WORKING PAPER NO. 2011-03

THE ECONOMIC VALUE OF VIEWING MIGRATORY SHOREBIRDS ON THE DELAWARE BAY: AN APPLICATION OF THE SINGLE SITE TRAVEL COST MODEL USING ON-SITE DATA

By

Peter E.T. Edwards, George R. Parsons, Kelley H. Myers

WORKING PAPER SERIES

UNIVERSITY OF DELAWARE | Alfred Lerner College of Business & Economics

DEPARTMENT OF ECONOMICS

The Economic Value of Viewing Migratory Shorebirds on the Delaware Bay: An Application of the Single Site Travel Cost Model Using On-Site Data

June 2011

Peter E.T. Edwards, George R. Parsons, Kelley H. Myers

School of Marine Science and Policy

University of Delaware

Newark, DE 19716

Abstract

Using data from an on-site survey of recreational birders in southern Delaware during the annual horseshoe crab/shorebird spring migration, we estimated three truncated count data models of recreation demand. We analyzed day-trips only and conducted sensitivity analysis on measurement of the value of time and inclusion of covariates. Our estimates from the models using all covariates were in the range of $32 to $142/trip/household (2008$). The variation is due to differences in the value of time. The average household size is 1.66.

Keywords: Recreational Birding, Economic Value, Shorebird Migration, Onsite Sampling, Endogenous Stratification

The Economic Value of Viewing Migratory Shorebirds on the Delaware Bay: An Application of the Single Site Travel Cost Model Using On-Site Data

Abstract

Using data from an on-site survey of recreational birders in southern Delaware during the annual horseshoe crab/shorebird spring migration, we estimated three truncated count data models of recreation demand. We analyzed day-trips only and conducted sensitivity analysis on measurement of the value of time and inclusion of covariates. Our estimates from the models using all covariates were in the range of $32 to $142/trip/household (2008$). The variation is due to differences in the value of time. The average household size is 1.66.

Keywords: Recreational Birding, Economic Value, Shorebird Migration, Onsite Sampling, Endogenous Stratification

The Economic Value of Viewing Migratory Shorebirds on the Delaware Bay: An Application of the Single Site Travel Cost Model Using On-Site Data

1. Introduction

Each year from early May to the middle of June thousand of migratory shorebirds stopover on the Delaware Bay to feed on horseshoe crab eggs during the horseshoe crab spawning season. The eggs provide vital nutrition for the birds on their journey from South American to Canada. The migrating birds include, among others, the Red Knot, Ruddy Turnstone, Semi-Palmated Sandpiper, and Sanderling. The Red Knot is probably best known. Due to declining numbers in recent years, it has become a candidate for listing as an endangered species.[1]

The purpose of this study is to estimate the use value of these migratory shorebirds to recreational birders. Our goal is to provide a set of estimates that may be useful in damage assessment and benefit-cost analysis. We estimate a single-site travel cost model using data from an on-site sample of recreational birders visiting the Delaware Bay in Delaware. We confine our analysis to day-trips and use the household as our unit of observation. Our model is applied to birding during the horseshoe crab/shorebird migration in 2008. A viewing 'season' is about 5 or 6 weeks long.

We estimated a negative-binomial count data travel-cost model. Count data models were introduced to recreation demand modeling in the late eighties and have been improved and applied since along a number of lines. We are particular interested in accounting for biases

[1] See http://www.ceoe.udel.edu/horseshoecrab/Shorebird/index.html for more on the horseshoe crab/shorebird migration.

introduced by on-site sampling – endogenous stratification (over sampling frequent visitors) and truncation (only observing household making at least one trip during the season).

Hellerstein (1991), Hellerstein and Mendelsohn (1993), and Creel and Loomis (1990) were the first to explore research on applications using count data models in recreation demand. Shaw (1988) was the first to design a correction for endogenous stratification and truncation due to on-site sampling. His correction applied to simple Poisson models. Englin and Shonkwiler (1995) later introduced an on-site correction for negative-binomial models. For some recent applications along these lines and similar to ours see Donovan and Champ (2009), Ovaskainen, Mikkola, and Pouta (2001), McKean, Johnson, and Walsh (2003), Englin, Holmes, and Sills (2003), and Martínez-Espiñeira and Amoako-Tuffour (2008).

