CAPE COD FRESHWATER INITIATIVE; ECONOMIC VALUE

FINAL REPORT

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April 2024

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1 EXECUTIVE SUMMARY

1.1 Background

In the fall of 2022, the Cape Cod Commission (CCC or the Commission, hereafter) contracted with Eastern Research Group, Inc. (ERG) of Concord, MA to develop an assessment of the economic value of freshwater resources on Cape Cod. This study forms a component of the Commission's larger Freshwater Initiative. The CCC Freshwater Initiative is a science-based, information-driven planning process that will engage stakeholders and enable action to protect and restore Cape Cod's freshwater ponds. The goal of our economic assessment is to broaden understanding of the impact of ponds and lakes and their respective water quality on housing and rental markets, pond visitation, spending, and public perceptions about freshwater resources. The results of these analyses will help inform decisions about future freshwater restoration and preservation efforts.

1.2 Approach

ERG implemented four separate tasks on behalf of the Cape Cod Commission between November 2022 and November 2023:

- A survey of the perceptions of freshwater resources on Cape Cod.
- An analysis of how proximity to and quality of freshwater resources affect property and rental values (in economics, this is referred to as a "hedonic analysis").[1]
- An economic benefits analysis where we elicited information to better understand the economic value that people place on different pond attributes (in economics, this is referred to as a "discrete choice experiment").
- An on-site intercept survey where we counted pond visitors and surveyed pond-goers to understand their spending and visitation.

ERG conducted a survey to understand perceptions surrounding Cape Cod's freshwater resources. The survey was performed in February and March of 2023 and included 827 respondents. 154 (18.6%) respondents were residents, 86 (10.4%) were NROs, and 587 (71.0%) were visitors. Results of the survey were used to better understand pond and lake recreation, visitation rates, and attitudes towards ponds and lakes from both locals and visitors to the Cape.

ERG completed the hedonic property price analysis to estimate the value of proximity to ponds and pond water quality to home buying and rental values. We used data on Cape home sales from 2015 to 2022 and home rental prices in 2022 to derive estimates of how people value specific characteristics of homes including the number of bedrooms and bathrooms, whether a property is located on a waterfront, water quality levels at nearby ponds and lakes, property acreage, and more. Overall, our data sources covered 21,061 home sales and 7,954 rental properties.

[1] Secchi depth, which measures water clarity, is used as a proxy for water quality in the hedonic analysis

ERG designed and conducted a discrete choice experiment to derive estimates of the demand for freshwater ponds on Cape Cod by residents, NROs, and tourists. Choice experiments are a "stated preference" method in which survey respondents are asked about their preferences for specific attributes or characteristics of ponds and lakes. ERG investigated demand for several aspects of ponds and lakes including signs about water quality, bacterial issues, beach size, litter or garbage, shoreline development, amenities (e.g., picnic tables, bathrooms), and travel time required to arrive at the pond or lake. ERG collected data from 382 respondents accounting for 102 residents, 13 non-resident owners, and 267 tourists for the discrete choice experiment between September and November of 2023.

Finally, from May to August of 2023, ERG administered on-site intercept surveys and visitor counts at Cape Cod ponds and lakes to collect information about visitors' activities during their visit, spending, and perceptions of water quality among other things. During the survey period, ERG's on-site teams performed five visits to the Cape that involved 20 days of collecting in-person data. We visited 75 unique ponds and lakes and talked with 606 pond and lake visitors who represented 2,252 total people (i.e., the respondent themselves plus others in their party). ERG used data from the intercept surveys to demonstrate and communicate the importance of freshwater ponds and lakes to the Cape Cod economy.

1.3 Key Findings

Across ERG's perception survey, hedonic analysis, spending and visitation analyses, and discrete choice experiment, ERG finds that the presence and quality of freshwater has a wide impact on the Cape Cod economy and tourism. Below, we present a selection of key findings from our research.

- *Cape Cod ponds and lakes are popular destinations.* 82 percent of Cape residents, non-resident homeowners, and tourists reported sometimes or frequently visiting ponds and lakes. There are between 1.34 million and 1.70 million visits to Cape Cod ponds and lakes annually, with 66% of those visits coming between June and August.
- *People prefer to visit ponds and lakes with clean water and clean beaches.* We see a positive association between water quality and visitation, with "better" ponds being more highly recreated. Additionally, residents, non-resident Cape homeowners, and Cape tourists reported that they are more likely to visit ponds and lakes that are free of bacteria, post signs containing water quality information, and are free of litter.

Clean Water and Clean Beaches Increase Visitation

Visitors are **1.8 TIMES** more likely to visit a pond that **rarely or never has bacterial issues** than a pond with issues every summer.

Visitors are **2.5 TIMES** more likely to visit a pond that has **little to no litter** than a pond with a noticeable amount of litter.

Visitors are **1.2 TIMES** more likely to visit a pond that has **signs about recent water testing** than one with no sign.

- *Cape residents and non-resident homeowners value clean ponds.* 90.8 percent either "agree" or "strongly agree" that ponds and lakes are important to the Cape Cod environment and they are willing to pay a premium to live near them. A home near a pond with clear water will sell for $22,300 (5 percent more than the median sales price) more than a similar home near a pond with algal issues, and a rental property near a pond with clear water will rent for $189 more per week (an 8 percent increase over median weekly rental value) than a similar rental property near a pond with algal issues.

Clean Water Increases Nearby Home Value

A home near a pond with clear water will sell for **$22,300 MORE** than a similar home near a pond with algal issues.

A rental property near a pond with clear water will rent for **$189 MORE** per week than a similar rental property near a pond with algal issues.

- *Cape residents and non-resident homeowners support targeted pond improvements.* Residents and NROs indicated that the most impaired ponds and lakes, the ones with the highest support for improvement, and the most used/visited should be prioritized. Additionally, Cape residents and NROs overwhelmingly indicated that pond improvement projects with ecosystem benefits should be prioritized.
- *Lakes and ponds are important to the Cape Cod economy.* 83.9 percent of Cape residents and non-resident homeowners either "agree" or "strongly agree" that ponds and lakes are important to the Cape Cod economy, (only 3.3 percent "disagree" or "strongly disagree"). Spending associated with visits to lakes and ponds contributes between approximately 656 and 833 jobs annually and is responsible for $70 - $89 million of the region's GDP. Each pond or lake visitor spends an average of $50 locally per visit.

While this report captures a significant portion of the economic value attached to Cape Cod ponds and lakes, our valuation is not comprehensive and does not represent the total value of ponds and lakes on Cape Cod. We do not attempt to assess certain values that may be associated with ponds and lakes such as ecosystem services, cultural value, natural resource generation (such as fish production), willingness to pay, and more, which play a significant role in overall freshwater value. Despite their limitations, the results of our analyses demonstrate that ponds and lakes contribute significant value to the Cape Cod economy. Additionally, we found that Cape Cod residents and tourists alike are willing to pay more for clean water and clean beaches at ponds and lakes.

2 PERCEPTIONS OF CAPE COD FRESHWATER RESOURCES

2.1 Background

In February and March of 2023 ERG implemented an online survey via ERG's Qualtrics account to understand perceptions surrounding Cape Cod's freshwater resources. Respondents were selected from an online panel access by Qualtrics on behalf of ERG. ERG grouped respondents by their association with Cape Cod to better understand the differences in how residents, non-resident owners (NROs), and visitors/tourists viewed freshwater resources on the Cape. The survey was performed in February and March of 2023 and included 827 respondents. Results of the survey were used to better understand pond and lake recreation, visitation rates, and attitudes towards ponds and lakes from both locals and non-locals.

ERG targeted an overall sample of 800 respondents, with 30 percent of responses from residents and NROs and 70 percent from visitors. Of the 827 responses recorded, 154 (18.6 percent) were residents, 86 (10.4 percent) were NROs, and 587 (71.0 percent) were visitors. In reviewing the respondent demographics, ERG found that some groups were over- or under-represented in the survey, therefore ERG weighted the responses to better reflect the populations. ERG presents key data from the Qualtrics survey here. For a more thorough discussion and presentation of the data, methods, and background, please see Appendix A: Perceptions Survey.

2.2 Respondent Characteristics

Table 1 presents a demographic summary of the sample. These summaries reflect unweighted data to provide an overview of the sample itself. A majority of respondents were women (61 percent). Almost a quarter of the sample was aged 65 or older and 54 percent was under age 45, but only 23.6 percent of sample was aged 45 to 64. Almost half (47.7 percent) of the respondents had annual household incomes between $30,000 and $90,000. Almost one quarter of the respondents identified as black, Hispanic or another non-white racial/ethnic group. Three-quarters of the respondents live in households with two to four people. A majority of respondents live in households without children (55 percent) and approximately one quarter live in households with children 10 and younger. As discussed above, after reviewing these distributions, the Cape Cod Commission and ERG decided to develop weights partly based on age and race with Cape location being the third weighting factor.

Table 1. Demographic summary of survey respondents

How would you describe your gender identity?		
Gender	**Respondents**	**Percent**
Male	300	36.3%
Female	504	61.0%
Other/declined	22	2.7%
How old are you?		
Age	**Respondents**	**Percent**
18 to 24	117	14.2%
25 to 34	156	18.9%
35 to 44	172	20.9%
45 to 54	97	11.8%
55 to 64	89	10.8%
65 plus	191	23.2%
Preferred not to say	3	0.4%
What is your combined household income from all sources?		
Income	**Respondents**	**Percent**
Less than $30K	96	11.6%
$30K - $50K	125	15.1%
$50K - $70K	146	17.7%
$70K - $90K	123	14.9%
$90K - $120K	114	13.8%
$120K - $140K	74	9.0%
$140K - $160K	41	5.0%
More than $160K	62	7.5%
Preferred not to say	46	5.6%
How would you describe yourself? (Select all that apply)		
Identity	**Respondents**	**Percent**
White	595	72.0%
Black	113	13.7%
Hispanic	95	11.5%
Other	53	6.4%
In your household, do you have children in any of the following age ranges? (Select all that apply)		
Age Range	**Respondents**	**Percent**
Under 5	86	10.4%
Between 5 and 10	143	17.3%
Between 11 and 17	148	17.9%
18 and Older	118	14.3%
No children	443	53.6%

Figure 1 illustrates the geographic distribution of resident respondents across 14 Cape Cod municipalities. The resident sample is concentrated in the upper and mid Cape. Wellfleet is

the only municipality not represented in the resident sample, where an estimated 1.7 percent of full-time residents live according to 2020 American Community Survey (ACS) data. Further comparisons to ACS data from that year suggest Mashpee residents are modestly over-represented in our sample.

Figure 1. Where do respondents live on Cape Cod? (residents only)

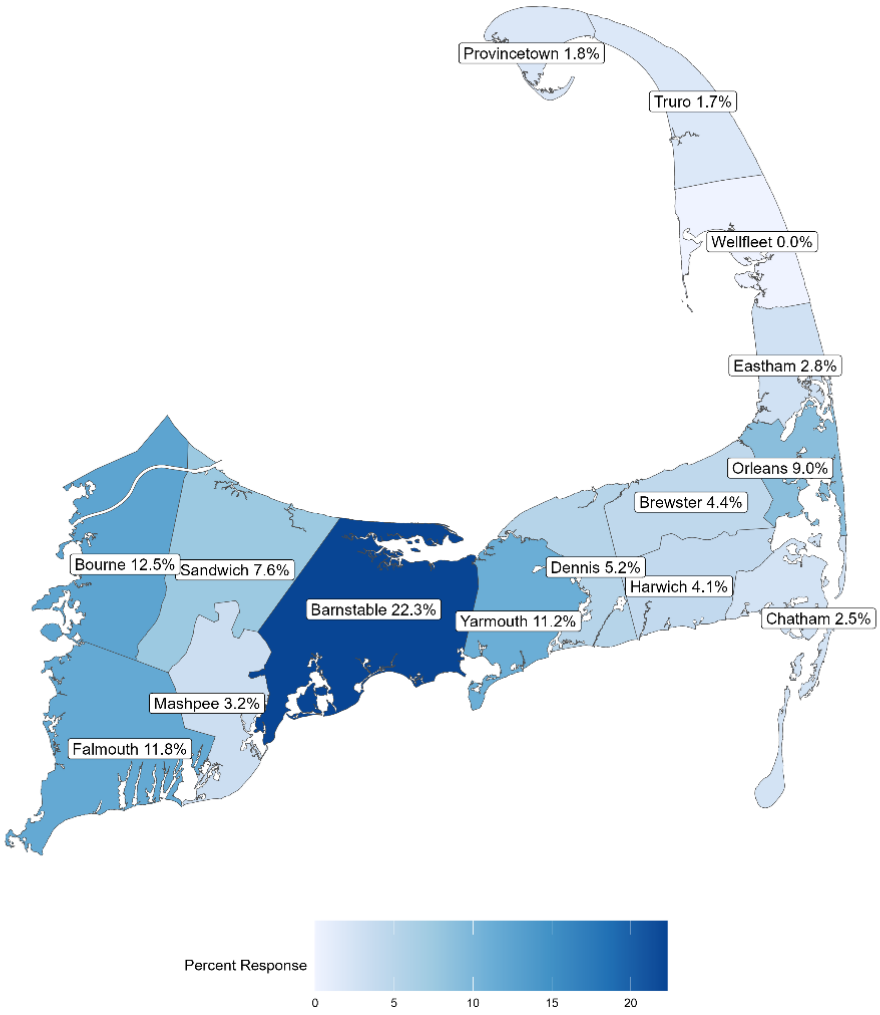
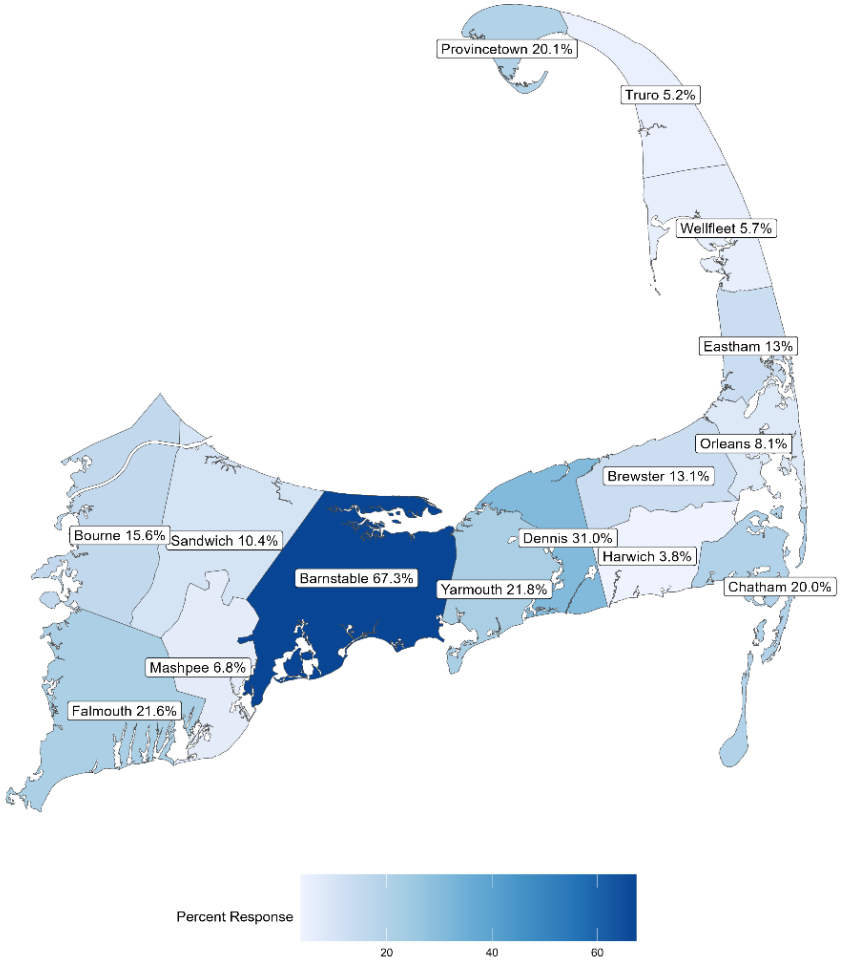


Figure 2 illustrates the geographic distribution of where nonresident owners and tourists tend to stay across Cape Cod. The nonresident sample is concentrated in Barnstable, where 67 percent of NROs and tourists tend to stay. We note that nonresident owners and tourists were allowed to select more than one location in response to this question.

Figure 2. Where do visitors stay? (nonresidents owners and tourists)



2.3 Results

2.3.1 Recreation

Table 2 presents the extent to which residents, NROs, and tourists engage in a range of recreational activities on Cape Cod. More than 90 percent of residents, NROs, and tourists sometimes or frequently participate in beach activities (94.1 percent) and dining (95.9 percent). More than 70 percent of residents, NROs, and tourists rarely or never participate in organized sports (78 percent) or sail (70.2 percent).

Table 2. Recreational Activity on Cape Cod (All Respondents)

To what extent do you participate in the following activities on Cape Cod?				
Activity	**Not at all**	**Rarely**	**Sometimes**	**Frequently**
Swimming	5.5%	13.6%	41.0%	39.8%
Canoeing, etc.	26.2%	23.6%	35.6%	14.6%
Sailing	47.1%	23.1%	22.5%	7.3%
Motorboats	43.2%	22.0%	25.3%	9.5%
Beach	1.2%	4.5%	22.8%	71.5%
Birding	37.9%	25.0%	26.4%	10.7%
Walk/hike	2.9%	10.3%	41.5%	45.4%
Enjoying Cultural Attractions	3.2%	19.2%	41.7%	36.0%
Organized Sports	49.4%	28.6%	15.6%	6.4%
Shopping	2.0%	12.8%	39.3%	45.9%
Dining	0.4%	3.7%	28.8%	67.1%
Nightlife	12.5%	26.4%	36.7%	24.5%

2.3.2 Pond and Lake Visitation

Respondents were asked to reflect on how frequently they visit ponds and saltwater beaches on Cape Cod. Table 3 summarizes visit frequency by association with Cape Cod. Eighty-two percent of residents, NROs, and tourists sometimes or frequently visit ponds and lakes. For context, 93.2 percent of residents, NROs, and tourists sometimes or frequently visit saltwater beaches. More than one-third of residents (33.7 percent) and nonresident owners (35.9 percent) frequently visit ponds and lakes, twice the share of tourists who do the same (16.3 percent).

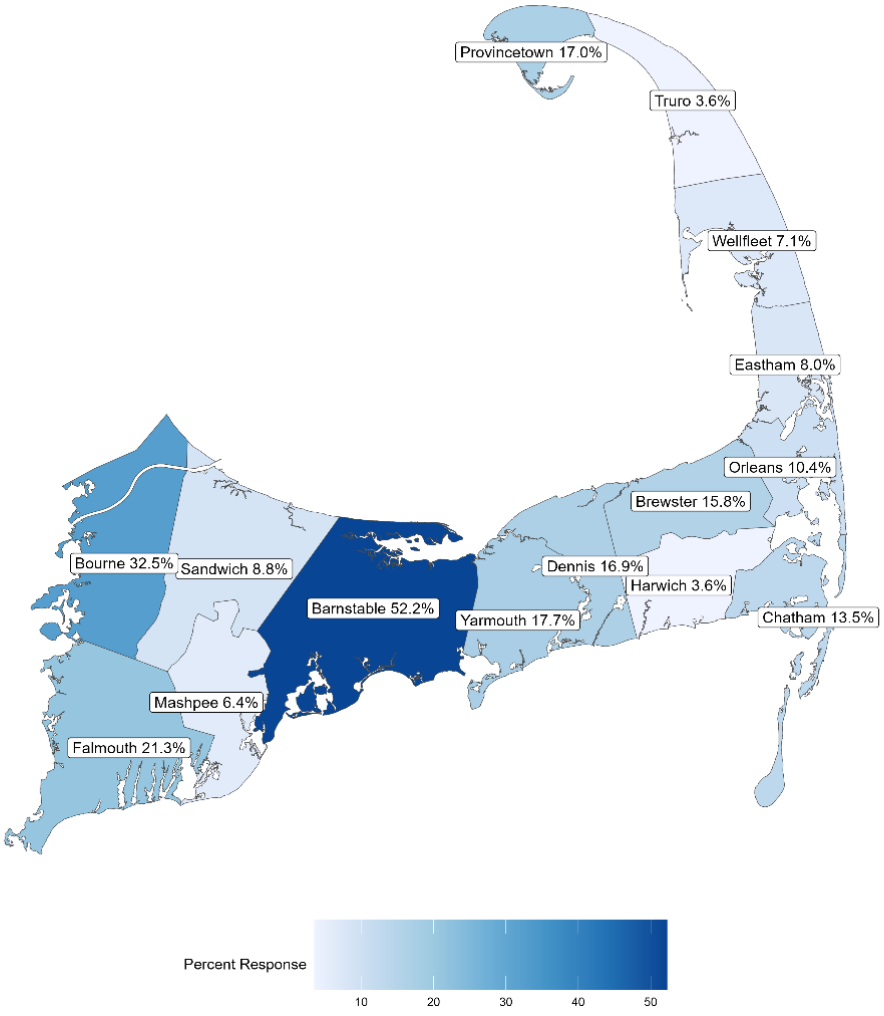
Table 3. Visits to Cape Cod Ponds and Lakes: Frequency by Association with Cape Cod (All Respondents)

How frequently do you visit the following types of areas on Cape Cod?				
Frequency of Visiting	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Ponds [a]				
Rarely	18.1%	17.6%	28.4%	27.9%
Sometimes	48.2%	46.5%	55.3%	55.0%
Frequently	33.7%	35.9%	16.3%	17.2%
Saltwater Beaches				
Not at all	0.3%	0.2%	0.3%	0.3%
Rarely	7.7%	3.5%	6.4%	6.4%
Sometimes	32.9%	14.0%	38.9%	38.4%
Frequently	59.1%	82.4%	54.4%	54.8%

[a] Respondents who stated their frequency of visiting ponds as “Not at all” were screened out of the survey.

Figure 3 illustrates the geographic distribution of villages and towns where residents, NROs, and tourists most often visit ponds and lakes. The leading destination is the town of Barnstable where more than half of residents, NROs, and tourists indicate they often visit ponds and lakes (52.2 percent). We note that survey respondents could select more than one village or town in the question.

Figure 3. Distribution of ponds and lakes visited on Cape Cod (all respondents)



Respondents were asked to name the specific ponds or lakes they visit on Cape. Almost two-thirds of respondents did not identify ponds by name. The pond most frequently mentioned by respondents is “Long Pond,” which is a named pond in more than one Cape town, followed by “Flax pond”, which is also a named pond in more than one town, and then Scargo Lake in Dennis.

2.3.3 Preferences for Pond Characteristics

To better understand residents, NROs, and tourists' preferences for pond characteristics, we included a series of questions that asked respondents to select the "most preferred" and "least preferred" characteristics from a list. The approach is referred to as best-worst scaling (BWS). For this work, CCC and ERG developed a list of 14 pond characteristics:[2]

- Litter – "The pond/lake and areas are free of litter."
- Bacteria – "The water is free of bacteria."
- Water clarity – "The water is clear."
- Stand – "The pond/lake's bottom/floor is comfortable to walk on/stand in."
- Crowded – "The pond/lake is not crowded."
- Fishing – "Fishing is possible."
- Shoreline – "The shoreline is not developed."
- Algae – "The water is free of algae."
- Parking – "Resident and nonresident parking is available."
- Restrooms – "Public restrooms are present."
- Weeds – "The pond/lake is free of weeds."
- Dock – "There is a dock to stand on/jump off."
- Beach – "There is a beach."
- Boat – "There is enough water to launch my boat."

To analyze these data, ERG performed a statistical analysis using a conditional logistic regression model. The model is designed to assess which of the items are more likely to be selected as the "most" preferred and which are more likely to be selected as the "least" preferred.[3] The output from the model is a set of logistic regression coefficients that reflect the strength that items were selected as the "most" preferred item relative to being selected as the "least" preferred item. Positive values reflect items that were more likely to be selected as "most" preferred and negative values reflect items that were more likely to be selected as "least" preferred. The estimated values reflect the strength of that association (e.g., larger positive values reflect items more likely to be selected as "most" preferred compared to smaller positive values).

Table 4 provides the results of our analysis with pond characteristic items sorted by their overall rating based on the BWS index values. Four characteristics rated very strongly in terms of being more likely to be selected as the "most" preferred: bacteria, beach, algae, and litter. We also performed the statistical analysis taking into consideration other survey data; Table 4 also provides the pond characteristic items ranked by association with the Cape and by pond visit frequency. The table presents the BWS Index values accounting for these other factors and

[2] In the list, the pond attribute appears first followed by the exact wording presented to respondents in quotes.
[3] An alternative approach is to simply assign each item selected as "most" a value of +1 and each item selected as "least" preferred a value of -1 for each respondent and then add up the values over all respondents for each item. The adding up approach, however, does not work as well when the items are divided across multiple questions such as in this case. Later in survey we implemented two other BWS questions which did not divide the items across questions, and we present those using the adding up approach.

the rank (highest to lowest) for each factor. For these two other factors, the top four items are the same as in the overall analysis (bacteria, beach, algae, and litter). Regardless, the absence of bacteria remains among the top two in each analysis and the absence of litter is either the third or fourth ranked item in each.[4]

Table 4. Best-Worst scaling pond characteristics ratings, overall and by association with Cape Cod and pond visit frequency

Item	Overall	Association with Cape				Pond Visit Frequency					
		Resident/ NROs		Tourists		Rarely		Sometimes		Frequently	
	Score	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Bacteria	2.795	3.501	1	2.763	2	2.862	2	2.966	2	2.283	1
Beach	2.754	2.519	3	2.767	1	3.058	1	2.986	1	1.866	2
Algae	2.117	2.659	2	2.089	3	2.553	3	2.131	4	1.470	4
Litter	2.049	1.963	4	2.055	4	1.671	4	2.396	3	1.814	3
Restrooms	1.021	0.360	6	1.052	5	1.059	5	1.312	5	0.399	6
Water clarity	0.725	0.887	5	0.717	6	0.814	6	0.750	6	0.573	5
Parking	0.360	-0.228	7	0.390	7	0.757	7	0.483	7	-0.559	10
Crowded	-0.070	-0.496	9	-0.049	8	0.100	8	-0.261	8	0.249	7
Weeds	-1.008	-0.248	8	-1.049	9	-1.660	10	-0.945	9	-0.371	9
Fishing	-1.340	-1.320	11	-1.341	10	-2.138	11	-1.437	11	-0.190	8
Shoreline	-1.445	-1.189	10	-1.460	11	-1.490	9	-1.352	10	-1.754	14
Stand	-1.605	-2.081	12	-1.584	12	-2.319	12	-1.482	12	-1.044	11
Boat	-2.579	-2.936	14	-2.563	13	-2.971	13	-2.743	13	-1.669	13
Dock	-2.603	-2.529	13	-2.609	14	-2.999	14	-2.886	14	-1.520	12

2.3.4 Perceptions and Attitudes about Pond and Lake Health

Table 5 captures perceptions about Cape Cod ponds and lakes among residents, NROs, and tourists. Overall, residents and NROs strongly agreed that ponds are important to the Cape economy (53.3 percent of respondents) and strongly agreed that ponds are important to the Cape environment (60.6 percent of respondents). Residents and NROs indicated concern over the health of Cape ponds overall and concern over ponds that they personally visit.

[4] The analysis was also performed by breaking out the results by ages of children in the respondents' families and the age of respondents themselves. We have not reported those here. Nevertheless, the top four items were the same in all analyses with some re-ordering of the items.

Table 5. Perceptions of Cape cod ponds and lakes (all respondents)

Do you agree or disagree with the following statements about freshwater Cape Cod ponds and lakes?				
	Cape Association			
	Residents	NROs	Tourists	All Respondents
Ponds and lakes are important to the Cape Cod economy				
Strongly disagree	1.8%	5.8%	2.4%	2.4%
Disagree	2.0%	0.5%	0.9%	0.9%
Neither agree nor disagree	10.5%	2.8%	11.0%	10.9%
Agree	27.4%	27.7%	30.8%	30.6%
Strongly agree	55.2%	63.2%	53.1%	53.3%
Not sure/don't know	3.2%	0.0%	1.9%	1.9%
Ponds and lakes are important to a town's economy				
Strongly disagree	0.3%	5.7%	2.1%	2.0%
Disagree	3.0%	0.1%	0.7%	0.8%
Neither agree nor disagree	14.3%	11.1%	9.5%	9.7%
Agree	37.7%	42.4%	38.4%	38.4%
Strongly agree	42.1%	40.7%	46.6%	46.4%
Not sure/don't know	2.7%	0.1%	2.7%	2.7%
Ponds and lakes are important to the Cape Cod environment				
Strongly disagree	1.0%	6.0%	1.7%	1.7%
Disagree	1.8%	0.0%	1.3%	1.3%
Neither agree nor disagree	4.6%	6.8%	4.7%	4.7%
Agree	25.0%	28.3%	30.4%	30.2%
Strongly agree	64.9%	58.9%	60.4%	60.6%
Not sure/don't know	2.7%	0.1%	1.5%	1.6%
Ponds and lakes are important to a town's environment				
Strongly disagree	0.3%	5.6%	2.0%	1.9%
Disagree	0.5%	4.7%	0.9%	1.0%
Neither agree nor disagree	4.2%	6.7%	7.5%	7.4%
Agree	33.3%	32.4%	36.5%	36.3%
Strongly agree	58.7%	50.3%	52.1%	52.3%
Not sure/don't know	3.1%	0.3%	1.0%	1.1%
I seek out news highlighting the status of ponds/lakes				
Strongly disagree	2.1%	4.7%	6.2%	6.0%
Disagree	15.7%	10.2%	19.3%	19.1%
Neither agree nor disagree	29.1%	37.2%	31.1%	31.1%
Agree	38.8%	21.7%	27.2%	27.5%
Strongly agree	11.9%	25.5%	15.1%	15.1%
Not sure/don't know	2.4%	0.8%	1.2%	1.2%
I understand the connection between ponds/lakes and drinking water				
Strongly disagree	0.9%	4.3%	1.0%	1.0%
Disagree	3.0%	4.3%	5.6%	5.5%

Neither agree nor disagree	12.3%	14.6%	17.2%	16.9%
Agree	43.6%	43.3%	38.3%	38.6%
Strongly agree	34.0%	32.8%	32.7%	32.8%
Not sure/don't know	6.3%	0.8%	5.2%	5.2%
I understand the connection between ponds/lakes and marine water				
Strongly disagree	0.5%	4.2%	2.1%	2.1%
Disagree	6.6%	0.6%	5.6%	5.6%
Neither agree nor disagree	21.2%	16.8%	17.4%	17.5%
Agree	34.2%	39.8%	41.2%	40.9%
Strongly agree	32.3%	38.6%	29.4%	29.6%
Not sure/don't know	5.3%	0.0%	4.4%	4.4%
I am concerned about the state of Cape Cod ponds/lakes				
Strongly disagree	0.9%	4.7%	3.6%	3.5%
Disagree	3.8%	3.1%	9.0%	8.7%
Neither agree nor disagree	17.7%	12.0%	29.4%	28.7%
Agree	34.0%	34.7%	34.6%	34.6%
Strongly agree	40.2%	41.0%	21.6%	22.5%
Not sure/don't know	3.4%	4.5%	2.0%	2.0%
I am concerned about the state of the ponds/lakes I visit				
Strongly disagree	0.5%	4.9%	2.8%	2.7%
Disagree	4.7%	0.8%	9.4%	9.1%
Neither agree nor disagree	14.9%	27.8%	25.0%	24.6%
Agree	37.1%	39.1%	37.3%	37.3%
Strongly agree	38.9%	23.2%	23.4%	24.0%
Not sure/don't know	4.0%	4.2%	2.1%	2.2%
Addressing pond/lake health should be a Cape-wide priority				
Strongly disagree	0.3%	5.7%	0.8%	0.8%
Disagree	1.0%	4.2%	2.0%	2.0%
Neither agree nor disagree	13.6%	6.3%	11.8%	11.8%
Agree	41.7%	29.4%	44.2%	44.0%
Strongly agree	40.3%	50.1%	39.1%	39.2%
Not sure/don't know	3.1%	4.2%	2.1%	2.2%
Addressing pond/lake health should be a priority for towns				
Strongly disagree	1.0%	4.2%	0.4%	0.4%
Disagree	0.3%	0.2%	1.1%	1.1%
Neither agree nor disagree	9.6%	6.4%	10.8%	10.7%
Agree	43.0%	38.7%	43.4%	43.3%
Strongly agree	42.9%	42.2%	41.4%	41.4%
Not sure/don't know	3.2%	8.3%	3.0%	3.1%

Other key perceptions to highlight are that Residents, NROs, and visitors all agree that towns and the County have the largest role to perform in pond and lake management. We also

asked residents and NROs what aspects of ponds and lakes and what aspects of projects should be used in prioritizing pond improvement projects. In terms of ponds and lakes, residents and NROs indicated that the most impaired ponds and lakes, the ones with the highest support for improvement, and the most used/visited should be prioritized. In terms of projects, residents and NROs overwhelmingly indicated that projects with ecosystem benefits should be prioritized.

3 IMPACT OF FRESHWATER RESOURCES ON HOME AND RENTAL PROPERTY VALUES

3.1 Background

ERG performed a statistical analysis that linked property sales prices to proximity to ponds and pond water quality. This type of analysis is referred to as a "hedonic" analysis. Economists view homes as "composite" goods; specifically, homes are a bundle of characteristics (e.g., number of bedrooms, location) that people place values on. Using this information, we can use data on home sales to derive estimates of how people value different characteristics of homes. This includes physical characteristics of the home and its property, but also amenities such as nearby ponds or the distance to the ocean. ERG highlights key findings from the hedonic analysis in this chapter.

