associated with learning dimension motivations to participate in BioBlitz programs.

Survey Items	Park Unit	Mean	SD
Learn how nature works	Biscayne	3.6	1.4
	Saguaro	3.7	1.2
	Rocky Mt.	3.8	1.2
Learn about different species of flora and fauna	Biscayne	3.9	1.2
	Saguaro	3.8	1.5
	Rocky Mt.	4.0	1.0
Learn about the practice of science	Biscayne	3.3	1.3
	Saguaro	3.5	1.6
	Rocky Mt.	3.8	1.1

Table 12b. Comparisons among survey items associated with self-improvement dimension motivations to participate in BioBlitz programs.

Survey Items	Park Unit	Mean	SD
Help build my self-confidence	Biscayne	2.0	1.2
	Saguaro	2.1	1.2
	Rocky Mt.	2.6	1.7
Help with my personal growth	Biscayne	2.7	1.4
	Saguaro	2.7	1.3
	Rocky Mt.	3.4	1.5
Help me to stay healthy	Biscayne	2.6	1.3
	Saguaro	2.7	1.4
	Rocky Mt.	3.4	1.5

Table 12c. Comparisons among survey items associated with contribution to society dimension motivations to participate in BioBlitz programs.

Survey Items	Park Unit	Mean	SD
Feel I am doing something useful	Biscayne	3.8	1.2
	Saguaro	3.9	1.2
	Rocky Mt.	3.7	1.7

Table 12c (continued). Comparisons among survey items associated with contribution to society dimension motivations to participate in BioBlitz programs.

Survey Items	Park Unit	Mean	SD
Be of benefit to society or the community	Biscayne	3.9	1.1
	Saguaro	3.8	1.1
	Rocky Mt.	3.8	1.6
Feel I can play a role in the conservation of nature	Biscayne	3.9	1.1
	Saguaro	4.1	1.1
	Rocky Mt.	4.0	1.6
I like to support the park	Biscayne	4.0	1.0
	Saguaro	4.1	1.4
	Rocky Mt.	4.1	1.0

Table 12d. Comparisons among survey items associated with solitude dimension motivations to participate in BioBlitz programs.

Survey Items	Park Unit	Mean	SD
Be in a quiet peaceful spot	Biscayne	2.7	1.3
	Saguaro	2.1	1.5
	Rocky Mt.	3.2	2.0
Be alone with my thoughts	Biscayne	1.9	1.1
	Saguaro	1.7	1.2
	Rocky Mt.	2.7	2.2

Level of Involvement

Involvement in the BioBlitz program was measured through four dimensions: attraction, centrality, social bonding, and self-expression (Table 13). Individual survey items that were associated with each factor are listed in Table 17a-d. The most important kind of involvement in the BioBlitz was “attraction” at BISC (M=3.6, SD=0.8), SAGU (M=3.7, SD=0.7), and ROMO (M=3.7, SD=0.8). A comparison was conducted using the common items measured across the three parks (Figure 9). There was a statistically significant difference in the means of “centrality” (Table 14), “social bonding” (Table 15), and “self-expression” (Table 16).

Table 13. Average scores for four ways that visitors felt involved with the BioBlitz program.

Park Unit	Attraction M (SD) ¹	Centrality M (SD) ¹	Social Bonding M (SD) ¹	Self-expression M (SD) ¹
Biscayne	3.6 (0.8)	2.2 (0.8)	2.8 (0.7)	3.3 (0.9)
Saguaro	3.7 (0.7)	2.4 (1.0)	3.5 (0.7)	3.4 (1.0)
Rocky Mt.	3.7 (0.8)	2.5 (1.0)	3.3 (0.9)	3.5 (1.0)

¹ Measured along a Likert-type scale where 1= “Strongly agree” through 5= “Strongly disagree”

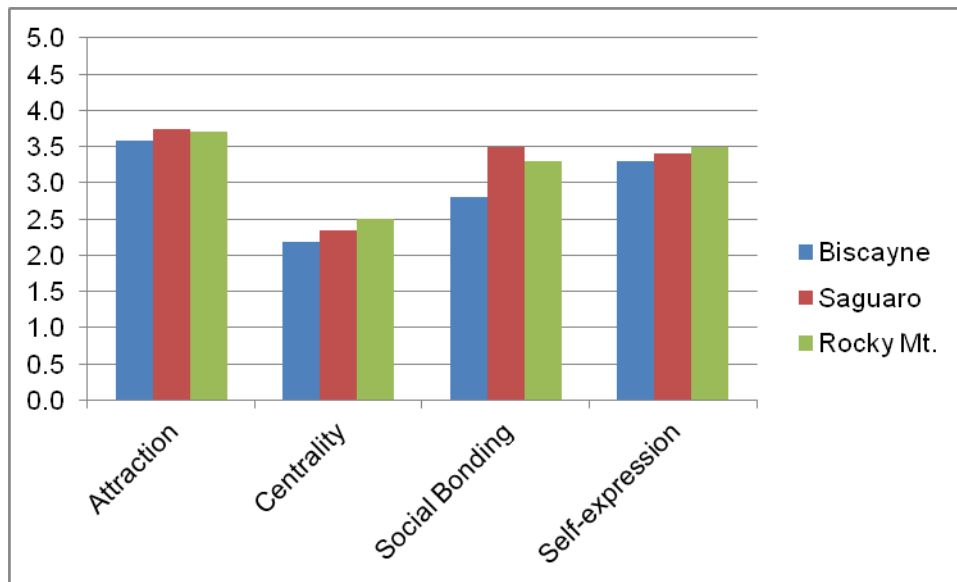


Figure 9. Comparison among mean values of four dimensions of involvement across three national parks.

Table 14. Analysis of variance test of average levels of centrality as a means for visitors to feel involved with BioBlitz programs at three national parks.

Involvement Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	34.875	2	17.437	19.938	.0001 ¹
Within Groups	327.101	374	.875	N/A	N/A
Total	361.976	376	N/A	N/A	N/A

¹There were statistically significant difference among groups as determined by a one-way ANOVA ($F(2, 374) = 17.437, p = .000$). A Tukey *post-hoc* test revealed that the level of centrality was significantly higher in respondents from ROMO ($M=2.5, SD=1.0, p = .000$) compared to BISC ($M=2.2, SD=0.8$) and SAGU ($M=2.4, SD=1.0$). There were no statistically significant differences between SAGU and BISC respondents ($p = .358$).

Table 15. Analysis of variance test of average levels of social bonding as a means for visitors to feel involved with BioBlitz programs at three national parks.

Social Bonding Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	28.981	2	14.490	26.519	.000 ¹
Within Groups	203.264	372	.546	N/A	N/A
Total	232.244	374	N/A	N/A	N/A

¹There were statistically significant differences between groups as determined by a one-way ANOVA ($F(2, 372) = 26.519, p = .000$). A Tukey *post-hoc* test revealed that the level of social bonding was statistically significantly higher in respondents from SAGU ($M=3.5, SD=0.7, p = .000$) and ROMO ($M=3.3, SD=0.9, p = .000$) compared to BISC ($M=2.8, SD=0.7$). There was no statistically significant differences between SAGU and ROMO respondents ($p = .940$).

Table 16. Analysis of variance test of average levels of self-expression as a means for visitors to feel involved with BioBlitz programs at three national parks.

Self-expression Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	5.657	2	2.829	3.033	.049 ¹
Within Groups	347.822	373	.932	N/A	N/A
Total	353.479	375	N/A	N/A	N/A

¹There were statistically significant differences between groups as determined by a one-way ANOVA ($F(2, 373) = 3.303, p = .049$). A Tukey *post-hoc* test revealed that the level of self-expression was statistically significantly higher in respondents from ROMO ($M=3.5, SD=1.0, p = .000$) compared to BISC ($M=3.3, SD=0.9$). There was no statistically significant differences between BISC and SAGU respondents ($p = .418$) or between SAGU and ROMO respondents ($p = .331$).

Table 17a. Comparisons among survey items associated with attraction dimension of involvement in BioBlitz programs.

Dimensions and Survey Items	Park Unit	Mean	SD
Participating in the BioBlitz has been one of the most enjoyable things I've done	Biscayne	3.3	1.0
	Saguaro	3.5	1.0
	Rocky Mt.	3.5	1.1
My involvement with the BioBlitz was important to me	Biscayne	3.8	0.8
	Saguaro	4.0	0.7
	Rocky Mt.	3.8	0.9

Table 17b. Comparisons among survey items associated with centrality dimension of involvement in BioBlitz programs.

Dimensions and Survey Items	Park Unit	Mean	SD
A lot of my life was organized around the BioBlitz	Biscayne	2.2	0.9
	Saguaro	2.4	1.0
	Rocky Mt.	3.4	1.2
The BioBlitz occupied a central role in my life	Biscayne	2.2	0.9
	Saguaro	2.3	1.0
	Rocky Mt.	2.4	1.0

Table 17c. Comparisons among survey items associated with social bonding dimension of involvement in BioBlitz programs.

Dimensions and Survey Items	Park Unit	Mean	SD
I enjoyed discussing the BioBlitz with my friends	Biscayne	3.0	1.2
	Saguaro	3.7	0.9
	Rocky Mt.	3.7	1.0
I identified with the people associated with the BioBlitz	Biscayne	3.4	0.9
	Saguaro	3.8	0.8
	Rocky Mt.	3.6	1.0
Participating in the BioBlitz provided me with an opportunity to be friends	Biscayne	2.1	0.9
	Saguaro	2.9	1.1
	Rocky Mt.	3.1	1.1

Table 17d. Comparisons among survey items associated with self-expression dimension of involvement in BioBlitz programs.

