

## **Visitor Sun Protection in the National Parks**

*A Report to the National Park Service*

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## About the research

This research study was approved by George Mason University's Institutional Review Board (#1726789) and the Office of Management and Budget (Control #1024-0224). Scientific research permits were issued by Cape Lookout National Seashore (CALO-2021-SCI-0010) and Kaloko-Honokōhau National Historical Park (KAHO-2021-SCI-0004).

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## Executive summary

To reduce sunscreen chemical pollution in aquatic ecosystems, the National Park Service (NPS) suggests that visitors apply non-nanotized mineral-based sunscreens and wear sun-protective clothing.<sup>1</sup> In summer 2021, researchers from George Mason University tested whether visitor exposure to programs promoting NPS sun protection recommendations was associated with these behaviors. A survey was fielded in July and August 2021 at two coastal parks, Cape Lookout National Seashore in North Carolina and Kaloko-Honokōhau National Historical Park in Hawaii ( $n=683$ ,  $n=613$ ). Response rates were respectively 41.0% and 76.6%. At both parks, visitor exposure to at least one of the interventions on sun protection related to higher levels of intent to practice the recommended behaviors.

Four audiences were identified at each park that correspond to different behavioral profiles: sunscreen protection tourists, multi-modal sun protection tourists, in-state frequent park visitors, and frequent beachgoers who skip sunscreen. The second-largest audience, sunscreen protection tourists, represent 28.8% of Cape Lookout visitors and 25.3% at Kaloko-Honokōhau. This group of out-of-state visitors is recommended as a top priority for future interventions because they use sunscreen, but not typically other methods such as protective clothing, and they have lower levels of issue awareness. Further, because they tend to be younger, and are not frequent beachgoers, their sun protection behaviors in these locations may be less entrenched. National media alerts will allow NPS to reach this audience in early stages of travel planning, when they are purchasing clothing and sunscreen.

### Additional primary findings:

- Of the three sunscreen chemical “Os” that have been banned in regions of the United States—octocrylene, oxybenzone, and octinoxate<sup>2,3</sup>—octocrylene was the most frequently reported as an active ingredient in both Cape Lookout and Kaloko-Honokōhau. The other three most common chemicals were avobenzone, octisalate, and homosalate. Notably, relatively low levels of oxybenzone or octinoxate, as banned in Hawaii,<sup>2</sup> were reported in sunscreen brands by visitors. Sunscreen with octocrylene has been banned in the U.S. Virgin Islands.<sup>3</sup>
- Visitors reported lower levels of the use of common mineral-based sunscreen ingredients zinc oxide and titanium dioxide than of avobenzone, octocrylene, octisalate, and homosalate. About a third of product formulations reported by visitors included *only* the minerals zinc oxide and/or titanium dioxide, including those identified as non-nano (Cape Lookout, 34.2%; Kaloko-Honokōhau, 33.8%).
- More than half of sprayed sunscreen is lost to the environment when applied.<sup>4</sup> Substantial percentages of visitors to Cape Lookout and Kaloko-Honokōhau said they used sprays (52.6%, 37.3%).

- Only 14.8% of Cape Lookout visitors said they remembered contact with NPS about sun protection and 31.6% at Kaloko-Honokōhau. Rates of specific types of intervention contact were uniformly low for both parks.
- While only 34.3% of Cape Lookout visitors and 42.1% at Kaloko-Honokōhau indicated on the first page of the paper survey that they typically use mineral-based sunscreen, by the end of the survey, the majority of respondents said they would do so when they next visit the park (57.2%, 68.0%) or during their next trip to the beach (60.0%, 69.4%). Majorities also said they would wear sun-protective clothing at the park (63.7%, 62.0%) and at other beaches (63.4%, 62.6%).
- The majority of Cape Lookout visitors were from North Carolina (59.2%). Only a quarter from Kaloko-Honokōhau were in-state (25.4%). Another 23.8% of the latter park's visitors were residents of California, the second most common state. Aside from state representation, the demographic profiles of the two park samples were highly similar.

## Background

More than a decade of ecotoxicological research suggests that sunscreen chemicals such as oxybenzone, octinoxate, and octocrylene can cause harm to corals and other aquatic species,<sup>5-9</sup> including other invertebrates,<sup>8-11</sup> fish,<sup>12-18</sup> and mammals.<sup>19</sup> As a result, state,<sup>2</sup> territory,<sup>3</sup> and local-level<sup>20</sup> governments have enacted laws restricting use of some chemicals in sunscreen formulations. Oxybenzone and octinoxate have been banned by the state of Hawaii.<sup>2</sup> A U.S. Virgin Islands ban covers the “three Os”: octocrylene, oxybenzone, and octinoxate.<sup>3</sup> And, as of Oct. 2022, Maui County will not allow the sale, distribution, or use of any non-mineral sunscreen.<sup>20</sup> With increasing national park visitation rates placing evermore pressure on public lands and waters,<sup>21</sup> the National Park Service (NPS) recommends avoiding sunscreen chemicals identified by the National Oceanic and Atmospheric Administration as potentially ecologically harmful.<sup>22</sup> Instead, the agency suggests that visitors use non-nanotized mineral-based sunscreens and wear protective hats and clothing.<sup>1</sup> The goal of these recommendations is to reduce sunscreen chemical pollution in the parks while still shielding park visitors from sun exposure.

In conjunction with this strategy, the agency has begun to develop national outreach to support parks in promoting visitor adoption of non-polluting sun protection behaviors.<sup>23</sup> NPS park managers require information to develop and implement effective communication programs to engage visitors in taking actions that protect themselves from the sun while also protecting park natural and cultural resources. With increasing preference for outdoor recreation due to the pandemic and the expectation that the pent-up demand for travel will result in high visitation to national parks, NPS has an immediate need to make decisions about visitor communication programs that alleviate the threat.

### Study rationale

In summer 2020, ideas42—a behavioral design non-profit organization—conducted a series of online workshops with NPS staff on visitor sun protection. Based on these conversations, they developed a set of “intervention” recommendations that parks can employ to encourage visitors to wear sun protective clothing and choose environmentally friendly sunscreen. In summer 2021, researchers from George Mason University sought to test the interventions to see if they are associated with recommended visitor sun protection behaviors. Data collection was conducted in July and August 2021 at two coastal parks, Cape Lookout National Seashore in North Carolina (Figures 1-3) and Kaloko-Honokōhau National Historical Park in Hawaii (Figures 4-5). The goal of the research was to inform the design and implementation of NPS programs nationally and contribute to the agency’s ability to protect resources before they are damaged in a way that will require decades for recovery. Further, these types of behavioral research can ensure that limited park visitor engagement resources are being used effectively and efficiently.

## Study sites

The two study locations—Cape Lookout National Seashore and Kaloko-Honokōhau National Historical Park—were designated as parks respectively in 1966 and 1978.<sup>24</sup> They differ in geomorphology, ecology, and cultural history. Kaloko-Honokōhau National Historical Park lies in Hawaii, a state known for its coral reefs that has banned sunscreen containing oxybenzone and octinoxate.<sup>2</sup> Corals can be found offshore of North Carolina in the region surrounding Cape Lookout National Seashore,<sup>25,26</sup> but there are no reefs in the park and the state has not enacted legislation on sunscreen chemical formulations.

### *Cape Lookout National Seashore*

The park's barrier islands feature long sandy beaches and low-lying inland vegetation.<sup>27</sup> For centuries, Native Americans and early European settlers frequented the barrier islands of North Carolina, known for rich fisheries. These days, visitors to the islands will find the historical Cape Lookout Lighthouse, wild horses, nesting sea turtles, and opportunities for shelling, fishing, and camping. On the sound side of the islands, boaters often drop anchor just offshore to spend a day in the water and on the sand. Visitors typically access the three park areas—North Core Banks, South Core Banks and Shackleford Banks—by either ferry or personal watercraft. In order to reach both types of visitors, we surveyed people before they embarked on ferries to Shackleford Banks (Figures 2a-d) and South Core Banks (Figures 3a-c), and on the islands themselves.



**Figure 1.** The seashore extends along the southern reaches of the Outer Banks. Study sites: 1) Shackleford Banks; 2) Cape Lookout Lighthouse. (Image courtesy of National Park Service)





**Figures 2a, 2b, 2c, 2d.** [Study Site 1] Shackleford Banks, a barrier island within Cape Lookout National Seashore, can be reached by ferry or personal watercraft. (*Photo credits: Author*)



**Figures 3a, 3b, 3c. [Study Site 2]** Cape Lookout lighthouse is located on the South Core Banks of Cape Lookout National Seashore. It is accessible by ferry and personal watercraft. Families set up camp on the beach. The park also allows campers to live on the barrier island for limited durations. Sea turtles nest on the ocean side of the barrier island. *(Photo credits: Author)*



### *Kaloko-Honokōhau National Historical Park*

The park lies on the western coast of the “big” island of Hawaii, which is ringed by a marine coral reef ecosystem. However, the park is perhaps best known for its archeology. In 1974, the Honokōhau Study Advisory Commission, composed of native Hawaiian elders, recommended the designation of the park to protect the site of an ancient settlement, including fish ponds, a fishtrap, house platforms, petroglyphs, and temples.<sup>28</sup> Aiopio Fishtrap, at the southern end of the park, served as our second location and third survey research site (Figure 4). It is well-known locally as a good site to see “honu,” or green sea turtles, who come up on the shore to bask (Figures 5a-c). The small sheltered cove also features an array of archeological remains, including low walls built along the shore to capture fish during low tide. Reaching the beach was a short walk from parking lots, accessed alternately by trail from the park visitor center or from a nearby marina.



**Figure 4.** The third study site was at Aiopio Fishtrap on the southernmost end of Kaloko-Honokōhau National Historical Park. (Image courtesy of National Park Service)



**Figures 5a, 5b, 5c. [Study Site 3] Aiopio Fishtrap in Kaloko-Honokōhau National Historical Park. (Photo credits: Author)**

## Study methodology

We recruited visitors 18 years and older to participate in the summer 2021 study. Data collection began July 23<sup>rd</sup> at Cape Lookout National Seashore (CALO) and August 13<sup>th</sup> at Kaloko-Honokōhau National Historical Park (KAHO) (Tables 1a-c). The survey was fielded at each park location for a period of approximately a week and garnered almost 1,300 total respondents between both sites (CALO, 6 days,  $n=683$ ; KAHO, 10 days,  $n=613$ ). The fielding dates were selected because they were anticipated to be periods of high visitation for both parks. Response rates were respectively 41.0% and 76.6% for each park (Table 2). At Cape Lookout, the time available to visitors to participate in the study was more circumscribed due to ferry schedules.

### Protocol and non-response bias

At Cape Lookout National Seashore, respondents were recruited as they boarded the ferry to the park and on the sound-side beaches of Shackleford Banks and South Core Banks where the ferries disembarked. Recruitment of respondents on the barrier islands focused on visitors traveling by personal watercraft. At Kaloko-Honokōhau National Historical Park, all visitor intercepts were conducted at Aiopio Fishtrap. The research team began recruitment each day

**Tables 1a, 1b, 1c.** Sample distribution by location and survey fielding dates.

(a) Cape Lookout dates	<i>n</i>	%	(c) Kaloko-Honokōhau dates	<i>n</i>	%
7/23/2021	46	6.7	8/13/2021	56	9.1
7/24/2021	175	25.6	8/14/2021	56	9.1
7/25/2021	144	21.1	8/15/2021	77	12.6
7/29/2021	135	19.8	8/16/2021	71	11.6
7/30/2021	122	17.9	8/17/2021	65	10.6
7/31/2021	61	8.9	8/18/2021	58	9.5
<i>Total</i>	683		8/19/2021	56	9.1
			8/20/2021	61	10.0
(b) Cape Lookout sites	<i>n</i>	%	8/21/2021	64	10.4
Shackleford Banks-Ferry	271	39.7	8/22/2021	49	8.0
Shackleford Banks-Beach	94	13.8	<i>Total</i>	613	
South Core Banks-Ferry	284	41.6			
South Core Banks-Beach	34	5.0			
<i>Total</i>	683				

**Table 2.** Response totals for both parks.

	Cape Lookout	Kaloko-Honokōhau
Respondents, <i>n</i>	683	613
Hard refusals, <i>n</i>	717	74
Soft refusals, <i>n</i>	266	113
Non-response total, <i>n</i>	983	187
Soft refusals, %	27.1%	60.4%
Response rate, %	41.0%	76.6%





**Figures 6a, 6b, 6c.** The parks posted images of the research team on Facebook to alert visitors to the research project and encourage them to participate.

when the park opened and concluded in the afternoon as either visitor numbers declined or weather conditions became unfavorable (high winds, etc.).

At least two members of the research team staffed a table at each site location. When at all possible, the table was sited in an area where visitors pass in order to reach the beach, allowing the team to approach respondents at the start of their park visit. Signs in front of the tables read: “Ask us how you can help the National Park Service!” (Figures 6a-c) Researchers approaching visitors wore a name tag with their university affiliation. They approached guests and requested their participation in the survey with the following introduction: “Hi! We’re part of a research

team from George Mason University. We have been working with the National Park Service to learn about how park visitors protect themselves from the sun. Do you have a few minutes to answer some questions?”

If visitors agreed to participate in the study they were handed a clipboard and pen with the survey and consent information. Researchers provided the following information to respondents: “This first page provides information about the study. The second section has a short number of questions about sun protection. Do you have any questions about the study that we can answer for you now? Feel free to take this with you to fill it out, and we’ll come to you and collect them when you’re done, or you can drop them back off in the box here. If you have any questions as you are reading the material, please let us know.”

To assess non-response bias, if visitors declined to participate in the study, they were asked how they planned to protect themselves from the sun at the park (Table 3). At Cape Lookout National Seashore, reported sun protection behaviors between soft refusals and respondents were within 5 percentage points with the exception of cap and wide-brimmed hat use, which was reported more frequently by respondents than soft refusals by a difference of 21-22 percentage points. As a result, there may be a bias in respondent data toward higher rates of hat use. At Kaloko-Honokōhau National Historical Park, respondents were more likely to cite use of all types of sun protection than soft refusals, but especially sunscreen, shade, caps, hats, and pants. This bias may reflect differences in the length of park visits, which correlate with ease of survey recruitment. The research team was more likely to successfully engage visitors who intended to spend time on the beach at Aiopio Fishtrap, and less likely to recruit people who were passing through quickly.

**Table 3.** Comparisons between soft refusals and respondents on sun protection use at each park.

	<b>Cape Lookout</b>			<b>Kaloko-Honokōhau</b>		
	%, soft refusals (n=266)	%, respondents (n=683)	Δ	%, soft refusals (n=113)	%, respondents (n=613)	Δ
Sunscreen	83.5	88.0	<b>4.5</b>	50.4	78.6	<b>28.2</b>
Shade	50.0	52.3	<b>2.3</b>	50.4	76.3	<b>25.9</b>
Cap	42.5	63.0	<b>20.5</b>	31.0	49.4	<b>18.4</b>
Hat	21.4	43.2	<b>21.8</b>	23.0	33.3	<b>10.3</b>
Shirt	18.4	19.8	<b>1.4</b>	17.7	16.0	<b>1.7</b>
Pants	6.0	2.5	<b>3.5</b>	14.2	5.9	<b>8.3</b>
Other	2.6	4.7	<b>2.1</b>	1.8	4.4	<b>2.6</b>
None	1.1	3.4	<b>2.3</b>	7.0	6.5	<b>0.5</b>

### Sample demographics

The survey respondents at Cape Lookout National Seashore and Kaloko-Honokōhau National Historical Park demonstrated similar demographic characteristics (Table 4, Appendix A). The majority identified as female (62.1%; 61.5%) and as white (94.6%; 70.0%). More than half were under the age of 45 (57.1%; 51.4%). Most had at least a bachelor’s degree, if not also an advanced degree (59.2%; 60.9%). The greatest difference was in state residence. Most of the Cape Lookout visitors were from North Carolina (59.2%), but only a quarter from Kaloko-Honokōhau were in-state (25.4%). Another 23.8% of the Kaloko-Honokōhau’s visitors were residents of California, the second most common state. Notably, few visitors to either park were from countries other than the United States, likely due to pandemic-related travel restrictions.

**Table 4.** Respondent demographics

		CALO %	KAHO %
Gender	Female	62.1	61.5
Race	White	94.6	70.0
	Black or African American	1.8	0.9
	Asian	1.0	15.5
	Native Hawaiian/Pacific Islander	0.3	4.3
	American Indian or Alaska Native	0.2	1.6
	Multi-race	2.0	7.6
Ethnicity	Hispanic	4.7	11.9
Age	18-34	37.4	33.3
	35-44	19.7	18.1
	45-54	16.8	20.6
	55-64	16.6	13.5
	65+	9.5	14.5
Education	Less than high school	0.0	0.2
	High school or GED	10.5	9.6
	Some college, no degree	17.6	19.3
	Associate degree	12.7	10.1
	Bachelor’s degree	34.5	29.4
	Advanced degree beyond a bachelor’s degree	24.7	31.5
In-state	N. Carolina/Hawaii	59.2	25.4



## Descriptive survey findings

Cape Lookout National Seashore and Kaloko-Honokōhau National Historical Park offer unique cultural and recreational experiences, attract visitors from different places within the United States, and are located within states that have placed varying levels of policy prioritization on mitigating sunscreen chemical pollution within aquatic environments. As a result, one might expect that visitors to these two parks would have different attitudes toward sunscreen and corresponding sun protection behaviors. Instead, as the following sections illustrate, while there are indeed some differences between visitors of the two parks, primarily in issue awareness, we found that risk perceptions toward sunscreen chemicals and reported sun protection behaviors and behavioral intent were remarkably similar.

### Motivation

The first question on the survey was open-ended. Visitors were asked “why did you visit this national park today?” We coded the responses based on the most frequent terms that appeared in the responses (Table 5, Appendix B). Engaging in a “beach day” was a common motivation for visits to both Cape Lookout National Seashore (13.7%) and Kaloko-Honokōhau National Historical Park (22.8%). Most respondents took the survey in groups (83.7%; 79.0%), and described the other people with them that day as a spouse or partner (43.6%; 50.9%), other family members, including children (52.9%; 47.5%), and friends (30.2%; 27.6%). The most frequent ages of children included those who were elementary school-age (24.3%; 19.4%) and adolescents (16.4%; 13.9%). Visitors to the parks were also motivated by local wildlife. At Cape Lookout, 9.9% of visitors cited the wild horses as the reason for their visit and 9.7% said they had come to the park to go shelling. In Kaloko-Honokōhau, 29.5% said they were drawn by the sea turtles. Motivation may be important in understanding the characteristics of the park that visitors see as iconic and most important to conserve.

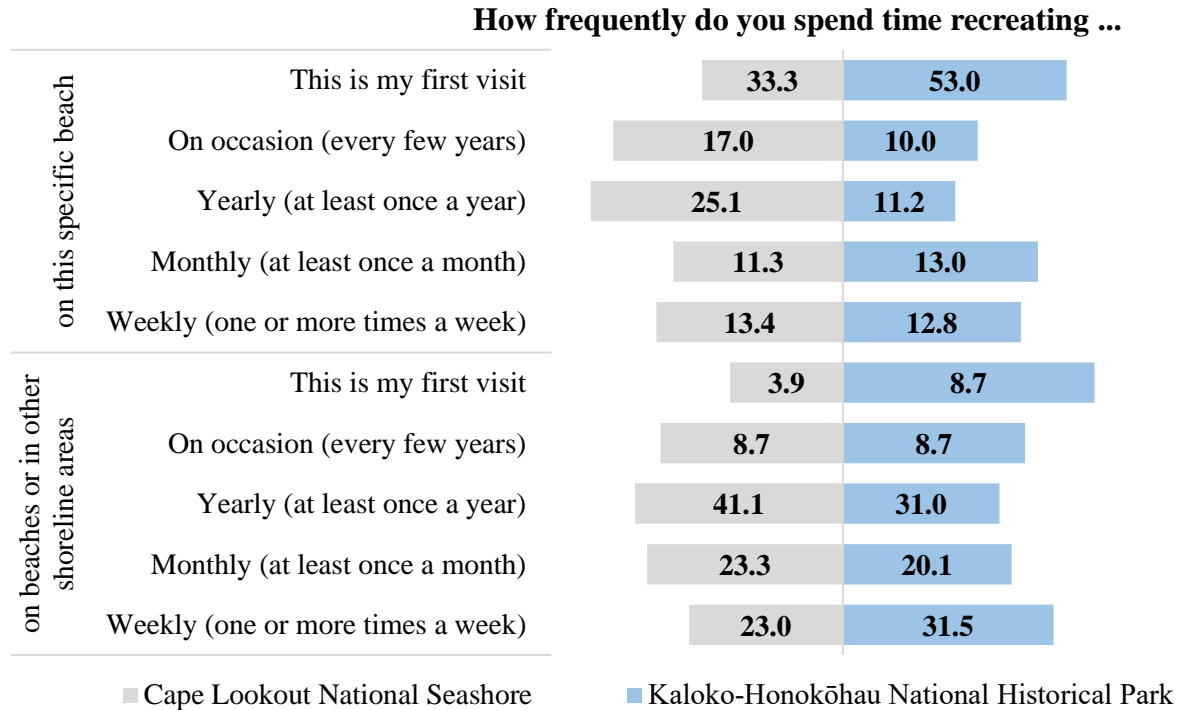
### Frequency of park and beach visitation

Many of those surveyed at Cape Lookout and Kaloko-Honokōhau said they are frequent beachgoers and park visitors, which implies they likely have established regular sun protection habits. Strikingly, about half of visitors said they visit a beach at least once a month (46.3%;

**Table 5.** Why did you visit this national park today?

	Cape Lookout %		Kaloko-Honokōhau %
Beach day	13.7%	Turtles	29.5%
Vacation	10.5%	Beach day	22.8%
Horses	9.9%	Swimming/calm water	9.5%
Shelling	9.7%	Convenient	8.2%
Lighthouse	9.5%	Snorkel	7.5%
Family	9.5%		
<i>n</i> = 504		<i>n</i> = 549	

**Figure 7.** For about half of Kaloko-Honokōhau National Historical Park visitors, the trip was their first time to the park.



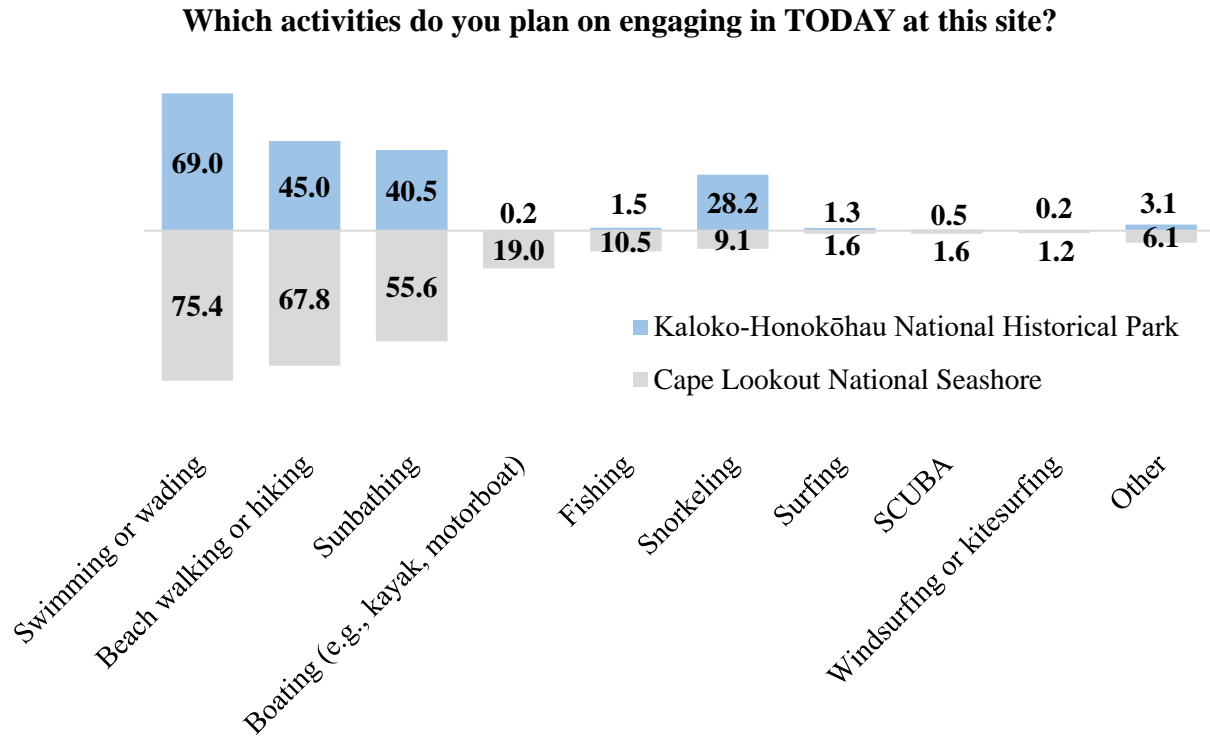
51.6%) (Figure 7). About a quarter visit these specific parks at least once a month (24.7%; 25.8%). For two thirds of Cape Lookout visitors, this trip to the park was not their first (66.7%), but more than half of the Kaloko-Honokōhau visitors were new to the site (53.0%).

### Recreation in the parks

Previous studies have found that audiences differ based on their coastal recreational preferences.<sup>29</sup> Visitors’ sun protection may also depend on the activities they choose to pursue at the beach. For example, hikers may find it more convenient to wear long pants and a shirt to defend against the sun than sun-bathers for whom the goal of the activity is to get a tan. Both Cape Lookout and Kaloko-Honokōhau visitors were most likely to say that they wanted to swim or wade (75.4%; 69.0%), beach walk (67.8%; 45.0%), and sunbathe (55.6%; 40.5%) (Figure 8).

Recreational opportunities varied at the two locations. The barrier islands of Cape Lookout National Seashore are easily accessible by private boat. Boating (40.4%) and fishing (29.6%) were cited as typical beach recreational activities for park visitors; 19.0% said they planned on boating at the park that day. Other activities that Cape Lookout visitors said they would engage in that day included fishing (10.5%) and snorkeling (9.1%). Snorkeling was a more popular activity for Kaloko-Honokōhau visitors. More than half said they typically snorkel when they go to the beach (51.7%). Fish and other aquatic life can be found among the partially submerged walls of the fishtrap; 28.2% said they planned to snorkel there that day.

**Figure 8.** Swimming, beach walking, and sunbathing were the most frequently cited recreational activities.



### Sun protection choices

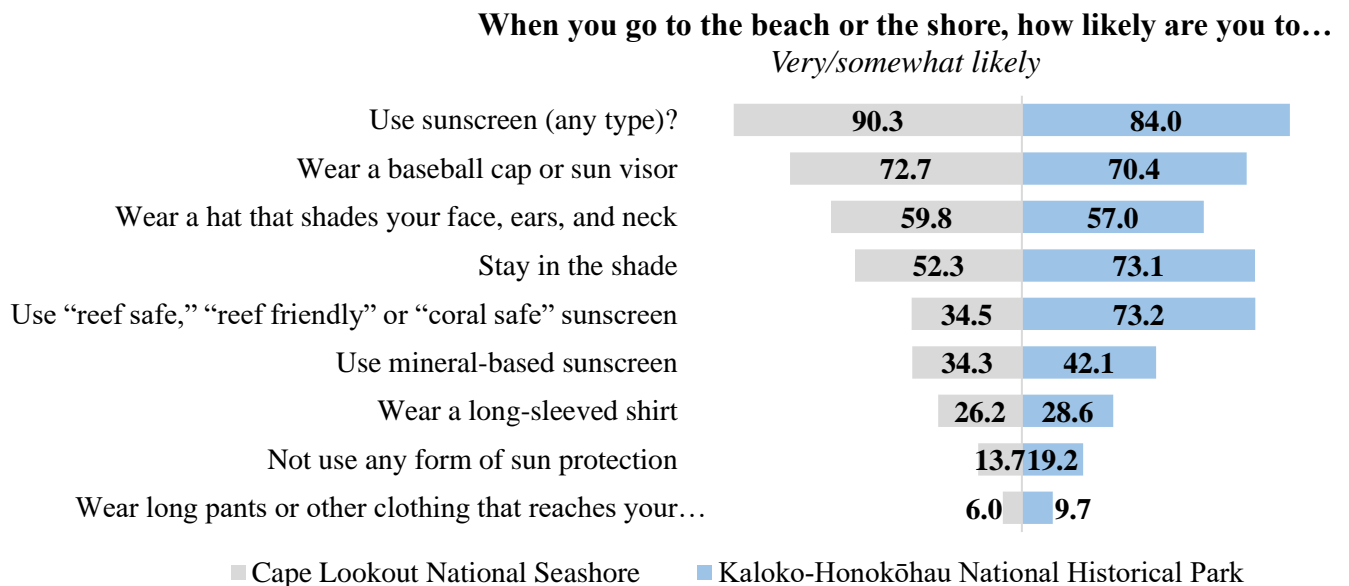
The typical sun protection behaviors reported by Cape Lookout and Kaloko-Honokōhau visitors were highly similar, aside from differences in the type of sunscreen they said they typically use (Figure 9). While only about a third of Cape Lookout visitors said they typically use “reef friendly,” “reef safe,” or “coral safe” sunscreen (34.5%), almost three-quarters at Kaloko-Honokōhau claimed to do so (73.2%). Yet, even in Hawaii, less than half of visitors to Kaloko-Honokōhau said they typically use mineral sunscreen (42.1%)—the type recommended by the National Park Service as least ecologically harmful—a difference of less than 10 percentage points from those in Cape Lookout who said the same (34.3%).

Visitors of both Cape Lookout and Kaloko-Honokōhau said they typically wear sunscreen (90.3%, 84.0%), a cap or wide-brimmed hat (cap, 72.7%, 70.4%; hat, 59.8%, 57.0%), and stay in the shade (52.3%, 73.1%). Other than hats, visitors were unlikely to wear protective clothing. Less than a third said they typically wear a long-sleeved shirt on the beach (26.2%, 28.6%), and even fewer said they wear long pants (6.0%, 9.7%).

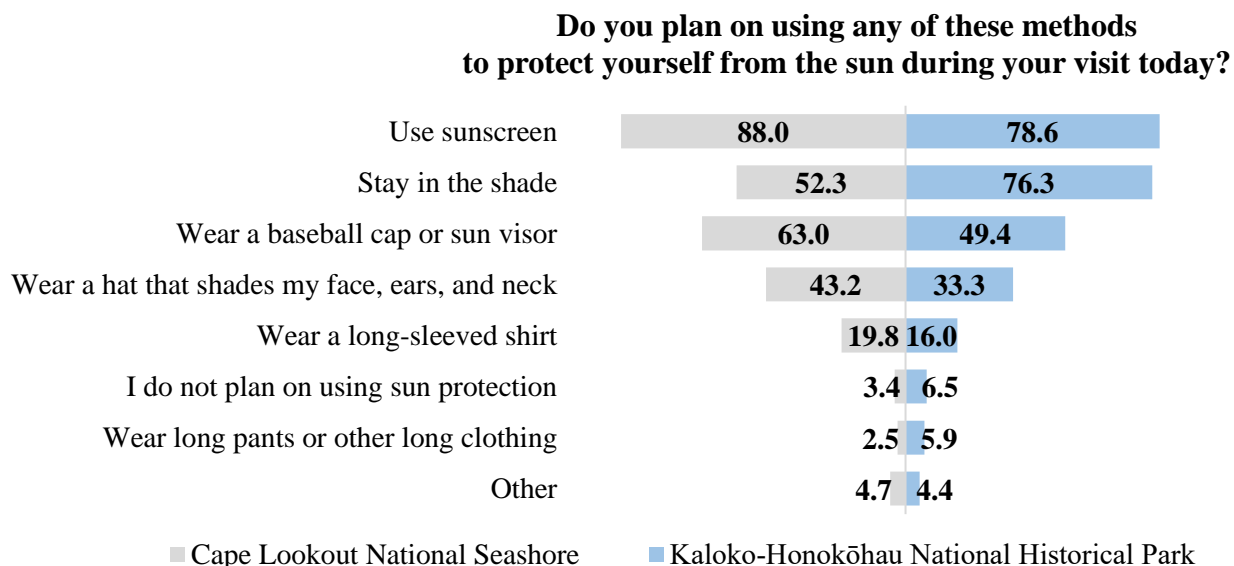
When we asked visitors what they planned on using for sun protection at the park that day, most said that they would use sunscreen (88.0%, 78.6%) (Figure 10). The largest difference was in those relying on shade to reduce their exposure to the sun. While more than three-quarters of

Kaloko-Honokōhau visitors (76.3%) said they would find a shady location, only half of those surveyed in Cape Lookout said the same (52.3%). The two parks offer different opportunities for shade. At Cape Lookout, the low trees and other vegetation extend across the inland portion of the barrier islands, and thus do not provide much protection from the sun along the shoreline. Instead, park visitors bring their own shade: beach tents and “Shibumi Shades.” At Kaloko-Honokōhau, trees and other dense foliage overhang the beach and a traditional Hawaiian structure can be used as refuge from the sun. Beach tents with stakes are not permitted due to the archeological resources within the park.