3.2 Methods

For our analysis, ERG was provided data from the Cape Cod and Islands Association of Realtors available to the Commission. The data included the sales of homes on the Cape from 2015 to 2022. As a first step, ERG performed a series of data cleaning tasks. First, any home in the data that was not actually on Cape Cod (Barnstable County) was removed. Second, we removed any home that had missing or suspect key data elements; for example, homes listed as having zero square footage were removed as were ones that were listed as having no bedrooms or no bathrooms. Third, we removed any home that had a sales price less than $100,000 or greater than $10 million.[5] Fourth, we removed any property that was built before 1900 since those properties may have historical significance we cannot reasonably account for in the model. Fifth, we kept only sales of single-family homes and condominiums (e.g., we removed mobile homes and other rarer property types; overall, however, single family homes and condominiums represented more than 99 percent of the sales in the base data). Finally, we removed properties that had more than six bedrooms and more than five bathrooms. Overall, this results in an analytical data set of 21,061 property sales from 2015 to 2022.

Hedonic price analysis involves estimating a multivariate linear regression using the sales price of the property as the dependent variable and the characteristics of the home as the independent variables. For our model, we measured sales price using a natural log transformation. The model included several independent variables:

- The number of bedrooms
- The number of bathrooms

[5] The reason for removing lower values is to remove data points where the sales price may be happening outside of the market (e.g., between family members); the value of $100,000 seems to be a reasonable value for this (only 197 sales of approximately 40,000 in the data were removed. Sales on the upper end (greater than $10 million) were removed since those properties may be part of a broader (e.g., beyond Cape Cod) real estate market and values that large may influence our estimated values (there were 173 sales above $10 million).

- The total acres of land (converted to a natural log)
- The total living space in square footage (converted to a natural log)
- Whether or not the property has a garage
- Whether or not the property has a pool
- If the property is a condominium (compared to a single-family home)
- If the property is labeled as waterfront
- The distance to the ocean (measured as a natural log)
- The average distance to the three nearest ponds
- Average Trophic State Index (TSI) value for the 3 nearest ponds[6]

We also included binary control variables for towns on the Cape and binary controls for years.

For our purposes in this project, we are most interested in the characteristics that reflect ecosystem services on the Cape:

- Waterfront location. These data provided a yes/no indicator of whether the property is listed as a waterfront location. Including this in the analysis captures the value that people place on owning a property on the water. Unfortunately, the data do not indicate what type of water the property is next to (e.g., ocean, pond). To parse out the effects of ocean and pond waterfront locations, we formed two separate variables: (1) a binary indicator for when a property was listed as waterfront and was less than 100 meters from the ocean and (2) a binary indicator for when a property was listed as being waterfront and was less than 100 meters from its closest pond (see below).[7] For completeness, we also formed a "waterfront, other" variable that was any property that was listed as waterfront, but not within 100 meters of a pond or the ocean. Our expectation is that waterfront location will have a positive effect on sales price and that ocean waterfront locations would be more valuable than pond waterfront locations.
- Proximity to the ocean. ERG used GIS analysis to calculate each property's distance (in kilometers (km)) to the ocean. This factor captures the value that people place on being closer to a primary form of recreation on the Cape. Our expectation is that distance from the ocean will have a negative effect on sales price (i.e., further from the ocean leads to lower prices).
- Proximity to ponds. ERG used GIS analysis to calculate the distance that each property was to nearby ponds.[8] We measured this factor as the average distance to the three nearest ponds. Initial specification testing indicated that using three ponds worked better statistically than using just the closest pond. Thus, this factor is measuring the

[6] TSI estimates are derived from Secchi depth. TSI is a measure of the "total weight of living biological material (biomass) in a waterbody at a specific location and time." See here for more details.
[7] We also performed analyses that defined ocean or pond waterfront as simply being within 100 meters of the ocean or pond; the statistical results were similar to the results using this formulation.
[8] ERG's freshwater data included latitude and longitude points to the center of each pond. As a result, the distance to the nearest pond is a measurement to the center of the pond instead of the waterfront. This may inflate the true distance to a body of water, but ERG does not believe it has an appreciable impact on the analysis.

extent to which a property has multiple (three) nearby ponds. Our expectation is that average distance from the three nearest ponds will have a negative effect on sales price (i.e., further from the ponds lead to lower prices).

- Water quality at nearby ponds. For the three nearest ponds, we measured the TSI (derived from Secchi depth; see link for details) for each and took an average over the three ponds. Secchi depth was chosen as the preferred water quality indicator because it measures water clarity, which is visible to prospective home buyers. Secchi depth is also the variable for which there is the most data, allowing us to expand the analysis to more ponds. Lower TSI values reflect clearer water which may be perceived as better water quality with a value of 30 reflecting clear water and a value of 80 reflecting low water transparency and dense plant growth, traits often visibly associated with poor water quality.[9] Our expectation is that lower TSI values (better quality) in nearby ponds is associated with higher prices.

After running the analysis we take the regression coefficient for each variable in the model and convert it to its marginal effect. Given our use of price measured as a natural log, each marginal effect is phrased in terms of a percentage change. The conversion depends on the form of the variable used. For binary (yes/no) variables, the associated regression coefficient is interpreted as a percentage difference between the sales price of the two groups defined by the binary variable (e.g., difference between homes with and without pools). For variables measured as natural logs, the regression coefficient is directly interpreted as an elasticity reflecting the percent change in sales price from a one-percent change in the variable. For variables measured as cardinal values (e.g., number of bedrooms), the marginal effect reflects the percentage change in sales price for a one-unit change in the variable.

Next, we multiply the marginal effect by the median sales price in the data ($445,900) to convert to a monetary value. We can convert the value at the median price to an annualized value using the approach suggested by Freeman (2003); we multiply the marginal effect by the interest rate (r) plus the tax rate (t).[10] The annualized value reflects how much people are willing to pay annually for a one-unit change in the variable valued at the median sales price. Finally, we calculate the amortized value by multiplying the marginal effect by $\left[1 + {}^{t}/_{r}\right]$ (Freeman, 2003). The amortized value reflects the value people place on a one-unit change in the variable over the time they will occupy the home. For our variables reflecting towns and years, however, we only calculate the marginal effects valued at the median sales price since interpretation of the annual and amortized values is not relevant.

To supplement the property sales price analysis, ERG performed a similar analysis of rental prices on Cape Cod. ERG used VRBO and Airbnb rental data from 2022 which included

[9] ERG recognizes that Secchi depth may vary from year to year or even month to month within the same pond. However, without time series data on Secchi depth at the ponds in our analysis, we are assuming that the values we have in the data represent a decent approximation of the clarity at the ponds overall.

[10] To calculate the interested rate, we took the average of the annual mortgage rates from the St. Louis Federal Reserve Bank data. For tax rates, we used publicly available data on 2022 (our base year in the analysis) tax rates for each town and calculated a weighted average using sales in each town in the analysis data as the weighting factor.

number of bedrooms, maximum numbers of guests, number of bathrooms, type of property (e.g., home, room), and location (both named place and latitude and longitude). The data also included month-by-month information for each property on average daily revenue (ADR), number of guest nights, and total monthly revenue. Our rental analysis focused on ADR as the key "price" variable. Overall, the source data contained 7,954 properties. ERG used latitude and longitude data to calculate the distance to the nearest three ponds from each rental property, and then matched the nearest ponds to water quality measures.

3.3 Results

Table 6 presents the property price valuation results for pond and ocean-related characteristics. First, we note that proximity to the ocean is valuable. For each kilometer away from the ocean, a home's price drops by $25,891 (about 6 percent) when valued at the median sales price. This translates into a $1,240 annual premium for each kilometer closer to the ocean and a $31,361 amortized value for each kilometer.

Waterfront locations (not distinguished between ocean and ponds) are associated with high premiums with waterfront homes selling for $182,283 more (40.9 percent) than non-waterfront locations when valued at the median. The waterfront differential translates to an $8,729 annual value and $220,797 amortized value. When we distinguish between ocean and pond waterfronts, we see that ocean waterfront locations are valued at $14,320 annually ($362,230 amortized) and pond waterfront locations are valued at $4,006 annually ($101,346 amortized).

The average distance to the three nearest ponds, however, is associated with a positive and statistically significant coefficient. In other words, people are willing to pay more for being away from ponds, rather than closer to them. It is unclear why value increases as homes are further from ponds in the estimated model since we have already included distance to ocean as a factor as well. One possibility is that being further from a pond puts a home closer to services and other amenities such as stores and businesses. Another consideration is that because there are close to 900 ponds on Cape Cod, residents will usually be close to a pond, and they may therefore place more value on other amenities like proximity to towns and services than they otherwise would. Additionally, of the close to 900 ponds on Cape Cod, close to 500 are less than two acres. If those smaller ponds are associated with less valuable geographic characteristics (wooded, remote areas), that could influence this coefficient. We note, however, that living at pond waterfront locations was found to have significant value. Thus, the value of being close to a pond may be solely attributable to having a waterfront location on the pond and not simply being close to ponds.

The change in price for being close to clean ponds is statistically significant. As TSI values decline (i.e., pond water is clearer), home sales prices increase. As noted above, a TSI value of 80 indicates a poor-clarity pond and one that has a TSI value of 30 is relatively clear/better

quality.[11] For each 10-unit improvement (decrease) in TSI at a home's three nearest ponds, home sales prices increase by $7,474 (1.7 percent) at the median. This translates to a $358 annualized value and a $9,053 amortized value.

Table 6. Valuation results for pond and ocean characteristics

Characteristic	Regression Coefficient [c]	Marginal Effect	Value at Median Home Price	Annualized Value	Amortized Value
Waterfront location [a]	0.4088	40.88%	$182,283	$8,729	$220,797
Waterfront location on ocean	0.6707	67.07%	$299,045	$14,320	$362,230
Distance to Ocean (km)	-0.0598	-5.81%	($25,891)	($1,240)	($31,361)
Waterfront location on pond	0.1876	18.76%	$83,668	$4,006	$101,346
Average Distance to Three Nearest Ponds (km)	0.0501	5.14%	$22,913	$1,097	$27,754
Average TSI Value of Three Nearest Ponds, 10 Unit Change	-0.0017	-1.68%	($7,474)	($358)	($9,053)
Waterfront, other than pond/ocean [b]	0.4087	40.87%	$182,254	$8,727	$220,762

Note: Except where noted, values derived from Model 2.
[a] Derived from Model 1.
[b] We note that this factor was measured as being listed as waterfront and not being within 100 meters of either a pond or the ocean. Thus, many of these may include properties that have water views or have property abutting a pond or the ocean (but within 100 meters or the GIS coordinates assigned to the property.
[c] All regression coefficients were statistically significant at the one percent level.

One way to think about the results for water quality is to estimate the value associated with pond improvements. Given the estimates are linear in TSI values, a one-unit improvement in TSI in the three nearest ponds to a home would be valued at $35.80 annually. Although the number seems small, if all ponds on the Cape were to see a one-point improvement in TSI, the value of that one-point improvement would be calculated as the total number of homes on the Cape multiplied by the $35.80 value.

This type of exercise can also be done at a finer level of detail. The analyses above use the median home value to project out annual and amortized values. Another approach would be to look at the value by town, and also different housing characteristics.

Overall, ERG found similar results for the rental price hedonic model as it did for the sales price model. ERG found that rental prices increase as you move away from ponds, possibly

[11] See https://www.nalms.org/secchidipin/monitoring-methods/trophic-state-equations/.

reflecting renters' desire to be closer to other amenities like town centers which might have fewer ponds. ERG also found that better water quality is associated with higher rental prices. ERG found that a 10-unit increase in TSI is worth approximately $6 in daily revenue in a linear model and $9 in daily revenue in a Tobit model.[12] ERG found similar trends in rental markets regarding number of bedrooms, bathrooms, and town-based premiums embedded in rental prices. Coefficients of and daily values of other variables considered for the rental analysis can be found in Appendix B: Hedonic Analysis Regression results and methods.

[12] A Tobit model is a statistical model that accounts for truncated data. Truncated data occurs when the values for the dependent variable (average daily revenue in our analysis) are set to the same value above or below a certain threshold value. In our analysis, the Tobit model accounts for zeros from average daily revenue values from unrented property-weeks. Ignoring the truncated nature of the data in the analysis will skew the results of the analysis.

4 PREFERENCES ABOUT POND AND LAKE CHARACTERISTICS

4.1 Background

To better understand the values that people place on ponds attributes, ERG designed and conducted a discrete choice experiment. Discrete choice experiments are a "stated preference" method in economics in which survey respondents are asked about their preferences for a specific good or service. Stated preference methods are used in situations in which a market for a good or service is absent; that is, we construct a hypothetical market and use respondents' decisions within that constructed market to assess demand.

4.2 Methods

4.2.1 Choice Experiment Design

Choice experiments are a more general form of a contingent valuation survey. In a standard contingent valuation survey (e.g., for an environmental restoration project), respondents are provided with a description of the project or resource and a description of the project's or resource's benefits. They are then asked whether or not they are willing to contribute or pay a certain amount (usually in the form of increased property or income taxes) for the project to be performed or resource to be protected.[1] The dollar amounts are varied among respondents and respondents' answers to the yes/no willingness to pay (WTP) question along with other data collected through the survey are used to characterize demand for the project/resource.

In a choice experiment, respondents are also provided with a description of a good or service and a description of the potential benefits of that good or service. Instead of simply asking if the respondent is willing to pay a certain amount to visit a pond, respondents are provided with two (or more) ponds to choose from, including an option to choose "neither pond." Each option is characterized by a set of "attributes." In this survey, the attributes reflect features of Cape Cod's freshwater ponds, including signs about water quality, typical water quality at the pond, beach size, absence/presence of litter, development around the pond, amenities (bathrooms, picnic tables), and the time it takes to travel to the pond. Each attribute is assigned a pre-determined set of "levels" reflecting specific values for the feature. For example, one attribute we used to characterize Cape Cod ponds was the level of "amenities"; for that attribute we defined two levels: "the pond has no amenities such as restrooms and picnic tables" and "the pond has amenities such as restrooms and picnic tables." In a choice experiment, we develop a set of hypothetical ponds using the attributes set at specific levels and then present those to the respondent alongside one or more other ponds. In this project, we asked respondents to choose between two ponds or to select neither pond.

In this project we also used "travel time" to represent the "price" of visiting ponds rather than a fee or other dollar amount. This was done based on discussions with the Commission. Specifically, most ponds do not currently charge a fee to visit; thus, using a fee in the survey to visit ponds would (1) not be realistic to most respondents and (2) raise concerns that fees were indeed being considered for the future. The second of those reasons (concerns about future fees) may, in turn, lead some respondents to provide "protest" responses where they select neither pond to make a point. Finally, ponds are generally accessible to residents and can be accessed by tourists through beach stickers in many Cape towns.

Table 7 contains a list of the attributes and their associated levels that were used in our survey. Attributes were chosen based on results from the perceptions survey in Section 2. Each attribute is defined as follows:

- **Availability of water quality information:** Does the pond have a sign that describes recent water quality testing?
- **Bacterial issues:** How frequently has the pond had issues with bacteria?
- **Beach size:** How large is the pond's beach area?
- **Litter/garbage:** Is there litter or garbage present?
- **Shoreline development:** Are homes, lawns, or private docks visible from the shoreline?
- **Amenities:** Does the pond have amenities such as restrooms and picnic tables?
- **Travel time:** How long does it take to travel to the pond?

The levels in Table 7 are listed in order of hypothesized preference (e.g., we assumed that "amenities such as restrooms and picnic tables" would be preferred to "no amenities"). The final attribute included in the design is travel time, which we use as our price attribute. ERG used four values for travel time: 5, 15, 25, and 35 minutes.

Table 7: Attributes and levels used in choice experiment

Attribute	Levels
Availability of water quality information	• The pond has a sign that describes recent water quality testing. • The pond does not have a sign that describes recent water quality testing.
Bacterial issues	• The pond rarely or never has issues with bacteria. • The pond had bacterial issues in the last 2 years. • The pond has bacterial issues each summer.
Beach size	• The pond has a spacious beach area. • The pond has a moderate-sized beach. • The pond has almost no beach.
Litter/garbage	• The pond and its beach are always clear of litter or garbage. • The pond and its beach sometimes have a small amount of litter or garbage. • The pond and its beach usually have a noticeable amount of litter and garbage.
Shoreline development	• You can see only trees and other natural features around the shoreline. • You can see a few homes, lawns, and private docks around the shoreline. • You can see several homes, lawns, and private docks around the shoreline
Amenities	• The pond has amenities such as restrooms and picnic tables. • The pond has no amenities such as restrooms and picnic tables.
Travel time	• 5 minutes • 15 minutes • 25 minutes • 35 minutes

4.2.2 Experimental Design

Several experimental design decisions were made as part of this research. These included:

- Determining the appropriate number of ponds to use in each choice question.
- Combining the levels of each attribute to formulate "hypothetical ponds."
- Combining the hypothetical ponds into pairs that are presented to respondents.
- Determining the number of times we ask respondents to select between pairs of ponds.

A key aspect of a choice experiment is selecting a manageable design for combining attributes into options for respondents to select from. Our design involved two attributes with two levels, four attributes with three levels, and one attribute with four levels. This implies there are 1,296 (=2x2x3x3x3x3x4) possible hypothetical ponds; this is referred to as the "full factorial design." Using 1,296 combinations is unwieldy to design and would require a large sample size to adequately analyze. ERG used "fractional factorial design" methods to select a set of combinations that would allow for efficient statistical estimation. This process resulted in 48 ponds that were combined into 24 choice sets (pond pairs). Each of the 24 sets contains specific values for "Pond A" and "Pond B." One consideration in developing the set of 48 ponds was to ensure that each level within an attribute appears an equal number of times as other levels within the attribute across all 48 ponds. ERG was able to satisfy this requirement.

CCC and ERG reviewed the 48 ponds and 24 pairings to assess:

- **Realism** – We reviewed the initial set of ponds to ensure that each hypothetical pond was composed of a realistic combination of features.
- **Dominance** – Some combinations will be "dominated" (unlikely to be chosen over another option) by others. For example, a combination with the lowest level for each attribute and the longest time to travel to would be dominated by any other combination.
- **Relevant comparison** – CCC and ERG also reviewed the pairings to ensure that the two ponds were sufficiently different to allow respondents to make a meaningful choice.

Finally, ERG decided to ask each respondent three choice questions; that is, to make a choice between two ponds (or choose neither) three times. Thus, each of our 24 pairings was assigned to a "block" of three ponds. As respondents entered the survey, they were randomly assigned to a block which, in turn, provides them with a set of three pond pairings to review.

4.2.3 Sample Size and Selection

The sample size for the survey was calculated using the "rule of thumb" for choice experiments developed by Johnson and Orme (1996) and summarized in Orme (2010). The rule of thumb value provides a minimum sample size needed for a choice experiment study that involves having respondents assess multiple alternatives in which the attributes of the alternatives have multiple levels. In our case, the alternatives are the ponds for which we asked the respondents to indicate their preference. The attributes and their levels are defined in Table 7. The rule of thumb is:

$$n \geq \frac{500c}{ta}$$

Where,

- n is the (minimum) sample size.
- t is the number of tasks that each respondent is being asked to perform. In our case, this is the number of choice questions we asked each respondent, or $t = 3$.
- a is the number of alternatives being presented to respondents each time they are asked to choose (excluding the "neither" option). In our case, we are asking respondents to compare two ponds each time ($a = 2$).
- c is the maximum number of levels among the attributes. For this project, the largest number of levels for any attribute is 4 ($c = 4$).

Using the values specified above for t, a, and c in the rule of thumb results in an estimated sample size of 334 respondents. ERG budgeted for a sample size of 350 respondents in the data collection effort, more than satisfying the required size for our design. In the implementation of the survey, a total of 382 respondents provided data. For information on

ponds and pairings, sample demographics, response tables, and statistical analysis techniques, please see Appendix C: Discrete Choice Experiment Supplemental Information.

4.3 Results

Initially, the analysis plan called for estimating a "willingness to drive" (WTD) estimate based on standard methods for deriving willingness to pay values from choice experiments. In the survey, travel time was defined as the "price" variable and the idea was to derive WTD values for the different levels of the attributes. As will be discussed, however, travel time does not appear to be a factor in pond decisions as we had anticipated. Specifically, we found that travel time tended to be positively associated with pond choice (i.e., longer travel times were associated with choosing a pond); the relationship was not significant, however, in the base model without survey weights.[13]

Table 8 shows the most and least important attributes cited by respondents when asked to select a pond in the survey. The most important attribute was bacterial issues (37.4 percent most important), followed by signs about water quality and litter or garbage (19.9 percent and 13.6 percent most important respectively). Thirty four percent of respondents indicated that travel time was the least important aspect in making a decision.

Table 8: Most and least important aspect respondents cited in making choice question selections

Aspect	Most important aspect in making decision		Least important aspect in making decision	
	Number	Percentage	Number	Percentage
Signs about water quality	76	19.9%	22	5.8%
Bacterial issues	143	37.4%	18	4.7%
Beach size	29	7.6%	64	16.8%
Litter or garbage	52	13.6%	11	2.9%
Shoreline development	14	3.7%	71	18.7%
Amenities (picnic tables, bathrooms)	43	11.3%	50	13.2%
Time to drive to the pond	16	4.2%	129	34.0%
None in particular	9	2.4%	15	4.0%
Total	**382**	**100%**	**380**	**100%**

Despite our finding that drive time was the least important factor as respondents made their decisions, the choice experiment data provide useful results to understand how attributes affect people's pond choices. To see model outputs, please see Appendix C: Discrete Choice Experiment Supplemental Information

[13] We reference the base model without weights due to the idea that the addition of weights will make all effects significant since the purpose of weights is to extrapolate to the population.

The following are what ERG considers to be the key results from the choice experiment:

- **Clean ponds, in all aspects, are highly preferred.** This takeaway combines the results from both bacterial issues and litter. A pond that rarely or never has bacterial issues and that is always clear of litter is 4.4 times more likely to be selected by pond-goers than one with bacterial issues each summer and noticeable amounts of litter.

- **The absence of litter is the most significant driver of pond preference.** The strongest effect we found was that pond-goers are 2.5 times more likely to select a pond with no litter to one that has noticeable amounts. Furthermore, a pond that sometimes has a small amount of litter is 1.8 times as likely to be selected compared to one with noticeable amounts.

- **Pond-goers demand *bacteria-free* ponds.** Specifically, we found that the only level in the bacterial issues attribute that was preferred was a pond "rarely or never" having bacterial issues. Pond-goers clearly showed a dislike of ponds with issues each summer *and* ponds with issues in the last two years. Additionally, based on the similar values of the odd ratios, it appears that pond-goers do not see a difference between ponds that have issues every summer and ones that have had issues in the last two years. The clear preference is for *bacteria-free* ponds, with respondents 1.79 more likely to select ponds having bacterial issues "rarely or never" compared to ones having issues "every summer".

- **Signage about water quality testing is important, but less important than bacteria-free water and litter-free areas.** The presence of signs on recent water quality testing increases the likelihood of a pond being chosen by about 17 percent, but the effect pales in comparison to the pond being litter- and/or bacteria-free.

- **Beach size and the presence of amenities have modest impacts on beachgoers preferences.** Although the unweighted model indicated that respondents preferred moderate-sized beaches to spacious ones, the weighted model shows that respondents are 10 percent more likely (odds ratio of 1.095) to select a pond with a spacious beach than one with almost no beach. Similarly, the presence of picnic tables and other amenities increases the likelihood of a respondent selecting a pond by about 12 percent (odds ratio of 1.12).

- **Travel time to ponds is not important within the range we used.** Our travel times for ponds were 5, 15, 25, and 35 minutes. The effect of travel time was not significant in the unweighted model and 34 percent of respondents indicated travel time was the least important aspect they considered when making decisions. Given the insignificance in the unweighted model and the fact that 34 percent of respondents indicated that travel time was the least important aspect they considered, we place less emphasis on this

result. Nevertheless, we performed some sensitively analyses around this result in Section 4.4: Alternative Formulations of Travel Time. We note, however, that these results may only apply within the range we used (i.e., less than 35 minutes). Had we selected 60 minutes as the upper bound, a value that we deemed unrealistic for the Cape, we may have seen some effect of travel time

4.4 Alternative Formulations of Travel Time

To investigate the issue with travel time working in the "opposite" direction as anticipated, we performed three sub-analyses which altered how we used travel time in the analysis. First, we formulated travel time as we did the other levels with a separate variable for each level. Second, we dropped travel time from the model altogether to see if removing it affected other factors. Finally, we restricted the sample by removing respondents who indicated that travel time was the least important factor in making their decision (see Table 8). These results are presented Table C-9 of Appendix C: Discrete Choice Experiment Supplemental Information. For the most part, the results from the alternative formulations are consistent with the base weighted model (our preferred model). Of note, when we excluded travel time, the effect of having a pond free of litter become much larger on the likelihood that respondents chose a pond. Additionally, when we excluded respondents who said that travel time was the least important factor in making decision, ponds with amenities are less preferred to those without amenities.

5 POND AND LAKE VISITOR ACTIVITIES, SPENDING, AND PERCEPTIONS OF WATER QUALITY

5.1 Background

Between May and September of 2023, ERG administered on-site intercept surveys at Cape Cod ponds and lakes. The surveys gathered information about pond and lakes visitors' activities during their visit, spending, and perceptions of water quality. The intercept survey team also conducted instantaneous counts of visitors at Cape Cod ponds and lakes to help us understand overall visitation, inclusive of individuals who declined to participate in intercept surveys or could not be reached for survey (e.g., motorized and non-motorized boaters). During the survey period, ERG's on-site teams performed five visits to the Cape that involved 20 days of collecting in-person data. We visited 75 unique ponds and lakes and talked with 606 pond and lake visitors who represented 2,252 total people (i.e., the respondent themselves plus others in their party).

A key aspect of the survey was to gather data for an Economic Contribution Analysis (ECA) and an Economic Impact Analysis (EIA) of pond related spending on Cape Cod. ERG used data from the intercept surveys to conduct these analyses using IMPLAN (Impact Analysis for Planning), an Input-Output modeling software. EIAs measure the economic effect of an event on the economy in a specified geographic area. Using IMPLAN, ERG estimated what the impact to the Cape Cod economy would be if people no longer visited Cape ponds and lakes.

Like the EIA, the ECA describes the importance of economic activity generated through visitation to the Cape Cod Economy. The ECA differs in that it captures total gross economic activity associated with spending, whereas the EIA only captures the economic impacts of an event on the economy in a specified geographic area.[14] In the case of ponds and lakes on Cape Cod, the ECA we performed estimates the amount of spending that happens in association with ponds and lake visitation, and the EIA estimates economic impacts in the event that visitation to ponds and lakes on Cape Cod changes.

The purpose of conducting the ECA and EIA is to demonstrate and communicate the importance of freshwater ponds and lakes to the economic vitality of Cape Cod. ERG discusses the methodology utilized to conduct the intercept surveys, the ECA, and EIA in sections 5.2.2 and 5.2.3. We present the results of the EIA and ECA in section 5.3.9 and discuss their implications in section 5.4.

[14] A helpful way to think about the difference between the ECA and EIA is that the ECA captures spending that we think would occur even in the absence of ponds and lakes, and the EIA does not. For instance, the ECA captures spending from a resident who buys lunch and eats it at a pond, but the EIA does not, because we assume that the resident will buy lunch regardless, and therefore the absence of ponds and lakes would not lead to an economic loss from that purchase.

5.2 Methods

5.2.1 Survey Instrument and Mode of Survey Implementation

ERG worked with Commission staff to develop a survey instrument that could be used for the on-site data collection. The instrument asks respondents about:

- Their group's activities at the pond/lake
- Group characteristics
- Trip characteristics (e.g., length of stay, purpose of stay, party size, etc.)
- Spending associated with their visit to the pond/lake
- Perceptions of water quality

The instrument that was approved and implemented can be found in Appendix D: Intercept Survey Questions. The survey was made available in English and Portuguese.[15]

To collect the data on-site, ERG used portable electronic tablets to administer the questionnaire to visitors encountered at ponds and lakes on Cape Cod in-person. All tablets were equipped with the Qualtrics Offline Surveys Mobile App developed by Qualtrics, Inc.

The target population for the survey included individuals visiting ponds and lakes on Cape Cod and was sub-divided into the same groups as used in the perceptions survey:

- Residents – People who live on Cape Cod year-round.
- Nonresident owners (NROs) – People who own property on Cape Cod but live off of the Cape.
- Visitors – People visiting or vacationing on Cape Cod.

Individuals working at Cape Cod ponds and lakes or traveling by the survey site (e.g., bicycling or walking by the site to reach another destination) were excluded from the survey.

In addition to administering the on-site survey, the ERG survey team also collected instantaneous visitor count data (i.e., the total number of people at the pond or lake) and site characteristics data. For a list of data collected as part of visitation counts and site characteristic assessments, see Appendix E: Visitation Count and Site Characteristics Assessment Data Fields.

[15] Not all ERG survey team members were able to communicate with respondents who spoke Portuguese. If a survey team member could not speak Portuguese, but encountered a potential respondent who spoke Portuguese, the survey team member presented the potential respondent with introductory text on the tablet in Portuguese that identified ERG staff as survey team members and provided a brief overview of the survey so that respondents could decide whether to participate.

5.2.2 Surveying Methods

ERG selected five 4-day periods during the 2023 warm weather season to perform the on-site surveys; the 4-day periods were always either a Thursday-Sunday timeframe or a Saturday-Tuesday. Additionally, we included two holidays: Memorial Day and Independence Day. ERG selected sampling locations based on Cape Cod Freshwater Access Points seen in Figure 4

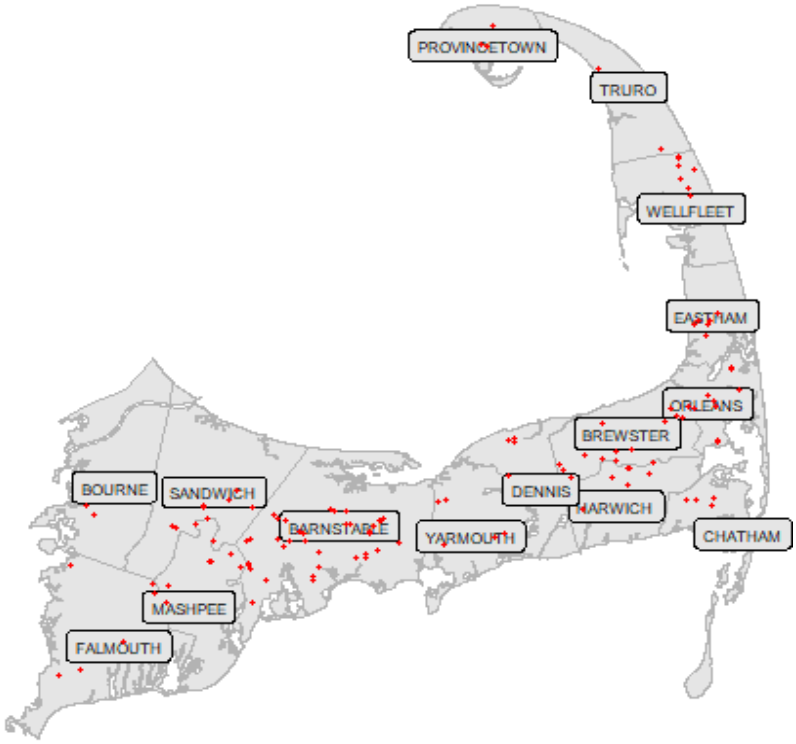


Figure 4: Cape Cod freshwater access points

Ponds and lakes were stratified by activity level and geographic region.[16] ERG selected eight primary ponds in each geographic region to sample, as well as a list of alternate ponds to sample if time allowed. The primary ponds were made up of all "high activity" ponds within a region and randomized low activity ponds.[17] ERG prioritized the primary ponds when sampling but found that there was generally enough time to sample alternate ponds as well.

[16] We divided the Cape into 5 "regions" based on the distribution of ponds seen in Figure 4. The geographic areas covered can be seen in Table 9. Ponds were deemed either "high activity" or "low activity" based on perceived use with guidance from the Cape Cod Commission.

[17] ERG prioritized high activity ponds because we assumed they would provide the most valuable spending data.

During each 4-day sampling period, ERG focused on a new geographic area of Cape Cod that contained clusters of freshwater ponds and lakes. A breakdown of visitation dates and geographies is found in Table 9. During each sampling period, the survey team resampled the same ponds and lakes multiple times. Each site was visited at least once on a weekend and once on a weekday at different times of day to gather data on how time of day and type of day (weekday and weekend) affected visitor numbers.

Table 9: List of geographic areas covered and corresponding dates of visitation

Geographic Area	Dates of Visitation
Bourne, Sandwich, Mashpee, Falmouth	May 27-30
Barnstable, Yarmouth, Dennis	June 8-11
Brewster, Harwich, Chatham	July 1-4
Orleans, Eastham	July 13-16
Wellfleet, Truro, Provincetown	August 12-15

Once on-site, the team assigned one team member to conduct an instantaneous count of visitors and record site characteristics, while the others began administering intercept surveys. The survey team estimated that approximately 75 percent of potential respondents approached agreed to participate in the survey. Given the time on site and the numbers of people at the ponds and lakes we visited, ERG generally attempted to survey all parties at a site. Usually, surveyors were able to achieve this goal, however, at times some potential respondents happened to leave the site before the team was able to approach them for survey participation, or there were too many visitors for team members to survey within a reasonable time frame (about two hours). We also note that surveyors were only able to approach individuals they could find. At many sites, it was easy to identify potential respondents. Surveying sites that covered small geographic areas with few obstructions of view, such as a pond beach directly adjacent to a parking area, presented few challenges to potential respondent identification. Survey sites that covered large geographic areas with many visual obstructions, such as forested hiking paths around lakes and ponds, presented significant challenges to identifying potential survey respondents, as well as counts of visitors. When appropriate, surveyors divided up to conduct surveys individually. When there were no visitors left to interview, or after about two hours, a final instantaneous count was conducted, and the team traveled to a new pond or lake.

5.2.3 Statistical Methods

ERG collected data on recreational activities and water quality perception during surveys. These components of the intercept survey did not require data analysis, and those responses are presented in 5.2.3. To perform the EIA and ECA, ERG needed to estimate the annual spending from pond and lake visits. To do this, we first estimate daily spending, which can be thought of as the number of season-specific daily visitors, by visitor type, multiplied by season-specific daily spending, by visitor type. Summing this over the course of the year yields an estimate of annual spending. A calculation for annual pond spending can be found in Equation 1.