Dimensions and Survey Items	Park Unit	Mean	SD
My involvement with the BioBlitz allowed me to be myself	Biscayne	3.3	0.9
	Saguaro	3.4	1.0
	Rocky Mt.	3.6	1.0

Impact of Participation on Understanding of Science and Nature

“The program has allowed me to experience the park in a new way” was the statement reflecting the most important impact of participation according to BISC (M=4.2, SD=0.8) and SAGU participants (M=4.0, SD=0.9). Also, respondents thought “the program has provided a unique opportunity to learn from professionals” was another influential element associated with participation in BioBlitz programs (SAGU; M=4.0, SD=0.9 and ROMO; M=4.3, SD=0.7) (Table 18). Mean values for the four statements reflecting impacts of participation were compared across three sites (Figure 10). There were statistically significant differences among the mean values of the following statement: “the BioBlitz has provided a unique opportunity to learn from professionals” (Table 19).

Table 18. Elements of participation that influenced respondents’ understandings of science and nature.

Impact of Participation	Biscayne M (SD) ¹	Saguaro M (SD) ¹	Rocky Mt. M (SD) ¹
The BioBlitz has taught me a lot about a variety of species of plants and animals living in the park	3.8 (0.9)	3.8 (1.0)	3.8 (1.0)
The BioBlitz has provided me with an opportunity to learn about science	4.0 (0.9)	3.9 (0.9)	4.1 (0.7)
The BioBlitz has allowed me to experience the park in a new way	4.2 (0.8)	4.0 (0.9)	4.0 (0.9)
The BioBlitz has provided a unique opportunity to learn from professionals	4.1 (0.9)	4.0 (0.9)	4.3 (0.7)

¹ Measured along a Likert-type scale where 1= “Strongly disagree” through 5= “Strongly agree”

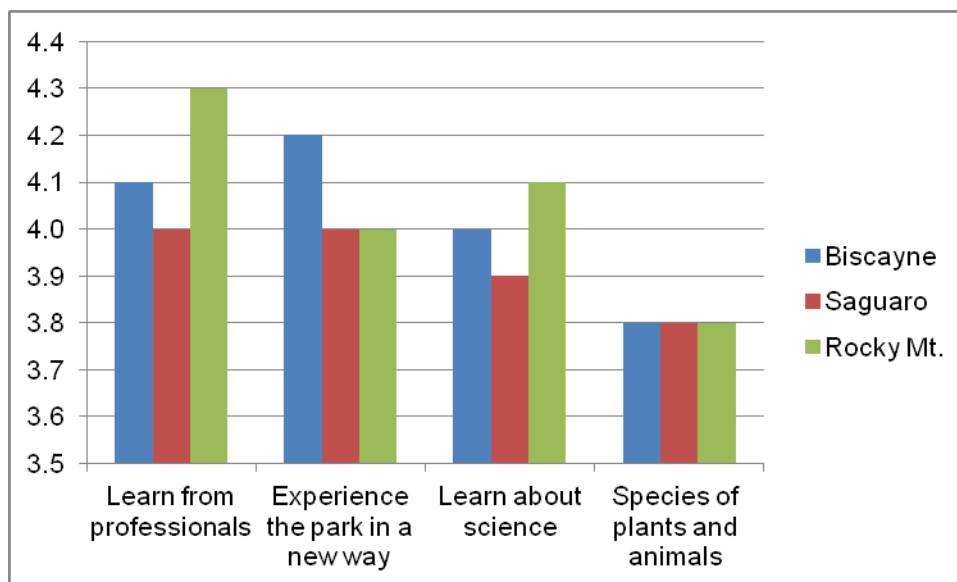


Figure 10. Comparison among mean values of four statements reflecting the impact of participation in BioBlitz programs across three national parks.

Table 19. Analysis of variance test of average levels of statement reflecting the impact of participation on BioBlitz participants' understandings of science and nature.

Impact of Participation Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	7.676	2	3.838	5.242	.000 ¹
Within Groups	270.887	370	.732	N/A	N/A
Total	278.563	372	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 370) = 5.242, p = .000$). A Tukey *post-hoc* test revealed that the level of the item "The Bioblitz has provided a unique opportunity to learn from professionals" was significantly higher among respondents from ROMO ($M=4.3, SD=0.7, p = .004$) compared to SAGU ($M=4.0, SD=0.9$). There were no differences between BISC and SAGU ($p = .557$), and BISC and ROMO participants ($p = .164$).

Experience with three national park sites

Visitation History

In the previous 12 months, BISC respondents had visited an average of about three times, respondents from SAGU had visited just over six times, and respondents from ROMO had visited around ten times (Table 20) (Figure 11). There were statistically significant differences among the three groups ($p = .001$) in terms of the number of previous visits to the parks that hosted BioBlitz programs (Table 21).

Table 20. Visits in previous year.

Park Unit	Mean	SD
Biscayne	3.1	4.6
Saguaro	6.6	10.9
Rocky Mt.	10.3	19.3

Table 21. Analysis of variance test of average number of visits across three national parks

Visitation Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	2645.293	2	1322.646	7.456	.001 ¹
Within Groups	61559.057	347	177.404	N/A	N/A
Total	64204.350	349	N/A	N/A	N/A

¹There were statistically significant differences between groups as determined by a one-way ANOVA ($F(2, 347) = 7.456, p = .001$). A Tukey *post-hoc* test revealed that the number of visits to the park in the last 12 months was statistically significantly higher in respondents from Rocky Mt. NP ($M=10.3, SD=19.3, p = .000$) compared to Biscayne NP ($M=3.1, SD=4.6$). There was no statistically significant differences between Biscayne and Saguaro ($p = .123$) or between Saguaro and Rocky Mt. ($p = .072$).

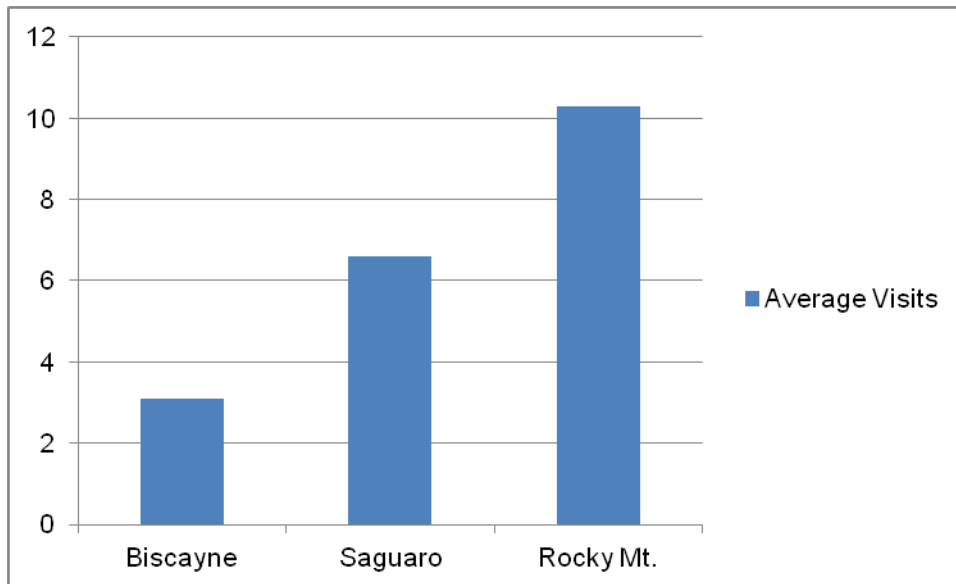


Figure 11. Comparison among previous visits across three national parks.

On average, respondents began visiting between 1985 and 1999: BISC (1999.8), SAGU (1994.6), and ROMO (1985.5) (Table 22). Differences among the year of first visit across parks are reported in Figure 12 and Table 23.

Table 22. Visitation history among participants engaged in BioBlitz programs.

Park Unit	Mean	SD
Biscayne	1999.8	12.4
Saguaro	1994.6	15.8
Rocky Mt.	1985.5	16.3

Table 23. Analysis of variance test of average year when BioBlitz participants first visited three national parks.

First Visit Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	10760.260	2	5380.130	23.290	.000 ¹
Within Groups	81083.720	351	231.008	N/A	N/A
Total	91843.980	353	N/A	N/A	N/A

¹There were statistically significant differences between groups as determined by a one-way ANOVA ($F(2, 351) = 23.290, p = .000$). A Tukey *post-hoc* test revealed that the first year's visit to the park was significantly lower among respondents from SAGU ($M=1994.6, SD=15.8, p = .030$) and ROMO ($M=1985.5, SD=16.3, p = .000$) compared to BISC ($M=1999.8, SD=12.4$).

