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Tourism and Beaches: Their Multilayered Demand and Sustainability

Abstract

We estimate the demand for tourism on Oʻahu, Hawaiʻi, from multiple perspectives. While the literature on nonmarket valuation focuses on estimating the willingness to pay for single use value or a single purpose, this study applies onsite survey data to address visitors' willingness to pay for multilayered tourism: for an Oʻahu trip as a whole and for individual beach visits on the island. Our survey data reveal that those visitors who have visited Oʻahu in the past do not necessarily visit beaches less frequently on subsequent Oʻahu trips. The estimated consumer surplus per person for a trip to Oʻahu is considerably large ($3,400-$5,480 based on the preferred estimate) and is in line with the literature on resort island travel costs. The aggregate surplus of all Oʻahu visitors would be approximately $21 to $34 billion. The surplus increases with the number of beach trips during each island visit, indicating that maintaining beaches enhances the demand for tourism as a whole. Our beach travel cost analysis also illustrates that the extent of substitution among different beaches is limited for Oʻahu visitors such that losing an Oʻahu beach is unlikely to be compensated for by access to the remaining beaches on the island.

Keywords

Nonmarket valuation, travel cost methods, recreation demand, coastal management, Hawaiʻi

I. Introduction and Background

Given the current and future risks of sea level rise associated with climate change and coastal erosion, many local governments face challenging coastal management decisions (IPCC, 2022). In the case of Hawaiʻi, researchers predict that approximately 40% of the state's beaches may be eroded by 2050 not only because of sea level rise but also because of the impacts associated with coastal hardening, such as seawalls (Tavares et al., 2020).

Management efforts to mitigate the risks of sea level rise and coastal erosion and adapt to them entail different degrees of costs depending on the type of adaptation (e.g., protection, restoration, accommodation in place or retreating inland). While the benefits of adaptation may outweigh such costs, some benefits are not realized through market transactions. This is because, in many cases, users of beaches and the nearshore environment do not pay for all of the services and amenities provided by the maintained environment. Lacking this information makes it challenging to address critical management issues such as valuing the recreational benefits provided by beaches, how much beaches matter in the overall experiences of island visitors, and whether beaches can compensate for the loss of a particular beach on an island.

Several studies address the value of maintaining beaches by applying various nonmarket valuation methods. Building on the methods established in the literature, we apply travel cost methods from multilayered perspectives. Most travel cost studies focus on a single recreational activity in question (e.g., visiting a beach, a lake, or a national park), which typically involves a day trip or a multiday visit with a single purpose. Some studies apply a travel cost method to a multiday vacation visit to the destination (e.g., Bhat et al., 2014).

A challenge in identifying the benefits of maintaining individual beaches is that tourism at destinations such as O‘ahu, Hawai‘i, involves multiple recreational objectives. Some visitors go to O‘ahu for its beaches, some for its cultural and historical heritage, and others for shopping. In fact, visitors typically engage in all of these activities during their stay. What is the overall willingness to pay for a visit to O‘ahu? What part of the overall travel costs can we attribute to a particular beach visit? How do consumer surpluses differ between visitors and residents? We address these questions in this paper.

Moncur (1975) estimates the demand for visiting beach parks on O‘ahu by considering the travel costs to various beach areas on the island by the visitors' origin zip code. The sample is limited to O‘ahu residents. Few studies have examined the demand for Hawai‘i or beaches in the state since then, except for Peng et al. (2023). They found that, based on the same survey used in this study, beachgoers to Waikīkī Beach are willing to pay $2 to $4 for an extra foot of beach width; 10 dollars or more for an extra 1-foot of underwater visibility; and approximately $400 for the experience of visiting Waikīkī Beach as is. These estimates translate to approximately $100 million in willingness to pay for a 3-ft increase in beach width on the basis of the estimated number of visitors overall, indicating vast benefits (relative to the costs) of preventing the erosion of Waikīkī Beach.

