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An Economic Analysis of the Importance Of Saltwater Beaches in Florida

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FLORIDA SEA GRANT COLLEGE

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Executive Summary

Economic Impact

Resident Saltwater Beach Users

(1983-84: 12 Months)

1. Of the Florida residents 18 years and older, 65 percent or 5,217,807 use Florida saltwater beaches at some point during the year;
2. The resident saltwater beach users spend over 76 million days at the beaches which generates beach-related sales of over $1.1 billion in Florida;
3. The resident beach-related sales support an estimated 36,619 jobs with an annual payroll of over $240 million;
4. Beach-related sales generate over $65 million in direct States taxes;
5. From a Socioeconomic point of view, resident beach users tend to have higher household income, live closer to coastal beaches and exhibit a higher percentage of white individuals than Florida's general population 18 years and older. Also, older residents and those living longer in Florida participated in beach use less than the general population.

Tourist Saltwater Beach Users

(1984)

1. Of the Florida tourists 18 years and older, 33.87 percent or approximately 8 million use Florida saltwater beaches at some time during the year;
2. The tourist saltwater beach users spend over 69 million days at the beaches which generates beach-related direct sales of $1.15 billion in Florida;
3. The tourist beach-related direct sales support an estimated 47,546 jobs with an annual payroll of nearly $287 million;
4. Beach related direct sales generate over $57 million in State taxes;
5. In contrast to residents, the tourist dollar has a multiplier impact on the Florida economy which produced induced sales, employment, wages and taxes. Using a conservative multiplier of 3, it is estimated that $2.3 billion in induced sales generate 95,092 jobs with an annual payroll of nearly $574 million. Induced State taxes are estimated at about $41 million;
6. In total, beach using tourists create over $3.4 billion in sales supporting 142,638 jobs with an annual payroll of over $860 million. Total estimated State taxes generated from beach related tourist economic activitiy are nearly $99 million.

<u>Resident and Tourist Saltwater Beach Users Combined</u>

1. During 1984, over 13.2 million residents and tourists used Florida saltwater beaches;
2. Residents and tourists spent an estimated 146 million beach recreational days of which 48 percent were accounted for by tourists;
3. Residents and tourists generated direct and indirect beach-related sales of $4.581 billion or 2.8 percent of gross sales in the State of Florida;
4. The sales generated by residents and tourists created an estimated 179,256 jobs or 4.1 percent of Florida employment;
5. In turn, the jobs created by beach-related sales generated an annual payroll of $1.1 billion or 2.3 percent of all wages and salaries in Florida;
6. Residents and tourists generated enough beach-related business to raise over $164 million in revenue for the State of Florida or 2.8 percent of total state tax collections;
7. Tourist beach users are dominated by males as compared to residents where beach use is evenly divided among the sexes. Tourist household income is higher than resident household income but the gap is narrower based upon per capita income because tourists have larger household sizes than residents. There is no significant age difference between residents and tourists, with average age for each 45 years old from a population of those 18 years or older.

<u>Economic Valuation</u>

<u>Theory</u>

1. Since beaches are common property resources, there is no <u>overt</u> market price; therefore, indirect methods must be used to estimate the value of a recreational beach day;
2. Beaches will have a value equal to the area under the aggregate demand curve, which is called consumer's surplus;
3. Contingent Valuation (CVM) Method is an interviewing process by which consumers are asked questions on their willingness to pay for a recreational day, thereby yielding estimates of consumer's surplus;
4. A second method of estimating consumer surplus is by the estimation of a demand function for beach days where expenditures per day is used as a surrogate for price;

5. Consumer surplus or the value of a beach day to the consumer may be approached by estimating equivalent (i.e., willingness to pay) and compensating (i.e., willingness to sell) variation using the demand function approach;

Empirical Results

1. Using survey data, 69 percent of the residents perceive Florida saltwater beaches as moderately or severely crowded. Over one third of the residents felt that parking was inadequate for beach use. Overwhelmingly, residents felt that coastal waters were clean and beaches attractive;
2. Using survey data, a little over 43 percent of the tourists felt that saltwater beaches were moderately or severely crowded. Only 12 percent of tourist beach users felt that parking was inadequate. Practically all tourists were satisfied with water quality and beach appearance;
3. The typical beach in Florida is about 5,500 linear feet; 175-200 feet in width and approximately 1,000,000 square feet based upon a sample of one-half of public beaches;
4. The typical beach has about 425 square feet of beach per user per day with considerable variation from beach to beach;
5. The typical beach has about one-third of a parking space per user per day;
6. The typical beach has about 15 of 23 designated facilities (i.e., parking, restrooms, lifeguards, etc.);
7. Based upon a survey sample, residents were willing to pay $1.31 per day for a beach day; however, 29 percent were willing to pay nothing for the recreation experience. This per day value may to be seriously biased downward;
8. Tourists were willing to pay $1.45 per day for a beach day; however, 38 percent were willing to pay nothing for the recreation experience. This may be seriously biased downward;
9. Variation in willingness to pay among beach users can be explained by income, number of beach days; tastes; availability of substitutes and beach characteristics;

10. Variation in beach days (i.e., demand function) can be explained by a proxy for price or expenditures per day, income, substitute activities, age and beach perceptions.
11. From the demand function, user value or consumer surplus per day varied from $10.23 for residents to $29.32 for tourists;
12. Depending on whether willingness to pay or consumer surplus from the demand function was used, the property or asset value of Florida saltwater beaches could vary from $2 to $28 billion.

Policy Issues

1. The regional economic impact of a beach on a county, for example, may be estimated for most beaches in Florida using a cross-section equation that predicts expenditures per day for tourists and residents. To do a complete regional impact, data from the existing sample, extraneous data and existing data from various state agencies can be used as detailed in the text;
2. A value of a day for an individual beach may be estimated using sub-sample data or a cross-section regression relating beach values per day to various independent variables. Illustrations of this procedure for both the willingness to pay and demand functions are illustrated for selected Florida beaches;
3. The findings on beach valuation may be used in beach renourishment projects with comparatively little research cost to compute "benefits." A hypothetical model is given in the text;
4. The measurement of beach values throughout Florida may serve as an important baseline in the case of oil spills. Increasingly, consumer surplus is becoming acceptable as a legal basis for compensatory damages to state property or property over which the state has perview;
5. Beach values may be helpful in the beachfront acquisition program since beach values (i.e., consumer surplus) may be used to compare to beach acquisition cost to efficiently use state dollars;
6. Beach access is an important policy issue. It was not found that existing variation in beach access was linked to willingness to pay or demand for beach days.

