

## **GUADALUPE ESTUARY**

### **ECONOMIC IMPACTS OF RECREATIONAL ACTIVITIES AND COMMERCIAL FISHING**

Prepared for the  
**TEXAS WATER DEVELOPMENT BOARD**

by

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March, 1998

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## **Guadalupe Estuary: Economic Impact of Recreational Activities and Commercial Fishing**

### **I. Introduction**

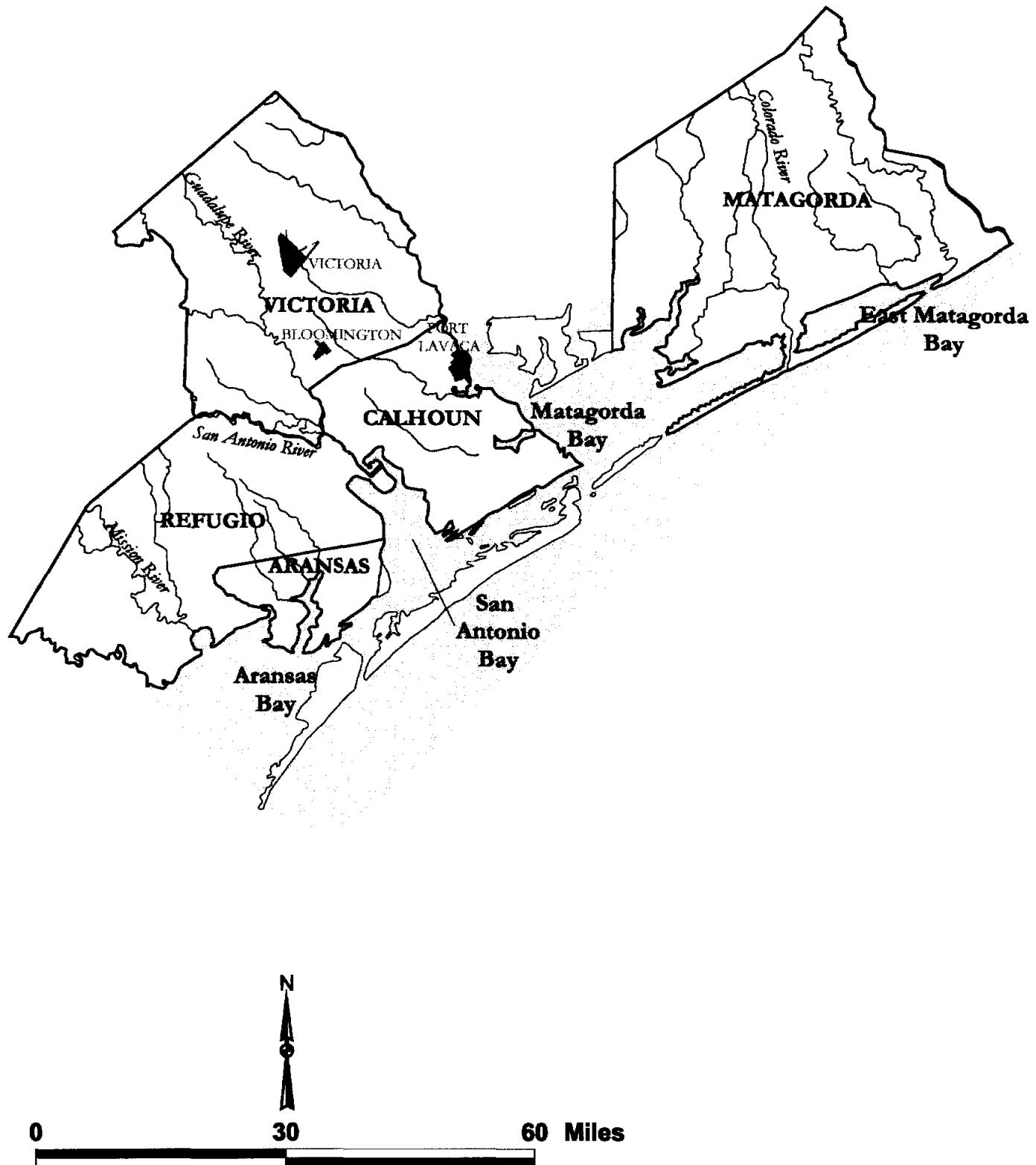
The primary objective of this study is to estimate regional and statewide economic impacts of estuarine dependent activities that generate income and employment in the Guadalupe estuary region. These include water-related recreational activities (travelers spend money in different sectors in the region) as well as the commercial fishing industry. Estimation of economic impacts of these uses of the bays and estuaries is crucial for sound water resource management. This study updates an earlier study (Fesenmaier et al., 1987) that estimated economic impacts of recreational activities and commercial fishing for six estuaries along the Texas Gulf Coast.

This report is one of six reports that provide estimates of the economic impacts of bay and estuarine dependent recreational activities and commercial fishing. Together these six reports provide regional and statewide economic impact estimates for the Texas Gulf Coast (Tanyeri-Abur et al., Economic Impact of Recreational Activities and Commercial Fishing, (1997a to 1997f).

The Guadalupe Estuary includes Calhoun, Matagorda, Victoria, and Refugio counties (Figure I.1). In 1995, population in the area was 159,701. The 1993-1995 average employment was 55,526 and average wages paid were about \$974 million (Table I.1). Most travel to the area is non water-related recreation and business, and the commercial fishing industry is the largest of all estuaries. The Guadalupe estuary region includes the San Antonio bay system which accounts for about 8.4 percent in value of all

Figure I.1. Guadalupe estuary region

## Guadalupe Region



shrimp landings in Texas bay systems. The San Antonio bay system landings of blue crab represent about 25 percent of all Texas bay system landings (Robinson, et al., 1996).

