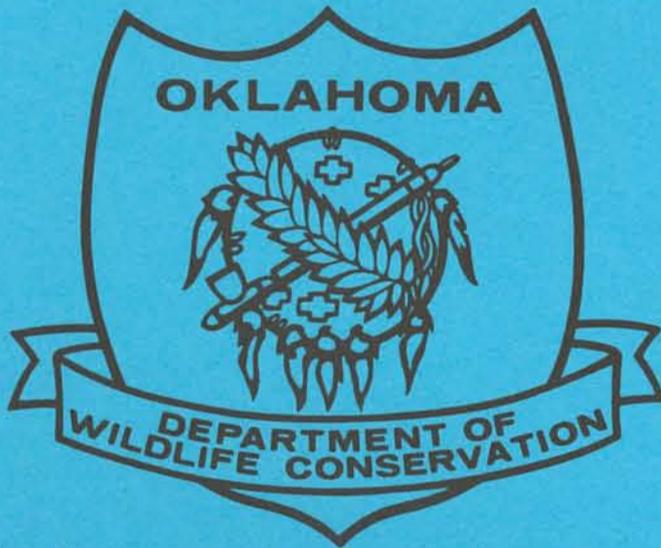


**FINAL REPORT**

**RESEARCH AND SURVEYS**



**FEDERAL AID PROJECT NO. F-49-R**

**LAKE TEXOMA STRIPED BASS FISHERY:  
ECONOMIC IMPACT AND CASTNET EVALUATION**

**JOB NO. 2**

**ECONOMIC IMPACT ASSESSMENT OF THE LAKE TEXOMA FISHERY**

**AUGUST 1, 1989 TO AUGUST 31, 1991**

FINAL REPORT

STATE: Oklahoma PROJECT NUMBER: F-49-R

PROJECT TITLE: Lake Texoma Striped Bass Fishery:  
Economic Impact and Castnet Evaluation

JOB TITLE: Economic impact assessment of the Lake Texoma fishery

PERIOD COVERED: August 1, 1989 to August 31, 1991

OBJECTIVE NUMBER: 2 JOB NUMBER: 2

ABSTRACT

Economic impact analysis of the Lake Texoma fishery was conducted in 1990, with special reference to the striped bass fishery. Mail and telephone (follow-up) surveys were employed to acquire data on angler trip expenditures. Estimates of total angler expenditures are based on total angler hours estimated from a 1990 roving creel survey. The IMPLAN (IMPact Analysis for PLANning) modelling system was used to evaluate the impact of fishing expenditures on the regional economy.

Our results suggest that fishing activity on Lake Texoma in 1990 contributed about \$25,641,000 of expenditures to the local economy (seven counties bordering the reservoir). An estimated \$22,779,000 were spent by striped bass anglers and \$2,800,000 were spent by non-striped bass anglers. Angler expenditures created \$33,917,000 to \$57,392,000 of output (value of business transactions), \$16,025,000 to \$20,896,000 of income (employee compensation, proprietary income, and other property taxes), \$17,842,000 to \$23,273,000 of value added (adds indirect business

taxes to income), and 535 to 718 jobs within the impact region. Striped bass fishing expenditures accounted for about 89 percent of regional output, income, value added, and employment impacts, whereas all other fishing expenditures accounted for the remaining 11 percent of impacts. Non-regional striped bass angler expenditures for striped bass fishing accounted for 77 - 79 percent of regional impacts on income, value added, and employment associated with all Lake Texoma fishing activity.

Our results indicate clearly that striped bass fishing by non-regional anglers on Lake Texoma in 1990 had the greatest impact on the local economy. Therefore, economic activity in the local region could be augmented by increased fishing activity. Without the striped bass fishery of Lake Texoma, non-regional anglers may go elsewhere to fish and local economies could suffer substantial losses.

#### I. PROGRAM NARRATIVE OBJECTIVE:

To conduct an economic impact analysis on the striped bass fishery of Lake Texoma during 1989 - 1991.

#### II. REPORT CONTENT:

This report is a summary of methods and findings from an economic impact study of the Lake Texoma fishery, with special reference to the striped bass fishery. Samples of the survey questionnaires used in this study are presented in Appendices I - III. Ancillary data on the socioeconomic characteristics of Lake

Texoma anglers, records of local business activities, and estimates of Oklahoma fishing-trip expenditures (SFI 1988) are presented in Appendices IV - XIII. The more detailed report for this economic impact study is provided in Addendum I.

### III. INTRODUCTION:

Utilization of aquatic resources often has considerable economic effects on local regions. Reservoir fisheries, for example, provide fishing opportunities which generate substantial expenditures. Angler expenditures thus provide an influx of dollars into local economies and stimulate economic growth. In 1980, reservoirs accounted for 272 million days of fishing and \$5,400,000,000 - 41 percent of all fishing expenditures in the United States (Fisher et al. 1986; USFWS 1986). Furthermore, the average number of reservoir fishing days per year (per angler) in 1980 was higher in Oklahoma than any other state (Fisher et al. 1986; USFWS 1986).

Lake Texoma has been nationally recognized for its striped bass fishery since 1980 (Harper and Namminga 1986; Mauck 1990). In 1989 alone, about 289,046 anglers spent about \$16,200,000 on striped bass fishing on Lake Texoma (Mauck 1990). Most angler spending at Lake Texoma probably occurs within the vicinity of the reservoir, dependent on the demand of goods and services (factors and commodities), and would not exist without the striped bass fishery. Existence of such exogenous demands stimulates economic growth through multiplier effects (i.e., each

dollar spent by anglers produces more than a dollar of direct, indirect, and induced effects on the local economy). For example, initial purchases of fishing rods by anglers (direct impacts) causes directly and indirectly affected businesses to purchase materials needed to make the rods (indirect impacts), which results in additional purchases with wages paid by directly and/or indirectly affected businesses (induced impacts) (Rockland 1985).

Economic impact refers to the economic activity generated by use of a resource, such as a fishery. Economic impact analysis is a procedure for estimating the total economic impact - the summation of direct, indirect, and induced impacts. In economic impact assessments, type-I multipliers can be used to estimate direct and indirect impacts, whereas type-II or type-III multipliers may be used to estimate direct, indirect, and induced impacts (Propst and Gavrilis 1987). Since most legal and political decisions affecting our fisheries are based largely on monetary grounds, economic impact analysis has become an essential tool for today's fishery managers (Rockland 1985).

#### IV. PROCEDURES:

Collection of Data.-Angler surveys comprised the largest component of this study. A mail survey was conducted to acquire data on angler activities, characteristics, and expenditures, including a telephone number for a follow-up survey. Using a randomized process, self-addressed postage-paid cards were

distributed quarterly among anglers at six access points around Lake Texoma, January 1990 - April 1991. One-hundred and ninety-three anglers successfully completed and returned the survey cards.

A telephone survey was conducted to obtain additional information on fishing participation, fishing expenditures, and the socioeconomic status of anglers. Telephone interviews were conducted with randomly selected respondents from the mail survey. Detailed socioeconomic data were acquired from 101 anglers who fished on Lake Texoma, January - December 1990. In July 1991, a follow-up (two-question) telephone survey was conducted because about 50 percent of the questionnaires lacked information on "fishing hours/trip". These interviews helped acquire information on fishing effort from another 29 percent of the respondents.

A randomized, roving creel survey conducted by the Oklahoma Department of Wildlife Conservation (ODWC) and Texas Parks and Wildlife Department (TPWD) provided estimates of fishing effort (mean angler hours/day and total angler hours/year) in 1990, which allowed individual angler expenditures to be extrapolated to the population level. Furthermore, 1,030 interviews provided additional information on the distribution of distances traveled by anglers (highly correlated with trip expenditures), which was used to correct for distance bias in angler expenditures estimated from phone survey data.

An attempt was made to evaluate regional business activity

by evaluating regional socioeconomic factors including numbers of employees, wage rates, and capital. However, because of economic devastation brought on by a record flood in the spring of 1990, socioeconomic data collected during this time were biased and this portion of the study was discontinued. Nevertheless, data on regional business activities from 1980 - 1989 were obtained from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). These data were used to evaluate the relative economic contribution of fishing expenditures in impacted counties.

Reservoir visitation data were acquired from the U.S. Army Corps of Engineers (COE). These data provided information on the annual number of trips to U.S. Army COE reservoirs, but did not specify the type of use (e.g., fishing, boating, camping).

Impact Region.-The impact region (or local economy) was defined as the group of counties immediately surrounding Lake Texoma. Bryan, Carter, Marshall, Love, and Johnston counties in Oklahoma, and Grayson and Cooke counties in Texas were defined as the impact region. These seven counties were assumed, a priori, to be the most impacted by spending associated with fishing activities. All other counties (other than above seven) formed the non-impact region. Only those expenditures made within the impact region were used in this study.

Angler Types.-Anglers were categorized based on their place of residence and fishing preference. Regional anglers lived within the lake's seven-county impact region. Non-regional anglers lived outside of the impact region. Anglers who fished for

striped bass were defined as striped bass (SB) anglers, whereas those who fished for other species were defined as non-striped bass (NSB) anglers.

IMPLAN Model.-The IMPLAN (IMPact Analysis for PLANning) modelling system was employed in this study to evaluate the impact of the Lake Texoma fishery on the regional economy. Micro-IMPLAN Release 89-03, version 2.0 (Alward et al. 1989), was developed by the U.S. Department of Agriculture and U.S. Forest Service Department. Initially, the Regional Input-Output Modelling System (RIMS-II; Beemiller et al. 1986) was selected for this study; however, IMPLAN was found to be an equally sound input-output modelling system (Crookshank 1991, Sport Fishing Institute [personal communication]; Beemiller 1991, U.S. Department of Commerce, Bureau of Economic Analysis [personal communication]), and was considerably less expensive than RIMS-II.

Aggregation of Sectors.-The Lake Texoma economy was defined by aggregating the region's 219 industries into 8 retail sectors. The following 8 retail sectors were based on the industry classification of the micro-IMPLAN 528 sector Input-Output tables (Alward et al. 1989): (1) agriculture, forestry, and fishery (live bait); (2) manufacturing of non-food products (fishing tackle); (3) manufacturing of food and kindred products (ice, groceries, etc.); (4) transportation (travel, fuel, boat launching/storage fees); (5) retail and wholesale trade (trade margins); (6) hotels and lodging places (lodging costs); (7) restaurants; and (8) other services (fishing guide fees,

equipment rental, misc.).

Method of Analysis.-Economic impacts were derived from angler survey and IMPLAN data using the following methodology:

- (1) Estimate mean angler expenditures per fishing trip to Lake Texoma (from mail and telephone survey data);
- (2) Allocate mean angler expenditures made on various supplies and services (from telephone survey data) to appropriate industrial sectors (defined by micro-IMPLAN);
- (3) Expand mean sectorwise angler expenditures to the population level expenditures using mean angler hours (per day) and total angler hours (per year) (estimated from roving creel survey);
- (4) Convert sectorwise expenditures from consumer to producer values using margining;
- (5) Use IMPLAN data to compute impact multipliers for identified sectors;
- (6) Multiply results of steps 4 (total sectorwise expenditures) and 5 (sectorwise multipliers) to compute economic impacts.

Expenditures, multipliers, impacts associated with fishing activity on Lake Texoma were computed for output, income, value added, and employment, relative to regional SB and NSB anglers and non-regional SB and NSB anglers. Type-I multipliers were used to estimate direct and indirect impacts, and Type-III multipliers were used to estimate direct, indirect, and induced impacts. Addendum I provides a more detailed description of the procedures used in this study.

#### IV. RESULTS:

Angler Characteristics.-Among 101 respondents of the telephone survey who fished on Lake Texoma from February through December 1990, 17 resided within the impact region (regional anglers) and 84 resided outside of the impact region (non-regional anglers). Eighty-one percent of all anglers surveyed preferred to fish for striped bass over other fishes. Striped bass was the first choice of 86 percent of non-regional anglers and 47 percent of regional anglers. Fifty-eight percent of non-regional anglers preferred to fish exclusively for striped bass, compared with only 17 percent of regional anglers. Other preferred species included black basses, white bass, catfishes, crappie, and panfishes (sunfishes).

Fishing Effort.-Individual anglers fished an average of 27.7 days per year on Lake Texoma in 1990. Regional anglers spent 103 days per year fishing versus 12.6 days for non-regional anglers. However, 82 percent of trips made by regional anglers lasted about one day, while 81 percent of those made by non-regional anglers lasted two or more days. Non-regional anglers fished for striped bass 78.6 percent of the time compared with 52.4 percent for regional anglers.

Mean Individual Fishing Expenditures.-Anglers spent an average of \$305 per fishing trip on Lake Texoma in 1990. Regional anglers spent about \$85 per trip with all expenditures made within the impact region. Non-regional anglers spent about \$350 per trip with about 85 percent occurring within the impact region.

Striped bass fishing accounted for 51 percent and 87 percent of trip expenditures made by regional and non-regional anglers, respectively. Most regional and non-regional fishing expenditures were made on other services (>22%), transportation (>19%), manufactured food and kindred products (>18%), and lodging (>15%).