**Figure 9.** Kaloko-Honokōhau visitors were more likely to say that they use reef safe sunscreen.



**Figure 10.** Visitors of both parks planned to use sunscreen, stay in the shade, and/or wear a cap.



**Sunscreen brands and SPF**

For visitors who said they were wearing sunscreen that day at the park, we asked them to identify the brand, SPF, and active ingredients. The top brands were largely similar at both parks: Coppertone, Banana Boat, Neutrogena, Hawaiian Tropic, and Sun Bum (Table 6). Visitors identified up to three different brands, often differentiating between face and body applications. Most of the Cape Lookout and Kaloko-Honokōhau brands reported by visitors were SPF 50 (49.0%, 56.1%) or SPF 30 (both, 25.2%). As of 2021, a proposed order from the U.S. Food & Drug Administration would set the maximum labeled SPF value as SPF 60+.<sup>30</sup>

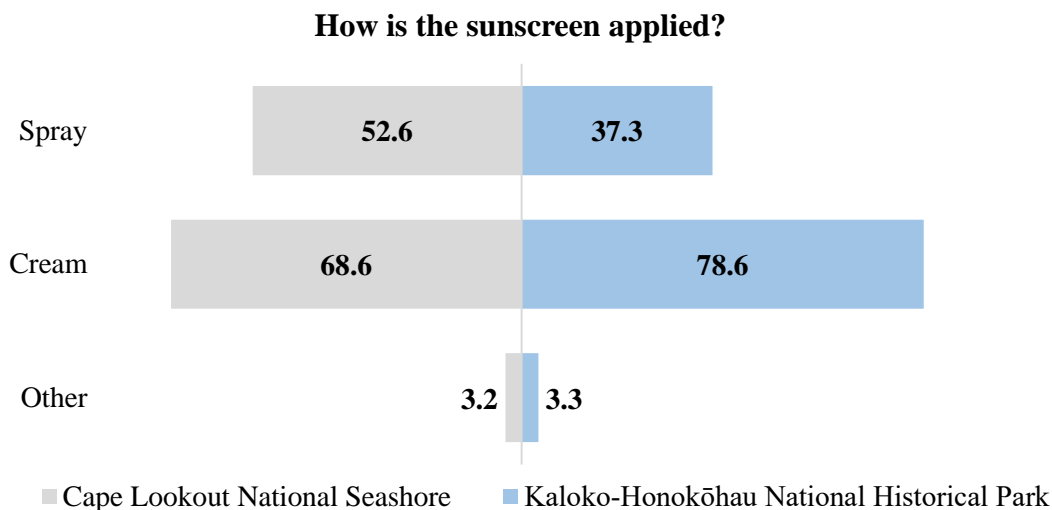
**Table 6.** [Top 10 brands of sunscreen] If you are—or will be—using sunscreen at this site today ... What is the brand and SPF number?

Cape Lookout %		Kaloko-Honokōhau %		
1	Coppertone	22.4	Banana Boat	16.9
2	Banana Boat	15.4	Neutrogena	13.2
3	Neutrogena	15.8	Hawaiian Tropic	11.2
4	Sun Bum	10.5	Coppertone	8.8
5	Equate	6.6	Sun Bum	8.1
6	Hawaiian Tropic	5.1	Alba Botanica	5.9
7	Blue Lizard	2.4	Up & Up (Target)	5.7
8	Up & Up (Target)	2.4	Ocean Potion	2.2
9	CeraVe	2.1	All Good	1.8
10	EltaMD	1.7	CVS Health	1.5
<i>n</i> =532 labels		<i>n</i> =455 labels		

**Purchase and application**

Most respondents at Cape Lookout and Kaloko-Honokōhau said that they purchased the sunscreen that they were using (62.1%, 54.6%). But about one in five said it was bought by a spouse or partner (20.9%, 18.8%), followed by parents (5.4%, 4.1%), or a friend (3.8%, 7.0%). While choices regarding sunscreen active ingredients can impact the aquatic life, so too can the method of sunscreen application. One study characterized 57% of sprayed sunscreen as lost to the environment at the time it is applied.<sup>4</sup> While the majority of park visitors said that they used creams (68.6%, 78.6%), substantial percentages said they used sprays as well (52.6%, 37.3%) (Figure 11). Sunscreen application thus may represent another opportunity to influence visitor choice and sun protection behavior in ways that reduce sunscreen chemical pollution.

**Figure 11.** While most use sunscreen in a cream formulation, substantial percentages use sprays.



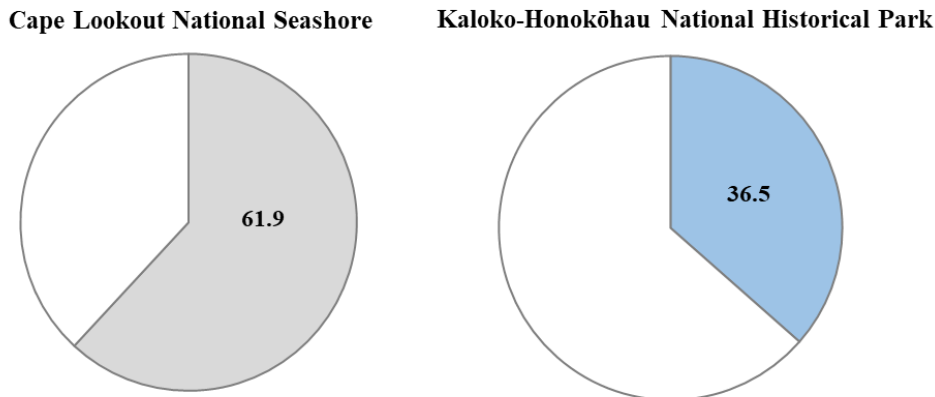
### Chemical formulations

In designing the survey, we assumed that most people would have their sunscreen bottles with them and could easily look up the active ingredients on the label. However, we found that large percentages of visitors were not able to look up, and did not know, the chemicals described on their sunscreen product label. More than half (61.9%) of visitors to Cape Lookout could not name the active ingredients and 36.5% in Kaloko-Honokōhau (Figures 12a-b). Many more could name the brand and SPF, however. We looked up the active ingredients for sunscreen brand/SPF using a U.S. National Library of Medicine online database—DailyMed<sup>31</sup>—in which manufacturers report labeling for prescription and nonprescription drugs. Most sunscreen products for each park were located within the database (94.0%, 92.7%) (Appendix C). Environmental Working Group’s sunscreen database<sup>32</sup> and Google search were used to locate the remaining entries. Multiple products often appeared under the respondent-provided brand and SPF. Active ingredients for the top five products listed as a match in the database were recorded. Frequency of active ingredients is provided for those brands in which the chemical occurred in more than half of the products identified within the database as a potential match.

Higher rates of avobenzone, octocrylene, octisalate, and homosalate were observed in database records for brands provided by Cape Lookout visitors than were cited by respondents in the survey (Table 7), but all four remained the most frequent sunscreen chemicals regardless of the data source. Database information about the brands and SPF relatively closely matched respondent-provided chemical information for Kaloko-Honokōhau (Table 8). “Hawaii compliant” listed sunscreen brands contain different formulations than sold elsewhere (personal communication, Craig Downs, PhD, Haereticus Environmental Laboratory). In alignment with the survey findings, a common “Hawaii compliant” brand sold at grocery stores also listed avobenzone, octocrylene, and homosalate as the primary active ingredients.

Of the three sunscreen chemical “Os” that have been banned in regions of the U.S.—octocrylene, oxybenzone, and octinoxate—octocrylene, banned in the U.S. Virgin Islands,<sup>3</sup> was the most frequently reported as an active ingredient in both Cape Lookout and Kaloko-Honokōhau (Tables 7-8). The other three most common chemicals were avobenzone, octisalate, and homosalate. Notably, relatively low levels of the chemicals oxybenzone or octinoxate that have been banned in Hawaii were reported in sunscreen brands by visitors, which appears to by-and-large correspond to database information from the manufacturers. The Consumer Healthcare Products Association claimed in 2019 that the chemicals oxybenzone and octinoxate were in a majority of sunscreen products.<sup>33</sup> The relatively low rates of banned chemicals suggests that companies may have changed their formulations. Thus, the somewhat higher levels of oxybenzone in the database information than reported by visitors may be an indication of a lag between online manufacturer reporting and changes in brand formulations.

About a third of product formulations reported by visitors included *only* the minerals zinc oxide and/or titanium dioxide, including those identified as non-nano (Cape Lookout, 34.2%; Kaloko-Honokōhau, 33.8%). Just over a third of products at both parks contained zinc oxide according to visitors (Cape Lookout, 38.3%; Kaloko-Honokōhau, 34.8%) (Tables 7-8). Fewer products contained titanium dioxide (Cape Lookout, 14.0%; Kaloko-Honokōhau, 9.8%). Database information suggests these numbers may even be somewhat high. Visitors reported less than 5% of products as non-nano (zinc oxide, 2.3%, 4.6%; titanium dioxide, 2.3%, 3.3%).



**Figures 12a, 12b.** Many people could not name the active ingredients in their sunscreen (%).

**Table 7.** [Cape Lookout] The three sunscreen chemical “Os” that have been banned in regions of the U.S. are octocrylene, oxybenzone, and octinoxate. Octocrylene was frequently reported as an active ingredient in Cape Lookout visitor sunscreen products.

	<b>Respondents who provided brand &amp; chemical information</b>		<b>Respondents who provided brand information only</b>
	%, respondent info (n=222)	%, database sourced (n=210)	%, database sourced (n=289)
Avobenzone	52.3	77.9	65.2
<b>Octocrylene</b>	<b>50.0</b>	<b>77.5</b>	<b>66.2</b>
Octisalate	48.6	68.2	59.0
Homosalate	47.3	72.0	61.0
Zinc oxide	38.3	14.2	25.2
Titanium dioxide	14.0	3.1	12.9
<b>Oxybenzone</b>	<b>9.5</b>	<b>22.8</b>	<b>13.8</b>
<b>Octinoxate</b>	<b>4.5</b>	<b>4.8</b>	<b>5.7</b>
Other	4.1	1.0	1.4
Non-nano titanium dioxide	2.3	0.0	0.0
Non-nano zinc oxide	2.3	0.0	0.0

**Table 8.** [Kaloko-Honokōhau] Octocrylene was also frequently reported as an active ingredient among Kaloko-Honokōhau visitor sunscreen products.

	<b>Respondents who provided brand &amp; chemical information</b>		<b>Respondents who provided brand information only</b>
	%, respondent info (n=305)	%, database sourced (n=278)	%, database sourced (n=154)
Avobenzone	57.7	61.2	68.8
<b>Octocrylene</b>	<b>56.1</b>	<b>63.3</b>	<b>71.4</b>
Homosalate	51.8	53.6	66.2
Octisalate	48.2	51.8	61.7
Zinc oxide	34.8	28.1	14.3
Titanium dioxide	9.8	10.1	3.9
Other	7.5	3.2	3.2
<b>Oxybenzone</b>	<b>7.5</b>	<b>13.7</b>	<b>5.2</b>
Non-nano zinc oxide	4.6	1.8	0.6
<b>Octinoxate</b>	<b>3.9</b>	<b>1.4</b>	<b>3.9</b>
Non-nano titanium dioxide	3.3	0.0	0.0



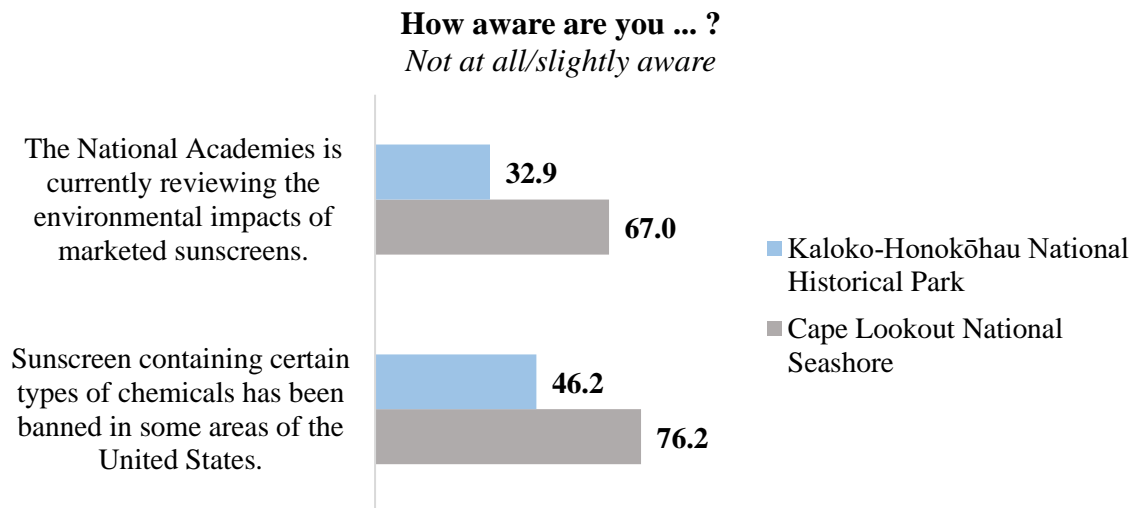
### Issue awareness

As of December 2021, an ad hoc committee of the National Academies of Sciences, Engineering, and Medicine was considering the implications of sunscreen chemicals on aquatic organisms and human health.<sup>34</sup> The committee was tasked with preparation of a consensus report by the U.S. Environmental Protection Agency. However—as mentioned—state,<sup>2</sup> territory,<sup>3</sup> and local-level<sup>20</sup> governments have already enacted laws on sunscreen chemical formulations. In Hawaii, a state-wide ban on the chemicals oxybenzone and octinoxate in sunscreen formulations was in effect at the time of the survey fielding.<sup>2</sup>

We asked park visitors whether they were aware of bans in some areas of the United States and potential concerns about sunscreen environmental impacts (Figure 13). The majority of Cape Lookout visitors were not aware of the bans (61.2%), or only slightly aware (15.0%). While visitors to Kaloko-Honokōhau were more likely to be aware of the bans, close to half were not well-informed; 28.1% were not at all aware and another 18.1% just slightly aware of these types of bans, such as the state of Hawaii’s.

Respondents were slightly more likely to say they were aware of environmental concerns about sunscreen. Just under half of Cape Lookout visitors (46.3%) said they were not at all aware of potential harms and another 20.7% said they were slightly aware. In Kaloko-Honokōhau, almost a third were relatively unaware: 15.0% not at all aware, and 17.9% just slightly aware.

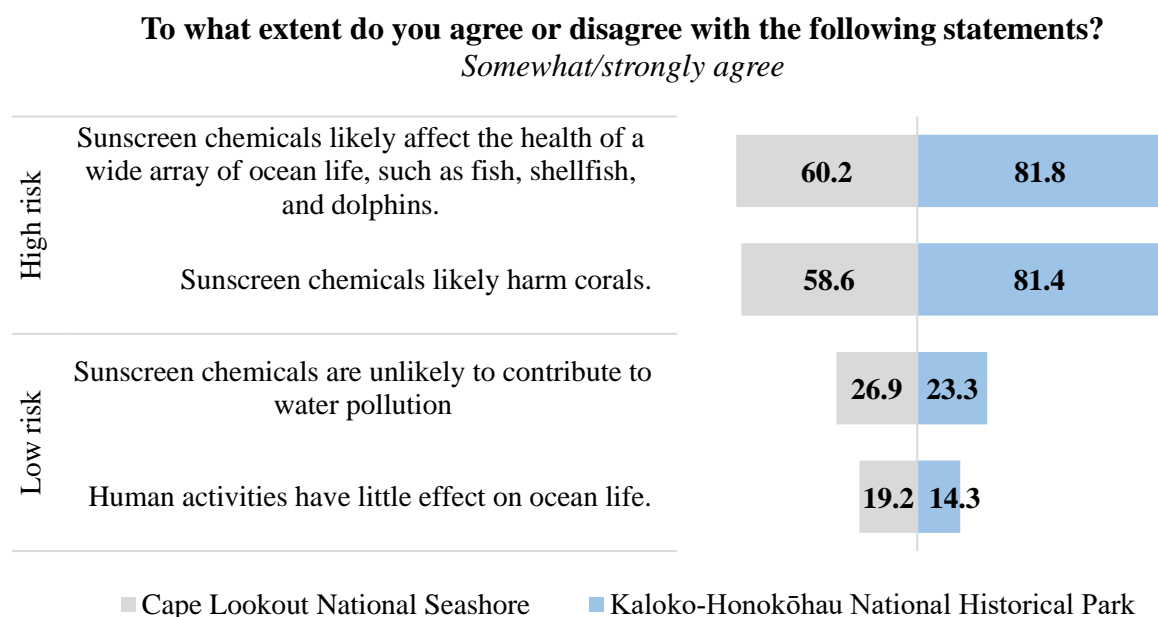
**Figure 13.** Two-thirds of Cape Lookout National Seashore respondents were not aware of sunscreen bans and environmental concerns. Fewer Kaloko-Honokōhau visitors were not aware.



## Risk perceptions

Awareness of emerging sunscreen environmental science and policy may be lower among Cape Lookout National Seashore visitors than Kaloko-Honokōhau National Historical Park, but both groups' responses to risk perception questions ranked fairly high (Figure 14). Majorities in both parks agreed that sunscreen chemicals not only likely harm corals (58.6%, 81.4%), but also a wide array of ocean life (60.2%, 81.8%). Few agreed that sunscreen chemicals were unlikely to contribute to water pollution (26.9%, 23.3%), or that human activities have little effect on ocean life (19.2%, 14.3%). Following an online test of sunscreen messaging in summer 2020, Florida, North Carolina, and Hawaii residents were found to have similarly high levels of perceived risk (72.3%, sunscreen likely harms corals; 74.5%, the chemicals affect a wide array of ocean life).

**Figure 14.** Both Cape Lookout and Kaloko-Honokōhau visitors are concerned about the risks of sunscreen chemicals to water quality and aquatic life.



## Contact with park programs

Parks offer varying types of programs and informational materials on sun protection. The NPS Natural Resource Office of Communications provided the parks in this study with printed posters and wallet cards describing recommended sun protection behaviors,<sup>35</sup> and an online sun protection pledge that can be easily linked to individual park sites.<sup>36</sup> Website content for all parks is available internally as well through SharePoint. But park staff have also developed their own strategies. For example, at Cape Lookout, Ranger Karen Duggan incorporates the science of sun protection into educational programs with youth groups (Figure 15), and Ranger Kathleen O’Grady talks to ferry passengers before they board for Shackleford Banks about the island ponies and sun protection. At Kaloko-Honokōhau, as travelers enter the visitor center they pass by a display where staff provide information on sun protection (Figure 16).

**Figure 15.** Ranger Karen Duggan at Cape Lookout National Seashore uses ultraviolet-sensitive beads to teach student groups about light and sun protection. The students make bracelets using pipe cleaners and the beads, which change colors when exposed to ultraviolet light. *(Photo credits: Author)*

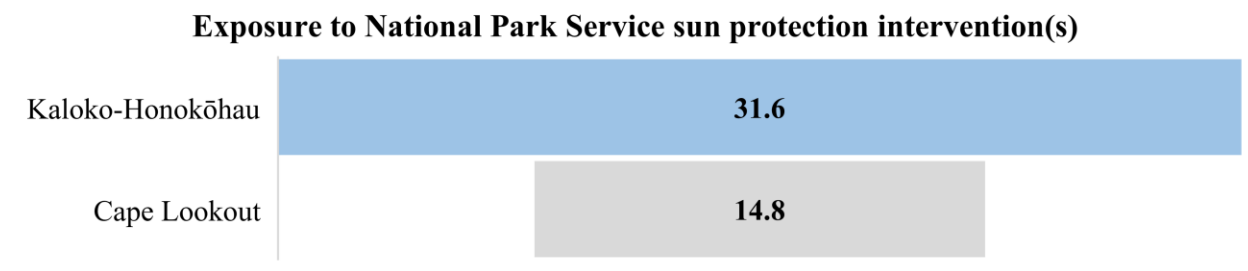


**Figure 16.** Rangers at the Kaloko-Honokōhau National Historical Park staff a visitor center display table at the front entrance with information on sunscreen. Visitors who may not remember what specific brand of sunscreen they use, may nonetheless recognize it among the bin of sunscreens that have been traded in for less polluting alternatives. *(Photo credits: Author)*



The National Park Service has struggled to manage increasing public use of the parks since the onset of the Covid-19 pandemic, combined with deficits of staffing and resources.<sup>37</sup> These pressures, in combination with easy public access via personal transportation or by ferry to Cape Lookout National Seashore and Kaloko-Honokōhau National Historical Park, likely increased the odds that visitors would reach the beaches without contact with programs designed to inform them about sun protection options. Indeed, only 14.8% of Cape Lookout visitors said they remembered contact with NPS about sun protection and 31.6% at Kaloko-Honokōhau (Figure 17). Rates of specific types of intervention contact were uniformly low for both parks, though contact with staff was the most frequently mentioned category for both parks (5.1%, 8.2%) (Table 9).

**Figure 17.** Few visitors at either park experienced contact with NPS programs on sun protection.



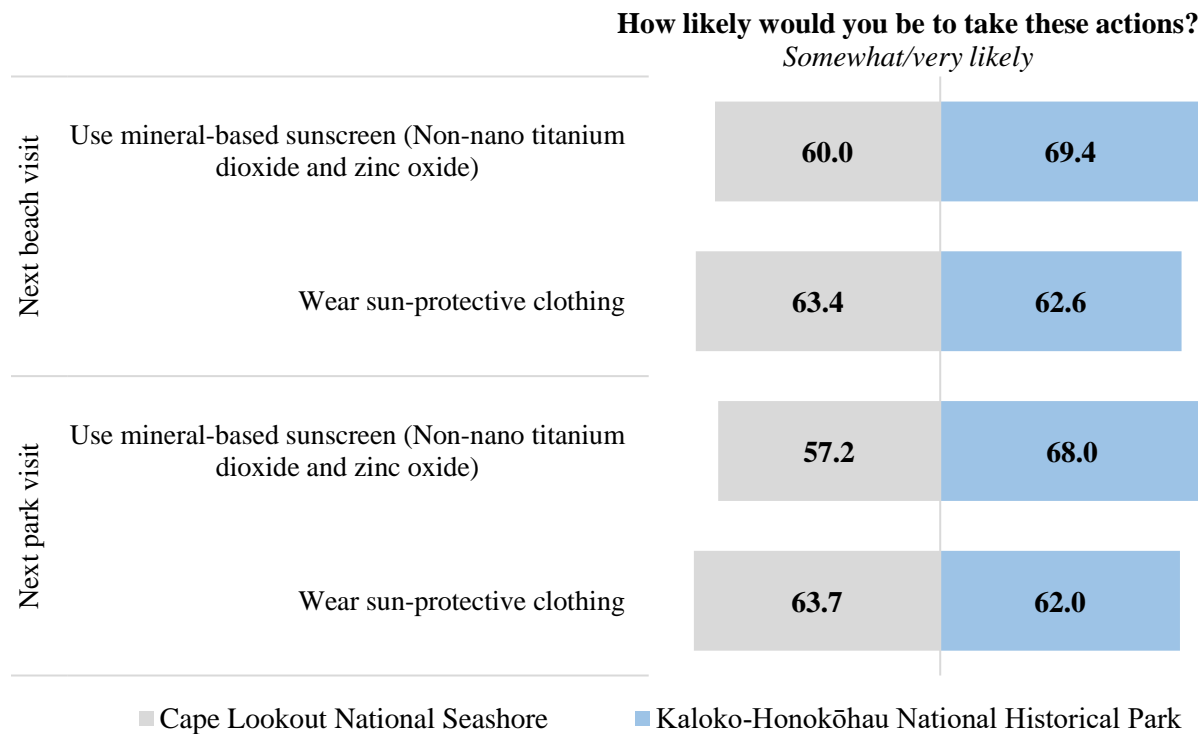
**Table 9.** Have you received sunscreen or sun protection information from any of the following [park] sources or programs?

<b>Cape Lookout</b>	<b>%</b>	<b>Kaloko-Honokōhau</b>	<b>%</b>
1. Staff	5.1	Staff	8.2
2. Park signs describing environmentally friendly sun protection	3.8	Information cards describing reef friendly sun protection	7.3
3. Social media sites	3.7	Social media sites	7.0
4. Website	3.1	Visitor center display	6.5
5. Online environmentally friendly sun protection pledge	1.2	Other	5.1
6. Other	1.2	Website	4.6
7. _____		Concession selling reef friendly sunscreen and protective clothing	3.9
<i>n</i> = 683		<i>n</i> = 613	

### Behavioral intent

In effect, the survey likely served as an intervention itself. Even for those who said they were not very familiar with the issue before participating in the study, by asking questions about sun protection, risk, and policy, visitors likely formed opinions during the approximately 10 minutes or more that they spent completing the paper survey and handing it back to researchers. While only 34.3% of Cape Lookout visitors and 42.1% at Kaloko-Honokōhau said on the first page of the study that they typically use mineral-based sunscreen, by the end of the survey, the majority of respondents said they would do so when they next visit the park (57.2%, 68.0%) or during their next trip to the beach (60.0%, 69.4%) (Figure 18). Majorities also said they would wear sun-protective clothing at the park (63.7%, 62.0%) and at other beaches (63.4%, 62.6%).

**Figure 18.** Visitors to both parks said they were somewhat or very likely to use mineral-based sunscreen and wear sun-protective clothing during their next visit to the park or a beach.





**Figure 19.** Outreach materials on sun protection were placed at the parks, including on this billboard at a Cape Lookout National Seashore visitor center. (Photo credits: Author)



## Intervention effects

To investigate whether exposure to the National Park Service interventions relate to sun protection behavioral intent the next time visitors go to the park or another beach, we tested for effects with a series of ordinal logistic regression models (Appendix D). The analyses assessed the relationship of (1) visitor exposure to specific park interventions and (2) exposure to at least one park intervention with behavioral intent. The latter was measured with four questions, differentiated by location and type of behavior:

- If you were to visit this park again, how likely would you be to take these actions? *Wear sun-protective clothing; Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)*
- The next time you go to a beach other than this park, how likely would you be to take these actions? *Wear sun-protective clothing; Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)*

At both parks, visitor exposure to at least one of the interventions on sun protection related to higher levels of intent to practice more environmentally friendly behaviors. At Kaloko-Honokōhau National Historical Park, one of the specific interventions—a visitor center display (Figure 16)—also related to increased likelihood of such behavior.

**Cape Lookout National Seashore.** The park conducted five types of sun protection-related outreach: staff communication, website content, a sun protection pledge (online), signage (Figure

19), and social media. None of the individual-level interventions significantly accounted for variance in behavioral intent. However, visitors who stated on the survey that they experienced some form of NPS contact on sun protection—regardless of the type of intervention—were more likely to say that they would use mineral-based sunscreen the next time they go to a beach other than the park. The odds of having a higher score in behavioral intent on that measure were 1.55 times greater for visitors who remembered having contact with NPS on sun protection than those who had not (95% CI, 1.02-2.38).

**Kaloko-Honokōhau National Historical Park.** The park has a longer history than Cape Lookout of conducting a wide array of outreach on sun protection with visitors: staff contact, website content, a visitor center display, a sunscreen trade-in program, information cards, concession sales of reef friendly sunscreen and protective clothing, a sun protection pledge (online), and social media. One of the interventions specifically correlated with stronger behavioral intent. Visitors who said they encountered the visitor center display (see Figure 16) were more likely to say that they would wear sun-protective clothing the next time they go to a beach other than this park. The odds of having a higher score in behavioral intent on the measure were 2.85 times greater for visitors who remembered having contact with the NPS visitor center display than those who had not (95% CI, 1.40-5.82).

Exposure to any form of contact with NPS regarding sun protection significantly correlated with intent to wear sun-protective clothing the next time respondents visit the park or go to a different beach. The odds of having a higher score in behavioral intent on those two measures was approximately 1.5 times greater for visitors who remembered having some contact with NPS on sun protection as opposed to those who did not (park, odds ratio 1.46, 95% CI 1.07-2.0; beach, odds ratio 1.50, 95% CI, 1.09-2.06).

## Park audiences

Segmentation is a technique used to distinguish differences between audiences, whether of attitudes, knowledge, or behavior,<sup>38</sup> in order to tailor interventions to meet the needs of each group. A Latent Class Analysis was run in MPlus v. 8.7 using maximum likelihood.

Dichotomous measures from the survey that characterize audience sun protection context, motivation, and behaviors served as the independent variables for the analysis, chosen for the degree to which they distinguished between groups of visitors with different characteristics (Appendix E). Twenty-five measures were included in the model for Cape Lookout National Seashore and 21 for Kaloko-Honokōhau National Historical Park. Models ranging between 2-7 classes were tested with each of the park datasets. A four-class model provided the most explanatory value in both cases. Interestingly, the audiences for both parks proved remarkably similar in their sizes and characteristics. As a result, the names given to the audiences are the same across both parks.

