The Economic Impacts of Recreational Fishing in the Corpus Christi Bay System

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Executive Summary

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The objective of this report was to estimate the economic impacts of marine recreational fishing in the Corpus Christi Bay System. The estimates presented include only impacts associated with fishing trips and not spending on durable goods (fishing gear, rods, boats, etc.) related to fishing. The data used to estimate the economic impacts came from fishing effort estimates provided by the Texas Parks and Wildlife Department and a National Marine Fisheries Service study titled: "The Economic Contribution of Marine Angler Expenditures in the United States, 2011." Major findings include:

- Total annual economic impacts of marine recreational fishing in the Corpus Christi Bay System were estimated to be:
    - 611 jobs,
    - $21.7 million in labor income,
    - $33.8 million in value-added (contribution to Texas GDP), and
    - $59.4 million in output (sales value of goods and services).
- Shore-based fishing trips accounted for about 71% of all angler-trips, more than any other Texas bay system, and the majority of economic impacts (~61%).
- Non-resident anglers accounted for a greater percentage of trips taken (~9%) and economic impacts (~11%) than any other Texas bay system.

Introduction

The Corpus Christi Bay System, located in Nueces County, is approximately 192 square miles in size and is separated from the Gulf of Mexico by Mustang Island (Moretzsohn et al. 2016). The Corpus Christi Bay System includes Corpus Christi Bay, Nueces Bay, Oso Bay, and Redfish Bay. The bay system is fed by the Nueces River (by way of Nueces Bay) and Oso Creek (by way of Oso Bay) (Leatherwood 2016). The bay system contains a mix of oyster reefs, shoreline vegetation, and bottom vegetation that serve as gathering places for fish (Moretzsohn et al. 2016). The large size of the Corpus Christi Bay System along with its varied habitats allow for numerous recreational fishing opportunities. Species commonly targeted by anglers include spotted seatrout, flounder, sheepshead, and red and black drum.

The abundant fishing opportunities available in the Corpus Christi Bay System make recreational fishing a favored pastime of both locals and visitors to the area. The Texas economy benefits from these fishing trips through angler spending on goods and services such as lodging, food, ice, bait, and fuel. In this paper, we estimate the annual economic impacts of Corpus Christi Bay System recreational fishing on the Texas economy. Our analysis combines data from the Texas Parks and Wildlife Department (TPWD) on recreational fishing in the Corpus Christi Bay System with Texas marine recreational angler spending estimates from a National Marine Fisheries Service (NMFS) report (Lovell, Steinback, and Hilger 2013) to calculate estimated economic impacts. The analysis presented covers three types of bay fishing: 1) for-hire fishing trips utilizing a guide or charter service, 2) fishing from a private vessel, and 3) fishing from shore[4].

Recreational Angler Effort Data

Data on fishing effort by bay system in the state of Texas are collected annually by the TPWD through their creel surveys. TPWD conducts creel surveys throughout the year at specified boat-access sites along the Texas coast from Port Arthur to Port Isabel. More than 1,000 surveys are scheduled annually on randomly selected weekdays and weekend days, with site survey frequency proportional to site fishing pressure, meaning more active sites are surveyed more frequently (Green 2016). While the major objective of the surveys is to determine how many fish are being caught, TPWD also uses the data gathered to estimate fishing effort (number of trips) in each bay system, including the Corpus Christi Bay System. Table 1, shown below, provides TPWD estimates of

[4] Shore fishing includes fishing from fishing piers.

recreational angler effort in the Corpus Christi Bay System for anglers employing for-hire vessels (charter trips), fishing from private vessels, and shore anglers. The estimates are provided in "angler-trips," which accounts for multiple anglers on a trip; for instance, if four anglers went fishing together, it would represent four angler-trips, not a single group fishing trip. The percentage of anglers from Texas is also included. The estimates for private vessel and for-hire effort is from the 2014-2015 fishing year, while the estimate for shore fishing effort is from the 2013-2014 fishing year[5].