Population-Level Fishing Expenditures.-In 1990, an estimated total of \$25,641,000 was spent by anglers within the Lake Texoma region. Of this amount, \$20,902,000 (81.6%) was spent by non-regional anglers and \$4,739,000 (18.4%) was spent by regional anglers. Striped bass fishing was responsible for \$22,779,000 of angler expenditures (87% non-regional and 13% regional). Non-striped bass fishing accounted for \$2,800,000 of angler expenditures (37% non-regional and 63% regional).

Impact of Angler Expenditures.-The economic effects of angler expenditures on the Lake Texoma economy in 1990 are expressed through Type I (direct and indirect effects) and Type III (direct, indirect, and induced effects) impacts on regional output, income, value added, and employment (Table 1). Impact region business transactions (output) associated with angler expenditures ranged from \$33,917,000 to \$57,392,00 for Type I and Type III impacts, respectively. Regional income (employee compensation, proprietary income, and other property income) associated with angler expenditures was \$16,025,000 for Type I income impact and \$20,896,000 for Type III income impact. Value added (adds direct business taxes to regional income estimates

presented above) ranged from \$17,842,000 to \$23,273,000 depending on the degree of associated linkages included in the analysis. Impact region employment (number of jobs) associated with Lake Texoma angler expenditures was 535 jobs for Type I employment impact, and 718 jobs for Type III employment impact.

Non-regional angler expenditures accounted for approximately 81.5 percent of aggregate regional expenditure impacts, 82.0 percent of regional income and value added impacts, and 83.0 percent of regional employment impacts. Regional angler expenditures accounted for the remaining impacts of Lake Texoma fishing activity. Striped bass fishing expenditures accounted for about 89 percent of the regional expenditure, income, value added, and employment impacts, whereas, all other fishing expenditures accounted for the remaining 11 percent of impacts. Non-regional angler expenditures for striped bass fishing accounted for 77 to 79 percent of regional impacts on income, value added, and employment associated with all Lake Texoma fishing activity.

#### V. DISCUSSION:

Our results indicate that Lake Texoma's anglers spent more time fishing for striped bass than for other species, especially non-regional anglers. Roving creel surveys conducted on Lake Texoma by ODWC and TPWD in 1988 and 1989 reported that striped bass fishing accounted over 60 percent of total angler hours (1,416,733 and 1,328,815 hours, respectively) (TPWD [unpublished

data]). Over the past 10 years, Lake Texoma's striped bass population has become the lake's most abundant and popular sport fishery (Harper and Namminga 1986; Mauck 1990).

Mauck (1990) estimated that Lake Texoma anglers spent a total of \$26,400,000 on fishing activities in 1989, only three percent higher than our 1990 estimate of \$25,641,000. Moreover, estimates of fishing pressure on Lake Texoma were also quite similar in 1989 (1,416,733) and 1990 (1,328,815), with over 60 percent of the effort directed towards striped bass during both years (TPWD [unpublished data]). These striking similarities suggest that 1) striped bass fishing activity was stable in 1989 and 1990 and 2) estimated total expenditures of \$25,600,000 - 26,400,000 appear to be reasonably accurate. With 2,061,537 estimated angler hours on Lake Texoma in 1988 (45 - 55% higher than in 1989 and 1990) (TPWD [unpublished data]), total angler expenditures were probably much higher.

Total angler trip-related expenditures in Oklahoma were estimated at \$240,142,749 in 1988 (SFI 1988). Assuming that trip expenditures did not change substantially from 1988 to 1989 and with evidence from this study that over 90 percent of Lake Texoma fishing expenditures occurred in Oklahoma, the economic contribution of fishing activity on Lake Texoma in 1989 (Mauck 1990) can be evaluated relative to that for the entire state (SFI 1988) (procedures used to estimate fishing-trip expenditures by both studies were comparable). Therefore, we can speculate that trip-related expenditures made by Lake Texoma anglers accounted

for about 10 percent of Oklahoma's total fishing expenditures in 1988 ( $(0.90 \times 26,400,000)/240,142,749 = 0.099$ ). However, with evidence of substantially higher fishing pressure on Lake Texoma in 1988 (45% higher than in 1989; TPWD [unpublished data]), and more total trips to the lake (33% higher than in 1989; US Army COE [unpublished data]), trip-related spending by Lake Texoma anglers may have accounted for a larger proportion of the total fishing expenditures in Oklahoma.

In the absence of fishing on Lake Texoma, local economies would obviously suffer. Local economies impacted the most by fishing expenditures (e.g., 69% in Marshall County) would experience the greatest losses. Although data obtained from the U.S. Department of Commerce, BEA did not allow comparisons to be made during the same year, measures of economic activity such as employment (number of jobs) changed very little over time in the impact counties. In Marshall County, for example, total employment remained relatively stable from 1980 - 1989 (mean = 3686 jobs; CV = 26%) (U.S. Department of Commerce, BEA [unpublished data]). Based on our findings, 69 percent of total employment (369 and 495 jobs for Type I and Type III impacts, respectively) created by fishing activity on Lake Texoma could account for about 10 - 13 percent (for Type I and Type III impacts, respectively) of all full-time and part-time jobs in Marshall County.

Of all fishing activity conducted on Lake Texoma in 1990, striped bass fishing by non-regional anglers had the greatest

economic impact on the local economy. Substantially higher trip expenditures of non-regional anglers associated with target fisheries has been documented in other related studies (Anderson et al. 1986; Martin 1987). The importance of striped bass fishing and non-regional anglers to the regional economy of Lake Texoma has been indicated clearly by the results of this study. Because the majority of anglers come to Lake Texoma to enjoy good striped bass fishing, careful measures should be taken to protect this valuable resource.

#### VI. RECOMMENDATIONS:

Alternative methods of acquiring angler phone numbers and minimal socioeconomic data could have greatly reduced the cost of this study, and improved the quality of the data. Future access and/or roving creel surveys on Lake Texoma should obtain angler telephone numbers for purposes of follow-up economic studies. Furthermore, by asking surveyed anglers one question on trip expenditures (as did by Mauck in 1989 (Mauck 1990)), annual population-level estimates of fishing expenditures would be available. This would allow managers to study the dynamics of fishing expenditures for several years, and possibly foresee future changes.

Economic studies of the Lake Texoma fishery should be conducted periodically, at least every 5 years. Future surveys should be designed to address the two basic benefits of a fishery - economic impact and economic value. Results would provide

fishery managers with up-to-date estimates of regional fishing expenditures, impacts, and values. Economic value estimates how much more anglers are willing to pay for their fishing experience (e.g., fishing trip), that is above and beyond the actual fishing expenditures. The concept of economic value has become increasingly more applicable in fishery management (Malvestuto 1983; Rockland 1985; Martin et al. 1987). With this information in hand, efforts to protect our fishery resources would be greatly enhanced. Moreover, economic studies on Lake Texoma could become models for similar studies on other large Oklahoma reservoirs.

Future economic impact studies of the Lake Texoma fishery should be conducted in conjunction with other related studies of regional and/or state business activities. In 1992, for example, the U.S. Department of Commerce, BEA will take censuses of all state, municipal, and county business activities. By comparing indices of economic activity (e.g., income, employment, value added, etc.) associated with the Lake Texoma fishery and those for the entire region, the contribution of the fishery to the regional economy could be better quantified. Additional comparisons could be made with other economic studies of fishery resources conducted by the Sport Fishing Institute (SFI 1988) and U.S. Fish and Wildlife Service (USFWS 1986 and 1989).

## VI. ACKNOWLEDGMENTS:

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VIII. Prepared by:

Mark Sch

Mark S. Schorr, Jaysingh Sah,

Dean F. Schreiner, Michael R. Meador,

and Loren G. Hill

IX. Date:

22 October 1991

X. Approved by:

Harold Namminga

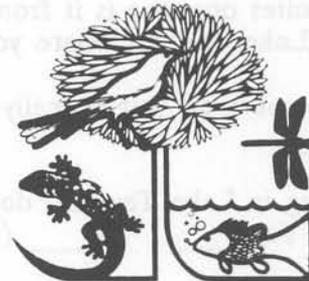
Harold E. Namminga

Federal Aid/Research Coordinator

Table 1. Regional aggregate impacts of angler expenditures associated with fishing activity on Lake Texoma in 1990. Direct and indirect impacts were estimated using type-I multipliers. Direct, indirect, and induced impacts were estimated using type-III multipliers.

Angler Type	Output (\$)	Income (\$)	Value Added (\$)	Employment (Jobs)
<b>Direct and Indirect Impacts</b>				
Striped Bass				
Regional	3,926,000	1,744,000	1,967,000	57.8
Non-regional	<u>29,201,000</u>	<u>12,496,000</u>	<u>13,896,000</u>	<u>420.5</u>
Total	30,127,000	14,240,000	15,863,000	478.3
Non-Striped Bass				
Regional	2,368,000	1,154,000	1,271,000	32.9
Non-regional	<u>1,422,000</u>	<u>631,000</u>	<u>708,000</u>	<u>23.8</u>
Total	3,790,000	1,785,000	1,979,000	56.7
Total				
Regional	6,294,000	2,898,000	3,238,000	90.7
Non-regional	<u>27,623,000</u>	<u>13,127,000</u>	<u>14,604,000</u>	<u>444.3</u>
Total	33,917,000	16,025,000	17,842,000	535.0
<b>Direct, Indirect, and Induced Impacts</b>				
Striped Bass				
Regional	6,710,000	2,282,000	2,564,000	77.9
Non-regional	<u>44,263,000</u>	<u>16,312,000</u>	<u>18,140,000</u>	<u>565.0</u>
Total	50,973,000	18,594,000	20,704,000	642.9
Non-Striped Bass				
Regional	3,923,000	1,462,000	1,623,000	42.7
Non-regional	<u>2,496,000</u>	<u>840,000</u>	<u>946,000</u>	<u>32.8</u>
Total	6,419,000	2,302,000	2,569,000	75.5
Total				
Regional	10,633,000	3,744,000	4,187,000	120.6
Non-regional	<u>46,759,000</u>	<u>17,152,000</u>	<u>19,086,000</u>	<u>597.8</u>
Total	57,392,000	20,896,000	23,273,000	718.4

Appendix I. Sample of the postcard questionnaire used in the mail survey of Lake Texoma anglers. This survey was conducted by the University of Oklahoma Biological Station.



Dear Angler:

Date: \_\_\_\_\_

Please complete this brief questionnaire and drop it in a mailbox. No postage is necessary.

1. Please estimate how much this trip cost *you* in total including transportation, food, accommodations and other expenses. \$ \_\_\_\_\_
  2. What is your place of residence?  
County \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
  3. What species of fish were you fishing for?  
striped bass  black bass  crappie   
catfish  panfish  all  other  \_\_\_\_\_
  4. Of the total amount of money this trip cost you, how much of it (in dollars) was spent within:  
less than 5 miles \_\_\_\_\_ 5-10 miles \_\_\_\_\_  
10-15 miles \_\_\_\_\_ 15-20 miles \_\_\_\_\_  
greater than 20 miles \_\_\_\_\_ from Lake Texoma.
  5. Have you ever used a castnet on Lake Texoma?  
Yes  No
  6. May we phone you if we need more information on your fishing experience? Yes  No
- Number (\_\_\_\_\_) \_\_\_\_\_

Thanks.

Appendix II. Sample of questions used in the telephone survey of Lake Texoma anglers. This survey was conducted by the University of Oklahoma Biological Station.

Section I Fishing Participation

I would like to ask you some questions about your fishing activity.

1.01 About how many miles one way is it from your permanent residence to the area of Lake Texoma where you usually fish? \_\_\_\_\_

1.02 How many days per year do you typically spend fishing on Lake Texoma? \_\_\_\_\_

1.03 When you go fishing in Lake Texoma, do you fish for a particular species? Yes \_\_\_\_\_ No \_\_\_\_\_ (Go to 1.05).

1.04 In order of preference, what 3 species do you fish for in Lake Texoma?

1st choice \_\_\_\_\_  
2nd choice \_\_\_\_\_  
3rd choice \_\_\_\_\_

1.05 How many days per year do you typically spend fishing on Lake Texoma for:

\_\_\_\_\_ striped bass  
\_\_\_\_\_ black bass  
\_\_\_\_\_ white bass (sand bass)  
\_\_\_\_\_ catfish  
\_\_\_\_\_ panfish, bluegill, sunfish,  
\_\_\_\_\_ all  
\_\_\_\_\_ other

1.06 When you fish on Lake Texoma, are your fishing trips generally:

\_\_\_\_\_ one day  
\_\_\_\_\_ overnight  
\_\_\_\_\_ over 2 nights  
\_\_\_\_\_ more than 2 days and 2 nights

Appendix II. (continued)

Section 3 Fishing Expenditures

The next questions relate to your fishing expenditures.