Equation 1: Annual pond spending

$$Annual\ Spending = \sum_{\theta=1}^{365} [(DR_\theta * DRS_\theta) + (DV_\theta * DVS_\theta) + (DNRO_\theta * DNROS_\theta)]$$

Where:

- θ is a given day in the year, starting with January 1st
- DR_θ is equal to the number of resident visits on day θ
- DRS_θ is equal to the average spending per day for residents on day θ
- DV_θ is equal to the number of visitors visits on day θ
- DVS_θ is equal to the average spending per day for visitors on day θ
- $DNRO_\theta$ is equal to the number of NRO visits on day θ
- $DNROS_\theta$ is equal to the average spending per day for NROs on day θ

Specifically, for each day of the year, we multiply an estimate of daily pond-related spending by the total number of pond visits for each respondent category. Our process for building the component parts of this computation is outlined below.

Spending Estimates

ERG standardized spending estimates as per-day spending for each of the "Visitor", "Resident", and "NRO" categories using data we collected during the intercept survey. For residents and NROs, we calculated per-day spending estimates by dividing the average total daily resident and NRO spending from the survey data by the average group size. For visitors, person per-day spending is calculated by dividing the average visitor group spending from the survey data by the product of the average number of visitors in the group and the average number of days the group was staying on Cape Cod. By doing this, we estimate the average spending per day for NROs, Residents, and Visitors, for our trips in May, June, July, and August. ERG assumed that spending captured in our May visit could be used to represent spending habits in "off-season" months (September through May). ERG acknowledges that spending may differ across the off-season but believes that the magnitude of spending in May is not dissimilar

from spending in other off-season months. ERG averaged per-day spending estimates from our June, July, and August samplings to generate average per-day spending for "in-season" visitation.

Observed Pond Visitation Estimates

To calculate the average number of people at a pond throughout the day from our instantaneous counts of visitors, we multiplied the instantaneous counts by hourly specific scaling factors.[18] Next, we multiply our estimated average number of people at a pond by the hours the pond is open to arrive at "person-hours" spent at the pond in a day.[19] Finally, we divided the person-hours by the average length of stay for pond visits from the survey data to arrive at an estimate of total pond visits in a day.

ERG estimated total daily pond visits for every pond at which ERG conducted an instantaneous visitor count. Estimates were divided into weekday visitation estimates and weekend visitation estimates. Where ERG had multiple weekend or weekday instantaneous visitor counts for the same pond, ERG averaged the resulting estimated daily visitors for that pond. In total, ERG had 74 ponds or lakes with daily weekday visitor estimates and 67 ponds or lakes with daily weekend visitor estimates.[20]

Unobserved Visitation Estimates

ERG then developed estimates of visitation for months and ponds or lakes we did not visit. To estimate visitation in unobserved months, ERG used cell phone data for six ponds throughout a year which show the relationship between cell phone use at ponds and lakes and the month. ERG used those data to scale estimated visitation to unobserved months. For instance, if April has one third the number of cell phone uses as July, we estimate that ponds will have one third the number of visits in April as they do in July.

To estimate visitation at unobserved ponds and lakes, ERG first divided estimated total daily visits for each pond by the size of the pond/lake to calculate the number of daily Visits Per Acre (VPA) in peak season at every pond visited.[21] Due to uncertainty in the relationship between pond size and visitation, ERG generated two VPA estimates. The first is computed by averaging all unique pond VPAs together, and the second is computed by taking total estimated visitors among all observed ponds/lakes and dividing that by the total number of acres of all observed ponds/lakes. The second method of generating VPA estimates weights the size of the

[18] Hourly specific scaling factors were derived from data showing cellphone use throughout the day at six ponds on Cape Cod. Scaling factors were used to relate an instantaneous count of visitors to total visitors in the day.
[19] Hours the pond or lake is "open" is not strictly defined, but from cellphone data we know that the vast majority of visitation occurs between 8:00 AM and 8:00 PM. We accordingly assume ponds and lakes are "open" for 12 hours a day.
[20] In some cases, ERG only visited a pond on a weekday or weekend. This was rare, and was due to circumstances such as access closures, or weekend visits taking longer on average than weekday visits.
[21] Visitation estimates were all initially converted to peak season visitation, so that visitation estimates could be compared across ponds/lakes and sampling trips.

pond in the average VPA estimate, and the former does not. ERG believes that the former estimate is likely more accurate because the average unobserved pond is smaller than the average observed pond. ERG estimates total visitation using both VPAs due to uncertainty in characteristics of unobserved ponds and lakes. Using the two VPA estimates, we calculate a high and a low estimate for pond and lake contribution and impact to the Cape Cod economy. ERG only applied these VPA factors to named ponds and lakes, because we assume unnamed ponds and lakes have significantly different size and visitation characteristics (the average size of named ponds and lakes is about 25 acres, compared to an average size of about 1 acre for unnamed ponds and lakes). We did not estimate visitation for unnamed ponds and lakes. We acknowledge this will result in an underestimate of pond visitation, but we believe our methods will account for the vast majority of visitation and therefore spending.

Using the described methodology, ERG estimates the number of visits at a pond on any given weekend and weekday in peak season. By multiplying these visitation estimates by a monthly scaling factor derived from cellphone data, ERG generated unique estimates of weekend and weekday pond visits for every month. ERG applies weekend-specific estimates to weekday holidays to account for higher visitation on holidays. Summing these estimates across the year, we estimated total annual visitation. ERG multiplied the total daily visitors in every month by the percent estimated to be residents, visitors, and NROs to estimate the visitor-type distribution of total daily visitors.[22]

Total Spending Estimates

ERG used the spending per day estimates to estimate total spending from visitors, residents, and NROs in each day. ERG estimates spending associated with pond visits by summing all the spending from residents, NROs, and visitors throughout the year. ERG input all spending associated with pond and lake visits into the IMPLAN software (described in section 4.1) to estimate the economic contribution of ponds and lakes to the Cape Cod economy. For the EIA, ERG only input a subset of spending which does not include NRO and Resident spending, because we assume that their spending would occur on Cape Cod with or without the presence of ponds and lakes.

5.3 Results

5.3.1 Survey and Instantaneous Count Summary

In total, ERG collected 606 surveys, accounting for 2,252 visitors (the survey respondents plus people in their party) to ponds and lakes on Cape Cod. ERG also conducted

[22] ERG estimated the distribution of residents, visitors, and NROs throughout the year using intercept survey data, perceptions survey data, and a survey of second-homeowners conducted by The Cape Cod commission which describes NRO occupation rates by month.

221 total instantaneous visitor counts in which we enumerated a total 3,865 visitors.[23] A distribution of surveys and counts of visitors by surveying period are found in Table 10.

Table 10: Surveying efforts by trip

	5/27 – 5/30	6/8 – 6/11	7/1 – 7/4	7/13 – 7/16	8/12 – 8/15	Total
Number of Counts	47	57	48	69	35	221
Total People Counted	593	321	1350	758	843	3,865
Number of Surveys	81	70	225	139	91	606
Total People Surveyed	337	159	942	455	359	2,252

5.3.2 Recreation

During the survey interviews, ERG asked respondents to select the primary reason for their visit to the pond from a set of options including: swimming, beachgoing, canoeing, kayaking, or paddle boarding, boating, birding, other wildlife viewing, fishing, walking/hiking, and other. During late May, "beachgoing" was the most cited reason that people visited ponds and lakes, followed by fishing. As summer progressed, more respondents selected "swimming" as the most common reason for visitation. We want to note that we did not capture any birders in our survey, which we believe is due to a tendency of birders to visit ponds and lakes early in the morning and be on secluded trails away from our surveying efforts. A complete breakdown of respondents' primary reason for pond visitation can be seen in Table 11.

[23] These are not necessarily unique visitors, as sometimes someone would be counted twice: once during the first count, and again during a second count at the same location. This does not result in double counting because we are only interested in the number of people at a pond at a given time.

Table 11: Primary reasons given for pond visitation

Purposes - Resident	5/27 - 5/30	6/8 - 6/11	7/1 - 7/4	7/13 - 7/16	8/12 - 8/15
Swimming	4%	14%	32%	66%	67%
Beachgoing	40%	10%	25%	13%	0%
Canoeing, kayaking, or paddle boarding	4%	4%	6%	6%	0%
Boating (e.g., motorboats, sailboats, jet skis)	12%	2%	2%	0%	0%
Birding	0%	0%	0%	0%	0%
Other wildlife viewing	0%	0%	0%	0%	7%
Fishing	15%	12%	6%	2%	0%
Walking/hiking	12%	29%	17%	13%	13%
Other	13%	29%	11%	0%	13%
Purposes - NRO	**5/27 - 5/30**	**6/8 - 6/11**	**7/1 - 7/4**	**7/13 - 7/16**	**8/12 - 8/15**
Swimming	0%	0%	39%	69%	58%
Beach going	50%	25%	28%	14%	26%
Canoeing, kayaking, or paddle boarding	7%	25%	4%	3%	5%
Boating (e.g., motorboats, sailboats, jet skis)	14%	0%	3%	0%	0%
Birding	0%	0%	0%	0%	0%
Other wildlife viewing	0%	0%	0%	0%	0%
Fishing	21%	25%	6%	14%	5%
Walking/hiking	0%	13%	4%	0%	5%
Other	7%	13%	16%	0%	0%
Purposes - Visitor	**5/27 - 5/30**	**6/8 - 6/11**	**7/1 - 7/4**	**7/13 - 7/16**	**8/12 - 8/15**
Swimming	0%	9%	40%	71%	74%
Beach going	47%	18%	17%	16%	16%
Canoeing, kayaking, or paddle boarding	7%	0%	6%	5%	4%
Boating (e.g., motorboats, sailboats, jet skis)	0%	0%	3%	0%	2%
Birding	0%	0%	0%	0%	0%
Other wildlife viewing	0%	18%	0%	0%	0%
Fishing	20%	18%	6%	5%	0%
Walking/hiking	7%	9%	13%	2%	2%
Other	20%	27%	14%	2%	4%

5.3.3 Water Quality Perception

Respondents were also asked to report their perceptions of the water quality at the pond or lake they were visiting. Respondents generally thought favorably of the water quality across all surveying periods, though there does appear to be a difference in how different visitor types perceive water quality. Across all visits, residents responded that the water quality

was “excellent” at the lowest rate. Water quality perception by visit and visitor type can be found in Table 12.

Table 12: Survey respondents' perceptions of water quality by sampling trip and visitor type

5/27 – 5/30			
Rating	Resident	Visitor	NRO
Excellent	42%	53%	71%
Good	38%	40%	29%
Fair	17%	7%	0%
Poor	2%	0%	0%
6/8 – 6/11			
Rating	Resident	Visitor	NRO
Excellent	41%	73%	50%
Good	39%	27%	38%
Fair	18%	0%	13%
Poor	2%	0%	0%
7/1 – 7/4			
Rating	Resident	Visitor	NRO
Excellent	52%	61%	67%
Good	41%	31%	28%
Fair	6%	3%	6%
Poor	0%	0%	0%
7/13 – 7/16			
Rating	Resident	Visitor	NRO
Excellent	60%	65%	59%
Good	32%	32%	34%
Fair	6%	3%	7%
Poor	2%	0%	0%
8/12 – 8/15			
Rating	Resident	Visitor	NRO
Excellent	53%	79%	84%
Good	33%	19%	16%
Fair	13%	0%	0%
Poor	0%	0%	0%

5.3.4 Estimated Visitation

Using visitation estimation methods in Section 5.2.3, ERG estimated the annual number of pond and lake visits to Cape Cod. ERG estimates between 1.3 and 1.7 million pond visits a year, with 66 percent of those visits coming between June and August. Total estimated visits by month across different visitor types using high and low VPA estimates are found in Table 13 and

Table 14. ERG estimates that visitors to Cape Cod account for slightly less than half of all annual pond visits, but account for the greatest share of pond visits in July and August out of all visitor types, reflecting the Cape Cod high tourist season. A graph of visitors per month by visitor type (high VPA) can be seen in Figure 5.

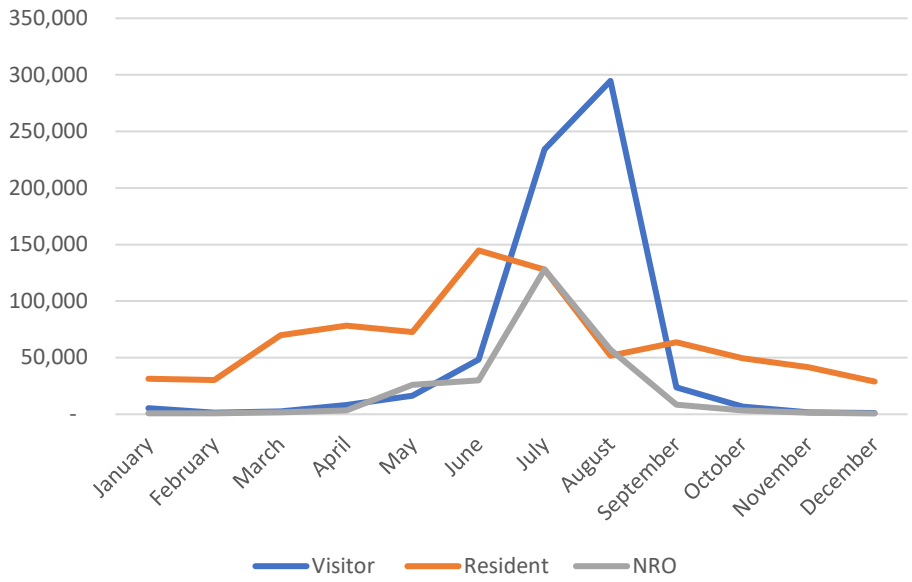
Table 13: Estimated visits by month, high VPA

Month	Visitor	Resident	NRO	Total
January	5,332	31,467	832	37,631
February	1,474	30,293	708	32,475
March	2,477	69,853	1,567	73,898
April	8,330	78,310	3,333	89,972
May	16,418	72,641	26,086	115,145
June	48,375	144,802	30,018	223,195
July	234,315	127,825	128,071	490,211
August	294,674	51,802	57,057	403,533
September	23,633	63,633	8,384	95,650
October	6,781	49,500	3,476	59,757
November	1,822	41,449	1,302	44,573
December	1,111	28,910	679	30,701
Total	644,741	790,485	261,514	1,696,740

Table 14: Estimated visits by month, low VPA

Month	Visitor	Resident	NRO	Total
January	4,234	24,915	664	29,813
February	1,168	23,933	563	25,665
March	1,953	54,929	1,240	58,122
April	6,621	62,062	2,661	71,345
May	12,952	57,259	20,573	90,785
June	38,695	113,934	23,475	176,104
July	186,549	101,064	101,695	389,309
August	231,829	40,398	45,158	317,385
September	18,738	50,242	6,678	75,659
October	5,372	39,091	2,766	47,229
November	1,444	32,775	1,037	35,257
December	883	22,899	542	24,323
Total	510,439	623,501	207,054	1,340,994

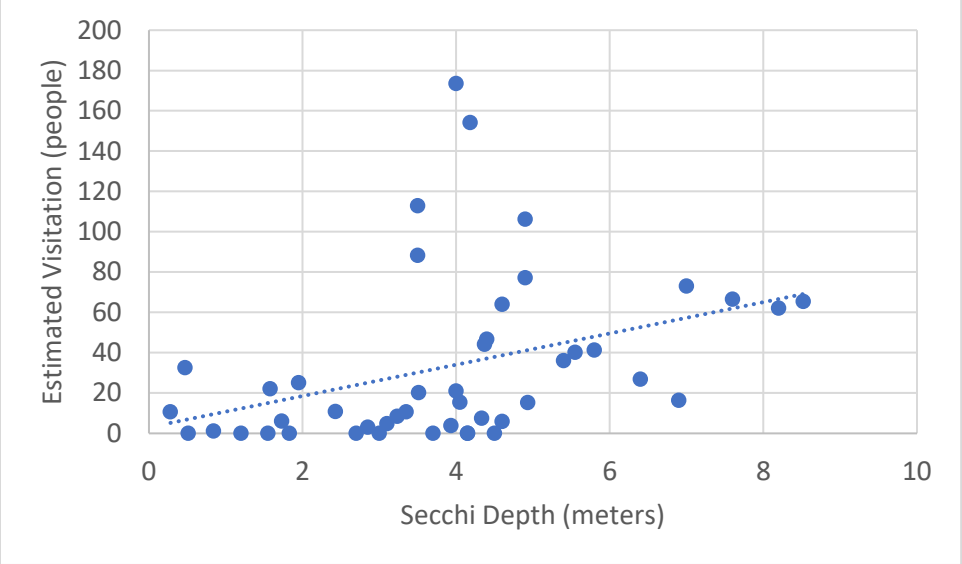
Figure 5: Visits by month by visitor type



5.3.5 Water Quality and Visitation

ERG used water quality data provided by the Cape Cod Commission to check whether better quality ponds and lakes have higher visitation rates. A plot of Secchi depth and estimated pond and lake visitation is displayed in Figure 6. To remove outliers due to pond size, only ponds within two standard deviations of the mean pond acreage on Cape Cod were considered for this analysis. Although of interest, this relationship was not evaluated for significance, and ERG did not have water quality data for every pond visited, resulting in the plot being based on a subset of data. However, available data shows that better water quality is associated with higher visitation. Also of note is that the ponds with the highest estimated visitation on the plot (which are: Mashpee-Wakeby Pond, Little Cliff Pond, and Long Pond in Brewster) are all large and in highly recreated areas, which could explain their high visitation despite having relatively average Secchi values. Excluding these high visitation ponds would lead to a higher regression R-squared value (R-squared goes from .1373 to .3026), meaning approximately 30 percent of variation in visitation is explained by water quality.

Figure 6: Secchi depth vs estimated visitation



5.3.6 Estimated Expenditures

ERG analyzed and reported spending by spending type to better understand spending characteristics. Across spending categories, home/property rentals accounted for the majority of expenditures reported, making up 53 percent of all spending by respondents. The second and third highest spending categories were Restaurants and Groceries, at 17 percent and 13 percent respectively, followed by a sharp drop off in spending in other categories. Total percent spending by category can be found in Table 15.

Table 15: Spending by spending category

Spending Category	Percent of Total Spending
Hotels/Motels	2%
Other Lodging*	53%
Fuel	4%
Parking Passes	2%
Water Sport Rentals	2%
Water Sport Purchases	1%
Clothing/accessories	2%
Travel Agencies	0%
Restaurants	17%
Groceries	13%
Cabs, ubers	0%
Car Rentals	2%
Souvenirs	2%

*Other lodging accounts for home rentals such as Airbnb and Vrbo

5.3.7 Pond Associated Spending Estimates

To conduct the ECA, we first need to estimate all spending associated with pond and lake visits. ERG estimates spending associated with ponds and lake visits to the Cape Cod economy by multiplying the high and low estimates for visitation (described in Section 5.2.3), by visitor-specific spending estimates. Pond associated spending considers all spending that happens in relation to pond and lake visits. Some spending may be directly attributable to pond visits, and other spending may be "incidental".[24] The ECA considers both spending directly attributable to ponds and spending that happens incidentally.

For unobserved months, ERG multiplied visitation estimates by monthly specific scaling factors derived from cellphone data. These estimates are found in Table 16 and Table 17. We estimate spending associated with Cape Cod pond and lake visits to be between $48 million and $61 million annually.

[24] An example of spending attributable to ponds is a tourist buying fishing tackle specifically to go fishing at a Cape Cod pond. An example of "incidental" spending is a resident buying lunch and eating it at a pond, where the spending would likely happen even in the absence of ponds.

Table 16: Pond and lake associated spending, high VPA

Month	Visitor	Resident	NRO	Total
January	$ 450,649	$ 570,952	$ 13,944	$ 1,035,545
February	$ 128,026	$ 513,644	$ 11,684	$ 653,355
March	$ 226,146	$ 1,004,786	$ 25,072	$ 1,256,004
April	$ 697,331	$ 1,460,152	$ 56,136	$ 2,213,619
May	$ 1,484,565	$ 1,140,381	$ 408,622	$ 3,033,567
June	$ 2,423,647	$ 2,215,670	$ 1,723,607	$ 6,362,924
July	$ 12,217,011	$ 1,930,489	$ 5,768,093	$ 19,915,593
August	$ 16,867,345	$ 811,401	$ 2,722,267	$ 20,401,014
September	$ 2,032,566	$ 1,056,912	$ 139,125	$ 3,228,602
October	$ 588,208	$ 827,320	$ 57,392	$ 1,472,919
November	$ 156,667	$ 721,910	$ 21,611	$ 900,188
December	$ 93,949	$ 529,939	$ 11,376	$ 635,264
Total	$ 37,366,110	$ 12,783,556	$ 10,958,928	$ 61,108,593

Table 17: Pond and lake associated spending, low VPA

Month	Visitor	Resident	NRO	Total
January	$ 353,029	$ 469,039	$ 11,209	$ 833,276
February	$ 100,113	$ 421,492	$ 9,367	$ 530,972
March	$ 176,273	$ 822,016	$ 19,987	$ 1,018,277
April	$ 546,630	$ 1,200,029	$ 45,165	$ 1,791,824
May	$ 1,157,860	$ 934,515	$ 324,481	$ 2,416,855
June	$ 1,916,471	$ 1,738,267	$ 1,331,706	$ 4,986,444
July	$ 9,620,793	$ 1,521,285	$ 4,473,040	$ 15,615,118
August	$ 13,162,875	$ 631,586	$ 2,109,045	$ 15,903,506
September	$ 1,590,421	$ 866,985	$ 111,642	$ 2,569,048
October	$ 459,992	$ 678,724	$ 46,014	$ 1,184,731
November	$ 122,588	$ 592,659	$ 17,342	$ 732,588
December	$ 73,597	$ 435,416	$ 9,145	$ 518,158
Total	$ 29,280,643	$ 10,312,011	$ 8,508,142	$ 48,100,796

5.3.8 Pond Impact Spending Estimates

To conduct the EIA, we first need to estimate all spending that would not occur without ponds and lakes. We do this by multiplying visits from visitors to the Cape by average per-day visitor spending. These methods are further described in Section 5.2.3 above. For these estimates, we only consider spending that happens because of visits to ponds and lakes. We exclude spending by residents and non-resident owners because we assume that they would spend money on Cape Cod with or without pond and lake visits, and we exclude a small portion of visitor spending that we believe would occur without ponds and lakes. We estimate spending

that occurs because of visits to ponds and lakes to be between $29 million and $37 million annually. Estimated spending from ponds and lake visits are found in Table 18 and Table 19.

Table 18: Estimated economic impact, high VPA

Month	Visitor	Resident	NRO	Total
January	$ 442,317	$ -	$ -	$ 442,317
February	$ 125,659	$ -	$ -	$ 125,659
March	$ 221,965	$ -	$ -	$ 221,965
April	$ 684,439	$ -	$ -	$ 684,439
May	$ 1,457,118	$ -	$ -	$ 1,457,118
June	$ 2,378,838	$ -	$ -	$ 2,378,838
July	$ 11,991,142	$ -	$ -	$ 11,991,142
August	$ 16,555,501	$ -	$ -	$ 16,555,501
September	$ 1,994,988	$ -	$ -	$ 1,994,988
October	$ 577,333	$ -	$ -	$ 577,333
November	$ 153,771	$ -	$ -	$ 153,771
December	$ 92,212	$ -	$ -	$ 92,212
Total	$ 36,675,283	$ -	$ -	$ 36,675,283

Table 19: Estimated economic impact, low VPA

Month	Visitor	Resident	NRO	Total
January	$ 346,502	$ -	$ -	$ 346,502
February	$ 98,263	$ -	$ -	$ 98,263
March	$ 173,015	$ -	$ -	$ 173,015
April	$ 536,524	$ -	$ -	$ 536,524
May	$ 1,136,453	$ -	$ -	$ 1,136,453
June	$ 1,881,039	$ -	$ -	$ 1,881,039
July	$ 9,442,923	$ -	$ -	$ 9,442,923
August	$ 12,919,519	$ -	$ -	$ 12,919,519
September	$ 1,561,017	$ -	$ -	$ 1,561,017
October	$ 451,488	$ -	$ -	$ 451,488
November	$ 120,321	$ -	$ -	$ 120,321
December	$ 72,237	$ -	$ -	$ 72,237
Total	$ 28,739,300	$ -	$ -	$ 28,739,300

5.3.9 Economic Contribution and Impact Analyses

To fully understand the effects of pond-related spending, ERG ran two contribution analyses and two impact analyses in IMPLAN, one using the high VPA estimate and one using the low VPA estimate. The impact analyses show what would be lost from the Cape Cod economy in the absence of pond and lake spending on Cape Cod, and the contribution analyses show how total spending associated with ponds and lakes contributes to the Cape Cod

economy. The difference between the analyses is that the contribution analyses consider spending that happens at ponds and lakes that would occur even in the absence of ponds and lakes, and the impact analyses do not.[25]

To conduct the impact and contribution analyses, ERG calculated spending by industry based on the spending categories in Table 15 and used IMPLAN to estimate the effects of the spending on employment, labor income, value added, and economic output.[26] In IMPLAN, "employment" refers to the number of individuals hired for a salary or compensation to work within a sector, "labor income" represents the total value of income from employment, "value added" is the increase in a product or service's market value at each stage of production, and "economic output" refers to the total value of all goods and services produced in an economy. The direct effects from IMPLAN show the immediate impact that a change has on its own sector. The indirect effects consider how that change impacts the economic sectors that support that sector, and the induced effects show how changes in household income result in additional economic impacts. The indirect and induced effects are calculated using inter-sector data to determine how the effects of an economic event in one economic sector will affect other sectors.

Economic contributions from pond-related spending are estimated by multiplying annual pond spending, by regional economic "multipliers" from IMPLAN. Multipliers are rates of change describing how a given change or event in one sector creates impacts in the larger economy. Employment multipliers, for example, describe the total jobs created or lost as a result of an additional job being added or lost in an economic sector. So, if one job is added to a specified economic sector with an employment multiplier of 3, we may conclude that every job directly in that sector creates 2 jobs in the larger economy.

ERG estimates that ponds and lakes contribute between $69.7 and $88.6 million to the Cape Cod regional economy, and that they are directly responsible for between $37.4 and $47.0 million. Because the contribution analysis considers all spending at ponds and lakes, and the impact analysis only considers spending that is directly attributable to ponds and lakes, the difference between the two estimates is equal to the money spent at ponds that would still be spent in the absence of ponds. This means that between $37.4 and $47.0 million would be lost from the Cape Cod economy in the absence of pond and lake spending. The economic

[25] An example of spending that is captured by the ECA and not the EIA would be a resident who buys lunch at eats it at a pond. While the pond is contributing to this spending, the spending would likely occur even in the absence of ponds.

[26] Economic sectors in IMPLAN are aggregated from NAICS (North America Industry Classification System) codes. Some examples of economic sectors in IMPLAN are "Full-service restaurants", "Elementary and secondary schools", and "Landscape and horticultural services".

contribution and impact analyses are summarized in Table 20, Table 21, Table 22, and Table 23.[27]

Table 20: Economic contribution of estimated spending associated with pond and lake visitation, high VPA

Impact	Employment	Labor Income	Value Added	Output
1 – Direct	668.45	$36,186,570.44	$43,309,867.90	$61,108,593.42
2 – Indirect	63.89	$3,106,983.37	$4,546,425.96	$9,958,363.07
3 – Induced	101.4	$5,968,642.50	$10,453,836.22	$17,543,860.76
Total	833.73	$ 45,262,196.30	$ 58,310,130.08	$ 88,610,817.25

Table 21: Economic contribution of spending associated with pond and lake visitation, low VPA

Impact	Employment	Labor Income	Value Added	Output
1 – Direct	526.16	$28,483,765.32	$34,090,771.75	$48,100,795.76
2 – Indirect	50.29	$2,445,619.58	$3,578,657.18	$7,838,589.65
3 – Induced	79.81	$4,698,135.53	$8,228,594.59	$13,809,410.69
Total	656.27	$ 35,627,520.42	$ 45,898,023.52	$ 69,748,796.11

Table 22: Economic Impact associated with a complete decline in spending associated with pond and lake visitation, high VPA

Impact	Employment	Labor Income	Value Added	Output
1 – Direct	-349.75	($19,285,920.89)	($22,973,821.72)	($31,501,880.71)
2 – Indirect	-33.01	($1,594,156.93)	($2,284,857.58)	($4,928,976.66)
3 – Induced	-66.02	($3,725,537.73)	($6,315,632.33)	($10,631,100.97)
Total	-448.78	$ (24,605,615.55)	$ (31,574,311.63)	$ (47,061,958.35)

Table 23: Economic Impact associated with a complete decline in spending associated with pond and lake visitation, low VPA

Impact	Employment	Labor Income	Value Added	Output
1 – Direct	-276.53	($15,530,548.50)	($18,487,917.21)	($25,054,016.87)
2 – Indirect	-25.6	($1,237,004.88)	($1,772,696.28)	($3,814,763.46)
3 – Induced	-52.97	($2,989,465.53)	($5,067,619.93)	($8,530,202.62)
Total	-355.11	$ (19,757,018.91)	$ (25,328,233.42)	$ (37,398,982.96)

[27] We note that the values in Table 22 and Table 23 are presented as negative values reflecting the idea that we are estimating the impact of a complete decline in pond visitation. That is, without pond-related spending, we would expect a loss of approximately 450 jobs.

5.4 Discussion and Limitations

Our analysis finds that spending from pond and lake visits accounts for a significant amount of economic activity annually. We also found there to be between 1.3 and 1.7 million visits to ponds and lakes annually. These findings convey the importance of ponds and lakes to the Cape Cod economy and local recreation. We find that individuals use pond and lakes for a variety of purposes, spanning from beach days to stopping by for ten minutes on a work break. We find that activities and visitor-type distribution changes throughout the season.

An important consideration for pond visitation is water quality. ERG surveyors commonly heard positive reports about water quality from survey respondents, and that the water quality was a primary driver of their decision on which pond to visit. Analysis of visitation and water quality also suggests that ponds and lakes with better water quality have higher rates of visitation. Although ERG did not encounter any pond closures, we did hear from respondents across a variety of ponds and lakes that water quality declines in the late summer and fall leading to pond closures and undesirable swimming conditions.

There are some limitations to ERG's ECA and EIA which are worth discussing. During surveys, ERG asked respondents to estimate total spending in certain categories for their entire group. ERG believes that often the respondent was underestimating total spending for their group because their group members may have incurred expenses of which they are not aware. Additionally, the ECA and EIA are dependent on instantaneous visitation counts, and it was not always possible to count everyone at a pond due to limited visibility of the entire recreational area from the access point. This undercount would have resulted in an underestimate of total spending. A final factor that might have resulted in visitation underestimates (and thus spending underestimates) is that often the presence of survey administrators seemed to suppress visitation because pond and lake visitors assumed the ERG survey team was associated with parking or other regulatory enforcement.

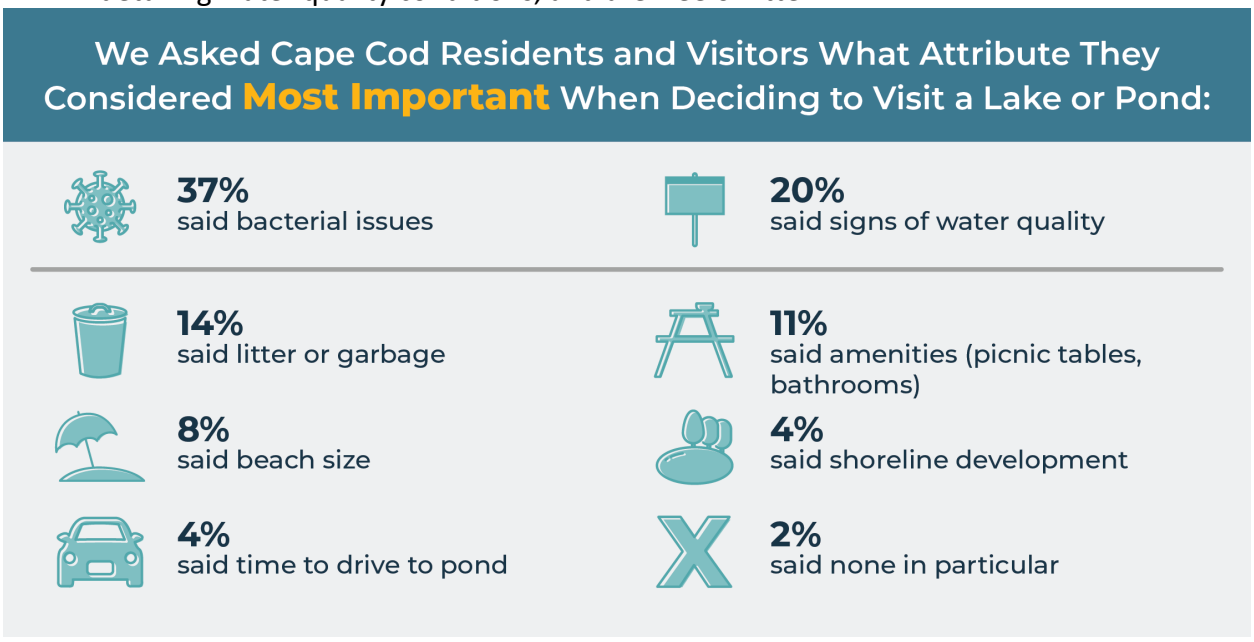
Another area of uncertainty is how visitation habits at unobserved ponds and lakes relate to visitation at observed ponds and lakes. ERG estimated that all named ponds and lakes have the same visitation characteristics to scale visitation to unobserved ponds and lakes. However, if named ponds and lakes which were not observed have lower visitation than the observed ponds and lakes, it would result in an overestimate of total visitation. Conversely, ERG likely underestimated visitors at unnamed ponds and lakes (of which there are close to 500) by assuming they do not have significant visitation. ERG conveys this uncertainty with multiple estimates of visitation but believes that the overestimate and underestimate may even out.