7. With respect to crowding, it was found that a beach standard somewhere between 50 and 100 square feet per person may yield maximum consumer satisfaction using willingness to pay as a criterion. The Florida Department of Natural Resource "standard" of 200 square feet may be excessive leading to an under estimation of beach carrying capacity, a critical beach management and beach acquisition statistic;
8. Measures of user value or consumer surplus may be helpful in establishing coastal construction setback lines where the estimation of recreational benefits from increasing beach areas are critical to decision making.

Chapter 1

Introduction

The Florida economy is highly dependent on natural resources. Beaches are one of the natural resources which has made Florida a mecca for outdoor recreation seekers from all over the world. Florida's abundance of natural resources and pleasant climate have resulted not only in its reputation as a national and international vacation spot but also as a popular location for permanent retirement communities. The purpose of this report is to engage in an extensive economic analysis of the importance of saltwater beaches to Florida's economy. The reasons for this analysis are many. Due to natural processes, such as storms and littoral drift, and man-made structures such as inlets which accelerate the beach erosion process, some consider Florida's beaches to be a declining resource. To make matters worse, beaches are also common property. That is, all people can use the resource without paying a fee. Therefore, private individuals do not have the incentive to invest in beach preservation or restoration since the amount invested cannot be recovered by the investor, since everyone has a right to use it without charge. This is essentially the reason government intervention is required to fund the preservation and restoration of Florida's beaches. Before government can undertake such projects, the economic benefits must be estimated as part of a benefit-cost analysis. One of the objectives of the research reported here is to quantify economic benefits received by residents and tourists who use Florida's saltwater beaches. Another objective is to report the economic impact of the saltwater beach resource in terms of sales, employment, wages and taxes generated by beach users.

There is an important distinction between "economic impact" and "economic valuation." Economic impact considers how many people participate in beach activities and how much they spend while recreating. These expenditures create jobs and income for people who directly and indirectly depend on beaches for their livelihood. Economic valuation attempts to measure the benefits received by beach users or the value people place on a day at the beach. Why are separate estimates of economic impact and economic valuation necessary? The answer is that economic valuation estimates are the proper measure of the benefits received by beach users and, therefore, the proper measure to compare with the cost of beach projects (e.g., renourishment).

Economic impact relates to the sales, employment, wages and taxes generated by people using saltwater beaches for recreation. Such an analysis is important to a regional economy such as Florida where beach resources are important in generating jobs and income.

Curtis and Shows (1982, 1984) have conducted economic studies for several beaches in Florida. For Delray Beach, Florida these authors (1982) estimated the recreational benefits (i.e., beach users' willingness to pay to use Delray Beach for a full day) to be over $3 million a year. This is an example of economic valuation. They also estimated that out-of-state visitors to Delray Beach spend over $26.6 million, which has a total economic impact of supporting 966 jobs and generating tax receipts (i.e., state and local) of nearly $1.4 million. This is a good example of the economic impact of a particular beach in Florida. This report will analyze a substantial sample of all beaches in Florida so that all the beach resources may be studied with respect to economic valuation and impact. One hypothesis is that a generalized model of beach valuation may be developed so that individual studies of particular beaches at considerable cost may not be necessary. Or, in a case where funds are unavailable, the valuation procedure developed here may be a useful approximation for a particular beach area in Florida. From time to time, the works of Curtis and Shows (1982, 1984) shall be compared with the generalized results obtained in this study.

Chapter 2 addresses the dimensions of resident saltwater beach use including the number of participants, demographic profile of participants, total recreational beach days and the economic impact. Chapter 3 is devoted to tourist use of beaches in much the same way as residents except the multiplier impact of the injection of tourist dollars into the state's economy is considered. In Chapter 4, the economic impact of both residents and tourists is combined so that the reader may evaluate the total economic impact of beach-related spending. Chapter 5 addresses the theoretical and empirical approaches to beach valuation. In Chapter 6, willingness to pay and demand functions for saltwater beaches in Florida are used to estimate the value of a recreational day at the beach. Two methods of measuring the value of beaches are compared using data collected from residents and tourists. Finally, in Chapter 7 the results of this study are applied to selected beach policy issues such as renourishment, access, overcrowding and acquisition. To highlight the difference between economic impact and valuation, this report has been divided into two parts. The first part contains Chapters 2-4 which look at the economic impact of Florida's saltwater beaches while the second part deals with economic valuation or Chapters 5-6. Chapter 7 explores the use of economic impact and valuation within the context of fundamental policy issues involving beaches today and possibly in the future.

Part 1

Economic Impact of Saltwater Beaches in Florida

Chapter 2

The Economic Impact of Resident Saltwater Beach Users

Methodology, Sample Design and Economic Impact

The first step in estimating the economic impact of beach users requires an estimate of how many people visit Florida's beaches. The second step is to find out on average how many days beach users visit beaches annually and on average how much they spend while visiting Florida's beaches. Given these two estimates, it is then easy to determine the total sales impact. The next step is to determine how many people depend on the beaches for their livelihoods and how much income (wages) they receive. Also from the sales information one can derive estimates of various tax revenues received by state government. Taxes generated locally will not be considered in this study since they vary from locality to locality while this study is statewide in nature.

To complete step one for the resident population of Florida two telephone surveys were conducted by the Policy Sciences Program at Florida State University under the guidance of the authors. The first survey was a random sample of over 1,000 residents age 18 years of age or older and was part of a regularly implemented state public opinion poll.[1] This survey asked only one question of the respondent about beaches, simply, "Did they visit or use any of Florida's saltwater beaches over the past 12 months?" Seventy percent of the sample indicated they visited or used a beach at least once in the past 12 months. The purpose of the first survey was to obtain a beach participation rate for residents in order to estimate the expected number of necessary

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[1] The decision to make a telephone survey was partially dictated by a budget constraint, but also by the efficiency of this method of obtaining information. The survey procedure is called two stage random digit dialing. In the first stage, a large sample of households telephone numbers are obtained. The purpose here is to screen out businesses, government, etc. The second stage is a random dialing of households (i.e., obtained in stage 1). The survey was conducted so that anyone in the household who was a saltwater recreational beach user had an equal chance of being selected providing he or she was 18 years or older. Thus, the sampling was restricted to "adult" recreational beach users. This is an important point to note since it restricts the sample to a sub-population of the state of Florida. The reason for making this decision is that individuals under 18 might not have either the information or sophistication to answer survey questions. Consequently, the estimated economic impact will include only adults.

contacts and associated cost for achieving a large enough sample for statistical reliability in the second or main survey.