Table 1. Corpus Christi Bay System Recreational Fishing Effort by Angler Type

Angler Type	Angler-Trips	% Texan
For-Hire	18,704	92.7%
Private Vessel	71,300	87.5%
Shore	215,908	91.4%

Recreational Angler Spending Data

Data on recreational angler spending were gathered from a NMFS report titled "The Economic Contribution of Marine Angler Expenditures in the United States, 2011." This report used survey results to estimate marine recreational fishing expenditures for each coastal state. The report defined marine recreational fishing as: "… fishing for finfish in the open ocean or any body of water that is marine or brackish for sport or pleasure." The surveys collected data on angler-trip expenditures related to their most recent marine recreational fishing trip. The data gathered were used to calculate the economic impacts of marine recreational fishing at the state and national level (Lovell, Steinback, and Hilger 2013). The analysis presented in this paper adjusts the trip expenditure estimates to account for changing prices (fuel) and general inflation and calculates current estimates of the economic impacts associated with marine recreational fishing in Texas.

Texas survey data were collected through a mail survey of fishers with valid Texas fishing licenses that allowed marine recreational fishing in 2011[6]. Surveys were conducted monthly

[5] TPWD creel survey data are annualized for a fishing year spanning from May 15th to May 14th. TPWD collects shore angler effort data less frequently, and the 2013-2014 creel year represents the most recent estimate of shore angler effort.

[6] Some Texas fishing licenses are restricted to freshwater fishing only; these were excluded from the sample frame. The license holders that were included in the sample frame were: resident fishing and hunting combination, resident all-water, resident marine, non-resident all-water, and non-resident marine.

throughout the year to capture seasonality in trip expenditures. The survey response rate was 17.6%; 1,025 of the 5,820 mail surveys sent out were at least partially completed[7] (Lovell, Steinback, and Hilger 2013). The survey asked respondents questions about their expenditures related to their most recent marine fishing trip and spending on marine fishing-related durable goods (tackle, clothing, boats, license fees, etc.) during the previous year[8]. Respondents were asked to report what they personally spent on themselves and others and to not include any money that was spent on them by others; the question was asked in this manner in an attempt to calculate per-angler expenditures and not per-angling-party expenditures. For multi-day trips that included other activities (sightseeing, beach-going, etc.), fishers were asked to estimate expenses related to the entire trip and not just the days spent fishing. Although all spending on multi-day trips was included in survey responses, reported mean trip expenditures were for an angler-trip, which was defined as a single day of fishing for a single angler (Lovell, Steinback, and Hilger 2013). Mean angler-trip expenditures from the report are presented in Table 2 by angler effort type (for-hire, private vessel, and shore) and residency status. The next section outlines the calculation of angler-trip economic impact estimates.

Angler-Trip Economic Impact Estimates

The first step in calculating the angler-trip economic impact estimates was to update the 2011 spending estimates to account for inflation and price changes. Spending estimates were updated to 2015 values. Fuel costs were adjusted to account for the decrease in fuel costs that occurred between 2011 and 2015[9]. All other expense categories were adjusted for inflation using the United States Bureau of Labor Statistics CPI figures[10]. After accounting for inflation and lower fuel costs, mean angler-trip costs fell an average of 5% across the different angling types (for-hire, private boat, and shore) and angler types (resident and non-resident).

The second step in estimating the angler-trip economic impacts was to use IMPLAN, an input-output analysis software package, to determine how spending on recreational fishing impacted the Texas state economy (IMPLAN Group LLC. 2015). Each type of trip expenditure (fuel, lodging, food, etc.) is included in an IMPLAN sector that matches the type of business activity it represents,

[7] Some responses did not have all questions answered.
[8] The analysis presented in this paper focuses on fishing trip expenditures and their impacts; durable goods expenditures are not included in the analysis.
[9] The United States Energy Information Administration website was used to estimates changes in fuel costs. Per the website, the average fuel cost was $3.37/gallon in 2011 and $2.17/gallon in 2015. Mean angler-trip fuel expenditures were divided by the 2011 value and then multiplied by the 2015 value.
[10] Estimated inflation was 5.5% between 2011 and 2015.