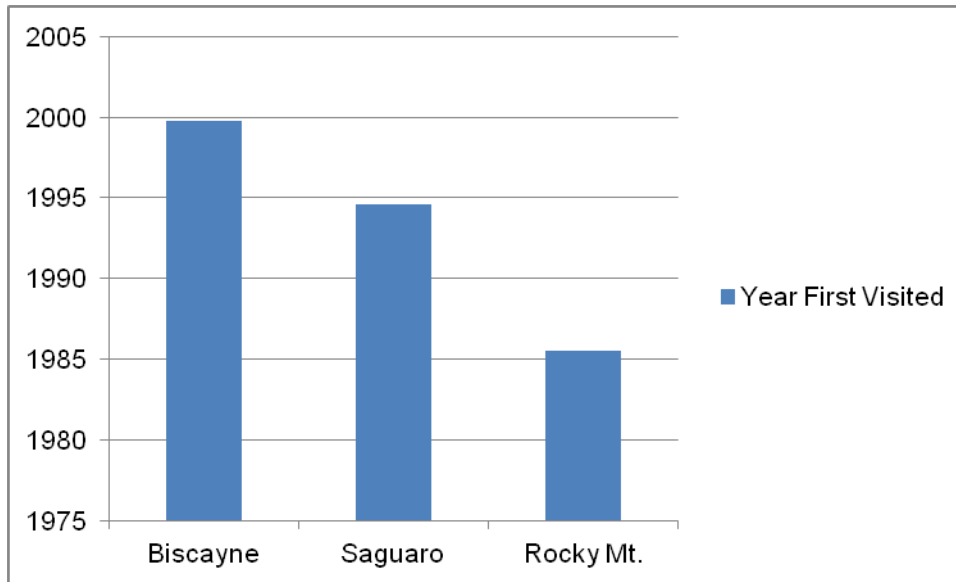


Figure 12. Comparison among average year when BioBlitz participants first visited three national parks.

Activity Participation

BioBlitz participants engaged in a diverse set of activities (Table 24). At BISC, the most frequent activities were going to the visitor and/or nature center (58.0%), wildlife watching/birdwatching (45.0%), and nature/landscape photography (41.0%). At SAGU, the most popular activities were going to the visitor and/or nature center (71.2%), hiking (76.9%), nature/landscape photography (55.3%), and wildlife watching/birdwatching (54.7%). Among ROMO respondents, the most frequent activities were hiking (87.6%), wildlife watching/birdwatching (73.6%), and going to the visitor and/or nature center (67.4%). Differences emerged in a comparison across sites based on activity engagement (Figure 13).

Note: Respondents checked all that apply (Table 24) (Figure 13).

Camping: Pearson $X^2(2)=99.507, p=.000***$

Hiking: $X^2(2)=35.798, p=.000**$

Biking: $X^2(2)=43.774, p=.000**$

Visiting the visitor center/nature center: $X^2(2)=48.614, p=.000***$

Nature/landscape photography: $X^2(2)=71.291, p=.000***$

Picnicking: $X^2(2)=110.9, p=.000***$

Wildlife watching/Birdwatching: $X^2(2)=81.391, p=.000***$

Table 24. Activities participated in over the last 12 months.

Activity	Biscayne ¹	Saguaro ¹	Rocky Mt. ¹
Camping	8.0%	22.6%	38.8%
Hiking	26.0%	76.9%	87.6%
Biking	2.0%	15.4%	7.8%

¹ Multiple choice questions; respondents checked all that apply

Table 24 (continued). Activities participated in over the last 12 months.

Activity	Biscayne ¹	Saguaro ¹	Rocky Mt. ¹
Visiting the visitor center/nature center	58.0%	71.2%	67.4%
Nature/landscape photography	41.0%	55.3%	62.8%
Picnicking	29.0%	31.5%	51.2%
Wildlife watching or birdwatching	45.0%	54.7%	73.6%
Motorboating	13.0%	7.6%	1.6%

¹ Multiple choice questions; respondents checked all that apply

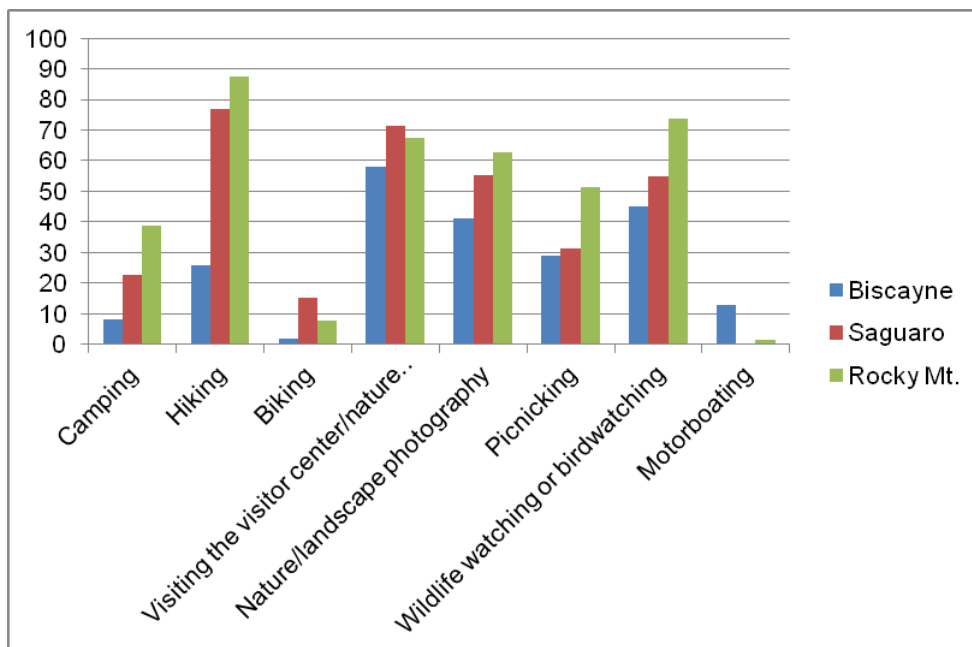


Figure 13. Comparison among activity participation across three national parks.

Favorite Places in the Parks

Some respondents reported that they had favorite places within BISC (25.0%), SAGU (31.4%), and ROMO (50.8%) (Table 25) (Figure 14).

Table 25. Proportion of visitors that reported having a favorite place.

Park Unit	Yes
Biscayne	25.0%
Saguaro	31.4%
Rocky Mt.	50.8%

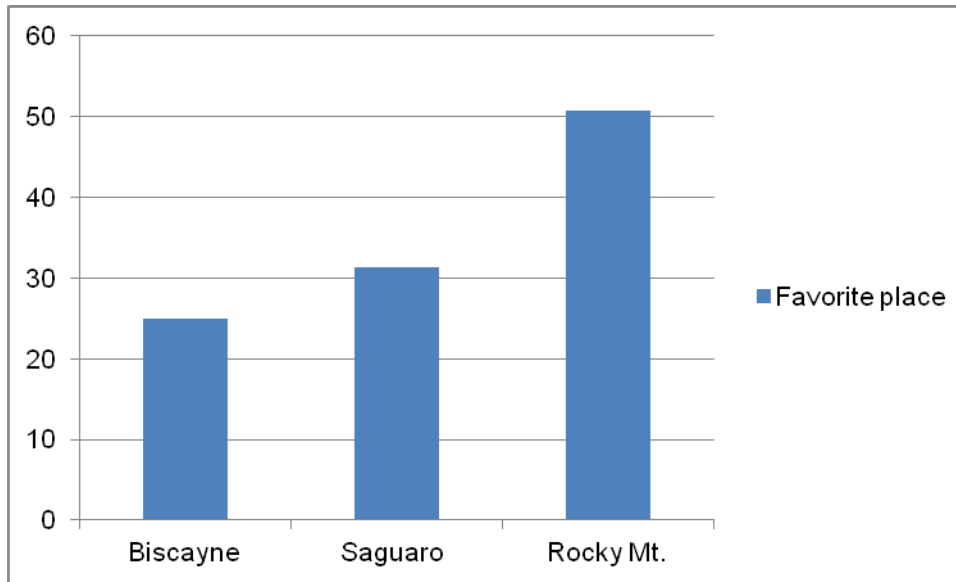


Figure 14. Comparison among proportion of visitors that claimed to have a favorite place within three national parks.

Place Attachment

Place attachment was measured with four dimensions: place identity, place dependence, affective attachment, and social bonding (Table 26). Individual survey items associated with each place attachment dimension are listed in Table 31a-d). Respondents’ levels of attachment to the park were mostly driven by “affective attachment” (BISC: M=3.1, SD=0.7), “place identity” (SAGU: M=3.9, SD=0.7) (ROMO: M=4.3, SD=0.6) and “place social bonding” (SAGU: M=3.9, SD=0.9). There were significant differences in the mean values of the four place attachment dimensions across the three parks (see Figure 15). Specifically, there were statistically significant differences in the average values of “place identity” (Table 27), and “place dependence” (Table 28), “affective attachment” (Table 29), and “social bonding” (Table 30).

Table 26. Average scores for four kinds of connections that form between participants in the BioBlitz program and places within the parks.