Overall, this analysis shows the importance of ponds and lakes to the Cape Cod economy and the Cape Cod community. Without pond and lake visitation, an estimated $37-$47 million dollars would be lost from the Cape Cod economy. This estimate does not account for things like willingness to pay, existence values, or ecosystem services, and therefore represents only a subset of benefits provided by ponds to Cape Cod.

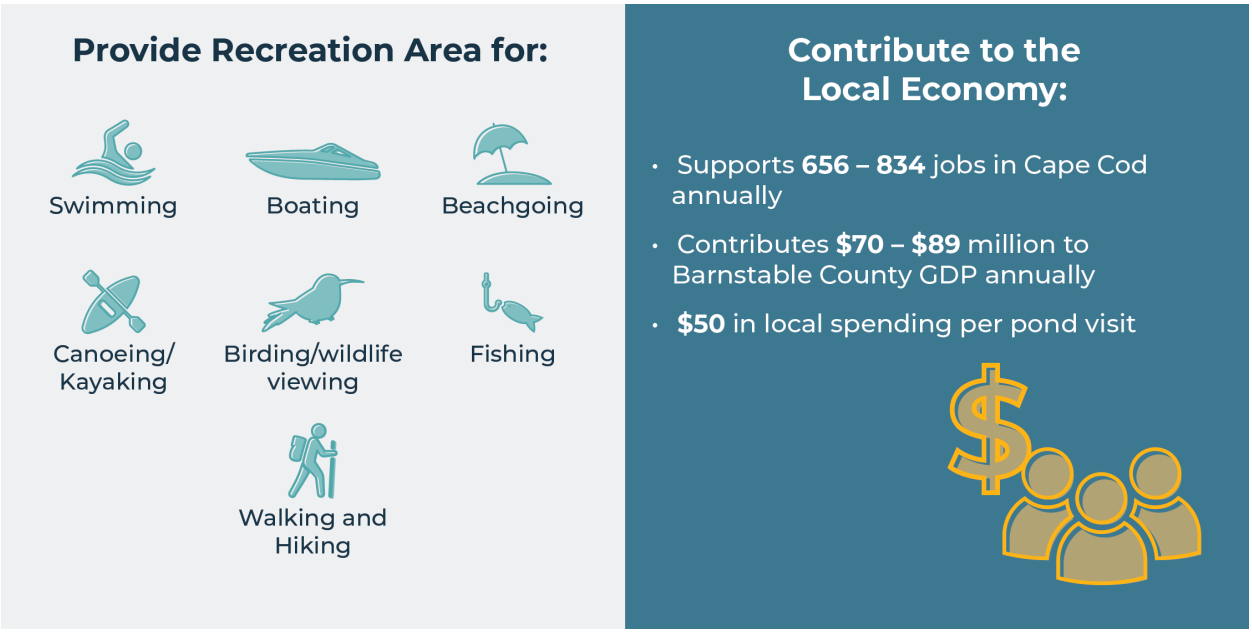
6 CROSS-CUTTING FINDINGS

Across ERG's perception survey, hedonic analysis, spending and visitation analyses, and discrete choice experiment, ERG finds that the presence and quality of freshwater has wide-reaching positive impacts on the Cape Cod economy and tourism. While this report captures a significant portion of the economic value attached to Cape Cod ponds and lakes, our valuation is not comprehensive and does not represent an estimate of the total value of ponds and lakes on Cape Cod. We do not attempt to assess certain values that may be associated with ponds and lakes such as ecosystem services, cultural value, natural resource generation (such as fish production), willingness to pay, and more. ERG recognizes that unaccounted for values may be significant. Nevertheless, the results of our analyses demonstrate that ponds and lakes contribute significant value to the Cape Cod economy. We have shown that Cape Cod residents and tourists alike value clean water and clean beaches at ponds and lakes. ERG finds that many residents, visitors, and non-resident owners commonly visit freshwater ponds for recreation. Pond and lake waterfront property is valued highly by homebuyers, especially if the water is clean. Visitors to Cape Cod ponds and lakes also favor clean water; they are significantly more likely to choose to visit ponds with clean beaches and a demonstrated history of excellent water quality. Below, we present a selection of key cross-cutting findings from our analyses.

- *Cape Cod ponds and lakes are popular destinations.* 82 percent of Cape residents, non-resident homeowners, and tourists reported sometimes or frequently visiting ponds and lakes. We estimate between 1.34 million and 1.70 million visits to Cape Cod ponds and lakes annually, with 66 percent of those visits coming between June and August.
- *People prefer to visit ponds and lakes with clean water and clean beaches.* We see a positive association between water quality and visitation, with "better" ponds being more highly recreated. Also, residents, non-resident homeowners, and tourists reported being more likely to visit ponds and lakes that are free of harmful bacteria, post signs detailing water quality conditions, and are free of litter.



- *Cape residents and non-resident homeowners value clean ponds.* 90.8 percent either "agree" or "strongly agree" that ponds and lakes are important to the Cape Cod environment, and they are willing to pay a premium to live near clean ponds and lakes. A home near a pond with clear water will sell for $22,300 (5 percent more than the median sales price) more than a similar home near a pond with algal issues, and a rental property near a pond with clear water will rent for $189 more per week (an 8 percent increase over median weekly rental value) than a similar rental property near a pond with algal issues.
- *Cape residents and non-resident homeowners support targeted pond improvements.* Residents and NROs indicated that the most impaired ponds and lakes, the ones with the highest support for improvement, and the most used/visited should be prioritized. Additionally, Cape residents and NROs overwhelmingly indicated that pond improvement projects with ecosystem benefits should be prioritized.
- *Lakes and ponds are important to the Cape Cod economy.* 83.9 percent of Cape residents and non-resident homeowners either "agree" or "strongly agree" that ponds and lakes are important to the Cape Cod economy, (only 3.3 percent "disagree" or "strongly disagree"). Spending associated with visits to lakes and ponds contributes between approximately 656 and 833 jobs annually and is responsible for $70 - $89 million of the region's GDP. Each pond or lake visitor spends an average of $50 locally per visit.



A APPENDIX A: PERCEPTIONS SURVEY

SURVEY OF ATTITUDES AND PERCEPTIONS RELATED TO CAPE COD FRESHWATER RESOURCES

FINAL REPORT

Submitted to:
CAPE COD COMMISSION (CCC)
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April 28, 2023

EXECUTIVE SUMMARY

In 2022, the Cape Cod Commission (CCC, or the Commission) contracted with Eastern Research Group, Inc. (ERG) of Concord Massachusetts to conduct an economic analysis exploring the value of freshwater ponds and lakes[28] on Cape Cod. As part this work, ERG conducted a survey of residents, nonresident owners (NROs),[29] and tourists on their attitudes and perceptions related to the Cape Cod freshwater resources. This report presents ERG's findings from that survey.

The survey was implemented in February and March of 2023 and resulted in collecting data from 827 respondents. Among the 827 respondents were 154 Cape Cod residents, 86 nonresident owners, and 587 tourists.[30] Based on the demographics of the sample, ERG developed sample weights that adjusted the sample for (1) the town the respondents live in or visited, (2) age, and (3) race.[31] Given our approach to weighting, most of the data presented in this report represent estimates of population (residents, NROs, and tourists) values.

Key findings from the survey include:

Demographics. A majority of respondents were women (61 percent). Almost a quarter of the sample was aged 65 or older and 54 percent were under age 45, but only 23.6 percent of sample was aged 45 to 64. Almost one quarter of the respondents identified as black, Hispanic or another non-white racial/ethnic group. A majority of respondents live in households without children (56 percent) and approximately one quarter live in households with children 10 and younger. Section A.3 of the report provides a more detailed overview the sample demographics.

Visiting ponds. More than one-third of residents (33.7 percent) and nonresident owners (35.9 percent) frequently visit ponds while only 16.3 percent of tourists visit ponds frequently. The most popular town for ponds visits is Barnstable (52.2 percent of pond visitors) followed by Bourne (32.5 percent) and Falmouth (21.3 percent). Most pond visits last between two to four hours with a large number lasting less than four hours total. Summer is the most popular time to visit ponds across all groups, fall is also a relatively popular time for residents and NROs.

Activities at ponds. Sitting at the beach is the most popular activity, with 66.2 percent of residents, NROs, and tourists frequently engaging in this activity at ponds. Walking or hiking is a close second among residents, with 48.5 percent of residents frequently taking walks or hikes at ponds and lakes. Though fishing and birding were not as popular as other activities, respondents still reported to engage in them at substantial rates of roughly 40 percent. While residents, NROs, and tourists engage in a full range of activities during the summer, visiting the beach, walking, and hiking remain popular during the fall and spring.

[28] Throughout the report, we use the terms "ponds and lakes" and simply "ponds" interchangeably.
[29] Individuals who own property on Cape Cod, but do not live on Cape Cod.
[30] The tourist sample was drawn from the six New England states, New York, and New Jersey.
[31] Given the nature of the population information for each category, the weights also implicitly accounted for Cape association (i.e., residents, NROs, and tourists).

Preferences for pond characteristics. As part of the survey, we implemented a series of questions to better understand which pond characteristics respondents most preferred. Based on that set of questions, respondents overwhelmingly selected four characteristics that are most preferred at ponds (in order of preference):

- Having the water free of bacteria
- Having a beach
- Having the water free of algae
- Having the beach/pond free of litter

Attitudes towards ponds. Overall, residents, NROs, and tourists strongly agreed that ponds are important to the Cape economy (53.3 percent of residents, NROs, and tourists) and strongly agreed that ponds are important to the Cape environment (60.6 percent). Residents and NROs indicated concern over the health of Cape ponds overall, but less concern about the health of ponds they visited personally.

Roles in maintaining pond health. When asked about a set of roles that towns, Barnstable County, and volunteer groups could take to maintain ponds health, residents and NROs indicated towns and the County had the largest roles to perform among most activities. In particular, a large majority of residents and NROs indicated that the towns and County should conduct and coordinate water quality monitoring.

Prioritizing pond improvement projects. We asked residents and NROs what aspects of ponds and what aspects of projects should be used in prioritizing pond improvement projects. In terms of ponds, residents and NROs indicated that the most impaired ponds, the ones with the highest support for improvement, and the most used/visited should be prioritized. In terms of projects, residents and NROs overwhelmingly indicated that projects with ecosystem benefits should be prioritized.

A.1 Introduction

In 2022, the Cape Cod Commission (CCC, or the Commission) contracted with Eastern Research Group, Inc. (ERG) of Concord to conduct an economic analysis exploring the value of freshwater ponds on Cape Cod. As part of this work, ERG conducted a survey of residents, nonresident owners (NROs), and tourists on their attitudes and perceptions related to the Cape Cod freshwater resources. This report presents ERG's findings from that survey.

The survey was implemented in February and March of 2023 and resulted in collecting 827 total responses from residents, nonresident owners, and tourists. The data were collected using an online survey instrument administered through Qualtrics, Inc. public samples.

The contents of the report can be described as follows:

- Section A.2 provides an overview of the survey implementation process and the weighting procedure we used to generate representative data.
- Section A.3 discusses the demographic characteristics of the respondents.
- Section A.4 summarizes the survey data related to the time that respondents spend on Cape Cod.
- Section A.5 provides an overview of the data related to respondents' visits to ponds.
- Section A.6 discusses the characteristics of ponds that respondents indicated are most and least preferred to them.
- Section A.7 discusses the data on respondents' attitudes and perceptions about pond health and improvement.
- Section A.8 provides a summary of the data on how respondents participate in pond health-related updated projects and where they get information on pond health.
- Section A.9 provides a discussion of the key results.

A.2 Survey Implementation and Weighting

The target population for the survey included three primary groups:

- Residents – People who live on Cape Cod year-round.
- Nonresident owners (NROs) – People who own property on Cape Cod but live off of the Cape.
- Tourists – People who vacationed on Cape Cod within the last three years and who were residents of the six New England states plus New York and New Jersey.[32]

ERG targeted an overall sample size of 800 respondents with sub-targets of 240 respondents (30 percent) from the residents and NROs combined and 560 respondents (70 percent) from tourists. ERG recommended, and the Commission agreed, that a target would need to be set for tourists and NROs since tourist comprise most of the target population for the survey. Thus, to ensure adequate representation in the sample, ERG suggested a target of 30 percent for residents and NROs.

The survey was fielded from February 1, 2023 to March 15, 2023[33] using a Qualtrics, Inc. public sample. A total of 827 responses were collected. Table A-1 provides a summary of the number of respondents by target population, referred to as "association with Cape Cod" throughout this report. Of the two sub-targets, reaching the target for resident/NROs was more challenging, but Qualtrics was able to attain the desired sample of 240 respondents (154 residents and 86 NROs). A total of 587 responses from tourists were collected.

Table A-1. Summary of data collected by target population by association with Cape Cod (all respondents)

Which of the following best describes your association with Cape Cod?		
Cape Association	**Number of Respondents**	**Percent of Respondents**
Residents	154	18.6%
NROs	86	10.4%
Tourists	587	71.0%
All Respondents	**827**	**100.0%**

CCC and ERG determined that the survey data should be weighted to better reflect the population. In particular, the distribution of respondents by age and race were determined to be not representative of the target populations.[34] Additionally, CCC felt that the information on where residents lived and where NROs and tourist stayed on the Cape (hereafter, "Cape

[32] This group also included people who indicated they worked on Cape Cod and also visited the Cape for recreation/vacation.

[33] The survey was not in the field for the full time period, however. During implementation, ERG asked Qualtrics to pause implementation to review the data and to adjust the data collection process as needed. One adjustment that was made was to limit the number of tourist respondents from New York state which, within the first few days of implementation, were more numerous than the tourists from Massachusetts. Thus, a cap of 149 respondents was set for tourists from New York to ensure they were not over-represented in the sample.

[34] This stems from the use of a web-based survey implementation where respondents tend to be younger and tend to skew towards Caucasians.

location") was also skewed. Calculating standard survey weights for these three factors, however, requires knowing the cross-tabulation in the population of all three groups at once (e.g., the population number of whites aged 25 to 34 who live in/visit the outer Cape). Those types of cross-tabulations are not available at the population level. To overcome this, ERG used a statistical poststratification procedure called raking.[35] In a raking procedure, the totals for relevant sub-groups (e.g., people aged 25 to 34) are used iteratively to calculate weights. Weights are calculated over one factor (e.g., age) first, then over a second factor (e.g., race) which alters the weights for the first factor, and then over the third factor (e.g., Cape location) which alters the weights for the first two factors. This process is repeated until the changes in the weights are very small between the iterations. The following should also be noted about this process:

- The raking procedure explicitly included age, race, and Cape location, but since Cape location depends on Cape association, the process implicitly weights for Cape association.
- Raking, and weighting in general, requires each cross-tabulation within the sample data to contain a sufficient number of respondents to be stable. As such, it was necessary to collapse the following categories in the sample:
    - For Cape location, all towns were placed into one of four Cape regions: Lower Cape, Upper Cape, Mid-Cape, and Outer Cape.[36]
    - Race was collapsed into two categories of "white" and "non-white" and since the race question in the survey was a "select all" question, we classified respondents as "white" if they only selected "white" in the survey.
- The question defining Cape location for NROs and tourists was a "select all" question. ERG collapsed this first to the four regions defined above and then calculated eight separate weights[37] by cycling through the different selections respondents made in the "select all" question. This required running the raking procedure eight times. As such, the final calculated weight for each respondent reflected an average of the eight separate procedures.

The survey weights were applied to most of the questions in the survey. We did not apply them to the questions that provided information on the distribution of the sample respondents. There were other cases where the weighting did not make sense as well and we note those in the sections below. Given our approach to weighting, most of the data presented in this report represent estimates of population (residents, NROs, and tourists) values.

[35] This raking procedure is also described in Appendix C: Discrete Choice Experiment Supplemental Information.
[36] The Outer Cape was defined as Provincetown, Truro, Wellfleet, and Eastham. The Mid-Cape was defined as Barnstable, Dennis, and Yarmouth. The Lower Cape was defined as Brewster, Chatham, Harwich, and Orleans. The Upper Cape was defined as Bourne, Falmouth, Mashpee, and Falmouth.
[37] The eight cycles were defined by ordering the selections to calculate four weights and reverse-ordering them to calculate the second four weights. The use of the reverse-ordering ensured the original ordering did not dominate the weight calculation.

A.3 Respondent Characteristics

Table A-2 presents a demographic summary of the sample. As noted above, these summaries reflect unweighted data to provide an overview of the sample itself. A majority of respondents were women (61 percent). Almost a quarter of the sample was aged 65 or older and 54 percent was under age 45, but only 23.6 percent of sample was aged 45 to 64. Almost half (47.7 percent) of the respondents had annual household incomes between $30,000 and $90,000. Almost one quarter of the respondents identified as black, Hispanic or another non-white racial/ethnic group. Three-quarters of the respondents live in households with two to four people. A majority of respondents live in households without children (55 percent) and approximately one quarter live in households with children 10 and younger. As discussed above, after reviewing these distributions, CCC and ERG decided to develop weights partly based on age and race with Cape location (next section) being the third weighting factor.

Table A-2. Demographic summary of survey sample (all respondents)

How would you describe your gender identity?		
Gender	**Respondents**	**Percent**
Male	300	36.3%
Female	504	61.0%
Other/declined	22	2.7%
How old are you?		
Age	**Respondents**	**Percent**
18 to 24	117	14.2%
25 to 34	156	18.9%
35 to 44	172	20.9%
45 to 54	97	11.8%
55 to 64	89	10.8%
65 plus	191	23.2%
Preferred not to say	3	0.4%
What is your combined household income from all sources?		
Income	**Respondents**	**Percent**
Less than $30K	96	11.6%
$30K - $50K	125	15.1%
$50K - $70K	146	17.7%
$70K - $90K	123	14.9%
$90K - $120K	114	13.8%
$120K - $140K	74	9.0%
$140K - $160K	41	5.0%
More than $160K	62	7.5%
Preferred not to say	46	5.6%
How would you describe yourself? (Select all that apply)		
Identity	**Respondents**	**Percent**
White	595	72.0%
Black	113	13.7%
Hispanic	95	11.5%
Other	53	6.4%
In your household, do you have children in any of the following age ranges? (Select all that apply)		
Age Range	**Respondents**	**Percent**
Under 5	86	10.4%
Between 5 and 10	143	17.3%
Between 11 and 17	148	17.9%
18 and Older	118	14.3%
No children	443	53.6%

A.4 Spending Time on Cape Cod

Figure A-1 illustrates the geographic distribution of resident respondents across 14 Cape Cod municipalities. A blue color gradient is used to represent the share of resident respondents residing in each municipality, ranging from pale blue (Wellfleet, 0.0 percent; no respondents) to dark blue (Barnstable, 22.3 percent). The resident sample is concentrated in the upper and mid Cape. Wellfleet is the only municipality not represented in the resident sample, where an estimated 1.7 percent of full-time residents live according to 2020 American Community Survey (ACS) data. Further comparisons to ACS data from that year suggest Mashpee residents are modestly over-represented in our sample.

Figure A-1. Where do residents live on Cape Cod? (residents only)

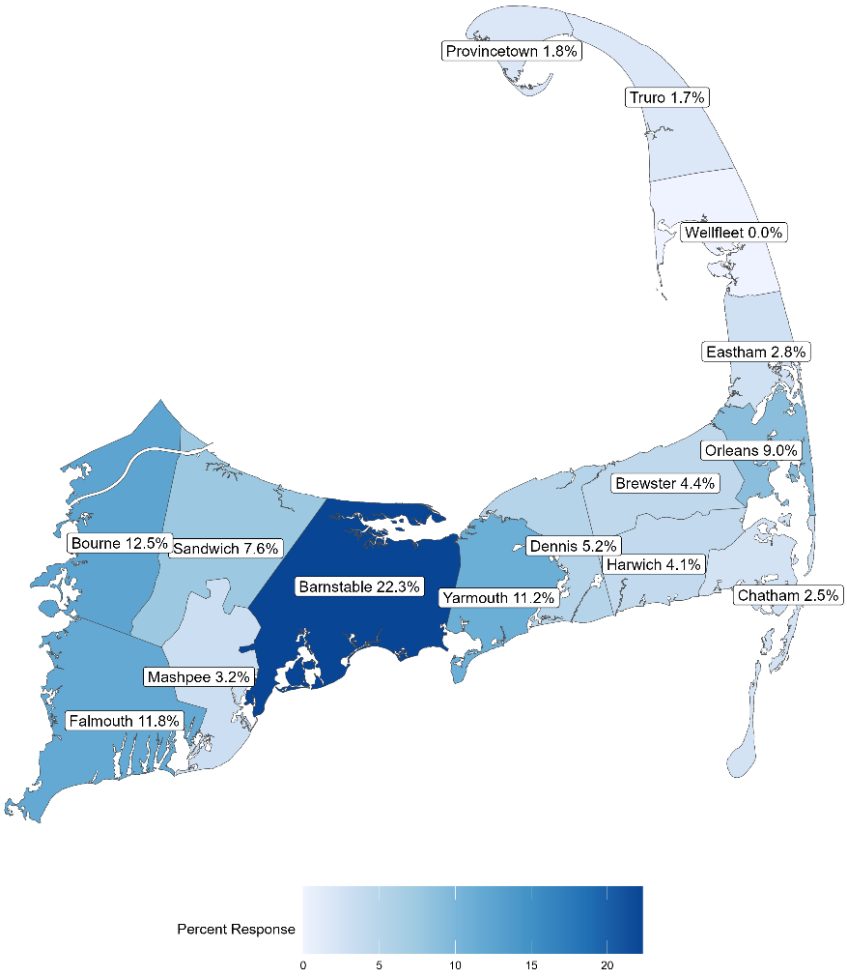


Figure A-2 illustrates the geographic distribution of where nonresident owners and tourists tend to stay across Cape Cod. The blue color gradient represents the share of

nonresident respondents that visit each municipality, ranging from pale blue (Harwich, 3.8 percent) to dark blue (Barnstable, 67.3 percent). The nonresident sample is concentrated in Barnstable, where 67 percent of NROs and tourists tend to stay. We note that nonresident owners and tourists were allowed to select more than one location in response to this question, meaning the figure does not show preferred location to stay, or give us information on the amount of time spent in each location.

Figure A-2: Where do visitors tend to stay?

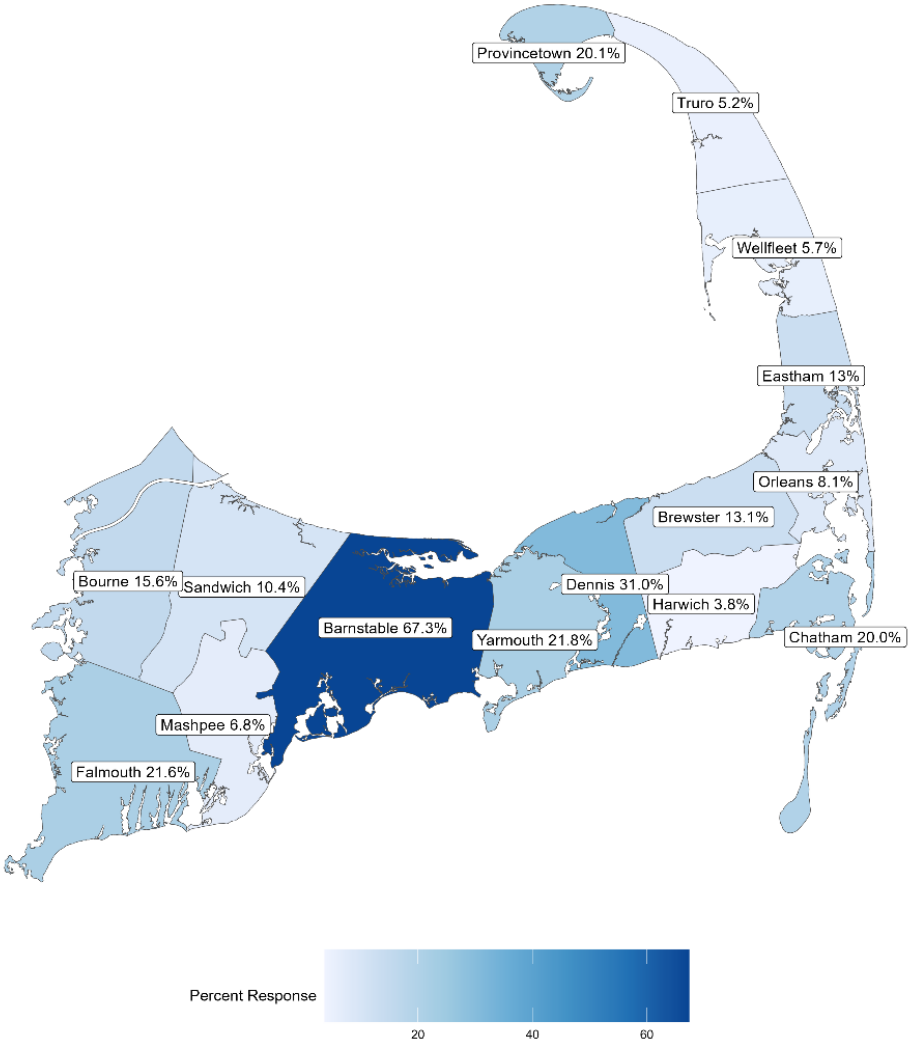


Table A-3 captures the time nonresident owners usually spend on Cape Cod each year. Most nonresident owners (65.8 percent) spend fewer than two months on Cape Cod.

Table A-3. Time spent on cape cod (nonresident owners)

How much time do you usually spend on Cape Cod each year?	
Time	**Frequency**
Less than 4 weeks	35.6%
5 - 8 weeks	30.2%
9 - 12 weeks	13.6%
13 - 16 weeks	6.8%
17 - 20 weeks	13.4%
21 - 24 weeks	0.3%
More than 24 weeks	0.2%

More than half of tourists normally stay overnight (51.6 percent), 8.8 percent usually take day trips, and remaining (39.6 percent) take both day and overnight trips when they visit Cape Cod. Among those taking both overnight and day trips 58.8 percent of their visits, on average, involve an overnight stay.[38] Table A-4 presents the amount of time tourists tend to stay when they vacation on or visit Cape Cod. Most tourists and nonresident owners (95.1 percent) stay 2 or fewer weeks.

Table A-4. Length of stay on cape cod (tourists only)

When you vacation on/visit Cape Cod, how long do you tend to stay?	
Time on Cape	**Frequency**
0 – 2 days	18.6%
3 – 6 days	45.6%
1 – 2 weeks	30.8%
3 – 4 weeks	3.1%
5 – 8 weeks	0.7%
9 – 12 weeks	0.7%
More than 12 weeks	0.5%

Figure A-3 provides a distribution of which months tourists tend to spend time on Cape Cod with the most popular months being June, July, August, and September.

[38] The value 58.8 percent comes from a Question 13 in the survey in which we asked tourists who take both day and overnight trips the percentage of trips that involved an overnight stay. The value reflects responses from 250 of the tourists who provided a value.

Figure A-3. Visits to Cape Cod by season (tourists only)

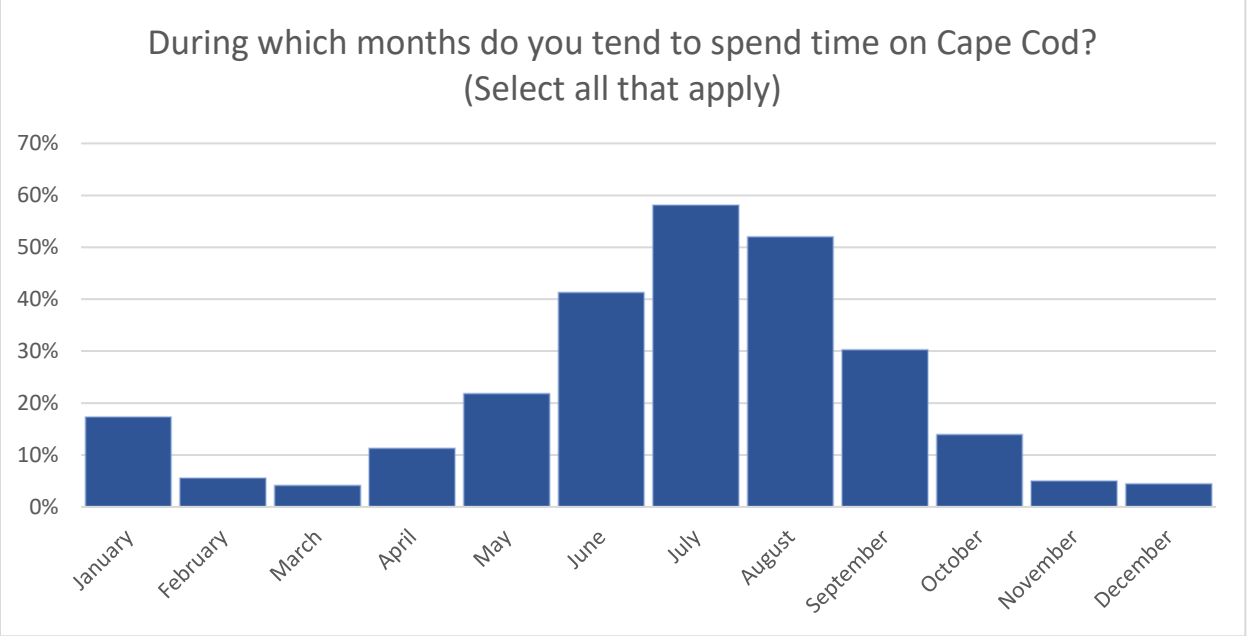


Table A-5 presents the extent to which residents, NROs, and tourists engage in a range of recreational activities on Cape Cod. More than 90 percent of residents, NROs, and tourists sometimes or frequently participate in beach activities (94.1 percent) and dining (95.9 percent). More than 70 percent of residents, NROs, and tourists rarely or never participate in organized sports (78 percent) or sail (70.2 percent). For activity participation by association with Cape Cod, please see Table A-8.

Table A-5. Recreational activity on Cape Cod (all respondents)

To what extent do you participate in the following activities on Cape Cod?				
Activity	**Not at all**	**Rarely**	**Sometimes**	**Frequently**
Swimming	5.5%	13.6%	41.0%	39.8%
Canoeing, etc.	26.2%	23.6%	35.6%	14.6%
Sailing	47.1%	23.1%	22.5%	7.3%
Motorboats	43.2%	22.0%	25.3%	9.5%
Beach	1.2%	4.5%	22.8%	71.5%
Birding	37.9%	25.0%	26.4%	10.7%
Walk/hike	2.9%	10.3%	41.5%	45.4%
Enjoying Cultural Attractions	3.2%	19.2%	41.7%	36.0%
Organized Sports	49.4%	28.6%	15.6%	6.4%
Shopping	2.0%	12.8%	39.3%	45.9%
Dining	0.4%	3.7%	28.8%	67.1%
Nightlife	12.5%	26.4%	36.7%	24.5%

A.5 Visits to Ponds and Lakes

Respondents were asked to reflect on how frequently they visit ponds and saltwater beaches on Cape Cod. Table A-6 summarizes visit frequency by association with Cape Cod. Eighty-two percent of residents, NROs, and tourists sometimes or frequently visit ponds and lakes. For context, 93.2 percent of residents, NROs, and tourists sometimes or frequently visit saltwater beaches. More than one-third of residents (33.7 percent) and nonresident owners (35.9 percent) frequently visit ponds and lakes, twice the share of tourists who do the same (16.3 percent).

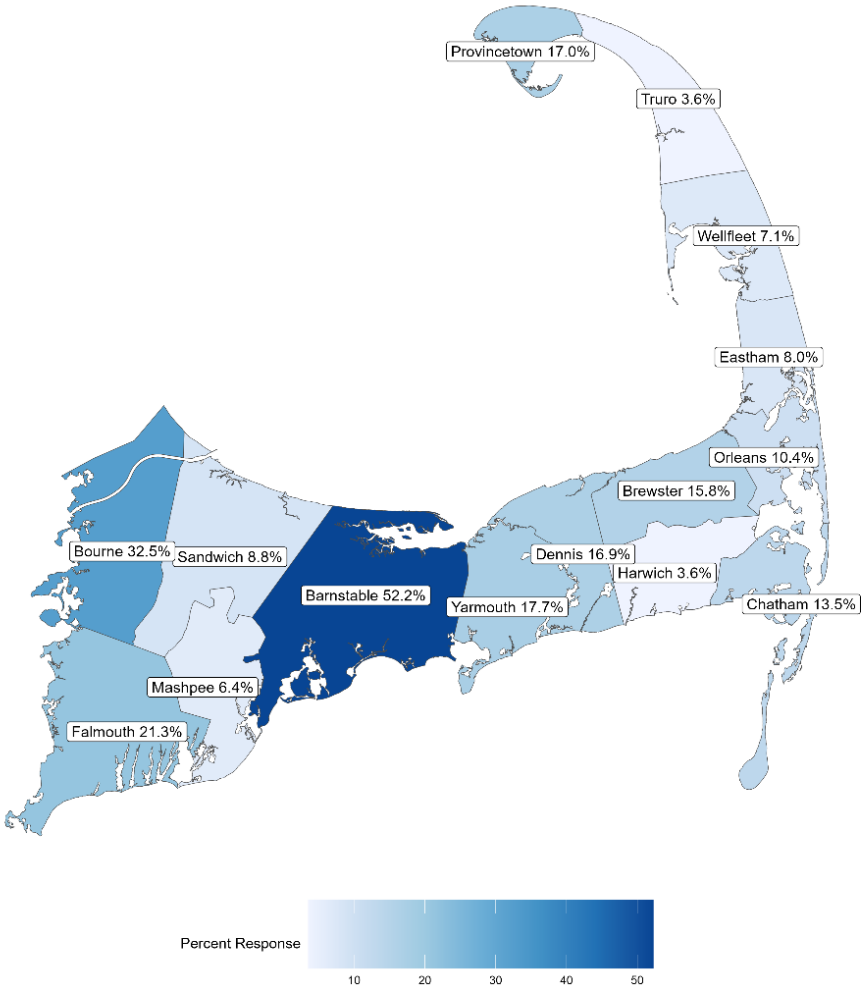
Table A-6. Visits to Cape Cod ponds and lakes: frequency by association with Cape Cod (all respondents)

How frequently do you visit the following types of areas on Cape Cod?				
Frequency of Visiting	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Ponds [a]				
Rarely	18.1%	17.6%	28.4%	27.9%
Sometimes	48.2%	46.5%	55.3%	55.0%
Frequently	33.7%	35.9%	16.3%	17.2%
Saltwater Beaches				
Not at all	0.3%	0.2%	0.3%	0.3%
Rarely	7.7%	3.5%	6.4%	6.4%
Sometimes	32.9%	14.0%	38.9%	38.4%
Frequently	59.1%	82.4%	54.4%	54.8%

[a] Respondents who stated their frequency of visiting ponds as "Not at all" were screened out of the survey.

