FINAL PHASE II REPORT

AREA VI RED RIVER CHLORIDE CONTROL: RECREATION STUDY

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EXECUTIVE SUMMARY

The U. S. Army Corps of Engineers (USACE), Tulsa District (SWT), is conducting a reevaluation of the Congressionally authorized Area VI project designed to reduce chlorides contributed to the Red River by the Elm Fork of the river's North Fork. As part of the reevaluation, SWT is evaluating how a potential change in the chlorides would affect the recreational fishery of Lake Texoma. In particular, concerns were raised about how a change in chloride would affect the striped bass population and the recreational fishing industry that surrounds it. The purpose of this study is to estimate the economic impact of a change in the recreational fishery.

Of particular interest is the striped bass fishing on Lake Texoma, which is considered some of the best in the country and draws people from all over the United States. With anglers come all of the associated goods and services that directly benefit the local region, including: bait and tackle, guide services, restaurants, and accommodations. A survey was determined to be the best method for estimating anglers' reaction to any potential changes in the recreational fishery and the associated economic impacts. Telephone surveys were selected as least invasive to an angler's recreational experience, and not subject to seasonal concerns.

Econometric analyses were performed to develop lower-bound, upper-bound, and most-likely willingness-to-pay (WTP) estimates for the striped bass fishery. The range of estimates calculated was reasonable compared with previous similar research and ranged from $9 to $21 per year, with a most likely value of $17 per year for the Texas (surveyed) side of the lake. Due to average incomes being lower in Oklahoma, the WTP for that side of the lake is estimated to be $16 per year. The Texas user population is approximately 39,000 anglers and the Oklahoma user population is an estimated 62,000 anglers per year. Based on the calculated WTP values and user population, the aggregate WTP for Lake Texoma's striped bass fishery ranges from $909,000 to $2,121,000, with a most likely value of $1,655,000.

This report represents Phase II of the study, which includes survey implementation, statistical and econometric analysis of the completed survey questionnaires, determination of National

Economic Development (NED) benefits (or losses) and preliminary Regional Economic Development (RED) benefits, and a risk and uncertainty analysis of the WTP estimates. Phase I was completed in September 2007 and defined the study area, potential substitute recreation sites, sample design, economic valuation methods, and development of the survey instrument.

Table of Contents

Executive Summary ..... **i**

1.0 Introduction **1**
1.1 Phase I Overview 1
1.2 Phase II Overview 2
1.3 Report Outline 2

2.0 Survey Implementation **3**
2.1 Survey Approval 3
2.2 Sampling Procedures 3
2.3 Data Collection Procedures 4
2.4 Survey Results 7

3.0 Econometric Analysis **12**
3.1 Contingent Valuation Questions 12
3.2 Theoretical Model 14
3.3 Empirical Model 16
3.4 Willingness to Pay 18
3.4.1 User Population 18
3.4.2 Benefit Transfer for Oklahoma 22
3.4.3 Aggregate WTP Estimate 24
3.5 Regional Economic Development Benefits 24
3.6 Risk and Uncertainty 26

4.0 Summary **30**

5.0 References **31**

TABLES

Table 3-1: Independent Variable Descriptions 17
Table 3-2: Model Coefficient Values and Variable Means 18
Table 3-3: Number of Lake Licenses Sold in Texas and Oklahoma by Year 20
Table 3-4: Summary of Game Warden Data 21
Table 3-5: Lake Texoma User Population by State 22
Table 3-6: Median Household Income Texas and Oklahoma 23
Table 3-7: WTP with Adjusted Mean Income for Oklahoma 24
Table 3-8: Changes in Number of Trips Taken Under Without Program Conditions 25
Table 3-9: Average Trip Expenses per Year 25
Table 3-10: Upper-Bound Tobit Results and Variable Means 27
Table 3-11: Protest Model Results and Variable Means, “Not Sure” as “NO” 28
Table 3-12: Protest Model Results and Variable Means, “Not Sure” as “YES” 28

Table of Contents

FIGURES

Figure 2-1: Respondent Knowledge of the Recreational Opportunities on Lake Texoma 8
Figure 2-2: Respondent Knowledge of the RRCCP.....9
Figure 2-3: Respondent Ranking of the Fishing Quality at Lake Texoma.....10
Figure 2-4: Primary Purpose for a Typical Visit to Lake Texoma 10
Figure 2-5: Top Three Fish Species Targeted by Respondents 11
Figure 3-1: Survey Contingent Valuation Question.....13
Figure 3-2: Yes Response to CV Question.....14

APPENDICES

Appendix A Scope for Phase II
Appendix B Comments from Stakeholders and Responses
Appendix C Survey
Appendix D Response to SWT Comments

Section One: Introduction

1.0 INTRODUCTION

The U. S. Army Corps of Engineers (USACE), Tulsa District (SWT), is conducting a reevaluation of the Congressionally authorized Area VI project designed to reduce chlorides contributed to the Red River by the Elm Fork of the river's North Fork. SWT is conducting the Red River recreation study in accordance with USACE regulations and addressing the potential socio-economic impacts of changing the chloride levels in the Red River Basin. The goal of the Red River Basin Chloride Control Project (RRCCP) is to reduce naturally occurring chlorides that limit or preclude the use of Red River waters for municipal, industrial, or agricultural purposes. The project includes a reevaluation of Area VI alternatives, costs, benefits, and cumulative impacts to the environment, which include the impact on recreation due to changes in chloride levels in Lake Texoma and the entire Red River Basin.

Lake Texoma, located on the border between Texas and Oklahoma, has economic importance to the area as a major tourist/recreational destination. Six million people are estimated to visit the lake annually (USACE 2009). Concerns have been raised about how a change in chloride levels would affect the recreational fisheries of Lake Texoma, specifically striped bass. To evaluate the economic impact, SWT required a study for economic valuation of changes to recreational activities on Lake Texoma.

1.1 Phase I Overview

Phase I of the Area VI RRCCP Recreation Study was completed in September 2007. The following tasks were performed during Phase I:

- Refined study area
- Identified potential impacts to recreational activities
- Inventoried existing recreational opportunities
- Developed economic valuation methods and survey instrument

During Phase I, telephone interviews were determined to be the most appropriate method to administer the survey. Telephone interviews would be conducted utilizing data provided by

the Texas Parks and Wildlife Department (TPWD) for people who purchased Lake Texoma fishing licenses in Texas (similar data were not available for Oklahoma).

The Phase I report was provided to the TPWD, U.S. Fish and Wildlife Service (USFWS), and Oklahoma Department of Wildlife Conservation (ODWC) in the fall of 2008. The agencies provided comments on the report to SWT. Those comments and accompanying responses are provided in Appendix B.

1.2 Phase II Overview

Phase II of the RRCCP Recreational study focused on evaluating the value angler's place on Lake Texoma's striped bass fishery. The following tasks were completed during Phase II (refer to Appendix A for Scope of Work):

- Refined survey instrument and obtained approval from the Office of Management and Budget (OMB) for its use
- Conducted telephone interviews
- Analyzed survey results to calculate user willingness to pay (WTP)
- Developed and utilized a methodology for approximating the user population for Lake Texoma as it pertains to the scope of this study

1.3 Report Outline

The current efforts and report represent Phase II of the study. Section 2 describes the survey implementation, including the sampling and data collection procedures, risk and uncertainty as it pertains to the survey, and results of the survey. Section 3 describes the econometric model specification and results. The summary of Phase II is provided in Section 4.

Section Two: Survey Implementation

2.0 SURVEY IMPLEMENTATION

A detailed discussion of the survey methodology is provided in the Phase I report. The survey instrument was revised slightly from the initial instrument developed during Phase I. The survey instrument used during Phase II is provided in Appendix C. The following represents the implementation of the survey.

2.1 Survey Approval

All surveys conducted by the USACE must be approved by OMB prior to survey administration. OMB is required to approve the surveys to ensure the data gathered are appropriate to the goals of the study, provide statistically reliable results, and do not place an undo burden on society. SWT prepared the final OMB package for this study based on the survey methodology and instrument developed during Phase I. The survey methodology and instrument was approved by OMB in the summer of 2008. SWT provided the approved survey instrument to URS Group, Inc. at the beginning of Phase II.

2.2 Sampling Procedures

To make the sample as representative as possible, the initial survey design called for randomly selecting 1,000 individuals from the Lake Texoma fishing license records. The license data were obtained through the Texas Department of Parks and Wildlife. The data and sampling frame are discussed in detail in Section 2.3.

The ideal sampling frame for the population of recreational fishers is Lake Texoma fishing license sales data. Because both Texas and Oklahoma sell Lake Texoma-specific licenses, there was no need to subset data from the two States or screen respondents to locate users of Lake Texoma. Sample data was obtained from the TPWD for people who purchased Lake Texoma fishing licenses in Texas. Data was also requested from the comparable agency in Oklahoma, but the request was denied. Consequently, only individuals who purchased a Lake Texoma license in Texas were included in the sampling frame. Analytical adjustments of the user population based on data provided by local game wardens were made as needed to correct for the sample deficiency. These adjustments are discussed in detail in Section 3.4.1.

Section Two: Survey Implementation

The data files received from the offices of TPWD were cleaned to remove unusable entries (missing key data) or multiple entries. If the database had multiple entries for an individual, the multiple entries were collapsed into one and the most recent contact information was kept in the sample file. This was done to avoid contacting the same individual multiple times, and by keeping the most recent contact information, the number of inaccurate phone numbers in the sample was reduced. Of the total records in the final file, 44,804 (87.13%) were issued to Texans, 2,024 (3.94%) were issued to Oklahomans, and 4,596 (8.94%) came from other States. A discussion of the steps taken to produce a clean, usable sample file was provided in the Phase I Report. In all, the sample included 988 usable contacts for Oklahoma and other States and 8,140 usable contacts within Texas.

2.3 Data Collection Procedures

All telephone interviews were subcontracted out to a small firm that specializes in conducting surveys. The firm has had many years experience in successfully completing similar survey projects for USACE and URS. Prior to data collection, telephone interviewers received extensive training. The training proceeded in two stages. First, a general training on telephone survey methodology was provided that stressed the importance of: establishing rapport with the respondent, reading questions exactly as written (never "ad libbing"), coding answers carefully and accurately, following specified skip patterns correctly, probing only where written instructions to the interviewer were provided, and not offering or implying any evaluation of respondents' answers.

In the second phase of interviewer training, interviewers were trained on the specifics of the questionnaire. Once the interviewers understood the structure of the questionnaire and the way in which it was to be administered and coded, interviewers practiced mock interviewers until they were extremely comfortable with the interview process. This allowed the interviewers move through the questionnaire smoothly when speaking with survey respondents. They also received training to effectively deal with problems and questions that might arise in the course of the interview.

Before full survey implementation, a pre-test was conducted with 20 interviews of individuals in Texas and 10 interviews of individuals in Oklahoma. The purpose of the

pre-test was to identify any problems with the questionnaire (e.g., questions that respondents had trouble understanding, questions that did not seem to be interpreted as intended), to test the data collection procedures, and to identify any unanticipated issues or problems that suggested the need to refine the data collection procedures. The pretest was conducted by experienced Optinet Resources personnel.

Two main issues were uncovered during the pre-test that related more to survey administration than the instrument itself. The first issue that emerged was that women sometimes served as "gatekeepers" when answering the phone. In other words, when a household of a male license-holder was called, a woman answered the phone and responded that "he's not interested," "he's never been fishing there," or "he's unavailable." This situation was not entirely unexpected, as women typically answer the phone more often than men do in households. Once this pattern was identified, interviewers were instructed to simply thank the woman who answered the phone and hang up. The interviewer then made 2 to 3 additional callbacks, at different days/times of day, to see if the male license-holder might answer the phone.

The other issue stemmed from the number of times the individual had actually fished on Lake Texoma. Interviewers discovered that some individuals, particularly in the non-Texas sample data, had fished at Lake Texoma only once and were, therefore, reluctant to participate in the study. If these respondents could be persuaded to complete the questionnaire in its entirety, the information was collected.

After completing the pre-test, the procedures described above were integrated into the training for the remaining interviewers. No problems involving the format or wording of the questions were identified, so no changes were made to the survey instrument. The pre-test responses are included in the final database.

Because phone numbers are attached to households and the unit of analysis for this study was individuals, whoever answered the phone was asked if the license-holder in the household was available, by name. In instances were the license-holder did not live there, the interviewer asked if anyone in the household fished on Lake Texoma to reduce the number of

lost interviews from the sample. The personal information pertaining to the actual person interviewed was updated in these instances as appropriate.

For the most part, interviews went smoothly. However, as is currently the trend in telephone interviewing, there were a large number of refusals, and likely a large number of individuals evaded the calls (via answering machines or caller identification). In an attempt to increase the response rate, a Web site domain name (http://www.LakeTexomaSurvey.com) was established. If an interviewer received an answering machine or voice mail message, he or she left a message describing the nature of the study and directing the license-holder to go to the Web site for more information. Domain forwarding was set up so any individual who typed in that URL was redirected to a page on the SWT website that described the survey and provided additional USACE contact information. In most cases, interviewers made 5 attempts to contact each license-holder.

In designing the sample, the goal was to draw sufficiently large samples from each of the three groups of licensees (Texas, Oklahoma, and all others) to facilitate analytic comparisons among them. Given that and the relatively small size of the non-Texas portion of the sample population, the initial plan was to employ a stratified sampling design following the logic of a probability proportional to size design to sample Texas license-holders. Because the number of non-Texas license-holders was relatively small, all non-Texas license holders in the sampling frame were contacted to complete the survey. Since more unusable numbers were in the database than had been anticipated, and because a large number of respondents could not be reached despite repeated attempts, nearly every individual in the sample population was called. Complete, full-length interviews with 286 respondents in Texas, 18 in Oklahoma, and 82 residents of other States were collected. As previously mentioned, the under-representation of Oklahoma responses was addressed in the analysis and is described in Section 3. Based on the total numbers called (9,128) and the number of completed full-length interviews (386), the response rate for this survey is 4 percent. Approximately 150 people were contacted, especially among those outside of Texas and Oklahoma, that did not complete the full survey because they had only visited the lake once. Most of these people did not feel they could accurately value the fishery with such a limited experience.

Section Two: Survey Implementation

2.4 Survey Results

The survey instrument served a dual purpose for SWT. It facilitated the collection of data needed to calculate the value of Lake Texoma's striped bass fishery as well as basic information about the lake itself. This section focuses on survey questions not used in the econometric analyses. The econometric valuation of the recreational striped bass fishery is discussed in detail in Section 3 of this report.

The questions at the beginning of the survey served two primary purposes (Appendix C). First they were designed to get the respondent to think about Lake Texoma, their experiences at the lake, and how often they recreate there so that information was fresh in their minds before the economic valuation questions were asked. In addition, the first questions provide general information on user opinions of Lake Texoma that may be useful or interesting to USACE because it is responsible for lake management.

Because the focus of this study is recreational uses for Lake Texoma, the first question was used to gauge the respondent's knowledge of the recreational opportunities. Respondents were asked to rank their knowledge of the lake's recreational opportunities on a scale from 0 to 5, with 5 representing full knowledge (Figure 2-1). The majority of respondents felt that they had at least a basic understanding of the recreational opportunities available.

Section Two: Survey Implementation

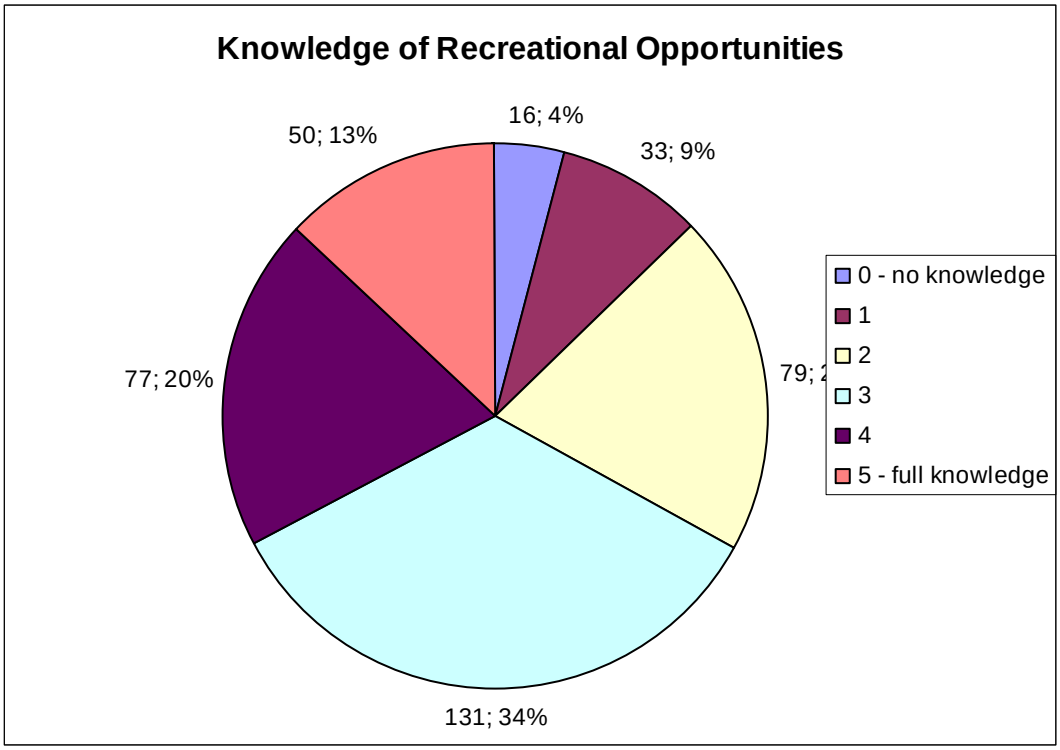

Figure 2-1: Respondent Knowledge of the Recreational Opportunities on Lake Texoma

As discussed in the Phase I report, this study is a result of the proposed RRCCP. The level of public awareness about the RRCCP is not only useful to SWT, but may also affect respondents' WTP to maintain the lake's recreational resources. Respondents were asked to rate their knowledge of the RRCCP from 0 to 5, with 5 representing full knowledge (Figure 2-2). Almost all of the respondents felt they had little to no knowledge of the RRCCP. This indicates that additional efforts to inform users about the RRCCP and its impact on Lake Texoma may be warranted to ensure a reasonable level of public awareness.

