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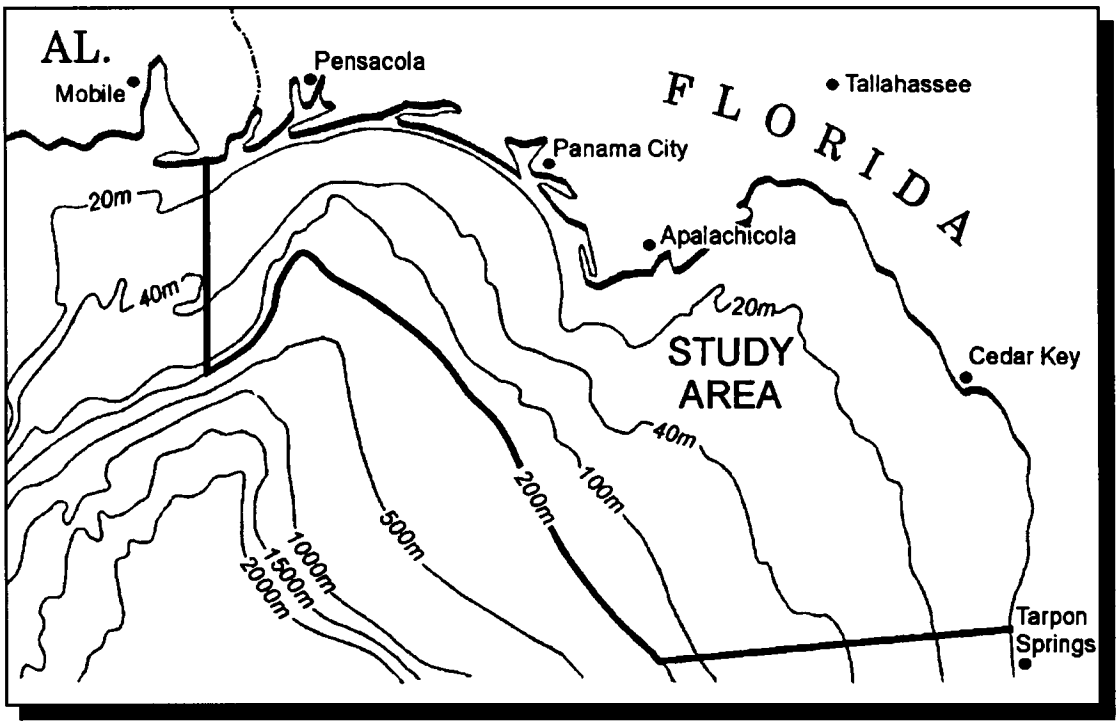

Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Data Search and Synthesis

Appendix F, Part 2: County Socioeconomic Summaries

U.S. Department of the Interior
U.S. Geological Survey
Biological Resources Division

MMS
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Appendix F, Part 2: County Socioeconomic Summaries

August 1997

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Gulf of Mexico OCS Region

PROJECT COOPERATION

This study was procured to meet information needs identified by the Minerals Management Service (MMS) in concert with the U.S. Geological Survey, Biological Resources Division (BRD).

DISCLAIMER

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ACKNOWLEDGMENT

These County Summaries were developed and written by Dr. F. Bell of Florida State University. An integrated summary written by Dr. Bell for all the counties is located in the Synthesis Report.

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Introduction

With the possibility of further oil and gas development and production and the associated potential for ecological, environmental and socioeconomic impacts, the U. S. Geological Survey, Biological Resources Division initiated a phased sequence of studies which will produce a comprehensive description of the dominant environmental processes, the ecological communities, and their potential sensitivities to development in the project study area (the Florida Panhandle and the Big Bend region). As the first phase in the process of establishing a rational base for management decisions, the present project conducted a comprehensive search and integration of existing environmental and socioeconomic information.

Presentation of project results are in two forms:

- Comprehensive annotated bibliographies for each of the key topical areas of interest, and

- An descriptive synthesis of information for each of the topical areas.

One of the disciplines examined was socioeconomics, in particular as it relates to marine and environmental factors. One chapter in the Synthesis Report summarizes the socioeconomic conditions for the various coastal counties. That summary chapter was a distillation of separate reports for each county.

To assure broader access to and use of overall project results, BRD decided to compile and distribute the individual county reports as a single separate project volume. Among the various county reports there may be some duplication where state-wide or regional factors were presented. However, by incorporating available material for each individual county, that report stands as a single source of information.

In the subsequent material, each report section is a socioeconomic description for a separate coastal county in the study area. The Table of Contents indicates the order in which the material appears in this report.

Each of these county socioeconomic summaries was prepared by Dr. Fred Bell of Florida State University.

County Name: Bay, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

BAY.1 Introduction

Bay County is located in the central section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 1). It contains 764 square miles of land, ranking it 29th among the 67 counties in Florida. In 1990, Bay County had a population of 126,994, ranking it 24th among Florida's counties. The population density was 176 people per square mile in 1990, ranking it 24th in Florida. Bay County has a relatively low median age of 33.2 years, compared to the Florida-wide median of 36.4 years.

The population of Bay County had a per capita income of $16,779 in 1992, 26th of the 67 Florida counties and 18% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Bay County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Bay County had 11.2% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 9.1% (relative to a statewide average of 7.0%), indicating a tight labor market.

BAY.2 Trends in Population, Income and Employment in Bay County, 1980-93.

Table 1 shows the trend in key economic variables in Bay County from 1980 through 1993. Over this interval, resident population increased by 39.4% (3.03% annually), which was the almost the same as the 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 198% from 1980 to 1993 (Table 1). Adjusted for inflation, real aggregate personal income increased by 66% (5.1% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

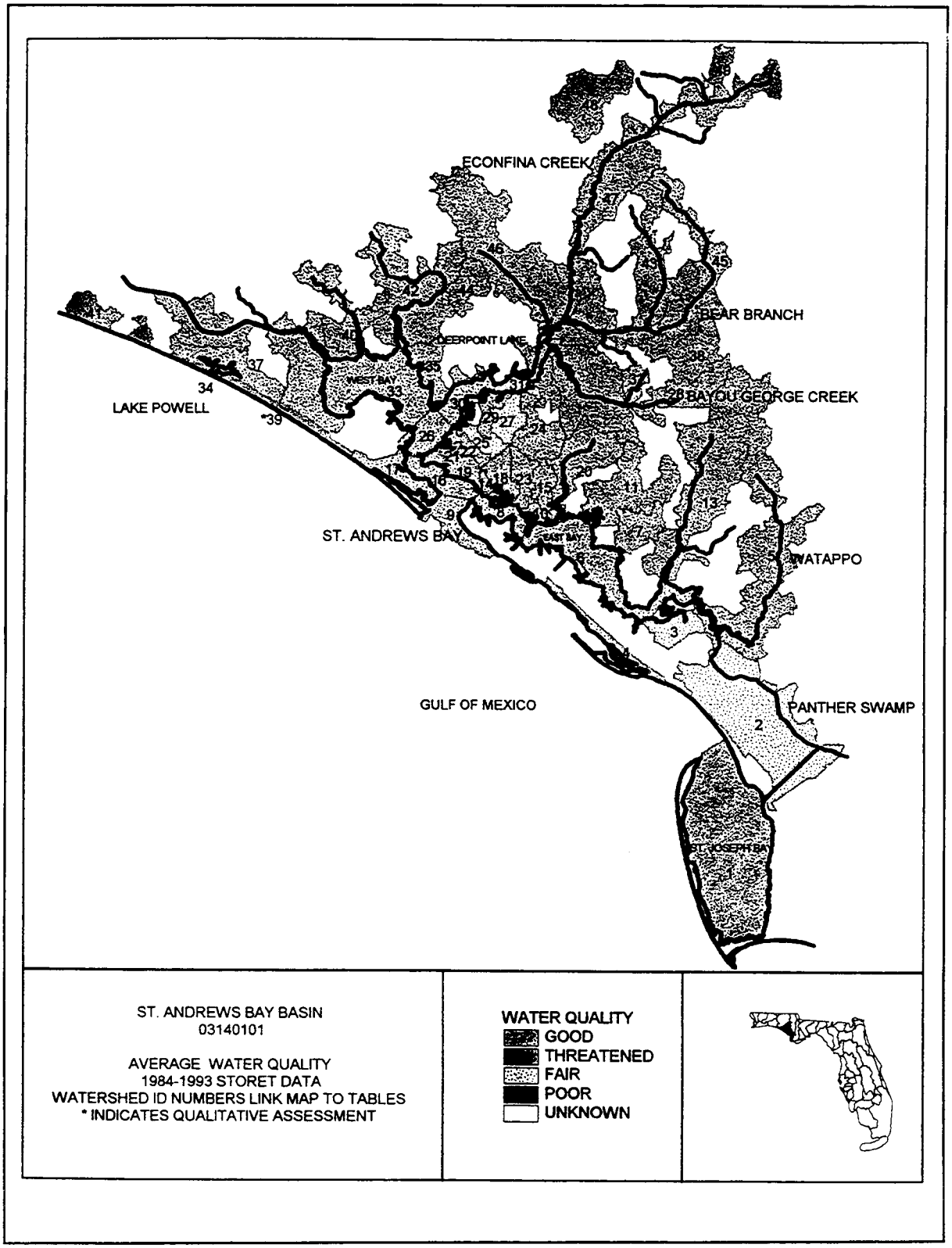


Figure 1. Map of Bay County, Florida, showing levels of water quality and areas of quality testing (St. Andrews Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 1. Trends in Key Economic Aggregate Variables in Bay County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	98,400	$774,650	$940,109	45,984
1981	100,300	885,723	974,393	47,850
1982	103,600	972,497	1,007,769	49,429
1983	105,700	1,069,819	1,074,115	51,259
1984	108,900	1,202,531	1,157,393	56,002
1985	112,900	1,324,518	1,230,965	59,970
1986	117,300	1,438,672	1,312,657	62,101
1987	120,600	1,517,601	1,335,916	63,614
1988	122,500	1,616,398	1,366,355	65,358
1989	124,800	1,741,854	1,404,721	66,668
1990	127,300	1,908,861	1,460,490	70,129
1991	130,000	2,054,880	1,508,722	71,111
1992	133,400	2,191,853	1,562,262	72,234
1993	137,200	2,311,669	1,559,831	74,228

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Bay County increased from 45,984 in 1980 to 74,228 in 1993, a 61.2% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region; income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Bay County grew less rapidly than the measure of county output — real aggregate personal income — as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

BAY.3 Trends in Various Welfare Measures in Bay County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Bay County derived 97.6% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Bay County in Table 2.

BAY.4 Industrial Base: Bay County

The "industrial base" for Bay County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage

Table 2. Trends in Components of Personal Income in Bay County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$7,875	$5,276	$114	$30	$1,420	$1,036
1981	8,827	5,824	121	27	1,610	1,244
1982	9,385	6,034	118	43	1,783	1,408
1983	10,118	6,547	116	59	1,912	1,484
1984	11,038	7,327	121	34	1,945	1,610
1985	11,731	7,770	118	38	2,113	1,692
1986	12,268	8,064	110	47	2,173	1,874
1987	12,586	8,284	108	43	2,295	1,855
1988	13,198	8,690	132	39	2,450	1,887
1989	13,961	8,892	154	44	2,697	2,174
1990	14,994	9,547	187	52	2,969	2,239
1991	15,803	10,085	232	70	3,247	2,230
1992	16,426	10,395	305	120	3,457	2,150
1993	16,852	10,628	293	110	3,642	2,180

Source: BEA (1995)

of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the nation consumes all it produces — no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 3 shows the main identified export industries and their contribution to personal income in Bay County. This county depends primarily on tourism, retirement, manufacturing, fishing and the military for its economic survival. Some of the largest individual employers in Bay County have, from time to time, had negative impacts on the ecosystem. For Bay County, Table 4 shows the top ten employers, along with the products they produce that may generate conflicts with the environment. Products such as oil processing, pulp and paper, and boatmaking must be rigorously controlled or they will reduce water and air quality. Historically, Bay County has had problems with industries located in this county. Wastewater from manufacturing plants and construction runoff have led to some water quality problems, however, in 1993, the EPA reported that the companies in Bay County did not discharge any toxic chemicals into the surface water.

BAY.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Bay County, the industries shown in Table 5 fall into this category.

The Bay County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. This county has a deep-water port and serves as a naval and air station for the U.S. military and a port for a variety of materials and products. Tourism is also important, with Panama City Beach being a major resort area. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

BAY.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 6.

Table 3. Major Export Industries in Bay County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Tourism			
Hotels and Lodging	$42,606	1.84	2.7
Eating and Drinking Places	71,855	3.1	1.9
Other Retail Sales	220,661	9.44	1.0
Retirement			
Real Estate	24,222	.71	1.5
Construction	103,232	4.45	1.21
Manufacturing (Assorted)	23,196	1.0	.2
Water Transportation	11,720	.5	4.0
Fishing (Commercial)	2,082	.1	2.9
Federal Employees	137,088	5.9	2.5
Military (Tyndall AFB & US Naval Reservation)	170,262	7.4	7.9

*LQ =Location quotient. See Text.

Source: BEA (1995)

Table 4. Top Ten Employers in Bay County, Florida and Products Produced, 1994.

Employer	Employees
1. Sunshine Food Store, Grocery	725
2. HCA Gulf Coast Hospital, Health Care	650
3. Hilton, Inc., Resort	610
4. Sallie Mae, Brokers and Loans	605
5. Marriott Bay Point, Resort	450
6. Stone Container, Linerboard	580
7. Arizona Chemical, oil	410
8. Edgewater Beach Resort, Resort	284
9. Bay Point Resort, Resort	221
10. Berg Pipe, Line Pipe	200
Sub-Total	4,735
Total	74,228
Percent of Total	6.3%

Source: Florida Department of Commerce (1994)

Table 5. Ecosystem-Sensitive Industries in Bay County, Florida.

	Industry	Earnings ($000)
1.	Manufacturing (Assorted)	
	Non-Durable	$53,596
	Durable	41,383
2.	Water Transportation	11,720
	Sub-Total	$106,699
	Total Earnings (Non-Farm)	$2,311,669
	Percent of Total	4.6

Source: **BEA** (1995)

Table 6. Ecosystem-Insensitive Industries in Bay County, Florida.

	Industry	Earnings ($000)
1.	Tourism (Hotels, Retail Stores, etc.)	$335,122
2.	Retirement	105,564
3.	Military/Federal Government	307,350
	Sub-Total	$748,036
	Total Earnings	$2,311,669
	Percent of Total	32%

Source: Table 3

In general, industries such as tourism and retirement have a less adverse impact on local ecosystem health than other industries in Bay County. Over the 1969-93 period, ecosystem-insensitive industries grew faster than the ecosystem-sensitive industries, meaning that recent economic growth is less of a threat to the marine environment.

BAY.7 Commercial Fishery Landings in Bay County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Bay County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $6.7 million worth of commercial fishery products were landed in Bay County at the *ex vessel* level (Table 7). Finfish and shrimp account for 89% of this value. Among the finfish,

Table 7. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Bay County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Yellowfin Tuna	397,229	$973,211.60
Gag Grouper	328,111	731,687.56
Ladyfish	1,317,318	526,927.19
Red Grouper	191,580	337,180.81
King Mackerel	231,791	329,143.22
Red Snapper	107,337	259,755.55
Bluerunner	649,037	240,143.69
Round Scad	739,576	192,289.75
Swordfish	49,577	159,142.17
All Others	3,391,051	1,384,239.93
Total		$5,291,394.68
Invertebrates		
Blue Crabs	527,762	$340,041.83
Oysters	314,109	389,495.16
Calico Scallops	1,872	1,067.04
Squid	2,759	1,020.83
Spanish Lobster	494	854.62
All Others		3,266.60
Total		$733,612.16
Shrimp (Total)	364,141	645,191.78
Grand Total		$6,670,198.62

* State average *ex vessel* price used.
Source: FDEP (1994)

yellowfin tuna was the leading species as measured by value. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Bay County ranked 2nd in the *ex vessel* value of all commercial fishery landings.

Even though the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively large component of the economic base of Bay County, where aggregate personal income was $2.3 billion in 1993. Over the last fourteen years, commercial fishery landing has decreased by 15% while the *ex vessel* value of the catch has increased by 7.5%. When adjusted for inflation, the value of landings decreased by 30% (FDNR, 1980).

BAY.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively that engage in saltwater recreationalfishing in Florida. In Milon and Thunberg (1992), there is

some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell, et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 8). Bay County had 13,265 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment, as shown in Table 8. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 9 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 8. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Bay County showed a fishing effort of 232,214 days.

Finally, Table 10 is derived from Table 8 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $18,056,788 in Bay County in 1993-94.

Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell, et al. (1982) have estimated the per day value

Table 8. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	**13,265**	**1,349**	**25,172**
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 9. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	**131,526**	**100,688**	**232,214**
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 8. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 8. See Bell (1993).

Table 10. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	**6,981,108**	**11,075,680**	**18,056,788**
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 8 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 8 multiplied by $440.00 per angler.

of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists respectively (in 1994 dollars). The annual flow of value for Bay County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 7,011 = $2.6 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 4,121 = $0.8 million.

Thus, saltwater recreational fishing generates $10.4 million per year in Bay County with a capitalized value of $346 million using a 3% discount rate (i.e., $10.4 million ÷ .03).

BAY.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to statistically link marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of

such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 11.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight

Table 11. Economic Value of Wetlands.

Wetland Function	**Value ($/acre/year)**	**Capitalized Value ($/acre at 5% discount rate)**
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Bay County has 8,200 acres of salt marsh (NOAA, 1991), which would be worth $43.6 million ($5,316 x 8,200) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Bay County wetlands.

BAY.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Table 12 lists the key beaches for Bay County.

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Table 12. Key Saltwater Beaches in Bay County, Florida.*

Western District
Environmentally Endangered Lands:
Panama City Beach and Pier
Bay County Pier and Park
Central District
St. Andrews State Recreational Area
Eastern District
Mexico Beach

*In Bay County alone, the University of West Florida (1985b) reported 66 individual saltwater beaches which were 26.8 miles in length and 14.1 million square feet (public and private).

Source: University of West Florida (1985a)

Using the CV technique, Leeworthy, et al. (1989) found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Bay County would have 2,536,750 saltwater beach days per year in 1990 for the beaches listed in Table 12. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $7.61 million. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $253 million – the asset value of the beach.

Finally, beach-related spending in Bay County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 2,536,750 x $12 = $10.9 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 2,536,750 x $30 = $48.7 million

Combined, saltwater beaches in Bay County attracted an estimated $59.6 million in beach-related spending in 1990, with tourists accounting for 82% of this spending.

Table 13 identifies three ecological resources that are an asset to Bay County and induce a considerable level of economic activity in this region.

Table 13. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Bay County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$6.7[3]	N/A	N/A
Recreational Fishing	$11[4]	$10.4[5]	$346[5]
Saltwater Marsh[5]	N/A	.207[6]	43.6[6]
Saltwater Beaches	$59.6[6]	$7.61[6]	$253.0[6]
Marine Boating[7]	N/A	.867[7]	$28.9[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 7, *ex vessel* price
[4] Table 10, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 15

BAY.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 14 is an inventory of these water-dependent facilities in Bay County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Bay County but are used for purposes of illustration.

Bay County has 55 saltwater boat ramp lanes and 2,314 wet slips and dry racks, as shown in Table 14. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Bay County is estimated and shown in Table 15. This value is about $.87 million.

Recreational boating in marine waters is rapidly growing in Bay County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Bay County grew as follows, with projected (P) numbers included:

Table 14. An Inventory of Marine-Related Recreational Facilities in Bay County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	24
b. Length (all) (LFT)*	12,236
2. Boardwalks/Catwalks	
a. Number	25
b. Length (all) (LFT)*	7,220
3. Jetties	
a. Length (all) (LFT)*	1,300
Boating	
1. Boat Ramps	
a. Number	40
b. Total Lanes	55
2. Marinas	
a. Total	28
b. Slips/Moorings	1,431
c. Dry Storage	883

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 15. Estimation of the Annual User Value for Saltwater Boating Off Bay County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas
$312,274 = $5.02[1] x 13,096[2] x .19[3] x 25[4]
2. Boat Ramps
$324,650 = $1.48[1] x 13,096 x .67[4] x 25
3. Private Docks
$230,097 = $5.02[5] x 13,096 x .14 x 25
Total Annual User Value = $867,021

*Asset Value = 867,021 ÷ .03 = $28.9 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Bay County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Bay County
[5] Assumed $/day same for marinas and private docks

1983	10,051	
1984	10,400	
1985	10,966	
1986	11,602	
1987	12,073	
1988	12,525	
1989	12,844	
1990	12,769	
1991	12,997	
1992	13,096	
2000	15,131	(P)
2005	16,773	(P)
2010	18,550	(P)

BAY.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Bay County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Bay County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria, and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Bay County, St.

Andrews Bay has been selected for a brief summary of the current state of water quality in this region of the study area (see Figure 1).

The St. Andrews Bay Basin is in the central region or the panhandle. Major pollution sources are from chemical processing, pulp and paper mills and urban runoff. Arizona Chemical and Stone Container are primarily responsible for the manufacturing wastewater. Panama City, a high-density population center, is responsible for the urban pollution. There are many other possible sources of pollution into the water in Bay County. The Majette Landfill is located in one bayou. Development along the shorelines and recreation activities also have negative effects. A recent study found high levels of lead, mercury, DDT, and PCB's in Watson Creek.

The Panama City Beach area has water quality problems with decreased dissolved oxygen levels. The most significant threat is due to industrial rather than domestic waste. This problem has been addressed recently and improvements are expected. Other pollution sources include small, package plants and septic tanks which empty into ditches leading into St. Andrews Bay, highway and construction runoff and runoff from logging operations.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 16 indicates that in 1994, two companies (Stone Container and Arizona Chemical) discharged toxic substances in and around the surface water of Bay County. The WQI and TSI for selected areas are listed in Table 17.

Shellfish harvesting has been closed in 35,149 acres in the St. Andrews Bay area, and opened conditionally in 37,359 acres in the same areas, indicating significant coliform levels in over 51% of the beds.

Table 16. Toxic Chemical Releases Into Surface Water by Firms Located in Bay County, Florida in 1994.

	Company	SIC	Discharge	Main[1]
1.	Stone Container (Pulp and Paper)	2,621	N/A	
2.	Arizona Chemical	2,824	N/A	
	Total			

[1] Leading chemical released based on pounds.
Source: EPA Toxic Release Inventory, unpublished data, 1994.

Table 17. Water Quality Indices for Selected Areas of Bay County, Florida.

Water Areas: St. Andrews Bay		Water Quality Indices*	
Water Body Type: Estuary		WQI	TSI
3	Walker Bay	--	52
4	Direct Runoff	--	12
6	East Bay (E)	--	32
7	California Bayou	--	46
8	East Bay (W)	--	36
9	St. Andrews Bay (mouth)	--	31
10	Pitts Bay	--	24
11	Laird Bayou	--	43
14	Massalina Bayou	--	37
15	Parker Bay	--	41
16	St. Andrews Bay	--	25
17	Woodlawn Canal	--	37
18	Watson Bayou	--	49
19	Direct Runoff	--	35
21	Pretty Bayou	--	37
22	Robinson Bayou	--	28
24	Mill Bayou	--	46
25	Goose Bayou	--	53
26	St. Andrews Bay (N)	--	35
27	Beatty Bayou	--	55
29	Direct Runoff	--	39
30	North Bay (N)	--	37
31	North Bay (N)	--	50
33	West Bay	--	38
35	Direct Runoff	--	48
Water Body Type: Lake			
34	Lake Powell	--	24
44	Merial Lake	--	22
48	L. Gap Pond	--	20
49	Compass Lake Outlet	--	22
Water Body Type: Stream			
20	Calloway Creek	20	--
28	Bayou George Creek	34	--
32	Beefwood Branch	17	--
38	So. Fk. Little Bear Creek	20	--
40	Crooked Creek	24	--
42	Burnt Mill Creek	23	--
43	Bear Branch	18	--
45	Little Bear Creek	18	--
46	Cedar Creek	18	--
47	Econfina Creek	15	--

* Higher values indicate lower water quality

County Name: Citrus, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

CIT.1 Introduction

Citrus County is located in southeastern section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 2). It contains 584 square miles of land, ranking it 47th among the 67 counties in Florida. In 1990, Citrus County had a population of 93,512, ranking it 30th among Florida's counties. The population density was 173 people per square mile in 1990, ranking it 27th in Florida. Citrus County has a median age of 50.8 years, very high when compared to the Florida-wide median of 36.4 years.

The population of Citrus County had a per capita income of $15,290 in 1992, 35th of the 67 Florida counties and 23% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Citrus County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Citrus County had 8.5% of the households below the poverty level in 1989, which was lower than the State of Florida average of 9.0%. In 1993, the unemployment rate was also 8.5% (relative to a statewide average of 7.0%), indicating a slack labor market.

CIT.2 Trends in Population, Income and Employment in Citrus County, 1980-93.

Table 18 shows the trend in key economic variables in Citrus County from 1980 through 1993. Over this interval, resident population increased by 83% (6.4% annually), which was rapid when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 364% from 1980 to 1993. (Table 18). Adjusted for inflation, real aggregate personal income increased by 130% (10% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

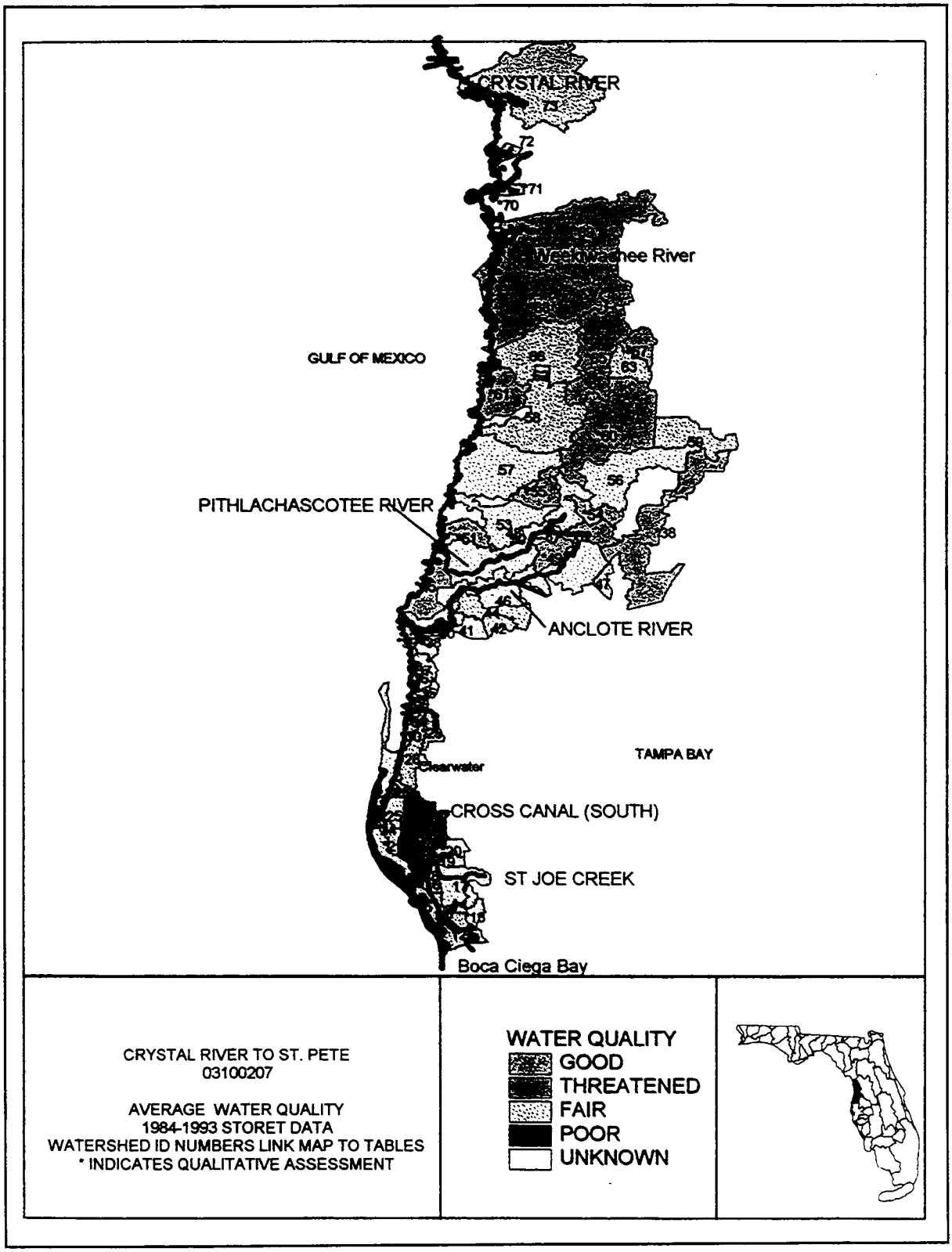


Figure 2. Map of Citrus County, Florida, showing levels of water quality and areas of quality testing (Crystal river to St. Pete)[from Bureau of Surface Water Management (1994c)].

Table 18. Trends in Key Economic Aggregate Variables in Citrus County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	55,800	$385,897	$468,322	15,525
1981	59,600	469,343	516,329	17,449
1982	62,800	528,002	547,152	18,450
1983	66,800	597,726	600,127	19,173
1984	70,600	722,208	695,099	21,101
1985	74,500	858,573	797,930	23,218
1986	78,700	949,791	866,597	24,198
1987	82,700	1,034,321	910,494	26,890
1988	85,900	1,112,777	940,640	28,120
1989	90,000	1,254,554	1,011,737	29,064
1990	94,600	1,366,764	1,045,726	30,553
1991	97,500	1,428,765	1,049,020	31,040
1992	100,100	1,491,622	1,063,166	31,404
1993	101,900	1,558,130	1,078,291	32,585

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Citrus County increased from 15,525 in 1980 to 32,585 in 1993, a 110% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Citrus County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

CIT.3 Trends in Various Welfare Measures in Citrus County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income maintenance and unemployment insurance, since the former is taxable while

the latter is not. In 1993, Citrus County derived 97.9% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Citrus County in Table 19.

CIT.4 Industrial Base: Citrus County

The "industrial base" for Citrus County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the nation

Table 19. Trends in Components of Personal Income in Citrus County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,912	$2,207	$66	$18	$2,029	$2,096
1981	7,870	3,030	69	18	2,313	2,440
1982	8,403	3,230	73	34	2,582	2,484
1983	8,953	3,332	75	37	2,816	2,695
1984	10,225	3,768	67	29	2,994	3,367
1985	11,528	4,424	64	22	3,210	3,808
1986	12,066	4,432	66	24	3,290	4,253
1987	12,514	4,875	71	22	3,396	4,150
1988	12,959	4,949	85	30	3,508	4,386
1989	13,932	5,235	101	33	3,657	4,907
1990	14,442	5,558	120	48	3,777	4,939
1991	14,650	5,625	156	78	4,033	4,731
1992	14,901	5,920	210	116	4,225	4,429
1993	15,295	6,149	215	97	4,406	4,428

Source: BEA (1995)

consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 20 shows the main identified export industries and their contribution to personal income in Citrus County. This county depends primarily on fishing, manufacturing, utilities and retirement for its economic survival. Some of the largest individual employers in Citrus County have, from time to time, had negative impacts on the ecosystem. For Citrus County, Table 21 shows the top ten employers, along with the products they produce that may generate conflicts with the environment. Industries such as utilities and manufacturing must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Citrus County discharged no toxic chemicals into surface water (Lester, 1995).

CIT.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Citrus County, the industries shown in Table 22 fall into this category.

The Citrus County economy is heavily based upon manufacturing. This economic activity creates various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. This industry is primarily involved in the export sector and therefore is critical to this coastal county.

CIT.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 23.

In general, an industry such as retirement has a less adverse impact on local ecosystem health than other industries in Citrus County. Over the 1969-93 period, the ecosystem-insensitive industries grew faster than the ecosystem-sensitive industries, meaning that the growth in the Citrus County economy is not in conflict with the environment.

CIT.7 Commercial Fishery Landings in Citrus County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from

Table 20. Major Export Industries in Citrus County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Fishing	$945	.06	1.95
Manufacturing			
Printing	4,179	.26	PJ*
Chemicals	311	N/A	PJ
Lumber	N/A	N/A	PJ
Electrical Equipment	N/A	N/A	PJ
Transportation Equipment	N/A	N/A	PJ
Utilities (Crystal River Power Plant)	N/A	N/A	PJ
Retirement	315,763	20	PJ
Construction	66,524	4	PJ

*LQ = Location quotient. See Text.
*PJ = Professional Judgment.
Source: BEA (1995)

Table 21. Top Ten Employers in Citrus County, Florida and Products Produced, 1994.

Employer	Employees
1. Florida Power Corporation, Utilities	1,279
2. Citrus Memorial Hospital, Health Care	903
3. Seven Rivers Hospital, Health Care	530
4. Winn-Dixie, Grocery	519
5. Sunshine Material Corporation, Contractor	330
6. WalMart, Retail Store	295
7. Publix, Grocery	283
8. Proline, Boat Manufacturing	265
9. Kash-N-Karry, Grocery	201
10. K-Mart, Retail Sales	197
Sub-Total	4,802
Total	32,585
Percent of Total	15%

Source: Florida Department of Commerce (1994)

Table 22. Ecosystem-Sensitive Industries in Citrus County, Florida.

	Industry	Earnings ($000)
1.	Manufacturing	$20,040
2.	Utilities	N/A
3.	Construction	66,524
	Sub-Total	$86,564
	Total Earnings (Non-Farm)	$493,386
	Percent of Total	17.5%

Source: BEA (1995)

Table 23. Ecosystem-Insensitive Industries in Citrus County, Florida.

	Industry	Earnings ($000)
1.	Retirement	$315,763
2.	Fisheries	945
	Sub-Total	$316,708
	Total Earnings	$1,558,130
	Percent of Total	20%

Source: Table 20

the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Citrus County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $6.5 million worth of commercial fishery products were landed in Citrus County at the *ex vessel* level (Table 24).

Finfish and shrimp account for 31% of this value. Among the finfish, red grouper was the leading species as measured by value. Stone crabs account for 60% of the total *ex vessel* value of the landings. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Citrus County, where aggregate personal income was $1.5 billion in 1993. Over the last fourteen years, commercial fishery landing has increased by 7.7% while the *ex vessel* value of the catch has increased by 262%. When adjusted for inflation, the value of landings changed by 102% (FDNR, 1980).

