EVER REACH OIL SPILL
LOST RECREATIONAL USE VALUATION REPORT

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Prepared for the
Ever Reach Trustee Council

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I. Executive Summary

This report presents the data and methods used to calculate lost use damages due the Ever Reach oil spill. The term "lost-use damages" refers to the decline in value of recreational uses associated with resources affected by the spill. The release of oil from the Ever Reach spill affected both recreational shrimp baiting and recreational shellfishing. Potential impacts to other recreational activities were not found to be significant. Determining the nature and extent of the spill's effect on recreational use and the value of the resulting losses is the purpose of the analysis contained herein.

Calculation of damages due to lost recreational use is part of the Natural Resource Damage Assessment (NRDA) process. Ecological damages, such as harm to wildlife or habitats, will also be included in the public NRDA claim and are described in other case documents. Commercial losses and spill-related out-of-pocket expenses to residents are subject to a private claim and are not part of the NRDA process. Total estimated recreational-use damages and the two sub-categories that comprise total damages are presented in the table below.

Summary of Lost Use Damages (2002 Dollars)	
Lost shrimp-baiting trips to Charleston	4,232
Total value of shrimp-baiting losses (Estimated range)	\$74,476 to \$114,452
Lost shellfishing trips	497
Value of shellfishing losses (Estimated range)	\$7,452 to \$9,936
Total value of recreational losses	\$81,928 to \$124,388

An estimated total of 4,729 recreational trips were lost due to the spill, consisting of 4,232 lost shrimp-baiting trips and 497 lost shellfishing trips. Additional affected trips include those taken to Charleston Harbor during the spill under degraded conditions. Degraded trips are included in the estimated value of losses but the number of degraded trips was not estimated separately. Shellfishing losses occurred as a result of a closure, so it is assumed that no trips were taken under degraded conditions. Monetary losses for shrimp baiting were estimated to range from \$74,476 to

$114,452, while the estimated losses for shellfishing range from $7,452 to $9,936. Total estimated losses range from $81,928 to $124,388.

II. Description of the Spill Incident

On September 30, 2002, U.S. Coast Guard officials received a report of an oil sheen on the Cooper River in Charleston, South Carolina. It was later determined that a release of No. 6 heavy fuel oil from the vessel M/V Ever Reach had occurred, and the amount of the release was estimated at 12,500 gallons. The oil flowed from the Cooper River into Charleston Harbor and the Atlantic Ocean, causing light to heavy oiling along approximately 30 miles of shoreline, including marsh, mudflats, sand beaches and man-made structures. A map of the location and vicinity of the spill are shown in Figure 1.

Shortly after being notified of the spill, representatives from the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, the South Carolina Department of Natural Resources (DNR), the South Carolina Department of Health and Environmental Control, and the U.S. Navy together initiated preliminary assessment activities. These five state and federal agencies are the natural resource trustees (hereafter, Trustees) with the authority to investigate and assess natural resource damages for this spill incident. The Trustees determined that sufficient evidence of injury existed to proceed with a natural resource damage (NRD) assessment, including evaluation of losses related to recreational use of the affected resources. The owner of the vessel, Evergreen International, S.A., acting through Evergreen America Corp., assumed responsibility for the cleanup and joined with the Trustees in a cooperative NRD assessment process.

Both the Cooper River and Charleston Harbor were affected by the spill, including parts of the shoreline in Charleston and Mt. Pleasant, as well as James Island and Fort Sumter National Park. Oil also came ashore along Folly Island, south of the entrance to Charleston Harbor, and reached areas of the Folly River, the Kiawah River and

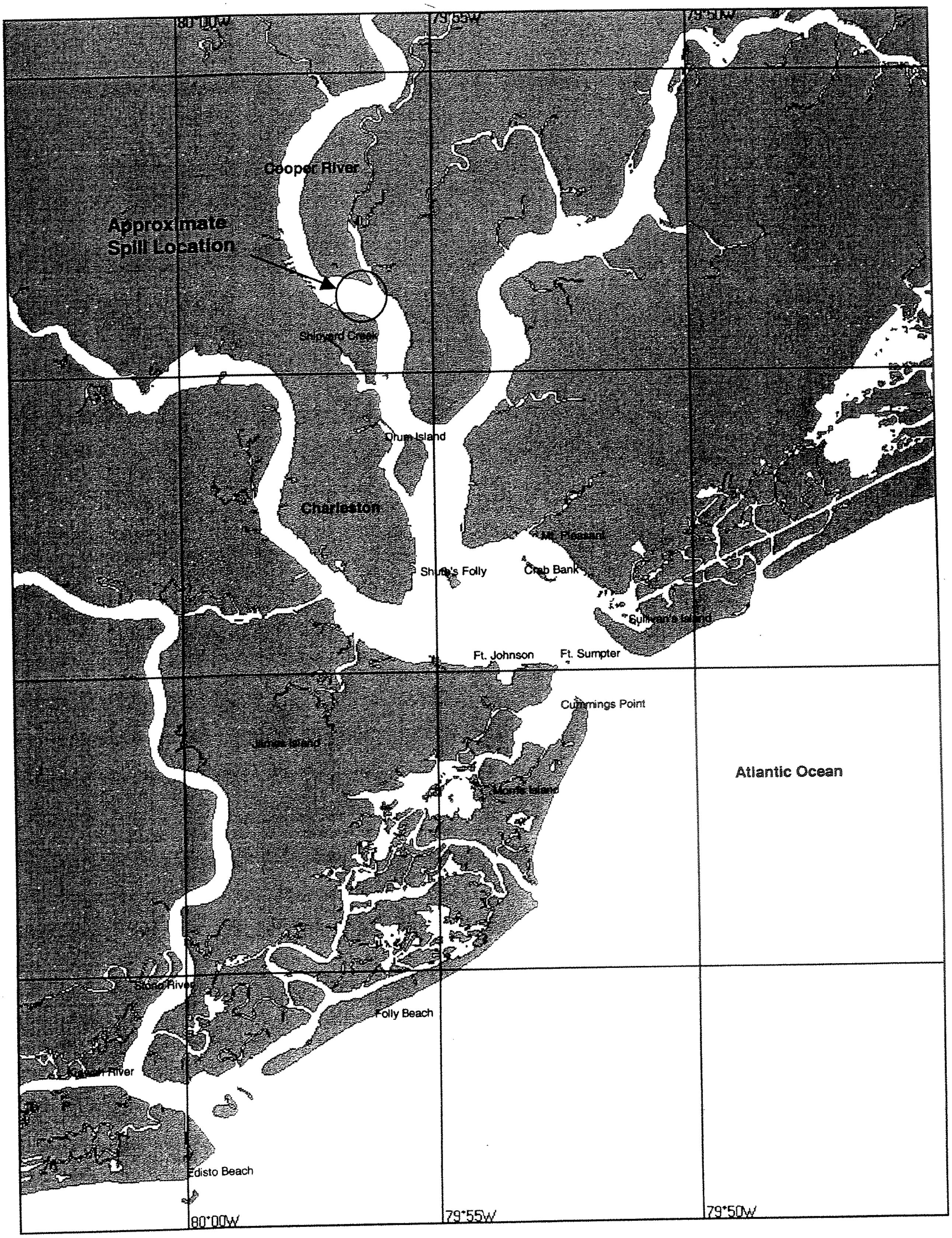

Figure 1. M/V EVER REACH incident vicinity, Charleston, South Carolina.

Morris Island. The shoreline in these areas varies from heavily urban to suburban, with natural shoreline ranging from relatively sheltered wildlife habitat to areas popular for shoreline recreation. Recreational areas potentially affected by the spill included the Cooper River Marina, Folly Beach, shellfish beds in and adjacent to the Folly River, and areas of Charleston Harbor popular for shrimp baiting in the fall season.

III. Damage Assessment Methods and Results

This section presents an overview of the study and analyses undertaken to determine lost-use damages for affected recreational activities. After considering potential effects to several types of resource-based recreational activities, the Trustees determined that recreational shrimp baiting and recreational shellfish harvesting losses had occurred and were sufficient to warrant including in assessment and restoration planning. The details of the shrimp baiting assessment are set forth in Appendices I and II. The details of the shellfishing assessment are set forth in Appendix III. The Trustees also examined potential losses associated with impacts to recreational boating and beach use but concluded that further assessment activities for these categories were not warranted, as described in Section IV.

Losses to Recreational Shrimp Baiting

Recreational shrimp baiting takes place throughout Charleston Harbor and in several other areas of coastal South Carolina. It typically takes place at night to improve catch, and usually involves marking several spots with poles, setting bait in the water and casting a net over the shrimp that are drawn to the bait. The activity is almost always undertaken using a boat. Recreational shrimp baiting was first permitted in South Carolina in the early 1980s, and takes place during an approximately 60-day season from mid-September to mid-November. Well over 10,000 permits are sold annually, and over 3,000 residents of the Charleston area purchased a permit in 2002. The 2002 season ran from September 13 through November 12. Forty-three days of the season followed the spill.

Losses to recreational shrimp baiting were determined based on information from a survey of shrimp baiting license holders. Since 1987, South Carolina's DNR has conducted an annual survey of shrimp baiting license holders to estimate the level and type of activity and the quantity of harvest (e.g. Low, 2002). For the survey conducted in November 2002, following the end of the shrimp-baiting season, questions were added to assist with the assessment of impacts to this fishery as a result of the spill. The questions focused on changes in the location of respondents' shrimp-baiting trips. In particular, respondents were asked if they took fewer trips than planned to the Charleston area, and if so, they were asked to state the reason. From those respondents reporting fewer trips to Charleston, and stating the oil spill as the reason, the total number of affected trips was determined. For the sample of license holders who were contacted and who returned the surveys, this came to 184 trips. Assuming 2.5 people per vehicle (see Appendix I), and extrapolating to the population of all license-holders in the state, the total number of lost trips was 4,232.