The descriptive statistics of our survey indicate that beaches contribute to the overall reslience of tourism. According to our survey, visitors to Waikīkī indicate that they also visit other beaches on the island. The survey subjects who have visited O‘ahu two or more times indicate that the number of trips to beaches (including Waikīkī) does not decline across visits. Kalākaua Avenue, which is in front of Waikīkī Beach, is the most frequently visited location in the State (Hawai‘i Tourism Authority, 2024). Some commentators do not provide a favorable review of Waikīkī by stating that it is touristy and inauthentic (Hood, 2023). Our findings reveal that repeat visitors still visit Waikīkī Beach without indicating saturated demand for the beach.

Our estimated consumer surplus for a trip to O‘ahu is approximately $3,700 to $5,500 per visitor per trip. While there are few studies about willingness to pay for island tourism, this estimate is on the same order of magnitude as an estimate in the literature (1,200 to 2,200 in 2020 U.S. dollars per visitor per trip to the Maldives, Bhat et al., 2014). The surplus increases with the number of beach trips during each island visit, indicating that maintaining beaches enhances the demand for tourism as a whole. We also see that the extent of substitution among different beaches is limited for visitors such that beach loss on O‘ahu is unlikely to be compensated for by access to the remaining beaches on the island. Taken together, these findings indicate that maintaining each beach area on O‘ahu contributes to the overall sustainability of the island's tourism.

II. Method

1. Characterizing beach visits

We first describe beach trips by O‘ahu visitors. By applying our survey response, we investigate how the number of trips to each beach area on O‘ahu is related to the visitors' characteristics, including the number of trips to O‘ahu. Many tourists visit O‘ahu multiple times. Our survey data corroborate this finding and describe the number of beach visits across different trips to O‘ahu.

2. The demand for a trip to O‘ahu

We apply several different versions of the travel cost method, which estimates how the frequency of trips to a destination of interest depends on the travel cost to the destination and other alternatives and on the traveler's socioeconomic characteristics. Travel cost methods have a long history of application and were first suggested to the National Park Service by Harold Hotelling as a method for measuring the economic value of parks (Shaw, 2005). With the individual travel cost method, researchers regress the number of trips on the travel cost to estimate a demand curve and consumer surplus, a measurement of the benefits to travelers (Haab & McConnell, 2002). Both onsite and offsite sampling are compatible with the individual travel cost method. Although onsite sampling oversamples those who visit the site frequently and undersamples those who make no trips at all, truncation can be corrected in both the Poisson and negative binomial regressions common to the individual travel cost method (Parsons, 2017). We apply this method, as applied in the recent travel cost literature, on the basis of an onsite survey.

First, we apply a single-site travel cost model to estimate visitors' willingness to pay for a visit to O‘ahu. The left-hand side of the model ($Trips\_O_i$ introduced below) consists of the number of trips to O‘ahu taken by subject i over the last 5 years. Owing to the survey design, this variable is top-coded at 11. Only 1 subject indicated that they had visited O‘ahu 11 times in the past 5 years. The method follows Bhat et al. (2014), who estimated a travel cost model based on the number of visits to the Maldives.

$$Trips\_O_i = \exp[\beta_0 + \beta_1 TR\_O_i + X_i \gamma + \beta_2 Triplength_i + \beta_2 Beachtrips_i].$$

Here, the travel costs TR_O_i represents the costs of travel per person to O‘ahu and the accommodation costs on O‘ahu. The variable X_i represent the visitor's socioeconomic characteristics; $Triplength_i$ represents the number of days the visitor stayed on O‘ahu; and *Beachtrips* represents the average number of visits to beaches in a trip to O‘ahu for each individual.

The travel cost variable TR_O is defined as follows:

$$TR\_O = AirFare + Travel\,Time \times WageRate + \frac{Accommodation}{Trsize}.$$

Here, $AirFare$ is the cost of a roundtrip flight to the Honolulu Airport from the visitor‘s airport of origin. The wage rate represents the visitor's opportunity cost of time traveling to the tourism destination. In the last term, $Accommodation$ represents the accommodation costs for the visitor's party (i.e., the cost per night times the number of nights per individual), whereas $Trsize$ is the total number of individuals traveling with the visitor (including the visitor).