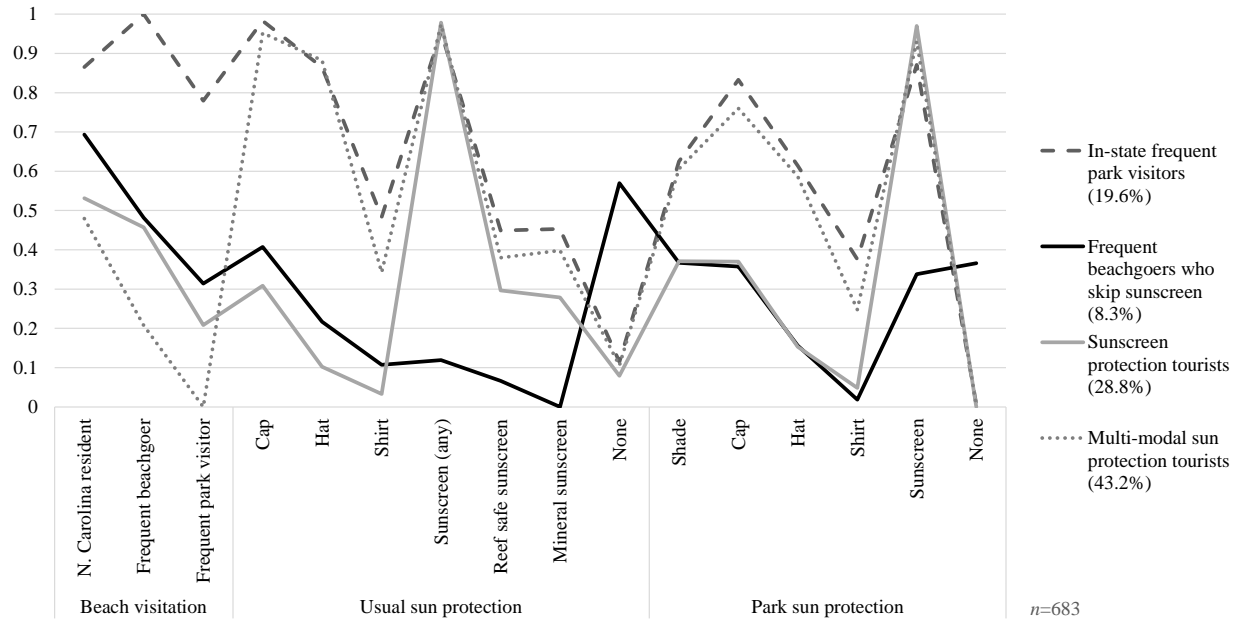
- **Cape Lookout National Seashore:** in-state frequent park visitors (19.6%); sunscreen protection tourists (28.8%); multi-modal sun protection tourists (43.2%); frequent beachgoers who skip sunscreen (8.3%)
- **Kaloko-Honokōhau National Historical Park:** in-state frequent park visitors (18.9%); sunscreen protection tourists (25.3%); multi-modal sun protection tourists (44.0%); frequent beachgoers who skip sunscreen (11.7%)

The audiences can be characterized by the following motivations and behaviors:

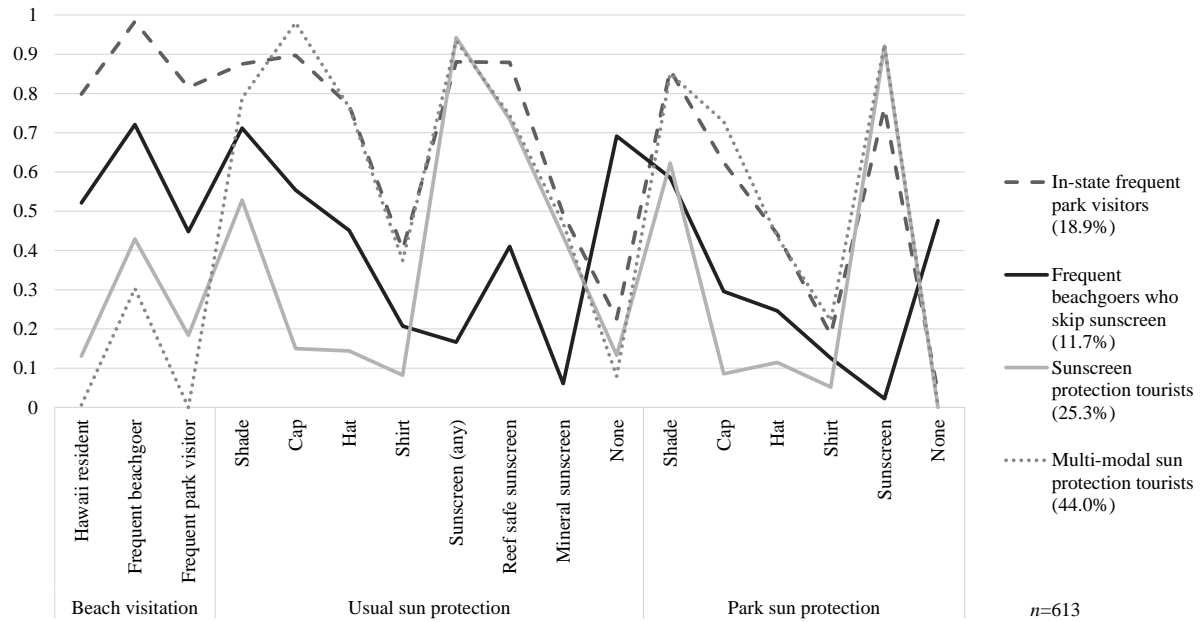
- **Multi-modal sun protection tourists:** These visitors are new to the park. They are typically not in-state and are also not avid beachgoers. They use a variety of means of sun protection.
- **Sunscreen protection tourists:** This group of out-of-state visitors uses sunscreen, but not typically other methods, such as protective clothing.
- **In-state frequent park visitors:** The vast majority are in-state residents who visit beaches frequently, including the park where they were surveyed. They use sunscreen, but also other forms of sun protection.
- **Frequent beachgoers who skip sunscreen:** This audience is the second most likely to be in-state and frequent the park and beaches, but is unlikely to use sunscreen.

For each park, two of the audiences are more likely to be local residents and two are more likely to be tourists (Figures 20-21). The groups are further differentiated between their use of sunscreen: no use, sunscreen use as the primary form of protection, and use in conjunction with other methods. The largest group in both parks is of “multi-modal sun protection tourists” (43.2%, 44.0%), followed by “sunscreen protection tourists” (28.8%, 25.3%), and “in-state frequent park visitors” (19.6%, 18.9%). The smallest audience is of “frequent beachgoers who skip sunscreen” (8.3%, 11.7%).





**Figure 20.** [Cape Lookout National Seashore] Probability of the members of each audience ranking high on each of the listed variables (each coded 0-1).



**Figure 21.** [Kaloko-Honokōhau National Historical Park] Probability of the members of each audience ranking high on each of the variables (each coded 0-1).





Members of tourist audiences at both parks were more likely to cite seeing horses and shelling (North Carolina) or turtles (Hawaii) as the reason for their visit. However, wildlife motivation to visit the park was scored from an open-ended question that at times became obscured by the clipboard, so likely is under-represented. Each of these audiences is further described below.

**Cape Lookout National Seashore.** Each audience can be described by its probability of scoring high on specific behavior-related measures used within the Latent Class Analysis (Figure 20, Appendix E1) and its demographic characteristics (Table 10).

- **Multi-modal sun protection tourists (43.2%):** Members of this group are least likely to be from North Carolina (probability, 48%). The probability for each member is high that they will use shade at the park (61%), wear a cap (76%) and/or wide-brimmed hat (59%), and sunscreen (93%). Of the audiences, they have the second highest probability for saying that they typically use reef safe (38%) or mineral (40%) sunscreen. The majority of the audience identifies as female (60%) and white (96%); 39% are between the ages of 18-34. They are well-educated; 59% have a bachelor's degree or higher. The probability is highest that they will swim (69%) and/or walk (69%) while at the park, and less likelihood of sunbathing (44%).
- **Sunscreen protection tourists (28.8%):** The probability is high that members will report wearing sunscreen typically when at the beach (98%) and at the beach the day they were surveyed (97%). They have a low probability of using any other form of sun protection. While members have a moderate probability of being from North Carolina (53%), they are one of the two groups least likely to be in-state. The audience tends to be young; 46% are between the 18-34 years old. And they are well-educated. More than half (57%) have at least a bachelor's degree. They have a high probability of swimming (85%), walking (77%), and sunbathing (73%) at the park.
- **In-state frequent park visitors (19.6%):** Members of this group have a high probability of being a North Carolina resident (87%), going to the beach frequently (100%), visiting the park frequently (78%), and engaging in multiple forms of sun-protection at the park (shade, 63%; cap, 83%; hat, 61%, sunscreen 87%). They also have a fairly high probability of typically using reef safe or mineral safe sunscreen (each, 45%) and wearing a shirt (48%). This audience has the greatest likelihood of boating at the park (45%) and fishing (18%) among the audiences. The vast majority of this group identifies as white (97%), and female (66%), and has at least a bachelor's degree (38%), if not also an advanced degree (21%). This audience is the oldest; three-quarters are over the age of 34 (77%). While the probability that one of this group's members has children with them at the park is low (21%), it is the highest among the audiences. Members have a high probability of swimming (86%), walking (62%), and sunbathing (64%) at the park.

- Frequent beachgoers who skip sunscreen (8.3%):** A member of this group has a high probability of being from North Carolina (69%) and not using sunscreen (57%). They have a moderate probability of going to the beach every week or month (48%). Just over half (51%) of the respondents in this group are male; females comprise the majority of the other three audiences. Among the generally non-racially and ethnically diverse respondents, this audience is somewhat less likely to self-describe themselves as white—only 82%—with 12% reporting that they are black. This audience is the least educated; the majority do not have a bachelor’s degree (60%). Interestingly, this group is also the *most* likely to say that they had received information on sun protection from NPS staff (14%). Their probability of swimming, sunbathing, or walking at the park is less than 50%. Of all the surveyed activities, members are most likely to swim (49%) or walk (46%).

**Table 10.** [Cape Lookout National Seashore] The four park audiences are characterized by somewhat different demographic profiles and likely exposure to some forms of NPS outreach on sun protection.

	<b>In-state frequent park visitors</b> 19.6% 	<b>Sunscreen protection tourists</b> 28.8% 	<b>Multi-modal sun protection tourists</b> 43.2% 	<b>Frequent beachgoers who skip sunscreen</b> 8.3% 
<b>Male</b>	34%	33%	40%	51%
<b>White</b>	97%	94%	96%	82%
<b>Black</b>	0%	2%	1%	12%
<b>18-34</b>	23%	46%	39%	33%
<b>65+</b>	13%	6%	10%	13%
<b>Bachelor’s degree</b>	38%	35%	35%	24%
<b>Advanced degree</b>	21%	22%	30%	16%
<b>Received information from NPS staff</b>	5%	4%	4%	14%

*\*Gender, race, age, education, and the intervention listed above each demonstrate significantly significant differences by audience ( $\chi^2$ ,  $p < .05$ ). (For full statistics, see Appendix E1)*

**Kaloko-Honokōhau National Historical Park.** Fewer visitors to the park are in-state compared to Cape Lookout National Seashore. As a result, there are wider gaps between the tourist and in-state groups in probability of state residence and motivation to see the park (Figure 21).





Members of the tourist audiences have a higher probability of reporting that turtles are the motivation for their visit than in-state audiences (sunscreen protection tourists, 42%; multi-modal sun protection tourists, 35%; in-state frequent park visitors, 14%; frequent beachgoers who skip sunscreen, 11%). Demographic characteristics of the audiences are otherwise fairly similar to those of Cape Lookout (Table 11, Appendix E2).

- **Multi-modal sun protection tourists (44.0%):** Members of this group of out-of-state visitors have zero probability of visiting the park weekly or monthly and also have a low probability of being a frequent beachgoer (30%). Perhaps as a result, there is a high probability that they will report using a wide array of sun protection measures: shade (79%), cap (98%), wide-brimmed hat (77%), and sunscreen (93%). Members also have a high probability of saying that they typically use “reef safe” sunscreen (74%), but are not as likely to say it is mineral-based (47%). This group of survey respondents is largely female (60%) and white (71%) with the largest percentage of members who identify as Asian (21%). About a third of the group (32%) is between ages 18-34. Members are well-educated with 68% reporting a bachelor’s degree or higher. Members of this audience have the highest probability of reporting that they will engage in a specific activity at the beach (beach walking, 53%).
- **Sunscreen protection tourists (25.3%):** Members from this group have a low probability of stating they are Hawaii residents (13%), but a high probability of reporting that they use sunscreen typically when at the beach (94%) and at the beach the day they were surveyed (93%). Members have roughly the same probability of reporting using reef safe sunscreen as multi-modal sun protection tourists (73% compared to 74% above), and again, are more likely to cite it than mineral-based sunscreen (44%). While they have a low probability of using most other forms of sun protection, there’s one exception: shade (typical use, 53%; park use, 62%). The audience tends to be young; 48% are between the 18-34 years old. And they are well-educated. More than half (57%) have at least a bachelor’s degree.
- **In-state frequent park visitors (18.9%):** Members of this group have the highest probability of being a Hawaii resident (80%), going to the beach frequently (98%), visiting the park frequently (82%), and engaging in multiple forms of sun-protection at the park (shade, 86%; cap, 62%; sunscreen 76%). They also have a fairly high probability of reporting using reef safe sunscreen (88%), but not as high for mineral-based (49%). The vast majority of this group identifies as white (70%), and female (68%), and has at least a bachelor’s degree (24%), if not also an advanced degree (38%). Hawaiian or Pacific Islander respondents represent 10% of the audience. This audience is one of the

oldest; three-quarters of respondents are over the age of 34 (75%). This group has the highest rate of contact with NPS concessions selling sun protection products (9%) and the park's online sun protection pledge (5%).

- **Frequent beachgoers who skip sunscreen (11.7%):** Members have high rates of probability of not using sunscreen (69%) and going to the beach every week or month (72%), with somewhat lower probabilities of being a Hawaiian resident (52%) and of going to the park every week or month (45%). More than half (58%) of the respondents in this group are male; females comprise the majority of the other three audiences. This audience is the most diverse with 19% identifying as Hispanic/Latino/Spanish heritage, 14% Asian, and 7% Hawaiian/Pacific Islander. It is also the oldest; a third of the audience is 65 years or older. And it is the least educated; the majority do not have a bachelor's degree (58%).

**Table 11.** [Kaloko-Honokōhau National Historical Park] The four park audiences are characterized by somewhat different demographic profiles and likely exposure to some forms of NPS outreach on sun protection.

	<b>In-state frequent park visitors</b>	<b>Sunscreen protection tourists</b>	<b>Multi-modal sun protection tourists</b>	<b>Frequent beachgoers who skip sunscreen</b>
	18.9%	25.3%	44.0%	11.7%
				
<b>Male</b>	32%	32%	40%	58%
<b>White</b>	70%	69%	71%	67%
<b>Asian</b>	7%	13%	21%	14%
<b>Native Hawaiian/Pacific Islander</b>	10%	2%	2%	7%
<b>Hispanic/Latino</b>	9%	16%	9%	19%
<b>18-34</b>	25%	48%	32%	18%
<b>65+</b>	26%	5%	11%	33%
<b>Bachelor's degree</b>	24%	33%	34%	14%
<b>Advanced degree</b>	38%	24%	34%	28%
<b>Contact with NPS concession selling reef friendly sunscreen and protective clothing</b>	9%	3%	3%	3%
<b>Online sun protection pledge</b>	5%	1%	2%	0%

*\*Gender, race, ethnicity, age, education, and each of the interventions listed above demonstrate significantly significant differences by audience ( $\chi^2$ ,  $p < .05$ ). (For full statistics, see Appendix E2)*

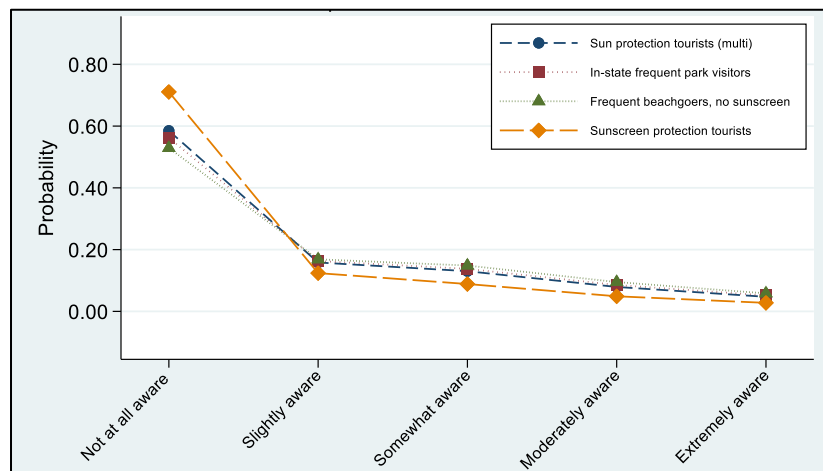
## Relationships between audiences and outcomes of interest

In order to evaluate whether the audiences significantly predicted outcomes of interest, ordinal logistic regression models tested the relationship between group membership and future park and beach sun protection behaviors, issue awareness, and risk perception. Sunscreen protection tourists served as the contrast category, compared to the other three audiences. The following sections describe the findings for each park’s audiences.

### Cape Lookout: Audience awareness, risk perceptions, behavioral intent

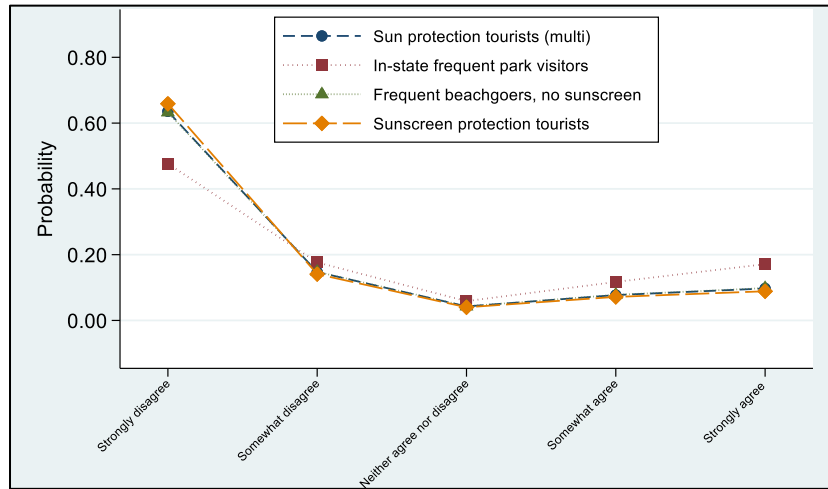
**Issue awareness.** All three audiences—multi-modal sun protection tourists, in-state frequent park visitors, and frequent beachgoers who skip sunscreen—were more likely than sunscreen protection tourists to say that they were aware that sunscreen containing certain types of chemicals had been banned in areas of the United States (Figure 22). The odds of having a higher score on issue awareness on the measure were 1.74 times for multi-modal sun protection tourists (95% CI, 1.18-2.57), 1.91 times for in-state frequent park visitors (95% CI, 1.21-3.03), and 2.19 times for frequent beachgoers who skip sunscreen (95% CI, 1.21-3.96). However, there were no significant differences between audiences when it came to awareness of potential concerns about sunscreen environmental impacts ( $p=.05$ ).

**Figure 22.** Estimated marginal means: Sunscreen containing certain types of chemicals has been banned in some areas of the United States.

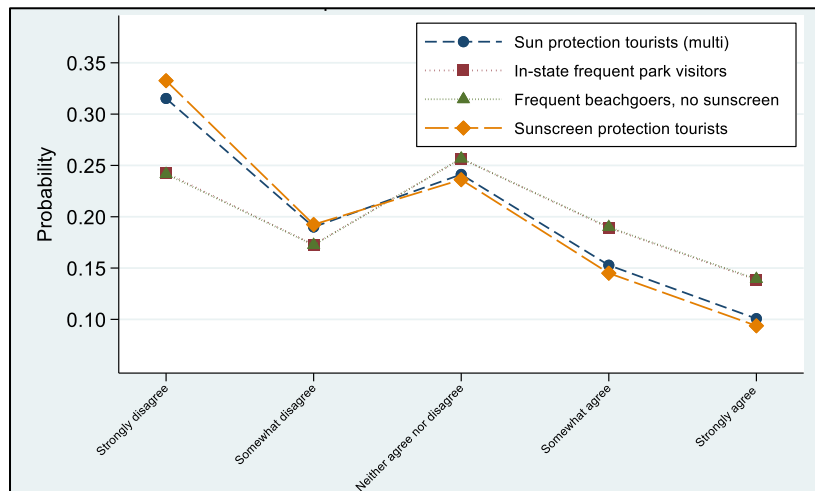


**Risk perception.** On two of the four risk perception measures, in-state frequent park visitors were more likely to view effects of human activities and sunscreen chemicals on the environment as lower risk than sunscreen protection tourists (Figures 23-24). In-state frequent park visitors had 2.21 times the odds for selecting a higher level of agreement that “human activities have little effect on ocean life” than sunscreen protection tourists (95% CI, 1.37-3.29), and 1.55 times greater in regards to the effects of sunscreen chemicals on water pollution (95% CI, 1.04-2.32).

**Figure 23.** Estimated marginal means: Human activities have little effect on ocean life.



**Figure 24.** Estimated marginal means: Sunscreen chemicals are unlikely to contribute to water pollution.



**Behavioral intent.** Two of the audiences—multi-modal sun protection tourists and in-state frequent park visitors—were more likely than sun protection tourists to say that they would wear sun protective clothing the next time they visited the park again or another beach (Figures 25, 27). Frequent beachgoers who skip sunscreen were less likely than sun protection tourists to say that they would use mineral-based sunscreen (Figures 26, 28).

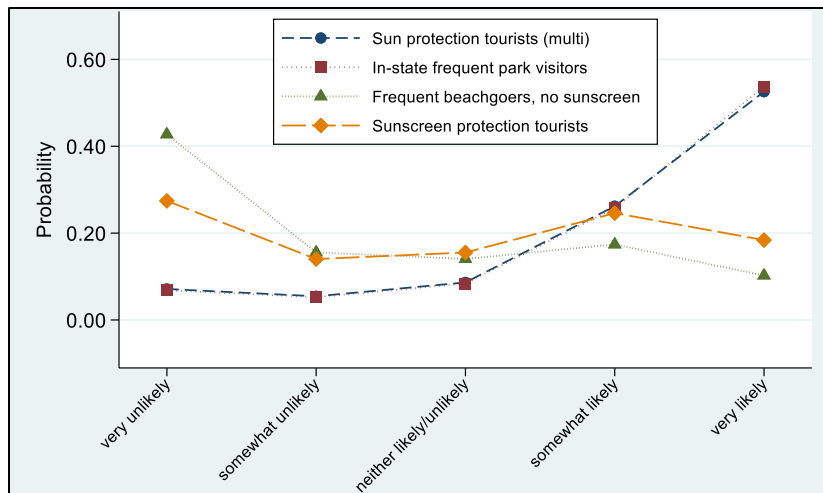
- Multi-modal sun protection tourists and in-state frequent park visitors had higher odds—respectively, 4.92 and 5.15 times greater—for indicating a greater likelihood



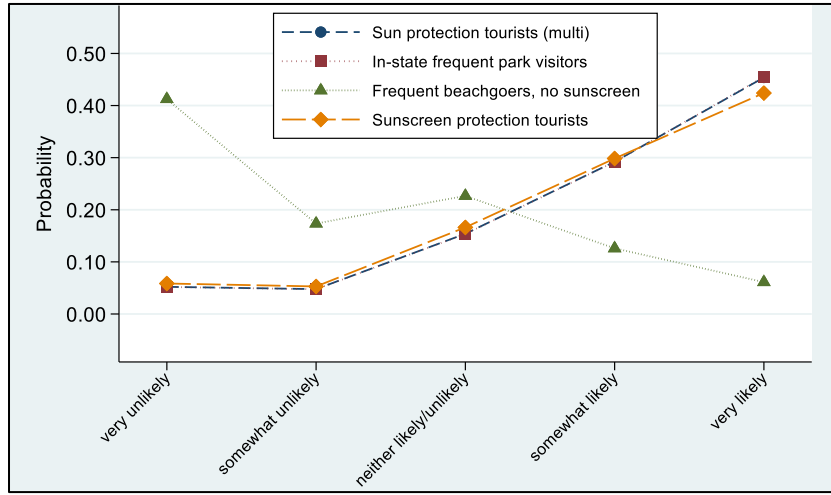
of wearing sun-protective clothing when they *next visited the park* compared to sunscreen tourists (95% CI, 3.41-7.08; 3.32-7.99). Frequent beachgoers who skip sunscreen had odds 1.98 times greater than sunscreen tourists that they would select a category indicating they were *less likely* to use protective clothing when they next visited the park (95% CI, 1.12-3.47).

- The odds for frequent beachgoers who skip sunscreen were 11.24 times that of sunscreen tourists to choose a *less likely* category for use mineral-based sunscreen when they *next visited the park* (95% CI, 5.74-22.22).
- Multi-modal sun protection tourists and in-state frequent park visitors were more likely than sunscreen tourists to select a higher category indicating they would wear sun-protective clothing when they next visited *another beach*, with odds that were 5.38 and 5.43 times that of sunscreen tourists (95% CI, 3.72-7.79; 3.49-8.45).
- Frequent beachgoers who skip sunscreen had odds 11.11 times that of sunscreen tourists that they would select a *less likely* category for using mineral-based sunscreen when they next visited *another beach* (95% CI, 5.74-22.22).

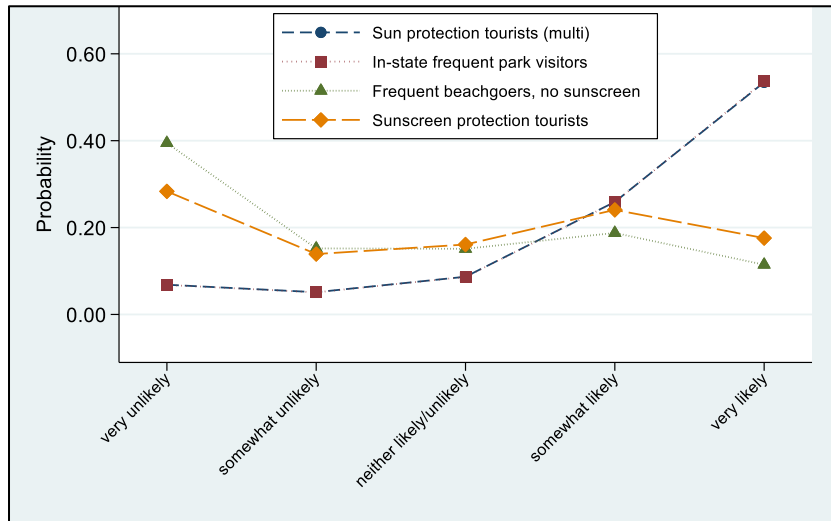
**Figure 25.** Estimated marginal means: If you were to visit this park again, how likely would you be to take these actions? [Wear sun-protective clothing]



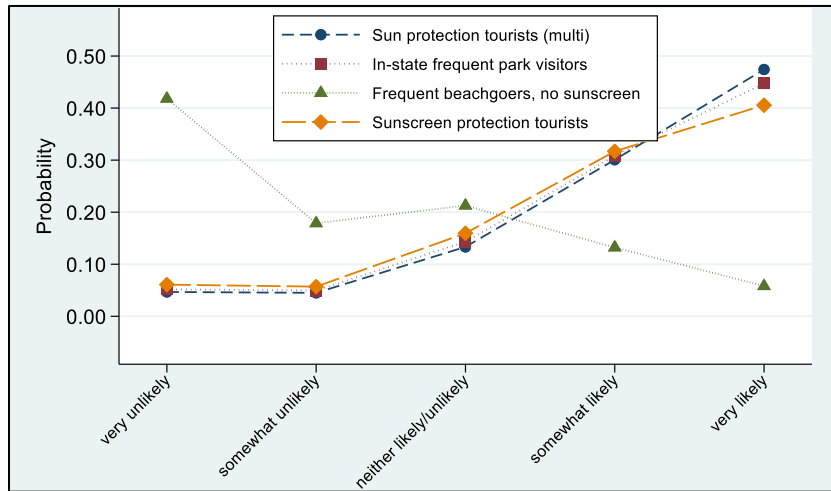
**Figure 26.** Estimated marginal means: If you were to visit this park again, how likely would you be to take these actions? [Use mineral-based sunscreen]



**Figure 27.** Estimated marginal means: The next time you go to a beach other than this park, how likely would you be to take these actions? [Wear sun-protective clothing]



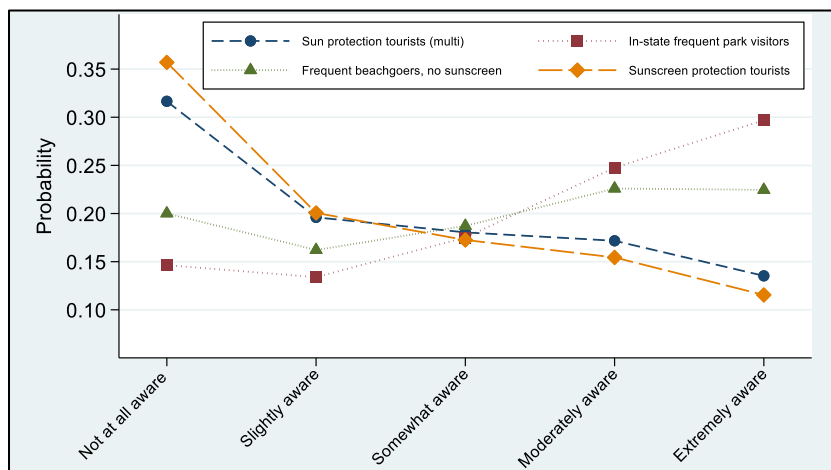
**Figure 28.** Estimated marginal means: The next time you go to a beach other than this park, how likely would you be to take these actions? [Use mineral-based sunscreen]



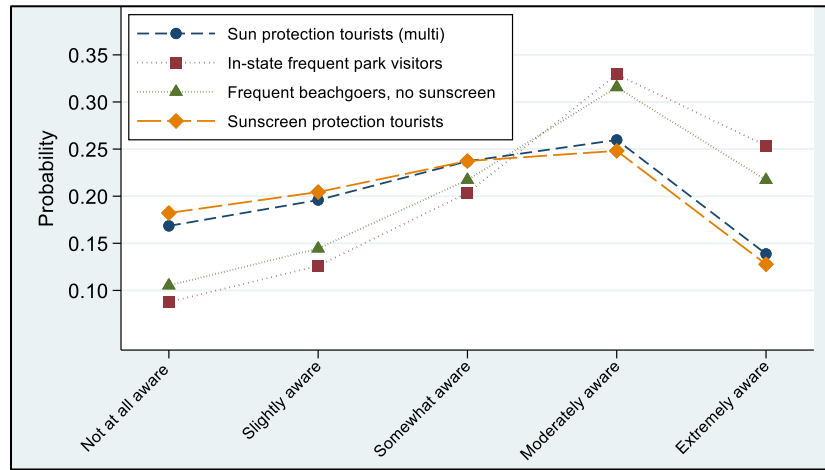
***Kaloko-Honokōhau: Audience awareness, risk perceptions, behavioral intent***

**Issue awareness.** In-state frequent park visitors and frequent beachgoers who skip sunscreen were more likely to be aware of sunscreen bans in the United States and concerns about environmental effects than sunscreen protection tourists. There were no significant differences between the two tourist groups on the measures (Figures 29-30). The odds for in-state frequent park visitors and frequent beachgoers to select a category indicating greater issue awareness were 3.24 and 1.33 times as great as that of sunscreen protection tourists for bans (95% CI, 2.09-5.02; 1.33-3.69) and 2.31 and 1.89 for environmental concerns (95% CI, 1.500-3.59; 1.14-3.15).

**Figure 29.** Estimated marginal means: Sunscreen containing certain types of chemicals has been banned in some areas of the United States.



**Figure 30.** Estimated marginal means: The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?

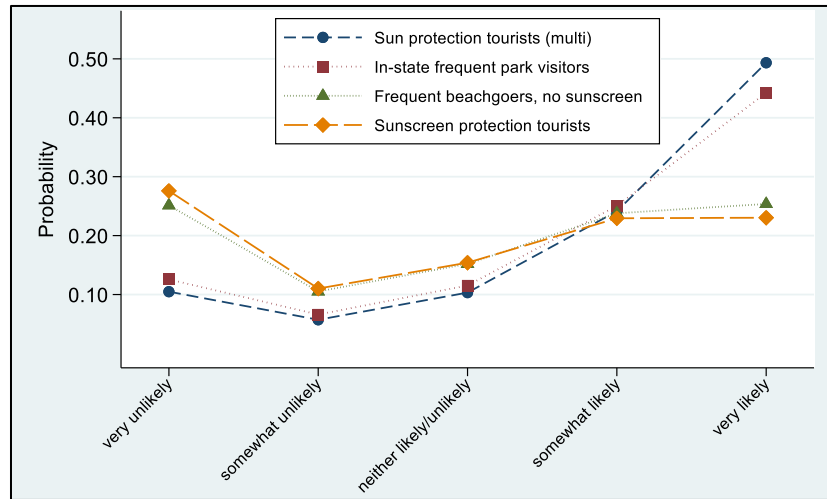


**Risk perception.** There were no significant differences between the audiences on measures of risk perception.

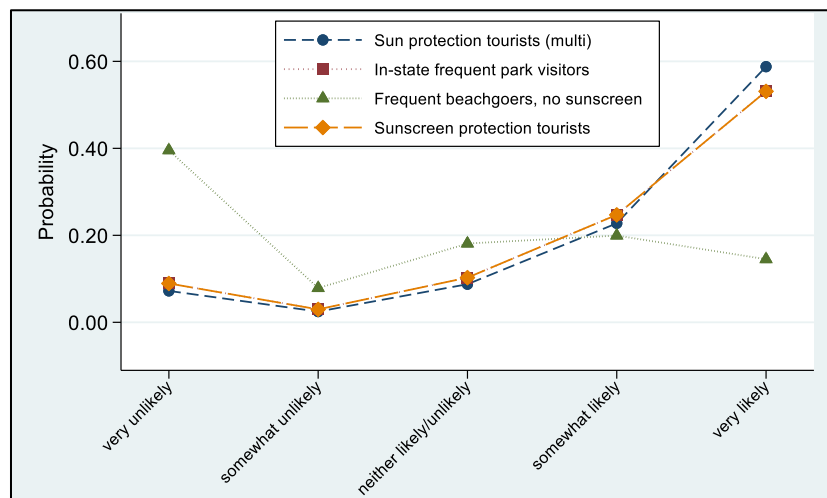
**Behavioral intent.** Demonstrating the same pattern identified with audiences from Cape Lookout National Seashore, two of the audiences—multi-modal sun protection tourists and in-state frequent park visitors—were more likely than sun protection tourists to say that they would wear sun protective clothing the next time they visited the park again or another beach (Figures 31, 33). Frequent beachgoers who skip sunscreen were less likely than sun protection tourists to say that they would use mineral-based sunscreen (Figures 32, 34).

