

NUECES-MISSION-ARANSAS ESTUARY

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

Prepared for the

TEXAS WATER DEVELOPMENT BOARD

by

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Nueces-Mission-Aransas Estuary: Economic Impact of Recreational Activities and Commercial Fishing

I. Introduction

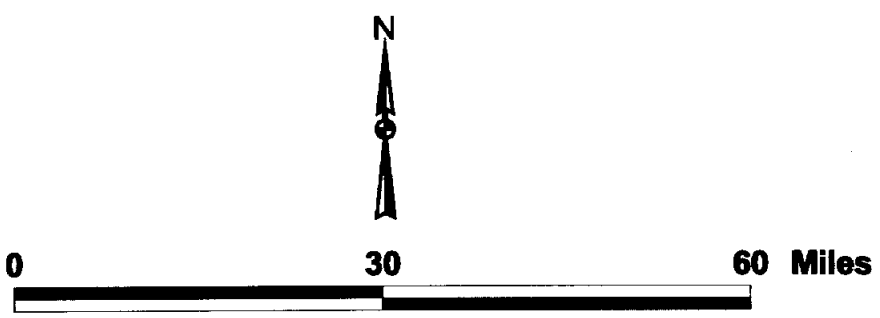
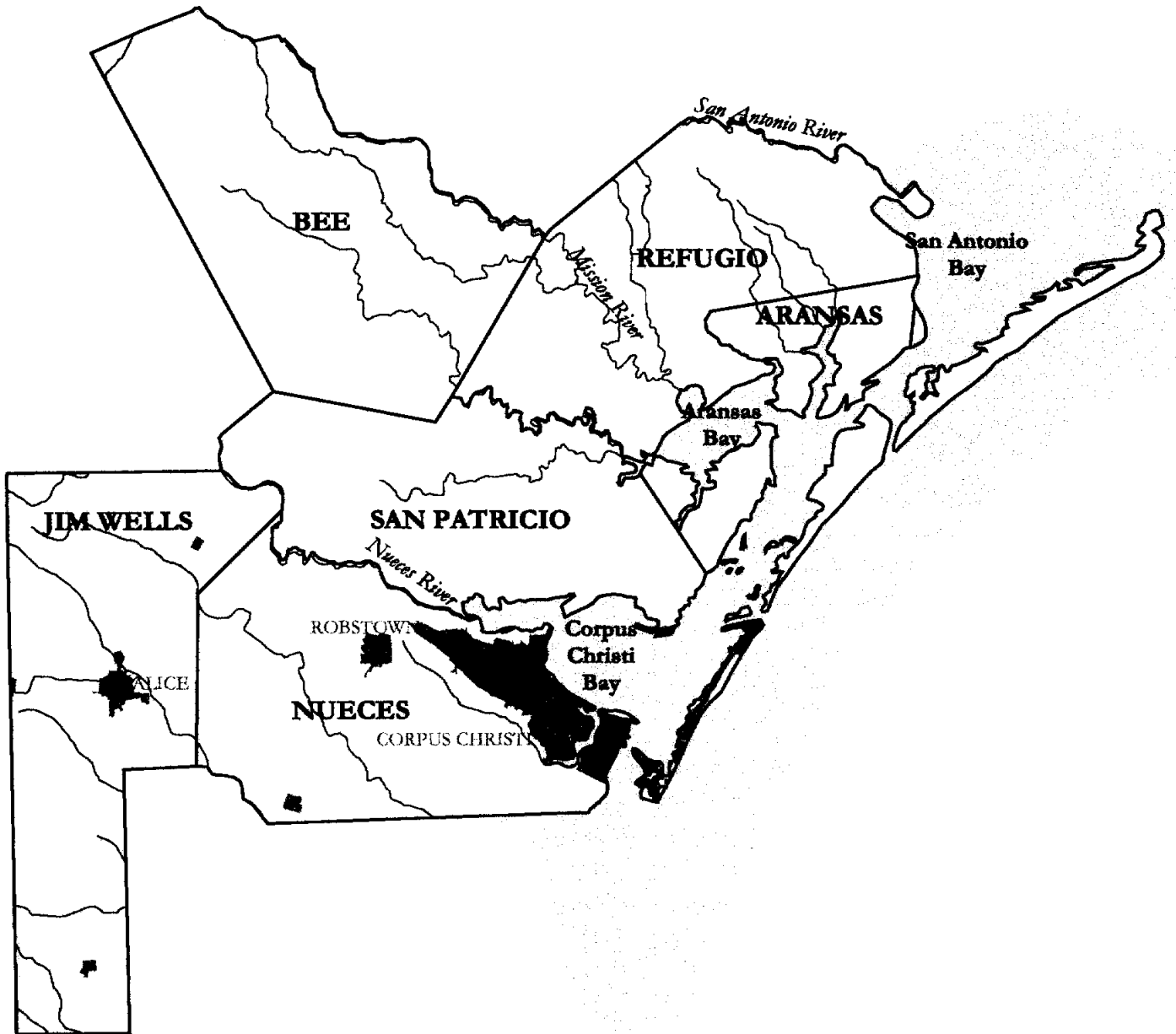
The primary objective of this study is to estimate regional and statewide economic impacts of estuarine dependent activities that generate income and employment in the Nueces-Mission-Aransas estuary region. These include water-related recreational activities (travelers spend money in different sectors 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 Nueces-Mission-Aransas Estuary Aransas, Bee, Jim Wells, Nueces, Refugio, and San Patricio counties (Figure I.1). In 1995, population in the area was 456,854, with the city of Corpus Christi as the largest metropolitan area in the region. The 1993-1995 average employment was 498,853 and average wages paid were about \$3.8 billion (Table I.1).