Table I.1. Average quarterly wage and employment in the Guadalupe estuary region, 1993-1995.

Year	Wage	Employment
	(\$millions)	(Jobs)
1993	927.38	54,391
1994	980.51	56,025
1995	1013.19	56,162
3-Year Average	973.69	55,526

Source: Texas Workforce Commission (TWC)

Total travel expenditure, payroll, and employment for the Guadalupe estuary in 1995 are given in Table I.2. These figures include business and leisure travel expenditures spent within the area for all kinds of business and leisure activities including bay and estuary related recreation. Total travel expenditures in the region were \$154.8 million in 1995. Travel expenditures are lowest in Refugio county and highest in Victoria county with about one third of all travel expenditures in the region. About 800 of the total 2,300 jobs in travel related sectors in the Guadalupe estuary region are in Victoria county. (Table I.2).

**Table I.2. Travel expenditures, payroll, and employment in the Guadalupe estuary region, 1995.**

County	Travel Expenditures	Travel Payroll	Employment
	(\$millions)	(\$millions)	(jobs)
Aransas	44.3	8.81	680
Calhoun	25.77	4.82	350
Matagorda	30.86	5.46	400
Victoria	4.5	0.75	60
Refugio	49.34	11.35	800
Total	154.77	31.19	2,290

Source: TDOC, 1996

## **II. Methodology**

In the 1987 Fesenmaier study a 1979 Texas Input-Output model was updated and used to estimate economic impacts. The Texas model is no longer available in a current and regional format. The model used in the present analysis is IMPLAN, a large computer algorithm of a system of equations, each representing a sector of the economy and identifying the interrelationships among sectors (Olsen, et al., 1993). The system shows the interdependence of all sectors of the economy by capturing the intermediate sales among sectors, as well as sales to households, exports and other components of final demand. Using IMPLAN, input-output models may be developed for any county in the US or, by aggregation within the database, any group of counties to form a regional impact analysis. The input-output models, developed for each estuary, use the direct

impact estimates from each of the bay related economic sectors as a starting point for estimating total economic impacts.

In the 1987 Fesenmaier study, an extensive survey was conducted to estimate direct impacts of estuarine dependent recreational activities. No survey was conducted for the present analysis. Instead, expenditure and recreational activity data provided by the Texas Department of Commerce (TDOC) along with updated information from the 1987 survey were used to estimate direct impacts of recreational activities in the region. The TDOC data include a travel survey conducted by D.K.Shifflett and Associates Ltd. (D.K.S.&A Ltd.) along with total travel expenditures from 1987 to 1995 by county compiled by the TDOC. The D. K. S & A. Ltd. survey is by Metropolitan Statistical Area (MSA) or Designated Market Area (DMA). In this study the MSA's were used because the counties included in the MSA's provided the best correspondence with the counties included in the estuary region. The Victoria MSA data were used for travel expenditure breakdowns and share of business and leisure travel. Direct impacts of commercial fishing was estimated using data from the Texas Parks and Wildlife Department (TPWD), and the National Marine Fisheries Service (NMFS).

The input-output model calculates multipliers, which show the impact of an increase in the output of one sector on other sectors. Direct impacts estimated for each activity are then multiplied by these multipliers to estimate total impacts. There are several multipliers depending on the economic variable of interest:

- 1) The output multiplier which is an estimate of the change in total output (business sales) by all sectors within the regional economy that results from a change in sales to final demand by one particular sector in the economy.

2) The employment multiplier which estimates the change in total employment (all jobs) throughout the regional economy that results from a change in sales to final demand by a given sector.

3) The total income multiplier which is an estimate of the change in total household income from all sources (wages, salaries, profits, and rents) resulting from a change in sales to final demand of a given sector.

4) The value-added multiplier which is an estimate of the change in total, regional economic returns from the employment of all resources of production in the economy from a change in sales to final demand by a given sector. Value-added is the same as the value of all goods and services produced within the study area. It is analogous to Gross Domestic Product as reported at the national level. Hence, value-added within a region may be referred to as Gross Regional Product.

Multiplier estimates are expressed as the impact on a selected economic variable of a one-dollar change in final demand. It is assumed that the functional relationship to final demand is linear so the multiplier may be used to estimate the impact of larger sales to final demand by any given sector in the economy.

The notion of multipliers rests on the difference between the initial effect of a change in final demand and total effects of that change. Total effects can be defined as the sum of direct and indirect effects (which does not include the effects generated by the increase in household incomes) or direct, indirect, and induced effects (which includes the effect of increased household incomes on the economy) (Miller and Blair, 1985). Impact estimates in this study include the effect of increased household incomes along with direct and indirect impacts.

Like any economic model, input-output analysis is limited by its assumptions and by the accuracy of the endogenous equations, as well as the data on exogenous variables that drive the model. Input-output analysis is limited by several assumptions, which include: (1) categorization of individual firms by their primary products, (2) the linearity of all equations in the model, (3) the assumption of proportionality of output to inputs, and (4) fixed prices and technology.