- Multi-modal sun protection tourists and in-state frequent park visitors had higher odds—respectively, 3.25 and 2.65 times greater—for indicating a greater likelihood of wearing sun-protective clothing when they *next visited the park* compared to sunscreen tourists (95% CI, 2.24-4.72; 1.70-4.14).
- The odds for frequent beachgoers who skip sunscreen were 6.67 times that of sunscreen tourists to choose a *less likely* category for use mineral-based sunscreen when they *next visited the park* (95% CI, 3.68-12.05).
- Multi-modal sun protection tourists and in-state frequent park visitors were more likely than sunscreen tourists to select a higher category indicating they would wear sun-protective clothing when they next visited *another beach*, with odds that were 3.60 and 2.79 times that of sunscreen tourists (95% CI, 2.47-5.25; 1.78-4.37).
- Frequent beachgoers who skip sunscreen had odds 5.18 times that of sunscreen tourists that they would select a *less likely* category for using mineral-based sunscreen when they next visited *another beach* (95% CI, 2.94-9.17).

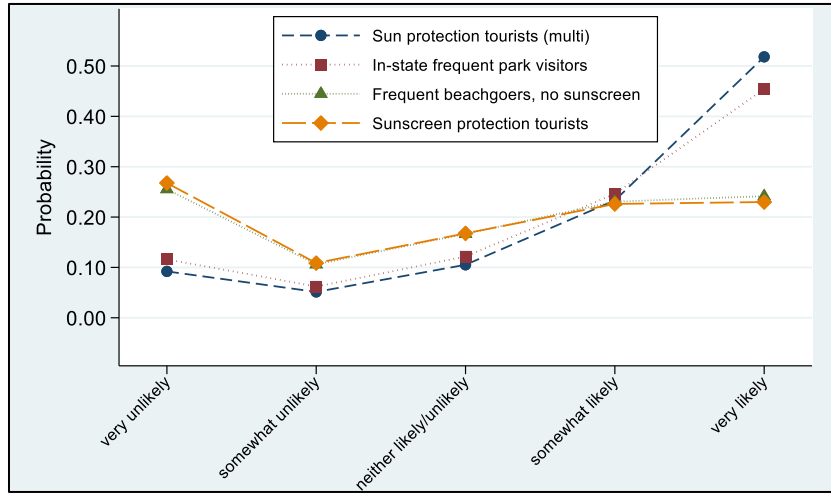
**Figure 31.** Estimated marginal means: If you were to visit this park again, how likely would you be to take these actions? [Wear sun-protective clothing]



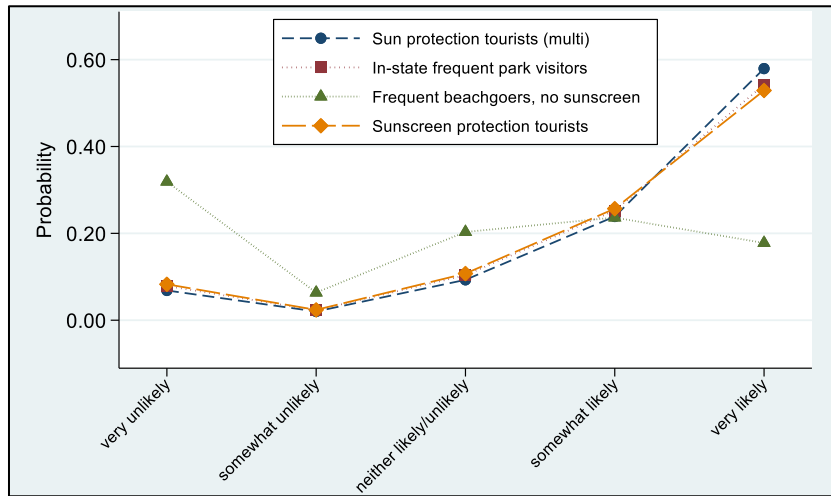
**Figure 32.** Estimated marginal means: If you were to visit this park again, how likely would you be to take these actions? [Use mineral-based sunscreen]



**Figure 33.** Estimated marginal means: The next time you go to a beach other than this park, how likely would you be to take these actions? [Wear sun-protective clothing]



**Figure 34.** Estimated marginal means: The next time you go to a beach other than this park, how likely would you be to take these actions? [Use mineral-based sunscreen]



## Recommendations

Analyses in this report demonstrate that contact with NPS interventions on sun protection is related to visitor intent to adopt recommended sun protection behaviors. Given staff and resource limitations, NPS and its individual parks should focus on interventions that are easy to implement, require limited personnel hours, and are targeted to specific audiences of most concern. In order to align national and individual park strategies on this fast-moving science and policy issue, NPS may wish to consider a two-tiered communication approach for both internal and external audiences.

### External audiences

Because together the two tourist audiences—sunscreen protection tourists and multi-modal sun protection tourists—comprise the vast majority of visitors who have less opportunity for contact with NPS (both parks) and are less likely to prioritize mineral-based sunscreen than other audiences (Cape Lookout), they represent the top two priorities for interventions. In-state frequent park visitors represent a lower priority because they require a strategy that will vary from park-to-park, in some areas are more likely to have contact with NPS, and already implement a variety of the recommended sun protection behaviors. Notably, “frequent beachgoers who skip sunscreen” are not a priority audience.

**Highest priority audience—sunscreen protection tourists.** While this audience represents only approximately a quarter of visitors, they rely on sunscreen as their primary form of sun protection and have lower levels of issue awareness (Cape Lookout) and intent to engage in wearing sun-protective clothing (both parks) than other audiences. In Cape Lookout, a member of this audience has a 28% probability of saying they use mineral-based sunscreen, compared to a 40% probability for multi-modal sun protection tourists and 45% for in-state frequent park visitors. They are the youngest of the groups—about half are between the ages of 18 and 34—and are well educated. They are also less likely to be frequent beachgoers or in-state residents. Reaching this audience before they reach parks will help ensure that they choose the recommended sun protection options in preparing for the trip. Because they are not frequent beachgoers and are relatively young, they also may have less engrained sun protection habits and may be more open to changing their behavior. The two tourist audiences are more likely to cite wildlife as a draw to the park than frequent visitors.

**Second highest priority audience—multi-modal sun protection tourists.** This is the largest of the audiences in both parks, presenting more than 40% of visitors. While this audience is somewhat older, still approximately a third of its members are between 18-34 years old, and they are well-educated. The audience is less of concern because members already rely on more than sunscreen for protection. Like sunscreen protection tourists, they are more than likely new to each of these parks and are not frequent beachgoers. Many of the same strategies used to reach sunscreen protection tourists will also reach this audience. Information on mineral-based sunscreen is equally applicable to both.

**Figures 35a, 35b.** (a) Kohala Center informational cards used at Kaloko-Honokōhau National Historical Park instruct visitors to select zinc oxide and titanium dioxide sunscreen formulations, but do not describe them as “non-nano.” (b) Fair Wind A-frame sign boards explain the status of Hawaii sunscreen restrictions and what sun protection behaviors visitors should take.



**Tourist recommendations**

A two-pronged approach leveraging NPS national media outreach and strategically placed information and product availability on-site will provide reach before and after visitors arrive in the national parks. While each of the following actions ideally will not take any of the following staff long to implement, internal communication within NPS will be required to support national and park-level coordination among these groups.

- *[Headquarters communication and media staff]* Leverage mass media to reach the two tourist audiences at scale:
  - Prior to peak visitation seasons at coastal parks, send national media alerts for stories on using healthy forms of sun protection that don’t pollute the parks.
  - Prioritize sunscreen protection tourists as the target audience for media with storylines of interest to younger audiences and focused promotion of sun-protective clothing and mineral-based *cream* sunscreen.
- *[Natural Resource Office of Communications]* Create one online webpage where all NPS sun protection information recommendations—and the sun protection pledge—can be accessed through a QR code posted on park materials and linked to national media alerts:
  - Clarify that reef friendly sunscreen is not a regulated term and may still contain chemicals of concern to aquatic life. Only sunscreens with just zinc oxide and/or titanium dioxide are recommended by NPS.



- Water pollution is consistently the top environmental concern in the U.S.<sup>39</sup>; describe sunscreen chemicals as water pollutants (“choose sun protection that doesn’t pollute”; “when you use spray sunscreen, the majority of the chemicals go into the air, water, and sand—not on you”).
- Consider dropping “non-nano” in describing preferred mineral-based sunscreen formulations as per the approach used by the Kohala Center (Figure 35a).
- In imagery and text, emphasize the impacts of sunscreen pollution on charismatic wildlife, like turtles, corals, fish, etc. that are a draw for visitors to the parks (see Figure 35a).
- Emphasize visitors should use park restrooms instead of the ocean, lakes, or rivers (Figure 35b). (Sunscreen chemicals are excreted through urine.<sup>40</sup> )
- *[NPS App staff]* Update the NPS App to include recommended sun protection information when visitors search on locations that have water features, such as beaches, lakes, and rivers. Include park-specific information about state and territory laws regarding sunscreen use.
- *[Park rangers and staff]* Identify visitor traffic “choke-points” and place signage and sunscreen dispensers at these locations at the beginning of each peak beach visitation season:
  - Position A-frame sign boards in front of concessions, transportation ticket windows and waiting areas, visitor centers, and restrooms with information about the legal status of sunscreen formulations (Hawaii, U.S. Virgin Islands), recommended sun protection behaviors, and use of park restrooms instead of waterways (Figure 35b). Place QR codes on boards for visitors to access more information.
  - Place mineral-based sunscreen dispensers next to restrooms and other heavily frequented areas with information on recommended sunscreen and sun protection behaviors. Place QR codes on boards for visitors to access more information.
- *[Concessionaires and friends of the park gift stores]* Stock sun-protective UPF clothing and mineral-based sunscreen in prominent displays with signage on recommended NPS sun protection behaviors and a QR code for more information.

### **In-state frequent visitor recommendations**

This audience is the lowest priority. Frequent park visitors are familiar with individual parks, they want to be reef safe, but don’t equate it with “mineral-based” (Kaloko-Honokōhau) or have members that are somewhat more likely than other audiences to select mineral-based sunscreen, but more likely than not, do not do so (Cape Lookout). Some of the strategies—such as park-based signage and dispensers—that are recommended for tourists will be accessible to this audience as well, but additional strategies are also available because of these members’ role in the local community.

- *[Park rangers and staff]* Recruit members of this audience, especially retirees, to talk to visitors on beaches and educate visitors on sun protection. Provide them with a script and any park informational materials to disseminate.
- *[Park rangers and staff]* Partner with local individuals or organizations already active on this issue who can help spread the message (and materials) at the park and within the community.

### **Internal audiences**

The Park Services has its own internal audiences to consider in coordinating visitor programs on sun protection. Among these include: interpretative and visitor education staff, natural resource managers and biologists, and concessionaires. The following suggested activities will support implementation of the recommendations above:

- *[All internal audiences]* Offer an online yearly webinar update on the science and policy of sunscreen chemical formulations for all national parks that also covers national messaging, programmatic materials, and examples of what parks are doing. Invite scientists from across federal agencies and those involved in policy formation, such as at the National Academies, National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency or U.S. Food & Drug Administration to present. Information provided at the webinar could be used to inform yearly national media alerts.
- *[Interpretative and visitor education staff]* Make funding sources available to the parks for sun protection educational kits (such as UV-sensitive beads), printed materials, sunscreen exchange programs, sunscreen dispensers, and A-frame sign boards.
- *[Concessionaires and friends of the park gift stores]* Schedule a yearly webinar to provide guidance to concessionaires to inform their selection of sun protection product orders well in advance of peak visitation periods and apprise them of the NPS national strategy.

## Acknowledgements

Thank you to University of Florida graduate student Jacqueline Loevenich for her assistance in preparing this report, and to her and George Mason University graduate students Eric Mazur and Kim Magalona for their work fielding the surveys in North Carolina and Hawaii. Also, enormous thanks to the National Park Service and its staff who made the research possible.

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## Appendix A: Survey frequency data



Appendix A1: [Cape Lookout National Seashore] Survey response frequencies

## Demographics

**Table A1.1 What is your gender?**

	%
Female	62.1
Male	37.6
Other (WRITE)	0.3
<i>n</i> = 620	

**Table A1.2 Race**

	%
White	94.6
Black or African American	1.8
Asian	1
Native Hawaiian/Pacific Islander	0.3
American Indian or Alaska Native	0.2
Multirace	2
<i>n</i> = 597	

**Table A1.3 Are you of Hispanic, Latino, or Spanish descent?**

	%
No	95.3
Yes	4.7
<i>n</i> = 683	

**Table A1.4 Age**

	%
18-34	37.4
35-44	19.7
45-54	16.8
55-64	16.6
65+	9.5
<i>n</i> = 589	

**Table A1.5 Education**

	%
High school or GED	10.5
Some college, no degree	17.6
Associate degree	12.7
Bachelor's degree	34.5

Advanced degree beyond a bachelor's degree	24.7
<i>n</i> = 608	

**Table A1.6 State**

	%
No Response	10.1
AL	0.1
AR	0.3
CA	0.4
CO	0.6
CT	0.1
DC	0.6
FL	0.4
GA	1.8
IA	0.1
IL	0.3
IN	0.7
KY	1.2
LA	0.3
MA	0.4
MD	0.9
ME	0.1
MI	0.3
MO	0.3
MS	0.6
NC	59.2
NE	0.1
NH	0.4
NJ	0.7
NV	0.1
NY	1.9
OH	3.5
OK	0.1
PA	2.2
RI	0.3
SC	1.2
TN	1.6
TX	0.7
UT	0.3
VA	5.3

WA	0.1
WI	0.4
WV	1.5
Bermuda	0.3
Spain	0.1
<i>n</i> = 683	

**Table A1.7 Is the respondent in a group that took the survey?**

	%
Yes	83.7
No	16.3
<i>n</i> = 679	

**Table A1.8 How frequently do you spend time recreating on beaches or in other shoreline areas?**

	%
Weekly (one or more times a week)	23.0
Monthly (at least once a month)	23.3
Yearly (at least once a year)	41.1
On occasion (every few years)	8.7
This is my first visit	3.9
<i>n</i> = 669	

**Table A1.9 How frequently do you spend time recreating on this specific beach or shoreline site?**

	%
Weekly (one or more times a week)	13.4
Monthly (at least once a month)	11.3
Yearly (at least once a year)	25.1
On occasion (every few years)	17
This is my first visit	33.3
<i>n</i> = 613	

**Table A1.10 Which activities do you USUALLY engage in on the beach or shore?**

	%
Swimming or wading	90.0
Sunbathing	69.3
Snorkeling	13.0
Beach walking or hiking	81.8

Surfing	4.7
SCUBA	2.8
Fishing	29.6
Boating (e.g., kayak, motorboat)	40.4
Windsurfing or kitesurfing	1.9
Other (WRITE):	6.6
<i>n</i> = 683	

**Table A1.11 Which activities do you plan on engaging in TODAY at this site?**

	%
Swimming or wading	75.4
Sunbathing	55.6
Snorkeling	9.1
Beach walking or hiking	67.8
Surfing	1.6
SCUBA	1.6
Fishing	10.5
Boating (e.g., kayak, motorboat)	19.0
Windsurfing or kitesurfing	1.2
Other	6.1
<i>n</i> = 683	

**Table A1.12 Other (WRITE):**

	%
ATV tour	0.2
Beach games	0.1
Boarding	0.1
Bocchi	0.1
Body boarding and SUP	0.1
Boogie Boarding	0.2
Building Sandcastles	0.1
Camping	0.2
Drinking, shells	0.1
Grilling	0.1
Jet ski	0.3
Lighthouse	0.2
Looking at the water	0.1
Paddle board / tube	0.1
Paddleboarding	0.3
Play in sand, ball catch etc.	0.1

Playing in sand	0.2
Relaxing in the shade	0.1
Sand play, paddleboard	0.1
Seeing horses	0.1
Shelling	2.9
Shells horses	0.1
Sightseeing and look for seashells	0.1
Sitting in chairs under the tent	0.1
Sitting in the shade	0.1
Sunbathing	0.1
Volleyball	0.1
Work	0.1
<i>n</i> = 683	

**Table A1.13 When you go to the beach or the shore, how likely are you to...**

		%
<b>Stay in the shade</b>	Very likely	22.8
	Somewhat likely	29.5
	Neither likely nor unlikely	13.6
	Somewhat unlikely	16.9
	Very unlikely	16.5
	Don't know	0.7
	<i>n</i> = 668	
<b>Wear a baseball cap or sun visor</b>	Very likely	54
	Somewhat likely	18.7
	Neither likely nor unlikely	4.9
	Somewhat unlikely	6.4
	Very unlikely	15.4
	Don't know	0.4
	<i>n</i> = 667	
<b>Wear a hat that shades your face, ears, and neck</b>	Very likely	40.1
	Somewhat likely	19.7
	Neither likely nor unlikely	7.9
	Somewhat unlikely	11.3
	Very unlikely	20.3
	Don't know	0.6
	<i>n</i> = 670	
	Very likely	12.3
	Somewhat likely	13.9
	Neither likely nor unlikely	9.8

<b>Wear a long-sleeved shirt</b>	Somewhat unlikely	11.9
	Very unlikely	51.4
	Don't know	0.8
	<i>n</i> = 664	
<b>Wear long pants or other clothing that reaches your ankles</b>	Very likely	2.7
	Somewhat likely	3.3
	Neither likely nor unlikely	6.5
	Somewhat unlikely	12.1
	Very unlikely	74.1
	Don't know	1.2
<b>Use sunscreen (any type)?</b>	<i>n</i> = 660	
	Very likely	79.2
	Somewhat likely	11.1
	Neither likely nor unlikely	1.9
	Somewhat unlikely	2.1
	Very unlikely	5
	Don't know	0.7
<b>Use "reef safe," "reef friendly" or "coral safe" sunscreen</b>	<i>n</i> = 677	
	Very likely	22.1
	Somewhat likely	12.4
	Neither likely nor unlikely	14.7
	Somewhat unlikely	5.3
	Very unlikely	14.7
	Don't know	30.8
<b>Use mineral-based sunscreen</b>	<i>n</i> = 660	
	Very likely	21.2
	Somewhat likely	13.1
	Neither likely nor unlikely	15.3
	Somewhat unlikely	5.2
	Very unlikely	13.5
	Don't know	31.7
<b>Not use any form of sun protection</b>	<i>n</i> = 659	
	Very likely	9
	Somewhat likely	4.7
	Neither likely nor unlikely	3.4
	Somewhat unlikely	6
	Very unlikely	72.5
	Don't know	4.4
	<i>n</i> = 654	

**Table A1.14 Do you plan on using any of these methods to protect yourself from the sun during your visit today?**

	%
Stay in the shade	52.3
Wear a baseball cap or sun visor	63
Wear a hat that shades my face, ears, and neck	43.2
Wear a long-sleeved shirt	19.8
Wear long pants or other long clothing	2.5
Use sunscreen	88
Other	4.7
I do not plan on using sun protection	3.4
<i>n</i> = 683	

**Table A1.15 Other (WRITE):**

	%
No Response	96.2
CA++ and EFA	0.1
Coverup	0.1
Glasses	0.1
Reapply	0.1
Shea butter natured sunscreen	0.1
Shibumi	0.2
Short sleeve shirt	0.5
Sunglasses	1
Sunscreen only on nose and lips	0.1
Umbrella	0.4
Use a neck sleeve	0.1
Water shirt	0.1
Zinc for lips	0.1
<i>n</i> = 683	

**Table A1.16 Does the sunscreen you are using today contain one or more of the following chemicals listed under “active ingredients”?**

	%
Titanium dioxide	4.5
Non-nano titanium dioxide	0.7
Zinc oxide	12.4
Non-nano zinc oxide	0.7
Octocrylene	16.3
Octisalate	15.8



Oxybenzone	3.1
Octinoxate	1.5
Avobenzone	17
Homosalate	15.4
Other (WRITE):	1.3
I don't know	50.8
<i>n</i> = 683	

**Table A1.17 Other (WRITE):**

	%
	98.8
Has none of those	0.1
Mineral Based	0.1
N/A	0.1
Non-mineral	0.1
Octty Salicylate	0.1
Organic	0.1
Reef safe only	0.1
Shea butter	0.1
<i>n</i> = 683	

**Table A1.18 How is the sunscreen applied?**

	%
Spray	46.3
Cream	60.3
Other	2.8
<i>n</i> = 683	

**Table A1.19 Other - Text**

	%
	97.2
Cream for face, spray for body	0.1
Face stick	0.1
Gel	0.1
I have a few bottles with me	0.1
N/A	0.1
Rub on	0.1
Spray 50 and Cream 30	0.1
Spray and cream	0.6
Spray cream	0.1

Stick	0.7
Waterbabies is cream nose is vaseline based	0.1
<i>n</i> = 683	

**Table A1.20 Who purchased the sunscreen?**

	%
I purchased it	62.1
A spouse or partner	20.9
A friend	3.8
A parent	5.4
Other (WRITE):	1.9
I don't know	1.8
<i>n</i> = 683	

**Table A1.21 Other (WRITE):**

	%
AirBnb provided	0.1
Amazon	0.1
Family member	0.7
N/A	0.1
Online	0.1
<i>n</i> = 683	

**Table A1.22 To what extent do you agree or disagree with the following statements?**

		%
<b>Human activities have little effect on ocean life.</b>	Strongly agree	10.9
	Somewhat agree	8.3
	Neither agree nor disagree	4.5
	Somewhat disagree	15.1
	Strongly disagree	61.2
	<i>n</i> = 650	
<b>Sunscreen chemicals are unlikely to contribute to water pollution</b>	Strongly agree	10.9
	Somewhat agree	16
	Neither agree nor disagree	24.3
	Somewhat disagree	18.6
	Strongly disagree	30
	<i>n</i> = 649	
<b>Sunscreen chemicals likely harm corals.</b>	Strongly agree	34.6
	Somewhat agree	24

	Neither agree nor disagree	29.8
	Somewhat disagree	5.2
	Strongly disagree	6.3
	<i>n</i> = 650	
<b>Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins. following statements?</b>	Strongly agree	35.9
	Somewhat agree	24.3
	Neither agree nor disagree	29.1
	Somewhat disagree	4.6
	Strongly disagree	6.2
	<i>n</i> = 647	

**Table A1.23 Have you received sunscreen or sun protection information from any of the following Cape Lookout National Seashore sources or programs?**

	%
Staff	5.1
Website	3.1
Online environmentally friendly sun protection pledge	1.2
Park signs describing environmentally friendly sun protection	3.8
Social media sites	3.7
Other (WRITE)	1.2
None of the above	74.8
<i>n</i> = 683	

**Table A1.24 Other (WRITE):**

	%
	99.0
Dermatologist	0.1
Dr	0.1
N/A	0.1
No	0.1
Self	0.1
Signs	0.1
Survey George Mason	0.1
<i>n</i> = 683	

**Table A1.25 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	%
Not at all aware	61.2
Slightly aware	15.0
Somewhat aware	12.1
Moderately aware	7.3
Extremely aware	4.3
<i>n</i> = 645	

**Table A1.26 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	%
Not at all aware	46.3
Slightly aware	20.7
Somewhat aware	16.8
Moderately aware	11.5
Extremely aware	4.7
<i>n</i> = 642	

**Table A1.27 If you were to visit this park again, how likely would you be to take these actions?**

		%
<b>Wear sun-protective clothing</b>	Very likely	39.1
	Somewhat likely	24.6
	Neither likely nor unlikely	10.8
	Somewhat unlikely	8.5
	Very unlikely	15.6
	Don't know	1.3
	<i>n</i> = 621	
<b>Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)</b>	Very likely	34.1
	Somewhat likely	23.1
	Neither likely nor unlikely	13.3
	Somewhat unlikely	4.9
	Very unlikely	6.8
	Don't know	17.7
	<i>n</i> = 615	
	Very likely	39.1
	Somewhat likely	24.3

<b>Wear sun-protective clothing</b>	Neither likely nor unlikely	11.1
	Somewhat unlikely	8.2
	Very unlikely	15.1
	Don't know	2.3
	<i>n = 622</i>	
<b>Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)</b>	Very likely	35.1
	Somewhat likely	24.9
	Neither likely nor unlikely	12.6
	Somewhat unlikely	5
	Very unlikely	6.9
	Don't know	15.5
	<i>n = 619</i>	

**Table A1.28 Besides yourself, how many other people are you here with today?**

	%
0	0.9
1	23.2
2	13.5
3	18.6
4	11.8
5	9.7
6	4.9
7	4.3
8	2.9
9	1
10	2.4
11	0.9
12	1.7
13	1.7
14	0.3
15	1
16	0.3
17	0.3
20	0.3
22	0.2
47	0.2
<i>n = 587</i>	

**Table A1.29 If there are other people with you visiting the site today ...**

	%
Friends	30.2
A spouse or partner	43.6
Other family members, including children or extended family	52.9
Infant (Less than 1 year old)	1.3
Toddler (1-2 years)	4.5
Preschooler (3-5 years)	9.8
School-aged child (6-12 years)	24.3
Young adolescent (13-19 years)	16.4
No children are in our group	37.9
Other (WRITE)	1.5
<i>n</i> = 683	

**Table A1.30 Other (WRITE):**

	%
	99.1
Co-worker	0.2
Dog	0.1
Family reunion - all adults	0.1
Grandson	0.1
Workers	0.1
<i>n</i> = 683	

Appendix A2: [Kaloko-Honokōhau National Historical Park] Survey response frequencies



## Demographics

**Table A2.1 What is your gender?**

	%
Female	61.5
Male	38.5
<i>n</i> = 592	

**Table A2.2 Race**

	%
White	70
Black or African American	0.9
Asian	15.5
Native Hawaiian/Pacific Islander	4.3
American Indian or Alaska Native	1.6
Multirace	7.6
<i>n</i> = 554	

**Table A2.3 Are you of Hispanic, Latino, or Spanish descent?**

	%
No	88.1
Yes	11.9
<i>n</i> = 683	

**Table A2.4 Age**

	%
18-34	33.3
35-44	18.1
45-54	20.6
55-64	13.5
65+	14.5
<i>n</i> = 564	

**Table A2.5 Education**

	%
Less than high school	0.2
High school or GED	9.6
Some college, no degree	19.3
Associate degree	10.1
Bachelor's degree	29.4
Advanced degree beyond a bachelor's degree	31.5
<i>n</i> = 585	

**Table A2.6 State**

	%
No Response	4.2
AZ	2.4
CA	23.8
CO	0.7
CT	1.1
FL	1.5
GA	0.3
HI	25.4
ID	1.3
IL	2.0
KY	0.3
MA	2.4
MD	1.3
ME	0.2
MI	0.7
MN	0.2
MO	1.6
MT	0.5
NC	1.1
NH	0.2
NJ	0.5
NM	0.5
NV	0.7
NY	1.6
OH	0.7
OK	0.3
OR	5.5
PA	2.3
TN	0.2
TX	1.6
UT	2.3
VA	2.1
WA	9.1
WI	0.7
Ontario, Canada	0.7
<i>n</i> = 613	

**Table A2.7 Is the respondent in a group that took the survey?**

	%
Yes	79.0
No	21.0
<i>n</i> = 613	

**Table A2.8 How frequently do you spend time recreating on beaches or in other shoreline areas?**

	%
Weekly (one or more times a week)	31.5
Monthly (at least once a month)	20.1
Yearly (at least once a year)	31.0
On occasion (every few years)	8.7
This is my first visit	8.7
<i>n</i> = 597	

**Table A2.9 How frequently do you spend time recreating on this specific beach or shoreline site?**

	%
Weekly (one or more times a week)	12.8
Monthly (at least once a month)	13.0
Yearly (at least once a year)	11.2
On occasion (every few years)	10.0
This is my first visit	53.0
<i>n</i> = 562	

**Table A2.10 Which activities do you USUALLY engage in on the beach or shore?**

	%
Swimming or wading	87.3
Sunbathing	58.2
Snorkeling	51.7
Beach walking or hiking	73.2
Surfing	10.0
SCUBA	8.0
Fishing	12.4
Boating (e.g., kayak, motorboat)	15.3
Windsurfing or kitesurfing	1.8

Other (WRITE):	7.2
<i>n</i> = 613	

**Table A2.11 Which activities do you plan on engaging in TODAY at this site?**

	%
Swimming or wading	69.0
Sunbathing	40.5
Snorkeling	28.2
Beach walking or hiking	45.0
Surfing	1.3
SCUBA	0.5
Fishing	1.5
Boating (e.g., kayak, motorboat)	0.2
Windsurfing or kitesurfing	0.2
Other	3.1
<i>n</i> = 613	

**Table A2.12 Other (WRITE):**

	%
BBQ	0.2
Bird Watching	0.4
Boogie boarding	0.4
Canoeing	0.2
Chilling	0.2
Dog walking	0.4
Eat food	0.4
Exercise on sand, play in sand w/ kids	0.2
Free diving	0.2
Girl watching	0.2
Have coffee, read paper.	0.2
Hiking	0.2
Ke kai moni seal ola response team	0.2
Kite flying	0.2
Outrigger	0.2
Paddleboarding	10.7
Photography	0.2
Play in sand	0.4
Reading	0.3
Reading and relaxing	0.4
Relax in shade	0.4

Sailing	0.2
See the turtles	0.2
Sightseeing	0.4
Sitting	0.4
Sitting & reading	0.2
Sitting in the shade	0.2
Sleeping/napping	0.2
Turtle or dolphin watching	0.2
Visit national parks	0.2
Visiting with friends	0.2
Watching turtles	0.2
Wildlife	0.2
Yoga	0.2
<i>n</i> = 613	

**Table A2.13 When you go to the beach or the shore, how likely are you to...**

		%
<b>Stay in the shade</b>	Very likely	41.6
	Somewhat likely	31.5
	Neither likely nor unlikely	12.1
	Somewhat unlikely	8.8
	Very unlikely	6.1
	Don't know	
	<i>n</i> = 604	
<b>Wear a baseball cap or sun visor</b>	Very likely	51.6
	Somewhat likely	18.8
	Neither likely nor unlikely	6.8
	Somewhat unlikely	8.0
	Very unlikely	14.9
	Don't know	
	<i>n</i> = 591	
<b>Wear a hat that shades your face, ears, and neck</b>	Very likely	40.1
	Somewhat likely	16.9
	Neither likely nor unlikely	9.5
	Somewhat unlikely	14.4
	Very unlikely	18.8
	Don't know	0.3
	<i>n</i> = 591	
	Very likely	14.9

	Somewhat likely	13.7
	Neither likely nor unlikely	10.2
<b>Wear a long-sleeved shirt</b>	Somewhat unlikely	13.0
	Very unlikely	47.8
	Don't know	0.3
	<i>n = 598</i>	
	Very likely	4.4
	Somewhat likely	5.3
	Neither likely nor unlikely	9.2
<b>Wear long pants or other clothing that reaches your ankles</b>	Somewhat unlikely	12.2
	Very unlikely	68.0
	Don't know	0.9
	<i>n = 588</i>	
	Very likely	68.8
	Somewhat likely	15.2
	Neither likely nor unlikely	4.4
<b>Use sunscreen (any type)?</b>	Somewhat unlikely	3.2
	Very unlikely	8.0
	Don't know	0.3
	<i>n = 597</i>	
	Very likely	58.4
	Somewhat likely	14.8
	Neither likely nor unlikely	7.9
<b>Use "reef safe," "reef friendly" or "coral safe" sunscreen</b>	Somewhat unlikely	3.4
	Very unlikely	5.7
	Don't know	9.8
	<i>n = 594</i>	
	Very likely	26.7
	Somewhat likely	15.4
	Neither likely nor unlikely	14.3
<b>Use mineral-based sunscreen</b>	Somewhat unlikely	3.9
	Very unlikely	14.5
	Don't know	25.3
	<i>n = 566</i>	
	Very likely	11.6
	Somewhat likely	7.6
	Neither likely nor unlikely	7.6
<b>Not use any form of sun protection</b>	Somewhat unlikely	7.6
	Very unlikely	64.2