While Poisson regression is a standard way to estimate the count model, we face issues when applying the Poisson model to data based on onsite sampling (Parsons, 2017; Haab & McConnell, 2002): the variance of the count should not exceed the mean (otherwise, the data tend to exhibit overdispersion); truncation (we do not observe subjects who do not visit O'ahu); and endogenous stratification (due to possible oversampling of those visitors who visit the site very often). By following the convention in the literature (Parsons, 2017), we subtract 1 from the dependent variable (the number of trips) to address endogenous stratification. We also estimate alternative models that address one or more of the other issues (truncated negative binomial model and negative binomial regression with endogenous stratification).

We follow the literature and estimate the consumer surplus based on the estimated coefficient of the travel costs and the average number of trips.

3. The demand for a trip to beaches

The second approach is a single-site travel cost model to estimate the willingness to pay for a visit to a beach on O'ahu.

$$Trips\_B_{ij} = \exp\left[\beta_0 + \sum_{k=1}^{m} \beta_k TR\_I_{ik} + X_i \Upsilon\right].$$

Here, $Trips\_B_{ij}$ is the number of trips by subject i to beach j, and TR_I_{ik} is the (inland) round trip travel costs of subject i from the subject's place of accommodation to beach k:

$$\begin{aligned} TR\_I_{ij} = {} & Distance_{AccomodationToBeach} \times Rate_{TransportationMode} + TravelTime \times WageRate \\ & + Distance_{BeachToAccomodation} \times Rate_{TransportationMode} \\ & + TravelTime \times WageRate. \end{aligned}$$

Here, $Rate_{TransportationMode}$ is all based on the survey response regarding the transportation mode, accommodations, and time spent. We also estimate the models by applying a rate of 1/3 wages to travel time as the opportunity costs, as in Fezzi et al. 2014 (see Appendix B).

This specification allows each subject's trips to beach site j to depend on not only the costs to reach site j but also the costs to reach other beach sites. The estimated model describes the extent of substitutability between the different beaches on O‘ahu.

III. Data

We conducted a survey at Waikīkī Beach between November 2019 and January 2020. The sample (n=307) consists of randomly selected individuals on the beach, with each subject representing a distinct group or household on site. The sample includes both visitors from outside Hawai‘i and O‘ahu residents. A small number of non-O‘ahu Hawai‘i residents are classified as visitors for the purpose of this analysis. The field survey instrument consists of four parts: general perceptions, choice scenarios, travel costs, and demographics. Peng et al. (2023) primarily applied the response to the choice scenarios (a discrete choice experiment asking each subject to choose among visual representations of alternative beaches with different beach widths, underwater visibilities, and costs to access the beach). They applied the data to estimate beachgoers' willingness to pay for changes in beach width and underwater visibility, with a primary focus on valuing environmental changes in Waikīkī Beach. This study focuses on the travel costs component of the survey while investigating both the O‘ahu trip as a whole and visits to Waikīkī and other beaches on the island.

We collected responses from 398 beach recreationists. We asked the respondents about their origin, travel mode, accommodations, ground transportation on O‘ahu, frequency of visits, attitudes, and socioeconomic background. While we determined the costs of the most recent trip, we did not attempt to determine the costs of past trips and only considered the frequency (Parsons, 2017). We excluded from the sample a small number of observations (less than 10) associated with no travel information or those who reached O‘ahu via a cruise ship. Thus, the sample consists of the visitors with complete travel information and the residents of Hawai‘i. To represent the social and demographic characteristics of the subjects, we considered the variables income and sex.

$AirFare$ is calculated based on a standardized airfare table that is commercially available and provided through the Hawai‘i Tourism Authority. The travel time is based on the shortest flight time according to a Google airfare search.