To complete the second step of estimating the economic impact, a more extensive survey of beach users was designed. Again, the Policy Sciences Program at Florida State University was utilized by attaching a series of questions to the regularly implemented statewide public opinion poll conducted in March of 1984. The survey questions are shown in Appendix A.1. This second survey was a random sample of 911 residents 18 years of age or older in Florida of which 592 indicated they visited or used a saltwater beach in Florida sometime in the past 12 months. This second survey indicated that 65 percent of the resident population 18 years and older were beach participants in contrast to 70 percent in the first telephone survey discussed above. The Florida Department of Natural Resources or DNR (1981) reports an all resident participation percent for saltwater beach activities of 70.9 percent; however, the 65 percent figure will be used in this study as a "conservative estimate." Then, the estimated Florida's population 18 years of age and older in 1983 (8,027,395), published by the Bureau of Economic and Business Research at the University of Florida, was multiplied by the estimate of 65 percent participation in beach use to arrive at a total of 5,217,807 resident beach users 18 years of age and older in Florida in 1983. This is the first item found in Table 2.1. Those that visited one or more of Florida's saltwater beaches were asked additional questions as to what beaches they visited, how many days were spent at each beach, their personal perceptions as to parking conditions, physical appearance, water conditions and crowding conditions. The survey also ascertained the annual expenditures while recreating at Florida's saltwater beaches. The results from some of these questions will be discussed elsewhere in this report.

Analysis of the data indicated that, on average, residents of Florida spend 14.68 days per year recreating on Florida's beaches.[2] Multiplying this by our previously derived estimate of beach users (from step 1 above) yields a total of 76,597,407 resident beach user recreational days. This is item 2 in Table 2.1.

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2 The median days were used as a measure of central tendency because many residents reported spending a large number of days at the beach. These outliers had tremendous impact on the mean.

Table 2.1

A Summary of the Economic Impact of Resident Saltwater Beach Use in Florida, 1983-84 (12 months)
(Sample Size: 592)

(1) Number of Beach Users
18 years or older..5,217,807
(65 percent of Florida's Population 18 and over or 8,027,395 participated in beach use)

(2) Total Days at Florida's Beaches..........................76,597,407
(14.68 median days per person x 5,217,807)

(3) Number of Households Which Visted Florida's
Beaches..2,496,558
(5,217,807 ÷ 2.09 average number of adults 18 years or older in household)

(4) Total Sales Impact
(2,496,558 x $450 or average annual household expenditures while visiting beaches)....................................$1,123,451,100

(5) Total Employment Impact (Derived from Table 2.2)..............36,619

(6) Total Wages Generated (Derived from Table 2.2)..........$240,757,124

To estimate annual beach-related expenditures, annual household beach-related expenditures were obtained from the survey. Thus, in order to arrive at an estimate of total expenditures or sales on beach related activities the total number of beach users 18 years of age or older was divided by the average number of adults 18 years of age or older in each household in the sample. This yielded an estimate of 2,496,558 households which visited Florida's beaches (item 3, Table 1). If this figure is multiplied by the average annual household expenditure while visiting saltwater beaches of $450, an estimate of the total beach related sales impact of over one billion dollars in 1983-4 (item 4, Table 2.1) is obtained.[3]

The final steps to complete the estimates of resident economic impact utilized the total sales impact figure derived above. Table 2.2 illustrates how the sales impact can be translated into employment and wage impacts. Column one of Table 2.2 shows the SIC (Standard Industrial Classification) numbers associated with each expenditure category. Sales to employment ratios and wages to employment ratios are available for Florida by SIC from the U.S. Bureau of Census, The Economic Censuses for Florida 1982. These ratios are presented in columns 4 and 6 respectively. Referring to Table 2.2, dividing lodging expenditures (SIC 7011) of $313,617,616 by the sales to employment ratio for SIC 7011 of $27,793 yields an estimate of over eleven thousand people in the hotel, motel and lodging industry that depend on resident beach users for their livelihoods. These people earned an average of $7,360 (column 6) for a total wages impact of over 83 million dollars in the hotel, motel and lodging industry. Repeating this procedure for each expenditure category yields a total employment impact of over 36 thousand employees earning over

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[3] To derive beach-related expenditures, the respondent was asked to estimate how much was spent by the household while visiting Florida's coastal beaches in five categories: (1) Hotel/Motel; (2) Food and Drink; (3) Travel to and from the beach; (4) Beach Access Fees and (5) Other beach-related expenditures. The respondent was also asked what percent of the time was actually spent on the beach. This percent of Hotel/Motel and Food and Drink expenditures was attributable to the beach along with 100 percent of categories (3) - (5). Finally, travel cost to Florida for tourist (See Chapter 3) was added after prorating total travel cost by first days spent in Florida and then time spent at the beach. For residents, travel costs were restricted to category (3) listed above. Details of these calculations can be obtained from the authors.

Table 2.2

Total Sales, Employment and Wages Generated by Resident Saltwater Beach Users in Florida, 1983-84 (12 months)

SIC	Category	Sales Impact (Dollars)	Sales to Employment Ratio	Employment Impact	Wages to Employment Ratio	Wages Impact (Dollars)
7011	Lodging	$ 313,617,616	$ 27,793	11,284	$ 7,360	$ 83,050,240
5812 & 5813[1]	Food & Drink	449,979,614	21,823	20,619	5,440	112,167,360
5541	Travel	252,152,358	162,444	1,552	8,282	12,853,664
Public Parks[2]	Beach Access Fees	22,144,469	12,126	1,826	12,028	21,963,128
5311	Other	85,557,043	63,936	1,338	8,014	10,722,732
	Total	$1,123,451,100	N/A	36,619	N/A	$240,757,124

[1]Sales to employment and wages to employment ratios are averages for SIC 5812A, 5812B, and 5813.

[2]Sales to employment and wages to employment ratios were derived using receipts, employment and wages for selected state parks which have beaches. Personal correspondence with James Cook, Deputy Director, Parks & Recreations, DNR.