Figure I.1. Nueces - Mission - Aransas estuary region

Nueces - Mission - Aransas Region



The Nueces-Mission-Aransas estuary region is a popular destination for water-related recreation activities. The commercial fishing industry is the third largest in the state, which includes the Corpus Christi and Aransas bay systems accounting for 30 percent of all shrimp caught in Texas bay systems.

Table I.1. Average quarterly wage and employment in the Nueces-Mission-Aransas Estuary region, 1993-1995.

Year	Wage	Employment
	(\$millions)	(Jobs)
1993	3,639.06	486,077
1994	3,812.42	499,297
1995	3,974.79	511,185
3-Year Average	3,808.76	498,853

Source: Texas Workforce Commission (TWC)

Total travel expenditure, payroll, and employment for the Nueces-Mission-Aransas 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 \$572.56 million in 1995. Nueces county alone accounted for about 82 percent of total travel expenditures in the region. Travel related employment was 8,440 jobs in Nueces county compared to a total employment of 9,930 for the Nueces-Mission-Aransas Estuary region in 1995 (Table I.2).

Table I.2. Travel expenditures, payroll, and employment in the Nueces-Mission-Aransas Estuary region, 1995.

County	Travel Expenditures (\$millions)	Travel Payroll (\$millions)	Employment (jobs)
Aransas	44.30	8.81	680
Bee	9.94	1.96	150
Jim Wells	18.25	3.56	280
Nueces	472.36	130.61	8,440
Refugio	4.50	0.75	60
San Patricio	23.21	4.22	320
Total	572.56	149.91	9,930

Source: TDOC, 1996

References and comparisons to the 1987 Fesenmaier study are made within the body of the report. The two studies were conducted using different data sources and models. Therefore, the comparisons should be interpreted with care.

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 Corpus Christi 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). Expenditures for 1987 were unusually large and were considered as an outlier in the data set. Expenditures for 1987 were therefore excluded from the data to enable a more accurate projection of expenditures. 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 1.07 for the Nueces-Mission-Aransas estuary, which represents an increase in expenditures of about 7 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 \$314.7 million for the Nueces-Mission-Aransas estuary compared to \$197.92 million in 1987, an increase of about 60 percent for the study period.