IV. Results

1. Descriptive statistics

Table 1: Summary statistics (trips to O'ahu)

	mean	sd	min	max
#Trips to O'ahu	5.07	6.47	1	48
Travel costs to O'ahu (in $)	2,266.7	1,246.2	679.5	11,466.4
Annual income (in $1,000)	96.58	73.10	0	250
Sex (female=1)	0.61	0.49	0	1
College education	0.63	0.48	0	1
Trip length on O'ahu	9.00	6.57	2	32
Travel group size	2.63	1.97	1	22
Observations	307			

Note: Based on intercept surveys conducted by the authors. The sample was limited to visitors to O'ahu. One outlier with 150 trips was excluded from the sample.

Table 2. Travel costs to beach areas

	Residents				Visitors (1)				Visitors (2)			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max
C_Waikiki	16.9	25.2	0	121.6	29.3	26.0	3.12	289.5	100.3	55.0	14.7	585.8
C_AlaMoana	17.5	20.8	0.25	111.7	49.5	23.2	6.44	199.3	120.8	59.8	18.0	593.3
C_NShore	53.8	45.3	7.92	194.7	112.7	55.1	15.6	266.5	184.5	88.0	32.7	618.5
C_Kailua	31.9	28.0	4.15	115.2	79.1	36.7	9.38	192.0	150.6	72.2	24.7	605.1
C_Hanaum	23.9	23.9	1.19	115.4	61.2	27.4	9.36	211.2	132.6	63.9	21.0	598.1
C_SandyB	27.6	28.1	0.94	150.0	67.1	30.3	10.5	214.9	138.5	66.3	22.1	600.2
C_West	50.5	41.8	12.7	177.8	108.1	52.4	12.5	252.2	179.8	85.4	31.3	616.5
N	82				302				298			

Note: For residents of O'ahu, the numbers represent the round–trip travel costs from their home to each beach area. Visitors (1) refer to the round-trip travel costs from their accommodations on O'ahu to each beach area, whereas Visitors (2) refer to the round-trip travel costs, including air fare and accommodation costs, associated with the beach trip.

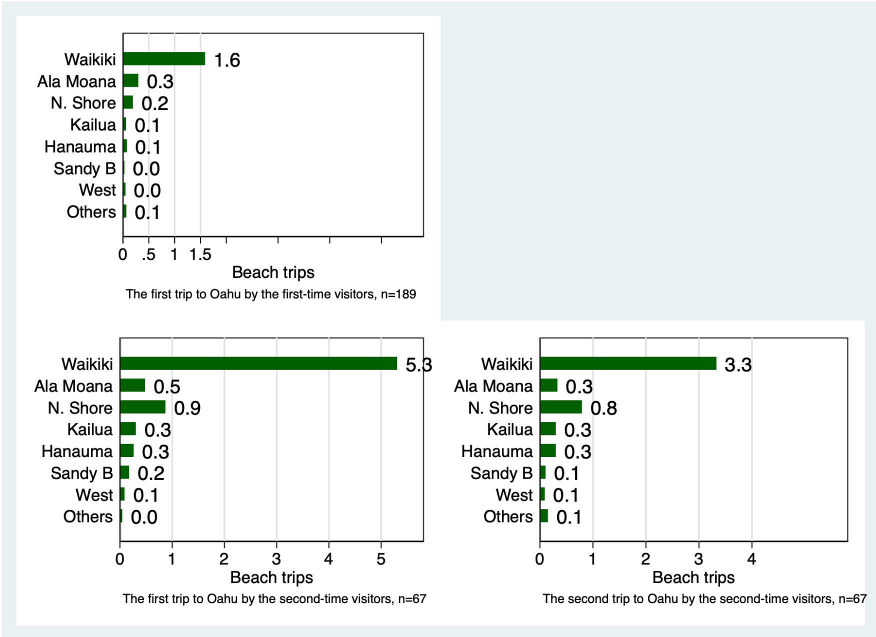
We exclude responses with incomplete entries on the origin airport, with trips sponsored by the military, and those who reached Oʻahu on a cruise ship. In Table 1, we follow Bhat et al. (2014) to define "#Trips to Oʻahu" as the number of trips in the past five years multiplied by "Travel group size," which represents the group size (the number of individuals traveling with the subject, including the subject). The accommodation costs refer to what is reported divided by the group size. The variable "Trip length" represents the number of days on Oʻahu.