Input-output analysis is also limited in terms of the use and interpretation of its results. In some cases, attempts are made to use input-output results as a means of evaluating and justifying public, or private, expenditures on projects. That is, the results are used as benefit-cost assessments. These uses of input-output models are incorrect. Input-output models are limited to providing information on secondary impacts of some economic activity. While this is most useful for planning purposes, it does not answer questions as to the feasibility or justification of the activity itself. Those questions are best answered using cost-benefit analysis.

Results of the study are presented in terms of total output, income, value-added, and employment impacts both at the regional and state levels. Multipliers and detailed impacts are presented in Appendices II and III.

### **III. Recreation and Tourism**

#### **III.1. Estimation of Direct Impacts**

Recreation and tourism related activities provide economic benefits to the economy of the region where these activities occur as well as throughout Texas. These economic impacts can be classified into direct and secondary impacts. Impacts on a regional or state

economy are typically indicated by total output value, employment, or total income resulting from sales to final demand by a given sector of the economy. Estimation of economic impacts for recreational activities is not so straightforward since the direct impacts (expenditures) are not organized within an economic sector but may be distributed over several sectors of the economy. Recreational activities such as boating, fishing, birdwatching, and others do not have immediately measurable economic values such as sales or payrolls. However, contribution to local businesses is significant as participants in these activities generate local income by recreational spending. Direct impacts for recreational activities are represented by estimated total expenditures by leisure travelers. These direct impacts also have secondary impacts on regional and state economies. To estimate secondary impacts of these activities, direct expenditures are allocated to the sectors in which money is spent, according to the Standard Industrial Classification (SIC), to match up with the input-output model. Secondary impacts are estimated to be the direct recreational expenditures multiplied by the input-output multiplier.

Since no survey was conducted for this study, the choice of methodology for estimation of direct impacts was dictated by availability of data and a desire for a consistent methodology for all six estuaries. An estimate of total expenditures by leisure travelers participating in water-related activities was obtained by using direct impact estimates from the 1987 Fesenmaier survey and projecting them to 1995. Projections were made using a trend function developed from total expenditure data from TDOC for the period 1987-1995 (Table III.1).

Table III.1 Total travel expenditures for the Guadalupe Estuary, 1987-1995.

Year	Expenditures (\$millions)
1987	136.63
1988	110.21
1989	86.23
1990	125.16
1991	138.42
1992	144.05
1993	145.33
1994	151.16
1995	154.77

Source: Texas Department of Commerce, 1996.

Total travel expenditures were regressed using a trend function defined as:

$$X = b m^t$$

Where:

$X$  = total travel expenditures

$b$  = constant

$m$  = growth rate

$t$  = years

The estimate for  $m$ , the growth rate, was 1.04 for the Guadalupe estuary, which represents an increase in expenditures of about 4 percent per year during the period. Assuming expenditures for water-related activities increased at the same rate, the 1987 estimate from the Fesenmaier study was used as a base and total expenditures by leisure

travelers participating in water-related activities were projected for 1995 (see Appendix I). These expenditures were estimated as \$6.94 million for the Guadalupe estuary compared to \$4.89 million in 1987, an increase of about 42 percent during the period.

These changes in expenditures include inflation that occurred during the 1987 through 1995 period. An alternate projection was also made of recreational expenditures discounted for annual inflation using the Consumer Price Index. This projection more nearly estimates the real increase in expenditures that result from either more visitors or greater spending by the same number of visitors. In real terms, 1995 expenditures were estimated to be \$4.90 million. Hence, in real terms, recreational expenditures in the Guadalupe estuary region showed little change.

Direct impacts of water-related recreational activities by economic sector in the study area were estimated using average daily expenditure shares from D.K.S.&A Ltd (Table III. 2). The assumption is made here that the distribution of water-related expenditures to the various sectors is the same as that for all leisure travel. Expenditures by sector were then allocated to the corresponding sector in the input-output model for the purpose of estimating secondary impacts (Table III.3).

Table III.2. Distribution of leisure expenditures per person per day, Victoria MSA, 1995

Travel Expenditures		
Expenditure Category	\$/ person/ day	% of total
Transport	16.2	0.25
Lodging	8.9	0.13
Food	17.3	0.26
Shopping	4.8	0.07
Entertainment	1.4	0.02
Other	17.5	0.26
Total	66.1	1

Source: D.K.S.&A Ltd., 1996

Visitors to the area for all leisure purposes spent approximately \$66.1 per person per day in the Victoria MSA in 1995 (Table III.2). Out of this total, the majority of daily expenditures were for transportation and food. Using shares of each expenditure category, total regional expenditures were allocated to the major expenditure categories. Expenditures in these categories were then allocated to appropriate sectors that are represented by SIC's to be used in the input-output model to estimate secondary impacts. The allocation of estimated 1995 direct recreational expenditures (\$6.94 million) to Guadalupe regional economic sectors is shown in Table III.3.

**Table III.3. Direct Impacts of bay and estuary recreation related sectors in the Guadalupe estuary region.**

Expenditure category	Total (\$millions)	Corresponding Regional Economic Sector
Transport	1.70	Gas Service Stations
Lodging	0.93	Hotels and Motels
Food	1.82	Restaurants and Food Stores
Entertainment	0.50	Amusement, Theaters,etc
Other	0.15	Miscellaneous Retail
Shopping	1.84	Miscellaneous Retail
<b>TOTAL</b>	<b>6.94</b>	

Source: Estimated from D.K.S.&A Ltd. and TDOC.