There are a number of studies that have focused on the economic impact of recreational birding and ecotourism (Eubanks, Stoll and Kerlinger (2000) and Glowinski (2008) but only a few have estimated consumer surplus for use values of birdwatching (Eubanks, Stoll, and Ditton (2004) and Issacs and Chi (2005)). There are several estimates for broad categories such as nonconsumptive wildlife recreation (Rockel and Kealy (1991)) and wildlife viewing for other species such as elk (Donovan and Champ (2009)). There are also a number of studies that have estimated non-use values for endangered or threatened species of birds such as the Spotted Owl (Rubin, Helfand, and Loomis (1991)), the Red Cockaded Woodpecker (Reaves, Kramer and Holmes (1999)) or Canadian wild geese (MacMillan, Hanley, and Daw (2004)). But the published literature on use values for birdwatching remains extremely sparse. Rosenberger and Loomis (2001) conducted a meta-analysis of a number of consumptive and nonconsumptive activities including a category identified as wildlife viewing. The wildlife viewing studies they considered ranged in value from $2.36 to $161.59 (1996 dollars) per day. They reported an expected value over all wildlife viewing studies of $29.57 (2001 dollars).

We being with a short discussion of our data and then turn to our model and results.

2. Data

Our primary data come from an on-site survey of visitors to key shorebird viewing sites on the Delaware side of the Delaware Bay. The migration occurs from early to mid-May through early June. Our sampling was done in 2008 from May 17th through June 6th – respondents were asked to report actual trips since May 1 and expected trips to June 15. Birders were intercepted while they were birdwatching (usually after) at two selected sites in the area: Port Mahon and Mispillion Harbor Reserve. These sites are approximately 25 miles apart and are shown in Figure 1. After an on-site pretest of the survey in 2007 we determined that most people visiting the area to view the horseshoe crab/migratory shorebird migration would visit one of these major sites. We also determined that most birders would visit several sites on each trip. In our final analysis we treat the entire area as a single site. We also discovered that sampling and questionnaire response would be easiest if done by household, instead of individual. Nearly half of the respondents reported that their trips were taken as a couple and those that travel on their own could easily be treated as the birding part of their household. This simplified and clarified the survey. The average household size was 1.66.

A team of interviewers intercepted visitors over eleven selected week and weekend days during the shorebird migration. Visitors were informed about the study and then asked to take a packet that contained the questionnaire, to complete it as soon as possible after receiving it (preferably the same day), and to mail it back using an enclosed envelop. Upon being intercepted visitors were asked if the primary purpose of their trip was for birdwatching and if they would be on-site for at 15 minutes. If not, they were not given a survey. A total of 581 questionnaires were handed out with 376 returned, giving a response rate of 65%. Given that our sampling protocol precluded use of postcard reminders or a second round of contacts, this response rate came without follow-up to the initial survey. Again, based on our on-site pretest in the previous year, we decided that having birders complete the survey on-site was too intrusive and time consuming and might result less thoughtful (hurried) responses.

The survey also included questions on where their household birding day began and ended, home zip code, number of hours spent birding, visits to other birding sites, income, size and composition of travel party, activities during the birding trip, age, income, and other demographic information. The respondents were also asked to answer a series of stated preference questions depending on their type of trip (day or overnight). The results are reported by Myers, Parsons, and Edwards (2010)).

The mean age of the day-trip respondents was 58 years. Forty-two percent were women. Mean household income was $106,825 (2008$), mean education was about 14 years, and the mean value of birding equipment owned by respondents was $4,097/household. Finally, 55% reported being members of birding clubs or societies while 84% reported that they had previously made a least one visit to the Delaware Bay to view shorebirds in years prior to the intercept.[2]

---

[2] The numbers reported here vary somewhat from those reported in Table 3 because they pertain to the entire day and overnight trip sample. Table 3 pertains to the observations used in estimation.

Of the 376 people who returned a survey, 229 were either on a day-trip, had taken a day-trip earlier in the season or were planning to take a day-trip later in the season. Of the 229, five reported having taken a day trip of longer than 300 miles. We decided to exclude these from the analysis. It is difficult to believe that a single day-trip of 600 miles (10 to 12 hours) plus time for birding is possible. Table 1 shows a frequency distribution of trips by distance. Over half of the households travel more than 150 miles for a day trip. Table 2 show the median distance traveled per household by the number of trips taken.

