Compensation for Anglers from the Deepwater Horizon Spill

Compensación para Pescadores Deportivos por el Derrame del Deepwater Horizon

Indemnisation pour Pêcheurs Loisirs de la Marée Noire de Deepwater Horizon

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ABSTRACT

At an estimated 205 million gallons, the Deepwater Horizon (DWH) is the largest oil spill in the history of the United States. During nearly three months of active discharge, oil reached the coasts of Louisiana, Mississippi, Alabama, and Florida, resulting in large scale fishery closures. Many recreational anglers who planned visits to the Gulf Coast likely canceled, rescheduled, or changed their trip location to areas not affected. The Oil Pollution Act of 1990 allows resource trustees to claim and recover losses on behalf of the public. Recoverable damages include the cost of primary restoration and interim losses that encompass passive and direct use values, such as recreation. Trustees must use funds recovered for restoration activities. In this paper, we use a series of random utility models of site choice by recreational anglers in the Southeast U.S. to estimate monetary compensation measures for losses by anglers due to the DWH spill. The models allow us to estimate different compensation measures for anglers who fish from shore, private boats, and those who fish from charter and party boats. Our most conservative estimates indicate that the total monetary compensation due to anglers is in the range of 540 million dollars.

KEY WORDS: Recreational fishing, Deepwater Horizon, oil spill, random utility model, welfare measure

INTRODUCTION

In 2010, the largest oil spill in the history of the United States occurred off the coast of Louisiana in the Gulf of Mexico. After an explosion on April 20 in the Deepwater Horizon (DWH), a drilling platform operated by British Petroleum, crude oil gushed from the sea floor at a depth of approximately one mile until July 15 when the well was successfully capped. During this time, an estimated 205 million gallons of oil were released into Gulf waters. For comparison, the Exxon -Valdez spill resulted in an estimated 11 million gallons of crude being discharged into Prince William Sound, Alaska. As a result of the DWH spill, large areas of Federal and State waters were closed to fishing throughout the Gulf. At the spill's height, 37% of Federal waters were under a fishery closure. State imposed closures varied between 95% of State waters closed in Mississippi, 55% in Louisiana, 40% in Alabama, and nearly 2% in Florida (Upton 2011).

The Oil Pollution Act (OPA) of 1990 stipulates the kinds of compensable losses and damages from oil spills in the United States. These compensable damages include 'market' losses such as damages to private property, as well as losses of profits and wages from decreased economic activity as a result of spills. In the case of market losses, the affected party can seek compensation from responsible parties directly through the courts. But the OPA also establishes 'non-market' losses, such as damages to biological and ecological resources as well as lost recreational opportunities, to be subject to compensation by responsible parties. In such cases, State, Federal, or Tribal Authorities acting as resource trustees for the public can seek compensation from responsible parties through the legal system (Jones 1997, Jones and Pease 1997).

A combination of fishery closures and media coverage of the spill is likely to have contributed to lower participation in coastal and marine based recreation throughout the Gulf States. In the jargon of economics, we could have expected a decrease in the demand for recreational activities in the Gulf of Mexico as a result of the DWH spill. The purpose of this research is to determine the magnitude of this decrease in demand for marine recreational fishing in the Southeastern United States and to estimate the monetary compensation due to the fishing public as a result of the DWH spill. This document summarizes our methods and preliminary results.

METHODS AND DATA

The basic insight behind the valuation of recreational activities and the resources upon which nature-based recreation depends is the use of travel costs to the recreational location as a proxy of the price paid to engage in such activities (Bockstael et al. 1991). The earliest recreation-based valuation applications consisted on estimating a demand curve for recreation at a single site throughout a season. Such methods yield a demand curve similar to that for market goods, with the notable exception that instead of price and quantity consumed, the demand curve is estimated based on travel costs to the site and the total number of trips taken over a season. Estimation of such a demand function allows the computation of measures of consumer surplus, which are the relevant measures of economic benefits for Benefit Cost Analysis (BCA) and policy relevant decision-making.