Table III.1. Total travel expenditures for the Nueces-Mission-Aransas Estuary, 1987-1995.

Year	Expenditures (\$millions)
1987	360.35
1988	380.96
1989	321.30
1990	427.08
1991	468.58
1992	508.32
1993	520.18
1994	563.07
1995	572.56

Source: Texas Department of Commerce, 1996.

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 \$206.73 million. Hence, in real terms, recreational expenditures in the Nueces-Mission-Aransas estuary region showed a 5 percent increase during the study period.

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, Corpus Christi MSA, 1995

Expenditure Category	Travel Expenditures	
	\$/ person/ day	% of total
Transport	18.1	0.26
Lodging	11.4	0.17
Food	15.0	0.22
Entertainment	7.3	0.11
Other	2.0	0.03
Shopping	15.1	0.22
Total	68.9	1

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

Visitors to the area for all leisure purposes spent approximately \$68.9 per person per day in the Corpus Christi 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 (\$314.7 million) to Nueces-Mission-Aransas regional economic sectors is shown in Table III.3.

Table III.3. Direct Impacts of bay and estuary recreation related sectors in the Nueces-Mission-Aransas Estuary Region.

Expenditure category	Total (\$millions)	Corresponding Regional Economic Sector
Transport	82.67	Gas Service Stations
Lodging	52.07	Hotels and Motels
Food	68.51	Restaurants and Food Stores
Entertainment	33.34	Amusement, Theaters, etc
Other	9.13	Miscellaneous Retail
Shopping	68.97	Miscellaneous Retail
TOTAL	314.7	

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

It is estimated that leisure travelers participating in water-related activities spent \$82.7 million in the region for transportation, and about \$68.5 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 Nueces-Mission-Aransas 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 Nueces-Mission-Aransas estuary in 1995 were \$314.7 million and travelers spent \$68.9 per person

per day, on average. Dividing total expenditures by per-person expenditures yields an estimated average of 4,567,489 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 Nueces-Mission-Aransas 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 Nueces-Mission-Aransas 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 Nueces-Mission-Aransas estuary region given in Appendix II. It is estimated in total, that these sectors’ sales to final demand stimulated total regional business sales of \$545.3 million, personal income of \$215.7 million, value-added of about \$340 million and over 12,348 jobs in the Nueces-Mission-Aransas 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 Nueces-Mission-Aransas Estuary region, 1995.

Total Impacts		
Economic Impact		
Variable	Regional	State
Direct Impact (\$ mil)	314.7	314.7*
Output (\$ mil)	545.28	606.10
Personal Income(\$ mil)	215.66	246.14
Value-Added (\$ mil)	339.63	379.97
Employment (jobs)	12,348	12,546

*/ 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 Nueces-Mission-Aransas Estuary region, but within the state.

Statewide impacts are slightly larger for all variables. Recreation related industries contribute an additional \$55 million in output and about \$30 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 \$314.7 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 \$1.73 in total output, \$0.69 of personal income, and \$1.08 of value-added in the Nueces-Mission-Aransas estuary regional economy. In addition, an employment multiplier of about 39 jobs per million dollars of tourist and recreationist expenditures is indicated by the analysis.

IV. Commercial Fishing

The Nueces-Mission-Aransas estuary includes the Aransas and Corpus Christi bay systems. (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 Nueces-Mission-Aransas estuary may sell their catch locally or outside the region. Likewise, gulf boats fishing in areas remote from the Nueces-Mission-Aransas estuary may land fish and shrimp in counties within the estuary.

The Corpus Christi bay systems account for \$8.9 million in value of finfish, shellfish, and shrimp landings (estimated from Robinson, et al. 1996). The majority of this value is from shrimp. Landings both from the Aransas and Corpus Christi bay systems and Gulf fishing, account for about 28 percent of the Texas total for the 1993-1995 period. On the other hand, about \$25.3 million worth of fish and shrimp caught elsewhere lands in

Aransas and Nueces 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 that 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 value of finfish, shellfish, and shrimp landed in the Aransas and Corpus Christi bay systems (inshore) and the allocation for gulf fishing based on the percentage weight of the Corpus Christi 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 (TableIV.2).