240 million dollars in wages. This is .8% of total employment in Florida. Remember this is just the impact of resident beach users.

An additional important impact should be emphasized, the tax revenues collected by the State of Florida due to spending by resident beach users while visiting Florida's beaches. Table 2.3 shows the estimates of three taxes which were estimated using the sales information given in Table 2.2. Resident beach users alone generated over 65 million dollars in tax revenues for the State of Florida. A discussion of how the tax estimates were calculated is contained in Appendix A.2.

During the 1965-83 period, the State of Florida spent approximately 32 million dollars on beach renourishment whereas resident beach users alone generated over 65 million dollars in State tax revenues while visiting Florida's beaches in just one year (1983-84)! Of course, most taxes are not levied for such specific purposes but are used for general revenue to support a broad range of programs. The existence of beaches does give rise to a segment of Florida's taxes. If beaches were not available, Floridians might simply purchase some other recreational experience in Florida. This might lead to temporary dislocations of employment and investment of capital. However, if Floridians chose to purchase recreational services (e.g., beaches), in Georgia or Alabama, the State of Florida might suffer significant losses in business and corresponding losses in state revenue!

A Demographic Profile: Who Are the Beach Users?

For the Florida resident survey, what is the demographic profile of the "typical" saltwater beach user? The following demographics were obtained.

1. Race
2. Household Income
3. Sex
4. Age
5. Household Size
6. Years Lived in Florida
7. Percent who live in Coastal Counties

Table 2.3

Estimated State Tax Revenues Generated By Resident Saltwater Beach Users In Florida, 1983-84 (12 months)*

Spending Category	Sales Taxes	Gasoline Taxes	Corporate Profit Taxes	Total
Lodging	$ 14,934,172	N.A.	$ 708,332	$ 15,642,504
Food & Drink	21,427,600	N.A.	505,984	21,933,584
Travel	13,872,765	$ 8,770,517	64,860	22,708,142
Beach Access Fees	N.A.	N.A.	N.A.	N.A.
Other	4,074,145	N.A.	742,756	4,816,901
TOTAL	$ 54,308,682	$ 8,770,517	$ 2,021,932	$ 65,101,131

* For description of the methodology used to make these estimates, see Appendix A.2.

Table 2.4 shows the demographic profile of the beach users compared to the general population. Compared to the general population, resident saltwater beach users are younger; have a higher household income; show a higher percentage of whites; have a greater percent that live in coastal areas and have lived in Florida less years. Of course, these conclusions are derived from rather simple demographic data shown in Table 2.4. There is a more rigorous way of testing for the difference between the sub-population of beach users and the general population 18 years and older. The following statistical model was used:

(1) D = f (HY, COS, RACE, YFL, AGE)

where

D = dummy variable: 1 if beach user; 0 if not a beach user;

HY = household income;

COS = dummy variable: 1 if live in coastal county; 0 if live in non-coastal county;

RACE = dummy variable: 1 if white; 0 if nonwhite;

YFL = number of years lived in Florida

AGE = age of respondent

Of the 911 individuals interviewed, 838 useable responses were available to test the statistical significance of the demographic variables listed above in influencing the participation rate or dummy variable, D. Equation (1) was specified as a linear model and estimated using ordinary least-squares. The following results were obtained:

$$\text{(2)}\quad D = .6595 + \underset{(6.30)}{.044HY} + \underset{(2.28)}{.0735\ COS} + \underset{(3.65)}{.176\ RACE} - \underset{(-1.60)}{.00147\ YFL} - \underset{(-9.37)}{.00825\ AGE}$$

$\bar{R}^2$ = .19; F = 40.7; N = 838 and t - values are in parentheses.

The results indicate that all the explanatory variables are statistically significant at the one percent level except YFL and exhibit the hypothesized sign as surmised from the preliminary data in Table 2.4. The authors are aware that the OLS estimation of equation (1) is subject to econometric criticisms. See Judge et al (1982, p. 528). A logit procedure of estimation was not used because of the considerable expense and controversy associated with this procedure. See Smith and Munley (1978). The OLS is a simplified procedure for testing the statistical significance of demographic variables that might influence beach participation within the sample data. From this

Table 2.4

A Comparison of the Socioeconomic
Profiles of the General Resident Population
and the Resident Beach Going Population
In Florida, 1984
(18 years and Older)

	General Population	Beach Visitors
Race		
White	88.7%	92.2%
Black	10.0%	6.4%
Other	1.3%	1.4%
Household Income		
under $ 5,000	7.3%	4.4%
$ 5,000 - $ 9,999	11.2%	7.3%
$10,000 - $14,999	14.3%	12.2%
$15,000 - $19,999	14.6%	15.5%
$20,000 - $24,999	13.5%	13.8%
$25,000 - $29,999	12.4%	13.3%
$30,000 - $40,000	11.2%	13.7%
over $40,000	15.6%	19.9%
mean	$ 23,785	$ 26,045
Gender		
Male	46.4%	49.7%
Female	53.6%	50.3%
Age (mean)	47.8	43.5
Household Size		
(mean)	2.636	2.754
Years Lived in Florida (mean)	22.08	19.88
Percent who live in Coastal Counties	69.33%	71.70%

SOURCE: Florida State University
Florida Annual Policy Sciences Survey, March 1984

analysis, it can be stated that the following demographic factors contribute to or detract from beach use:

1. Positive Factors
   - Higher household income
   - Greater proximity to the coast
   - Greater the percentage white
2. Negative Factors
   - Older the population
   - Longer residency in Florida (statistically significant at 10 percent level)

A numerical use of equation (2) can be illustrated. For example, at the margin the beach participation rate is 7.35 percentage points higher for those Florida residents in coastal areas than noncoastal areas. The beach participation rate is 17.6 percentage points higher for whites than nonwhites. Participation equations may be used to project the demand for beach use as socioeconomic characteristics change. Also, such analysis is useful for targeting advertising of products for beach users and a variety of other commercial uses.