Section Two: Survey Implementation

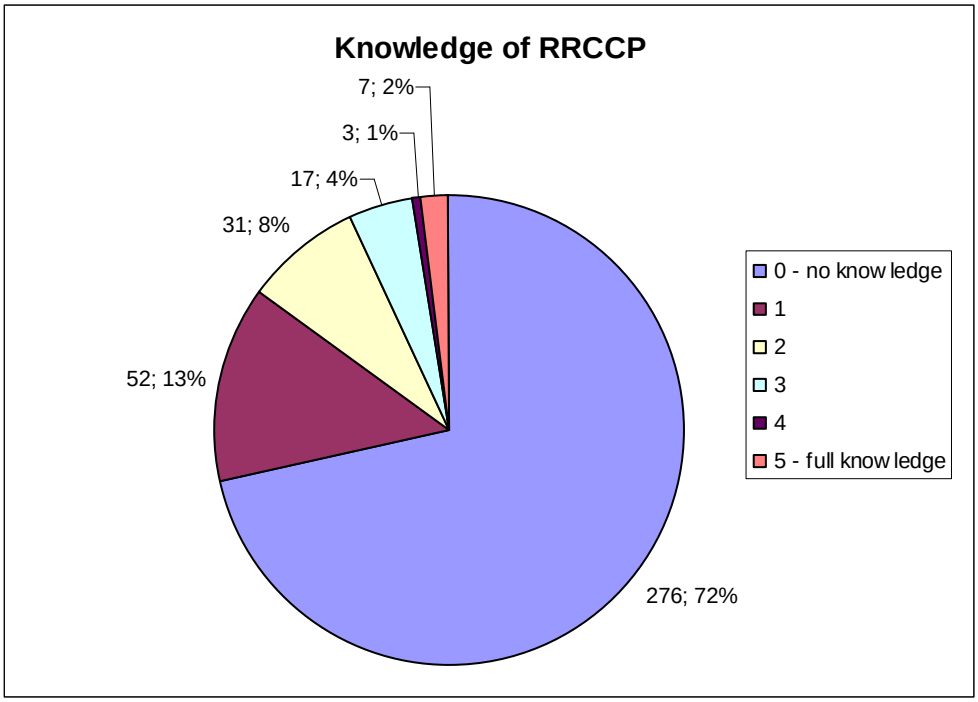

Figure 2-2: Respondent Knowledge of the RRCCP

The focus of the survey is on the recreational fishery at Lake Texoma, which is considered to be a major draw to the area. Therefore, the respondents were also asked to rate the quality of fishing at Lake Texoma's fishery from 0 to 5, with 5 being the highest quality (Figure 2-3). As anticipated, most respondents rated the quality of fishing very high. In a follow-up question, respondents were asked what their primary purpose was for a typical trip to Lake Texoma (Figure 2-4). Optional responses included: camping, fishing, boating, swimming, water skiing, and other. Responses for the 'Other' option typically were relaxation or listed some combination of options (e.g., fishing and camping, camping, fishing, and boating) in which the respondent did not pick one as the primary reason for the visit. Note, however, that the survey sample was based on people who purchased a Lake Texoma fishing license, meaning that every respondent at some point fished (or planned) to fish on the lake.

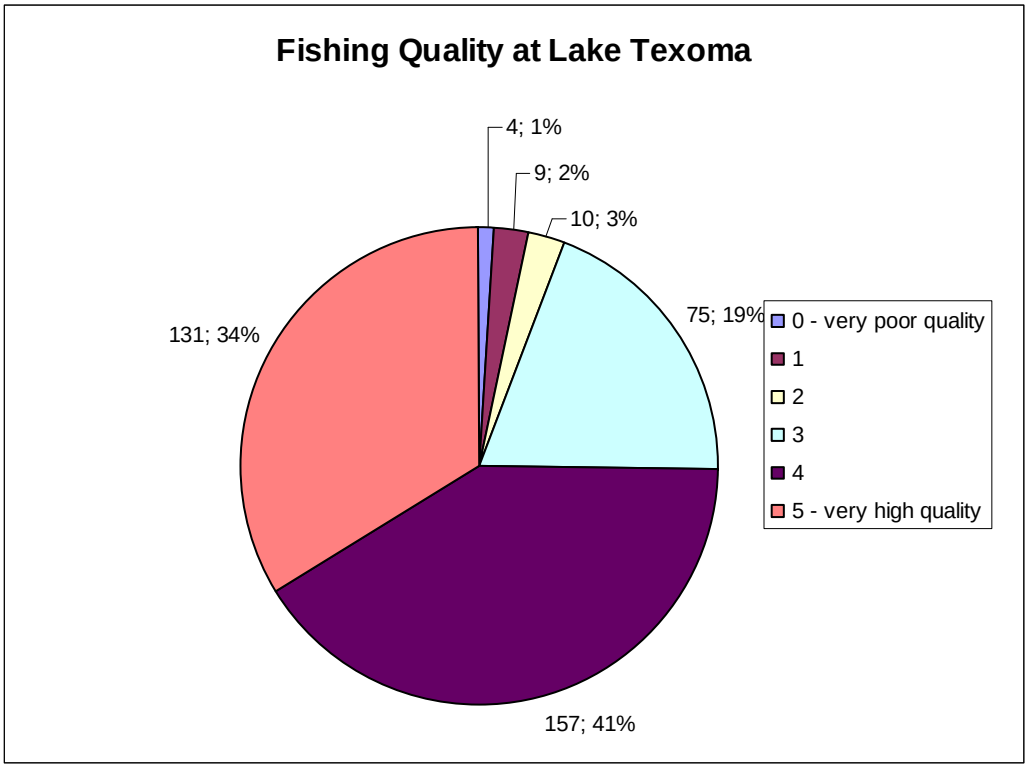

Figure 2-3: Respondent Ranking of the Fishing Quality at Lake Texoma

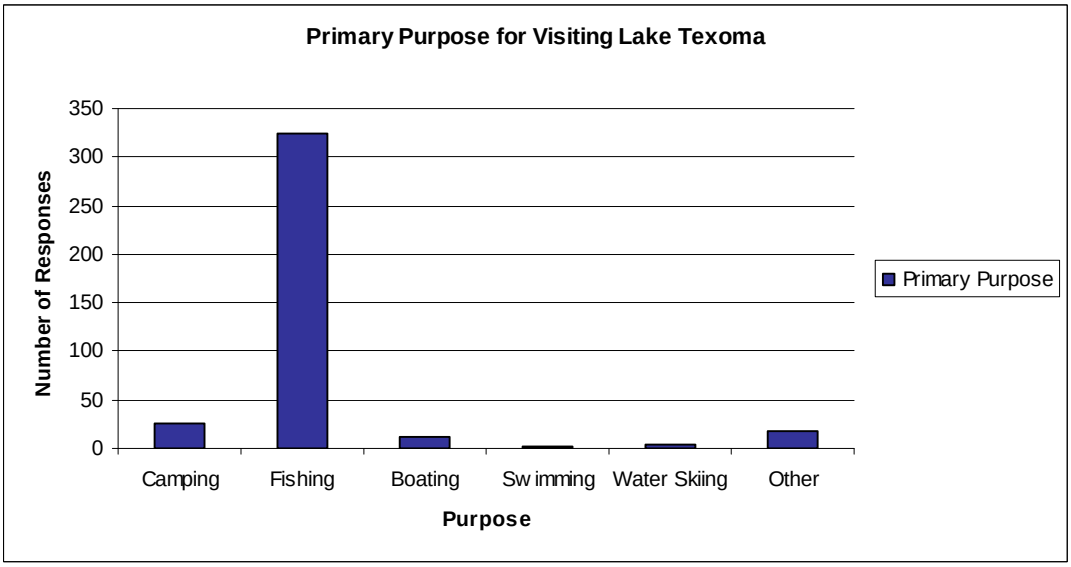

Figure 2-4: Primary Purpose for a Typical Visit to Lake Texoma

Anglers tend to target some species over others when they fish. Respondents were asked to provide their top three target species (in preference order) (Figure 2-5). Respondents were

able to respond with 'other' or 'no target', but responses tended to be from a certain set of species. Almost all of the "other" responses were for black bass or sand bass, a few respondents mentioned bait fish, and one mentioned paddle fish, grass carp, and alligator gar. Note that if a respondent said they only have one or two target species, "not applicable" was listed for their second and/or third targets.

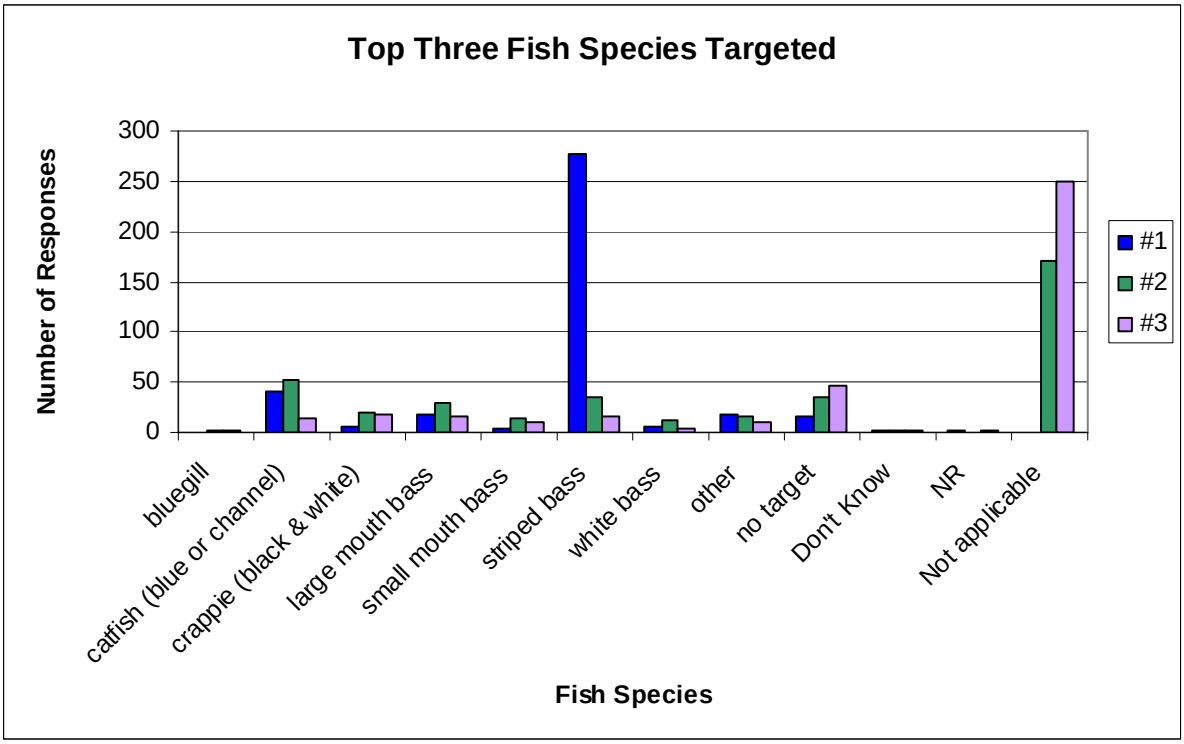

Figure 2-5: Top Three Fish Species Targeted by Respondents

Section Three: Econometric Analysis

3.0 ECONOMETRIC ANALYSIS

Estimating the value of a change in the striped bass fishery on recreational fishing can be difficult. Because people do not pay directly for the experience of fishing, it is considered a nonmarket good or service. An argument could be made that fishermen do pay for the experience through external costs, such as licenses, bait and tackle, and guide services. However, capturing these costs provides a better estimate of the economic impact of the resource to the economy, as opposed to the value that a fisherman may place on the experience or any changes in the experience. Therefore, survey questions were framed to capture the particular respondent values for the striped bass fishery that are not observable in the real market place.

The goal of the econometric analysis is to measure the potential change in the National Economic Development (NED) benefits caused by the changes in the striped bass fishery. According to the Economic and Environmental Principles and Guidelines (Water Resources Council 1983), the benefits arising from recreation opportunities created by a project can be measured by WTP. The economic methodologies considered for econometric analysis were examined and discussed in the Phase I report. The contingent value method (CVM) was selected as the primary technique to calculate NED benefits for this study.[1]

3.1 Contingent Valuation Questions

Multiple approaches or formats to the contingent value (CV) questions were examined and are described in the Phase I report. The payment card (PC) question format provides a more precise WTP value for each respondent than what can be collected using a different approach such as a dichotomous choice or open ended question. PC questions are an expansion on the standard dichotomous choice format (Collins and Rosenberger 2007). With PC, the individual is given a wide range of bid amounts for the recreational improvement that would be paid by the respondent over a specific timeframe (e.g., per visit, season, or year). The respondent is asked to indicate whether or not they would pay each bid amount with a varying degree of certainty. This WTP question format captures a greater amount of

[1] During Phase I, a Travel Cost/CVM was considered to calculate the WTP estimates. As the study developed it was decided to use a CVM for NED benefits and use the travel cost data for the RED benefits discussed in Section 3.5.

information than other WTP question formats, while still partially simulating the market experience for the respondent. Because PC provides a higher level of detail and is straightforward enough to administer through a telephone survey, this format was selected for the survey's CV question (Figure 3-1).

Now, suppose you had the option to purchase an annual special striped bass stamp that would help pay for a Lake Texoma fish hatchery project. Through stocking, this project would maintain Lake Texoma's striped bass catch rates at the current level. I am going to provide you a series of dollar amounts that represent possible annual costs to you of the special striped bass stamp to cover the cost of the hatchery project. For each amount, please respond with "yes" (willing to pay the amount annually), "not sure" (may or may not be willing to pay the amount annually), or "no" (will not pay the amount annually):

Cost to you per year	*Yes*	*Not Sure*	*No*
$ 0.01	□	□	□
$ 1.00	□	□	□
$ 5.00	□	□	□
$ 10.00	□	□	□
$ 25.00	□	□	□
$ 50.00	□	□	□
$ 75.00	□	□	□
$ 100.00	□	□	□
$ 250.00	□	□	□

[If all responses NO, continue; if WTP>0 skip to Q23]

Figure 3-1: Survey Contingent Valuation Question

Starting the dollar values at one cent allows for the separation of near zero WTP from true zero WTP. Also, including a high value of $250.00 provides the opportunity to collect the choke price for respondents, except in a few extreme cases. It is important to note that a hatchery/stocking program will not actually be implemented for logical reasons. It serves as a way to explain to the respondent how the maintenance of the fishery could be performed. The hatchery/stocking program was selected simply because such programs are familiar to anglers and can easily be explained over the phone without confusing the respondent. Figure 3-2 provides the number of 'Yes' responses for each dollar value on the payment card.