Park Unit	Place Identify M (SD) ¹	Place Dependence M (SD) ¹	Affective Attachment M (SD) ¹	Social Bonding M (SD) ¹
Biscayne	2.5 (1.0)	2.2 (1.0)	3.1 (0.7)	2.2 (1.3)
Saguaro	3.9 (0.7)	3.3 (0.9)	3.8 (0.7)	3.9 (0.9)
Rocky Mt.	4.3 (0.6)	3.5 (0.9)	4.2 (0.6)	4.2 (0.8)

¹ Measured along a Likert-type scale where 1= “Not important” through 5= “Extremely important”

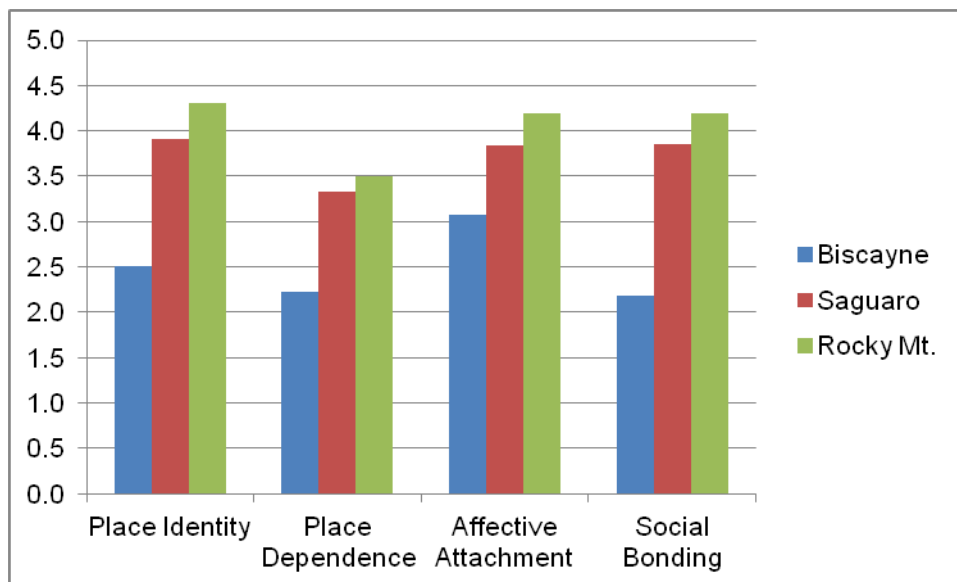


Figure 15. Comparison among mean values of four dimensions of place attachment across three national parks.

Table 27. Analysis of variance test of average levels of place identity across three groups of respondents.

Identity Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	133.481	2	66.740	85.534	.000 ¹
Within Groups	161.519	207	N/A	N/A	N/A
Total	294.999	N/A	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 207) = 85.534, p = .000$). A Tukey post-hoc test revealed that the level of place identity was significantly higher in respondents from SAGU ($M=3.9, SD=0.7, p = .000$) and ROMO ($M=4.3, SD=0.6, p = .000$) compared to BISC ($M=2.5, SD=1.0$). There were no differences between SAGU and ROMO participants ($p = .161$).

Table 28. Analysis of variance test of average levels of place dependence across three groups of respondents.

Place Dependence Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	77.167	2	38.583	42.021	.000 ¹
Within Groups	190.984	208	.918	N/A	N/A
Total	268.151	N/A	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 208) = 42.021, p = .000$). A Tukey post-hoc test revealed that the level of place dependence was significantly higher in respondents from SAGU ($M=3.3, SD=0.9, p = .000$) and ROMO ($M=3.5, SD=0.9, p = .000$) compared to BISC ($M=2.2, SD=1.0$). There were no differences between SAGU and ROMO participants ($p = .452$).

Table 29. Analysis of variance test of average levels of affective attachment across three groups of respondents.

Attachment Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	45.332	2	22.666	48.937	.000 ¹
Within Groups	96.803	209	.463	N/A	N/A
Total	142.136	211	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 209) = 48.937, p = .000$). A Tukey post-hoc test revealed that the level of affective attachment was significantly higher in respondents from SAGU ($M=3.8, SD=0.7, p = .000$) and ROMO ($M=4.2, SD=0.6, p = .000$) compared to BISC ($M=3.1, SD=0.7$). Also, the mean was significantly higher among respondents from ROMO ($M=4.2, SD=0.6, p = .000$) than SAGU ($M=3.8, SD=0.7$).

Table 30. Analysis of variance test of average levels of social bonding across three groups of respondents.

Social Bonding Groups	Sum of squares ¹	df ¹	Mean Square ¹	F ¹	Sig ¹ .
Between Groups	180.745	2	90.372	79.823	.000 ¹
Within Groups	236.620	209	1.132	N/A	N/A
Total	417.365	211	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by one-way ANOVA ($F(2, 209) = 79.823, p = .000$). A Tukey post-hoc test revealed that the level of social bonding was significantly higher in respondents from SAGU ($M=3.9, SD=0.9, p = .000$) and ROMO ($M=4.2, SD=0.8, p = .000$) compared to BISC ($M=2.2, SD=1.3$). There was no differences between SAGU and ROMO participants ($p = .235$).

Table 31a. Mean values of survey items associated with place and identity dimension of place attachment.

Dimensions and Survey Items	Park Unit	Mean	SD
I identify with the Park	Biscayne	2.2	1.3
	Saguaro	3.8	0.9
	Rocky Mt.	4.0	1.8
I feel the park is a part of me	Biscayne	2.5	0.9
	Saguaro	3.7	1.0
	Rocky Mt.	3.8	1.8
The park means a lot to me	Biscayne	2.8	1.1
	Saguaro	4.3	0.8
	Rocky Mt.	4.2	2.4

Table 31b. Mean values of survey items associated with place dependence dimension of place attachment.

Dimensions and Survey Items	Park Unit	Mean	SD
The park is the best place for the recreation activities that I enjoy	Biscayne	2.2	1.3
	Saguaro	3.6	1.0
	Rocky Mt.	3.5	1.8
Compared to this park, there are few satisfactory alternatives	Biscayne	2.0	1.2
	Saguaro	3.0	1.1
	Rocky Mt.	3.0	1.8
I can't imagine a better place for what I like to do than this park	Biscayne	2.5	0.8
	Saguaro	3.3	1.1
	Rocky Mt.	3.6	1.9

Table 31c. Mean values of survey items associated with place effective dimension of place attachment.

Dimensions and Survey Items	Park Unit	Mean	SD
I feel a strong sense of belonging to the park	Biscayne	2.6	0.9
	Saguaro	3.9	1.0
	Rocky Mt.	3.9	2.8
I really enjoy the park	Biscayne	4.1	0.5
	Saguaro	4.4	0.6
	Rocky Mt.	4.5	1.8
I am happiest when I get to visit the park	Biscayne	2.5	0.9
	Saguaro	3.3	1.0
	Rocky Mt.	3.7	0.9

Table 31d. Mean values of survey items associated with social bonding dimension of place attachment.

Dimensions and Survey Items	Park Unit	Mean	SD
I have a lot of fond memories of past experiences with family and friends in the park	Biscayne	2.2	1.4
	Saguaro	4.2	0.8
	Rocky Mt.	4.4	1.9

Table 31d (continued). Mean values of survey items associated with social bonding dimension of place attachment.

Dimensions and Survey Items	Park Unit	Mean	SD
I associate special people in my life with the park	Biscayne	2.0	1.2
	Saguaro	3.6	1.1
	Rocky Mt.	3.8	1.0
Visiting this park allows me to spend time with my family and friends	Biscayne	2.4	1.4
	Saguaro	3.8	1.0
	Rocky Mt.	4.2	0.8

Feelings about the Natural Environment

Park Protection

Respondents indicated moderate willingness to protect the park (Table 32). The mean score of items asked measured across parks was between 3.5 and 4.0 BISC ($M=3.8$), SAGU ($M=3.5$) and ROMO ($M=3.7$) respondents. Generally, respondents were less likely to feel responsible for protecting the park as an individual. Differences emerged in the comparison (Figure 16) (Table 33). Individual survey items associated with each dimension are listed in Table 34.

Table 32. Average scores reflecting respondents' inclinations to protect three national parks.

Park Unit	Willing to Protect M (SD) ¹	Felt Responsibilities as an Individual M (SD) ¹
Biscayne	3.8 (0.6)	2.2 (0.7)
Saguaro	3.5 (0.6)	2.1 (0.6)
Rocky Mt.	3.7 (0.6)	2.1 (0.6)

¹ Measured along a Likert-type scale where 1= "Strongly Agree" through 5= "Strongly Disagree"

Table 33. Analysis of variance test of average levels of park protection across three groups of respondents.

Park Protection Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	4.674	2	2.337	6.628	.001 ¹
Within Groups	129.027	366	.353	N/A	N/A
Total	133.701	368	N/A	N/A	N/A

¹There were statistically significant differences among groups as determined by a one-way ANOVA ($F(2, 366) = 6.628, p = .001$). A Tukey post-hoc test revealed that the level of willingness to protect the park was significantly higher in respondents from BISC ($M=3.8, SD=0.6, p = .008$) and ROMO ($M=3.7, SD=0.6, p = .006$) than SAGU ($M=3.5, SD=0.6$). There were no significant differences between BISC and SAGU respondents ($p = .997$).

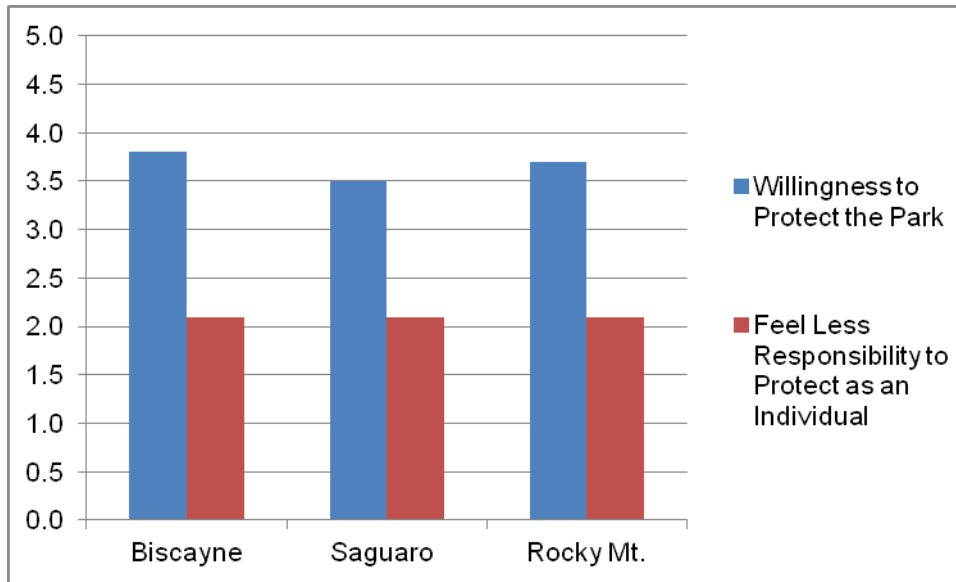


Figure 16. Comparison among mean values of park protection dimensions across three national parks.