Table 24. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Citrus County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Red Grouper	416,997	$733,914.69
Black Mullet	818,443	384,668.22
Black Grouper	53,314	110,359.98
Crevalle Jack	183,208	60,458.64
Spotted Sea Trout	44,766	53,719.20
Porgies	25,028	23,025.76
Sheepshead	22,437	10,281.57
Grunts	22,437	10,545.39
Permit	8,359	10,281.57
Ladyfish	23,325	9,330.00
All Others	126,492	83,735.05
Total		$1,491,869.54
Invertebrates		
Blue Crabs	932,220	$596,645.69
Stone Crabs	732,192	3,885,951.30
Octopus	2,919	2,714.67
Spanish Lobster	192	332.16
Total		$4,485,703.78
Shrimp (Total)	214,055	489,468.61
Grand Total		$6,467,037.93

* State average *ex vessel* price used.
Source: FDEP (1994)

CIT.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Citrus County had 11,685 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal

conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment. This is shown in Table 25 where nonresidents are shown in the second column. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 26 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 25. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Citrus County showed a fishing effort of 188,747 days.

Finally, Table 27 is derived from Table 25 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $11,227,755 in Citrus County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

Table 25. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	**11,685**	**6,926**	**5,312**
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 26. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	**167,499**	**21,248**	**188,747**
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 8. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 8. See Bell (1993).

Table 27. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	**8,890,475**	**2,337,280**	**11,227,755**
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 8 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 8 multiplied by $440.00 per angler.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Citrus County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 18,611 = $7.0 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 5,312 = $1.0 million.

Thus, saltwater recreational fishing generates $8.0 million per year in Citrus County with a capitalized value of $267 million using a 3% discount rate (i.e., $8 million ÷ .03).

CIT.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 28.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast

Table 28. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida at $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its

production elasticity of 0.19). Citrus County has 27,400 acres of salt marsh (NOAA, 1991), which would be worth $145 million ($5,316 x 27,400) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Citrus County wetlands.

CIT.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. The Citrus County coast is primarily saltwater marsh. The University of West Florida (1985b) reported one saltwater beach which is 0.2 miles in length with 142,500 square feet. Since there is very little user information, and because of the relatively small importance of beaches in this county, the value was not estimated.

Some ecological resources have been identified that are an asset to Citrus County and induce a considerable level of economic activity (Table 29).

CIT.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 30 is an inventory of these water-dependent facilities in Citrus County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Expressed in 1994 dollars, Bell (1995) found that the user value per day is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Citrus County, but are used for purposes of illustration.

Citrus County has 15 saltwater boat ramp lanes and 49 wet slips and dry racks, as shown in Table 30. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al.(1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Citrus County is estimated and shown in Table 31. The annual user value for marine boating off Citrus County is about $.99 million.

Table 29. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Citrus County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$6.4[3]	N/A	N/A
Recreational Fishing	$11.2[4]	$8.0[5]	$145[5]
Saltwater Marsh[5]	N/A	.207[6]	145[6]
Saltwater Beaches	N/A[6]	N/A[6]	N/A[6]
Marine Boating[7]	N/A	$.991[7]	$33.05[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 7, *ex vessel* price
[4] Table 10, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 14

Table 30. An Inventory of Marine-Related Recreational Facilities in Citrus County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	2
b. Length (all) (LFT)*	170
2. Boardwalks/Catwalks	
a. Number	4
b. Length (all) (LFT)*	0
3. Jetties	
a. Length (all) (LFT)*	200
Boating	
1. Boat Ramps	
a. Number	12
b. Total Lanes	15
2. Marinas	
a. Total	4
b. Slips/Moorings	49
c. Dry Storage	--

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 31. Estimation of the Annual User Value for Saltwater Boating Off Citrus County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $357,072 = $5.02[1] x 11,699[2] x .19[3] x 32[4]
2. Boat Ramps $371,223 = $1.48[1] x 11,699 x .67[4] x 32
3. Private Docks $263,106 = $5.02[5] x 11,699 x .14 x 32
Total Annual User Value = $991,401

*Asset Value = 991,401 ÷ .03 = $33.05 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Citrus County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Citrus County
[5] Assumed $/day same for marinas and private docks

Recreational boating in marine waters is rapidly growing in Citrus County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal waters. From the FDEP (1983-1992) and Bell (1995), pleasure boat registrations in Citrus County grew as follows, with projected (P) numbers included:

1983	7,998	
1984	8,427	
1985	8,772	
1986	9,157	
1987	9,658	
1988	10,190	
1989	10,979	
1990	11,771	
1991	11,808	
1992	11,818	
1993	11,445	
1994	11,699	
2000	15,373	(P)
2005	17,791	(P)
2010	20,590	(P)

CIT.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands. There are three sources of information on

local water quality surrounding Citrus County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Citrus County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Citrus County, the Crystal River Basin has been selected for a brief summary of the current state of water quality in this region of the study area.

The Crystal River Basin is unique from some of the other rivers in its vicinity, in that it has some tidal characteristics. The water in the area typically is clear and transparent, and is a common spot for diving. It also serves as a winter manatee refuge. The river is designated as an Outstanding Florida Water. The river typically has high nutrient input and occasionally has dense aquatic weed growths. The usual sources of these nutrients are waste water treatment plant discharge, septic tanks and runoff. There is a nuclear power plant in the basin, but it does not discharge waste into the water. The WQI and TSI for selected areas are listed in Table 32.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). In 1994, there were no companies that discharged toxic substances in and around the surface water of Citrus County.

Shellfish harvesting has been closed in 4,534 acres, and opened in 42,432. This would suggest that there are not any significant coliform problems in the water area.

Table 32. Water Quality Indices for Selected Areas of Citrus County, Florida.

Water Areas: Crystal River Basin		Water Quality Indices*	
Water Body Type: Estuary		WQI	TSI
73	Crystal River	--	36
Water Body Type: Spring			
72	Homosassa Spring	27	--

A.* Higher values indicate lower water quality

County Name: Dixie, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

DIX.1 Introduction

Dixie County is located in the southeastern section of the study area, which ranges from Escambia to Citrus County in northwestern Florida. It contains 704.1 square miles of land, ranking it 33rd among the 67 counties in Florida. In 1990, Dixie County had a population of 10,585, ranking it 61st among Florida's counties. The population density was 17 people per square mile in 1990, a ranking of 63rd in Florida. Dixie County has an median age of 36.8 years, which is approximately equal to the Florida-wide median of 36.4 years.

The population of Dixie County had a per capita income of $11,205 in 1992, 65th of the 67 Florida counties and 43% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Dixie County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Dixie County had 21.3% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 8.7 % (relative to a statewide average of 7.0%), indicating a slack labor market.

DIX.2 Trends in Population, Income and Employment in Dixie County, 1980-93.

Table 33 shows the trend in key economic variables in Dixie County from 1980 through 1993. Over this interval, resident population increased by 46% (3.6% annually), which was faster than the 39.5% increase for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 159% from 1980 to 1993 (Table 33). Adjusted for inflation, real aggregate personal income increased by 48% (3.7% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

Table 33. Trends in Key Economic Aggregate Variables in Dixie County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	7,800	$45,530	$55,256	$2,423
1981	8,000	48,975	53,878	2,447
1982	8,400	53,631	55,576	2,547
1983	8,800	60,919	61,164	2,607
1984	9,000	65,403	62,948	2,721
1985	9,100	72,006	66,920	2,817
1986	9,400	77,598	70,801	2,908
1987	9,700	85,812	75,539	3,142
1988	10,000	94,551	79,925	3,290
1989	10,300	106,494	85,882	3,540
1990	10,700	113,571	86,894	3,532
1991	11,000	113,327	83,206	3,387
1992	11,300	120,801	86,102	3,395
1993	11,400	117,910	81,599	3,570

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Dixie County increased from 2,423 in 1980 to 3,570 in 1993, a 47% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Dixie County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

DIX.3 Trends in Various Welfare Measures in Dixie County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Dixie County derived 93.7% of its personal income from earnings, retirement and capital income compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown in Table 34 for Dixie County.

DIX.4 Industrial Base: Dixie County

The "industrial base" for Dixie County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%) assuming the nation consumes

Table 34. Trends in Components of Personal Income in Dixie County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$5,571	$3,638	$188	$26	$1,076	644
1981	6,115	3,805	210	28	1,288	784
1982	6,406	3,957	204	21	1,429	794
1983	6,891	4,264	204	22	1,515	887
1984	7,294	4,546	209	14	1,586	943
1985	7,913	4,862	210	26	1,765	1,049
1986	8,297	5,000	210	16	1,804	1,266
1987	8,820	5,442	222	21	1,891	1,245
1988	9,445	5,669	300	22	2,165	1,289
1989	10,324	6,185	294	23	2,344	1,478
1990	10,657	6,134	381	33	2,478	1,631
1991	10,298	5,579	458	71	2,670	1,520
1992	10,716	5,790	524	93	2,897	1,413
1993	10,334	6,149	566	74	3,077	467

Source: BEA (1995)

all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), is the following in this example:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 35 shows the main identified export industries and their contribution to personal income in Dixie County. This county depends primarily on forestry services, lumber and wood, textile manufacturing, local governments and fishing for its economic survival. Some of the largest individual employers in Dixie County have, from time to time, had negative impacts on the ecosystem. For Dixie County, Table 36 shows the top ten employers along with the products they produce that may generate conflicts with the environment. Products such as textiles and lumber must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Dixie County discharged no toxic chemicals into surface water (Lester, 1995).

DIX.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Dixie County, the industries shown in Table 37 fall into this category.

The Dixie County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

DIX.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Dixie County is of mostly ecosystem-sensitive industries. The remainder, ecosystem-insensitive industries, have little impact on the ecosystem and are shown in Table 38.

In general, industries such as fishing and local government have a less adverse impact on local ecosystem health than other industries in the economics base for Dixie County. Over the 1969-93 period, the ecosystem-insensitive industries grew slower than the ecosystem-sensitive industries, meaning that the growth of the Dixie County economy is in conflict with the environment.

Table 35. Major Export Industries in Dixie County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Forestry Services	$612	.51	9.1
Fishing	1,151	.97	31.5
Lumber and Wood	13,239	11.22	26.2
Textiles	N/A	N/A	N/A
Water Transportation	195	.16	1.3
State and Local Government	21,143	17.93	2.11
Limited Tourism (Horseshoe Beach)	N/A	N/A	PJ*

*LQ = Location quotient. See Text.
*PJ = Professional Judgment.

Source: BEA (1995)

Table 36. Top Ten Employers in Dixie County, Florida and Products Produced, 1994.

Employer		Employees
1. Georgia Pacific Corporation, Timber		200
2. Great Bear Industries, Textile		200
3. Suwannee Lumber Company, Timber		140
4. Rick's Seafood, Fishing		60
5. Cross City Veneer Company, Timber		40
6. Anderson-Columbia, Asphalt paving		40
7. Gulf Stream Crab Company, Fishing		30
8. Knights Sawmill, Timber		25
9. Joe C. Smith Trucking, Timber		20
10. Sand T Service, Construction		15
	Sub-Total	770
	Total	3,570
	Percent of Total	22%

Source: Florida Department of Commerce (1994)

Table 37. Ecosystem-Sensitive Industries in Dixie County, Florida.

	Industry	Earnings ($000)
1.	Forestry Services	$612
2.	Lumber and Wood	1,151
3.	Textiles	13,239
4.	Water Transportation	N/A
	Sub-Total	$15,002
	Total Earnings (Place of Work)	$63,482
	Percent of Total	24%

Source: BEA (1995)

Table 38. Ecosystem-Insensitive Industries in Dixie County, Florida.

	Industry	Earnings ($000)
1.	Fishing	$1,151
2.	State and Local Government	21,143
3.	Tourism	N/A
	Sub-Total	$22,294
	Total Earnings	$63,482
	Percent of Total	35%

Source: Table 35

DIX.7 Commercial Fishery Landings in Dixie County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Dixie County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $2.1 million worth of commercial fishery products were landed in Dixie County at the *ex vessel* level (Table 39). Finfish and shrimp account for 32% of this value. Crabs accounted for 65% of the *ex vessel* value for the county. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species.

Table 39. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Dixie County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Spotted Sea Trout	139,058	$166,869.61
Black Mullet	287,871	135,299.38
Shad	196,798	59,039.40
Grunts	107,134	50,352.98
Spanish Mackerel	115,208	48,387.36
Sea Bass	56,401	25,944.46
Gag Grouper	5,659	12,619.57
Red Grouper	8,312	14,454.88
Black Grouper	7,938	16,431.66
Spot	30,102	12,040.80
All Others	147,436	82,670.00
Total		$624,110.10
Invertebrates		
Stone Crabs	134,702	781,065.86
Blue Crabs	857,404	578,480.05
Oysters	29,120	36,108.80
Clams	5,680	29,231.35
All Others	7,276	6,654.12
Total		$1,431,540.18
Shrimp (Total)	23,757	45,495.52
Grand Total		$2,101,145.80

* State average *ex vessel* price used.
Source: FDEP (1994)

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively important component of the economic base of Dixie County, where aggregate personal income was $.17 billion in 1993. Over the last fourteen years, commercial fishery landing has increased by 101% while the *ex vessel* value of the catch has increased by 244%. When adjusted for inflation, the value of landings changed by 91.6% (FDNR, 1980).

Construction of an estimate of the number of anglers, fishing days (i.e., the fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 40). Dixie County had 2,892 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment, as shown in Table 40. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate

Table 40. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	**2,892**	**5,191**	**2,993**
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 41 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 40. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Dixie County showed a fishing effort of 84,719 days.

Finally, Table 42 is derived from Table 40 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $5,178,169 in Dixie County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources.

Table 41. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	**72,747**	**11,972**	**84,719**
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 8. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 8. See Bell (1993).

Table 42. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	**3,861,249**	**1,316,920**	**5,178,169**
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 8 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 8 multiplied by $440.00 per angler.

Using the contingent value (CV) method, Bell, et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists respectively (in 1994 dollars). The annual flow of value for Dixie County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 7,011 = $2.6 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 4,121 = $0.8 million.

Thus, saltwater recreational fishing generates $3.6 million per year in Dixie County with a capitalized value of $120 million using a 3% discount rate (i.e., $3.6 million ÷ .03).

DIX.8 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 43.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a

Table 43. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of West Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its

production elasticity of .19). Dixie County has 20,300 acres (NOAA, 1991) of salt marsh which would be worth $108 million ($5,316 x 20,300) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by wetlands off the shore of Dixie County.

DIX.9 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Horseshoe Beach is the only major beach area in the county. Since no user information is available the estimated value of the beaches cannot be calculated (see Table 44).

DIX.10 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 45 identifies ecological resources that are an asset to Dixie County and induce a considerable level of economic activity. Table 46 is an inventory of these water-dependent facilities in Dixie County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

Table 44. Key Saltwater Beaches in Dixie County, Florida.*

Western District
Environmentally Endangered Lands
Horseshoe Beach

*In Dixie County alone, the University of West Florida (1985b) reported 2 individual saltwater beaches which were 1 mile in length and 132,000 square feet (public and private).
Source: University of West Florida(1985a)

Table 45. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Dixie County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$2.1[3]	N/A	N/A
Recreational Fishing	$5.17[4]	$3.6[5]	$120[5]
Saltwater Marsh[5]	N/A	.207[6]	108[6]
Saltwater Beaches	N/A[6]	N/A[6]	N/A[6]
Marine Boating[7]	N/A	$.138[7]	$4.63[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 39, *ex vessel* price
[4] Table 42, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 47

Table 46. An Inventory of Marine-Related Recreational Facilities in Dixie County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	--
b. Length (all) (LFT)*	--
2. Boardwalks/Catwalks	
a. Number	3
b. Length (all) (LFT)*	485
3. Jetties	
a. Length (all) (LFT)*	--
Boating	
1. Boat Ramps	
a. Number	13
b. Total Lanes	15
2. Marinas	
a. Total	6
b. Slips/Moorings	80
c. Dry Storage	36

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or

may not be good estimates for Dixie County, but are used for purposes of illustration.

Dixie County has 15 saltwater boat ramp lanes and 116 wet slips and dry racks, as shown in Table 46. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Dixie County is estimated and shown in Table 47. This value is about $0.14 million.

Recreational boating in marine waters is rapidly growing in Dixie County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Dixie County grew as follows, with projected (P) numbers included:

1983	1,046	
1984	1,160	
1985	1,223	
1986	1,233	
1987	1,269	
1988	1,361	
1989	1,365	
1990	1,407	
1991	1,398	
1992	1,496	
1993	1,544	(P)
1994	1,639	(P)
2000	2,488	(P)
2005	3,242	(P)
2010	4,226	(P)

DIX.11 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Dixie County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Dixie County.

Table 47. Estimation of the Annual User Value for Saltwater Boating Off Dixie County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $50,024 = $5.02[1] x 1,639[2] x .19[3] x 32[4]
2. Boat Ramps $52,007 = $1.48[1] x 1,639 x .67[4] x 32
3. Private Docks $36,860 = $5.02[5] x 1,639 x .14 x 32
Total Annual User Value = $138,891

*Asset Value = 138,891 ÷ .03 = $4.63 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Dixie County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Dixie County
[5] Assumed $/day same for marinas and private docks

Two indices used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Dixie County, the Econfina Creek/Steinhatchee River Basin has been selected for a brief summary of the current state of water quality in this region of the study area.

The water bodies in Dixie County are primarily smaller river systems that drain swampy lowlands and empty into marshes near the Gulf of Mexico. Water quality in this area has traditionally been very good because of

relatively low development. Sources of pollution include highway runoff and septic tank leakage. The WQI and TSI for selected areas are listed in Table 48.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). In 1994, there were no companies that discharged toxic substances in and around the surface water of Dixie County. Shellfish harvesting has been closed in 3,612 acres and restricted, conditionally or permanently, in another 35,588 acres. This leaves open over 90,000 acres, meaning that pollution levels in this area were not significant enough to prevent shellfish harvesting.

Table 48. Water Quality Indices for Selected Areas of Dixie County, Florida.

Water Areas: Steinhatchee River Basin		**Water Quality Indices***	
Water Body Type: Stream		WQI	TSI
1.	Sand Hill Creek	34	--
2.	Steinhatchee River	35	--
4.	Steinhatchee River	41	--
5.	Eightmile Creek	47	--
7.	Steinhatchee River	44	--

A. * Higher values indicate lower water quality

County Name: Escambia, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

ESC.1 Introduction

Escambia County is located in the western section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 3 and 4). Escambia County contains 664 square miles of land, ranking it 38th among the 67 counties in Florida. In 1990, Escambia County had a population of 262,798, ranking it 15th among Florida's counties. The population density was 410 people per square mile in 1990, ranking it 12th in Florida. Escambia County has a relatively low median age of 32.4 years, compared to the Florida-wide median of 36.4 years.

The population of Escambia County had a per capita income of $16,667 in 1992, 28th of the 67 Florida counties and 16% below the Florida-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies, compared to an area where income is earned at a local chemical plant. For Escambia County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Escambia County had 13.3% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 5.3% in Escambia county (relative to a statewide average of 7.0%), indicating a slack labor market.

ESC.2 Trends in Population, Income and Employment in Escambia County, 1980-93.

Table 49 shows the trend in key economic variables in Escambia County from 1980 through 1993. Over this interval resident population increased by 16.4% (1.3% annually), which was slow when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 147% from 1980 to 1993. (Table 49). Adjusted for inflation, real aggregate personal income increased by 38.2% (2.9% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

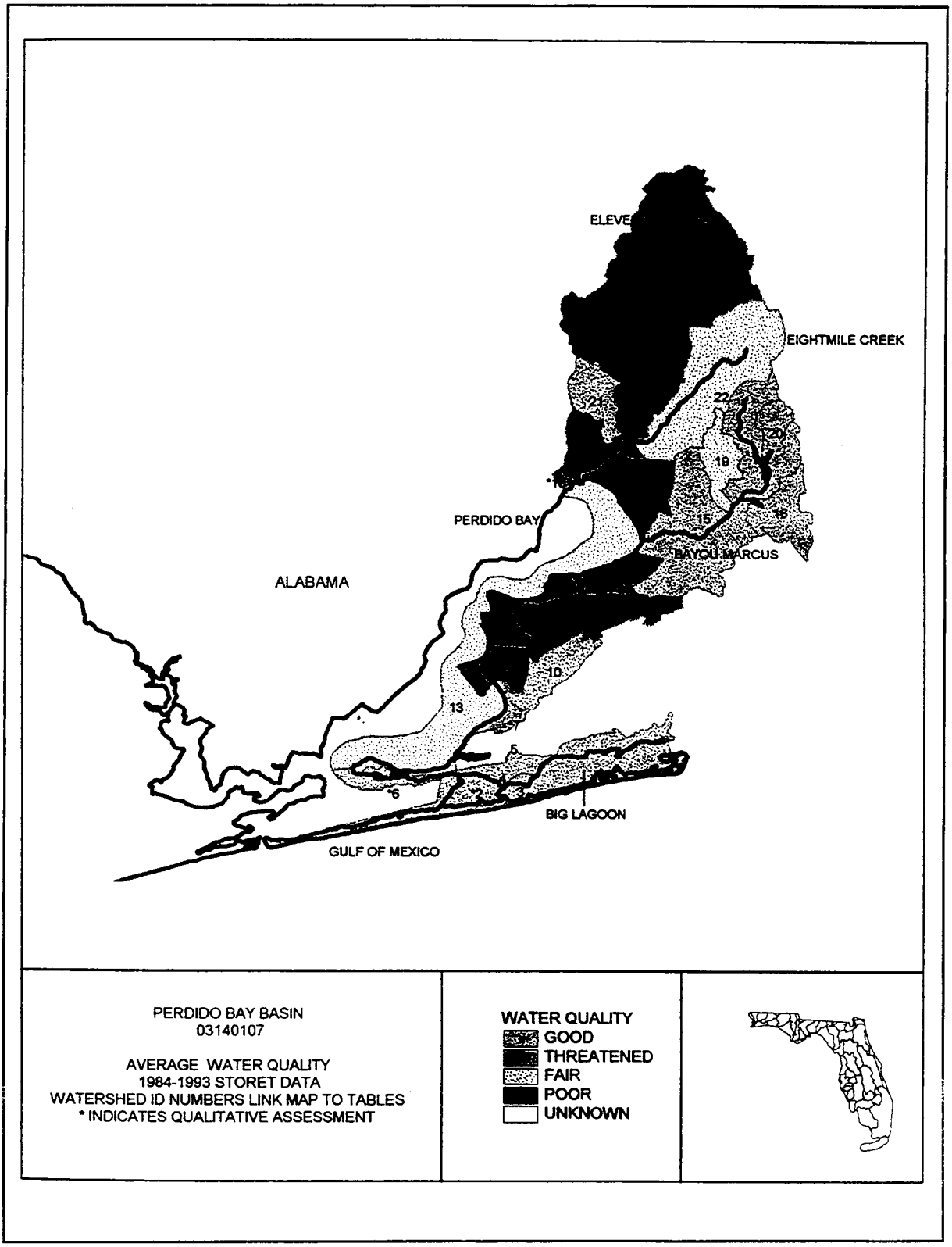


Figure 3. Map of Escambia County, Florida, showing levels of water quality and areas of quality testing (Perdido Bay Basin)[from Bureau of Surface Water Management (1994b)].

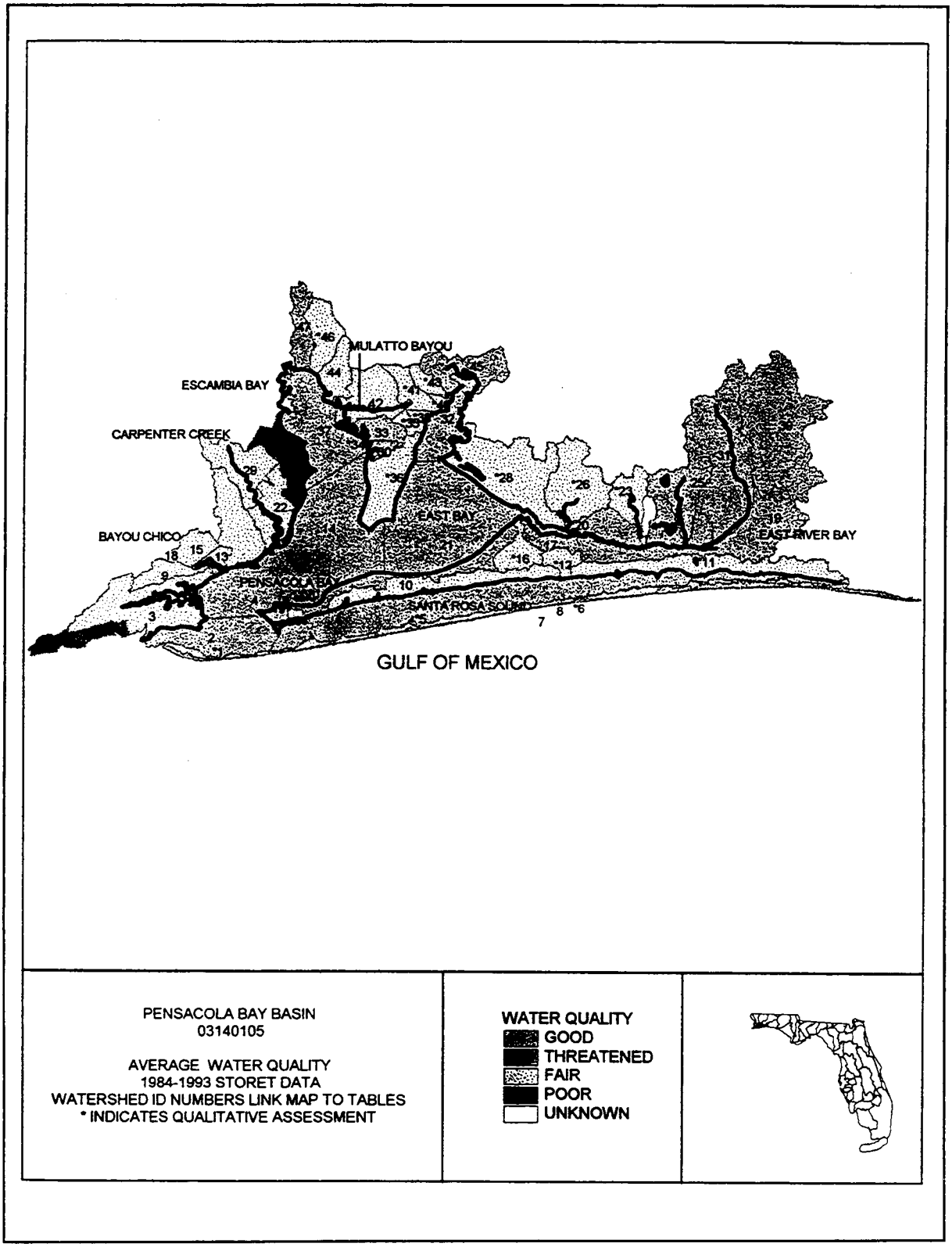


Figure 4. Map of Escambia County, Florida, showing levels of water quality and areas of quality testing (Pensacola Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 49. Trends in Key Economic Aggregate Variables in Escambia County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	235,600	$1,885,710	$2,288,483	113,101
1981	239,700	2,150,728	2,366,037	117,742
1982	243,200	2,323,311	2,407,576	117,905
1983	245,800	2,514,014	2,524,110	119,578
1984	249,000	2,723,858	2,621,615	126,114
1985	250,600	2,400,021	2,695,187	130,400
1986	255,000	3,104,779	2,832,828	135,195
1987	258,200	3,275,173	2,883,074	137,782
1988	258,000	3,433,251	2,883,075	137,753
1989	260,200	3,677,887	2,966,038	138,852
1990	263,300	3,952,498	3,024,099	140,547
1991	266,600	4,143,803	3,042,440	139,586
1992	270,200	4,408,297	3,142,051	142,954
1993	270,400	4,569,565	3,162,329	143,673

1. Includes earnings, dividends, interest, rent and transfer payments.
2. Deflated by CPI where 1982-84 = 100.
3. Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Escambia County increased from 113,101 in 1980 to 143,673 in 1993, a 27% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region; income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Escambia County grew less rapidly than the measure of county output — real aggregate personal income — as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

ESC.3 Trends in Various Welfare Measures in Escambia County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income

from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Escambia County derived 97.4% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is equally likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown in Table 50 for Escambia County.

ESC.4 Industrial Base: Escambia County

The "industrial base" for Escambia County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries fairly accurately. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles

Table 50. Trends in Components of Personal Income in Escambia County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$8,003	$5,622	$140	$15	$1,378	$847
1981	8,974	6,207	148	13	1,581	1,024
1982	9,555	6,531	147	22	1,748	1,107
1983	10,277	6,926	153	21	1,888	1,238
1984	10,938	7,412	146	15	1,945	1,421
1985	11,574	7,728	148	25	2,124	1,549
1986	12,176	8,050	159	22	2,221	1,723
1987	12,687	8,402	169	23	2,359	1,733
1988	13,306	8,725	190	22	2,536	1,833
1989	14,137	8,996	215	21	2,786	2,118
1990	15,011	9,494	256	26	3,063	2,172
1991	15,544	9,737	312	37	3,356	2,103
1992	16,316	10,265	396	59	3,589	2,008
1993	16,899	10,486	386	51	3,870	2,106

Source: BEA (1995)

from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all or most of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 51 shows the main identified export industries and their contribution to personal income in Escambia County. This county depends primarily on manufacturing, the Federal Government, water transportation, health services and tourism for its economic survival. Some of the largest individual employers in Escambia County, have, from time to time, had negative impacts on the ecosystem. For Escambia County, Table 52 shows the top ten employers, along with the products they produce that may generate conflicts with the environment. Products such as pulp and paper, chemicals, and utilities must be rigorously controlled or they will reduce water and air quality. Historically, Escambia County has had problems with industries located in this county. Terrebonne (1973) pointed out that the expansion of manufacturing firms in Escambia County (e.g., paper mills and chemical plants) has been accompanied by deteriorating water quality which in turn resulted in loss to other sectors of the economic base. Shrimp caught in inland waters near Pensacola declined from a high of 1.64 million pounds in 1968 to .77 million pounds in 1971 as a direct result of degraded conditions in local estuaries. Low dissolved oxygen and high bacteria counts present stresses that make shrimp more susceptible to other damaging factors. The oyster fishery also experienced severe losses as a result of water pollution. Virtually all oyster grounds in Escambia County were closed to shellfish harvesting over the 1951-1972 period according to Terrebonne (1973). In sum, from 1962-1972, environmental losses in terms of lost income from shrimping, shellfish harvesting, tourism, outdoor recreation and decreased property value because of poor water quality was over $1 billion. In 1993, the EPA reported that the companies in Escambia County discharged 18,440 pounds of toxic chemicals into surface water, ranking it 4th in volume among Florida's counties (see Lester, 1995).

ESC.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Escambia County, the industries shown in Table 53 fall into this category.

Table 51. Major Export Industries in Escambia County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Manufacturing	$362,315	10.5	
Paper and Allied Products			1.50
Printing and Publishing			1.50
Stone, Clay and Glass Products			1.58
Water Transportation	194,425	5.7	1.44
Federal Government, Civilian	384,120	11.2	3.52
Military	296,766	8.6	7.05
Health Services	466,890	13.6	1.60
Tourism	103,456	3.0	N/A

* LQ = Location quotient. See Text.

Source: BEA (1995)

Table 52. Top Ten Employers in Escambia County, Florida and Products Produced, 1994.

	Employer	Employees
1.	Baptist Healthcare, Health Care	2,846
2.	Sacred Heart Hospital, Health Care	2,700
3.	Monsanto Company, Nylon Fiber	2,300
4.	Gulf Power, Utilities	1,587
5.	HCA West Florida Regional Medical Center, Health Care	1,500
6.	Lakeview Center, Health Care	1,300
7.	Champion International Corporation, Paper Products	1,100
8.	Medical Center Clinic, Health Care	980
9.	Instrument Control Services, Inc., Instrumentation	750
10.	Pensacola Christian School, Private School/Publishing	724
	Sub-Total	15,787
	Total Jobs	143,673
	Percent of Total Jobs	11%

Source: Florida Department of Commerce (1994)

Table 53. Ecosystem-Sensitive Industries in Escambia County, Florida.

Industry	Earnings ($000)
1. Printing and Publishing	$23,871
2. Paper and Allied Products	80,966
3. Lumber and Wood Products	4,407
4. Furniture and Fixtures	6,247
5. Fabricated Metals	17,005
6. Stone, Clay and Glass Products	25,369
7. Water Transportation	8,940
8. Federal Civilian/Military (Naval Base)	680,886
Sub-Total	$847,691
Total Earnings (Non-Farm)	$2,381,390
Percent of Total	36%

Source: BEA (1995)

The Escambia County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. This county has a deep-water port and serves as a naval station for the U.S. military and a port for a variety of materials and products. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

ESC.6 Ecosystem-Insensitive Industries

As is indicated by earnings, the economic base of Escambia County is composed of primarily ecosystem-sensitive industries. The ecosystem-insensitive industries, which have less impact on the environment, are shown in Table 54.

In general, industries such as health services, tourism and retirement have a less adverse impact on local ecosystem health than other industries in Escambia County. Also, over the 1969-93 period, the ecosystem-insensitive industries were growing faster than the ecosystem-sensitive industries, meaning that the industrial structure is placing relatively less pressure on the marine ecosystem. Still, ecosystem-sensitive industries did grow in absolute terms and still place considerable stress on the ecosystem.

ESC.7 Commercial Fishery Landings in Escambia County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Escambia County.

Table 54. Ecosystem-Insensitive Industries in Escambia County, Florida.

Industry		Earnings ($000)
1. Health Services		$466,890
2. Tourism and Retirement		
Construction		216,732
Hotels/Motels		11,391
Eating and Drinking		92,065
	Sub-Total	$786,778
	Total Earnings	$2,381,390
	Percent of Total	33%

Source: Table 51

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $2.5 million worth of commercial fishery products were landed in Bay County at the *ex vessel* level (Table 55). Finfish and shrimp account for 97% of this value. Among the finfish, red snapper was by far the leading species as measured by quantity and value. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Escambia County ranked 8th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Escambia County, where aggregate personal income was $4.6 billion in 1993. Over the last fourteen years, commercial fishery landing has decreased by 91% while the *ex vessel* value of the catch has increased by 10%. When adjusted for inflation, the value of landings changed by -38%. Compared to other economic trends in Escambia County, commercial fishery landings are a declining component of the local economy (FDNR, 1980).