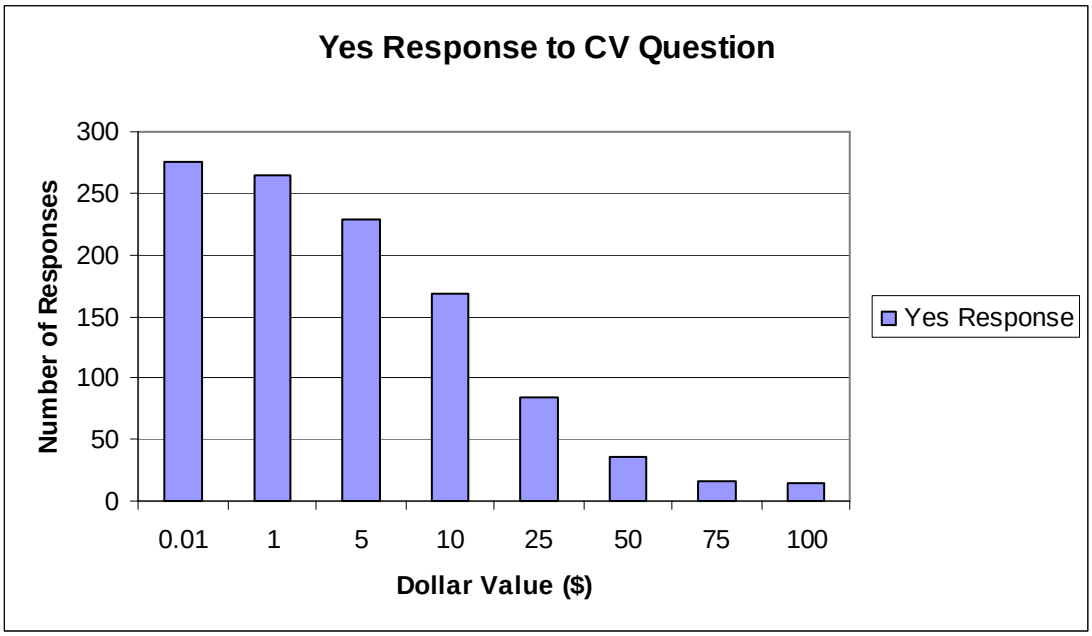

Figure 3-2: Yes Response to CV Question

3.2 Theoretical Model

The household production function provided the theoretical framework used to develop the empirical model for the WTP analysis, connecting household behavior and recreational opportunities. Household production functions fit well when using a PC question format to determine user WTP. This framework is based on the assumption that individual household utility is affected, in some way, by the availability of local recreational opportunities (Bockstael and McConnell 1981; Haab and McConnell 2002). The respondent's utility (*U*) is a function of private goods with price *Px* (*X*), the number of trips taken to Lake Texoma at cost *Pt* (*T*), and the catch per trip (a measure of trip quality) at price *Pc* (*C*). The utility for Lake Texoma users is specified as:

$$U = U(X, T, C) \qquad (1)$$

The user can maximize their utility given the following economic and environmental constraints: the budget constraint and the fish population constraint. The budget constraint shown in equation 2 expands on equation 1 and includes *I* as disposable income:

$$I = P_X X + P_T T + P_C C \qquad (2)$$

Section Three: Econometric Analysis

The fish population (*FISHPOP*) constraint is a function of environmental conditions of the lake (*E*) and management actions (*M*) implemented:

$$FISHPOP = f(E, M) \qquad (3)$$

A user combines the cost of their equipment and gear, varying consumed inputs (e.g., fuel and bait), skill, experience, *FISHPOP*, and other fixed characteristics of the lake (e.g., access and crowding) to generate the desired levels of recreational trips (*T*) and catch per trip (*C*) according to the household production framework (Bockstael and McConnell 1981).

By combining equations 1, 2, and 3, the solution to the utility maximization equation is an indirect utility[2] function (*V*) that shows the maximum utility a Lake Texoma user can obtain given the stated constraints:

$$V = V(P_X, P_T, P_C, I, FISHPOP) \qquad (4)$$

In the CV survey scenario (Figure 3-1), respondents[3] were asked to assume that because of a change in exogenous factors (*E* or *M*), the striped bass catch rate on Lake Texoma would decrease. The pathway by which changes in *E* or *M* decrease the catch rate is through decreases in *FISHPOP* (also exogenous). In the CV question, respondents were asked to assume that a decrease in catch rates could be avoided through a hatchery or stocking program (a change in *M*), which would maintain the current catch rate. The pathway by which the hatchery/stocking program maintains catch rates is by helping to maintain *FISHPOP* at higher levels compared to the "without program" level.

Respondents were asked to indicate their WTP for the hatchery/stocking program via a PC. WTP is maximized using equation 4 under the "with program" ($FISHPOP^W$) conditions (current fishery with a stocking program) and "without program" ($FISHPOP^{WO}$) conditions at the respondent's current level of disposable income (I^0). Therefore a respondent's maximum WTP for the program is defined as:

[2] Direct utility cannot be measured and, therefore, must be modeled and estimated indirectly.
[3] All respondents are assumed to be Lake Texoma users, since all respondents purchased a Lake Texoma fishing license.

$$V(P_X, P_T, P_C, I^0 - MaxWTP, FISHPOP^W) = V(P_X, P_T, P_C, I^0 - WTP, FISHPOP^{WO}) \quad (5)$$

Thus, *MaxWTP* in equation 5 is the amount of payment that makes a user indifferent between maintaining their current catch rate given $FISHPOP^W$ with a lower income (I^0-*MaxWTP*) and facing a lower catch rate with their current income (I^0-*WTP*).

The remaining subsections discuss the econometric modeling as it pertains to the specifics of this study.

3.3 Empirical Model

Respondent WTP for Lake Texoma's striped bass fishery is expected to vary by the utility protected by maintaining the status quo in comparison to their cost to maintain the fishery. As the user frequency of Lake Texoma increases, respondent WTP is expected to increase. In addition, because of the vibrant health of the striped bass fishery and because the negative impacts to the catch rate are not expected to exceed 30 percent, a number of respondents may not be willing to pay anything to prevent a decrease in the striped bass population.

The variables included in the final econometric model are provided in Table 3-1. Only one variable, *retired* which represented whether or not the respondent was a retired individual, was removed from the initial empirical model. *Retired* was removed because of its high correlation with *age*. Since *age* had a stronger explanatory power, it was selected to remain in the model. A respondents' *MaxWTP* was considered to be the highest value with a "Yes" response; for the primary analysis any "Not Sure" response was coded as a "No" response.

Section Three: Econometric Analysis

Table 3-1: Independent Variable Descriptions

Name	Description	Units	Equation 5
Usefreq	Frequency of use (number of trips per year to Lake Texoma), continuous	Trips per year	P_T
Income	Income of respondent, recorded as mid-point of range chosen	Dollars ($)	I
Knowl	Knowledge of the RRCCP	0 to 5 scale	P_T
Subs	Whether or not the respondent has a substitute fishing site	0/1 dummy	P_C
Age	Age of the respondent, continuous	Years	P_X
Member2	Whether or not the respondent is a member of a conservation or environmental club	0/1 dummy	P_X

Initially, Ordinary Least Squares (OLS) was used to estimate the model, however, due to nearly 25 percent of the survey population having a WTP value of zero, a censored model approach was required. Statistically speaking, the complete distribution of *MaxWTP* is not observable with the unobserved sample portion[4] of the population massed around zero (Haab and McConnell 2002). Under these conditions if OLS was used, the results would be inconsistent with true user WTP values and yield a downwards-biased estimate of the empirical model parameter estimates and an upwards-biased estimate of the intercept term. Therefore, Tobit models were used to evaluate survey responses to account for the data being censored around zero (Amemiya 1984; McDonald and Moffitt 1980).

In equation 6 below, *c* represents the intercept term and β represents the estimated coefficients of the models. Any survey with non-responses to questions used in the empirical model was removed from the analysis. Respondents classified as providing protest bids[5] were removed from the analysis as well, because these types of responses tend to affect the fit[6] of the empirical model in a negative way. However, protest bids were used as part of the uncertainty analysis, which is discussed in Section 3.6. In this analysis, these responses affected the model fit enough so that the model was not estimating the non-protest bids

[4] This occurs when some observations on the dependent variable, corresponding to known independent variables are not observed and therefore censored from the sample. In this case the demographic characteristics of the respondent are known but not their WTP.

[5] Protest bids are "No" votes for the recreational improvement, not because the respondent cannot afford the payment or disinterest in the improvement, but because of the dislike for the payment vehicle (in this case a tax) or because they believe recreational improvements should be free.

[6] Model fit refers to how well the econometric model explains the variation in the data set being analyzed.

appropriately. The final econometric model is shown below (Champ, et al. 2003; Collins and Rosenberger 2007):

$$MaxWTP = \left(c + \beta_1 Usefreq + \beta_2 Income + \beta_3 Knowl + \beta_4 Subs + \beta_5 Age + \beta_6 Member2\right) \quad (6)$$

3.4 Willingness to Pay

Since the PC modeling approach estimated *MaxWTP* directly, calculating the respondent WTP was straightforward. To calculate the average respondent WTP, the mean value of the independent variables along with the estimated model coefficients were entered into equation 6 and solved for *MaxWTP*. Even though most of the variables are insignificant, the variable of primary importance, *income*, is very significant. In addition the model fit statistics demonstrate that the model is a good fit (Akaike criterion and Hannan-Quinn criterion) to the data. The average respondent WTP is $17 per year. The model coefficients and variable means are provided in Table 3-2.

Table 3-2: Model Coefficient Values and Variable Means

Variable	Coefficient	P-Stat	Means
C	6.521211	0.3386	
USEFREQ	0.057889	0.3687	6.961131
INCOME	0.000131	0.0013	86466.43
KNOWL	-0.78709	0.7977	0.674912
SUBS	-0.25896	0.9323	0.318021
MEMBER2	5.440775	0.1606	0.166078
AGE	-0.02646	0.7906	49.48763
Akaike criterion		9.021156	
Hannan-Quinn criterion		9.124208	

3.4.1 User Population

The user population for Lake Texoma, for the purposes of this study, is not easy to define or quantify. Lake Texoma has numerous types of recreational users and this study only focuses on the fishery. Therefore, using the number of annual lake visitors would aggregate the user WTP estimate over too many people. Six million people may visit Lake Texoma per year, but they are all not anglers and should not be assigned a WTP value.

Section Three: Econometric Analysis

As discussed throughout Phase I, in the stakeholder comments, and this report, Lake Texoma can be fished using either a Lake Texoma fishing license (lake license) or a Texas or Oklahoma State freshwater fishing license (State license). Therefore, the total user population of people who fish on Lake Texoma was determined by estimating the number of people who fish with either type of license.

3.4.1.1 Correspondence with TPWD and ODWC

TPWD and ODWC were contacted to provide data or statistics on the number of people who purchased lake licenses at least over the past 10 years. These agencies on either side of the lake are believed to have the best expertise on the number of anglers for Lake Texoma because of their involvement with licensing.

Neal R. Chambliss of the License Department at TPWD provided statistics for the total number of people who purchased a lake license from a distributor (e.g., bait shop, sporting goods store) located in the State of Texas. The data are for the last 11 years (1998–2008) and include the zip codes of the purchaser (Table 3-3). However, Mr. Chambliss was unable to provide an estimate of the total user population of those who fished on Lake Texoma over that time period.

Mike Chrisman, License Supervisor for the ODWC, provided Lake Texoma License sales figures from 1999–2008, however, no information could be provided on the purchaser (e.g., zip code) because of legal restrictions (Table 3-3). Like his counterpart in Texas, he too was unable to provide data on total number of users.

Table 3-3: Number of Lake Licenses Sold in Texas and Oklahoma by Year

	Number of Lake Licenses Sold	
Year	*Texas*	*Oklahoma*
1998	24,009	not provided
1999	26,414	33,769
2000	27,145	34,330
2001	27,682	32,801
2002	24,834	31,818
2003	23,345	30,666
2004	27,404	43,889
2005	27,709	36,223
2006	29,938	36,518
2007	30,789	26,650
2008	31,936	38,540

3.4.1.2 Game Warden Interviews

Game Wardens for every county adjacent to Lake Texoma were contacted to provide information on the number of people who fished with a lake license compared to those who fished with a State license. Since game wardens typically check anglers for valid licenses, they have the most practical experience to approximate the user population for this study. Based on their individual experiences, the game wardens provided information on the approximate ratio of lake licenses versus State licenses. In particular, the game wardens were asked what percentage of the population in their area fished with a lake license. The game wardens consistently indicated that a major contributor to whether or not an angler purchases a lake license was the amount of shoreline available to them with a State license. The greater the shoreline in their assigned area, the less likely the wardens found people with lake licenses. Table 3-4 is a summary of the information obtained from the game wardens and the populations of their respective counties:

Table 3-4: Summary of Game Warden Data

State	County	Population 2000	Game Warden	Percent Using Lake License	Comments
Texas	Grayson	110,595	James Ballard	80%	
	Grayson	110,595	Randolf McGee	80%	
	Cooke	36,363	Jimmy Lundberg	NA	Unable to reach warden
Oklahoma	Bryan	36,534	Danny Clubb	60%	Comparatively greater shoreline
	Marshall	5737	Lt. Jimmie Henthorn	40–50%	
	Marshall	5737	Linda Powell	40–50%	
	Johnston	10,513	Curtis Latham	30%	
	Love	8,831	Bob Mullinax	NA	Unable to reach warden

3.4.1.3 Data Derivation

The number of lake licenses purchased in Texas and Oklahoma was assumed to represent the lake license holding segment of the user population for any given year. If the ratio of lake to State license users could be determined, because the number of lake licenses was known, the total user-population could be reasonably estimated.

As outlined in Section 3.4.1.2, an estimated ratio was determined for each county in each State from information provided by the game wardens. Oklahoma had a comparatively greater variation in ratio of lake to State license holders across the lake bordering counties. Furthermore, the ratios for lake to State licenses for the Oklahoma counties were lower across the board as compared to Texas. With the majority of Lake Texoma in Oklahoma, Oklahoma State-license holders can access to most of the lake without purchasing a lake license.

In order to develop a uniform ratio for all of Oklahoma, a weighted average of the warden license information was estimated based upon the population of each county bordering the lake. This resulted in an estimated average of approximately 52 percent of the Oklahoma user population using a lake license, compared to a 48 percent straight average of the warden license information.

The estimated number of State-only license users was obtained by multiplying the annual number of lake licenses sold by the inverse of the lake to State license ratio. Table 3-5 shows the estimated user population for each year by State.

Table 3-5: Lake Texoma User Population by State

Year	Lake Licenses Sold	Lake to State Ratio	Estimated State License	Estimated User Population
		OKLAHOMA		
1999	33,769	52%	31,171	64,940
2000	34,330	52%	31,689	66,019
2001	32,801	52%	30,278	63,079
2002	31,818	52%	29,370	61,188
2003	30,666	52%	28,307	58,973
2004	43,889	52%	40,513	84,402
2005	36,223	52%	33,437	69,660
2006	36,518	52%	33,709	70,227
2007	26,650	52%	24,600	51,250
2008	38,540	52%	35,575	74,115
		TEXAS		
1998	24,009	80%	6,002	30,011
1999	26,414	80%	6,604	33,018
2000	27,145	80%	6,786	33,931
2001	27,682	80%	6,921	34,603
2002	24,834	80%	6,209	31,043
2003	23,345	80%	5,836	29,181
2004	27,404	80%	6,851	34,255
2005	27,709	80%	6,927	34,636
2006	29,938	80%	7,485	37,423
2007	30,789	80%	7,697	38,486
2008	31,936	80%	7,984	39,920

Based on the data provided, the average number of lake license holders from Oklahoma was estimated to be 34,520 and the average number of State-only license holders was estimated to be 31,865, resulting in an Oklahoman user population of 61,903. Texas has an estimated 27,382 lake license holders and only 6,846 State license holders, resulting in a Texas user population of 38,711 on an average annual basis. The average annual user population was estimated by taking the estimated total user population for the two States, and rounding to the nearest thousand. The average annual user population for Lake Texoma is estimated to be 101,000.

3.4.2 Benefit Transfer for Oklahoma

The survey population only included lake license holders who purchased their license in Texas. Lake license holders who purchased their license in Oklahoma and State license holders were not included in the survey population as discussed in previous sections of this report and Phase I. Therefore, a potentially large portion of the user population was not

surveyed for this study. The WTP for this portion of the user population was estimated using benefit transfer.

People learn directly or through the experience of others. The experience of others is used as the basis for the benefit transfer methodology (Champ, et al. 2003). A few characteristics of the benefit transfer are important when selecting the values to transfer. The original site needs to be as close as possible to the transfer location in biology, climate, size, type of users, and recreational opportunities available. Also, the more recent the study was conducted, the better because the effects of inflation, public opinion, and other factors are minimized. Transferring the benefits from the Texas population to the Oklahoma population meets these requirements, especially because they apply to the same lake so all of the site conditions are held constant. Only the user population differs.

One of the demographic characteristics shown as a major driving factor in respondent WTP values is income. Intuitively, this makes sense because monetary decisions are limited by a budget constraint. Therefore, U.S. Census data were consulted for Texas and Oklahoma to compare the percent differences in State median income (Table 3-6).

Table 3-6: Median Household Income Texas and Oklahoma

State	Median Household Income (2009)	
Texas	$	46,248
Oklahoma	$	40,371
Percent Difference		12.7 %

Since the median household income of Oklahoma is 12.7 percent lower than Texas, the median income value used in the WTP calculations was lowered by 12.7 percent. The lower estimate will help reduce any overestimation in the WTP values for the Oklahoma portion of the user population. Adjusting the WTP for Oklahoma's lower median income drops the average survey income from 86,466.43 to 75,485.19. Using this median income, the Oklahoman per user WTP is $16. The derived coefficients of the model do not change with this calculation; a lower income is simply used instead of the survey data mean value for income (Table 3-7). This method was chosen because the 18 respondents from Oklahoma

did not create a statistically viable sample to analyze separately from the rest of the survey sample.