You estimated your proportion of total expenditures for this trip was \$ \_\_\_\_\_.  
How would you distribute this amount in dollars among the following categories:

- 3.01 Groceries, food, drinks, and refreshments \_\_\_\_\_
- 3.02 Lodging at motels, cabins, lodges, campgrounds, etc. \_\_\_\_\_
- 3.03 Restaurant meals \_\_\_\_\_
- 3.04 Round trip cost for transportation by private car or other private vehicle \_\_\_\_\_
- 3.05 Live bait \_\_\_\_\_
- 3.06 Ice \_\_\_\_\_
- 3.07 Guide fees \_\_\_\_\_
- 3.08 Boat launching fees \_\_\_\_\_
- 3.09 Boat mooring, storage, and maintenance \_\_\_\_\_
- 3.10 Equipment rental (boats, fishing equipment etc.) \_\_\_\_\_
- 3.11 Fishing tackle (rods, reels, line, artificial lures, etc.) \_\_\_\_\_
- 3.12 Boat fuel \_\_\_\_\_
- 3.13 How many gallons of boat fuel did you use \_\_\_\_\_
- 3.14 Miscellaneous related fishing expenses. This includes all other items that were purchased because you were going fishing \_\_\_\_\_
- 3.15 Of the total amount of money spent on your last fishing trip, how much of it (dollars) was spent in:

- |                           |                           |
|---------------------------|---------------------------|
| _____ Marshall County, OK | _____ Cooke County, TX    |
| _____ Bryan County, OK    | _____ Grayson County, TX  |
| _____ Love County, OK     | _____ other, OK           |
| _____ Carter County, OK   | _____ other, TX           |
| _____ Johnston County, OK | other (and specify) _____ |

Appendix II. (continued)

Section 4 Household Information

The final set of questions relate to household information.

- 4.01 Sex of respondent:  M  F
- 4.02 What is your age? \_\_\_\_\_
- 4.03 What is your principal occupation?
- |   |  |
|---|--|
| <input type="checkbox"/> Professional             | <input type="checkbox"/> Farmer or farm worker |
| <input type="checkbox"/> Sales                    | <input type="checkbox"/> Retired               |
| <input type="checkbox"/> Manager or administrator | <input type="checkbox"/> Unemployed            |
| <input type="checkbox"/> Craftsman                | <input type="checkbox"/> other                 |
| <input type="checkbox"/> Laborer or Operator      | (specify) _____                                |
- 4.04 What is your total household income per year (household income includes income from all sources and all wage earners for the most current year)?
- |  |  |
|--|--|
| <input type="checkbox"/> <\$10,000           | <input type="checkbox"/> \$50,000 - \$74,999 |
| <input type="checkbox"/> \$10,000 - \$24,999 | <input type="checkbox"/> \$75,000 - \$99,999 |
| <input type="checkbox"/> \$25,000 - \$49,999 | <input type="checkbox"/> >\$100,000          |
- 4.05 Overall, how satisfied are you with the fishing in Lake Texoma?
- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| <input type="checkbox"/> not at all | <input type="checkbox"/> moderately |
| <input type="checkbox"/> slightly   | <input type="checkbox"/> very       |
- 4.06 Do you have any comments you would like to make regarding fishing on Lake Texoma?

This completes our survey. We appreciate the time you have spent with us on the survey. Thank you very much and best of luck on your next fishing trip!

Time Interview Ended \_\_\_\_\_



Appendix IV. Percent frequency of species groups pursued by regional (N = 39) and non-regional (N = 154) anglers (surveyed by mail) who fished on Lake Texoma, February 1990 - April 1991.

Species	Fishermen	
	Regional	Non-regional
Striped bass (only)	48.7	72.2
(and others)	17.9	20.0
Black basses (only)	10.3	1.3
(and others)	2.6	1.3
Crappies (only)	7.7	<1.0
(and others)	5.1	
Catfishes	2.6	<1.0
Sunfishes	2.6	<1.0
Other fishes	2.6	1.3
All fishes <sup>1</sup>	2.6	1.9

<sup>1</sup> All fishes indicates that anglers were fishing for anything with no particular species preference.

Appendix V. Percent frequency of species preferences of regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone) who fished on Lake Texoma, March - December 1990. (SB=striped bass, BB=black basses, WB=white bass, CAT=catfishes, CRA=crappies).

Species Preference (1st, 2nd, 3rd)	Fishermen	
	Regional	Non-regional
<b>1 Species</b>		
SB	17.6	57.6
BB	5.9	3.5
WB	5.9	
CAT	5.9	
<b>2 Species</b>		
SB, CAT	5.9	7.1
SB, BB	5.9	1.2
SB, WB		1.2
BB, SB		1.2
WB, SB		1.2
<b>3 Species</b>		
SB, BB, CRA		3.5
SB, BB, CAT	5.9	2.3
SB, WB, BB	5.9	2.3
SB, CAT, BB		2.3
SB, CAT, CRA		2.3
SB, CRA, CAT	5.9	
SB, WB, CAT		1.2
SB, WB, CRA		1.2
SB, CAT, WB		1.2
SB, CRA, WB		1.2
BB, CAT, SB	5.9	
BB, CAT, CRA		1.2
BB, CRA, SB	5.9	
BB, CRA, CAT	5.9	
WB, SB, BB		1.2
WB, CRA, CAT		1.2
CAT, SB, WB		1.2

Appendix V. (continued)

Species Preference (1st, 2nd, 3rd)	Fishermen	
	Regional	Non-regional
CAT, BB, SB	5.9	
CRA, SB, WB		1.2
CRA, CAT, SB	5.9	
CRA, CAT, BB		1.2
CAR, CAT, WB		1.2

Appendix VI. Annual days spent fishing on Lake Texoma by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone), March - December 1990.

Species	Annual Fishing Days	
	Mean	Percent
<b>Regional Fishermen</b>		
Striped Bass	54.0	52.4
Black Basses	20.5	19.9
Catfishes	9.7	9.4
All fishes <sup>1</sup>	9.6	9.3
White Bass	6.0	5.8
Other fishes	2.4	2.3
Panfishes <sup>2</sup>	0.8	<1.0
	<u>103.0</u>	<u>100.0</u>
<b>Non-Regional Fishermen</b>		
Striped Bass	9.9	78.6
All fishes	2.1	16.7
Catfishes	0.3	2.4
White Bass	0.2	1.6
Black Basses	0.1	<1.0
Panfishes	<0.1	<1.0
Other fishes	0.0	0.0
	<u>12.6</u>	<u>100.0</u>

<sup>1</sup> All fishes indicates that anglers were fishing for anything with no particular species preference.

<sup>2</sup> Panfishes includes crappie and sunfishes

Appendix VII. Fishing-trip expenditures made by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone) who fished on Lake Texoma, March - December 1990.

Angler-Trip Expenditures		
Species	Mean (\$)	Percent
<b>Regional Fishermen</b>		
Striped Bass	43.4	51.0
Catfishes	26.9	31.6
Black Basses	12.1	14.2
White Bass	1.8	2.1
All fishes <sup>1</sup>	0.8	<1.0
Panfishes <sup>2</sup>	0.0	0.0
Other fishes	<u>0.0</u>	<u>0.0</u>
	85.0	100.0
<b>Non-Regional Fishermen</b>		
Striped Bass	304.1	87.0
All fishes	31.4	9.0
Black Basses	5.2	1.5
White Bass	4.1	1.2
Catfishes	3.8	1.1
Panfishes	0.9	<1.0
Other fishes	<u>&lt;0.1</u>	<u>&lt;1.0</u>
	349.5	100.0

<sup>1</sup> All fishes indicates that anglers were fishing for anything with no particular species preference.

<sup>2</sup> Panfishes include crappie and sunfishes.

Appendix VIII. Fishing-trip expenditures made on supplies and services by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone) who fished on Lake Texoma, March - December 1990.

Angler-Trip Expenditures

Supplies/Services      Mean (\$)      Percent

Regional Fishermen

Boat Storage/Maintenance	60.5	47.7
Miscellaneous	10.7	12.6
Groceries	8.1	9.5
Fishing Guide Fees	7.6	8.9
Boat fuel	7.0	8.2
Restaurants	4.6	5.5
Transportation	3.4	4.0
Fishing Tackle	1.1	1.3
Lodging	1.5	1.8
Bait	0.3	0.4
	<u>85.0</u>	<u>100.0</u>

Non-Regional Fishermen

Fishing Guide Fees	93.4	26.7
Groceries	60.5	17.3
Lodging	52.8	15.1
Transportation	45.8	13.1
Miscellaneous	38.9	11.1
Restaurants	25.6	7.3
Boat fuel	15.6	4.5
Boat Storage/Maintenance	10.3	2.9
Fishing Tackle	4.7	1.3
Bait	1.9	0.5
	<u>349.5</u>	<u>100.0</u>

Appendix IX. Fishing-trip expenditures made within the seven-county impact region by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone), March - December 1990.

Angler-Trip Expenditures		
County	Mean (\$)	Percent
<b>Regional Fishermen</b>		
Oklahoma		
Marshall	53.4	62.9
Bryan	9.8	11.5
Carter	8.5	10.0
Johnston	0.0	0.0
Love	0.0	0.0
Texas		
Grayson	10.5	12.4
Cooke	<u>2.8</u>	<u>3.3</u>
	85.0	100.0
<b>Non-Regional Fishermen</b>		
Oklahoma		
Marshall	239.5	69.5
Bryan	108.6	30.1
Carter	0.5	<1.0
Johnston	0.0	0.0
Love	0.0	0.0
Texas		
Grayson	0.9	<1.0
Cooke	<u>0.0</u>	<u>0.0</u>
	349.5	100.0

Appendix X. Frequency of fishery-related comments/concerns expressed by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone) who fished on Lake Texoma, March - December 1990.

Angler Comments	Fishermen			
	Regional		Non-regional	
	N	%	N	%
Good fishing experience	3	16.7	36	37.5
Oppose striped bass length/creel limit (1 fish $\geq$ 20 in.) <sup>1</sup>	3	16.7	23	24.0
More law enforcement	3	16.7		
No comment	2	16.7	10	10.4
Lake level too high			6	6.2
Striped bass have hurt other fisheries <sup>2</sup>	1	5.6	5	5.2
Oppose use of castnets/live bait	1	5.6	4	4.2
Oppose fishing guide activities <sup>3</sup>			3	3.1
Enjoyed fishing guide services			3	3.1
Support striped bass length/creel limit	1	5.6	2	2.1
Support use of castnets/live bait	1	5.6	1	1.0
Improve boat ramps			1	1.0
Favors introduction of "Florida strain" largemouth bass	1	5.6	1	1.0
Stop jug-line fishing	1	5.6		

Appendix X. (Continued)

Angler Comments	Fishermen			
	Regional		Non-regional	
	N	%	N	%
Favors more "catch and release" fisheries	1	5.6		
Favors a "life time" fishing license for Lake Texoma	<u>18</u>	<u>100.0</u>	<u>1</u> 96	<u>1.0</u> 100.0

- <sup>1</sup> Most of the anglers felt the striped bass creel/length limit (i.e., 1 fish  $\geq$  20 inches) was causing severe mortality (hooking mortality), especially during the summer. Several anglers would like to see this regulation changed to 2 - 5 fish  $\geq$  20 inches.
- <sup>2</sup> Respondents claimed that crappie, white bass, and catfish fishing has declined as a result of striped bass.
- <sup>3</sup> Respondents felt that there are too many fishing guides on the lake, and fisheries are being overexploited and some regulatory action was needed.

Appendix XI. Overall satisfaction with fishing on Lake Texoma expressed by regional (N = 17) and non-regional (N = 84) anglers (surveyed by telephone) who fished on the lake, March - December 1990.

Angler Satisfaction	Fishermen			
	Regional N	%	Non-regional N	%
Very satisfied	13	76.5	65	77.4
Moderately satisfied	4	23.5	18	21.4
Slightly satisfied	0	0.0	1	1.2
Not at all satisfied	0	0.0	0	0.0
	17	100.0	84	100.0

Appendix XII. Total income and employment of the seven impact counties in the Lake Texoma region (Oklahoma-Texas), 1980 - 1989. These data were provided by U.S. Department of Commerce, Bureau of Economic Analysis.

