ECONOMIC ACTIVITY ASSOCIATED WITH

HUNTING

ALONG THE TEXAS GULF COAST

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Contracted through the

River Systems Institute

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Introduction

This report focuses on estimating the economic activity[1] associated with hunting in Sabine Lake/Sabine-Neches Estuary, Galveston Bay/Trinity-San Jacinto Estuary, Matagorda Bay/Lavaca-Colorado Estuary, San Antonio Bay/Guadalupe Estuary, Aransas Bay/Mission-Aransas Estuary, Corpus Christi Bay/Nueces Estuary, Baffin Bay/Upper Laguna Madre Estuary, and South Bay/Lower Laguna Madre Estuary. Each bay/estuary area will define a separate geographic region of study comprised of one or more counties. The results show trip- and equipment-related spending of residents and non-residents on hunting in each of these regions and the impact this spending had on the economy in terms of earnings, employment and sales output. Migratory[2] and resident birds, including waterfowl are assumed to be the primary targets of hunting opportunities in the regions of interest to this study.

Estimates of the direct impacts associated with visitor spending were produced using IMPLAN, an input-output of the Texas economy developed by the Minnesota IMPLAN Group. General state information from the 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (U.S. Department of the Interior March 2003) and a study done by Southwick Associates (Southwick 2003)is available for hunting. However, no information exists on a regional basis for this type of activity, but stamp data exists on a county basis, and from this data, the number of licensed hunters can be obtained. Estimates of hunting economic activity are provided in terms of direct expenditure, sales output, income, and employment. These estimates are reported by category of expenditure.

Indirect and Induced (Secondary) impacts are generated from the direct impacts calculated by IMPLAN. Indirect impacts represent expenditures made and allocated to the sectors in which purchases made from suppliers. Induced impacts represent spending by employees who earn income within these industries.

Section A provides a brief overview of the study area and geography of the bay system. Section B briefly describes hunting in the study area. Section C summarizes the direct impact of hunting in each of the Bay areas. Section D will provide estimates of economic activity of each region of study - regional direct and indirect employment, as well as direct and indirect income generated by hunting. Appendix A contains definitions of words and terms used in this study. Appendix B provides details of data collection, methods used to calculate expenditures, adjustments made to the data, assumptions and

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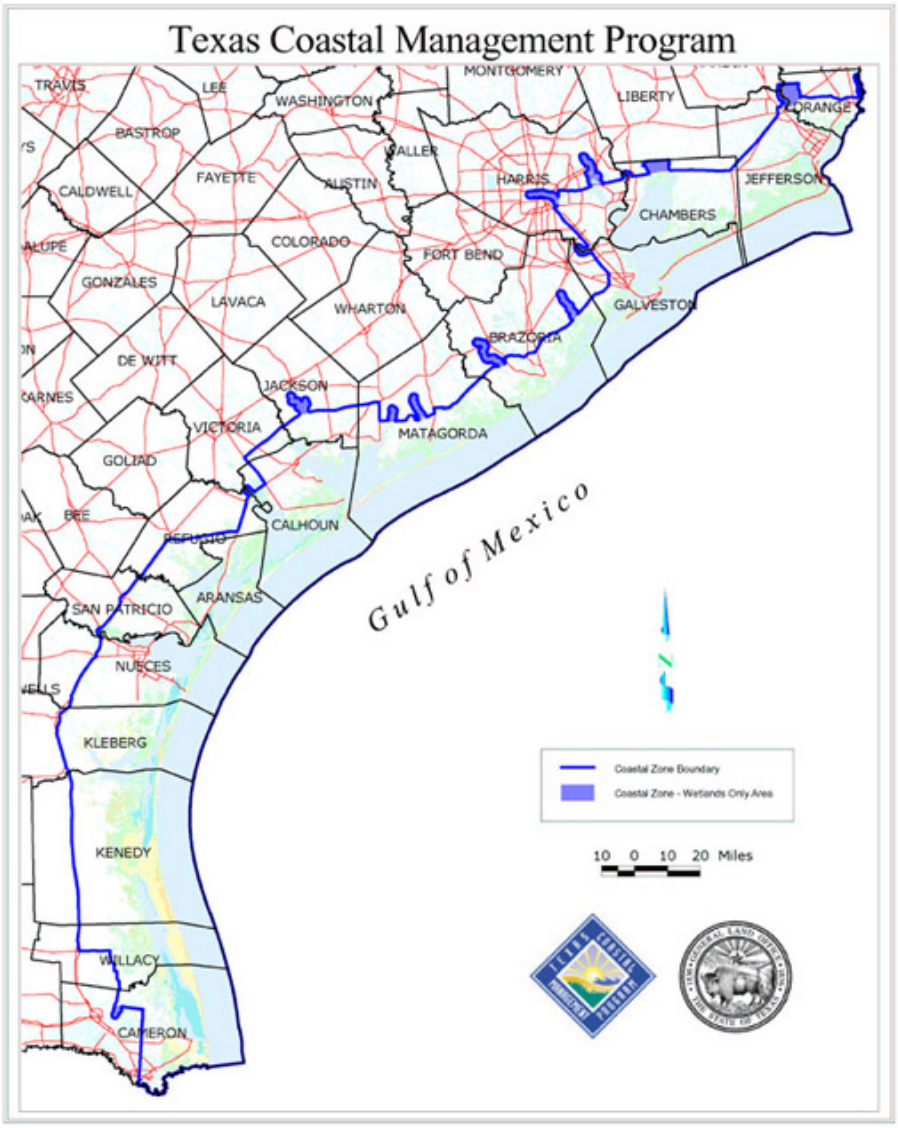
[1] In this study, economic activity refers to the direct stimuli generated by resident and non-resident expenditures. It is not uncommon to make a distinction between economic impact and economic activity. Southwick refers to economic activity as 'economic importance' Southwick, R. (2002). The Economic Effects of Sportfishing Closures in Marine Protected Areas: The Channel Islands Example - A Report Prepared for the American Sportfishing Association United Anglers of Southern California. Fernandina Beach, Florida, Southwick Associates, Inc.**:** 1-18.

[2] The USFWS and the U.S. Census 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation report lists Geese, Duck, Dove and other migratory birds in this category.

discusses limitations of the model. Appendix C explains the model used to estimate economic activity.

A. Study Area and Geography of the Bay System[3]

Figure 1: Counties of the Study Area



[3] See http://www.glo.state.tx.us/coastal/cmpdoc/jpegs/guidance-czb-sm.jpg for maps of Texas coastal zones.