Total value of output from inshore commercial fishing in the Nueces-Mission-Aransas estuary region was estimated as \$49.3 million for 1995 (Table IV.1). This is total value of output for inshore and offshore commercial fishing in the region. About \$8.9 million of this total was from inshore fishing with an estimated total value of output from offshore fishing of \$40.4 million (Table IV.1). These estimates are used as the direct impacts of commercial fishing within the Nueces-Mission-Aransas Estuary Region for scenarios I and II.

Table IV.1. Value (Direct Impacts) of inshore and offshore landings for finfish, shrimp, and shellfish for the Nueces-Mission-Aransas Estuary region (1993-1995 average) .

	Inshore	Offshore	Total
	(\$)	(\$)	(\$)
Fish and shellfish (except shrimp)	1,582,881	500,994	2,004,606
Shrimp	7,395,630	39,862,191	47,257,801
Total	8,978,511	40,363,186	49,341,697

Source: Robinson et al., 1996

Direct impacts of commercial fishing in the Nueces-Mission-Aransas estuary region were estimated as \$56.1 million in the 1987 study (Fesenmaier et al., 1987), compared to \$49.3 in 1995, representing an decrease of 12 percent in current dollars. In order to compare the value of output from commercial fishing in real terms, direct impacts for 1987 and 1995 were deflated by the respective Producer Price Indices for those years. In real dollars, direct impacts of commercial fishing for the Nueces-Mission-Aransas estuary were \$54.3 and \$39.5 million respectively, showing a decrease of about 27 percent from 1987 to 1995.

*IV.1.2. Direct Impacts of Nueces-Mission-Aransas Estuary Landings from
Other Gulf Grid Zones and Bay Systems*

As an alternative scenario, impacts of commercial fishing in the Nueces-Mission-Aransas 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 Nueces-Mission-Aransas 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 Nueces-Mission-Aransas Estuary Region (Aransas and Nueces counties) from any bay system or gulf grid zone in the Gulf of Mexico. Under this scenario, total value of shrimp is about \$27 million with fish and other shellfish valued around \$2 million, resulting in direct impacts of about \$29.4 million (Table IV.2). These fish and shrimp caught in other areas are brought ashore in the Nueces-Mission-Aransas estuary region and are sold and processed there, creating economic impacts in the region.

Table IV.2. Value of finfish, shellfish, and shrimp landed in Nueces-Mission-Aransas Estuary Region from all bay systems and Gulf grid zones (1993-1995 average).

Year	<u>Aransas</u>		<u>Nueces</u>		Total
	Fish+Shellfish	Shrimp	Fish+Shellfish	Shrimp	
1993	660,914	23,226,431	58,374	2,051,435	25,997,154
1994	1,417,769	28,802,138	127,329	2,586,697	32,933,933
1995	1,498,176	24,129,655	85,625	1,379,081	27,092,537
3-year average	1,922,286	25,386,075	90,443	2,005,737	29,404,541

Source: Robinson, et. al.

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

- I. Corpus Christi bay system (inshore) catch: \$8.9 million
- II. Inshore + offshore catch: \$49.3 million
- III. Landings in Aransas and Nueces counties: \$29.4 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 \$12.91 million in output, accounting for 258 jobs in the region in 1995. Impacts of total commercial fishing under scenario II (inshore+offshore) total to \$71.49 million in output and \$50 million in value-added. Commercial fishing activity by both inshore and offshore fishing generates 1,427 jobs and a personal income of \$20.71 million in the Nueces-Mission-Aransas estuary region (Table IV.3).

Table IV.3. Estimated total impacts of commercial fishing for scenarios I and II in the Nueces-Mission-Aransas Estuary region and Texas, 1995.