Table 34a. Mean values of survey items associated with the willingness to protect park dimension of park protection.

Dimensions and Survey Items	Park Unit	Mean	SD
I am willing to volunteer my time to help the environment of this national park	Biscayne	3.9	0.7
	Saguaro	3.6	0.9
	Rocky Mt.	3.7	0.9
It is important for me to reduce my negative personal impacts on the environment of this national park	Biscayne	4.2	0.7
	Saguaro	4.1	0.8
	Rocky Mt.	4.3	0.8
It is primarily the responsibility of individuals, not the government, to protect the environment of this national park	Biscayne	3.2	1.0
	Saguaro	2.9	1.2
	Rocky Mt.	3.3	1.1

Table 34b. Mean values of survey items associated with the feel less responsibility to protect park dimension of park protection.

Dimensions and Survey Items	Park Unit	Mean	SD
I do not feel I have any control over whether or not my daily activities harm this national park	Biscayne	2.1	0.9
	Saguaro	2.0	0.8
	Rocky Mt.	2.0	0.9

Table 34b (continued). Mean values of survey items associated with the feel less responsibility to protect park dimension of park protection.

Dimensions and Survey Items	Park Unit	Mean	SD
The efforts of one person to conserve the resources of this national park are insignificant as long as other people refuse to conserve	Biscayne	2.2	1.0
	Saguaro	2.2	0.9
	Rocky Mt.	1.9	0.9
Because my contribution to environmental problems at this national park is very small, I do not feel responsible for causing environmental problems in the park today	Biscayne	2.4	1.0
	Saguaro	2.3	0.9
	Rocky Mt.	2.4	1.0

Natural Resource Stewardship

Respondents were asked to indicate the extent to which they considered themselves to be natural resource stewards. Respondents from ROMO showed the highest level of stewardship (M=5.7, SD=1.0), followed by SAGU (M=5.3, SD=1.2) and then BISC (M=2.5, SD=2.7) (Figure 17). When comparing between nature-oriented and human-oriented kinds of stewardship, respondents felt their stewardship was nature-oriented (Table 35). For BISC respondents in particular, more thought they had nature-based (M=4.4) rather than human-based orientations (M=3.8). This was similar to respondents from SAGU that thought their stewardship was more nature (M =4.5) than human-oriented (M=3.9). There were no significant differences in the mean values of nature and human-oriented stewardship across the three sites (Table 36) (Table 37). See Table 38a-b for survey items associated with each factor.

Table 35. Average levels of stewardship reported by participants in the BioBlitz programs.

Stewardship	Park Unit	Mean	SD
Average stewardship for pooled survey items ¹	Biscayne	2.5	2.7
	Saguaro	5.3	1.2
	Rocky Mt.	5.7	1.0
Nature-oriented stewardship ²	Biscayne	4.4	0.6
	Saguaro	4.5	0.5
	Rocky Mt.	4.4	0.6
Human-oriented stewardship ²	Biscayne	3.8	1.0
	Saguaro	3.9	0.8
	Rocky Mt.	3.8	1.0

¹Measured along a Likert-type scale where 1= "Not at all a Problem" through 5= "Very Much a Problem"

²Measured along a Likert-type scale where 1= "Strongly Disagree" through 5= "Strongly Agree"

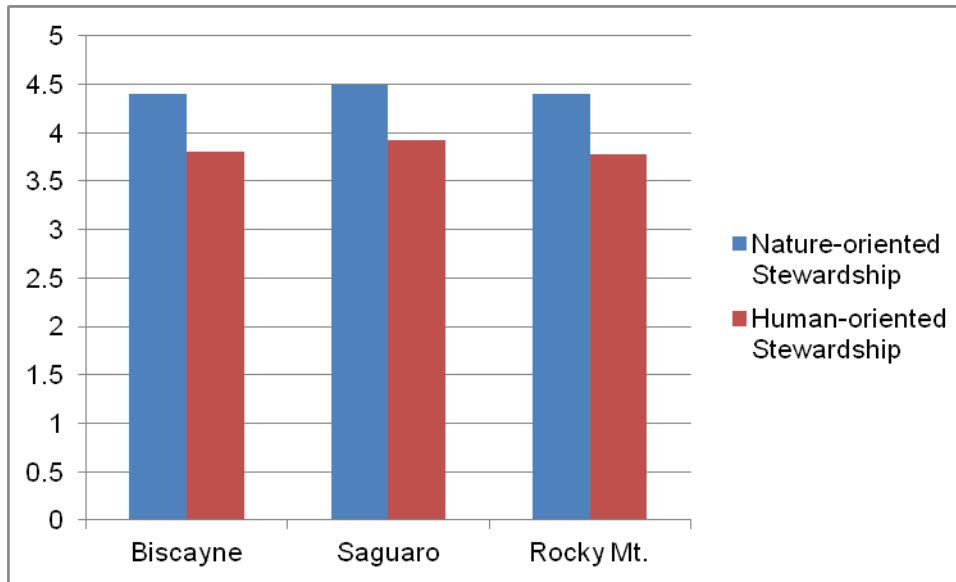


Figure 17. Comparison among mean values of park stewardship across three national parks.

Table 36. Analysis of variance test of average levels of nature-oriented stewardship across three groups of respondents.

Nature-oriented Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	.410	2	.205	.631	.533 ¹
Within Groups	119.893	369	.325	N/A	N/A
Total	120.303	371	N/A	N/A	N/A

¹No significant differences across the three sites to a statistically significant degree ($p = .533$).

Table 37. Analysis of variance test of average levels of human-oriented stewardship across three groups of respondents.

Human-oriented Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	1.508	2	.754	.993	.372 ¹
Within Groups	280.984	370	.759	N/A	N/A
Total	282.492	372	N/A	N/A	N/A

¹No significant differences across the three sites to a statistically significant degree ($p = .533$).

Table 38a. Mean values of items associated with nature-oriented stewardship.

Survey Items	Park Unit	Mean	SD
Preserving the environment in its natural state	Biscayne	4.5	0.7
	Saguaro	4.5	0.6
	Rocky Mt.	4.0	0.9
An ethical responsibility to care for the environment	Biscayne	4.4	0.7
	Saguaro	4.5	0.6
	Rocky Mt.	4.5	0.7
All animals' and plants' right to exist	Biscayne	4.3	0.8
	Saguaro	4.3	0.8
	Rocky Mt.	4.1	1.0
Protecting the environment for future generations	Biscayne	4.6	0.6
	Saguaro	3.9	1.0
	Rocky Mt.	4.5	0.6
Trying to reduce my negative impact on the environment	Biscayne	4.2	0.8
	Saguaro	4.4	0.7
	Rocky Mt.	4.4	0.7

Table 38b. Mean values of items associated with human-oriented stewardship.

Survey Items	Park Unit	Mean	SD
Managing our natural resources wisely to provide for human needs	Biscayne	3.8	1.1
	Saguaro	3.9	0.9
	Rocky Mt.	4.0	1.0
Protecting all species because we may find a use for them later (for example, curing disease)	Biscayne	3.7	1.0
	Saguaro	3.9	1.0
	Rocky Mt.	3.7	1.2

Information about Respondents

Gender

At BISC, respondents were about equal between male (54.1%) and female (45.9%). At SAGU, there were more males (68.0%) than females (32.0%), and at ROMO, there were more males (57.5%) than females (42.5%) (Table 39) (Figure 18).

Table 39. Gender of survey respondents.¹

Park Unit	Male	Female
Biscayne	54.1%	45.9%
Saguaro	68.0%	32.0%
Rocky Mt.	57.5%	42.5%

¹ Pearson $\chi^2(2)=5.121, p=.077$

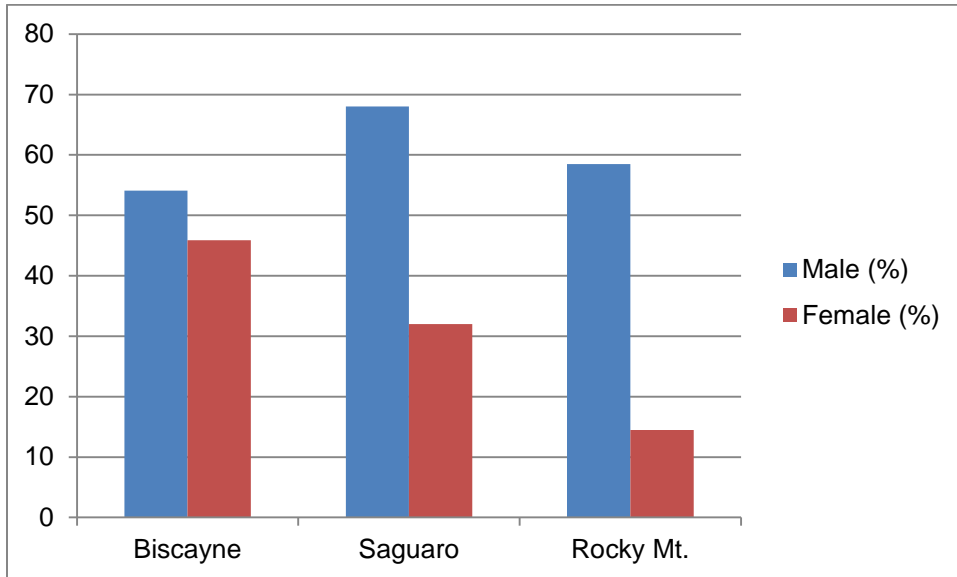


Figure 18. Gender of survey respondents across three national parks.