Don't know	1.2
<i>n</i> = 578	

**Table A2.14 Do you plan on using any of these methods to protect yourself from the sun during your visit today?**

	%
Stay in the shade	76.3
Wear a baseball cap or sun visor	49.4
Wear a hat that shades my face, ears, and neck	33.3
Wear a long-sleeved shirt	16.0
Wear long pants or other long clothing	5.9
Use sunscreen	78.6
Other	4.4
I do not plan on using sun protection	6.5
<i>n</i> = 683	

**Table A2.15 Other (WRITE):**

	%
Couldn't bring my hat here	0.2
Didn't buy any sunscreen yet	0.2
Full body skin suit	0.2
Life vest	0.2
Limit exposure	0.2
Not today, doing spiritual cleanse	0.2
Partially in the shade	0.2
Rash guard	0.6
Read in shade	0.4
Reef safe sunscreen	0.2
See #1, 2, and 3	0.2
Short sleeve shirt	0.6
Sun safety	0.2
Sunglasses	0.5
Towel	0.2
Umbrella	0.8
Use Little hands sunscreen	0.2
<i>n</i> = 613	

**Table A2.16 Does the sunscreen you are using today contain one or more of the following chemicals listed under “active ingredients”?**

	%
Titanium dioxide	4.9
Non-nano titanium dioxide	1.6
Zinc oxide	17.3
Non-nano zinc oxide	2.3
Octocrylene	27.9
Octisalate	24.0
Oxybenzone	3.8
Octinoxate	2.0
Avobenzone	28.7
Homosalate	25.8
Other (WRITE):	3.8
I don't know	27.9
<i>n</i> = 613	

**Table A2.17 Other (WRITE):**

	%
It's reef safe	0.4
It says reef friendly	0.7
N/A	0.4
No	0.2
No chemicals	0.2
None	0.6
Not using sunscreen today	0.2
Octo salicylate	0.2
Octyl salicylate	0.7
<i>n</i> = 613	

**Table A2.18 How is the sunscreen applied?**

	%
Spray	29.4
Cream	61.8
Other	2.6
<i>n</i> = 613	

**Table A2.19 Other (WRITE)**

	%
Balm	0.2



Both	0.2
Brushed on	0.2
Don't use	0.4
Liquid	0.2
N/A	0.4
Powder	0.2
Spray lotion	0.2
Stick	0.9
<i>n</i> = 613	

**Table A2.20 Who purchased the sunscreen?**

	%
I purchased it	54.6
A spouse or partner	18.8
A friend	7.0
A parent	4.1
Other (WRITE):	2.6
I don't know	2.0
<i>n</i> = 613	

**Table A2.21 Other (WRITE):**

	%
Family member	1.8
Gift	0.4
Host	0.3
N/A	0.3
Work	0.2
<i>n</i> = 613	

**Table A2.22 To what extent do you agree or disagree with the following statements?**

		%
<b>Human activities have little effect on ocean life.</b>	Strongly agree	10.0
	Somewhat agree	4.3
	Neither agree nor disagree	3.2
	Somewhat disagree	9.8
	Strongly disagree	72.8
	<i>n</i> = 602	
	Strongly agree	13.8
	Somewhat agree	9.5

<b>Sunscreen chemicals are unlikely to contribute to water pollution</b>	Neither agree nor disagree	9.0
	Somewhat disagree	13.3
	Strongly disagree	54.5
	<i>n</i> = 602	
<b>Sunscreen chemicals likely harm corals.</b>	Strongly agree	64.8
	Somewhat agree	16.6
	Neither agree nor disagree	8.3
	Somewhat disagree	2.2
	Strongly disagree	8.1
	<i>n</i> = 602	
<b>Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins. following statements?</b>	Strongly agree	62.2
	Somewhat agree	19.6
	Neither agree nor disagree	7.7
	Somewhat disagree	2.8
	Strongly disagree	7.7
<i>n</i> = 598		

**Table A2.23 Have you received sunscreen or sun protection information from any of the following Kaloko-Honokōhau National Historical Park sources or programs?**

	%
Staff	8.2
Website	4.6
Visitor center display	6.5
Sunscreen trade-in program	1.1
Information cards describing reef friendly sun protection	7.3
Concession selling reef friendly sunscreen and protective clothing	3.9
Online environmentally friendly sun protection pledge	2.0
Social media sites	7.0
Other (WRITE)	5.1
None of the above	62.5
<i>n</i> = 613	

**Table A2.24 Other (WRITE):**

	%
A person I met on the beach	0.2
Books	0.2
Common sense	0.2
Dermatologist	0.2
Family member	0.8

Internet	1.2
Local business	1.0
I'm part of	0.2
Info on product	0.2
Manauma Bay, Oahu 2016	0.2
Self-education	0.2
State govt	0.2
Sunscreen dispensed at beach	0.4
<i>n</i> = 613	

**Table A2.25 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	%
Not at all aware	28.1
Slightly aware	18.1
Somewhat aware	17.8
Moderately aware	18.8
Extremely aware	17.1
<i>n</i> = 601	

**Table A2.26 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	%
Not at all aware	15.0
Slightly aware	17.9
Somewhat aware	22.9
Moderately aware	27.6
Extremely aware	16.6
<i>n</i> = 602	

**Table A2.27 If you were to visit this park again, how likely would you be to take these actions?**

	%	
<b>Wear sun-protective clothing</b>	Very likely	38.3
	Somewhat likely	23.7
	Neither likely nor unlikely	12.4
	Somewhat unlikely	7.7
	Very unlikely	16.6

	Don't know	1.2
	<i>n</i> = 595	
<b>Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)</b>	Very likely	46.7
	Somewhat likely	21.3
	Neither likely nor unlikely	9.2
	Somewhat unlikely	2.8
	Very unlikely	9.9
	Don't know	10.2
	<i>n</i> = 578	
<b>Wear sun-protective clothing</b>	Very likely	39.5
	Somewhat likely	23.1
	Neither likely nor unlikely	13.1
	Somewhat unlikely	7.3
	Very unlikely	15.6
	Don't know	1.5
	<i>n</i> = 590	
<b>Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)</b>	Very likely	46.8
	Somewhat likely	22.6
	Neither likely nor unlikely	9.7
	Somewhat unlikely	2.2
	Very unlikely	8.9
	Don't know	9.7
	<i>n</i> = 585	

**Table A2.28 Besides yourself, how many other people are you here with today?**

	%
0	2.8
1	28.2
2	18.8
3	20.8
4	11.8
5	8.3
6	3.3
7	4.8
8	0.9
9	0.4
<i>n</i> = 568	

**Table A2.29 If there are other people with you visiting the site today ...**

	%
Friends	27.6
A spouse or partner	50.9
Other family members, including children or extended family	47.5
Infant (Less than 1 year old)	2.4
Toddler (1-2 years)	4.7
Preschooler (3-5 years)	9.8
School-aged child (6-12 years)	19.4
Young adolescent (13-19 years)	13.9
No children are in our group	38.8
Other (WRITE)	1.3
<i>n</i> = 683	

**Table A2.30 Other (WRITE):**

	%
Clients	0.2
Dog	0.2
Adult family member	0.4
N/A	0.2
Strangers	0.2
<i>n</i> = 613	

## Appendix B: Motivation for visiting the parks

**Table B1.1 Cape Lookout National Seashore**

<b>Why did you visit this national park today? (WRITE)</b>	
	%
Beach day	13.7%
Vacation	10.5%
Horses	9.9%
Shelling	9.7%
Lighthouse	9.5%
Family	9.5%
Pristine/beautiful/untouched	5.2%
Fun in sun	4.8%
Friends	4.4%
Recreation	3.6%
Relax	3.0%
First time	2.6%
National park	2.4%
Convenient	2.2%
Explore	2.0%
Recommended	1.8%

*n* = 504

**Table B1.2 Kaloko-Honokōhau National Historical Park**

<b>Why did you visit this national park today? (WRITE)</b>	
	%
Turtles	29.5%
Beach day	22.8%
Swimming/calm water	9.5%
Convenient	8.2%
Snorkel	7.5%
Recommended	6.0%
Friends	5.8%
Pristine/beautiful/untouched	5.6%
Relax	4.7%
Vacation	4.4%
Family	4.2%
History/cultural Significance	3.6%
National park	3.1%
Picnic	2.4%
Peaceful/quiet	2.2%
Kid friendly	2.2%
Dog friendly	2.2%
Fishing	2.2%
Not crowded	2.0%
Explore	2.0%

*n* = 549

## Appendix C: Sunscreen chemical database analyses



Appendix C1: [Cape Lookout National Seashore] Sunscreen chemical database analyses

**Table C1.1 Databases used for acquiring sunscreen chemical data\***

	%
National Institutes of Health	94.0
Environmental Working Group	3.1
Other (Google search)	2.9

*n* = 482

\*Databases: DailyMed, U.S. National Library of Medicine, National Institutes of Health, <https://dailymed.nlm.nih.gov/dailymed/index.cfm>; Environmental Working Group, <https://www.ewg.org/sunscreen/>

**Table C1.2 Number of sunscreen product matches to respondent-provided brand & SPF**

	%
1	9.5
2	9.3
3	1.9
4	3.9
5	11.0
More than 5	64.3

*n* = 482

**Table C1.3 Percent of respondents who provided sunscreen chemical information**

	%
No	67.5
Yes	32.5

*n*=683

**Table C1.4 Database records for respondents who *did not* provide sunscreen chemical information**

	%
Oxybenzone	14.3
Octinoxate	3.0
Octocrylene	48.6
Octisalate	42.7
Avobenzone	48.8
Homosalate	45.1
Titanium dioxide	2.0
Zinc oxide	8.9
Other	0.7

*n*=461

**Table C1.5 Database records for respondents who *did* provide sunscreen chemical information**

	%
Oxybenzone	13.1
Octinoxate	5.4
Octocrylene	62.6
Octisalate	55.9
Avobenzone	61.7
Homosalate	57.7
Titanium dioxide	12.2
Zinc oxide	23.9
Other	1.4

*n*=222

Appendix C2: [Kaloko-Honokōhau National Historical Park] Sunscreen chemical database  
analyses

**Table C2.1 Databases used for acquiring sunscreen chemical data\***

	%
National Institutes of Health	92.7
Environmental Working Group	3.9
Other (Google search)	3.4

*n* = 411

\*Databases: DailyMed, U.S. National Library of Medicine, National Institutes of Health, <https://dailymed.nlm.nih.gov/dailymed/index.cfm>; Environmental Working Group, <https://www.ewg.org/sunscreen/>

**Table C2.2 Number of sunscreen product matches to respondent-provided brand & SPF**

	%
1	11.9
2	13.9
3	2.7
4	3.9
5	5.4
More than 5	62.3

*n* = 411

**Table C2.3 Percent of respondents who provided sunscreen chemical information**

	%
No	50.2
Yes	49.8

*n*=613

**Table C2.4 Database records for respondents who *did not* provide sunscreen chemical information**

	%
Oxybenzone	2.6
Octinoxate	1.9
Octocrylene	35.7
Octisalate	30.8
Avobenzone	34.4
Homosalate	33.1
Titanium dioxide	1.9
Zinc oxide	7.1
Non-nano zinc oxide	0.3
Other	1.6

*n*=308

**Table C2.5 Database records for respondents who *did* provide sunscreen chemical information**

	%
Oxybenzone	12.5
Octinoxate	1.3
Octocrylene	57.7
Octisalate	47.2
Avobenzene	55.7
Homosalate	48.9
Titanium dioxide	9.2
Zinc oxide	25.6
Non-nano zinc oxide	1.6
Other	3.0

*n*=305

## Appendix D. Interventions and behavioral intent

Appendix D1. [Cape Lookout National Seashore] Interventions and behavioral intent



**Table D1.1 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Exposure to National Park Service intervention(s)=1.00	3.149	1	0.076	1.434	0.963	2.135
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=613)=3.149, p=.076$

**Table D1.2 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Exposure to intervention(s)=1.00	3.297	1	0.069	1.490	0.969	2.293
Exposure to intervention(s)=.00				1		

$\chi^2 (1, n=506)=3.297, p=.069$

**Table D1.3 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Exposure to National Park Service intervention(s)=1.00	3.138	1	0.077	1.432	0.963	2.129
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=608)=3.138, p=.077$

**Table D1.4 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
<b>Exposure to National Park Service intervention(s)=1.00</b>	<b>4.118</b>	<b>1</b>	<b>0.042</b>	<b>1.553</b>	<b>1.015</b>	<b>2.377</b>
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=523)=4.118, p=.042$

Appendix D2. [Kaloko-Honokōhau National Historical Park] Interventions and behavioral intent

**Table D2.1 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	<i>df</i>	<i>p</i>		Lower	Upper
Staff	1.514	1	0.218	0.702	0.400	1.233
Website	1.446	1	0.229	1.602	0.743	3.456
<b>Visitor center display</b>	<b>8.288</b>	<b>1</b>	<b>0.004</b>	<b>2.851</b>	<b>1.397</b>	<b>5.819</b>
Sunscreen trade-in	0.459	1	0.498	1.670	0.379	7.357
Information cards	1.990	1	0.158	1.562	0.841	2.903
Concession	0.008	1	0.929	0.964	0.425	2.184
Online pledge	1.034	1	0.309	1.880	0.557	6.348
Social media sites	2.198	1	0.138	0.629	0.340	1.161

*Contrast category, "other" or no program exposure*

$\chi^2 (8, n=581)=20.450, p=.009$

**Table D2.2 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$			Odds ratio	95% Confidence Interval	
	$\chi^2$	<i>df</i>	<i>p</i>		Lower	Upper
<b>Exposure to National Park Service intervention(s)=1.00</b>	<b>5.539</b>	<b>1</b>	<b>0.019</b>	<b>1.459</b>	<b>1.065</b>	<b>1.999</b>
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=588)=5.539, p=.019$

**Table D2.3 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$			Odds ratio	95% Confidence Interval	
	$\chi^2$	<i>df</i>	<i>p</i>		Lower	Upper
Exposure to National Park Service intervention(s)=1.00	2.962	1	0.085	1.357	0.958	1.922
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=519)=2.962, p=.085$

**Table D2.4 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	<i>df</i>	<i>p</i>	Odds ratio	95% Confidence Interval	
					Lower	Upper
<b>Exposure to National Park Service intervention(s)=1.00</b>	<b>6.185</b>	<b>1</b>	<b>0.013</b>	<b>1.500</b>	<b>1.090</b>	<b>2.064</b>
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=581)=6.185, p=.013$

**Table D2.5 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	<i>df</i>	<i>p</i>	Odds ratio	95% Confidence Interval	
					Lower	Upper
Exposure to National Park Service intervention(s)=1.00	2.068	1	0.150	1.289	0.912	1.822
Exposure to National Park Service intervention(s)=.00				1		

$\chi^2 (1, n=528)=2.068, p=.150$

## Appendix E. Audience analyses

Appendix E1. [Cape Lookout National Seashore] Audience analyses

**Table E1. 1 Model fit criteria**

<i>Models</i>	<b>LL</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>
2 Class	-8073.52	16249.04	16479.89	16317.96
3 Class	-7908.86	15971.71	16320.25	16075.77
4 Class	-7761.05	15728.10	16194.33	15867.29
5 Class	-7649.99	15557.97	16141.89	15732.30

\*LL = log-likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; SABIC = sample-size adjusted BIC.

**Table E1. 2 Diagnostic criteria**

<i>Models</i>	<b>Smallest class count (n)</b>	<b>Smallest class size (%)</b>	<b>Entropy</b>	<b>LL (parametric bootstrapped likelihood ratio test)</b>	<b>2x LL difference</b>	<b>p</b>
2 Class	285	41.7%	0.77	-8448.99	750.943	<0.001
3 Class	135	19.8%	0.81	-8073.52	329.324	<0.001
4 Class	57	8.3%	0.84	-7908.86	295.61	<0.001
5 Class	51	7.5%	0.88	-7761.05	222.133	<0.001

**Table E1.3 [Cape Lookout National Seashore] Probability of the members of each audience ranking high on each of the 25 variables included in the Latent Class Analysis (coded 0-1).**

		<b>In-state frequent park visitors (19.6%)</b>	<b>Sunscreen protection tourists (28.8%)</b>	<b>Multi-modal sun protection tourists (43.2%)</b>	<b>Frequent beachgoers who skip sunscreen (8.3%)</b>
Motivation	See horses	0.024	0.158	0.106	0.000
	Go shelling	0.045	0.121	0.117	0.000
Beach visitation	N. Carolina resident	0.866	0.531	0.480	0.693
	Frequent beachgoer	1.000	0.457	0.207	0.482
	Frequent park visitor	0.780	0.208	0.000	0.314
Park recreation	Swim	0.860	0.850	0.690	0.493
	Sunbathe	0.641	0.728	0.435	0.376
	Walk	0.617	0.769	0.689	0.459
	Fish	0.180	0.054	0.094	0.157
	Boat	0.450	0.102	0.128	0.170

Usual sun protection	Cap	0.983	0.309	0.952	0.408
	Hat	0.865	0.102	0.882	0.217
	Shirt	0.484	0.033	0.342	0.107
	Sunscreen (any)	0.955	0.979	0.974	0.119
	Reef safe sunscreen	0.449	0.297	0.380	0.066
	Mineral sunscreen	0.453	0.279	0.398	0.000
	None	0.115	0.079	0.106	0.570
	Park sun protection	Shade	0.625	0.371	0.606
Cap		0.833	0.370	0.760	0.357
Hat		0.614	0.153	0.587	0.156
Shirt		0.376	0.048	0.248	0.018
Sunscreen		0.871	0.970	0.931	0.338
None		0.007	0.000	0.004	0.366
Children in the group		0.213	0.088	0.104	0.051
NPS staff contact	0.059	0.040	0.038	0.140	

**Table E1. 4 Audience demographic characteristics and intervention exposure**

		<b>In-state frequent park visitors (19.6%)</b>	<b>Sunscreen protection tourists (28.8%)</b>	<b>Multi-modal sun protection tourists (43.2%)</b>	<b>Frequent beachgoers who skip sunscreen (8.3%)</b>
<b>Gender*</b>	<b>Female</b>	66.4%	67.2%	59.4%	46.9%
	<b>Male</b>	33.6%	32.8%	40.2%	51.0%
<b>Race***</b>	<b>White</b>	96.6%	94.2%	96.5%	82.0%
	<b>Black</b>	0.0%	1.7%	0.8%	12.0%
	<b>Asian</b>	0.8%	0.6%	1.6%	0.0%
	<b>Native Hawaiian/ Pacific Islander</b>	0.8%	0.0%	0.4%	0.0%
	<b>American Indian/ Alaska Native</b>	0.8%	0.0%	0.0%	0.0%
	<b>Multi-race</b>	0.8%	3.5%	0.8%	6.0%
<b>Ethnicity*</b>	<b>Hispanic</b>	5.2%	5.1%	4.4%	3.5%
<b>Age*</b>	<b>18-34</b>	22.7%	45.7%	39.4%	32.6%



	<b>35-44</b>	24.4%	16.8%	20.7%	13.0%
	<b>45-54</b>	20.2%	15.0%	16.3%	17.4%
	<b>55-64</b>	20.2%	16.2%	13.9%	23.9%
	<b>65+</b>	12.6%	6.4%	9.6%	13.0%
<b>Education*</b>	<b>High school or GED</b>	13.1%	11.4%	8.5%	11.8%
	<b>Some college, no degree</b>	13.1%	20.6%	13.8%	37.3%
	<b>Associate degree</b>	14.8%	11.4%	12.7%	11.8%
	<b>Bachelor's degree</b>	37.7%	34.9%	35.0%	23.5%
	<b>Advanced degree</b>	21.3%	21.7%	30.0%	15.7%
<b>NPS intervention exposure</b>	<b>Staff*</b>	5.2%	3.6%	4.4%	14.0%
	<b>Website</b>	2.2%	2.5%	4.1%	1.8%
	<b>Online pledge</b>	0.0%	1.0%	1.4%	3.5%
	<b>Park signs</b>	4.5%	3.6%	3.7%	3.5%
	<b>Social media sites</b>	3.7%	3.0%	4.1%	3.5%
	<i>n</i> =	134	197	295	57

$\chi^2$ , \*\*\*,  $p < .001$ ,  $p < .001$ ,  $p < .05$

**Table E1. 5 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	Wald	<i>df</i>	<i>p</i>	Odds ratio	95% Confidence Interval	
					Lower	Upper
<b>Multi-modal sun protection tourists (43.2%)</b>	<b>73.388</b>	<b>1</b>	<b>0.000</b>	<b>4.915</b>	<b>3.414</b>	<b>7.075</b>
<b>In-state frequent park visitors (19.6%)</b>	<b>53.433</b>	<b>1</b>	<b>0.000</b>	<b>5.151</b>	<b>3.319</b>	<b>7.994</b>
<b>Frequent beachgoers who skip sunscreen (8.3%)</b>	<b>5.561</b>	<b>1</b>	<b>0.018</b>	<b>0.506</b>	<b>0.288</b>	<b>0.891</b>
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2$  (3,  $n=613$ )=119.197,  $p < .001$

**Table E1.6 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	Wald	<i>df</i>	<i>p</i>	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (43.2%)	0.373	1	0.541	1.129	0.765	1.666
In-state frequent park visitors (19.6%)	0.286	1	0.593	1.134	0.715	1.799
<b>Frequent beachgoers who skip sunscreen (8.3%)</b>	<b>49.142</b>	<b>1</b>	<b>0.000</b>	<b>0.089</b>	<b>0.045</b>	<b>0.174</b>
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2$  (3,  $n=506$ )=61.124,  $p < .001$

**Table E1. 7 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
<b>Multi-modal sun protection tourists (43.2%)</b>	<b>79.759</b>	<b>1</b>	<b>0.000</b>	<b>5.382</b>	<b>3.720</b>	<b>7.787</b>
<b>In-state frequent park visitors (19.6%)</b>	<b>56.292</b>	<b>1</b>	<b>0.000</b>	<b>5.429</b>	<b>3.490</b>	<b>8.446</b>
Frequent beachgoers who skip sunscreen (8.3%)	2.935	1	0.087	0.607	0.342	1.075
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2$  (3, n=608)=119.543, p<.001

**Table E1. 8 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (43.2%)	1.978	1	0.160	1.321	0.896	1.948
In-state frequent park visitors (19.6%)	0.541	1	0.462	1.186	0.753	1.868
<b>Frequent beachgoers who skip sunscreen (8.3%)</b>	<b>51.785</b>	<b>1</b>	<b>0.000</b>	<b>0.090</b>	<b>0.047</b>	<b>0.174</b>
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2$  (3, n=523)=70.705, p<.001

**Table E1. 9 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
<b>Multi-modal sun protection tourists (43.2%)</b>	<b>7.860</b>	<b>1</b>	<b>0.005</b>	<b>1.744</b>	<b>1.182</b>	<b>2.572</b>
<b>In-state frequent park visitors (19.6%)</b>	<b>7.663</b>	<b>1</b>	<b>0.006</b>	<b>1.914</b>	<b>1.209</b>	<b>3.030</b>
<b>Frequent beachgoers who skip sunscreen (8.3%)</b>	<b>6.650</b>	<b>1</b>	<b>0.010</b>	<b>2.186</b>	<b>1.206</b>	<b>3.961</b>
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2$  (3, n=645)=11.637, p<.01

**Table E1.10 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (43.2%)	5.687	1	0.017	1.531	1.079	2.172
In-state frequent park visitors (19.6%)	4.846	1	0.028	1.603	1.053	2.441
Frequent beachgoers who skip sunscreen (8.3%)	3.764	1	0.052	1.735	0.994	3.029
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2 (3, n=642)=7.814, p=.050$

**Table E1.11 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (43.2%)	0.276	1	0.600	1.106	0.759	1.612
<b>In-state frequent park visitors (19.6%)</b>	<b>11.342</b>	<b>1</b>	<b>0.001</b>	<b>2.121</b>	<b>1.369</b>	<b>3.285</b>
Frequent beachgoers who skip sunscreen (8.3%)	0.134	1	0.714	1.120	0.610	2.056
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2 (3, n=650)=13.637, p<.01$

**Table E1.12 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (43.2%)	0.221	1	0.638	1.083	0.778	1.506
<b>In-state frequent park visitors (19.6%)</b>	<b>4.628</b>	<b>1</b>	<b>0.031</b>	<b>1.554</b>	<b>1.040</b>	<b>2.323</b>
Frequent beachgoers who skip sunscreen (8.3%)	2.652	1	0.103	1.564	0.913	2.681
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2 (3, n=649)=6.640, p=.084$

**Table E1. 13 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	<i>df</i>	<i>p</i>		Lower	Upper
Multi-modal sun protection tourists (43.2%)	0.328	1	0.567	1.102	0.790	1.539
In-state frequent park visitors (19.6%)	1.224	1	0.269	1.259	0.837	1.892
Frequent beachgoers who skip sunscreen (8.3%)	0.966	1	0.326	1.317	0.760	2.281
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2 (3, n=650)=1.714, p=.634$

**Table E1.14 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	<i>df</i>	<i>p</i>		Lower	Upper
Multi-modal sun protection tourists (43.2%)	0.093	1	0.760	1.054	0.754	1.473
In-state frequent park visitors (19.6%)	0.534	1	0.465	1.165	0.773	1.756
Frequent beachgoers who skip sunscreen (8.3%)	0.755	1	0.385	1.277	0.736	2.216
<i>Sunscreen protection tourists (28.8%)</i>				1		

$\chi^2 (3, n=647)=1.061, p=.787$

Appendix E2. [Kaloko-Honokōhau National Historical Park] Audience analyses

**Table E2.1 Model fit criteria**

<i>Models</i>	<b>LL</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>
2 Class	-6918.47	13922.94	14112.93	13976.41
3 Class	-6695.88	13521.75	13808.95	13602.58
4 Class	-6564.60	13303.19	13687.59	13411.38
5 Class	-6468.77	13155.55	13637.15	13291.10

*\*LL = log-likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; SABIC = sample-size adjusted BIC.*

**Table E2.2 Diagnostic criteria**

<i>Models</i>	<b>Smallest class count (n)</b>	<b>Smallest class size (%)</b>	<b>Entropy</b>	<b>LL (parametric bootstrapped likelihood ratio test)</b>	<b>2x LL difference</b>	<b><i>p</i></b>
2 Class	227	37.0%	0.82	-7248.37	659.80	<0.001
3 Class	158	25.8%	0.85	-6918.47	445.19	<0.001
4 Class	72	11.7%	0.87	-6695.88	262.56	<0.001
5 Class	79	12.9%	0.86	-6566.75	195.94	<0.001

Observations, *n*=613

**Table E2.3 [Kaloko-Honokōhau National Historical Park] Probability of the members of each audience ranking high on each of the 21 variables included in the Latent Class Analysis (coded 0-1).**

		<b>In-state frequent park visitors (18.9%)</b>	<b>Sunscreen protection tourists (25.3%)</b>	<b>Multi-modal sun protection tourists (44.0%)</b>	<b>Frequent beachgoers who skip sunscreen (11.7%)</b>
	See turtles	0.143	0.415	0.350	0.108
Beach visitation	Hawaii resident	0.798	0.131	0.006	0.522
	Frequent beachgoer	0.984	0.429	0.303	0.721
	Frequent park visitor	0.816	0.184	0.000	0.448
Park recreation	Sunbathe	0.351	0.441	0.445	0.267
	Snorkel	0.169	0.325	0.334	0.190

Usual sun protection	Walk	0.335	0.446	0.527	0.373
	Shade	0.875	0.528	0.788	0.712
	Cap	0.897	0.150	0.981	0.554
	Hat	0.769	0.144	0.765	0.451
	Shirt	0.403	0.082	0.375	0.207
	Sunscreen (any)	0.881	0.943	0.934	0.167
	Reef safe sunscreen	0.879	0.734	0.745	0.410
	Mineral sunscreen	0.493	0.436	0.469	0.061
	None	0.226	0.133	0.080	0.691
	Park sun protection	Shade	0.859	0.622	0.850
Cap		0.624	0.086	0.728	0.295
Hat		0.442	0.115	0.435	0.246
Shirt		0.185	0.052	0.221	0.126
Sunscreen		0.764	0.921	0.924	0.022
None		0.038	0.000	0.005	0.476

**Table E2. 4 Audience demographic characteristics and intervention exposure**

		<b>In-state frequent park visitors (18.9%)</b>	<b>Sunscreen protection tourists (25.3%)</b>	<b>Multi-modal sun protection tourists (44.0%)</b>	<b>Frequent beachgoers who skip sunscreen (11.7%)</b>
<b>Gender**</b>	<b>Female</b>	67.8%	68.2%	59.9%	41.8%
	<b>Male</b>	32.2%	31.8%	40.1%	58.2%
<b>Race***</b>	<b>White</b>	69.7%	68.8%	71.5%	67.2%
	<b>Black</b>	0.9%	0.7%	0.4%	3.4%
	<b>Asian</b>	7.3%	13.0%	20.9%	13.8%
	<b>Native Hawaiian/ Pacific Islander</b>	10.1%	2.2%	2.4%	6.9%
	<b>American Indian/ Alaska Native</b>	1.8%	1.4%	1.2%	3.4%
	<b>Multi-race</b>	10.1%	13.8%	3.6%	5.2%
<b>Ethnicity*</b>	<b>Hispanic</b>	8.6%	16.1%	8.9%	19.4%
	<b>18-34</b>	24.8%	48.3%	32.1%	18.3%
<b>Age***</b>	<b>35-44</b>	17.4%	18.2%	19.8%	11.7%
	<b>45-54</b>	21.1%	15.4%	23.0%	21.7%
	<b>55-64</b>	11.0%	13.3%	14.3%	15.0%

	<b>65+</b>	25.7%	4.9%	10.7%	33.3%
<b>Education**</b>	<b>Less than high school</b>	0.0%	0.0%	0.0%	1.6%
	<b>High school or GED</b>	7.9%	10.9%	7.7%	17.2%
	<b>Some college, no degree</b>	18.4%	21.8%	15.4%	31.3%
	<b>Associate degree</b>	12.3%	10.9%	9.2%	7.8%
	<b>Bachelor's degree</b>	23.7%	32.7%	33.8%	14.1%
	<b>Advanced degree</b>	37.7%	23.8%	33.8%	28.1%
	<b>NPS intervention exposure</b>	<b>Staff</b>	9.5%	7.1%	7.4%
<b>Website</b>		3.4%	5.8%	4.8%	2.8%
<b>Visitor center</b>		7.8%	5.2%	7.4%	4.2%
<b>Sunscreen trade-in</b>		2.6%	0.0%	1.5%	0.0%
<b>Information cards</b>		6.9%	5.2%	9.6%	4.2%
<b>Concession *</b>		8.6%	2.6%	3.0%	2.8%
<b>Online pledge*</b>		5.2%	0.6%	1.9%	0.0%
<b>Social media sites</b>		6.9%	10.3%	5.6%	5.6%
	<b>n=</b>	116	155	270	72

$\chi^2$ , \*\*\*,  $p < .001$ ,  $p < .001$ ,  $p < .05$

**Table E2.5 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
<b>Multi-modal sun protection tourists (44.0%)</b>	<b>38.693</b>	<b>1</b>	<b>0.000</b>	<b>3.253</b>	<b>2.243</b>	<b>4.717</b>
<b>In-state frequent park visitors (18.9%)</b>	<b>18.300</b>	<b>1</b>	<b>0.000</b>	<b>2.651</b>	<b>1.696</b>	<b>4.143</b>
Frequent beachgoers who skip sunscreen (11.7%)	0.234	1	0.628	1.136	0.678	1.901
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2$  (3,  $n=588$ )=47.339,  $p < .001$

**Table E2.6 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (44.0%)	1.189	1	0.275	1.259	0.832	1.905
In-state frequent park visitors (18.9%)	0.000	1	0.999	1.000	0.612	1.634



<b>Frequent beachgoers who skip sunscreen (11.7%)</b>	<b>38.897</b>	<b>1</b>	<b>0.000</b>	<b>0.150</b>	<b>0.083</b>	<b>0.272</b>
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2(3, n=519)=56.933, p<.001$