ESC.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. These counties include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Table 55. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Escambia County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Vermilion Snapper	73,595	$178,099.91
Red Snapper	416,137	645,012.31
Black Mullet	335,843	157,846.20
Porgies	75,664	69,610.88
Amberjacks	48,249	46,801.53
Spanish Mackerel	94,791	39,812.22
Black Roe Mullet	3,319	39,064.63
Triggerfish	41,121	37,831.32
Gag Grouper	15,750	35,122.50
Yellowedge Grouper	13,962	29,180.58
All Others	194,254	171,493.40
Total		$1,449,875.49
Invertebrates		
Blue Crabs	83,902	$53,810.85
Stone Crabs	240	1,123.48
Squid	17,329	6,411.73
Spiny Lobster	753	3,222.84
Total		$64,491.45
Shrimp (Total)	489,539	981,593.17
Grand Total	N/A	$2,496,960.11

* State average *ex vessel* price used.
Source: FDEP (1994)

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 56). Escambia County had 11,004 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment, as shown in Table 56. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 57 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 56. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers respectively. Escambia County showed a fishing effort of 125,792 days.

Table 56. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	**11,004**	**148**	**6,356**
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 57. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	**100,368**	**25,424**	**125,792**
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 56. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 56. See Bell (1993).

Finally, Table 58 is derived from Table 56 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $8.1 million in Escambia County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Escambia County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 11,152 = $4.2 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 6,356 = $1.2 million.

Thus, saltwater recreational fishing generates $5.4 million per year in Escambia County with a capitalized value of $180 million using a 3% discount rate (i.e., $5.4 million ¸ .03).

ESC.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 59.

Table 58. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	**$5,327,310**	**$2,796,640**	**$8,123,950**
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 54 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).

[2] Figures in Table 54 multiplied by $440.00 per angler.

Table 59. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Escambia County has 1,300 acres of salt marsh (NOAA, 1991), which would be worth $6.9 million ($5,316 x 1,300) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Escambia County wetlands.

ESC.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. It is difficult to separate Escambia County from neighboring Santa Rosa County since one beach runs into another. Table 60 lists the key beaches for these two counties.

Table 60. Key Saltwater Beaches in Escambia County, Florida.*

Western District
Environmentally Endangered Lands:
Perdido Key State Preserve #1
Perdido Key State Preserve #2
Gulf Islands National Seashore
Perdido Key and Johnson Beach
Perdido Key State Preserve
Big Lagoon State Recreational Area
Central District
Gulf Islands National Seashore
Fort Pickens and Langdon Beach
Unnamed Beaches
Quietwater Beach
Casino Beach
Pensacola Beach

* In Escambia County alone, the University of West Florida (1985b) reported 37 individual saltwater beaches which were 50.9 miles in length and 86.6 million square feet (public and private).

Source: University of West Florida(1985a)

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Using the CV technique, Leeworthy, et al. found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Escambia County would have 951,555 saltwater beach days per year in 1990 for the beaches listed in Table 60. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $2.85 million. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $95 million – the asset value of the beach. Finally, beach-related spending in Escambia County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 951,555 x $12 = $4.11 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 951,555 x $30 = $18.3 million

Combined, saltwater beaches in Escambia County attracted an estimated $22.41 million in beach-related spending in 1990 with tourists accounting for 83% of this spending.

Table 61 summarizes three ecological resources that are an asset to Escambia County and induce a considerable level of economic activity in this region.

ESC.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent such as fisheries and beaches. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 62 is an inventory of these water-dependent facilities in Escambia County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Escambia County, but are used for purposes of illustration.

Table 61. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Escambia County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$2.5[3]	N/A	N/A
Recreational Fishing	$8.1[4]	$5.4[5]	$180[5]
Saltwater Marsh[5]	N/A	.207[6]	6.9[6]
Saltwater Beaches	$22.41[6]	$2.85[6]	$95.0[6]
Marine Boating[7]	N/A	$1.15[7]	$38.45[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 55, *ex vessel* price
[4] Table 58, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 63

Table 62. An Inventory of Marine-Related Recreational Facilities in Escambia County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	9
b. Length (all) (LFT)*	10,410
2. Boardwalks/Catwalks	
a. Number	21
b. Length (all) (LFT)*	11,065
3. Jetties	
a. Length (all) (LFT)*	0
Boating	
1. Boat Ramps	
a. Number	26
b. Total Lanes	38
2. Marinas	
a. Total	28
b. Slips/Moorings	1,383
c. Dry Storage	515

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Escambia County has 38 saltwater boat ramp lanes and 1,898 wet slips and dry racks as shown in Table 62. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Escambia County is estimated and shown in Table 63. This value is about $1.15 million.

Recreational boating in marine waters is rapidly growing in Escambia County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Escambia County grew as follows, with projected (P) numbers included:

1983	13,495	
1984	13,892	
1985	14,204	
1986	14,542	
1987	14,898	
1988	15,325	
1989	15,944	
1990	15,790	
1991	15,432	
1992	15,558	
2000	17,460	(P)
2005	19,066	(P)
2010	20,803	(P)

Table 63. Estimation of the Annual User Value for Saltwater Boating Off Escambia County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $415,498 = $5.02[1] x 15,558[2] x .19[3] x 28[4]
2. Boat Ramps $431,965 = $1.48[1] x 15,558 x .67[4] x 28[4]
3. Private Docks $306,157 = $5.02[5] x 15,558 x .14 x 28
Total Annual User Value = $1,153,620

*Asset Value = 1,153,620 ÷ .03 = $38.45 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Escambia County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Escambia County
[5] Assumed $/day same for marinas and private docks

ESC.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Escambia County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Escambia County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in

Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Escambia County, Perdido Bay and Pensacola Bay have been selected for a brief summary of the current state of water quality in this region of the study area (see Figures 3 and 4).

The Perdido Bay Basin is on the Florida-Alabama border, with Escambia County on the eastern side of this basin. Major pollution sources are from pulp and paper mills and urban runoff. Champion Paper Corp. (formerly the St. Regis Paper Company) is a good example of the former, while the City of Pensacola is a high density population center and a good example of the latter. The discharge from Champion Paper Corp. negatively effects many in-stream water quality parameters, particularly biological integrity, color, DO, BOD, nutrients, turbidity and solids. Complaints from individuals living around Elevenmile Creek below the paper mill are over low density, diversity and species richness values for benthic fauna. Also, dissolved oxygen violations were recorded for Perdido Bay and Elevenmile Creek during the spring of 1994. EPA work on fish and dioxin concentrations resulted in advisories being issued urging no consumption of fish from Elevenmile Creek. Stormwater continues to be a pollution source to the bayou and the bay from a variety of non-point sources. The Florida side contributes mostly urban and construction stormwater, whereas the Alabama side has more agricultural runoff. The WQI and TSI for selected areas are listed in Table 64.

The Pensacola Bay Basin extends from Escambia County to Santa Rosa County. Urban runoff and wastewater treatment plant discharges are the major pollution sources. These latter sources are from well-defined points such as the University of West Florida WWTP, Monsanto industrial discharges, and Gulf Power thermal discharges that enter the Escambia River upstream of the mouth. Therefore, reduced DO concentrations, fish kills and bacteria problems have been evident around the mouth of the Escambia River. This portion of Escambia Bay also receives discharges from CYTEC and Air Products, two manufacturing plants. Both discharges have been found to be toxic in several bioassays. These companies discharge high levels of nitrogen and BOD. As outlined earlier in this report, the industrial structure of Escambia County is such that the ecosystem is under constant attack from many major industries in this area. This has manifested itself in fish kills (April, 1994), toxic bioassays and dirty foam near point source outfalls. Moving east in this basin, water quality improves, especially in Santa Rosa Sound. The WQI and TSI for important areas are also shown in Table 64.

Table 64. Water Quality Indices for Selected Areas of Escambia County, Florida.

Water Areas: Perdido Bay Basin		Water Quality Indices	
Water Body Type: Estuary		WQI	TSI
3	Direct Runoff to Bay	--	50
4	Big Lagoon	--	35
5	Direct Runoff to Bay	--	46
13	Perdido Bay	--	51
Water Body Type: Stream			
10	Unnamed Stream	36	--
12	Bridge Creek	72	--
15	Marcus Creek	26	--
16	Bellshead Branch	18	--
19	Turner Creek	52	--
20	Unnamed Branch	29	--
21	Hurst Branch	41	--
22	Eight Mile Creek	41	--
23	Eleven Mile Creek	76*	--
Water Areas: Pensacola Bay Basin		**Water Quality Indices**	
Water Body Type: Estuary			
2	Pensacola Bay (Mouth)	--	24
3	Bayou Grande	--	44
4	Pensacola Bay (Mid)	--	27
13	Bayou Chico	--	52
14	Pensacola Bay (N)	--	25
18	Bayou Grande	--	44
22	Texar Bayou	--	56*
24	Escambia Bay (S)	--	41
Water Body Type: Stream			
9	Jones Creek	56*	--
15	Jackson Creek	49	--
29	Carpenter Creek	30	--

*Poor water quality.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 65 indicates that in 1994, two companies (Champion and Monsanto) discharged toxic substances in and around the surface water of Escambia County. Of the 13 counties in the study area, Escambia County ranked fourth in pounds of toxic chemical discharges. These discharges may be highly variable from year to year.

As of 1993, Perdido Bay had 6,887 acres closed to shellfishing (while 3,050 acres were conditionally approved). Of a larger magnitude, the Pensacola Bay System had 62,457 acres closed to shellfishing (43,474 acres conditionally approved). Thus, in and around Escambia County, water quality is very poor for shellfishing (i.e., high coliform counts) in that nearly 70,000 acres are closed.

Table 65. Toxic Chemical Releases Into Surface Water by Firms Located in Escambia County, Florida in 1994.

Company	SIC	Discharge	Main[1]
1. Champion International (Pulp and Paper)	2,621	114,710	Ammonia
2. Monsanto (Chemicals)	2,824	799	Nickel/ Copper
Total		115,509	

[1] Leading chemical released based on pounds.
Source: EPA Toxic Release Inventory, unpublished data, 1994.

County Name: Franklin, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

FRA.1 Introduction

Franklin County is located in the central section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 5 and 6). It contains 534 square miles of land, ranking it 56th among the 67 counties in Florida. In 1990, Franklin County had a population of 8,967, ranking it 64th among Florida's counties. The population density was 18 people per square mile in 1990, a ranking of 62nd in Florida. Franklin County has a fairly high median age of 38.9 years, compared to the Florida-wide median of 36.4 years.

The population of Franklin County had a per capita income of $14,063 in 1992, 45th of the 67 Florida counties and 28.9% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies, compared to an area where income is earned at a local chemical plant. For Franklin County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Franklin County had 23.3% of the households below the poverty level in 1989, which was considerably higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 4.2% (relative to a statewide average of 7.0%), indicating a slack labor market.

FRA.2 Trends in Population, Income and Employment in Franklin County, 1980-93.

Table 66 shows the trend in key economic variables in Franklin County from 1980 through 1993. Over this interval, resident population increased by 23% (1.7% annually), which was slow when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 197% from 1980 to 1993 (Table 66). Adjusted for inflation, real aggregate personal income increased by 70% (5% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

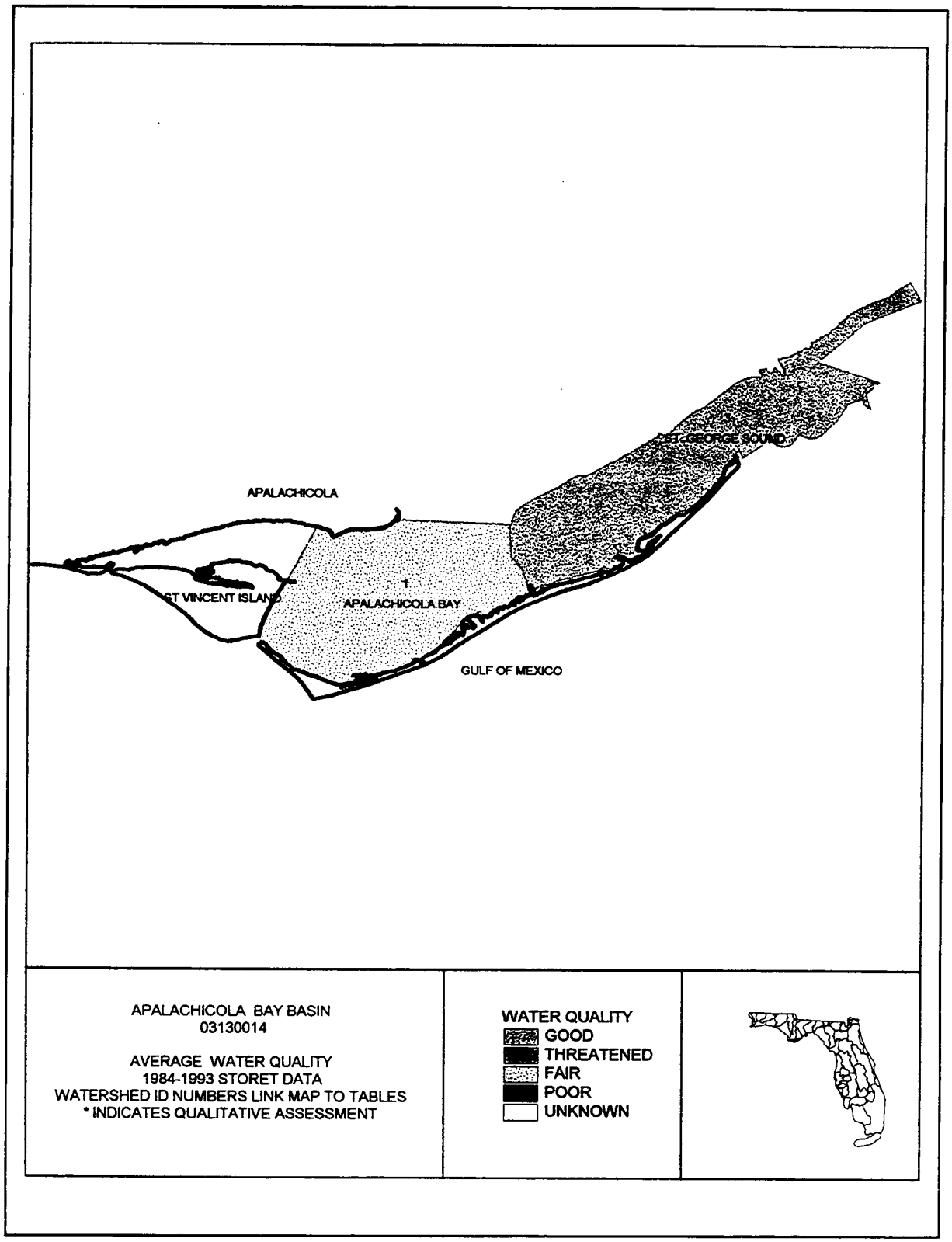


Figure 5. Map of Franklin County, Florida, showing levels of water quality and areas of quality testing (Apalachicola Bay Basin)[from Bureau of Surface Water Management (1994b)].

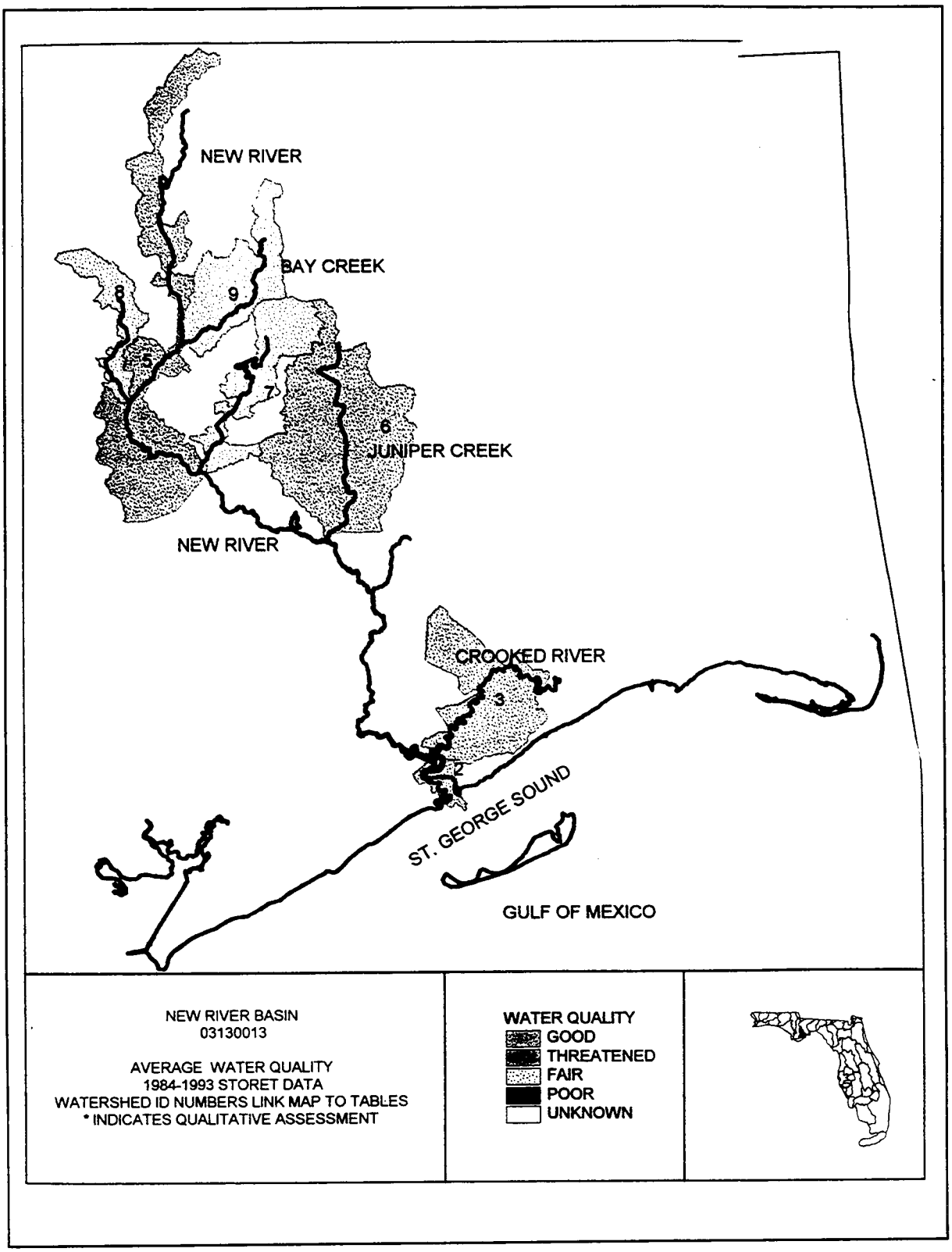


Figure 6. Map of Franklin County, Florida, showing levels of water quality and areas of quality testing (New River Basin)[from Bureau of Surface Water Management (1994b)].

Table 66. Trends in Key Economic Aggregate Variables in Franklin County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	7,700	$46,007	$55,834	2,716
1981	7,800	49,489	54,443	2,951
1982	8,000	52,471	54,374	2,924
1983	8,100	58,836	59,072	2,934
1984	8,400	64,932	62,495	3,003
1985	8,400	75,331	70,010	3,131
1986	8,500	84,287	76,904	3,235
1987	8,600	87,888	77,366	3,363
1988	8,700	96,184	81,305	3,641
1989	8,900	104,989	84,668	3,703
1990	9,000	115,083	88,051	3,569
1991	9,100	121,381	89,120	3,781
1992	9,200	128,650	91,692	3,937
1993	9,500	136,900	94,740	4,020

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Franklin County increased from 2,716 in 1980 to 4,020 in 1993, a 48% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Franklin County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

FRA.3 Trends in Various Welfare Measures in Franklin County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Franklin County derived 96% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Franklin County in Table 67.

FRA.4 Industrial Base: Franklin County

The "industrial base" for Franklin County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared

Table 67. Trends in Components of Personal Income in Franklin County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$5,984	$3,375	$241	$16	$1,427	$925
1981	6,328	3,350	238	12	1,607	1,121
1982	6,563	3,382	237	13	1,756	1,176
1983	7,254	3,820	223	15	1,906	1,289
1984	7,689	3,971	247	11	1,901	1,559
1985	8,919	4,747	239	34	2,130	1,769
1986	9,937	5,537	277	20	2,137	1,966
1987	10,180	5,760	235	14	2,233	1,939
1988	10,995	6,094	471	24	2,507	1,899
1989	11,860	4,496	375	28	2,793	2,169
1990	12,844	6,811	577	31	3,086	2,340
1991	13,309	7,060	646	41	3,434	2,127
1992	13,923	7,388	578	59	3,750	2,148
1993	14,458	7,701	583	38	4,041	2,095

Source: BEA (1995)

to the same percentage nationally (e.g., 0.5%) assuming the nation consumes all it produces — no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), is the following in this example:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 68 shows the main identified export industries and their contribution to personal income in Franklin County. This county depends primarily on fishing, forestry, health services, tourism and retirement for its economic survival. Franklin County is interesting in that it is two separate parts. In the west, the cutting of timber and harvesting of oysters are very large industries. In the east, Dog Island and St. George Island host a tourism- and retirement-based economy. This dichotomy has been in conflict in recent years. Some of the largest individual employers in Franklin County have, from time to time, had negative impacts on the ecosystem. Table 69 shows the top ten employers for Franklin County, along with the products they produce that may generate conflicts with the environment. Products such as lumber, and in this county, residents, must be rigorously controlled or they will reduce water and air quality.

Historically, Franklin County has had problems with industries located in this county. As stated earlier, the residents of Franklin County living on Dog Island and St. George Island have been accused by the fishing community of polluting the waters with waste from septic tanks. Since there is no paper or lumber mill, industrial waste is not a major concern in Appalachicola Bay. In 1993, the EPA reported that the companies in Franklin County discharged no toxic chemicals into surface water (Lester, 1995).

FRA.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Franklin County, the industries shown in Table 70 fall into this characterization.

The Franklin County economy is heavily based upon timber which is harvested and processed in Gulf County into various paper-based products. This county is a fishing community and Apalachicola produces nearly 95 percent of all Florida oysters. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

Table 68. Major Export Industries in Franklin County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Fisheries	$3,329	2.4	78.6
Forestry			
Forestry Services	253	.18	3.2
Lumber and Wood Products	1,783	.42	3.0
Railroad Transportation	926	.67	2.6
Water Transportation	728	.53	4.1
Health Services	9,212	6.7	1.1
Tourism/Retirement			
Building and Construction	2,303	1.7	1.0
Food Stores	2,806	2.0	1.8
Eating and Drinking Places	2,330	1.7	1.0
Hotels and Lodging	1,545	1.1	1.6

*LQ = Location quotient. See Text.

Source: BEA (1995)

Table 69. Top Ten Employers in Franklin County, Florida and Products Produced, 1994.

Employer		Employees
1. Leavins Seafood, Fishing		100
2. D. W. Wilson Seafood, Fishing		100
3. Annewakee, Private School		92
4. Bayside Shellfish, Fishing		90
5. Willis IGA, Grocery		70
6. Eastpoint Nursing Home, Health Services		47
7. Florida Power Corporation, Utilities		35
8. Jr. Foods, Grocery		30
9. Gibson Inn, Hotel		30
10. Miller Trucking Company, Trucking		30
	Sub-Total	624
	Total	4,020
	Percent of Total	15%

Source: Florida Department of Commerce (1994)

Table 70. Ecosystem-Sensitive Industries in Franklin County, Florida.

	Industry	Earnings ($000)
1.	Forestry	
	Forestry Services	$253
	Railroad Transportation	926
	Water Transportation	728
	Lumber/Wood	1,783
2.	Tourism/Retirement (Dog Island, St. George Island)	
	Building	3,378
	Food Stores	2,806
	Eating and Drinking Places	2,330
	Hotels	1,545
	Private Households	519
	Sub-Total	$14,268
	Total Earnings (Non-Farm)	$136,900
	Percent of Total	10%

Source: BEA (1995)

FRA.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 71. In general, industries such as health services and fishing have a less adverse impact on local ecosystem health than other industries in Franklin County. Over the 1969-93 period, the ecosystem-insensitive industries grew slower than the ecosystem-sensitive industries, meaning that new economic growth is in conflict with the environment.

FRA.7 Commercial Fishery Landings in Franklin County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Franklin County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $12.3 million worth of commercial fishery products were landed at the *ex vessel* level (Table 72). Finfish and shrimp account for 77% of this value. Among the finfish, grouper was by far the leading species as measured by quantity and value. Oysters and scallops accounted for 21% of the *ex vessel* value. Brown shrimp, which depends on

Table 71. Ecosystem-Insensitive Industries in Franklin County, Florida.

	Industry		Earnings ($000)
1.	Health Services		$9,212
2.	Fisheries		3,339
		Sub-Total	12,551
		Total Earnings	$136,900
		Percent of Total	9%

Source: Table 68

Table 72. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Franklin County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Red Grouper	427,374	$752,178.25
Gag Grouper	232,216	517,891.69
Yellowedge Grouper	236,507	494,299.62
Swordfish	51,674	165,873.55
Black Mullet	308,078	144,796.66
Shark Fins	4,945	91,581.40
Shark	212,435	84,974.00
Tilefish	53,895	79,764.60
Pompano	20,005	67,616.90
Amberjack	57,399	55,677.03
All Others	439,340	472,559.60
Total		$2,927,163.30
Invertebrates		
Oysters	1,478,875	$1,833,805.00
Calico Scallops	1,245,048	714,807.38
Blue Crabs	362,407	293,844.43
Spanish Lobster	17,940	31,036.20
Clams	2,661	12,187.38
All Others	11,499	2,782.45
Total		$2,888,462.84
Shrimp (Total)	2,938,079	6,578,489.85
Grand Total		$12,394,115.99

* State average ex vessel price used.
Source: FDEP (1994)

wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Franklin County ranked first in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively large component of the economic base of Franklin County, where aggregate personal income was $136 million in 1993. Over the last fourteen years, commercial fishery landing has decreased by 37% while the *ex vessel* value of the catch has decreased by 3%. When adjusted for inflation, the value of landings decreased by 43%. Compared to other economic trends in Franklin County, commercial fishery landings are an important component of the local economy (FDNR, 1980).

FRA.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 73). Franklin County had 1,793 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment, as shown in Table 73. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 74 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 73. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Franklin County showed a fishing effort of 73,394 days.

Table 73. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	**1,793**	**1,273**	**11,450**
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 74. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	**27,594**	**45,800**	**73,394**
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 73. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 73. See Bell (1993).

Finally, Table 75 is derived from Table 73 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $6,502,628 in Franklin County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate the order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) Counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Franklin County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 7,011 = $2.6 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 4,121 = $0.8 million.

Thus, saltwater recreational fishing generates $3.37 million per year in Franklin County with a capitalized value of $112 million using a 3% discount rate (i.e., $3.37 million ÷ .03).

FRA.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 76.

Table 75. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	**1,464,628**	**5,038,000**	**6,502,628**
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 73 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 73 multiplied by $440.00 per angler.

Table 76. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Franklin County has 18,400 acres of salt marsh (NOAA, 1991), which would be worth $98 million ($5,316 x 18,400) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Franklin County wetlands.

FRA.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Table 77 lists the key beaches for this county.

Table 77. Key Saltwater Beaches in Franklin County, Florida.*

Western District
Environmentally Endangered Lands:
St. Vincent National Wildlife Refuge
Eastern District
St. George Island
Dr. Julian G. Bruce State Park/St. George Island
Carrabelle Beach
Dog Island

*In Franklin County alone, the University of West Florida(1985b) reported 26 individual saltwater beaches which were 40.5 miles in length and 187 million square feet (public and private).

Source: University of West Florida (1985a)

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Using the CV technique, Leeworthy, et al. (1989) found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Franklin County would have 30,660 saltwater beach days per year in 1990 for the beaches listed in Table 77. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $91,980. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $3 million – the asset value of the beach.

Finally, beach-related spending in Franklin County in 1990 can be calculated in the following manner [with the percent of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 30,660 x $12 = $132,451

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 30,660 x $30 = $588,672

Combined, saltwater beaches in Franklin County attracted an estimated $0.72 million in beach-related spending in 1990, with tourists accounting for 83% of this spending.

Table 78 identifies three ecological resources that are an asset to Franklin County and induce a considerable level of economic activity in this region.

FRA.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 79 is an inventory of these water-dependent facilities in Franklin County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1995 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Franklin County, but we shall use these values for purposes of illustration.

Franklin County has 19 saltwater boat ramp lanes and 624 wet slips and dry racks, as shown in Table 79. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al.(1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Franklin County is shown in Table 80. This value is about $0.13 million.

Table 78. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Franklin County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$12.3[3]	N/A	N/A
Recreational Fishing	$6.5[4]	$3.37[5]	$112[5]
Saltwater Marsh[5]	N/A	.207[6]	98[6]
Saltwater Beaches	$.72[6]	$.09[6]	$3.0[6]
Marine Boating[7]	N/A	$.131[7]	$4.4[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 72, ex vessel price
[4] Table 75, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 80

Table 79. An Inventory of Marine-Related Recreational Facilities in Franklin County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	4
b. Length (all) (LFT)*	2,000
2. Boardwalks/Catwalks	
a. Number	27
b. Length (all) (LFT)*	630
3. Jetties	
a. Length (all) (LFT)*	1,100
Boating	
1. Boat Ramps	
a. Number	19
b. Total Lanes	25
2. Marinas	
a. Total	11
b. Slips/Moorings	304
c. Dry Storage	320

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 80. Estimation of the Annual User Value for Saltwater Boating Off Franklin County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. <u>Marinas</u> $47,522 = $5.02[1] x 1,557[2] x .19[3] x 32[4]
2. <u>Boat Ramps</u> $49,405 = $1.48[1] x 1,557 x .67[4] x 32
3. <u>Private Docks</u> $35,016 = $5.02[5] x 1,557 x .14 x 32
Total Annual User Value = $131,943

*Asset Value = 131,943 ÷ .03 = $4.4 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Franklin County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Franklin County
[5] Assumed $/day same for marinas and private docks

Recreational boating in marine waters is rapidly growing in Franklin County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Franklin County grew as follows, with projected (P) numbers included:

1983	886	
1984	957	
1985	1,010	
1986	1,033	
1987	1,068	
1988	1,074	
1989	1,128	
1990	1,185	
1991	1,309	
1992	1,366	
1993	1,424	
1994	1,557	
2000	1,850	(P)
2005	2,496	(P)
2010	3,237	(P)

FRA.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Franklin County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Franklin County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in

Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Franklin County, Apalachicola Bay and New River have been selected for a brief summary of the current state of water quality in this region of the study area (Table 81).

The Apalachicola Bay Basin contains approximately 200 square miles of estuary area. The bay is defined by a stretch of barrier islands including St. George Island, Cape St. George and St. Vincent Islands. The entire bay has been declared an Outstanding Florida Water. The most serious threats to the bay are direct stormwater runoff and runoff from fish-houses. The fish-houses create high BOD levels and some waste from boats docking and refueling. In the southern section of the bay, leakage from failing septic tanks has caused problems.

The New River Basin covers low wet forests between the Ochlockonee and Apalachicola Rivers. There is very little development in the basin. The only sources of pollution are near Carrabelle, where the city used to discharge treated wastewater directly into St. George Sound. This problem has since been addressed, but marinas and shellfishing continue to threaten the water quality.

Shellfish harvesting has been closed in 1,028 acres during the summer months. During the winter, the entire Apalachicola Bay, which is a major source of shellfish for the state, is open for harvesting.

Table 81. Water Quality Indices for Selected Areas of Franklin County, Florida.

Water Areas: Apalachicola Bay		**Water Quality Indices**	
Water Body Type: Estuary		WQI	TSI
1	Apalachicola Bay		58
2	Apalachicola Bay		64
2	St. George Sound		40
Water Areas: New River Basin			
Water Body Type: Estuary			
4	Alligator Harbor	--	64
Water Body Type: Stream			
2	New River	44	--
3	Crooked River	43	--

County Name: Gulf, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

GUL.1 Introduction

Gulf County is located in the central section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 7). It contains 565.1 square miles of land, ranking it 52nd among the 67 counties in Florida. In 1990, Gulf County had a population of 11,504, ranking this county 57th among Florida's counties. The population density was 22 people per square mile in 1990, a ranking of 59th. Gulf County has a median age of 35.7 years, slightly lower than the Florida-wide median of 36.4 years.

The population of Gulf County had a per capita income of $13,840 in 1992, 48th of the 67 Florida counties and 30% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Gulf County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Gulf County had 13.7% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 7.3% (relative to a statewide average of 7.0%), indicating a tight labor market.

GUL.2 Trends in Population, Income and Employment in Gulf County, 1980-93.

Table 82 shows the trend in key economic variables in Gulf County from 1980 through 1993. Over this interval, resident population increased by 12% (0.9% annually), which was very low when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 141% from 1980 to 1993. (Table 82). Adjusted for inflation, real aggregate personal income increased by 37% (3% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth. (Hall, 1994).