The single-site travel cost method, however, does not deal with substitute sites and is not suitable for valuing changes in quality that affect multiple sites simultaneously. In the case of a localized oil spill that affects a single bay or beach, for instance, we could use a single site travel cost model to estimate the loss caused by the spill. If the spill affects a large area and many recreational locations suffer as a consequence, a different valuation method is required. One of such methods, known as the Random Utility Model (RUM), takes each recreational location as a discrete alternative and models the choice that each individual makes from the set of available alternatives. Individuals are seen as choosing the location that yields the maximum utility, and this choice is related to the attributes of the chosen location and the available alternatives.

Key among these attributes is the cost of travel to each available location, which must account for the monetary costs of travel and the opportunity costs of time or the income foregone by choosing to recreate. Estimating a choice model with travel costs as an attribute allows us to estimate monetary values for changes in the other attributes in the model, as well as the value of site closures or new sites (e.g., Bockstael et al. 1987, Kaoru 1995, Thomas et al. 2010). In practice, the valuation exercise consists of developing a series of counterfactual scenarios in which recreationists can pay to obtain improvements in different attributes (Haab and McConnell 2002), hence the measure is referred to as willingness-to-pay. Computation of willingness-to-pay is possible once the parameters of the RUM are estimated.

To estimate a RUM of marine recreational fishing in the Southeastern United States we use creel survey data from the Marine Recreational Information Program (MRIP). The MRIP intercept survey reports the county of origin and destination of a large sample of recreational fishing trips, as well as the level and composition of catch (Hicks et al. 2000). MRIP intercepts are reported in two-month fishing locations, and use this distance to create measures intervals known as waves. We complement this dataset by calculating the distances traveled between the county of origin and the available of the costs incurred in travel. We also use the median income in the angler's county of residence to compute approximate measures of the opportunity costs of time. Further, we use the fishing closure maps created by the National Oceanic and Atmospheric Administration (NOAA) during the DWH spill to create a binary index of oil spill impacts for each location during each wave. For each angler intercepted by MRIP in 2009 and 2010, therefore, we have information on the costs of travel to each available location and whether or not each location was affected by oil at the time the fishing trip took place. In addition, we use historic MRIP intercepts from 2006 to 2008 to compute indices of historic catch per unit effort in each location.

To create a catch-based attribute that varies across individuals and locations, we develop a count-data model of catch (McConnell et al. 1995). Using this model we attempt to predict the number of fish each angler would have caught in each of the available locations. As predictors, we use the historic catch in each location during the season in which the trip takes place, the angler's participation in the last year, and the fishing mode used by the angler, among others. This predicted catch measure gives us an attribute that captures the heterogeneity that exists among anglers, as well as differences between fishing locations.

MODEL SPECIFICATION

We estimate separate models for anglers in three distinct fishing modes. The shore-based fishing models include anglers fishing from natural or man-made structures such as beaches, jetties, docks, and piers. The for-hire fishing models include anglers fishing in guided trips from charter, party or head boats. The private boat models include all anglers who use their own boats or who rent vessels for fishing, and includes motorboats as well as non-motorized vessels such as canoes or kayaks.

There exists a substantial literature on the selection of discrete alternatives for recreational RUM models (e.g., Parsons and Kealy 1992, Parsons and Needleman 1992, Feather 1994, Lupi and Feather 1998). Ideally, each alternative would represent an elemental site, or the actual location where recreation takes place. In the case of recreational fishing, one could think of fishing 'spots', or at least individual access points, as the elemental sites. When the area under study is large and contains many access points and fishing spots, however, modelers can run into computational limitations that would preclude the estimation of a RUM. In the case of recreational fishing in the Southeastern United States, for instance, the number of access points from Louisiana to North Carolina may run in the hundreds of thousands, and the number of fishing spots may well run in the millions. To deal with this problem, modelers can use a random sample of alternatives — rather than the entire set — or can aggregate elemental sites into larger discrete locations, or a combination of both.