**Table E2.7 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
<b>Multi-modal sun protection tourists (44.0%)</b>	<b>44.453</b>	<b>1</b>	<b>0.000</b>	<b>3.603</b>	<b>2.472</b>	<b>5.251</b>
<b>In-state frequent park visitors (18.9%)</b>	<b>19.964</b>	<b>1</b>	<b>0.000</b>	<b>2.788</b>	<b>1.778</b>	<b>4.372</b>
Frequent beachgoers who skip sunscreen (11.7%)	0.057	1	0.811	1.066	0.631	1.802
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2(3, n=581)=55.307, p<.001$

**Table E2.8 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.948	1	0.330	1.226	0.813	1.850
In-state frequent park visitors (18.9%)	0.046	1	0.831	1.055	0.645	1.726
<b>Frequent beachgoers who skip sunscreen (11.7%)</b>	<b>32.298</b>	<b>1</b>	<b>0.000</b>	<b>0.193</b>	<b>0.109</b>	<b>0.340</b>
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2(3, n=528)=48.905, p<.001$

**Table E2.9 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.997	1	0.318	1.199	0.840	1.711
<b>In-state frequent park visitors (18.9%)</b>	<b>27.567</b>	<b>1</b>	<b>0.000</b>	<b>3.236</b>	<b>2.087</b>	<b>5.016</b>

<b>Frequent beachgoers who skip sunscreen (11.7%)</b>	<b>9.382</b>	<b>1</b>	<b>0.002</b>	<b>2.219</b>	<b>1.332</b>	<b>3.694</b>
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		
$\chi^2 (3, n=601)=35.364, p<.001$						

**Table E2.10 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.277	1	0.599	1.100	0.772	1.566
<b>In-state frequent park visitors (18.9%)</b>	<b>14.311</b>	<b>1</b>	<b>0.000</b>	<b>2.319</b>	<b>1.500</b>	<b>3.586</b>
<b>Frequent beachgoers who skip sunscreen (11.7%)</b>	<b>6.058</b>	<b>1</b>	<b>0.014</b>	<b>1.893</b>	<b>1.139</b>	<b>3.148</b>
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		
$\chi^2 (3, n=602)=20.228, p<.001$						

**Table E2.11 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.387	1	0.534	1.158	0.729	1.839
In-state frequent park visitors (18.9%)	1.719	1	0.190	1.437	0.836	2.470
Frequent beachgoers who skip sunscreen (11.7%)	4.512	1	0.034	1.927	1.052	3.531
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		
$\chi^2 (3, n=602)=5.340, p=.149$						

**Table E2.12 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**

	Wald			Odds ratio	95% Confidence Interval	
	$\chi^2$	df	p		Lower	Upper
Multi-modal sun protection tourists (44.0%)	2.094	1	0.148	1.327	0.905	1.948
In-state frequent park visitors (18.9%)	0.200	1	0.655	1.113	0.697	1.777

Frequent beachgoers who skip sunscreen (11.7%)	1.461	1	0.227	1.394	0.813	2.390
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2 (3, n=602)=47.339, p=.438$

**Table E2.13 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?**

	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.108	1	0.742	1.070	0.716	1.598
In-state frequent park visitors (18.9%)	2.713	1	0.100	1.541	0.921	2.578
Frequent beachgoers who skip sunscreen (11.7%)	0.267	1	0.605	0.862	0.492	1.511
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2 (3, n=602)=47.339, p=.250$

**Table E2.14 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.] To what extent do you agree or disagree with the following statements?**

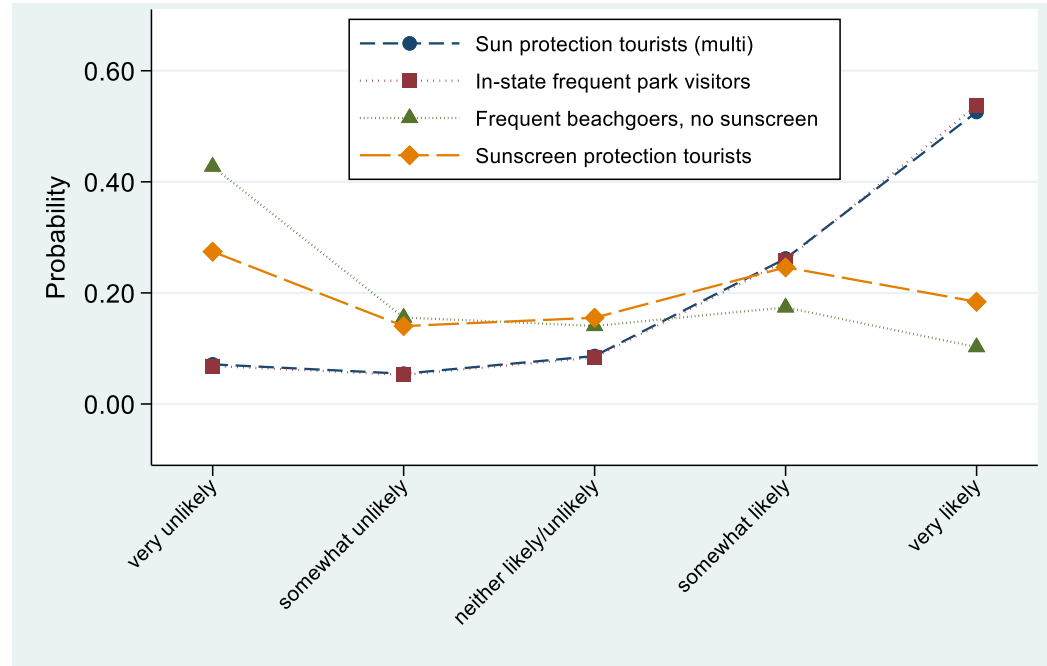
	Wald $\chi^2$	df	p	Odds ratio	95% Confidence Interval	
					Lower	Upper
Multi-modal sun protection tourists (44.0%)	0.004	1	0.950	0.987	0.664	1.468
In-state frequent park visitors (18.9%)	1.654	1	0.198	1.390	0.841	2.298
Frequent beachgoers who skip sunscreen (11.7%)	0.014	1	0.907	0.967	0.551	1.698
<i>Contrast category: Sunscreen protection tourists (25.3%)</i>				1		

$\chi^2 (3, n=598)=47.339, p=.482$

## Appendix F. Estimated marginal means by audience

Appendix F1. [Cape Lookout National Seashore] Estimated marginal means by audience

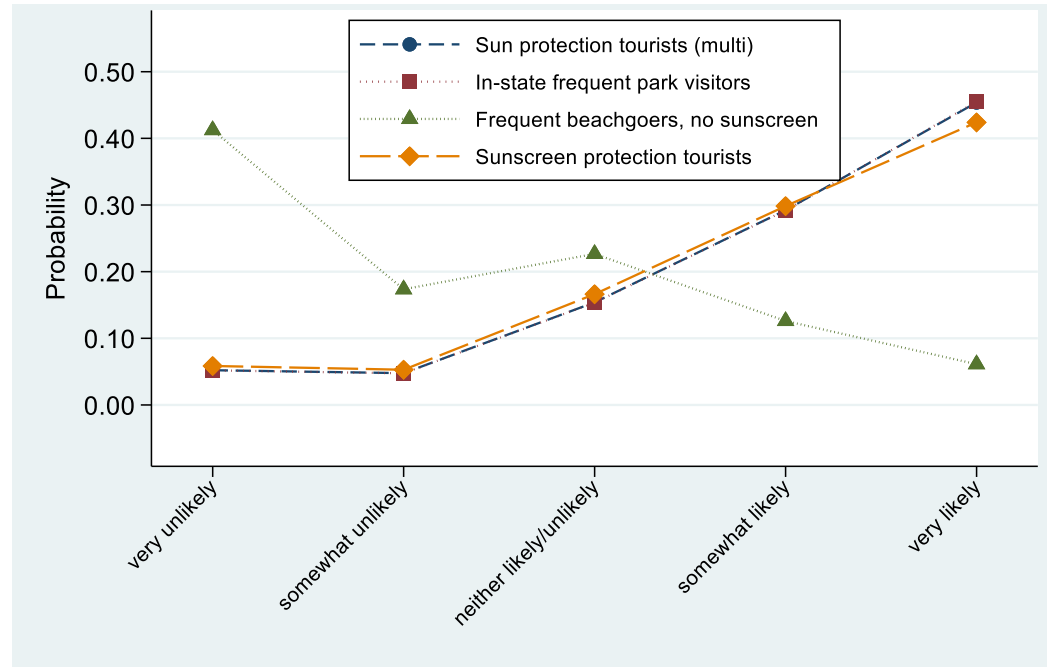
**Figure F1. 1 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**



**Table F1. 1 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (43.2%)	0.07	0.01	6.58	0.00	0.05	0.09
[Very unlikely] In-state frequent park visitors (19.6%)	0.07	0.01	5.24	0.00	0.04	0.09
[Very unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.43	0.06	6.82	0.00	0.30	0.55
[Very unlikely] Sunscreen protection tourists (28.8%)	0.27	0.03	9.04	0.00	0.21	0.33
[Somewhat unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	6.26	0.00	0.04	0.07
[Somewhat unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	5.31	0.00	0.03	0.07
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.16	0.02	7.73	0.00	0.12	0.20
[Somewhat unlikely] Sunscreen protection tourists (28.8%)	0.14	0.02	7.55	0.00	0.10	0.18
[Neither likely nor unlikely] Multi-modal sun protection tourists (43.2%)	0.09	0.01	7.49	0.00	0.06	0.11
[Neither likely nor unlikely] In-state frequent park visitors (19.6%)	0.08	0.01	6.35	0.00	0.06	0.11
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.14	0.02	7.38	0.00	0.10	0.18
[Neither likely nor unlikely] Sunscreen protection tourists (28.8%)	0.16	0.02	8.73	0.00	0.12	0.19
[Somewhat likely] Multi-modal sun protection tourists (43.2%)	0.26	0.02	13.37	0.00	0.22	0.30
[Somewhat likely] In-state frequent park visitors (19.6%)	0.26	0.02	11.58	0.00	0.21	0.30
[Somewhat likely] Frequent beachgoers who skip sunscreen (8.3%)	0.17	0.03	5.86	0.00	0.12	0.23
[Somewhat likely] Sunscreen protection tourists (28.8%)	0.25	0.02	11.99	0.00	0.21	0.29
[Very likely] Multi-modal sun protection tourists (43.2%)	0.53	0.03	17.61	0.00	0.47	0.58
[Very likely] In-state frequent park visitors (19.6%)	0.54	0.04	12.58	0.00	0.45	0.62
[Very likely] Frequent beachgoers who skip sunscreen (8.3%)	0.10	0.02	4.11	0.00	0.05	0.15
[Very likely] Sunscreen protection tourists (28.8%)	0.18	0.02	7.84	0.00	0.14	0.23

**Figure F1. 2 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

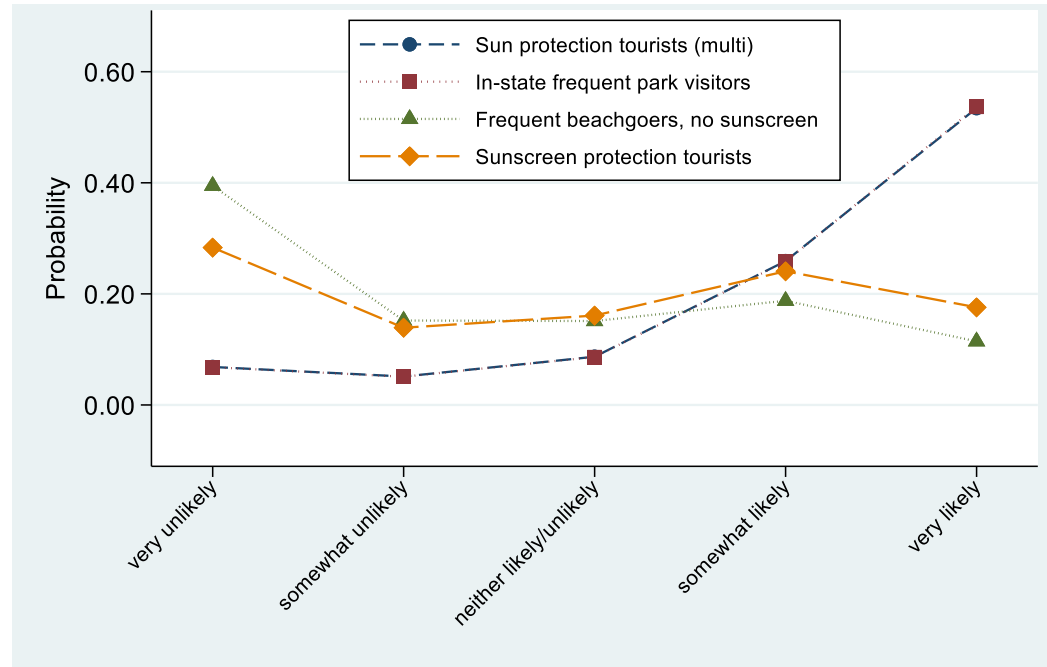




**Table F1. 2 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.04	0.00	0.03	0.07
[Very unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	4.27	0.00	0.03	0.08
[Very unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.41	0.07	5.81	0.00	0.27	0.55
[Very unlikely] Sunscreen protection tourists (28.8%)	0.06	0.01	4.72	0.00	0.03	0.08
[Somewhat unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	4.98	0.00	0.03	0.07
[Somewhat unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	4.34	0.00	0.03	0.07
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.17	0.03	5.72	0.00	0.11	0.23
[Somewhat unlikely] Sunscreen protection tourists (28.8%)	0.05	0.01	4.74	0.00	0.03	0.07
[Neither likely nor unlikely] Multi-modal sun protection tourists (43.2%)	0.15	0.02	8.36	0.00	0.12	0.19
[Neither likely nor unlikely] In-state frequent park visitors (19.6%)	0.15	0.02	6.86	0.00	0.11	0.20
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.23	0.03	6.80	0.00	0.16	0.29
[Neither likely nor unlikely] Sunscreen protection tourists (28.8%)	0.17	0.02	7.81	0.00	0.12	0.21
[Somewhat likely] Multi-modal sun protection tourists (43.2%)	0.29	0.02	13.65	0.00	0.25	0.33
[Somewhat likely] In-state frequent park visitors (19.6%)	0.29	0.02	12.92	0.00	0.25	0.34
[Somewhat likely] Frequent beachgoers who skip sunscreen (8.3%)	0.13	0.03	4.25	0.00	0.07	0.18
[Somewhat likely] Sunscreen protection tourists (28.8%)	0.30	0.02	13.67	0.00	0.26	0.34
[Very likely] Multi-modal sun protection tourists (43.2%)	0.45	0.03	14.01	0.00	0.39	0.52
[Very likely] In-state frequent park visitors (19.6%)	0.46	0.05	10.01	0.00	0.37	0.54
[Very likely] Frequent beachgoers who skip sunscreen (8.3%)	0.06	0.02	3.36	0.00	0.03	0.10
[Very likely] Sunscreen protection tourists (28.8%)	0.42	0.04	11.00	0.00	0.35	0.50

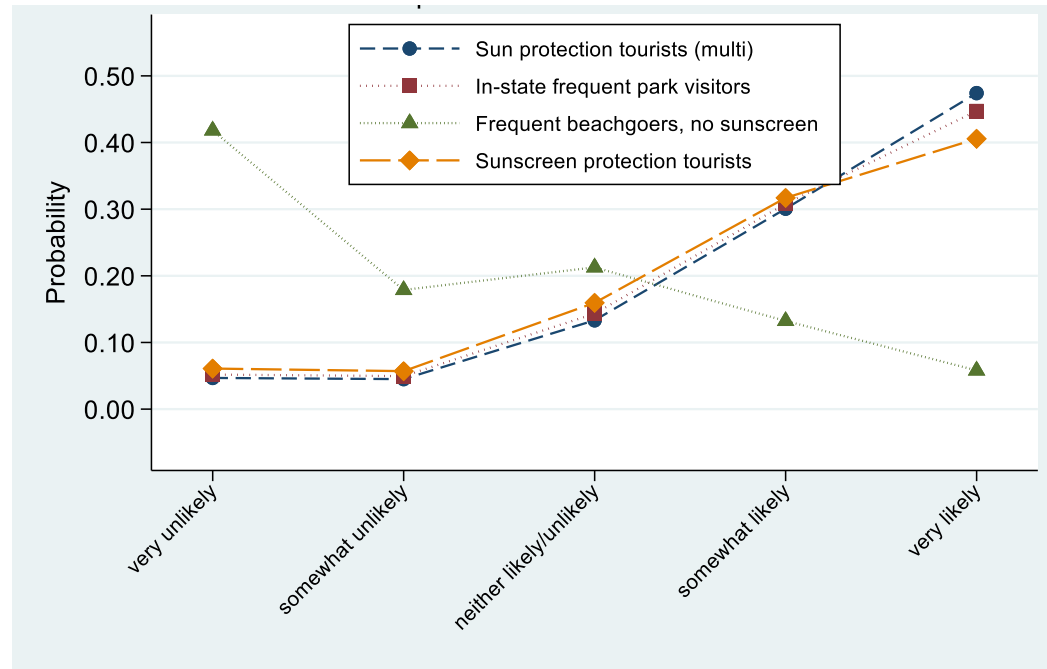
**Figure F1. 3 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**



**Table F1. 3 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (43.2%)	0.07	0.01	6.51	0.00	0.05	0.09
[Very unlikely] In-state frequent park visitors (19.6%)	0.07	0.01	5.20	0.00	0.04	0.09
[Very unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.39	0.06	6.33	0.00	0.27	0.52
[Very unlikely] Sunscreen protection tourists (28.8%)	0.28	0.03	9.11	0.00	0.22	0.34
[Somewhat unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	6.12	0.00	0.03	0.07
[Somewhat unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	5.22	0.00	0.03	0.07
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.15	0.02	7.53	0.00	0.11	0.19
[Somewhat unlikely] Sunscreen protection tourists (28.8%)	0.14	0.02	7.43	0.00	0.10	0.18
[Neither likely nor unlikely] Multi-modal sun protection tourists (43.2%)	0.09	0.01	7.52	0.00	0.06	0.11
[Neither likely nor unlikely] In-state frequent park visitors (19.6%)	0.09	0.01	6.35	0.00	0.06	0.11
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.15	0.02	7.87	0.00	0.11	0.19
[Neither likely nor unlikely] Sunscreen protection tourists (28.8%)	0.16	0.02	8.89	0.00	0.13	0.20
[Somewhat likely] Multi-modal sun protection tourists (43.2%)	0.26	0.02	13.20	0.00	0.22	0.30
[Somewhat likely] In-state frequent park visitors (19.6%)	0.26	0.02	11.50	0.00	0.21	0.30
[Somewhat likely] Frequent beachgoers who skip sunscreen (8.3%)	0.19	0.03	6.12	0.00	0.13	0.25
[Somewhat likely] Sunscreen protection tourists (28.8%)	0.24	0.02	11.67	0.00	0.20	0.28
[Very likely] Multi-modal sun protection tourists (43.2%)	0.53	0.03	17.91	0.00	0.48	0.59
[Very likely] In-state frequent park visitors (19.6%)	0.54	0.04	12.46	0.00	0.45	0.62
[Very likely] Frequent beachgoers who skip sunscreen (8.3%)	0.11	0.03	4.13	0.00	0.06	0.17
[Very likely] Sunscreen protection tourists (28.8%)	0.18	0.02	7.67	0.00	0.13	0.22

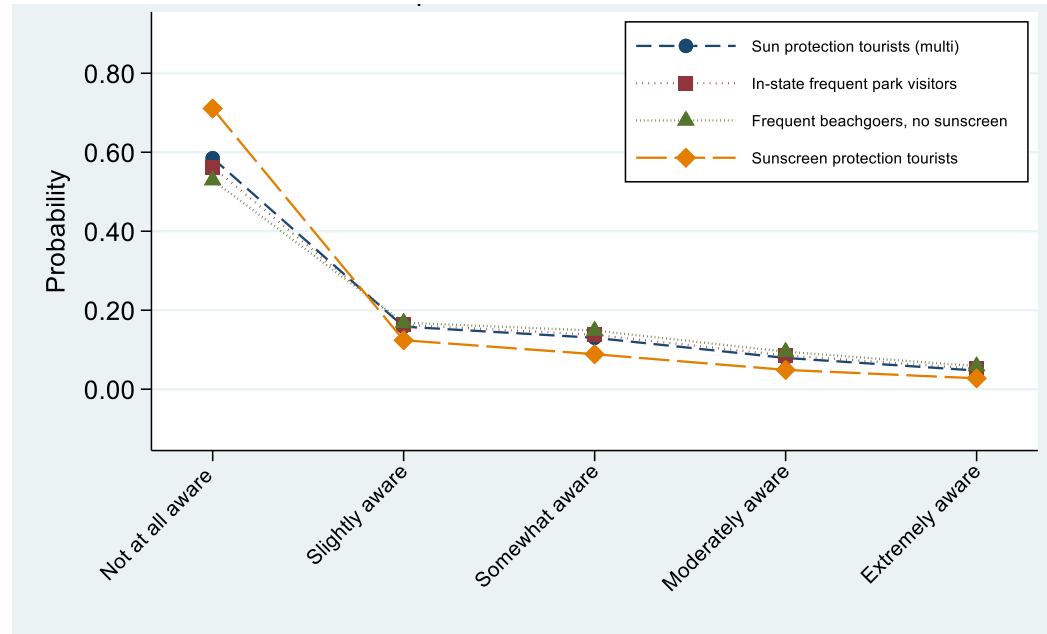
**Figure F1. 4 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**



**Table F1. 4 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.00	0.00	0.03	0.07
[Very unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	4.35	0.00	0.03	0.08
[Very unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.42	0.07	6.00	0.00	0.28	0.55
[Very unlikely] Sunscreen protection tourists (28.8%)	0.06	0.01	4.75	0.00	0.04	0.09
[Somewhat unlikely] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.01	0.00	0.03	0.06
[Somewhat unlikely] In-state frequent park visitors (19.6%)	0.05	0.01	4.48	0.00	0.03	0.07
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.18	0.03	5.82	0.00	0.12	0.24
[Somewhat unlikely] Sunscreen protection tourists (28.8%)	0.06	0.01	4.84	0.00	0.03	0.08
[Neither likely nor unlikely] Multi-modal sun protection tourists (43.2%)	0.13	0.02	7.99	0.00	0.10	0.17
[Neither likely nor unlikely] In-state frequent park visitors (19.6%)	0.14	0.02	6.80	0.00	0.10	0.18
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (8.3%)	0.21	0.03	6.67	0.00	0.15	0.28
[Neither likely nor unlikely] Sunscreen protection tourists (28.8%)	0.16	0.02	7.73	0.00	0.12	0.20
[Somewhat likely] Multi-modal sun protection tourists (43.2%)	0.30	0.02	14.03	0.00	0.26	0.34
[Somewhat likely] In-state frequent park visitors (19.6%)	0.31	0.02	13.45	0.00	0.26	0.35
[Somewhat likely] Frequent beachgoers who skip sunscreen (8.3%)	0.13	0.03	4.34	0.00	0.07	0.19
[Somewhat likely] Sunscreen protection tourists (28.8%)	0.32	0.02	14.45	0.00	0.27	0.36
[Very likely] Multi-modal sun protection tourists (43.2%)	0.47	0.03	14.80	0.00	0.41	0.54
[Very likely] In-state frequent park visitors (19.6%)	0.45	0.04	10.09	0.00	0.36	0.53
[Very likely] Frequent beachgoers who skip sunscreen (8.3%)	0.06	0.02	3.42	0.00	0.02	0.09
[Very likely] Sunscreen protection tourists (28.8%)	0.41	0.04	10.68	0.00	0.33	0.48

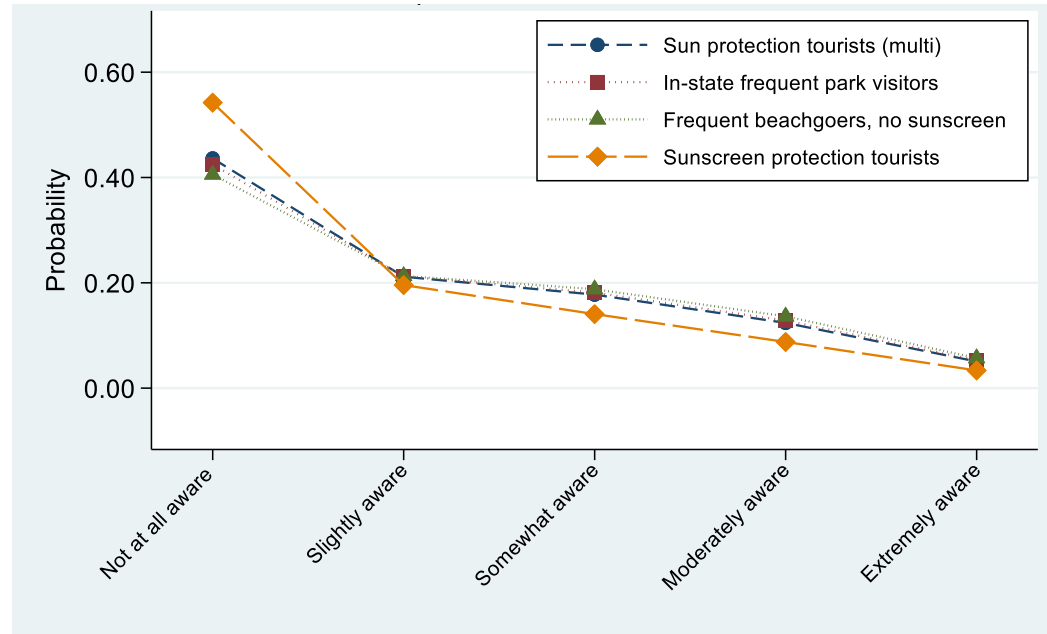
**Figure F1. 5 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**



**Table F1. 5 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Not at all aware] Multi-modal sun protection tourists (43.2%)	0.58	0.03	20.21	0.00	0.53	0.64
[Not at all aware] In-state frequent park visitors (19.6%)	0.56	0.04	13.43	0.00	0.48	0.64
[Not at all aware] Frequent beachgoers who skip sunscreen (8.3%)	0.53	0.07	7.99	0.00	0.40	0.66
[Not at all aware] Sunscreen protection tourists (28.8%)	0.71	0.03	21.71	0.00	0.65	0.77
[Slightly aware] Multi-modal sun protection tourists (43.2%)	0.16	0.02	10.26	0.00	0.13	0.19
[Slightly aware] In-state frequent park visitors (19.6%)	0.16	0.02	9.71	0.00	0.13	0.20
[Slightly aware] Frequent beachgoers who skip sunscreen (8.3%)	0.17	0.02	9.13	0.00	0.13	0.20
[Slightly aware] Sunscreen protection tourists (28.8%)	0.12	0.01	8.29	0.00	0.09	0.15
[Somewhat aware] Multi-modal sun protection tourists (43.2%)	0.13	0.02	8.44	0.00	0.10	0.16
[Somewhat aware] In-state frequent park visitors (19.6%)	0.14	0.02	7.34	0.00	0.10	0.17
[Somewhat aware] Frequent beachgoers who skip sunscreen (8.3%)	0.15	0.03	5.79	0.00	0.10	0.20
[Somewhat aware] Sunscreen protection tourists (28.8%)	0.09	0.01	6.60	0.00	0.06	0.11
[Moderately aware] Multi-modal sun protection tourists (43.2%)	0.08	0.01	6.37	0.00	0.05	0.10
[Moderately aware] In-state frequent park visitors (19.6%)	0.09	0.02	5.47	0.00	0.05	0.12
[Moderately aware] Frequent beachgoers who skip sunscreen (8.3%)	0.10	0.02	4.15	0.00	0.05	0.14
[Moderately aware] Sunscreen protection tourists (28.8%)	0.05	0.01	5.20	0.00	0.03	0.07
[Extremely aware] Multi-modal sun protection tourists (43.2%)	0.05	0.01	4.97	0.00	0.03	0.07
[Extremely aware] In-state frequent park visitors (19.6%)	0.05	0.01	4.34	0.00	0.03	0.07
[Extremely aware] Frequent beachgoers who skip sunscreen (8.3%)	0.06	0.02	3.37	0.00	0.02	0.09
[Extremely aware] Sunscreen protection tourists (28.8%)	0.03	0.01	4.26	0.00	0.01	0.04

**Figure F1. 6 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

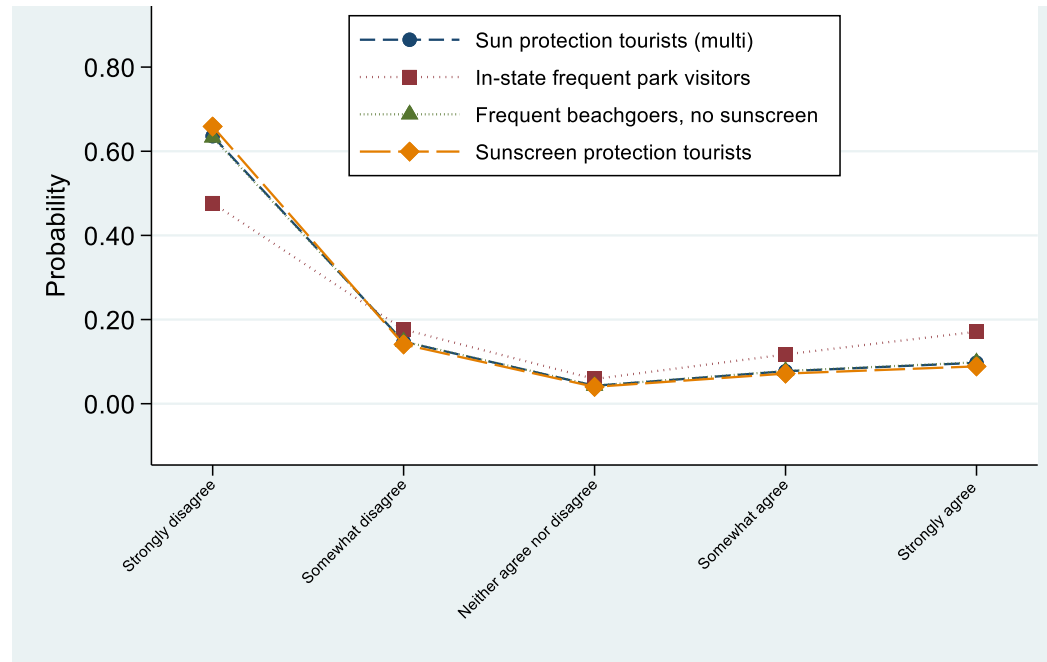




**Table F1. 6 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Not at all aware] Multi-modal sun protection tourists (43.2%)	0.44	0.03	15.42	0.00	0.38	0.49
[Not at all aware] In-state frequent park visitors (19.6%)	0.42	0.04	10.55	0.00	0.35	0.50
[Not at all aware] Frequent beachgoers who skip sunscreen (8.3%)	0.41	0.06	6.47	0.00	0.28	0.53
[Not at all aware] Sunscreen protection tourists (28.8%)	0.54	0.03	15.51	0.00	0.47	0.61
[Slightly aware] Multi-modal sun protection tourists (43.2%)	0.21	0.02	12.90	0.00	0.18	0.24
[Slightly aware] In-state frequent park visitors (19.6%)	0.21	0.02	12.85	0.00	0.18	0.24
[Slightly aware] Frequent beachgoers who skip sunscreen (8.3%)	0.21	0.02	12.92	0.00	0.18	0.25
[Slightly aware] Sunscreen protection tourists (28.8%)	0.20	0.02	11.91	0.00	0.16	0.23
[Somewhat aware] Multi-modal sun protection tourists (43.2%)	0.18	0.02	10.47	0.00	0.14	0.21
[Somewhat aware] In-state frequent park visitors (19.6%)	0.18	0.02	9.17	0.00	0.14	0.22
[Somewhat aware] Frequent beachgoers who skip sunscreen (8.3%)	0.19	0.03	7.36	0.00	0.14	0.24
[Somewhat aware] Sunscreen protection tourists (28.8%)	0.14	0.02	8.63	0.00	0.11	0.17
[Moderately aware] Multi-modal sun protection tourists (43.2%)	0.12	0.02	7.98	0.00	0.09	0.15
[Moderately aware] In-state frequent park visitors (19.6%)	0.13	0.02	6.57	0.00	0.09	0.17
[Moderately aware] Frequent beachgoers who skip sunscreen (8.3%)	0.14	0.03	4.67	0.00	0.08	0.19
[Moderately aware] Sunscreen protection tourists (28.8%)	0.09	0.01	6.52	0.00	0.06	0.11
[Extremely aware] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.18	0.00	0.03	0.07
[Extremely aware] In-state frequent park visitors (19.6%)	0.05	0.01	4.51	0.00	0.03	0.08
[Extremely aware] Frequent beachgoers who skip sunscreen (8.3%)	0.06	0.02	3.44	0.00	0.02	0.09
[Extremely aware] Sunscreen protection tourists (28.8%)	0.03	0.01	4.59	0.00	0.02	0.05