Average Age

Survey respondents were of a similar age, in that most were born in the early 1960s (BISC: M=1966.7; SAGU: M=1963.2; ROMO: M=1964.3) (Table 40). There were no significant differences in age when compared across the three sites (Figure 19) (Table 41).

Table 40. Average age of survey respondents.

Park Unit	Mean	SD
Biscayne	45.3	14.0
Saguaro	48.8	15.8
Rocky Mt.	47.9	15.0

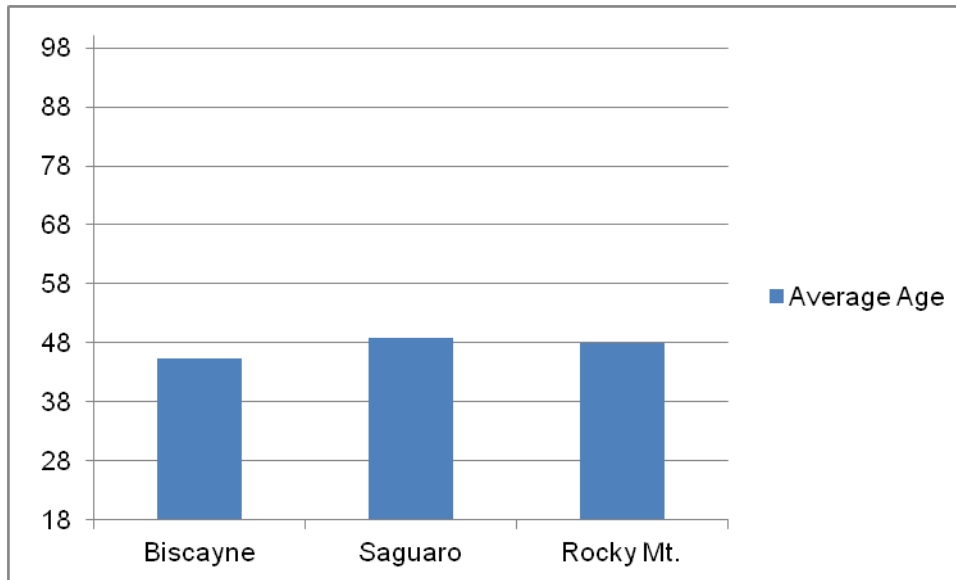


Figure 19. Average age of survey respondents across three national parks.

Table 41. Analysis of variance test of average reported age of survey respondents.

Age Groups	Sum of squares	df	Mean Square	F	Sig.
Between Groups	662.160	2	331.080	1.452	.236 ^a
Within Groups	77062.057	338	227.994	N/A	N/A
Total	77724.217	340	N/A	N/A	N/A

Education

The majority of the respondents were well-educated. Over 90% received some college or a higher level of education: BISC (95.3%), SAGU (96.8%), and ROMO (95.1%) (Table 42). Similar trends emerged when these averages were compared across the three sites (Figure 20).

Table 42. Education attained by BioBlitz participants.¹

Education	Biscayne	Saguaro	Rocky Mt.
Less than high school	1.2%	-	-
Some high school	-	0.6%	-
High school graduate	1.2%	2.6%	2.4%
Vocational/trade school certificate	2.3%	0%	2.4%
Some college	5.8%	18.2%	9.4%
Two-year college	11.6%	5.2%	7.9%

¹ Pearson $\chi^2(16)=24.523, p=.079$

Table 42 (continued). Education attained by BioBlitz participants.¹

Education	Biscayne	Saguaro	Rocky Mt.
Four-year college	27.9%	31.2%	37.8%
Master's degree	34.9%	27.3%	27.6%
Ph.D., M.D., J.D., or equivalent	15.1%	14.9%	12.6%

¹ Pearson $\chi^2(16)=24.523, p=.079$

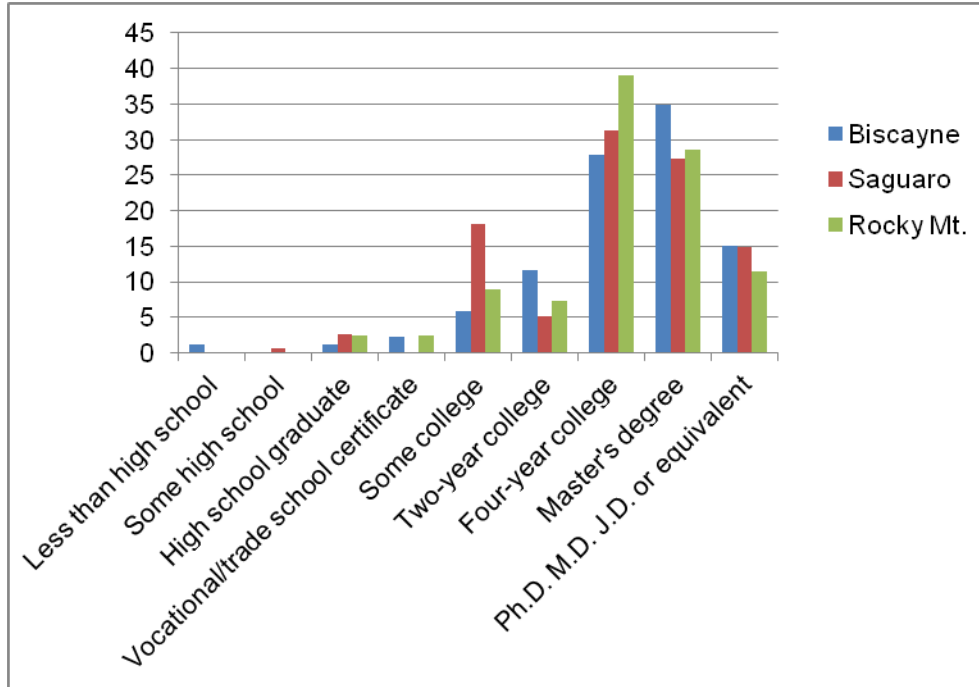


Figure 20. Comparison among respondents' average levels of education across three national parks.

Income

Over half of the respondents across the three parks earned more than \$50,000 per year. Specifically, 62.9% of BISC respondents, 56.7% of SAGU respondents, and 73.5% of ROMO respondents reported earning this annual income (Table 43) (Figure 21).

Table 43. Average income among BioBlitz participants.¹

Income	Biscayne	Saguaro	Rocky Mt.
Less than \$24,999	11.1%	12.9%	9.0%
\$25,000 to \$34,999	3.7%	9.0%	5.0%
\$35,000 to \$49,999	14.8%	10.3%	11.6%
\$50,000 to \$74,999	16.0%	18.7%	24.8%

¹ Pearson $\chi^2(14)=13.309, p=.502$

Table 43 (continued). Average income among BioBlitz participants.¹

Income	Biscayne	Saguaro	Rocky Mt.
\$75,000 to \$99,999	14.8%	14.2%	16.5%
\$100,000 to \$149,999	19.8%	14.8%	23.1%
\$150,000 to \$199,999	4.9%	4.5%	7.4%
\$200,000 or more	7.4%	4.5%	1.7%

¹ Pearson $\chi^2(14)=13.309$, $p=.502$

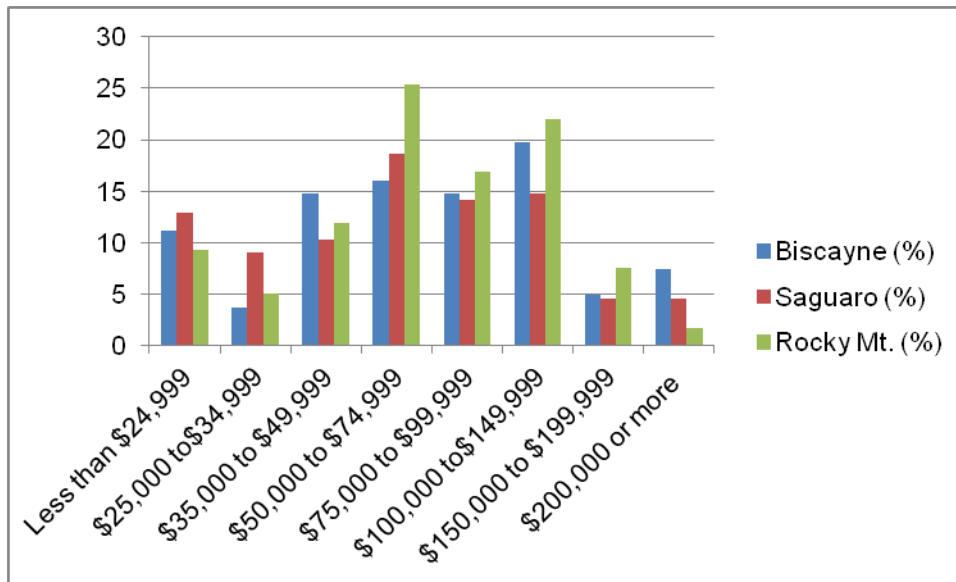


Figure 21. Comparison among respondents' average levels of income across three national parks.