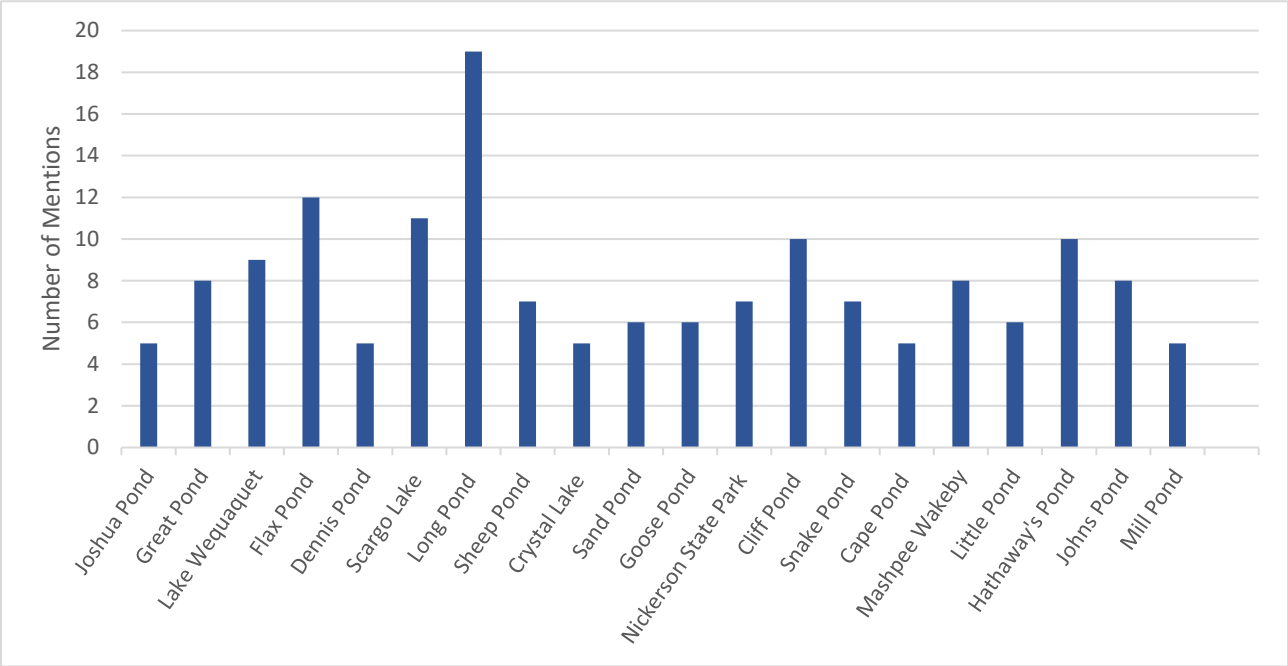
Figure A-4 illustrates the geographic distribution of towns where residents, NROs, and tourists most often visit ponds and lakes. The color gradient is used to represent the share of residents, NROs, and tourists who most often visit ponds and lakes in different towns, ranging from pale blue (Harwich & Truro) to dark blue (Barnstable). The leading destination is the Town of Barnstable, where more than half of residents, NROs, and tourists indicate they often visit ponds and lakes (52.2 percent). We note that survey respondents could select more than one town in the question.

Figure A-4. Distribution of ponds and lakes visited on Cape Cod (all respondents)



Respondents were asked to name the specific ponds or lakes they visit on Cape. Almost two-thirds of respondents were not able to identify ponds by name. Figure A-5 provides a tabulation of the pond names identified by respondents. The pond most frequently mentioned by respondents is “Long Pond,” which is a named pond in more than one Cape town.

Figure A-5. Pond names identified by respondent



Respondents were asked how long they stay at lakes or ponds when they visit one on Cape Cod. Table 7 summarizes this information by association with Cape Cod. On a typical visit, 83.1 percent of residents, NROs, and tourists spend less than six or fewer hours at ponds or lakes, with most (52.1 percent) staying 2-4 hours. Residents and nonresident owners tend to make shorter visits, with more than 70 percent staying four or fewer hours at a pond or lake. More than half of nonresident owners (53.3 percent) and tourists (52.3 percent) stay 2-4 hours during a typical pond visit.

Table A-7. Visits to Cape Cod ponds and lakes: length of stay (all respondents)

How long do you stay at a pond or lake when you visit one on Cape Cod?				
Time at Pond	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Less than 2 hours	40.0%	22.2%	15.3%	16.3%
2 to 4 hours	45.2%	53.3%	52.3%	52.1%
4 to 6 hours	12.0%	19.1%	25.3%	24.7%
6 to 8 hours	2.3%	4.9%	4.4%	4.3%
More than 8 hours	0.7%	0.6%	2.7%	2.6%

Respondents were asked how many people (including themselves) are in their group when they visit ponds and lakes on Cape Cod. Table A-7 summarizes group size by association with Cape Cod. Most residents, NROs, and tourists (83.6 percent) visit ponds and lakes in groups of two to four people. A larger share of residents visit lakes and ponds on their own (14.9 percent), than nonresident owners (5 percent) and tourists (3.3 percent). Nonresident

owners and tourists are more likely to visit in groups of three to four people, while parties of 2 are more common among residents.

Table A-7. Visits to Cape Cod ponds and lakes: size of group (all respondents)

Including yourself in the number, how many people are in your group when you go to ponds or lakes on Cape Cod?				
Number	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Just themselves	14.9%	5.0%	3.3%	3.7%
Two people	51.6%	34.3%	35.9%	36.5%
Three to four people	25.5%	50.3%	47.9%	47.1%
Five to six people	7.3%	10.2%	11.2%	11.0%
Seven or more people	0.8%	0.3%	1.7%	1.7%

Respondents were asked how frequently they visit Cape Cod ponds or lakes during each season. Responses are presented by association with Cape Cod in Figure A-6 (residents), Figure A-7 (nonresident owners), and Figure A-8 (tourists). Winter visits appear least frequent among tourists. In fact, 6 in 10 tourists never visit lakes or ponds during the winter. By comparison, only 3 in 10 residents and 4 in 10 non-resident owners never visit lakes or ponds during the winter.

Figure A-6. Visits to Cape Cod Ponds and lakes by season (residents)

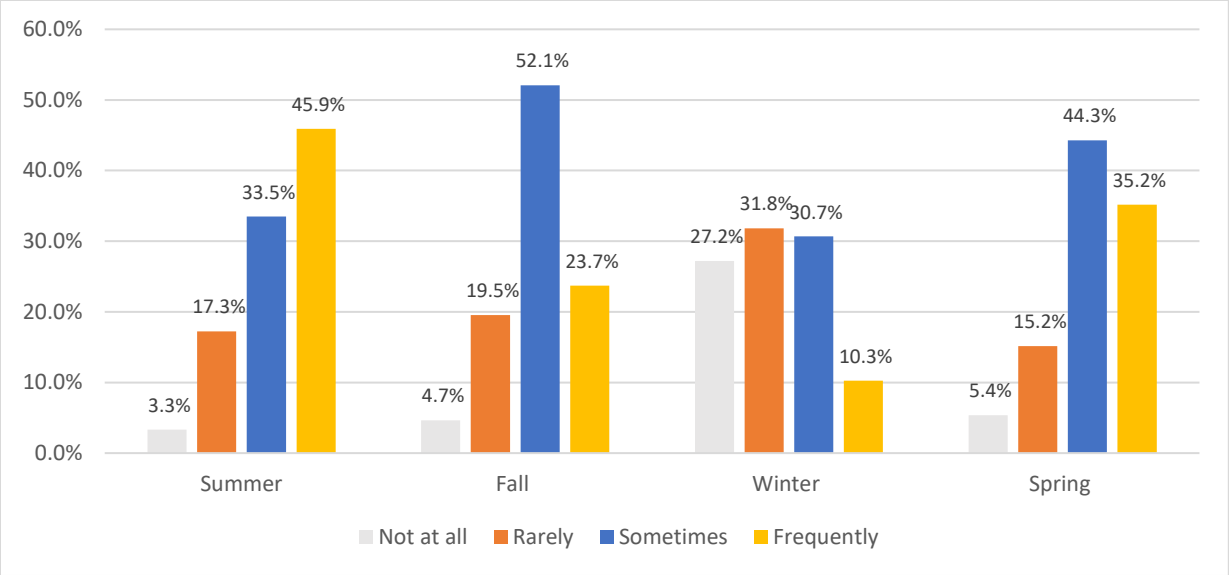


Figure A-7. Visits to Cape Cod ponds and lakes by season (nonresident owners)

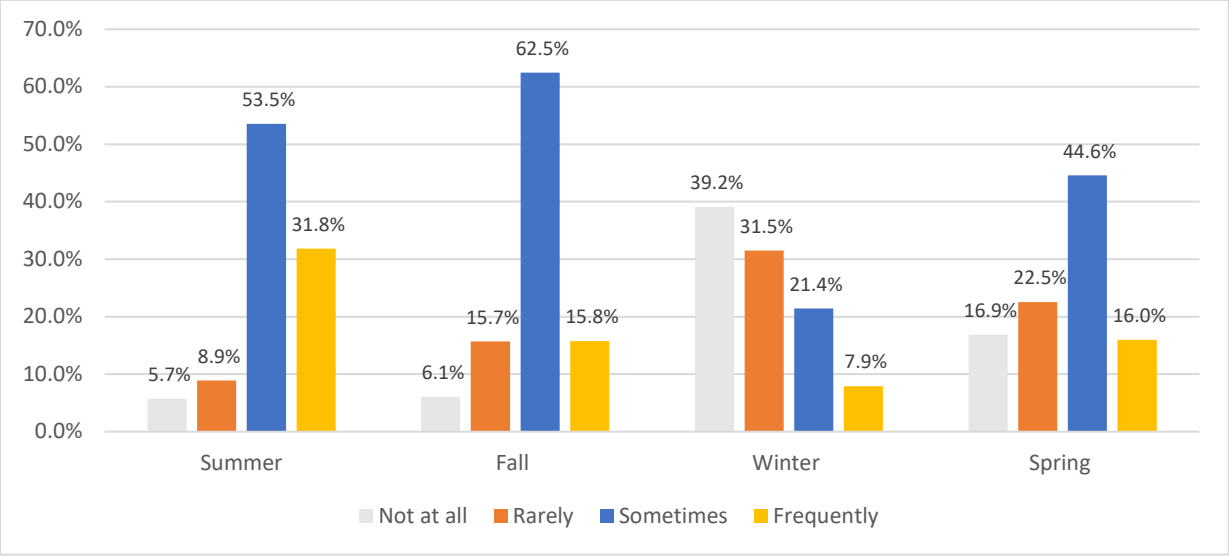


Figure A-8. Visits to Cape Cod ponds and lakes by season (tourists)

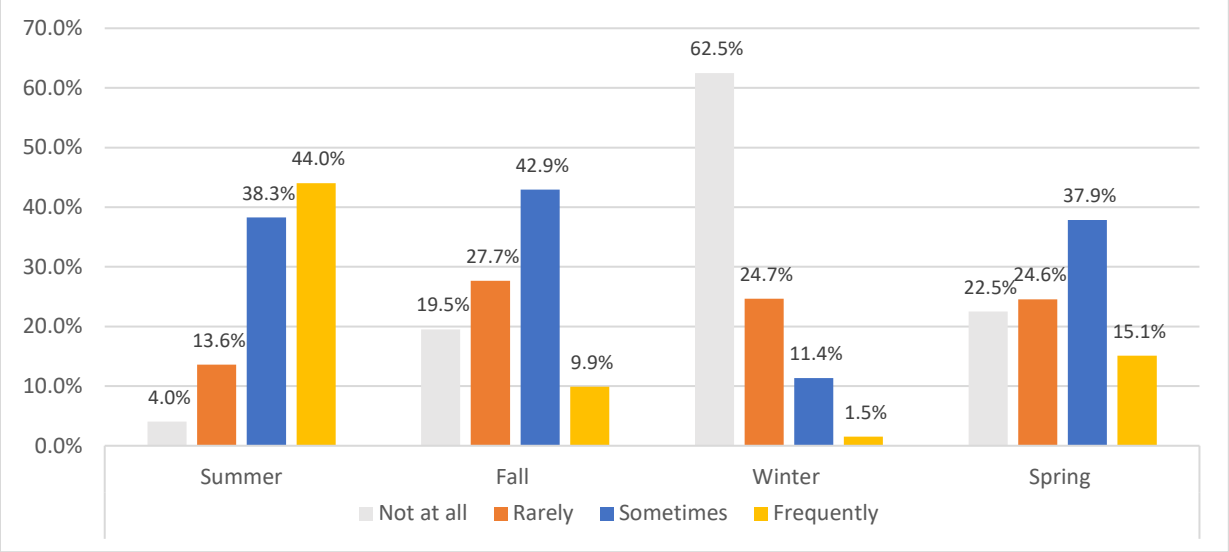


Table A-8 summarizes the recreational activities residents, NROs, and tourists engage in when they visit ponds and lakes on Cape Cod by association with Cape Cod. Sitting at the beach is the most popular activity, with 66.2 percent of residents, NROs, and tourists frequently engaging in this activity when they visit ponds and lakes. Walking or hiking is a close second among residents, with 48.5 percent of respondents frequently taking walks or hikes at ponds and lakes. Fishing and birding are the least popular, with more than 60 percent of residents, NROs, and tourists rarely or never engaging in these activities. 68 percent of nonresident owners frequently or sometimes boat, more than twice the share of residents (29.0 percent).

Table A-8. Activities at Cape Cod ponds and lakes by association with Cape Cod (all respondents)

When you visit ponds or lakes on Cape Cod, how often do you do the following activities?				
Frequency	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Swimming				
Not at all	12.3%	21.7%	14.4%	14.4%
Rarely	20.7%	14.8%	18.7%	18.7%
Sometimes	38.3%	30.0%	36.3%	36.3%
Frequently	28.7%	33.5%	30.6%	30.6%
Sit at the Beach				
Not at all	4.7%	4.2%	3.4%	3.4%
Rarely	4.9%	6.4%	4.5%	4.6%
Sometimes	36.6%	16.6%	25.5%	25.8%
Frequently	53.8%	72.9%	66.6%	66.2%
Kayak or Paddleboard				
Not at all	36.9%	25.3%	31.4%	31.5%
Rarely	23.4%	30.0%	26.4%	26.3%
Sometimes	26.8%	26.9%	29.1%	28.9%
Frequently	12.9%	17.9%	13.2%	13.2%
Walking/Hiking				
Not at all	3.0%	4.7%	5.4%	5.3%
Rarely	7.9%	11.3%	9.3%	9.2%
Sometimes	40.6%	35.5%	40.3%	40.3%
Frequently	48.5%	48.6%	45.1%	45.2%
Fishing				
Not at all	41.6%	9.1%	40.0%	39.7%
Rarely	21.4%	41.4%	20.2%	20.5%
Sometimes	24.4%	27.7%	27.3%	27.2%
Frequently	12.6%	21.8%	12.5%	12.6%
Birding				
Not at all	38.6%	31.8%	40.7%	40.5%
Rarely	17.2%	32.4%	23.0%	22.9%
Sometimes	28.9%	28.2%	24.0%	24.3%
Frequently	15.4%	7.6%	12.3%	12.4%
Boating				
Not at all	43.5%	17.8%	32.3%	32.6%
Rarely	27.4%	13.9%	23.1%	23.1%
Sometimes	17.5%	54.0%	34.6%	34.2%
Frequently	11.5%	14.4%	10.0%	10.1%

Table A-9 illustrates the seasonal distribution of recreational activity at Cape Cod ponds and lakes. While residents, NROs, and tourists engage in a full range of activities during the summer, visiting the beach, walking, and hiking remain popular during the fall and spring. Recreational activity dips in winter, but more than 1 in 10 residents, NROs, and tourists walk and hike around ponds and lakes during the winter months.

Table A-9. Activities at Cape Cod Ponds and Lakes by Season and Association with Cape Cod (All Respondents)

What activities do you do at Cape Cod ponds or lakes during the different seasons? (Select all that apply)[39]				
Activity	**Summer**	**Fall**	**Winter**	**Spring**
Swimming	76.0%	8.2%	1.9%	9.4%
Beach	82.4%	33.7%	6.8%	30.7%
Kayak/paddle	53.2%	7.7%	2.3%	10.4%
Walk/hike	72.6%	48.4%	11.3%	40.1%
Fish	45.5%	13.4%	3.4%	16.6%
Birding	37.9%	22.1%	7.1%	22.1%
Boating	53.4%	8.5%	2.4%	11.2%

[39] Percentages will not add to 100 because respondents were prompted to "select all that apply".

A.6 Preferences for Pond Characteristics

To better understand residents, NROs, and tourists' preferences for pond characteristics, we included a series of questions that asked respondents to select the "most preferred" and "least preferred" characteristics from a list. The approach is an alternative to rating scale questions, such as used in other parts of the survey, and is referred to as best-worst scaling (BWS). The advantage of a BWS approach over rating scales is that BWS questions force respondents to choose a most- and least-preferred characteristic from a list, rather than having them provide ratings for each characteristic. For this work, CCC and ERG developed a list of 14 pond characteristics:[40]

- Litter – "The pond/lake and areas are free of litter."
- Bacteria – "The water is free of bacteria."
- Water clarity – "The water is clear."
- Stand – "The pond/lake's bottom/floor is comfortable to walk on/stand in."
- Crowded – "The pond/lake is not crowded."
- Fishing – "Fishing is possible."
- Shoreline – "The shoreline is not developed."
- Algae – "The water is free of algae."
- Parking – "Resident and nonresident parking is available."
- Restrooms – "Public restrooms are present."
- Weeds – "The pond/lake is free of weeds."
- Dock – "There is a dock to stand on/jump off."
- Beach – "There is a beach."
- Boat – "There is enough water to launch my boat."

BWS designs with several items such as this one generally involves presenting respondents with subsets of the items across multiple questions. This approach reduces the cognitive burden of selecting "most" and "least" preferred from among the full set. Using multiple questions also allows respondents to select multiple items for the "most" and "least" preferred and provides a more complete picture of relative preferences among the items. For this survey, ERG developed a design that presented respondents with seven questions that contained four items each with each item appearing in two questions. Thus, respondents selected seven "most" and seven "least" preferred options from the set of seven questions.

To analyze these data, ERG performed a statistical analysis using a conditional logistic regression model. The model is designed to assess which of the items are more likely to be selected as the "most" preferred and which are more likely to be selected as the "least" preferred.[41] The output from the model is a set of logistic regression coefficients that reflect

[40] In the list, the pond attribute appears first followed by the exact wording presented to respondents in quotes.
[41] An alternative approach is to simply assign each item selected as "most" a value of +1 and each item selected as "least" preferred a value of -1 for each respondent and then add up the values over all respondents for each item. The adding up approach, however, does not work as well when the items are divided across multiple questions such as in this case. Later in survey we implemented two other BWS questions which did not divide the items across questions, and we present those using the adding up approach.

the strength that items were selected as the "most" preferred item relative to being selected as the "least" preferred item. Positive values reflect items that were more likely to be selected as "most" preferred and negative values reflect items that were more likely to be selected as "least" preferred. The estimated values reflect the strength of that association (e.g., larger positive values reflect items were more likely to be selected as "most" preferred compared to smaller positive values). The statistical analyses were performed on the weighted data. For simplicity, we refer to the estimated regression coefficients as BWS index values.

Table A-10 provides the results of our analysis with pond characteristic items sorted by their overall rating based on the BWS index values. Four characteristics rated very strongly in terms of being more likely to be selected as the "most" preferred: bacteria, beach, algae, and litter. We also performed the statistical analysis taking into consideration other survey data. Table A-10 also provides the pond characteristic items ranked by association with the Cape and by pond visit frequency. The table presents the BWS Index values[42] accounting for these other factors and the rank (highest to lowest) for each factor. For these two other factors, the top four items are the same as in the overall analysis (bacteria, beach, algae, and litter). Regardless, the absence of bacteria remains among the top two in each analysis and the absence of litter is either the third or fourth ranked item in each.[43]

Table A-10. Best-Worst Scaling pond characteristics ratings, overall and by association with Cape Cod and pond visit frequency

Item	Overall	Association with Cape				Pond Visit Frequency					
		Resident/ NROs		Tourists		Rarely		Sometimes		Frequently	
	Score	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Bacteria	2.795	3.501	1	2.763	2	2.862	2	2.966	2	2.283	1
Beach	2.754	2.519	3	2.767	1	3.058	1	2.986	1	1.866	2
Algae	2.117	2.659	2	2.089	3	2.553	3	2.131	4	1.470	4
Litter	2.049	1.963	4	2.055	4	1.671	4	2.396	3	1.814	3
Restrooms	1.021	0.360	6	1.052	5	1.059	5	1.312	5	0.399	6
Water clarity	0.725	0.887	5	0.717	6	0.814	6	0.750	6	0.573	5
Parking	0.360	-0.228	7	0.390	7	0.757	7	0.483	7	-0.559	10
Crowded	-0.070	-0.496	9	-0.049	8	0.100	8	-0.261	8	0.249	7
Weeds	-1.008	-0.248	8	-1.049	9	-1.660	10	-0.945	9	-0.371	9
Fishing	-1.340	-1.320	11	-1.341	10	-2.138	11	-1.437	11	-0.190	8
Shoreline	-1.445	-1.189	10	-1.460	11	-1.490	9	-1.352	10	-1.754	14
Stand	-1.605	-2.081	12	-1.584	12	-2.319	12	-1.482	12	-1.044	11
Boat	-2.579	-2.936	14	-2.563	13	-2.971	13	-2.743	13	-1.669	13
Dock	-2.603	-2.529	13	-2.609	14	-2.999	14	-2.886	14	-1.520	12

[42] The Index Values are the regression coefficients from a conditional logistic regression. They reflect the likelihood of respondents selecting the item relative to other items.

[43] We also performed the analysis accounting for the ages of children the age of respondents as well. The top four remained the same among these analyses with the absence of bacteria in the top two in each and the absence of litter being the third or fourth ranked item.

A.7 Perceptions and Attitudes About Pond and Lake Health

Table A-11 summarizes perceived significance of barriers to addressing Cape Cod pond and lake health as expressed by Cape Cod residents and nonresident owners. More than 75 percent of residents and NROs perceive funding, awareness, and education as moderate to significant barriers to addressing Cape Cod pond and lake health.

Table A-11. Perceived barriers to addressing Cape Cod pond and lake health

To what extent are the following barriers to addressing Cape Cod pond and lake health?			
Response	**Cape Association**		
	Residents	**NROs**	**Residents and NROs Combined**
Funding			
Not a barrier	3.6%	1.6%	3.1%
Minor barrier	6.2%	9.6%	7.0%
Moderate barrier	34.3%	40.0%	35.6%
Significant barrier	40.7%	39.8%	40.5%
Not sure/don't know	15.2%	9.1%	13.8%
Awareness			
Not a barrier	1.4%	0.8%	1.2%
Minor barrier	12.7%	12.2%	12.6%
Moderate barrier	47.3%	49.1%	47.7%
Significant barrier	30.5%	33.2%	31.1%
Not sure/don't know	8.1%	4.7%	7.3%
Education			
Not a barrier	1.6%	1.0%	1.5%
Minor barrier	9.0%	29.0%	13.6%
Moderate barrier	48.9%	24.0%	43.2%
Significant barrier	31.4%	41.3%	33.7%
Not sure/don't know	9.0%	4.8%	8.0%
Agreement on project priorities			
Not a barrier	0.6%	5.8%	1.8%
Minor barrier	10.0%	12.1%	10.5%
Moderate barrier	34.7%	21.6%	31.7%
Significant barrier	35.3%	47.3%	38.1%
Not sure/don't know	19.4%	13.2%	17.9%
Ownership			
Not a barrier	2.8%	2.9%	2.8%
Minor barrier	10.4%	11.1%	10.5%
Moderate barrier	28.8%	27.0%	28.3%
Significant barrier	36.8%	41.5%	37.9%
Not sure/don't know	21.3%	17.5%	20.4%
Agreement on management strategies			
Not a barrier	3.0%	3.4%	3.1%
Minor barrier	6.2%	5.9%	6.2%
Moderate barrier	37.2%	26.4%	34.7%
Significant barrier	36.2%	47.0%	38.7%
Not sure/don't know	17.5%	17.3%	17.5%

Table A-12 captures perceptions about Cape Cod ponds and lakes among residents, NROs, and tourists. Overall, residents and NROs strongly agreed that ponds are important to the Cape economy (53.3 percent of respondents) and strongly agreed that ponds are important to the Cape environment (60.6 percent of respondents). Residents and NROs indicated concern

over the health of Cape ponds overall, but less concern about the health of ponds they visited personally.

Table A-12. Perceptions of Cape Cod ponds and lakes (all respondents)

Do you agree or disagree with the following statements about freshwater Cape Cod ponds and lakes?	Cape Association			
	Residents	NROs	Tourists	All Respondents
Ponds and lakes are important to the Cape Cod economy				
Strongly disagree	1.8%	5.8%	2.4%	2.4%
Disagree	2.0%	0.5%	0.9%	0.9%
Neither agree nor disagree	10.5%	2.8%	11.0%	10.9%
Agree	27.4%	27.7%	30.8%	30.6%
Strongly agree	55.2%	63.2%	53.1%	53.3%
Not sure/don't know	3.2%	0.0%	1.9%	1.9%
Ponds and lakes are important to a town's economy				
Strongly disagree	0.3%	5.7%	2.1%	2.0%
Disagree	3.0%	0.1%	0.7%	0.8%
Neither agree nor disagree	14.3%	11.1%	9.5%	9.7%
Agree	37.7%	42.4%	38.4%	38.4%
Strongly agree	42.1%	40.7%	46.6%	46.4%
Not sure/don't know	2.7%	0.1%	2.7%	2.7%
Ponds and lakes are important to the Cape Cod environment				
Strongly disagree	1.0%	6.0%	1.7%	1.7%
Disagree	1.8%	0.0%	1.3%	1.3%
Neither agree nor disagree	4.6%	6.8%	4.7%	4.7%
Agree	25.0%	28.3%	30.4%	30.2%
Strongly agree	64.9%	58.9%	60.4%	60.6%
Not sure/don't know	2.7%	0.1%	1.5%	1.6%
Ponds and lakes are important to a town's environment				
Strongly disagree	0.3%	5.6%	2.0%	1.9%
Disagree	0.5%	4.7%	0.9%	1.0%
Neither agree nor disagree	4.2%	6.7%	7.5%	7.4%
Agree	33.3%	32.4%	36.5%	36.3%
Strongly agree	58.7%	50.3%	52.1%	52.3%
Not sure/don't know	3.1%	0.3%	1.0%	1.1%
I seek out news highlighting the status of ponds/lakes				
Strongly disagree	2.1%	4.7%	6.2%	6.0%
Disagree	15.7%	10.2%	19.3%	19.1%
Neither agree nor disagree	29.1%	37.2%	31.1%	31.1%
Agree	38.8%	21.7%	27.2%	27.5%
Strongly agree	11.9%	25.5%	15.1%	15.1%

Not sure/don't know	2.4%	0.8%	1.2%	1.2%
I understand the connection between ponds/lakes and drinking water				
Strongly disagree	0.9%	4.3%	1.0%	1.0%
Disagree	3.0%	4.3%	5.6%	5.5%
Neither agree nor disagree	12.3%	14.6%	17.2%	16.9%
Agree	43.6%	43.3%	38.3%	38.6%
Strongly agree	34.0%	32.8%	32.7%	32.8%
Not sure/don't know	6.3%	0.8%	5.2%	5.2%
I understand the connection between ponds/lakes and marine water				
Strongly disagree	0.5%	4.2%	2.1%	2.1%
Disagree	6.6%	0.6%	5.6%	5.6%
Neither agree nor disagree	21.2%	16.8%	17.4%	17.5%
Agree	34.2%	39.8%	41.2%	40.9%
Strongly agree	32.3%	38.6%	29.4%	29.6%
Not sure/don't know	5.3%	0.0%	4.4%	4.4%
I am concerned about the state of Cape Cod ponds/lakes				
Strongly disagree	0.9%	4.7%	3.6%	3.5%
Disagree	3.8%	3.1%	9.0%	8.7%
Neither agree nor disagree	17.7%	12.0%	29.4%	28.7%
Agree	34.0%	34.7%	34.6%	34.6%
Strongly agree	40.2%	41.0%	21.6%	22.5%
Not sure/don't know	3.4%	4.5%	2.0%	2.0%
I am concerned about the state of the ponds/lakes I visit				
Strongly disagree	0.5%	4.9%	2.8%	2.7%
Disagree	4.7%	0.8%	9.4%	9.1%
Neither agree nor disagree	14.9%	27.8%	25.0%	24.6%
Agree	37.1%	39.1%	37.3%	37.3%
Strongly agree	38.9%	23.2%	23.4%	24.0%
Not sure/don't know	4.0%	4.2%	2.1%	2.2%
Addressing pond/lake health should be a Cape-wide priority				
Strongly disagree	0.3%	5.7%	0.8%	0.8%
Disagree	1.0%	4.2%	2.0%	2.0%
Neither agree nor disagree	13.6%	6.3%	11.8%	11.8%
Agree	41.7%	29.4%	44.2%	44.0%
Strongly agree	40.3%	50.1%	39.1%	39.2%
Not sure/don't know	3.1%	4.2%	2.1%	2.2%
Addressing pond/lake health should be a priority for towns				
Strongly disagree	1.0%	4.2%	0.4%	0.4%
Disagree	0.3%	0.2%	1.1%	1.1%
Neither agree nor disagree	9.6%	6.4%	10.8%	10.7%
Agree	43.0%	38.7%	43.4%	43.3%
Strongly agree	42.9%	42.2%	41.4%	41.4%

Not sure/don't know	3.2%	8.3%	3.0%	3.1%[44]

Table A-13 reports residents' and NROs' perceptions about the role *town government* should play in Cape Cod pond and lake health oversight. Across the board, NROs were more likely to indicate that town governments should play a large role in pond and lake health oversight. Residents and NROs both generally indicated that town governments should play a moderate or large role in pond and lake health oversight.

Table A-13. Perspectives on Cape cod pond and lake health oversight: role of town government (residents & non resident owners)

How large of a role should your town (where you live/own real estate on the Cape) have in the following activities related to pond and lake health?			
	Cape Association		
	Residents	NROs	Residents and NROs Combined
Provide pond/lake water quality monitoring training			
No role	1.0%	4.6%	1.9%
Small role	7.5%	10.7%	8.2%
Moderate role	36.6%	18.8%	32.5%
Large role	46.7%	57.4%	49.2%
Don't know/not sure	8.1%	8.6%	8.2%
Conduct pond/lake water quality monitoring			
No role	1.0%	0.1%	0.8%
Small role	4.4%	6.7%	4.9%
Moderate role	23.4%	14.2%	21.2%
Large role	67.0%	74.2%	68.7%
Don't know/not sure	4.2%	4.9%	4.4%
Coordinate pond/lake water quality monitoring			
No role	0.7%	0.1%	0.6%
Small role	4.7%	9.6%	5.8%
Moderate role	31.6%	16.7%	28.2%
Large role	58.7%	69.0%	61.1%
Don't know/not sure	4.3%	4.6%	4.4%
Educate the public about pond/lake health and impacts			
No role	0.0%	4.2%	1.0%
Small role	7.5%	5.6%	7.1%
Moderate role	28.4%	31.1%	29.0%
Large role	57.6%	58.5%	57.8%
Don't know/not sure	6.5%	0.5%	5.1%
Coordinate pond/lake health assessments			
No role	1.7%	4.3%	2.3%

Small role	7.7%	10.0%	8.2%
Moderate role	32.6%	22.3%	30.2%
Large role	51.6%	61.6%	53.9%
Don't know/not sure	6.5%	1.8%	5.4%
Develop pond/lake management plans			
No role	1.0%	0.1%	0.8%
Small role	5.3%	8.5%	6.0%
Moderate role	36.9%	23.9%	33.9%
Large role	52.2%	65.6%	55.3%
Don't know/not sure	4.6%	1.9%	4.0%
Identify funding for pond/lake improvement strategies			
No role	1.4%	4.4%	2.1%
Small role	9.2%	5.7%	8.4%
Moderate role	30.6%	17.2%	27.5%
Large role	51.8%	66.6%	55.2%
Don't know/not sure	7.1%	6.1%	6.8%
Identify funding for pond/lake water quality monitoring			
No role	2.8%	4.2%	3.1%
Small role	4.9%	1.6%	4.1%
Moderate role	31.0%	28.0%	30.3%
Large role	52.7%	64.1%	55.4%
Don't know/not sure	8.6%	2.2%	7.1%
Change zoning to benefit water quality			
No role	2.8%	6.4%	3.7%
Small role	9.2%	10.2%	9.4%
Moderate role	27.8%	13.5%	24.5%
Large role	48.3%	51.4%	49.0%
Don't know/not sure	11.9%	18.5%	13.4%
Implement regulations to benefit pond/lake water quality			
No role	2.0%	0.1%	1.6%
Small role	5.2%	5.4%	5.2%
Moderate role	30.7%	25.1%	29.4%
Large role	54.9%	61.7%	56.5%
Don't know/not sure	7.2%	7.7%	7.3%

Table A-14 presents resident and NRO perceptions about the role *Barnstable County* should play in Cape Cod pond and lake health oversight. NROs were consistently more likely to indicate that Barnstable County should play a large role in pond and lake health oversight. Residents and NROs both generally indicated that Barnstable County should play a moderate or large role in pond and lake health oversight.