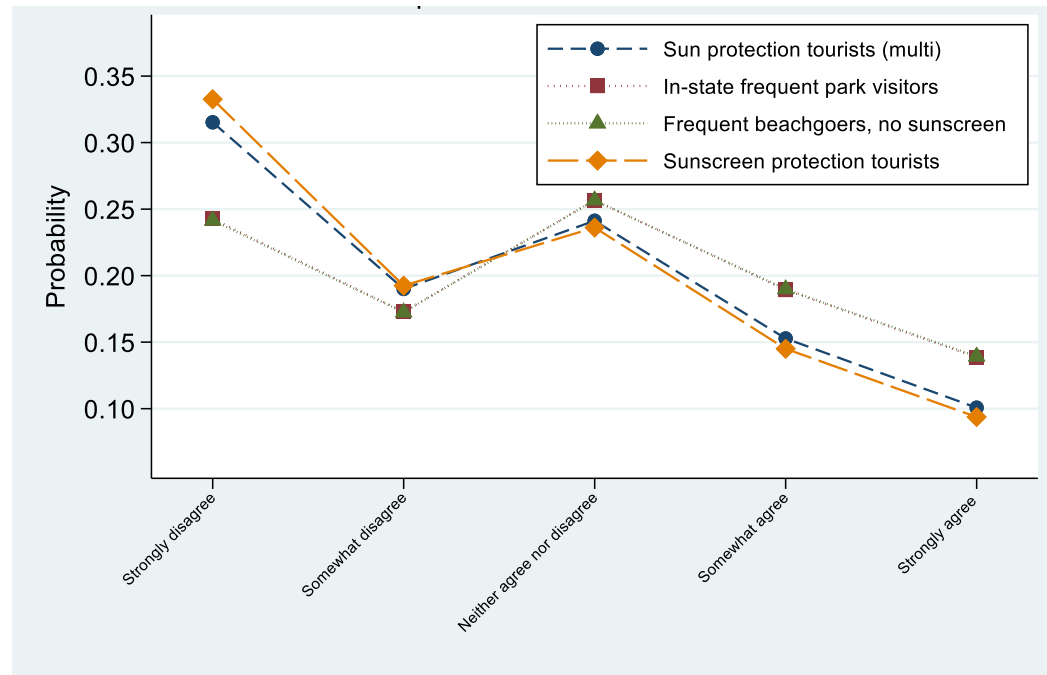
**Figure F1. 7 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**



**Table F1. 7 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (43.2%)	0.64	0.03	22.72	0.00	0.58	0.69
[Strongly disagree] In-state frequent park visitors (19.6%)	0.48	0.04	11.23	0.00	0.39	0.56
[Strongly disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.63	0.06	9.99	0.00	0.51	0.76
[Strongly disagree] Sunscreen protection tourists (28.8%)	0.66	0.03	19.38	0.00	0.59	0.73
[Somewhat disagree] Multi-modal sun protection tourists (43.2%)	0.15	0.01	9.95	0.00	0.12	0.18
[Somewhat disagree] In-state frequent park visitors (19.6%)	0.18	0.02	10.52	0.00	0.14	0.21
[Somewhat disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.15	0.02	7.01	0.00	0.11	0.19
[Somewhat disagree] Sunscreen protection tourists (28.8%)	0.14	0.02	9.11	0.00	0.11	0.17
[Neither agree nor disagree] Multi-modal sun protection tourists (43.2%)	0.04	0.01	5.28	0.00	0.03	0.06
[Neither agree nor disagree] In-state frequent park visitors (19.6%)	0.06	0.01	5.28	0.00	0.04	0.08
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.04	0.01	4.15	0.00	0.02	0.06
[Neither agree nor disagree] Sunscreen protection tourists (28.8%)	0.04	0.01	5.01	0.00	0.02	0.06
[Somewhat agree] Multi-modal sun protection tourists (43.2%)	0.08	0.01	6.83	0.00	0.05	0.10
[Somewhat agree] In-state frequent park visitors (19.6%)	0.12	0.02	6.65	0.00	0.08	0.15
[Somewhat agree] Frequent beachgoers who skip sunscreen (8.3%)	0.08	0.02	4.35	0.00	0.04	0.11
[Somewhat agree] Sunscreen protection tourists (28.8%)	0.07	0.01	6.09	0.00	0.05	0.09
[Strongly agree] Multi-modal sun protection tourists (43.2%)	0.10	0.01	7.03	0.00	0.07	0.12
[Strongly agree] In-state frequent park visitors (19.6%)	0.17	0.03	6.42	0.00	0.12	0.22
[Strongly agree] Frequent beachgoers who skip sunscreen (8.3%)	0.10	0.03	3.82	0.00	0.05	0.15
[Strongly agree] Sunscreen protection tourists (28.8%)	0.09	0.01	6.00	0.00	0.06	0.12

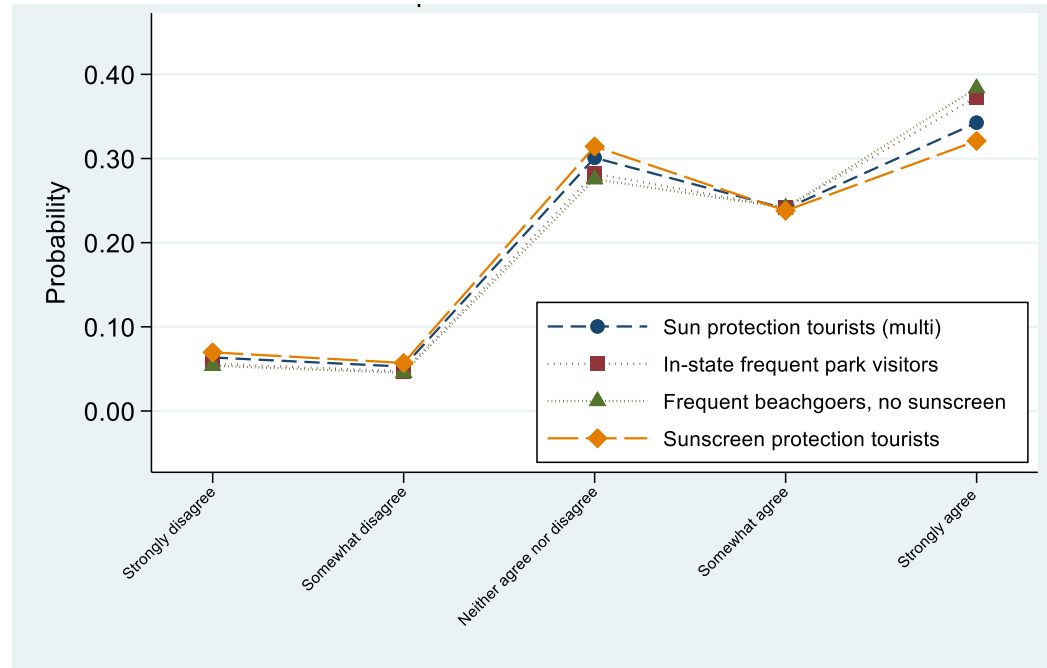
**Figure F1. 8 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**



**Table F1. 8 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (43.2%)	0.32	0.03	12.43	0.00	0.27	0.36
[Strongly disagree] In-state frequent park visitors (19.6%)	0.24	0.03	7.80	0.00	0.18	0.30
[Strongly disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.24	0.05	5.29	0.00	0.15	0.33
[Strongly disagree] Sunscreen protection tourists (28.8%)	0.33	0.03	11.04	0.00	0.27	0.39
[Somewhat disagree] Multi-modal sun protection tourists (43.2%)	0.19	0.02	11.99	0.00	0.16	0.22
[Somewhat disagree] In-state frequent park visitors (19.6%)	0.17	0.02	10.39	0.00	0.14	0.21
[Somewhat disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.17	0.02	8.69	0.00	0.13	0.21
[Somewhat disagree] Sunscreen protection tourists (28.8%)	0.19	0.02	12.04	0.00	0.16	0.22
[Neither agree nor disagree] Multi-modal sun protection tourists (43.2%)	0.24	0.02	13.83	0.00	0.21	0.28
[Neither agree nor disagree] In-state frequent park visitors (19.6%)	0.26	0.02	14.20	0.00	0.22	0.29
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.26	0.02	13.92	0.00	0.22	0.29
[Neither agree nor disagree] Sunscreen protection tourists (28.8%)	0.24	0.02	13.26	0.00	0.20	0.27
[Somewhat agree] Multi-modal sun protection tourists (43.2%)	0.15	0.02	9.50	0.00	0.12	0.18
[Somewhat agree] In-state frequent park visitors (19.6%)	0.19	0.02	8.62	0.00	0.15	0.23
[Somewhat agree] Frequent beachgoers who skip sunscreen (8.3%)	0.19	0.03	6.62	0.00	0.13	0.25
[Somewhat agree] Sunscreen protection tourists (28.8%)	0.15	0.02	8.63	0.00	0.11	0.18
[Strongly agree] Multi-modal sun protection tourists (43.2%)	0.10	0.01	7.34	0.00	0.07	0.13
[Strongly agree] In-state frequent park visitors (19.6%)	0.14	0.02	6.25	0.00	0.10	0.18
[Strongly agree] Frequent beachgoers who skip sunscreen (8.3%)	0.14	0.03	4.44	0.00	0.08	0.20
[Strongly agree] Sunscreen protection tourists (28.8%)	0.09	0.01	6.54	0.00	0.07	0.12

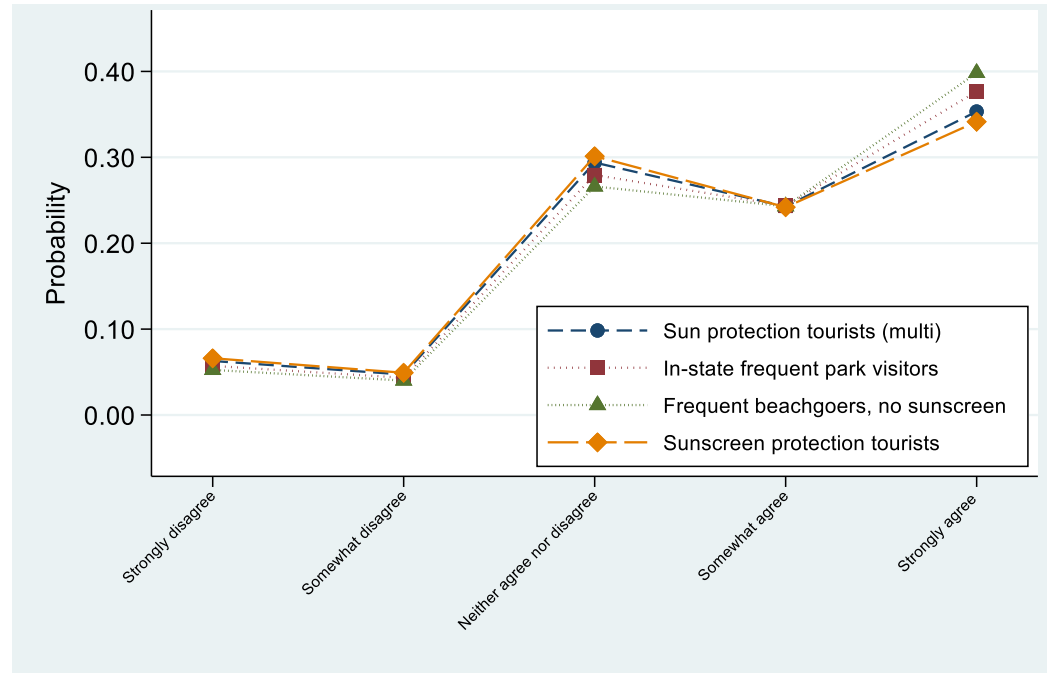
Figure F1.9 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?



**Table F1.9 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?**

	EM				95% Confidence	
	M	SE	z	p> z	Interval	
[Strongly disagree] Multi-modal sun protection tourists (43.2%)	0.06	0.01	5.90	0.00	0.04	0.08
[Strongly disagree] In-state frequent park visitors (19.6%)	0.06	0.01	4.87	0.00	0.03	0.08
[Strongly disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.05	0.01	3.71	0.00	0.03	0.08
[Strongly disagree] Sunscreen protection tourists (28.8%)	0.07	0.01	5.53	0.00	0.04	0.09
[Somewhat disagree] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.56	0.00	0.03	0.07
[Somewhat disagree] In-state frequent park visitors (19.6%)	0.05	0.01	4.81	0.00	0.03	0.07
[Somewhat disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.05	0.01	3.85	0.00	0.02	0.07
[Somewhat disagree] Sunscreen protection tourists (28.8%)	0.06	0.01	5.32	0.00	0.04	0.08
[Neither agree nor disagree] Multi-modal sun protection tourists (43.2%)	0.30	0.02	14.14	0.00	0.26	0.34
[Neither agree nor disagree] In-state frequent park visitors (19.6%)	0.28	0.03	10.52	0.00	0.23	0.33
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.28	0.04	7.31	0.00	0.20	0.35
[Neither agree nor disagree] Sunscreen protection tourists (28.8%)	0.31	0.02	12.93	0.00	0.27	0.36
[Somewhat agree] Multi-modal sun protection tourists (43.2%)	0.24	0.02	14.27	0.00	0.21	0.27
[Somewhat agree] In-state frequent park visitors (19.6%)	0.24	0.02	14.32	0.00	0.21	0.27
[Somewhat agree] Frequent beachgoers who skip sunscreen (8.3%)	0.24	0.02	14.32	0.00	0.21	0.27
[Somewhat agree] Sunscreen protection tourists (28.8%)	0.24	0.02	14.07	0.00	0.20	0.27
[Strongly agree] Multi-modal sun protection tourists (43.2%)	0.34	0.03	13.16	0.00	0.29	0.39
[Strongly agree] In-state frequent park visitors (19.6%)	0.37	0.04	9.74	0.00	0.30	0.45
[Strongly agree] Frequent beachgoers who skip sunscreen (8.3%)	0.38	0.06	6.59	0.00	0.27	0.50
[Strongly agree] Sunscreen protection tourists (28.8%)	0.32	0.03	10.43	0.00	0.26	0.38

**Figure F1. 10 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.]  
To what extent do you agree or disagree with the following statements?**



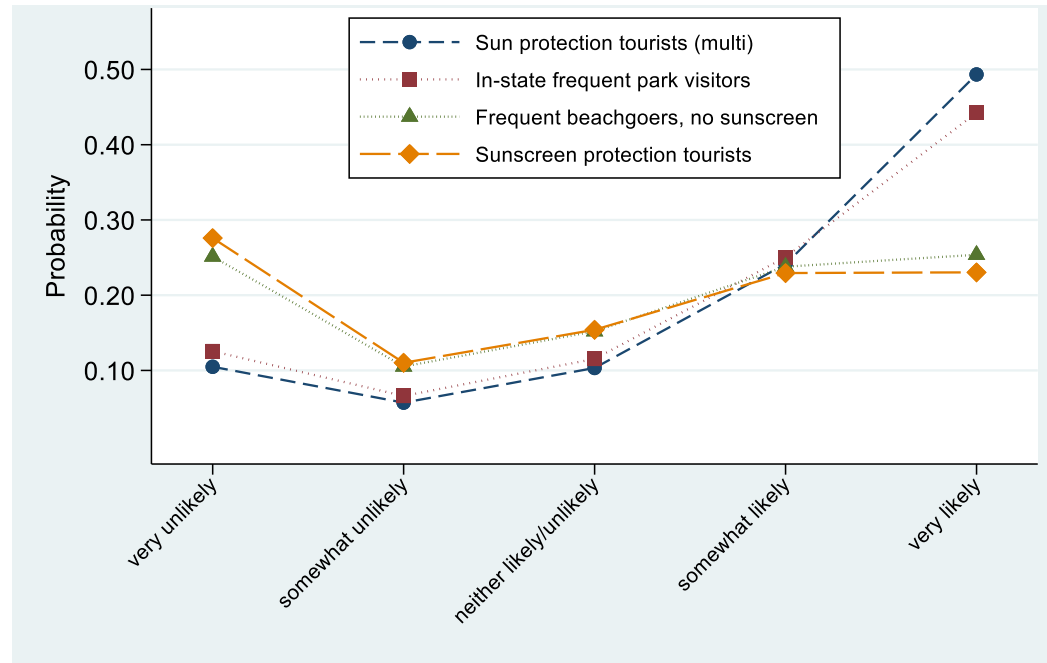


**Table F1. 10 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.] To what extent do you agree or disagree with the following statements?**

	EM M	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (43.2%)	0.06	0.01	5.84	0.00	0.04	0.08
[Strongly disagree] In-state frequent park visitors (19.6%)	0.06	0.01	4.86	0.00	0.03	0.08
[Strongly disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.05	0.01	3.71	0.00	0.02	0.08
[Strongly disagree] Sunscreen protection tourists (28.8%)	0.07	0.01	5.45	0.00	0.04	0.09
[Somewhat disagree] Multi-modal sun protection tourists (43.2%)	0.05	0.01	5.23	0.00	0.03	0.06
[Somewhat disagree] In-state frequent park visitors (19.6%)	0.04	0.01	4.62	0.00	0.02	0.06
[Somewhat disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.04	0.01	3.74	0.00	0.02	0.06
[Somewhat disagree] Sunscreen protection tourists (28.8%)	0.05	0.01	5.04	0.00	0.03	0.07
[Neither agree nor disagree] Multi-modal sun protection tourists (43.2%)	0.29	0.02	13.56	0.00	0.25	0.34
[Neither agree nor disagree] In-state frequent park visitors (19.6%)	0.28	0.03	10.38	0.00	0.23	0.33
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (8.3%)	0.27	0.04	7.08	0.00	0.19	0.34
[Neither agree nor disagree] Sunscreen protection tourists (28.8%)	0.30	0.02	12.50	0.00	0.25	0.35
[Somewhat agree] Multi-modal sun protection tourists (43.2%)	0.24	0.02	14.36	0.00	0.21	0.28
[Somewhat agree] In-state frequent park visitors (19.6%)	0.24	0.02	14.40	0.00	0.21	0.28
[Somewhat agree] Frequent beachgoers who skip sunscreen (8.3%)	0.24	0.02	14.26	0.00	0.21	0.28
[Somewhat agree] Sunscreen protection tourists (28.8%)	0.24	0.02	14.32	0.00	0.21	0.28
[Strongly agree] Multi-modal sun protection tourists (43.2%)	0.35	0.03	13.22	0.00	0.30	0.41
[Strongly agree] In-state frequent park visitors (19.6%)	0.38	0.04	9.82	0.00	0.30	0.45
[Strongly agree] Frequent beachgoers who skip sunscreen (8.3%)	0.40	0.06	6.81	0.00	0.28	0.51
[Strongly agree] Sunscreen protection tourists (28.8%)	0.34	0.03	10.91	0.00	0.28	0.40

Appendix F2. [Kaloko-Honokōhau National Historical Park] Estimated marginal means by audience

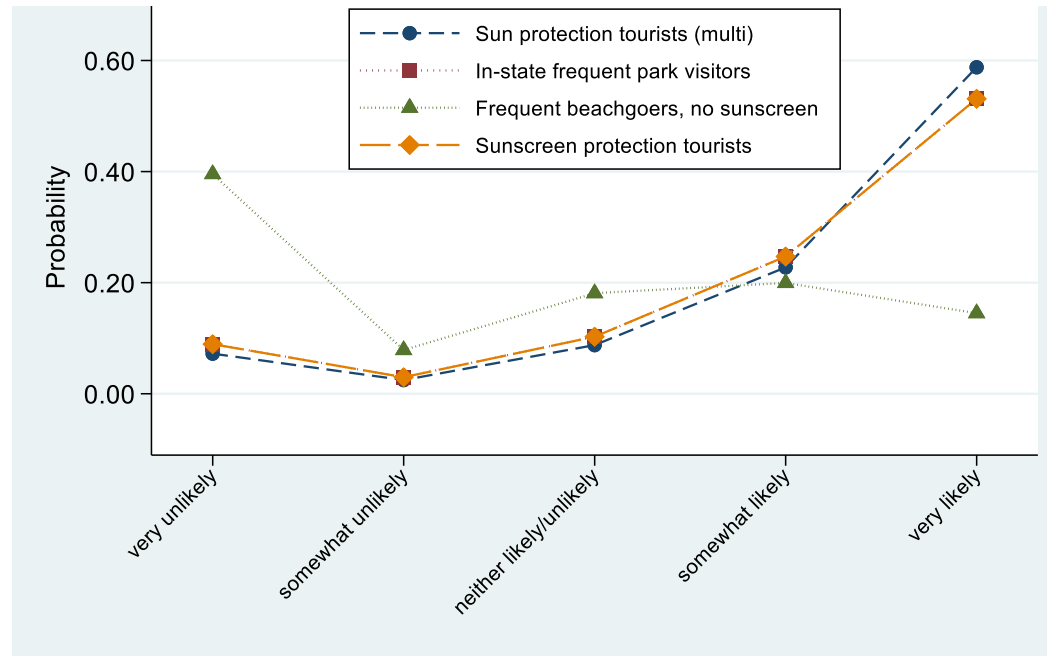
**Figure F2.1 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**



**Table F2.1 [Wear sun-protective clothing] If you were to visit this park again, how likely would you be to take these actions?**

	EM M	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (44.0%)	0.10	0.01	7.38	0.00	0.08	0.13
[Very unlikely] In-state frequent park visitors (18.9%)	0.13	0.02	5.92	0.00	0.08	0.17
[Very unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.25	0.04	5.74	0.00	0.17	0.34
[Very unlikely] Sunscreen protection tourists (25.3%)	0.28	0.03	8.70	0.00	0.21	0.34
[Somewhat unlikely] Multi-modal sun protection tourists (44.0%)	0.06	0.01	6.21	0.00	0.04	0.08
[Somewhat unlikely] In-state frequent park visitors (18.9%)	0.07	0.01	5.64	0.00	0.04	0.09
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.11	0.02	6.21	0.00	0.07	0.14
[Somewhat unlikely] Sunscreen protection tourists (25.3%)	0.11	0.02	6.87	0.00	0.08	0.14
[Neither likely nor unlikely] Multi-modal sun protection tourists (44.0%)	0.10	0.01	8.11	0.00	0.08	0.13
[Neither likely nor unlikely] In-state frequent park visitors (18.9%)	0.12	0.02	7.54	0.00	0.09	0.15
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.15	0.02	8.97	0.00	0.12	0.19
[Neither likely nor unlikely] Sunscreen protection tourists (25.3%)	0.15	0.02	9.20	0.00	0.12	0.19
[Somewhat likely] Multi-modal sun protection tourists (44.0%)	0.24	0.02	13.13	0.00	0.21	0.28
[Somewhat likely] In-state frequent park visitors (18.9%)	0.25	0.02	13.13	0.00	0.21	0.29
[Somewhat likely] Frequent beachgoers who skip sunscreen (11.7%)	0.24	0.02	11.04	0.00	0.20	0.28
[Somewhat likely] Sunscreen protection tourists (25.3%)	0.23	0.02	12.01	0.00	0.19	0.27
[Very likely] Multi-modal sun protection tourists (44.0%)	0.49	0.03	16.27	0.00	0.43	0.55
[Very likely] In-state frequent park visitors (18.9%)	0.44	0.04	10.41	0.00	0.36	0.53
[Very likely] Frequent beachgoers who skip sunscreen (11.7%)	0.25	0.04	5.86	0.00	0.17	0.34
[Very likely] Sunscreen protection tourists (25.3%)	0.23	0.03	8.22	0.00	0.18	0.29

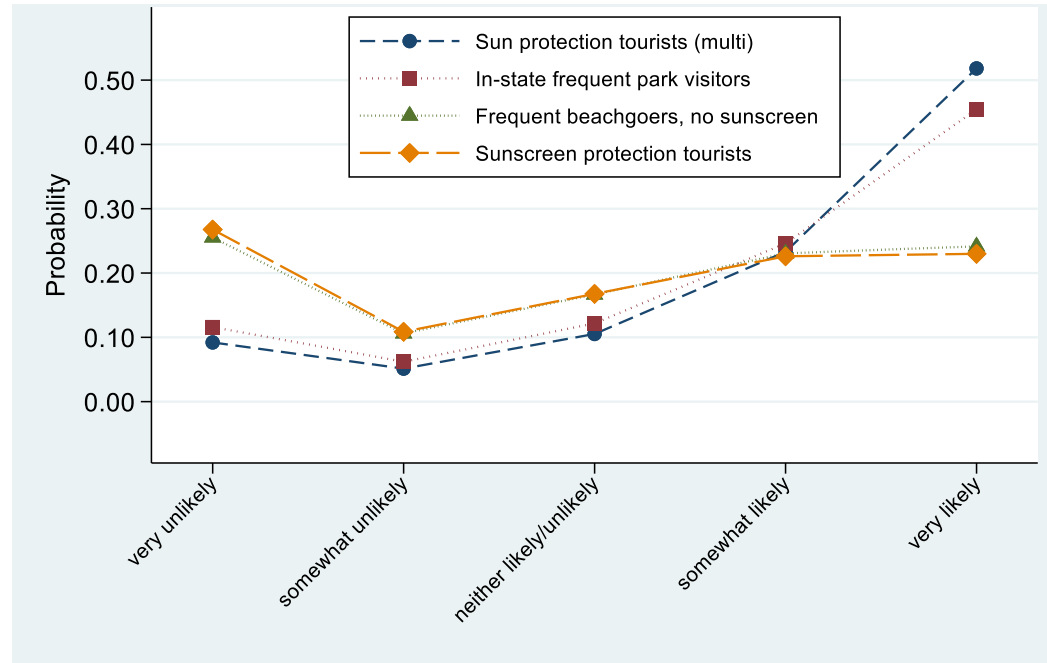
**Figure F2.2 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**



**Table F2.2 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] If you were to visit this park again, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (44.0%)	0.07	0.01	5.86	0.00	0.05	0.10
[Very unlikely] In-state frequent park visitors (18.9%)	0.09	0.02	4.84	0.00	0.05	0.13
[Very unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.40	0.06	6.14	0.00	0.27	0.52
[Very unlikely] Sunscreen protection tourists (25.3%)	0.09	0.02	5.24	0.00	0.06	0.12
[Somewhat unlikely] Multi-modal sun protection tourists (44.0%)	0.02	0.01	3.82	0.00	0.01	0.04
[Somewhat unlikely] In-state frequent park visitors (18.9%)	0.03	0.01	3.56	0.00	0.01	0.05
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.08	0.02	4.04	0.00	0.04	0.12
[Somewhat unlikely] Sunscreen protection tourists (25.3%)	0.03	0.01	3.69	0.00	0.01	0.05
[Neither likely nor unlikely] Multi-modal sun protection tourists (44.0%)	0.09	0.01	6.69	0.00	0.06	0.11
[Neither likely nor unlikely] In-state frequent park visitors (18.9%)	0.10	0.02	5.87	0.00	0.07	0.14
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.18	0.02	7.52	0.00	0.13	0.23
[Neither likely nor unlikely] Sunscreen protection tourists (25.3%)	0.10	0.02	6.24	0.00	0.07	0.13
[Somewhat likely] Multi-modal sun protection tourists (44.0%)	0.23	0.02	11.36	0.00	0.19	0.27
[Somewhat likely] In-state frequent park visitors (18.9%)	0.25	0.02	10.70	0.00	0.20	0.29
[Somewhat likely] Frequent beachgoers who skip sunscreen (11.7%)	0.20	0.03	6.44	0.00	0.14	0.26
[Somewhat likely] Sunscreen protection tourists (25.3%)	0.25	0.02	11.03	0.00	0.20	0.29
[Very likely] Multi-modal sun protection tourists (44.0%)	0.59	0.03	18.72	0.00	0.53	0.65
[Very likely] In-state frequent park visitors (18.9%)	0.53	0.05	11.32	0.00	0.44	0.62
[Very likely] Frequent beachgoers who skip sunscreen (11.7%)	0.15	0.03	4.16	0.00	0.08	0.21
[Very likely] Sunscreen protection tourists (25.3%)	0.53	0.04	12.65	0.00	0.45	0.61

**Figure F2.3 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

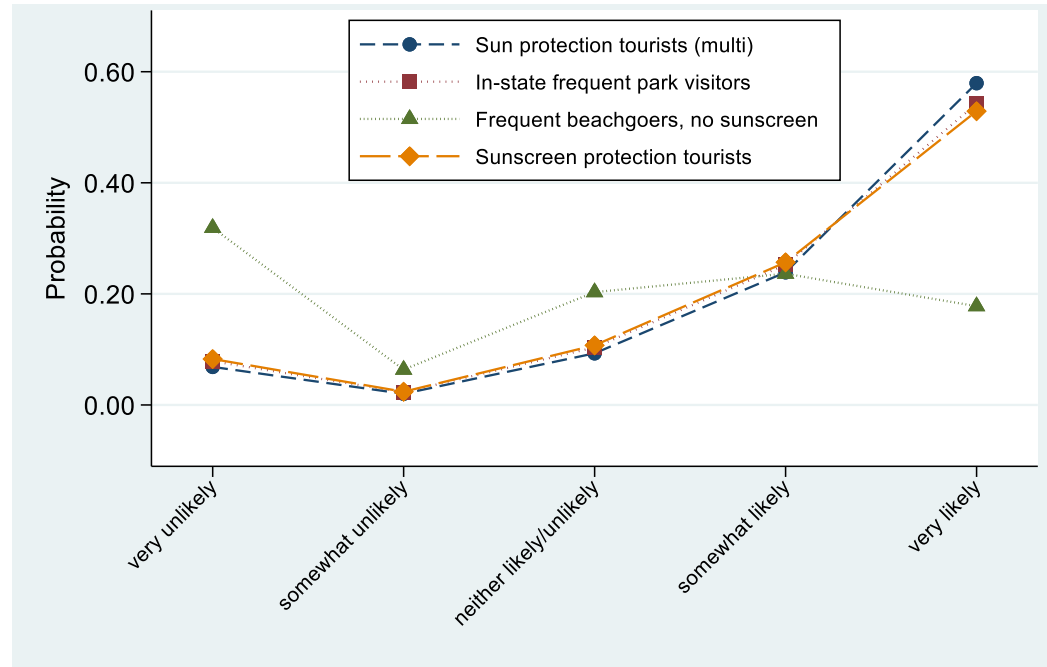


**Table F2.3 [Wear sun-protective clothing] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (44.0%)	0.09	0.01	7.04	0.00	0.07	0.12
[Very unlikely] In-state frequent park visitors (18.9%)	0.12	0.02	5.75	0.00	0.08	0.16
[Very unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.26	0.05	5.63	0.00	0.17	0.34
[Very unlikely] Sunscreen protection tourists (25.3%)	0.27	0.03	8.45	0.00	0.21	0.33
[Somewhat unlikely] Multi-modal sun protection tourists (44.0%)	0.05	0.01	5.95	0.00	0.03	0.07
[Somewhat unlikely] In-state frequent park visitors (18.9%)	0.06	0.01	5.43	0.00	0.04	0.08
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.11	0.02	6.03	0.00	0.07	0.14
[Somewhat unlikely] Sunscreen protection tourists (25.3%)	0.11	0.02	6.64	0.00	0.08	0.14
[Neither likely nor unlikely] Multi-modal sun protection tourists (44.0%)	0.11	0.01	8.12	0.00	0.08	0.13
[Neither likely nor unlikely] In-state frequent park visitors (18.9%)	0.12	0.02	7.53	0.00	0.09	0.15
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.17	0.02	9.25	0.00	0.13	0.20
[Neither likely nor unlikely] Sunscreen protection tourists (25.3%)	0.17	0.02	9.43	0.00	0.13	0.20
[Somewhat likely] Multi-modal sun protection tourists (44.0%)	0.23	0.02	12.68	0.00	0.20	0.27
[Somewhat likely] In-state frequent park visitors (18.9%)	0.25	0.02	12.73	0.00	0.21	0.28
[Somewhat likely] Frequent beachgoers who skip sunscreen (11.7%)	0.23	0.02	10.27	0.00	0.19	0.27
[Somewhat likely] Sunscreen protection tourists (25.3%)	0.23	0.02	11.75	0.00	0.19	0.26
[Very likely] Multi-modal sun protection tourists (44.0%)	0.52	0.03	17.02	0.00	0.46	0.58
[Very likely] In-state frequent park visitors (18.9%)	0.45	0.04	10.57	0.00	0.37	0.54
[Very likely] Frequent beachgoers who skip sunscreen (11.7%)	0.24	0.04	5.59	0.00	0.16	0.33
[Very likely] Sunscreen protection tourists (25.3%)	0.23	0.03	8.14	0.00	0.17	0.29