It is estimated that leisure travelers participating in water-related activities spent \$1.7 million in the region for transportation, and about \$1.8 million for food related purchases (food restaurants and stores). Other businesses impacted by direct expenditures include hotels and motels, amusement services, and miscellaneous retail (Table III.3).

### **III.2. Visitation patterns and trends**

Total number of leisure visitor days to the Guadalupe estuary were estimated using projected 1995 expenditures and data on daily expenditures by travelers from the D.K.S.&A Ltd. survey. Total leisure travel expenditures for the Guadalupe estuary in 1995 were \$6.94 million and travelers spent \$66.1 per person per day, on average.

Dividing total expenditures by per-person expenditures yields an estimated average of 104,992 annual visits for bay and estuary related recreation activities in 1995.

### **III.3. Regional and Statewide Impacts**

Estimated direct impacts presented in Table III.3 provide the basis for estimating total economic impacts of recreation related sectors in the Guadalupe estuary region. Sales to recreational travelers participating in water-related activities by these sectors constitute initial impacts that stimulate demand for goods and services from other sectors of the economy through secondary and tertiary rounds of market exchanges. This "ripple effect" in the regional economy leads to a total impact larger than original sales transactions. The input-output model used in this study provides a methodology by which these successive rounds of impacts are aggregated into a total for regional and state economies (Leontief).

Estimated impacts of recreation related economic activities in the Guadalupe estuary region are presented in Table III.4. Estimates of total impacts are given for total regional output, personal income, value-added, and employment for each of the six recreation related economic sectors. These are calculated using economic impact multipliers for the Guadalupe estuary region given in Appendix II. It is estimated in total, that these sectors' sales to final demand stimulated total regional business sales of over \$10.8 million, personal income of \$4.26 million, value-added of \$68.3 million and 275 jobs in the Guadalupe region (Table III.4).

Employment, personal income, and value-added are the most useful economic variables to use in comparing the relative contribution of bay and estuary recreation

related sectors. Output or total regional business sales is a less desirable variable because it includes double counting of sales of products as they move through the production, processing, and marketing system.

Table III.4. Regional and statewide impacts of water-related recreational activities in the Guadalupe estuary region, 1995.

Total Impacts		
Economic Impact		
Variable	Regional	State
Direct Impact (\$ mil)	6.94	6.94 <sup>a</sup>
Output (\$ mil)	10.81	13.3
Personal Income(\$ mil)	4.26	5.41
Value-Added (\$ mil)	6.83	8.38
Employment (jobs)	275	283

a/ State level economic impacts are derived from regional direct expenditures. They are generally larger in magnitude because they include secondary and tertiary impacts that occur outside the Guadalupe estuary region, but within the state.

Statewide impacts are slightly larger for all variables. Recreation related industries contribute an additional \$2.5 million in output and an additional \$1.2 million in personal income at the state level (Table III.4).

In constructing the model to estimate total impacts, it was not possible to develop a multiplier for tourism and recreation because expenditures from these activities are spread among several sectors. However, after the analysis, "pseudo-multipliers" may be constructed. Total impacts presented in Table III.4 are based on an estimated \$6.94 million annual expenditure by recreationists in the regional economy (Table III.3).

Therefore, it may be stated that, on average, each dollar of tourist and recreationist expenditures resulted in about \$1.56 in total output, \$0.61 of personal income, and \$0.98 of value-added in the Guadalupe estuary regional economy. In addition, an employment multiplier of about 40 jobs per million dollars of tourist and recreationist expenditures is indicated by the analysis.

#### **IV. Commercial Fishing**

The Guadalupe estuary includes the San Antonio bay system (Figure I.1). Commercial fishing in the area is composed of two distinct activities: bay fishing (inshore) and gulf fishing (offshore). Bay fishing primarily consists of smaller boats that sell their catch at points of landing in the local area. Gulf fishing uses larger commercial boats that may fish over a wide expanse of the Gulf of Mexico. Gulf boats fishing the waters off the Guadalupe estuary may sell their catch locally or outside the region. Likewise, gulf boats fishing in areas remote from the Guadalupe estuary may land fish and shrimp in counties within the estuary.

The San Antonio bay system accounts for \$3.2 million in ex-vessel value of finfish, shellfish, and shrimp landings (estimated from Robinson, et al. 1996). The majority of this value is from shrimp and blue crab. Ex-vessel landings, both bay system and gulf fishing, account for about 8.5 percent of the Texas total for the 1993-1995 period. On the other hand, about \$45.6 million worth of fish and shrimp caught elsewhere lands in Matagorda, Aransas, and Calhoun counties, which creates economic impacts in the region. The estimation of total value of landings for both cases is discussed below.

#### **IV.1. Estimation of Direct Impacts**

Total value of commercial fishing in the area was estimated using data from Robinson, et al.. and the National Marine Fisheries Service (NMFS). These data were used to estimate the total value of inshore and offshore finfish and shellfish, and inshore shrimp. Since offshore landings for shrimp are reported only as a total for the state of Texas, a weighted allocation scheme (explained below) was developed to allocate the total to each estuary. This approach represents the production capacity of the estuary system and economic impacts created by this capacity. In other words, it represents the economic impacts generated by fish and shrimp caught in bay and estuary waters, which reflects the potential economic impact of fish and shrimp spawned from estuaries.

However, from a current economic point of view, it is important to account for economic impacts generated in the region from output from commercial fishing activity elsewhere than land in the counties within the estuary. Fish and shrimp unloaded in a particular region will generate economic impacts in that region, through direct sales or processing, regardless of where they are caught. In this study, this alternative was estimated where landings by county were used as an indicator of economic impacts. For commercial shrimp, data from NMFS were used. These data include shrimp landings by bay system, gulf zones, and by county landed.