3. The Travel Cost Model in Negative Binomial Form

The travel cost model (TCM) has a long tradition in environmental economics (Freeman (2003)). It treats a person's price of a recreation trip as his/her travel and time cost of reaching the site. Since people live at different distances from a given site, there is natural price variation among visitors. The further a person lives from the site, the higher his/her price. Observing a decline in the number trips taken with distance from the site is synonymous with a downward sloping demand curve (Parsons, 2003). A travel cost demand model is derived from a classical constrained utility maximization problem where utility is twice differentiable and there is a linear budget constraint. Maximizing utility gives a Marshallian demand function for household i of the form

(1) $x_i = f(tc_i, tcs_i, z_i)$

where x_i is the number of trips taken by household i in a season, tc_i is the trip cost to the site, tcs_i is a vector of trip costs to substitute sites, and z_i is a vector of individual respondent characteristics. In the Negative Binomial form household i's probability of taking x_i trips during the season *correcting for on-site sampling* is given by

(2) $$pr(x_i \mid x_i > 0) = x_i \cdot \frac{\Gamma\left(x_i + \alpha^{-1}\right)}{\Gamma(x_i + 1) \cdot \Gamma\left(\alpha^{-1}\right)} \cdot (\alpha^{x_i} \lambda_i^{x_i - 1}) \cdot (1 + \alpha\lambda_i)^{-(y_i + \alpha^{-1})},\ x_i = 1, 2, ...$$

where Γ is a gamma distribution and λ_i is the expected number of trips.[3] The parameter $\alpha \geq 0$ is a measure of dispersion. A large α indicates observations are 'over-dispersed' with respect to the Poisson model. In some applications α is allowed to vary across respondents introducing heterogeneity. In our model it is fixed. In estimation the expected number of trips taken by household, it has the form

(3) $$\lambda_i = \exp\{f(tc_i, tcs_i, z_i; \beta)\}$$

and serves as our demand function (equation (1)).

Consumer surplus or access value has the familiar per season (CS_i) and per trip (cs_i) forms

(4) $$CS_i = \frac{\hat{\lambda}_i}{\hat{\beta}_{tc}} \text{ and } cs_i = \frac{\hat{\lambda}_i}{\hat{\beta}_{tc}} \frac{1}{\hat{\lambda}_i} = \frac{1}{\hat{\beta}_{tc}}$$

where $\hat{\lambda}_i$ and $\hat{\beta}_{tc}$ are estimates. $\hat{\beta}_{tc}$ is the parameter estimate on trip cost.[4] We report the latter and also account for sensitivity over models that include and exclude covariates with trip cost and use different measures for the opportunity cost of time. Given the uncertainty and importance of

[3] This is the NB2 version of the Negative Binomial (see Cameron and Trivedi (1998, p. 70)). We used STATA code from Hilbe and Martinez-Espineira (2005) to estimate our model.

[4] See Englin and Shonkwiler (1995, p 109) for compensating and equivalent variation measures.

this piece of the trip cost, we felt sensitivity analysis would be important in any applications that might use these values.

4. Model Specification and Variable Definitions

The dependent variable x_i in our study is defined as a day-trip to the area for the primary purpose of viewing the horseshoe crab/migratory shorebird occurrence on the Delaware Bay during the 2008 migration. In our application demand is specified as

$$(6) \qquad E(x_i) = \lambda_i = \exp\left(\beta_{tc} tc_i + \beta_{tcs} tcs_i + \boldsymbol{\beta}_z \boldsymbol{z}\right)$$

where tc_i is the trip cost of traveling to a birding site on the Delaware Bay, tcs_i is the trip cost of reaching a site on the New Jersey side of the Delaware Bay which serves as our substitute site, and z_i is a vector of individual characteristics believed to influence a household's decision to take a birding trip. Trip cost is defined as the sum of round trip travel and time cost and has the following form

$$(7) \qquad tc_i = \left(.20 \cdot dist_i\right) + \left(v \cdot \frac{income_i}{2040} \cdot time_i\right)$$

where $dist_i$, is the round trip distance to the birding sites, $time_i$, is the round trip time to the sites, and $income_i$, is household income. We let $v = 0,\ .33,\text{ and } 1$ for sensitivity analysis on the value of time. We used Google Maps© to calculate time and distance and we used the site where the household was intercepted as the destination site in this calculation. For travel cost, we used the