Based on the number of lost trips, the total monetary value of losses to shrimp baiting were estimated using a Random Utility Model (RUM). The RUM is a standard econometric technique for estimating the value of changes at a recreational site, such as a temporary reduction in the quality of a site due to an oil spill. By examining the pattern of shrimp baiting trips and the change in trips following the spill incident, the loss associated with the spill can be determined. Data from the shrimp baiting survey provided the necessary information on where residents live and which sites they visit. For additional information on RUM analysis and the theoretical framework of RUM valuation, see Parsons (2003).

Several additional inputs required for the RUM model were drawn from publicly available sources. Travel distances from each respondent's residence to the six sites specified in the survey were calculated using Yahoo Maps, available on the World Wide Web. The average travel speed was also determined using Yahoo Maps, based on a random sample of 100 trips. The cost of driving is another required input, with two components: the cost of time, and monetary expenses. The cost of time is based on the hourly wage of respondents. We used 2002 figures from the U.S. Census on average earnings for South Carolina residents. Since South Carolina officials indicate that most participants in recreational shrimp baiting are male, the U.S. Census figure applied to the RUM model was $16.01, the average hourly earnings for South Carolina men. Based on standard practice in the analysis of recreational demand, the wage was multiplied by 1/3 to get the opportunity cost of the time spent driving. The second component of the cost of driving – monetary expenses – is based on the per-mile cost of operating a vehicle. This was determined based on information for 2002 from the American Automobile Association.

Using the above inputs, an initial RUM analysis was performed showing a loss of $54,762 for the full population of licensed shrimp baiters. This implies a loss of about $13 for each lost trip to Charleston. However, this basic RUM analysis assumes that residents attempting to avoid the spill can switch relatively easily to other sites. It is reasonable to believe that substituting an unfamiliar site for a familiar site may be difficult in the short term. Shrimp baiting typically takes place at night and requires some familiarity with the local geography for safe navigation to and from the shrimp-baiting site, and for proper placement of gear. To address such constraints, we relied on results from the economics literature that addressed the issue of substitution to unfamiliar sites. Parsons *et al.* (1999) used the example of a short-term closure of a public beach, and found that with substitution constraints, losses increased over the basic RUM model by a factor of 1.36 to 2.09. We applied these factors to our basic model to get a range of damages of $74,476 to $114,452.

Losses to Recreational Shellfishing

The South Carolina Department of Health and Environmental Control (DHEC) closed shellfish bed S200 on October 1, 2002, due to potential contamination from the spill. DHEC lifted the closure November 5, 2002. The designated area S200 is located near Folly Island and is accessed primarily from the Folly River boat landing, located on

State Route 171. There are four other shellfish beds in or adjacent to the Folly River which are open to recreational use and are accessed from the same boat landing. These other shellfish beds were not closed following the spill. There are additional shellfishing areas nearby in the Kiawah River and Clark Sound.

To determine recreational shellfishing losses due to closure of S200, we multiplied the estimated number of lost trips by the estimated value of a South Carolina shellfishing trip. Information on trips for recreational shellfishing in the Folly River area was taken from a 1990 report entitled "South Carolina Marine Recreational Fish and Shellfish Fishery Surveys, 1988" (Waltz, *et al.*, 1990). This report is the most recent source of information on recreational shellfishing trips available for the relevant area. The report provides data from 28 days of intercept surveys conducted at the Folly River boat landing during 1988 and 1989, indicating that an average of 13.8 people accessed the Folly River each day. For most of them (92.5 percent) shellfishing was the primary purpose of their visit. For our analysis, we estimate a loss of 13.8 person-trips per day.

Several points regarding this estimate are worth noting. First, there is no information available to indicate whether the level of shellfishing activity in Folly River in 2002 may have been higher or lower than in 1989. South Carolina officials were not able to provide any additional information regarding trends in activity over time. Second, the figures in the 1990 report reflect use at three shellfish beds accessible from the Folly River boat landing, including S200. Since only S200 was closed following the spill, the figure of 13.8 could be an overestimate of lost trips. Third, public understanding or perception regarding the closure may have affected trips and led to losses in several areas of the Folly River near to S200, since the general public may not have been careful to distinguish between the closed bed and nearby shellfishing areas. In 2002, there were five areas in or adjacent to Folly River designated for recreational shellfishing (S189, S196, S200, S206 and R201). The designation of two additional recreational beds since the 1989 data were collected, along with the potential public perception that all Folly River sites might be closed or tainted, may imply that 13.8

person trips per day represents an underestimate of lost trips. While the net effect of these factors is unknown, the Trustees have determined that further investigation is not warranted, given the modest identified losses and the potential cost of efforts to refine the effect of these factors.

The value of a shellfishing trip was estimated based on evidence from the shrimp-baiting survey. The survey is a good source of information since it captures the practices and preferences of South Carolina residents regarding a similar marine-based, recreational-fishing activity. However, there is evidence that shellfishing trips may have slightly lower value than shrimp-baiting trips. In particular, shrimp baiting draws a greater share of its participants from inland counties compared to shellfishing (see Table 1 in Appendix III). In the context of recreational demand, this implies that shellfishing is a less valuable recreational activity. The range in value for person-trips in the shrimp-baiting analysis is $17.60 to $22.32. For shellfishing, a slightly lower range of $15.00 to $20.00 was assumed, consistent with this evidence.

The calculation of total loss is presented in Table 2 of Appendix III. A total of 36 days of closure, with 13.8 trips lost each day, results in 497 lost days. Applying the value range of $15.00 to $20.00, total losses to shellfishing as a result of the spill are $7,452 to $9,936.

IV. De Minimis Losses

Potential losses to recreational boating and beach use were also examined. While it is likely that losses occurred in each of these categories, the Trustees did not find evidence of significant loss. The Trustee Council determined that a claim for losses in these categories of recreational use was not warranted. The basis for this determination is described below.

Recreational Boating

The Trustees conducted a preliminary investigation of potential recreational boating losses in Charleston Harbor due to the spill. This investigation focused on potential losses associated with the disruption of access to the Harbor as a result the spill and required response activities by boaters using the Cooper River Marina. Considerable oiling occurred in the vicinity of the marina, and during the course of containment and cleanup activities an oil boom was placed around the perimeter of the marina. For a period of 10 days, there would have been no access to the harbor for boats moored at the marina as a result of this response action. At the same time, however, the hulls of most of the boats at the marina were oiled to some degree, preventing their use until the boats could be cleaned. Access for some boats continued to be limited for weeks or months after the spill, as decontamination continued and oil was cleaned from the hulls of the boats.

From the available evidence, the trustees determined that potential boating losses should not be included in the public NRD claim. This decision reflects several factors. First, any recreational boating losses due to the containment booming around the marina can be expected to be minimal since the period the booms were in place was short (10 days) and the affected area of the river was small. In addition, most boats kept at the marina experienced some level of oiling of hulls and could not have been used during the period that public access to the river was restricted. When private boats are oiled, boat owners can assert private claims against a responsible party for their particular losses, including for individualized boating losses. For this spill, the trustees are aware that the RP entered into discussions with boat owners at the Cooper River Marina in an effort to resolve such claims. A public boating loss claim assertable on behalf of boaters using the marina would be diminished by compensation of individualized boating losses, and could be fully addressed by the private claims process.

Finally, assessing public losses to recreational boating associated with the marina with any accuracy would be difficult, and likely to involve costs in excess of the modest amount of the public claim. For these reasons, the trustees believe further action to assess public boating losses is unwarranted.

Lost Beach Use

Following the spill, some oiling was observed at Folly Beach, a county-operated recreation site located directly on the Atlantic Ocean south of the entrance to Charleston Harbor. Because Charleston county beaches continue to have considerable levels of use during late September and early October, particularly on the weekends, the Trustees initiated a preliminary investigation into potential spill-related losses at Folly Beach. Data on beach attendance at three county beaches was obtained, and an analysis of the data indicated that potential losses associated with any disruption of beach use were not significant. A summary of the analysis of potential losses at Folly Beach appears below. Additional details, including the spreadsheet calculations and a graph comparing predicted use with actual use, appear in Appendix IV.

The investigation of lost beach use relies on regression analysis, a technique for determining the statistical relationship between two or more variables. In the beach use analysis, a regression is used to describe the relationship between attendance at Folly Beach and attendance at two other Charleston County beaches: Beachwalker County Park, located south of Folly Beach on Kiawah Island, and Isle of Palms County Park, located north of Folly Beach. Both beaches are similar to Folly Beach in size and amenities. Since they are close to Folly Beach, they are subject to similar weather conditions. These are the only county-operated beaches in the area. Other state-operated sites had attendance data available, but were not included in the analysis because they were further away, and they differed in size and the types of amenities offered.

In the analysis, beach attendance at Folly Beach is regressed against beach use at the two other sites. There are 33 observations, consisting of data for each weekend day during September and October for the years 2001 and 2002. A variable representing effects of the spill was added for the eight weekend days in October 2002, the period that was potentially affected. The analysis relies on the following assumptions:

1. The factors that cause changes in beach use from day to day are the same for Folly Beach and at least one of the other two beaches. The most obvious factor is variation in the weather.
2. The relationship between use at Folly and the other two beaches has not changed significantly over time. For example, if Folly typically got twice as much use as Kiawah Island in 2001, that's also true in 2002.
3. There were no unusual events at Folly Beach during October 2002, aside from the oil spill.
4. The oil spill had a greater effect on Folly than on the other two beaches (including the case where the spill had no effect on the other beaches).

Based on the regression analysis, recorded use at Kiawah Island and Isle of Palms is used to make a best prediction of use at Folly Beach on any given weekend day. For October 2002, the prediction is compared to actual use to determine whether a loss occurred. Based on visual inspection of a graph showing the comparison for previous months, the prediction of use at Folly Beach appears reasonable (the graph appears in Appendix IV). However, the variable representing the spill is not statistically significant, and contrary to expectations, has a positive sign. Furthermore, the predictions of use for Folly Beach in October 2002 are lower than actual use. This indicates that no significant events influenced attendance at Folly Beach during October 2002, and that random fluctuations led to slightly higher-than-expected use during that month. Based on this evidence, the Trustees determined that no significant loss to beach use occurred.