Table 3-7: WTP with Adjusted Mean Income for Oklahoma

Variable	Coefficient	P-Stat	Means
C	6.521211	0.3386	
USEFREQ	0.057889	0.3687	6.961131
INCOME	0.000131	0.0013	75485.19
KNOWL	-0.78709	0.7977	0.674912
SUBS	-0.25896	0.9323	0.318021
MEMBER2	5.440775	0.1606	0.166078
AGE	-0.02646	0.7906	49.48763
Akaike criterion		9.021156	
Hannan-Quinn criterion		9.124208	

3.4.3 Aggregate WTP Estimate

The previous subsections of Section 3 have detailed the methodology used to calculate individual WTP and the estimated number of users for this study. This WTP value is specific to the striped bass fishery on Lake Texoma and inferences were not made during this phase for the value of the lake's fishery or recreational value as a whole. With the individual user WTP value of $17 annually and an annual user population of 39,000 for Texas; the annual Texas WTP value is $663,000. The Oklahoman user WTP value is $16 annually with an annual user population of 62,000 resulting in an annual WTP value of $992,000. Therefore with an average user population of 101,000 anglers, the average annual WTP value for the Lake Texoma fishery is $1,655,000.

Upper and lower bounds for the aggregate WTP estimate are provided in Section 3.6 as part of the risk and uncertainty discussion.

3.5 Regional Economic Development Benefits

The Regional Economic Development (RED) benefits of the RRCCP project are expected to be minimal in relation to changes in the striped bass fishery. The vibrant striped bass fishery on Lake Texoma, even if the catch rate is reduced by 30 percent, will still be considered a good fishery by many of its current anglers. This statement is supported by the survey

responses. In addition to the CV question, respondents were asked if they would take fewer trips to Lake Texoma with the reduced catch rate provided in the PC question.

Table 3-8 shows the change in number of trips if no program is implemented and the catch rate decreases. As shown in Table 3-2, the average number of trips taken per year to Lake Texoma is 7, the mean of *USEFREQ* (*USEFREQ* is the variable name for number of trips taken per year). With the reduced catch rate, the average number of trips taken by respondents to Lake Texoma each year is expected to drop by one full trip from 7 to 6.

Table 3-8: Changes in Number of Trips Taken Under Without Program Conditions

Change in Trips	Number of Responses	Percent of Responses
Same number of trips	269	70%
1 less trip	58	15%
2 less trips	16	4%
3 or more less trips	26	7%
No response	17	4%
Total	**386**	**100%**

Table 3-9 summarizes average per-trip expenses given by survey respondents. On average, respondents spent $311 per trip on all expenses. The average annual expense per respondent under current conditions is $2,180. If no program is implemented, the cost per year will drop by the expense of one trip ($311) resulting in an average annual expense of $1,869.

Table 3-9: Average Trip Expenses per Year

Cost Category	Average Spent Per Respondent			
	Per Trip ($)	Per Year, Current ($)	Per Year, Without Program ($)	Difference ($)
Lodging	69.95	489.67	419.72	69.95
Food & Beverage	79.74	558.19	478.45	79.74
Transportation	113.71	795.97	682.26	113.71
Activities/Entertainment	28.28	197.97	169.69	28.28
Supplies/Equipment	12.24	85.68	73.44	12.24
Miscellaneous Expenses	7.51	52.60	45.09	7.51
Total	**311.44**	**2,180.08**	**1,868.64**	**311.44**

Because this study focuses only on the striped bass fishery, the RED effects are only applicable to the striped bass fishery and not to Lake Texoma's overall recreation industry.

Anglers could easily switch to a different species if they desired; the fishery on the lake as a whole will not disappear. Lake Texoma also offers numerous recreational activities, discussed in the Phase I Report, that attract numerous visitors who are not anglers.

3.6 Risk and Uncertainty

Multiple sources of uncertainty are present in any study. A large portion of uncertainty comes from the unknown biological impacts of the RRCCP within Lake Texoma. The biological impacts were not finalized or validated at the time of survey development and implementation. Biologists performing the biological impact analysis were consulted to develop the catch rate percent decrease range utilized in the survey to ensure the most extreme impacts were covered by this study to reduce this uncertainty but it could not be eliminated.

A certain level of uncertainty is inherent in survey responses and a person's words do not always match their actions. However, nonmarket economic methodology has a long and continuously tested history that is accepted in academia and in the general public. CV research has proven that while imperfect, results of properly designed CV studies result in WTP estimates reliable enough for policy decisions. Steps such as receiving OMB approval for the survey instrument are designed to minimize this uncertainty as much as possible.

Another source of uncertainty comes from the CV question responses themselves, as shown in Figure 3-1 with the availability of a "Not Sure" response. The survey results were re-run using the same model described in Section 3.5 but with "Not Sure" responses coded as a "YES" instead of a "NO." This provided the upper-bound WTP estimate for Lake Texoma's striped bass fishery, with a user WTP value of $21 per year. A difference of only $4 per user between the most-likely and upper-bound results indicates respondents were confident in their responses. With a user WTP estimate of $21, the aggregate WTP upper-bound value would be $2,121,000 annually. Table 3-10 provides the model estimation results, coefficient significance, and variable means for the upper-bound Tobit model.

Table 3-10: Upper-Bound Tobit Results and Variable Means

Variable	Coefficient	P-Stat	Means
C	14.06543	0.0685	
USEFREQ	0.110668	0.1231	7.045296
INCOME	0.000123	0.0067	87132.87
KNOWL	-3.058775	0.3747	0.686411
SUBS	0.566497	0.8680	0.313589
MEMBER2	3.023873	0.4847	0.167247
AGE	-0.053516	0.6331	49.65854
Akaike criterion		9.301283	
Hannan-Quinn criterion		9.403548	

Protest responses were not included in the models discussed up to this point in the report because of the adverse impact they had on estimation results. However, excluding protest bids from the analysis brings a level of uncertainty into the WTP estimates. Researchers have found that excluding protesters completely implies that protesters have the mean WTP found in the sample, if in reality protester WTP is lower, this method biases results upwards. However, if protesters are included in the sample with zero WTP and in reality their WTP is greater than zero, this produces WTP results that are biased downwards (Collins and Rosenberger 2007). With the data collected, no value can be assigned to protest bids besides a value of zero. While this may in fact produce WTP results biased downward, it provides the most conservative lower-bound estimate. Including protesters (86 respondents in total) in the Tobit model resulted in a WTP estimate of $9 per year, or $909,000 over the total user population. Table 3-11 provides the estimated coefficients, significance levels, and variable means when protesters are included and any "Not Sure" response is coded as a "NO."

Table 3-11: Protest Model Results and Variable Means, "Not Sure" as "NO"

Variable	Coefficient	P-Stat	Means
C	0.595547	0.9317	
USEFREQ	-0.03153	0.5930	8.229111
INCOME	0.0000976	0.0199	86442.05
KNOWL	0.576819	0.8540	0.668464
SUBS	2.791824	0.3771	0.296496
MEMBER2	10.24349	0.0131	0.142857
AGE	-0.056737	0.5833	49.59838
Akaike criterion		7.451662	
Hannan-Quinn criterion		7.485201	

Coding "Not Sure" responses as a "YES" response instead of as a "NO," and including the protest bidders as having a zero WTP results in a lower-bound estimate to $12 per year (Table 3-12) which is higher than when "Not Sure" is coded as "NO". Because this value is higher, it is recommended as a conservative lowest-bound estimate of $9, using the results provided in Table 3-11.

Table 3-12: Protest Model Results and Variable Means, "Not Sure" as "YES"

Variable	Coefficient	P-Stat	Means
C	3.075077	0.6973	
USEFREQ	-0.00036	0.9957	8.209677
INCOME	0.000107	0.0243	86442.05
KNOWL	0.310913	0.9304	0.669355
SUBS	3.35692	0.3502	0.295699
MEMBER2	8.270718	0.0772	0.145161
AGE	-0.06104	0.6034	49.59409
Akaike criterion		7.747282	
Hannan-Quinn criterion		7.780821	

The last main area of uncertainty surrounds the user population for Lake Texoma. Despite a lengthy search through different State agencies in both Texas and Oklahoma, a reliable count of lake anglers is unavailable. The USACE Web site provides a number of lake users: currently 6 million visitors annually (USACE 2009). However, this number includes all lake users, not the number of anglers on Lake Texoma and, therefore, cannot be used as the user

population for this study. As discussed in Section 3.4.1 of this report, the user population was estimated using historic license data and information gathered from the local game wardens. Their estimates are based on their experiences talking with people and checking licenses during routine inspections, which may be skewed based on frequency of checking avid fishermen (who have a more likely chance of being inspected). These fishermen may or may not be representative of the user population in regard to lake license holders vs. State license holders. Also, fishermen can hold both a State license and a lake license, and it is unknown which license would be presented to the game warden during an inspection. These impacts could potentially skew the ratio of lake to State license holders, and thus change the user population. The best user population estimate available was used to aggregate the WTP estimates; however, it is an estimate and not a precise count of lake anglers.

Section Four: Summary

4.0 SUMMARY

This report represents Phase II of the study, which includes survey implementation, statistical and econometric analysis of the completed survey questionnaires, determination of NED benefits (or losses) and preliminary RED benefits, and a risk and uncertainty analysis. This report was reviewed by the Tulsa District; all report comments and responses are provided in Appendix D.

As part of the RRCCP, SWT is evaluating how a potential change in the chlorides would affect the recreational fishery of Lake Texoma. In particular, concerns were raised about how a change in chloride would affect the striped bass population and the recreational fishing industry that surrounds it. The purpose of this study was to estimate the economic impact of a change in the recreational fishery through a survey questionnaire. Telephone surveys were selected as least invasive to an angler's recreational experience and not subject to seasonal concerns.

Econometric analyses using Tobit models were performed to develop lower-bound, upper-bound, and most-likely WTP estimates for the striped bass fishery. The user population was estimated to be 101,000 anglers on Lake Texoma annually based on information collected from Texas and Oklahoma. The lower-bound WTP estimate for the striped bass fishery is $909,000 per year and the upper-bound WTP estimate is $2,121,000. The most likely annual WTP value for Lake Texoma's striped bass fishery is an estimated $1,655,000.

Section Five: References

5.0 REFERENCES

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APPENDIX A
SCOPE FOR PHASE II

Appendix A: Scope for Phase II

Area VI Red River Chloride Control Project
Recreation Study
Scope of Work
Contract No. W912HY-05-D-0003
Delivery Order No. 11
April 2008

I. INTRODUCTION

The Area VI project will impact the water quality of the Red River, Elm Fork, OK tributary, and Lake Texoma by removing the naturally occurring chloride salts. By doing so, the water will be more suitable for municipal, industrial, and agricultural purposes. Though there is high uncertainty in degree, the reduction of chlorides might change the water quality and turbidity of Lake Texoma in a way that will impact certain species of game fish. As a result, some anglers at Lake Texoma, those who sell goods and services to those anglers, resource agencies, and those with interests in local economic development have expressed concern about any changes to the fishery.

The USACE, Tulsa District (SWT) requires services to conduct and analyze a public survey. The survey strategy was designed in Phase I of this study. Phase II activities consist of the following tasks:

- Administration of the survey
- Statistical and econometric analysis of the completed survey questionnaires
- Determination of National Economic Development and Regional Economic Development benefits (losses)
- Conduct a risk and uncertainty analysis

II. PURPOSE

SWT requires the administration and analysis of the public survey for contribution to final Corps decision documents (EIS and Study Report) for the Area VI report. This scope-of-work is to identify the activities to be performed for this recreation study and the report that is due upon completion of this phase of work. All work conducted under this task order shall be in compliance with pertinent USACE Civil Works planning and recreational regulations. **The product of Phase II is a detailed analysis of the survey results and a determination of NED and RED benefits.**

III. ACTIVITIES

The contractor will perform the following activities for this phase:

1. Administration of the Survey

Upon receiving approval from the Office of Management and Budget (OMB), the contractor shall administer the telephone survey using the methods established in Phase I of this study. This telephone survey will focus on recreational fishing participation on Lake Texoma. The survey questions were designed in Phase I to ensure that, through econometric analysis, a

statistically valid estimate of user mean willingness to pay (WTP) can be derived for potential changes to the lake's recreational fishery. Surveys shall be administered by interviewers who have been trained in the appropriate protocol for eliciting responses over the telephone.

2. Statistical and Econometric Analysis of Survey Results

Survey Results shall be analyzed in the manner outlined in Phase I. Two valuation methods, travel cost model (TCM) and contingent valuation model (CVM), and several limited dependent variable econometric models were presented as means for determining the economic benefits associated with alternative recreational opportunity enhancement plans. This analysis will include calculating WTP for the Lake Texoma recreational fishery.

3. Determination of NED and RED Benefits

The contractor shall formally present findings of WTP and NED and RED recreation benefits generated in the analysis of the survey. The contractor will also provide the theoretical rationale of the measures and assumptions and limitations of the application of these findings. A discussion of the risk and uncertainty in these measures shall be included.

4. Risk and Uncertainty Analysis

Phase I identified two primary ways in which uncertainty will be incorporated into the economic analysis. First, the originally estimated sample size will be multiplied by a contingency factor to account for uncertainty associated with telephone numbers and invalid responses (protest and yea-saying respondents). Second, confidence intervals around WTP point estimates will be developed to allow the presentation of a statistically based range of possible WTP values for each evaluated recreational feature.

5. Independent Technical Review (ITR)

ITR will be ongoing throughout the study. Contractor will provide for one presentation of this report to support SWT's Quality Assurance (QA) Program.

6. Meetings and presentations related to project

The Contractor shall be available for a kick-off meeting, pre-survey meeting, mid-project progress review, and response to comments meeting. One of these meetings should be face to face, while others can be performed via teleconference. The Contractor shall also make one presentation of this report in person to support SWT's QA Program.

IV DELIVERABLES

Draft and final reports are due upon completion of all work activities and they will include the following as a minimum:

1. Documents

The contractor will provide two detail documents; one reflecting the results of the telephone survey and one reflecting the statistical and econometric analysis of the results which also shall include a discussion of risk and uncertainty.

The Survey Results Document will include:

- Discussion of the sampling and data collection procedures.
- Descriptive and graphical presentations of the results.
- Discussion of risk and uncertainty in sampling and data collection procedures.
- Copy of the database where the collected information is stored.

The Statistical and Econometric Analysis Document shall include:

- Description of the model specification and procedures.
- Clear and concise description of the results with appropriate graphical representations.
- Discussion of the risk and uncertainty in the model and the results.

2. Electronic Files

The contractor will provide electronic files containing data, report documents, and executable files for both the survey and statistical and econometric analysis.

The reports are to be generated in an electronic media compatible with Microsoft Office and the Corps' communications format. Modeling files will be in a format that is compatible with existing Corps software. The Initial Drafts shall include five (5) hard copies and the electronic versions. The Final Drafts shall include five (5) hard copies and the electronic versions.

3. Status Report

The contractor shall provide monthly status reports on the progress of the study. The reports can be e-mail messages providing a short description of the status of the task order work and any problems or delays that need to be addressed.

V MATERIALS AND SUPPORT PROVIDED BY SWT:

Corps will provide all relevant documents, data, maps and other information to the contractor. Informal briefings from SWT staff regarding current SWT activities planned or existing in the recreational study area are to be coordinated through the Point of Contact (POC) listed at end of this document.

VI SCHEDULE

Start work – No later than 10 days following Notice to Proceed (NTP).

Appendix A: Scope for Phase II

Surveys completed – [est.] 90 days after NTP.

Initial Draft Report (5 hard copies and electronic copy) – [est.] 180 days after NTP.

SWT review of initial draft and return comments to contractor; if needed, ITR presentation by contractor takes place during this time – days after NTP.

Final report (5 copies and electronic copy) – [est.] 30 days after receipt of SWT initial draft report's comments.

POC

The SWT representative will be:

Ed Rossman.
Phone: 918-669-4921
Email: Edwin.J.Rossman@usace.army.mil

Within 10 days of the NTP, the contractor shall provide SWT a contractor POC for this work.

APPENDIX B

COMMENTS FROM STAKEHOLDERS AND RESPONSES

Appendix B: Comments from Stakeholders and Responses

RESPONSE TO RESOURCE AGENCY COMMENTS

RED RIVER CHLORIDE CONTROL RECREATION STUDY

FINAL PHASE I REPORT (Study Design)

February 2009

BACKGROUND

Agencies provided informal written comments on the subject study. The resources agencies provide the comments via e-mail the week of January 5, 2009. The Corps and the resource agencies meet on January 8, 2008 to discuss the study and addressed many of the comments below. That meeting and the discussion are documented in a memorandum for record. Agency comments are *italics*. The Corps response is listed below each comment.

USFWS COMMENTS

1. *The USFWS does not agree with the U.S. Army Corps of Engineers, Tulsa District (SWT) decision to focus or limit the economic evaluation to the striped bass fishery. The assumption in the following sentence; "SWT determined that changes to other fisheries and other recreational activities on Lake Texoma would be minimal", is unsupported by any data or references in the report. It is our opinion that changes in salinity, productivity and water clarity would affect all aquatic and aquatic dependent species. In combination with other portions of the RRCCP, the proposed Area VI project also may have potential to affect Red River flows and Lake Texoma inflows, withdrawals, and reservoir water surface elevations (especially under drought or low flow conditions). Reduced Lake Texoma water surface elevations and increased fluctuations in the elevations are likely to affect a wide range of species from fish to waterfowl. We can find no biological basis for SWT's determination that only the striped bass fishery would potentially be affected (see previous comments in the Fish and Wildlife Coordination Act Report for the Wichita River chloride control projects). Modeling of potential project-related impacts on Red River flows and Lake Texoma surface elevations should be completed before attempting to determine what fish and wildlife resources or recreational uses may be affected.*

The modeling effort being conducted by Steve Bartell is designed to predict effects to aquatic species and that effort is supposedly near completion. It is premature for SWT to make assumptions about potential impacts to other species prior to seeing the results of the modeling. We believe it is more appropriate to evaluate the potential economic value and project-related impacts for all species in the fishery, and not limit the focus to striped bass. The lake supports an excellent fishery for other species such as catfish, largemouth and smallmouth bass, crappie, and white bass, and the value of these fisheries should not be ignored. The effort and cost involved in evaluating the economic value of the entire fishery would be similar to that of evaluating the value of the striped bass fishery, and we do not see any reason to limit the evaluation to striped bass only.