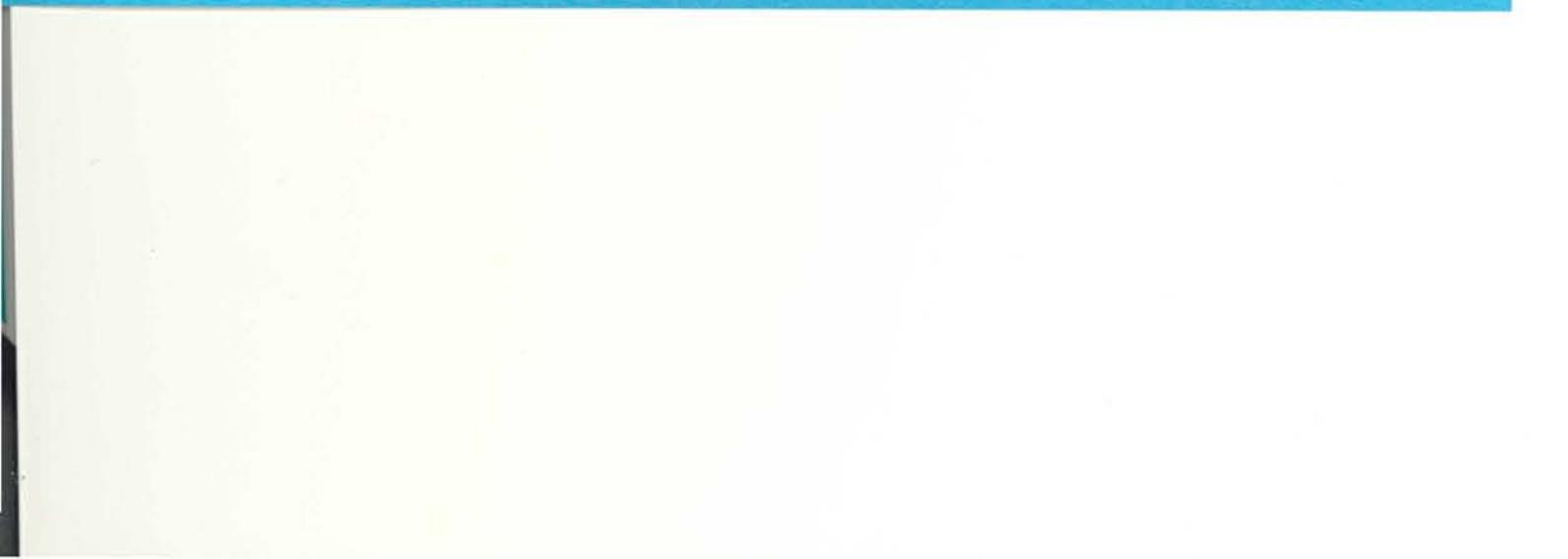
Year	Oklahoma					Texas	
	Bryan	Carter	Johnston	Love	Marshall	Cooke	Grayson
<b>Income (\$1,000,000)</b>							
1980	200.8	407.1	61.8	60.0	76.9	260.5	827.8
1981	229.9	476.4	69.3	69.7	88.4	295.5	927.2
1982	253.4	512.4	78.7	77.6	99.4	319.1	1,002.1
1983	270.3	524.9	76.0	79.3	102.8	317.6	1,067.3
1984	282.8	554.3	79.3	80.9	107.7	336.1	1,166.0
1985	293.3	576.4	82.0	83.6	111.5	347.6	1,242.4
1986	303.0	575.7	86.4	87.4	119.2	359.6	1,296.9
1987	308.9	573.4	86.7	87.9	120.2	366.2	1,329.6
1988	329.7	600.9	92.6	92.6	128.5	382.3	1,400.5
1989	356.7	636.0	95.9	99.8	136.7	404.7	1,477.9
<b>Employment (Jobs)</b>							
1980	11,322	22,660	3,293	2,760	3,690	14,855	44,019
1981	11,303	23,599	3,230	2,707	3,916	14,876	44,202
1982	11,230	23,580	3,300	2,855	4,040	14,773	43,525
1983	11,680	23,271	3,375	2,835	3,985	14,076	43,823
1984	12,003	23,870	3,448	2,811	4,091	14,167	45,400
1985	11,579	23,870	3,525	2,807	4,002	14,052	46,806
1986	11,447	22,746	3,391	2,822	3,940	13,549	46,868
1987	11,523	22,118	3,434	2,959	3,911	13,421	46,841
1988	11,992	22,084	3,406	2,999	4,008	13,563	47,341
1989	12,420	22,484	3,331	3,331	4,277	13,552	47,491

Appendix XIII. Estimated fishing-trip expenditures made by resident and non-resident anglers in Oklahoma, 1988 (SFI 1988<sup>1</sup>).

Category	Trip-Related Expenditures (\$)		
	Residents	Non-Residents	Total
Food, Drink, and Refreshments	65,930,892	13,946,764	79,877,656
Lodging	11,977,867	2,510,415	14,488,282
Public Transportation	1,286,853	268,677	1,555,530
Private Transportation	65,479,808	13,860,730	79,340,583
Boat Fuel	18,638,736	3,911,603	22,550,339
Fishing Guide Fees	326,759	11,737	353,496
Pack Trip or Package Fees	207,739	11,737	219,476
Public Land Use or Access Fees	715,553	87,351	802,904
Private Land Use	253,413	30,935	284,348
Boat Launching Fees	340,314	37,845	372,859
Boat Mooring, Storage, and Maintenance	4,913,038	594,213	5,507,251
Equipment Rental	323,965	33,350	357,315
Live Bait	19,005,624	2,306,846	21,312,470
Cut Bait	2,033,184	247,806	2,280,990
Prepared Baits	1,448,061	173,779	1,621,840
Ice	8,255,042	1,002,113	9,227,155
<u>Total</u>	<u>201,106,848</u>	<u>39,035,901</u>	<u>240,142,749</u>

<sup>1</sup> SFI (Sport Fishing Institute). 1988. The economic impact of sport fishing in the state of Oklahoma. Sport Fishing Institute, Washington, D.C. 29 pp.





ACKNOWLEDGMENTS

**REGIONAL ECONOMIC IMPACT OF LAKE TEXOMA  
STRIPED BASS AND NON-STRIPED  
BASS FISHING ACTIVITIES**

**Jaysingh Sah, Dean F. Schreiner,  
and Mark Schorr\***

**Department of Agricultural Economics  
Oklahoma State University  
Stillwater, Oklahoma**

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\* Jaysingh Sah is Research Associate and Dean F. Schreiner is Professor, Department of Agricultural Economics, Oklahoma State University, Stillwater. Mark Schorr is Research Associate, University of Oklahoma Biological Station, Kingston, Oklahoma.

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# REGIONAL ECONOMIC IMPACT OF LAKE TEXOMA STRIPED BASS AND NON-STRIPED BASS FISHING ACTIVITIES

Jaysingh Sah, Dean F. Schreiner, and Mark Schorr\*  
Department of Agricultural Economics  
Oklahoma State University  
Stillwater, Oklahoma

## Summary and Conclusions

A large water-based multi-purpose project such as Lake Texoma has various economic effects on the surrounding impact region. This analysis was limited to the economic effect of the fishing activity, and specifically angler expenditures, on the local impact region of Bryan, Carter, Marshall, Love, and Johnston counties in Oklahoma and Grayson and Cooke counties in Texas. Furthermore, the effects of angler expenditures were separated between expenditures for striped bass fishing versus expenditures for fishing all other species. The economic impact was determined for the local region's output of goods and services, income, value added, and employment.

Data on angler expenditures and angler characteristics were collected by the University of Oklahoma Biological Station from randomly selected samples of anglers completing fishing trips to Lake Texoma in 1990. These data were used to estimate expenditure per angler hour of striped bass (SB) fishing and per angler hour of non-striped bass (NSB) fishing. Total number of angler hours of fishing at Lake Texoma in 1990 was estimated by the Oklahoma and Texas Cooperative Creel Survey based on pressure count and creel surveys. Angler hours and expenditures per angler hour were estimated separately for anglers coming from residences within the seven county impact region (regional anglers) versus those coming from outside the impact region (non-regional anglers).

Aggregate impacts of angler expenditures were determined based on output, income, value added, and employment multipliers estimated using the micro IMPLAN (IMpact Analysis for PLANing) data base developed by the USDA Forest Service Department. Type I and Type III impact multipliers were identified within the IMPLAN data base. Type I multipliers measure the direct and indirect effects of angler expenditures whereas the Type III multipliers measure the direct, indirect, and induced effects of angler expenditures. The direct effects are limited to those associated with the angler expenditures. Anglers expend on items such as bait and tackle, prepared foods, lodging, transportation, guide fees, and other services. These expenditures create a direct need for outputs from businesses in the economic sectors of the impact region. In turn, direct sector output creates direct sector income, value added, and employment.

Indirect effects are created when businesses providing the direct purchases of anglers, in turn, make purchases from other businesses in the economic sectors of the impact region. For example, lodging places make purchases from linen and janitorial services and eating and drinking places make purchases from food suppliers.

Induced effects are created when increased household incomes from the direct income effects are used to make additional direct and indirect purchases from businesses in the impact region. The Type III multipliers incorporate the concept of measuring the effects of marginal expenditures from increased household incomes versus the concept of measuring the average effects of household expenditures frequently identified with Type II multipliers.

Median family income of Lake Texoma anglers fell within the broad income range of \$25,000 - \$75,000 in 1990 with median income of anglers with residence in the impact region below \$50,000 and

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\* Jaysingh Sah is Research Associate and Dean F. Schreiner is Professor, Department of Agricultural Economics, Oklahoma State University, Stillwater. Mark Schorr is Research Associate, University of Oklahoma Biological Station, Kingston, Oklahoma.

anglers with residence outside the impact region above \$50,000. About three-fourths of the anglers coming from outside the region were classified by occupation as professional, manager/administrator, retired, or other. Over 90 percent of the anglers coming from within the impact region were classified as labor/operator, retired, sales, or other. Based on creel survey data 38.3 percent of the anglers lived within 50 miles of Lake Texoma, 25.5 percent were between 51 and 100 miles, 16.2 percent were between 101 and 200 miles, 15.4 percent were between 201 and 500 miles, and 4.6 percent were from greater than 500 miles.

On average, regional anglers spent about 5.8 hours fishing during a typical trip to Lake Texoma versus 17.4 hours for non-regional anglers. This was highly correlated with duration of trip because about 81 percent of non-regional anglers spent more than one day versus only 18 percent for regional anglers.

Regional anglers in 1990 spent about \$85 per trip per angler with all of the expenditures occurring within the impact region. Non-regional anglers spent about \$350 per trip per angler with about 85 percent of the expenditures occurring within the impact region. Regional anglers associated about 51 percent of their expenditures with striped bass fishing versus 87 percent for non-regional anglers. Regional anglers spent about \$10.40 per angler hour of striped bass fishing and \$7.20 per angler hour of other specie fishing. Non-regional anglers spent about \$31.10 per angler hour of striped bass fishing and \$5.50 per hour of other specie fishing. These angler hour expenditures included only expenditures occurring within the impact region.

The Oklahoma and Texas Cooperative Creel Survey estimated total angler hours of fishing at Lake Texoma at 1,328,815 for 1990. Total expenditures from Lake Texoma anglers occurring within the impact region was estimated in this study at \$25,641,000. Of this amount, \$20,902,000 (81.5 percent) was associated with non-regional anglers and \$4,739,000 (18.5 percent) was associated with regional anglers. Striped bass fishing was associated with about \$22,779,000 of expenditures and all other specie fishing was associated with about \$2,861,000 of expenditures (88.8 percent and 11.2 percent, respectively, of the total). About 95.0 percent of non-regional angler expenditures was associated with striped bass fishing versus 61.8 percent of regional angler expenditures.

The aggregate economic effects of angler expenditures was expressed through the Type I and Type III multiplier impacts. Value of impact region business transactions (outputs) associated with angler expenditures ranged from \$33,917,000 for Type I impact to \$57,392,000 for Type III impact. Regional income (employee compensation, proprietary income, and other property income) associated with angler expenditures was \$12,156,000 for direct purchases by anglers, \$16,025,000 for Type I income impact, and \$20,896,000 for Type III income impact. These results imply that the effect of angler expenditures on impact region income ranged from about \$12,000,000 to \$21,000,000 depending on the degree of associated linkages or multiplier effects included in the analysis. The lower end of the income range captures only the direct income associated with angler expenditures while the higher end of the income range captures direct, indirect, and induced income associated with angler expenditures. Value added adds indirect business taxes to regional income estimates as presented above and thus the range of value added was from \$13,560,000 to \$23,273,000 depending on the degree of associated linkages included in the analysis.

Impact region employment (number of jobs) associated with Lake Texoma angler expenditures was 417 direct jobs, 535 jobs for Type I employment impact, and 718 jobs for Type III employment impact.

The importance of striped bass fishing and of non-regional anglers was identified through associated expenditures. Non-regional angler expenditures accounted for approximately 81.5 percent of aggregate regional expenditure impacts, 82 percent of regional income and value added impacts, and 83 percent of regional employment impacts. Regional angler expenditures accounted for the remaining impacts of the Lake Texoma fishing activity. Striped bass fishing expenditures accounted for about 89 percent of the regional expenditure, income, value added and employment impacts and all other specie fishing expenditures accounted for the remaining 11 percent of impacts. Non-regional angler expenditures for striped bass fishing accounted for 77 to 79 percent of the regional impacts on income, value added, and employment associated with Lake Texoma total fishing activity. These latter results indicate the importance of non-regional anglers and the striped bass fishing activity on the total economy of the impact region.