In our case, the attribute of interest is the impact of the DWH spill. As the largest spill in U.S. history, this spill affected a large number of elemental sites simultaneously. Furthermore, all locations within the same county, and in many cases within the same state, were more or less equally affected by oil at the same time. We therefore aggregate elemental sites into ten distinct regions. The states of Louisiana, Mississippi, Alabama, Georgia, South Carolina, and North Carolina are all treated as individual regions. The state of Florida is divided into four sub-regions which can be expected to have suffered differential oil spill impacts: Northwest Florida, Southwest Florida, the Florida Keys, and the Florida Atlantic Coast.

A decision tree that establishes a sequence in which choices are made is implicit in the creation of the discrete alternatives in the RUM. In our case we allow substitution not only between the ten aggregated regions, but also across six time periods in each year. For the definition of time periods we use MRIP's system of fishing waves. Therefore, we assume that anglers who fish in the Southeastern U.S. can choose to fish during one of six seasons, in one of ten regions. Each angler thus has a total of 60 distinct alternatives from which to choose, and the observed choice is assumed to be that which maximizes each angler's utility.

We include seven trip attributes in our RUMs of fishing choice. Travel cost, which includes both travel-related expenses and the opportunity costs of time, is perhaps the most important attribute as it allows the monetary valuation of the other attributes. Our main attribute of interest, the indicator of impacts from the DWH spill, is also included in the models that use data from 2010, the year in which the oil spill took place. We also include indicators for the season in which the fishing trip takes place by using indicators for the spring, summer and fall months. We control for site popularity by using the number of interviews conducted in each region, as well as for the size of each region in terms of the number of access points or elemental sites contained in each. We also use an indicator for whether the fishing region is located in the Gulf of Mexico or the Atlantic Coast to control for geographic preferences. Finally, we use our expectation of the catch that each angler would have enjoyed in each fishing region during each wave as a trip attribute.

Two different procedures are used to estimate our RUMs. \ First, we use the conditional logit (McFadden 1974), which is the earliest of all methods consistent with the random utility concept and suffers from a wide range of shortcomings, in particular the Independence of Irrelevant Alternatives (IIA) assumption. The second procedure used is the state-of-the-art mixed or random parameters logit (Train 2003), which uses simulated maximum-likelihood to estimate not only the parameters themselves but also their distributions. The use of simulation methods makes IIA not be problem, and the mixed logit is considered one of the best methods available for the estimation of random utility models.

RESULTS

As expected, the willingness-to-pay measures obtained are positive, indicating that anglers were negatively affected by the DWH spill and that there exists a positive and finite monetary amount that could make anglers whole. The measures we estimate are the willingness-to-pay for oil spill prevention of the average angler in each of the three fishing modes for each fishing trip. That is, our measures are the amount due to anglers for each fishing trip as compensation for the DWH oil spill. The compensation estimates obtained vary across estimation procedures, with those obtained from the mixed logit being more conservative than those obtained from the conditional logit.

The conditional logit estimates of per trip monetary compensation range from a mean of $125.63 due to anglers in the for-hire sector to a mean of $9.95 due to anglers fishing from private boats. The mean per trip compensation due to anglers fishing from shore is $65.57 (Figure 1). The distribution of willingness-to-pay is relatively wide in the for-hire sector, but less so in the shore and private boat fishing modes. Using estimates of total fishing effort in the ten regions under study obtained from MRIP statistics (Table 1), the total damages to anglers fishing from shore, for-hire, and private boats are $1.2 billion, $119 million and $221 million, respectively, for a total compensable loss of $1.452 billion U.S. dollars (Table 2).