V. Conclusions

As part of a cooperative assessment process, losses to recreational use were determined. The Trustees have concluded that both recreational shrimp baiting and recreational shellfishing were affected by the spill. The Trustees also examined recreational boating and beach use, but determined that losses to these activities were not significant. Shrimp-baiting occurs in and around Charleston Harbor, in addition to other sites in Coastal South Carolina. Effects of the spill included a loss of trips to the Charleston area and a decline in value of trips taken to the Charleston area during the period of spill impacts. Total losses to shrimp baiting were $74,476 to $114,452. Closure of a shellfish bed in the Folly River also led to a loss of recreational trips. The estimated losses for shellfishing were $7,452 to $9,936. Total estimated losses range from $81,928 to $124,388.

Appendix I
Shrimp Baiting Assessment: Data and Methods

Appendix I: Shrimp Baiting Assessment Data and Methods

What follows is a detailed description of the data and methods used to calculate damages for lost recreational shrimp baiting. The data were obtained primarily from a 2002 survey of shrimp-baiting license holders. Among other things, the survey provides an estimate of the number of recreational trips lost due to the spill. The analytical methods rely primarily on a Random Utility Model, an econometric analysis of recreation demand. Using the survey data, along with information from South Carolina officials and from publicly available sources, the model estimates the value associated with a loss of recreational trips. Finally, adjustments to the damage model are made using results obtained from the economics literature. The spreadsheet calculations for the shrimp-baiting assessment appear in the first table of Appendix II (located at Tab 1).

The Survey of Shrimp-Baiting License Holders

Each year the South Carolina Department of Natural Resources conducts a survey of recreational shrimp baiting. The survey is sent to a sample of licensed recreational shrimp baiters. Participants who use their own shrimp-baiting equipment must have a license, while those who accompany others do not need a license. The survey is conduced in November of each year following the end of the shrimp-baiting season, which runs from mid-September to mid-November. In 2002, the year of the spill, a sample of 4,000 was randomly selected from a total of 13,903 license holders, and 1,520 responded. A copy of the 2002 survey is contained in Appendix II (Tab 2).

The essential information obtained from the surveys includes, for each respondent, the number of recreational trips taken and the origin and destination of each trip. On the survey form, the zip code for each respondent (provided in question 1) gives the approximate origin for each of the shrimp-baiting trips. For trip destination, question 3 of the survey divides the South Carolina coast into six sections, and respondents are asked to specify how many trips they took to each location. The six destinations, moving from south to north on the South Carolina coast, are Beaufort, St. Helena, Wadmalaw/Edisto Island, Charleston, Bulls Bay and Georgetown. In order to create the damage model, it was necessary to calculate the travel distance for each trip using the data on origin and destination. This process is described below in the section called "Calculation of Travel Distance."

Another important component of the survey provides an estimate of the number of trips lost due to the spill. For the 1,520 responses received, question 6 indicates that a total of 184 fewer trips were taken to Charleston because of the spill. Further details are provided below in the section entitled "Calculation of Lost Trips."

Finally, the number of participants on the average trip (or number of people per vehicle) is also estimated from survey data. Question 8 asks, "How many different people assisted you on boat trips?" Since this question appears to refer to the entire season, adjustments were made to estimate the number of people assisting on the average trip. Details of these adjustments appear below in the section entitled "The Number of People per Trip."

The Calculation of Travel Distance

The Random Utility Model requires as an input the travel distance to all six shrimp-baiting destinations from each respondent's residence. These distances were found using Yahoo Maps, a Web-based service available at www.maps.yahoo.com. For each respondent to the survey, the zip code of residence and the address for each of the six destinations were entered into Yahoo Maps. The exact street addresses of the respondents are not known, but the Yahoo program appears to select a central point in the specified zip code, returning a reasonable approximation of trip origin. The precise destination for each trip is also not known. Based on conversations with South Carolina officials familiar with shrimp-baiting activities, a specific destination was selected for each of the six sites specified in the survey. Most shrimp-baiting activity appears to involve a limited number of sites where boaters enter the water. The sites chosen, and links to the relevant Yahoo Maps site, appear in Appendix II under the heading "Shrimp-Baiting Trip Destinations" (Tab 3).

It should be noted that in the RUM analysis to follow, it is assumed that all trips entail some travel cost. In fact, some trips taken close to a respondent's home may not involve any travel, for example, if a residence abuts the water. In such cases, the short travel distance calculated makes the cost of travel for these trips insignificant.

The Calculation of Lost Trips

The number of trips lost due to the spill is identified in survey question 6, which asks, "Did you take fewer trips than planned this year to the Charleston area, other than due to bad weather?" If the answer is yes, the respondent is asked how many fewer trips were taken, and is prompted to give the reason. If a respondent took fewer trips than planned and identified the oil spill as the reason, at least some of his trips are counted as lost due to the spill.

Several types of response to this question are possible. A respondent may answer yes, identify the oil spill as the reason, and provide the number of fewer trips taken. These trips are counted as lost due to the spill. A respondent may answer yes, identify more than one reason (including the oil spill), and provide only a single estimate of fewer trips taken. In this case, the number of trips specified is allocated evenly to the reasons stated. For example, if two reasons are given, half of the specified trips are counted as trips lost due to the spill. Some respondents reporting several reasons allocated trips to each reason, so that no additional assumptions were necessary. Another category of respondents answered yes to the question about fewer trips and indicated the oil spill as the reason, but offered no estimate of the number of trips affected. The figure applied in these cases is the average for all respondents reporting a specific number of lost trips. Finally, one respondent indicated an additional trip taken to a site other than Charleston, and indicated the oil spill as the reason. The respondent did not respond to question 6, regarding trips to Charleston. Since substitute trips to other sites are an expected response to the oil spill in Charleston, and since the number of lost trips would presumably be at least as great as the number of substitute trips, one additional lost trip was added to the total.

The total number of lost Charleston trips for all respondents was 184, based on the above assumptions. Details of this calculation appear in the table entitled "Number of Lost Trips Calculation" (Tab 4). The memo at Tab 5 gives additional detail regarding the calculations. (The total shown in Table 3 is 183, because it does not include the single substitute trip, which was obtained from a separate examination of the survey records.) Extrapolated to the full population, the figure of 184 is multiplied by the total number of license holders divided by the number of respondents. This extrapolation factor is 9.2 (13,903 / 1,520 = 9.2). The total extrapolated number of lost trips is 1,693 (184 x 9.2 = 1,693). This figure reflects the number of vehicle-trips. The number of people in each vehicle is determined next.

The Number of People per Trip

An average of 2.5 people are assumed to participate on each shrimp-baiting trip. This is the same as saying that for each trip reported in the survey, there were an average of 2.5 people riding in the vehicle going to the site. This figure will be important in the calculation of the cost of driving, one of the calculations supporting the damage analysis.

Question 6 of the survey asks, "How many different people assisted you on boat trips." As mentioned previously, the question appears to refer to the total number of assistants during the season. This notion is supported by the fact that respondents taking more trips reported a greater number of assistants, as shown in the table entitled "Number of Assistants by the Number of Total Trips Taken" (Tab 6). To estimate the average number of assistants per trip, responses by those making a large number of trips need to be factored out. An estimate of 1.5 assistants per trip was chosen for several reasons. First, the total number of assistants reported for each respondent, on average, is 1.93 for the season. Since most people took more than one trip during the season, this represents an upper bound on the average number of assistants on each trip. Second, the total number of assistants reported by those taking only one trip is 1.26. This probably represents a lower bound estimate, since those who know fewer people who like to go shrimp baiting may be less likely to go (and thus take only one trip). In any case, the estimate for those taking only one trip is based on a small amount of information and may not be reliable. The number of assistants for respondents taking from one to three trips is 1.48 on average. In our judgment, this represents a reasonable mid-range estimate. This would imply a total of about 2.5 people per trip, including the respondent. This figure is comparable with estimates in the literature for the typical number of people on other recreational trips, like fishing.

The Use of a Random Utility Model to Calculate Damages

The inputs described in the preceding sections are incorporated into a Random Utility Model that relies on trip patterns to estimate site-specific constants while using the survey information on lost trips to evaluate the extent of the loss. The discussion below assumes a basic knowledge on the part of the reader regarding the theory and function of a Random Utility Model. See Morey (1999) for a detailed presentation. While reviewing the steps outlined below, the reader may find it useful to refer to the table entitled "Calculations of Monetary Losses Due to Reduced Trips To Charleston," contained in Appendix II (Tab 1).

The basic procedure can be summarized as follows:

- Using trips data from the surveys, estimate parameters for a nested RUM, consisting of site-specific constants, the travel cost parameter and the scale parameter;
- Define the length of time during which effects of the spill are assumed to persist;

- Set up calculations for two models, one representing baseline conditions, the other representing degraded conditions. The parameters in both models will be the same, except for the site-specific constant for Charleston, which is allowed to vary;
- The output of each model is a prediction of trips to the six sites. Divide the model predictions into two time periods, multiplying by the appropriate factor: 25/60 for the spill-impact period, and 35/60 for the remainder of the season;
- Set up two constraints that must be satisfied by the combined models: 1) For the 25 days of the spill-impact period, the difference in trips predicted for Charleston under degraded and baseline conditions must be 184, the number of lost trips, and 2) The sum of Charleston trips predicted for 25 days under degraded conditions and 35 days under baseline conditions must equal the total number of trips reported for the season;
- Adjust the two Charleston site-specific constants until both constraints are satisfied;
- Calculate, according to the standard practice, the difference of the log-sum for each respondent, multiply by the number of choice occasions, and sum up over respondents to find the total loss.

Calculations below involving the RUM analysis refer to the set of survey respondents only, with losses referring to the 184 lost trips reported in the sample. Extrapolation to the full population occurs in the final calculation of damages at the end of this Appendix.