Employment Status

The majority (67.4%) at BISC was employed outside the home (Table 44) (Figure 22). Among them, 85.7% were employed full-time (Table 45) (Figure 23). About half (52.3%) of the SAGU respondents were employed outside the home (81.0%, full-time) and 21.9% were retired. Among the ROMO respondents, over half (58.4%) were employed outside the home and 18.4% were retired.

Table 44. Employment status among BioBlitz participants.¹

Employment	Biscayne	Saguaro	Rocky Mt.
Employed outside the home	67.4%	52.3%	58.4%
Unemployed	8.1%	1.3%	5.6%
Retired	7.0%	21.9%	18.4%

¹ Pearson $\chi^2(8)=18.169$, $p=.020^*$

Table 44 (continued). Employment status among BioBlitz participants.¹

Employment	Biscayne	Saguaro	Rocky Mt.
Full-time homemaker	10.5%	9.7%	9.6%
Student	7.0%	12.3%	8.0%

¹ Pearson $\chi^2(8)=18.169, p=.020^*$

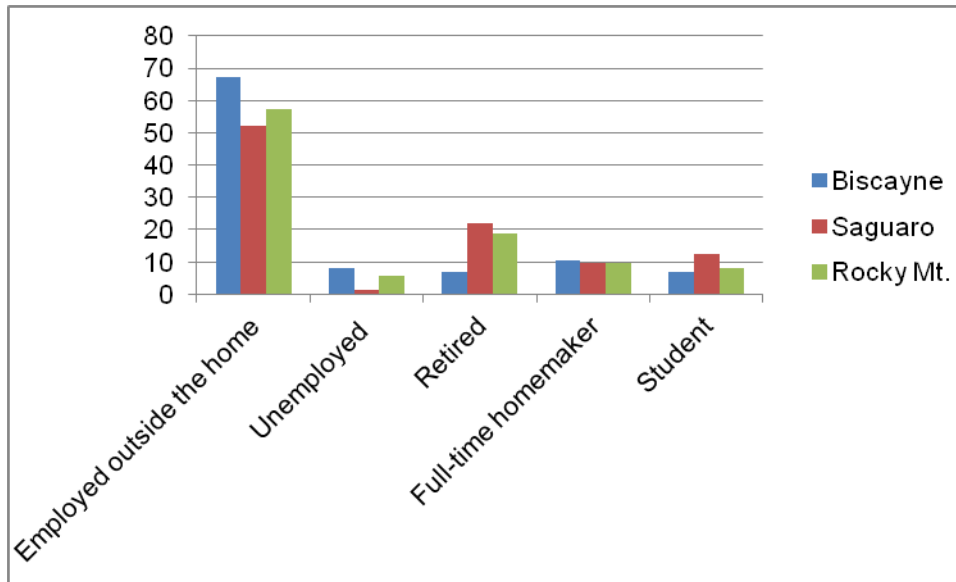


Figure 22. Comparison among respondents' forms of employment across three national parks.

Table 45. Full-time versus part-time employment among BioBlitz participants.

Park Unit	Employed full-time	Employed part-time
Biscayne	85.7%	14.3%
Saguaro	81.0%	19.0%
Rocky Mt.	91.0%	9.0%

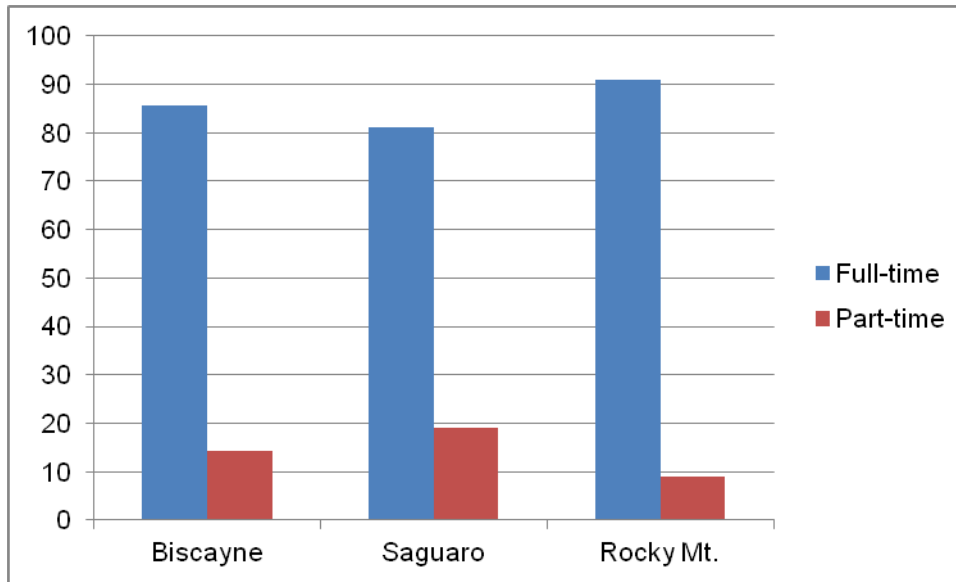


Figure 23. Full-time versus part-time employment of BioBlitz participants across three national parks.

Ethnicity and Race

Most respondents were not Hispanic or Latino: BISC (86.7%), SAGU (92.1%), and ROMO (98.3%) (Table 46) (Figure 24). The majority was White: BISC (97.5%), SAGU (94.0%), and ROMO (94.4%) (Table 46) (Figure 25).

Table 46. Reported ethnicity among BioBlitz participants. ¹

Site	Hispanic or Latino	Not Hispanic or Latino
Biscayne	13.3%	86.7%
Saguaro	7.9%	92.1%
Rocky Mt.	1.6%	98.4%

¹ Pearson $\chi^2(2)=10.251, p=.006^{**}$

Note: Respondents checked all that apply (Table 47) (Figure 25).

American Indian or Alaska Native: n/a

Asian: Pearson $\chi^2(2)=9.00, p=.003^{**}$

Black or African American: n/a

Native Hawaiian or other Pacific Islander: $\chi^2(2)=2.00, p=.157$

White: $\chi^2(2)=338.0, p=.000^{***}$

** $p<.01$, *** $p<.001$

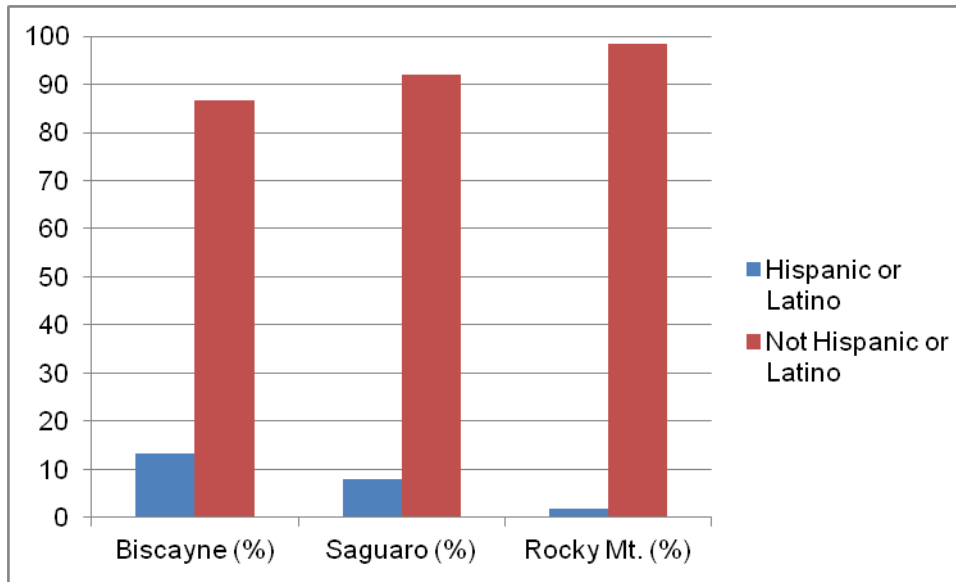


Figure 24. Reported ethnicity of BioBlitz participants across three national parks.

Table 47. Reported race among BioBlitz participants.