Next, we summarize the number of beach trips by the number of visits to Oʻahu. Figures 1 and 2 indicate the average number of trips to each beach area by the number of visits to Oʻahu. Figure 1 indicates that the average number of visits to Waikīkī Beach is less than 2, although a cohort effect may be present. Indeed, those who indicated in the survey that it was their second trip to Oʻahu reported a larger number of trips to beaches overall in both their first and second visits. Although the average number of trips to Waikīkī Beach is lower for the second trip, it still exceeds 3, indicating a strong preference for visiting the beach. Figure 2 shows that the average number of trips to Waikīkī Beach does not decrease in the later visits to Oʻahu. Both figures indicate that beach visits are a part of the travel experience on Oʻahu, even among repeat visitors.

Table 3 (1) reports the ordinary least squares estimation of the following model
$\bar{B}_i = \alpha + \beta totaln_i + X_i\gamma + \varepsilon_{ni}$,:
where $\bar{B}_i$ is subject i's average number of beach trips per visit to Oʻahu, $totaln_i$ is the total number of visits to Oʻahu, and X_i represents the subject's characteristics. As another indicator of how beach trip frequency changes across visits to Oʻahu, we estimate the following model:

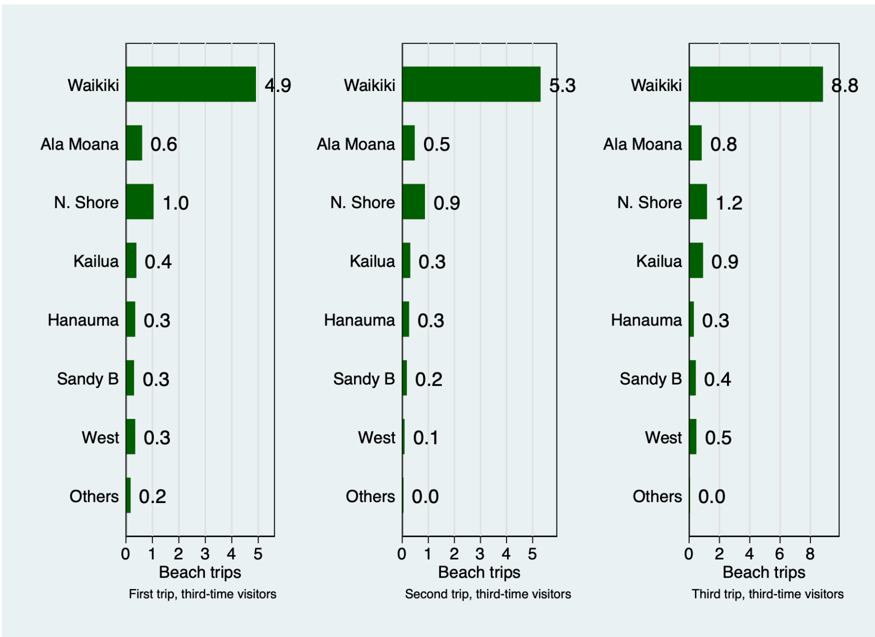
$$B_{ni} = \alpha + \beta n_i + X_i\gamma + \varepsilon_{ni},$$

where B_{ni}, the number of beach trips on the n-th visit to Oʻahu in the past 5 years by subject i, is regressed on n_i, the order of the trip to Oʻahu (first, second, third in specification 2; indicators for the second and third visits to Oʻahu in specification 3) in Table 3. The subjects who reported visiting Oʻahu four times or more in the past 5 years were not included in the sample because of the small number of corresponding observations.



Note: Based on intercept surveys conducted by the authors. The sample was limited to visitors to O'ahu. One outlier with 150 trips was excluded from the sample.

Figure 1. Beach trips by first and second time visitors to O'ahu.



Note: Based on an intercept survey conducted by the authors. The sample was limited to visitors to O'ahu (n=23). One outlier with 150 trips was excluded from the sample.

Figure 2. Beach trips by third time visitors to O'ahu.