Derivation of Baseline and Degraded-State Models

The first step in constructing the damage model is the estimation of RUM parameters using data from the surveys regarding trips taken by respondents. To incorporate the possibility that some people would decide to take fewer total trips in response to the spill (rather than simply substituting to other sites), a two-level nested structure is used. The first level describes the choice of taking a trip versus participating in some other activity. The second level is the site-choice model, describing the choice among the six sites given the decision to take a trip. There are 31 choice occasions in the participation level of the model. This number was chosen to allow for up to 30 shrimp-baiting trips per respondent. For those few individuals who took more trips, figures are truncated at 30. The estimated parameters for this model consist of the travel distance coefficient, five site-specific constants, the estimated utility of "opting out" (or choosing not to take a trip), and the scale parameter for the two-level nested structure. The assigned missing variable for the site-specific constants is Georgetown (that is, the Georgetown constant is set to zero). The estimated model parameters are:

Travel distance (one-way)	-0.0011
Beaufort	0.0521
St. Helena	0.0547
Wadmalaw/Edisto Island	0.0146
Charleston	0.0205
Bulls Bay	0.0384
Opt Out	1.9113
Scale Parameter	0.0173

Inspection of the model parameters indicates that the model performs well. The travel distance parameter is negative, indicating that respondents prefer closer sites, all else equal. The site-specific constants indicate that Beaufort and St. Helena are the most desirable sites for shrimp baiting. Remembering that Georgetown effectively has a constant of zero, Charleston appears to be roughly in the middle of the range in terms of site desirability. Values of the "Opt Out" and scale parameters depend on variance and covariance properties of the data and do not have intuitive interpretations.

The parameters listed above do not reflect conditions that actually existed at any time during the 2002 season. Rather, they represent a mixture of spill-impacted days (starting September 30) and non-impacted days (occurring prior to September 30 and after the effects of the spill were gone). To proceed with estimation of damages, we must determine the length of time that effects of the spill influenced shrimp-baiting activities. Based on anecdotal evidence from on-scene observations, it was determined that effects of the spill lasted about 25 days (see Line (1) of the damage calculations, Appendix II, Tab 1). Reducing the assumed period of the spill to 15 days or increasing it to 35 days has only a modest effect on total damages.

To represent conditions as they actually occurred – that is, a baseline period and a degraded period – requires two separate calculations. First, trips must be estimated over a period of 25 days, using a constant for Charleston that reflects degraded conditions. These estimated trips appear in Line (4) of the calculations table. Second, trips must be estimated for a period of 35 days with a constant for Charleston that reflects baseline conditions. These estimated trips appear in Line (8). Constants at all other sites, and parameters for the inclusive value and the opt-out alternative, are the same for both models.

A third set of estimates is also required. Line (6) of the calculations shows predicted trips under baseline conditions for the 25-day spill-impact period. In order to correctly determine losses, the calculations must reflect a decline of 184 trips to Charleston during the spill-impact period, compared to baseline conditions. As noted earlier, the figure of 184 is based on information from the surveys. Line (7) shows the difference between trips under baseline conditions and trips under degraded conditions (Line (4) minus Line (6)). Line (7) shows that the loss of 184 Charleston trips is correctly reflected in the calculations.

There are an unlimited number of paired constants (reflecting baseline and degraded conditions in Charleston) that would result in a loss of 184 trips. To find the appropriate estimate of losses, another constraint must be satisfied. Namely, the number of actual Charleston trips recorded in the surveys throughout the 60-day season should equal the sum of the number of trips estimated for the period of the spill (shown in Line 4) plus the number of trips estimated during the 35 days of baseline conditions (shown in Line 8). The comparison is shown in Lines (9) and (10). For the Charleston site, total actual trips and total estimated trips are indeed equal. Lines (11) through (13) use the Solver algorithm in Excel to iteratively find a solution that satisfies the two constraints on lost trips and total trips, respectively.

The constraint on total trips is applied to Charleston because that is the focus of the analysis. One might argue that predicted trips should match actual trips throughout the season for each of the six sites. There are two reasons why this would not be expected. First, due to the statistical nature of the analysis, such precise predictions are unlikely to occur in practice. Second, as noted previously, there is evidence that substitution to potentially unfamiliar sites would have been limited following the spill. Since these substitution constraints are not included in the basic RUM model, the actual distribution of trips among the various sites would be expected to differ from model predictions.

Calculation of Monetary Losses

Once the appropriate site-specific constants for Charleston are found, losses can be calculated using the standard log-sum formula. Specifically, following the appropriate algebraic expressions for the nested formulation, the log-sum term with the constant for Charleston in the degraded state is subtracted from the log-sum term with the baseline constant for Charleston. This is done for each respondent, with travel-cost values changing for each respondent based on zip code of residence. This difference, which reflects the loss on a single choice occasion, is then multiplied by 31 choice occasions for each respondent, and added up over all respondents. Finally, the result is multiplied by 25/60 to reflect the 25-day period of degraded conditions.

The resulting utility loss for our sample is 5.1, shown in Line (14). The units of this number are not defined in a meaningful way, but can be converted to miles using the absolute value of the coefficient on the travel-distance parameter. Dividing by 0.0011, the loss expressed in miles is 4,599 for the members of our sample, as shown in Line (16). For simplicity, the model used one-way distance in its calculations. Since each visit to a site actually requires round-trip travel, the correct figure for the loss is 9,197 miles, shown in Line (17).

To convert the loss to dollars, the cost associated with driving these additional miles must be determined. There are two primary components to the cost of driving: (1) the monetary cost of operating and maintaining an automobile, and (2) the implicit cost of one's time spent on the road. These calculations are outlined in rows A through P in Line (18).

Figures on the monetary costs of driving are available from a number of sources. Documents from the Web pages of the American Automobile Association are presented in Appendix II (Tab 7). Operating expenses, including gas, oil, and maintenance, average about 11.8 cents per mile. This represents a middle estimate from a range that includes small, mid-sized and large cars, as well as SUVs. The mid-range estimate for depreciation is 17.8 cents per mile, based on depreciation costs for each 1,000 miles over 15,000. The sum of these expenses is 29.6 cents. According to South Carolina officials familiar with shrimp baiting recreation in the state, virtually all participants haul a boat when traveling to and from their destination. To account for this, operating costs are adjusted upward by 15 percent. Total operating and depreciation costs are 31 cents per mile, as shown in Row E.

The cost of one's time is customarily calculated based on the wage rate. Wage information from the U.S. Census Bureau is reprinted in Appendix II (Tab 8). The median earnings for male, full-time, year-round workers in South Carolina were $32,027 in 1999. The figure for male earnings is used because most participants in recreational shrimp baiting in South Carolina are male, according to state officials.[1] Several adjustments are made to this figure. To convert to hourly wages, annual earnings are divided by 2,080 working hours per year. To convert to base-year 2002 (the year of the shrimp-baiting survey) the hourly figure is inflated by 4 percent,

[1] Based on a personal communication with Ed Duncan of the South Carolina Department of Natural Resources.

based on an index of average hourly earnings reported by the U.S. Department of Labor. The Department of Labor figures are reprinted in a table in Appendix II (Tab 9). The resulting hourly wage for the average South Carolina male in 2002 is $16.01, as shown in Row J.

To obtain the cost of time, we follow the common practice of using 1/3 the wage rate (see Cesario (1976), Parsons et al. (2000) or Train (1998)). The resulting figure is allocated to miles assuming an average travel speed of 40 miles per hour. This average is based on travel speeds for a set of randomly selected trips, based on travel times reported in Yahoo Maps and MapQuest, two services commonly available on the World Wide Web. As shown in Row M, the resulting cost of time is $0.13 per person per mile.

Many trips recorded in the surveys likely involved more than one person. The average cost of time on a given trip is the product of the individual cost of time per mile and the average number of people per trip. Assuming 2.5 people per trip, the result is $0.33, shown in Row O. The average number of people per trip was calculated using responses to question 6 of the shrimp-baiting survey, as described above.

Adding together the cost of time and vehicle costs for each trip, the total cost of driving is estimated at $0.65 per mile, as shown in Row P.

Multiplying the per-mile cost of driving by the loss expressed in miles, the dollar loss implied by the RUM model thus far is $0.65 x 9,197 = $5,952. Based on information from South Carolina officials who implemented the shrimp baiting survey, applying a factor of 9.2 will correctly extrapolate the sample results to the full population. The implied loss for the total population is $54,762, as shown in Line (21).

Adjustment for Constrained Substitution

Trustee representatives and other officials from South Carolina familiar with shrimp baiting activities presented evidence that substitution among sites may be constrained in the short term. Limitations to substitution may result from several factors. These include the fact that shrimp baiting typically takes place at night, and safe navigation to and from the site required knowledge of the local geography. Placing shrimp baiting gear and anticipating tidal effects also require some familiarity with local conditions. In addition, there may be significant loyalty among participants to their familiar sites. Based on these factors, we concluded that the RUM formulation presented thus far might overstate the degree to which participants can mitigate losses from the spill by switching to other sites.

To account for possible constraints on substitution, we reviewed the literature on Random Utility Models and the definition of choice sets, or consideration sets. A choice set refers to the group of sites available to a given participant as represented in a model of recreational behavior. In more complex models, various choice sets may be available to varying degrees. To represent the constrained substitution of South Carolina shrimp baiting, we selected a model developed by Parsons et al. (1999). In the Parsons model, recreational beach use is considered, and choices available to participants are divided into familiar and unfamiliar sites. While they choose from among the familiar sites in the usual (flat RUM) manner, the unfamiliar sites are grouped into a separate nest. This allows the model to reflect a tendency by participants to alter their substitution patterns when confronted with unfamiliar sites. A site is defined as familiar if the respondent visited the site within the last three years.

In the Parsons RUM, welfare losses are calculated for the closure of a beach. Results are compared to the same closure using a "basic model," that is, without the separate treatment of familiar and unfamiliar sites. The study found that welfare losses were considerably higher using the model that allowed for substitution constraints. The increase in losses ranged from a factor of 1.36 to 2.09.