Such major SWT determinations or assumptions can significantly affect the design and results of an economic study. The usefulness and accuracy of the study's results would be questionable if the assumptions that go into it are flawed. The resource agencies want to avoid potential problems in interpreting or evaluating studies related to this project and suggest the study be re-evaluated or redesigned if this determination cannot be adequately supported.

Response. The study initially focuses on the striped bass fishery as it is the most unique to the area. There are number of economic substitutes for other species listed in the comment. If the Lake Texoma CASM indicates a substantial impact to those species, further analysis would be conducted to account for the economic value of those changes according to the National Economic Development Account as specified in the *Principal and Guidelines*.

Study Area Identification

2. *2.3 Revised Study Area – The information provided in this section is inaccurate. The special Lake Texoma fishing license data in this report (provided by the Texas Parks and Wildlife Department) represents licenses sold in Texas only. Current utilized data only represents what was sold by TPWD in 2006 and part of 2007. It should be noted that 2007 is an outlier year and may have fewer license sales due to flooding conditions and limited lake access. The Lake Texoma fishing license sales from Oklahoma are not included in that data base. Assumptions and interviews based only on Texas sales may not be representative of all the people purchasing the license or all anglers using the lake. Approximately two thirds of the lake is in Oklahoma and ignoring the sales from this State could drastically underestimate the total anglers buying the special license.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will be determined during Phase II of the study.

Survey Administration and Sample Design

3. *If the license sales from Oklahoma were included, the total number of sales and sales attributed to Oklahoma, Texas, and others States could change significantly. The number of interviews and percentages completed for each State would be likely to change. The information in sections 4.2-4.4 should be revised to include surveys of anglers buying the Lake Texoma fishing license in Oklahoma.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will

be determined during Phase II of the study. Statistical adjustments will be made to the interview results so the States are properly represented.

4. *The USFWS recommends using onsite interviews to collect information from Lake Texoma anglers. Due to the size of the lake and number of boat launches, onsite interviews would have required more effort, but we do not agree that this would not be "viable". The resource agencies frequently address these same issues when doing creel surveys. A cooperative effort with resource agencies that included a creel survey would provide more reliable information based on actual users.*

Response: The term "viable" was used in reference to survey timing (seasonality of major fishing activities), study timing (funding was not available in time for the 2008 summer season), ability to obtain a representative sample, and budgetary concerns. Onsite surveys are a nonprobability sampling method, which means that not all anglers have a probability of selection - only those fishing on the lake (or boat launch area) on the days and times that the surveys are conducted have a (nonzero) chance of selection. And even for them, that chance of selection is not known. With a nonprobability sample, you cannot generalize from the sample to the population—you can only describe the sample, the group of people who were there, at the time and place you collected data, agreed to talk with you, and completed the survey. Telephone surveys were seen as the best method to obtain a representative sample of the user population. We note that a probability sample — in which all elements of the sampling frame have a known, nonzero probability of selection — adjustments can be made for the proportional representation of Texas and Oklahoma anglers on the sampling frame.

5. *An onsite survey would be more likely to sample frequent users and would include those anglers that buy an Oklahoma or Texas fishing license (as well as those that buy the special Lake Texoma license). Basing the phone survey on the special license sales and limiting the non-Texans to 300 interviews may not accurately represent the actual fishing-related use. The proposed methods are likely to under-represent nearby or resident anglers, especially the Oklahoma anglers, relative to an onsite survey.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will be determined during Phase II of the study. Statistical adjustments will be made to the interview results so the States are properly represented. Our methodology was selected precisely because it permits that kind of statistical adjustment. An onsite survey, which would by definition entail a nonprobability sampling method, would not permit any adjustment or weighting of the data.

6. *While more distant users should be included, the number of trips they would make per year is likely to be limited with or without a change in catch rates (questions Q18 and Q19). The input of distant and infrequent users (with the proposed methods) is likely to be over-represented relative to an onsite survey.*

Response: The goal of the study is to obtain a representative sample of anglers who use Lake Texoma, not necessarily the heavy users of the lake. The willingness to pay values (WTP) are being determined based on the purchase of an annual license, not a per trip basis. The WTP value to maintain the fishing experience will inherently take into account fishing frequency and the overall expenses related to a fishing trip.

Appendix A

7. *The Area VI project could reduce demand for Altus water and cause less dramatic pool reductions at Lake Altus, only if demand for the water does not increase (such as increased acres of irrigation), or if water is protected and allocated for recreational use. Increased irrigation has been one of the primary benefits claimed by the SWT for the RRCCP and we are assuming that demands for agricultural and domestic use are likely to increase over time. If the project life is 50-100 years then it's relatively certain that demands for water will increase and the storage available in Lake Altus will decrease.*

Response. The USACE will conduct a recreation impact study of Altus-Lugart once hydrologic and agricultural-economic studies have been completed and results related to stream discharge and irrigation water usage have been quantified and identify impacts to Altus-Lugart Reservoir. However, at present Altus-Lugart Reservoir is not included within the project area because the confluence of the Elm Fork and North Fork of the Red River is downstream of Altus-Lugart Dam.

Appendix C

8. *There are no questions that would reveal how many times the person had fished at Lake Texoma in the past 12 months, or any other time frame. There are similar questions, but they use the term "recreational trips" and not fishing. A person that had fished Lake Texoma only once may be able to answer all the questions, but it would be difficult or the answers could be misleading for some questions (such as those that ask them to rank the quality of the fishery, costs of a typical trip, or average time spent). Many questions appear to be related to more general recreational uses or opportunities, but it is unclear what the purpose of these questions are if the focus is on the economic value of the fishery.*

Response: There is a revised final survey questionnaire that was not included in Appendix C of the Phase I report. In this final version, Q15 asks, "How many total recreational trips, regardless of purpose, have you taken to Lake Texoma in the past 12 months?" Q-15b (new question) asks, "Of the total # of trips you took to Lake Texoma during the past 12 months (answer to Q-15 above), how many were for the primary purpose of striped bass fishing?" For US Army Corps of Engineers projects (and also other federal agencies such as the USDA Forest Service), trips taken for the primary purpose of an activity are counted as "activity trips" or "activity days" for that particular activity. Thus, we do have the information needed to calculate annual striped bass fishing trips. In addition, the Q-15 response (total number of recreation trips) minus the Q-15b response (total number of striped bass fishing trips) provides an estimate of trips taken for other purposes, including for the primary purpose of fishing for a species other than striped bass. The responses to Q-8 ("What are the top three fish species you seek while fishing on Lake Texoma, please list in order of

preference") provide additional information on the primary purpose of recreational trips to Lake Texoma.

9. *Focusing on anglers that fish for striped bass and then further focusing on guided striped bass anglers is likely to give misleading results for estimating the value of the Lake Texoma fishery. How would the information related to guided trips be used? We think it is likely that the Corps is underestimating the unguided fishing pressure for striped bass at Lake Texoma. Using onsite interviews, we could estimate the total fishing pressure for each species and determine what percentage of the anglers were guided.*

Response: At this point, we only plan on using the responses to Q-11 and Q-12 to estimate the proportions of striped bass recreational that are guided and unguided. These proportions can be used with the responses to Q-15 and Q-15b to estimate annual guided striped bass trips and annual unguided striped bass trips. This information may be used in future regional economic development (RED) analysis since guided trips tend to involve more expenditures than unguided trips. For national economic development (NED) analysis, we do not plan on estimating willingness-to-pay (WTP) separately for guided and unguided trips (e.g., these trips are pooled in the NED analysis).

10. Q18 – *This question should be reworded. The decrease in catch rates is much more likely to result in less fish caught in a given period of time than "a longer time period to catch the same number of fish". Anglers are more likely to fish for a given time period than a set number of fish. Even after catching a legal limit, anglers may continue to fish using catch and release. If the questions appear or sound like they were written by people that do not fish, it could affect the rate or degree of cooperation.*

The wording of the question says that "it may take a longer period of time to catch the same number of striped bass" which is a true statement. For at least some anglers, it *may* indeed take them longer, for example, to catch their limit of striped bass (note: this is the same thing as saying that they may catch fewer striped bass holding time spent fishing constant). However, we don't say that this is necessarily the case. Anglers employing their fishing skills may be able to catch the same number of fish in the same amount of time even under the assumption of overall reduced catch rates.

Note that what is of most interest for Regional Economic Development and National Economic Development analysis is how anglers' trip behavior reflected in number of trips taken to Lake Texoma will be affected by changes in catch rates. In addition to altering their number of trips to Lake Texoma, anglers may adjust the time spent fishing per trip and/or "catch and release" behavior on their trips to Lake Texoma. Exactly what anglers do on their trips (e.g., more "catch and release") is not as important as the end result on number of trips taken to the lake.

11. *Q20 – We don't recommend using the term hatchery. This question could give people the false illusion that the loss of productivity or impacts to lake elevations could be mitigated via a hatchery.*

Response: In a contingent valuation survey, it is important to provide information about how a good or service will be provided to establish context. Thus, we needed to describe a mechanism to respondents by which *status quo* catch rates could be maintained. Most anglers are familiar with stocking programs as a means for enhancing catch rates. Thus, we felt that a hatchery/stocking program would be a credible means for maintaining catch rates at current levels. During pre-testing and current telephone interviews, respondents have appeared to accept the hatchery/stocking program as a realistic and credible means for maintaining catch rates at current levels. We acknowledge the scientific complexity involved in actually making a hatchery/stocking program work. However, any other mechanism posed to respondents for maintaining catch rates at current levels may be equally if not more scientifically complex. Thus, we chose a mechanism the basics of which we felt the typical lay-person respondent could understand and accept as a possible means for maintaining *status quo* catch rates.

12. *The first Q28 and the following question which appears to be mislabeled as Q25, are very similar and refer to sportsmen's and conservation organizations. The interviewer would be forced to explain the difference between the questions in nearly every interview. What is the purpose of these questions?*

Response: The labeling error was fixed in the final questionnaire version. Q-29 is meant to capture membership in a hunting or fishing club or organization which may be involved in resource conservation, but this is not the primary purpose of the club or organization. Q-30 is meant to capture membership in an organization with the primary purpose of conservation which may or may not involve hunting or fishing. We agree that the questions could be more sharply worded to emphasize this difference. Our telephone interviewers do help respondents to understand the differences in the questions. The purpose of the questions is to better understand the make-up of our sample; in particular, people who are motivated enough to join sportsmen's organizations/clubs and(or) conservation organizations tend to hold stronger preferences with respect to natural resource management issues. Reponses to these questions may therefore be useful for modeling and explaining differences in preferences and WTP across respondents.

Appendix B: Comments from Stakeholders and Responses

ODWC COMMENTS

Sources of Data

13. Although of greatest importance within the Lake Texoma fishery, we disagree with the decision to focus all efforts on striped bass. The report states on page 2, "SWT determined that changes to other fisheries and other recreational activities on Lake Texoma would be minimal". We strongly disagree with this unreferenced assumption. It is our understanding that changes in salinity, productivity and water clarity would affect all aquatic and aquatic dependant species. Lake Texoma boosts an excellent fishery for other species including largemouth and smallmouth bass, crappie, catfish, and white bass which shouldn't be overlooked. Competitive fishing events for black bass far outnumber those for striped bass. In addition, potential changes due to RRCCP might significantly alter other recreational activities at the lake. A more comprehensive study including all fish species would be more appropriate. The usefulness and accuracy of the study's results depend on sound assumptions.

Section 6.1 (pg 29) states, "There is currently a lot of uncertainty surrounding the impacts of a reduction in chlorides. Therefore, the survey instrument will have to be updated with the correct values when the biological information becomes available". It is our understanding that telephone surveys have already been initiated. If so, has the "biological information" become available? If so, we would like to review.

Response. As noted, the study initial focuses on the stripe bass fishery as it is the most unique to the area. The survey being conducted is to obtain a baseline condition. The biological model will provide changes in that condition. If the biological indicate a substantial impact to those species further analysis will be conducted to account for the economic value of those changes according to the National Economic Development Account as specified in the *Principal and Guidelines.* The biological model information will be share with agencies when such modeling is complete.

14. *The sampling frame suggested for the proposed (and now possibly completed) survey has limitations that may be more significant than acknowledged. Section Four (pages 16-21) discusses the pros and cons of different methods of survey administration and sampling frames. It was ultimately decided to survey only Lake Texoma Fishing license holders, due to the assumption that State license holders (either Texas or Oklahoma) "generally fish from shore within one of several campgrounds, and constitute a minimal proportion of total anglers on Lake Texoma". Furthermore, "shore anglers constitute a very small portion of Lake Texoma's anglers, and changes resulting from the Red River Chloride Control Project are not expected to affect their behavior. Therefore, not interviewing State License holders should not produce biased results."*

Response: It is our understanding that a majority of anglers who fish on Lake Texoma purchase a Lake Texoma fishing license because it is affordable and it allows the angler to fish anywhere on the lake. The total user population of the lake will be determined during

Phase II of the study through multiple methods, including the Lake Texoma fishing license databases from Texas and Oklahoma and adjustments made for anglers who only use State licenses.

15. *All license holders at Lake Texoma have a stake in the Red River Chloride Control Project and should be included in the survey design. I would suggest supplementing the survey of Lake Texoma Fishing License holders with State License holders.*

Response: The Corps has no reason to believe that the anglers who hold Lake Texoma licenses are not representative of the angling population on Lake Texoma. The total user population of the lake will be determined during Phase II of the study through multiple methods, including the Lake Texoma fishing license databases from Texas and Oklahoma and adjustments made for anglers who only use State licenses. Including all State license holders from Texas and Oklahoma into the sample would result in a lot of unnecessary calls to people who do not fish on Lake Texoma.

16. *Furthermore, angler name, address and phone number data for Lake Texoma Fishing license holders were obtained only from the TPWD. This sampling frame does not include Lake Texoma Fishing Licenses sold in Oklahoma. The report indicated 87 percent of the licenses were issued to Texans and less than four percent to Oklahomans. Had the Lake Texoma Fishing licenses sold by the ODWC been included in the sampling frame, the distribution would have been considerably different. Section 4.2 on page 19 indicates the final data file from the Texas Parks and Wildlife Department included 51,546 Lake Texoma Licenses sold to unique individuals from January 2006 through June 2007. (People who purchased in both years were only counted once.) When examining Oklahoma sales of the Lake Texoma Fishing license during this same time period, we found 70,949 unique individuals. With Oklahoma's sales included in the sampling frame, the proportion of license holders from Oklahoma increased from less than four percent to nearly a quarter (see table below). Under-representing the opinions of Oklahomans could significantly bias the results.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will be determined during Phase II of the study. Statistical adjustments will be made to the interview results so the States are properly represented.

17. *Although not explicitly stated in Section 2.1 on page 3, a few quick calculations revealed that 0.7 percent of the Texas population lives in a county adjacent to Lake Texoma, while 3.4 percent of the Oklahoma population lives in an adjacent county. The table further illustrates a higher proportion of the population in Oklahoma is employed in fishing/hunting and recreation industries than in Texas. One might argue the impact of a change to Lake Texoma is greater to Oklahomans than Texans. Clearly, Oklahomans have a significant stake in the Red River Chloride Control Project and they should be fairly represented in a survey of stakeholders in the region.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will be determined during Phase II of the study. Statistical adjustments will be made to the interview results so the States are properly represented.

18. *It is unknown whether the number of license holders were used in the models or if this number may later be used to assign value to the fishery. If in fact total users are important, disregarding Lake Texoma Fishing Licenses sold in Oklahoma and general State Licenses would underestimate the total anglers utilizing the Lake Texoma fishery. Again, if total users are important, license sales information over a longer range of time would be desirable. Current utilized data only represents what was sold by TPWD in 2006 and part of 2007. It should be noted that 2007 is an outlier year due to flooding conditions and limited access.*

Response: Data on the sales of the Lake Texoma fishing licenses that were sold in Oklahoma were not available when the Phase I report was completed. The TPWD data included purchases by residents of Oklahoma and other States. The sample for the interviews was weighted to select a large number of non-Texans. The total user population of the lake will be determined during Phase II of the study. Statistical adjustments will be made to the interview results so the States are properly represented. The historical number of Lake Texoma license holders will be evaluated to determine the average annual number of users and tends.