In estimating direct impacts, three distinct scenarios were considered:

- I. bay system only (inshore catch),
- II. bay and gulf catch (inshore+offshore),
- III. total value of gulf and bay catch that land in the counties in the estuary, regardless of where caught.

#### *IV.1.1. Direct impacts of offshore and inshore commercial fishing*

Total value of output from commercial fishing in the region was used as an estimate of direct impacts for this industry. In addition, since landings from one year to the other may differ significantly, an average of landings in 1993, 1994, and 1995 were computed to represent a typical year. Direct impacts for the commercial fishing industry were estimated by total ex-vessel value of finfish, shellfish, and shrimp landed in the San Antonio bay system (inshore) and the allocation for gulf fishing based on the percentage weight of each of the bay systems of all bay system catch along the Texas Gulf coast. Data from Robinson, et al., 1996, were used in developing weights and estimating direct impacts. This procedure is consistent with that of the 1987 study and assumes that the Texas offshore shrimp catch is landed in the same pattern as the bay catch. As is shown by comparison with the county landings data used in scenario III, this assumption may not be true (Table IV.2).

Total value of output from commercial fishing in the Guadalupe estuary region was estimated to be \$14.8 million for 1995 (Table IV.1). This is total value of output for inshore and offshore commercial fishing in the region. Total value of output from offshore fishing was \$11.6 million .(Table IV.1). These estimates are used as the direct impacts of commercial fishing within the Guadalupe estuary region for scenarios I and II

**Table IV.1. Ex-Vessel Value (Direct Impacts) of inshore and offshore landings for finfish, shrimp, and shellfish for the Guadalupe estuary region (1993-1995 average).**

	Inshore (\$)	Offshore (\$)	Total (\$)
Fish and shellfish (except shrimp)	1,132,914	377,480	1,510,394
Shrimp	2,084,169	11,233,597	13,317,766
Total	3,217,083	11,611,077	14,828,160

Source: Robinson et al., 1996

#### *IV.1.2. Direct Impacts of Guadalupe Estuary Landings from Other Gulf*

##### *Grid Zones and Bay Systems*

As an alternative scenario, impacts of commercial fishing in the Guadalupe estuary region were estimated for total landings in the counties included in the estuary regardless of where the fish were caught. As mentioned earlier, estimated values of shrimp and fish by county landed in the Guadalupe estuary region may be of more immediate significance in terms of current, direct impact to the regional economy within the time frame of this study. This estimate includes the value of shrimp and fish landed within the region during the time period studied irrespective of the area in the Gulf or bay system in which they were caught. For shrimp, these data were readily available from the NMFS. However, finfish and other shellfish landings are reported as Gulf total only.

To estimate finfish landings by county, percent shares of total shrimp landings by counties in the estuary were estimated and applied to total bay and gulf finfish and shellfish

landings for the Gulf of Mexico. That is, it is assumed that finfish and shellfish landing pattern by county are the same as that of shrimp.

Table IV.2 shows estimated finfish and shrimp landed in the Guadalupe estuary region (Aransas, Calhoun, and Matagorda counties) from any bay system or gulf grid zone in the Gulf of Mexico. Over half of all landings are in Aransas county with about \$28 million in value of shrimp and fish. Matagorda county is also important with about \$15 million worth of shrimp landed in this county (Table IV.2). Direct impacts for this scenario are \$50.3 million (Table IV.2). These fish and shrimp caught in other areas are brought ashore in the Guadalupe estuary region and are sold and processed there, creating economic impacts in the region.

Table IV.2. Ex-vessel values of finfish, shellfish, and shrimp landed in the Guadalupe estuary region from all bay systems and Gulf grid zones (1993-1995 average)

Totals	Aransas		Calhoun		Matagorda		Total
	<u>fish</u>	<u>shrimp</u>	<u>fish</u>	<u>shrimp</u>	<u>fish</u>	<u>shrimp</u>	
\$							
1993	2,273,573	23,226,431	190,650	1,947,645	1,597,176	16,316,473	45,551,948
1994	2,441,603	28,802,138	732,571	8,641,706	2,057,526	24,271,414	66,946,958
1995	2,879,107	24,129,655	593,485	4,973,967	593,485	4,973,967	38,143,665
3 yr aver	2,543,537	25,386,075	519,785	5,187,773	1,521,677	15,187,285	50,346,131

Source: Robinson, et. al. 1996 and NMFS 1997

The three scenarios considered in the model have the following direct impacts:

- I. San Antonio bay system (inshore) catch: \$3.2 million
- II. Inshore + offshore catch: \$14.8 million
- III. Landings in Aransas, Calhoun, and Matagorda counties: \$50.3 million

#### **IV.2. Regional And Statewide Impacts of Commercial Fishing**

Regional and statewide total impacts of commercial fishing in the area for all three scenarios are presented in Tables IV.3. and IV.4. Total impacts from inshore fishing are about \$4.35 million in output, accounting for 107 jobs in the region in 1995. Impacts of total commercial fishing under scenario II (inshore+offshore) total to \$20 million in output and about \$14.5 million in value-added. Commercial fishing activity by both inshore and offshore fishing generates 497 jobs and a personal income of \$6.2 million in the Guadalupe estuary region (Table IV.3).