	Regional		Statewide	
	Inshore	Inshore+ offshore	Inshore	Inshore+ offshore
Output (\$ mil)	12.91	71.49	14.09	78.03
Personal Income (\$ mil)	3.74	20.71	4.35	24.12
Value-added (\$ mil)	9.08	50.29	9.72	53.82
Employment (jobs)	258	1,427	312	1,726

At the state level, impacts are estimated to be about \$78 million in total output and 1,726 jobs for scenario II (Table IV.3). In terms of value-added, an additional \$3.6 million is generated in Texas but outside the Nueces-Mission-Aransas estuary.

In scenario III, regional output impacts are \$31.1 million and value-added impacts are about \$22 million. This scenario generates an estimated total of 917 jobs and \$10.14 million in personal income (Table IV.4). At the state level, estimates are \$35.7 million in output, \$24.6 million in value-added and about \$11 million in personal income. (Table IV.4).

Table IV.4. Estimated total impacts of commercial fishing in Nueces-Mission-Aransas Estuary Region from all bay systems and Gulf grid zones (scenario III), regional and statewide impacts ,1995.

	Regional	Statewide
Output (\$ mil)	42.63	46.53
Personal Income (\$ mil)	12.35	14.38
Value-added (\$ mil)	29.99	32.10
Employment (jobs)	851	1,029

V. Summary and Conclusions

The present study estimates economic impacts associated with bay and estuary related recreational activity and commercial fishing in the Nueces-Mission-Aransas estuary region. To estimate these economic impacts of the bay and estuarine related activities, an input-output model was developed for the Nueces-Mission-Aransas 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 \$572.56 million in 1995, including business and non-water-related recreational travel (TDOC,1996). Out of this total, \$314.7 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 Nueces-Mission-Aransas estuary region.

Table V.1. Direct impacts for recreational activities and commercial fishing in the Nueces-Mission-Aransas Estuary region (1995).

Sector	Direct Impacts (\$millions)
Total recreation	314.7
Commercial Fishing I (inshore only)	8.9
Commercial Fishing II (inshore+offshore)	49.3
Commercial Fishing III (by county landed)	29.4

It is estimated that bay and estuary recreation related sectors sales to final demand stimulated total regional business sales of about \$545.3 million, personal income of \$215.6 million, value-added of about \$340 million, and around 12,348 jobs in the Nueces-Mission-Aransas estuary region (Table V.2). For the case where fishing impacts are estimated by the sum of inshore and offshore landings, output impacts of bay and estuary related sectors were estimated as \$71.49 million, along with a personal income impact of \$20.71 million , and employment impact of 1,427 jobs. For the case where commercial fish landings from all areas in the Gulf are considered, total employment impacts were 851, with a personal income impact of about \$12.3 million, output impact of \$42.6 million and value-added impact of about \$30 million (Table V.2).

Table V.2. Estimated total impacts of recreational activities and commercial fishing on the Nueces-Mission-Aransas Estuary region and Texas, 1995.

Economic Impact Variable	<u>Recreational Activities</u>		<u>Commercial Fishing (I)</u>		<u>Commercial Fishing (II)</u>		<u>Commercial Fishing (III)</u>	
	Regional	Texas	Regional	Texas	Regional	Texas	Regional	Texas
Output (\$mils)	545.28	606.10	12.91	14.09	71.49	78.03	42.63	46.53
Personal Income(\$mils)	215.66	246.14	3.74	4.35	20.71	24.12	12.35	14.38
Value-Added(\$mils)	339.63	379.97	9.08	9.72	50.29	53.82	29.99	32.10
Employment(jobs)	12,348	12,546	258	312	1,427	1,726	851	1,029