Automobile Association of America's (AAA) cost of operating a vehicle in the summer of 2008 (20 cents/mile).[5] We use income divided by the number of working days in a year (2040) as a proxy for wage and then one-third of that wage as a proxy for opportunity cost of time. The substitute site price was calculated in the same way for each person. We used Reeds Beach in New Jersey as the substitute. Reeds Beach is one of the largest and most popular sites in New Jersey for viewing shorebirds including the Red Knot. The vector z_i includes household income and a set of variables intended to capture intensity of interest in birding. This includes the current market value of birding equipment owned, membership in a birding club, and whether or not the respondent viewed the wood sandpiper. In May of 2008, the wood sandpiper was spotted on the Delaware coast, making this its third appearance in the United States since 1907. The Wood Sandpiper is typically found in Siberia and parts of Australia, so its presence in the Delaware Bay area was extremely rare. Of all the birders we intercepted, we thought that birders who made a specific trip see this species might be among the more avid birders. We present descriptive statistics for all of the variables used in the model in Table 3.

5. Results & Conclusions

Our estimation results are shown in Table 4 using time costs at zero, one-third, and full wage. As expected, the coefficient on trip cost is negative and statistically significant in all models. The coefficient on trip cost to the substitute site is positive but insignificant. Two of the three birding intensity variables help predict trips: viewing the wood sandpiper and the market

[5] Our estimate of travel cost includes gas plus half of the AAA depreciation costs. These are incremental costs associated with the trip. Our use of half of the depreciation costs is arbitrary but using the full depreciation would be in error since some is due simply to aging. Our data are from http://www.aaaexchange.com/Assets/Files/20084141552360.DrivingCosts2008.pdf .

value of household birding equipment. Both have positive and significant coefficients. Club membership, on the other hand, was statistically insignificant across the models. Income was also a poor predictor of choice as is often the case in recreation demand models. Our parameter estimates for $\ln(\alpha)$ also suggests that our data has some over-dispersion but the statistical significance is not large.[6]

Table 4 also presents the welfare estimates along with sensitivity analysis over opportunity cost of time and inclusion of covariates. Using one-third of the wage instead of the full wage gives welfare estimates (access values) that are 45% of the full wage values. Using no time cost gives estimates that are 22% of the full wage values. If the opportunity cost of time is lower, people are revealing a lower willingness to forgo other resources when taking a trip. The exclusion of covariates from the model caused values to increase by 25% in the no-wage model, 35% in the 1/3 wage model, and 50% in the full wage model. The trip cost coefficient in all cases dropped by more than we had anticipated. This implies that we are controlling for some important influences in our covariate selection and that some are correlated with trip cost. Our final values range from $32/trip/household to $215/trip/household. If one accepts 1/3 the wage as the appropriate measure for the value of time, as seems to be the norm in the literature, our best estimate is $64/trip/household.

Rosenberger and Loomis' (2001) value for wildlife viewing converted to 2008$ ranges from $3 to $221/trip/person with a mean of $41. Our estimated values (after adjusting from

[6] We also estimated our model in Possion form and considered versions of both Possion and Negative Binomial that ignored truncation and on-site sampling and that accounted for truncation but ignored on-site sampling. Since our reported model clearly dominates all of these, they were not included here.

household to person) range from $19 to $130/trip/person.[7] Using 1/3 the wage and the model with all covariates, our best estimate is $38/trip/person. All wildlife viewing, of course, is not the same. It varies by place, time, and type of wildlife. Also, methods and data used in the studies are quite variable. Nevertheless, our results are some validation for their widely used estimates. Our results also highlight the importance of the value of time and covariates a researcher chooses to include in a model. The former is well-known, the latter less so.

Finally, in a companion study covering the same sample of users we ask a simple contingent valuation question: "Suppose the cost to you to make this trip possible had been $XX more than it actually cost. Would you still have made this trip?" The best estimate of the value of a day trip from that study was $40-$60 per person (Myers, Parsons, and Edwards (2010)). So, our travel-cost estimates are on the lower end of that range. We also predicted total visitation for a season in that analysis at about 3,363 households (or 5,583 persons). This gives and annual birdwatching use value using the travel-cost model of $215,000. This estimate, of course, ignores nonuse values and values related to other uses of the resource.

Acknowledgements

We would like to thank Delaware State Wildlife Biologist Kevin Kalasz, Dawn Webb and other Delaware Division of Fish and Wildlife staff as well as the Delaware Ornithological Society for their assistance with survey development and implementation. Andy Krueger, Meredith

[7] Average household size was 1.66 in our sample.