It should be noted that limitations in applying these results to the shrimp-baiting RUM have not been fully explored. Beach goers and shrimp baiters may regard unfamiliar sites differently. Substituting to an unfamiliar beach is likely to be easier than substituting to an unfamiliar site for shrimp baiting. In this sense, the Parson model may be conservative for our purposes. Also, there are a greater number of sites in the Parsons model than in the shrimp baiting RUM. While the effect of these factors is unknown, adequate information is not available to investigate the matter further. In our judgment, it is reasonable to adjust the loss estimated by our "basic RUM" according to the Parsons results.

Multiplying $54,762 by 1.36 gives in a lower bound estimate of $74,476. Multiplying by 2.09 results in an upper bound estimate of $114,452. The midpoint of this range is $94,464 in total damages.

For comparison with RUM results in the literature, we also present the loss per trip. It should be noted that the RUM model calculates losses for both lost trips and trips taken to Charleston under degraded conditions. In the basic model, the number of degraded person-trips can be calculated from Line (4): 386 degraded trips multiplied by 2.5 people per trip and an extrapolation factor of 9.2 comes to 8,869 degraded person-trips. However, this calculation would not apply to the model after adjustment for substitution constraints. We therefore express per-trip damages based on lost trips only. With 184 fewer trips taken to Charleston, 2.5 people per trip, and an extrapolation factor of 9.2, the total number of lost person-trips is 4,232. The midpoint of the monetary loss per trip is about $22, a figure that is within the rage of values calculated by other RUM studies of similar marine recreational activities.

Appendix II
Shrimp Baiting Assessment: Tables and Supporting Documents

TAB 1

Calculation of Damages Due To Reduced Shrimp Baiting Trips to Charleston

Data Inputs Are Highlighted in Bold Type

Derivation of Baseline and Degraded-State Models

Selected Inputs to the Derivation

(1) Period of spill **25** days
(2) Total Length of Season 60 days

(3) Parameters:

	Baseline	Degraded
Travel Distance (One-Way)	0.00	-0.0011
Beaufort	0.05	0.0521
St. Helena	0.05	0.0547
W/Edisto	0.01	0.0146
Charleston	0.02	0.0143 *
Bulls Bay	0.04	0.0384
Opt Out	1.91	1.9113
IV	0.02	0.0173
(Georgetown)	0.00	0.00

* Charleston parameters are calculated below.

Calculation of Damages Due To Reduced Shrimp Baiting Trips to Charleston

Data Inputs Are Highlighted in Bold Type

	Beaufort	Helena	Edisto Is.	Charleston	Bulls Bay	Georgetown	Total
During the 25-Day Period of Spill Impact:							
(4) Estimated Trips, Degraded Conditions	608.6	455.2	178.8	385.6	545.1	148.5	2,321.7
(5) Charleston Lost Trips				**184.0**			
(6) Predicted Trips, Baseline Conditions	567.0	424.5	149.4	569.6	474.0	141.5	2,326.1
(7) Change: Actual minus Baseline [(4)-(6)]	41.6	30.6	29.4	-184.0	71.1	6.9	-4.4
During the 35-Days Without Spill Impacts:							
(8) Estimated Trips	793.8	594.3	209.1	797.5	663.6	198.2	3,256.5
During the Total 60-Day Season:							
(9) Total Estimated Trips	1,402.4	1,049.5	387.8	1,183.1	1,208.7	346.6	5,578.2
(10) Total Actual Trips	1,339.0	991.0	351.0	1,183.0	1,310.0	405.0	5,579.0
Iterative Solution to Satisfy Two Model Constraints							
(11) Prediction error 1 — Total trips				0.1			
(12) Prediction error 2 — Lost Trips				0.0			
(13) Squared Sum of Prediction Errors for Use in Solver Algorithm				0.00934091			

Calculation of Damages Due To Reduced Shrimp Baiting Trips to Charleston

Data Inputs Are Highlighted in Bold Type

Calculation of Monetary Losses

(14) Difference of Log Sums		5.1	
(15) Travel Distance Parameter		-0.0011	
(16) Loss In One-Way miles [(14)/(15)]		4,598.7	
(17) Loss in Round-Trip miles		9,197.4	
(18) Cost per mile			

Monetary Costs:

	Operating cost per mile (A)	$	**0.118**
	Depreciation cost per mile (B)		**0.178**
A+B	Total Marginal Cost w/out Boat (C)		0.296
	Adjustment for Hauling Boat (D)		**1.15**
(AxD)+C	Total Marginal Cost with Boat (E)		0.31

The Cost of Time:

	Median Male Earnings (F)	$	**32,027**
	Working Hours per year (G)		**2080**
F/G	1999 Hourly Wage (H)		15.40
	Increase 2002/1999 (I)		**1.04**
HxI	2002 Hourly Wage (J)	$	16.01
	Fraction Applied to Wage Rate (K)		**0.33**
	Travel Speed (L)		**40** mph

Calculation of Damages Due To Reduced Shrimp Baiting Trips to Charleston

Data Inputs Are Highlighted in Bold Type

JxKxL	Cost of Time (M)		0.13	per person
	Number of people per vehicle trip (N)		**2.5**	
MxN	Total Cost of Time (O)		0.33	
E+O	Trip Cost per Mile (P)		0.65	
(19)	Loss [(17)x(18)]	$5,952		
(20)	Extrapolation	9.2		
(21)	Total Loss [(19)x(20)]	$54,762		

Adjustment for Constrained Substitution

	Low	High	Midpoint
(22) Adjustment Factor	1.36	2.09	1.73 [1]
(23) Total Loss	$74,476	$114,452	$94,464
(24) Total Person-Trips	4,232		
(25) Loss per Trip	$17.60	$27.04	$22.32

[1] Adjustment factors are based on Parsons (1999). Increases in loss associated with constrained choice sets range from 36 percent to 109 percent, based on results from the "Familiar Sites" model developed in that study.

TAB 2

1. Please give the count ____________ and zip code ________ you live in.
2. How many trips did you make using your permit and gear?
   _____SEP _____OCT _____NOV _______ All season
3. Please indicate the number of trips you made in each area.

_____BEAUFORT _____CHARLESTON

_____ST. HELENA SD. _____BULLS BAY

_____WADMALAW/EDISTO IS. _____GEORGETOWN

4. Did you make more trips than planned at any of the above areas? If yes,
   How many more? _____ Which area? __________ Reason? ______________

   How many more? _____ Which area? __________ Reason? ______________
5. Did you make fewer trips than planned this year in the Charleston area, other than due to bad weather? If yes,
   How many fewer? ______ Reason? ____________________

   How many fewer? ______ Reason? ____________________
6. How many different people assisted you on boat trips? ________
7. What was your average catch per trip in quarts of whole shrimp? ________
8. What was your total catch for the season in quarts of whole shrimp? ________

TAB 3

Trip Distance Calculations
Links to Yahoo Maps for the Six Shrimp Baiting Destinations

Beaufort: Broad oaks drive and route 802
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=Broad+oaks+drive+and+route+802&tarcsz=Beaufort,+SC+29906&newtcountry=us&newcountry=us&tuz=29906&doit=1

St. Helena: Wilkins, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Wilkins,+SC&newtcountry=us&newcountry=us&tuz=29902&doit=1

Two points of access for Wadmalaw/Edisto (assume shorter of two):
1) Edisto Beach, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Edisto+Beach,+SC&newtcountry=us&newcountry=us&tuz=29438&doit=1
2) Rockville, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Rockville,+SC&newtcountry=us&newcountry=us&tuz=29487&doit=1

Charleston: Charleston, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Charleston,+SC&newtcountry=us&newcountry=us&tuz=29401&doit=1

Bulls Bay: Buck Hall, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Buck+Hall,+SC&newtcountry=us&newcountry=us&tuz=29458&doit=1

Georgetown: Georgetown, SC
http://maps.yahoo.com/py/ddResults.py?Pyt=Tmap&tarname=&tardesc=&tarhash=&taraddr=&tarcsz=Georgetown,+SC&newtcountry=us&newcountry=us&tuz=29440&doit=1

TAB 4

Ever Reach February 14, 2003

Yellow represents Totals. Blue represents assigned values.

Number of lost trips calculation:

Total Lost Trips = 183

Code	Description	Value	
94	a few, less, little	3	= Weighted ave. of 1, 2, 3, & 4 lost trips involving oil spill
95	many, more, lots, a lot	12	= Weighted ave. of 10, 13, & 15 lost trips involving oil spill
96	some	6	= Weighted ave. of 5, 6, 7, & 8 lost trips involving oil spill
97	?, unknown	0	
98	check mark, "X"	0	
99	n/a	0	
.	missing	6	= Weighted ave. no. of lost trips involving oil spill

Oil Spill only (Reason code 1):

	# trips	frequency	product
ftripsx	1	1	1
	2	3	6
	3	2	6
	5	4	20
	6	1	6
	7	1	7
	8	2	16
	10	2	20
	15	2	30
	"lots" (code 95)	2	24
	missing	1	6
ftripsy	4	1	4
	missing	1	6
Total Lost Trips due to Oil Spill (only) =			**152**

Oil Spill Combination (Reason codes 12 - 19):

	# trips	frequency	product
ftripsx	2	1	2
	4	2	8
	5	1	5
	6	1	6
	10	1	10
	13	1	13
	missing	2	12
ftripsy	missing	1	6
Total Lost Trips due to Oil Spill & Some other Reason =			**62**
Assume only 1/2 trips are lost due to oil spill =			**31**

TAB 5

MEMORANDUM

TO: *Ever Reach* NRD Group

FROM: Rick Dunford and Jeanne Foley

DATE: February 18, 2003

SUBJECT: Shrimp-bait Fishing: Lost trips

This memorandum presents TER's findings on lost trips related to the oil spill. The Excel file attached to this memorandum provides the details for our estimates.