Several conclusions are drawn from the results of this study and include the following:

1. Lake Texoma anglers have a significant impact on the economy of the counties bordering the lake. Aggregate direct expenditures of anglers equaled \$25,640,000 which generated \$12,156,000 of income and 417 jobs. When all multiplier effects of these expenditures were included, total area income impact expanded to \$20,896,000 and total employment expanded to 718 jobs.
2. About 82 percent of the income impacts and 83 percent of the employment impacts were associated with anglers that come from outside the impact region thus representing an exogenous source of income and employment attributed to the Lake Texoma fishing activity.
3. About \$19,849,00 of angler expenditures were associated with striped bass fishing by non-regional anglers. This represented about \$9,539,000 of direct area income and about 328 direct area jobs. When all multiplier effects of these expenditures were included, total area income impact expanded to \$16,312,000 and total employment expanded to 565. Without striped bass sport fishing at Lake Texoma, impact region income and employment could be significantly reduced.
4. Lake Texoma provides a recreation alternative for the impact region population as well as for the non-regional population. This study has not quantified the value of Lake Texoma fishing to the impact region population. However, the direct angler expenditures for the impact region population were estimated at \$4,738,000. If these angler expenditures by local people had not occurred at Lake Texoma, the potential exists for a significant part of these expenditures to flow out of the impact region for expenditure in other regions to satisfy the local demand for recreation including fishing at alternative sites.
5. The current study emphasizes the economic impact Lake Texoma anglers have on the local (impact) region. The study does not quantify the value (willingness-to-pay) an angler places on a Lake Texoma fishing trip. Such information is important in determining the aggregate value anglers place on the Lake Texoma fishing activity. Knowing this information, fish and wildlife managers can better plan resource use in managing (protecting) the Lake Texoma fishery including the striped bass fishery.
6. The pressure count and creel surveys administered from the Oklahoma and Texas Cooperative Creel Survey provide critical information needed to manage the Lake Texoma fishery. However, the surveys do not obtain all of the data needed to estimate the value of a fishing trip. It is recommended that the creel survey should include the angler telephone number and that a follow-up survey of a random sample of anglers be administered for purposes of obtaining information needed to estimate the value of a fishing trip to Lake Texoma.

## Introduction

Lake Texoma is known for its water-based recreation, especially striped bass (SB) fishing. Over the years, it has attracted large numbers of visitors (Appendix Table A-1). About two-thirds of the anglers prefer the striped bass specie for fishing. In 1989, about 289,046 striped bass anglers spent about \$16,200,000 on trips to Lake Texoma (Mauck et al, page 22). A large portion of this spending occurred within the vicinity of the lake on goods and services demanded by anglers. Existence of this source of exogenous demand stimulates economic growth in the local economies through a multiplier effect.<sup>1</sup> These multiplier effects are translated into income and employment effects for the local economies surrounding Lake Texoma.

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<sup>1</sup> Each dollar spent by striped bass anglers within the vicinity produces more than a dollar's worth of direct, indirect, and induced effects on the local economy.

## Objective

The objective of this study was to analyze the economic effects of expenditures by Lake Texoma anglers on the local economy in terms of a) output of goods and services, b) income, c) value added, and d) employment.

## Methodology

### Identification of Impact Region

The local economy or impact region was defined as the contiguous group of counties immediately surrounding Lake Texoma. These counties were thought, *a priori*, to be most impacted by spending associated with fishing. The Oklahoma counties of Bryan, Carter, Marshall, Love, and Johnston, and the Texas counties of Grayson and Cooke were considered to constitute the impact region. All other counties (other than the above seven) formed the non-impact region.

### Data and Method of Analysis

Travel Cost Method (TCM) and Contingent Value Method (CVM) are procedures used to evaluate the value of non-market economic activities such as recreation or fishing activities (Hansen and Badger). The purpose is to measure the consumer surplus or willingness-to-pay by recreationists or anglers. However, these procedures do not necessarily measure the contribution of such non-market activities to regional or local economic growth. Cordell et al. have used trip expenditure and IMPLAN (Impact Analysis for PLANing) data to evaluate the local impact effects of recreation. Uwakonye used similar data to create a Social Accounting Matrix and measure the distributional impact of exogenous demand associated with several activities of Broken Bow Lake (including recreation) on the economy of McCurtain county in Southeastern Oklahoma.

This study used trip expenditure and IMPLAN data (Alward, et al.) to measure the economy wide impact of Lake Texoma anglers. The general approach was to: 1) estimate mean expenditures per angler per trip to Lake Texoma; 2) allocate expenditures to various economic sectors of the impact region; 3) estimate aggregate angler expenditures; 4) use margining data to convert sectorwise estimated expenditures from purchasers' value to producers' value; 5) use IMPLAN data to obtain expenditure (output) multipliers for identified sectors within the impact region; and 6) use the results of 4) and 5) to estimate the impacts of aggregate angler expenditures on area income, value added, and employment.

For estimating trip expenditures, data collected by the University of Oklahoma Biological Station, Kingston, Oklahoma were used. These data were collected quarterwise during 1990. First, survey cards were distributed to anglers (irrespective of whether they were striped bass or other species anglers) at six access points around Lake Texoma. Cards were distributed using a randomized process to ensure that weekdays, weekends, and holidays were represented in the sample. A total of 193 cards were returned by the anglers. Of this number, 102 were interviewed by telephone. Information was collected on 1) distance between the anglers' residence and the lake site, 2) days spent fishing (annually) at the lake for SB and all other species, 3) duration of trip, 4) hours spent fishing during last trip, 5) itemwise (sectorwise) allocation of trip expenditures, 6) proportion of total trip expenditure associated with fishing SB specie only, and 7) proportion of total trip expenditure spent within the region. One observation was incomplete on expenditure and hence was discarded.

Data on population level of angler hours was available from the Oklahoma and Texas Cooperative Creel Survey for 1990 (Appendix Table A-II). IMPLAN input-output data were available in micro computer software form. This study used micro IMPLAN Release 89-03 (version 2.0) developed by the US Forest Service. The data base was for the year 1985 but industry structure was for 1977. This study assumes no significant change in structure for the impact area between 1977 and 1990.

## Aggregation of Sectors

Micro IMPLAN contains data for 528 sectors specified under the Standard Industrial Codes. However, there were only 219 industries in the study region. Considering the pattern of expenditures made by the anglers, and based on homogeneity in the nature of industries, the 528 sectors were aggregated into the following eight sectors (See Appendix Table A-III for detail): 1) Agriculture, Forestry, and Fishery (includes live bait); 2) Manufactured - Food & Kindred Products (includes groceries, ice, beverages, etc); 3) Manufactured - Non-food Products (includes fishing tackle); 4) Hotels and Lodging Places; 5) Eating and Drinking Places; 6) Retail & Wholesale Trade (includes trade margins); 7) Transportation (includes associated travel, transport margin, vehicle repair and maintenance, fuels, etc.); and 8) Other (includes guide fees and miscellaneous.)

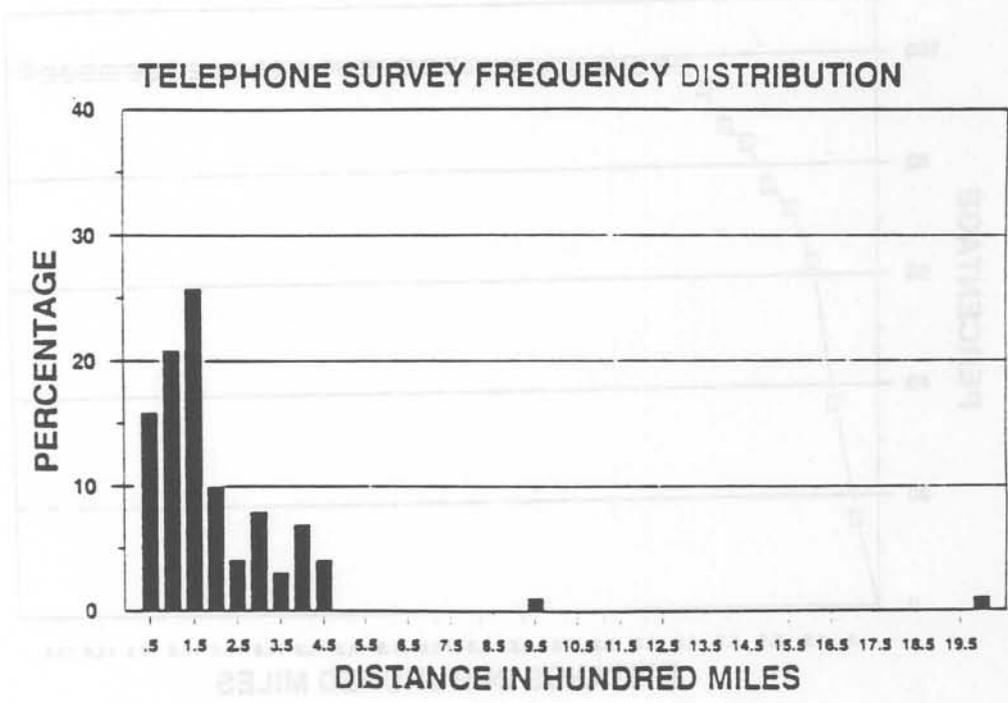
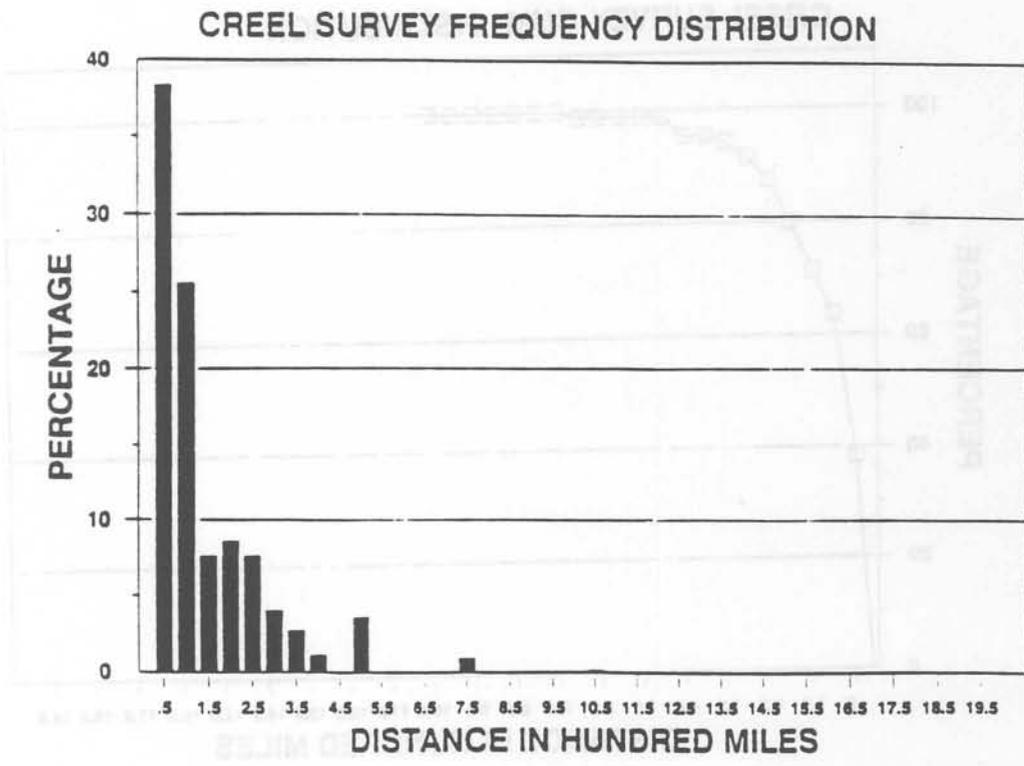
## Estimation of Per Angler Hour and Aggregate Trip Expenditures for Striped Bass and Non-Striped Bass Fishing

Aggregate expenditures by economic sector were estimated using sample data from telephone surveys and aggregate angler hours estimated from the Oklahoma and Texas Cooperative Creel Survey. The following procedures were used:

1. Using the telephone survey data the (a) average annual days fishing was estimated and divided between time spent SB and time spent NSB fishing for regional and non-regional anglers, (b) the average number of days per trip was estimated for regional and non-regional anglers, and (c) the average expenditure (occurring within the impact region and outside the region) for SB and NSB fishing per trip was estimated and by item (and economic sector) for regional and non-regional anglers.
2. The average number of hours fishing per day per angler reported by the Oklahoma and Texas Cooperative Creel Survey was multiplied by the average length (days) of trip estimated in (1) to estimate the average number of fishing hours per trip for regional and non-regional anglers.
3. The average expenditure per hour for regional and non-regional anglers and for SB and NSB fishing was estimated using the average expenditure per trip from (1) and the average number of fishing hours per trip from (2).
4. The proportion of annual angler time spent SB and NSB fishing from (1) was multiplied by the aggregate annual hours fishing reported by the Oklahoma and Texas Cooperative Creel Survey to estimate annual hours of SB and NSB fishing.
5. The aggregate expenditures for SB and NSB fishing were estimated using the aggregate hours of fishing from (4) multiplied by estimated expenditures per angler hour from (3). The results are aggregated expenditures by regional and non-regional anglers for SB and NSB fishing and by economic sector and place of expenditure (within the impact region and outside the region).