Chapter 3
The Economic Impact of Tourist

Introduction

Estimating the economic impact of tourist beach users is somewhat different than the economic impact of their resident counterparts analyzed in Chapter 2. Because tourists bring in new dollars to the state, economists view tourism as an export industry. Nothing is actually shipped out of the state but services are provided in exchange for dollars flowing into the economy. These new dollars have a direct impact identical to that outlined in the analysis of residents. The difference is that tourist dollars have a "multiplier effect" which is limited by the extent to which the money leaves the economy. The multiplier creates what economist call "induced sales, employment and wages" which are added to the direct impact to arrive at the total impact.[1]

Methodology, Sample Design and the Participation Rate

To estimate the economic impact of tourist saltwater beach users, a survey questionnaire was designed and Rife Market Research, Inc. of Miami, Florida was employed to interview tourists as they left the State of Florida on all major highways and at all the major airports. Rife surveys tourists for the Florida Department of Commerce's Division of Tourism. The beach survey piggybacked this process in order to reduce costs. The survey was started in January and completed in November 1984.

The tourist survey instrument is shown in Appendix A.3 along with a map of Florida's coastal counties and associated saltwater beaches. This map was used by the telephone interviewers in the resident survey discussed above as a guide. Most residents are familiar with the beaches; however, tourists were actually shown the maps by the interviewer on a face to face basis. Thus, the map was a vital instrument in the tourist survey since tourists are not likely to be as familiar with the location of beaches they visited as residents.

As with residents, an estimate of how many tourists participate in beach use in Florida is required. The key is to estimate the participation rate.

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[1] Induced impacts presented here include the indirect (input industries) and induced (second round income spending) effects that are similar but not identical to more sophisticated and costly Input-Ouput Models.

The questionnaire was designed with a tally sheet on the front so the interviewers, while contacting the general tourist population, could ask if the tourists contacted used or visited a beach in Florida over the last 12 months. If the tourist responded "no," a tick mark was recorded in the appropriate column, and if they responded they "did participate" but for some reason could not be interviewed this was also recorded. Of course, the third response was "yes" and they were interviewed. These tally sheets were used to estimate the percent of all tourists who participate in beach use. 4,333 tourist contacts were made over the months of 1984. Only 1,425 indicated that they used or visited coastal beaches for a gross participation rate of 32.89 percent. The Florida Department of Natural Resources (1981) reports that for the year 1979, 86.2 percent of tourists participated in "saltwater beach activities." The DNR study is at considerable variance with the findings reported by this study; therefore, a closer analysis of the gross participation rate was made. Table 3.1 shows the number of questionnaires received by site from Rife Marketing Research.[2] The contacts made by Rife Marketing Research were more heavily weighted toward the airport mode of tourist travel than that shown by the Division of Tourism for the general tourist population. An analysis of the data collected in this study indicated a lower beach participation rate for air travelers. To correct for possible bias, the air and auto beach participation rates were multiplied by the air and auto tourist populations respectively and then added together to obtain a correctly weighted percentage. For the January - December 1984 period, the weighted beach participation rate was 33.87 percent of all tourists which is somewhat higher than the gross rate.

The Florida Visitors Study (1983) did ask people about things they liked about Florida. About 37 percent of the air travelers and 53 percent of the auto travelers mentioned Florida's beaches. This translates into a weighted average of about 47 percent. This result is conceptually different from the

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[2] Of the 4,333 contacts, 826 were interviewed and participated in saltwater beach use while 599 could not be interviewed completely because of lack of time (e.g., leaving for a plane) or refused to be interviewed, but did indicate saltwater beach use. Rife Market Research, Inc. controls for duplicate interviews thus aleviating the possibility of double counting.

Table 3.1

Number of Saltwater Beach Questionnaires Received Per Site, Florida Tourists (1984)

Site	Number Received
I-10	80
U.S. 231	51
I-75	137
U.S. 1 - 301	41
I-95	150
TOTAL HIGHWAY	459
Miami	99
Ft. Lauderdale	52
W. Palm Beach	50
Orlando	35
Tampa	52
Jacksonville	26
Sarasota	26
Ft. Myers	27
TOTAL AIRPORT	367
TOTAL HIGHWAYS AND AIRPORTS	826

participation rate in beach use estimated in the study, since it includes people that may enjoy the beach environment but may not physically use the beach!

Rife Market Research was careful in this study to explain that the beach must have actually been visited and used. That is, tourists must have actually used the beach not just been located near it or desire it for scenic beauty. It is not uncommon to view tourists in a swimming pool near a beach in Florida. The actual physical use of a beach is extremley critical for policy decisions which will be discussed in Chapter 7. Therefore, we must digress a moment and address the issue of the large difference between the tourist participation rate esitmated by DNR (86.5%) and that estimated in this study (34%).

Difference Between FSU-SEAGRANT and DNR Tourist Beach Participation Rates

There are three possible explanation for the difference in the FSU-SEAGRANT and the DNR estimate: (1) sampling error; (2) difference in definition of population; and/or (3) nonresponse bias.

Sampling error might account for a difference of one or two percentage points given the sample sizes involved (4,333 FSU-SEAGRANT - 6,000 DNR). Sampling error, therefore, is probably not a major factor.

There is an important difference between the definition of tourist population surveyed and for which participation rates are estimated in the two studies. The FSU-SEAGRANT study, as mentioned above, only surveys tourists 18 years of age an older whereas the DNR study surveys all tourists. If we assume that 100 percent of all tourists under the age of 18 that visited Florida participated in beach use, this would add 12.5 percentage points to the estimate of 34 percent contained in the report.[3] This would yield a beach participation rate of all tourists of 46.5 percent. The DNR's estimate is 86.5 percent. Thus, the difference in definition of population surveyed cannot explain the large difference between the two studies.

The differences in sampling methodology employed may be responsible for the large discrepancy between estimates. The methodology used in this study was described above. The DNR used a mail survey. Questionnaires were handed

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[3] 12.5 percent of all tourists in Florida are under the age of 18 (Florida Visitor Study 1983).

out randomly to tourist as they departed Florida at all major airports and highways of Florida. The questionnaire asked the respondent and each member of the family to fill out a separate questionnaire. Questions were asked about participation in 25 outdoor recreation activities. If the respondent had not participated in any of the 25 activities while in Florida over the past 12 months, the respondent was asked to check a box indicating they had not participated and mail the questionnaire back to DNR. The response rate was fairly low (20-30 percent).[4] The low response rate suggests the possibilty that nonresponse bias might be a source of error. Less active recreationist generally have a lower probability of response. That is, respondents to the DNR survey are most probably high users of recreational resources including beaches thereby biasing the DNR saltwater beach participation rate upward. The DNR has not investigated the nature of the nonrespondents; that is, there was no method designed for following up on nonrespondents in order to evaluate the issue of nonresponse bias. Since the sample of tourists and methodology employed to compute a participation rate in the FSU-SEAGRANT study does not seem too small or flawed as the DNR study, the authors suggest that data on participation and total use estimated by the DNR be deflated by about 61 percent to conform to the tourist participation rate in this study.[5] This is an important adjustment when aggregating the results obtained from models presented in Chapter 7.