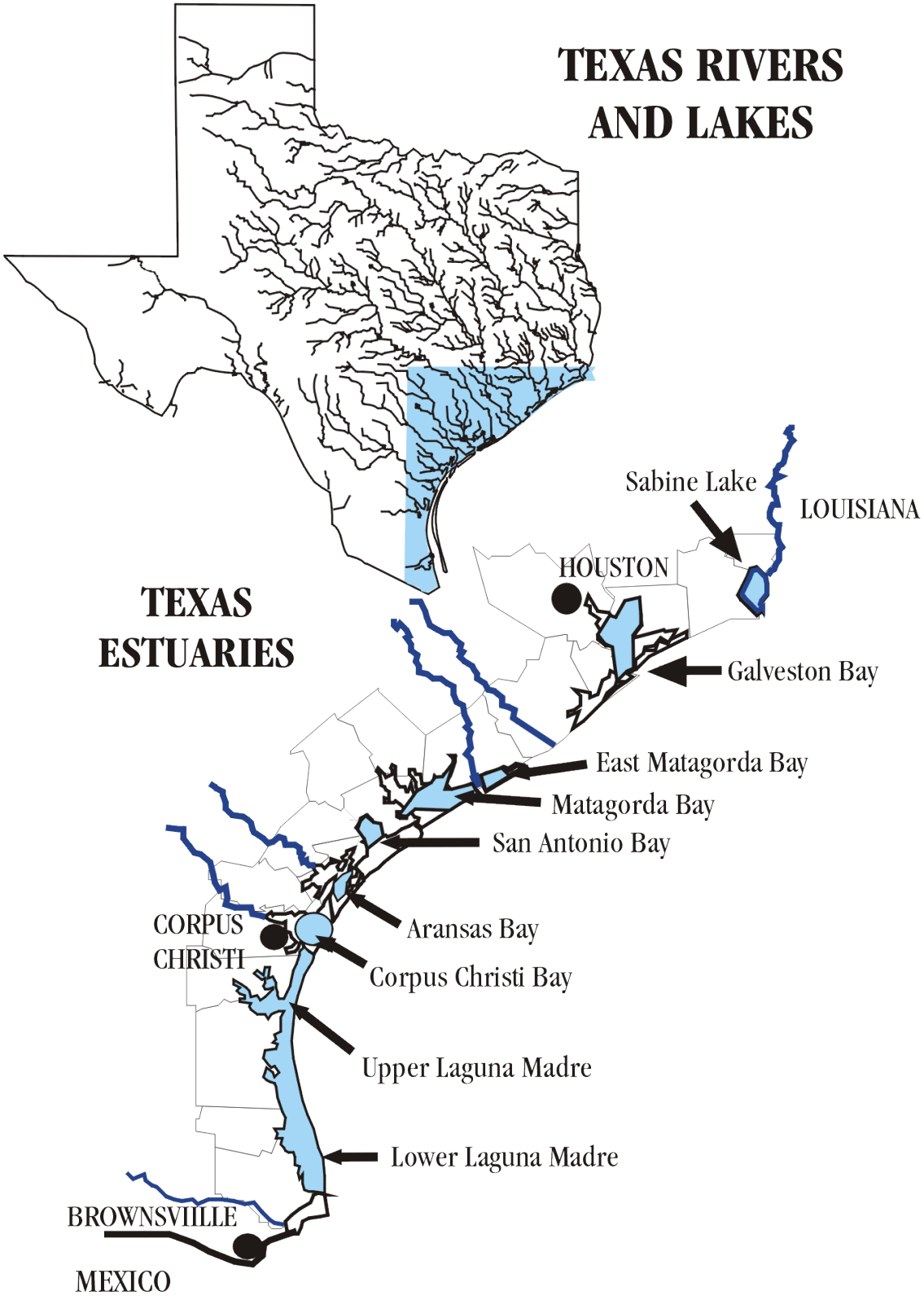


Figure 2: Bay Areas Comprising the Study Area

Table 1: Texas Bays, Estuaries and County Breakdown of Study Area	
Bay/Estuary	Counties
South Bay/Lower Laguna Madre Estuary	
	+ ½ Kenedy (Port Mansfield Area)
	Cameron
	(Hidalgo)
	Willacy
Baffin Bay/Upper Laguna Madre Estuary	
(Jim Wells)	Kenedy (- ½ Kenedy Baffin Area)
	Kleberg
Corpus Christi Bay/Nueces Estuary	
	Nueces
	San Patricio
	Aransas (½ Aransas)
Aransas Bay/Mission-Aransas Estuary	
	(2/3 Refugio)
	Aransas
	San Patricio
San Antonio Bay/Guadalupe Estuary	
(Goliad)	(1/3 Refugio)
	Calhoun
	(½ Aransas)
	(Victoria)
Matagorda Bay/Lavaca-Colorado Estuary	
(Wharton)	(Jackson)
	Matagorda
	Calhoun
	Victoria
Galveston Bay and the Trinity-San Jacinto Estuary	
(Fort Bend)	Galveston
	Brazoria
	Harris
	(Liberty)
	Chambers
Sabine Lake and the Sabine-Neches Estuary	
	Orange
	Jefferson

Figure 3:

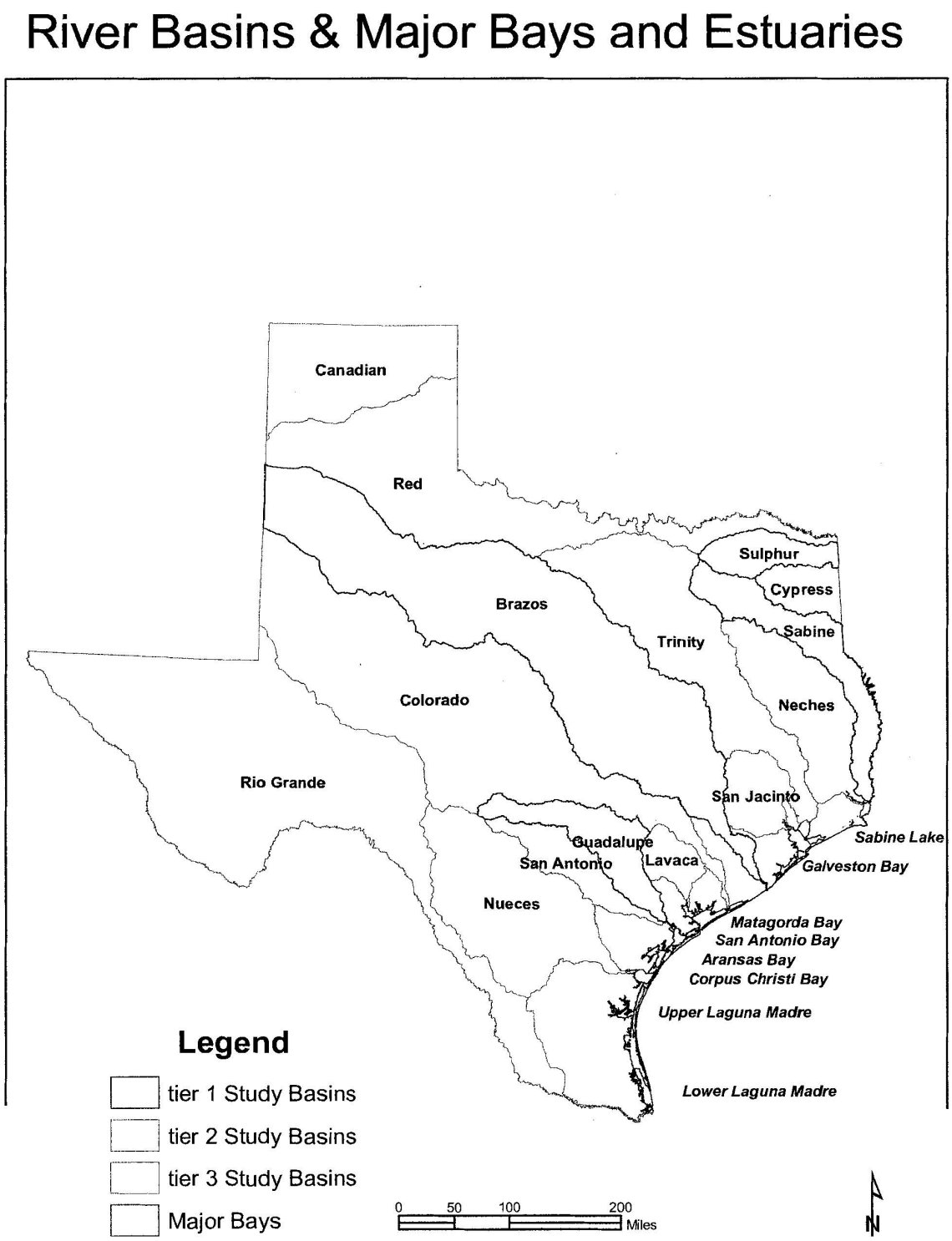

River Basins & Major Bays and Estuaries
Canadian
Red
Brazos
Colorado
Rio Grande
Nueces
Sulphur
Cypress
Sabine
Trinity
Neches
San Jacinto
Guadalupe
San Antonio
Lavaca
Sabine Lake
Galveston Bay
Matagorda Bay
San Antonio Bay
Aransas Bay
Corpus Christi Bay
Upper Laguna Madre
Lower Laguna Madre
Legend
tier 1 Study Basins
tier 2 Study Basins
tier 3 Study Basins
Major Bays
0 50 100 200
Miles
N

Figure 1 shows the study area by county where hunting takes place. Study area will be defined in this study as the area where both the activity and the economic activity takes place. Figure 2 shows the location of each bay. Table 1 shows the counties which are the primary beneficiaries of the sales, employment, and income from activities in the bays and estuaries fed by freshwater inflows. Bay regions may overlap more than one county boundary to define the economic region of interest to this study.

B. About Hunting in Texas[4]

Gulf coast estuaries and bays, fed by freshwater inflows, contain coastal wetlands which are breeding grounds, food source, and habitat for many animal species, including local and migratory birds. Waterfowl use the wetlands plants and animals as food sources as they migrate or look to 'winter' in a warmer climate. Healthy estuaries and bays, which depend on freshwater inflows, provide cover for nesting waterfowl and other birds. Coastal counties such as Jefferson, Fort Bend, Wharton, Calhoun and Chambers provide excellent habitat for these birds and plenty of opportunities for hunters[5].

Expenditures on hunting generally reflect those of participants 16 years and older. In 2001, 500,000 state residents and nonresidents, 16 years and older hunted migratory birds in Texas, spent over 4000 days hunting and spent money on trip, equipment and miscellaneous other things such as magazines, membership dues, licenses, permits and land leasing.

Estimates of hunting participation on the local or regional level is made difficult by the lack of published data. Almost 33,000 stamps were issued to participants in waterfowl hunting by the end of Summer 2003. Counties surrounding Galveston Bay and Matagorda Bay were the sources of the largest number of waterfowl stamp licensees, with approximately[6] 63% and 16% of licenses issued. Sabine Lake had approximately 11% of licensed hunters and Corpus Christi had a smaller (less than 10%), but appreciable number of waterfowl stamp holders. It is important to note that estuaries along the Texas Gulf coast vary by size, population, and economic viability, as noted in a Jones and Tanyeri-Abur study (Jones and Tanyeri-Abur 2001).

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[4] 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, Texas

[5] http://southern.ducks.org/TXLettertoHunters.php

[6] Note: Some counties are included in more than one estuary.

C. Initial Spending

Spending on hunting is measured by the spending by hunters, 16 years or older, for such things as food and lodging, transportation, rentals, guide and access fees, ice and bait, oil, equipment and other expenditures. These expenditures become revenues from sales to final demand. Trip Related Expenditures typically make up 28% of hunting related expenditures – USFWS and U.S. Census 2001 National Survey. This includes Food and Lodging 47%, Transportation 38%, Other 20 % (guide fees, private and public land use, equipment rental, boating costs, Heating and Cooking). Equipment Related Expenditures typically make up 44% of hunting related expenditures - 2001 National Survey. This includes include Hunting Equipment 73% (shotguns, guns, rifles, sights, ammunition, dogs), Auxiliary Equipment 9% (Camping Equipment, Binoculars, Specific Hunting Equipment, Clothing), and Special Equipment 17% (Campers, Trail Bikes). Other Expenditures typically make up 25% of hunting related expenditures. This includes Magazines 2%, Dues and Contributions 4%, Land Leasing and Ownership 80%, and Licenses, Stamps, Tags and Permits 14%.

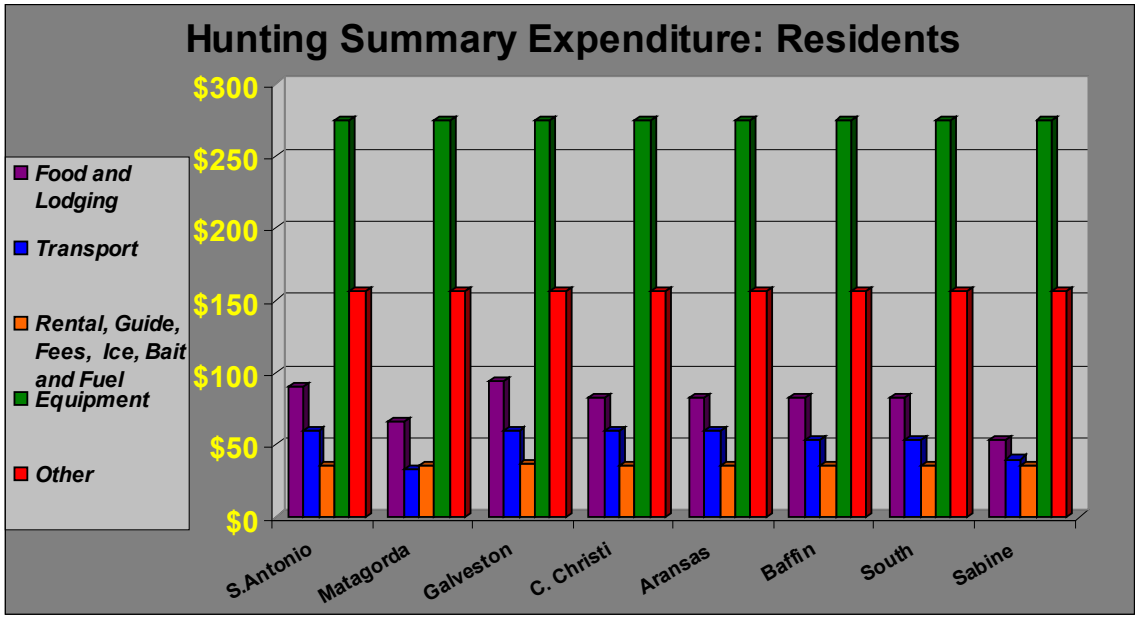
1. Summary of Expenditures

Total expenditures in each Bay area was estimated using category expenditure data from a study by Southwick Associates (Southwick 2003), with reference made to the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. This data was used to estimate trip and equipment expenditures. Methodology used to adapt these figures to spending at the bay/estuary regional level is explained in Appendix B. The following is a summary of expenditures in the Bay region of Texas adjusted for inflation[7].

[7] 2001 adjusted to 2003 dollars.

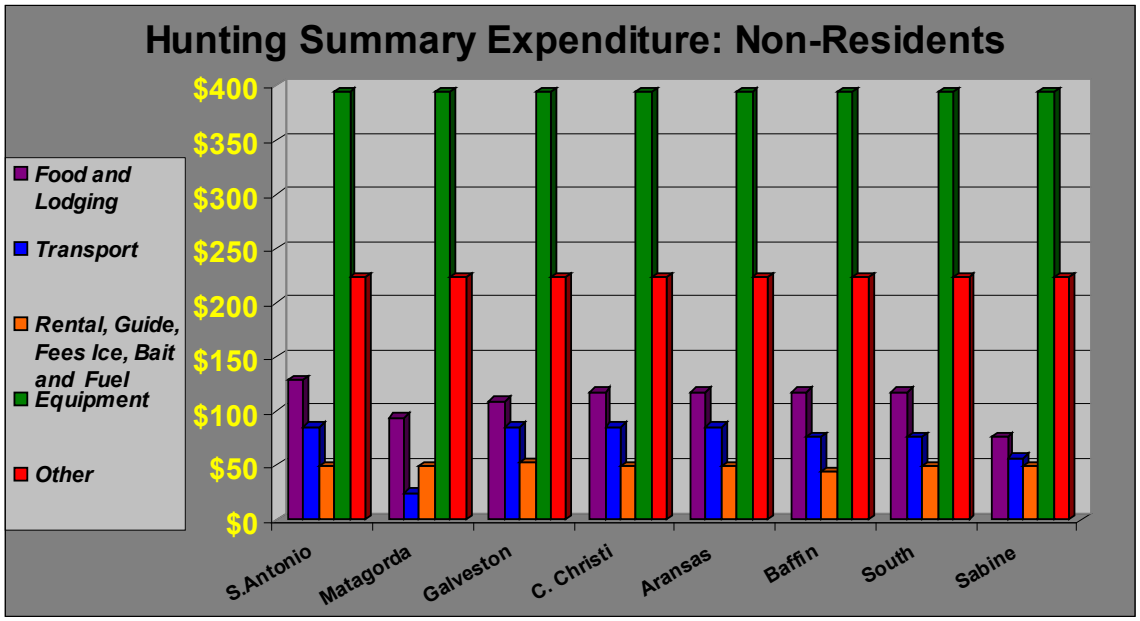
Table 2: Summary of Resident and Non-Resident Category Expenditures[8] – by Bay ($)

Bay: Resident	Food and Lodging	Transport	Rental Guide, Fees, Ice, Bait and Fuel	Equip-ment	Other
S.Antonio	90.38	59.79	34.96	274.72	156.09
Matagorda	65.73	33.22	34.96	274.72	156.09
Galveston	94.49	59.79	36.71	274.72	156.09
C. Christi	82.16	59.79	34.96	274.72	156.09
Aransas	82.16	59.79	34.96	274.72	156.09
Baffin	82.16	53.14	34.96	274.72	156.09
South	82.16	53.14	34.96	274.72	156.09
Sabine	53.41	39.86	34.96	274.72	156.09



[8] Expenditures for Rentals, Guides, Fees, Ice, Bait, Fuel, Equipment and Misc. Other are the same or similar in this summary table, and other Bay Expenditure tables because separate regional information on these types of expenditures were not available. Therefore, category proportions of the average were used. Details can be found in Appendix B. Expenditures for the other categories could be determined by individual regions.

Bay: Non-Resident	Food and Lodging	Transport	Rental Guide, Fees, Ice, Bait and Fuel	Equip-ment	Other
S.Antonio	129.66	85.77	50.16	394.09	223.91
Matagorda	94.29	25.08	50.16	394.09	223.91
Galveston	109.59	85.77	52.66	394.09	223.91
C. Christi	117.87	85.77	50.16	394.09	223.91
Aransas	117.87	85.77	50.16	394.09	223.91
Baffin	117.87	76.24	44.78	394.09	223.91
South	117.87	76.24	50.16	394.09	223.91
Sabine	76.61	57.18	50.16	394.09	223.91

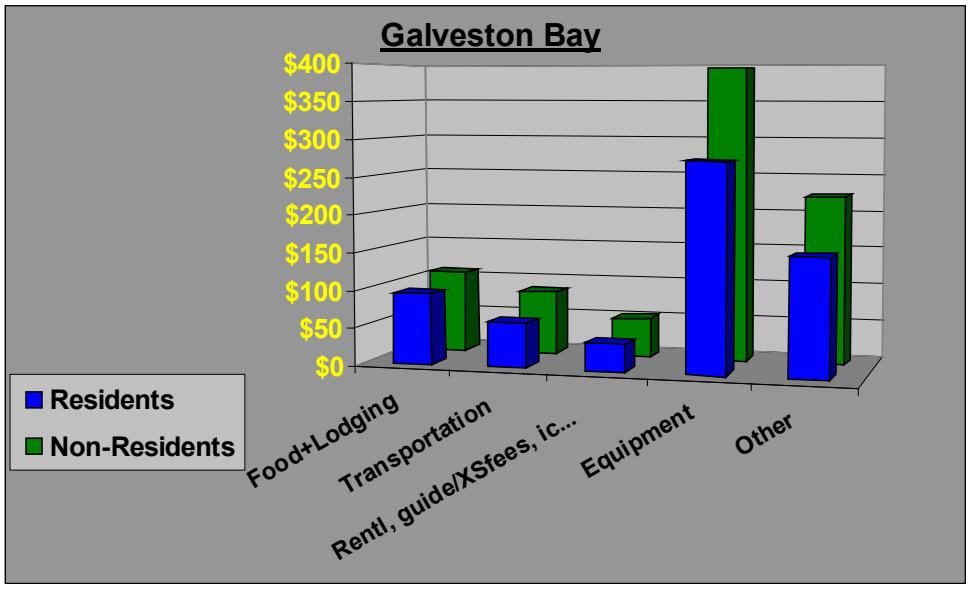


2. Expenditures For Each Bay Area

I. Trinity-San Jacinto Estuary and the Galveston Bay System

Table 3:

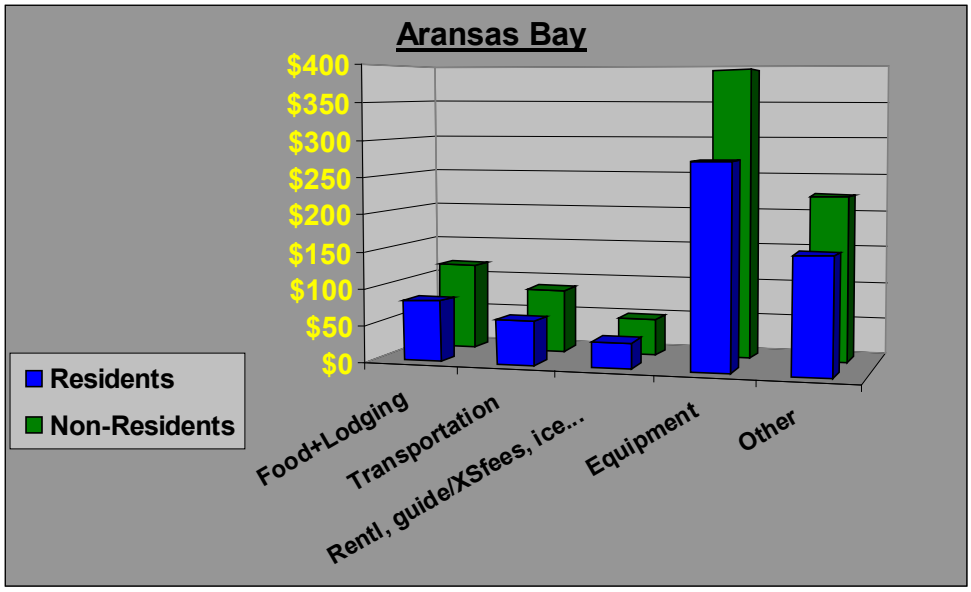
	Residents	Non-Residents
Food+Lodging	94.48962	109.5926
Transportation	59.78807	85.76813
Rentl, guide/XSfees, ice/bait,oil)	36.71197	52.66464
Equipment	274.7154	394.0891
Other	156.0883	223.9143



II. Mission-Aransas Estuary and the Aransas Bay System

Table 4:

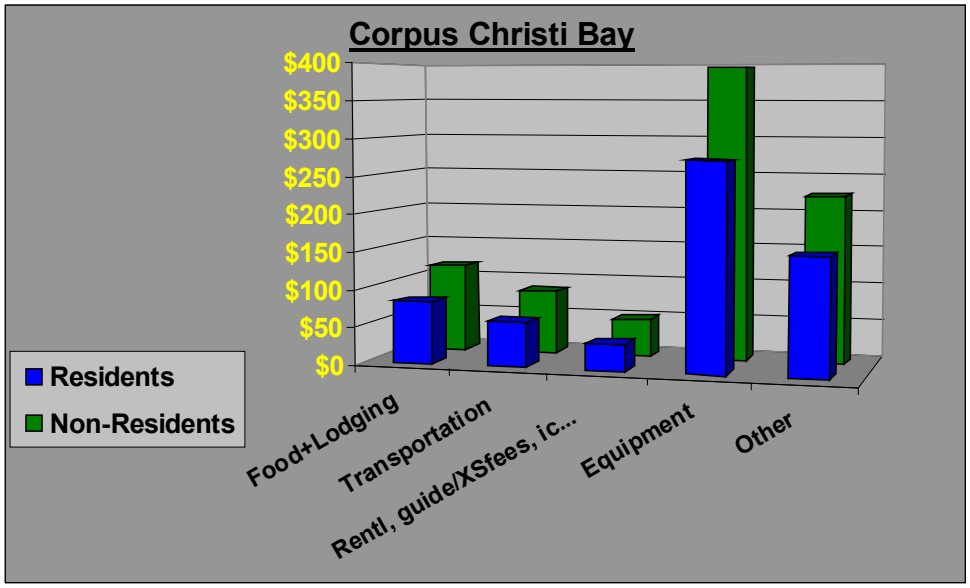
	Residents	Non-Residents
Food+Lodging	82.16489	117.8685
Transportation	59.78807	85.76813
Rentl, guide/XSfees, ice/bait,oil)	34.96378	50.1568
Equipment	274.7154	394.0891
Other	156.0883	223.9143



III. Nueces Estuary and the Corpus Christi Bay System

Table 5:

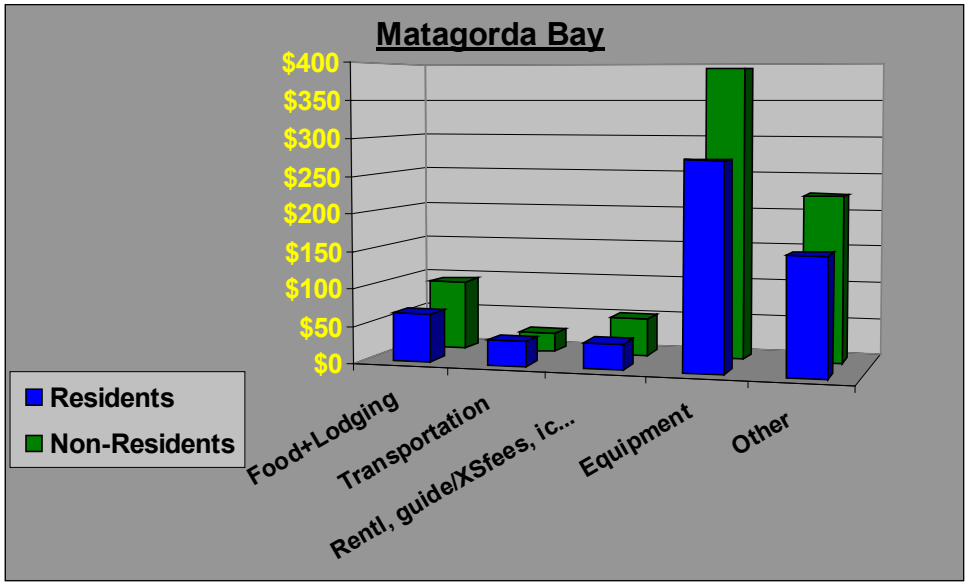
	Residents	Non-Residents
Food+Lodging	82.16489	117.8685
Transportation	59.78807	85.76813
Rentl, guide/XSfees, ice/bait,oil)	34.96378	50.1568
Equipment	274.7154	394.0891
Other	156.0883	223.9143



IV. Lavaca-Colorado Estuary and the Matagorda Bay System

Table 6:

	Residents	Non-Residents
Food+Lodging	65.73191	94.29478
Transportation	33.21559	25.0784
Rentl, guide/XSfees, ice/bait,oil)	34.96378	50.1568
Equipment	274.7154	394.0891
Other	156.0883	223.9143



V. Upper and Lower Laguna Madre Estuary and the Baffin Bay/South Bay Systems

Table 7:

	Residents	Non-Residents
Food+Lodging	82.16489	117.8685
Transportation	53.14495	76.23834
Rentl, guide/XSfees, ice/bait,oil)	34.96378	44.78286
Equipment	274.7154	394.0891
Other	156.0883	223.9143

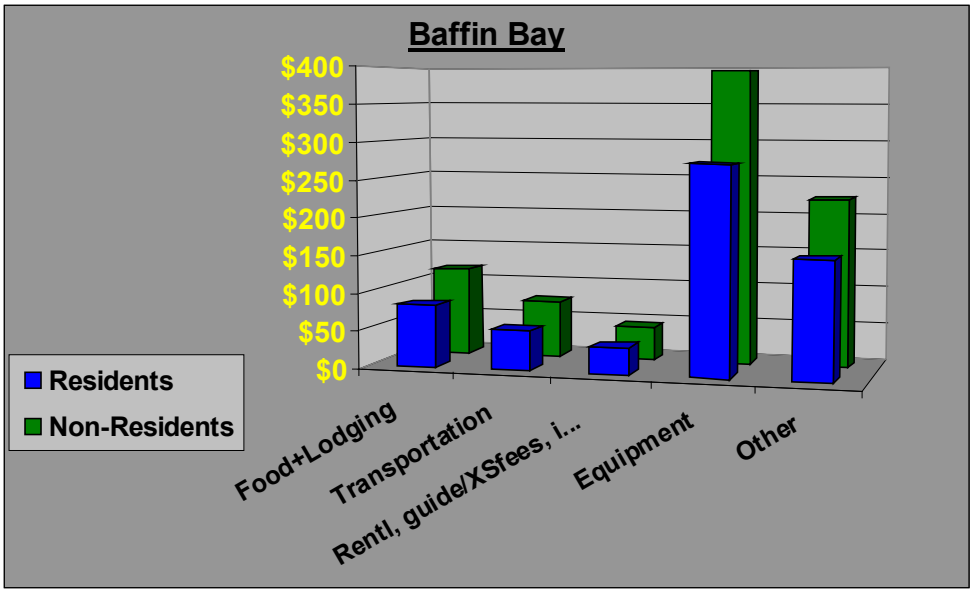
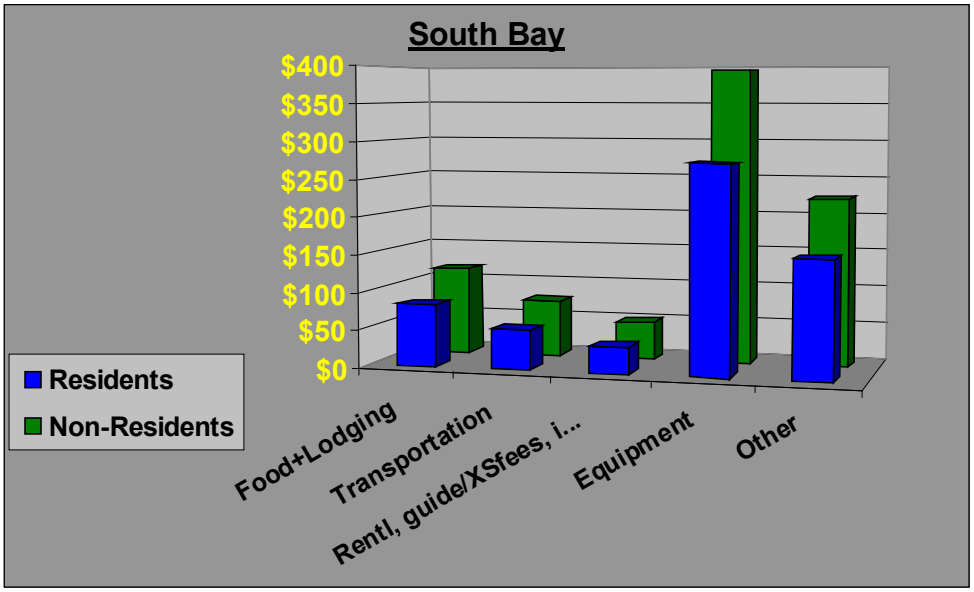

Baffin Bay
$400
$350
$300
$250
$200
$150
$100
$50
$0
Residents
Non-Residents
Food+Lodging
Transportation
Rentl, guide/XSfees, i...
Equipment
Other

Table 8:

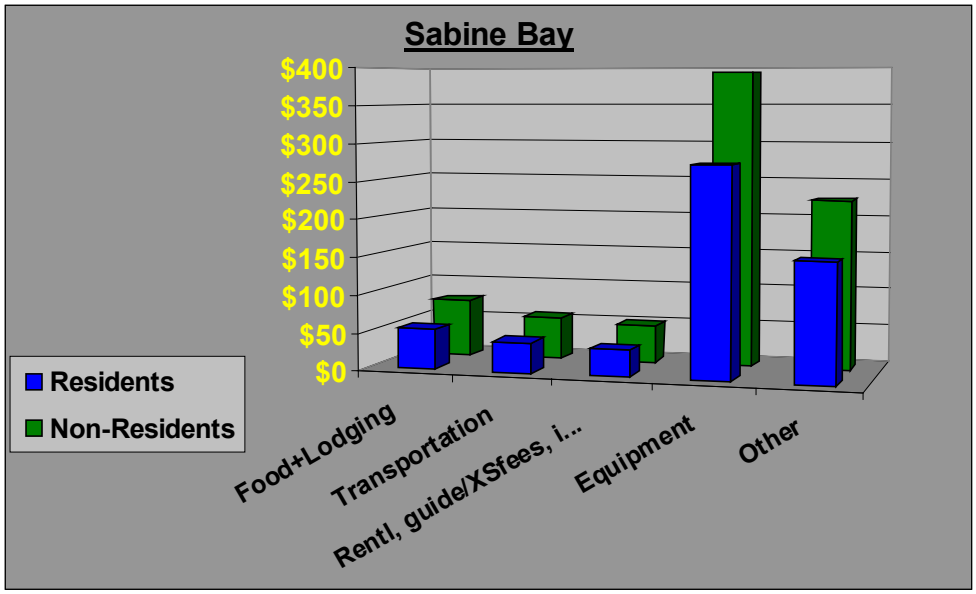
	Residents	Non-Residents
Food+Lodging	82.16489	117.8685
Transportation	53.14495	76.23834
Rentl, guide/XSfees, ice/bait,oil)	34.96378	50.1568
Equipment	274.7154	394.0891
Other	156.0883	223.9143



VI. Sabine-Neches Estuary and the Sabine Lake System

Table 9:

	Residents	Non-Residents
Food+Lodging	53.40718	76.61451
Transportation	39.85871	57.17875
Rentl, guide/XSfees, ice/bait,oil)	34.96378	50.1568
Equipment	274.7154	394.0891
Other	156.0883	223.9143



C. Estimates of Economic Activity

1. Impact Categories

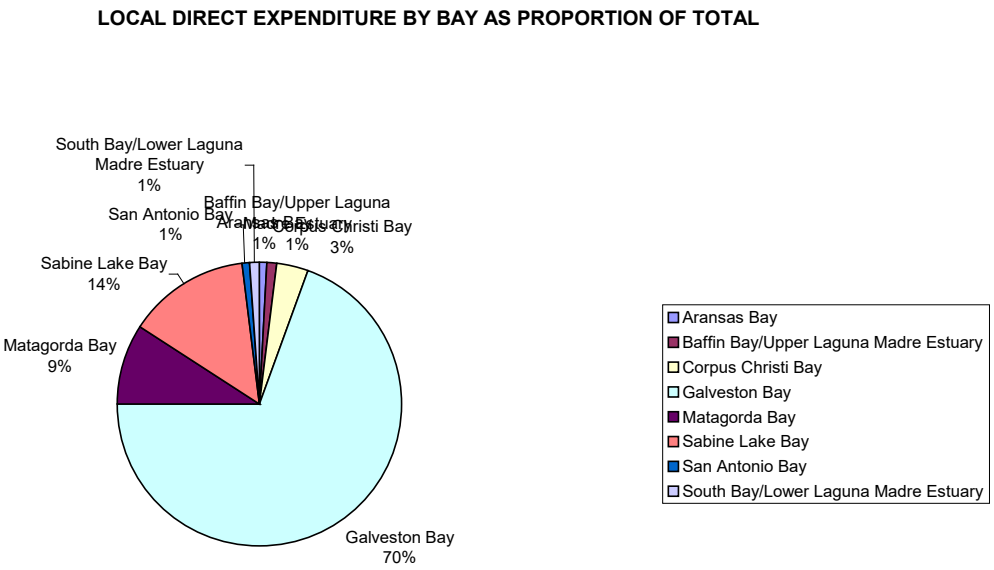
Impact Category	Description
Sales Output	• Measured in dollars • The amount of total regional business sales revenue stimulated from goods sold in recreational fishing related sectors, as a result of the direct, indirect, and induced effect of an extra dollar of spending on recreational fishing activity in the region.
Income	• Measured in dollars • The amount of personal income stimulated in recreational fishing related sectors, as a result of the direct, indirect, and induced effect of an extra dollar of spending in the region.
Employment	• Measured by number of jobs • The number of jobs (not full-time equivalent) created in recreational fishing related sectors, as a result of the direct, indirect, and induced effect of an extra dollar of spending in the region. Includes wages,

	salaries and proprietors, full- and part-time positions.

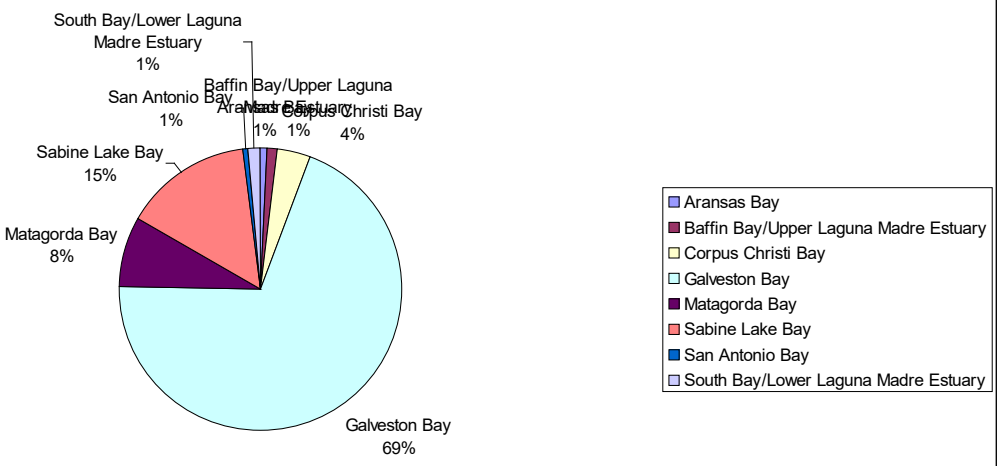
2. Direct and Indirect Impacts of Recreational Fishing Expenditures in Bays and Estuaries of the Gulf Coast: A Summary

- A total of approximately 7600 hunters participated in hunting in bay/estuary regions along the Texas Gulf Coast. The largest trip related expenditure category was Equipment, followed Other hunting-related expenditures such as magazines, dues, leasing and ownership, stamps, tags and permits.
- Expenditures made by local hunters generate direct, indirect, and induced results of economic activity. The sum of these is the total economic activity resulting from hunter expenditure. Total economic activity from local hunter expenditures adjusted to 2003 dollars in Gulf Coast bays is estimated at $3,530,769.
- Expenditures made by non-local hunters generate direct, indirect, and induced results of economic activity. The sum of these is the total economic activity resulting from hunter expenditure. Total economic activity from non-local hunter expenditures adjusted to 2003 dollars in Gulf Coast bays is estimated at $1,477,775.
- Sales Output Total retail sales generated from expenditures adjusted to 2003 dollars from local hunters is estimated at $5,175,733.
- Sales Output Total retail sales generated from expenditures adjusted to 2003 dollars from non-local hunters is estimated at $2,087,688.
- Income Total household earnings generated from expenditures adjusted to 2003 dollars from local hunters is estimated at $2,950,250.
- Income Total household earnings generated from expenditures adjusted to 2003 dollars from non-local hunters is estimated at $1,184,291.
- Employment Hunting by local participants supported 114.1 full-time and part-time jobs in the Gulf Coast region of Texas. These are jobs that are directly associated with hunting in addition to jobs in industries that indirectly support these activities.
- Employment Hunting by non-local participants supported 47.7 full-time and part-time jobs in the Gulf Coast region of Texas. These are jobs that are directly associated with hunting in addition to jobs in industries that indirectly support these activities.

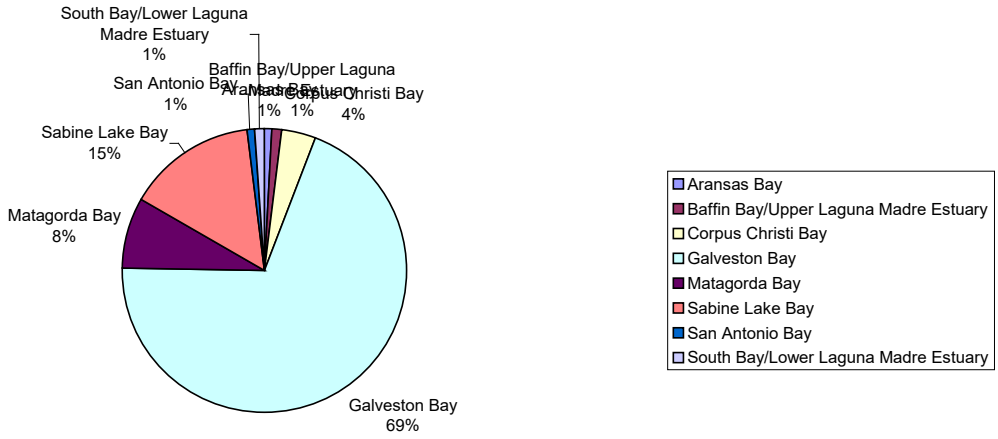
Figure 10: Economic Activity of Hunting as a Result of Local Spending - Bay Proportion of Total



SALES OUTPUT GENERATED BY LOCAL EXPENDITURE



INCOME GENERATED BY LOCAL EXPENDITURE



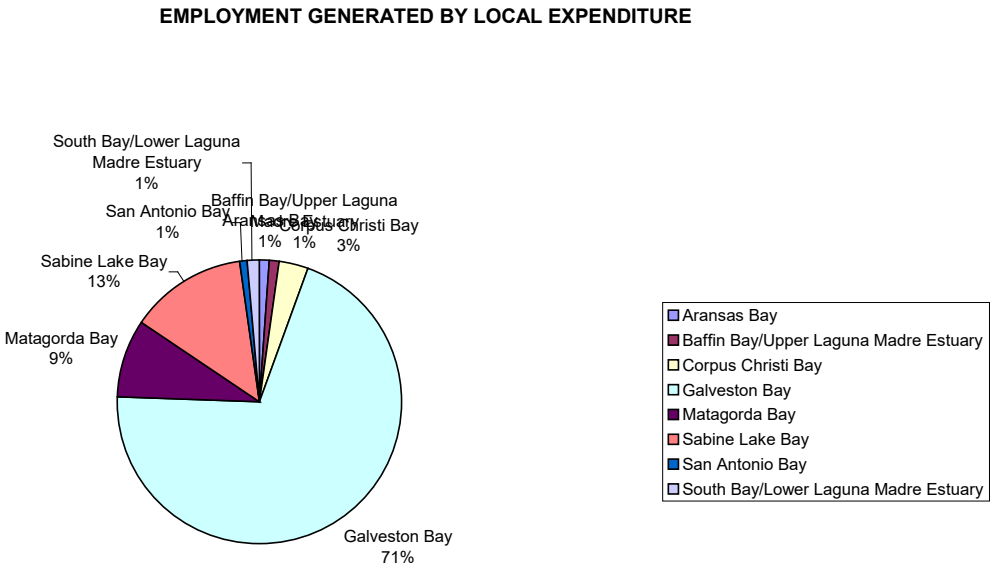
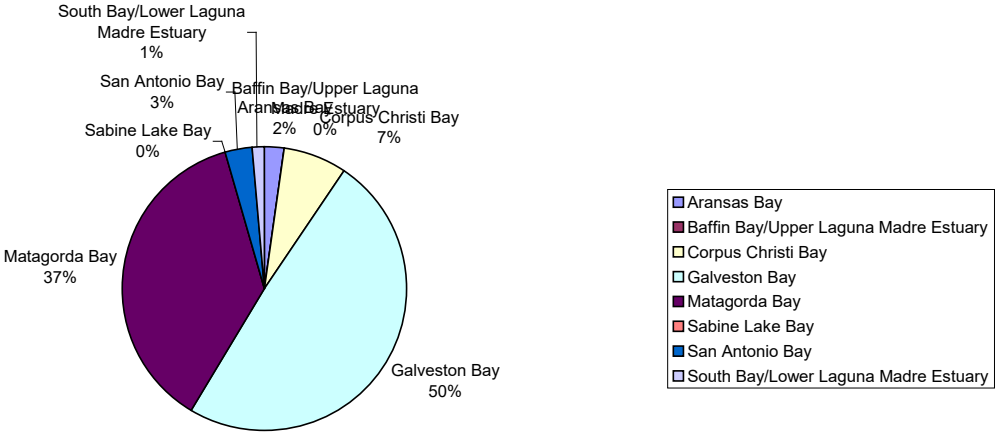


Table 10:

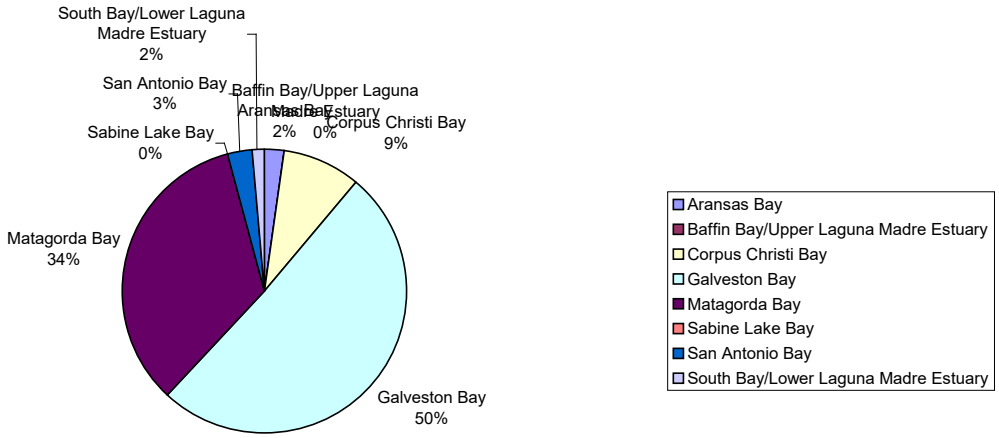
Economic Impact of Bird Hunting Expenditure

BAY	LOCAL DIRECT EXPENDITURE	OUTPUT	INCOME	EMPLOYMENT
Aransas Bay	$33,429	$46,062	$25,991	1.2
Baffin Bay	$37,869	$51,559	$28,661	1.3
Corpus Christi Bay	$120,344	$206,449	$120,554	3.8
Galveston Bay	$2,453,001	$3,592,195	$2,046,133	79.9
Matagorda Bay	$328,091	$423,960	$239,344	10.3
Sabine Lake Bay	$486,976	$752,523	$432,194	15.2
San Antonio Bay	$30,184	$37,388	$20,657	0.9
South Bay	$40,875	$65,597	$36,716	1.5
	$3,530,769	**$5,175,733**	**$2,950,250**	**114.1**

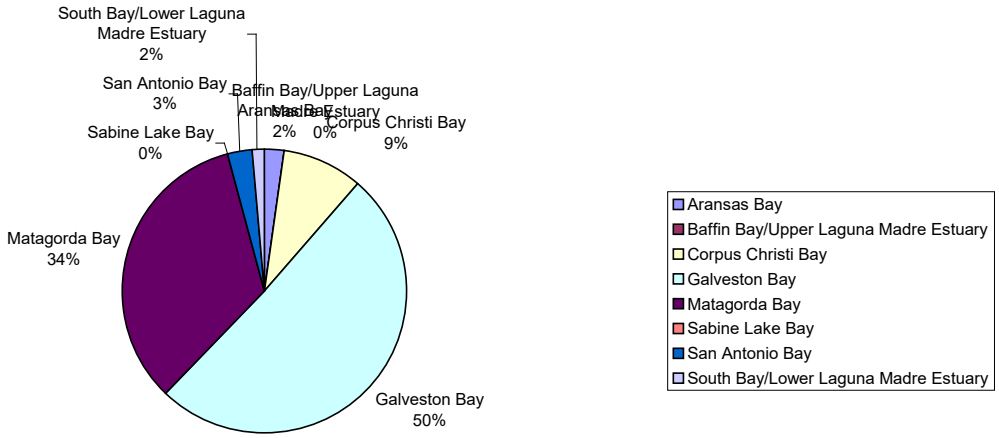
DIRECT EXPENDITURE



SALES OUTPUT GENERATED BY NON-LOCAL EXPENDITURE



INCOME GENERATED BY NON-LOCAL SPENDING



EMPLOYMENT GENERATED BY NON-LOCAL EXPENDITURE

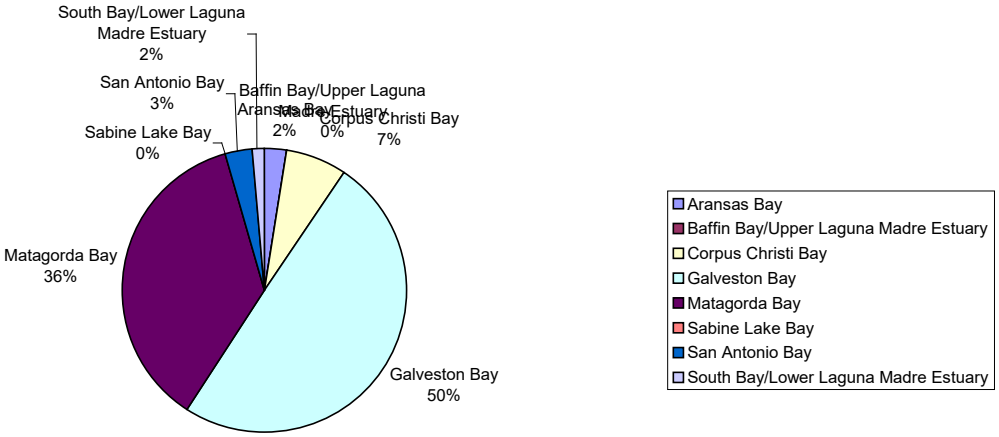
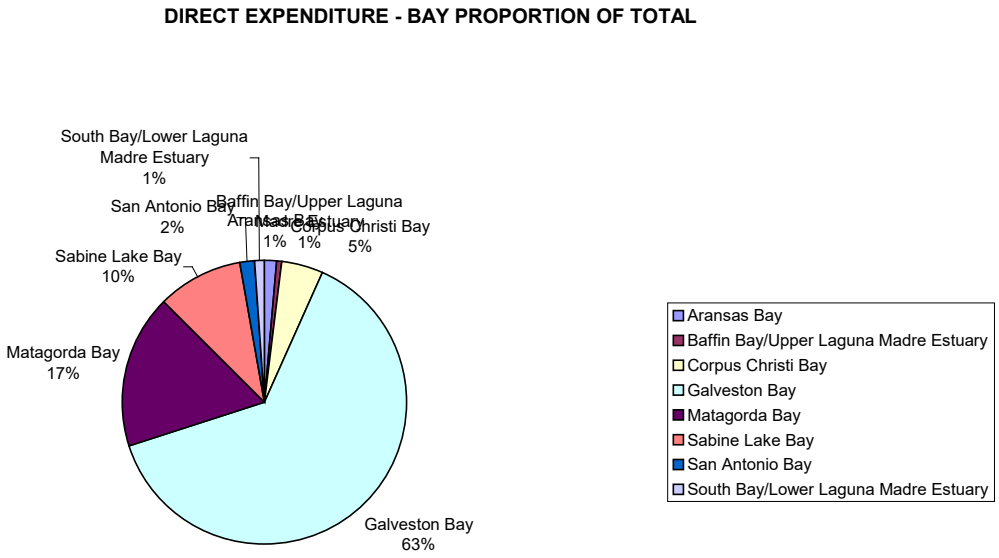


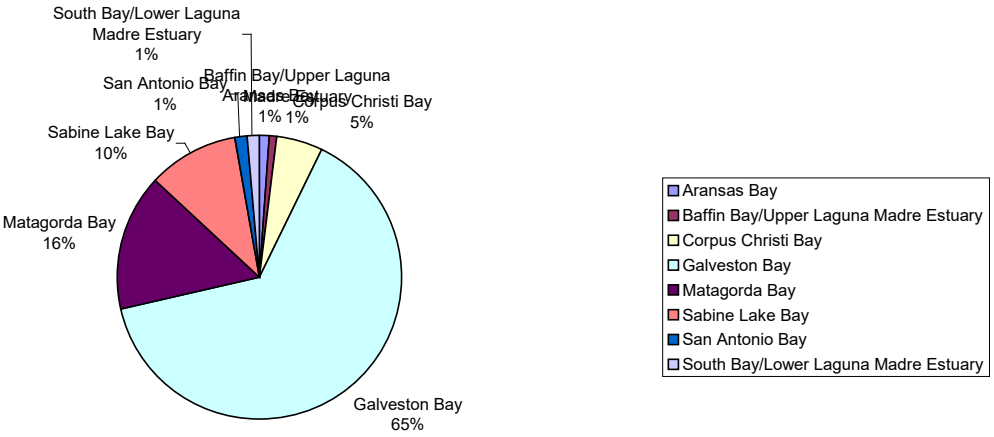
Table 11:

	NON-LOCAL			
	DIRECT EXPENDITURE	OUTPUT	INCOME	EMPLOYMENT
Aransas Bay	$32,260	$44,451	$25,083	1.1
Baffin Bay	$0	$0	$0	0.0
Corpus Christi Bay	$108,116	$185,470	$108,305	3.4
Galveston Bay	$724,926	$1,062,335	$603,912	23.7
Matagorda Bay	$545,807	$705,592	$397,125	17.3
Sabine Lake Bay	$0	$0	$0	0.0
San Antonio Bay	$46,836	$58,014	$32,053	1.4
South Bay	$19,831	$31,825	$17,813	0.7
	$1,477,775	**$2,087,688**	**$1,184,291**	**47.7**

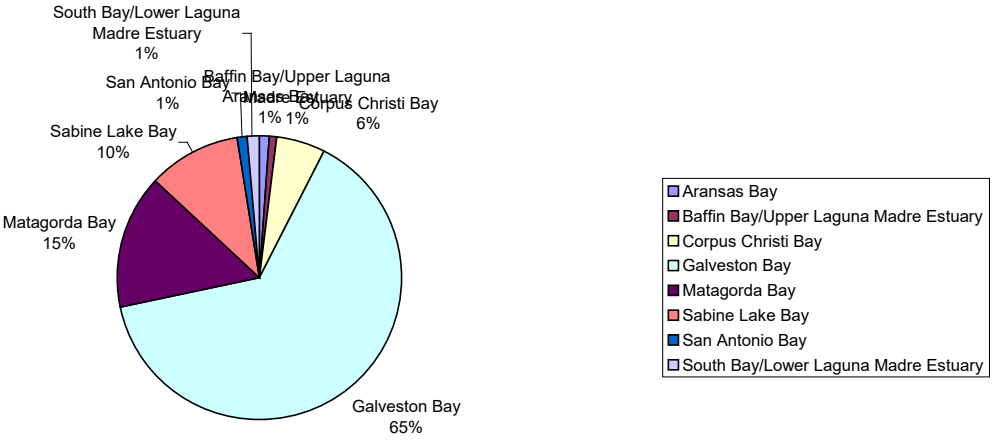
Figure 10: Economic Activity of Hunting – Local and Non-Local Spending as Bay Proportions of Total



SALES OUTPUT - BAY PROPORTION OF TOTAL



INCOME - BAY PROPORTION OF TOTAL



EMPLOYMENT - BAY PROPORTION OF TOTAL

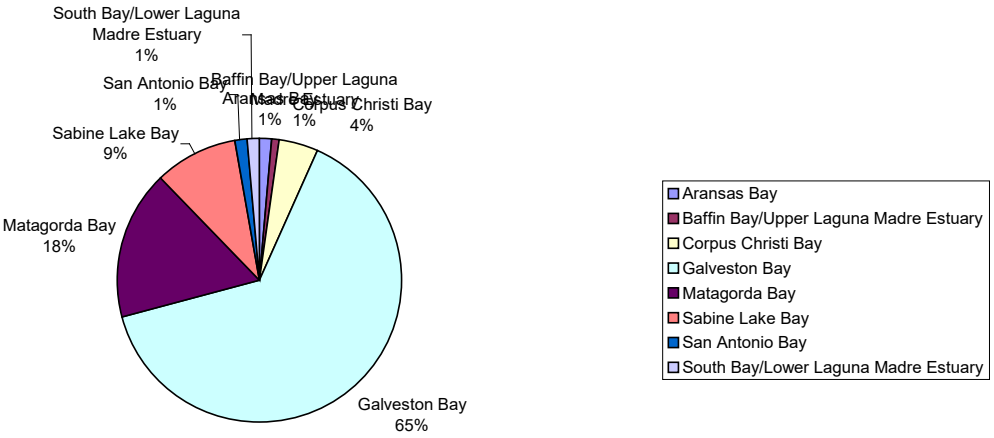


Table 12:

Economic Impact of Bird Hunting Expenditure

BAY	LOCAL			
	DIRECT EXPENDITURE	OUTPUT	INCOME	EMPLOYMENT
Aransas Bay	$33,429	$46,062	$25,991	1.2
Baffin Bay	$37,869	$51,559	$28,661	1.3
Corpus Christi Bay	$120,344	$206,449	$120,554	3.8
Galveston Bay	$2,453,001	$3,592,195	$2,046,133	79.9
Matagorda Bay	$328,091	$423,960	$239,344	10.3
Sabine Lake Bay	$486,976	$752,523	$432,194	15.2
San Antonio Bay	$30,184	$37,388	$20,657	0.9
South Bay	$40,875	$65,597	$36,716	1.5
	$3,530,769	**$5,175,733**	**$2,950,250**	**114.1**
	NON-LOCAL			
	DIRECT EXPENDITURE	OUTPUT	INCOME	EMPLOYMENT
Aransas Bay	$32,260	$44,451	$25,083	1.1
Baffin Bay	$0	$0	$0	0.0
Corpus Christi Bay	$108,116	$185,470	$108,305	3.4
Galveston Bay	$724,926	$1,062,335	$603,912	23.7
Matagorda Bay	$545,807	$705,592	$397,125	17.3
Sabine Lake Bay	$0	$0	$0	0.0
San Antonio Bay	$46,836	$58,014	$32,053	1.4
South Bay	$19,831	$31,825	$17,813	0.7
	$1,477,775	**$2,087,688**	**$1,184,291**	**47.7**
	TOTAL			
	DIRECT EXPENDITURE	OUTPUT	INCOME	EMPLOYMENT
Aransas Bay	$65,689	$90,513	$51,074	2.3
Baffin Bay	$37,869	$51,559	$28,661	1.3
Corpus Christi Bay	$228,460	$391,919	$228,859	7.2
Galveston Bay	$3,177,927	$4,654,530	$2,650,045	103.6
Matagorda Bay	$873,898	$1,129,552	$636,469	27.6
Sabine Lake Bay	$486,976	$752,523	$432,194	15.2
San Antonio Bay	$77,020	$95,402	$52,710	2.4
South Bay	$60,705	$97,422	$54,529	2.2
	$5,008,544	**$7,263,421**	**$4,134,541**	**161.8**

Appendix A – Terms and Definitions

Direct Effect or Direct Impact – the money actually spent in local regional economy. In hunting, this refers to money spent by hunters.

