Estimating the Economic Value of the Recreational Boat Fishery in Galveston Bay, Texas

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ABSTRACT

As coastal resources come under greater pressure with increasing numbers of users, land development, industrial growth, tourism, and other competing interests, managers must consider the ramifications of making trade-offs in their planning decisions. Valuation of natural resources is necessary to substantiate these decisions and allocations. Due to the lack of a direct market for sport fishing experiences, indirect methods for resource valuation have been derived. In this paper we used the travel cost method (TCM) to value the recreational boat fishery in Galveston Bay. Using fishing pressure estimates for the Galveston Bay recreational boat fishery with an estimate of angler willingness to pay above fishing trip costs (consumer surplus), we calculated the total annual economic value of the recreational boat fishery to range between $25.4 million and $28.4 million. Discussion focused on the importance and management implications for this and other such studies.

INTRODUCTION

U.S. Bureau of the Census figures from the last three decades reveal a shift in U.S. population toward coastal areas and adjacent metropolitan centers (Edwards, 1989). This movement has been accompanied by increasing coastal development, which has put pressure on coastal resources including recreational fisheries. Concerns over the impacts associated with these developments have made it imperative that decision makers understand the economic value of coastal natural resources in order to be effective in the public policy arena.

The Galveston Bay System and surrounding counties in Texas are a good example of these trends (Ditton *et al.*, 1989). Area industries include commercial fishing, shipping, petroleum and chemical production, tourism, and many others. Most of the available data for Galveston Bay deal with revenue and expenditures, payrolls, and re-spending effects of market related uses of the bay and adjacent lands. For example, it was estimated that there were over $171 million in expenditures for all sport fishing in the Galveston Bay complex in 1986, generating over $433 million in total regional economic impact (Fessenmaier and Jones, 1987). Unfortunately, expenditure and economic impact data do not fully address the economic value of the fishery.

Although not unrelated, the concepts of economic value and economic impact have different meanings and measurements. Economic impact is a measure of the economic activity generated by use of the resource, while

economic value is the total worth or value that society places on the resource. Gross expenditures have often been used as a proxy for the economic value of natural resources, but doing so underestimates the actual value of the resource (Huppert, 1983). Economic value of a resource includes not only the gross expenditures of users, but the amount they would be willing to pay in addition to expenditures for continued use of the resource. To be comprehensive, societal assessment of resource values should include valuation by non-users of the resource as well as users. User values may take one of three forms: consumptive use, non-consumptive use, and indirect use (Rockland, 1985). This paper focuses on the consumptive use values of a recreational fishery.

Since the recreational use of the Galveston Bay fishery resources is not a marketed good, and neither users nor non-users pay directly for its amenities, there is no established market price. Lack of a direct market to create a market price for recreational use of a resource does not mean that it has no value, but rather that direct measurement of that value is not possible (Rockland, 1985).

In addition, the commercial price for fish should not be confused with the value of the fishing experience or use of the resource. In cases where no direct market for users occurs, Clawson and Knetsch (1966) have discussed the biases and fallacies associated with using the commercial price as the total value. Therefore, valuation by indirect assessment methods is necessary. The travel cost method (TCM) is one of the most accepted and widely used today (Huppert, 1983; Fisher, 1986; USDA, 1987). The purpose of this paper is to demonstrate this methodology by estimating the annual economic value of the recreational boat fishery in Galveston Bay.

METHODS

Data were collected by the Texas Parks and Wildlife Department (TPWD) through its coastwide creel survey which uses a stratified proportional sampling of sport boat anglers (Osburn and Osborn, 1991). Whereas the survey began in 1974, the social and economic questions used in this analysis were implemented May 15, 1987. For this study the first two years of social and economic data were used (May 15, 1987 to May 14, 1989). This included two high use and two low use periods as defined by Ferguson and Green (1987). Only interviews from sites in the Galveston Bay system were included in the analysis.

On-site creel interviews were conducted by TPWD personnel stationed at randomly selected boat access sites on randomly selected weekend and weekday days, and targeted party leaders as they completed their trips (Osburn *et al.*, 1988). Access sites included boat ramps, marinas with wet slips, and other public launch areas. The sampling design provides good representation of all bay anglers since 78% of all saltwater sport-boat fishing trips originate from the access sites covered by the TPWD creel survey (Ferguson and Green, 1987).