From the results of this analysis, on average, each dollar of bay and estuary related tourist and recreationist expenditure resulted in about \$1.73 in total value of output, \$0.69 of personal income, and \$1.08 of value-added in the regional economy. In addition, an employment multiplier of about 39 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 Nueces-Mission-Aransas 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 Nueces-Mission-Aransas estuary region, the recreation related sectors were estimated to have an output impact of about \$606 million and personal income impact of \$246 million with 12,546 jobs at the state level (including regional impacts). Statewide impacts of commercial fishing activity including both inshore and offshore fishing was \$78million for output, and \$53.82 million for value-added. The third scenario for commercial fishing had an estimated output impact of \$46.5 million, value-added impact of \$14.3 million, personal income impact of \$32.10 million and a total employment impact of 1,029 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 Nueces and Mission-Aransas Estuary Region

TableII.1 Output Multipliers for the Nueces and Mission-Aransas Estuary Region

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	1	0.18	0.27	1.45
2	Food and Eating & Drinking	1	0.31	0.42	1.74
3	Automotive Dealers & Service Stations	1	0.26	0.47	1.73
4	Miscellaneous Retail	1	0.20	0.48	1.68
5	Hotels and Lodging Places	1	0.35	0.42	1.77
6	Amusement and Recreation Services	1	0.41	0.38	1.79

TableII.2 Employment Multipliers for the Nueces and Mission-Aransas Estuary Region

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	22.87	1.82	4.27	28.95
2	Food and Eating & Drinking	29.90	3.72	6.67	40.29
3	Automotive Dealers & Service Stations	18.51	3.16	7.45	29.13
4	Miscellaneous Retail	43.68	2.47	7.57	53.72
5	Hotels and Lodging Places	22.88	5.70	6.57	35.16
6	Amusement and Recreation Services	22.26	6.32	6.01	34.59

TableII.3 Personal Income Multipliers for the Nueces and Mission-Aransas Estuary Region

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	0.28	0.05	0.09	0.42
2	Food and Eating & Drinking	0.42	0.09	0.14	0.65
3	Automotive Dealers & Service Stations	0.48	0.09	0.16	0.73
4	Miscellaneous Retail	0.51	0.07	0.16	0.74
5	Hotels and Lodging Places	0.37	0.13	0.14	0.64
6	Amusement and Recreation Services	0.33	0.13	0.13	0.59

TableII.4 Total Value Added Multipliers for the Nueces and Mission-Aransas Estuary Region

Events	Sector	Direct Effects	Indirect Effects	Induced Effects	Total
1	Commercial Fishing	0.77	0.08	0.16	1.02
2	Food and Eating & Drinking	0.57	0.16	0.25	0.99
3	Automotive Dealers & Service Stations	0.73	0.15	0.28	1.16
4	Miscellaneous Retail	0.79	0.12	0.28	1.19
5	Hotels and Lodging Places	0.59	0.19	0.25	1.03
6	Amusement and Recreation Services	0.44	0.21	0.23	0.88

Table II.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

Table II.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

Table II.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

Table II.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 Nueces and Mission-Aransas Estuary

Table III.1 Regional Output Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (Million\$)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	68.51	21.24	28.77	119.21
Automotive Dealers & Service Stations	82.67	21.49	38.85	143.02
Miscellaneous Retail	78.10	15.62	37.49	131.21
Hotels and Lodging Places	52.07	18.22	21.87	92.16
Amusement and Recreation Services	33.34	13.67	12.67	59.68
Commercial Fishing (Inshore+Offshore)	49.30	8.87	13.31	71.49
Commercial Fishing (Inshore)	8.90	1.60	2.40	12.91
Commercial Fishing (Inshore+Offshore by County)	29.40	5.29	7.94	42.63

Table III.2 Regional Employment Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (Jobs)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	2048	255	457	2760
Automotive Dealers & Service Stations	1530	261	616	2408
Miscellaneous Retail	3411	193	591	4196
Hotels and Lodging Places	1191	297	342	1831
Amusement and Recreation Services	742	211	200	1153
Commercial Fishing (Inshore+Offshore)	1127	90	211	1427
Commercial Fishing (Inshore)	204	16	38	258
Commercial Fishing (Inshore+Offshore by County)	672	54	126	851