Table 3. Frequency of beach trips and the number of visits to O‘ahu

	(1)		(2)		(3)	
Number of visits to O’ahu	0.824***	(0.258)				
Order O’ahu visits			3.620***	(0.797)		
2nd O’ahu visit					3.989***	(1.260)
3rd O’ahu visit					7.045***	(1.677)
Sex (female=1)	1.459	(0.887)	1.849	(1.195)	1.845	(1.197)
College education	-0.481	(0.917)	-1.326	(1.233)	-1.337	(1.234)
Annual income	-0.036	(0.063)	-0.134	(0.085)	-0.133	(0.086)
AUSNZ	-0.690	(1.501)	-1.639	(2.002)	-1.545	(2.020)
Canada	-1.391	(1.378)	3.222*	(1.837)	3.358*	(1.874)
Japan	-1.622	(1.166)	-2.675*	(1.602)	-2.619	(1.611)
Other	-2.145	(1.481)	-1.762	(2.193)	-1.676	(2.207)
Constant	-0.690	(1.477)	0.300	(2.077)	3.754**	(1.716)
N	311		435		435	

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Although these are only correlations and do not allow for causal inference, we observe that the average number of beach trips is greater for subjects with a greater number of O‘ahu trips and that repeat visitors are associated with more beach trips. These findings indicate that beach trips remain an integral part of a visit to the island even for repeat visitors.

Table 4. Poisson model estimation results.

	(1)	(2)	(3)	(4)	(5)
Tr costs	-0.010***	-0.021***	-0.022***	-0.027***	-0.022***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Annual income		0.025***	0.023***	0.028***	0.026***
(in $10,000)		(0.005)	(0.005)	(0.005)	(0.005)
Female			-0.106*	-0.111*	-0.192***
			(0.058)	(0.059)	(0.060)
College education			0.137**	0.183***	0.216***

			(0.062)	(0.064)	(0.065)
Trip length on O'ahu				0.017***	-0.006
				(0.004)	(0.005)
#Beach trips					0.022***
					(0.002)
N	305	305	305	305	304
C. Surplus ($)	40,910	19,871	18,341	15,194	18,390
C_Surplus per trip ($)	10,002	4,858	4,484	3,715	4,496

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<.01.

Note: Based on an intercept survey conducted by the authors. The sample was limited to visitors to O'ahu. One outlier with 150 trips was excluded from the sample.

Table 4 summarizes the Poisson regression results for a specification similar to that of Bhat et al. The estimates associated with travel costs, income, and college education exhibit the expected sign. The consumer surplus, CS, as computed as in Bhat et al. (2014) and is given by the mean number of trips divided by the estimated coefficient for travel costs. This number is approximately $3,700 to $4,500 per person per visit to O'ahu. The magnitude is in line with Bhat et al.'s estimate for the Maldives but is higher (1,200 to 2,200 in 2020 US dollars on the basis of the CPI adjustments applied to their estimates).

Table 5. Negative binomial regression estimation results

	(1)	(2)	(3)	(4)	(5)
Tr costs	-0.009	-0.018***	-0.018***	-0.027***	-0.029***
	(0.005)	(0.007)	(0.007)	(0.008)	(0.008)
Annual income		0.024**	0.023**	0.033***	0.034***
(in $10,000)		(0.011)	(0.011)	(0.012)	(0.012)
Female			-0.067	-0.092	-0.297**
			(0.148)	(0.147)	(0.145)
College education			0.132	0.227	0.148
			(0.152)	(0.156)	(0.151)
Trip length on O'ahu				0.032**	-0.005

				(0.015)	(0.015)
#Beach trips					0.088***
					(0.019)
alpha	1.44	1.38	1.37	1.33	1.17
chi2	847	830	824	818	750
N	305	305	305	305	304
C. Surplus ($)	59,829	28,559	27,953	18,551	17,319
C. Surplus per trip ($)	11,731	5,600	5,481	3,637	3,396

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<.01.

Note: chi2 (χ^2) refers to the chi-square for the null hypothesis that alpha equals zero.