and the economic impacts associated with spending in each sector are calculated. Once the appropriate IMPLAN sectors were identified, the IMPLAN model was run to estimate the associated impacts. Four different economic impact measures were calculated: employment, labor income, value-added, and output. Employment measures the number of jobs created by the marine recreational fishing expenditures. Labor income measures the wages paid to those employed due to marine recreational fishing in the Corpus Christi Bay System. Value-added measures the increase in Texas GDP due to the spending of recreational fishers, and output measures the total value of goods and services purchased because of Corpus Christi Bay System recreational fishing. Labor income is a component of value-added, which is a share of output; thus, these figures cannot be summed. The economic impacts estimated in this report are state-level impacts. Respondents to the NMFS survey were asked to report their trip expenditures incurred in the State of Texas; as such, we are unable to determine what percentage of spending occurred in the Corpus Christi Bay System area. Because we are unable to determine where in Texas expenditures were incurred, estimating city or county level impacts was not feasible. The IMPLAN sectors associated with each expense category are presented in Table 3[11].

For each impact measure, three different effect types were estimated: direct, indirect, and induced. Direct effects are directly attributable to marine recreational fishing and include spending on goods and services by recreational anglers. Indirect effects are due to changes in inter-industry purchases as businesses used by recreational fishers purchase more goods and services from other businesses; an example of an indirect effect would be increased recreational fishing leading bait shops to buy more bait from commercial bait fishers. Induced effects include increased purchases of goods and services by those employed due to marine recreational fishing (bait fish retailers, charter guides, etc.).

[11] An examination of Table 3 will highlight differences between the IMPLAN sectors we used in our calculations of economic impacts and those used in the NMFS study. For a few of the expense categories, we felt different IMPLAN sectors better fit the expense than the sectors selected by the NMFS researchers.

Table 2. Mean Angler-Trip Expenditures by Fishing Type (from Lovell, Steinback, and Hilger 2013)

	For-Hire		Private Boat		Shore	
	Resident	Non-Resident	Resident	Non-Resident	Resident	Non-Resident
Auto Fuel	$54.94	$85.63	$46.04	$36.93	$44.52	$47.26
Auto Rental	$0.00	$22.57	$0.00	$14.27	$0.04	$3.16
Bait	$4.26	$2.55	$13.60	$10.20	$12.33	$10.35
Boat Fuel	$0.00	$0.00	$32.99	$16.11	$0.00	$0.00
Boat Rental	$6.72	$5.89	$1.98	$0.66	$0.00	$0.00
Charter Fees	$205.77	$152.20	$0.00	$0.00	$0.00	$0.00
Crew Tips	$13.86	$19.65	$0.00	$0.00	$0.00	$0.00
Fish Processing	$0.00	$0.00	$0.00	$0.00	$0.00	$0.09
Food from Grocery Stores	$34.16	$27.89	$32.74	$15.64	$33.16	$32.21
Food from Restaurants	$37.31	$30.41	$23.84	$28.68	$24.39	$24.82
Gifts/Souvenirs	$8.13	$24.83	$1.70	$8.94	$3.04	$10.24
Ice	$5.45	$2.42	$4.19	$3.17	$2.87	$3.50
Lodging	$38.56	$67.44	$22.35	$21.35	$33.84	$48.66
Parking & Site Access	$0.58	$4.64	$1.68	$1.59	$2.33	$2.60
Public Transportation	$0.00	$13.55	$0.00	$21.37	$0.02	$3.56
Tournament Fees	$0.00	$0.11	$1.74	$2.71	$0.00	$0.00
Total	**$409.74**	**$459.78**	**$182.85**	**$181.62**	**$156.54**	**$186.45**