Blaydes-Lilley, Jon Lilley, Ami Kang and Kate Semmens provided invaluable assistance with survey administration in the field, and Michael Hidrue helped with some last minutes glitches in model estimation. This study was made possible with funding from NOAA Sea Grant and Dupont Clear into the Future.

References

Cameron, A.C. and P.K. Trivedi (1998). Regression Analysis of Count Data Cambridge, England.

Creel, M. and J. B. Loomis (1990). Theoretical and empirical advantages of truncated count data estimators for analysis of deer hunting in California. *American Journal of Agricultural Economics* 72, 434–441.

Donovan, G. and P. Champ, (2009). The Economic Benefits of Elk Viewing at the Jewell Meadows Wildlife Area in Oregon. *Human Dimensions of Wildlife*. 14: 51-60

Englin, J. and J. Shonkwiler (1995). Estimating social welfare using count data models: An application under conditions of endogenous stratification and truncation. *Review of Economics and Statistics* 77, 104–112.

Englin, J. E., T. P. Holmes, and E. O. Sills (2003). Estimating forest recreation demand using count data models. In E. O. Sills (Ed.), Forests in a Market Economy, Chapter 19, pp. 341–359. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Eubanks, T.L. Jr, J.R. Stoll and P. Kerlinger (2000). Wildlife-associated Recreation on the New Jersey Delaware Bay Shore. Austin, Texas: Fermata, Inc

Eubanks, J., T.L., J. R. Stoll, and R. B. Ditton, (2004). Understanding the diversity of eight birder sub-populations: sociodemographic characteristics, motivations, expenditures and net benefits. *Journal of Ecotourism* 3:151-172.

Freeman, M. A., (2003). The measurement of environmental and resource values: Theory and methods (2nd ed.). Washington, DC: Resources for the Future Press

Glowinski S.L., (2008). Bird-Watching, ecotourism, and economic development: A review of the evidence. *Applied Research in Economic Development*, vol. 5 issue 3, December 2008:

Daniel M. Hellerstein (1991) Using Count Data Models in Travel Cost Analysis with Aggregate Data. *American Journal of Agricultural Economics.* 73(3): 860-866

Hellerstein, D. and R. Mendelsohn (1993). A theoretical foundation for count data models. *American Journal of Agricultural Economics* 75 (3), 604–611.

Hilbe, J.M., 2005. GNBSTRAT: Stata module to estimate generalized negative binomial with endogenous stratification. Statistical Software Components, Boston College Department of Economics, available online at http://ideas.repec.org/c/boc/bocode/s456413.html

Hilbe,J.M., Martínez-Espiñeira, R., (2005). NBSTRAT: Stata module to estimate negative binomial with endogenous stratification. Statistical Software Components, Boston College Department of Economics, available online at http://econpapers.repec.org/software/bocbocode/s456414.htm

Isaacs, J. C. and Y.N. Chi. (2005) A Travel Cost Analysis of a Bird Watching Festival: The Grand Isle Migratory Bird Celebration. Louisiana Department of Wildlife and Fisheries: Baton Rouge, LA, October, 2005.

MacMillan, D., N. Hanley, M. Daw, (2004). Costs and benefits of wild goose conservation in Scotland. *Biological Conservation* 119: 475-485.

Martínez - Espiñeira, R. and J. Amoako-Tuffour (2008). Recreation demand analysis under truncation, overdispersion, and endogenous stratification: An application to Gros Morne National Park. *Journal of Environmental Management* 88:1320-1332.

Myers, K. H., G. R. Parsons, P. E. T. Edwards (2010). Measuring the recreational use value of migratory shorebirds: a stated preference study of birdwatching on the Delaware Bay. *Marine Resource Economics* 25: 247-64.

McConnell, K. E. and I. Strand (1981). Measuring the cost of time in recreation demand analysis: An application to sportfishing. *American Journal of Agricultural Economics* 63 (1), 153–156.

McKean, J. R., D. M. Johnson, and R. G. Walsh (1995). Valuing time in travel cost demand analysis: An empirical investigation. *Land Economics* 71 (1), 96–105.

Ovaskainen, V., J. Mikkola, and E. Pouta (2001). Estimating recreation demand with on-site data: An application of truncated and endogenously stratified count data models. *Journal of Forest Economics* 7 (2), 125–144.