As explained earlier, Poisson regression may lead to inefficiency if overdispersion is present. The negative binomial regression results indicate that the overdispersion parameter estimate (alpha) is statistically significant (Table 5). This suggests that the sample observations exhibit overdispersion. Therefore, we conclude that the negative binomial is preferable to the Poisson specification.

We also estimated the negative binomial model with endogenous stratification to address three issues of onsite sampling: overdispersion relative to the Poisson; truncation at zero; and endogenous stratification due to oversampling of frequent users of the site (Hilbe & Espiñeira, 2005). The estimates are largely the same as the above results for the truncated negative binomial model (summarized in Appendix A). If we evaluate the opportunity costs of travel time by applying 1/3 of each subject‘s wage rate, the consumer surplus estimate becomes marginally smaller (Appendix B).

According to the (truncated) negative binomial regression, college education and sex are not statistically significant. The estimate for the travel costs coefficient is similar to the Poisson estimate. In specification (5), the number of beach trips is positively associated with the travel frequency to O‘ahu. The consumer surplus estimates for an average sample visitor to O‘ahu are similar to the Poisson estimates, ranging between $3,400 and $5,480.

Next, we investigate the travel costs to each beach site. Table 6 lists the Poisson model estimation results with the sample restricted to O'ahu residents. The left-hand side variable is the number of trips to each beach over a year (minus 1 for Waikīkī to adjust for onsite bias).[1] For the three beach areas considered (Waikīkī, Ala Moana, and North Shore), the consumer surplus per resident ranges from $56 to $411, whereas the surplus per resident per visit is $8 to $43. Many of the cross-price coefficients are estimated to be positive and statistically significant. Therefore, among residents, beaches appear to serve as substitutes.

A caveat for this beach travel cost estimation is that the sample is limited to those residents who were intercepted in Waikiīkī. To the extent that there are residents who do not visit beaches or have a strong preference for beaches other than Waikiīkī, the result is not representative of average O'ahu residents.

Table 7 summarizes the Poisson multisite regression results for the visitors. For this regression, the travel costs consist of the inland travel costs (between the area in which each visitor stayed and the corresponding beach area), the flight costs, the opportunity costs of the flight time, and the accommodation costs. The last three costs are divided by the number of days spent on the island travelling multiplied by the share of daytime spent on the beach, i.e., by 3.5/16. The beach time estimate (3.5 hours) is based on another airport-incept survey conducted in 2023, and we assume that the discretionary hours per day are 16 hours.

Table 6. Travel costs model of beach visits (O'ahu residents)

	(1) Waikīkī		(2) Ala Moana		(3) N Shore	
C_Waikiki	-0.0659***	(0.00572)	0.0493***	(0.0161)	-0.0433***	(0.0113)
C_AlaMoana	0.138***	(0.0171)	-0.226***	(0.0540)	0.0908***	(0.0345)
C_NShore	0.0442***	(0.0104)	-0.0753**	(0.0329)	-0.0352***	(0.0123)
C_Kailua	0.0216***	(0.00794)	0.0669**	(0.0310)	-0.00555	(0.00775)
C_Hanaum	-0.152***	(0.0181)	-0.0778*	(0.0413)	-0.0650**	(0.0315)
C_SandyB	0.0707***	(0.00819)	0.128***	(0.0169)	0.0254*	(0.0135)
C_West	-0.134***	(0.0109)	0.191**	(0.0751)	-0.00571	(0.0235)
Female	0.168**	(0.0673)	0.627***	(0.117)	0.299**	(0.123)
Income ($10,000)	0.525***	(0.0762)	-0.859***	(0.238)	0.322**	(0.148)

College education	-0.185***	(0.0612)	-0.263***	(0.102)	-0.142	(0.111)
Constant	3.764***	(0.167)	-0.425	(0.583)	1.930***	(0.334)
N	77		81		80	
C. surplus ($)	268.4		30.7		138.9	
Mean number of trips	17.7		14.2		4.9	
C. surplus per trip ($)	15.2		2.2		28.4	

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<.01.