**Table IV.3. Estimated total impacts of commercial fishing for scenarios I and II in the Guadalupe estuary region and Texas, 1995.**

	Regional		Statewide	
	Inshore	Inshore+ offshore	Inshore	Inshore+ offshore
Output (\$ mil)	4.35	20.13	5.06	23.43
Personal Income (\$ mil)	1.34	6.22	1.57	7.24
Value-added (\$ mil)	3.14	14.5	3.49	16.16
Employment (jobs)	107	497	112	518

At the state level, impacts are estimated to be about \$4.35 million in output and \$3.14 million in value-added with an employment impact of 112 jobs for inshore fishing. For inshore+offshore fishing, statewide impacts are \$23.43 million for output and \$16.16 million for value-added. In terms of employment, 518 jobs are generated statewide (Table IV.3).

In scenario III, regional output impacts are \$68 million and value-added impacts are more than \$49 million. This scenario generates an estimated total of 1,690 jobs and \$21.13 million in personal income (Table IV.4). At the state level, estimates are about \$80 million in output, \$55 million in value-added and \$25 million in personal income. An estimated 1,761 jobs are supported by the value of fish and shrimp landings in the Guadalupe estuary region (Table IV.4).

Table IV.4. Estimated total impacts of commercial fishing from all bay systems and Gulf grid zones in the Guadalupe estuary region (scenario III), 1995.

	Regional	Statewide
Output (\$ mil)	68.41	79.61
Personal Income (\$ mil)	21.13	24.61
Value-added (\$ mil)	49.29	54.91
Employment (jobs)	1,690	1,761

## V. Summary and Conclusions

The present study estimates economic impacts associated with bay and estuary related recreational activity and commercial fishing in the Guadalupe estuary region. To estimate these economic impacts of the bay and estuarine related activities, an input-output

model was developed for the Guadalupe regional economy and Texas, using IMPLAN. This input-output model was used to estimate multipliers that show the impact of an increase in the sales to final demand of one sector on the value of output of other sectors of the economy (Appendix II). Total regional and state impacts were then estimated in terms of the total value of output, personal income, employment and value-added.

Travel expenditures in the region were about \$154.8 million in 1995, including business and non-water-related recreational travel (TDOC,1996). About \$6.94 million of this was by travelers participating in water-related recreational activities such as recreational fishing, boating, swimming, birdwatching, and others.

Impacts of the commercial fishing industry were estimated for three different scenarios:

- I. Inshore catch
- II. Inshore+offshore catch
- III. Total commercial fish landed

The first two cases estimate the impacts of the productive capacity of the estuary region and estimates total value of output by area caught (i.e. within the estuary region). The third scenario includes total value of fish and shrimp actually landed in the estuary region regardless of where caught.

As a first step in developing the input-output model and estimating economic impacts, direct impacts of bay and estuarine related sectors were estimated. Direct impacts (sales to final demand) were estimated for recreational travel related sectors and commercial fishing. A summary of direct impacts by sector is shown in Table V.1. Estimated direct impacts or sales to final demand shown in Table V.I provide the basis

for estimating total economic impacts of bay related sectors in the Guadalupe estuary region.

**Table V.1. Direct impacts for recreational activities and commercial fishing in the Guadalupe estuary region (1995).**

Sector	Direct Impacts (\$millions)
Total recreation	6.9
Commercial Fishing I (inshore only)	3.2
Commercial Fishing II (inshore+offshore)	14.8
Commercial Fishing III (by county landed)	50.3

It is estimated that bay and estuary recreation related sectors sales to final demand stimulated total regional business sales of about \$10.8 million, personal income of \$4.3 million, value-added of about \$6.8 million, and around 275 jobs in the Guadalupe estuary region (Table V.2). For the case where fishing impacts are estimated by the sum of inshore and offshore landings, output impact of bay and estuary related sectors were estimated as \$20.13 million, along with a personal income impact of \$6.22 million, and an employment impact of 497 jobs. For the case where commercial fish landings from all areas in the Gulf are considered, total employment impacts were 1,690, with a personal income impact of about \$21.13 million, output impact of \$68.4 million and value-added impact of about \$49 million (Table V.2).

Table V.2. Estimated total impacts of recreational activities and commercial fishing on the Guadalupe estuary region and Texas, 1995.

Economic Impact	<u>Recreational Activities</u>		<u>Commercial Fishing (I)</u>		<u>Commercial Fishing (II)</u>		<u>Commercial Fishing (III)</u>	
Variable	Regional	Texas	Regional	Texas	Regional	Texas	Regional	Texas
Output (\$mils)	10.81	13.3	4.35	5.06	20.13	23.43	68.41	79.61
Personal Income(\$mils)	4.26	5.41	1.34	1.57	6.22	7.24	21.13	24.61
Value-Added(\$mils)	6.83	8.38	3.14	3.49	14.5	16.16	49.29	54.91
Employment(jobs)	275	283	107	112	497	518	1,690	1,761

From the results of this analysis, on average, each dollar of bay and estuary related tourist and recreationist expenditure resulted in about expenditures resulted in about \$1.56 in total output, \$0.61 of personal income, and \$0.98 of value-added in the regional economy. In addition, an employment multiplier of about 40 jobs per million dollars of tourist and recreationist expenditures is indicated by the analysis.