Table A-14. Perspectives on Cape cod pond and lake health oversight: role of Barnstable County (residents & non resident owners)

How large of a role should Barnstable County have in the following activities related to Cape Cod pond and lake health?			
	Cape Association		
	Residents	NROs	Residents and NROs Combined
Provide pond/lake water quality monitoring training			
No role	2.4%	1.7%	2.2%
Small role	5.6%	13.6%	7.4%
Moderate role	28.8%	26.8%	28.3%
Large role	54.5%	57.4%	55.1%
Don't know/not sure	8.8%	0.5%	6.9%
Conduct pond/lake water quality monitoring			
No role	1.9%	0.2%	1.5%
Small role	5.2%	9.3%	6.2%
Moderate role	32.0%	17.7%	28.7%
Large role	55.6%	72.9%	59.6%
Don't know/not sure	5.4%	0.0%	4.1%
Coordinate pond/lake water quality monitoring			
No role	1.8%	0.7%	1.5%
Small role	4.7%	0.9%	3.9%
Moderate role	29.2%	15.6%	26.1%
Large role	59.1%	82.8%	64.6%
Don't know/not sure	5.1%	0.0%	3.9%
Educate the public about pond/lake health and impacts			
No role	2.6%	0.4%	2.1%
Small role	5.6%	7.4%	6.0%
Moderate role	31.7%	16.6%	28.2%
Large role	55.0%	62.5%	56.7%
Don't know/not sure	5.1%	13.0%	6.9%
Coordinate pond/lake health assessments			
No role	2.7%	1.7%	2.5%
Small role	7.6%	5.4%	7.1%
Moderate role	30.2%	23.7%	28.7%
Large role	52.8%	68.9%	56.5%
Don't know/not sure	6.6%	0.3%	5.2%
Develop pond/lake management plans			
No role	1.8%	0.4%	1.5%
Small role	5.3%	5.8%	5.4%
Moderate role	32.7%	25.7%	31.1%
Large role	54.1%	63.1%	56.2%
Don't know/not sure	6.1%	5.1%	5.9%

Identify funding for pond/lake improvement strategies			
No role	2.6%	0.7%	2.1%
Small role	4.9%	2.1%	4.2%
Moderate role	30.2%	30.7%	30.3%
Large role	52.5%	60.4%	54.3%
Don't know/not sure	9.8%	6.2%	9.0%
Identify funding for pond/lake water quality monitoring			
No role	1.6%	0.4%	1.3%
Small role	5.7%	0.8%	4.5%
Moderate role	26.2%	23.4%	25.6%
Large role	57.6%	69.1%	60.3%
Don't know/not sure	8.9%	6.2%	8.3%
Implement regulations to benefit pond/lake water quality			
No role	1.9%	0.0%	1.4%
Small role	5.3%	9.5%	6.3%
Moderate role	27.6%	24.0%	26.8%
Large role	57.5%	65.7%	59.4%
Don't know/not sure	7.7%	0.8%	6.1%

Table A-15 describes resident and NRO perspectives about the role *volunteer groups* should play in Cape Cod pond and lake health oversight. NROs were consistently more likely to indicate that volunteer groups should play a moderate or large role in pond and lake health oversight compared to residents. Residents and NROs both generally indicated that volunteer groups should play a moderate or large role in pond and lake health oversight. Residents and NROs were also generally more likely to indicate that the role of volunteer groups should have no or small role compared to the role of towns and Barnstable County.

Table A-15. Perspectives on Cape Cod pond and lake health oversight: role of volunteer groups (residents & non resident owners)

How large of a role should volunteer pond/lake groups have in the following activities related to Cape Cod pond and lake health?			
	Cape Association		
	Residents	**NROs**	**Residents and NROs Combined**
Provide pond/lake water quality monitoring training			
No role	4.6%	0.3%	3.6%
Small role	16.0%	12.4%	15.2%
Moderate role	39.8%	47.7%	41.6%
Large role	30.9%	35.2%	31.9%
Don't know/not sure	8.7%	4.4%	7.7%
Conduct pond/lake water quality monitoring			
No role	5.0%	7.2%	5.5%
Small role	18.5%	6.0%	15.6%

Moderate role	36.3%	49.1%	39.3%
Large role	32.5%	37.4%	33.6%
Don't know/not sure	7.7%	0.3%	6.0%
Coordinate pond/lake water quality monitoring			
No role	6.1%	4.4%	5.7%
Small role	16.2%	7.3%	14.1%
Moderate role	39.4%	46.6%	41.1%
Large role	32.9%	41.2%	34.8%
Don't know/not sure	5.4%	0.4%	4.2%
Educate the public about pond/lake health and impacts			
No role	2.3%	0.4%	1.9%
Small role	15.2%	5.6%	13.0%
Moderate role	39.8%	34.5%	38.6%
Large role	35.7%	57.7%	40.8%
Don't know/not sure	6.9%	1.7%	5.7%
Coordinate pond/lake health assessments			
No role	8.7%	4.6%	7.8%
Small role	17.2%	1.9%	13.6%
Moderate role	34.9%	56.7%	40.0%
Large role	30.3%	36.3%	31.7%
Don't know/not sure	8.9%	0.4%	6.9%
Develop pond/lake management plans			
No role	9.5%	4.4%	8.3%
Small role	24.8%	15.0%	22.5%
Moderate role	28.6%	35.0%	30.1%
Large role	28.4%	45.0%	32.3%
Don't know/not sure	8.7%	0.5%	6.8%
Identify funding for pond/lake improvement strategies			
No role	11.3%	4.6%	9.7%
Small role	16.8%	12.8%	15.9%
Moderate role	34.6%	38.4%	35.5%
Large role	27.9%	43.8%	31.7%
Don't know/not sure	9.3%	0.4%	7.2%
Identify funding for pond/lake water quality monitoring			
No role	10.7%	4.4%	9.2%
Small role	15.9%	2.3%	12.7%
Moderate role	37.0%	34.8%	36.5%
Large role	27.8%	54.0%	33.9%
Don't know/not sure	8.7%	4.5%	7.7%

As part of the questions on priorities for pond health, we also asked resident and nonresident owners about priorities for pond improvement projects. The two questions we

asked followed a best-worst scaling (BWS) approach where we asked respondents to select a most and least preferred alternative from a list. In contrast to the BWS approach discussed in Section A.6, we did not need to spread the alternatives over several questions and included all characteristics in one question. Respondents were asked about two different sets of priorities: (1) characteristics of *ponds* to prioritize for improvement projects and (2) characteristics of *projects* themselves. To present these data, we assigned a value +1 to each item a respondent selected as "most important" and a value of -1 to each item a respondent selected as "least important." We then calculated the sum of those values across respondents. Among pond characteristics (Table A-16), residents and nonresident owners favored prioritizing ponds that are most impaired, have the highest support for improvement, and are most used/visited. Among the project characteristics (Table A-17), residents and nonresident owners strongly favored prioritizing projects that generated ecosystem benefits followed by projects that were most likely to succeed as a distant second.

Table A-16. Prioritization of pond characteristics for improvement projects

Characteristic	Number of Times Selected as Most/Least Important	Sum of Most and Least Important Scores [a]
Most impaired	78	30
Highest support	74	28
Most used/visited	66	20
Most data available	52	-2
Largest ponds	53	-17
No or little data	75	-19
Fishing	68	-32

[a] Each item selected as "most important" was assigned a value of +1 and each item selected as "least important" was assigned a value of -1; the values in this column reflect the total over all respondents.

Table A-17. Prioritization of project characteristics for pond improvement projects

Characteristic	Number of Times Selected as Most/Least Important	Sum of Most and Least Important Scores [a]
Ecosystem benefits	120	78
Most likely success	58	18
Least disruptive	78	8
Suitability	66	2
Lowest cost	67	-43
Shortest timeline	73	-55
Fishing	68	-32

[a] Each item selected as "most important" was assigned a value of +1 and each item selected as "least important" was assigned a value of -1; the values in this column reflect the total over all respondents.

Respondents were asked to describe where they think improvements, if any, can be made to address Cape Cod pond and lake health. Responses to this open-ended question are presented in Table D.A-8 which may be found in Appendix D.A.

A.8 Participation and Information

Table A-18 captures resident, NRO, and tourist perspectives on their role in Cape Cod pond and lake health oversight. Across all groups, 46.4 percent indicated they had a role in improving pond health, but this varied across groups with 52.6 percent of residents, 63.5 percent of NROs, and 46 percent of tourists indicating they had a role. When asked about what activities they had participated in to improve pond health, beach cleanup was the most popular activity with 34.4 percent of respondents indicating they had participated in one.

Table A-18. Perspectives on Cape Cod pond and lake health oversight: role of respondents (all respondents)

Do you think you have a role in improving Cape Cod pond or lake health?				
Response	**Cape Association**			
	Resident	**NROs**	**Tourists**	**All Respondents**
Yes	52.6%	63.5%	46.0%	46.4%
No	16.5%	15.4%	22.4%	22.1%
Not sure	30.9%	21.2%	31.6%	31.5%

The survey asked respondents about pond and lake health activities they participated in; these data appear in Table A-19. The most popular activity is beach cleanup, which a third of respondents participate in. Overall, 60 percent of respondents selected at least one activity from the list (not in table).

Table A-19. Pond & lake health: respondent participation (all respondents)

Have you participated in any of the following activities related to Cape Cod pond or lake health? (Select all that apply)[45]	
Activity	**Frequency**
Water quality monitoring	10.0%
Invasive species	6.0%
Advocacy	7.5%
Beach cleanup	34.4%
Pond association	2.8%
Individual property actions	5.4%

[45] Percentages will not add to 100 because respondents were prompted to "select all that apply".

Table A-20 summarizes the sources that residents, NROs, and tourists use to obtain information on Cape Cod pond or lake health or water quality. More than 40 percent of residents, NROs, and tourists cited town or regional newspapers as a source for this information.

Table A-20. Sources of information (all respondents)

From which sources do you obtain your information about Cape Cod pond or lake health or water quality? (Select all that apply)[46]	
Source	**Frequency**
Pond group	15.6%
Association to Preserve Cape Cod/Other	11.5%
Town	28.5%
County	10.9%
Town newspaper	24.3%
Regional newspaper	16.4%

Table A-21 summarizes the sources residents, NROs, and tourists would go to with questions on Cape Cod pond or lake health. Residents, NROs, and tourists most frequently cited town natural resources departments (48.2 percent). Cape Cod Commission was mentioned in 26.6 percent of respondents.

Table A-21. Sources of information: questions (all respondents)

If you have a question about Cape Cod pond or lake health, who would you ask? (Select all that apply)[47]	
Source	**Frequency**
Town natural resource dept	48.2%
Town recreational dept	24.4%
Town conservation commission	22.7%
CCC	26.6%
Barnstable County Department of Health and Environment	11.6%
Pond group	21.3%
APCC	18.4%
Local Land Trust	5.9%

Respondents were asked to reflect on the resources they would find most valuable or beneficial to learn more about the topic of Cape Cod pond or lake health. Data are tabulated in Table A-22. Overall, 78.9 percent of residents, NROs, and tourists cited websites as a valuable/beneficial source of information; the second most valuable/beneficial source cited was social media postings at 36.4 percent.

[46] Percentages will not add to 100 because respondents were prompted to "select all that apply".
[47] Percentages will not add to 100 because respondents were prompted to "select all that apply".

Table A-22. Sources of information: perspectives (all respondents)

Of the following, what resources would you find most valuable/beneficial to learn more about the topic of Cape Cod pond or lake health? (Select all that apply)[48]	
Resource	**Frequency**
Websites	78.4%
Educational flyers	29.4%
Public meetings	21.8%
Speaker series	8.3%
Podcasts	14.1%
Videos	21.2%
Social media postings	36.4%
Newsletters	24.3%

A.9 Summary

The key data and findings from the survey can be summarized as follows:

Demographics. A majority of respondents were women (61 percent). Almost a quarter of the sample was aged 65 or older and 54 percent were under age 45, but only 23.6 percent of sample was aged 45 to 64. Almost one quarter of the respondents identified as black, Hispanic or another non-white racial/ethnic group. A majority of respondents live in households without children (56 percent) and approximately one quarter live in households with children 10 and younger.

Time and activities on the Cape. Barnstable represented the town where most resident respondents lived and where most NROs and tourists stayed on Cape Cod. Almost two thirds (65.8 percent) of NROs indicated they spend less than eight weeks on the Cape each year. Among tourists, 64.2 percent spend less than a week on the Cape each year with 30.8 percent spending 1-2 weeks. As might be expected, the summer months were the most popular time for tourists to visit; among the summer months, July and August were the months when most indicated they visited. Going to the beach and dining were the most popular activities residents, NROs, and tourists enjoyed with sailing, motorboats, organized sports, and birding being the least popular activities.

Visiting ponds. More than one-third of residents (33.7 percent) and nonresident owners (35.9 percent) frequently visit ponds and lakes while only 16.3 percent of tourists visit ponds frequently. The most popular town for pond visits was Barnstable (52.2 percent of pond visitors) followed by Bourne (32.5 percent) and Falmouth (21.3 percent). Most pond visits last between two to four hours with a large number lasting less than four hours total. Summer is the most popular time to visit ponds across all groups, fall is also a relatively popular time for residents and NROs.

[48] Percentages will not add to 100 because respondents were prompted to "select all that apply".

Activities at ponds. Sitting at the beach is the most popular activity, with 66.2 percent of residents, NROs, and tourists frequently engaging in this activity when they visit ponds and lakes. Walking or hiking is a close second among residents, with 48.5 percent of residents frequently taking walks or hikes at ponds and lakes. Fishing and birding are the least popular, with more than 60 percent of residents, NROs, and tourists rarely or never engaging in these activities. While residents, NROs, and tourists engage in a full range of activities during the summer, visiting the beach, walking, and hiking remain popular during the fall and spring.

Preferences for pond characteristics. As part of the survey, we implemented a series of questions to better understand which pond characteristics respondents most preferred. Based on that set of questions, residents, NROs, and tourists overwhelmingly selected four characteristics that are most preferred at ponds (in order of preference):

- Having the water free of bacteria
- Having a beach
- Having the water free of algae
- Having the beach/pond free of litter

Attitudes towards ponds. Overall, residents, NROs, and tourists strongly agreed that ponds are important to the Cape economy (53.3 percent of respondents) and strongly agreed that ponds are important to the Cape environment (60.6 percent of respondent). Residents and NROs indicated concern over the health of Cape ponds overall, but less concern about the health of ponds they visited personally.

Roles in maintaining pond health. When asked about a set of roles that towns, Barnstable County, and volunteer groups could take to maintain ponds health, residents and NROs indicated towns and the County had the largest roles to perform among most activities. In particular, a large majority of residents and NROs indicated that the towns and County should conduct and coordinate water quality monitoring.

Prioritizing pond improvement projects. We asked residents and NROs what aspects of ponds and what aspects of projects should be used in prioritizing pond improvement projects. In terms of ponds, residents and NROs indicated that the most impaired ponds, the ones with the highest support for improvement, and the most used/visited should be prioritized. In terms of projects, residents and NROs overwhelmingly indicated that projects with ecosystem benefits should be prioritized.

Participating in pond improvement. Across all groups, 46.4 percent indicated they had a role in improving pond health, but this varied across groups with 52.6 percent of residents, 63.5 percent of NROs, and 46 percent of tourists indicating they had a role. Roughly 30 percent of all respondents indicated that they were “not sure” if they had a role in pond improvement, possibly suggesting some people may not know how their actions impact ponds and lakes. When asked about what activities they had participated in to improve pond health, beach cleanup was the most popular activity with 34.4 percent of respondents indicating they had participated in one.

Sources of information. Town-based sources such as town newspapers and town natural resource departments were the most popular among residents, NROs, and tourists for getting information about pond health. When asked where they obtained pond health information, 28.5 percent indicated "town" as the source. When asked where they would ask questions about pond health, 48.2 percent indicated the town natural resource department, 24.4 percent said the town recreation department, and 22.7 percent said the town conservation commission. Of note, 26.6 percent indicated CCC would be a source to ask their questions. When asked which sources of information were most valuable for pond health, the overwhelming most popular choice was websites (78.4 percent).

A.10 Appendix D.A: Additional Tables

Table D.A-1. Distribution of where resident respondents live on Cape Cod

Where do you live on Cape Cod?	
Town	**Frequency**
Barnstable	22.3%
Bourne	12.5%
Brewster	4.4%
Chatham	2.5%
Dennis	5.2%
Eastham	2.8%
Falmouth	11.8%
Harwich	4.2%
Mashpee	3.2%
Orleans	9.0%
Provincetown	1.8%
Sandwich	7.6%
Truro	1.7%
Yarmouth	11.2%
Wellfleet	0.0%

Table D.A-2. Distribution of where nonresidents owners and tourists tend to stay on Cape Cod

In which towns(s) on the Cape do you most often visit ponds or lakes? (Select all that apply)[49]	
Town	**Frequency**
Barnstable	52.2%
Bourne	32.5%
Brewster	15.8%
Centerville	13.8%
Chatham	13.5%
Cotuit	18.1%
Dennis	16.9%
Eastham	8.0%
Falmouth	21.3%
Harwich	3.6%
Hyannis	11.7%
Marston Mills	1.7%
Mashpee	6.4%
Orleans	10.4%
Osterville	2.2%
Provincetown	17.0%
Sandwich	8.8%
Truro	3.6%
Wellfleet	7.1%
West Barnstable	3.6%
Yarmouth	17.7%

[49] Percentages will not add to 100 because respondents were prompted to "select all that apply".

Table D.A-3 Recreational activities at saltwater beaches on Cape Cod (all respondents)

When you visit Cape Cod saltwater beaches, how often do you do the following activities?				
Frequency	**Cape Association**			
	Residents	**NROs**	**Tourists**	**All Respondents**
Swimming				
Not at all	10.7%	8.8%	9.8%	9.9%
Rarely	12.5%	13.7%	12.2%	12.2%
Sometimes	34.9%	13.9%	32.6%	32.5%
Frequently	41.9%	63.7%	45.4%	45.5%
Sit at the Beach				
Not at all	0.0%	0.1%	1.6%	1.5%
Rarely	2.6%	5.6%	2.9%	2.9%
Sometimes	22.2%	7.5%	17.8%	17.9%
Frequently	75.2%	86.9%	77.7%	77.7%
Kayak or Paddleboard				
Not at all	45.1%	35.2%	37.8%	38.1%
Rarely	18.1%	32.1%	30.1%	29.7%
Sometimes	23.8%	28.6%	22.7%	22.8%
Frequently	13.0%	4.1%	9.3%	9.4%
Walking/Hiking				
Not at all	2.7%	9.2%	3.1%	3.1%
Rarely	12.6%	15.2%	10.7%	10.8%
Sometimes	37.7%	17.6%	39.8%	39.5%
Frequently	47.1%	58.0%	46.4%	46.6%
Fishing				
Not at all	50.1%	18.1%	45.4%	45.3%
Rarely	23.2%	31.7%	18.9%	19.2%
Sometimes	12.1%	30.4%	25.0%	24.6%
Frequently	14.5%	19.8%	10.7%	11.0%
Birding				
Not at all	41.4%	14.9%	44.6%	44.1%
Rarely	12.1%	46.2%	21.0%	21.0%
Sometimes	28.0%	25.6%	19.8%	20.2%
Frequently	18.5%	13.4%	14.6%	14.8%
Boating				
Not at all	42.0%	13.8%	37.2%	37.1%
Rarely	22.5%	27.4%	26.8%	26.7%
Sometimes	21.0%	43.3%	27.6%	27.5%
Frequently	14.6%	15.5%	8.4%	8.7%

Table D.A-4 Visits to Cape Cod Interrupted by the COVID-19 Pandemic (Nonresidents Only)

Did you skip a trip to the Cape due to the COVID-19 pandemic within the last three years? (Nonresidents)	
Response	Percent
Yes	60.9%
No	39.1%

Table D.A-5. When you visit Cape Cod, do you normally stay overnight, take day trips, or both? (Nonresidents Only)

When you visit Cape Cod, do you normally stay overnight, take day trips, or both?	
Trip Type	Percent
Overnight	51.6%
Day Trips	8.8%
Both	39.6%

Table D.A-6. What percentage of your trips to Cape Cod ponds or lakes occur on weekends or holidays (e.g., 4th of July, Memorial Day)?

What percentage of your trips to Cape Cod ponds or lakes occur on weekends or holidays (e.g., 4th of July, Memorial Day)? (Please enter a number between 0 and 100 to report the percentage; for example, 20% would be '20")	
Responses	**Mean**
823	40.10%

Table D.A-7 Approximately what percentage of your visits to Cape Cod are overnight trips? (Please enter a number between 1 and 100)

Approximately what percentage of your visits to Cape Cod are overnight trips? (Please enter a number between 1 and 100)	
Responses	**Mean**
250	58.80%

Table D.A-8: Responses to Question 37: Please describe where you think improvements, if any, can be made to address Cape Cod pond and lake health (note: all responses are presented verbatim; ERG has not altered spelling, wording, or punctuation)

Please describe where you think improvements, if any, can be made to address Cape Cod pond and lake health
Stop the red tape and allow groups to coordinate efforts for improvement
I have had no invovlement with this issue and was not really aware of much discussion on this matter.
making sure the water stays clean, as well as making sure people are aware of the condition of the water.
The beaches need improvements
Locally within communities.
I think this must be done on a county level, as well as at a town level because water quality affects all areas of the Cape
regulations that restrict abusive activities
In national camp sites somtimes those get real messy.
Not to put any harmful chemicals or bacteria into them.
make there be less algae
It's good but U really think we need cleaner ponds and cleaner barhrooms. They are good. but could be better.
Change some human living environment and protect the river
Anyone should be able to visit our pond/lakes without having to pay for parking. Also one should in no way be concerned about the water quality we are swimming in
I don't know enough about the system to know. I don't know how much of a priority the lakes and ponds are to local governments and the county -- and how good their system is for overseeing their quality and protection. All I know is that it's critically important to do so.
None
Provide more access to real estate
Make sure all ponds have signs saying littering will have a fine if Caught littering
I don't know
Stop pandering to tourists who litter and pollute our water resources. Impose strict fines for pollution. Locals should be encouraged to participate in our local pond and lake health initiatives. Local clean up days and de-trash initiatives would be LOVED by myself and other locals. Good way to get us out there to see what we have and how to protect it for generations to come.
i dont really think so i just feel people could polute less
I don't know much about improving pons, but it's really sad how you have to ask the same question for five and six times
Good quality filtrations system
Water
More visible bins can reduce litter on the ground
The ones I've been to have all been quite clean
Planting more trees to improve the environment
I've lived in Yarmouth and in Harwich, and I find the Harwich Conservation Trust does a fantastic job of getting people involved and educated about the lake health in the area. Yarmouth, not so much so. I think the main responsibility should be on the Country to put educational programs out to the public

and become move visible. If only 1 town is good at educating the public and pulling in volunteers, and another isn't as good, then it doesn't help much because all the towns are intertwined.
That's out of my realm, but I think it should be everyone's mission who visits Cape Cod.
Im not sure
Limit residential building around ponds, build a sewer system for surrounding homes.
Awareness
N/A
Wonderful experience work vend good deal
I think coordinated effort between towns, county, and state are crucial to accomplish any goals. Education of the public about water quality is also important. I think locals are more informed, but he's to target new residents and visitors on the importance of fresh water health. Heavy fines should be implemented.
There is a dedicated staff to clean and manage the merge
Iys vey good and I loke it so midgsm
Not allow boats or any kind of water sports in ponds that are designed for drinking
takin care of the water and the litter
I think donating would help
it is very good
Research ways to raise funds to assist shore owners to convert to new methods of preventing home waste water from entering waters.
Get more volunteers
monitoring algae and bacteria closer so when red tide or other blooms arise itis carefully explained to the public at large.
Cleaning up the waters and stop polluting all together
I really do not know enough to comment on it.
Keeping an eye on quality and bacteria levels as well as litter
Reinforce people's environmental awareness on all the issues targeted by this
All towns should participate in water quality
Adress the issues
Trash
Idk
Is amazing all is good help every time
more community involvement
Because it's cool
I think the maintenance of water quality and cleaniness should be done more regularly, say weekly. That way, it'll help to keep the water clean and the community safe.
Mkeeping these waters clean and bacteria free I think more testing is needed
It is possible to use some high-tech means to improve the pollution of
people awareness and agreement have to prove they helpfull to the lake health
It's a very nice place I suggest any one reading this to go there
Get a little bit more than you can afford for a new
Cleaner & beacheswater
Good
Provide more education
I am not sure
Unsure

Deal with pollution more actively
Know where they are
Non at all
More parking
I think the twn and the residents share some responsibility in keeping the water safe
Keep clean and healthy
stop developing on the ponds
I'm around the lake health
Yeah
This is stupid
Coordination with all departments that oversee the pond lakes. Everyone should be on the same page.
I think there needs to be a more connected approach with all stake holders involved.
people need to be aware that any action will have an impact on the ponds and lakes, positive or negative actions
Maybe by making a specific group to solely be about this particular act
Not allow swimming or boating in fresh ponds , especially if used to provide drinking water
make people more aware
too many people here year round with septics and fertilizers running off into water, both fresh and salt water areas
Strengthen the protection of the environment and the inspection of the environment
Necessary funding needs to continue
Making the place cleaner
Brewster green made new developments for housings
I believe a volunteer task force could help offset cost of the monitoring and management of water quality that is needed currently.
None that I can see
Todo me parece correcto
Updated septic cont
KEEP PROVIDING CLEANILESS TO PEOPLE AND SECURITY
Increasing environmental protection along the lake
Continued monitoring and clean up programs, both town, county and volunteer
Town should address these issues at town meetings to make communities aware of the problems associated with these ponds
I believe having fundraising and making sure to establish awareness and education on environmental sustainability. Utilizing the surrounding area to make sure that the pond and lake health are maintained at optimal levels especially when human interference is a common thing in the environment.
There should be a coordination of effort by all communities on Cape Cod to keep Cape waters clean.
Litter, mostly
I can make all these obstacles non-existent
Put some warnings on the side roads
I guess more testing and getting information out to all residents free and efficiently would be good. It would be nice to be aware of problems and know how they are being addressed. I would like to know which bodies of water are safe to be around and which are best to avoid.
Address water quality assessments in the summer time when the bacteria levels are high.

Education, knowledge and good attitude, if follow those three rules of sanity and know if people are not enough educated doesn't have the enough knowledgeable to have a good attitude to keep the ponds and lakes clean and environment for always be there whe them come to visit
Pick up trash and clean lakes and ponds
Op
Prohibit boating and water sports in freshwater ponds and lakes
Public awareness
No improvements needed.
Using free resources, CCCC s , Upper Cape Tech, and Cape Tech, to provide a method of monitoring and evaluating water quality
I have no idea what
I'm not sure we typically visit salt water beaches
Awareness
I think the people living on Cape Cod year round as well as vacationers, should be educated so they understand the severity of maintaining our ecosystems, not just on Cape Cod but throughout the world
If I knew that I would advise the local concomm!
open discussion necessary
I think there needs to be a team assigned to monitor and take care of the pond and lakebed's health.
The changes and important factors need to be discussed more and brought to the attention of the Cape Town.
Officials need to be on the same page
I believe there should be a national push for natural ways to keep homeowners' yard looking pretty without degrading the natural ecosystems AND there needs to be another focus on informing people who use watercraft of any sort needs to be rinsed off with fresh clean water between uses. EVERY TIME to reduce bacteria from one body of water from contaminating another These are just a few friendly demands :)
Yes
I think you should pick up some of the litter
Think the handling now is great. So many incredible places to visit.
People should take this seriously.
Protection
I think that Cape Cod pond and lake health needs to be put in front of everyone on the capes awareness and education
addressing the water quality is very important
More public awareness placements in social media, town halls, schools, recreational facilities, television and radio about concerns.
i dont know
Keeping them clean and beautiful and making sure the visitors do the same
minimize or do not allow the use of pesticides and chemicals on lawns, educate so people stop trying to grow grass lawns and instead keep "cape Cod" lawns.
I am so much enjoy travel time Cope Cod pond
Reduce environmental pollution and waste disposal problems
I have no opinions
Litter, weeds, improved handicap access for everyone to enjoy the lakes and ponds. Older residents could be an asset for improvement
No litering

Trained volunteers would be most helpful. Funding should come from state/federal support.
More rules to regulate the behavior of tourists at the lake
I'm not sure.. I only know it's needed
good things happen
Ore resident involvement
Regulate the number of tourist by selling temp. visitor passes. Limit number hours for parking, per vehicle.
just love the planet
If there is no enforcement of the already existing rules,etc,then there's no use making new ones
Public restrooms
Just make sure safe
Everything and everything
Not sure I know enough to comment.
Well their is nothing to do
Reduce human visits and casual access to the area
Management meeting somewhere by the lake
Reduce the amount of nutrient contamination entering the water
Everywhere it is needed as budget allows
Realize the benefit of having such wonderous entities in our own back yards.
Awareness. I do not think people associate lakes (fresh water) with Cape Cod, only the ocean. There does not seem to be a tie in to water quality of our lakes and the overall water system.
Ho
Improvements that could be made to address Cape Cod pond and lake health could include: fewer algae and more bacteria-free water (if the water isn't clear, that's okay but at least make it clean)
General public arwareness. Establish solid longterm plan for sustaining water quality
The creation of paths and beaches would significantly give more people access to the beautiful ponds and lakes. Parking lots would improve it even more. The more guests the more the awareness of the need to take care of and help with the pond health
Check if the water is clear and not too deep for the swimmers. Make sure the water is good and won't affect the swimmers health
Im not too sure
Clean water

Table D.A-9: Responses to Question 27: Which pond(s) or lake(s) do you visit on the Capes? (note: all responses are presented verbatim; ERG has not altered spelling, wording, or punctuation)

Which pond(s) or lake(s) do you visit on the Cape?
Joshua Pond
Bizzard Bay
sterile and eco-frindly.
Coonameset pond
Great pond
Wequaquet, Eagle, Hamlin, Hathaway, lovell
Sandy Pond
Flax pond,
Eagle Pond
Not sure
Flax pond and wequaquet lake
Hamblins Pond. Lake Wequaquet
Jenkin pond or John pond
Dennis
Great Pond, Eastham
Plashes pond scargo beach
Daveys Lake
Brewster
Sandwich
Long Pond
Bird
Hathways
The water showr
Point beach
Eel
Cod
Sheep, long Pond,cliff no bottom
John's Pond
Chatham
Spectacle
Goodwill park lakes
bourne . younouth
Spring lake
Joshua Pond
there's one in Chatham I really like it's hidden in the woods. It's very nice and it has a small beach.
Bear mountain
Great Pond Eastham
Crystal lake
Sand Pond; Bells Neck
Grand
Picture Lake
Scargo lake

Kiss
Sheep pond
Wequaquet Lake
Joshua's and mikas
Coonamessett Pond
Great, crystal, round, long, snake
Orleans
Goose Pond
Waterways
flax pond
Cooper
Snake pond, Paines creek
Oyster pond little mill pond
Monument
Everything in Nickerson State Park
Provincetown
Wequaquet
Hyannis
Snake Pond
Clapps and Blackwater
slough pond, cliff pond, cobbs pond
Cliff Pond, Nickerson
Snake,Wakeby.Hoxie.Follins,Greenough
Fresh water
Private little beach
Pimelco
Lake mission
Chatham lake, Oguta lake, Ogbunike lake, nike lake.
Lake trotuo
Pond, Johns pondPine crest, snake
Kettle Ponds in Brewster
orlens and sandwich
Nickerson State Park
North truoro
Hamblins
Towneck beach
Nauset, coast guard,old silver, mayflower,
Cliff Pond, Flax pond
Flax Pond, Scargo Lake, Nickerson State Park
Fresh water pond
Cape pond
Mashpee/Wakeby
Scargo Lake, Flax Pond, Long Pond, Johns Pond, Picture Lake
Schoolhouse,Greatpond,goose pond,east and west resevoir
scargo lake cliff pond flax pond little pond
cliff,little cliff,flax,sheeps,mill pond,herring,gull,peters,triangle,snake,pimlico,many more

good will park
Eagle pond, Joshua's pond
Lake Koomo
Long Pond , Mashpee Pond
Sutherland pond, Long Pond, Upper mill pond, Sheep pond, Hinckleys pond
John's Pond, Jenkin's Pond, pond at Goodwill Park, Fell's Pond
wiley park
Gull Pond
Yarmouth
Swan pond in Brewster
hathaways
higgins cliff duck little cliff great pond
Kettle ponds
Big Cliff Flax pond Little Cliff
Joshua Pond,
Dennis Pond
Yarmouth
Long pong
Dennis Pond , Long Pond
Goose pond
Mostly beach
Centerville, Cotuit, Marstons mills, South dennis
Bakers pond
Lake
Massachusetts
Cape lake
Sheep pond & Hathaway's Pond
Clapps pond, great pond, and pasture pond.
Kulanger Lake
Yak town
Peters Pond
Sand Pond
Chapee
Lawrence Pond, Peters Pond, Spectacle Pond
Sand Pond, Long Pond, Duck Pond
Brewster's Long Pond
Wequaquet lake, Hamblins's Pond, Long Pond
cape cod pond
Long Pond in Brewster and Harwich
Green Pond
Crystal and pilgrim
White
Scargo, Wequaquet
Goose
Eel Pond, Black River, Wequaquet Lake
Jenkins pond, Mares Pond

Hathaways Pond
Sheep Pond, Upper Mill Pond, Nickerson State Park
Not sure
Hinkleys pond, harwich
Knickerson
Nauset
Band members
don't recall the names
mashpee wakepee
Old Silver
Crystal lake
Mostly Long Pond
Several. Mostly Santuit and Mashpee Wakeby
dean pond
Natural pond
Cliff Pond, Crystal Lake, Pilgrim Lake,
Nicholston State Park
Mashpee Pond,
Goose pond,scargo lake
Twinings Pond, Pilgrim Lake
Dennis
Woods Hole Marine Biological Station in Falmouth, then day trips elsewhere on Cape Cod
Long pond, sheep's pond, I can't remember the other ones
Pine
Scarfing lake, Goose pond, Gull pond, Nickerson Park
John's Pond
Bourne
Marmouth
nearby lake
White Pond and Oyster Pond, Chatham
Snake pond, long pond
Scargo Lake, Flax Pond
Cape code lake
Claps pond
Love the kettle ponds in brewster
Cliff pond, great pond and scargo lake
a lot
Salt pond
Long Pond
Long Pond; Flax Pond;
LamJe co
Scargo
Lake Attitash
Hacher
Long Pond, Scargo Lake, Flax Pond
Wequaquet, long pond,

Bass Pond
John's Pond Park
Johns pond
Shubael, Hathaway's Pond

Table D.A-10: Responses to Question 40: Are there other aspects that should be considered in prioritizing Cape Cod pond or lake improvement projects? (note: all responses are presented verbatim; ERG has not altered spelling, wording, or punctuation)

Are there other aspects that should be considered in prioritizing Cape Cod pond or lake improvement projects?
Sustainability with specific ponds to insure common wealth
No idea
The most Innovative eco-friendly filters available.
Areas of greatest population and use.
not knowledgeable
None
Yes, making cleaner areas imo.
Change the environment around nearby ponds
Litter, water quality, parking, no night time partying because they ruin the place
I don't know.
No
Make sure all ponds have rules and regulations to make sure that the pawn stays in good shape with environment
Not aware of any
Including locals!!
less algal growth in ponds and lakes
got nothing to say
Good quality
The improvement should be comprehensive and specific and should not stop halfway
Transformation without damaging the ecology
Decrease litter by increasing recycling and composting programs in the towns.
Publicize the need to all visitors and residents, all over Massachusetts!
I don't know
Na
N/A
Good and wonderful experience and do the cold clothing and show
Action needs to be taken immediately before it is too late.
the animals and environment around
everything all right
group volunteers ---
Nothing else to add.
Again I can not give an opinion as I am not that deeply educate about this aspect
Set up billboards to remind people in the neighborhood at all times
Isk
All is good amazing I love all is very good all
Shortest timeline
Prioritizing making the Cape Cod Pond up to the quality or standard where it can be of tourist's attraction. Thats what I think should be prioritized.
Nothing

Data sharing between towns
environmental issues
people should strict to see don't wrong happening in there
Both are very good enjoy both love it too
For a few months now we are still looking at it from our first
Not sure
Good
Additional maintenance
Not that I can think of
Unsure
Improve the sanitary quality and ecological environment of the pond
Nah
Not at all
I don't know
No
Unaware
not taking away the right to use the pond
Just chilling
Stupid
Coordination with ALLdeoartments is key.signage for the public would also be helpful, especially for visitors not that familiar with the Po flakes.
i can't think of any
To my little knowledge it seems the questions have covered the important questions
Provide reasonable funding to support the project and development
nothing
Daily protection of people living in the surrounding area
Making parks in the beaches
Everything is good
Many of the public ponds lack restrooms. This could be a contributing factor to water quality.
I'm not really sure but it's fun going there for my trips just maybe they need to clean the ponds and lakes
No hay
Need volunteers
work on prices and rentability so other people of different economy status can also stay there
Freshwater organisms living in the lake
They should consider how it affects the ecosystem of the pond, a way to make sure the environment isn't getting ruined while humanity utilizes it's functions for entertainment and fun. And also making sure that the reciprocal relationship between the lake and the towns surrounding it continues to be beneficial for both parties.
Getting the public involved and educated.
Set up the fishing platform to be more secure
I guess time of year. when can improvements be made. I suppose it would be best not to interfere with tourism and do projects in the summer if they can wait.