Lost Shrimp-Bait Fishing Trips Related to Oil Spill

As we discussed previously, some respondents did not provide a numeric answer for the number of fewer trips they took because of the oil spill. Two respondents answered "Lots" or "Many." We reviewed the distribution of numeric responses for the number of fewer trips and found that the upper end of the distribution was 10, 13, and 15 trips. The weighted average of the three largest numbers is 12.1, so we have replaced the two "Lots/Many" responses with 12 trips. (It seemed to us that whole numbers of trips were most appropriate in this part of the analysis.)

Five respondents did not give any response (numeric or otherwise) for the number of fewer trips, even though they said that they had made fewer trips because of the oil spill. We determined that the weighted average number of fewer trips based on the numeric answers was 6.15, so we have replaced the missing responses with 6.

Twenty-three respondents said that the oil spill was the sole reason for their fewer trips to the Charleston area. Ten respondents had two or more reasons for fewer trips to the Charleston area, with the oil spill as one of the reasons. As Eric suggested in our February 10 call, we have assumed that the oil spill was responsible for half of the fewer trips to the Charleston area for these ten people.

Our estimate of total lost trips caused by the oil spill by the survey respondents is 183. The worksheet in the attached Excel file labeled "Lost Trips" provides the details on the derivation of this estimate.

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Durham, NC 27713

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-mail: rdunford@ter.com

TAB 6

TER

April 2, 2003

South Carolina Shrimp Bait Fishing Data

Number of Assistants by the Number of Total Trips Taken

CHARLESTON TRIPS

# of trips	# of assistants	respondents	Cumulative % of respondents
1	1.38	24	10.39%
1 to 2	1.45	51	22.08%
1 to 3	1.54	89	38.53%
1 to 4	1.67	115	49.78%
1 to 5	1.78	145	62.77%
1 to 6	1.89	166	71.86%
1 to 7	1.92	176	76.19%
all	2.18	231	100.00%

ALL TRIPS

# of trips	# of assistants	Respondents	Cumulative % of respondents
1	1.26	191	17.47%
1 to 2	1.36	356	32.57%
* 1 to 3	1.48	501	45.84%
1 to 4	1.57	633	57.91%
1 to 5	1.64	755	69.08%
1 to 6	1.70	834	76.30%
1 to 7	1.73	883	80.79%
all	1.93	1093	100.00%

TAB 7

Your Driving Costs

Section Quick Links

Driving Costs

Here are some samples of vehicle driving costs:

	2002 Chevrolet Cavalier LS 4-cyl. (2.2 liter) 4-door sedan	2002 Ford Taurus SEL 6-cyl. (3.0 liter) 4-door sedan	2002 Mercury Grand Marquis LS 8-cyl. (4.6 liter) 4-door sedan	Average
operating costs	per mile	per mile	per mile	per mile
gas and oil	5.2 cents	5.9 cents	6.5 cents	5.9 cents
maintenance	3.9 cents	4.1 cents	4.3 cents	4.1 cents
tires	1.2 cents	1.8 cents	2.2 cents	1.8 cents
cost per mile	10.6 cents	11.8 cents	13.0 cents	11.8 cents *
ownership costs	per year	per year	per year	per year
comprehensive insurance ($250 deductible)	$200	$144	$174	$173
collision insurance ($500 deductible)	$391	$321	$358	$357
bodily injury and property damage ($100,000,$300,000,$50,000)	$484	$484	$484	$484
license, registration, taxes	$162	$203	$238	$201
depreciation (15,000 miles annually)	$3,037	$3,706	$4,420	$3,721
finance charge (20% down; loan @ 9.0%/4 yrs.)	$604	$842	$1,039	$828
cost per year	$4,878	$5,700	$6,713	$5,764
cost per day	$13.37	$15.62	$18.39	$15.79
added depreciation costs (per l ,000 miles over 15,000 miles annually)	$158	$185	$192	$178 *
total cost per mile				
15,000 total miles per year	per year	per year	per year	per year
cost per mile x 15,000 miles	$1,590	$1,770	$1,950	$1,770
cost per day x 365 days ***	$4,880	$5,701	$6,712	$5,763
total cost per year	$6,470	$7,471	$8,662	$7,533
total cost per mile*	43.1 cents	49.8 cents	57.7 cents	50.2 cents

20,000 total miles per year	per year	per year	per year	per year
cost per mile x 20,000 miles	$2,120	$2,360	$2,600	$2,360
cost per day x 365 days ***	$4,880	$5,701	$6,712	$5,763
depreciation cost x 5 **	$790	$925	$960	$890
total cost per year	$7,790	$8,986	$10,272	$9,013
total cost per mile*	39.0 cents	44.9 cents	51.4 cents	45.1 cents
10,000 total miles per year	per year	per year	per year	per year
cost per mile x 10,000 miles	$980	$1,080	$1,190	$1,080
cost per day x 365 days ****	$4,362	$4,924	$6,172	$5,154
total cost per year	$5,342	$6,004	$7,362	$6,234
total cost per mile*	53.4 cents	60.0 cents	73.6 cents	62.3 cents

* total cost per year ÷ total miles per year
** excess mileage over 15,000 miles annually (in thousands)
*** ownership costs based on a 4-year/60,000-mile retention cycle
**** ownership costs based on a 6-year/60,000-mile retention cycle

Next: Additional Driving Cost Samples >>

Your Driving Costs

Driving Costs

Here are some samples ot vehicle driving costs:

	2002 Chevrolet Blazer 6-cyl. (4.3 liter) 2WD 4-door sport utility	2002 LS Dodge Caravan SE 6-cyl. (3.0 liter) passenger van
operating costs	per year	per year
gas and oil	5.8 cents	5.4 cents
maintenance	4.1 cents	4.0 cents
tires	1.7 cents	1.6 cents
cost per mile	11.6 cents	11.0 cents
ownership costs	per year	per year
comprehensive insurance ($250 deductible)	$204	$130
collision insurance ($500 deductible)	$451	$354
bodily injury and property damage ($100,000,$300,000,$50,000)	$389	$389
license, registration, taxes	$261	$234
depreciation (15,000 miles annually)	$3,220	$2,974
finance charge (20% down; loan @ 9.0%/4 yrs.)	$662	$578
cost per year	$5,187	$4,659
cost per day	$14.21	$12.76
added depreciation costs (per l ,000 miles over 15,000 miles annually)	$171	$174
total cost per mile		
15,000 total miles per year	per year	per year
cost per mile x 15,000 miles	$1,740	$ 1,650
cost per day x 365 days ***	$6,336	$5,709
total cost per year	$8,076	$7,359
total cost per mile*	53.8 cents	49.1 cents

Related Links

- Maintaining And Repairing Your Car
- AAA Approved Auto Repa
  St. Louis Diagnostic Clinic
- Daily Fuel Gauge Report

Print-friendly version this section

20,000 total miles per year	per year	per year
cost per mile x 20,000 miles	$2,320	$2,200
cost per day x 365 days ***	$6,336	$5,709
depreciation cost x 5 **	$855	$870
total cost per year	$9,511	$8,779
total cost per mile*	47.6 cents	43.9 cents

10,000 total miles per year	per year	per year
cost per mile x 10,000 miles	$1,160	$1,100
cost per day x 365 days ****	$5,187	$4,657
total cost per year	$6,347	$5,757
total cost per mile*	63.5 cents	57.6 cents

* total cost per year ÷ total miles per year
** excess mileage over 15,000 miles annually (in thousands)
*** ownership costs based on a 4-year/60,000-mile retention cycle
**** ownership costs based on a 6-year/60,000-mile retention cycle

Next: Vacation Planning >>

TAB 8

Quick Tables

DP-3. Profile of Selected Economic Characteristics: 2000
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **South Carolina**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, and definitions see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	3,114,016	100.0
In labor force	1,974,222	63.4
Civilian labor force	1,938,195	62.2
Employed	1,824,700	58.6
Unemployed	113,495	3.6
Percent of civilian labor force	5.9	(X)
Armed Forces	36,027	1.2
Not in labor force	1,139,794	36.6
Females 16 years and over	1,626,362	100.0
In labor force	935,656	57.5
Civilian labor force	928,772	57.1
Employed	868,936	53.4
Own children under 6 years	297,176	100.0
All parents in family in labor force	186,013	62.6
COMMUTING TO WORK		
Workers 16 years and over	1,822,969	100.0
Car, truck, or van -- drove alone	1,447,338	79.4
Car, truck, or van -- carpooled	255,857	14.0
Public transportation (including taxicab)	15,468	0.8
Walked	42,567	2.3
Other means	23,504	1.3
Worked at home	38,235	2.1
Mean travel time to work (minutes)	24.3	(X)
Employed civilian population 16 years and over	1,824,700	100.0
OCCUPATION		
Management, professional, and related occupations	530,117	29.1
Service occupations	268,661	14.7
Sales and office occupations	459,724	25.2
Farming, fishing, and forestry occupations	10,679	0.6
Construction, extraction, and maintenance occupations	209,048	11.5
Production, transportation, and material moving occupations	346,471	19.0
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	20,785	1.1
Construction	150,608	8.3
Manufacturing	354,386	19.4
Wholesale trade	60,503	3.3
Retail trade	217,604	11.9
Transportation and warehousing, and utilities	91,698	5.0
Information	38,554	2.1
Finance, insurance, real estate, and rental and leasing	102,764	5.6
Professional, scientific, management, administrative, and waste management services	125,514	6.9
Educational, health and social services	339,708	18.6
Arts, entertainment, recreation, accommodation and food services	151,099	8.3
Other services (except public administration)	85,794	4.7