Economic Activity - the economic stimuli as a result of resident and non-resident expenditures. The direct effect in hunting refers to the money spent by hunters. This term is especially useful even when the data does not identify the percentage of hunters comprised by non-residents[9].

Freshwater inflows – water that is less saline than marine water, and generally refers to water which flows downstream from inland sources. This water enters into the bay and mixes with the more saline seawater, creating an estuary area that is less salty than the ocean.[10]

Hunting – Defined as in Southwick Associates study of Migratory Waterfowl Hunting. The activity of interest in this study is the hunting of migratory waterfowl. Migratory bird hunting includes the hunting of geese, duck, dove and other migratory waterfowl (e.g., coot, rail, woodcock). Migratory waterfowl hunting only includes the hunting of geese and ducks.

IMPLAN © – a micro-computer-based input-output (I-O) modeling system. With IMPLAN, one can estimate 528 sector I-O models for any region consisting of one or more counties. IMPLAN includes procedures for generating multipliers and estimating impacts by applying final demand changes to the model. **Indirect Effect** – impacts which originate in the businesses that supply inputs to businesses which are the recipients of the dollars spent by hunters.

Induced Effect – results from the wages paid to employees in hunting-related businesses who then spend their earnings on goods and services.

Input-Output Model[11] – An input-output model is a representation of the flows of economic activity between sectors within a region. The model captures what each business or sector must purchase from every other sector in order to produce a dollar's worth of goods or services. Using such a model, flows of economic activity associated

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[9] See Steinbeck, Steinbeck, S. R. (1999). " Regional Economic Impact Assessments of Recreational Fisheries: An Application of the IMPLAN Modeling System to Marine Party and Charter Boat Fishing in Maine." North American Journal of Fisheries Management **19**: 724-736.

[10] http://www.texaswatermatters.org

[11] Definitions of Input-output model, IMPLAN, and Sector are adapted from Daniel J. Stynes, Economic Impacts of Tourism, s.v. "Glossary of Economic Impact Terms", http://www.msu.edu/course/prr/840/econimpact/pdf/ecimpvol1.pdf

with any change in spending are calculated. Multipliers maybe derived from an input-output model. Estimates of sales output, employment and income due to economic spending in a particular category are obtained by multiplying total expenditures by output, income and employment multipliers.

Trip-related expenditures – expenditures such as food, lodging and fuel.

Equipment-related expenditures – expenditures such as shotguns, scopes.

Local participants – commonly refers to participants who traveled less than one mile from home for the purpose of recreational fishing.

Multiplier – Estimates the impact that every dollar of hunting expenditure has on the economy. A multiplier of 1.50 indicates that for every dollar of expenditure in hunting, $1.50 worth of products and services is generated in the regional economy. IMPLAN multipliers are used, which do not estimate the duration of the impact.[12]

Non-local participants – commonly refers to participants who traveled one mile or more from home for the purpose of hunting.

Sector – is a grouping of industries that produce similar products or services.

Total Effect – the sum of the direct effect, the indirect effect, and the induced effect. Economic impact is usually described in terms of employment (jobs), sales, income, and value added. For instance, direct income is the earnings of labor and owners in recreational fishing activity. Indirect income is the earnings of labor and owners in firms supplying those directly involved in recreational fishing. Induced earnings, are the earnings of labor and owners that occur when those earning direct and indirect income spend their income.

Trips – measured in terms of the number of days from the time left from home until the return to the home.

Wetlands – lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant, animal, and marine life communities living in the soil and on its surface[13].

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[12] Definitions of direct, indirect, induced, total effects and multipliers are adopted from Ransom, M. M. (2001). Economic Impact of Salmon Fishing. Davis, CA, USDA Natural Resources Conservation Service.

[13] Adapted from California Wetlands Information System, s.v. "Defining Wetlands," http://ceres.ca.gov/wetlands/introduction/defining_wetlands.html

Appendix B – Details of Data Collection, Estimation Methods, Assumptions, and Limitations

Method of Data Collection and Estimation Methods

Expenditure Data

Although state expenditure data on hunting is available, expenditure data is not available for the regions of interest to this study. Categories of expenditure were obtained from the Southwick Report (Southwick 2003) and studies done by Shifflet and Associates, conducted for the Texas Department of Economic Development (Shifflet Associates Ltd. and Development 2001). An index was calculated to determine how a specific bay compared to the Gulf Coast average for different expenditure categories. The index was calculated by dividing the Bay average trip expenditure by the Gulf average expenditure. For instance, an index greater than one indicated that the regional expenditure was above the Gulf Coast average. This index was then multiplied by the Gulf Coast average for each expenditure category, to determine the Bay's categories of expenditure. Non-local daily expenditure was given in the Southwick report and also adjusted for each expdniture categories. An adjustments for inflation (2003) was made to each expenditure category.

Other Input Data

Number of Local and Non-local Hunters

Stamp data by county was used to obtain the number of hunters. The number of stamps issued to residents of coastal counties was used as the number of local hunters for that county. The number of stamps issued to residents of adjacent and non-coastal county residents was used as the number of non-local hunters. Total number of hunters per Bay was determined by adding the stamp data for the counties surrounding each Bay area.

Assumptions[14] and Limitations

Local and Non-local

Stamp data was categorized as coastal, adjacent and non-coastal. Hunting licenses issued to coastal counties surrounding a Bay were assumed to indicate local activity. Stamp licenses issued to adjacent (contiguous to a coastal county) and non-coastal counties were assumed to indicate non-local activity.

Trip Length

1.5 days

Average number of days spent hunting per year

8.5 days based on the Southwick Report.

Average Number of Trips per year

An assumption of 6 trips is used in this study.

[14] Based on Wade Griffin survey or log data. All assumptions based on this data are my responsibility.

Estimates

All estimates are adjusted for inflation and are based on the most current information which was available at the beginning of this study. The estimates of direct impact and secondary impacts reported here represent regional impacts. County level direct and indirect impacts have been aggregated and averaged to determine regional impacts, but regional estimates should be used and compared with caution, since bay/estuary regions can overlap several counties. Finally, estimates of hunting impacts in each region may differ from those obtained from different models, methodologies and data sources. However, the input data contained herein compares with approaches taken in other studies.

Appendix C – The IMPLAN Model[15]

IMPLAN© was used to analyze the economic activity from hunting expenditures in the bay/estuaries of the Texas Gulf Coast. The economic data used in the analysis, as well as the model, was purchased for and used by Sang-Kwon Lee[16], under the direction of Dr. John Crompton[17]. Jamie-Rae Lee[18] provided research assistance. IMPLAN and the database of relevant county social/economic accounts represent the regional economy in terms of transactions between households and industry sectors.

The data input to the IMPLAN model are the estimates of direct hunting expenditures made by participants in hunting along the Texas Gulf Coast. Direct expenditure estimates are based on extrapolations from various studies, reports and data sources (see text for relevant bibliography references).

The IMPLAN model uses multipliers which are reported elsewhere in this report. Multipliers are estimates of how a dollar of spending multiplies itself throughout the regional economy. As a consequence of this, the total effect of the economic activity at the regional level, resulting from the hunting, is greater than the actual amount of direct expenditure.

The total amount of spending by hunting participants is the first round of spending and represents direct expenditure. This direct spending stimulates economic activity as these dollars are paid to those who supply inputs to businesses which directly sell to the hunters. These suppliers then spend the money they receive as income to pay for labor (salaries, wages and benefits). The indirect effect, then, of the initial spending of hunters are purchases from other local industries. These are payments of the recipient businesses to other private sector businesses in the same locality to restock inventories, provide for future sales, maintenance and other services, such as insurance. The induced effect of the initial spending of hunters is payments (personal income) to employees who reside in the area, in the form of salaries and wages.

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[15] The description of IMPLAN in this section draws heavily from Thompson, M. and E. Wagenhals (2002). Economic Impact of Nature Tourism and Cultural Activities in Worcester County, Maryland. College Park, Maryland, University of Maryland.

[16] Ph.D student, Department of Recreation, Parks, and Tourism Sciences, Texas A&M University

[17] Distinguished Professor, Department of Recreation, Parks, and Tourism Sciences, Texas A&M University

[18] Ph.D student, Department of Recreation, Parks, and Tourism Sciences, Texas A&M University.

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