Table 1: TCM questions used on the TPWD on- site creel survey since 1987.

A. Since this time last year, how many fishing trips have you made to:

(a) saltwater sites in Texas?
(b) freshwater sites in Texas?
(c) this launching site from where you currently live?

B. What is the ZIP code where you currently live?

C. How much will you spend on this fishing trip from when you left home until you get home?

Furthermore, boat anglers account for the majority of sportfishing pressure on the Texas coast (McEachron, 1980; McEachron *et al.*, 1981).

Questions used for the travel cost economic valuation method (TCM) were incorporated into the social and economic section of the survey (Table 1). The TCM is used to estimate consumer surplus which is the amount over the actual cost or expenditure to use a resource that the user would have been willing to pay to continue to use the resource (Rockland, 1985).

Surveyed anglers whose reported round-trip expenditures were in excess of $10,000 were removed from the sample since spending of this magnitude is unlikely and unreasonable for a single day of fishing in Galveston Bay. This resulted in the removal of two individuals from the data. Anglers who reported more than 365 trips to the intercept site in the previous year were also eliminated from the data since it was assumed that a "trip" was equivalent to a single day of fishing.

ANALYSIS

Travel cost was analyzed using the zonal model (Fisher, 1986). With a zonal model, visitors to each given site are grouped by distance zones according to how far they traveled to reach the site. Using the average distance a person from each zone travelled to reach the site, the cost per mile traveled, the total round-trip expenditures for the trip, and the number of visits to the site, an estimated demand curve is derived. On the demand curve, price is measured by travel cost and other expenditures, and quantity demanded is measured by the average number of trips to the site.

To implement the TCM, the travel distance from each interview site to each of the ZIP codes reported by anglers was calculated. This was done by grouping the launch sites into eight regional zones, and measuring from the center of each zone to the center of the area defined by the first three digits of the ZIP codes. The functional form of the cost equation is:

$$TC_{ijn} = EXP_i + ((D_{in}/40) * 3.80)$$

where D_{in} is distance travelled.

The first part of the equation is the actual expenditures per trip to the site, and the second term is known as the opportunity cost for travel. Opportunity cost represents wages that potentially could have been earned during travel time (at the minimum wage rate from 1989); this calculation was done with the hourly wage set at both \$0.00 and \$3.80 (Milon, 1993), and an average driving speed of 40 miles per hour (American Auto Association, 1990). As Milon suggested, the opportunity cost for travel is removed by using the \$0.00 wage rate to provide a baseline value estimate and to test the sensitivity of the model to its presence.

Regression analysis (SAS, 1988) was used to calculate a demand curve for the data with a regression model of the following form:

$$Q = \beta_0 + \beta_1(TC) + e$$

where:

Q = visits to the interview site in the past year;

TC = cost of round-trip travel to the site;

e = random error;

ß's = parameters to be estimated.

The mean number of reported annual trips to the surveyed Galveston Bay sites was calculated to be 15.87, and the equation for the demand curve was solved for the price at which this mean number of trips to the sites would have occurred. The gross willingness to pay, represented by the area under the demand curve (Hansen, 1987), was calculated by integrating the regression formula over the range from 0 to \$76.72 and \$68.90 (the mean calculated prices at which 15.87 trips were taken with opportunity cost for travel included and omitted, respectively).

RESULTS

The regression parameters for the estimated TCM demand curves are summarized in Table 2 and 3. With the mean number of annual fishing trips to Galveston Bay sites set at 15.87 trips and the opportunity cost included, annual angler willingness to pay was calculated to be \$1243.96, or \$78.40 per trip (day). With opportunity cost removed, annual willingness to pay was \$1113.71 annually, or \$70.19 per trip (day).

Recreational fishing pressure at Galveston Bay sites during this study was estimated to be 362,270 individual boat trips per year (Weixelman *et al.*, 1992). Using the TCM willingness to pay estimate with opportunity cost for travel included, the estimated total annual economic value for Galveston Bay boat anglers was \$28.4 million. When opportunity cost was removed, the estimate was \$25.4 million annually.