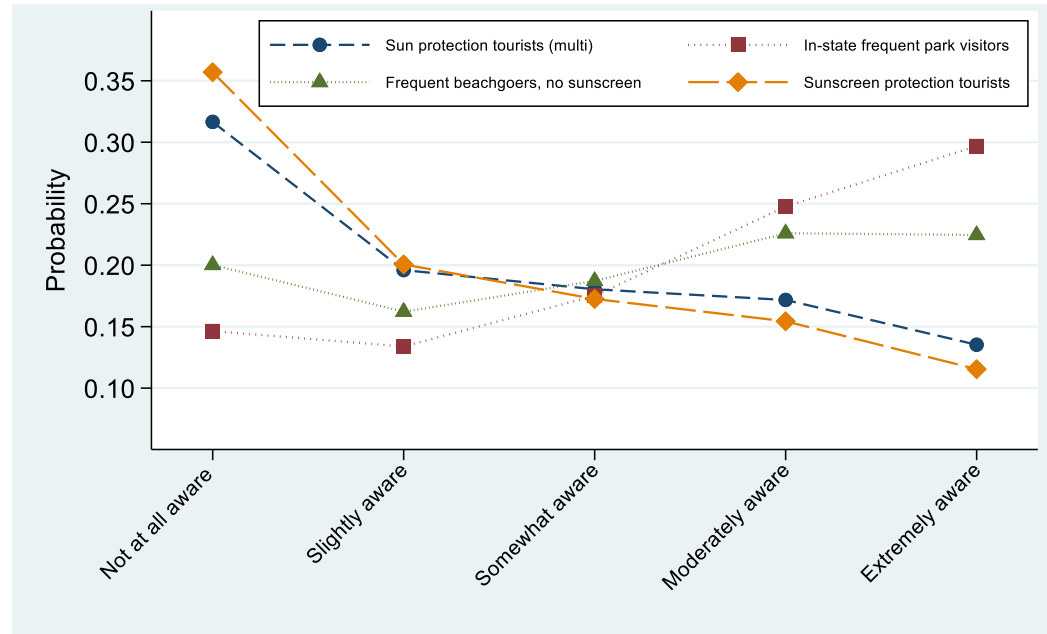
**Figure F2.4 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**



**Table F2.4 [Use mineral-based sunscreen (Non-nano titanium dioxide and zinc oxide)] The next time you go to a beach other than this park, how likely would you be to take these actions?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Very unlikely] Multi-modal sun protection tourists (44.0%)	0.07	0.01	5.79	0.00	0.05	0.09
[Very unlikely] In-state frequent park visitors (18.9%)	0.08	0.02	4.69	0.00	0.05	0.11
[Very unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.32	0.06	5.60	0.00	0.21	0.43
[Very unlikely] Sunscreen protection tourists (25.3%)	0.08	0.02	5.15	0.00	0.05	0.11
[Somewhat unlikely] Multi-modal sun protection tourists (44.0%)	0.02	0.01	3.48	0.00	0.01	0.03
[Somewhat unlikely] In-state frequent park visitors (18.9%)	0.02	0.01	3.24	0.00	0.01	0.04
[Somewhat unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.06	0.02	3.55	0.00	0.03	0.10
[Somewhat unlikely] Sunscreen protection tourists (25.3%)	0.02	0.01	3.36	0.00	0.01	0.04
[Neither likely nor unlikely] Multi-modal sun protection tourists (44.0%)	0.09	0.01	6.91	0.00	0.07	0.12
[Neither likely nor unlikely] In-state frequent park visitors (18.9%)	0.10	0.02	5.81	0.00	0.07	0.14
[Neither likely nor unlikely] Frequent beachgoers who skip sunscreen (11.7%)	0.20	0.03	8.03	0.00	0.15	0.25
[Neither likely nor unlikely] Sunscreen protection tourists (25.3%)	0.11	0.02	6.33	0.00	0.07	0.14
[Somewhat likely] Multi-modal sun protection tourists (44.0%)	0.24	0.02	11.81	0.00	0.20	0.28
[Somewhat likely] In-state frequent park visitors (18.9%)	0.25	0.02	10.59	0.00	0.21	0.30
[Somewhat likely] Frequent beachgoers who skip sunscreen (11.7%)	0.24	0.03	7.88	0.00	0.18	0.30
[Somewhat likely] Sunscreen protection tourists (25.3%)	0.26	0.02	11.37	0.00	0.21	0.30
[Very likely] Multi-modal sun protection tourists (44.0%)	0.58	0.03	18.60	0.00	0.52	0.64
[Very likely] In-state frequent park visitors (18.9%)	0.54	0.05	11.47	0.00	0.45	0.64
[Very likely] Frequent beachgoers who skip sunscreen (11.7%)	0.18	0.04	4.55	0.00	0.10	0.25
[Very likely] Sunscreen protection tourists (25.3%)	0.53	0.04	12.67	0.00	0.45	0.61

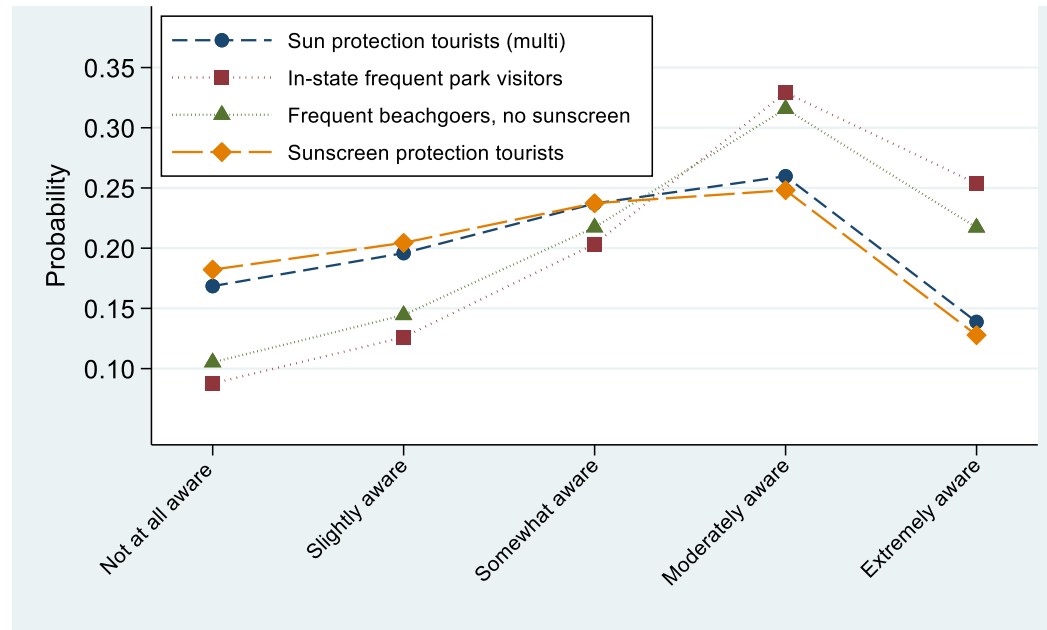
**Figure F2.5 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**



**Table F2.5 Sunscreen containing certain types of chemicals has been banned in some areas of the United States. How aware are you of these bans?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Not at all aware] Multi-modal sun protection tourists (44.0%)	0.32	0.03	12.20	0.00	0.27	0.37
[Not at all aware] In-state frequent park visitors (18.9%)	0.15	0.02	6.41	0.00	0.10	0.19
[Not at all aware] Frequent beachgoers who skip sunscreen (11.7%)	0.20	0.04	5.36	0.00	0.13	0.27
[Not at all aware] Sunscreen protection tourists (25.3%)	0.36	0.04	10.18	0.00	0.29	0.43
[Slightly aware] Multi-modal sun protection tourists (44.0%)	0.20	0.02	11.45	0.00	0.16	0.23
[Slightly aware] In-state frequent park visitors (18.9%)	0.13	0.02	8.01	0.00	0.10	0.17
[Slightly aware] Frequent beachgoers who skip sunscreen (11.7%)	0.16	0.02	7.84	0.00	0.12	0.20
[Slightly aware] Sunscreen protection tourists (25.3%)	0.20	0.02	11.49	0.00	0.17	0.23
[Somewhat aware] Multi-modal sun protection tourists (44.0%)	0.18	0.02	11.22	0.00	0.15	0.21
[Somewhat aware] In-state frequent park visitors (18.9%)	0.18	0.02	10.43	0.00	0.14	0.21
[Somewhat aware] Frequent beachgoers who skip sunscreen (11.7%)	0.19	0.02	11.16	0.00	0.15	0.22
[Somewhat aware] Sunscreen protection tourists (25.3%)	0.17	0.02	10.51	0.00	0.14	0.20
[Moderately aware] Multi-modal sun protection tourists (44.0%)	0.17	0.02	10.29	0.00	0.14	0.20
[Moderately aware] In-state frequent park visitors (18.9%)	0.25	0.02	11.50	0.00	0.21	0.29
[Moderately aware] Frequent beachgoers who skip sunscreen (11.7%)	0.23	0.02	9.27	0.00	0.18	0.27
[Moderately aware] Sunscreen protection tourists (25.3%)	0.15	0.02	8.47	0.00	0.12	0.19
[Extremely aware] Multi-modal sun protection tourists (44.0%)	0.14	0.02	8.17	0.00	0.10	0.17
[Extremely aware] In-state frequent park visitors (18.9%)	0.30	0.04	8.15	0.00	0.23	0.37
[Extremely aware] Frequent beachgoers who skip sunscreen (11.7%)	0.22	0.04	5.50	0.00	0.14	0.30
[Extremely aware] Sunscreen protection tourists (25.3%)	0.12	0.02	6.51	0.00	0.08	0.15

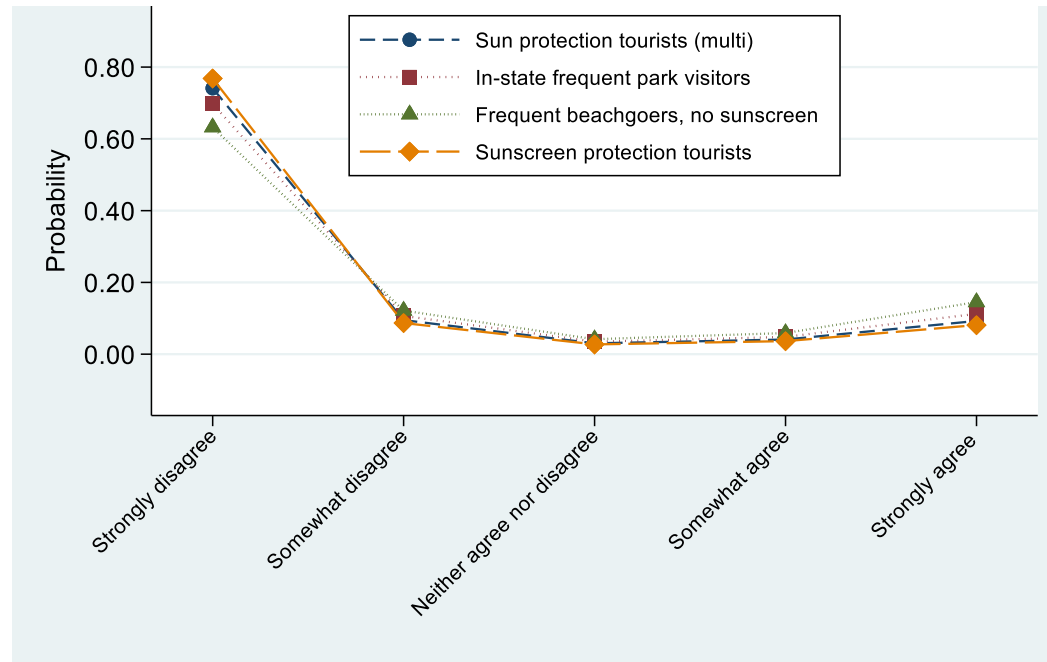
**Figure F2.6 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**



**Table F2.6 The National Academies is currently reviewing the environmental impacts of marketed sunscreens. How aware are you of potential concerns about sunscreen environmental impacts?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Not at all aware] Multi-modal sun protection tourists (44.0%)	0.17	0.02	8.72	0.00	0.13	0.21
[Not at all aware] In-state frequent park visitors (18.9%)	0.09	0.02	5.61	0.00	0.06	0.12
[Not at all aware] Frequent beachgoers who skip sunscreen (11.7%)	0.11	0.02	4.46	0.00	0.06	0.15
[Not at all aware] Sunscreen protection tourists (25.3%)	0.18	0.02	7.40	0.00	0.13	0.23
[Slightly aware] Multi-modal sun protection tourists (44.0%)	0.20	0.02	10.69	0.00	0.16	0.23
[Slightly aware] In-state frequent park visitors (18.9%)	0.13	0.02	7.11	0.00	0.09	0.16
[Slightly aware] Frequent beachgoers who skip sunscreen (11.7%)	0.14	0.02	5.89	0.00	0.10	0.19
[Slightly aware] Sunscreen protection tourists (25.3%)	0.20	0.02	9.95	0.00	0.16	0.24
[Somewhat aware] Multi-modal sun protection tourists (44.0%)	0.24	0.02	13.38	0.00	0.20	0.27
[Somewhat aware] In-state frequent park visitors (18.9%)	0.20	0.02	10.67	0.00	0.17	0.24
[Somewhat aware] Frequent beachgoers who skip sunscreen (11.7%)	0.22	0.02	10.25	0.00	0.18	0.26
[Somewhat aware] Sunscreen protection tourists (25.3%)	0.24	0.02	13.39	0.00	0.20	0.27
[Moderately aware] Multi-modal sun protection tourists (44.0%)	0.26	0.02	13.09	0.00	0.22	0.30
[Moderately aware] In-state frequent park visitors (18.9%)	0.33	0.02	14.40	0.00	0.28	0.37
[Moderately aware] Frequent beachgoers who skip sunscreen (11.7%)	0.32	0.03	11.64	0.00	0.26	0.37
[Moderately aware] Sunscreen protection tourists (25.3%)	0.25	0.02	10.95	0.00	0.20	0.29
[Extremely aware] Multi-modal sun protection tourists (44.0%)	0.14	0.02	8.28	0.00	0.11	0.17
[Extremely aware] In-state frequent park visitors (18.9%)	0.25	0.03	7.51	0.00	0.19	0.32
[Extremely aware] Frequent beachgoers who skip sunscreen (11.7%)	0.22	0.04	5.31	0.00	0.14	0.30
[Extremely aware] Sunscreen protection tourists (25.3%)	0.13	0.02	6.74	0.00	0.09	0.17

**Figure F2.7 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**

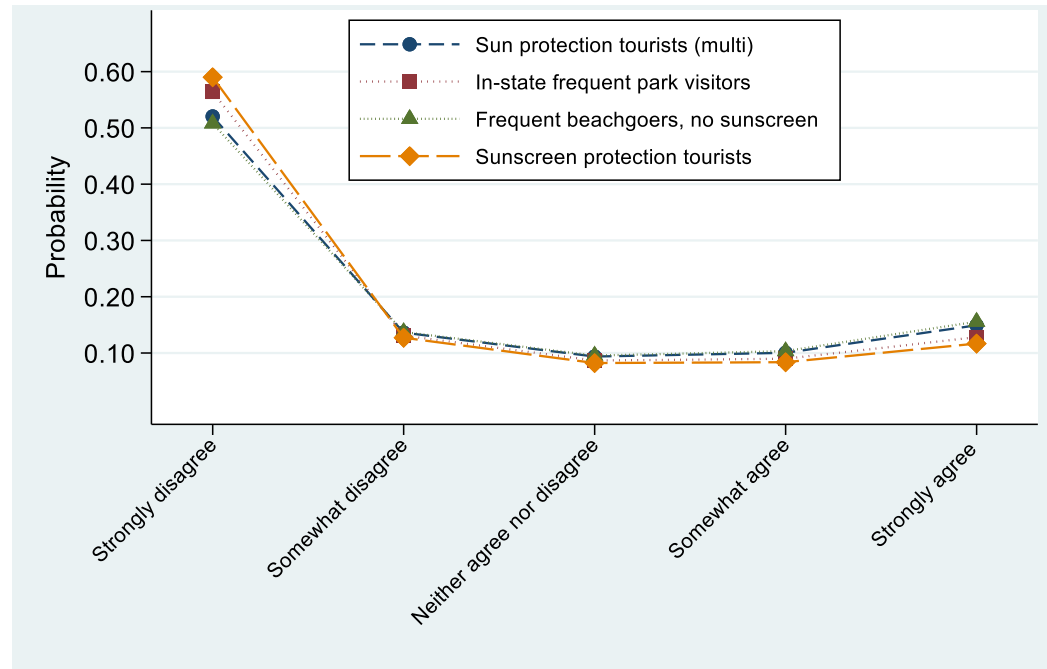


**Table F2.7 [Human activities have little effect on ocean life.] To what extent do you agree or disagree with the following statements?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (44.0%)	0.74	0.03	28.03	0.00	0.69	0.79
[Strongly disagree] In-state frequent park visitors (18.9%)	0.70	0.04	16.35	0.00	0.61	0.78
[Strongly disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.63	0.06	11.14	0.00	0.52	0.74
[Strongly disagree] Sunscreen protection tourists (25.3%)	0.77	0.03	22.57	0.00	0.70	0.84
[Somewhat disagree] Multi-modal sun protection tourists (44.0%)	0.09	0.01	7.31	0.00	0.07	0.12
[Somewhat disagree] In-state frequent park visitors (18.9%)	0.11	0.02	6.55	0.00	0.07	0.14
[Somewhat disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.12	0.02	6.59	0.00	0.09	0.16
[Somewhat disagree] Sunscreen protection tourists (25.3%)	0.09	0.01	6.15	0.00	0.06	0.11
[Neither agree nor disagree] Multi-modal sun protection tourists (44.0%)	0.03	0.01	4.23	0.00	0.02	0.04
[Neither agree nor disagree] In-state frequent park visitors (18.9%)	0.04	0.01	3.94	0.00	0.02	0.05
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.04	0.01	3.88	0.00	0.02	0.06
[Neither agree nor disagree] Sunscreen protection tourists (25.3%)	0.03	0.01	3.87	0.00	0.01	0.04
[Somewhat agree] Multi-modal sun protection tourists (44.0%)	0.04	0.01	4.80	0.00	0.02	0.06
[Somewhat agree] In-state frequent park visitors (18.9%)	0.05	0.01	4.31	0.00	0.03	0.07
[Somewhat agree] Frequent beachgoers who skip sunscreen (11.7%)	0.06	0.01	4.18	0.00	0.03	0.09
[Somewhat agree] Sunscreen protection tourists (25.3%)	0.04	0.01	4.26	0.00	0.02	0.05
[Strongly agree] Multi-modal sun protection tourists (44.0%)	0.09	0.01	6.38	0.00	0.06	0.12
[Strongly agree] In-state frequent park visitors (18.9%)	0.11	0.02	5.00	0.00	0.07	0.16
[Strongly agree] Frequent beachgoers who skip sunscreen (11.7%)	0.15	0.03	4.51	0.00	0.08	0.21
[Strongly agree] Sunscreen protection tourists (25.3%)	0.08	0.02	5.00	0.00	0.05	0.11



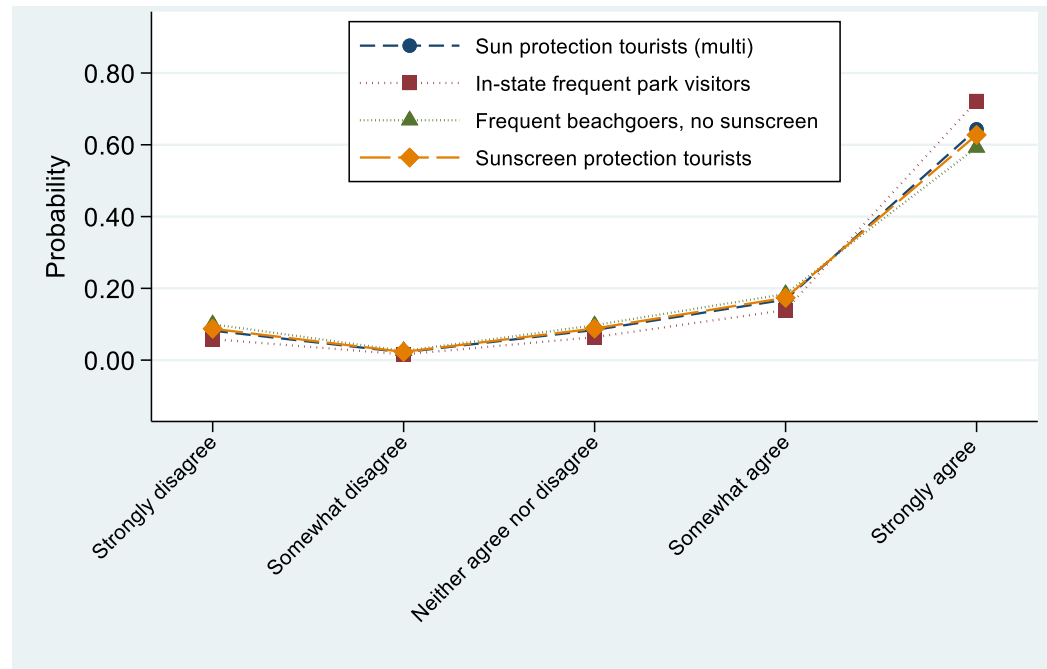
**Figure F2.8 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**



**Table F2.8 [Sunscreen chemicals are unlikely to contribute to water pollution.] To what extent do you agree or disagree with the following statements?**

	EM M	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (44.0%)	0.52	0.03	17.66	0.00	0.46	0.58
[Strongly disagree] In-state frequent park visitors (18.9%)	0.56	0.05	12.29	0.00	0.47	0.65
[Strongly disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.51	0.06	9.01	0.00	0.40	0.62
[Strongly disagree] Sunscreen protection tourists (25.3%)	0.59	0.04	15.47	0.00	0.52	0.66
[Somewhat disagree] Multi-modal sun protection tourists (44.0%)	0.14	0.01	9.50	0.00	0.11	0.16
[Somewhat disagree] In-state frequent park visitors (18.9%)	0.13	0.01	8.90	0.00	0.10	0.16
[Somewhat disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.14	0.02	9.15	0.00	0.11	0.17
[Somewhat disagree] Sunscreen protection tourists (25.3%)	0.13	0.01	8.92	0.00	0.10	0.16
[Neither agree nor disagree] Multi-modal sun protection tourists (44.0%)	0.09	0.01	7.47	0.00	0.07	0.12
[Neither agree nor disagree] In-state frequent park visitors (18.9%)	0.09	0.01	6.52	0.00	0.06	0.11
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.10	0.01	6.53	0.00	0.07	0.12
[Neither agree nor disagree] Sunscreen protection tourists (25.3%)	0.08	0.01	6.78	0.00	0.06	0.11
[Somewhat agree] Multi-modal sun protection tourists (44.0%)	0.10	0.01	7.41	0.00	0.07	0.13
[Somewhat agree] In-state frequent park visitors (18.9%)	0.09	0.02	5.92	0.00	0.06	0.12
[Somewhat agree] Frequent beachgoers who skip sunscreen (11.7%)	0.10	0.02	5.73	0.00	0.07	0.14
[Somewhat agree] Sunscreen protection tourists (25.3%)	0.08	0.01	6.35	0.00	0.06	0.11
[Strongly agree] Multi-modal sun protection tourists (44.0%)	0.15	0.02	8.13	0.00	0.11	0.19
[Strongly agree] In-state frequent park visitors (18.9%)	0.13	0.02	5.58	0.00	0.08	0.17
[Strongly agree] Frequent beachgoers who skip sunscreen (11.7%)	0.16	0.03	4.95	0.00	0.09	0.22
[Strongly agree] Sunscreen protection tourists (25.3%)	0.12	0.02	6.22	0.00	0.08	0.15

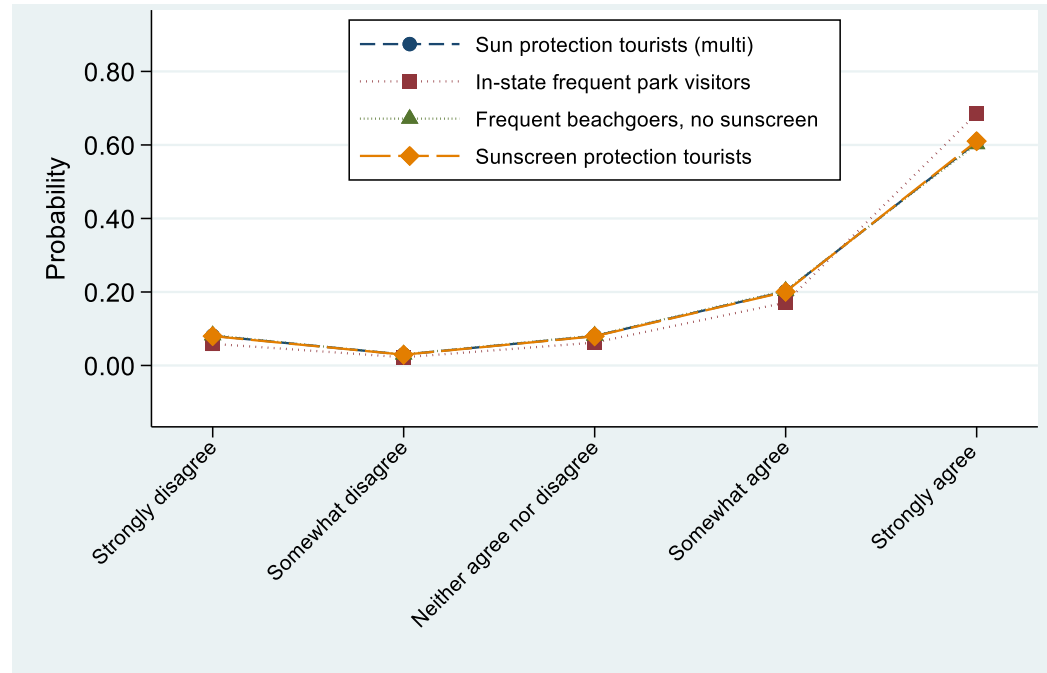
**Figure F2.9 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?**



**Table F2.9 [Sunscreen chemicals likely harm corals.] To what extent do you agree or disagree with the following statements?**

	EM				95% Confidence	
	M	SE	z	p> z	Interval	
[Strongly disagree] Multi-modal sun protection tourists (44.0%)	0.08	0.01	6.23	0.00	0.06	0.11
[Strongly disagree] In-state frequent park visitors (18.9%)	0.06	0.01	4.32	0.00	0.03	0.09
[Strongly disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.10	0.02	4.26	0.00	0.05	0.15
[Strongly disagree] Sunscreen protection tourists (25.3%)	0.09	0.02	5.38	0.00	0.06	0.12
[Somewhat disagree] Multi-modal sun protection tourists (44.0%)	0.02	0.01	3.52	0.00	0.01	0.03
[Somewhat disagree] In-state frequent park visitors (18.9%)	0.02	0.01	3.09	0.00	0.01	0.03
[Somewhat disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.03	0.01	3.13	0.00	0.01	0.04
[Somewhat disagree] Sunscreen protection tourists (25.3%)	0.02	0.01	3.38	0.00	0.01	0.04
[Neither agree nor disagree] Multi-modal sun protection tourists (44.0%)	0.08	0.01	6.65	0.00	0.06	0.11
[Neither agree nor disagree] In-state frequent park visitors (18.9%)	0.06	0.01	4.87	0.00	0.04	0.09
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.10	0.02	5.17	0.00	0.06	0.13
[Neither agree nor disagree] Sunscreen protection tourists (25.3%)	0.09	0.01	6.04	0.00	0.06	0.12
[Somewhat agree] Multi-modal sun protection tourists (44.0%)	0.17	0.02	9.93	0.00	0.14	0.20
[Somewhat agree] In-state frequent park visitors (18.9%)	0.14	0.02	6.95	0.00	0.10	0.18
[Somewhat agree] Frequent beachgoers who skip sunscreen (11.7%)	0.18	0.02	8.23	0.00	0.14	0.23
[Somewhat agree] Sunscreen protection tourists (25.3%)	0.17	0.02	9.19	0.00	0.14	0.21
[Strongly agree] Multi-modal sun protection tourists (44.0%)	0.64	0.03	22.25	0.00	0.59	0.70
[Strongly agree] In-state frequent park visitors (18.9%)	0.72	0.04	17.20	0.00	0.64	0.80
[Strongly agree] Frequent beachgoers who skip sunscreen (11.7%)	0.59	0.06	10.54	0.00	0.48	0.70
[Strongly agree] Sunscreen protection tourists (25.3%)	0.63	0.04	16.42	0.00	0.55	0.70

**Figure F2.10 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.]  
To what extent do you agree or disagree with the following statements?**



**Table F2.10 [Sunscreen chemicals likely affect the health of a wide array of ocean life, such as fish, shellfish, and dolphins.] To what extent do you agree or disagree with the following statements?**

	EMM	SE	z	p> z	95% Confidence Interval	
[Strongly disagree] Multi-modal sun protection tourists (44.0%)	0.08	0.01	6.16	0.00	0.06	0.11
[Strongly disagree] In-state frequent park visitors (18.9%)	0.06	0.01	4.39	0.00	0.03	0.09
[Strongly disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.08	0.02	4.04	0.00	0.04	0.12
[Strongly disagree] Sunscreen protection tourists (25.3%)	0.08	0.02	5.26	0.00	0.05	0.11
[Somewhat disagree] Multi-modal sun protection tourists (44.0%)	0.03	0.01	4.02	0.00	0.02	0.04
[Somewhat disagree] In-state frequent park visitors (18.9%)	0.02	0.01	3.45	0.00	0.01	0.03
[Somewhat disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.03	0.01	3.36	0.00	0.01	0.05
[Somewhat disagree] Sunscreen protection tourists (25.3%)	0.03	0.01	3.79	0.00	0.01	0.04
[Neither agree nor disagree] Multi-modal sun protection tourists (44.0%)	0.08	0.01	6.47	0.00	0.06	0.10
[Neither agree nor disagree] In-state frequent park visitors (18.9%)	0.06	0.01	4.93	0.00	0.04	0.09
[Neither agree nor disagree] Frequent beachgoers who skip sunscreen (11.7%)	0.08	0.02	4.77	0.00	0.05	0.11
[Neither agree nor disagree] Sunscreen protection tourists (25.3%)	0.08	0.01	5.86	0.00	0.05	0.11
[Somewhat agree] Multi-modal sun protection tourists (44.0%)	0.20	0.02	10.98	0.00	0.17	0.24
[Somewhat agree] In-state frequent park visitors (18.9%)	0.17	0.02	7.75	0.00	0.13	0.21
[Somewhat agree] Frequent beachgoers who skip sunscreen (11.7%)	0.20	0.03	8.07	0.00	0.15	0.25
[Somewhat agree] Sunscreen protection tourists (25.3%)	0.20	0.02	9.92	0.00	0.16	0.24
[Strongly agree] Multi-modal sun protection tourists (44.0%)	0.61	0.03	20.62	0.00	0.55	0.67
[Strongly agree] In-state frequent park visitors (18.9%)	0.69	0.04	15.79	0.00	0.60	0.77
[Strongly agree] Frequent beachgoers who skip sunscreen (11.7%)	0.60	0.06	10.50	0.00	0.49	0.71
[Strongly agree] Sunscreen protection tourists (25.3%)	0.61	0.04	15.91	0.00	0.54	0.69