Maintenance, inspectors and vigilante, if the city, town or state provide a quality and significant maintenance on ponds and lakes, on the high season have inspections and vigilantes guarding the place, it will be way more clean and environmentally improved
L
Prohibit boating and all other activities as I believe this is the most important issue effecting the quality of marine life in the lakes and ponds
No other aspects.
Restoration to now natural habitats like the coonamesset River and child's river restorations
Just be careful of the water you drink
Idk
I think we need to create awareness about this subject in order to get people to listen and take action.
No knowledge of this
It's important to consider funding and what the ponds do for the ecosystems and environment around us.
Effects of surrounding ecosystem
Getting the public more involved in schools, offices, churches, town meetings, billboards. Anything everywhere. Please. Let's get the ecosystems back where they're healthy and thriving so us humans can too
they could yes
nit sure
Not that I can think of now.
Protection
I cannot think of any
can't think of any right now
make advertising and reach out more people
Improve the surrounding environmental pollution
Good
Less litering and more experienced reaserchers
Off season work would be most helpful for Cape economy.
Do your best to protect the environment during the implementation of the project
The seasonal tourists.. they don't care cos they may never return
Preservation
restrict all motor boats, regardless if only 10 hp.
watre quality
Costs
Everything and
It's great
Improve ecosystem quality of ponds and lakes
None
Pollution from reducing the amount of chemicals used
H
No!

The price to enter the lake
Wildlife health

B APPENDIX B: HEDONIC ANALYSIS REGRESSION RESULTS AND METHODS

B.1 Property Price Hedonic Results

Regression model results appear in Table B-5. We estimated two models based on how we measured waterfront locations. In Model 1, we used the variable included in the base data set only which is a yes/no indicator or waterfront locations (i.e., no distinguishing between ocean and ponds). In Model 2, we use the measure discussed in section 3.2 that combined the waterfront location aspect with the distance to ocean/pond. Overall, both models explained approximately 77 percent of the variation in the sales price data. All factors included in the model were significant at the one percent level of significance. In summarizing the results, we primarily use the results of Model 2; we do, however, include the value of waterfront property (not distinguished between ocean and ponds) derived from Model 1.

In this section, we discuss the valuation results associated with the estimated statistical model. First, we take the regression coefficient for each variable in the model and convert it to its marginal effect. Given our use of price measured as a natural log, each marginal effect is phrased in terms of a percentage change. The conversion depends on the form of the variable used. For binary (yes/no) variables, the associated regression coefficient is interpreted as a percentage difference between the sales price of the two groups defined by the binary variable (e.g., difference between homes with and without pools). For variables measured as natural logs, the regression coefficient is directly interpreted as an elasticity reflecting the percent change in sales price from a one-percent change in the variable. For variables measured as cardinal values (e.g., number of bedrooms), the marginal effect is calculated as $(e^{\beta} - 1)$ where *e* is the exponential operator and β is the estimated regression coefficient and reflects the percentage change in sales price for a one-unit change in the variable.

Next, we multiply the marginal effect by the median sales price in the data ($445,900) to convert to a monetary value. The value at the median sales price reflects how a one-unit change in the variable would affect the sales price of a home at the median price. Next, we convert the value at the median price to an annualized value using the approach suggested by Freeman (2003); we multiply the marginal effect by the interest rate (*r*) plus the tax rate (*t*).[50] The annualized value reflects how much people are willing to pay annually for a one-unit change in the variable valued at the median sales price. Next, we calculate the amortized value by multiplying the marginal effect by $\left[1 + {}^{t}/_{r}\right]$ (Freeman, 2003). The amortized value reflects the value people place on a one-unit change in the variable over the time they will occupy the home. For our variables reflecting towns and years, however, we only calculate the marginal

[50] To calculate the interested rate, we took the average of the annual mortgage rates from the St. Louis Federal Reserve Bank data. For tax rates, we used publicly available data on 2022 (our base year in the analysis) tax rates for each town and calculated a weighted average using sales in each town in the analysis data as the weighting factor.

effects valued at the median sales price since interpretation of the annual and amortized values is not relevant.

Table B-1 summarizes the valuation result for the property characteristics using the methods discussed above. Here we see that people value each bedroom at $352 annually and each bathroom at $2,684 annually, at the median sales value. A one percent change in the acreage of the property results in a $4 annualized value and a one percent change in the amount of space in property is valued at $102 annually. A garage has a $1,513 value annually ($38,266 over the full life of the property for the buyer). A pool is valued at $1,199 annually ($30,324 amortized value). Finally, relative to single-family homes, condominiums sell at $124,035 lower (at the median) and people place a $5,939 annual premium on living in single-family homes ($150,242 amortized value).

Table B-1. Valuation Results for Property Physical Characteristics

Characteristic	Regression Coefficient [a]	Marginal Effect	Value at Median Home Price	Annualized Value at Median Sales Value	Amortized Value at Median Sales Value
Bedrooms	0.0163	1.65%	$7,346	$352	$8,898
Bathrooms	0.1184	12.57%	$56,047	$2,684	$67,889
Acres	0.0207	0.02%	$92	$4	$112
Space	0.4772	0.48%	$2,128	$102	$2,578
Garage	0.0708	7.08%	$31,591	$1,513	$38,266
Pool	0.0561	5.61%	$25,034	$1,199	$30,324
Condo	-0.2782	-27.82%	-$124,035	-$5,939	-$150,242

Note: Values derived from Model 2.
[a] All regression coefficients were statistically significant at the one percent level.

Table B-2 provides the results for towns. Each value is estimated relative to Barnstable since inclusion of all towns in the model would result in perfect collinearity. As such, each value can be interpreted as the premium, valued at the median sales price, for purchasing a home in that town relative to Barnstable.

Table B-2: Results for Towns

Towns	Regression Coefficient [a]	Marginal Effect	Value at Median Home Price
Bourne	-0.0981	-9.81%	-$43,728
Brewster	0.0854	8.54%	$38,090
Chatham	0.4264	42.64%	$190,117
Dennis	0.0807	8.07%	$35,981
Eastham	0.1109	11.09%	$49,432
Falmouth	0.0198	1.98%	$8,831
Harwich	0.1154	11.54%	$51,460
Mashpee	0.1493	14.93%	$66,561

Towns	Regression Coefficient [a]	Marginal Effect	Value at Median Home Price
Orleans	0.3034	30.34%	$135,306
Provincetown	0.7200	72.00%	$321,058
Sandwich	0.0206	2.06%	$9,190
Truro	0.3232	32.32%	$144,113
Wellfleet	0.1852	18.52%	$82,566
Yarmouth	-0.0564	-5.64%	-$25,130

Note: Values derived from Model 2.
[a] All regression coefficients were statistically significant at the one percent level.

Table B-3 provides the valuation results for each year in the data. We add one component to the calculations here by back-calculating the year-over-year increase from 2015 onwards. This allows us to calculate how the COVID-19 pandemic affected property prices. We note that the use of 2022 as the base years implies all values reflect 2022 price levels. Here we see that 2020 saw a substantial increase from 2019 ($57,355) and 2021 an exceptionally large increase ($131,862). The price increase in 2022 ($71,318) was less than in 2021, but still was larger than the 2020 increase.

Table B-3. Valuation Results for Years

Year	Regression Coefficient [a]	Marginal Effect	Value at Median Home Price	Estimated Annual Increase
2015	-0.6062	-62.19%	$375,724	-
2016	-0.5759	-59.11%	$356,924	$18,801
2017	-0.5103	-52.53%	$316,290	$40,634
2018	-0.4555	-47.05%	$282,282	$34,008
2019	-0.4204	-43.54%	$260,535	$21,748
2020	-0.3278	-34.23%	$203,179	$57,355
2021	-0.1151	-13.01%	$71,318	$131,862
2022	-	-	-	$71,318

Note: Values derived from Model 2.
[a] All regression coefficients were statistically significant at the one percent level.

Table B-4 presents the valuation results for pond and ocean-related characteristics. First, we note that proximity to the ocean is valuable. For each kilometer away from the ocean, a home's price drops by $25,891 when valued at the median sales price. This translates into a $1,240 annual premium for each kilometer closer to the ocean and a $31,361 amortized value for each kilometer.

Waterfront locations (not distinguished between ocean and ponds) are associated with high premiums with waterfront homes selling for $182,283 more than non-waterfront locations

when valued at the median. The waterfront differential translates to an $8,729 annual value and $220,797 amortized value. When we distinguish between ocean and pond waterfronts, we see that ocean waterfront locations are valued at $14,320 annually ($362,230 amortized) and pond waterfront locations are valued at $4,006 annually ($101,346 amortized).

The average distance to the three nearest ponds, however, is associated with a positive and statistically significant coefficient.[51] In other words, people are willing to pay more for being away from ponds, rather than closer to them. It is unclear why value increases as homes are further from ponds in the estimated model since we have already included distance to ocean as a factor as well. One possibility is that being further from a pond puts a home closer to services and other amenities such as store and businesses. We note, however, that living at pond waterfront locations was found to have significant value. Thus, the value of being close to a pond may be solely attributable to having a waterfront location on the pond and not simply being close to ponds.

The value for being close to clean ponds is statistically significant. As TSI values decline (i.e., ponds are better quality), home sales prices increase. As noted above, a TSI value of 80 indicates a poor-quality pond and one that has a TSI value of 30 is relatively clear/better quality.[52] For each 10-unit decrease in TSI at a home's three nearest ponds, home sales prices increase by $7,474 at the median. This translates to a $358 annualized value and a $9,053 amortized value.

Table B-4. Valuation Results for Pond and Ocean Characteristics

Characteristic	Regression Coefficient [c]	Marginal Effect	Value at Median Home Price	Annualized Value	Amortized Value
Waterfront location [a]	0.4088	40.88%	$182,283	$8,729	$220,797
Waterfront location on ocean	0.6707	67.07%	$299,045	$14,320	$362,230
Distance to Ocean (km)	-0.0598	-5.81%	-$25,891	-$1,240	-$31,361
Waterfront location on pond	0.1876	18.76%	$83,668	$4,006	$101,346
Average Distance to Three Nearest Ponds (km)	0.0501	5.14%	$22,913	$1,097	$27,754
Average TSI Value of Three Nearest Ponds, 10 Unit Change	-0.0017	-1.68%	-$7,474	-$358	-$9,053
Waterfront, other than pond/ocean [b]	0.4087	40.87%	$182,254	$8,727	$220,762

Note: Except where noted, values derived from Model 2.

[51] Distance to ponds is measured as the straight-line distance from the property to the center of the nearest pond. This may inflate the true distance to a body of water, but ERG does not believe it has an appreciable impact on the analysis.

[52] See https://www.nalms.org/secchidipin/monitoring-methods/trophic-state-equations/.

[a] Derived from Model 1.
[b] We note that this factor was measured as being listed as waterfront and not being within 100 meters of either a pond or the ocean. Thus, many of these may include properties that have water views or have property abutting a pond or the ocean (but within 100 meters or the GIS coordinates assigned to the property.
[c] All regression coefficients were statistically significant at the one percent level.

Table B-5: Sales Price Regression Results

Variable	(1)	(2)
Total number of bedrooms	0.0169***	0.0163***
	(5.24)	(5.08)
Total number of bathrooms	0.119***	0.118***
	(35.39)	(35.35)
Acres of land (natural log)	0.0204***	0.0207***
	(5.36)	(5.43)
Living space (natural log)	0.475***	0.477***
	(58.98)	(59.32)
Has a garage	0.0708***	0.0708***
	(16.30)	(16.34)
Has a pool	0.0561***	0.0561***
	(6.35)	(6.37)
Is a condominium (relative to single family home)	-0.278***	-0.278***
	(-41.35)	(-41.53)
Is located on waterfront	0.409***	-
	(60.32)	-
Is located on ocean waterfront	-	0.671***
	-	(18.69)
Distance to ocean (natural log)	-0.0600***	-0.0598***
	(-49.36)	(-49.24)
Is located on pond waterfront	-	0.188***
	-	(5.61)
Average distance to three nearest ponds (natural log)	0.0519***	0.0501***
	(12.25)	(11.83)
Average TSI value for three nearest ponds	-0.00167***	-0.00168***
	(-9.56)	(-9.62)
Is located on waterfront, not ocean or pond	-	0.409***
	-	(58.56)
Bourne [a]	-0.0985***	-0.0981***
	(-8.59)	(-8.57)
Brewster [a]	0.0853***	0.0854***
	(10.62)	(10.67)
Chatham [a]	0.425***	0.426***
	(49.31)	(49.56)
Dennis [a]	0.0806***	0.0807***
	(8.25)	(8.28)
Eastham [a]	0.111***	0.111***
	(11.34)	(11.38)
Falmouth [a]	0.0198***	0.0198***
	(2.88)	(2.89)
Harwich [a]	0.115***	0.115***
	(11.88)	(11.93)

Variable	(1)	(2)
Mashpee [a]	0.149***	0.149***
	(17.55)	(17.56)
Orleans [a]	0.302***	0.303***
	(28.02)	(28.17)
Provincetown [a]	0.742***	0.720***
	(43.81)	(41.95)
Sandwich [a]	0.0209**	0.0206**
	(2.17)	(2.14)
Truro [a]	0.324***	0.323***
	(20.65)	(20.62)
Wellfleet [a]	0.184***	0.185***
	(10.85)	(10.94)
Yarmouth [a]	-0.0566***	-0.0564***
	(-8.71)	(-8.69)
2015 [b]	-0.605***	-0.606***
	(-75.64)	(-75.94)
2016 [b]	-0.576***	-0.576***
	(-74.05)	(-74.18)
2017 [b]	-0.510***	-0.510***
	(-66.62)	(-66.84)
2018 [b]	-0.455***	-0.455***
	(-59.40)	(-59.55)
2019 [b]	-0.420***	-0.420***
	(-54.54)	(-54.73)
2020 [b]	-0.328***	-0.328***
	(-44.23)	(-44.35)
2021 [b]	-0.115***	-0.115***
	(-15.06)	(-15.06)
Constant	9.696***	9.686***
	(183.07)	(183.21)
Observations	21,061	21,061
R^2	0.769	0.770
Adjusted R^2	0.768	0.769

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] Coefficient values are relative to Barnstable.
[b] Coefficient values are relative to 2022.

B.2 Rental Price Hedonic Methods and Results

ERG processed and analyzed rental data similarly. The methods and results for the rental price regression are described below, beginning with descriptions of data and models, and then moving to results.

- The data included rental information for only 2022 from VRBO and Airbnb. Each property in the data included information on number of bedrooms, maximum number of guests, number of bathrooms, type of property (e.g., home, room), and location (both named place and latitude and longitude). The data also included month-by-month

information for each property on average daily revenue (ADR), number of guest nights, and total monthly revenue. Our analysis focused on ADR as the key "price" variable in the analysis. Overall, the source data contained 7,954 properties.

- The location information was converted from the format provided to the 15 Cape towns. For example, properties listed as being in "Buzzards Bay" were coded as being in Bourne.
- For a property to be considered in-scope for the analysis it had to have between 1 and 5 bedrooms, have between 1 and 4 bathrooms, and allow between 1 and 16 guests. ERG excluded properties on the higher end of those aspects since larger properties may be in more niche rental markets.[53] Overall, 84 percent of properties met these three criteria combined.
- As noted, the rental price information was tabulated monthly and most properties have at least one month in 2022 when the ADR was $0 (i.e., no rentals occurred). We used a statistical method referred to as "Tobit" modeling (discussed below) which accounts for large numbers of zero values in the dependent variable. Additionally, we also excluded 338 properties that had no rental revenue in 2022.
- ERG used the latitude and longitude information from the rental data and data on pond locations to identify the closest pond to each property.[54] Finally, we merged in water quality information (Trophic Stata Index (TSI)) that we used in the property price analysis for the three closest ponds.

Our initial analysis found that (1) the number of bedrooms and the maximum number of guests cannot be combined in the same model due to the high correlation between the two and (2) information (distance and TSI) for the closest pond worked best in the modeling. Including the water quality data in the analysis, however, limited our modeling to 3,951 properties since many properties were not close to ponds with TSI information.

Our statistical modeling resulted in four estimated models:

- Model A – A linear regression model that uses number of bedrooms and then the other independent variables.
- Model B – A linear regression model that uses maximum number of guests and then the other independent variables.
- Model C – A Tobit regression model that uses number of bedrooms and then the other independent variables.
- Model D – A Tobit regression model that uses maximum number of guests and then the other independent variables.

[53] For example, properties that can accommodate more than 16 guests are rare, offering less choice to those wishing to rent them.

[54] We note that this differs from the sales price analysis where we used three closest ponds. In short, the statistical models for rental properties performed better (statistically) with using just one pond. Additionally, we expect that a single close pond would be valuable to a renter and that included two other ponds in the analysis would dilute that effect.

A note on linear and "Tobit" regression models. A Tobit is a model that was developed to deal with situations where a dependent variable has a "truncation point". For us, that value is $0 in daily rental income. The Tobit specification treats truncated and non-truncated values as arising from different statistical distributions. A simple linear regression looks for the relationship between a dependent variable (ADR) and the independent variables (bedrooms, bathrooms, etc.). A Tobit focuses on the identifying that relationship but (1) focuses on the relationship when the dependent variable is non-zero and (2) treating non-zero values of the dependent variable as a statistical outcome. In short, a Tobit adjusts the linear regression using a probabilistic model to account for the fact that some values of the dependent variable are zero and some are non-zero. We present both types of models since each has some value in this work.

Results

Unlike the property price analysis, we used ADR in its levels (i.e., not in natural log form). Thus, each regression coefficient in the table can be interpreted as the dollar value for a one-unit change in the independent variable. The analytical components, and their associated results are as follows:

- **Distance to nearest pond.** As with the sales price model, distances from ponds tend to be positively correlated rental prices; that is, rental prices increase as you move further from ponds. The Tobit model, however, corrects for this to some degree with the coefficient being positive, but insignificant.
- **TSI value for nearest pond.** Similar to the sales price model, better water quality is associated with higher rental prices. Each 10-unit increase in TSI is worth approximately $6 in daily revenue in the linear model and $9 in daily revenue in the Tobit model. The total number of guest nights among the in-scope properties is 530,666. Thus, an across the board 10-unit increase in TSI values at all Cape ponds would be valued at $4.8 million annually in the rental market (using the Tobit model estimate).
- **Number of bedrooms.** Each additional bedroom is worth $41 in daily revenue in the linear regression and $49 in daily revenue in the Tobit model.
- **Maximum number of guests.** Each additional guest that a rental can accommodate is worth $22 in daily revenue in the linear regression and $30 in daily revenue in the Tobit.
- **Number of bathrooms.** Each additional bathroom in worth $41-$50 in daily revenue in the linear model and $53 to $69 in daily revenue in the Tobit.
- **House.** We included a binary variable to reflect when the rental was a detached home (not a cottage, condo, apartment, or room). Overall, a "home" rental has a $9-$10 discount in daily revenue relative to a condo/room in the linear model and a $37-$41 discount in daily revenue in the Tobit model. This should not, however, be taken to indicate that renting a home is worth less (overall) than renting a condo/room. Homes earn premiums from having more bedroom and bathrooms and being able to accommodate more guests. Instead, these "discounts" should be interpreted as an economy of scale for renters.

- **Cottage.** The value of a cottage relative to a condo/room (same base as home above) is virtually non-existent; the differences in renting a cottage compared to a condo/room tend to be insignificant.
- **Airbnb vs. VRBO listing.** Relative to VRBO, Airbnb listings earn a $24-$28 premium in daily revenue in the linear model and $60-$63 in daily revenue in the Tobit model.
- **Months.** Using May as a baseline, we see that June to September each show premiums above May in daily revenue and other months show discounts in daily revenue relative to May. The premiums for July and August are the largest, as expected.
- **Towns.** Town-based premiums mirror what was found in the sales price analysis with most towns being discounted relative to Barnstable (the base) and Provincetown and Chatham reflecting the largest premiums above Barnstable, respectively.

Table B-6: Regression results for Average Daily Revenue Using 2022 Rental Data, Linear Regression and Tobit Specifications, Dependent Variable Measured in Levels

	Model A	Model B	Model C	Model D
Statistical method	*Linear regression*	*Linear regression*	*Tobit*	*Tobit*
		Amenities		
Number of bedrooms	40.53*** (12.88)	- -	48.82*** (8.23)	- -
Max number of guests	- -	22.42*** (13.06)	- -	30.15*** (10.25)
Number of bathrooms	50.07*** (12.44)	41.31*** (10.22)	68.63*** (9.32)	53.05*** (7.20)
Airbnb listing	24.43*** (5.67)	27.59*** (6.48)	59.93*** (7.08)	63.12*** (7.55)
House (relative to condo/ room)	-10.18* (-1.74)	-9.097 (-1.55)	-36.81*** (-2.79)	-41.13*** (-3.21)
Cottage (relative to condo/ room)	6.297 (1.14)	10.62* (1.94)	-1.657 (-0.12)	2.135 (0.16)
Distance to closest pond (km)	7.182** (2.26)	5.862* (1.85)	2.386 (0.39)	0.318 (0.05)
TSI value for closest pond	-0.508*** (-3.37)	-0.562*** (-3.80)	-0.846*** (-3.04)	-0.923*** (-3.37)
		Months [a]		
January	-143.4*** (-34.85)	-143.3*** (-34.85)	-396.6*** (-33.99)	-395.4*** (-34.09)
February	-161.2*** (-39.54)	-161.1*** (-39.53)	-476.8*** (-36.01)	-475.8*** (-36.13)
March	-149.6*** (-36.71)	-149.5*** (-36.69)	-414.4*** (-35.31)	-412.9*** (-35.38)
April	-89.79*** (-24.48)	-89.78*** (-24.49)	-195.3*** (-24.23)	-195.2*** (-24.30)
May	- -	- -	- -	- -
June	126.4*** (27.57)	126.4*** (27.58)	196.3*** (25.58)	195.9*** (25.64)
July	214.5***	214.6***	302.4***	302.3***

	Model A	Model B	Model C	Model D
	(37.46)	(37.50)	(33.12)	(33.21)
August	222.0***	222.1***	313.6***	313.4***
	(38.33)	(38.37)	(33.74)	(33.83)
September	128.6***	128.8***	209.6***	209.4***
	(25.26)	(25.30)	(24.59)	(24.66)
October	-18.12***	-17.94***	-25.50***	-25.09***
	(-4.42)	(-4.38)	(-3.30)	(-3.26)
November	-107.4***	-107.3***	-262.5***	-261.6***
	(-26.09)	(-26.09)	(-26.68)	(-26.69)
December	-120.5***	-120.4***	-310.4***	-309.4***
	(-28.48)	(-28.47)	(-28.68)	(-28.73)
		Towns [b]		
Barnstable	-	-	-	-
	-	-	-	-
Bourne	-43.91***	-38.22***	-43.20	-35.45
	(-3.23)	(-2.78)	(-1.46)	(-1.20)
Brewster	-48.63***	-44.94***	-92.44***	-86.69***
	(-5.96)	(-5.52)	(-5.25)	(-4.96)
Chatham	25.84**	28.09***	42.66**	46.00**
	(2.47)	(2.73)	(2.23)	(2.44)
Dennis	-38.42***	-33.94***	-62.20***	-56.86***
	(-3.97)	(-3.63)	(-2.98)	(-2.80)
Eastham	-40.09***	-27.82***	-66.87***	-49.38**
	(-4.12)	(-2.84)	(-3.40)	(-2.51)
Falmouth	-36.72***	-32.31***	-67.05***	-61.32***
	(-3.08)	(-2.81)	(-3.02)	(-2.83)
Harwich	-27.90**	-25.19**	-49.38**	-45.44**
	(-2.24)	(-2.10)	(-2.16)	(-2.04)
Mashpee	1.514	9.859	-10.29	1.617
	(0.15)	(0.96)	(-0.50)	(0.08)
Orleans	-21.13*	-17.34	-54.32**	-49.39**
	(-1.81)	(-1.55)	(-2.48)	(-2.33)
Provincetown	58.71***	77.21***	94.58***	120.7***
	(6.58)	(8.52)	(5.48)	(6.95)
Sandwich	-38.24*	-34.02	-30.10	-22.50
	(-1.87)	(-1.63)	(-0.67)	(-0.50)
Truro	7.431	16.94	9.930	24.14
	(0.55)	(1.27)	(0.38)	(0.94)
Wellfleet	-57.18***	-47.29***	-101.3***	-87.81***
	(-5.50)	(-4.65)	(-4.55)	(-4.00)
Yarmouth	-22.53**	-20.96**	-16.19	-14.19
	(-2.41)	(-2.27)	(-0.89)	(-0.79)
Undefined	-51.64***	-49.58***	-162.5***	-157.5***
	(-7.13)	(-6.94)	(-11.60)	(-11.44)
Regression constant	9.837	-8.657	-152.1***	-180.6***
	(0.74)	(-0.64)	(-5.86)	(-6.86)
Number of observations [c]	46,036	46,036	46,036	46,036
Number of properties	3,951	3,951	3,951	3,951
R-squared	0.310	0.317	-	-

	Model A	Model B	Model C	Model D
Adjusted R-squared	0.310	0.317	-	-
Pseudo R-squared	-	-	0.0454	0.0462

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] May was used as the base month so all values are relative to May.
[b] Barnstable was used as the base town, so all values are relative to Barnstable.
[c] Observations reflect properties over months; that is, an observation is a property-month. Not all properties had an observation for each month.

C APPENDIX C: DISCRETE CHOICE EXPERIMENT SUPPLEMENTAL INFORMATION

C.1 Description of Collected Survey Data and Sample Weighting

The survey was implemented on September 19, 2023 and was completed on November 20, 2023. The two-month implementation period was longer than expected to collect a target of 350 responses. The time in the field represented efforts by the sample list provider (Qualtrics, Inc.) to collect data from the harder to reach categories of Cape residents and NROs. Overall, the data collection resulted in a total of 382 responses. A summary of the sample by Cape association appears in Table . We note that the sample included only 13 NROs; this was partly due to the Commission and ERG's decision to ask Qualtrics to focus on residents as the response rate began to slow in late October. As noted above, the target for residents and NROs was 105 respondents (30 percent of the sample); the data collection was able to obtain both the numeric target and the percentage target as well. Before turning to the data analysis in the next section, we provide a brief overview of the sample data including demographics, pond visit frequencies and activities at ponds, and how respondents answered the choice questions and the associated debrief questions. Finally, we provide an overview of the process used in calculating sample weights.

Table C-1: Distribution of Respondents by Association with Cape Cod

Category	Number of Respondents	Percentage of Sample
Cape Cod Resident	102	26.7%
Non-Resident Owners	13	3.4%
Tourists [a]	267	69.9%
Total	**382**	**100%**

[a] The number of tourists includes individuals who stated they work on the Cape and also visit the Cape for recreation/tourism.

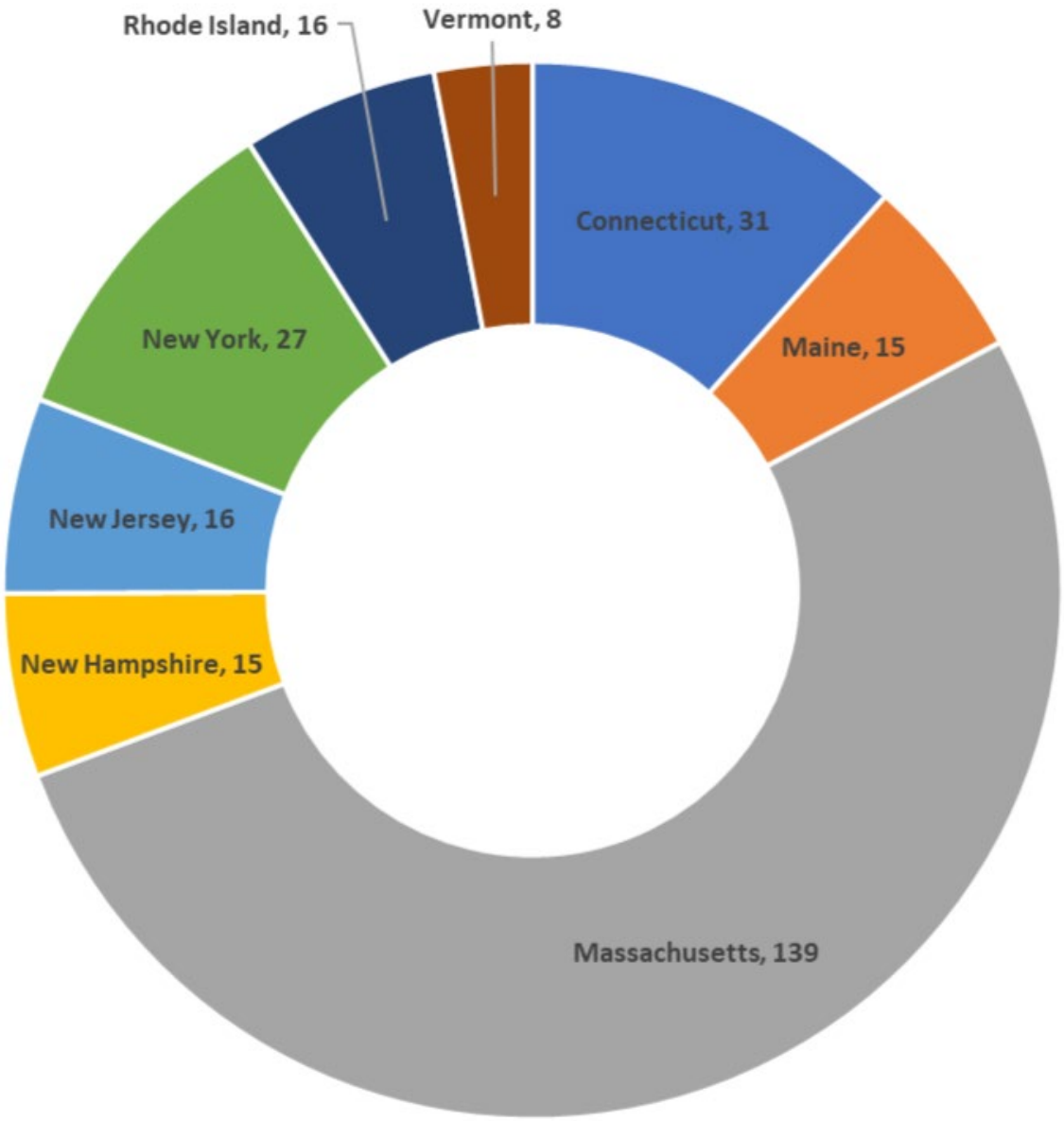


Figure C-1: Distribution of Tourists by State

Figure C-1 provides a summary of where tourist respondents lived. A majority of tourists in the sample were from Massachusetts (139) with Connecticut (31) and New York (27) having the second and the third most respondents. As noted in the sample design section, however, we asked Qualtrics to place caps on the number of respondents from states other than Massachusetts to ensure New York (or other states) did not dominate the sample.