Park Unit	American Indian or Alaska Native	Asian	Black or African American	Native Hawaiian or other Pacific Islander	White
Biscayne	-	1.2%	-	1.2%	97.5%
Saguaro	-	5.3%	-	0.7%	94.0%
Rocky Mt.	1.6%	-	1.6%	-	94.4%

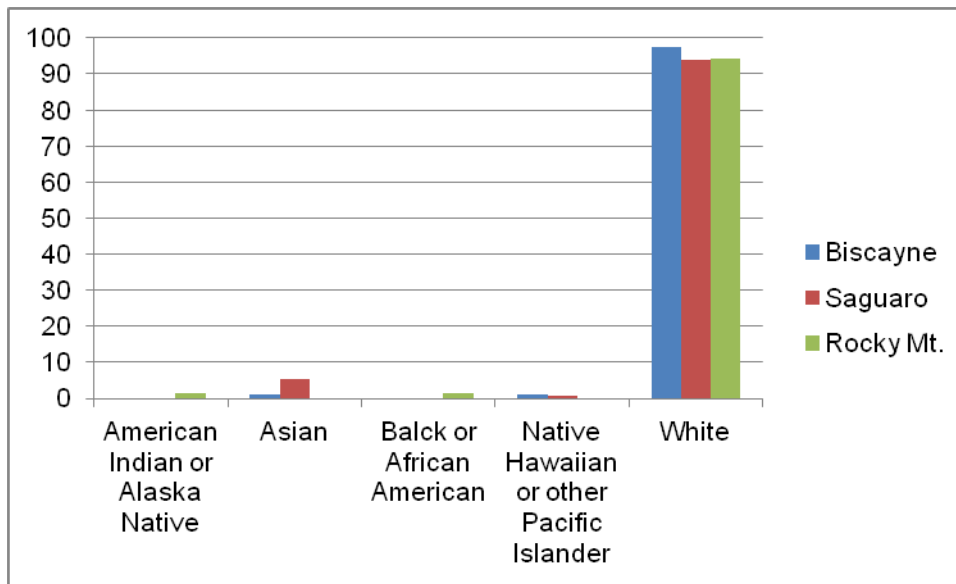


Figure 25. Reported race of BioBlitz participants across three national parks.

Discussion

The purpose of this investigation was to better understand the characteristics of visitors / participants that engaged in NPS-NGS BioBlitzes. Findings in this report compare three events held at Biscayne (BISC), Saguaro (SAGU), and Rocky Mountain (ROMO) National Parks. On-site and web-based / mailback surveys were conducted in 2010, 2011, and 2012 in association with the BISC, SAGU, and ROMO BioBlitz programs. These studies provide insight on: (a) visitor participation in BioBlitzes and NPS programs; (b) experiences with the parks (c) commitment to and involvement in the BioBlitz program; (d) motives for becoming involved with the BioBlitz program; (e) impacts from participation including understandings of science and nature, park protection behavior, and associated implications for the national park system; (f) attachment to places within the parks; (g) stewardship and attitudes toward resource protection; and (h) socio-demographics

Visitor participation in the BioBlitz programs were similar across the three parks. Respondents did not report extensive previous experience with BioBlitz activities in that most were first-time participants that had limited previous exposure to the program. The majority of ROMO participants and over half of the respondents from BISC and SAGU were affiliated with an organization. Many individuals engaged in program activities with friends, families, and colleagues and became familiar with the BioBlitz through various outlets including others' recommendations and newspapers and/or magazine articles. While visiting the respective parks, approximately one third were involved with NPS programs outside of this NPS / National Geographic Society (NGS) sponsored event.

Experiences with the parks that hosted BioBlitzes were diverse, in that ROMO participants had significantly more previous visitation than did respondents at BISC and SAGU. ROMO respondents had been visiting over a longer time period and reported a greater number of previous visits. The most popular on-site activities were going to the visitor and/or nature center, wildlife and/or birdwatching, and nature and/or landscape photography. Visitor satisfaction with activities and opportunities to learn about the parks was generally high. Informational tents and booths, scientific presentations, and arts / cultural activities were rated particularly high by survey respondents at ROMO. Other attributes of the visitor experience such as the expertise of organizers, assistance provided by staff and volunteers, and provisions for visitor safety were well-regarded. The availability of food and the electronic fieldtrip were rated relatively low.

Respondents' levels of commitment to the BioBlitz were based on a variety of factors. At ROMO, participants felt that engagement in the program was exciting and important to one's self. Across the three parks, involvement in the BioBlitz was not central to participants' lives but it was supported by the appealing and attractive nature of the program. The most important influences on involvement were promotional material from the park and/or NGS, information for planning and scheduling, and NPS / NGS sponsorship to help defray costs of participation. Required waivers (e.g., photographs, permission slips) carried relatively less weight in influencing involvement in the ROMO program. The most important motives for becoming involved in the ROMO program related to discovering nature and engaging in a meaningful activity. Across the three sites, contributing to society and opportunities to learn from others compelled participants to engage in this event. There were mixed

results regarding the solitude dimension of motivation, which were noteworthy. This element of the on-site experience was a motivating factor for participants at BISC but less important for visitors at the other two parks.

Impacts from participation in the BioBlitz program were widespread. Across the three parks, survey respondents were in agreement with statements indicating that the program provided opportunities to learn from professionals, better understand science, and experience the park in a new way. Various feelings about the natural environment were also influential. Participants reported moderate willingness to engage in park protection behavior such as volunteering time and reducing environmental impacts. However, across all three sites, responsibility was not ascribed at the individual level to conserve the park's resources and avert negative consequences from environmental impacts. At ROMO and SAGU, a series of related questions were asked about potential implications of the BioBlitz program for the national park system. On average, respondents agreed that this kind of event would help manage the park's natural resources, acquire science-based knowledge, understand biodiversity, and inform the public about park resources.

Survey respondents formed connections with places at BISC, ROMO, and SAGU. BioBlitz participants at ROMO reported the highest levels of place attachment, which likely corresponded to their relatively extensive visitation histories at the park. Over time, ROMO respondents have developed connections with places based on emotional ties (e.g., feelings of belongingness and happiness), individual identity (e.g., believing the park is part of one's self), and opportunities to socialize (e.g., spending time with family and friends). Across all three sites, affect / emotion, as well as social and individual factors underpinned human-place bonds. These dimensions of place attachment may be supported by relatively high levels of self-expression and social bonding that comprised respondents' involvement in the BioBlitz program. The least important factor that contributed to participants' reported levels of attachment was the notion that places provided unique opportunities that could not be attained elsewhere. This latter finding aligns with past research.

Reported levels of stewardship were examined across the three sites. Respondents at ROMO considered themselves to be natural resource stewards to a greater degree than respondents at the other two parks. BioBlitz participants at BISC showed the lowest levels of self-reported stewardship. Across all three sites, survey respondents thought their stewardship was more nature-based than oriented toward people. For example, respondents more strongly agreed with statements defining stewardship such as, "all animals and plants have a right to exist" compared to statements such as "managing our natural resources wisely to provide for human need." At ROMO, an analysis of survey items examining attitudes toward protection suggested it was important to reduce negative impacts on the environment and that it was up to individuals and not the government to protect the park.

Socio-demographic characteristics were consistent across ROMO, BISC and SAGU. More males than females completed the survey, most were in their mid-40s, were well-educated, and employed outside the home. Between half to three quarters of respondents at the three parks reported earning more than \$50,000 on an annual basis. The majority was white and of non-Hispanic origin.

Implications and Management Options

- Given the limited previous experiences with BioBlitz activities among visitors across the three parks, participants should be provided with sufficient background on the purpose of the program, its workings, and how to stay involved into the future. Providing sufficient information to be shared with others will be particularly important to maintain future interest in the program considering the proportion of visitors that become aware of BioBlitzes via friends/relatives/word of mouth and involved through organizational affiliations.
- Varied levels of visitation histories should be considered in the provision of information to potential stewards of the parks. At ROMO, individuals that engaged with BioBlitz programs are “regular” visitors, whereas those likely to become involved with such activities at BISC and SAGU have been visiting for shorter amounts of time and at less frequent time intervals.
- Attributes of the on-site experience that were rated highly at individual host parks (e.g., provision of information; expertise of scientists, volunteers, and staff; visitor safety) should be maintained and aspects of the on-site experience that received relatively lower satisfaction ratings (e.g., availability of food) warrant future attention.
- The most important factor underlying involvement is centered on the attractive nature of the BioBlitz, suggesting that importance and pleasure are associated with engagement and can serve as a source of satisfaction. Managers should note that the program is not central to participants’ lives.
- Motivations reported by survey respondents can be targeted by managers in different ways. The contributions to society that emerge from BioBlitz data collection and opportunities to learn from others are the most important factors that push or pull respondents into BioBlitz activities. At ROMO opportunities to discover nature and at BISC opportunities for solitude should be provided to maintain satisfactory experiences that may help ensure continued participation.
- Survey data across the three parks suggest BioBlitz participants would be willing to engage in park protection behavior and that the individual should take it on him or herself to minimize impacts. To encourage environmentally-friendly behavior, managers might consider framing interpretation / outreach messages in a way that suggests individual actions can substantially reduce environmental impacts and should be pursued despite reluctance from other people. More pronounced degrees of environmental protection will likely ensue if survey respondents take more ownership over their individual contributions to supporting the national parks, especially at ROMO given the strong environmental attitudes toward park protection reported by survey respondents.
- Levels of place attachment measured by four dimensions were most pronounced in the ROMO sample and relatively low among participants at BISC. Affective / emotional bonds were key components of the connections formed between people and places, which can be maintained through experiential opportunities. The BioBlitz program may help to foster attachment to settings given its potential to allow participants to interact with the park in new and exciting ways.

- The majority of survey respondents were not dependent on the parks that hosted BioBlitz programs for specific activities, which will require more complex approaches to satisfy visitors' needs and communicate management plans. Moving beyond activity and setting-based management will be necessary to consider the experiences, beliefs, and attitudes of survey respondents that comprise the emotional connections formed between people and settings.
- The diversity of experiences, attitudes, and behaviors reported by survey respondents at BISC, SAGU, and ROMO suggest that a “one size fits all” management approach may exclude important segments of the survey population. Research results that shed light on the varied elements that comprise visitor experiences can be used as a guide to most effectively respond to the preferences reported by BioBlitz participants.

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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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