Sample Design

19. *While we understand that the size of Lake Texoma and number of access locations makes on-site interviews challenging, we don't think this approach should be labeled unviable. Creel surveys utilized by resource agencies must often overcome these same obstacles. Telephone surveys give equal probability to all license holders but fail to take into account frequency of use. This method may under-represent nearby or resident anglers relative to onsite interviews. While the survey asks how many "recreational trips" were taken to the lake in a given amount of time (Q14), this doesn't help define how often an individual fished the lake. Additionally, the utilization of an onsite interview would have eliminated the problem of only sampling Lake Texoma Fishing Licenses.*

Response: The term "viable" was used in reference to survey timing (seasonality of major fishing activities), study timing (funding was not available in time for the 2008 summer season), ability to obtain a representative sample, and budgetary concerns. The goal of the interview sample set is to obtain a representative selection of all anglers who use Lake Texoma, not necessarily the heavy users of the lake. The WTP values are being determined based on the purchase of an annual license, not a per trip basis. The WTP value to maintain the fishing experience will inherently take into account fishing frequency and the overall expenses related to a fishing trip. There is a revised final survey questionnaire which was not

included in Appendix C of the Phase I report. In this final version, Q15 asks, "How many total recreational trips, regardless of purpose, have you taken to Lake Texoma in the past 12 months?" Q-15b (new question) asks, "Of the total # of trips you took to Lake Texoma during the past 12 months (answer to Q-15 above), how many were for the primary purpose of striped bass fishing?"

20. *The report lists a number of reasons why one survey method or another was eliminated due to potential bias. However, the telephone method decided upon still contains numerous sources of bias, most notably the non-inclusion of the Oklahoma license sale database discussed above. Web-based surveys were considered unacceptable because of potential for economic bias (pg 16); however, bank anglers were precluded in the "accepted" design (also potential economic bias). The executive summary on page ii indicates "many" license holder records contained phone numbers. The use of the word "many" instead of "most" is a concern. The proportion of license holders with phone number data is not documented in Section 4. In Oklahoma, 23 percent of the Lake Texoma fishing license holders did not provide a phone number at the time of purchase. Limiting data collection to license holders with telephone number data on file may further bias the sample toward higher socio-economic brackets. Although the report suggests an approach to identifying and addressing this possible bias, it would be best to disclose the magnitude of the problem before deciding if a telephone survey is the appropriate methodology.*

Response: We agree and acknowledge that any survey method has inherent biases. Although not all fishing license records contained telephone numbers, enough telephone numbers were available to develop a sufficient sample for this study. The characteristics (e.g., age, income) of the respondents will be evaluated to ensure that a representative sample of the angling population was surveyed. Telephone surveys were seen as the best method to obtain a representative sample of the user population.

Inventory of Existing Conditions

21. *There appears to be a possible contradiction between the Section 3 introduction (pg 9) and the section summary (pg 15). The introduction acknowledges that Lake Texoma is a "unique recreational resource" that provides opportunities substitute lakes don't offer. Using the reports own analogy, "if the site of interest [in this case Lake Texoma] has no substitutes or significantly inferior substitutes, people are likely to be affected by negative changes because they cannot easily obtain the same recreation experience elsewhere". The introduction further states that "Lake Texoma is a unique recreational resource and while people can always fish elsewhere, the experience will not be a comparable substitution". While the summary acknowledges a unique opportunity because of the size of Lake Texoma, it goes on to state "there are alternative fishing recreation areas within the region surrounding the lake" and in neighboring States. It should be realized that Lake Texoma is a world-class striped bass fishery offering opportunities these suggested fisheries can't offer. Even "neighboring lakes" containing striped bass populations, such as Lake Keystone, don't offer the same opportunities (i.e. high density, abundant harvest) that Lake Texoma does and isn't an appropriate substitute.*

Response: It is agreed that Lake Texoma is a world class striped bass fishery that offers opportunities other fisheries do not. Due to the uniqueness, the survey questionnaire was focused on the impacts to striped bass fishing, whereas there are a greater number of substitutes for other species. Having available substitutes allows anglers to have a similar experience with a similar cost, which would be a "wash" in the economic evaluation.

Site Visit

22. *The report makes several references to a June 2007 meeting that included "USACE personnel, city officials and local stakeholders" yet neither the Oklahoma Department of Wildlife Conservation nor Texas Parks and Wildlife Department were present, according to the meeting notes beginning on page B-1. During this site visit, URS reportedly discovered "public opinion is not as uniformly negative as initially thought" (page 18). This discovery appears to be based on conversations with two people: 1) the office manager of the Denison Chamber of Commerce who was not at all aware of the RRCCP, and 2) a fishing guide from Oklahoma who did not think the project would affect striped bass fishing…but also displayed limited knowledge of limnology in his assessment that clear water does not support many fish. Regardless of the amount of knowledge these two individuals possessed, a sample size of two is not sufficient to document that "public opinion is not as uniformly negative as initially thought." The statement was leading and unnecessary in what should have been an impartial analysis of the situation.*

Response: The statement "public opinion is not as uniformly negative as initially thought" was a general observation based on our discussions with people during the site visit. These discussions were not limited to the two people referenced. This observation was presented in the report to note that a general public opinion survey may be beneficial to determine the public's attitude towards the RRCCP. Our survey was not intended, nor designed, to capture the public's attitude toward a particular project. This observation had no impact on our study and should not be given more weight than was intended.

Survey Instrument

23. *The long introduction (page C-1) is authoritarian and intimidating (i.e. "Red River Chloride Control Project for the United States Army Corps of Engineers," "Water Resources Council Principles and Guidelines," "Record Center" and "Federal and State water and land management agencies"). Social desirability bias (when a respondent tries to gives answers s/he thinks will please the interviewer) is likely. I would suggest the survey be conducted by a neutral third party without the reference to the federal interest in the outcome.*

Response: We determined it was important for context and credibility to explain to address the "who and why" questions about the study up-front. During pre-testing and current telephone interviews, respondents do not appear to have a negative or positive reaction to this preamble. Since the interviews are being conducted by a neutral third party, interviewer bias related to negative or positive feelings towards the resource management agency should be minimized. Much of the language

24. *Questions 1 and 2 are extremely subjective. On the heels of an intimidating introduction, respondents may underestimate their knowledge, fearing a test of their professed expertise.*

Reponses: This effect is possible; however, during pre-testing and current telephone interviews we have not observed a reluctance on the part of respondents to answer this question and evidence of worry or fears about how their responses will be used (e.g., follow-up test or quiz).

25. *Question 18 masks the issue at hand by adding natural causes to the equation. While reservoir aging may be a legitimate factor, it is not the topic at hand. Manmade causes are listed second, as if they carry less impact. In addition, Question 18 only allows respondents to predict a decline in their angling. While an increased number of trips to a declining fishery may appear counter-intuitive, it should not be ruled out. To avoid leading the respondent, the answer set should contain an equal number of both positive and negative responses, with a neutral response anchored in the middle.*

Response: For context and credibility, we wanted to acknowledge up-front to respondents that both natural and manmade factors could impact catch-rates. The purpose of the study is to determine respondent's reaction to a change in fishing conditions, which could results from natural and/or manmade impacts. The WTP of any impacts from manmade actions will be determined by the difference between the estimated catch rates for the without-project and with-project alternatives. In general, we agree that it is good practice in preference/attitude/opinion surveys to mix positive and negative responses. However, we also have to balance this with concerns about question rejection and question or item non-response bias which could occur by presenting respondents with choices that seem counter-intuitive and perhaps confusing (or written by confused researchers!).

26. *Question 20 is misleading by suggesting that potential reductions in the Lake Texoma striped bass population could be augmented by hatchery stockings to maintain the current catch rate. This scenario isn't feasible given that the magnitude of naturally spawned fish far surpasses hatchery capabilities. Reduced numbers of fish available for harvest would alter management options currently in place (i.e. harvest regulations) thus influencing angler opinion. Furthermore, this question doesn't consider reduced productivity and its affect on standing crop. Regardless of what is stocked or naturally produced, sufficient food availability is necessary for growth and survival. We don't recommend using the term hatchery or stocking as it could give people false illusions.*

Response: In a contingent valuation survey, it is important to provide information about how a good or service will be provided to establish context. Thus, we needed to describe a mechanism to respondents by which *status quo* catch rates could be maintained. Most anglers are familiar with stocking programs as a means for enhancing catch rates. Thus, we felt that a hatchery/stocking program would be a credible means for maintaining catch rates at current levels. During pre-testing and current telephone interviews, respondents have appeared to accept the hatchery/stocking program as a realistic and credible means for maintaining catch rates at current levels. We acknowledge the scientific complexity involved in actually making a hatchery/stocking program work. However, any other mechanism posed

to respondents for maintaining catch rates at current levels may be equally if not more scientifically complex. Thus, we chose a mechanism the basics of which we felt the typical lay-person respondent could understand and accept as a possible means for maintaining *status quo* catch rates.

27. *Furthermore, the willingness-to-pay assessment in Question 20 is confounded by the inclusion of both natural and manmade causes in the decline. We would predict different willingness to pay for efforts to mitigate natural decline vs. efforts to mitigate water desalinization.*

Response: In a resource policy or management scenario, the particular "means" leading to particular "ends" could bias WTP results if respondents have strong positive or negative feelings with respect to the particular "means". For example, two "means" for reducing overpopulation of deer in a residential area may be 1) capture and relocate deer; or 2) thin out the herd by selective killing. Animal-rights people who have strong negative feelings about killing animals would likely reject that means of reducing overpopulation. During pre-testing and current telephone interviews in our survey, respondents have not expressed or showed evidence of strong positive or negative feelings with respect to the "means" (e.g., natural and manmade factors) leading to the "ends" (e.g., changes in catch rates). Thus, we do not believe scenario rejection based on the proffered "means" is a major problem in our study.

28. *We question the relevance of mislabeled questions 28 and 25 regarding membership in various organizations and clubs. Furthermore, these questions are very similar and, if used, are in need of definition.*

Response: The labeling error was fixed in the final questionnaire version. Q-29 is meant to capture membership in a hunting or fishing club or organization which may be involved in resource conservation, but this is not the primary purpose of the club or organization. Q-30 is meant to capture membership in an organization with the primary purpose of conservation which may or may not involve hunting or fishing. We agree that the questions could be more sharply worded to emphasize this difference. Our telephone interviewers do help respondents to understand the differences in the questions.

29. *Several of the questions refer to "recreation trips" but don't provide information on number of fishing trips.*

Response: There is a revised final survey questionnaire which was not included in Appendix C of the Phase I report. In this final version, Q15 asks, "How many total recreational trips, regardless of purpose, have you taken to Lake Texoma in the past 12 months?" Q-15b (new question) asks, "Of the total # of trips you took to Lake Texoma during the past 12 months (answer to Q-15 above), how many were for the primary purpose of striped bass fishing?" For US Army Corps of Engineers projects (and also other federal agencies such as the USDA Forest Service), trips taken for the primary purpose of an activity are counted as "activity trips" or "activity days" for that particular activity. Thus, we do have the information needed to calculate annual striped bass fishing trips. In addition, the Q-15 response (total number of

recreation trips) minus the Q-15b response (total number of striped bass fishing trips) provides an estimate of trips taken for other purposes, including for the primary purpose of fishing for a species other than striped bass. The responses to Q-8 ("What are the top three fish species you seek while fishing on Lake Texoma, please list in order of preference") provide additional information on the primary purpose of recreational trips to Lake Texoma.

30. *Separate from the interview questions themselves, we question why the general public was not pre-tested (section 6.2). Even with lack of RRCCP knowledge, personnel from the contractor and SWT offices are more familiar with these types of surveys than the lay person. Anglers aren't accustomed to WTP questions regarding non-tangible products (i.e. recreation, fishing) and may not know how to respond or what it is really worth to them. Phone surveys often blindside people making it difficult to recall information, recall specific details, or have time to ponder their responses.*

Response: The questionnaire was developed with input from experienced researchers and consultants, resource managers and anglers. The questionnaire was also pre-tested as described in the report. Over the past 30 years, a very large number of contingent valuation studies have been conducted of WTP for hunting and fishing. These studies have shown robust results with a high degree of internal and external validity. Previous studies suggest that because of their experience with the resource, hunters and anglers appear to be some of the most capable respondents when it comes to understanding and responding to contingent "what if" type survey questions. In general, the contingent valuation method has stood up to years of validity testing as has been accepted by US government agencies and the US courts as a valid methodology for measuring peoples' preferences and values. All survey modes (e.g., personal interviews, mail surveys, telephone surveys) have their advantages and disadvantages. For the purposes of this survey, we determined that a telephone survey offered the best option for collecting data in a timely, cost-efficient and accurate manner. A particular advantage of the phone survey in this study was the ability to provide clarification to respondents about the survey.

TPWD COMMENTS

31 *Many factors may potentially impact fish in general and striped bass in particular, but in context of the proposed RRCCP, lets consider chlorides and flow. For sure striped bass will be affected by reductions in flow rate on Red River, as predicted by the implementation of RRCCP procedures in Area VI. The success of striped bass in Lake Texoma is attributed to water chemistry (chlorides) and flow (FAO Fisheries Synopsis No. 121). The presence of chlorides (salinity) increases the density of the water; hence, provides extra buoyancy to fertilized and semi-buoyant striped bass eggs floating downstream. Striped bass larvae do better in low salinity water than in fresh water. Along with buoyancy, water flow (velocity and volume) are very important in developing striped bass spawns (Hassler 1958). High and regular flows resulted in the most successful spawns. A minimum of 1 foot per second velocity and 50 miles of unimpeded river flow is important to successful striped bass spawning. Albrecht (1964) concluded that striped bass egg distribution within the water column depended upon current velocities. A minimum of 30.5 cm per second was required to maintain the eggs in suspension. These conditions are currently provided. Successful striped bass spawns have produced the most popular premier inland striped bass fishery in the United States. Lake Texoma supports at least 100 striped bass fishing guides. The lake attracts anglers from all over the world. So maybe we should leave mother nature alone!!!*

In late 2007 Texas Parks and Wildlife (TPWD) and ODWC biologists met with USACOE and USFWS personnel in Tulsa to hear a proposal by Dr. Steve Bartell, a purveyor of mathematical modeling of biological systems, who proposed to conduct such a modeling to predict effects to aquatic species of changes in water chemistry resulting from the RRCCP. Supposedly this effort is near completion. While we have reservations regarding such predictions, why not hear him out before "shotgunning" potential impacts to the aquatic ecosystem. Obviously USACE felt the modeling was important to this process, so let's see what it predicts.

Response. Modeling efforts utilizing the Comprehensive Aquatic System Model (CASM) for application to Lake Texoma are proceeding. Dr. Steven Bartell has provided USACE with preliminary outputs of future with- and future without-project conditions. When Dr. Bartell will be present the CASM-Lake Texoma results to the natural resource agencies once the calibration of the model is complete.

32. *We object to the position that direct interviews of anglers on Lake Texoma are unviable because of its size and frequency of boat ramps, etc. ODWC and TPWD biologists conducted angler interviews through a process called roving creel survey on Lake Texoma starting in 1987 to assess angling pressure, catch rate, harvest, and costs incurred by anglers (Hysmith 1989). The survey was continued annually until 1999. Certainly this approach required more effort than the telephone survey reported in Final Phase 1, but the data represented a more comprehensive spectrum on the angling public. And because it came from direct interviews onsite, was much more accurate. If we use a flawed instrument to measure the economic impacts of changes in water chemistry and/or flow rate on recreational angling, our assumptions will be flawed; hence, meaningless.*

Response: The term "viable" was used in reference to survey timing (seasonality of major fishing activities), study timing (funding was not available in time for the 2008 summer season), ability to obtain a representative sample, and budgetary concerns. Onsite surveys are a nonprobability sampling method, which means that not all anglers have a probability of selection - only those fishing on the lake (or boat launch area) on the days and times that the surveys are conducted have a (nonzero) chance of selection. And even for them, that chance of selection is not known. With a nonprobability sample, you cannot generalize from the sample to the population—you can only describe the sample—the group of people who were there, at the time and place you collected data, agreed to talk with you, and completed the survey. Telephone surveys were seen as the best method to obtain a representative sample of the user population.

33. *The shortcomings of the telephone interview of Lake Texoma users delineated by the other natural resource agencies, would be overcome by an onsite roving creel survey whereby anglers are directly confronted, their catch identified, counted, and measured. The only subjective data would involve the anglers start and stop time and catch and release information. Paramount here is contact with bank as well as boat anglers and contact with all the anglers who use Lake Texoma and not just a minority isolated from a specific license sales. Forgive me, but the statement regarding not as much uniform negativity about the RRCCP as originally thought being based on the interview of two persons really stretches USACE integrity.*

Response: The purpose of a creel survey is much different than the purpose of the economic analysis that is being conducted. It is agreed that an onsite interviews are possible, but we have discussed the difficulties with using onsite interviews for this study. Telephone interviews were seen as the best method to obtain a representative sample of the user population. The statement regarding public opinion towards the RRCCP not being as negative as originally thought was a general observation based on our discussions with people during the site visit. These discussions were not limited to the two people referenced. This observation was presented in the report to note that a general public opinion survey may be beneficial to determine the public's attitude towards the RRCCP. Our survey was not intended, nor designed, to capture the public's attitude toward a particular project. This observation had no impact on our study and should not be given more weight than was intended.

34. *Minimal is not a measurement. It should be incumbent on the person(s) preparing this report to report in measured amounts the potential impacts of the RRCCP to fisheries, angling, and other water recreation in Lake Texoma.*

Response: At the time that the Phase I report was prepared, the exact values for the impacts were not known. The Phase II report will quantify, where possible, the potential impacts associated with the RRCCP.