Table 3. IMPLAN Sectors

Expense Category:	IMPLAN Sectors	IMPLAN Sector Descriptions
Auto Fuel	402	Retail - Gasoline Stores
Auto Rental	442	Automotive Equipment Rental & Leasing
Bait	404	Retail - Sporting Goods
Boat Fuel	402	Retail - Gasoline Stores
Boat Rental	443	General and Consumer Goods Rental
Charter Fees	414	Scenic and Sightseeing Transportation
Crew Tips	414	Scenic and Sightseeing Transportation
Fish Processing	93	Seafood Product Preparation & Packaging
Food from Grocery Stores	400	Retail - Food & Beverage Stores
Food from Restaurants	501	Full Service Restaurants
Gifts & Souvenirs	406	Retail - Miscellaneous
Ice	402	Retail - Gasoline Stores
Lodging - Hotels & Motels	499	Hotels & Motels
Lodging - Other Accommodations	500	Other Accommodation
Parking & Site Access	512	Other Personal Services - Parking
Public Transportation	408	Air Transportation

Calculation and Presentation of Economic Impacts

Angler-trip economic impacts were calculated for all three angling types (for-hire, private vessel, and shore) for both Texas resident and non-resident anglers. Total economic impacts from recreational fishing in the Corpus Christi Bay System were calculated as the product of TPWD estimates of angler-trips, and the estimated economic impacts per angler-trip. The economic impacts from for-hire, private vessel, and shore anglers are presented in Tables 4, 5, and 6, respectively. Economic impacts associated with shore-based fishing accounted for just over half of all economic impacts. The higher impacts from shore fishing were due to the large number of shore-based recreational fishing trips taken (71% of all trips). Total impacts across all three angler types (for-hire, private vessel, and shore) are presented in Table 7. The impacts associated with resident anglers were significantly higher than the those associated with non-resident trips. While non-resident fisher trips generally led to greater angler-trip expenditures and economic impacts, the larger volume of residential trips (91% of all trips) outweighed the per-trip effects.

Table 4. Economic Impacts of Corpus Christi Bay System For-Hire Recreational Fishing

For-Hire Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	58.42	$2,274,317	$2,855,640	$5,889,102
Indirect Effect	20.39	$1,127,864	$1,770,597	$3,114,581
Induced Effect	21.27	$988,664	$1,722,721	$3,023,399
Total Effect	**100.07**	**$4,390,845**	**$6,348,958**	**$12,027,082**
For-Hire Non-Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	4.89	$184,848	$255,998	$494,801
Indirect Effect	1.58	$87,051	$139,608	$247,454
Induced Effect	1.70	$79,045	$137,736	$241,728
Total Effect	**8.17**	**$350,944**	**$533,342**	**$983,983**
For-Hire Total				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	63.31	$2,459,165	$3,111,638	$6,383,903
Indirect Effect	21.96	$1,214,914	$1,910,205	$3,362,035
Induced Effect	22.97	$1,067,710	$1,860,457	$3,265,127
Total Effect	**108.24**	**$4,741,789**	**$6,882,300**	**$13,011,065**

Table 5. Economic Impacts of Corpus Christi Bay System Private Vessel Recreational Fishing

Private Vessel Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	70.81	$1,954,700	$2,808,994	$4,679,982
Indirect Effect	12.10	$626,119	$1,108,104	$1,990,508
Induced Effect	16.22	$754,299	$1,314,578	$2,307,019
Total Effect	**99.13**	**$3,335,117**	**$5,231,676**	**$8,977,509**
Private Vessel Non-Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	11.53	$354,828	$561,342	$978,966
Indirect Effect	2.31	$128,661	$230,865	$427,116
Induced Effect	3.04	$141,244	$246,153	$431,988
Total Effect	**16.88**	**$624,733**	**$1,038,360**	**$1,838,070**
Private Vessel Total				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	82.34	$2,309,528	$3,370,336	$5,658,948
Indirect Effect	14.41	$754,780	$1,338,969	$2,417,624
Induced Effect	19.25	$895,542	$1,560,731	$2,739,007
Total Effect	**116.01**	**$3,959,850**	**$6,270,036**	**$10,815,580**

Table 6. Economic Impacts of Corpus Christi Bay System Shore-Based Recreational Fishing