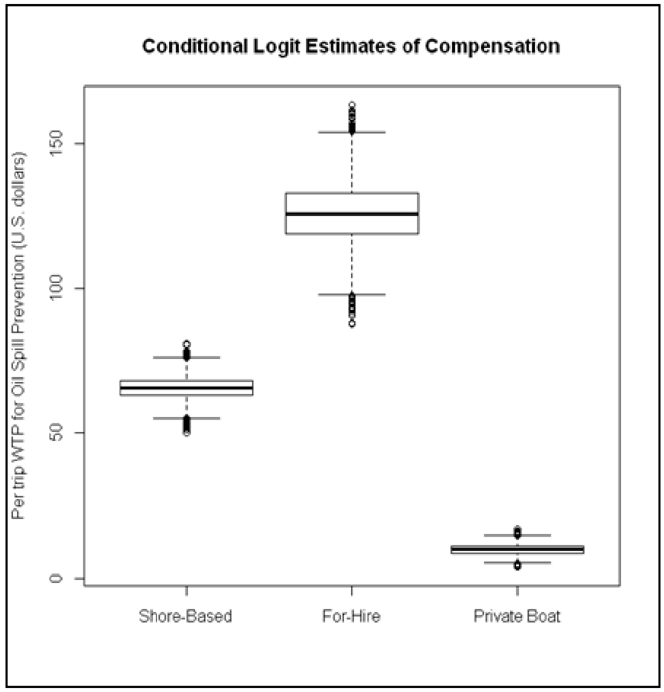

Figure 1. Conditional Logit estimates of monetary compensation by fishing mode.

Table 1. Estimated Marine Recreational Fishing Participation in the Southeastern United States, excluding Texas (Fishing Trips in 2010).

Mode	Trips
Shore	16,967,139
For Hire	948,044
Private	22,198,529
TOTAL	40,113,712

Source: Marine Recreational Information Program

Table 2. Total Loss Estimates (Millions of U.S. Dollars)

	Conditional Logit			Mixed Logit		
	Mean	95% CI		Mean	95% CI	
Shore	$1,112.50	$983.90	$1,239.50	$471.00	$399.20	$545.30
For Hire	$119.10	$99.10	$138.60	$32.70	$22.90	$42.60
Private	$220.90	$142.10	$299.00	$36.40	$0.20	$73.40
TOTAL	$1,452.50	$1,225.10	$1,677.10	$540.10	$422.30	$661.30

The estimates of per trip compensation due to anglers from the mixed logit range from a mean of $34.53 for anglers who hire fishing guides to a mean of $1.64 for anglers who use private boats for fishing. Anglers fishing from shore are due a mean compensation of $27.76 per trip according to the mixed logit (Figure 2). As in the conditional logit results, the distribution of willingness-to-pay is widest in the for-hire sector and narrowest in the private boat fishing mode, while that of shore-based anglers is somewhere in between. Multiplying the mean willingness to pay for oil spill prevention figures by the estimated number of recreational fishing trips in the Southeast yields compensable losses of $471 million, $32.7 million and $36.4 million U.S. dollars for anglers in the shore, for-hire, and private boat fishing modes, respectively. The total compensable loss according to the mixed logit estimates has a 95 percent confidence interval ranging between $442 and $661 million and a mean of $540 million.

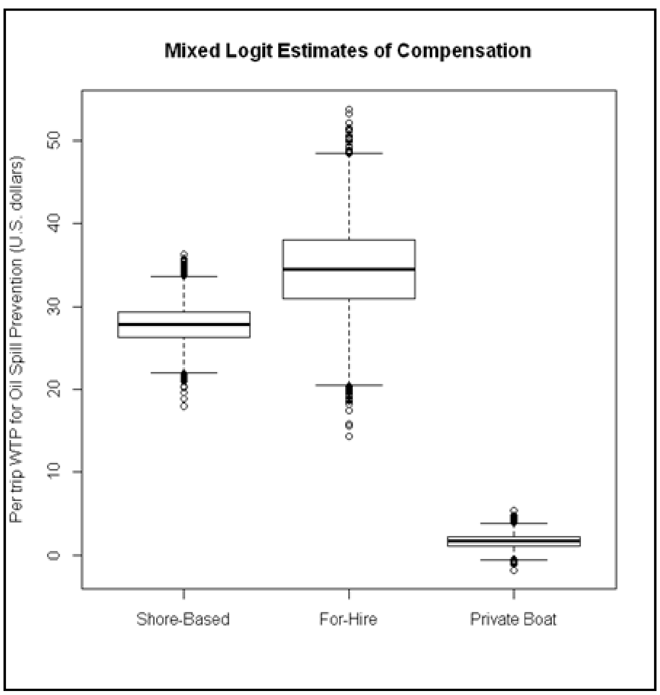

Figure 2. Mixed Logit estimates of monetary compensation by fishing mode.