Parsons, G. R. (2003). The travel cost model. In P. A. Champ, K. J. Boyle,and T. C. Brown (Eds.), A Primer on Nonmarket Valuation, Chapter 9.London: Kluwer Academic Publishing.

Reaves, D.W., R. A. Kramer and T.P. Holmes, (1999). Does question format matter? Valuing an endangered species. *Environmental and Resource Economics* 14: 365–383, 1999

Rockel , M.L. and M.J. Kealy, (1991). The Value of nonconsumptive wildlife recreation in the United States. *Land Economics*, Vol. 67 (4): 422-434

Rosenberger, R.S.; J.B., Loomis, (2001). Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Rubin, J., G. Helfand and J. Loomis, (1991). Benefit cost analysis of the Northern Spotted Owl. Results from a contingent valuation survey. *Journal of Forestry* 89(12):25-30

Shaw, D. (1988). On-site sample regression: Problems of non-negative integers, truncation, and endogenous stratification. *Journal of Econometrics* 37, 211–223.

Stoll, J.R., Ditton, R., Eubanks, T., (2006). Platte River Birding and the Spring Migration: Humans, Value, and Ecological Resources. *Human Dimensions of Wildlife* 11: 241-254

Table 1: Distance Traveled by Household

Distance Traveled One-Way in Miles	Number of Households	Cumulative Percent of Sample
< 10	10	4%
10 – 20	15	11%
21 – 40	13	17%
41 – 50	16	24%
51 – 80	17	32%
81 – 100	13	38%
101 – 150	24	48%
151 – 200	31	62%
201 – 300	85	100%
Total	**224**	**--**

Table 2: Median Distance Traveled by Number of Trips Taken[1]

Number of Trips	Median Distance Traveled One-Way in Miles
1	201
2	185
3	109
4	83
5	67
6	97
7	57
8	76
9	46
10	94
11	74
12	74
13 - 14	60
15 - 19	24
20 - 30	19
31 - 41	20

1. Our 224 respondents took 905 trips.

Table 3: Summary of the Variables Used in the Econometric Model (*n* = 224)

Parameter	**Mean**	**SD**	**Description**
Day Trips	4.10	5.20	Visit on which a person leaves and returns home on the same day
Trip Cost	$115.38	109.78	Round trip travel plus time cost using 1/3 wage. See equation (7). (2008$)
Substitute Site Trip Cost	$204.55	109.83	Round trip travel plus time cost using 1/3 wage. See equation (7). (2008$)
Membership in a Birding Club	0.55	0.50	1= yes, 0= no
Viewed the Wood Sandpiper	0.13	0.34	1= yes, 0= no
Household Income	$106,508	65,512	2008$
Equipment Value	$3,914	6,422	2008$

Table 4: Estimation Results from Negative Binomial Model Correcting for On-site Data Collection (t-statistics in parenthesis)

	Model with Value of Time Set = 0	**Model with Value of Time = 1/3 Wage**	**Model with Value of Time = Full Wage**
Travel Cost	-0.0316 (7.9)	-0.0157 (6.6)	-0.00704 (5.6)
Substitute Site	0.0015 (0.6)	0.0003 (0.2)	-0.0002 (0.2)
Bird Club	-0.051 (0.3)	-0.131 (0.7)	-0.204 (1.1)
View Wood Sandpiper	0.544 (2.4)	0.527 (2.2)	0.550 (2.3)
Income ($10,000)	-0.0226 (1.5)	0.035 (1.7)	0.056 (2.2)
Equipment ($1,000)	0.052 (3.6)	0.054 (3.3)	0.053 (3.0)
Constant	0.448 (0.7)	-0.766 (0.5)	-3.23 (0.2)
$\ln(\alpha)$	1.323 (1.7)	2.230 (1.5)	4.598 (0.3)
Log-Likelihood	-444.37	-452.15	-458.52
χ^2	132.09	105.23	86.15
Sample Size	224	224	224
Per Trip Per Household Access Values (2008$)	**$31.65**	**$63.69**	**$142.05**
95% CI rounded	**($18 – 45)**	**($39 – 94)**	**($86 - 221)**
Per Trip Per Household Access Values From Same Model estimated without Covariates (2008$)	**$39.17**	**$86.13**	**$215.39**
95% CI rounded	**($31 - 48)**	**($63 - 110)**	**($105 - 325)**

Figure 1 Data Collection Sites on the Delaware Bay: Port Mahon and Mispillion Harbor