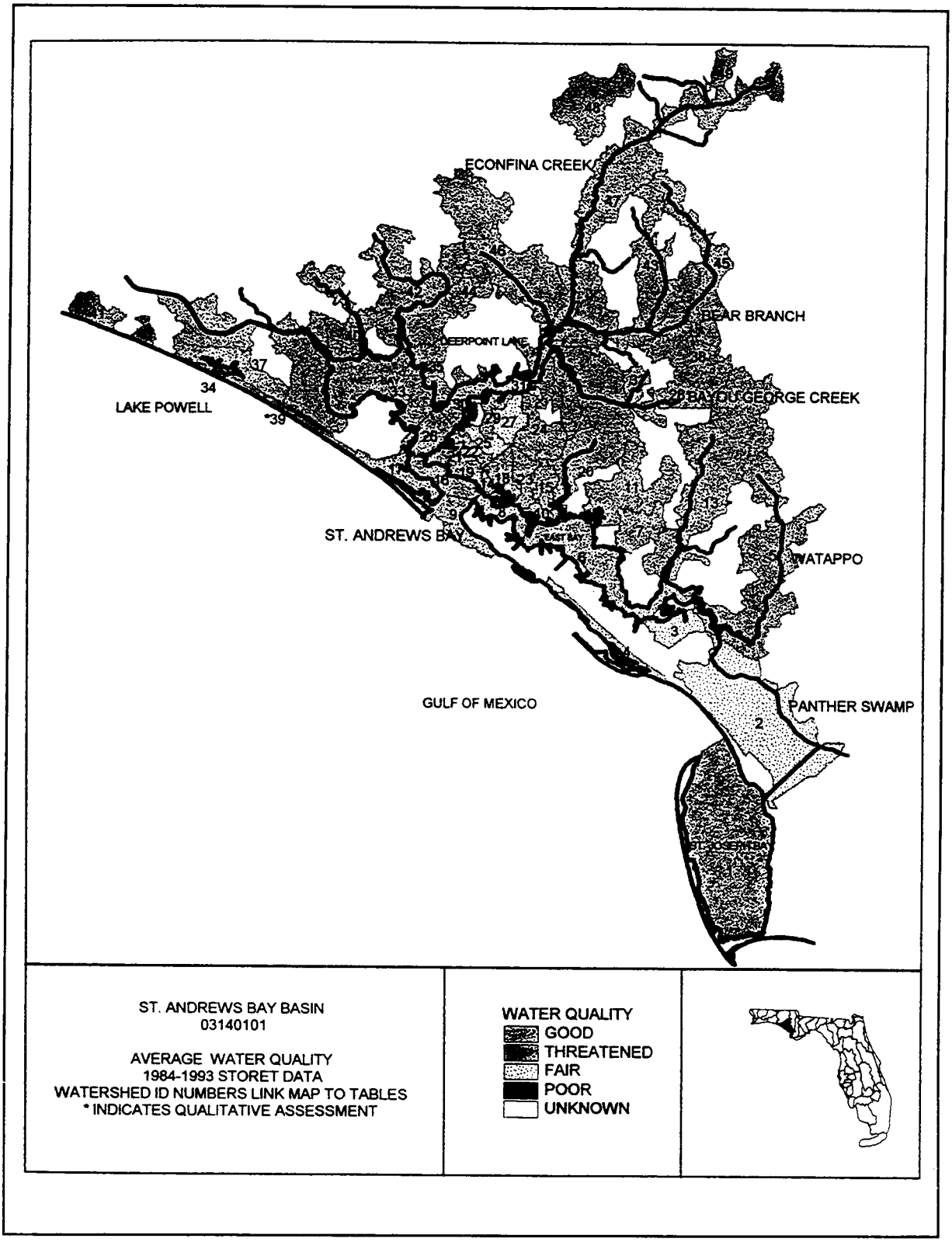


Figure 7. Map of Gulf County, Florida, showing levels of water quality and areas of quality testing (St. Andrews Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 82. Trends in Key Economic Aggregate Variables in Gulf County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	10,700	$72,191	$87,610	3,795
1981	10,600	80,528	88,590	3,909
1982	10,700	86,821	89,970	3,996
1983	10,800	93,290	93,665	4,071
1984	10,900	100,804	97,020	4,046
1985	11,100	105,645	98,183	4,016
1986	11,100	113,979	103,995	4,107
1987	11,200	117,544	103,472	4,218
1988	11,300	124,685	105,397	4,251
1989	11,400	132,476	106,835	4,371
1990	11,500	141,834	105,519	4,440
1991	11,600	150,105	110,209	4,301
1992	11,700	161,599	115,181	4,424
1993	12,000	174,258	120,594	4,692

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Gulf County increased from 3,795 in 1980 to 4,692 in 1993, a 24% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region; income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Gulf County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

GUL.3 Trends in Various Welfare Measures in Gulf County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Gulf County derived 96% of its personal income from earnings, retirement and capital income, compared to 98.2% for Florida as a whole. Thus, the county is more likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Gulf County in Table 83.

GUL.4 Industrial Base: Gulf County

The "industrial base" for Gulf County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the

Table 83. Trends in Components of Personal Income in Gulf County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,765	$4,723	$190	$28	$1,157	$666
1981	7,630	5,175	194	29	1,413	819
1982	8,094	5,335	199	53	1,596	912
1983	8,673	5,667	210	71	1,727	998
1984	9,268	6,045	224	34	1,820	1,146
1985	9,533	6,170	215	33	1,984	1,132
1986	10,244	6,537	216	31	2,111	1,350
1987	10,503	6,816	203	35	2,204	1,244
1988	11,082	7,058	270	28	2,366	1,360
1989	11,651	7,161	266	31	2,699	1,493
1990	12,329	7,356	341	38	3,016	1,579
1991	12,988	7,410	413	59	3,412	1,694
1992	13,832	7,776	480	107	3,747	1,722
1993	14,482	8,188	464	87	3,990	1,753

Source: BEA (1995)

nation consumes all it produces – no imports or exports. This is rather simplistic, but does serve as a barometer of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 84 shows the main identified export industries and their contribution to personal income in Gulf County. This county depends primarily on forestry, paper products, fishing and chemical production for its economic survival. The county's largest employers are St. Joe Forest Products and two other forestry-related companies. Raffield Fisheries also is based in Gulf County. Other major employers in the county include two chemical companies and Apalachicola Northern Railroad. In this county, tourism is not a major industry. Some of the largest individual employers in Gulf County have, from time to time, had negative impacts on the ecosystem. Table 85 shows the top employers in Gulf County, along with the products they produce that may generate conflicts with the ecosystem. Products such as chemicals, lumber and paper products must be rigorously controlled or they will reduce water and air quality. Gulf County has had problems with industries located in this county; Arizona Chemical and St. Joe paper mill both discharge large quantities of chemicals to the City of Port St. Joe Waste Water Treatment Plant which are then released into the surface water.

GUL.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Gulf County, the industries shown in Table 86 fall into this category.

The Gulf County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. Fishing is also a very important export, and Port St. Joe serves as a major port for shipping these products. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

GUL.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Gulf County is composed primarily of ecosystem-sensitive industries. The remainder, ecosystem-insensitive industries, have relatively little impact on the environment and are shown in Table 87.

Table 84. Major Export Industries in Gulf County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Forestry	$200	.11	2.00
Lumber	N/A		
Paper Products (Manufacturing)	35,961		
Railroad Transportation	2,717	1.55	6.10
Fishing	388	.22	7.17
Chemicals (Manufacturing)	5,827		

*LQ = Location quotient. See Text.

Source: BEA (1995)

Table 85. Top Employers in Gulf County, Florida and Products Produced, 1994.

Employer		Employees
1. St. Joe Forest Products, Paper		900
2. Raffield Fisheries, Fishing		160
3. Arizona Chemicals, Chemicals		126
4. Premier Services, Chemicals		106
5. Whitfield Timber Company, Lumber and Millwork		100
6. Apalachicola Northern Railroad, Railroad Services		98
7. St. Joe Container, Paper Products		87
8. Material Transfer, Coal		15
	Sub-Total	1,592
	Total	4,692
	Percent of Total	34%

Source: Florida Department of Commerce (1994)

Table 86. Ecosystem-Sensitive Industries in Gulf County, Florida.

	Industry	Earnings ($000)
1.	Lumber/Forestry/Paper Products	$3,700
2.	Railroad Transportation	2,717
3.	Chemicals	5,000
	Sub-Total	$43,748
	Total Earnings (Non-Farm)	174,258
	Percent of Total	26%

Source: BEA (1995)

Table 87. Ecosystem-Insensitive Industries in Gulf County, Florida.

	Industry	Earnings ($000)
1.	Fisheries	$388
	Sub-Total	388
	Total Earnings	$174,258

Source: Talbe 84

In general, industries such as fisheries have a less adverse impact on local ecosystem health than other industries in Gulf County. Over the 1969-93 period, ecosystem-insensitive industries were growing slower than ecosystem-sensitive industries, meaning that the economic base of Gulf county is in direct conflict with the environment.

GUL.7 Commercial Fishery Landings in Gulf County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Gulf County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $3.8 million worth of commercial fishery products were landed in Gulf County at the *ex vessel* level (Table 88). Finfish and shrimp account for 90% of this value. Among the finfish, ladyfish and menhaden were the leading species as measured by quantity and value. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Gulf County ranked 5th in the *ex vessel* value of all commercial fishery landings. Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively important component of the economic base of Gulf County, where aggregate personal income was $174 million in 1993. Over the last fourteen years, commercial fishery landing has increased by 91% while the *ex vessel* value of the catch has increased by 154%. When adjusted for inflation, the value of landings changed by 41%.

GUL.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional

Table 88. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Gulf County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Ladyfish	1,467,167	$586,866.81
Menhaden	5,059,917	556,590.88
Misc. Foot Fish	763,755	450,615.44
Misc. Industrial Fish	2,815,391	450,462.56
Little Tuna	931,336	232,834.00
Spanish Sardines	815,968	122,395.20
Round Scad	424,314	110,321.63
Goatfishes	54,321	63,545.04
Black Mullet	126,018	59,228.46
Baitfish	413,158	45,447.38
All Others	593,933	146,587.45
Total		$2,888,232.17
Invertebrates		
Calico Scallops	633,536	$361,115.50
Clams	5,104	9,864.52
Blue Crabs	10,182	6,516.48
Squid	10,771	3,985.27
Oysters	2,529	3,135.96
All Others	34,899	3,501.13
Total		$388,118.86
Shrimp (Total)	267,329	500,270.15
Grand Total		$3,756,621.18

* State average *ex vessel* price used.
Source: FDEP (1994)

breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an approximation to the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 89). Gulf County had 3,316 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in

Table 89. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	**1,967**	**1,349**	**4,919**
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

close geographical proximity to each county, using personal judgment, as shown in Table 89. Finally, tourists must purchase a license, and the number is shown for just the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 90 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 89. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Gulf County showed a fishing effort of 49,520 days.

Finally, Table 91 is derived from Table 89 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $3,748,413 in Gulf County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of

Table 90. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	**29,844**	**19,676**	**49,520**
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 89. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 89. See Bell (1993).

Table 91. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	**1,584,053**	**2,164,360**	**3,748,413**
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 89 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 89 multiplied by $440.00 per angler.

recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Gulf County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 3,316 = $1.2 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 4,919 = $.95 million.

Thus, saltwater recreational fishing generates $2.1 million per year in Gulf County with a capitalized value of $70 million using a 3% discount rate (i.e., $21 million ÷ .03).

GUL.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 92.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper,

Table 92. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Gulf County has 2,800 acres (NOAA, 1991)

of salt marsh which would be worth $14.9 million ($5,314 x 2,800) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by wetlands off the shore of Gulf County.

GUL.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters.

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Using the CV technique, Leeworthy, et al. (1989) found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Gulf County would have 103,860 saltwater beach days per year in 1990 for the beaches listed in Table 93. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $3.11 million. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $10 million – the asset value of the beach.

Finally, beach-related spending in Gulf County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 103,860 x $12 = $.44 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 103,860 x $30 = $2.0 million

Table 93. Key Saltwater Beaches in Gulf County, Florida.*

Western District

Environmentally Endangered Lands:
- Beacon Hill Public Beach
- St. Joe Beach
- St. Joe Beach - Port St. Joe
- Port St. Joe City Park

Eastern District

- Indian Pass
- Cape San Blas
- St. Joseph Peninsula State Park

*In Gulf County alone, the University of West Florida (1985b) reported 12 individual saltwater beaches which were 16.4 miles in length and 6.4 million square feet (public and private).

Source: University of West Florida (1985a)

Combined, saltwater beaches in Gulf County attracted an estimated $2.44 million in beach-related spending in 1990 with tourists accounting for 83% of this spending. Table 94 identifies three ecological resources that are an asset to Gulf County and induce a considerable level of economic activity in this region.

GUL.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

Table 94. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Gulf County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$3.8[3]	N/A	N/A
Recreational Fishing	$3.7[4]	$2.1[5]	$70[5]
Saltwater Marsh[5]	N/A	.207[6]	14.9[6]
Saltwater Beaches	$2.44[6]	$3.11[6]	$10.0[6]
Marine Boating[7]	N/A	$.169[7]	$5.64[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 88, *ex vessel* price
[4] Table 91, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 95

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used ($5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and are used for purposes of illustration.

Gulf County has 5 saltwater boat ramp lanes and 121 wet slips and dry racks. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Gulf County is estimated and is shown in Table 95. This value is about $.17 million.

Recreational boating in marine waters is rapidly growing in Gulf County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations grew as follows, with projected (P) numbers included:

1983	1,352	
1984	1,492	
1985	1,537	
1986	1,672	
1987	1,735	
1988	1,821	
1989	1,883	
1990	1,883	
1991	1,836	
1992	1,917	
1993	1,866	
1994	1,996	
2000	2,763	(P)
2005	3,461	(P)
2010	4,334	(P)

GUL.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Gulf County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Gulf County.

Table 95. Estimation of the Annual User Value for Saltwater Boating Off Gulf County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $60,921 = $5.02[1] x 1,996[2] x .19[3] x 32[4]
2. Boat Ramps $63,335 = $1.48[1] x 1,996 x .67[4] x 32
3. Private Docks $44,8889 = $5.02[5] x 1,996 x .14 x 32
Total Annual User Value = $169,415

*Asset Value = 169,415 ÷ .03 = $5.64 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Gulf County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Gulf County
[5] Assumed $/day same for marinas and private docks

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Gulf County, we have selected St. Andrews Bay for a brief summary of the current state of water quality in this region of the study area (Figure 7).

The portion of the St. Andrews Bay Basin that lies in Gulf County includes Panther Creek, St. Joseph Bay, and Watappo. The major sources of pollution in these areas are from St. Joe Forest Products and the Premier Services Corporation. Both of these companies discharge into the Gulf County Canal near the St. Joseph Bay, where the pollution becomes diluted with cleaner bay water. This, however, has changed the water quality near the canal for

the worse. Sediments are mucky, not sandy, and seagrass coverage has decreased. High pH and TSS levels are becoming larger problems for the bay. The WQI and TSI for selected areas are listed in Table 96.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 97 indicates that in 1994, two companies (Arizona Chemical and St. Joe Paper) discharged toxic substances to the wastewater treatment plant in the City of Port St. Joe. These discharges may be highly variable from year to year. Shellfish harvesting has been closed in 6,088 acres, while still being allowed in 34,137 acres. Gulf County is the second largest oyster-producing county in the state.

Table 96. Water Quality Indices for Selected Areas of Gulf County, Florida.

Water Areas: St. Andrews Bay Basin		**Water Quality Indices***	
Water Body Type: Estuary		WQI	TSI
1	St. Joseph Bay	--	52
2	Panther Swamp	--	56
Water Body Type: Stream			
5	Watappo	22	--

* Higher values indicate lower water quality

Table 97. Toxic Chemical Releases Into Surface Water by Firms Located in Gulf County, Florida in 1994.

	Company	**SIC**	**Discharge**	**Main**[1]
1.	Port St. Joe Forest Products (Pulp and Paper)	2,621	101,250	Methanol
2.	Arizona Chemicals	2,957	16,173	Biphenyl
	Total		117,423	

[1] Leading chemical released based on pounds.
Source: EPA Toxic Release Inventory, unpublished data, 1994.

County Name: Jefferson, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

JEF.1 Introduction

Jefferson County is located in eastern section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 8). It contains 597.8 square miles of land, ranking it 45th among the 67 counties in Florida. In 1990, Jefferson County had a population of 11,296, ranking it 58th among Florida's counties. The population density was 22 people per square mile in 1990, a ranking of 59th in Florida. Jefferson County has a relatively low median age of 33.8 years, compared to the Florida-wide median of 36.4 years.

The population of Jefferson County had a per capita income of $13,739 in 1992, 49th of the 67 Florida counties and 44% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Jefferson County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Jefferson County had 17.5% of the households below the poverty level in 1989, which was considerably higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 4.9% (relative to a statewide average of 7.0%), indicating a slack labor market.

JEF.2 Trends in Population, Income and Employment in Jefferson County, 1980-93.

Table 98 shows the trend in key economic variables in Jefferson County from 1980 through 1993. Over this interval resident population increased by 9% (0.7% annually), which was slow when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 152% from 1980 to 1993. (Table 98). Adjusted for inflation, real aggregate personal income increased by 44% (3.4% annually). Since real income growth outstripped population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth. (Hall, 1994).

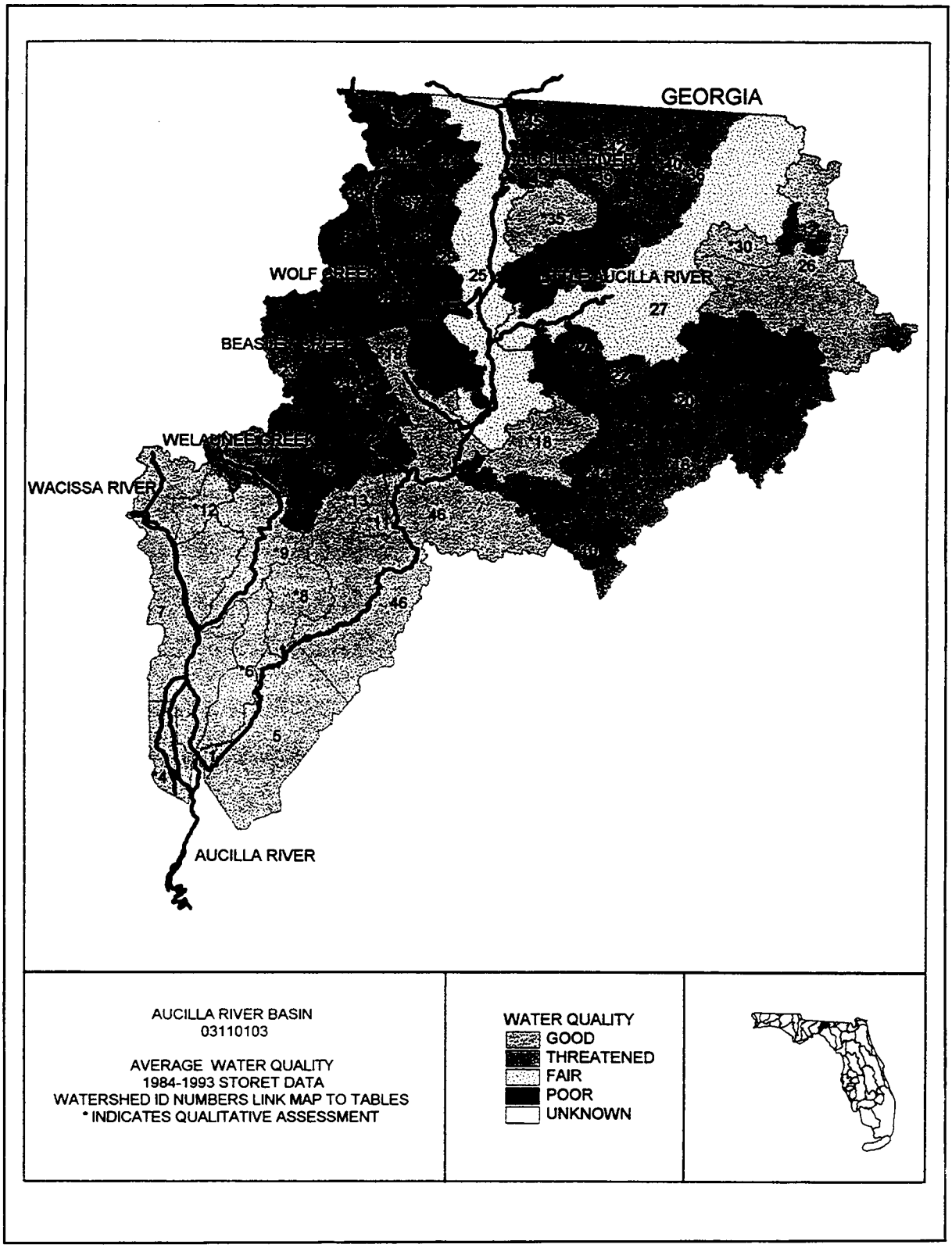


Figure 8. Map of Jefferson County, Florida, showing levels of water quality and areas of quality testing (Aucilla River Basin)[from Bureau of Surface Water Management (1994a)].

Table 98. Trends in Key Economic Aggregate Variables in Jefferson County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	10,800	$68,094	$82,638	3,903
1981	10,900	72,968	80,273	3,788
1982	11,000	80,433	83,350	3,764
1983	11,100	84,442	84,781	3,837
1984	11,200	89,667	86,301	3,801
1985	11,100	96,807	89,969	3,684
1986	11,000	104,040	94,927	3,683
1987	11,100	111,501	98,152	3,850
1988	11,200	121,051	102,325	3,993
1989	11,200	131,364	105,939	3,888
1990	11,400	145,054	110,982	4,163
1991	11,600	155,938	114,492	4,281
1992	11,700	165,579	118,018	4,402
1993	11,800	172,176	119,153	4,453

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Jefferson County increased from 3,903 in 1980 to 4.453 in 1993, a 14% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Jefferson County grew less rapidly than the measure of county output — real aggregate personal income — as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

JEF.3 Trends in Various Welfare Measures in Jefferson County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Jefferson County derived 95.6% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Jefferson County in Table 99.

JEF.4 Industrial Base: Jefferson County

The 'industrial base" for Jefferson County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the

Table 99. Trends in Components of Personal Income in Jefferson County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,325	$4,417	$253	$9	$930	$716
1981	6,712	4,517	268	10	1,065	852
1982	7,288	4,776	273	20	1,180	1,040
1983	7,633	4,958	279	21	1,281	1,095
1984	7,979	5,197	298	14	1,327	1,142
1985	8,754	5,619	311	19	1,508	1,296
1986	9,439	6,136	299	13	1,618	1,373
1987	10,066	6,676	296	12	1,713	1,364
1988	10,851	7,208	333	10	1,823	1,476
1989	11,717	7,429	360	13	2,067	1,849
1990	12,767	7,974	425	18	2,289	2,060
1991	13,501	8,215	506	28	2,581	2,171
1992	14,105	8,596	661	43	2,849	1,955
1993	14,575	8,854	606	34	3,074	2,007

Source: BEA (1995)

nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 100 shows the main identified export industries and their contribution to personal income in Jefferson County. This county depends primarily on agricultural services, lumber manufacturing, apparel manufacturing, utilities and local government for its economic survival. Some of the largest individual employers in Jefferson County have, from time to time, had negative impacts on the ecosystem. For Jefferson County, Table 101 shows the top ten employers, along with the products they produce that may generate conflicts with the environment. Industries such as logging, lumber and wood products, and utilities must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Jefferson County discharged no toxic chemicals into surface water (Lester, 1995).

JEF.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Jefferson County, the industries shown in Table 102 fall into this category.

Table 100. Major Export Industries in Jefferson County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Agricultural Services	$3,867	2.2	5.6
Manufacturing			
Apparel	1,624	.94	2.5
Lumber and Wood	3,607	2.1	4.9
Utilities	3,798	2.2	2.2
State and Local Government	20,215	11.7	1.4

*LQ = location quotient. See Text.

Source: BEA (1995)

Table 101. Top Ten Employers in Jefferson County, Florida and Products Produced, 1994.

Employer	Employees
1. Command Enterprises, Apparel	145
2. Simpson Nursery, Plants	125
3. Brynwood Center, Nursing Home	105
4. Bassett's Dairy, Food Products	50
5. Winn-Dixie, Grocery	46
6. Florida Power Corporation, Utilities	45
7. Farmers and Merchants Bank, Financial Services	34
8. Monticello Foodway, Grocery	28
9. Kaleidoscope Limited	20
10. Jefferson County Kennel Club, Dog Racing	19
Sub-Total	617
Total	4,453
Percent of Total	14%

Source: Florida Department of Commerce (1994)

Table 102. Ecosystem-Sensitive Industries in Jefferson County.

Industry	Earnings ($000)
1. Agricultural Services	$3,867
2. Apparel	1,624
3. Lumber and wood	3,607
4. Utilities	3,798
Sub-Total	$12,896
Total Earnings (Non-Farm)	69,470
Percent of Total	19%

Source: BEA (1995)

The Jefferson County economy is heavily based upon agricultural services. Lumber and wood products also are large components of the Jefferson County economy. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

JEF.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Jefferson County is composed of primarily ecosystem-sensitive industries. The remainder are ecosystem-insensitive industries, which have relatively little impact on the environment and are shown in Table 103.

Table 103. Ecosystem-Insensitive Industries in Jefferson County.

	Industry	Earnings ($000)
1.	State and Local Government	20,215
	Sub-Total	$20,215
	Total Earnings	69,470
	Percent of Total	29%

Source: Table 100 And 102

In general, an industry such as government has a less adverse impact on local ecosystem health than other industries in Jefferson County. Over the 1969-93 period, the ecosystem-insensitive industries grew faster than the ecosystem-sensitive industries, meaning that the growth of the Jefferson County economy is not in conflict with the environment.

JEF.7 Commercial Fishery Landings in Jefferson County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Jefferson County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. Jefferson County only had $1,000 of fishery landings in 1994 (Table 104); with very little coastal area, fisheries are a relatively insignificant part of the economy. Among the 13 counties in the study area, Jefferson County ranked 13th in the *ex vessel* value of all commercial fishery landings.

JEF.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist

Table 104. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Jefferson County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Porgies	287	$264.04
Gag Grouper	78	173.94
Cobia	63	111.51
Grunts	228	107.16
Flounder	36	62.28
Sea Bass	66	30.36
Red Snapper	10	24.20
Triggerfish	18	16.56
Other Jack	26	11.44
Total		$801.49
Invertebrates		
Blue Crabs	270	172.80
Total		172.80
Shrimp (Total)	0	0.00
Grand Total		$974.29

* State average *ex vessel* price used.
Source: FDEP (1994)

angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study or Bell (1993) statewide figures may be very conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county (Table 105). Jefferson County had 250 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment, as shown in Table 105. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 106 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 105. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers respectively. Jefferson County showed a fishing effort of 15,277 days.

Table 105. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	**250**	**1,327**	**271**
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 106. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	**14,193**	**1,084**	**15,277**
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 105. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 105. See Bell (1993).

Finally, Table 107 is derived from Table 105 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $872,573 in Jefferson County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Jefferson County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 1,577 = $.59 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 271 = $.05 million.

Table 107. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	**753,333**	**119,240**	**872,573**
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 105 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).

[2] Figures in Table 105 multiplied by $440.00 per angler.

Thus, saltwater recreational fishing generates $.64 million per year in Jefferson County with a capitalized value of $21 million using a 3% discount rate (i.e., $.64 million ÷ .03).

JEF.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export, rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 108.

Table 108. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Jefferson County has 3,800 acres of salt marsh (NOAA, 1991), which would be worth $20.2 million ($5,316 x 3,800) in fishery production alone. Negative ecological factors, such as dredging or oil spills would threaten the value provided by Jefferson County wetlands.

JEF.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of

the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Jefferson County, much like the eastern Gulf panhandle counties, does not have any significant beach areas. Ecological resources that are an asset to Jefferson County and induce a considerable level of economic activity in the region are summarized in Table 109.

JEF.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities. There are no such facilities in Jefferson County.

As an outdoor recreational activity, boating makes use of common property water resources. Expressed in 1994 dollars, Bell (1995) found that the user value per day is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Jefferson County, but are used for purposes of illustration.

Jefferson County has no saltwater boat ramp lanes, wet slips or dry racks. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Jefferson County is estimated and shown in Table 110. This value is about $40,345.

Table 109. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Jefferson County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$0[3]	N/A	N/A
Recreational Fishing	$.87[4]	$.64[5]	$21[5]
Saltwater Marsh[5]	N/A	.207[6]	20.2[6]
Saltwater Beaches	N/A[6]	N/A[6]	N/A[6]
Marine Boating[7]	N/A	$.040[7]	$1.34[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 104, *ex vessel* price
[4] Table 107, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 110

Table 110. Estimation of the Annual User Value for Saltwater Boating Off Jefferson County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas
$4,072 = $5.02[1] x 669[2] x .19[3] x 32[4]
2. Boat Ramps
$21,228 = $1.48[1] x 669 x .67[4] x 32
3. Private Docks
$15,045 = $5.02[5] x 669 x .14 x 32
Total Annual User Value = $40,345

*Asset Value = 40,345 ÷ .03 = $1.34 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Jefferson County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Jefferson County
[5] Assumed $/day same for marinas and private docks

Recreational boating in marine waters is rapidly growing in Jefferson County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Jefferson County grew as follows, with projected (P) numbers included:

1983	505	
1984	524	
1985	556	
1986	569	
1987	612	
1988	621	
1989	616	
1990	597	
1991	576	
1992	659	
1993	669	
1994	669	
2000	928	(P)
2005	1,115	(P)
2010	1,340	(P)

JEF.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Jefferson County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Jefferson County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Jefferson County, we have selected the Aucilla River Basin for a brief summary of the current state of water quality in this region of the study area. The WQI and TSI for important areas are shown in Table 111.

The Aucilla River extends approximately 70 miles into Florida and Georgia from the Gulf of Mexico. Both the Aucilla and Wacissa Rivers are considered very pristine waters. The headwaters are a series of swamps, lakes, sinkholes and natural springs which contain very few pollution sources. The pH is naturally low in the Aucilla River, but improves when the stream becomes more defined. Overall, the whole basin is thought to have very good water quality.

Table 111. Water Quality Indices for Selected areas of Jefferson County, Florida.

Water Areas: Aucilla River Basin		**Water Quality Indices***	
Water Body Type: Stream		WQI	TSI
1	Aucilla River	25	--
5	Aucilla River	28	--
7	Wacissa River	25	--
46	Aucilla River	35	--

* Higher values indicate lower water quality

A.The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). In 1994, there were no companies that discharged toxic substances in and around the surface water of Jefferson County. Shellfish is not harvested in significant numbers in the waters near Jefferson County, so information on closed areas is limited.

County Name: Levy, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

LEV.1 Introduction

Levy County is located in Southeastern section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 9). It contains 1,118 square miles of land, ranking it 9th among the 67 counties in Florida. In 1990, Levy County had a population of 25,912, ranking it 46th among Florida's counties. The population density was 25 people per square mile in 1990, ranking it 54th in Florida. Levy County has a relatively high median age of 38.5 years, compared to the Florida-wide median of 36.4 years.

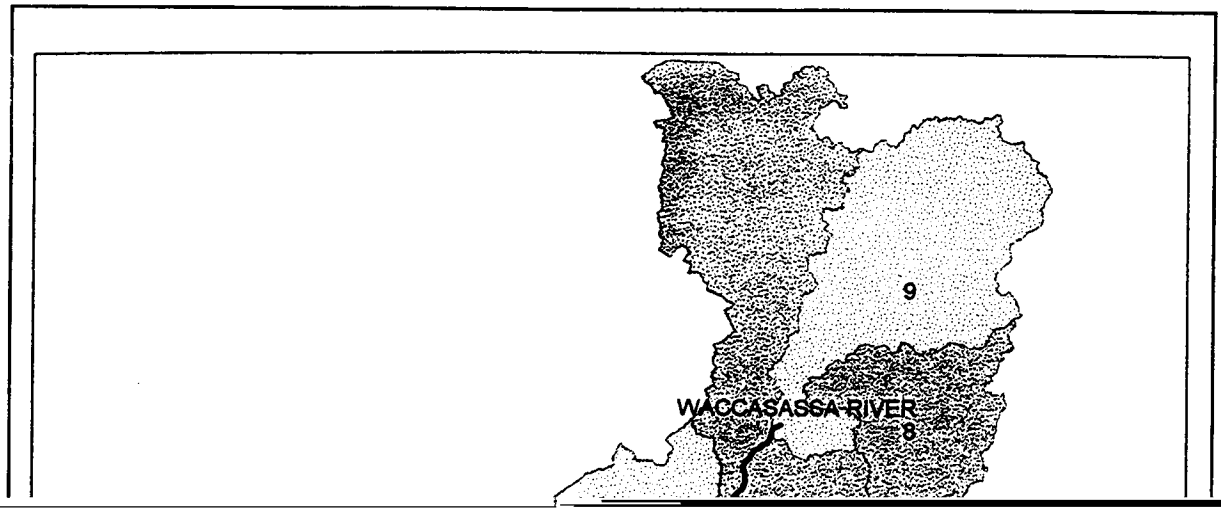
The population of Levy County had a per capita income of $12,766 in 1992, 60th of the 67 Florida counties and 35% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Levy County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Levy County had 16.6% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 6.7 % (relative to a statewide average of 7.0%), indicating a slack labor market.

LEV.2 Trends in Population, Income and Employment in Levy County, 1980-93.

Table 112 shows the trend in key economic variables in Levy County from 1980 through 1993. Over this interval, resident population increased by 40% (3% annually), which was approximately equal to the 39.5% increase for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 182% from 1980 to 1993. (Table 112). Adjusted for inflation, real aggregate personal income increased by 61% or 4.6% annually. Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).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WAGGASASSA RIVER
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Table 112. Trends in Key Economic Aggregate Variables in Levy County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	20,100	$130,350	$158,191	5,852
1981	20,900	146,915	161,623	5,805
1982	21,800	161,738	167,604	6,193
1983	22,200	174,198	174,898	6,115
1984	22,700	191,097	183,924	6,522
1985	23,300	211,196	196,279	6,846
1986	23,900	228,299	208,302	7,133
1987	24,200	242,815	213,745	7,454
1988	24,600	265,294	224,255	7,724
1989	25,300	286,779	231,273	8,212
1990	26,100	305,711	233,903	8,333
1991	26,600	327,803	240,678	8,454
1992	27,100	349,080	248,810	8,591
1993	28,100	367,523	254,341	9,021

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Levy County increased from 5,852 in 1980 to 9,021 in 1993, a 54% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Levy County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

LEV.3 Trends in Various Welfare Measures in Levy County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able

to protect the ecosystem than one which is highly dependent on income maintenance and unemployment insurance since the former is taxable while the latter is not. In 1993, Levy County derived 96.5% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Levy County in Table 113.

LEV.4 Industrial Base: Levy County

The "industrial base" for Levy County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area,

Table 113. Trends in Components of Personal Income in Levy County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,481	$4,011	$140	$18	$1,242	$1,070
1981	7,045	4,165	147	17	1,426	1,289
1982	7,429	4,376	149	26	1,590	1,287
1983	7,849	4,371	150	30	1,717	1,581
1984	8,424	4,841	152	20	1,810	1,601
1985	9,066	5,165	152	21	2,010	1,717
1986	9,561	5,346	163	20	2,108	1,923
1987	10,022	5,608	170	21	2,226	1,997
1988	10,771	5,897	212	24	2,310	2,328
1989	11,330	6,189	222	20	2,546	2,354
1990	11,715	6,276	275	27	2,780	2,357
1991	12,341	6,508	338	42	3,097	2,356
1992	12,863	6,793	408	72	3,326	2,265
1993	13,062	6,989	395	56	3,479	2,142

Source: BEA (1995)

compared to the same percentage nationally (e.g., 0.5%), assuming the nation consumes all it produces — no imports or exports. This is rather simplistic, but it does serve as a barometer of which industries are predominately export. This figure, known as the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 114 shows the main identified export industries and their contribution to personal income in Levy County. This county depends primarily on boat manufacturing, lumber and wood, fisheries, and machinery for its economic survival. Some of the largest individual employers in Levy County have, from time to time, had negative impacts on the ecosystem. Table 115 shows the top ten employers for Levy County, along with the products they produce that may generate conflicts with the environment. Products such as lumber and manufacturing must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Levy County did not discharge any toxic chemicals into surface water (Lester, 1995).