DISCUSSION

An important point that must be made at the outset is that the estimates of compensable losses reported here are based on 'revealed preferences'. That is, these estimates are based on actual consumer behavior — Southeast marine anglers in this case — rather than on 'stated preferences' surveys that ask anglers about their willingness-to-pay for oil spill prevention directly. Our methods determine the relative importance of different trip attributes, most importantly travel costs and impacts from the DWH spill, on the probability of choosing particular times and locations to go fishing. These indices of relative importance of attributes on choices, which we estimate as model parameters, are then used to compute monetary measures of loss based on counterfactual scenarios in which the relative importance of attributes remains the same. The counterfactual scenarios use simple algebra to posit the question: If the DWH spill could have been prevented, would anglers be willing to pay more to go fishing?

As such, these estimates are not measures of economic impact and do not measure the impacts of the DWH spill on the economy of the Southeastern states and their coastal communities. Also, while these measures are related to market expenses, they are not measures of lost expenditures on fishing trips and fishing equipment as a result of the DWH spill. Rather, they are a measure of the loss in well being experienced by Southeast anglers as a result of the spill. To illustrate this loss, consider an individual whose preferred activity on a given day is fishing in her favorite spot in the Mississippi coast. On average, she spends a given amount of money in trips to that spot, and since that is her preferred activity there is nothing else she would rather do with her time and money than fishing in that particular spot. On this particular day though, there is a large amount of oil in her favorite spot. The oil makes the fishing trip undesirable and possibly a health concern. As a result, she decides to stay home and watch TV instead of going fishing. Even though she now has more money than if she had gone fishing, she is likely upset at not being able to go fishing as she would have liked to do. This negative feeling from not being able to fish is what we are attempting to quantify in this research.

A result that may seem surprising is the large magnitude of the loss experienced by shore-based anglers compared to that suffered by those who fish from private boats. *A priori*, one could expect that since those who fish from private boats probably spend more money on fishing trips and on fishing related equipment, their loss would have been larger. However, the magnitude of the compensation measure is directly related to anglers' response to the oil spill and inversely related to their response to travel costs. That is, if anglers are highly averse to traveling long distances their compensation measures for oil spill effects tend to be small. Conversely, if anglers are highly averse to visiting locations impacted by oil their compensation measures tend to be large. Through our behavioral models we find that anglers who fish from private boats are very responsive to travel costs and are the most averse to traveling long distances to go fishing, as can be expected since their travel costs are likely to be larger than those for anglers in other modes who do not have to pull trailers with heavy boats. Anglers who use private boats are also the least responsive to oil spill impacts and were the least likely to cancel or substitute trips due to the DWH spill. Both of these results are reflected on the relatively small estimates of per trip willingness-to-pay for prevention of the spill for private boat anglers.

On the other hand, anglers fishing from shore and using the for-hire sector are less responsive to travel costs and are willing to travel longer distances to go fishing. Similarly, anglers in both of these fishing modes were more responsive to the impacts of the DWH spill, and were more likely to cancel or substitute trips away from regions that were affected by oil. This explains the high per trip estimates of willingness-to-pay for prevention of the DWH spill in the shore and for-hire fishing modes relative to private boats.

Our most conservative estimates suggest that individuals who fish in saltwater in the Southeastern United States are owed close to $540 million dollars as a result of the DWH oil spill. The Federal and State governments, acting on behalf of the angler citizenry could attempt to recover these damages from responsible parties, as stipulated in the OPA of 1990. If they did, recovered funds would have to be used in restoration activities (Jones and Pease 1997). For the sake of fairness, it would seem that restoration activities should compensate anglers according to their loss. The results reported here could be used to determine the size of the pie to be used for restoration, as well as the portion of the pie that should be directed to improving fishing for each of the different modes.

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