Statewide impacts represent estimated impacts of the recreational activity related sectors and commercial fishing in the Guadalupe estuary region on the rest of the state of Texas. Total statewide impacts can be interpreted as the regional impact plus the additional impact created elsewhere in the state by the sectors included in the study. For the Guadalupe estuary region, the recreation related sectors were estimated to have an output impact of about \$13.3 million and personal income impact of \$5.4 million with 283 jobs at the state level (including regional impacts). Statewide impacts for commercial fishing including both inshore and offshore fishing activity were \$23.4 million for output, with a value-added impact of \$16.2 million and personal income impact of \$7.2 million. Employment impacts for this scenario was 518 jobs. For the case where Guadalupe estuary region landings from all other areas of the Gulf were considered, the commercial fishing activity had an estimated output impact of \$79.6 million, value-added impact of about \$55 million, personal income impact of \$25 million and a total employment impact of 1,761 jobs at the state level (Table V.2).

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## **Appendix I. Methodology for Estimation of Projected Travel Expenditures**

$$X = b m^t \quad (1)$$

Where:

$X$  = total travel expenditures

$b$  = constant

$m$  = growth rate

$t$  = years

The estimated equation is:

$$\hat{X} = 169 (1.036)^t \quad (2)$$

Given

$$\hat{X}_{1995} = \hat{b} \hat{m}^9 \quad (3)$$

$$\hat{X}_{1987} = \hat{b} \hat{m}^1 \quad (4)$$

Where  $\hat{X}_{1987}$  is the 1987 Fesenmaier estimate.

Solving for  $\hat{X}_{1995}$ , from (3) and (4)

$$\hat{X}_{1995} = m^8 (\hat{X}_{1987})$$

## Appendix II. Multipliers for the Guadalupe Estuary Region

**TableII.1 Output Multipliers for the Guadalupe Estuary Region**

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	1	0.13	0.23	1.36
2	Food and Eating & Drinking	1	0.24	0.32	1.56
3	Automotive Dealers & Service Stations	1	0.20	0.36	1.55
4	Miscellaneous Retail	1	0.15	0.37	1.52
5	Hotels and Lodging Places	1	0.29	0.30	1.59
6	Amusement and Recreation Services	1	0.41	0.24	1.65

**TableII.2 Employment Multipliers for the Guadalupe Estuary Region**

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	28.15	1.62	3.81	33.59
2	Food and Eating & Drinking	31.25	3.06	5.36	39.67
3	Automotive Dealers & Service Stations	19.32	2.40	6.00	27.72
4	Miscellaneous Retail	46.11	1.86	6.14	54.11
5	Hotels and Lodging Places	24.84	4.21	5.10	34.15
6	Amusement and Recreation Services	21.36	6.27	4.05	31.68

**TableII.3 Personal Income Multipliers for the Guadalupe Region**

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	0.30	0.04	0.08	0.42
2	Food and Eating & Drinking	0.41	0.07	0.11	0.59
3	Automotive Dealers & Service Stations	0.48	0.06	0.12	0.66
4	Miscellaneous Retail	0.50	0.05	0.12	0.67
5	Hotels and Lodging Places	0.36	0.10	0.10	0.56
6	Amusement and Recreation Services	0.25	0.11	0.08	0.44

**TableII.4 Total Value Added Multipliers for the Guadalupe Region**

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	0.77	0.07	0.14	0.98
2	Food and Eating & Drinking	0.58	0.13	0.19	0.90
3	Automotive Dealers & Service Stations	0.73	0.11	0.22	1.06
4	Miscellaneous Retail	0.79	0.09	0.22	1.10
5	Hotels and Lodging Places	0.58	0.15	0.18	0.92
6	Amusement and Recreation Services	0.33	0.20	0.15	0.67

**TableII.5 Output Multipliers for Texas State**

Event	Sector	Direct	Indirect	Induced	Total
1	Commercial Fishing	1	0.2097	0.3731	1.5828
2	Food and Eating & Drinking	1	0.3782	0.5604	1.9386
3	Automotive Dealers & Service Stations	1	0.2792	0.6166	1.8958
4	Miscellaneous Retail	1	0.2183	0.6169	1.8352
5	Hotels and Lodging Places	1	0.3964	0.5687	1.9651
6	Amusement and Recreation Services	1	0.5251	0.6169	2.1421

**TableII.6 Employment Multipliers for Texas State**

Event	Sector	Direct	Indirect	Induced	Total
1	Commercial Fishing	28	2	5	35
2	Food and Eating & Drinking	29	4	8	42
3	Automotive Dealers & Service Stations	17	3	9	28
4	Miscellaneous Retail	41	2	9	52
5	Hotels and Lodging Places	20	6	8	34
6	Amusement and Recreation Services	20	8	9	37

**TableII.7 Income Multipliers for Texas State Estuary**

Event	Sector	Direct	Indirect	Induced	Total
1	Commercial Fishing	0.3026	0.0564	0.1302	0.4892
2	Food and Eating & Drinking	0.4209	0.1183	0.1956	0.7348
3	Automotive Dealers & Service Stations	0.4939	0.0993	0.2152	0.8084
4	Miscellaneous Retail	0.5165	0.077	0.2153	0.8089
5	Hotels and Lodging Places	0.3923	0.1548	0.1985	0.7456
6	Amusement and Recreation Services	0.4049	0.1887	0.2153	0.8089