## Correcting for Sample Bias

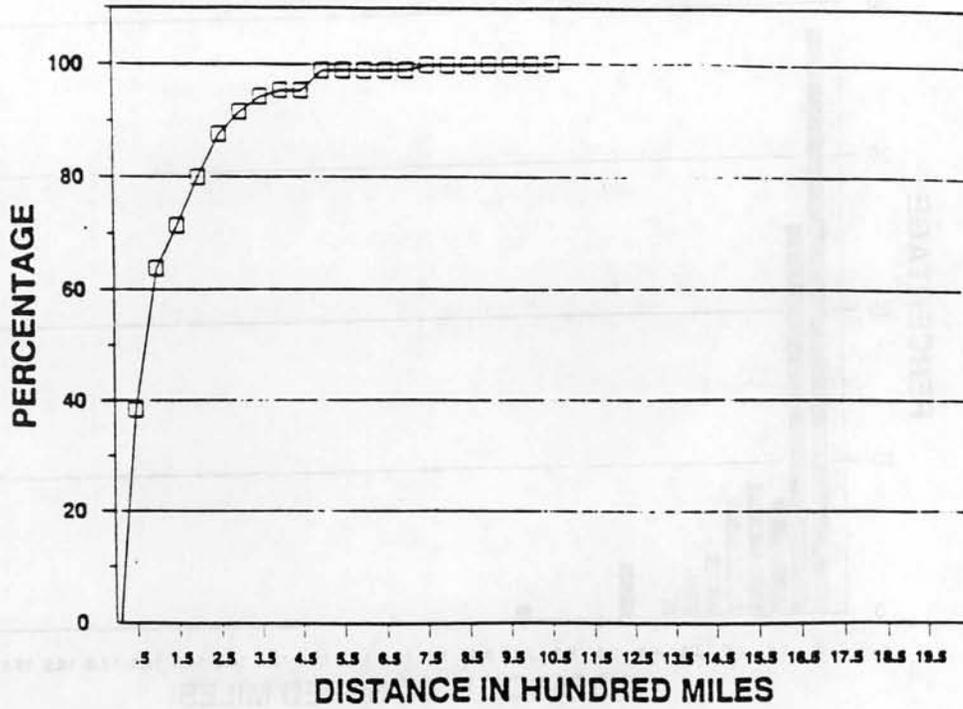
The telephone sample of anglers was compared to the more extensive creel sample taken by the Oklahoma and Texas Cooperative Creel Survey for travel distance or distance to residence. The frequency of anglers by distance to residence for the two samples is compared in Figure 1. The creel survey shows a higher frequency for anglers coming from shorter distances than does the telephone survey. For example, about 38 percent of the anglers in the creel survey are within 50 miles of the lake versus about 16 percent in the telephone survey. Figure 2 shows the cumulative distribution of anglers by distance. For example, 80 percent of the anglers in the creel survey are within 200 miles of the lake versus 72 percent for the telephone survey.



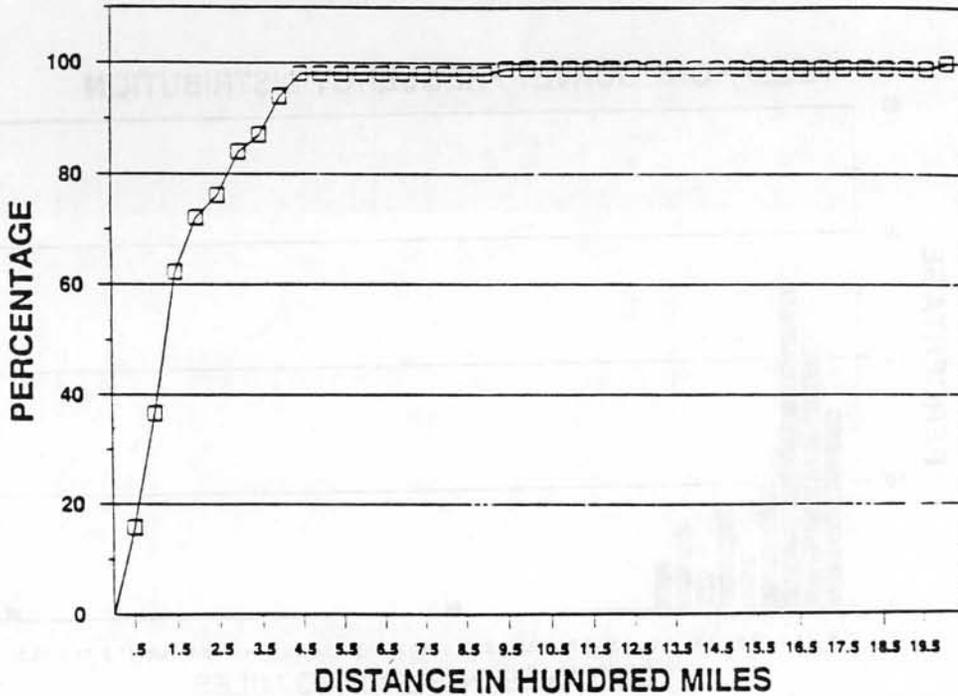
Source: Appendix Table A-IV.

**Figure 1. Comparison of Frequency Distribution for Samples of Lake Texoma Anglers by Distance to Residence.**

### CREEL SURVEY CUM. DISTRIBUTION



### TELEPHONE SURVEY CUM. DISTRIBUTION



Source: Appendix Table A-IV.

Figure 2. Comparison of Cumulative Distribution for Samples of Lake Texoma Anglers by Distance to Residence.

Because trip expenditures are highly correlated with distance travelled, results of the cumulative distribution for the creel survey were used in correcting for distance bias in estimates of aggregate expenditures given later in this report. It was felt the creel survey was more representative of the true population of Texoma anglers because of the random nature of the sample and because of the on-site interview process. The telephone sample was limited by who returned the survey cards and by nonresponse to the telephone calls.

## Margining

Trip expenditures obtained in the telephone survey and allocated to economic sectors were in purchasers' value. It was necessary to convert these to producers' value for purposes of consistency with IMPLAN data.<sup>2</sup> Thus, trade and transport margins (Appendix Table A-V) were computed for each expenditure item with the margin allocated to the appropriate retail and wholesale trade sector or transport sector. Expenditure results were expressed in producers' value when used for the impact analysis.

## Empirical Results

### Angler Characteristics

The sample of anglers was partitioned into regional (from the impact region) anglers and non-regional (from outside the impact region) anglers. From the sample of 101 anglers interviewed, 17 were regional and 84 were non-regional. Among the regional anglers, all were males while 82 percent of the non-regional anglers were males. The average age of all anglers was 44 with a standard deviation (sd) of 13.

**Income.** About two-thirds of the anglers fell within the household income range of \$25,000 - \$75,000. The percentage of anglers decreased as the income bracket decreased below \$25,000 and as it increased above \$75,000 (Table I). A higher percentage of the impact region anglers were below \$25,000 compared to anglers outside of the region.

**Table I. Percentage of Anglers by Household Income Range for Lake Texoma, 1990.**

Location of Residence	Annual Income Range (\$ 000)						Total
	<10	10-15	25-50	50-75	75-100	>100	
Regional	13	13	48	20	0	6	100
Non-Regional	0	13	32	34	14	7	100
Total	2	12	34	32	13	7	100

Source: Telephone survey.

<sup>2</sup> Most Input-Output tables are expressed in producers' value.

**Occupation.** The highest percentage of anglers was classified in the Professional occupation (19 percent) followed by Manager/Administrator (14 percent), Retired (14 percent), Sales (10 percent), and Labor/Operator (10 percent) (Table II). With increasing distance (from the lake site), number of anglers in the Professional and Manager/Administrator classes increased while the number in Sales, Labor/Operator, and Retired classes decreased.

**Table II. Anglers by Type of Occupation for Lake Texoma, 1990.**

Location of Residence	Occupation (Percent)									
	P	S	M/A	C	L/O	F	R	U	O	T
Regional	0.0	18.0	5.0	0.0	24.0	0.0	24.0	0.0	29.0	100.0
Non-Regional	23.0	8.5	13.5	5.0	9.5	0.5	12.5	0.5	27.0	100.0
Total	19.0	10.0	14.0	4.0	10.0	1.0	14.0	1.0	27.0	100.0

P = Professional  
 S = Sales  
 M/A = Manager/Administrator  
 C = Craftsman  
 L/O = Labor/Operator

F = Farmer  
 R = Retired  
 U = Unemployed  
 O = Others  
 T = Total

Source: Telephone survey.

**Distance Travelled.** The sample of anglers came from distances of less than one mile to more than 2000 miles. On an average, the one-way distance from the anglers' residence to Lake Texoma was 16.4 miles for regional anglers and 220 miles for non-regional anglers (Table III). However, the standard deviations were quite large indicating that the anglers were highly dispersed. Because one standard deviation (sd) measures the distance travelled for 66.7 percent (two-thirds) of the sample of anglers, the coefficient of variation (CV) measures the percentage dispersion from the mean for the sample of anglers.

**Table III. One-Way Travel Distance From Anglers' Residence for a Sample of Lake Texoma Anglers, 1990.**

Location of Residence	Statistic	Distance (miles)
Regional	Mean (miles)	16.4
	sd (miles)	17.3
	CV (%)	106.0
Non-regional	Mean (miles)	219.9
	sd (miles)	240.8
	CV (%)	110.0
Total	Mean (miles)	185.7
	sd (miles)	232.6
	CV (%)	125.0

Source: Telephone survey.

## Fishing Activity Characteristics

**Fishing Days.** On average, the sample of anglers spent 27.7 days fishing per year at Lake Texoma (Table IV). About 62.4 percent of the days were spent fishing for striped bass species and about 37.6 percent of the days were spent fishing for other species. Regional anglers spent 103 days fishing annually at Lake Texoma versus 12.6 days for non-regional anglers. About 52.4 percent of the days were spent fishing for striped bass by regional anglers versus 78.6 percent for non-regional anglers. The coefficient of variation, however, was much larger for non-regional anglers than for regional anglers. These results indicate that regional anglers spend significantly more days fishing per year at Lake Texoma than non-regional anglers but that non-regional anglers spend more time striped bass fishing than regional anglers.

**Table IV. Annual Fishing Days at Lake Texoma for a Sample of Anglers, 1990.**

Location of Residence	Statistic	Days Spent Fishing For					
		Striped Bass		Non-Striped Bass		Total	
		No.	%	No.	%	No.	%
Regional	Mean	54.0	52.4	49.0	47.6	103.0	100
	sd	64.8		56.4		63.7	
	CV	120.0		116.0		62.0	
Non-regional	Mean	9.9	78.6	2.7	21.4	12.6	100
	sd	16.5		6.1		17.8	
	CV	167.0		230.0		142.0	
Total	Mean	17.3	10.4	37.6	27.7	100	
	sd	34.7		29.4		45.7	
	CV	201.0		282.0		165.0	

Source: Telephone survey.

**Duration of Last Trip.** The majority (82 percent) of the regional anglers spent one day on their last trip to Lake Texoma while the majority (81 percent) of the non-regional anglers spent two or more days (Table V). About one-third of the non-regional anglers spent four or more days on their last trip to Lake Texoma.

**Table V. Frequency Distribution on Duration of Last Trip to Lake Texoma for a Sample of Anglers, 1990.**

Days	Frequency (Percent)		
	Regional Anglers	Non-regional Anglers	Total
1	82	19	29
2	6	18	16
3	6	29	25
4 or more	6	34	30
Total	100	100	100

Source: Telephone survey.

**Fishing Time.** Regional anglers spent, on average, about 5.8 hours fishing during their last trip while non-regional anglers spent about 17.4 hours (Table VI). The latter result is highly influenced by the greater number of days spent at Lake Texoma during the last trip by the non-regional anglers.

**Table VI. Hours Spent Fishing on Last Trip for a Sample of Anglers at Lake Texoma, 1990.**

Location of Residence	Statistic	Hours Spent Fishing on Last Trip for		
		Striped Bass	Other Species	Total
Regional	Mean (no.)	2.4	3.4	5.8
	sd (no.)	2.3	2.8	1.6
	CV (%)	96.0	82.0	28.0
Non-regional	Mean (no.)	14.6	2.8	17.4
	sd (no.)	25.9	6.1	26.5
	CV (%)	177.0	220.0	152.0
Total	Mean (no.)	12.6	2.9	15.4
	sd (no.)	24.1	5.7	24.5
	CV (%)	192.0	197.0	159.0

Source: Telephone survey.

Total hours spent fishing were divided between time spent fishing for striped bass versus time spent on all other species based on the percentage distribution of annual fishing days. Because information was available only on an annual basis on time spent striped bass fishing versus time spent fishing for all other species (Table IV), the individual angler percentages were applied to the data on total time spent fishing during the last trip. This distribution between striped bass fishing and non-striped bass fishing is presented in Table VI. For example, regional anglers on average spent 2.4 hours (or 41.4 percent of their time) striped bass fishing during the last trip versus 14.6 hours (or 83.9 percent) for non-regional anglers. The percentages differ slightly between Tables IV and VI because of differences between individual angler proportions of the sample for annual days versus trip hours.

### Angler Trip Expenditures

The telephone sample of anglers spent about \$ 305 per fishing trip in 1990 (Table VII). Of this amount, about 85 percent was spent within the region and about 85 percent was associated with striped bass fishing. Regional anglers spent about \$85 per trip of which 51 percent was associated with striped bass fishing and 49 percent was associated with all other fishing. Regional anglers made all of their expenditures within the region itself. Non-regional angler expenditures were about \$ 349.50 per fishing trip of which 85 percent was spent within the region and 87 percent was associated with striped bass fishing.

**Table VII. Trip Expenditures for a Sample of Anglers at Lake Texoma, 1990.**

Location of Residence	Total	Fishing Expenditures		Spent Within Region	
		Spent for		(\$)	(%)
		Striped Bass	Other Species		
	(\$)	(%)	(%)		
Regional	85.00	51.0	49.0	85.00	100.0
Non-regional	349.50	87.0	13.0	298.20	85.0
Total	305.00	85.0	15.0	262.30	85.0

Source: Telephone survey.