Subject	Number	Percent
Public administration	85,683	4.7
CLASS OF WORKER		
Private wage and salary workers	1,425,333	78.1
Government workers	289,867	15.9
Self-employed workers in own not incorporated business	104,649	5.7
Unpaid family workers	4,851	0.3
INCOME IN 1999		
Households	1,534,334	100.0
Less than $10,000	181,777	11.8
$10,000 to $14,999	106,693	7.0
$15,000 to $24,999	220,065	14.3
$25,000 to $34,999	213,504	13.9
$35,000 to $49,999	269,559	17.6
$50,000 to $74,999	288,757	18.8
$75,000 to $99,999	129,518	8.4
$100,000 to $149,999	81,624	5.3
$150,000 to $199,999	19,873	1.3
$200,000 or more	22,964	1.5
Median household income (dollars)	37,082	(X)
With earnings	1,225,859	79.9
Mean earnings (dollars)	47,936	(X)
With Social Security income	406,777	26.5
Mean Social Security income (dollars)	10,686	(X)
With Supplemental Security Income	71,720	4.7
Mean Supplemental Security Income (dollars)	5,726	(X)
With public assistance income	37,864	2.5
Mean public assistance income (dollars)	2,145	(X)
With retirement income	274,216	17.9
Mean retirement income (dollars)	16,933	(X)
Families	1,078,736	100.0
Less than $10,000	76,639	7.1
$10,000 to $14,999	55,247	5.1
$15,000 to $24,999	135,330	12.5
$25,000 to $34,999	143,201	13.3
$35,000 to $49,999	201,370	18.7
$50,000 to $74,999	241,243	22.4
$75,000 to $99,999	114,775	10.6
$100,000 to $149,999	73,186	6.8
$150,000 to $199,999	17,752	1.6
$200,000 or more	19,993	1.9
Median family income (dollars)	44,227	(X)
Per capita income (dollars)	18,795	(X)
Median earnings (dollars):		
Male full-time, year-round workers	32,027	(X)
Female full-time, year-round workers	23,329	(X)
POVERTY STATUS IN 1999 (below poverty level)		
Families	115,899	(X)
Percent below poverty level	(X)	10.7
With related children under 18 years	87,631	(X)
Percent below poverty level	(X)	15.7
With related children under 5 years	39,142	(X)
Percent below poverty level	(X)	18.4
Families with female householder, no husband present	67,249	(X)
Percent below poverty level	(X)	30.6
With related children under 18 years	58,503	(X)
Percent below poverty level	(X)	37.7
With related children under 5 years	25,796	(X)
Percent below poverty level	(X)	48.2

*

Subject	Number	Percent
Individuals	547,869	(X)
Percent below poverty level	(X)	14.1
18 years and over	360,594	(X)
Percent below poverty level	(X)	12.5
65 years and over	64,688	(X)
Percent below poverty level	(X)	13.9
Related children under 18 years	182,757	(X)
Percent below poverty level	(X)	18.5
Related children 5 to 17 years	130,304	(X)
Percent below poverty level	(X)	17.9
Unrelated individuals 15 years and over	164,484	(X)
Percent below poverty level	(X)	26.5

(X) Not applicable.
Detailed Occupation Code List (PDF 42KB)
Detailed Industry Code List (PDF 44KB)
User note on employment status data
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P32, P33, P43, P46, P49, P50, P51, P52, P53, P58, P62, P63, P64, P65, P67, P71, P72, P73, P74, P76, P77, P82, P87, P90, PCT47, PCT52, and PCT53

TAB 9

U.S. Department of Labor

Bureau of Labor Statistics

Bureau of Labor Statistics Data

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Change Output Options: From: 1993 To: 2003 GO

include graphs NEW! More Formatting Options

Data extracted on: February 27, 2003 (12:49:27 PM)

National Employment, Hours, and Earnings

Series Id: EES00500049 (n)
Seasonally Adjusted
Industry: Total private
Data Type: AVERAGE HOURLY EARNINGS, 1982 DOLLARS
SIC Code: N/A

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1993	7.39	7.38	7.41	7.39	7.38	7.39	7.39	7.39	7.40	7.38	7.39	7.39	
1994	7.41	7.42	7.40	7.41	7.41	7.39	7.38	7.37	7.37	7.39	7.38	7.39	
1995	7.38	7.38	7.38	7.37	7.37	7.38	7.40	7.40	7.41	7.41	7.42	7.42	
1996	7.41	7.41	7.40	7.40	7.40	7.43	7.43	7.44	7.44	7.44	7.45	7.45	
1997	7.46	7.47	7.50	7.51	7.53	7.54	7.55	7.57	7.58	7.60	7.62	7.64	
1998	7.65	7.69	7.72	7.74	7.74	7.76	7.76	7.78	7.80	7.80	7.81	7.82	
1999	7.83	7.84	7.86	7.85	7.86	7.89	7.88	7.87	7.86	7.86	7.87	7.86	
2000	7.88	7.88	7.85	7.88	7.89	7.87	7.87	7.90	7.88	7.91	7.92	7.94	
2001	7.90	7.93	7.96	7.95	7.92	7.94	7.98	8.01	8.00	8.06	8.10	8.14	
2002	8.14	8.14	8.13	8.10	8.11	8.13	8.12	8.14	8.13	8.15	8.16	8.18(p)	
2003	8.15(p)												

n : NAICS 2002 replaces SIC beginning June 2003. See http://www.bls.gov/ces/cesnaics.htm for details.
p : preliminary

Series Id: EEU00500049 (n)
Not Seasonally Adjusted
Industry: Total private
Data Type: AVERAGE HOURLY EARNINGS, 1982 DOLLARS
SIC Code: N/A

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1993	7.43	7.41	7.41	7.39	7.39	7.34	7.34	7.33	7.41	7.40	7.41	7.42	7.39
1994	7.46	7.44	7.41	7.41	7.42	7.35	7.34	7.30	7.39	7.43	7.41	7.42	7.40
1995	7.44	7.42	7.39	7.38	7.35	7.32	7.36	7.33	7.43	7.44	7.44	7.45	7.39
1996	7.47	7.43	7.40	7.41	7.38	7.39	7.37	7.38	7.47	7.45	7.46	7.50	7.43

1997	7.51	7.51	7.52	7.51	7.51	7.50	7.49	7.51	7.59	7.61	7.67	7.67	7.55
1998	7.71	7.74	7.74	7.73	7.72	7.69	7.69	7.73	7.80	7.81	7.85	7.85	7.75
1999	7.89	7.88	7.88	7.84	7.86	7.83	7.81	7.82	7.87	7.87	7.88	7.90	7.86
2000	7.95	7.90	7.85	7.90	7.86	7.81	7.83	7.84	7.90 (c)	7.94 (c)	7.94 (c)	7.97 (c)	7.89(c)
2001	7.96 (c)	7.96 (c)	7.97 (c)	7.96 (c)	7.89 (c)	7.87 (c)	7.94 (c)	7.95 (c)	8.03 (c)	8.07 (c)	8.11 (c)	8.19 (c)	7.99(c)
2002	8.19 (c)	8.18 (c)	8.14 (c)	8.10 (c)	8.08 (c)	8.08 (c)	8.06 (c)	8.07 (c)	8.17 (c)	8.15	8.18	8.24 (p)	8.14(p)
2003	8.21 (p)												

n : NAICS 2002 replaces SIC beginning June 2003. See http://www.bls.gov/ces/cesnaics.htm for details.
c : corrected
p : preliminary

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Other comments: feedback@bls.gov

Appendix III
Recreational Shellfishing: Tables and Supporting Documents

Table 1
Overview of Trip Origins for Shrimp Baiting and Shellfishing Coastal Counties Compared to Non-Coastal Counties

	Shrimp Baiting		Shellfishing	
	Number	Percent		
Coastal Trips:	2,884	62%	58,261	86%
Non-Coastal Trips:	1,796	38%	9,162	14%
Total:	4,680	100%	67,423	100%
Coastal Participants:	894	59%	12,442	83%
Non-Coastal Participants:	623	41%	2,460	17%
Total:	1,517	100%	14,902	100%

Source: South Carolina 2002 shrimp baiting survey, and "South Carolina Saltwater Fishing Stamp Survey," 1994, page 17.

Table 2
Calculations of Recreational Shellfishing Losses
Based on Marine Creel Surveys Conducted in 1988 and 1989

Person-Trips per Day	Number Of Days	Total Person-Trips	Value per Trip Per Person	Total Loss
(1)	(2)	(3)	(4)	(5)
			$15.00	$7,452
13.8	36	496.8	$20.00	$9,936
			$25.00	$12,420

Notes:

(1) Based on page 63 of the "South Carolina Marine Recreational Fish and Shellfish Fishery Surveys, 1988."

(2) The length of closure of S200, a shellfish bed accessed primarily by the Folly River Marina.