**TableII.8 Total Value Added Multipliers for Texas State**

Event	Sector	Direct	Indirect	Induced	Total
1	Commercial Fishing	0.7746	0.0966	0.2205	1.0917
2	Food and Eating & Drinking	0.5809	0.2002	0.3312	1.1123
3	Automotive Dealers & Service Stations	0.7335	0.168	0.3644	1.266
4	Miscellaneous Retail	0.7906	0.1309	0.3646	1.2861
5	Hotels and Lodging Places	0.6104	0.2262	0.3361	1.1727
6	Amusement and Recreation Services	0.4774	0.2859	0.3646	1.128

### Appendix III. Estimated Regional & Statewide Impacts for the Guadalupe Estuary

**Table III.1 Regional Output Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$millions)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	1.82	0.44	0.58	2.84
Automotive Dealers & Service Stations	1.70	0.34	0.61	2.64
Miscellaneous Retail	1.99	0.30	0.74	3.02
Hotels and Lodging Places	0.93	0.27	0.28	1.48
Amusement and Recreation Services	0.50	0.21	0.12	0.83
Commercial Fishing (Inshore+Offshore)	14.80	1.92	3.40	20.13
Commercial Fishing (Inshore)	3.20	0.42	0.74	4.35
Commercial Fishing (Inshore+Offshore by County)	50.30	6.54	11.57	68.41

**Table III.2 Regional Employment Impact of Travel and Commercial Fishing for the Guadalupe Estuary (Jobs)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	57	6	10	72
Automotive Dealers & Service Stations	33	4	10	47
Miscellaneous Retail	92	4	12	108
Hotels and Lodging Places	23	4	5	32
Amusement and Recreation Services	11	3	2	16
Commercial Fishing (Inshore+Offshore)	417	24	56	497
Commercial Fishing (Inshore)	90	5	12	107
Commercial Fishing (Inshore+Offshore by County)	1416	81	192	1690

**Table III.3 Regional Personal Income Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$millions)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	0.75	0.13	0.2	1.07
Automotive Dealers & Service Stations	0.82	0.10	0.20	1.12
Miscellaneous Retail	1.00	0.10	0.24	1.33
Hotels and Lodging Places	0.33	0.09	0.09	0.52
Amusement and Recreation Services	0.13	0.06	0.04	0.22
Commercial Fishing (Inshore+Offshore)	4.44	0.59	1.18	6.22
Commercial Fishing (Inshore)	0.96	0.13	0.26	1.34
Commercial Fishing (Inshore+Offshore by County)	15.09	2.01	4.02	21.13

**Table III.4 Regional Value Added Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$millions)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	1.06	0.24	0.35	1.64
Automotive Dealers & Service Stations	1.24	0.19	0.37	1.8
Miscellaneous Retail	1.57	0.18	0.44	2.19
Hotels and Lodging Places	0.54	0.14	0.17	0.86
Amusement and Recreation Services	0.17	0.10	0.08	0.34
Commercial Fishing (Inshore+Offshore)	11.40	1.04	2.07	14.50
Commercial Fishing (Inshore)	2.46	0.22	0.45	3.14
Commercial Fishing (Inshore+Offshore by County)	38.73	3.52	7.04	49.29

**Table III.5 Statewide Output Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$mils)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	1.82	0.69	1.02	3.53
Automotive Dealers & Service Stations	1.70	0.47	1.05	3.22
Miscellaneous Retail	1.99	0.43	1.23	3.65
Hotels and Lodging Places	0.93	0.37	0.53	1.83
Amusement and Recreation Services	0.50	0.26	0.31	1.07
Commercial Fishing (Inshore+Offshore)	14.80	3.10	5.52	23.43
Commercial Fishing (Inshore)	3.20	0.67	1.19	5.06
Commercial Fishing (Inshore+Offshore by County)	50.30	10.55	18.77	79.61

**Table III.6 Statewide Employment Impact of Travel and Commercial Fishing for the Guadalupe Estuary (Jobs)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	53	7	15	76
Automotive Dealers & Service Stations	29	5	15	48
Miscellaneous Retail	92	4	12	108
Hotels and Lodging Places	19	6	7	32
Amusement and Recreation Services	10	4	5	19
Commercial Fishing (Inshore+Offshore)	414	30	74	518
Commercial Fishing (Inshore)	90	6	16	112
Commercial Fishing (Inshore+Offshore by County)	1408	101	252	1761

**Table III.7 Statewide Personal Income Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$millions)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	0.77	0.22	0.36	1.34
Automotive Dealers & Service Stations	0.84	0.17	0.37	1.37
Miscellaneous Retail	1.03	0.15	0.43	1.61
Hotels and Lodging Places	0.36	0.14	0.18	0.69
Amusement and Recreation Services	0.20	0.09	0.11	0.40
Commercial Fishing (Inshore+Offshore)	4.48	0.83	1.93	7.24
Commercial Fishing (Inshore)	0.97	0.18	0.42	1.57
Commercial Fishing (Inshore+Offshore by County)	15.22	2.84	6.55	24.61

**Table III.8 Statewide Value Added Impact of Travel and Commercial Fishing for the Guadalupe Estuary (\$million)**

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	1.06	0.36	0.6	2.02
Automotive Dealers & Service Stations	1.25	0.29	0.62	2.15
Miscellaneous Retail	1.57	0.26	0.73	2.56
Hotels and Lodging Places	0.57	0.21	0.31	1.09
Amusement and Recreation Services	0.24	0.14	0.18	0.56
Commercial Fishing (Inshore+Offshore)	11.46	1.43	3.26	16.16
Commercial Fishing (Inshore)	2.48	0.31	0.71	3.49
Commercial Fishing (Inshore+Offshore by County)	38.96	4.86	11.09	54.91