Table C-2: Sample Demographics provides a set of demographics collected in the survey. Overall, the sample was comprised of 64 percent women with 74 percent of the sample identifying as white. The sample tended towards those who were younger (less than 34) and older (older than 55). Nearly half of the respondents had no children (46.4 percent) and 37.5

percent had children under the age of 18. Finally, slightly more than half the sample live in households with only one or two people.

Table C-2: Sample Demographics

Category	Respondents	Percentage of Sample
Gender Identity		
Female	245	64.1%
Male	126	33.0%
Other/declined	11	2.9%
Age		
18 to 24	66	17.3%
25 to 34	79	20.7%
35 to 44	62	16.2%
45 to 54	33	8.6%
55 to 64	52	13.6%
65 plus	89	23.3%
Preferred not to say	1	0.3%
Income		
Less than $30K	57	15.0%
$30K - $50K	65	17.1%
$50K - $70K	66	17.4%
$70K - $90K	56	14.7%
$90K - $120K	38	10.0%
$120K - $140K	21	5.5%
$140K - $160K	16	4.2%
More than $160K	37	9.7%
Preferred not to say	24	6.3%
Race		
White	301	74.1%
Black	40	9.9%
Hispanic	32	7.9%
Asian	15	3.7%
Other/declined	18	4.4%
Age of Children		
Under 5	44	10.4%
Between 5 and 10	51	12.0%
Between 11 and 17	64	15.1%
18 and Older	55	12.9%
No children	197	46.4%
Prefer not to say	14	3.29%
Number in Household		
1-2	202	53.0%
3-4	141	37.0%

Five or more	38	10.0%

Table C-3 provides data on the frequencies in which respondents reported visiting ponds or lakes and the ocean. Overall, respondents reported they are more frequent visitors to the ocean compared to ponds. The most common frequency of pond visitation report by respondents was "sometimes" (46.6 percent of respondent) while the most common frequency of ocean visitation was "frequently" (47.4 percent). In contrast, only one-fifth of respondents indicated they visited ponds "frequently."

Table C-3: Reported Frequencies of Visiting Cape Cod Ponds/Lakes and Beaches

Reported Frequency	Freshwater ponds or lakes		Saltwater beaches	
	Number	Percentage	Number	Percentage
Not at all	[a]	[a]	4	1.1%
Rarely	115	32.7%	41	11.6%
Sometimes	164	46.6%	140	39.8%
Frequently	73	20.7%	167	47.4%
Total	**352**	**100.0%**	**352**	**100.0%**

[a] Respondents who indicated they visited ponds "not at all" were screened out of the survey.

Table C-4 lists the frequency in which respondents participated in various activities at ponds. The most common activity respondents reported at ponds was sitting by the water or on the beach (90 percent performed this "Sometimes" or "Frequently") followed by walking and/or hiking (84 percent performed this "Sometimes" or "Frequently"). The least common was birding (33.7 percent performed this "Sometimes" or "Frequently").

Table C-4: Reported Frequencies of Participating in Specific Activities at Ponds

Activity	Not at all	Rarely	Sometimes	Frequently	Total Respondents
Swimming/floating/wading	10.9%	17.3%	41.9%	29.9%	**375**
Sitting by the water/on the beach	2.1%	7.9%	43.5%	46.4%	**379**
Kayaking/paddleboarding (or similar)	32.5%	26.6%	27.1%	13.8%	**376**
Walking and/or hiking	3.4%	12.6%	44.9%	39.1%	**381**
Fishing	41.3%	21.6%	23.4%	13.7%	**380**
Birding	46.3%	20.0%	23.7%	10.0%	**380**
Boating (motorized, sail, jet skis)	40.8%	22.9%	25.3%	11.1%	**380**

Choice Questions Responses and Associated Debriefing Questions

As discussed in the survey design section above, the choice experiment component of the survey asks respondents to choose between two hypothetical ponds or neither pond on three separate occasions. In each case, the two hypothetical ponds are defined by a set of attributes set to specific levels. The analysis of how those attribute levels relate to pond choices is the subject of the statistical analysis section to follow. However, a key component of the choice experiment process is to ensure respondents are choosing ponds in some cases, as well as choosing "neither pond" in other cases. That is, we need to ensure that respondents are

being presented with reasonable choices. Table C-5 provides a summary of the distribution between respondents choosing either pond (regardless of attribute levels) versus choosing neither pond for each of the three choice questions separately. The first choice question generates more pond choices (83.5 percent of respondents) compared to the second and third (60.5 percent and 61 percent, respectively). In reviewing the pairings that comprise the first choice question (the first pairing in each block of the design), we do not see any specific reason for this to occur. Nevertheless, it should be noted that the first choice question led to more pond choices compared to "Neither Pond" choices.

Table C-5: Respondents Who Selected a Pond vs Selected Neither Pond by Choice Questions

Selection	First Choice Question		Second Choice Question		Third Choice Question		All Three Questions Combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Selected a Pond	319	83.5%	231	60.5%	233	61.0%	**783**	**68.3%**
Neither Pond	63	16.5%	151	39.5%	149	39.0%	**363**	**31.7%**

The choice experiment also included a set of debrief questions to allow us to assess the quality of the choice data from the respondents. First, following each question, we asked respondents how confident they were in their choice. These data are summarized in Table C-6. For all three questions combined, respondents were "somewhat" or "very" confident in 94 percent of their choices. The second question had the lowest level of respondents being "somewhat" or "very" confident at 92.7 percent. Thus, overall, respondents appeared confident in their choices. For analytical purposes in the next section, we limit our analysis to just those who were "somewhat" or "very confident".

Table C-6: Reported Levels of Confidence in Choice Question Selections by Choice Question

Level of Confidence	First Choice Question		Second Choice Question		Third Choice Question		All Three Choice Questions Combined	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Not at all confident	3	0.8%	3	0.8%	4	1.0%	**10**	**0.9%**
Somewhat unsure	14	3.7%	22	5.8%	17	4.5%	**53**	**4.6%**
Somewhat confident	157	41.1%	156	40.8%	152	39.8%	**465**	**40.6%**
Very confident	206	53.9%	198	51.8%	208	54.5%	**612**	**53.4%**
Declined	2	0.5%	3	0.8%	1	0.3%	**6**	**0.5%**

Respondents who selected "neither pond" were asked to select among four potential reasons for not selecting a pond. These responses are provided in Table C-7. The most common selection among the four reasons we provided was that the respondent preferred the ocean to the ponds in the question. The second most common reason what that the respondents did not

think the characteristics of the ponds provided were worth a visit. Of note, the number of respondents who declined to answer this question increased dramatically from the first question to the second one; only one respondent declined to answer the question following the first choice question (1.6 percent), but 34.4 percent and 39.6 percent declined to answer it on the second and third question, respectively.

Table C-7: Reasons Selected by Respondents for Choosing "Neither Pond" Option in Choice Questions

Reason	Choice Question 1		Choice Question 2		Choice Question 3		All Question Combined	
	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.
Would prefer the ocean to these ponds	28	44.4%	49	32.5%	37	24.8%	114	31.4%
Would prefer to do something else besides visit ponds or oceans	8	12.7%	6	4.0%	13	8.7%	27	7.4%
Too far to travel to	1	1.6%	7	4.6%	6	4.0%	14	3.9%
Don't think the characteristics of those ponds are worth visiting	25	39.7%	37	24.5%	34	22.8%	96	26.4%
Declined to answer	1	1.6%	52	34.4%	59	39.6%	112	30.9%
Totals	**63**	**100.0%**	**151**	**100.0%**	**149**	**100.0%**	**363**	**100.0%**

C.2 Sample Weighting

ERG determined that the survey data should be weighted to better reflect the population. In particular, the distribution of respondents by gender, age, and race were determined to be not representative of the target populations. Furthermore, as we have noted, a key aspect of this data collection was to ensure residents and NROs were adequately represented in the data. Calculating standard survey weights for these factors, however, requires knowing the cross-tabulation in the population of all three groups at once (e.g., the population number of white women aged 25 to 34 who live on the Cape). Those types of cross-tabulations are not available at the population level. To overcome this, ERG used a statistical poststratification procedure called raking. In a raking procedure, the totals for relevant sub-groups (e.g., people aged 25 to 24) are used iteratively to calculate weights. Weights are calculated over one factor (e.g., age) first, then over a second factor (e.g., race) which alters the weights for the first factor, and then over the third factor (e.g., gender) which alters the weights for the first two factors. This process is repeated until the changes in the weights are very small between the iterations. The following should also be noted about this process:

- The raking procedure explicitly included age, race, and gender, but data were available to allow us to calculate population totals for race, age, and gender of Cape residents/NROs and tourists separately. Thus, although we are conducting the raking

procedure using age, race, and gender, we are doing the raking separately for residents/NROs and tourists which mean the process implicitly weights for residents/NROs and tourists.

- Raking, and weighting in general, requires each cross-tabulation within the sample data to contain a sufficient number of respondents to be stable. As such, it was necessary to collapse the following categories in the sample:
    - Race was collapsed into two categories of "white" and "non-white" and since the race question in the survey was a "select all" question, we classified respondents as "white" if they *only* selected "white" in the survey.
    - Gender was collapsed into female and non-female identifying.
    - For Cape residents/NROs, we collapsed age into two groups: under 55 and 55 and older.

Weights were used in the statistical analysis to be sure the estimated regression coefficients reflected population estimates and were not skewed by the sample composition.

C.3 Discrete Choice Experiment Results

This section provides the results of the statistical analyses we developed from the survey data. We begin by discussing a base analysis that includes all respondents and uses the variables defined in the ways described above. We then present a set of sensitivity analyses that (1) vary how the travel time variable is defined and (2) uses sub-sets of respondents that were used in the base analysis. Next, we present the results to identify how characteristics of respondents affected their pond choices.

Initially, the analysis plan called for estimating a "willingness to drive" (WTD) estimate based on standard methods for deriving willingness to pay values from choice experiments. In the survey, travel time was defined as the "price" variable and the idea was to derive WTD values for the different levels of the attributes. As will be discussed, however, travel time does not appear to be a factor in pond decisions as we had anticipated. Specifically, we found that travel time tended to be positively associated with pond choice (i.e., longer travel times were associated with choosing a pond); the relationship was not significant, however, in the base model without survey weights.[55] Additionally, travel time was selected as the least important factor in making a decision by 34 percent of the survey respondents. Nevertheless, the choice experiment data provide useful results to indicate how the aspects and their levels relate to pond choices.

[55] We reference the base model without weights due to the idea that the addition of weights will make all effects significant since the purpose of weights is to extrapolate to the population.

As noted above, this form of statistical analysis requires us to set one level from each aspect to be a "base" category and the values from all other levels are measured relative to that level. In almost all of the analyses we present, we set the "lowest" level to be the base. However, in analyzing the base results, we performed an analysis where we used the top level in each aspect to be the base do demonstrate how to interpret the values.

Finally, we present the results in terms of odd ratios. An odds ratio is defined as the relative odds of an "outcome" for a given "treatment." In our case, the outcome is selecting a pond to visit, and the treatment is the different levels of the various attributes. For example, for signs about water quality, the odds ratio will tell us the increased odds of someone choosing a pond if those signs are available. For odds ratios, the key value is 1.0 with values above 1.0 reflecting an increased likelihood the outcome occurs and the value below 1.0 reflecting a decreased likelihood the outcome occurs. For the example used (signs about water quality), the interpretation at the aspect-level is simple since the "signs about water quality" aspect only has two levels. Most of the other aspects, however, have three levels and interpretation of the odds ratios is more complicated, especially since one level must be excluded from each statistical estimation.56

C.3.1 Base Analysis

Table C-8 provides the base analysis for this work in three different ways. The base analysis includes all respondents who indicated they were either "somewhat" or "very" confident in the choice question response, time travel formulated as a numeric variable, and alternative-specific constants for:[57]

- Gender (defined as identifying as female)
- Presence of kids under 5 in the family
- Presence of kids between 5 and 10 in the family
- Presence of kids between 11 and 17 in the family
- Presence of kids 18 or older in the family
- Being a tourist
- Being a "frequent" pond visitor
- Being a "frequent" ocean visitor
- Being under 35
- Being between 35 and 54

[56] As mentioned in the prior paragraph, we performed an analysis where we revised the base level to be the highest level. This was done to demonstrate this concept and allow for easier interpretation of some results.
[57] These alternative-specific constants are used for the base and other analyses in this memo. Results related to these alternative-specific constants are presented in the section titled "Sub-Group Analyses" below.

Categories not included formed bases for comparison (e.g., the basis for the tourist category is residents/NROs). Overall, the base analysis included 378 respondents and 3,231 observations.58

The base, unweighted model reflects the analysis performed on the base set of responses using the data without sampling weights. The weighted model adds in the sampling weights and the "reverse controls" model uses the highest (instead of lowest) category as the control case. Overall, our assessment is that the base weighted model provides the preferred model to use. Nevertheless, comparing the results from the preferred to other models is instructive.

Following this section, we focus on weighted models. Unweighted models treat each respondent equally in the analysis while a weighted model takes into account that each respondent represents multiple other similar respondents. This is important in this analysis since we are combining residents/NROs and tourists. Although our sample is comprised of approximately 70 percent tourists, our population estimates indicate that tourists are 95 percent of the target population for this survey. Thus, despite their large representation in the sample, tourists are still comparatively underrepresented in the sample. Thus, the weighted model adjusts for this and other under- and over-representation in the analysis. Where relevant, we point out where the weighted model makes an adjustment in the estimates below.

Finally, we note that the weighted models will almost always results in statistically significant coefficients (not reported) and odds ratios (derived from the coefficients). This is because each record in the data is weighted and therefore represents multiple similar records. Given our target population is more than five million people, the weighted models are essentially analyses that are mimicking an analysis with approximately 45 million records (5 million people x 3 choice questions x 3 choices in each question). Any statistical analysis that uses 45 million records will most assuredly find statistically significant results. On the other hand, in cases where no statistically significant effect is found in an estimated weighted model, we can be truly certain no effect exists.

C.3.2 Key Results from Base Analysis

Signs for water quality. The models indicates that signs for water quality increase the odds of someone choosing a pond by about 17 percent. The unweighted model found a 19.5 percent increase in the odds which the weighted model pared down to the 17 percent value.
Bacterial issues. The analysis found that respondents were 1.79 time more likely to select ponds that are described as having bacterial issues "rarely or never" compared to ones that have issues "every summer." Additionally, it appears that ponds that have "issues within the last two years" are also much less preferred the clean ponds with an odds ratio of 0.78. Thus,

[58] Since we applied the confidence screening criteria at the question level, not all respondents have three choice questions and, ultimately, nine records in the data.

overall, respondents indicated a strong preference for clean ponds versus ponds that have *any* indication of bacterial issues.

Beach area. Although the unweighted model indicated that respondents preferred moderate-sized beaches to spacious ones, the weighted model reverses that to show respondents indeed prefer spacious beach sizes. The analysis indicates that respondents are 10 percent more likely (odds ratio of 1.095) to select a pond with a spacious beach than one with almost no beach. Respondents are also two percent more likely to select a pond with a moderate-sized beach to one with almost no beach.

Litter. Respondents showed the strongest preference in the survey for not being on a beach with a "noticeable amount of garbage." Specifically, respondents were 2.5 times more likely to select a pond that was always clear of litter compared to one with a noticeable amount and 1.84 times more likely to select a pond that sometimes has a small amount of litter compared to one with a noticeable amount.

Development. The results for shoreline development were somewhat unexpected. Respondents showed a preference for ponds where you could see "several" homes, lawns, and private docks which we defined as the lowest category followed by natural shorelines (i.e., no homes, lawns, or private docks).

Amenities. The presence of amenities such as restrooms and picnic tables increase the likelihood of a respondent selecting that pond by about 12 percent (odds ratio 1.12).

Travel time. The results for the travel time variable are also a bit counterintuitive. As travel time increased, respondents indicated they were more likely to select that pond. However, the result was insignificant in the unweighted model. Given that the variable is measured in minutes, the odds ratio (in the weighted models) indicates that each added minute of travel time increase the likelihood of selecting that pond by 1.7 percent. Given the insignificance in the unweighted model and the fact that 34 percent of respondents indicated that travel time was the least important aspect they considered, we place less emphasis on this result. Nevertheless, we performed some sensitively analyses around this result in the next section.

Table C-8: Base Model: Unweighted, Weighted, and Weighted with Reverse Control Categories; All Coefficient Estimates Presented as Odds Ratios

Aspect and Level	Based Model, Unweighted [a]	Base Model, Weighted [a]	Base Model, Weighted, Reverse Controls [a]
Sign that describes most recent water quality testing	1.195***	1.168***	-
	(3.28)	(325.84)	-
No sign describing most recent water quality testing	-	-	0.856***
	-	-	(-325.84)
Rarely or never has issues with bacteria	1.786***	1.790***	-
	(5.43)	(615.14)	-
Bacterial issues in the last 2 years	0.833**	0.775***	0.775***
	(-2.37)	(-370.12)	(-370.12)
Bacterial issues each summer	-	-	0.720***
	-	-	(-393.98)

Spacious beach area	1.077	1.095***	-
	(0.76)	(105.53)	-
Moderate-sized beach	1.143*	1.020***	1.020***
	(1.92)	(33.40)	(33.40)
Almost no beach	-	-	0.895***
	-	-	(-118.43)
Always clear of litter or garbage	2.711***	2.486***	-
	(6.06)	(639.00)	-
Sometimes have a small amount of litter or garbage	1.951***	1.840***	1.840***
	(4.45)	(465.84)	(465.84)
Noticeable amount of garbage	-	-	0.219***
	-	-	(-613.18)
Only trees and other natural features around the shoreline	1.060	0.999	-
	(0.66)	(-1.13)	-
A few homes, lawns, and private docks around the shoreline	0.768***	0.763***	0.763***
	(-3.24)	(-381.52)	(-381.52)
Several homes, lawns, and private docks around the shoreline	-	-	1.311***
	-	-	(327.21)
Amenities such as restrooms and picnic tables	1.103*	1.123***	-
	(1.79)	(241.96)	-
No amenities such as restroom and picnic tables	-	-	0.890***
	-	-	(-241.96)
Travel time	1.007	1.017***	1.017***
	(1.01)	(307.73)	(307.73)
Number of observations	**3,231**	**3,231**	**3,231**
Number of respondents	**378**	**378**	**378**
Chi-Squared	**196.1*** **	**2,673,498.8*** **	**2,673,498.9*** **

Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] Aspect levels that are excluded from each model (i.e., denoted with a dash) are the control categories.

C.4 Alternative Formulations of Travel Time

To investigate the issue with travel time working in the "opposite" direction as anticipated, we performed three sub-analyses which altered how we used travel time in the analysis. First, we formulated travel time as we did the other levels with a separate variable for each level coded with an effects coding approach (see above). Second, we dropped travel time from the model altogether to see if removing it affected other factors. Finally, we restricted the sample by removing respondents who indicated that travel time was the least important factor in making their decision (see Table 8). These results are presented Table C-9. For the most part, the results from the alternative formulations are consistent with the base weighted model (our

preferred model). Of note, when we excluded travel time, the effect of having a pond free of litter become much larger on the likelihood that respondents chose a pond. Additionally, when we excluded respondents who said that travel time was the least important factor in making decision, ponds with amenities are less preferred to those without amenities.

C.5 Sub-Group Analyses

Next, we looked at how the results would change if we altered the set of respondents we used in the statistical model. The statistical analyses for these sub-groups appear in Table C-10. These sub-groups we looked at and their associated results were as follows:

- **Limiting the sample to just respondents who were "very confident" in their discrete choice question response.** This reduced the analytical sample to 277 respondents. Overall, the results were consistent with the base model. Notably, the need for a pond with no litter/garbage was much more important to "very confident" respondents compared to the full sample (odds ratio of 3.76 for ponds being clear of litter compared to an odds ratio of 2.49 in the base model). Additionally, the presence of signs had a larger effect among "very confident" respondents compared the base model (odds ratio of 1.33 compared to 1.17 in the base). Overall, the positive effects on pond choice all increased among the "very confident" respondents compared to the base model.

- **Limiting the sample to just residents/NROs.** This reduced the analytical sample to 117 respondents. Overall, the results for residents/NROs were consistent with the base model. One notable difference was that residents/NROs have a very strong preference for ponds clear of litter/garbage (odds ratio of 4.59 for ponds being clear of litter compared to an odds ratio of 2.49 in the base model). Residents/NROs were also likely to prefer ponds with natural shorelines compared to ones with "lots of homes, lawns, and private docks" in view, but the quantitative effect was small.

- **Limiting the sample to tourists.** This reduced the analytical sample to 261 respondents. The results were consistent with the base model. There were, however, two notable differences. First, tourists showed a preference for either larger beaches or small/no beach at the ponds. Second, tourists preferred shorelines to have "lots of homes, lawns, and private docks" in view.

- **Removing respondents who indicated they "rarely" visit ponds.** The reduced the analytical sample to 205 respondents. Once again, results were roughly consistent with the base model. These respondents, however, showed stronger preference for signage (odds ratio of 1.46 compared to 1.17 in the base) and no litter compared to the base model (odds ratio of 3.23 compared to 2.49 in the base).

Table C-9: Statistic Methods Using Alternative Formulations for Travel Time; All Coefficient Estimates Presented as Odds Ratios

Aspect and Level	Formulating Travel Time as Binary Variables	Excluding Travel Time	Excluding Respondents Who Indicated Travel Time was Least Important Aspect
Sign that describes most recent water quality testing	1.154***	1.217***	1.310***
	(298.62)	(430.95)	(300.31)
Rarely or never has issues with bacteria	1.916***	1.975***	1.449***
	(672.90)	(758.33)	(204.58)
Bacterial issues in the last 2 years	0.716***	0.764***	0.826***
	(-441.27)	(-390.55)	(-143.66)
Spacious beach area	1.141***	1.209***	1.253***
	(149.20)	(236.49)	(139.02)
Moderate-sized beach	0.970***	1.024***	0.741***
	(-48.52)	(40.14)	(-248.79)
Always clear of litter or garbage	2.915***	3.060***	2.776***
	(683.88)	(889.46)	(364.85)
Sometimes have a small amount of litter or garbage	2.138***	1.872***	2.755***
	(536.00)	(481.09)	(404.51)
Only trees and other natural features around the shoreline	1.037***	1.111***	1.018***
	(46.52)	(155.58)	(12.14)
A few homes, lawns, and private docks around the shoreline	0.756***	0.752***	0.766***
	(-390.80)	(-408.13)	(-197.37)
Amenities such as restrooms and picnic tables	1.129***	1.199***	0.998**
	(215.59)	(420.10)	(-2.40)
Travel time	-	-	1.030***
	-	-	(266.78)
Travel time was 15 minutes	1.526***	-	-
	(288.01)	-	-
Travel time was 25 minutes	1.219***	-	-
	(146.99)	-	-
Travel time was 35 minutes	3.829***	-	-
	(357.01)	-	-
Number of observations	**3,231**	**3,231**	**1,122**
Number of respondents	**378**	**378**	**173**
Chi-Squared	**2,707,618.8**	**2,603,478.8**	**1,377,007.2**

Note: All models are estimated using the survey weights.
Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C-10: Statistical Models Using Sub-Groups; All Coefficient Estimates Presented as Odds Ratios

Aspect and Level	Very Confident in Response	Residents/ NROs	Tourists	Excluding Those Who Visit Ponds Rarely
Sign that describes most recent water quality testing	1.328***	1.103***	1.171***	1.456***
	(434.16)	(45.66)	(318.58)	(486.99)
Rarely or never has issues with bacteria	1.820***	1.682***	1.801***	1.871***
	(454.10)	(120.39)	(596.13)	(408.70)
Bacterial issues in the last 2 years	0.721***	0.822***	0.769***	0.764***
	(-340.83)	(-69.85)	(-366.57)	(-243.36)
Spacious beach area	1.279***	1.085***	1.098***	1.207***
	(212.64)	(20.33)	(104.97)	(140.21)
Moderate-sized beach	0.915***	1.526***	0.996***	0.917***
	(-104.41)	(141.01)	(-6.82)	(-86.73)
Always clear of litter or garbage	3.755***	4.588***	2.428***	3.234***
	(679.54)	(210.76)	(601.43)	(524.31)
Sometimes have a small amount of litter or garbage	2.056***	4.435***	1.781***	1.823***
	(380.18)	(249.86)	(421.72)	(269.57)
Only trees and other natural features around the shoreline	1.002	1.088***	0.978***	0.954***
	(1.48)	(22.64)	(-28.99)	(-38.46)
A few homes, lawns, and private docks around the shoreline	0.779***	1.228***	0.747***	0.786***
	(-252.50)	(66.80)	(-397.08)	(-206.13)
Amenities such as restrooms and picnic tables	1.184***	1.134***	1.121***	1.167***
	(251.40)	(59.46)	(228.43)	(201.56)
Travel time	1.020***	0.986***	1.020***	1.018***
	(264.81)	(-53.63)	(348.65)	(206.59)
Number of observations	**1,836**	**990**	**2,241**	**1,380**
Number of respondents	**277**	**117**	**261**	**205**
Chi-Squared	**2,189,517.3**	**242,978.8**	**2,621,934.9**	**1,620,329.1**

Note: All models are estimated using the survey weights.
Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C.6 Pond Choices and Respondent Characteristics

As a final set of results, we provide the estimates for the alternative-specific constants in model. ASC logit models, such as the one we used for this work, treats respondent characteristics as "shift parameters." That is, they either amplify or condense the impacts of the attributes based on the respondent characteristics. The alternative-specific constant output from this type of model comes in the form of estimates for the different options (ponds in our

case) setting one option to be a base. Since "Pond A" and "Pond B" vary over choice questions, the most interesting set of alternative-specific constants for us are the values for selecting "neither pond." These "neither pond" values reflect the likelihood of selecting that option. If we think of them in reverse (i.e., their inverse value), however, they provide an estimate of the likelihood a respondent selected a pond. That is, they show how respondent characteristics relate to a preference for visiting ponds.

Table C-11 provides these estimates in terms of odds ratios. Given that the odds ratio reflects the likelihood of choosing "neither pond" in the choice question, values below 1.0 reflect preference for ponds. The results can be summarized as follows:

- **Households with children** (compared to households with no children) show a preference for visiting ponds with the strongest preferences among households with children under the age of five.

- **Women** (compared to men and other gender identifications) show a distinct and strong preference for not visiting ponds. Quantitatively, women were more than twice as likely to select neither pond compared to men and other genders.

- **Tourists** were less likely to select ponds compared to residents/NROs. Thus, in converse, this result indicates that residents/NROs were more like to select a pond.

- **Respondents who indicated they visit ponds frequently** were less likely to select a pond. This is somewhat counterintuitive since these respondents showed a preference for visiting ponds in the question on visit frequency. One possible explanation is that some subset of these respondents have a "favored" specific pond and some choices they were offered did not match that favored pond.

- **Respondents under the age of 55** were more likely to select a pond compared to those over the age of 55.

- **Households with only one person** were less likely to select a pond (compared to households with more than two people).

Table C-11: Alternative Specific Constants for Selecting "Neither Pond" from the Weighted Base Model; All Coefficients Presented as Odds Ratios

Factor	Base Model, Weighted
Kids under 5 in the household	0.492***
	(-247.33)
Kids between 5 and 10 in the household	0.984***
	(-6.01)
Kids between 11 and 17 in the household	0.913***
	(-40.48)
Kids 18 plus in the household	0.789***
	(-106.27)
Women	2.135***
	(458.09)
Tourists	1.098***
	(30.04)
Visits ponds frequently	1.260***
	(115.63)
Visits oceans frequently	1.020***
	(13.15)
Under 35	0.915***
	(-44.04)
Age 35 to 54	0.878***
	(-67.78)
Household has only one person	1.055***
	(22.94)
Household has two people	0.998
	(-0.75)

Exponentiated coefficients; *t* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

D APPENDIX D: INTERCEPT SURVEY QUESTIONS

I1 What is the name of this pond?

I2 If you chose "Other," please provide the name of the pond:

_____

Q1 Where is your primary residence?

- ○ On Cape Cod
- ○ In Massachusetts but not on Cape Cod
- ○ Outside of Massachusetts

Q2 Are you a...

- ○ Resident or Non-Resident Home Owner
- ○ Visitor

Q3a How many people are you here with today including yourself?

_____

Q3b How many people are you traveling with including yourself?

_____

Q4 Is this an overnight or day trip?

- ○ Overnight
- ○ Day trip

Q5 What is the length of your trip?

_____

Q6 How many of those days are planned to be spent at lakes or ponds?

_____

Q7 How many hours will you spend at the pond today?

_____

Q8 What is the primary purpose of your visit to the pond today?

- ○ Swimming
- ○ Beach going
- ○ Canoeing, kayaking, or paddle boarding
- ○ Boating (e.g., motorboats, sailboats, jet skis)
- ○ Birding
- ○ Other wildlife viewing
- ○ Fishing
- ○ Walking/hiking
- ○ Other _____

Q9 About how much did you/your party **spend on the Cape** for the following items during your trip? NOTE: These spending estimates should be inclusive of the entire party as defined in Question 3.

- ○ Hotels/motels _____
- ○ AirBNB or other house rental _____
- ○ Fuel (gas or electric) _____
- ○ Parking passes _____
- ○ Water sports **rentals** (e.g., fishing poles, paddleboards, canoes, kayaks) _____
- ○ Water sport **purchases** (e.g., bait, canoe, paddleboard, kayaks, boats) _____
- ○ Clothing and accessories associated with your trip to the pond (e.g., hats, sunscreen, bug spray, sunglasses) _____
- ○ Travel agencies _____
- ○ Restaurants/other prepared food _____
- ○ Groceries _____
- ○ Cabs, Ubers, or other rideshare _____
- ○ Car rentals _____
- ○ Souvenirs _____

Q10 Visiting lakes and ponds on the Cape was the...

- ○ Primary purpose of my trip or stay
- ○ One of many activities of my trip or stay

Q11 How would you rate the water quality at this pond?

- ○ Excellent
- ○ Good
- ○ Fair
- ○ Poor
- ○ N/A

Q12 Would you return to this pond based on the water quality you experienced today?

- ○ Yes
- ○ No

Q13 Please provide any additional thoughts in the text box below.

_____

_____

_____

_____

_____

E APPENDIX E: VISITATION COUNT AND SITE CHARACTERISTICS ASSESSMENT DATA FIELDS

- Recording team member
- Pond/lake name
- Time of count/site characteristics evaluation
- Date of count/site characteristics evaluation
- Bikes
- Occupied parking spaces
- Total parking spaces
- Temperature (Fahrenheit)
- Precipitation
- Cloud conditions
- Wind speed and direction
- Litter conditions
- Development conditions
- Parking availability
- Bathrooms
- Algae level
- Water clarity
- Use restrictions
- Other notable site characteristics
- Number of visitors
- Number swimming
- Number hiking
- Number birding
- Number motorized boating
- Number sitting at the beach
- Number non-motorized water recreation
- Number fishing
- Visitors doing other things
- Notes about visitation

F APPENDIX F: PONDS VISITED

Table F-1: List of ponds that ERG visited and the town that they are located in.

Pond	Town
Barnstable	Joshua Pond
Barnstable	Long Pond
Barnstable	Lumbert Pond
Barnstable	Long Pond
Barnstable	Fresh Pond
Barnstable	Hathaway Pond (North)
Barnstable	Lovells Pond
Barnstable	Round Pond
Barnstable	Hamblin Pond
Barnstable	Shubael Pond
Barnstable	Wequaquet Lake
Barnstable	Rushy Marsh Pond
Barnstable	Middle Pond
Bourne	Queen Sewell Pond
Bourne	Flax Pond
Brewster	Higgins Pond
Brewster	Flax Pond
Brewster	Upper Mill Pond
Brewster	Little Cliff Pond
Brewster	Cliff Pond
Brewster	Slough Pond
Brewster	Seymour Pond
Brewster	Long Pond
Brewster	Sheep Pond
Chatham	White Pond
Dennis	Scargo Lake
Eastham	Herring Pond
Eastham	Bridge Pond
Eastham	Great Pond
Eastham	Jemima Pond
Eastham	Depot Pond
Eastham	Ministers Pond
Falmouth	Coonamessett Pond
Falmouth	Deep Pond
Falmouth	Grassy Pond

Falmouth	Frog Pond
Harwich	West Reservoir
Harwich	Sand Pond
Harwich	Hinckleys Pond
Harwich	Bucks Pond
Harwich	Josephs Pond
Mashpee	Johns Pond
Mashpee	Ashumet Pond
Mashpee	Mashpee-Wakeby Pond
Orleans	Cedar Pond
Orleans	Meadow Bog Pond
Orleans	Sarahs Pond
Orleans	Uncle Harveys Pond
Orleans	Crystal Lake
Orleans	Twinings Pond
Orleans	Bakers Pond
Orleans	Ice House Pond
Orleans	Reubens Pond
Provincetown	Shank Painter Pond
Provincetown	Clapps Pond
Provincetown	Great Pond
Provincetown	Blackwater Pond
Sandwich	Triangle Pond
Sandwich	Spectacle Pond
Sandwich	Pimlico Pond
Sandwich	Peters Pond
Sandwich	Shawme Lake
Sandwich	Lawrence Pond
Sandwich	Snake Pond
Truro	Village Pond
Truro	Horseleech Pond
Truro	Snow Pond
Wellfleet	Gull Pond
Wellfleet	Higgins Pond
Wellfleet	Herring Pond
Wellfleet	Spectacle Pond
Wellfleet	Dyer Pond
Wellfleet	Long Pond
Yarmouth	Long Pond
Yarmouth	Flax Pond