Economic Impact

Multiplying the weighted participation rate (33.87) by the total number of tourists estimated to have visited Florida by the Department of Commerce (23.72 million) during the January - December 1984 period yields an estimate of over 8 million tourist beach users during January - December 1984. This calculation is presented in Table 3.1.

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[4] DNR does not give enough information to determine their response rate. The DNR reports 11,000 surveys were handed out and that DNR received responses which included data on 6,000 individuals. Since each member of the household was surveyed, the response rate is not 54 percent (6,000 ÷ 11,000). Assuming an average party size of 2.5 (Florida Visitor Study 1983) would yield a response rate of about 22 percent (6,000 ÷ (11,000 x 2.5)).

[5] The DNR has recently changed their methodology for estimating participation in outdoor recreation activities. The DNR is now, employing face-to-face interview at all major highways and airports as tourist leave the state.

As with the resident survey (Chapter 2), questions about beaches visited; days spent at each beach, tourists perception of the beaches, dollars spent while at the beach were asked. On average, a typical tourist recreated 8.64 days per year on Florida's saltwater beaches. If this figure is multiplied by the over 8 million tourists, an estimate of over 69 million tourist recreational beach days in Florida for the January - December 1984 period is obtained (Table 3.2).

To estimate the direct sales, employment, wages and state tax revenues generated an estimate of the number of households which visited Florida's beaches must be obtained because the survey asked for household expenditures. The tourist sample indicated that on average 1.76 adults from the household accompanied each respondent to the beach. Therefore, the typical tourist beach household has 2.76 adults which visit Florida's beaches. Thus, dividing the total number of tourist beach users by 2.76 yields an estimate of over 2.9 million households which visit Florida's beaches. The average annual tourist household expenditure while visiting Florida's beaches was $395.40. The expenditures included hotel/motel; food and drink; travel to and from the beach and access fees. These expenditures are directly associated with beach use. Multiplying this figure by the estimated number of households yields a direct sales impact of over 1.1 billion dollars in 1984. Referring to Table 3.3 and using the same procedures outlined earlier for residents yields an estimate of over 47 thousand employees directly supported by tourist beach users and a direct wages impact of over 286 million dollars. Furthermore, these direct expenditures generated over 57 million dollars in estimated state tax revenues (Table 3.4).

Induced and Total Sales, Wages and Employment Generated by Tourist Beach Users: The Export Base Theory and Application

The economy of Florida is described as open, because the local economy imports goods and services from the rest of the Nation and in turn exports goods and services to the rest of the Nation and even the world (such as phosphate and tourism), as payment. Exports (X) represent 'foreign' spending for goods and services produced in the local economy, whereas imports (H) represent local spending for goods and services produced outside the local area. Since total income within the local economy equals expenditure for that income, the following equation holds for the local economy:

(1) $$Y \equiv C + I + X - H,$$

Table 3.2

A Summary of the Economic Impact of Tourist Saltwater Beach Use in Florida, 1984

(1)	Number of Beach Users (33.87% of Tourists 18 years of age and older or 23.72 million visited Florida Jan. - Dec. 1984)	8,033,210
(2)	Total Days at Florida's Beaches (8.64 average days per person x 8.033 million)	69,391,408
(3)	Number of Households Which Visited Florida's Beaches (8,033,210 ÷ 2.76 average number of adults in household which visited Florida's beaches)	2,914,496
(4)	Direct Sales Impact (2,914,496 x $395.40 or average annual household expenditures while visiting beaches)	$1,152,391,929
(5)	Induced Sales Impact [2 x Line (4)]	$2,304,783,858
(6)	Total Sales Impact [Lines (4) plus (5)]	$3,457,175,787
(7)	Direct Employment Impact (See Table 3.3)	47,546
(8)	Induced Employment Impact [2 x Line (7)]	95,092
(9)	Total Employment Impact [Lines (7) plus (8)]	142,638
(10)	Direct Wages Impact (See Table 3.3)	$286,842,136
(11)	Induced Wages Impact [2 x Line (10)]	$573,684,272
(12)	Total Wages Impact [Lines (10) plus (11)]	$860,526,408
(13)	Direct State Taxes (See Table A.4.1 in Appendix 4)	$ 57,489,290
(14)	Induced State Taxes (See Table A.4.2 in Appendix 4)	$ 41,117,760
(15)	Total State Taxes [Lines (13) plus (14)]	$ 98,607,050

Table 3.3

Direct Sales, Employment and Wages Generated by Tourist Saltwater Beach Users in Florida, 1984

SIC	Category	Sales Impact (Dollars)	Sales to Employment Ratio	Employment Impact	Wages to Employment Ratio	Wages Impact (Dollars)
7011	Lodging	371,583,481	27,793	13,370	7,360	98,403,283
5813 & 5813[1]	Food & Drink	730,368,520	21,823	33,465	5,440	182,051,474
5541	Travel	22,297,805	162,444	138	8,282	1,142,916
Public Parks[2]	Beach Access Fees	1,971,064	12,126	163	12,028	1,960,564
5311	Other	26,231,059	63,936	410	8,014	3,283,899
	Total	$1,152,391,929	N/A	47,546	N/A	$286,842,136

[1]Sales to employment and wages to employment ratios are averages for SIC 5812A, 5812B, and 5813.

[2]Sales to employment and wages to employment ratios were derived using receipts, employment and wages for selected state parks which have beaches. Personal correspondence with James Cook, Deputy Director, Parks and Recreations, DNR.

Table 3.4

Estimated Direct State Tax Revenues Generated By Tourist Saltwater Beach Users In Florida, 1984*

Spending Category	Sales Taxes	Gasoline Taxes	Corporate Profit Taxes	Total
Lodging	$ 17,694,452	N.A.	$ 839,233	$ 18,533,685
Food & Drink	34,776,596	N.A.	821,202	35,597,798
Travel	1,105,195	$ 775,575	5,735	1,886,505
Beach Access Fees	N.A.	N.A.	N.A.	N.A.
Other	1,249,098	N.A.	222,204	1,471,302
TOTAL	$ 54,825,341	$ 775,575	$ 1,888,374	$ 57,489,290

*Only Sales, Gasoline, and Corporate Profit Taxes could be estimated from survey information.

where Y is local area income, I is local area expenditures for locally produced investment goods and C is local area expenditures for both local and 'foreign' goods and services.

The level of consumption in the economy is related to income, e.g., the higher is income the higher is consumption. A simplified equation expressing this relationship, called the consumption function is:

$$C = a + bY \tag{2}$$

where "a" is a constant and "b" is the marginal propensity to consume.

Imports, H, are presumed also to be responsive to income as reflected in the following equation:

$$H = c + dY \tag{3}$$

where "d" is the marginal propensity to import. What is required is the relationship between a change in exports ΔX, and a change in local area income, ΔY. Let M be defined as:

$$M = \frac{\Delta Y}{\Delta X} . \tag{4}$$

M is a multiplier which shows how each dollar's worth of increased exports (such as an additional dollar's worth of tourist expenditures on saltwater beaches) gives rise to increases in area income. Suppose M = 3 and exports increase by \$200, then local area income will increase by $\Delta Y = M \cdot \Delta X = \$600$. An equation for the multiplier, M, can be derived by substituting equations (2) and (3) into (1) and assuming for simplification that I = 0. Local income can then be expressed as a function of exports as follows:

$$Y = \frac{a - c}{1-b-d} + \frac{1}{1-b+d} X \tag{5}$$

The "regional or export" multiplier, M, can now be expressed from (5)

$$M = \frac{\Delta Y}{\Delta X} = \frac{1}{1-b+d} \tag{6}$$

The export multiplier is dependent on the marginal propensity to consume or "b" and the marginal propensity to import or "d". Both "b" and "d" are expected to be less than 1, but greater than zero. The larger "b", within this range, the larger the multiplier M. Of special significance to regions, the larger "d", the smaller is M. Small areas such as cities or towns have a high propensity to import ("d") and therefore a lower multiplier. The State of Florida would be expected to have a larger regional multiplier than its geographical components. Canterbery (1977) has calculated an income multiplier for Florida of 5.18. This may be rather high based upon multipliers calculated for other states. For example, Bolton (1966) calculated an M for Florida as low as 2.04; therefore, a state multiplier of 3 was selected for use in this study to be conservative. This multiplier will be used for sales, employment and wages that are generated by primary beach expenditures.

Consider Table 3.2 once again. Line (5) shows "induced sales" or M-1 multiplied by line (4) or direct sales. Induced sales are the additional sales generated by the multiplier process or over \$2.3 billion. Total sales impact of over \$3.4 billion is shown on line (6). Notice that if line (6) is divided by line (4), the multiplier of 3 is obtained. In obtaining the added impact of the regional multiplier, the value of unity must be subtracted or M-1. In Table 3.2, the "induced employment" impact is estimated in a similar manner. Induced employment is over 95,000 jobs for a total impact of over 142,000 jobs. Direct plus induced wages would be more than \$850 million. Thus, beach-related tourist expenditures have a considerable impact on the Florida economy. Finally, direct State tax revenue was estimated at about \$58 million. These revenues consisted of sales, gasoline and corporate income taxes. The mix of beach user expenditures is heavily weighted toward "taxable items" such as hotels, restaurants (i.e., eating out) and travel (e.g., gasoline). The induced taxes were calculated by assuming that incidence of tax would be less for all kinds of goods and services in Florida; therefore, it was estimated that only \$41 million in induced taxes might be produced. The calculation and rational for this result is in Table A.4.2 of Appendix A.4. Total estimated State taxes from tourist beach users for 1984 was nearly \$99 million.

A Demographic Profile of Tourist Beach Users

From the tourist survey of saltwater beach users, a socioeconomic profile emerged. As a sub-group of the general tourist population, the saltwater beach user is predominantly male with a mean household income of over \$31 thousand as shown in Table 3.5. The mean age was nearly 45 which is somewhat surprising. The beach user is more likely to be employed as a white collar manager of some kind. In *Florida: The Image of Florida Among Vacation Travelers (1982)*, the demographic profile of visitors to Florida is discussed.

The general tourist population is likely to be evenly split between males and females. They are more heavily concentrated in the 25-44 age category

Table 3.5

A Socio-Demographic Profile of Tourist Beach Users In Florida, 1984

Sex	Percent
Male	71.2
Female	28.8

Household Income	Percent
\$ 0 - \$ 9,999	1.9
\$10,000 - \$19,999	10.9
\$20,000 - \$29,999	23.5
\$30,000 - \$39,999	27.2
\$40,000 - \$49,999	18.3
\$50,000 - \$59,999	9.0
over \$60,000	9.0
mean \$31,200	

Occupation	Percent
Professional, Executive	21.9
Manager, White Collar	31.7
Blue Collar	15.1
Student-Homemaker-Military	9.9
Retired	18.6
Unemployed	.8
Other	1.8
Age (mean)	44.68
Household Size (mean)	3.00

with occupational categories of manager/professional. Also, income of the general tourist population is more heavily concentrated in the lower household income brackets than the sample of beach users. It would appear that the Florida tourist beach user was more apt to be male, somewhat older and affluent than the general tourist population. These conclusions should be treated with caution since interviewers may be more inclined to interview males. The results are consistent with the resident survey which showed income positively influencing participation in beach use but inconsistent with age which had a negative influence on participation. A participation function could not be estimated for beach using tourist since non-beach users were not interviewed for socioeconomic characteristics. Further work is obviously necessary on the socioeconomic characteristics of tourist beach users.

Chapter 4
The Total Economic Importance of Saltwater Beach Use

Introduction

The purpose of this Chapter is to briefly summarize the total direct and indirect economic impact of both residents and tourists discussed in Chapters 2 and 3 respectively. This will give the reader a general idea of the relative economic importance of the two sectors with respect to their economic impact on the Florida economy. It should be remembered that residents have a direct economic impact while tourists have both a direct and induced economic impact via the regional multiplier for exports. The latter point was discussed in Chapter 3.

Beach Users and Recreational Days

Table 4.1 compares the number and recreational days of residents and tourist beach users. During 1984, over 13.2 million individuals used Florida's saltwater beaches of which 8 million or 61 percent were tourists. As expected, tourists participated only 8.64 days per year in beach use compared to 14.68 days for Florida residents. Therefore, of the nearly 146 million beach recreational days participated in by both groups, only 48 percent were accounted for by tourists. In terms of recreational activity as measured by days at the beach, the pressure on the rather fixed saltwater beach resource seemed to be equally divided between tourists and residents. This is in sharp contrast to DNR (1981) which attributes over three quarters of beach activities to tourists based on user occasions (i.e., number of visits to the beach and can be more than one per day). As discussed in Chapter 3, the lower participation rate found in this study when compared to that reported by DNR is largely responsible for this difference in usage among the two groups.

Table 4.1

Total Beach Users, Recreational Days And Beach Days Per Participant For Florida Saltwater Beaches, 1984

	Residents	Tourists	Total
Number of Beach Users 18 years of age and older	5,217,807	8,033,210	13,251,017
Number of Recreational Saltwater Beach Days	76,597,407	69,391,408	145,988,815
Number of Recreational Saltwater Beach Days Per Participant	14.68	8.64	11.02

Source: Tables 2.1 and 3.2

Direct Sales, Employment and Wages

The direct sales impact by both residents and tourists is as follows:

Group	Beach-Related Expenditures (Direct)	Average Household Expenditures
Residents[1]	$1,123,451,000	$450.00
Tourists[2]	$1,152,391,929	395.40
Total	$2,275,843,029	

1. Table 2.1; 2. Table 3.2.

Direct beach related expenditures were $2.276 billion for residents and tourists combined. As shown in Table 4.2, direct sales were responsible for 84,165 jobs and nearly $528 million in wages and salaries. As pointed out in Chapter 3, induced impacts of tourist expenditures as an export industry must be considered. The following is a tabulation of the total direct and indirect or induced economic impact of both residents and tourists.

Beach-Related Sales: Grand Total	
1. Direct[1]	$2,275,843,029
2. Induced[2]	2,304,783,858
Total	$4,580,626,887

1. Table 4.2; 2. Table 3.2

The grand total of beach-related sales was estimated at $4.581 billion. This amounted to about 2.8 percent of gross sales in Florida that were reported to the Department of Revenue in 1982 (See 1983 Florida Statistical Abstract). Of course, the total direct and indirect employment that is generated by beach-related sales can also be tabulated as follows.

Beach-Related Employment: Grand Total	
1. Direct[1]	84,165
2. Induced[2]	95,092
Total	179,257

1. Table 4.2; 2. Table 3.2

Table 4.2

Direct Sales, Employment and Wages Generated by Resident and Tourist Saltwater Beach Users in Florida, 1983-84 (12 Months)*

SIC	Category	Sales Impact (Dollars)	Sales to Employment Ratio	Employment Impact	Wages to Employment Ratio	Wages Impact (Dollars)
7011	Lodging	$ 685,201,097	27,793	24,654	7,360	$181,453,523
5813 & 5813[1]	Food & Drink	1,180,288,134	21,823	54,084	5,440	294,218,834
5541	Travel	274,450,163	162,444	1,690	8,282	13,996,580
Public Parks[2]	Beach Access Fees	24,115,533	12,126	1,989	12,028	23,923,692
5311	Other	111,788,102	63,936	1,748	8,014	14,006,631
	Total	$2,275,843,029	N/A	84,165	N/A	$527,599,260

*This table is the sum of Tables 2.2 and 3.3

[1]Sales to employment and wages to employment ratios are averages for SIC 5812A, 5812B, and 5813.

[2]Sales to employment and wages to employment ratios were derived using receipts, employment and wages for selected state parks which have beaches. Personal communication with James Cook, Deputy Director, Parks & Recreations, DNR.

The grand total of beach-related employment is 179,256 which is about 4.1 percent of Florida employment in 1982. Generally, industries depending upon beach use are more labor intensive than the general economy. This may explain why beach activities generate proportionately more jobs (as a percent of employment) than sales (as a percent of gross sales). Destruction or serious erosion of beach resources might have a significant impact on employment opportunities in Florida. The "saltwater beach industry" in 1984 generated 84,165 direct jobs which makes it a bigger industry than banking (62,894); insurance (63,863) or public utilities (36,298) for example.

The grand total of jobs created (179,257) by residents and tourists also generated the following wages and salaries:

Beach-Related Wages and Salaries:	Grand Total
1. Direct[1]	$527,599,260
2. Induced[2]	573,684,272
Total	1,101,283,531

1. Table 4.1; 2. Table 3.2.

The beach-related jobs generated over $1.1 billion in wages and salaries or 2.3 percent of all wages and salaries in Florida. The saltwater beach industry generates a lower percent of wages than employment because of its particular nature. Jobs in hotels/motels; restaurants; food stores and other beach-related businesses are not on the high end of the pay range since skills are easy to acquire and many of these jobs are very transitory because of seasonal factors involved in tourism.

Finally, the state tax revenue collected from beach related sales should be considered. This is an especially important issue since state dollars are required for beach nourishment programs and other forms of beach protection.

Beach-Related State Taxes:	Grand Total
1. Direct[1]	$122,590,421
2. Induced[2]	41,117,760
Total	$163,708,181

1. Table 4.3; 2. Table 3.2

Direct state taxes generated by beach-related expenditures are shown in some detail in Table 4.3. Sales, gasoline and corporate profit taxes are presented

Table 4.3

Estimated Direct State Tax Revenues
Generated From Direct Expenditures
By Resident and Tourist Saltwater
Beach Users In Florida, 1983-84 (12 Months)

Spending Category	Sales Taxes	Gasoline Taxes	Corporate Profit Taxes	Total
Lodging	$ 32,628,624	N.A	$ 1,547,565	$ 34,176,189
Food & Drink	56,204,196	N.A	1,327,186	57,531,382
Travel	14,977,960	$ 9,546,092	70,595	24,594,647
Beach Access Fees	N.A	N.A	N.A	N.A
Other	5,323,243	N.A	964,960	6,288,203
TOTAL	$109,134,023	$ 9,546,092	$ 3,910,306	$122,590,421

for tourists and residents. Sales tax revenue is by far the most important source of funds. The grand total of derived state taxes from beach-related activities is nearly $164 million which is 2.8 percent of total state taxes collected in 1981-1982. See Florida Statistical Abstract (1983). