# A Policy Tool for Evaluating Investments in Public Boat Ramps in Florida: A Random Utility Model Approach

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## Overview

Across the country many people engage in recreational boating. In 2008 there were over 12 million registered recreational boats in the United States, and nearly 8% of these were in Florida (US Coast Guard, 2008). Launching boats from publically available ramps is one of the primary methods of marine access. Within Florida, nearly 25% of all boating related trips in 2007 involved launching a trailered boat from a publically available ramp (Florida Fish and Wildlife Conservation [FWC], 2009). Lee County is one of the principle marine access counties within Florida and accounts for roughly 3% of all ramp-based boating trips (FWC, 2009). With hundreds of thousands of boating trips from dozens of publically accessible ramps, Lee County planners need analytical tools to understand demand and consumer surplus to assist them in evaluating new and enhanced launch facilities.

The boat ramp infrastructure in Lee County, Florida provides economic benefits to boaters that use the ramps to access Florida's waters. These economic benefits accrue to the boater's themselves, in the form of increased well-being and satisfaction from boating, and these benefits are above and beyond the direct costs of boating. Economists refer to such benefits as economic surplus. These benefits form the basis for benefit-cost analyses that are conducted in accordance with the norms of economic science. In this paper, we present the results and application of models capable of estimating such benefits.

The economic models developed here are models of the demand for access to boating sites and are suitable for valuing access as well as the characteristics of boating sites. The methods use "Random Utility Models (RUMs)" as the basis of the economic demand models. RUMs use data on individual trips and statistical techniques to explain boaters' site choices and to relate these choices to the costs and characteristics of alternative boating sites (Morey, 1999). Boaters' optimizing choices reveal their relative preferences for site characteristics and travel costs, i.e., the boaters' willingness to trade costs (or money) for site characteristics. Through this linkage, RUMs can value changes in site characteristics such as capacity.

## Background

Recreational behavior based on boating may be termed a non-market or public good because there is no direct charge to recreational boaters for access to Florida's waters. Yet, boating is not without costs, sometimes substantial: the purchase of a boat, licensing and registration, operation and maintenance costs, the costs of mooring the boat or of travel to the site, and the opportunity cost of time, to name some of the more obvious. Costs related to travel can be used to estimate the demand for recreational boating and evaluate the potential changes in welfare resulting from proposed polices.

This paper addresses the Fish and Wildlife Conservation Commission's objective of developing an integrated system of "…economic models necessary to predict the marginal social benefits of adding or reconstructing boating access facilities", by developing a series of individual-based random utility models (RUM) of consumer choice. Marginal social benefit (or marginal economic value) refers to the *change* in the social benefits provided by access to boating sites that is due to a change in either the characteristics of boating sites or access to boating sites. RUMs are state-of-the-art economic tools that are designed to measure the welfare implications of policy decisions that effect the provision and quality of public goods and services. They have been successfully employed by decision makers throughout the United States and Florida to measure the marginal economic value from policy changes for a wide variety of public goods and services (Milon, 1988; Bockstael, McConnell, and Strand, 1989; Morey, Rowe, and Watson. 1993; Greene, Moss, and Spreen, 1997; Thomas and Stratis, 2002).

When estimating a model of demand for public goods such as boat ramps, anchorages and beaches, the RUM approach is particularly well suited when there are many identifiable substitutes from which to choose. In the mid-1990's, the Florida Department of Environmental Protection

(FDEP) successfully used a RUM to estimate the recreational value that was lost to beach visitors following the 1993 Tampa Bay oil spill (Tomasi and Thomas, 1998). Bockstael, Hanemann, and Strand (1989); Milon (1988); Morey, Rowe, and Watson (1993), Greene, Moss, and Spreen (1997) Chen, Lupi and Hoehn (1999), and Lupi, Hoehn and Christie (2003) have applied RUMs to estimate marginal changes in welfare resulting from perturbations in recreational fishing and boating. More recently, FWC has used a RUM to evaluate the welfare lost to boaters from policies designed to protect the West Indian manatee in Lee County (restricted boating speeds and waterway access) and later they extended their modeling efforts to Brevard County in 2003 (Thomas and Stratis, 2002; FWC, 2003).

## Random Utility Model

In our application, it is assumed that a boater will choose a combination of a launch ramp and water destination among many possible alternatives each time he wants to make a trip. The factors that affect his choice include the cost of traveling to the ramp and the cost of boating to the water destination, and the characteristics of the ramp and water site. We can model the individual's conditional indirect utility from site j as a linear function of trip costs and site characteristics given by by $tc_j$ and $q_j$.

$$v_j = \beta_{tc} tc_j + \beta_q q_j + \varepsilon_j \qquad [1]$$

where $tc_j$ is the cost of traveling to the site j, $q_j$ is a vector of the site j characteristics, $\varepsilon_j$ is a random error term accounting for factors that remain unobservable for the researchers, and the $\beta$s are parameters. The absolute value of the travel cost parameter $\beta_{tc}$ is hypothesized to be negative and serves as a measure of the marginal utility of income. The elements of vector $\beta_q$ are the marginal utilities of site characteristics and are expected to be positive if the characteristics are desirable and negative if undesirable. Following RUM theory, a person is assumed to select the site with highest utility. Thus, the probability of an individual choosing site i is given by

$$\Pr(\beta_{tc} tc_i + \beta_q q_i + \varepsilon_i > \beta_{tc} tc_j + \beta_q q_j + \varepsilon_j) \quad \text{for all } i \neq j \qquad [2]$$

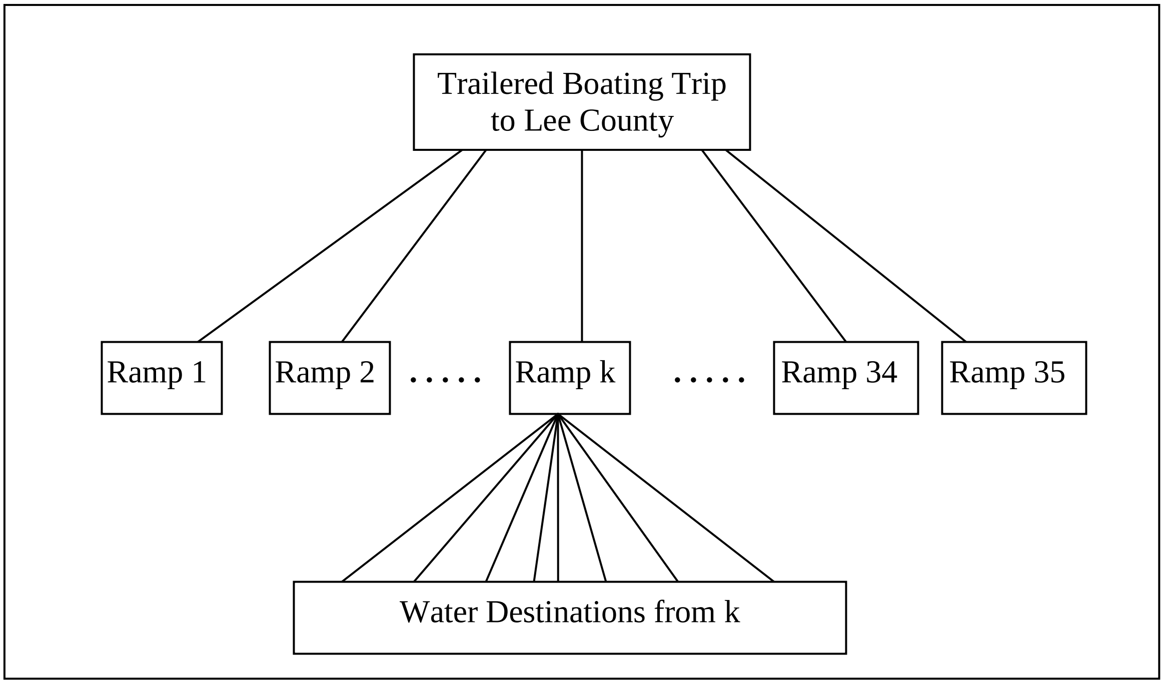
Assuming the random errors to be independently identically distributed type I extreme value distributed, the equation [2] can be estimated by a conditional logit model. In our case we expect that the errors associated with the water destinations are more correlated with one another than they are with ramp error terms, so we adopt a nested logit model in which the water destination sites are nested below ramp sites. Although the decision of ramp and water site is assumed to be made simultaneously, this two-level nesting structure is akin to an individual choosing a ramp and then choosing the water site conditional upon the selected ramp (see Figure 1).

Let k represent Lee County ramps and j represent the on-the- water sites. A water destination from a ramp is represented by combination of (j, k). The equations can be rewritten as

$$v_{jk} = \beta_{tc} tc_{jk} + \beta q_{jk} + \varepsilon_{jk} \qquad [3]$$

$$\Pr(\beta_{tc} tc_{il} + \beta_q q_{il} + \varepsilon_{il} > \beta_{tc} tc_{jk} + \beta_q q_{jk} + \varepsilon_{jk}) \qquad \text{for all } \; i \neq j \text{ and } l \neq k \qquad [4]$$

**Figure 1: Illustration of Two-Level Nested Logit Model Structure**



Let Pr(j,k) be the probability of choosing site (j, k) from among all feasible combinations, that is the probability that indirect utility from site (j, k) exceeds the indirect utility from any other site. Assuming error terms $\varepsilon_{jk}$ is distributed as generalized extreme value, then following Haab and McConnel (2002), the probability of choosing site (j, k) is

$$\Pr(j,k) = \frac{\exp(v_{jk})[\sum_{j=1}^{J_k}\exp(v_{jk})]^{\theta_k - 1}}{\sum_{k=1}^{K}[\sum_{j=1}^{J_k}\exp(v_{jk})]^{\theta_k}} \qquad [5]$$

where $\theta_k \ \forall k$ are nested logit distributional parameters to be estimated. To clarify our estimation approach, write Pr(j, k) as the product of the conditional probability of choosing site j, given ramp k, Pr(j|k), times the marginal probability of choosing ramp k, Pr(k). That is,

$$\Pr(j,k)=\Pr(j\mid k)\Pr(k)=\frac{\exp(v_{jk})}{\sum_{j=1}^{J_k}\exp(v_{jk})}*\frac{\sum_{k=1}^{J_k}\exp(v_{jk})}{\sum_{k=1}^{K}\sum_{j=1}^{J_k}\exp(v_{jk})}\quad , \qquad [6]$$

where Pr(j|k) and Pr(k) are given by

$$\Pr(j\mid k)=\frac{\exp(v_{jk})}{\sum_{j=1}^{J_k}\exp(v_{jk})}\quad \text{and} \qquad [7]$$

$$\Pr(k)=\frac{\sum_{k=1}^{J_k}\exp(v_{jk})}{\sum_{k=1}^{K}\sum_{j=1}^{J_k}\exp(v_{jk})}\quad . \qquad [8]$$

A common expression for Pr(k) is

$$\Pr(k)=\frac{\exp(\theta_k IV_k)}{\sum_{k=1}^{K}\exp(\theta_k IV_k)} \qquad [9]$$

where $IV_k=\ln(\sum_{j=1}^{J_k}\exp(v_{jk}))$ is known as the inclusive value for nest k and $\theta_k$ is the inclusive value parameter. Note too that if the utility function contains characteristics that do not vary across water sites but do vary across ramps, we can re-write equation [9] as

$$P_{ijk} = \exp(\beta Z_k+\theta IV_{j|k})\,/\,\sum_{k}^{n}\exp(\beta Z_k+\theta IV_{j|k}) \qquad [10]$$

Note that the two choice probabilities take the conditional logit form. A consistent estimation strategy for nested logit is to estimate two conditional logits, linked by the lower level inclusive value index. We present the sequentially estimated model below with the first part corresponding to water site choices conditional on a ramp and the second part corresponding to the ramp choices as a function of the inclusive value of the water sites available from each ramp.

The resulting estimated model can be used for policy analysis. The measure of welfare change (benfits or damages) follows the earlier work of Small and Rosen (1982) and Morey (1999). The post-policy welfare can then be calculated as equivalent variation,

$$EV = -\frac{1}{\beta_1}\left[\ln\sum_{k=1}^{n+1} e^{V_{postpolicyy}} - \ln\sum_{k=1}^{n} e^{V_{prepolicyy}}\right] \qquad [11]$$

where $V_{prepolicy}$ is the utility derived from the pre-policy, the current status quo, with n sites available, and $V_{postpolicy}$ is the utility derived from the addition of one site and $\beta_1$ is the parameter for travel cost that represents the marginal value of money. This welfare measure is suitable for the estimation of the benefits of changes in any of the site attributes or the addition or removal of a site (e.g., what happens is a new ramp is opened up).

## Results

The first step in estimating the choice model is to define those ramps that are available to the boating public. Ramps that are closed to public access are excluded from the analysis. Of the 97 Lee County inventoried ramps, 55 ramps are not available for public use for a variety of reasons including temporary closures, private or gated facilities and government ramps only open for official use. Included in the remaining 42 ramps are the obvious stand-alone public ramps and public access marinas with launch lanes.

Next, the juxtaposition of ramps to one another was considered. When choosing an access point, boaters likely consider ramps in close proximity to one another as members of a larger group or aggregate. For example, if the parking lot of one site is full the boater could easily move along to the nearby neighboring ramp with no significant increase in travel time or cost. Nearby ramps should be lumped together to capture this choice behavior, therefore ramps within 1.5 road miles of each other were grouped and considered single aggregated facilities. For Lee County, twelve ramps were aggregated into five groups leaving a total of 35 individual ramp choices (See Table 1).

With the ramps selected, the next step in preparing the data involved identifying on-the-water destination sites. FWC constructed a statewide GIS grid overlay comprised of 73,485 one-mile-square cells. Each grid cell contained at least 30 variables representing cell attributes including the presence or absence of salt and/or fresh water, natural and/or artificial reefs, sea grass, navigational aids, manatee protection status and marine protection/conservation status. Information also included bathymetry data and lake acreage among other variables. For Lee County, the one-mile-square grid cells were aggregated into 12 square mile polygons and cell attributes were statistically averaged for each polygon. In the boating survey, boaters were asked to identify their on-the-water destination using a geo-referenced mapping system. Their choice was then linked to the correct polygon with its aggregated site attributes. To avoid long distance trips, those clearly beyond a “normal” day trip, a 10% distance trim was employed, reducing the number of actual destination sites for Lee County boaters to 71.

Statewide there were 26,771 trip-level responses during the 12 month sampling period. Of this number, 6,690 (25%) reportedly used a boat ramp during their trip. Of those using a boat ramp, 195 (2.9%) used Lee County ramps. Some of these trips used private access (not valid for a public access model) and others failed to select a valid boat ramp so were removed from the analysis. After adjusting for a 10% distance trim, a total of 153 valid trips were available for the RUM analysis.

**Table 1. List of Lee County Public Boat Ramps (n=35)**

| Group Number | Name |
|---|---|
| 1000039 | BMX Strausser |
| 1000040 | Alva Boat Ramp |
| 1000041 | Burnt Store Boat Ramp |
| 1000043 | Cape Coral Yacht Basin |
| 1000044 | Lovers Key / Carl E. J |
| 1000046 | City of Fort Myers Yacht Basin |
| 1000047 | Fort Myers Shores Davis Boat Ramp |
| 1000049 | Franklin Locks North |
| 1000050 | Franklin Locks South |
| 1000051 | Bokeelia Boat Ramp & Cottages |
| 1000052 | Horton Park |
| 1000053 | Imperial River Boat Ra |
| 1000056 | Koreshan State Historic Site |
| 1000057 | Punta Rassa Boat Ramp |
| 1000058 | Sanibel Island |
| 1000078 | Ramp by Bonita Beach R |
| 1000079 | Cape Harbour Marina |
| 1000082 | Ramp on Ohio Avenue |
| 1000099 | Castaways Marina |
| 1000100 | Tween Waters Marina |
| 1000101 | Mullock Creek Marina |
| 1000103 | Fish Trap Marina |
| 1000104 | Riverside Park |
| 1000119 | Pine Island Commercial |
| 1000120 | Leeward Yacht Club #2 |
| 1001593 | Russell Park Ramp |
| 3000965 | Burnt Store Marina and |
| 3001001 | Pineland Marina |
| 3001115 | Terra Verde Country Club |
| 4000000 | Judd Park |
| 9350010 | Jug Creek Cottages, Malu Lani Inn, Bocilla Marina |
| 9350020 | Monroe Canal Marina, St. James Marina |
| 9350040 | Viking Marina, Matlacha Park, D&D Tackle |
| 9350150 | Hickory Bait & Tackle, Coconut Point Marina |
| 9350190 | Inlet Motel, Captain Con's Fish House |

Note: the last five groups are aggregated ramps, comprised of two or more single ramps.

The estimation results for the model of water site choices, conditional upon a ramp, is presented in Table 2. The table gives the estimated parameters, their standard errors (S.E.), and the significance levels at which the parameters would become significant (p-values). A variable is referred to as “significant at the X% level” if we would reject the hypothesis that it is zero with a confidence that we were correct in all but X% of the cases. The dependent variable in the model reported in Table 2 is the water destination chosen by survey respondents. The overall model is significant based on a chi-squared test of the joint parameter values. The travel cost for boating on the water is significant and of the expected sign. Recall that the cost was computed using the statute miles computed between the ramp latitude longitude and the latitude longitude for water site grids. The distance for this was computed using the Haversine method accounting for the curvature of the earth.

**Table 2: Random Utility Model Estimates for Choice of Water Sites**

| **Variable (Water Site Characteristic)** | **Estimated Parameter** | **S.E.** | **p-value** |
|---|---|---|---|
| **Travel cost** | -0.4609 | 0.0452 | 0.0000 |
| **Navigation aids** in grid | -0.9250 | 0.4908 | 0.0595 |
| **Artificial reef** in grid | -5.1340 | 2.3967 | 0.0322 |
| **Marine protected or conservation zone** in grid | 2.1276 | 0.3721 | 0.0000 |
| **Manatee zone** in grid | -1.2558 | 0.4550 | 0.0058 |
| **Mean depth** | 0.3174 | 0.0672 | 0.0000 |
| **Nearest ramp distance** | -0.4411 | 0.0904 | 0.0000 |

N=153
LogL = -516.65
McFadden R2 = 0.209

The results indicate that the final water destinations chosen by survey respondents are less likely to be in grids with navigation aids (significant at 10% but not at 5%). Similarly, grids with artificial reefs were less likely to be selected as the water destination. Water sites with marine protected zones or with conservation zones within the grid were significantly more likely to be chosen. Alternatively, water grids with a manatee zone were significantly less likely to be selected as the water destination. The mean depth of a grid was positively associated with the water destination. Finally, the distance from the water site to the nearest ramp (defined as any ramp, not just the ramp they launched from) was negatively associated with the water destination. In sum, preferred water destinations had low travel costs, were close to a ramp, and near a conservation zone yet were in deeper water away from navigation aids, artificial reefs and manatee zones.

**Table 3: Random Utility Model Estimates for Choice of Ramp Groups**

| **Variable (Ramp Characteristic)** | **Estimated Parameter** | **S.E.** | **p-value** |
|---|---|---|---|
| **Travel cost** | -0.0299 | 0.003 | <0.0000 |
| **Inclusive value** of water sites | 0.4586 | 0.126 | 0.0003 |
| **Number** of sites within group | 0.8701 | 0.138 | <0.0000 |
| **Average parking** size (1000's) | 0.0328 | 0.008 | 0.0001 |
| **Parking condition** index | 0.8340 | 0.328 | 0.0111 |
| **Ramp development** index | 4.4716 | 0.618 | <0.0000 |
| **Marina** | -1.4790 | 0.237 | <0.0000 |

N=153
LogL = -391.25
McFadden R2 = 0.281

The estimation results for the model of ramp site choices is presented in Table 3. The table gives the estimated parameters, their standard errors (S.E.), and the significance levels at which the parameters would become significant (p-values). The overall model is significant based on a chi-squared test of the joint parameter values. The travel cost for getting to the ramp is significant and of the expected sign. This cost was computed using the miles traveled and the launch fees which vary by ramps. The miles traveled was derived from the PC-miler software by adding the road miles from the origin of the trip to the location the boat is kept (which are the same in many cases) to the road miles from there to the latitude longitude associated with each of the ramp groups. It is assumed ramps in close proximity to one another would be viewed by many boaters as close substitutes, therefore all ramps within 1.5 road miles of each other were aggregated into groups. Travel costs were then the sum of the launch fee, bridge tolls, the driving cost assuming towing ($0.50 per mile) and the time costs derived as the driving time (miles/45 mph) multiplied by the time value (annual income/2080 hours per year).[1]

The inclusive value parameter for water sites is significant, and the parameter lies between 0 and 1 which is consistent with theory for nested logits (Morey, 1999). The parameter is also significantly different than one which indicates the superiority of the nesting structure relative to a simple un-nested conditional logit model. The number of ramps within a group was positive and significantly different than zero. The theory of aggregation of sites with random utility models suggests that the number of elements in a group should have a parameter of one (Lupi and Feather, 1998), and our result is consistent with the aggregation theory since the parameter on the number of ramps in a group is not significantly different from one.

The average parking size is significant and positive, as is the index of parking condition. Ramps with higher levels of development (measured by average facility counts) were significantly preferred to those with lower levels of facilities. However, being a marina was less preferred by those trailering their boats to a ramp.

Table 4 presents information for the specific ramp groups. The second column shows the survey data on ramp choices (giving both the ramp shares and the frequencies). The third major column presents the predicted probability of selecting a ramp based on the RUM. We can see that the model fit roughly corresponds to the distribution of the sample shares. In particular, the model predicts the highest site visitation probability for our site with the most visits and similarly predicts relatively

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[1] Travel times for two sites (Sanibel and Lovers Key) were adjusted downward to 20 mph for a portion of their travel distance to account for slower speeds on causeways and highly congested areas.

high visitation for sample sites with high visitation. Similarly, most of the sites that received low or no visits are predicted to have low probabilities of use.[2]

The final column shows the access value for each of the ramps using the equivalent variation calculation of equation (11). This value represents the lost economic value to boaters of loosing access to the site, yet retaining access to the other Lee county sites. The value is in the range in the literature and higher than the recently reported values for access to Hawaii ramps (Haab, Hamilton and McConnell, 2008). It important to not that the values reported in Table 3 are values that accrue to all ramp boating trips made to Lee County (i.e., the scope of choices in the model). These are not the values for a specific visitor that has visited a ramp for which access is lost. Such values are commonly reported in the literature that uses single site models. In the RUM, we can approximate such site specific values by dividing the Lee County trip values by the probability of making a Lee County trip to a specific ramp. If we make these adjustments for the trips to a particular ramp, we get values in the range of $30-40 per trip to a specific ramp. Such values are consistent with the range of user day values found in the recreation literature.

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[2] Although the model fits the sample data extremely well, our sample predicts a high share of boat launches from Matlacha Park. Local knowledge suggests that Matlacha does not receive such high visitation, perhaps because the waterways around Matlacha are difficult to maneuver and benefit from local knowledge. As such, few out-of-state boaters visit these sites (personal correspondence, blank blank). We note that our sample does not include out-of-state boaters so we cannot capture this effect with our data.

### Table 4: Estimated Site Values and Observed and Predicted Trips to the Ramp Groups

| Ramp Group Name | Survey Data on Ramps | | Predicted Probability a Lee County Trip is to a particular ramp | Access Value of Ramp (per Lee County Trip)* |
|---|---|---|---|---|
| | Visitation Shares | Frequency | | |
| BMX Strausser | 0.0% | 0 | 0.032 | $1.09 |
| Alva Ramp | 0.0% | 0 | 0.006 | $0.20 |
| Burnt Store Ramp | 5.9% | 9 | 0.059 | $1.99 |
| C. Coral Yacht Basin | 5.9% | 9 | 0.048 | $1.64 |
| Lovers Key | 9.2% | 14 | 0.070 | $2.71 |
| Ft. Myers Yacht Club | 6.5% | 10 | 0.033 | $1.11 |
| Ft. Myers Shores | 0.7% | 1 | 0.010 | $0.34 |
| Franklin Locks North | 0.0% | 0 | 0.008 | $0.28 |
| Franklin Locks South | 0.7% | 1 | 0.013 | $0.40 |
| Bokeelia Ramp | 0.7% | 1 | 0.018 | $0.62 |
| Horton Park | 9.2% | 14 | 0.144 | $5.27 |
| Imperial River Ramp | 3.3% | 5 | 0.012 | $0.42 |
| Koreshan State Hist. | 0.7% | 1 | 0.011 | $0.36 |
| Punta Rassa Ramp | 9.8% | 15 | 0.037 | $1.27 |
| Sanibel Is. Ramp | 2.6% | 4 | 0.022 | $0.73 |
| Bonita Beach Ramp | 0.0% | 0 | 0.003 | $0.09 |
| Cape Harbour Marina | 1.3% | 2 | 0.023 | $0.77 |
| Ohio Ave. Ramp | 0.0% | 0 | 0.007 | $0.24 |
| Castaways Marina | 0.0% | 0 | 0.029 | $1.07 |
| Tween Waters Marina | 2.6% | 4 | 0.026 | $1.04 |
| Mullock Creek | 5.2% | 8 | 0.008 | $0.28 |
| Fish Trap Marina | 0.0% | 0 | 0.006 | $0.20 |
| Riverside Park | 0.0% | 0 | 0.003 | $0.11 |
| Pine Is. Commercial | 0.0% | 0 | 0.015 | $0.51 |
| Leeward Yacht Club 2 | 0.0% | 0 | 0.006 | $0.21 |
| Russell Ramp Park | 0.0% | 0 | 0.003 | $0.09 |
| Burnt Store Marina | 1.3% | 2 | 0.005 | $0.17 |
| Pineland Marina | 2.0% | 3 | 0.015 | $0.51 |
| Terra Verde Co. Club | 0.0% | 0 | 0.005 | $0.16 |
| Judd Park | 0.0% | 0 | 0.007 | $0.21 |
| Jug Cr, Malu Lani, Bocilla Mar | 7.2% | 11 | 0.044 | $1.49 |
| Monroe Canal, St. James, | 5.9% | 9 | 0.023 | $0.78 |
| Viking Marina, Matlacha Park, D&D Tackle | 19.6% | 30 | 0.236 | $9.15 |
| Hickory Bait&Tckl, Coconut Pt | 0.0% | 0 | 0.011 | $0.36 |
| Inlet Motel, Cap. Con's Fish | 0.0% | 0 | 0.000 | $0.74 |
| Total | 100% | 153 | 1.00 | $36.61** |

One caveat for the models we present for Lee County relates to the water site choice model. Because many of the water site variables are correlated, the model is not well suited to evaluating the effect of changes in individual water site characteristics. However, the model does perform well in terms of predicting water site choice, and hence, the model does a good job of predicting the utility index (inclusive value) of the available water sites from any ramp. Thus, the combined models are well suited to valuation of ramps, but less-well suited to valuation of changes in specific water site characteristics. This is due to the correlation in the water site characteristics available from ramps in Lee County. However, a model with a broader scope would use data from more areas which likely would reduce the correlation problem for the water site characteristics making valuation of the water site characteristics feasible.

The model we present is based on boaters that have launched from ramps in Lee County. Thus, the scope of the model or what might be referred to as the “market area” covered by the model is boaters utilizing public ramps in Lee County. Lee County is a large area with many possible public ramps available to boaters. It is natural to think that ramps within Lee County are a part of the relevant market area for the segment of boaters that have used a Lee County ramp. These ramps are also natural substitute sites for Lee County boaters. Our model includes these possibilities. However, it may be that the geographic market area includes some ramps and boaters using other ramps outside of Lee County. For example, when the characteristics of a Lee County ramp are improved, it may attract some boaters that were not previously using a Lee County ramp. These boating behaviors occurring outside of Lee County would not be captured by our current Lee County RUMs. In this case our model may underestimate the benefits of a Lee County ramp improvement because it cannot capture the benefits to potential new users of Lee County ramps. That said, when an improvement occurs, we know that the main beneficiaries are those already using Lee County ramps and these benefits are captured by our models. A model with a broader scope using statewide boating data is under development and will allow us to assess the extent to which the relevant geographic market area for Lee County ramps extends to ramps outside of Lee County.

## Case Studies

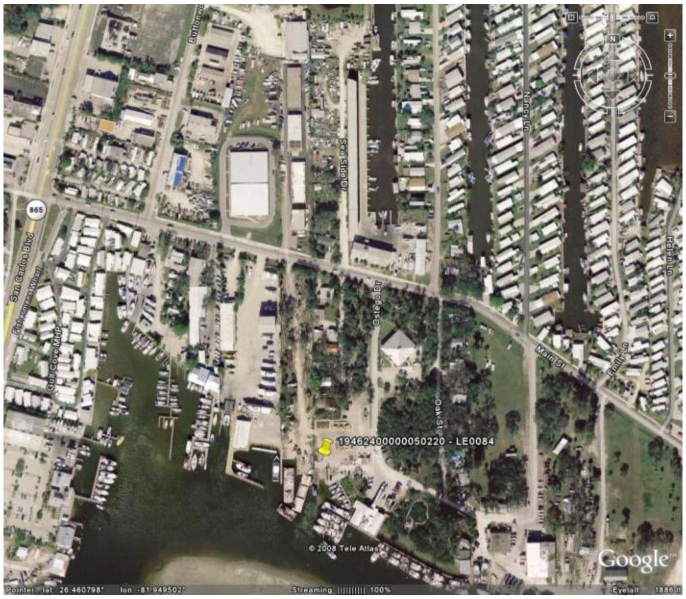
When faced with competing alternative uses for public funds, it is helpful to employ an analytical framework that permits an objective comparison of these alternatives. While the choice of measurement can vary by decision, e.g., number of jobs created, net return to the public treasury, number of species saved, etc., the most common approach is to compare alternatives by their economic value net the cost of implementation; benefits verses costs or benefit/cost analysis (BCA). In its simplest form, a BCA measures potential benefits and costs and provides a framework to compare alternatives using the common metric of monetary value. This comparison can be viewed as a ratio of benefits to costs (where values greater than one are considered beneficial) or as the net of benefits less costs (where positive values are considered beneficial).

In the following case studies, the benefits of an action are calculated as the discounted sum of value accruing to boaters for the lifetime of the action. Since public lands/ramps are held in trust indefinitely, the benefits can be viewed as a never ending stream of value that accrues to the boating public. However, benefits accruing in the future are worth less than those accruing today, so this stream of value must be discounted across time. The most commonly used rate for public projects is 3% per annum. The benefits of an action can now be simplified to the discounted value of an infinite stream of benefits; a perpetuity. To determine if the action is net beneficial, the perpetuity benefit can be compared to the implementation cost as either a ratio or the net of discounted benefits less costs.

### Case 1: Add public access to a new site (Ostega Dr).

In the first case policy makers wish to evaluate the benefit of adding an additional ramp to the set of ramps already available in the county. A ramp presently exists on Ostega Drive (please see Figure 2), but is not operational due to a regulatory constraint. The question becomes is the expense and time required by the County to successfully challenge the regulatory constraint a good investment of public funds? Using the RUM, it is possible to calculate the per trip value provided by opening this ramp and, by extension, the total value for all boaters dependent on ramp access in Lee County. To calculate the per trip additional value with the opening of this ramp, each surveyed boater's choice set was recomputed by adding the new site, its characteristics, and the individual's specific travel costs to this site. The RUM generated value added to all trailered boating trips for this additional ramp site was estimated to be $0.86 per trip to Lee County. For the 588,000 countywide boat trips using a trailer, this action would translate into a total annual value of $505,680 for boaters dependent on Lee County ramp access. Assuming that this action would be indefinite, it could be viewed as a perpetuity[3] with a 3% discount rate and equal the sum net present value of $16,856,000. This value would assume constant boater participation rates and ramp choices over time. If policy makers believe this sum is greater than the cost of litigating the regulatory constraint, then the action would make economic sense.

Figure 2. Aerial photo of Ostega Dr. ramp.



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[3] "Perpetuity" refers to an asset that perpetually pays an annual dividend of a fixed amount; the present value (PV) of a perpetual stream of periodic payments discounted at rate i is given by the formula, PV = annual payment/ i.

Case 2: Increase the average parking size at Pine Is. Commercial Marina and Bokeelia Boat Ramp and Cottages by 50% (i.e., 50% more parking).

In addition to adding or removing sites, policy makers might wish to enhance a site's features. In the case of ramps at Pine Island Marina and Bokeelia Boat Ramp and Cottages (please see Figure 3), policy makers would like to know if a significant increase in their parking areas is a worthwhile public investment. One of the significant RUM variables is average parking size (see Table 3) meaning this variable can be evaluated for marginal changes (increases and decreases in size). By increasing the value of this variable by 50% and using the estimated RUM, the value for this policy change was estimated to be $0.26 and $0.99 per trip to boaters dependent on Lee County ramps for Pine Island Marina and Bokeelia Boat Ramp and Cottages respectively. Overall, for the 588,000 countywide boat trips using a trailer, this action would translate into a total annual value of $153,000 and $882,000 for boaters using Lee County ramps due to added parking at Pine Island Marina and Bokeelia Boat Ramp and Cottages respectively. Assuming that this action of purchasing the land needed for the parking lot expansion would be indefinite, it could be view as a perpetuity with a 3% discount rate and would equal the sum net present value of $5,100,000 and $19,404,000 for Pine Island Marina and Bokeelia Boat Ramp and Cottages respectively. If policy makers believe this sum is greater than the cost of purchasing and preparing the parking lot expansions, then the action would make economic sense.

Figure 3. Aerial photo of Pine Island Marina Ramp (top) and Bokeelia Boat Ramp and Cottages (bottom).

<u>Case 3: Close access to Hickory Bait and Tackle at Week.</u>

Another possible policy consideration is the removable of ramps. For various reasons, present sites may be lost to public access. It becomes useful to document the economic value lost to public boating resulting from closures. In this case, the privately owned public access ramp located at

Hickory Bait and Tackle at Weeks Landing is scheduled be removed from public access (please see Figure 4). Policy makers may wish to document the value lost to boaters resulting from this closure. In the RUM, this is modeled by removing the site from the choice set and letting the model predict the likely distribution of future boating and economic value lost to boaters from the reduced number of boating access sites. In this particular case, the ramp under consideration for closure is in close proximity to Coconut Point Marina, another privately owned public access point. As an indication of the values for this case, we know that the value would be less that the total value of access to this aggregated site which is $0.36 per trip to Lee County (see Table 4). Working with this “upper limit” for the economic loss, this action would translate into a total annual loss of $212,000 for boaters using Lee County ramps. This is based on the yearly 588,000 trailer based boating trips in Lee County. Treated as a perpetuity with a 3% discount rate, the present value, “upper limit” loss of this action would be $7,066,000. While this estimate is likely high, even if one assumes half this value, the loss would still exceed $3 million if the ramp were to close. If this loss is larger than the cost of purchasing the ramp and keeping it open, then it would make economic sense to keep the ramp operational. As with the other cases, this view assumes constant boater participation rates and ramp choices across time.

Figure 4.  Aerial photo of Hickory Bait and Tackle at Week Landing.

## Discussion

The model was used to compute the value of changing site characteristics as well as to compute the access values for the sites.  The values for access to each of the ramps were computed.  As expected, the more popular ramps have the higher per choice occasion values.  The values per trip to a specific ramp were $30-$35. The model was also applied to assess the benefits of potential policy scenarios based on real decisions facing Lee County planners.  The three scenarios were: adding an additional access point, improving some access points by enlarging the parking lots, and removing an access point.  Benefits were aggregated by combining per-choice occasion benefits with total trips to Lee County.  The aggregated present values of social benefits ranged from $4 to $17 million dollars. Thus, the boating demand model serves as a tool to improve the efficiency of investments in the maintenance and supply of boating infrastructure.

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