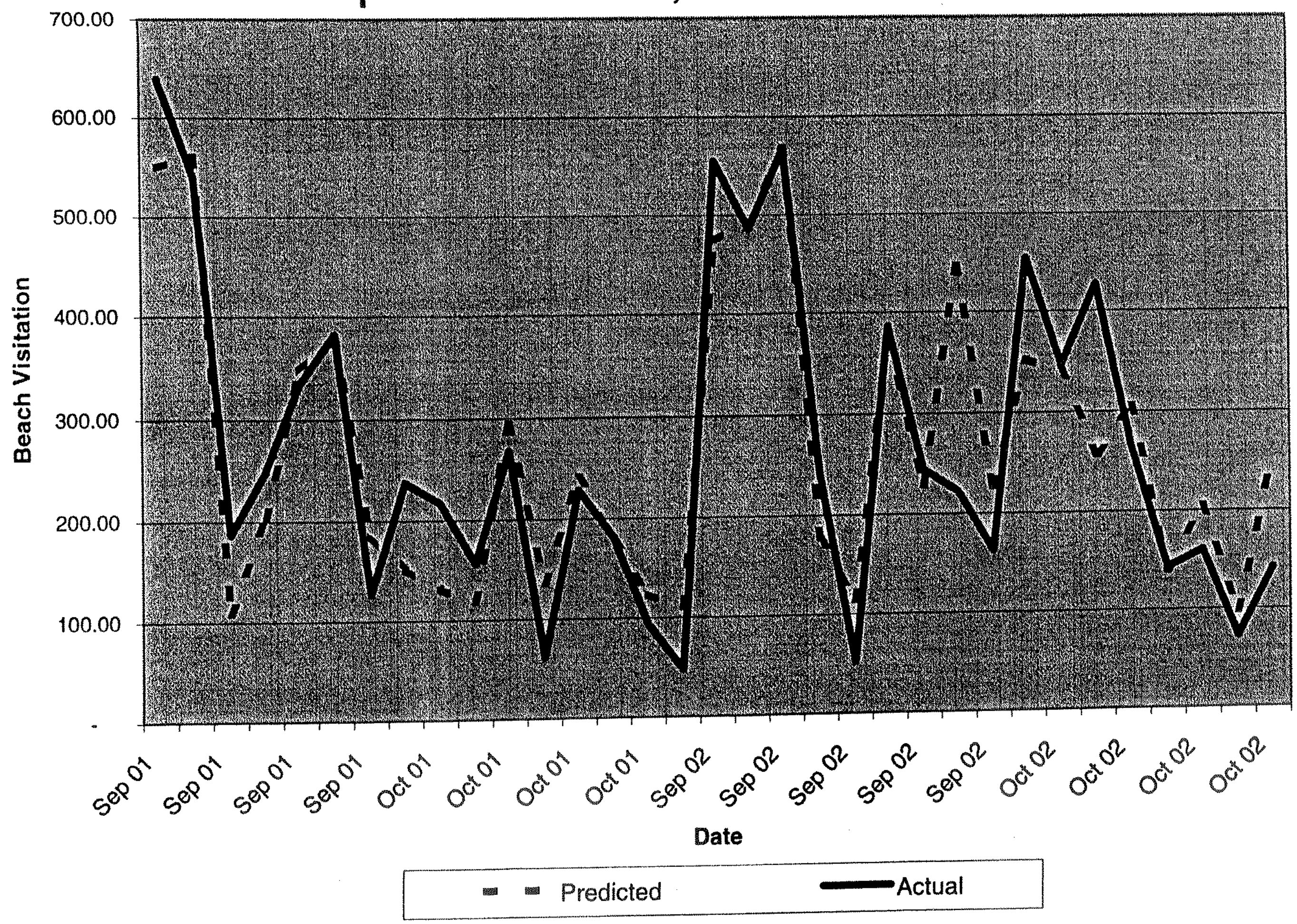
(3) Column (1) x Column (2)

(4) A range of values based on the travel cost model of South Carolina shrimp baiting.

(5) Column (3) x Column (4)

Appendix IV
Beach Use Analysis: Tables and Supporting Documents

Folly Beach
Comparison Of Predicted and Actual Trips*
September-October, Years 2001 and 2002



* Based on Model 4 in the table entitled "Beach Use Analysis."

Beach Use Analysis

DRAFT

Date	Person-Visits			Dummy	Other		Predicted Folly Visits			
	Folly	Beachwalker	Isle of Palms	Spill	(Beach W)^2	(Isle of P)^2	Model 1	Model 2	Model 3	Model 4
09/08/01	639	502	512	0	64	69	426.25	422.56	549.28	550.3364
09/09/01	541	627	359	0	155	17	439.95	437.64	560.84	560.5704
09/15/01	187	74	22	0	0	0	152.97	144.41	106.86	109.2548
09/16/01	248	105	197	0	0	2	203.91	195.73	200.35	203.3624
09/22/01	335	160	509	0	1	67	294.64	287.10	343.88	347.6667
09/23/01	382	180	647	0	1	175	333.11	325.81	375.77	379.5266
09/29/01	127	107	152	0	0	1	194.63	186.46	182.95	185.7251
09/30/01	237	71	125	0	0	0	174.82	166.24	148.41	151.3566
10/06/01	217	110	21	0	0	0	166.53	158.38	129.65	131.7383
10/07/01	157	87	25	0	0	0	158.62	150.21	116.52	118.8167
10/13/01	267	135	382	0	0	21	256.71	248.88	290.75	294.3415
10/14/01	62	76	82	0	0	0	167.13	158.61	133.52	136.2026
10/20/01	228	170	188	0	1	1	226.79	219.33	238.43	240.8439
10/21/01	182	85	169	0	0	1	190.01	181.59	175.86	178.9005
10/27/01	93	70	61	0	0	0	160.15	151.55	120.77	123.4012
10/28/01	48	73	27	0	0	0	153.70	145.14	108.33	110.7587
09/01/02	555	342	584	0	14	116	381.07	375.58	471.91	474.307
09/07/02	486	483	898	0	54	650	505.17	501.30	491.20	491.3173
09/08/02	567	1128	591	0	1,619	122	683.58	686.92	568.29	568.254
09/14/02	241	52	212	0	0	2	186.97	178.19	172.31	175.8499
09/15/02	53	42	82	0	0	0	154.12	145.21	111.57	114.5435
09/21/02	386	177	711	0	1	256	346.25	338.92	371.73	375.4125
09/22/02	244	332	1075	0	12	1,335	486.87	481.33	230.30	228.9085
09/28/02	222	287	657	0	7	186	376.31	370.21	443.60	446.4486
09/29/02	163	132	212	0	0	2	217.60	209.72	223.90	226.7552
10/05/02	454	164	516	1	1	71	297.73	290.24	358.34	351.8055
10/06/02	347	154	502	1	1	64	290.78	283.17	348.69	342.2035
10/12/02	427	118	311	1	0	9	234.35	226.32	264.41	257.5459
10/13/02	263	197	305	1	2	9	263.25	256.11	312.81	305.2454
10/19/02	143	73	96	1	0	0	169.11	160.55	147.80	140.2719
10/20/02	161	108	195	1	0	1	204.62	196.46	211.77	204.4363
10/26/02	72	53	26	1	0	0	145.82	137.03	105.31	97.59065
10/27/02	142	158	234	1	1	3	232.47	224.88	259.87	252.3019

Beach Use Analysis

DRAFT

		Predicted Minus Actual			
		Model 1	Model 2	Model 3	Model 4
October 2002	10/05/02	-156	-164	-96	-102
	10/06/02	-56	-64	2	-5
	10/12/02	-193	-201	-163	-169
	10/13/02	0	-7	50	42
	10/19/02	26	18	5	-3
	10/20/02	44	35	51	43
	10/26/02	74	65	33	26
	10/27/02	90	83	118	110
"Lost Trips"		-171	-234	0	-58
Actual Exceeds Prediction By:		9%	13%	0%	3%

Model 1
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.783389238
R Square	0.613698699
Adjusted R Sq	0.587945279
Standard Erro	104.2620861
Observations	33

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	2	518087.4916	259043.7458	23.82979	6.37E-07
Residual	30	326117.4781	10870.5826		
Total	32	844204.9697			

	Coefficients	*Standard Erroi*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	119.7253769	29.01867757	4.12580403	0.00027	60.46139	178.9894	60.46139	178.9894
Beachwalker	0.382883618	0.101004992	3.790739574	0.000676	0.176604	0.589163	0.176604	0.589163
Isle of Palms	0.223282958	0.080014694	2.790524436	0.00906	0.059871	0.386695	0.059871	0.386695

Model 2
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.787163
R Square	0.619625
Adjusted R	0.580276
Standard E	105.2279
Observatio	33

ANOVA

	df	*SS*	*MS*	*F*	*'ignificance F*
Regressior	3	523090.5	174363.5	15.74685	2.89E-06
Residual	29	321114.5	11072.91		
Total	32	844205			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	110.336	32.44806	3.40039	0.001978	43.97227	176.6998	43.97227	176.6998
Beachwalk	0.394111	0.1033	3.815209	0.000659	0.182839	0.605383	0.182839	0.605383
Isle of Paln	0.22339	0.080756	2.766237	0.009765	0.058226	0.388555	0.058226	0.388555
Spill	29.27998	43.55981	0.672179	0.50679	-59.80988	118.3698	-59.80988	118.3698

Model 3
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.892537
R Square	0.796622
Adjusted R	0.75896
Standard E	79.74325
Observatio	33

ANOVA

	df	*SS*	*MS*	*F*	*'ignificance F*
Regressior	5	672512.3	134502.5	21.15156	1.43E-08
Residual	27	171692.6	6358.986		
Total	32	844205			

	Coefficients	*'tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	49.77391	27.82043	1.789114	0.084822	-7.308854	106.8567	-7.308854	106.8567
Beachwalk	0.645756	0.157076	4.111116	0.00033	0.323464	0.968049	0.323464	0.968049
Isle of Paln	0.423101	0.101816	4.155529	0.000293	0.214191	0.632011	0.214191	0.632011
Spill	10.30818	33.73475	0.305566	0.762279	-58.90976	79.52612	-58.90976	79.52612
bw^2	-0.256704	0.101687	-2.524457	0.017773	-0.465348	-0.04806	-0.465348	-0.04806
IoP^2	-0.363599	0.089742	-4.05161	0.000386	-0.547734	-0.179464	-0.547734	-0.179464

Model 4
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.892143
R Square	0.795919
Adjusted R	0.766764
Standard E	78.4416
Observatio	33

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	4	671918.6	167979.7	27.30007	2.64E-09
Residual	28	172286.4	6153.084		
Total	32	844205			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0%*	*Jpper 95.0%*
Intercept	52.68554	25.71108	2.049137	0.049924	0.018712	105.3524	0.018712	105.3524
Beachwalk	0.637257	0.15207	4.190551	0.000252	0.325756	0.948759	0.325756	0.948759
Isle of Paln	0.428179	0.098812	4.333287	0.000171	0.225772	0.630585	0.225772	0.630585
bw^2	-0.254062	0.099665	-2.549166	0.016563	-0.458216	-0.049908	-0.458216	-0.049908
IoP^2	-0.368823	0.08666	-4.255969	0.000211	-0.546339	-0.191308	-0.546339	-0.191308

Appendix V: Bibliography

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