35. *During the onsite visit by USACE and associates, no contact was made to ODWC, USFWS, or TPWD, why not? TPWD has an office right on the lake and ODWC is located*

close to the lake. Has the telephone survey begun and if so, why the last minute rush to include comments from natural resource agencies?

- Response. The purpose of the site visit was to provide initial information on the geographical and visitation patterns at the reservoir. The Corps project office staff provided sufficient information for the purposes of the site visit. Follow up telephone calls were made to Texas Parks and Wildlife and Oklahoma Department of Wildlife Conservation. Telephone survey work began in the early fall 2007. Resource agencies requested to review the study design, after the survey became an issue of focus. A internal study design document was provided. Agencies requested a meeting to discuss the study design.

April 23, 2009

Red River Chloride Control Project (RRCCP) Area VI Recreation Study, Phase I, Evaluation of economic value of the Lake Texoma striped bass fishery

Additional U.S. Fish and Wildlife Service (USFWS) Comments on the Phase I Report
Area VI Red River Chloride Control Project (RRCCP) – Lake Texoma Recreational Fishery Study

General Comments on the Corps Response to the Resource Agency Comments

While we appreciate the Corps responding to our comments, some of the responses did not actually address the intent of our comments and it does not appear that the Corps intends to make any changes in the Phase I study. For some issues we are providing additional comments and have included comments from one of our USFWS economists. We recognize that the agency staff involved in the January 8, 2009, meeting were not economics experts and we are consulting with economists to improve our comments related to study methods and design. However, some of the issues are related to the quality or uniqueness of the regional fisheries and it would be difficult for the Corps to find more qualified input than that provided by the TPWD, ODWC, and USFWS. We realize that changing or adding to the study at this point is a significant workload and expense, but we have seen no evidence that our agencies were given any earlier opportunity to comment (other than the State agencies were asked to provide license data).

The USFWS does not support limiting the study to striped bass. We agree that the Lake Texoma striped bass fishery is the "most unique to the area", but we do not agree that there "are a number of economic substitutes for other species". There are limited substitutes for some of the species, but those opportunities are already being utilized by other anglers. Some of the substitute fisheries are on relatively small reservoirs and these facilities and the recreational values of the users would be negatively impacted by transferring even a portion of the use from Lake Texoma. The Phase I Report describes Lake Texoma as a site that is a unique resource (see page i) in the region and can be characterized as a site with no or

inferior substitutes (see page 9). Lake Texoma supports a world class fishery for trophy catfish and has produced several Oklahoma State record smallmouth bass. It supports good quality largemouth bass and crappie fisheries as well. It is the combination of so many good fisheries in one large reservoir that make it unique and a great recreational value. No other reservoir in Oklahoma or Texas has Lake Texoma's combination of fisheries quality and diversity.

The Corps response on the issue of question 20 is understandable, but it misses the point of the resource agency comments (also see comment 1 below from our economist). We object to the suggestion that a hatchery could mitigate for project impacts and maintain catch rates at current levels, because it is not possible. It's not feasible to produce that many hatchery fish and it would be pointless to stock fish that would die anyway (due to project-related reductions in productivity and the number of fish the lake can support). Anglers would never have the option of paying more to mitigate for project impacts and maintain existing catch rates. Their only option would be to accept the project-related degradation of the resources. It is very misleading to have questions that suggest otherwise. The anglers may put a higher value on a fishery that could not be replaced and the survey should be structured to measure this value.

Comments from Peter Grigelis (USFWS Division of Economics)

1. *The study proposes to estimate the value associated with maintaining Lake Texoma fishing quality (described as maintaining fish catch rates at current levels) via stated preference methods asking survey respondents their willingness-to-pay (WTP) for a fish hatchery and stocking program. Asking people their WTP for a program to maintain current fishing conditions on Lake Texoma after implementing the RRCCP (which would degrade conditions) is not the theoretically correct measure of economic value that should be elicited from survey respondents. The correct measure of economic value is willingness-to-accept (WTA) the degradation caused by the RRCCP. Because the study is asking respondents to maintain current conditions, this implies the status quo is the baseline or reference point from which initial utility is defined. The new level of utility associated with the change in quality can be defined as conditions when the RRCCP is implemented (which would degrade conditions). Therefore, it would be necessary to ask survey respondents what their WTA would be for them to be indifferent between current conditions and accepting the loss. Alternatively, it can be described as asking survey respondents their WTA to forego a return back to the status quo conditions after implementation of the RRCCP. Further explanation of WTA as the correct measure is given in Champ, Boyle, and Brown (2003) and Knetsch (2007).*

Response:

With respect to environmental degradation involving an imposed (or rationed) quantity change, there are two theoretical welfare change measures; equivalent surplus (ES) and compensating surplus (CS). ES can be interpreted as willingness-to-pay (WTP^{es}) to prevent the degradation thereby maintaining the status quo environment and services provided by that environment (e.g., current fish catch rate). CS can be interpreted as willingness-to-accept compensation (WTA^{cs}) for the

degraded environment and services provided (e.g., lower fish catch rate). From a theoretical perspective, the choice of which measure to use depends on the explicit or implicit assignment of property rights. In the case of our study, if anglers have rights to initial (current) fish catch rates, then WTA^{cs} would be the theoretically appropriate welfare change measure as the reviewer suggests. However, if anglers only have rights to subsequent (degraded) fish catch rates, then WTP^{es} is the theoretically appropriate welfare change measure. In our study, property rights to fish catch rates are unclear. Thus, the theoretically appropriate welfare change measure is also unclear (e.g., it could be WTP^{es} or WTA^{cs}). A number of stated preference studies over the years have shown that WTA measures tend to exceed WTP measures for the same change – moreover, the observed disparity between WTA and WTP measures appears to exceed what would be expected because of theoretical reasons (e.g., income effects). Because of the difficulty in obtaining valid empirical measures of WTA, the stated preference literature and the "Blue Ribbon" NOAA Panel Report on Contingent Valuation recommend that WTP be measured instead of WTA as a conservative approach (e.g., WTP can be interpreted as a lower-bound estimate of WTA). Thus, following the NOAA Panel recommendations and the bulk of previous stated preference studies, we chose to measure WTP^{es}.

For more detail and literature citations, see Chapters 3 and 6 in Freeman, A. Myrick III. The Measurement of Environmental and Resourced Values: Second Edition Washington, D.C., Resources for the Future, 2003; and Arrow, et al. Report of the NOAA Panel on Contingent Valuation, 1993 (available at: http://www.darrp.noaa.gov/library/pdf/cvblue.pdf)

2. *Comment #1 explains WTA is the theoretically correct measure of value in evaluating the impact of the RRCCP on recreational fishing on Lake Texoma. The Final Phase I Report describes Lake Texoma as a site that is a unique resource (see page i) in the region and can be characterized as a site with no or inferior substitutes (see page 9).*[7] *Both theoretical and empirical research has demonstrated that WTA is greater than WTP when valuing goods (public and private) with few or no substitutes (see Hanemann, 1991; Brown and Gregory, 1999; Horowitz and McConnell, 2002). Therefore, using WTP instead of WTA will lead to biased estimates and result in an underestimate of the loss in economic value associated with the RRCCP.*

Response:

Referring to response #1 above, because property rights to fish catch are not clearly delineated (e.g., anglers do not have a unambiguous and enforceable right to current fish catch rates), the theoretically appropriate welfare change measure could be WTP^{es} or WTA^{cs}. From theoretical and empirical perspectives, it is also not clear by how much an empirical measure of WTA^{cs} would exceed an empirical measure of WTP^{es}. It is true that uniqueness and lack of substitutes would contribute to a greater disparity – however, relatively low income effects could offset these effects and lead

[7] The Final Phase I Report provides a brief example of the relation between substitute sites and value stating Lake Texoma falls under the category of a site with "no substitutes or significantly inferior substitutes".

to a smaller disparity (Chapter 3 in Freeman, 2003; Randall, Alan and John R. Stoll. "Consumer's Surplus in Commodity Space", American Economic Review 70, 3 (1980):449-455). We agree that WTP^{es} is a conservation estimate of WTA^{cs} – but again, we do not necessarily agree that WTA^{cs} is the theoretically correct welfare change measure in our study, or that the disparity between empirical measures of WTP^{es} and WTA^{cs} would turn out to be large. It would take another empirical study to explore and verify the magnitude of the empirical disparity between WTP^{es} and WTA^{cs} assuming that a valid measure of WTA^{cs} could be obtained, which we doubt based on previous stated preference studies and the NOAA Panel recommendations.

3. *The rationale for only sampling license holders that purchased a license in Texas is not supported. The report describes sales of licenses by the Texas Parks and Wildlife Department (TPWD) for Lake Texoma fishing licenses as 87.13 percent of license holders are from Texas, 3.94 percent from Oklahoma, and 8.94 percent from all other States (see page 20, Final Phase I Report). Although the study proposes to implement a stratified random sample by placing a heavier weight on non-Texas resident license holders, this assumes that the Oklahoma residents that purchased a license in Texas are representative of the Oklahoma residents in general that purchased a license in Oklahoma. It is likely that the Oklahoma residents that purchased a license in Texas live close to the Texas border. However, given that approximately two-thirds of Lake Texoma is located in Oklahoma, only using the sample of license sales from the TPWD will not account for those Oklahoma residents that travel from locations further away that represent different demographic characteristics. Therefore, not utilizing license sales from the Oklahoma Department of Wildlife Conservation (ODWC) will lead to biased results.*

Response:

Data from ODWC was not made available for the study. Before the data is analyzed, it cannot be known if there are biased results. Efforts will be made during the analysis to mitigate bias as a result of not having the ODWC data to include in the survey sample.

4. *The rationale provided for not sampling general State recreational fishing license holders in addition to Lake Texoma only license holders is not supported. The report indicates that people that purchase a Lake Texoma license are more avid fisherman that those that have purchased a general fishing and fish on Lake Texoma stating general fishing license holders are simply fishing to "pass the time, for the simple enjoyment of fishing, and to spend quality time with friends and family" (page 18, Final Phase I Report). However, according to the data only 12.35 percent of the sales are for repeat sales (i.e., same license holder purchased license in 2006 and 2007). This low number of repeat Lake Texoma sales suggests that a significant number of Lake Texoma recreational fishermen may be general fishing license holders. Furthermore, the higher purchase price for general fishing licenses suggests that these recreational fishermen may be more avid fisherman and not simply fishing Lake Texoma to "pass the time" given the option to purchase a lower priced Lake Texoma license instead. As such, not*

sampling from general fishing license records for both Texas and Oklahoma would likely result in biased estimates.

Response:

Based on conversations during the site visit (conversations were had with people ranging from the USACE Lake Managers, the Chamber of Commerce, camp site managers, fishing guides, and people launching their own boats), it is our understanding that a majority of the people fishing on Lake Texoma purchase a Lake Texoma fishing license to avoid being limited to certain parts of the lake. Several attempts have been made to track down the number of people who actually fish on the lake and what type of license (State v lake) they have. No agency on either side of the lake appears to have this information and indicated it would great if they had it. Also the 12.35 percent is not of the total licenses sold, just what remained from the cleaned database and assuming no one who bought a license both in 2006 and 2007 moved or changed their phone number. This percentage is being interpreted to mean more than it does. Wording in future phases will be examined more closely to help avoid this confusion from happening again.

5. *Q14 of the survey asks respondents how many trips they took to Lake Texoma in the last twelve months. The respondent may have difficulty recalling the number of trips taken over this time period.*

Response:

A recall bias is a concern with all surveys. Therefore, the recall period was limited to a year, which is typical of recreational surveys. Asking respondents to state the number of trips for any other time period may introduce seasonality effects that may misrepresent the annual number of trips (e.g., a person may not fish for six months during the winter). Keeping the recall to one year is also consistent with the payment schedule, which asks respondents to state their WTP per year.

6. *How does the study account for overnight/multi-day trips from visitors?*

Response:

Even though we asked questions to separate out the overnight trips from day trips, they were not analyzed separately in the final econometric analysis. Since the payment is an annual fee, only paid once per year, there is no increased cost to the angler if they fish 5 consecutive days or once a month for 5 months. We did ask how mush time they spent fishing per recreational trip to help capture this data, just because someone takes a 5 day trip to Lake Texoma does not mean they fish each of those days.

7. *Q18 asks respondents to indicate how many fewer trips they would take if fish catch rate on Lake Texoma is expected to decrease by some percentage over the next several years. The time period for the respondent to consider these quality changes and the reduction in trips is not clearly defined. This question is not consistent with the time period of reference in Q14 which asks about trips in the past twelve months. Therefore, how*

reductions in trips that occur over several years allocated on an annual basis. Furthermore, by mixing manmade and natural causes as the reasons for catch rate reductions, the respondent is not able to accurately evaluate the policy being considered (i.e., the RRCCP). This will result in biased results.

Response:

The question first reminds respondents how many annual trips they reported taking to Lake Texoma. Thus, even though the catch rates changes are said to occur over the course of several years, the context and intent of the question is to measure changes in annual trips in response to catch rate changes. This appeared clear to respondents during the telephone interviews. In addition, respondents in the telephone interviews did not express confusion or concern with respect to mixing of manmade and natural causes and "scenario rejection" problems were not detected.

8. *Q20 does not indicate how the project would be funded (e.g., annual tax or increase in license price). Specifying a payment vehicle for the fish hatchery project would make the respondent consider a more realistic and understandable policy option.*

Response:

A specific payment vehicle was in fact used in the survey question. Respondents were asked to purchase a striped bass stamp for the various amounts. Since we were tasked only with valuating the striped bass, the stamp was seen as the best option. Note, as a reminder, the final copy of the survey was sent to stakeholders separate from the Phase I Report. The survey in the Phase I Report is NOT the final survey and this has been noted on other occasions.

9. *Conducting survey pre-tests on ten URS staff is not likely to ensure the survey instrument is understandable to those that will actually be taking the survey. Additional effort should be put towards doing pre-tests or focus groups on local users so that the survey respondent will be more likely to provide responses to questions that appropriately define policy scenarios, response options, payment amounts, etc.*

Response:

The purpose of the quasi-pretest was more to ensure the questions were clear enough in general before submitting the survey for approval by the Office of Management and Budget (OMB). OMB approval must be obtained prior to conducting a true pretest, without approval, only less than 10 surveys can be conducted which is insufficiently small for this survey. A pre-test of the survey questionnaire was completed at the beginning of the interview process. The pre-test was conducted on 30 randomly selected respondents from the sample population and the interviews were conducted by experienced interviewers. The interviewers reported that respondents did not have difficulties with the questionnaire during the pre-test. Therefore, no questions were revised on the questionnaire. Since the actual pretest was conducted during Phase II, a description of the pretest is included in the Phase II report.

APPENDIX C
SURVEY

Appendix C: Survey

Lake Texoma, Oklahoma and Texas

RECREATION VALUE QUESTIONNAIRE

US Army Corps of Engineers, Tulsa District

(Personal Telephone Interview)

OMB 0710-0001

Expires: 30 September 2009
June 2008

To be read to respondent:

The public report burden for this information collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this data collection, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503, Attn.: Desk Officer for U.S. Army Corps of Engineers. Respondents should be aware that notwithstanding any other provision of law, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid Office of Management and Budget control number. That number for this questionnaire is.

Appendix C: Survey

Initial Interviewer:_____ **Sample Number**:_____

Read: Hello, my name is _____ and I am conducting a survey for research on recreational fishing on Lake Texoma. May I speak with _____?

We are collecting information to investigate the change in economic and social benefits of recreational fishing associated with Lake Texoma as part of the Red River Chloride Control Project for the United States Army Corps of Engineers. The Corps of Engineers will use this survey to obtain information to aid in formulating the most economically, socially, and environmentally acceptable plan in accordance with the Water Resources Council Principles and Guidelines. Individual responses will be collected and tabulated by type of response, but information specific to an individual will not be published or released. Individual responses will be retained in our files as backup data and retired to the Record Center after 10 years. Only the tabulated totals of the type of responses will be published in a project report, which will be circulated to the public and other Federal and State water and land management agencies.

I want to assure you that all the information you give me will be kept strictly confidential. This interview is voluntary. If you don't want to answer any particular question, just tell me. Also, my supervisor may listen to part of the interview for quality control. First, **I am required to read you the following:**…. *From front page.*

We have a few questions that will take less than 15 minutes. Your responses would be appreciated and will greatly aid in our planning effort. Is now a good time to ask you those questions?

Date of Initial Call:_____ Time:_____ Interviewer:_____

(check one of the below)

[__] 1 CORRECT PERSON - NOW IS GOOD TIME

[__] 2 CORRECT PERSON – CALL BACK
Date:_____ Time_____ Number:_____

[__] 3 NO - WON'T LET YOU TALK TO CORRECT PERSON

[__] 4 CORRECT PERSON NOT AVAILABLE - SCHEDULE CALLBACK
Date:_____ Time_____ Number:_____

[__] 5 CORRECT PERSON REFUSES TO PARTICIPATE

Interviewer:_____ **Time Start:_____**

Date of Interview:_____

Appendix C: Survey

Q1: How would you rate, on a scale of 0 to 5—with 0 implying very little to no knowledge, and 5 meaning full knowledge—your knowledge of the recreational opportunities on Lake Texoma? (Please circle only one number)

0 1 2 3 4 5

Q2: How would you rate, on a scale of 0 to 5—with 0 again implying very little to no knowledge, and 5 meaning full knowledge—your knowledge of the Red River Chloride Control Project? (Please circle only one number)

0 1 2 3 4 5

Q3: How would you rate, on a scale of 0 to 5—with 0 implying very little to no quality, and 5 meaning full quality—the fishing quality of Lake Texoma? (Please circle only one number)

0 1 2 3 4 5

Q4: What is the typical primary purpose of your trips to Lake Texoma?