**Table IX. Expenditure Within Impact Region Per Hour of Striped Bass Fishing Distributed by Economic Sector for a Sample of Anglers at Lake Texoma, 1990.**

Location of Residence	Statistic	Sectors							
		1	2	3	4	5	7	8	Total
Regional	Mean (\$)	0.10	2.30	0.10	0.50	1.50	2.70	3.30	10.40
	Percent	1.3	21.7	1.0	4.4	14.4	25.5	31.9	100.0
	sd (\$)	0.50	5.90	0.40	1.80	3.50	3.50	11.20	19.20
Non-Regional	Mean (\$)	0.10	5.50	0.40	4.90	2.60	5.90	11.70	31.10
	Percent	0.4	17.8	1.2	15.8	8.5	18.9	37.5	100.0
	sd (\$)	0.30	8.90	1.10	7.50	4.00	8.10	13.40	31.90
Total	Mean (\$)	0.10	5.00	0.30	4.20	2.40	5.30	10.30	27.60
	Percent	0.4	18.1	1.2	15.1	8.8	19.3	37.1	100.0
	sd (\$)	0.40	8.60	1.00	7.10	3.90	7.60	13.40	31.10

Note: Sectors defined in Table VIII.  
Source: Telephone survey.

food and kindred products (21.7 percent), and eating and drinking establishments (14.4 percent). Non-regional anglers spent about \$31.10 within the region for every hour of time spent in fishing the striped bass specie. Of this, about one-third (37.5 percent) went to the all other sector followed by transport (18.9 percent), manufactured food and kindred products (17.8 percent), lodging (15.8 percent), and eating and drinking places (8.5 percent).

Results on expenditures per hour of non-striped bass (NSB) fishing (all other species) are presented in Table X. On average, anglers spent \$5.80 within the impact region for every hour spent on NSB fishing. Regional anglers spent more per hour of NSB fishing (\$7.20) than non-regional anglers (\$5.50). This result appears consistent with the importance of SB fishing to non-regional anglers and NSB fishing to regional anglers (see Table VI).

**Table X. Expenditures Within Impact Region Per Hour of Non-Striped Bass Fishing Distributed by Economic Sector for a Sample of Anglers at Lake Texoma, 1990.**

Location of Residence	Statistic	Sectors							
		1	2	3	4	5	7	8	Total
Regional	Mean (\$)	0.00	1.00	0.30	0.10	0.50	1.70	3.60	7.20
	Percent	0.0	14.2	3.8	1.3	7.2	23.3	50.1	100.
	sd (\$)	0.00	2.13	0.72	0.39	1.42	2.35	11.53	16.39
Non-Regional	Mean (\$)	0.10	1.10	0.10	1.30	0.70	1.50	0.80	5.50
	Percent	1.5	19.2	0.9	22.7	12.8	27.6	15.2	100.0
	sd (\$)	0.30	3.50	0.20	5.90	3.50	4.70	4.30	19.60
Total	Mean (\$)	0.10	1.10	0.10	1.10	0.70	1.50	1.30	5.80
	Percent	1.2	18.2	1.6	18.2	11.6	26.7	22.5	100.0
	sd (\$)	0.30	3.30	0.40	5.40	3.30	4.40	6.30	19.10

Note: Sectors defined in Table VIII.  
Source: Telephone survey.

**Aggregate Angler Expenditures.** The aggregate angler hours at Lake Texoma estimated by the Oklahoma and Texas Cooperative Creel Survey is 1,328,815. This number was disaggregated to anglers coming from distances of 0-60 miles, 61-250 miles, 251-500 miles, and more than 500 miles based on the creel survey results (Appendix Table A-IV). These allocated angler hours were further disaggregated to SB and NSB fishing based on telephone survey results (Table VI). Similarly, angler hour expenditures for anglers coming from the same distance groupings were estimated using telephone survey results. These results were used to estimate angler hours and aggregate angler expenditures by distance travelled for SB and NSB fishing at Lake Texoma for 1990 (Appendix Table A-VI). These aggregate expenditures were further disaggregated by economic sector and are presented in purchasers' and producers' values in Table XI.

An estimated \$25,641,000 was spent by all anglers within the region for fishing all species. Of this amount, 81.6 percent was spent by non-regional anglers and 18.4 percent was spent by regional anglers. Striped bass fishing accounted for about \$22,781,000 of which about 87 percent came from non-regional anglers and 13 percent came from regional anglers. NSB fishing accounted for about \$2,860,000 of which about 36.6 percent came from non-regional anglers and 63.4 percent came from regional anglers.

In general, the most impacted sectors (in producers' value) were other services and miscellaneous, transport, retail and wholesale trade, hotel and lodging places, food related manufacturing, and eating and drinking places.

## Economic Impact of Angler Expenditures

Economic impact of angler expenditures on the local economy was assessed in terms of a) output; b) income, c) value added, and d) employment. Impact in each case was measured in terms of multipliers and the aggregate effect of angler expenditures. The multipliers were computed for each economic sector separately using the IMPLAN data base and then a weighted multiplier was developed based on the sector distribution of angler expenditures.

**Impact on Regional Output.** Each dollar of expenditure by a Lake Texoma angler coming from within the region is expected to result directly and indirectly in an increase in impact region sector output equal to \$1.33 (Table XII). The direct increase is due to expenditures by anglers on such items as prepared foods, bait and tackle, lodging, transportation services, guide fees, and other services. Indirect effects are those associated with businesses making purchases from other businesses for purposes of providing the direct purchases by anglers. This results in a Type I output multiplier equal to 1.33 for expenditures by a Lake Texoma regional anglers. The Type III output multiplier for expenditures by the same Lake Texoma regional anglers is equal to 2.24 (Table XII).

**Table XII. Weighted Output Multipliers for Impact Region from Lake Texoma Angler Expenditures.**

Anglers	Regional		Non-regional	
	Type I	Type III	Type I	Type III
SB	1.34	2.29	1.32	2.23
NSB	1.31	2.17	1.35	2.37
Total	1.33	2.24	1.32	2.24

**Table XI. Aggregate Expenditures Within the Impact Region of Lake Texoma Anglers, 1990 (\$1,000).**

Sector	Expenditures in Purchasers' Value (SB-Anglers)			Expenditures in Producer's Value (SB-Anglers)		
	Regional	Non-regl.	Total	Regional	Non-regl.	Total
1	28	49	77	20	35	55
2	642	3601	4243	408	2286	2694
3	28	250	278	17	150	167
4	140	3111	3251	140	3111	3251
5	419	1704	2123	419	1704	2123
6	0	0	0	490	2572	3062
7	753	3681	4434	519	2552	3071
8	921	7454	8375	919	7439	8358
Total	2931	19850	22781	2932	19849	22781

Sector	Expenditures in Purchasers' Value (NSB-Anglers)			Expenditures in Producer's Value (NSB-Anglers)		
	Regional	Non-regl.	Total	Regional	Non-regl.	Total
1	0	15	15	0	11	11
2	251	204	455	159	130	289
3	75	15	90	45	9	54
4	25	212	237	25	212	237
5	126	141	267	126	141	267
6	0	0	0	259	177	436
7	427	291	718	292	199	491
8	904	173	1077	902	173	1075
Total	1808	1051	2859	1808	1052	2860

Sector	Expenditures in Purchasers' Value (All-Anglers)			Expenditures in Producer's Value (All-Anglers)		
	Regional	Non-regl.	Total	Regional	Non-regl.	Total
1	28	64	92	20	46	66
2	893	3805	4698	567	2416	2983
3	103	265	368	62	159	221
4	165	3323	3488	165	3323	3488
5	545	1845	2390	545	1845	2390
6	0	0	0	749	2749	3498
7	1180	3972	5152	811	2751	3562
8	1825	7627	9452	1821	7612	9433
Total	4739	20901	25640	4740	20901	25641

Source: Appendix Table A-VI. Economic sector distributions based on Tables IX and X.

The differences in magnitude of the output multipliers for expenditures by regional versus non-regional anglers and for striped bass fishing versus non-striped bass fishing are associated with differences in regional economic sector interdependencies among expenditures. For example, expenditures by regional striped bass anglers are marginally associated with more sector interdependence than expenditures by non-regional striped bass anglers (Type I multipliers of 1.34 versus 1.32, respectively). Expenditures by regional anglers for striped bass fishing are marginally associated with more sector interdependence than expenditures for non-striped bass fishing (Type I multipliers of 1.34 versus 1.31, respectively). However, the reverse is the case for non-regional anglers (Type I multipliers of 1.32 versus 1.35).

Significant differences, however, do exist between the Type I and Type III multipliers because Type III multipliers include the interdependence of household expenditures (Alward et al. and Miller and Blair). In general, the Type III multiplier results are used to capture more of the expected total impact of an exogenous regional effect such as expenditures by non-regional anglers.

Aggregate effects of Lake Texoma angler expenditures on economic sector output for the impact region are summarized in Table XIII by type of fishing (SB and NSB), by residential location of anglers (regional and non-regional), and by type of impact (Type I multiplier and Type III multiplier). Aggregate angler expenditures are classified in column (1) and show that of the estimated \$25,640,000 angler expenditures, \$22,779,000 (89 percent) was associated with SB fishing and \$20,902,000 (82 percent) was associated with non-regional anglers.

**Table XIII. Aggregate Effect of Lake Texoma Angler Expenditures on Impact Region Output, 1990.**

Anglers	Aggregate Expenditures (\$1,000)	Direct and Indirect Effect		Direct, Indirect, and Induced Effect	
		Type I Multiplier	Output (\$1,000)	Type III Multiplier	Output (\$1,000)
	(1)	(2)	(3)	(4)	(5)
Striped Bass					
Regional	2,930	1.34	3,926	2.29	6,710
Non-Regional	<u>19,849</u>	<u>1.32</u>	<u>26,201</u>	<u>2.23</u>	<u>44,263</u>
Total	22,779	1.32	30,127	2.24	50,973
Non-Striped Bass					
Regional	1,808	1.31	2,368	2.17	3,923
Non-Regional	<u>1,053</u>	<u>1.35</u>	<u>1,422</u>	<u>2.37</u>	<u>2,496</u>
Total	2,861	1.32	3,790	2.24	6,419
Total					
Regional	4,738	1.33	6,294	2.24	10,633
Non-Regional	<u>20,902</u>	<u>1.32</u>	<u>27,623</u>	<u>2.24</u>	<u>46,759</u>
Total	25,640	1.32	33,917	2.24	57,392

Type I multipliers are classified in column (2) and direct and indirect effects of angler expenditures on impact region sector outputs are classified in column (3). Type I output effects of angler expenditures for SB fishing were about \$30,127,000 of which 87 percent was associated with non-regional anglers. Type I output effects associated with NSB fishing expenditures were about \$3,790,000. Total impact region output effects associated with angler expenditures was \$33,917,000.

Type III multipliers are classified in column (4) and direct, indirect, and induced effects of angler expenditures on impact region sector outputs are classified in column (5). Total impact region sector output associated with Lake Texoma angler expenditures was estimated at \$57,392,000 of which \$50,973,000 (89 percent) was associated with SB fishing and \$46,759,000 (81 percent) was associated with non-regional anglers.

**Impact on Regional Income.** Expenditures by anglers were converted into direct income to the region by multiplying sectorwise angler expenditures by the corresponding income coefficients. The resulting income (employee compensation, proprietary income, other property income) was multiplied by Type I and Type III income multipliers to compute a weighted income multiplier for the region. Weighted Type I and Type III income multipliers classified by type of angler are given in Table XIV.

Aggregate effects of Lake Texoma angler expenditures on impact region income in 1990 are summarized in Table XIV. Direct income resulting from SB fishing expenditures is equal to \$ 10,821,000 of which \$ 9,539,000 (88 percent) is from non-regional anglers. Direct Income resulting from NSB fishing expenditures is equal to \$ 1,335,000 of which \$ 881,000 (66 percent) is from regional anglers. Total region direct income resulting from all Lake Texoma angler expenditures is equal to \$ 12,156,000 of which about \$ 9,993,000 (82 percent) is from non-regional anglers.

**Table XIV. Aggregate Effect of Lake Texoma Angler Expenditures on Impact Region Income, 1990.**

Anglers	Direct Income (\$1,000)	Direct and Indirect Effect		Direct, Indirect, and Induced Effect Income	
		Type I Multipliers	Income (\$1,000)	Type III Multiplier	(\$1,000)
	(1)	(2)	(3)	(4)	(5)
Striped Bass					
Regional	1,282	1.36	1,744	1.78	2,282
Non-Regional	<u>9,539</u>	<u>1.31</u>	<u>12,496</u>	<u>1.71</u>	<u>16,312</u>
Total	10,821	1.32	14,240	1.72	18,594
Non-Striped Bass					
Regional	881	1.31	1,154	1.66	1,462
Non-Regional	<u>454</u>	<u>1.39</u>	<u>631</u>	<u>1.85</u>	<u>840</u>
Total	1,335	1.34	1,785	1.72	2,302
Total					
Regional	2,163	1.34	2,898	1.73	3,744
Non-Regional	<u>9,993</u>	<u>1.31</u>	<u>13,127</u>	<u>1.72</u>	<u>17,152</u>
Total	12,156	1.32	16,025	1.72	20,896

Aggregate total regional income impact ranges from \$ 16,025,000 when including the direct and indirect effects to \$ 20,896,000 when including the direct, indirect, and induced effects. Of the latter, \$ 18,594,000 (89 percent) is associated with striped bass fishing and \$ 17,152,000 (82 percent) is associated with non-regional anglers. Clearly, non-regional anglers fishing the striped bass specie are important in contributing to impact region income-accounting for \$ 16,312,000 of regional income.