Table III.3 Regional Personal Income Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (Million\$)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	28.77	6.17	9.59	44.53
Automotive Dealers & Service Stations	39.68	7.44	13.23	60.35
Miscellaneous Retail	39.83	5.47	12.50	57.79
Hotels and Lodging Places	19.27	6.77	7.29	33.32
Amusement and Recreation Services	11.00	4.33	4.33	19.67
Commercial Fishing (Inshore+Offshore)	13.80	2.47	4.44	20.71
Commercial Fishing (Inshore)	2.49	0.45	0.80	3.74
Commercial Fishing (Inshore+Offshore by County)	8.23	1.47	2.65	12.35

Table III.4 Regional Value Added Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (Million\$)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	39.05	10.96	17.13	67.82
Automotive Dealers & Service Stations	60.35	12.40	23.15	95.90
Miscellaneous Retail	61.70	9.37	21.87	92.94
Hotels and Lodging Places	30.72	9.89	13.02	53.63
Amusement and Recreation Services	14.67	7.00	7.67	29.34
Commercial Fishing (Inshore+Offshore)	37.96	3.94	7.89	50.29
Commercial Fishing (Inshore)	6.85	0.71	1.42	9.08
Commercial Fishing (Inshore+Offshore by County)	22.64	2.35	4.70	29.99

Table III.5 Statewide Output Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (\$millions)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	68.51	25.91	38.39	132.81
Automotive Dealers & Service Stations	82.67	23.08	50.97	156.73
Miscellaneous Retail	78.1	17.05	48.18	143.33
Hotels and Lodging Places	52.07	20.64	29.61	102.32
Amusement and Recreation Services	33.34	17.51	20.57	71.42
Commercial Fishing (Inshore+Offshore)	49.30	10.34	18.39	78.03
Commercial Fishing (Inshore)	8.90	1.87	3.32	14.09
Commercial Fishing (Inshore+Offshore by County)	29.40	6.17	10.97	46.53

Table III.6 Statewide Employment Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (jobs)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	1987	274	548	2877
Automotive Dealers & Service Stations	1530	261	616	2408
Miscellaneous Retail	3411	193	591	4196
Hotels and Lodging Places	1191	297	342	1831
Amusement and Recreation Services	667	267	300	1234
Commercial Fishing (Inshore+Offshore)	1380	99	247	1726
Commercial Fishing (Inshore)	249	18	45	312
Commercial Fishing (Inshore+Offshore by County)	823	59	147	1029

Table III.7 Statewide Personal Income Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (\$millions)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	28.84	8.10	13.40	50.34
Automotive Dealers & Service Stations	40.83	8.21	17.79	66.83
Miscellaneous Retail	40.34	6.01	16.81	63.18
Hotels and Lodging Places	20.43	8.06	10.34	38.82
Amusement and Recreation Services	13.50	6.29	7.18	26.97
Commercial Fishing (Inshore+Offshore)	14.92	2.78	6.42	24.12
Commercial Fishing (Inshore)	2.69	0.50	1.16	4.35
Commercial Fishing (Inshore+Offshore by County)	8.90	1.66	3.83	14.38

Table III.8 Statewide Value Added Impact of Travel and Commercial Fishing for the Nueces and Mission-Aransas Estuary (\$millions)

Sector	Direct Effects	Indirect Effects	Induced Effects	Total
Food and Eating & Drinking	39.80	13.72	22.69	76.20
Automotive Dealers & Service Stations	60.64	13.89	30.12	104.66
Miscellaneous Retail	61.75	10.22	28.48	100.44
Hotels and Lodging Places	31.78	11.78	17.50	61.06
Amusement and Recreation Services	15.92	9.53	12.16	37.61
Commercial Fishing (Inshore+Offshore)	38.19	4.76	10.87	53.82
Commercial Fishing (Inshore)	6.89	0.86	1.96	9.72
Commercial Fishing (Inshore+Offshore by County)	22.77	2.84	6.48	32.10