- □ Camping
- □ Fishing
- □ Boating
- □ Swimming
- □ Water skiing
- □ Other (please specify)_____

Q5: On average, how much time, in hours, do you spend per recreational trip on Lake Texoma? **[Interviewer: for overnight visits this is the number of hours for the whole trip, you can record the arrival and departure days and times for accurate calculation to avoid adding additional burden to the respondent]**

# of Hours per Trip: _____

Q6: Of these hours, how much time, in hours, do you spend fishing per recreational trip on Lake Texoma? **[Interviewer: if overnight visit this is the sum of hours each day spent fishing on the lake]**

# of Hours Fishing per Trip: _____

Q7: What is the typical number of people in your group when you recreate on Lake Texoma?

Group Size: _____

Q8: What are the top three fish species you seek while fishing on Lake Texoma, please list in order of preference **[Interviewer: they may target less than three species]**?

Top Fish Species: _____
2nd Fish Species: _____
3rd Fish Species: _____

Q9: How much effort (i.e., percentage of trip time) do you put towards catching striped bass?
% Effort for Striped Bass: _____

Q10: How many striped bass do you catch, excluding the catch of the rest of your group, during a typical trip on Lake Texoma? **[Interviewer: this is on a day basis, if a multiple day trip, record their daily average]**

# of Striped Bass Caught: _____

Q11: Have you used a guide service when fishing for striped bass on Lake Texoma?
□ Yes
□ No (Skip to Q15)

Q12: On average, how many times per year do you use a guide service to catch striped bass?
# of Times Per Year: _____

Q13: On average, how much per trip, per person, do you spend on guide services to catch striped bass?
$ Spent Per Year: _____

Q14: On average, how many people are typically in your party when you use a guide service?

Guide Service Group Size: _____

Q15: How many total recreational trips, regardless of purpose, have you taken to Lake Texoma in the past 12 months?

# of Trips: _____

Q15b Of the total # of trips you took to Lake Texoma during the past 12 months (answer to Q14 above), how many were for the primary purpose of striped bass fishing?

# of trips

Q16: How much time does it take you to travel one-way from your home to a location along Lake Texoma where you begin a typical recreational trip?

# of Minutes: _____

Q17: How many miles do you travel one-way from your home to a location along Lake Texoma where you begin a typical recreational trip?

# of Miles: _____

Q18: Could you please list the amount of money you spend in each of the following categories during a typical trip to Lake Texoma (whole numbers please):

Lodging: _____
Food and Beverages: _____
Transportation (parking, tolls, gas, etc): _____
Activities/Entertainment: _____
Supplies/Equipment: _____
Miscellaneous Expenses: _____

Note to Interviewer: Please read the following:

I would now like to ask you a couple of hypothetical, or "if-then," questions regarding potential changes to the Lake Texoma fishery. Basically, these questions will present you with a proposed change, and then ask you if you would change your visitation habits concerning Lake Texoma. Again, your participation is voluntary, and there are no right or wrong answers.

Q19: You said that you make **(repeat answer from Q14)** _____ trips per year to Lake Texoma. Due to natural and manmade causes, the striped bass catch rate on Lake Texoma is expected to decrease by **[random percentage ranging from 5 percent to 30 percent, even distribution of values across sample]** over the course of the next several years. This means it may take a longer period of time to catch the same number of striped bass. If this occurred, would you take fewer trips to Lake Texoma? Please choose one of the following options.

□ I would not take any fewer trips **(Skip to Q20)**
□ I would take one less trip **(Skip to Q21)**
□ I would take two fewer trips **(Skip to Q21)**
□ I would take at least three fewer trips **(Proceed to Q19b)**

Q19b About how many trips would you take to Lake Texoma if the fish catch rate is expected to decrease by ____? (write "0" if answer is "zero")

Q20: Please choose one reason from the following list that best describes your decision not to take fewer trips if the striped bass catch rate dropped by **[random percentage ranging from 5 percent to 30 percent, even distribution of values across sample]** on Lake Texoma:

- □ I am going fishing for the enjoyment of spending time on the water by myself or with friends and family
- □ The number of fish I catch per trip is of little concern to me
- □ I will enjoy the extra challenge and patience required to catch the fish
- □ I catch all of the fish that I want, even with a reduction
- □ Other (please describe) _____

Q21: Now, suppose you had the option to purchase an annual special striped bass stamp that would help pay for a Lake Texoma fish hatchery project. Through stocking, this project would maintain Lake Texoma's striped bass catch rates at the current level. I am going to provide you a series of dollar amounts that represent a possible annual costs to you of the special striped bass stamp to cover the cost of the hatchery project. For each amount, please respond with "yes" (willing to pay the amount annually), "not sure" (may or may not be willing to pay the amount annually), or "no" (will not pay the amount annually):

Cost to you per year	Yes	Not Sure	No
$ 0.01	□	□	□
$ 1.00	□	□	□
$ 5.00	□	□	□
$ 10.00	□	□	□
$ 25.00	□	□	□
$ 50.00	□	□	□
$ 75.00	□	□	□
$ 100.00	□	□	□
$ 250.00	□	□	□
$ 500.00	□	□	□

[If all responses NO continue, if WTP>0 SKIP to Q23]

Q22: We have found in studies of this nature that people have a lot of different reasons for answering as they do. Which of the following statements best describes your reasons for answering zero to the previous question?

- □ That is what maintaining the current catch rates is worth to me
- □ All I can afford at this time
- □ Pay enough in taxes
- □ Do not want to place a dollar value on fishing experience
- □ Not enough information
- □ Object to the way the question is asked
- □ Other (please describe)_____

Q23: Since Lake Texoma was closed to recreational use for several weeks during this past summer (2007), you were not able to fish on the lake. During the time of the closure, did you fish in other locations?

□ Yes
□ No **(Skip Q24)**

Q24: Where did you choose to fish instead of Lake Texoma?

List of alternate fishing locations:_____

Note to interviewer: Please read the following before asking the questions:
"As a conclusion to this survey, I would like to ask a couple of questions about you. Remember that all of your answers are completely confidential."

Q25: What is your zip code: _____

Q26: What year were you born? _____

Q27: How many people presently live in your household?

Household Size: _____

Q28: Are you presently employed, retired, student, or unemployed?

□ Employed (including self-employed)

□ Retired
□ Student
□ Unemployed

Q29: Are you currently a member of an outdoor sportsmen's organization or club?

□ Yes
□ Name of organization/group: _____
□ No

Q30: Are you currently a member of a natural resource conservation organization, such as the Nature Conservancy or Ducks Unlimited?

□ Yes
□ Name of organization: _____
□ No

Appendix C: Survey

Q31: Please select the highest level of education you have completed:

- □ Grade School
- □ Some high school
- □ High school graduate
- □ Some college or technical school
- □ College graduate
- □ Graduate or advanced degree

Q32: Please approximate your annual household income before taxes, in 2008: (Please note that this survey is anonymous. This information will ensure that all income groups are represented.)

- □ Under $20,000
- □ $20,000 to $39,999
- □ $40,000 to $59,999
- □ $60,000 to $79,999
- □ $80,000 to $99,999
- □ $100,000 to $119,999
- □ $120,000 to $139,999
- □ over $140,000

Q33: What is your gender?

- □ Female
- □ Male

Q34: Do you wish to make any additional comments about fishing on Lake Texoma?

Appendix C: Survey

Note to interviewer: read the following:

"Thank you for participating in this survey. The information you have provided will be used by the U. S. Army Corps of Engineers in evaluating the project."

Information to be recorded by the interviewer: The Respondent was:

Q35: Cooperative _____ Yes _____ No

Q36: Appeared to understand the questions _____ Yes _____ No

Q37: Appeared to be intoxicated/impaired in some way _____Yes _____No

Time of Completion:_____

APPENDIX D
RESPONSE TO COMMENTS

APPENDIX D: RESPONSE TO SWT COMMENTS

AREA VI RED RIVER CHLORIDE CONTROL
RECREATION STUDY USACE COMMENTS
TULSA DISTRICT SEPTEMBER 2009

1. WTP (page 22): The lowering of median income of the sample to accommodate Oklahoma's lower average income may need to show how $16 WTP was derived. It may be as simple as 12.7% of $17. Were some of the respondents from Oklahoma? Page 6 says 18 respondents are from Oklahoma. How does this affect the $16 WTP? How does the WTP for those income changes outside Texas and Oklahoma?

URS Response: More detail and an additional table are provided in the final report. Only the income mean value was changed to get the different WTP for Oklahoma. The WTP value was not directly lowered by 12.7%; the other variables in the model were held constant. Although some of the respondents were from Oklahoma, they were Oklahoma residents who purchased their licenses in Texas . Since they purchased their license in Texas, they are counted in the Texas portion of the user population. State of residence does not dictate which part of the user population the angler falls in; where they purchase their license does.

And even though our respondent median income is high, it is not unusual for anglers to have higher incomes than the median income of the study area ("Demographics, Participation, Attitudes, and Management Preferences of Texas Anglers" by D. Anderson & R. Ditton, Department of Wildlife and Fisheries Sciences, Jan 2004; "Trout Angler Utilization, Attitudes, Opinions, and Economic Impact at the Canyon Reservoir Tailrace" by T. Bradle, S. Magnelia, & J. Taylor, Texas Parks and Wildlife Department, Final Report, March 2006; "2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, U.S. Fish and Wildlife Service, May 2008).

2. Can we get a copy of the raw data for our records?

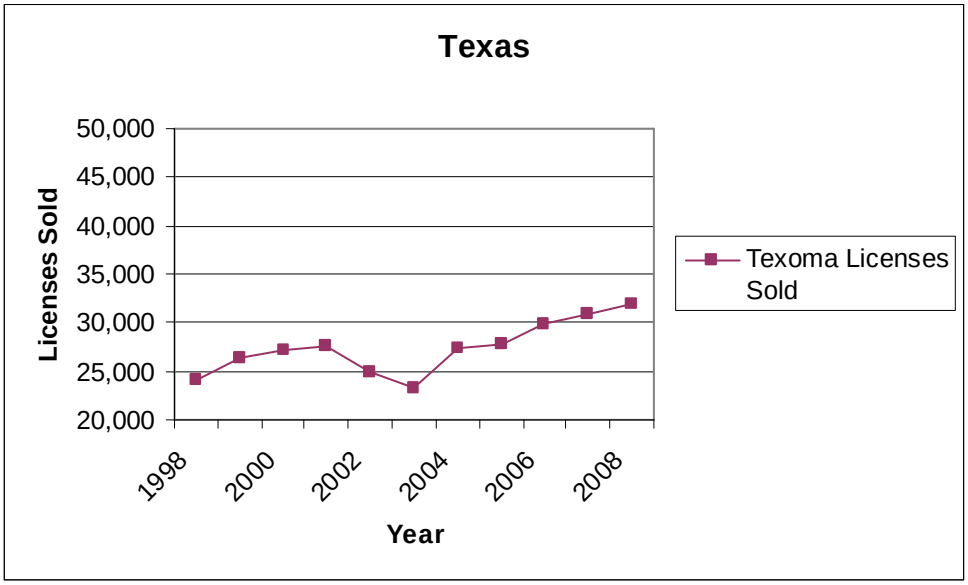
URS Response: Yes, the access database will be provided for both survey forms.

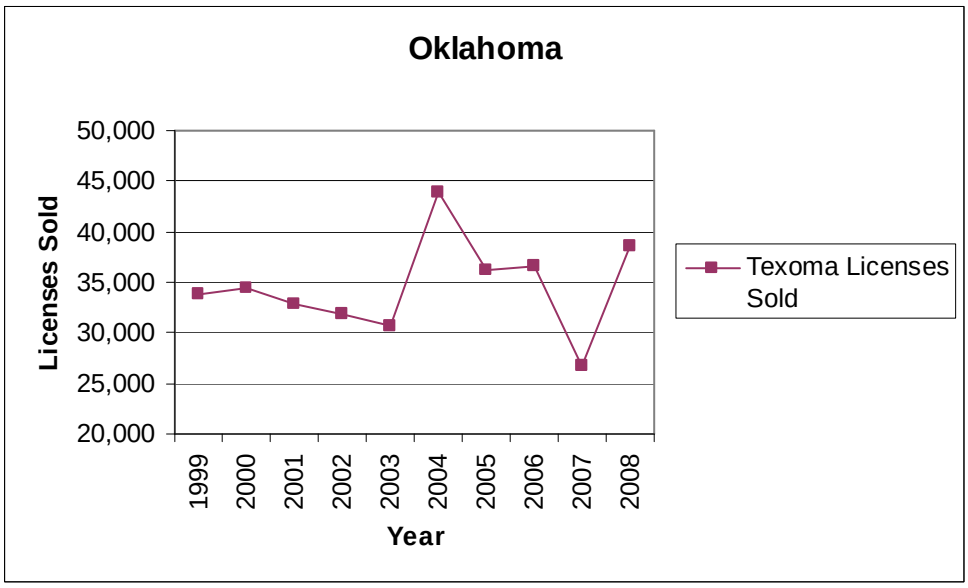
3. RED (page 24): In the responses, is there a verification of which county the expenses occurred? If possible, we could associate the expenses loss with county business patterns to see the possible effect on employment (Using a multiplier). One assumption could be to associate the expense with where the Texoma-specific licenses were sold.

URS Response: Optinet Resources went back to the original files from Texas, and that column of information was not provided in the dataset. Texas likely has that information, but since it was not provided originally, the additional information will likely not be provided. However, we are always willing to try.

4. User population: User population was estimated on an average of the past 10 years. The user population has continually gone up and an estimated to capture that progression may be appropriate.

URS Response: The user population has not continuously increased over the past 10 years on either side of the lake. Texas had a dip in the early 2000s and Oklahoma has been erratic (see graphs below). Therefore, we do not feel trend-line estimation is appropriate, and that the 10-year average approach should still be applied.





5. (Bottom of page 6): Especially those outside Texans and Oklahoma did not complete the survey. Does that mean that 150 people contacted did not feel they could value because they visited the lake only once. And where those people mostly outside

Texas and Oklahoma? Those that only visited once are still in RED expenditures. How will this affect the estimate?

URS Response: The 150 people were from outside Texas and Oklahoma and they were not asked the RED questions. The shortened survey was more of a customer satisfaction survey than a WTP survey. None of the responses from these surveys were included in any of the results presented in the report.

6. Response rate is 4 percent. Is this a normal response rate for this type of survey? Is there a benchmark for a response rate?

URS Response: This response rate is very low. We found it extremely difficult to secure respondent cooperation, despite instituting a number of different policies to increase response. We cannot know with certainty how many respondents avoided the survey by using voice mail, answering machines, and/or caller identification technology, as opposed to refusing the survey. Refusing the survey means they took the call and either declined the survey or terminated part way through the questions. These problems in telephone surveys are being experienced by other researchers, as well—as reported and discussed widely in the literature, response rates have plummeted in recent years. There is no standard, universally accepted "benchmark" for a response rate.

7. We assumed an alpha of 0.05 is that correct?

URS Response: Yes, that is correct.

8. WTP of respondents outside of Texas are grouped together. Did you try to group Oklahoma respondents separate from the other States or were Oklahoma and other State respondents grouped at the beginning? By grouping other States and Oklahoma together, does that affect the WTP for the Oklahoma number?

URS Response: The WTP estimates are based on State of purchase, not State of residence. The Oklahoma WTP estimate applies to only the user population who purchase their license in Oklahoma, and the Texas WTP estimate applies only to the user population who purchases their license in Texas. Their individual State of residence does not dictate which WTP value is applied to them.

9. In the executive summary section on page i, the calculated WTP values for the "with a most likely value of $1,655,000" Might add another sentence stating how $1,655,000 was derived. Without reading section 3.4.2, the WTP in the executive summary was read as (101,000 x $17 = $1,717,000).

URS Response: Clarification of the calculations has been added to the executive summary.

10. On the figures that refer to the survey questions, can we get the number of responses in parentheses for each category. Such as figure 2.3.

URS Response: The number of responses has been added to all of the pie chart figures in the report. No changes were made to the bar graphs because it made the graph harder to read, especially in the case of Figure 2-5. The number of responses can be easily and closely estimated with the information provided on the y-axis.

11. It states that the sample included 988 usable contacts for Oklahoma and other States and 8,140 usable contacts within Texas. Were all these contacts contacted five times if they hadn't completed the survey in previous attempts? Also, is there a way to determine how many license holders did not attempt the survey (could not be reached/refused)? And is there a way to determine the total number of surveys that were started but not completed?

URS Response: We did contact all usable numbers 5 times. We do not have compiled data that allow us to tally the number of terminations separately. There is not a way to break out the number who could not be reached/refused.