LEV.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health, are referred to as ecosystem-sensitive industries. For Levy County, these industries are shown in Table 116.

The Levy County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. Local and state governments also contribute about one-quarter of total earnings by place of work. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

LEV.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 117.

In general, retirement has a less adverse impact on local ecosystem health than other industries in Levy County. Over the 1969-93 period, the ecosystem-insensitive industries were growing faster than the ecosystem-sensitive industries, meaning that the new economic growth is not threatening the ecosystem.

Table 114. Major Export Industries in Levy County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Fishing	$838	.22	7.3
Manufacturing	71,019	4.5	PJ*
Lumber and Wood	3,993	1.1	2.5
Machinery	323	.09	PJ
Boats	N/A	N/A	PJ
Limited Tourism (Cedar Key)	N/A	N/A	PJ
Retirement	44,672	12.15	N/A
Agricultural Services	3,359	.91	2.3

*LQ = Location quotient. See Text.
*PJ = Professional Judgment.
Source: BEA (1995)

Table 115. Top Ten Employers in Levy County, Florida and Products Produced, 1994.

Employer		Employees
1. White Construction Company, Construction/Auto		250
2. Oakview Care Center, Health Care		159
3. WalMart, Retail Sales		135
4. Winn-Dixie, Grocery		100
5. Central Florida Electric Co-op, Utilities		95
6. Nature Coast Regional Hospital, Health Care		76
7. V.E. Whitehurst & Sons, Cattle/Construction		75
8. Levy County State Bank, Finance		66
9. Limerock Industries, Limerock		60
10. J-Mak Inc., Fiberglass		50
	Sub-Total	1,066
	Total	9,021
	Percent of Total	12%

Source: Florida Department of Commerce (1994)

Table 116. Ecosystem-Sensitive Industries in Levy County.

	Industry	Earnings ($000)
1.	Manufacturing (Lumber and Wood, Machinery)	$7,203
2.	Agricultural Services	3,359
	Sub-Total	10,562
	Total Earnings (Place of Work)	145,228
	Percent of Total	5.2%

Source: BEA (1995)

Table 117. Ecosystem-Insensitive Industries in Levy County.

	Industry	Earnings ($000)
1.	Fishing	$838
2.	Retirement	57,250
	Sub-Total	58,088
	Total Earnings	367,523
	Percent of Total	15.8%

Source: Table 114

LEV.7 Commercial Fishery Landings in Levy County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Levy County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $3.1 million worth of commercial fishery products were landed in Levy County at the *ex vessel* level (Table 118).

Finfish and shrimp account for 55% of this value. Among the finfish, grouper was the leading species as measured by value. Crabs accounted for 45% of the *ex vessel* value of the landings. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Levy County ranked 8th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively important component of the economic base of Levy County where aggregate personal income was $.367 billion in 1993. Over the last fourteen years, commercial fishery landing has decreased by 41% while the *ex vessel* value of the catch has increased by 269%. When adjusted for inflation, the value of landings changed by 105% (FDNR, 1980).

LEV.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to

Table 118. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Levy County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Red Grouper	140,729	$247,683.03
Gag Grouper	86,411	192,696.53
Black Mullet	297,365	139,761.55
Spotted Sea Trout	15,278	18,333.60
Pompano	5,094	17,217.72
Crevalle Jack	37,661	12,428.13
Shark Fins	560	10,371.20
Grunts	21,532	10,120.04
Sheepshead	18,308	9,520.16
All Others	72,141	49,807.47
Total		$726,037.44
Invertebrates		
Stone Crabs	156,238	846,138.91
Blue Crabs	581,185	422,067.68
Oysters	74,174	91,975.76
Clams	10,803	57,643.01
Octopus	74,174	3,319.17
Total		1,421,144.53
Shrimp (Total)	515,257	1,024,812.41
Grand Total		$3,171,994.38

* State average *ex vessel* price used.
Source: FDEP (1994)

Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Levy County had 6,447 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical

proximity to each county, using personal judgment, as shown in Table 119. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one or more of the coastal counties.

Table 120 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 119. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Levy County showed a fishing effort of 141,304 days.

Finally, Table 121 is derived from Table 119 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $8,182,713 in Levy County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

Table 119. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	**6,447**	**7,921**	**2,998**
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 120. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	**129,312**	**11,992**	**141,304**
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 119. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 119. See Bell (1993).

Table 121. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	**6,863,593**	**1,319,120**	**8,182,713**
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 119 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 119 multiplied by $440.00 per angler.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Levy County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 14,368 = $5.4 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 2,998 = $.6 million.

Thus, saltwater recreational fishing generates $6.0 million per year in Levy County with a capitalized value of $200 million using a 3% discount rate (i.e., $6 million ÷ .03).

LEV.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 122.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast

Table 122. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average

acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Levy County has 35,400 acres of salt marsh (NOAA, 1991), which would be worth $188 million ($5,316 x 35,400) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Levy County wetlands.

LEV.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Levy County, much like the rest of the eastern panhandle, has very little beach area (Table 123). The coastal areas are primarily saltwater marsh. Since little information is available about user demand, the value of the saltwater beaches could not be estimated. Table 124 identifies ecological resources that are an asset to Levy County and induce a considerable level of economic activity in the region.

LEV.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 125 is an inventory of these water-dependent facilities in Levy County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

Table 123. Key Saltwater Beaches in Levy County, Florida.*

Western District
Environmentally Endangered Lands:
Cedar Keys

*In Levy County alone, the University of West Florida (1985b) reported 4 individual saltwater beaches which were .3 miles in length and 38,000 square feet (public and private).

Source: University of West Florida (1985a)

Table 124. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Levy County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$3.1[3]	N/A	N/A
Recreational Fishing	$8.1[4]	$6.0[5]	$200[5]
Saltwater Marsh[5]	N/A	.207[6]	188[6]
Saltwater Beaches	N/A[6]	N/A[6]	N/A[6]
Marine Boating[7]	N/A	$.198[7]	$6.6[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 118, *ex vessel* price
[4] Table 121, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 126

Table 125. An Inventory of Marine-Related Recreational Facilities in Levy County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	2
b. Length (all) (LFT)*	400
2. Boardwalks/Catwalks	
a. Number	--
b. Length (all) (LFT)*	--
3. Jetties	
a. Length (all) (LFT)*	--
Boating	
1. Boat Ramps	
a. Number	5
b. Total Lanes	7
2. Marinas	
a. Total	3
b. Slips/Moorings	96
c. Dry Storage	--

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Levy County, but are used for illustrative purposes.

Levy County has 7 saltwater boat ramp lanes and 96 wet slips and dry racks as shown in Table 125. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Levy County is estimated and shown in Table 126. This value is about $0.2 million.

Recreational boating in marine waters is rapidly growing in Levy County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Levy County grew as follows, with projected (P) numbers included:

1983	1,530	
1984	1,588	
1985	1,667	
1986	1,715	
1987	1,720	
1988	1,870	
1989	1,889	
1990	1,916	
1991	1,998	
1992	2,154	
1993	2,162	
1994	2,337	
2000	2,802	(P)
2005	3,239	(P)
2010	3,743	(P)

LEV.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Levy County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Levy County.

Table 126. Estimation of the Annual User Value for Saltwater Boating Off Levy County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $71,329 = $5.02[1] x 2,337[2] x .19[3] x 32[4]
2. Boat Ramps $74,156 = $1.48[1] x 2,337 x .67[4] x 32
3. Private Docks $52,558 = $5.02[5] x 2,337 x .14 x 32
Total Annual User Value = $198,043

*Asset Value = 198,043 ÷ .03 = $6.6 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Levy County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Levy County
[5] Assumed $/day same for marinas and private docks

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Levy County, the Waccasassa River Basin has been selected for a brief summary of the current state of water quality in this region of the study area.

The Waccasassa River Basin stretches through 936 square miles of forest and wetlands in Levy County. The river has the blackwater color typical of those whose headwaters are primarily swamp and woodland drainage. There is very little development in the basin, so the only sources of pollution may be highway runoff or pollution from logging operations. Cedar Key, at the mouth of the river in the Gulf, is the only developed area, but has a waste water treatment plant. The WQI and TSI for selected areas are listed in (Table 127).

Table 127. Water Quality Indices for Selected Areas of Levy County, Florida.

Water Areas: Waccasassa River Basin		Water Quality Indices*	
Water Body Type: Estuary		WQI	TSI
3	Waccasassa River	--	38
Water Body Type: Lake			
8	Unnamed Slough	--	37
Water Body Type: Spring			
4	Wekiva River	36	--
Water Body Type: Stream			
1	Tenmile Creek	38	--
2	Horsehole Creek	56	--
5	Mule Creek	33	--
6	Otter Creek	48	--
7	Waccasassa River	27	--
9	Little Waccasassa River	58	--

* Higher values indicate lower water quality

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). In 1994, there were no discharged toxic substances in and around the surface water of Levy County.

Shellfish harvesting has been closed in 18,847 acres due to high coliforms. This is a small percentage of the 344,153 total acres of possible harvesting area.

County Name: Okaloosa, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

OKA.1 Introduction

Okaloosa County is located in western section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 10 and 11). It contains 936 square miles of land, ranking it 19th among the 67 counties in Florida. In 1990, Okaloosa County had a population of 143,777, ranking this county 23rd among Florida's counties. The population density was 165 people per square mile in 1990, ranking it 28th in Florida. Relative to other Florida counties, Okaloosa County has a low median age of 31.5 years, as compared to the Florida-wide median of 36.4 years.

The population of Okaloosa County had a per capita income of $18,060 in 1992, 18th of the 67 Florida counties and 10% below the Florida-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Okaloosa County, an analysis of the sources of income will be discussed below along with the interaction with the ecosystem.

Okaloosa County had 7.8% of the households below the poverty level in 1989, which was below the State of Florida average of 9.0%. In 1993, the unemployment rate was 6.2% (relative to a statewide average of 7.0%), indicating a slack labor market.

OKA.2 Trends in Population, Income and Employment in Okaloosa County, 1980-93.

Table 128 shows the trend in key economic variables in Okaloosa County from 1980 through 1993. Over this interval, resident population increased by 41% (3.1% annually), which was slightly lower than the 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 227% from 1980 to 1993 (Table 128). Adjusted for inflation, real aggregate personal income increased by 86% (6.6% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

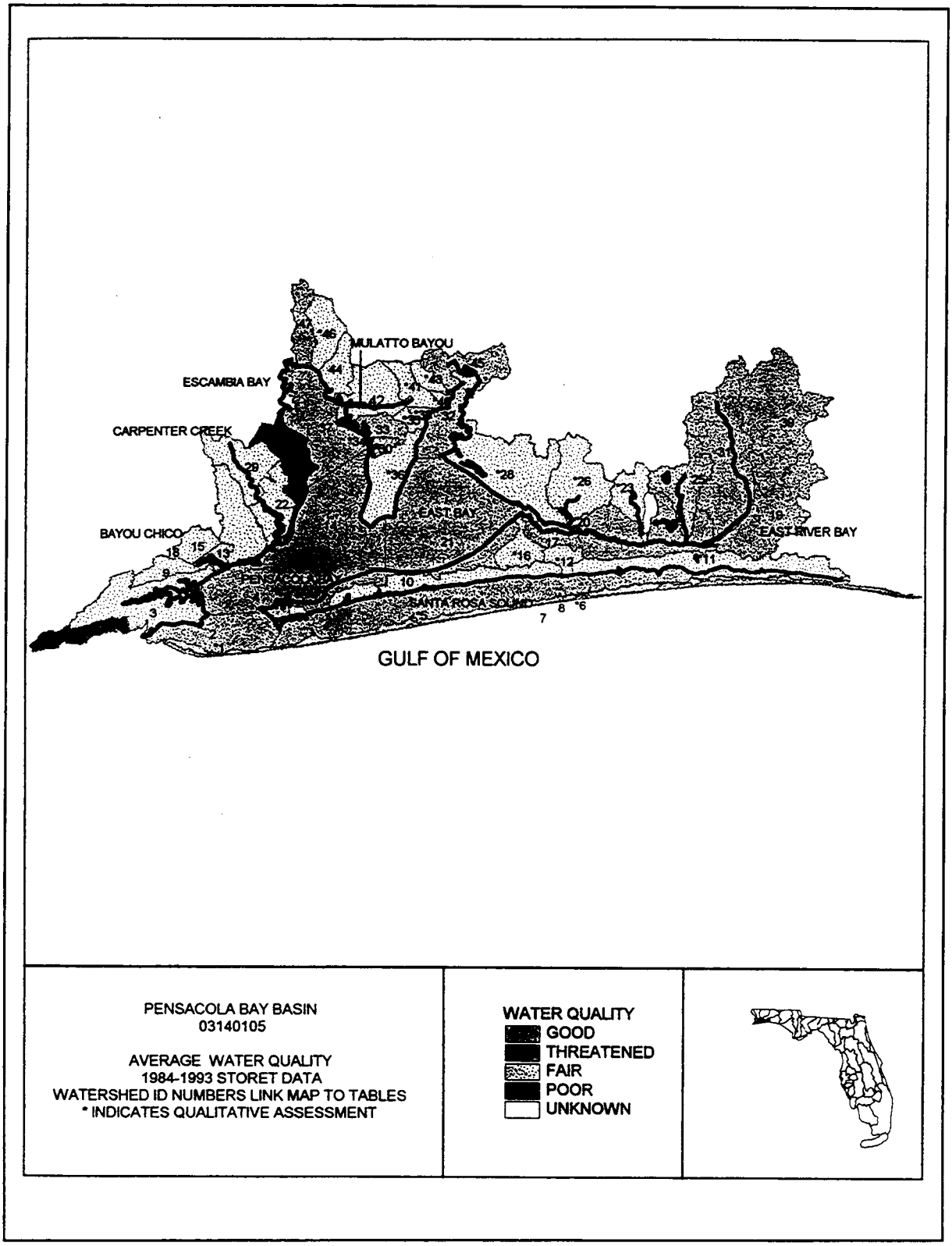

Figure 10. Map of Okaloosa County, Florida, showing levels of water quality and areas of quality testing (Pensacola Bay Basin)[from Bureau of Surface Water Management (1994b)].

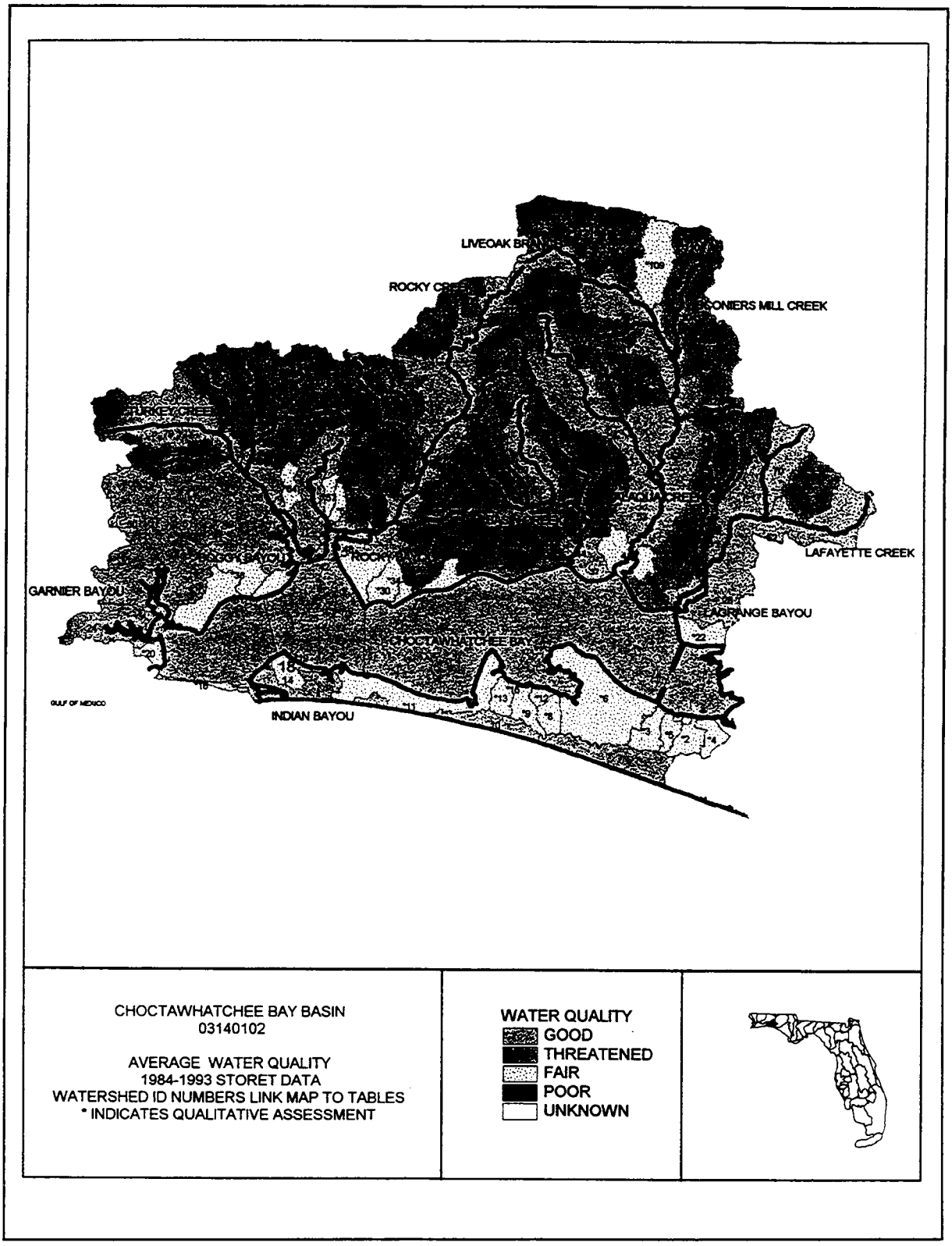

Figure 11. Map of Okaloosa County, Florida, showing levels of water quality and areas of quality testing (Choctawhatchee Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 128. Trends in Key Economic Aggregate Variables in Okaloosa County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	110,900	$876,247	$1,063,407	53,990
1981	113,100	1,036,674	1,140,455	57,235
1982	116,000	1,139,650	1,180,984	59,154
1983	120,400	1,267,972	1,273,064	62,496
1984	124,100	1,403,349	1,350,673	67,168
1985	127,900	1,538,055	1,429,419	69,486
1986	131,700	1,679,589	1,532,472	73,174
1987	135,400	1,838,302	1,618,224	77,106
1988	138,000	1,982,962	1,677,060	79,779
1989	141,000	2,158,726	1,740,908	81,605
1990	144,500	2,332,543	1,784,654	83,231
1991	148,000	2,508,389	1,841,695	84,191
1992	152,900	2,711,442	1,932,603	86,537
1993	157,300	2,863,026	1,981,333	89,337

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Okaloosa County increased from 53,990 in 1980 to 89,337 in 1993, a 65% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in this county. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Okaloosa County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

OKA.3 Trends in Various Welfare Measures in Okaloosa County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but the components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Okaloosa County derived 98.6% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is slightly more likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Okaloosa County in Table 129.

OKA.4 Industrial Base: Okaloosa County

The "industrial base" for Okaloosa County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area,

Table 129. Trends in Components of Personal Income in Okaloosa County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$7,901	$5,301	$84	$18	$1,585	$913
1981	9,165	6,082	89	17	1,817	1,161
1982	9,825	6,475	83	20	2,024	1,223
1983	10,532	6,903	82	25	2,152	1,369
1984	11,304	7,454	79	16	2,177	1,579
1985	12,030	7,783	77	25	2,409	1,735
1986	12,749	8,285	74	21	2,512	1,856
1987	13,581	8,915	73	22	2,659	1,912
1988	14,375	9,312	86	22	2,805	2,150
1989	15,310	9,727	100	22	3,046	2,415
1990	16,144	10,163	120	30	3,305	2,526
1991	16,946	10,555	145	45	3,583	2,619
1992	17,738	11,067	184	74	3,784	2,629
1993	18,202	11,291	179	68	3,989	2,675

Source: BEA (1995)

compared to the same percentage nationally (e.g., 0.5%), assuming the nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 130 shows the main identified export industries and their contribution to personal income in Okaloosa County. This county depends primarily on the military, tourism, manufacturing, retirement and commercial fishing for its economic survival. Some of the largest individual employers in Okaloosa County have, from time to time, had negative impacts on the ecosystem. For Okaloosa County, Table 132 shows the top ten employers, along with the products they produce that may generate conflicts with the environment. Products such as textiles, lumber and printing must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that none of the companies in Okaloosa County discharged toxic chemicals into surface water.

OKA.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Okaloosa County, the industries shown in Table 131 fall into this characterization.

The Okaloosa County economy is heavily based upon manufacturing. The county has an Air Force base for the U.S. military. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

OKA.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 133.

In general, industries such as the military, tourism and retirement have a less adverse impact on local ecosystem health than other industries in Okaloosa County. Over the 1969-93 period, the ecosystem-insensitive industries were growing slower than the ecosystem-sensitive industries, meaning that there may be relatively more stress on the marine ecosystem from recent economic growth.

Table 130. Major Export Industries in Okaloosa County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Commercial Fishing	$2,222	.077	2.5
Tourism			
Hotels	21,084	.73	1.07
Eating and Drinking	69,974	244	1.5
Building Materials	13,118	.45	1.2
Amusement	25,664	.83	1.1
Retirement/Tourism			
General Building	23,558	.87	PJ*
Real Estate	28,144	.98	1.4
Engineering Services	119,802	4.2	1.6
Military/Federal Government (Eglin Air Force Base)	704,335	24.6	7.4
Manufacturing			
Printing	6,302	.22	PJ
Apparel	9,061	.31	PJ
Lumber and Wood	7,490	.26	PJ
Machinery	3,560	.12	PJ
Electrical Machinery	16,695	.58	PJ
Transportation Equipment	36,008	1.3	1.5
Instruments	15,161	.53	PJ
Total	**$1,102,178**	**38.5**	

*LQ = Location quotient. See Text.
*PJ = Professional Judgment.

Source: BEA (1995)

Table 131. Ecosystem-Sensitive Industries in Okaloosa County, Florida.

Industry		Earnings ($000)
1. Manufacturing		106,315
	Total Earnings	2,863,492
	Percent of Total	3.7%

Source: BEA (1995)

Table 132. Top Ten Employers in Okaloosa County, Florida and Products Produced, 1994.

Employer		Employees
1.	Vitro Services Corporation, Instrumentation	1,400
2.	Metric Systems, Radar Systems	780
3.	Russell Corporation, Sports Clothing	430
4.	Sverdrup Technology, Technical Engineering	400
5.	Keltec Florida, Electronics	300
6.	Gulf Power Company, Utilities	163
7.	Tybrin Corporation, Scientific Data Processing	150
8.	NW Florida Daily News, Newspaper	145
9.	RMS Technologies, Engineering Services	110
10.	Rainbow Koolers, Sportswear	78
	Sub-Total	3,956
	Total	89,337
	Percent of Total	4%

Source: Florida Department of Commerce (1994)

Table 133. Ecosystem-Insensitive Industries in Okaloosa County, Florida.

	Industry	Earnings ($000)
1.	Tourism	$129,840
2.	Retirement	171,504
3.	Military/Government	704,335
4.	Commercial Fishing	2,222
	Sub-Total	1,007,901
	Total Earnings	$2,863,086
	Percent of Total	35%

Source: Table 130

OKA.7 Commercial Fishery Landings in Okaloosa County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed

here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Okaloosa County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $6 million worth of commercial fishery products were landed in Okaloosa County at the *ex vessel* level (Table 134). Finfish and shrimp account for 99% of this value. Among the finfish, swordfish and vermilion snapper were by far the leading species as measured by value. Brown shrimp (which depends on wetlands during a phase of its life cycle) was the dominant shrimp species. Among the 13 counties in the study area, Okaloosa County ranked 4th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Okaloosa County, where aggregate personal income was $2.9 billion in 1993. Over the last fourteen years, commercial fishery landing has decreased by 62% while the *ex vessel* value of the catch has increased by 73%. When adjusted for inflation, the value of landings changed by 42%. Compared to other economic trends in Okaloosa County, commercial fishery landings are a small component of the local economy (FDNR, 1980).

OKA.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Okaloosa County had 9,622 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment. This is shown in

Table 134. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Okaloosa County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Swordfish	68,922	$2,214,649.75
Vermilion Snapper	873,374	1,353,729.62
Ladyfish	1,033,055	413,222.00
Red Snapper	161,187	390,072.56
King Mackerel	119,899	170,256.58
Round Scad	575,560	149,645.59
Porgies	152,499	140,299.08
Amberjacks	123,960	120,241.20
Shark	253,198	101,279.20
Gag Grouper	33,854	75,494.42
All Others	915,091	577,968.70
Total		$5,706,858.70
Invertebrates		
Blue Crabs	654,246	$41,774.06
Stone Crabs	184	1,189.70
Spanish Lobster	5,817	10,063.41
Spiny Lobster	380	1,626.40
Squid	3,050	1,128.50
Total		$56,230.33
Shrimp (Total)	145,746	296,183.51
Grand Total		$6,059,272.54

* State average *ex vessel* price used.
Source: FDEP (1994)

Table 135 where nonresidents are shown in the second column. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 136 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 135. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Okaloosa County showed a fishing effort of 138,694 days.

Finally, Table 137 is derived from Table 135 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $10,251,169 in Okaloosa County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be

Table 135. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	**9,622**	**148**	**12,691**
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 136. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	**87,930**	**50,764**	**138,694**
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 135. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 135. See Bell (1993).

Table 137. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	**4,667,129**	**5,584,040**	**10,251,169**
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 135 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 135 multiplied by $440.00 per angler.

conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Okaloosa County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 9,770 = $3.7 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 12,691 = $2.5 million.

Thus, saltwater recreational fishing generates $6.2 million per year in Okaloosa County with a capitalized value of $207 million using a 3% discount rate (i.e., $6.2 million ÷ .03).

OKA.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 138.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows: (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average

Table 138. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Okaloosa County has 300 acres of salt marsh (NOAA, 1991) which would be worth $1.6 million ($5,316 x 300) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Okaloosa County wetlands.

OKA.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Table 139 lists the key beaches for this county.

Table 139. Key Saltwater Beaches in Okaloosa County, Florida.*

Western District
Environmentally Endangered Lands:
Liza Jackson Park
Central District
Garnier Beach
Santa Rosa Island/Okaloosa County Beach Access
Ross Marler Park
Newman Brackin Wayside Park/Okaloosa Island Pier
John C. Beasley Park
Gulf Islands National Seashore
Burney Henderson Beach State Recreation Area
Silver Beach Wayside Park

*In Okaloosa County alone, the University of West Florida (1985b) reported 45 individual saltwater beaches which were 18.9 miles in length and 11.5 million square feet (public and private).

Source: University of West Florida (1985a)

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Using the CV technique, Leeworthy, et al. found that Okaloosa, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Okaloosa County would have 904,470 saltwater beach days per year in 1990 for the beaches listed in Table 139. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $2.71 million. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $90 million – the asset value of the beach.

Finally, beach-related spending in Okaloosa County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 904,470 x $12 = $3.91 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 904,470 x $30 = $17.4 million

Combined, we estimate that saltwater beaches in Okaloosa County attracted $21.31 million in beach-related spending in 1990. Tourists accounted for 83 percent of this spending.

Three ecological resources that are an asset to Okaloosa County and induce a considerable level of economic activity in this region have been identified and are summarized in Table 140.

OKA.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 141 is an inventory of these water-dependent facilities in Okaloosa County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Okaloosa County, but are used for purposes of illustration.

Okaloosa County has 37 saltwater boat ramp lanes and 2,482 wet slips and dry racks, as shown in Table 141. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Okaloosa County is estimated and shown in Table 142. This value is about $.85 million.

Recreational boating in marine waters is rapidly growing in Okaloosa County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Okaloosa County grew as follows, with projected (P) numbers included:

1983	8,385	
1984	9,030	
1985	9,277	
1986	9,828	
1987	10,080	
1988	10,572	
1989	11,222	
1990	11,765	
1991	12,158	
1992	12,767	
2000	15,175	(P)
2005	16,516	(P)
2010	17,943	(P)

Table 140. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Okaloosa County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$6.0[3]	N/A	N/A
Recreational Fishing	$10.2[4]	$6.2[5]	$207[5]
Saltwater Marsh[5]	N/A	.207[6]	$1.6[6]
Saltwater Beaches	$21.31[6]	$2.71[6]	$90.0[6]
Marine Boating[7]	N/A	$.845[7]	$28.2[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 134, *ex vessel* price
[4] Table 137, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 142

Table 141. An Inventory of Marine-Related Recreational Facilities in Okaloosa County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	6
b. Length (all) (LFT)*	1,658
2. Boardwalks/Catwalks	
a. Number	24
b. Length (all) (LFT)*	2,606
3. Jetties	
a. Length (all) (LFT)*	720
Boating	
1. Boat Ramps	
a. Number	37
b. Total Lanes	41
2. Marinas	
a. Total	30
b. Slips/Moorings	1,449
c. Dry Storage	1,033

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 142. Estimation of the Annual User Value for Saltwater Boating Off Okaloosa County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $304,429 = $5.02[1] x 12,767[2] x .19[3] x 32[4]
2. Boat Ramps $316,494 = $1.48[1] x 12,767 x .67[4] x 32
3. Private Docks $224,316 = $5.02[5] x 12,767 x .14 x 32
Total Annual User Value = $845,239

*Asset Value = 845,239 ÷ .03 = $28.2 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Okaloosa County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Okaloosa County
[5] Assumed $/day same for marinas and private docks

OKA.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Okaloosa County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Okaloosa County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in

Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100; larger values indicate declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Okaloosa County, Pensacola Bay and Choctawhatchee Bay have been selected for a brief summary of the current state of water quality in this region of the study area. The WQI and TSI for important areas are shown in Table 143.

The Pensacola Bay Basin extends from Escambia County to Okaloosa County. Urban runoff and wastewater treatment plant discharges are the major pollution sources. These latter sources are from well-defined points such as the University of West Florida WWTP, Monsanto industrial discharges, and Gulf Power thermal discharges that enter the Escambia River upstream of the mouth. Therefore, reduced DO levels, fish kills and bacteria problems have been evident around the mouth of the Escambia River. This portion of Escambia Bay also receives discharges from CYTEC and Air Products, two

Table 143. Water Quality Indices for Selected Areas of Okaloosa County, Florida.

Water Areas: Pensacola Bay		**Water Quality Indices***	
Water Body Type: Estuary		WQI	TSI
19	East River Bay	--	37
Water Body Type: Stream			
25	Prairie Creek	15	--
31	Live Oak Creek	19	--
39	Turtle Creek	12	--
Water Areas: Choctawhatchee Bay			
Water Body Type: Estuary			
21	Choctawhatchee Bay	--	30
24	Cinco Bayou	--	25
25	Choctawhatchee Bay	--	36
27	Carnier Bayou	--	37
35	Poquito Bayou	--	12
43	Boggy Bayou	--	38
48	Rocky Bayou	--	42
Water Body Type: Stream			
49	Toms Creek	23	--
50	Lightwood Knot Creek	10	--
51	Garnier Creek	10	--
58	Turkey Creek	10	--
68	Juniper Creek	13	--
79	Turkey Creek	11	--

* Higher values indicate lower water quality

manufacturing plants whose discharges have been found to be toxic in several bioassays, with high levels of nitrogen and BOD. As outlined earlier in this report, the industrial structure of Okaloosa County is such that the ecosystem is under constant attack from many major industries in this area. This has manifested itself in fish kills (April, 1994), toxic bioassays and dirty foam near point-source outfalls. Finally, moving east in this basin, water quality improves, especially in Santa Rosa Sound.

The TRI is an annual summary of discharges to surface water as well as other kinds of discharges (e.g., airborne). In 1994 there were no toxic substances reported that were discharged in or around the surface waters of Okaloosa County.

Shellfish harvesting has been closed in 27,488 acres, and opened (conditional) in 68,077 acres of Choctawhatchee Bay, indicating somewhat cleaner conditions than those existing in the counties west of Okaloosa (i.e., Escambia and Santa Rosa).

County Name: Santa Rosa, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

SR.1 Introduction

Santa Rosa County is located in the western section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figure 12). It contains 1,016 square miles of land, ranking it 16th among the 67 counties in Florida. In 1990, Santa Rosa County had a population of 81,608, ranking it 33rd among Florida's counties. The population density was 89 people per square mile in 1990, ranking it 33rd in Florida. Santa Rosa County has a relatively low median age of 32.5 years, compared to the Florida-wide median age of 36.4 years.

The population of Santa Rosa County had a per capita income of $16,167 in 1992, 31st of the 67 Florida counties and 22% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies, compared to an area where income is earned at a local chemical plant. For Santa Rosa County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Santa Rosa County had 11.5% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 5.1% (relative to a statewide average of 7.0%), indicating a slack labor market.

SR.2 Trends in Population, Income and Employment in Santa Rosa County, 1980-93.