**Impact on Regional Value Added.** Industry value added includes employee compensation, proprietary income, other property income, and indirect business taxes. Of all expenditures by regional and non-regional anglers, 51.4 percent and 53.2 percent, respectively, were direct contributions to regional value

added. Weighted value added multipliers by type of angler are summarized in Table XV and are similar to the income multipliers presented in Table XIV.

Aggregate direct value added in the impact region from all Lake Texoma anglers was about \$13,560,000 in 1990 (Table XV). Of this amount, about \$ 12,065,000 (89 percent) was contributed through striped bass fishing expenditures and about \$11,125,000 (82 percent) was contributed by non-regional anglers fishing for both SB and NSB. The total regional impact on value added from angler expenditures ranges from \$ 17,842,000 for Type I effects to \$ 23,273,000 for Type II effects.

**Impact on Regional Employment.** Weighted employment multipliers were estimated from the IMPLAN data base to represent Lake Texoma angler expenditures (Table XVI). Type I and Type III employment multipliers for total regional angler expenditures were estimated at 1.29 and 1.71, respectively. These multipliers indicate that for each job created in the impact region from regional angler expenditures, the total direct and indirect impact was 1.29 jobs and the total direct, indirect, and induced impact was 1.71 jobs. Similar interpretations hold for the employment multipliers associated with non-regional angler expenditures and for expenditures disaggregated for striped bass fishing and for non-striped bass fishing.

Fixed employment-output ratios from IMPLAN were used to estimate the direct number of jobs created for each million dollars of sector output in the impact region. These ratios were then used to estimate the number of direct jobs associated with angler expenditures within the impact region (Table XVI). Regional angler expenditures were directly associated with 70.4 jobs and non-regional angler expenditures were associated with 346.7 jobs. Expenditures for striped bass fishing in 1990 were associated with 373 jobs and expenditures for non-striped bass fishing were associated with 44.1 jobs.

**Table XV. Aggregate Effect of Lake Texoma Angler Expenditures on Impact Region Value Added, 1990.**

Anglers	Direct Value Added (\$1,000)	Direct and Indirect Effect		Direct, Indirect, and Induced Effect	
		Type I Multiplier	Value Added (\$1,000)	Type III Multiplier	Value Added (\$1,000)
<b>Striped Bass</b>					
Regional	1,457	1.35	1,967	1.76	2,564
Non-Regional	<u>10,608</u>	<u>1.31</u>	<u>13,896</u>	<u>1.71</u>	<u>18,140</u>
Total	12,065	1.31	15,863	1.72	20,704
<b>Non-Striped Bass</b>					
Regional	978	1.30	1,271	1.66	1,623
Non-Regional	<u>517</u>	<u>1.37</u>	<u>708</u>	<u>1.83</u>	<u>946</u>
Total	1,495	1.32	1,979	1.72	2,569
<b>Total</b>					
Regional	2,435	1.33	3,238	1.72	4,187
Non-Regional	<u>11,125</u>	<u>1.31</u>	<u>14,604</u>	<u>1.72</u>	<u>19,086</u>
Total	13,560	1.32	17,842	1.72	23,273

Total direct and indirect impact of Lake Texoma angler expenditures was associated with 535 jobs of which 478.3 (89 percent) were associated with striped bass fishing and 444.3 (83 percent) were associated with non-regional anglers. Total direct, indirect, and induced impact of Lake Texoma angler expenditures was associated with 718.4 jobs of which 565 (79 percent) were associated with non-regional angler striped bass fishing.

**Table XVI. Aggregate Effect of Lake Texoma Angler Expenditures on Impact Region Employment, 1990.**

Anglers	Direct Employment	Direct and Indirect Effect		Direct, Indirect, and Induced Effect	
		Type I Multiplier	Employment	Type III Multiplier	Employment
<b>Striped Bass</b>					
Regional	44.5	1.30	57.8	1.75	77.9
Non-Regional	<u>328.5</u>	<u>1.28</u>	<u>420.5</u>	<u>1.72</u>	<u>565.0</u>
Total	373.0	1.28	478.3	1.72	642.9
<b>Non-Striped Bass</b>					
Regional	25.9	1.27	32.9	1.65	42.7
Non-Regional	<u>18.2</u>	<u>1.31</u>	<u>23.8</u>	<u>1.80</u>	<u>32.8</u>
Total	44.1	1.29	56.7	1.71	75.5
<b>Total</b>					
Regional	70.4	1.29	90.7	1.71	120.6
Non-Regional	<u>346.7</u>	<u>1.28</u>	<u>444.3</u>	<u>1.72</u>	<u>597.8</u>
Total	417.1	1.28	535.0	1.72	718.4

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**Appendix Table A-I. Visitor Days at Lake Texoma, 1973-1990.**

Year	No. of Visitor Days
1973	10,432,900
1974	10,693,300
1975	10,906,000
1976	11,046,100
1977	11,322,400
1978	11,615,800
1979	11,455,100
1980	12,780,200
1981	12,400,100
1982	10,679,600
1983	9,768,200
1984	8,324,300
1985	8,683,500
1986	8,479,100
1987	8,835,100
1988*	5,898,000
1989*	4,751,000
1990*	4,558,600

Source: U. S. Army Corps of Engineers.

\* Different estimation techniques used.  
Not comparable with the previous years.

**Appendix Table A-II. Data on Lake Texoma Anglers, 1988-1990**

Item	Unit	1988	1989	1990
Parties	No.	266,533	205,240	181,459
Fishermen	No.	647,820	472,297	415,128
Angler Hours	Hours	2,061,537	1,416,733	1,328,815
Av Fishg Hr/Day	Hours	3.18	3.00	3.20

Source: Oklahoma and Texas Cooperative Creel Survey.

Appendix Table A-III. Sector Classification for this Study.

No.	Sector Description	IMPLAN Sector No. <sup>1/</sup>	Questionnaire Description <sup>2/</sup>
1.	Agriculture, Forestry and Fishery	1- 25	Live bait
2.	Manufacturing-Food and and Kindred Products	82-130	Food, food products, beverages, ice, etc.
3.	Manufacturing-Non-food Products	76- 81 131-234 238-445	Fishing tackle
4.	Hotels and Lodging Places	471	Lodging costs
5.	Eating and Drinking Places	491	Restaurant meals
6.	Retail and Wholesale Trade	460-463	Trade margins
7.	Transportation	235-237 446-453 492-494	Transportation costs, boat launching fees, boat storage and maintenance, fuel
8.	All Other	26- 75 454-459 464-470 472-490 495-528	Misc., guide fees, equip. rental

<sup>1/</sup> Alward et al. 1989. Micro IMPLAN Software Manual. Colorado State University, Fort Collins, Colorado.

<sup>2/</sup> Telephone Survey Instrument, University of Oklahoma Biological Station, Kingston, Oklahoma.

Appendix Table A-IV. Frequency of Anglers by Distance for Telephone and Creel Surveys

TELEPHONE SURVEY DATA <sup>1/</sup>			CREEL SURVEY DATA <sup>2/</sup>		
Distance Interval (miles)	Freqcy Distn. (Percent)	Cum. Freq Distn. (Percent)	Distance Interval (miles)	Freqcy Distn. (Percent)	Cum. Freq Distn. (Percent)
0 - 50	15.8	15.8	0 - 50	38.3	38.3
51 - 100	20.8	36.6	51 - 100	25.5	63.8
101 - 150	25.7	62.3	101 - 150	7.6	71.4
151 - 200	9.9	72.2	151 - 200	8.6	80.0
201 - 250	4.0	76.2	201 - 250	7.6	87.6
251 - 300	7.9	84.1	251 - 300	4.0	91.6
301 - 350	3.0	87.1	301 - 350	2.7	94.3
351 - 400	6.9	94.0	351 - 500	1.1	95.4
401 - 450	4.0	98.0	401 - 450	0.0	95.4
451 - 500	0.0	98.0	451 - 500	3.6	99.0
501 - 550	0.0	98.0	501 - 550	0.0	99.0
551 - 600	0.0	98.0	551 - 600	0.0	99.0
601 - 650	0.0	98.0	601 - 650	0.0	99.0
651 - 700	0.0	98.0	651 - 700	0.0	99.0
701 - 750	0.0	98.0	701 - 750	0.9	99.9
751 - 800	0.0	98.0	751 - 800	0.0	99.9
801 - 850	0.0	98.0	801 - 850	0.0	99.9
851 - 900	0.0	98.0	851 - 900	0.0	99.9
901 - 950	1.0	99.0	901 - 950	0.0	99.9
951 - 1000	0.0	99.0	951 - 1000	0.0	99.9
1051 - 1100	0.0	99.0	1001 - 1050	0.1	100.0
1101 - 1150	0.0	99.0			
1151 - 1200	0.0	99.0			
1201 - 1250	0.0	99.0			
1251 - 1300	0.0	99.0			
1301 - 1350	0.0	99.0			
1351 - 1400	0.0	99.0			
1401 - 1450	0.0	99.0			
1451 - 1500	0.0	99.0			
1501 - 1550	0.0	99.0			
1551 - 1600	0.0	99.0			
1601 - 1650	0.0	99.0			
1651 - 1700	0.0	99.0			
1701 - 1750	0.0	99.0			
1751 - 1800	0.0	99.0			
1801 - 1850	0.0	99.0			
1851 - 1900	0.0	99.0			
1901 - 1950	0.0	99.0			
1951 - 2000	1.0	100.0			
Total	100.0			100.0	

<sup>1/</sup> Oklahoma University, Biological Station, Kingston.

<sup>2/</sup> Oklahoma and Texas Cooperative Creel Survey.

**Appendix Table A-V. Trade and Transport Margins by Economic Sector**

Sector	Expenditure (\$)	Trade Margin (\$)	Transport Margin (\$)
1	1.000	0.2424	0.0411
2	1.000	0.3340	0.0310
3	1.000	0.3793	0.0202
4	1.000	0.0000	0.0000
5	1.000	0.0000	0.0000
6	1.000	0.0000	0.0000
7	1.000	0.3422	0.0349
8	1.000	0.0004	0.0016

Source: Estimated by aggregation from Scheppach, R. C. (1972).

**Appendix Table A-VI. Estimated Angler Hours and Aggregate Angler Expenditures by Distance Travelled for Striped Bass and Non-Striped Bass Fishing at Lake Texoma, 1990.**

(a) Angler Hours by Distance Travelled

Distance (Miles) (1)	No. of Angler Days Per Year <sup>1/</sup> (2)	Av. Fishing Hours Per Day <sup>2/</sup> (3)	Total Sample Hours (4)=(2)*(3)	Total Angler Hours (5) = (4)*F6
0 - 60	411	3.2	1315.2	530236
60 - 250	491	3.2	1571.2	633445
250 - 500	118	3.2	377.6	152233
> 500	<u>10</u>	<u>3.2</u>	<u>32.0</u>	<u>12901</u>
Total	1030	3.2	3296.0	1328815 <sup>2/</sup>

Note: F6 = 1328815 / 3296

(b) Angler Hours and Expenditures Associated With Striped Bass Fishing

Distance (Miles)	SB Factor <sup>3/</sup> (6)	SB Associated Angler Hours (7) = (5)*(6)	Expend- -iture Per Angler Hr. <sup>4/</sup> (\$) (8)	Total Expend- -itures (\$) (9)=(7)*(8)
0 - 60	0.5263	279063	10.40	2902255
60 - 250	0.7586	480531	32.40	15569204
250 - 500	0.9268	141089	30.10	4246809
> 500	<u>0.8334</u>	<u>10752</u>	<u>3.10</u>	<u>33331</u>
Total	0.6859	911436	24.96	22751599

(c) Angler Hours and Expenditures Associated With Non-Striped Bass Fishing

Distance (Miles)	NSB Factor <sup>3/</sup> (10)	NSB Associated Angler Hours (11) = (5)*(10)	Expend- -iture Per Angler Hr. <sup>4/</sup> (\$) (12)	Total Expend- -itures (\$) (13)=(11)*(12)
0 - 60	0.4737	251173	7.20	1808446
60 - 250	0.2414	152914	6.60	1009232
250 - 500	0.0732	11144	2.00	22288
> 500	<u>0.1666</u>	<u>2149</u>	<u>9.90</u>	<u>21275</u>
Total	0.3141	417379	6.86	2861239

<sup>1/</sup> Creel survey by the Oklahoma and Texas Cooperative Creel Survey Department, 1990.

<sup>2/</sup> Annual Report of Oklahoma and Texas Cooperative Creel Survey, 1990.

<sup>3/</sup> Telephone survey, 1990 (See Table IV).

<sup>4/</sup> Telephone survey.

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