Shore Angler Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	246.51	$6,685,283	$9,861,777	$16,567,955
Indirect Effect	43.57	$2,253,338	$3,934,946	$7,109,361
Induced Effect	56.21	$2,614,463	$4,556,543	$7,996,472
Total Effect	**346.29**	**$11,553,084**	**$18,353,267**	**$31,673,788**
Shore Angler Non-Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	28.68	$803,200	$1,224,692	$2,054,151
Indirect Effect	5.34	$279,143	$485,717	$880,737
Induced Effect	6.80	$316,417	$551,449	$967,765
Total Effect	**40.82**	**$1,398,760**	**$2,261,858**	**$3,902,652**
Shore Angler Total				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	275.19	$7,488,483	$11,086,469	$18,622,106
Indirect Effect	48.91	$2,532,481	$4,420,663	$7,990,098
Induced Effect	63.01	$2,930,880	$5,107,992	$8,964,237
Total Effect	**387.11**	**$12,951,844**	**$20,615,125**	**$35,576,440**

Table. 7 Economic Impacts of Corpus Christi Bay System Recreational Fishing (All)

Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	375.74	$10,914,299	$15,526,412	$27,137,039
Indirect Effect	76.05	$4,007,321	$6,813,648	$12,214,450
Induced Effect	93.69	$4,357,426	$7,593,842	$13,326,890
Total Effect	**545.49**	**$19,279,047**	**$29,933,901**	**$52,678,380**
Non-Resident				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	45.10	$1,342,876	$2,042,032	$3,527,917
Indirect Effect	9.23	$494,855	$856,190	$1,555,307
Induced Effect	11.54	$536,705	$935,338	$1,641,481
Total Effect	**65.87**	**$2,374,437**	**$3,833,560**	**$6,724,706**
Total				
Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
Direct Effect	420.84	$12,257,176	$17,568,444	$30,664,957
Indirect Effect	85.28	$4,502,176	$7,669,837	$13,769,757
Induced Effect	105.23	$4,894,132	$8,529,180	$14,968,371
Total Effect	**611.36**	**$21,653,484**	**$33,767,461**	**$59,403,085**

Concluding Remarks

Marine recreational fishing in the State of Texas is not only a popular recreational activity but also a valuable part of the Texas economy. Our analysis indicates that Corpus Christi Bay System recreational fishing trips generates 611 jobs and $21.7 million in labor income in Texas annually. Trip spending by Corpus Christi Bay System recreational fishers is also responsible for $59.4 million of economic activity and contributes $33.8 million to the Texas economy each year. Shore fishing accounted for approximately 71% of all trips and 60% of all impacts. Non-resident fishing in the Corpus Christi Bay System accounted for a greater percentage of angler trips and economic impacts than any other Texas bay system.

The results of this analysis are presented with some caveats regarding the data from the NMFS survey. The first issue is that the data were not specific to the Corpus Christi Bay System; the survey gathered data on Texas marine recreational fishing regardless of where the fishing occurred. It is possible that Gulf of Mexico anglers spend more on fishing trips, on average, than bay anglers, which would lead to overstated economic impacts. Such a problem would be exacerbated if Gulf anglers were more willing to respond to the survey. Similar problems could arise if spending on fishing trips varied significantly by coastal region or bay system. The second issue concerns the possibility of response bias. Anglers were asked to report only what they personally spent on themselves or others and not to include expenses paid on their behalf by others (Lovell, Steinback, and Hilger 2013). If anglers that funded trips were more likely to respond to the survey than those being funded, the spending estimates at the angler-trip level would be skewed upwards, which would lead to overstated impacts. The NMFS survey did not look specifically at this form of response bias; the authors evaluated other possible forms of response bias and found no issues. While the issues noted could impact the findings of this analysis, we have no evidence that any of these issues exist (regional spending differences, bay vs. Gulf differences, non-response bias among non-paying anglers) and believe the results presented provide an appropriate estimate of the annual economic impacts of recreational fishing in the Corpus Christi Bay System.

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