Table 144 shows the trend in key economic variables in Santa Rosa County from 1980 through 1993. Over this interval, resident population increased by 62%, (4.8% annually), which was rapid when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by the industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 260% from 1980 to 1993 (Table 144). Adjusted for inflation, real aggregate personal income increased by 105% (8.1% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

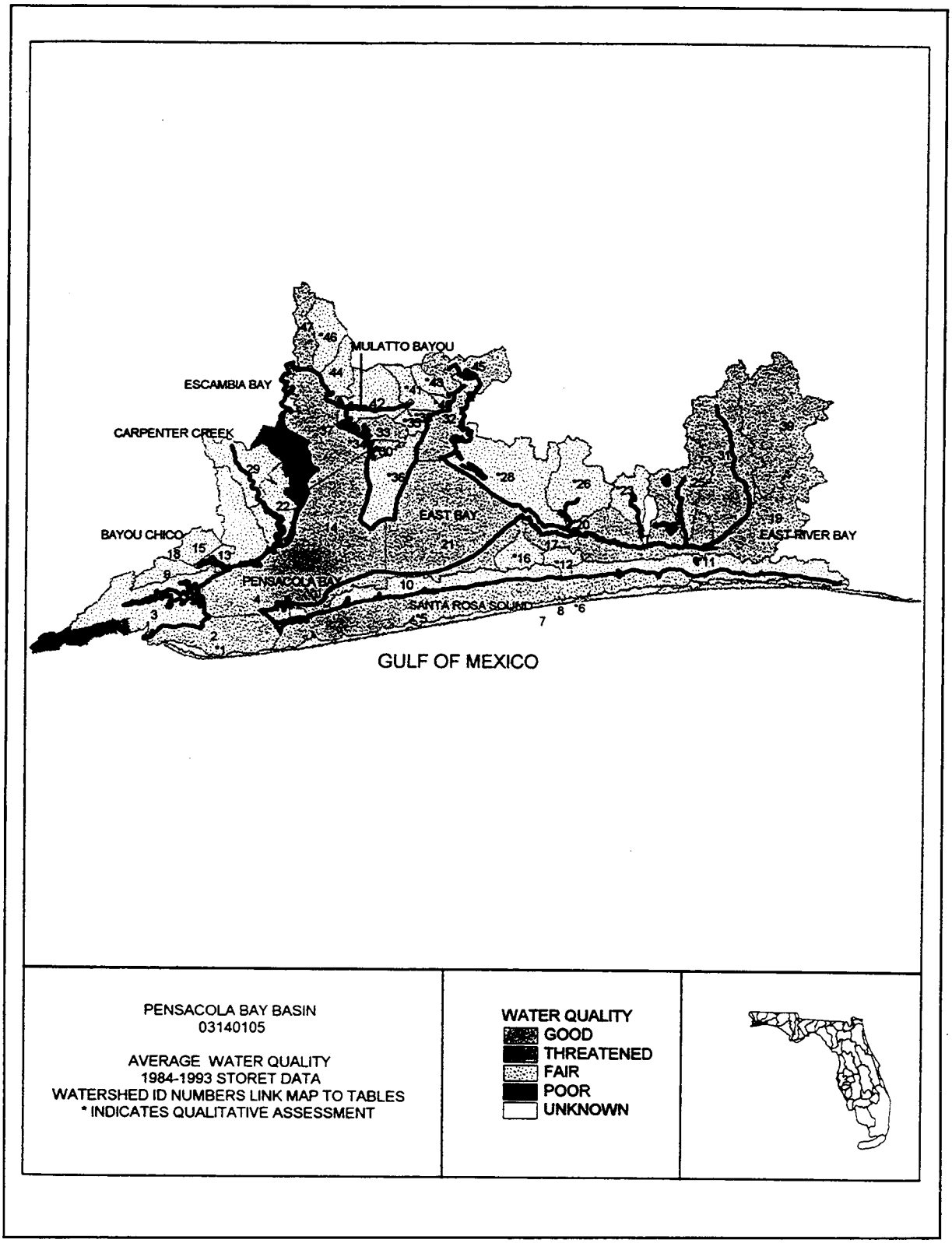

Figure 12. Map of Santa Rosa County, Florida, showing levels of water quality and areas of quality testing (Pensacola Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 144. Trends in Key Economic Aggregate Variables in Santa Rosa County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	56,500	$434,336	$527,107	18,011
1981	59,000	506,770	557,503	17,852
1982	60,900	567,070	587,637	18,520
1983	63,000	640,001	642,571	19,470
1984	65,600	712,494	685,750	20,395
1985	68,000	774,130	719,452	21,300
1986	70,400	843,764	816,019	22,271
1987	73,600	922,304	811,887	23,835
1988	76,000	1,002,118	847,099	24,991
1989	79,000	1,094,767	882,877	26,091
1990	82,200	1,221,088	934,268	27,847
1991	85,400	1,336,838	981,526	29,179
1992	90,100	1,462,337	1,042,293	30,169
1993	94,500	1,564,823	1,082,922	30,741

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Santa Rosa County increased from 18,011 in 1980 to 30,741 in 1993, a 70% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Santa Rosa County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

SR.3 Trends in Various Welfare Measures in Santa Rosa County, 1980-93

Per capita income is a general overall measure of how well-off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able

to protect the ecosystem than one which is highly dependent on income maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Santa Rosa County derived 99% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is more likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Santa Rosa County in Table 145.

SR.4 The Industrial Base: Santa Rosa County

The "industrial base" for Santa Rosa County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an

Table 145. Trends in Components of Personal Income in Santa Rosa County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$7,687	$5,561	$104	$16	$1,178	$828
1981	8,558	6,131	108	13	1,347	989
1982	9,318	6,556	106	19	1,489	1,148
1983	10,158	7,240	108	22	1,609	1,179
1984	10,859	7,730	102	18	1,661	1,349
1985	11,390	8,070	100	28	1,791	1,401
1986	11,985	8,485	109	27	1,878	1,486
1987	12,529	8,886	109	23	1,971	1,541
1988	13,194	9,272	120	25	2,170	1,607
1989	13,862	9,640	131	22	2,324	1,744
1990	14,861	10,314	157	28	2,474	1,889
1991	15,657	10,784	189	38	2,644	2,002
1992	16,237	11,231	238	61	2,782	1,925
1993	16,556	11,445	229	50	2,881	1,951

Source: BEA (1995)

area, compared to the same percentage nationally (e.g., 0.5%), assuming the nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 146 shows the main identified export industries and their contribution to personal income in Santa Rosa County. This county primarily depends on military, manufacturing, textiles and chemicals, and acts as a bedroom community to Escambia County for its economic survival. Some of the largest individual employers in Santa Rosa County have, from time to time, had negative impacts on the ecosystem. For Santa Rosa County, Table 147 shows the top ten employers, along with the products they produce that may generate conflicts with the ecosystem. Products such as textiles, chemicals and lumber must be rigorously controlled or they will reduce water and air quality. In 1993, the Florida Department of Environmental Protection reported that the companies in Santa Rosa County discharged 243,490 pounds of toxic chemicals into surface water, ranking it second in volume among Florida's counties.

SR.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health, are referred to as ecosystem-sensitive industries. For Santa Rosa County, the industries shown in Table 148 fall into this category.

The Santa Rosa County economy is partly based upon timber which is harvested and processed in this region into various kinds of paper-based products. This county serves as part of an air base for the U.S. Military. Many of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

SR.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 149. In general, industries such as an Air Force base (Eglin), tourism and being a "bedroom community" for Escambia County are less toxic to animals in the ecosystem than are other industries in Santa Rosa County. Over the 1969-93 period, ecosystem-insensitive industries grew faster than the ecosystem-sensitive industries, meaning that the relative impact of industrial growth has been less hazardous to the fragile marine environment.

Table 146. Major Export Industries in Santa Rosa County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Manufacturing	$71,019	4.5	PJ*
Food			3.9
Textiles			N/A
Paper & Printing, Lumber, Furniture			PJ
Chemicals			2.2
Machinery			PJ
Stone, Clay, Glass			PJ
Tourism (Meals & Motels)	19,208	1.2	PJ
Military	65,927	4.2	4.5
Federal, Civilian	25,245	1.6	PJ
Bedroom Community to Escambia County Plus Construction	539,546	N/A	PJ
Aggregate Personal Income	**$1,564,823**	?	?

*LQ = Location quotient. See Text.
*PJ = Professional Judgment.

Source: BEA (1995)

Table 147. Top Ten Employers in Santa Rosa County, Florida and Products Produced, 1994.

Employer	Employees
1. Vanity Fair Mills, Clothing	850
2. Beech Aerospace, Aircraft Maintenance	360
3. Santa Rosa Medical Center, Health Care	350
4. Air Products and Chemicals, Chemicals/Fertilizer	343
5. Cytec, Inc., Acrylic Fibers	320
6. Russell Corporation, Sportswear	
7. UNC Support Services, Helicopter Services	250
8. Mold-Ex Rubber Company, Rubber Products	200
9. South-Tek International, Military Drop Systems	80
10. Fabbro Marine Group, Boat Manufacturers	75
Sub-Total	3,128
Total	30,741
Percent of Total	11%

Source: Florida Department of Commerce (1994)

Table 148. Ecosystem-Sensitive Industries in Santa Rosa County, Florida.

	Industry	Earnings ($000)
1.	Food	N/A
2.	Textiles	N/A
3.	Chemicals	$40,056
4.	Paper & Printing	2,321
5.	Stone, Clay & Glass	1,371
	Sub-Total	$43,748
	Total Earnings (Non-Farm)	???
	Percent of Total	???

Source: BEA (1995)

Table 149. Ecosystem-Insensitive Industries in Santa Rosa County, Florida.

	Industry	Earnings ($000)
1.	Military and Federal Employees, Civilian	$91,172
2.	Tourism	19,208
	Eating and Drinking	???
	Hotels/Motels	???
3.	Bedroom Community	488,438
	Sub-Total	$488,438
	Total Earnings	???
	Percent of Total	???

Source: Table 146

SR.7 Commercial Fishery Landings in Santa Rosa County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Santa Rosa County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $1.24 million worth of commercial fishery products were landed in Santa Rosa County at the *ex vessel* level (Table 150). Finfish and shrimp account for 65% of this value. Among finfish, menhaden, an industrial fish, was by far the leading species as measured by quantity and value. Blue crabs were the leading species overall in

Table 150. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Santa Rosa County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Menhaden	1,635,190	$179,870.91
Black Mullet	183,797	86,384.59
Red Snapper	26,477	64,074.34
Yellowfin Tuna	22,882	56,060.90
Vermilion Snapper	32,038	49,658.90
Tilefish	33,155	49,069.40
Yellowedge Grouper	22,411	46,838.99
Round Scad	149,130	38,773.80
Ladyfish	83,792	33,516.80
Triggerfish	20,345	18,717.40
All Others	284,046	158,383.84
Total		$781,349.90
Invertebrates		
Blue Crabs	572,781	$367,277.88
Stone Crabs	0	0
Oysters	56,402	69,938.48
Squid	729	269.73
All Others	0	0
Total		$437,486.09
Shrimp (Total)	12,741	25,874.52
Grand Total		$1,244,710.51

* State average *ex vessel* price used.
Source: FDEP (1994)

quantity and value. Nearly all of the shrimp were of the brown species that depends on wetlands for a habitat during a phase of its life cycle. Among the 13 counties in the study area, Santa Rosa County ranked 11th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Santa Rosa County, where aggregate personal income was $1.56 billion in 1993. Over the last fourteen years, commercial fishery landing has increased by 34% while the *ex vessel* value of the catch has increased by 425%. When adjusted for inflation, the value of landings changed by 66% (FDNR, 1980).

SR.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to

Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Santa Rosa County had 6,863 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment.

This is shown in Table 151 where nonresidents are shown in the second column. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 152 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 151. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Santa Rosa County showed a fishing effort of 79,583 days.

Finally, Table 153 is derived from Table 151 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $5,162,394 in Santa Rosa County in 1993-94.

Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value

Table 151. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	**6,863**	**148**	**4,121**
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 152. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	**63,099**	**16,484**	**79,583**
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 151. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 151. See Bell (1993).

Table 153. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	**3,349,154**	**1,813,240**	**5,162,394**
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 151 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 151 multiplied by $440.00 per angler.

of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Santa Rosa County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 7,011 = $2.6 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 4,121 = $0.8 million.

Thus, saltwater recreational fishing generates $3.4 million per year in Santa Rosa County with a capitalized value of $113 million using a 3% discount rate (i.e., $3.4 million , .03).

SR.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export, rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common

property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 154.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight

Table 154. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Santa Rosa County has 6,500 acres of salt marsh (NOAA, 1991), which would be worth $34 million ($5,316 x 6,500) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Santa Rosa County wetlands.

SR.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. It is difficult to separate Escambia County from neighboring Santa Rosa County since one beach runs into another. Table 155 lists the key beaches for these two counties.

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Table 155. Key Saltwater Beaches in Santa Rosa County, Florida*

Western District
(none)
Central District
Gulf Islands National Seashore
Fort Pickens and Langdon Beach
Unnamed Beaches
Quietwater Beach
Casino Beach
Pensacola Beach
Eastern District
Gulf Islands National Seashore/ Santa Rosa Recreational Facility
Navarre Beach Public Access
Navarre Beach Fishing Pier
Shoreline Park

*In Santa Rosa County alone, the University of West Florida (1985b) reported 17 individual saltwater beaches which were 9.5 miles in length and 2.5 million square feet (public and private).

Source: University of West Florida (1985a)

Using the CV technique, Leeworthy, et al. found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Santa Rosa County would have 951,555 saltwater beach days per year in 1990 for the beaches listed in Table 155. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $2.85 million. Remember, these are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value flow at a real discount rate of 3% is over $95 million — the asset value of the beach.

Finally, beach-related spending in Santa Rosa County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 951,555 x $12 = $4.11 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 951,555 x $30 = $18.3 million

Combined, saltwater beaches in Santa Rosa County attracted an estimated $22.41 million in beach-related spending in 1990 with tourists accounting for 83 percent of this spending.

Three ecological resources have been identified that are an asset to Santa Rosa County and induce a considerable level of economic activity in this region. Such values are summarized in Table 156.

SR.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 157 is an inventory of these water-dependent facilities in Santa Rosa County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Santa Rosa County, but are used for purposes of illustration.

Santa Rosa County has 19 saltwater boat ramp lanes and 276 wet slips and dry racks, as shown in Table 157. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Santa Rosa County is estimated and shown in Table 158. This value is about $.39 million.

Table 156. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Santa Rosa County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$1.24[3]	N/A	N/A
Recreational Fishing	$5.1[4]	$3.4[5]	$113[5]
Saltwater Marsh[5]	N/A	.207[6]	34[6]
Saltwater Beaches	$22.41[6]	$2.85[6]	$95.0[6]
Marine Boating[7]	N/A	$.390[7]	$13.02[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 150, *ex vessel* price
[4] Table 153, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 158

Table 157. An Inventory of Marine-Related Recreational Facilities in Santa Rosa County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	6
b. Length (all) (LFT)*	10,318
2. Boardwalks/Catwalks	
a. Number	9
b. Length (all) (LFT)*	1,020
3. Jetties	
a. Length (all) (LFT)*	120
Boating	
1. Boat Ramps	
a. Number	17
b. Total Lanes	19
2. Marinas	
a. Total	4
b. Slips/Moorings	96
c. Dry Storage	180

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 158. Estimation of the Annual User Value for Saltwater Boating Off Santa Rosa County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $140,663 = $5.02[1] x 5,267[2] x .19[3] x 28[4]
2. Boat Ramps $146,237 = $1.48[1] x 5,267 x .67[4] x 28
3. Private Docks $103,646 = $5.02[5] x 5,267 x .14 x 28
Total Annual User Value = $390,546

*Asset Value = 390,546 ÷ .03 = $13.02 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Santa Rosa County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Santa Rosa County
[5] Assumed $/day same for marinas and private docks

Recreational boating in marine waters is rapidly growing in Santa Rosa County. Such boating can effect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Santa Rosa County grew as follows, with projected (P) numbers included:

1983	5,267	
1984	5,413	
1985	5,711	
1986	5,933	
1987	5,881	
1988	6,301	
1989	6,730	
1990	6,727	
1991	6,731	
1992	6,927	
2000	10,988	(P)
2005	15,605	(P)
2010	22,160	(P)

SR.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Santa Rosa County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Santa Rosa County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Santa Rosa County, Pensacola Bay has been selected for a brief summary of the current state of water quality in this region of the study area.

The Pensacola Bay Basin extends from Escambia County to Santa Rosa County. Urban runoff and wastewater treatment plant (WWTP) discharges are the major pollution sources. These latter sources are from well-defined points such as the University of West Florida WWTP, Monsanto industrial discharges and Gulf Power thermal discharges that enter the Escambia River upstream of the mouth. As a result, reduced DO levels, fish kills and bacteria problems have been evident around the mouth of the Escambia River. This portion of Escambia Bay also receives discharges from CYTEC and Air Products, two manufacturing plants. Both discharges have been found to be toxic in several bioassays. These companies discharge high levels of nitrogen and BOD. As outlined earlier in this report, the industrial structure of Santa Rosa County is such that the ecosystem is under constant attack from many major industries in this area. This has manifested itself in fish kills (April, 1994), toxic bioassays and dirty foam near point source outfalls. Finally, further east, water quality improves especially in Santa Rosa Sound. The WQI and TSI for important areas are shown in Table 159.

Table 159. Water Quality Indices for Selected Areas of Santa Rosa County, Florida.

Water Areas: Pensacola Bay		**Water Quality Indices***	
Water Body Type: Estuary		WQI	TSI
7	Direct Runoff to Gulf	--	12
8	Santa Rosa Sound	--	18
10	Direct Runoff to Bay	--	23
17	Direct Runoff to Bay	--	45
21	East Bay	--	46
30	Trout Bayou	--	43
32	Blackwater Bay	--	34
33	Indian Bayou	--	45
37	Escambia Bay (N)	--	48
42	Mulatto Bayou	--	55
44	Judges Bayou	--	53
45	Blackwater Bay	--	32
Water Body Type: Stream			
47	Pace Mill Creek	40	--

* Higher values indicate lower water quality

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 160 indicates that in 1994, two companies (Westlake and Cytec) discharged toxic substances in and around the surface water of Santa Rosa County. Of the 13 counties in the study area, Santa Rosa County ranked second in pounds of toxic chemical discharges. The reader should be warned that such discharges may be highly variable from year to year.

Shellfish harvesting has been closed in 70,448 acres of Pensacola Bay, Blackwater River, Santa Rosa Sound and the East Bay River, and opened (conditional) in 64,233 acres in these same areas, indicating significant coliform count problems in over 50% of the shellfish beds.

Table 160. Toxic Chemical Releases Into Surface Water by Firms Located in Santa Rosa County, Florida in 1994.

	Company	SIC	Discharge	Main[1]
1.	Westlake PVC		219,500	Ammonium Nitrate
2.	Cytec Industries		23,990	Ammonia/ Copper
	Total		243,490	

[1] Leading chemical released based on pounds.
Source: EPA Toxic Release Inventory, unpublished data, 1994.

County Name: Taylor, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

TAY.1 Introduction

Taylor County is located in the eastern-central section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 13 and 14). It contains 1,042 square miles of land, ranking it 13th among the 67 counties in Florida. In 1990, Taylor County had a population of 17,111, ranking it 52nd among the States' 67 counties. The population density was 17 people per square mile in 1990, a ranking of 63rd in Florida. Taylor County has a relatively low median age of 33.5 years, compared to the Florida-wide median of 36.4 years.

The population of Taylor County had a per capita income of $13,951 in 1992, 47th of the 67 Florida counties and 30% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies, compared to an area where income is earned at a local chemical plant. For Taylor County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Taylor County had 16.1% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 14.5% (relative to a statewide average of 7.0%), indicating a tight labor market.

TAY.2 Trends in Population, Income and Employment in Taylor County, 1980-93.

Table 161 shows the trend in key economic variables in Taylor County from 1980 through 1993. Over this interval, resident population increased by 3.6% (0.3% annually), which was extremely slow when compared to 39.5% for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 102% from 1980 to 1993. (Table 161). Adjusted for inflation, real aggregate personal income increased by 15.2% (1.2% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

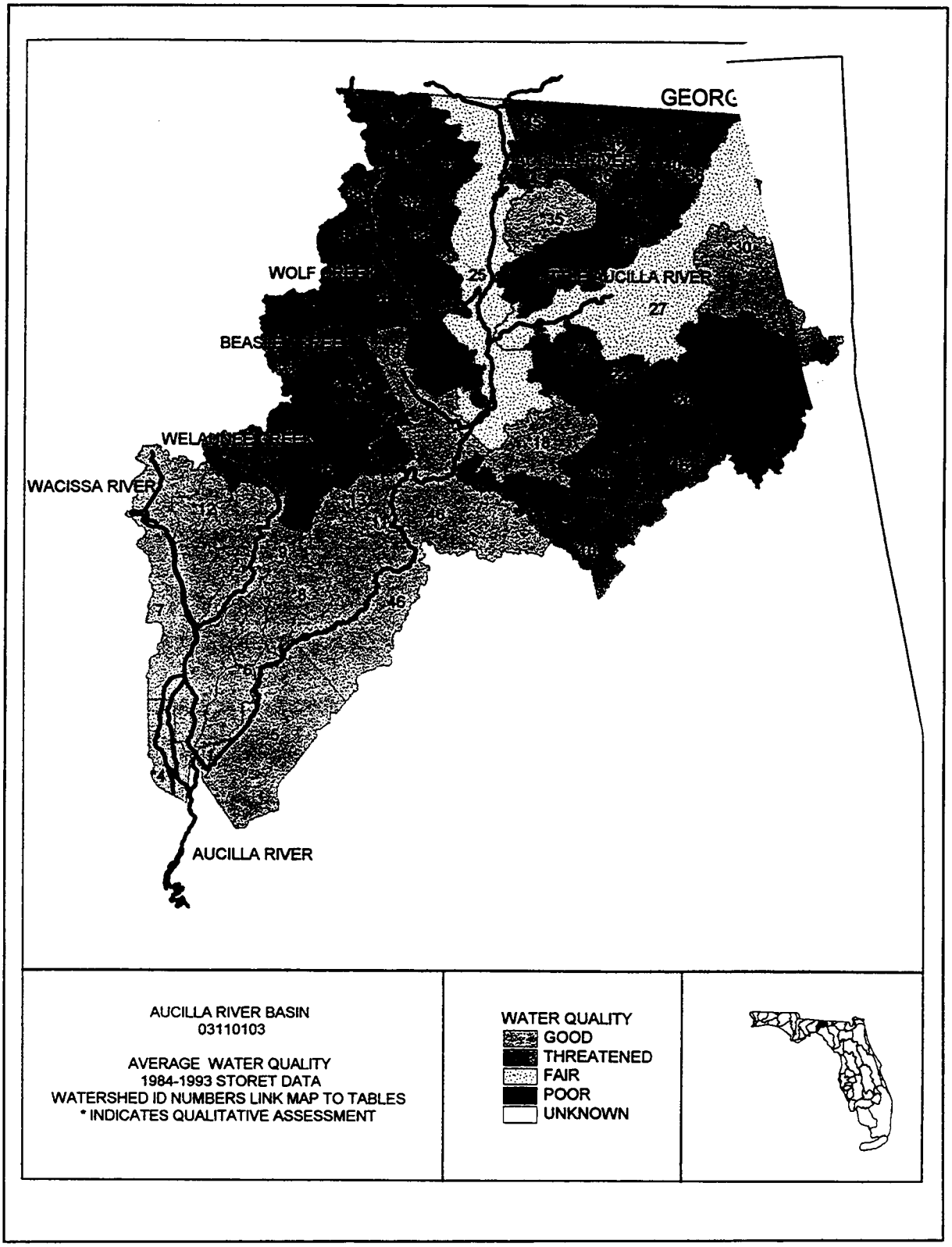

Figure 13. Map of Taylor County, Florida, showing levels of water quality and areas of quality testing (Aucilla River Basin)[from Bureau of Surface Water Management (1994a)].

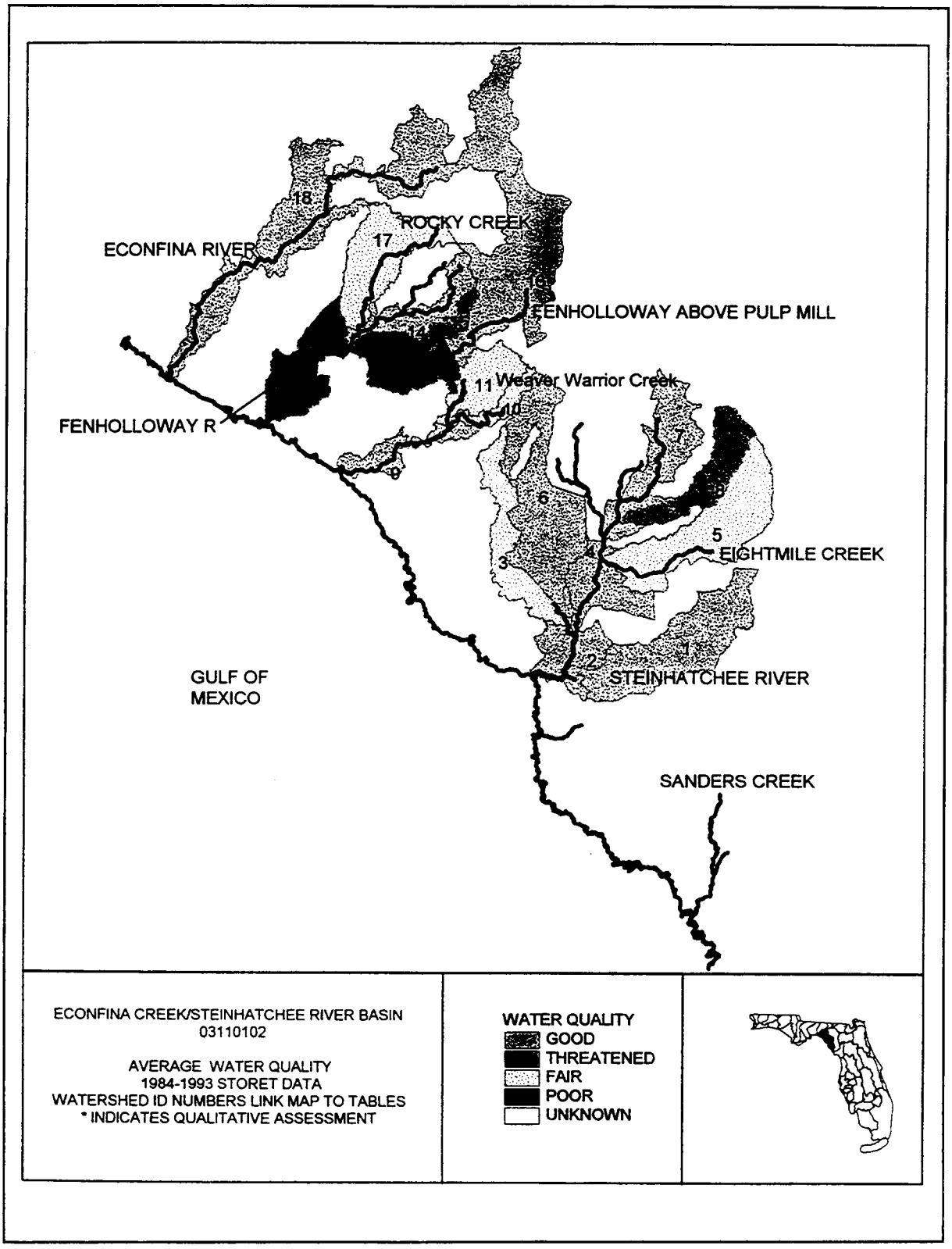

Figure 14. Map of Taylor County, Florida, showing levels of water quality and areas of quality testing (Ecofina Creek/Steinhatchee River Basin)[from Bureau of Surface Water Management (1994a)].

Table 161. Trends in Key Economic Aggregate Variables in Taylor County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	16,700	$116,910	$141,881	6,999
1981	16,800	134,917	148,424	7,322
1982	16,900	147,122	152,458	7,466
1983	16,800	152,730	153,343	7,439
1984	16,800	162,707	156,600	7,815
1985	16,800	170,593	158,544	7,637
1986	17,000	183,941	167,829	7,843
1987	17,000	186,190	163,900	7,957
1988	16,900	199,153	168,346	8,161
1989	17,000	210,482	169,743	8,042
1990	17,200	220,812	168,946	8,113
1991	17,400	226,248	166,114	7,225
1992	17,300	241,816	172,356	7,812
1993	17,300	236,255	163,498	7,541

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Taylor County increased from 6,999 in 1980 to 7,541 in 1993, a 7.7% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Taylor County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

TAY.3 Trends in Various Welfare Measures in Taylor County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but the components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Taylor County derived 95.1% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Taylor County in Table 162.

TAY.4 Industrial Base: Taylor County

The "industrial base" for Taylor County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the

Table 162. Trends in Components of Personal Income in Taylor County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$7,019	$5,097	$181	$26	$1,046	$669
1981	8,029	5,830	182	22	1,204	791
1982	8,712	6,191	182	42	1,364	932
1983	9,067	6,383	190	34	1,469	990
1984	9,668	6,776	205	22	1,548	1,118
1985	10,133	7,054	201	31	1,716	1,131
1986	10,847	7,547	194	24	1,845	1,237
1987	10,933	7,538	184	28	1,954	1,230
1988	11,765	8,028	215	37	2,138	1,348
1989	12,386	8,231	252	43	2,368	1,490
1990	12,868	8,425	310	65	2,574	1,493
1991	13,024	8,193	389	108	2,856	1,478
1992	13,988	8,728	527	142	3,144	1,446
1993	13,690	8,685	514	148	3,433	909

Source: BEA (1995)

nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 163 shows the main identified export industries and their contribution to personal income in Taylor County. This county depends primarily on fishing, lumber and wood products, chemicals, and local governments for its economic survival. Some of the largest individual employers in Taylor County have, from time to time, had negative impacts on the ecosystem. Table 164 shows the top employers in Taylor County, along with the products they produce that may generate conflicts with the environment. Products such as lumber and chemicals must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Taylor County discharged 16,470 pounds of toxic chemicals into surface water, ranking it 5th in volume among Florida's counties (Lester, 1995).

TAY.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Taylor County, the industries shown in Table 165 fall into this category.

The Taylor County economy is heavily based upon timber which is harvested and processed regionally into various paper-based products. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

TAY.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Taylor County is composed of primarily ecosystem-sensitive industries. The remainder are ecosystem-insensitive industries, which have relatively little impact on the environment, and are shown in Table 166.

In general, lumber accounts for the greatest portion of earnings and nearly all manufacturing revenue. This industry usually has adverse effects on local ecosystems. Over the 1969-93 period, the ecosystem-insensitive industries were growing slower than the ecosystem-sensitive industries, meaning that the growth in the Taylor County economy is in direct conflict with the environment.

Table 163. Major Export Industries in Taylor County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Fisheries	$573	.24	7.81
Manufacturing			
Lumber and Wood	11,387	4.8	11.25
Fabricated Metals	6,833	2.9	3.15
Electronics	N/A	N/A	N/A
Chemicals	N/A	N/A	N/A
State and Local Government	3,169	1.34	2.21

*LQ = Location quotient. See Text.
Source: BEA (1995)

Table 164. Top Employers in Taylor County, Florida and Products Produced, 1994.

Employer	Employees
1. Buckeye Florida, Cellulose	1,007
2. Watkins Engineering, Construction	250
3. Martin Electronics, Pyrotechnics	232
4. Doctor's Memorial Hospital, Health Care	123
5. Tom's Snack Food, Food	98
6. Perry Lumber Company, Lumber	83
7. Consolidated Forest Products, Lumber Products	54
Sub-Total	1,724
Total	7,541
Percent of Total	23%

Source: Florida Department of Commerce (1994)

Table 165. Ecosystem-Sensitive Industries in Taylor County, Florida.

Industry	Earnings ($000)
1. Manufacturing	
Lumber and Wood	$11,387
Fabricated Metals	6,833
Paper and Allied Products	50,000 (est.)
Sub-Total	$68,220
Total Earnings (Non-Farm)	$170,156
Percent of Total	40%

Source: BEA (1995)

Table 166. Ecosystem-Insensitive Industries in Taylor County, Florida.

	Industry	Earnings ($000)
1.	Fisheries	$573
2.	Food Stores	3,169
3.	State and Local Government	24,483
	Sub-Total	$28,225
	Total Earnings	$170,156
	Percent of Total	16%

Source: Table 163

TAY.7 Commercial Fishery Landings in Taylor County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Taylor County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $1.3 million worth of commercial fishery products were landed in Taylor County at the *ex vessel* level (Table 167). Finfish and shrimp account for 70% of this value. Among the finfish, sea bass was the leading species as measured by quantity and value. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Taylor County ranked 10th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Taylor County, where aggregate personal income was $236 million in 1993. Over the last fourteen years, commercial fishery landing has increased by 53% while the *ex vessel* value of the catch has increased by 316%. When adjusted for inflation, the value of landings changed by 132% (FDNR, 1980).

TAY.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional

Table 167. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Taylor County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Sea Bass	311,227	$143,164.42
Grunts	301,925	141,904.75
Red Grouper	64,475	113,476.00
Black Mullet	230,035	108,116.45
Spotted Sea Trout	85,198	102,237.60
Gag Grouper	27,147	60,537.81
Spanish Mackerel	103,475	43,459.50
Misc. Food Fish	37,876	22,346.84
Sand Sea Trout	22,389	13,209.51
All Others	99,748	97,140.73
Total		$866,877.81
Invertebrates		
Stone Crabs	35,368	$194,987.72
Blue Crabs	267,009	171,013.17
Octopus	16,405	15,256.65
Oysters	571	708.04
Total		$381,965.58
Shrimp (Total)	9,466	22,397.42
Grand Total		$1,271,240.81

* State average *ex vessel* price used.
Source: FDEP (1994)

breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Taylor County had 4,583 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment. This is shown in Table

168 where nonresidents are shown in the second column. Finally, tourists must purchase a license and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 169 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 168. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Taylor County showed a fishing effort of 98,271 days.

Finally, Table 170 is derived from Table 168 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists respectively. The calculations indicate that saltwater recreational fishermen spent approximately $7,347,174 in Taylor County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Taylor County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 6,759 = $2.5 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 9,360 = $1.8 million.

Thus, saltwater recreational fishing generates $4.3 million per year in Taylor County with a capitalized value of $143 million using a 3% discount rate (i.e., $4.3 million ÷ .03).

TAY.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts

Table 168. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	**4,583**	**2,176**	**9,360**
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 169. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	**60,831**	**37,440**	**98,271**
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 168. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 168. See Bell (1993).

Table 170. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	**3,228,774**	**4,118,400**	**7,347,174**
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 168 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 168 multiplied by $440.00 per angler.

by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 171.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper,

Table 171. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of West Florida at $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its

production elasticity of 0.19). Taylor County has 21,800 acres of salt marsh (NOAA, 1991), which would be worth $115.8 million ($5,316 x 21,800) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Taylor County wetlands.

TAY.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Taylor County only has one significant beach (Keaton Beach), and no visitor information is currently available, so the value of beaches cannot be estimated. Table 172 identifies ecological resources that are an asset to Taylor County and induce a considerable level of economic activity in the region.

TAY.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 173 is an inventory of these water-dependent facilities in Taylor County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Bell (1995) found that the user value per day, expressed in 1994 dollars, is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Taylor County, but are used for purposes of illustration.

Taylor County has 8 saltwater boat ramp lanes and 312 wet slips and dry racks, as shown in Table 173. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Taylor County is estimated and shown in Table 174. The annual user value for marine boating off Taylor County is about $.22 million.

Recreational boating in marine waters is rapidly growing in Taylor County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water

Table 172. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Taylor County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$1.3[3]	N/A	N/A
Recreational Fishing	$7.3[4]	$4.3[5]	$143[5]
Saltwater Marsh[5]	N/A	.207[6]	115.8[6]
Saltwater Beaches	N/A[6]	N/A[6]	N/A[6]
Marine Boating[7]	N/A	$.219[7]	$7.3[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 167, *ex vessel* price
[4] Table 170, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 174

Table 173. An Inventory of Marine-Related Recreational Facilities in Taylor County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	--
b. Length (all) (LFT)*	--
2. Boardwalks/Catwalks	
a. Number	5
b. Length (all) (LFT)*	470
3. Jetties	
a. Length (all) (LFT)*	50
Boating	
1. Boat Ramps	
a. Number	10
b. Total Lanes	8
2. Marinas	
a. Total	5
b. Slips/Moorings	195
c. Dry Storage	117

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 174. Estimation of the Annual User Value for Saltwater Boating Off Taylor County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $78,868 = $5.02[1] x 2,584[2] x .19[3] x 32[4]
2. Boat Ramps $81,993 = $1.48[1] x 2,584 x .67[4] x 32
3. Private Docks $58,113 = $5.02[5] x 2,584 x .14 x 32
Total Annual User Value = $218,974

*Asset Value = 218,974 ÷ .03 = $7.3 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Taylor County
[3] Bell et al.(1982), northwest Florida
[4] Bell (1995), Taylor County
[5] Assumed $/day same for marinas and private docks

resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Taylor County grew as follows, with projected (P) numbers included:

1983	1,639	
1984	1,731	
1985	1,787	
1986	1,810	
1987	1,917	
1988	1,967	
1989	1,944	
1990	2,099	
1991	2,298	
1992	2,391	
1993	2,399	
1994	2,584	
2000	3,298	(P)
2005	4,074	(P)
2010	4,988	(P)

TAY.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Taylor County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Taylor County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Taylor County, we have selected the Aucilla River and Econfina Creek/Steinhatchee River Basins for a brief summary of the current state of water quality in this region of the study area.

The Aucilla River is considered one of Florida's most outstanding waters. The river originates in Georgia in a series of lakes, swamps, sinkholes and underground passages. The water is characterized by tea-colored water due to natural substances. The overall water quality is considered very good, and will most likely stay that way, because of few pollution sources and very little development in the basin.

The Econfina Creek/Steinhatchee River Basin covers the coastal lowlands in Taylor County. A series of small rivers drain swampy lowlands and empty into the Gulf of Mexico. There are very few threats to most of these smaller rivers because of the surrounding wetlands. The exception is the Fenholloway River, which is the only waterbody in the state used for navigation, utility and industrial use. Discharges from the Buckeye Florida paper mill have severely affected water quality, and at times make up the river's entire flow. The mill also withdraws large quantities of water from the river, which also reduces the flow. Investigations near the river show that most of the nearby wells have been contaminated. At the mouths of the other estuaries, the water quality is considerably better and even supports commercial fishing. Other non-point discharges include septic tank leakage and poor drainage. The WQI and TSI for selected areas are listed in Table 175.

Table 175. Water Quality Indices for Selected Areas of Taylor County, Florida.

Water Areas: Aucilla River		Water Quality Indices*	
Water Body Type: Stream		WQI	TSI
5	Aucilla River	28	--
8	Aucilla River	35	--
Water Areas: Econfina Creek/Fenholloway River			
Water Body Type: Estuary			
10	Spring Warrior (at mouth)	--	57
Water Body Type: Stream			
3	Bevins (Boggy) Creek	54	--
4	Steinhatchee River	41	--
6	California (Rocky) Creek	40	--
9	Spring Warrior Creek	43	--
11	Weaver Warrior Creek	48	--
12	Fenholloway River (at mouth)	66	--
13	Fenholloway River (below pulp)	69	--
14	Spring Creek	44	--
16	Fenholloway River (at pulp)	43	--
17	Rocky Creek	55	--
18	Econfina River	32	--

* Higher values indicate lower water quality

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 176 indicates that in 1994, one company, Buckeye Florida, discharged toxic substances in and around the surface water of Taylor County. Of the 13 counties in the study area, Taylor County ranked third in pounds of toxic chemical discharges. These discharges may be highly variable from year to year.

Table 176. Toxic Chemical Releases Into Surface Water by Firms Located in Taylor County, Florida in 1994.

	Company	SIC	Discharge	Main[1]
1.	Buckeye Florida	2,823	10,997	Ammonia

[1] Leading chemical released based on pounds.
A.Source: EPA Toxic Release Inventory, unpublished data, 1994.

County Name: Wakulla, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

WAK.1 Introduction

Wakulla County is located in the western section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 15 and 16). It contains 606.7 square miles of land, ranking it 43rd among the 67 counties in Florida. In 1990, Wakulla County had a population of 14,202, ranking it 56th among Florida's counties. The population density was 25 people per square mile in 1990, a ranking of 54th in Florida. Wakulla County has a relatively low median age of 34.2 years, compared to the Florida-wide median of 36.4 years.

The population of Wakulla County had a per capita income of $14,718 in 1992, 41st of the 67 Florida counties and 26% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies, compared to an area where income is earned at a local chemical plant. For Wakulla County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Wakulla County had 11.1% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 4.5 % (relative to a statewide average of 7.0%), indicating a slack labor market.

WAK.2 Trends in Population, Income and Employment in Wakulla County, 1980-93.

Table 177 shows the trend in key economic variables in Wakulla County from 1980 through 1993. Over this interval, resident population increased by 47.7% (3.7% annually), which was greater than the 39.5% increase for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 250% from 1980 to 1993. (Table 177). Adjusted for inflation, real aggregate personal income increased by 99.6% (7.6% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

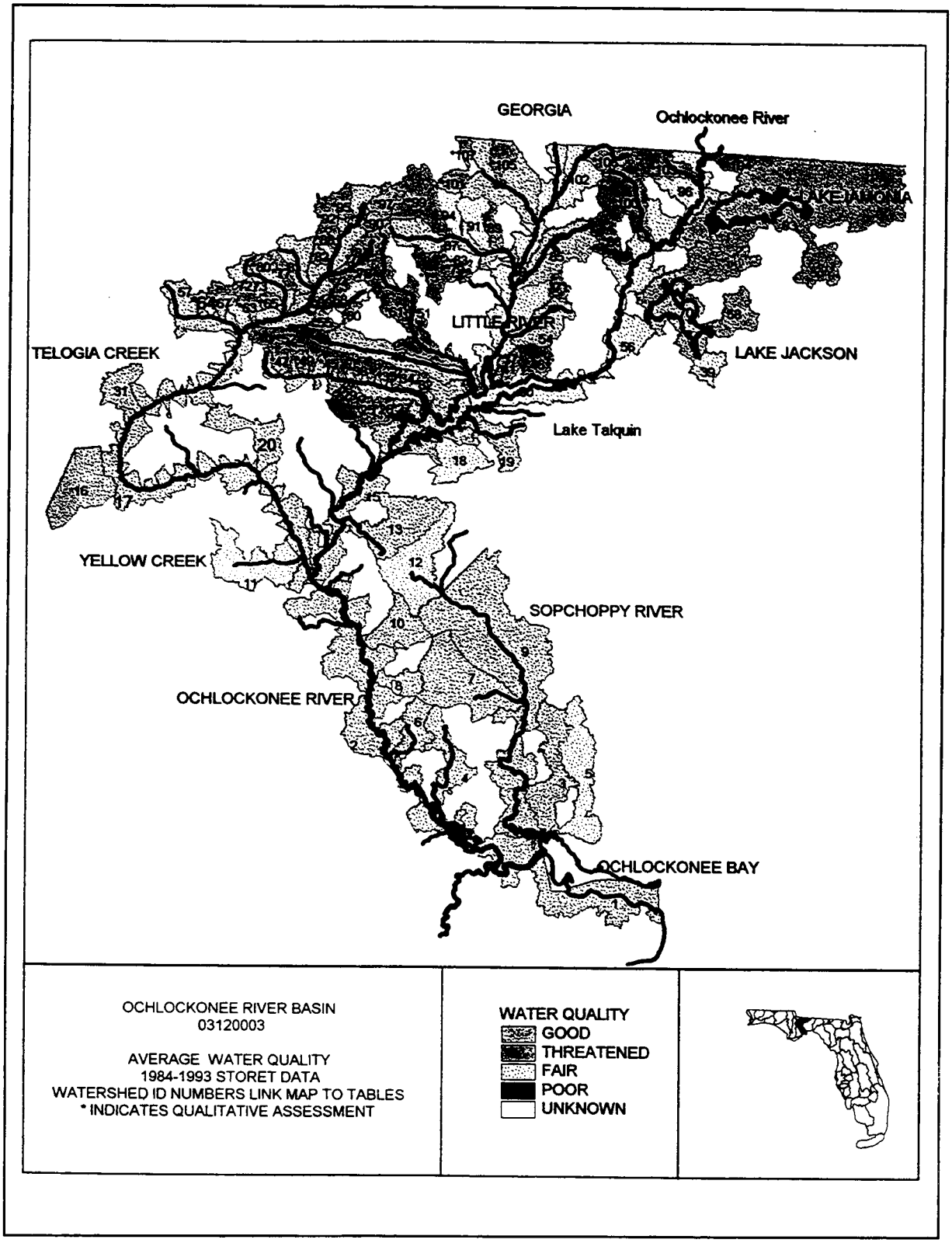

Figure 15. Map of Wakulla County, Florida, showing levels of water quality and areas of quality testing (Ochlockonee River Basin)[from Bureau of Surface Water Management (1994b)].

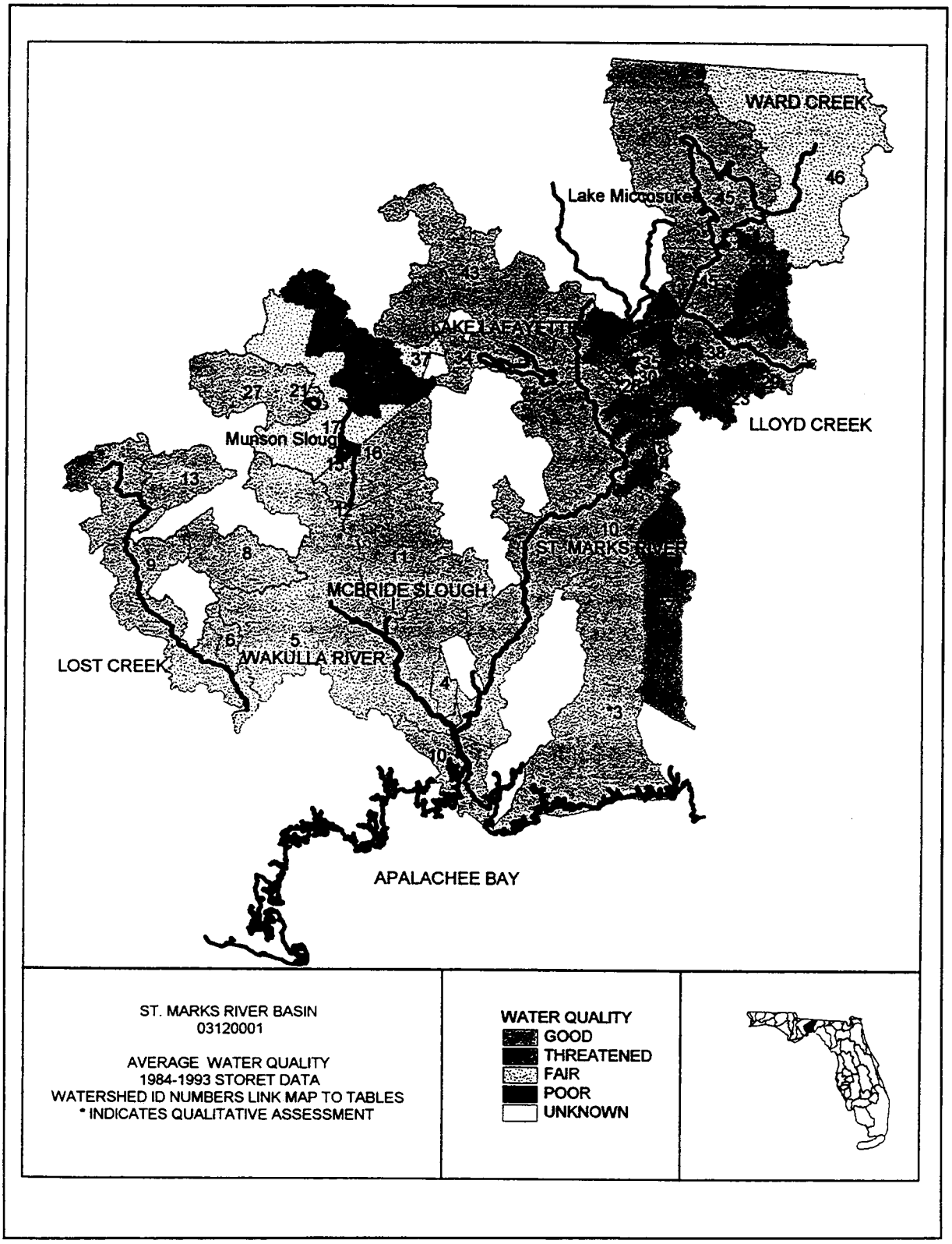

Figure 16. Map of Wakulla County, Florida, showing levels of water quality and areas of quality testing (St. Marks River Basin)[from Bureau of Surface Water Management (1994b)].

Table 177. Trends in Key Economic Aggregate Variables in Wakulla County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	10,900	$68,207	$82,775	2,731
1981	11,000	77,275	85,011	2,769
1982	11,400	82,942	85,850	2,942
1983	11,900	92,671	93,043	2,945
1984	12,400	100,022	96,268	3,025
1985	12,800	112,427	104,486	3,195
1986	12,900	127,380	116,223	3,288
1987	13,100	136,033	119,747	3,428
1988	13,600	153,948	130,134	3,711
1989	13,900	171,908	138,635	3,908
1990	14,400	189,247	144,795	3,986
1991	14,900	204,247	149,961	4,307
1992	15,400	219,925	156,753	4,413
1993	16,100	238,807	164,264	4,581

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Wakulla County increased from 2,731 in 1980 to 4,581 in 1993, a 68% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Wakulla County grew less rapidly than the measure of county output — real aggregate personal income — as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

WAK.3 Trends in Various Welfare Measure in Wakulla County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is likely to be more able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Wakulla County derived 97.4% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Wakulla County in Table 178.

WAK.4 Industrial Base: Wakulla County

The "industrial base" for Wakulla County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the

Table 178. Trends in Components of Personal Income in Wakulla County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,243	$4,408	$159	$12	$960	$704
1981	7,038	4,850	167	12	1,088	922
1982	7,299	4,986	154	15	1,197	947
1983	7,820	5,323	148	17	1,249	1,084
1984	8,089	5,687	159	9	1,248	986
1985	8,813	6,206	160	17	1,372	1,058
1986	9,839	6,991	165	14	1,467	1,202
1987	10,349	7,497	158	17	1,561	1,116
1988	11,314	8,019	207	15	1,754	1,319
1989	12,354	8,646	218	12	1,939	1,539
1990	13,168	9,088	281	15	2,111	1,674
1991	13,768	9,486	334	26	2,306	1,616
1992	14,255	9,881	354	37	2,468	1,516
1993	14,816	10,341	346	29	2,595	1,505

Source: _BEA (1995)

nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 179 shows the main identified export industries and their contribution to personal income in Wakulla County. This county depends primarily on fishing and manufacturing, and acts as a bedroom community for Leon County. The counties' largest employer is Olin Corporation, a producer of gun powder. There is also some logging and a small trace of tourism in the county economy. Some of the largest individual employers in Wakulla County have, from time to time, had negative impacts on the ecosystem. For Wakulla County, Table 180 shows the top employers, along with the products they produce that may generate conflicts with the environment. Products such as chemicals and gun propellants must be rigorously controlled or they will reduce water and air quality. In 1993, the EPA reported that the companies in Wakulla County discharged 1,017 pounds of toxic chemicals into surface water (Lester, 1995).

WAK.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Wakulla County, the industries shown in Table 181 fall into this category.

The Wakulla County economy is heavily based upon the Olin Corporation, which produces gun powder. The county also acts as a bedroom community for Leon County. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

WAK.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Wakulla County is composed of primarily ecosystem-sensitive industries. The remainder are known as ecosystem-insensitive industries, which have relatively little impact on the environment and are shown in Table 182

In general, industries such as health services, tourism and retirement have a less adverse impact on local ecosystem health than other industries in Wakulla County. Over the 1969-93 period, the ecosystem-insensitive industries grew more rapidly than the ecosystem-sensitive industries, meaning that the recent economic growth is not threatening to the marine environment.

Table 179. Major Export Industries in Wakulla County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Fisheries	$1,176	.49	15.87
Manufacturing			
Food and Kindred Products	1,735	.72	.72
Petroleum Products	415	.17	.92
Chemicals	D*	N/A	N/A
Water Transportation	402	.16	1.3
Tourism (Minor)			
Food Stores	2,858	1.19	1.1

*LQ = Location quotient. See Text.
*D = Disclosure
Source: BEA (1995)

Table 180. Top Employers in Wakulla County, Florida and Products Produced, 1994.

Employer		Employees
1. Olin Corporation, Ball Powder		400
2. Wakulla Manor Nursing Home, Health Care		150
3. Wakulla County State Bank, Banking		50
	Sub-Total	600
	Total	4,581
	Percent of Total	13%

Source: Florida Department of Commerce (1994)

Table 181. Ecosystem-Sensitive Industries in Wakulla County, Florida.

	Industry		Earnings ($000)
1.	Manufacturing		22,134
	Food and Kindred Products		
	Petroleum Products		
	Chemicals		
2.	Water Transportation		402
		Sub-Total	22,536
		Total Earnings (Non-Farm)	238,907
		Percent of Total	9%

Source: BEA (1995)

Table 182. Ecosystem-Insensitive Industries in Wakulla County, Florida.

	Industry	Earnings ($000)
1.	Fisheries	1,176
2.	Food Stores (tourism)	2,858
	Sub-Total	4,034
	Total Earnings	238,807
	Percent of Total	2%

Source: Table 179

WAK.7 Commercial Fishery Landings in Wakulla County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Wakulla County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $2.8 million worth of commercial fishery products were landed in Wakulla County at the *ex vessel* level (Table 183). Finfish and shrimp account for 40% of this value. Among the finfish, black mullet was the leading species as measured by quantity and value. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Crabs accounted for 60% of the *ex vessel* value. Among the 13 counties in the study area, Wakulla County ranked 7th in the *ex vessel* value of all commercial fishery landings.

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively important component of the economic base of Wakulla County, where aggregate personal income was $.23 billion in 1993. Over the last fourteen years, commercial fishery landing has increased by 10% while the *ex vessel* value of the catch has increased by 285%. When adjusted for inflation, the value of landings changed by 113% (FDNR, 1980).

WAK.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to

Table 183. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Wakulla County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Black Mullet	763,653	$358,916.91
Red Grouper	162,382	285,792.31
Gag Grouper	75,847	169,138.81
Grunts	168,748	79,311.56
Sea Bass	126,980	58,410.80
Spotted Sea Trout	16,177	19,412.40
Flounder	7,070	12,231.10
Gray Snapper	3,877	6,784.75
Spot	16,096	6,438.40
Porgies	6,415	5,901.80
All Others	60,921	41,051.65
Total		$1,043,390.49
Invertebrates		
Stone Crabs	150,562	$835,362.92
Blue Crabs	1,227,580	786,321.53
Oysters	51,841	64,282.84
All Others	13,250	10,336.49
Total		$1,696,303.78
Shrimp (Total)	26,806	57,769.11
Grand Total		$2,797,463.38

* State average *ex vessel* price used.
Source: FDEP (1994)

Escambia County. Such regions include both coastal and interior counties. These regional averages can be applied to the individual counties as an approximation. Bell (1993) has only statewide averages for tourist saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Wakulla County had 4,629 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical

proximity to each county, using personal judgment. This is shown in Table 184 where nonresidents are shown in the second column. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 185 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 184. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers, respectively. Wakulla County showed a fishing effort of 81,406 days.

Finally, Table 186 is derived from Table 184 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists respectively. The calculations indicate that saltwater recreational fishermen spent approximately $5,902,377 in Wakulla County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

Table 184. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	1,383	177	1,781
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	**4,629**	**1,329**	**6,946**
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 185. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	14,040	7,124	21,164
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	**53,622**	**27,784**	**81,406**
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 184. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 184. See Bell (1993).

Table 186. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	745,212	783,640	1,528,852
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	**2,846,137**	**3,056,240**	**5,902,377**
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 184 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 184 multiplied by $440.00 per angler.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Wakulla County can be computed as follows:

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 5,958 = $22 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 6,946 = $1.35 million.

Thus, saltwater recreational fishing generates $3.55 million per year in Wakulla County with a capitalized value of $118 million using a 3% discount rate (i.e., $3.55 million ÷ .03).

WAK.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property, where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 187.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five

Table 187. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows (at the means):

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida at $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Wakulla County has 18,600 acres of salt

marsh (NOAA, 1991), which would be worth $98.8 million ($5,316 x 18,600) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by Wakulla County wetlands.

WAK.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well-organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects. First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Wakulla County does not have any major beach areas, therefore, no value to the economy can be calculated.

WAK.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities, such as fisheries and beaches, in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 188 identifies ecological resources that are an asset to Wakulla County and induce a considerable level of economic activity in the region. Table 189 is an inventory of these water-dependent facilities in Wakulla County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

As an outdoor recreational activity, boating makes use of common property water resources. Expressed in 1994 dollars, Bell (1995) found that the user value per day is worth $3.56 more if a marina is used (i.e., $5.02 less $1.48) rather than a boat ramp. These are Florida-wide values and may or may not be good estimates for Wakulla County, but are used for purposes of illustration.

Wakulla County has 14 saltwater boat ramp lanes and 550 wet slips and dry racks as shown in Table 189. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Wakulla County is estimated and shown in Table 190. This value is about $0.3 million.

Recreational boating in marine waters is rapidly growing in Wakulla County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water

Table 188. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Wakulla County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$2.8[3]	N/A	N/A
Recreational Fishing	$5.9[4]	$3.55[5]	$118[5]
Saltwater Marsh[5]	N/A	.207[6]	98.8[6]
Saltwater Beaches	--[6]	--[6]	--[6]
Marine Boating[7]	N/A	$.305[7]	$10.2[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 183, *ex vessel* price
[4] Table 186, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 190

Table 189. An Inventory of Marine-Related Recreational Facilities in Wakulla County, Florida, 1995 (Public and Private).

Facilities	Inventory
Beaches	
1. Number	6
2. Length (all) (miles)	1.4
3. Area (all) (sq. ft.)	143,700
Fishing	
1. Piers	
a. Number	--
b. Length (all) (LFT)*	--
2. Boardwalks/Catwalks	
a. Number	1
b. Length (all) (LFT)*	2,110
3. Jetties	
a. Length (all) (LFT)*	--
Boating	
1. Boat Ramps	
a. Number	13
b. Total Lanes	14
2. Marinas	
a. Total	6
b. Slips/Moorings	359
c. Dry Storage	191

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Table 190. Estimation of the Annual User Value for Saltwater Boating Off Wakulla County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $110,152 = $5.02[1] x 3,609[2] x .19[3] x 32[4]
2. Boat Ramps $114,518 = $1.48[1] x 3,609 x .67[4] x 32
3. Private Docks $81,165 = $5.02[5] x 3,609 x .14 x 32
Total Annual User Value = $305,835

*Asset Value = 305,835 ÷ .03 = $10.2 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Wakulla County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Wakulla County
[5] Assumed $/day same for marinas and private docks

resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Wakulla County grew as follows, with projected (P) numbers included:

1983	1,420	
1984	1,663	
1985	1,752	
1986	1,785	
1987	1,845	
1988	1,991	
1989	2,126	
1990	2,157	
1991	2,243	
1992	2.874	
1993	3,321	
1994	3,609	
2000	3,866	(P)
2005	4,620	(P)
2010	5,521	(P)

WAK.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Wakulla County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Wakulla County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Wakulla County, we have selected the Ochlocknee River and St. Marks River Basins for a brief summary of the current state of water quality in this region of the study area.

The Ochlocknee River originates in Georgia and enters Florida north of Tallahassee. The river enters Wakulla County near Wakulla. The overall water quality in this basin is good. The Lower Ochlocknee and Sopchoppy Rivers both traditionally have very good water quality. There are relatively few pollution sources entering the water in this basin and, because of the relatively low county population, there appear to be no immediate threats to it. The St. Marks River begins in Georgia and drains into the Gulf of Mexico. The river widens and clarity begins to improve near the Wakulla County line due to water input from natural springs. The Wakulla River meets the St. Marks approximately three miles north of the Gulf of Mexico. Both rivers have very good water quality, and in some areas are protected by the St. Marks National Wildlife Refuge. The lower part of the St. Marks River, however, has in the past had problems with water quality. There are pumping stations for oil barges, a few small marinas, which have seen some oil spills in the past, and there are sediments coated with oil in the area. The lower portion of the Wakulla River is now being threatened by increased development and discharge from Olin Corporation into Boggy Branch. The WQI and TSI for selected areas are listed in Table 191.

Table 191. Water Quality Indices for Selected Areas of Wakulla County, Florida.

Water Areas: Ochlocknee River Basin		Water Quality Indices*	
Water Body Type: Estuary		WOI	TSI
1	Ochlocknee Bay	--	47
Water Body Type: Stream			
2	Ochlocknee River	26	--
3	Buckhorn Creek	22	--
4	Syprett Creek	42	--
5	Otter Creek	46	--
7	Monkey Creek	42	--
8	Smith Creek	34	--
9	Sopchoppy River	22	--
Water Areas: St. Marks River			
Water Body Type: Stream			
4	Big Boggy Branch	41	--
5	Wakulla River	19	--
10	St. Marks River	34	--

* Higher values indicate lower water quality

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 192 indicates that in 1994, a single company, Olin Ordnance, discharged toxic substances in and around the surface water of Wakulla County. These discharges may be highly variable from year to year.

Shellfish harvesting has been closed in 1,592 acres and conditional in 6,042 acres in the Ochlocknee Bay and Wakulla County. This means that 30% of the shellfish beds have been closed due to poor water quality.

Table 192. Toxic Chemical Releases Into Surface Water by Firms Located in Wakulla County, Florida in 1994.

	Company	SIC	Discharge	Main[1]
1.	Olin Ordnance	2,892	1,017	Nitro-glycerin

[1] Leading chemical released based on pounds.
A.Source: EPA Toxic Release Inventory, unpublished data, 1994.

County Name: Walton, Florida

Socioeconomic Components and Processes Occurring in the Northeastern Gulf of Mexico Coastal and Marine Ecosystem

WAL.1 Introduction

Walton County is located in the central section of the study area, which ranges from Escambia to Citrus County in northwestern Florida (Figures 17 and 18). It contains 1,058 square miles of land, ranking it 11th among the 67 counties in Florida. In 1990, Walton County had a population of 27,759, ranking it 44th among Florida's counties. The population density was 29 people per square mile in 1990, a ranking of 53rd in Florida. Walton County has an median age of 37.8 years, somewhat higher than the Florida-wide median of 36.4 years.

The population of Walton County had a per capita income of $13,531 in 1992, 51st of the 67 Florida counties and 32% below the state-wide average of $19,797. This income was derived primarily from earnings from local industries, return on investment (rent, interest, dividends), retirement income, and transfer payments (e.g., AFDC, food stamps, etc.). The sources of income for a county may lead to a characterization of how that area interacts with the natural ecosystem. For example, a retirement community may produce less toxic chemical discharges into waterbodies compared to an area where income is earned at a local chemical plant. For Walton County, an analysis of the sources of income will be discussed below, along with the interaction with the ecosystem.

Walton County had 15.1% of the households below the poverty level in 1989, which was higher than the State of Florida average of 9.0%. In 1993, the unemployment rate was 5.8% (relative to a statewide average of 7.0%) indicating a slack labor market.

WAL.2 Trends in Population, Income and Employment in Walton County, 1980-93.

Table 193 shows the trend in key economic variables in Walton County from 1980 through 1993. Over this interval, resident population increased by 41.4% (3.2% annually), which was comparable to the 39.5% increase for Florida as a whole. Population increases that were induced primarily by industrial structure (i.e., job creation) and natural amenities of the region place additional pressure on the carrying capacity of both living (e.g., coastal fishery stocks) and non-living natural resources (e.g., beaches).

Nominal aggregate personal income increased by 233% from 1980 to 1993 (Table 193). Adjusted for inflation, real aggregate personal income increased by 90% (6.9% annually). Since real income growth outstripped the population growth discussed above, the average level of affluence increased. This usually is a positive trend for ecosystems since people will have the financial resources to reduce negative externalities (e.g., air and water pollution) which often accrue from population growth (Hall, 1994).

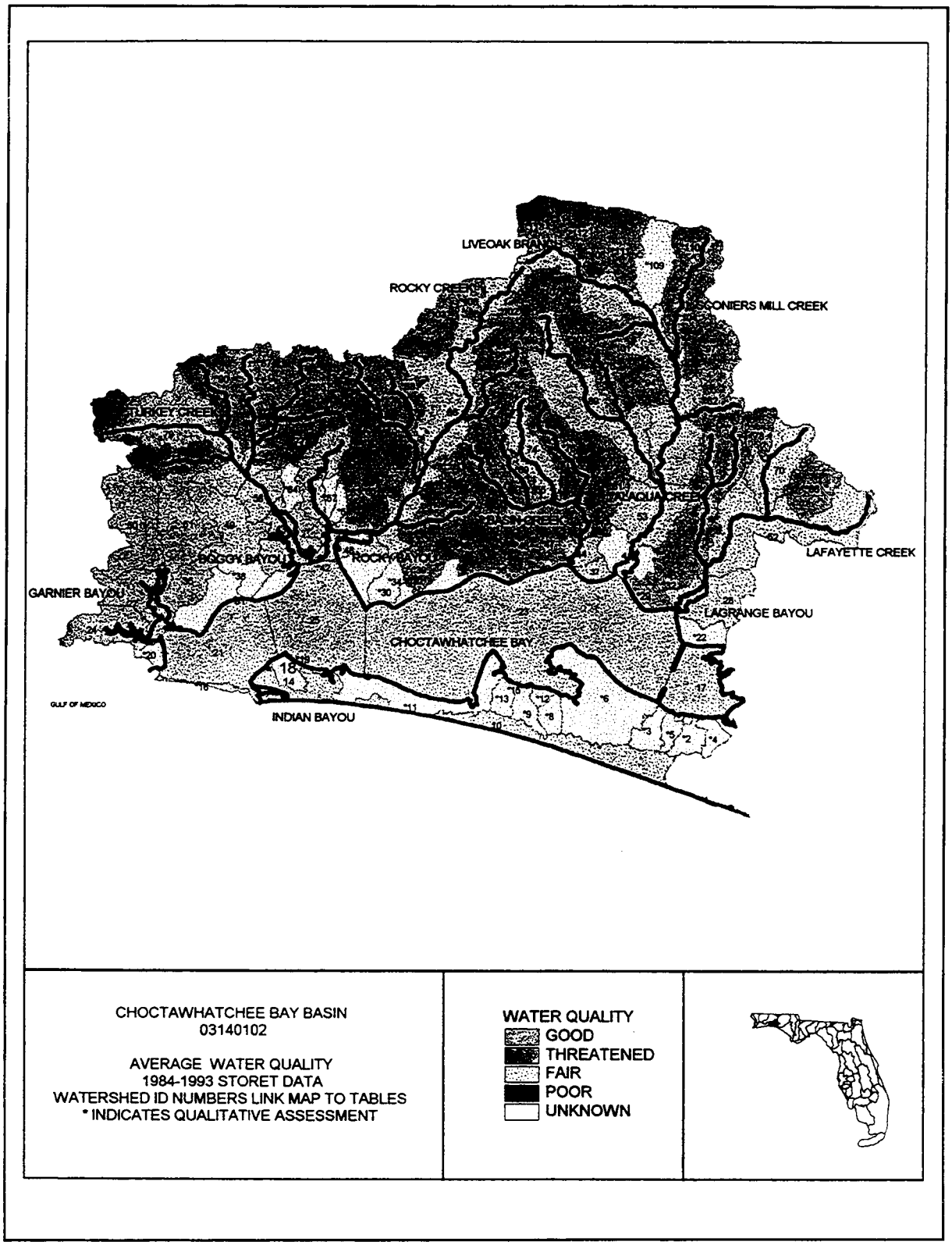

Figure 17. Map of Walton County, Florida, showing levels of water quality and areas of quality testing (Choctawhatchee Bay Basin)[from Bureau of Surface Water Management (1994b)].

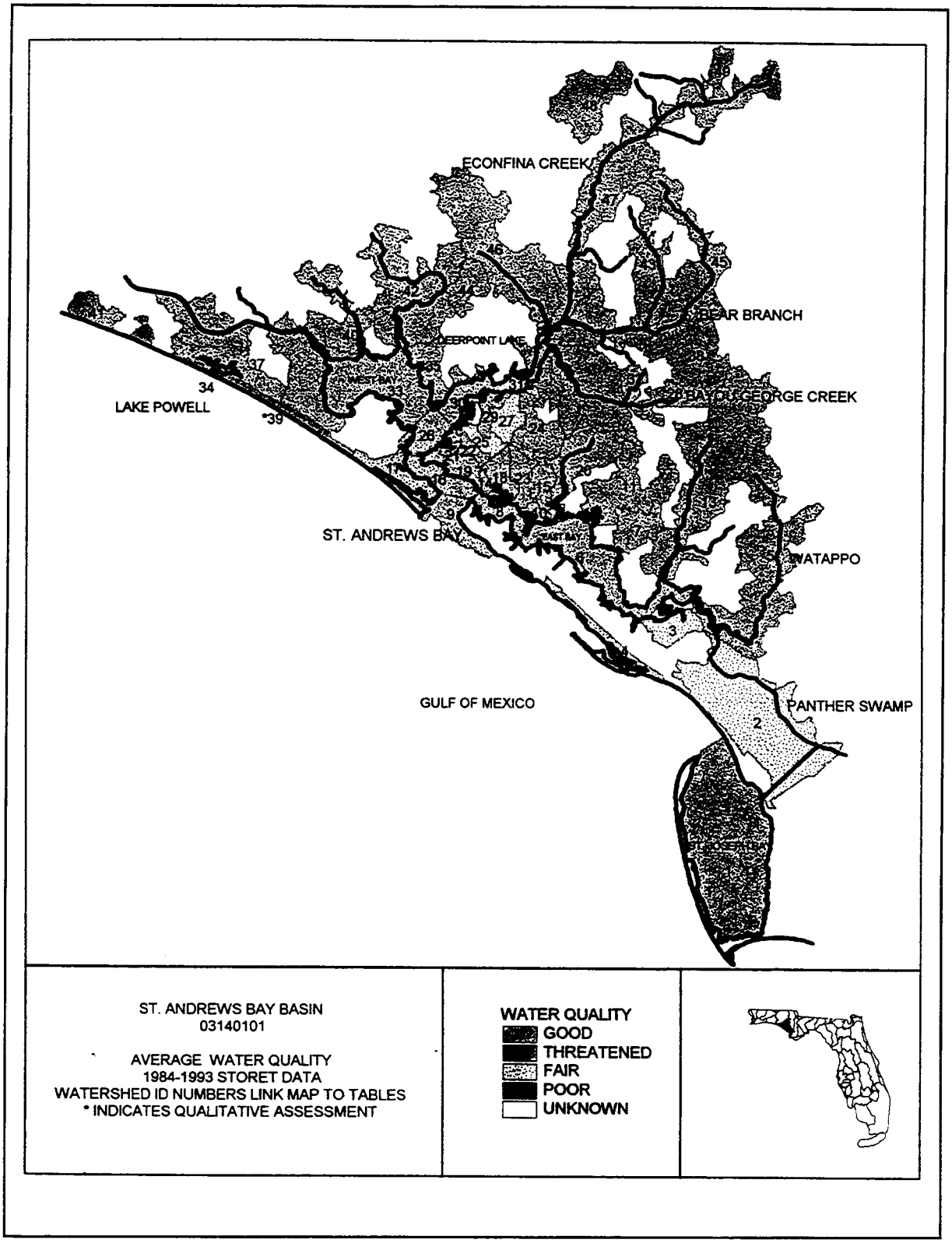

Figure 18. Map of Walton County, Florida, showing levels of water quality and areas of quality testing (St. Andrews Bay Basin)[from Bureau of Surface Water Management (1994b)].

Table 193. Trends in Key Economic Aggregate Variables in Walton County, Florida, 1980-93.

Year	Resident Population	Personal Income[1] (nominal) (000)	Real Personal Income[2] (000)	Employment[3]
1980	21,500	$128,838	$156,375	6,052
1981	21,900	146,630	161,309	6,126
1982	22,600	160,964	166,802	6,109
1983	23,100	177,162	177,873	6,389
1984	24,000	203,246	195,617	7,321
1985	24,900	224,020	208,197	8,374
1986	25,700	245,483	223,981	8,793
1987	26,200	254,699	224,207	9,174
1988	26,600	277,526	234,595	9,569
1989	27,200	303,526	244,779	9,978
1990	27,800	333,677	255,300	10,658
1991	28,600	368,994	270,921	10,787
1992	29,500	398,400	283,963	11,160
1993	30,400	429,411	297,170	11,652

[1] Includes earnings, dividends, interest, rent and transfer payments.
[2] Deflated by CPI where 1982-84 = 100.
[3] Full and part-time wages and salary and proprietors' employment.

Source: BEA (1995)

The number of jobs in Walton County increased from 6,052 in 1980 to 11,652 in 1993, a 93% increase. The growth of jobs is stimulated in a region by what is known as the export base. Simply put, a region's growth is determined by its ability to derive "export income" from outside the region. In Florida, such income may come from physically exporting goods such as electronic components or fish, but it is more likely to come from tourists visiting the region, income to retirees in Florida and injections of Federal dollars to sustain military bases such as Eglin Air Force Base in Okaloosa County. Through a multiplier process, this export income sustains both direct export jobs (e.g., civilians working for the military) and indirect or support jobs for those in export industries (e.g., barber shops, grocery stores and shopping malls). Job growth in Walton County grew less rapidly than the measure of county output – real aggregate personal income – as local entrepreneurs introduced labor-saving technological devices to economize on the rising cost of labor.

WAL.3 Trends in Various Welfare Measures in Walton County, 1980-93

Per capita income is an overall measure of how well off a community is in economic terms, but components of personal income are sometimes more revealing. A county that depends on earnings, retirement income and income from capital (i.e., dividends, interest and rent) is more likely to be able to protect the ecosystem than one which is highly dependent on income

maintenance and unemployment insurance, since the former is taxable while the latter is not. In 1993, Walton County derived 97% of its personal income from earnings, retirement and capital income, compared to 98.2% for the whole of Florida. Thus, the county is less likely to tax residents, compared to the state as a whole, to protect threats to the marine ecosystem. The trends in the components of personal income per capita are shown for Walton County in Table 194.

WAL.4 Industrial Base: Walton County

The "industrial base" for Walton County refers to the industries that are primarily export in nature as discussed above. These industries drive the local economy. The rest of the industries in the county are "non-export industries" that depend, for the most part, on what happens inside the region. These are called non-basic industries. For small areas such as counties, agriculture, fisheries, mining, manufacturing, transportation and service-oriented industries for tourists are likely to be export industries while wholesale and retail trade, finance, services and local government are likely to be non-basic industries. No data are available on exports from a county; however, location quotients and expert judgment can be used to identify such industries with some accuracy. If a given county is highly specialized relative to the nation in the production of a particular commodity, the product is presumed to be an export item (e.g., automobiles from Detroit). The specialization is measured by computing the percentage of personal income generated by an industry (e.g., 10%) in an area, compared to the same percentage nationally (e.g., 0.5%), assuming the

Table 194. Trends in Components of Personal Income in Walton County, Florida, 1980-93.

Year	Per Capita					
	Income[1] (Nominal)	Earnings	Income Maintenance	Unemployment	Retirement	Dividends, Interest, Rents
1980	$6,004	$3,563	$164	$18	$1,415	$843
1981	6,710	3,866	173	19	1,653	999
1982	7,128	3,965	176	23	1,880	1,084
1983	7,657	4,240	180	26	2,020	1,191
1984	8,470	4,899	172	16	2,060	1,325
1985	8,993	5,166	164	27	2,259	1,377
1986	9,552	5,479	166	30	2,313	1,564
1987	9,704	5,616	165	27	2,417	1,479
1988	10,434	6,003	190	30	2,682	1,528
1989	11,159	6,352	204	27	2,889	1,688
1990	11,999	6,804	237	34	3,189	1,734
1991	12,889	6,973	286	48	3,659	1,925
1992	13,527	7,395	374	58	3,960	1,740
1993	14,128	7,741	355	53	4,214	1,764

Source: BEA (1995)

nation consumes all it produces – no imports or exports. This is rather simplistic, but it does serve as an indicator of which industries are predominately export. This figure, the location quotient (LQ), would be:

(1) $LQ = 10\%/.5\% = 20$

Thus, 95% would be in export or

(2) $1 - LQ^{-1} = .95$

In reality, any manufacturing industries with a high LQ would most likely export all of its product outside the county (e.g., Olin Company makes gunpowder in Wakulla County and sells none locally).

Table 195 shows the main identified export industries and their contribution to personal income in Walton County. This county depends primarily on tourism, retirement and manufacturing for its economic survival. Some of the largest individual employers in Walton County have, from time to time, had negative impacts on the ecosystem. Table 196 shows the top ten employers in Walton County, along with the products they produce that may generate conflicts with the environment. Products such as lumber and wood, apparel and other manufacturing must be rigorously controlled or they will reduce water and air quality. In 1992, the EPA reported that the companies in Walton County discharged 10 pounds of toxic chemicals into surface water (Lester, 1995).

WAL.5 Ecosystem-Sensitive Industries

Those industries that, if left unchecked, may be a threat to environmental quality and ecosystem health are referred to as ecosystem-sensitive industries. For Walton County, the industries shown in Table 197 fall into this category.

The Walton County economy is heavily based upon manufacturing and tourism. The county's largest employer is a food processing plant. All of these economic activities create various kinds of waste that is a point or nonpoint discharge into rivers and coastal waters. These industries are primarily involved in the export sector and therefore are critical to this coastal county.

WAL.6 Ecosystem-Insensitive Industries

As indicated by earnings, the economic base of Citrus County is primarily composed of ecosystem-insensitive industries, those which have relatively little impact on the environment. These are shown in Table 198.

In general, industries such as tourism and retirement have a less adverse impact on local ecosystem health than other industries in Walton County. Over the 1969-93 period, the ecosystem-insensitive industries grew faster than the ecosystem-sensitive industries, meaning that the growth of the economy for Walton County is not a threat to the natural resources of the county.

Table 195. Major Export Industries in Walton County, Florida and Their Contribution to Aggregate Personal Income, 1993.

Industry	Earnings (000)	% of Personal Income	LQ*
Tourism			
Construction	$15,691	3.64	1.02
Real Estate	4,400	1.02	1.42
Manufacturing			
Lumber/Wood	1,259	.29	.68
Transportation Equipment	1,511	.35	.41
Apparel	1,896	.44	1.27
Food and Kindred Products	N/A	N/A	N/A
Tourism			
Food Stores	8,234	1.91	1.73
Eating and Drinking Places	9,097	2.11	1.30
Hotels	22,014	5.12	7.48

*LQ = Location quotient. See Text.

Source: BEA (1995)

Table 196. Top Ten Employers in Walton County, Florida and Products Produced, 1994.

Employer	Employees
1. Showell Farms of Florida, Poultry Processing	800
2. Sandestin Beach Resort, Resort	500
3. TopSail Beach and Racquet Resort, Resort	150
4. Walton Regional Hospital, Health Care	140
5. Seascape Resort, Resort	120
6. Walton County Convalescent Center, Health Care	115
7. Wal-Mart, Retail Sales	115
8. Professional Products, Orthopedic Wear	110
9. Continental Apparel, Ladies Wear	106
10. CHELCO, Electric Utility	99
Sub-Total	2,255
Total	11,652
Percent of Total	19%

Source: Florida Department of Commerce (1994)

Table 197. Ecosystem-Sensitive Industries in Walton County, Florida.

Industry		Earnings ($000)
1. Manufacturing		$26,126
Food and Kindred Products		16,000*
Apparel and Other Textiles		1,558
Lumber and Wood		1,259
Transportation Equipment		1,511
	Sub-Total	$46,454
	Total Earnings (Non-Farm)	$425,192
	Percent of Total	10.9%

Source: BEA (1995)

Table 198. Ecosystem-Insensitive Industries in Walton County, Florida.

Industry		Earnings ($000)
2. Tourism		
Food Stores		$8,234
Eating and Drinking Places		9,097
Hotels		22,014
	Sub-Total	$39,345
	Total Earnings	$425,192
	Percent of Total	9.2%

Source: Table 195

WAL.7 Commercial Fishery Landings in Walton County

Commercial fishery products are landed at the *ex vessel* level. At this level, processors, wholesalers and dealers purchase various species from the fishermen for food and industrial (e.g., fish meal) uses. Thus, the *ex vessel* value only reflects what the fishermen receive for their catch and not the value added in processing and distribution. All landings discussed here refer to marine or saltwater fisheries products caught somewhere in the Gulf of Mexico and landed for sale in Walton County.

Three categories of fishery products are found: (1) finfish; (2) invertebrates (e.g., crabs, lobsters, oysters) and (3) shrimp. It has been estimated that over 90% of commercially important species in the Gulf of Mexico are estuary-dependent during some part of their life. Wetlands habitat is thus important to the continued viability of Florida's fisheries. In 1994, about $87,000 worth of commercial fishery products were landed in Walton County at the *ex vessel* level (Table 199). Finfish and shrimp account for 84% of this value. Among the finfish, shark and black mullet were the leading species landed as by value and quantity, respectively. Brown shrimp, which depends on wetlands during a phase of its life cycle, was the dominant shrimp species. Among the 13 counties in the study area, Walton County ranked 12th in the *ex vessel* value of all commercial fishery landings.

Table 199. *Ex Vessel* Landings and Value of Commercial Fishery Landings in Walton County, Florida, 1994.

	Quantity (lb.)	Total Value
Finfish		
Shark Fins	2,357	$43,651.64
Black Mullet	6,388	3,002.36
Flounder	954	1,650.42
Spotted Seatrout	917	1,100.40
Silver Mullet	474	170.64
Other Snapper	69	109.71
Triggerfish	96	88.32
Gag Grouper	39	86.97
Porgies	58	53.36
Misc. Food Fish	3	1.77
All Others	16	1.58
Total		$49,917.06
Invertebrates		
Blue Crabs	14,747	$9,562.73
Oysters	2,973	3,686.52
Spanish Lobster	156	269.88
Squid	11	4.07
Total		$13,523.20
Shrimp (Total)	12,111	23,932.95
Grand Total		87,373.21

* State average *ex vessel* price used.
Source: FDEP (1994)

Although the *ex vessel* value does not include value added in processing and distribution, commercial fishing is a relatively small component of the economic base of Walton County, where aggregate personal income was $429 million in 1993. Over the last fourteen years, commercial fishery landing has decreased by 55% while the *ex vessel* value of the catch has increased by 64%. When adjusted for inflation, the value of landings changed by 54%. (FDNR, 1980).

WAL.8 Recreational Fishing

Recreational fishing data are not collected on a county level. Recently, Milon and Thunberg (1992) and Bell (1993) estimated economic parameters for residents and tourists, respectively, that engage in saltwater recreational fishing in Florida. In Milon and Thunberg (1992), there is some regional breakdown embracing the present study area from Hernando County north to Escambia County. Such regions include both coastal and interior counties. As an approximation, these regional averages can be applied to the individual counties. Bell (1993) has only statewide averages for tourist

saltwater anglers, which are also used as an approximation. In an earlier study, Bell et al. (1982) found that expenditures and days per tourist angler for Region I (i.e., Escambia to Jefferson County) were about 40-50% higher than the statewide average. Thus, using the latest study of Bell (1993), statewide figures may be conservative.

Construction of an estimate of the number of anglers, fishing days (i.e., fishing effort) and fishing expenditures by county in the present study area started with the 1993-94 saltwater fishing licenses sold in each county. Walton County had 1,531 resident anglers purchasing a one-year fishing license. It should be pointed out that purchase of a license in a county does not ensure that one is a resident of that county, but informal conversations with Florida Dept. of Environmental Protection personnel suggest little bias is associated with that assumption. Nonresidents are those that purchased saltwater fishing licenses in non-coastal counties. Such licenses were pro-rated to coastal counties in close geographical proximity to each county, using personal judgment. Finally, tourists must purchase a license, and the number is shown for the counties in the study area. This may underestimate tourist saltwater anglers since tourists may buy a license in an interior county and use it in one of the coastal counties.

Table 200 shows the estimated number of fishermen in each of the counties within the study area. Then, Table 201 shows an estimate of fishing effort (in days) for resident/ nonresident and tourist anglers. This was done by using the days fished per year by an angler and multiplying by the number of estimated anglers in Table 200. The Milon and Thunberg (1992) and Bell (1993) estimates are shown as nine and four days (per year) for residents and tourist anglers respectively. Walton County showed a fishing effort of 21,164 days.

Finally, Table 202 is derived from Table 200 using the Milon and Thunberg (1992) and Bell (1993) estimates of annual saltwater fishing expenditures per angler of $477.70 and $440.00 for residents and tourists, respectively. The calculations indicate that saltwater recreational fishermen spent approximately $1,528,852 in Walton County in 1993-94. Many assumptions were made to arrive at these estimates, however, these figures are believed to indicate an order of magnitude and relative ranking, and may actually be conservative. That is, it is not surprising that Bay (Panama City) and Citrus (Crystal River) counties are the top two counties for saltwater recreational fishing expenditures. Multiplier effects of nonresidents and tourists were not considered.

If this fishery were damaged due to pollution or other adverse ecological factors, it would be important to know the nonmarket or user value of recreational fishing. There is no organized market for recreational fisheries, since they are common property resources. Using the contingent value (CV) method, Bell et al. (1982) have estimated the per day value of saltwater recreational fishing in northwest Florida at $41.70 and $48.67 for residents and tourists, respectively (in 1994 dollars). The annual flow of value for Walton County can be computed as follows:

Table 200. Estimated Number of Recreational Saltwater Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident[1]	Nonresident[2]	Tourist[3]
Escambia	11,004	148	6,356
Santa Rosa	6,863	148	4,121
Okaloosa	9,622	148	12,691
Walton	**1,383**	**177**	**1,781**
Bay	13,265	1,349	25,172
Gulf	1,967	1,349	4,919
Franklin	1,793	1,273	11,450
Wakulla	4,629	1,329	6,946
Jefferson	250	1,327	271
Taylor	4,583	2,176	9,360
Dixie	2,892	5,191	2,993
Levy	6,447	7,921	2,998
Citrus	11,685	6,926	5,312
Total	**76,383**	**29,462**	**94,370**

[1] Resident one year saltwater fishing license.
[2] Resident one year saltwater fishing license from interior counties.
[3] Non-resident (out of state) saltwater fishing licenses for one year; seven days and three days.

Table 201. Estimated Number of Saltwater Recreational Days (Fishing Effort) in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	100,368	25,424	125,792
Santa Rosa	63,099	16,484	79,583
Okaloosa	87,930	50,764	138,694
Walton	**14,040**	**7,124**	**21,164**
Bay	131,526	100,688	232,214
Gulf	29,844	19,676	49,520
Franklin	27,594	45,800	73,394
Wakulla	53,622	27,784	81,406
Jefferson	14,193	1,084	15,277
Taylor	60,831	37,440	98,271
Dixie	72,747	11,972	84,719
Levy	129,312	11,992	141,304
Citrus	167,499	21,248	188,747
Total	**952,605**	**377,480**	**1,330,085**

[1] 9 days per angler year and Table 200. See Milon and Thunberg (1992).
[2] 4 days per angler year and Table 200. See Bell (1993).

Table 202. Estimated Expenditures by Saltwater Recreational Fishermen in the Thirteen County Study Area, 1993-94.

County	Resident + Nonresident[1]	Tourist[2]	Total
Escambia	$5,327,310	$2,796,640	$8,123,950
Santa Rosa	3,349,154	1,813,240	5,162,394
Okaloosa	4,667,129	5,584,040	10,251,169
Walton	**745,212**	**783,640**	**1,528,852**
Bay	6,981,108	11,075,680	18,056,788
Gulf	1,584,053	2,164,360	3,748,413
Franklin	1,464,628	5,038,000	6,502,628
Wakulla	2,846,137	3,056,240	5,902,377
Jefferson	753,333	119,240	872,573
Taylor	3,228,774	4,118,400	7,347,174
Dixie	3,861,249	1,316,920	5,178,169
Levy	6,863,593	1,319,120	8,182,713
Citrus	8,890,475	2,337,280	11,227,755
Total	**$50,562,157**	**$41,522,800**	**$92,038,955**

[1] Figures in Table 200 multiplied by $477.70 per angler per year. See Milon and Thunberg (1992).
[2] Figures in Table 200 multiplied by $440.00 per angler.

Residents

(Value/day) x (days/angler) x (# Anglers):

$41.70 x 9 x 1,531 = $.57 million

Tourists

(Value/day) x (days/angler) x (# Anglers):

$48.67 x 4 x 1,781 = $.35 million.

Thus, saltwater recreational fishing generates $0.92 million per year in Walton County with a capitalized value of $307 million using a 3% discount rate (i.e., $.92 million ÷ .03).

WAL.9 Fisheries and Wetlands

Wetlands provide the carrying capacity for many fishery stocks. The main link between estuarine wetlands and marine life is through detrital export rather than wetlands for grazing. The literature indicates few attempts to link statistically marine fishery catch with estuarine wetlands. Attempts by others have suggested such a link, but in many cases failed to consider fishing effort. For the most part, estuarine wetlands are quasi-common property where actual owners cannot capture the implied rental value of such wetlands. This produces a market failure and a great incentive to convert wetlands to uses consistent with organized markets, such as residential development and agricultural use. Although estuarine wetlands perform many and varied functions useful to society, the lack of a market

for such services produces a conflict between the owners and the general public. One important contribution is to stimulate such a market where the economic value of an estuarine wetland acre can be estimated. This establishes a monetary rationale for government purchase or intervention in preserving wetlands. Such functions and estimated values of wetlands are shown in Table 203.

Bell (1989) employed the marginal productivity theory of estuarine wetland valuation to the west coast of Florida. This theory looks at the incremental contribution of estuarine wetlands to the marine fishery catch. It is recognized that estuarine wetlands together with fishing effort produce a marine fishery catch. The marginal product of an acre of estuarine wetlands, holding all other factors constant, is valued by the price people are willing to pay for the fishery product. Since this marginal value can flow into perpetuity, one may estimate the capitalized value of this flow by dividing by the discount rate. In 1984, ninety-five percent of the value of commercial fishery landings on Florida's west coast were estuarine-dependent. A production function was estimated for eight estuarine-dependent species including blue crab, grouper, red snapper, oyster, spiny lobster, shrimp and black mullet. The result indicated a strong statistical link between catch and fishing effort as it interacts with salt marsh land. This link was established using a salt marsh time series over the 1952-1976 period on Florida's west coast for seven of the eight species, with grouper being the only exception to the empirical results. The value of the marginal products (1994 dollars) for an acre of saltwater marsh was as follows: (at the means)

Blue Crab	$ .37
Stone Crab	.37
Spiny Lobster	1.31
Red Snapper	10.60
Oyster	.69
Black Mullet	3.41
Shrimp	10.60
All other species	3.10
Total	$30.29

Capitalizing this flow into perpetuity at a discount rate of 3% yields a value of the marginal acre of salt marsh to the commercial fisheries of west Florida of $1,010 at the *ex vessel* level. The value of the average acre for saltwater marsh is $5,316 (i.e., marginal value divided by its production elasticity of 0.19). Walton County has 2,700 acres of salt marsh (NOAA, 1991), which would be worth $14.3 million ($5,316 x 2,700) in fishery production alone. Negative ecological factors such as dredging or oil spills would threaten the value provided by wetlands off the shore of Walton County.

WAL.10 Non-Living Resources: Saltwater Beaches

As in the case of recreational fisheries and wetlands discussed earlier, beaches do not have well organized markets for their recreational services. As with fisheries, beaches are common property resources. However, beaches provide a resource that produces two economic effects.

Table 203. Economic Value of Wetlands.

Wetland Function	Value ($/acre/year)	Capitalized Value ($/acre at 5% discount rate)
Flood conveyance	$191	$3,820
Erosion, wind, and wave barriers	$0.44	$9
Flood storage	N/A	N/A
Sediment replenishment	N/A	N/A
Fish and shellfish habitat	$32, $66	$700-$1,320
Waterfowl habitat	$167	$3,340
Mammal and reptile habitat	$12	$240
Recreation	$6, $25, $76, $70	$120, $500, $1,520, $1,400
Water supply	N/A	N/A
Timber	N/A	N/A
Historic and archaeological use	$323	$6,480
Educational and research use	$6	$120
Water quality improvement	N/A	N/A

Source: Robert Anderson and Mark Rockel, 1991, Economic Valuation of Wetlands, Discussion Paper No. 065, American Petroleum Institute, Washington, D.C.

First, they draw tourists into the local community, thereby becoming an important component of the economic base discussed earlier. Second, beaches provide user value to residents and tourists. Although a beach's user value is not traded in a traditional market for services, it can still be measured through such techniques as the travel cost method (TCM) and/or the contingent value (CV) method. Saltwater beaches are an integral part of the marine ecosystem which can be damaged by erosion, debris, oil spills and other toxic discharges into coastal waters. Table 204 lists the key beaches for this county.

In 1984, Bell and Leeworthy (1986) estimated expenditures per day of $12 (1994 dollars) and $30 (1994 dollars) for residents and tourists, respectively, on saltwater beach-related costs such as lodging, food and drink, etc. in Pensacola, Florida. These estimates will be used for all counties in the study area as an approximation since no recent studies have been undertaken.

Using the CV technique, Leeworthy, et al. (1989) found that Escambia, Franklin and Bay Counties had an averaged user value of about $3.0 per day (in 1994 dollars) for residents and tourists. In a comprehensive study of Florida beaches, the University of West Florida (1985b) projected that Walton County would have 239,440 saltwater beach days per year in 1990 for the beaches listed in Table 204. By multiplying the user value per day of $3 times the estimated number of saltwater beach days, the annual flow of value is $718,320. These are not actual expenditures, but an estimate of annual recreational benefits to beach users. The capitalized value of this value

Table 204. Key Saltwater Beaches in Walton County, Florida.*

Western District
Environmentally Endangered Lands:
Miramar Beach
Four Mile Village
Beach Highlands
Dune Allen Beach
Blue Mountain Beach
Eastern District
Grayton Beach State Recreational Area
Seagrove Beach
Phillips Inlet Area

*In Walton County alone, the University of West Florida (1985b) reported 17 individual saltwater beaches which were 3 miles in length and 1.2 million square feet (public and private).

Source: University of West Florida (1985a)

flow at a real discount rate of 3% is over $23.4 million – the asset value of the beach. Finally, beach-related spending in Walton County in 1990 can be calculated in the following manner [with the percentage of residents and tourists taken from the University of West Florida (1985b) study]:

Residents

(% Residents) x (Beach Days/Yr.) x (Expenditures/day)

.36 x 239,440 x $12 = $1.03 million

Tourists

(% Tourists) x (Beach Days/Yr.) x (Expenditures/day)

.64 x 239,440 x $30 = $4.6 million

Combined, it is estimated that saltwater beaches in Walton County attracted $5.63 million in beach-related spending in 1990. Tourists accounted for 82% of this spending.

Three ecological resources have been identified that are an asset to Walton County and induce a considerable level of economic activity in this region. These values are summarized in Table 205.

WAL.11 Man-Made Resources: Water Dependent

As discussed above, many economic activities such as fisheries and beaches in the marine ecosystem are water-dependent. To take advantage of the marine ecosystem in terms of outdoor recreation which has considerable economic value, man-made facilities or resources have been constructed. The Growth Management Act of Florida mandates that counties should give preferences in land planning to water-dependent facilities. Table 14 is an inventory of these water-dependent facilities in Walton County. Piers, boardwalks and jetties facilitate bank recreational fishing, beach use and other outdoor recreational activities.

Table 205. Spending, Annual User Value and Asset Value of Selected Ecological Resources in Walton County, Florida.

Resource/Activity	Spending (Millions)	User Value Per Year[1]	Asset Value (Millions)[2]
Commercial Fishing	$.09[3]	N/A	N/A
Recreational Fishing	$1.5[4]	$.92[5]	$30.7[5]
Saltwater Marsh[5]	N/A	.207[6]	14.3[6]
Saltwater Beaches	$5.63[6]	$.718[6]	$23.4[6]
Marine Boating[7]	N/A	$.156[7]	$5.2[7]

[1] Nonmarket value per year
[2] #1 divided by .03 = Asset Value
[3] Table 199, *ex vessel* price
[4] Table 202, retail price
[5] To commercial fishery landings only
[6] See text for discussion
[7] See Table 207

Table 206. An Inventory of Marine-Related Recreational Facilities in Walton County, Florida, 1995 (Public and Private).

Facilities	Inventory
Fishing	
1. Piers	
a. Number	1
b. Length (all) (LFT)*	300
2. Boardwalks/Catwalks	
a. Number	5
b. Length (all) (LFT)*	1,025
3. Jetties	
a. Length (all) (LFT)*	0
Boating	
1. Boat Ramps	
a. Number	10
b. Total Lanes	12
2. Marinas	
a. Total	4
b. Slips/Moorings	223
c. Dry Storage	168

*LFT = Linear Feet
Source: Bureau of Recreation and Parks (1995)

Walton County has 12 saltwater boat ramp lanes and 391 wet slips and dry racks, as shown in Table 206. The number of private docks from which to launch pleasure craft is unknown. Combining data from Bell et al. (1982) and Bell (1995), the annual user value from boating in the Gulf of Mexico off Walton County is estimated and shown in Table 207. This value is about $0.16 million.

Table 207. Estimation of the Annual User Value for Saltwater Boating Off Walton County, Florida, 1993-94.

Facility
Annual User Value = $/day x Pleasure Craft x Percent Use x Days Boated/Yr. (Marine)
1. Marinas $55,608 = $5.02[1] x 2,374[2] x .19[3] x 25[4]
2. Boat Ramps $58,851 = $1.48[1] x 2,374 x .67[4] x 25
3. Private Docks $41,711 = $5.02[5] x 2,374 x .14 x 25
Total Annual User Value = $156,170

*Asset Value = 156,170 ÷ .03 = $5.2 million
[1] Bell (1995), Florida-wide value
[2] FDEP (1992), Walton County
[3] Bell et al. (1982), northwest Florida
[4] Bell (1995), Walton County
[5] Assumed $/day same for marinas and private docks

Recreational boating in marine waters is rapidly growing in Walton County. Such boating can affect coastal water quality (e.g., inadequate pumping out facilities) as well as adding user value to those using coastal water resources. From the FDEP (1983-1992) and Bell (1995) studies, pleasure boat registrations in Walton County grew as follows, with projected (P) numbers included:

1983	2,104	
1984	2,043	
1985	2,062	
1986	2,176	
1987	2,276	
1988	2,357	
1989	2,449	
1990	2,365	
1991	2,276	
1992	2,374	
2000	3,010	(P)
2005	3,587	(P)
2010	4,274	(P)

WAL.12 Water Quality, the Ecosystem and the Economy

The interaction of the local economy and the marine ecosystem is manifested in the water quality surrounding the region. Florida's major surface water quality problems come from urban stormwater runoff, agricultural runoff, domestic wastewater, industry wastewater, and hydrological changes such as draining and filling wetlands.

There are three sources of information on local water quality surrounding Walton County. First, the Federal Water Pollution Control Act requires the state to prepare a 305(b) technical report on the status and trends in surface water quality. Second, the EPA Toxic Release Inventory (TRI) provides information on toxic and other chemical discharges by firms into surface water. Third, the acreage of shellfish harvesting that is prohibited from fishing is an indicator of high bacterial counts in the water. These three sources of information will give a profile of surface water conditions in Walton County.

Two indices are used in the 305(b) report for measuring surface water quality: the stream water quality index (WQI), and the lake/estuary Trophic State Index (TSI). Both are of interest to this study simply because streams flow into Gulf of Mexico estuaries. The TSI measures estuarine water quality that is critical to fish and wildlife. The WQI summarizes information from six categories including water clarity (turbidity and total suspended solids), dissolved oxygen, oxygen-demanding substances (BOD), nutrients, bacteria and macroinvertebrate diversity. The TSI measures the potential for algal or aquatic weed growth. Although the present emphasis is on the marine environment, the TSI can be used in Florida estuaries to describe their water quality, even though the TSI is more widely used for freshwater lakes. The WQI and TSI are constructed so they run from zero to 100 with larger values indicating declining water quality.

The geographical analysis of the 305(b) report is formulated by river basins, but this analysis is restricted to bays and some critical rivers because of this study's emphasis on the marine environment and how this ecosystem interacts with the economy of the area. For Walton County, Choctawhatchee Bay and St. Andrews Bay Basin have been selected for a brief summary of the current state of water quality in this region of the study area.

The Choctawhatchee Bay lies within the peninsula, south of Walton County. There is little interaction between the Gulf of Mexico and the bay, with only one inlet, East Pass, which is on the western side of the bay. Major populations include Eglin Air Force Base in the northern area of the basin, Ft. Walton Beach on the eastern shore and Destin on East Pass. Major pollution sources are primarily from the rapid growth of the county along the peninsula. Highway runoff, ditching and drainage of wetlands, and discharges from waste water treatment plants also contribute to the deterioration of water quality. Water quality has traditionally been good, but a few occurrences of fish kills and some grass bed die-offs have been reported. One endangered species of fish, the Okaloosa Darter, lives in the streams which drain into some of the county's bayous.

The St. Andrews Bay Basin only has three of its sites in Walton County, with Lake Powell being the most significant of the three. This lake is considered interesting because it contains both freshwater and saltwater characteristics. Recently it was designated as an Outstanding Florida Water. The rest of the basin lies in Bay County. The WQI and TSI for selected areas in the county are listed in Table 208.

The TRI is an annual summary of discharges to surface water, as well as other kinds of discharges (e.g., airborne). Table 209 indicates that in 1994 there was one company, Showell Farms, which was discharging toxic substances in and around the surface water of Walton County. These discharges may be highly variable from year to year. Shellfish harvesting has been closed in 27,488 acres, and opened conditionally in 68,007 acres, in the Choctawhatchee Bay, indicating that there have been significant coliform counts in almost 30% of the shellfish beds.

Table 208. Water Quality Indices for Selected Areas of Walton County, Florida.

Water Areas: Pensacola Bay		**Water Quality Indices***	
Water Body Type: Estuary		WQI	TSI
14	Indian Bayou	--	47
17	Choctawhatchee Bay	--	38
18	Joe's Bayou	--	52
23	Choctawhatchee Bay	--	35
37	Alaqua Creek Outlet	--	46
41	Alaqua Bayou	--	50
44	Basin Bayou	--	45
Water Body Type: Lake			
10	Lake Oyster	--	51
Water Body Type: Stream			
28	Lagrange Bayou	33	--
52	Lafayette Creek	24	--
70	Magnolia Creek	11	--
74	Watering Creek	17	--
75	Alaqua Creek	34	--
86	Rocky Creek	23	--
89	Little Alaqua Creek	22	--
Water Areas: St. Andrews Bay Basin			
Water Body Type: Lake			
34	Lake Powell	--	24
41	Western Lake Outlet	--	26
Water Body Type: Stream			
37	Direct Runoff to Bay	31	--

* Higher values indicate lower water quality

Table 209. Toxic Chemical Releases Into Surface Water by Firms Located in Walton County, Florida in 1994.

	Company	**SIC**	**Discharge**	**Main**[1]
1.	Showell Farms	2,015	10	Chlorine

[1] Leading chemical released based on pounds.

A.Source: EPA Toxic Release Inventory, unpublished data, 1994.

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