Table 2: Summary of regression, TCM analysis of Galveston Bay. (opportunity cost= $3.80)

Variable	ParameterEstimate andStandardError	tforH0:Parameter=0	Pr>(t)
Intercept	16.5609 (0.54468)	30.40	0.0001
Trip Cost	-0.009056 (0.00303)	-2.99	0.0028
n	3367		
Model F value	8.92 (p=0.0028)		
Gross Willingness to Pay (day trip)	$78.40		

Table 3: Summary of regression, TCM analysis of Galveston Bay. (opportunity cost= $0.00)

Variable	ParameterEstimate andStandardError	tforHO:Parameter=0	Pr>_t_
Intercept	16.4580 (0.53617)	30.70	0.0001
Trip Cost	-0.008588 (0.00307)	-2.80	0.0052
n	3367		
Model F value	7.81(p=0.0052)		
Gross Willingness to Pay (day trip)	$70.19		

DISCUSSION

Use of TCM in this situation has its limitations. As Hansen (1987) stated, this method is best suited to specific rural sites where visitors travel a wide variety of distances for the single purpose of using the resource being valued. While it can be assumed the anglers intercepted came to Galveston Bay for the sole purpose of fishing and did not participate in other recreational activities on the trip, the sites at which they were interviewed are spread along more than 80 miles of Texas coast (the resource/site being valued is diffuse). Furthermore, given the close proximity of Galveston Bay to the Houston metropolitan area, most of the anglers in this study reside nearby. Due to this uniformity in travel distances and the fact that only boat anglers were interviewed, trip expenditures

did not have a great deal of variance. These factors resulted in a relatively inelastic resource demand curve.

Another limitation for the use of the travel cost method in this study is with the regression model used to establish the demand curve. Ideally, the regression should include other independent explanatory variables such as income, evaluation of site characteristics, and the price, quality, and availability of substitute sites (Duffield *et al.*, 1987). Unfortunately, the data for this study were collected during a more extensive creel survey, thus limiting the depth of social and economic information to be collected. Therefore, the availability of useful regressors was limited to trip expenditures, the number of trips taken, and those variables that could be estimated using the anglers' zip codes.

The value estimates calculated are comparable to those reported by the American Fisheries Society (1992). While AFS has no specific estimates for saltwater fisheries in Texas, their estimates of an average of $49.99 per day of bay fishing in the United States (using CVM) and $76.12 per day of general saltwater fishing (using both CVM and TCM) are similar to our findings. Since the value estimates we presented are based on the expenditures of boat anglers only, whereas the AFS user value estimates came from an aggregate of angler types, we might expect our values to be larger per day fished.

The values put forth here are only a partial estimate of the total economic value of the Galveston Bay fishery. Our estimates represent only a portion of the total user value for the bay (thus a partial estimate of the consumptive user value), and does not include non-consumptive or indirect user values. In addition, non-user values as defined by Krutilla (1967) (existence value, bequest value, and option value) have not been considered at all. What we have provided might be considered a baseline estimate for the value of the recreational fishery in Galveston Bay, and a conservative partial estimate for the total value of Galveston Bay's fishery resources.

It bears repeating our previous point that using gross expenditures as a proxy for economic value underestimates the true value of the resource. In this study, anglers reported an average out-of-pocket expense of $41.76 per day trip. Had this average gross expenditure been used to approximate the value of Galveston Bay's recreational boat fishery, the annual value would have been under-estimated by as much as $13.3 million.

Study results have at least three implications for management. First, fishery management agencies, environmental organizations, and sport fishing constituency groups can use the consumptive use values presented herein together with angler expenditure and impact studies to support arguments in favor of resource conservation. Besides enhanced understanding of the current net economic value of the fishery, results can be used to forecast economic consequences of physical changes in the quality of the fishery resources involved. Second, estimates derived can be used to demonstrate potential

societal costs associated with proposed development projects that would deleteriously impact fishery resources and habitats, and to evaluate monetary damages (total value) associated with fish kills, habitat loss, etc. Third, value estimates can be used in support of resource enhancement efforts, *i.e.*, stocking and habitat protection, since net economic value of the resource would be expected to increase. In each of these situations, efforts need to ensure that economic value information is widely disseminated and understood by the public.

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