For the same three beach areas, the results indicate nonnegligible consumer surplus estimates. Unlike the results for residents, many of the cross-price coefficients are estimated to be statistically zero or negative. This result indicates that, for visitors, beaches are not necessarily substitutes.

Table 7. Travel costs model of beach visits (Oʻahu visitors)

	(1) Waikīkī		(2) Ala Moana		(3) N Shore	
C_Waikiki	-0.0874***	(0.0135)	-0.0928***	(0.0335)	-0.0644***	(0.0218)
C_AlaMoana	-0.0753***	(0.0263)	-0.0869	(0.0687)	-0.121***	(0.0445)
C_NShore	-0.0281***	(0.00523)	-0.0285*	(0.0166)	-0.0358***	(0.00614)
C_Kailua	-0.0765***	(0.0174)	-0.0922*	(0.0506)	-0.0804***	(0.0274)
C_Hanaum	0.367***	(0.0551)	0.308***	(0.107)	0.403***	(0.0847)
C_SandyB	-0.0942***	(0.0298)	0.000963	(0.0578)	-0.107**	(0.0431)
C_West	-0.0238***	(0.00708)	-0.0221	(0.0192)	-0.0174	(0.0107)
Female	0.822***	(0.109)	1.473***	(0.310)	0.670***	(0.213)
Income ($10,000)	0.112***	(0.0289)	0.0753	(0.0811)	0.195***	(0.0474)
College education	-0.664***	(0.0995)	-1.428***	(0.277)	0.0284	(0.211)
Constant	1.982***	(0.190)	-0.825*	(0.480)	0.564	(0.384)
N	298		298		298	
C. surplus ($)	19.7		3.7		11.8	
Mean number of trips	1.7		0.3		0.4	
C. surplus per trip ($)	11.4		11.5		27.9	

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<.01.

V. Discussion

Overall, our analysis based on onsite surveys in Waikīkī indicates that both O‘ahu residents and visitors take a considerable number of trips to various beach areas on the island. The visitors who travelled to O‘ahu for the second or the third time take a larger number of beach trips on the island. The consumer surplus associated with a trip to O‘ahu is between $3,400 and $5,500 per visitor per trip. Both the visitors' and the residents' beach travel responses indicate a limited degree of substitutability between O‘ahu beaches in different areas. We note that the limited substitutability may be due to the uniqueness of each beach area, individuals' limited familiarity with some beach areas, or both. These findings suggest that maintaining beaches likely enhances the sustainability of O‘ahu tourism.

More research with a closer look at recreationist behavior at a tourism destination (for example, time spent on beaches, nonbeach recreation, hiking, shopping, etc.), as well as the impacts of major tourism disruptions, can generate further insights into the sustainability and resilience of tourism from a broader perspective.

Appendix A Negative binomial model specification with endogenous stratification

The following table indicates that the estimates that take into account endogenous stratification are very similar to the negative binomial regression estimates in Table 2.

Table A1. Negative binomial model specification with endogenous stratification

	(1)		(2)		(3)	
Tr cost	-0.008*	(0.005)	-0.018***	(0.006)	-0.018***	(0.006)
Annual income ($10,000)			0.024**	(0.010)	0.022**	(0.010)
Female					-0.069	(0.133)
College education					0.127	(0.137)
N	305		305		305	
C. Surplus (USD)	61,315		28,973		28,274	
C. Surplus per trip (USD)	12,023		5,681		5,544	

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<.01.

Appendix B Consumer surplus estimates for O‘ahu travel by visitors with different assumptions about the opportunity costs of travel time

Table A2. Negative binomial regression with 1/3 of the wage rate as the opportunity costs of travel time

	(1)	(2)	(3)	(4)	(5)
C. Surplus (USD)	32,004	24,914	24,709	16,209	15,458
C_surplus per trip (USD)	7,825	6,091	6,041	3,963	3,082

Endnotes

[1] The results for Kailua, Hanauma Bay, Sandy Beach, and the West areas do not demonstrate statistical significance or show statistically positive estimates on the corresponding travel costs partly due to the low frequency of trips reported. Thus, they are not listed in Tables 6 and 7.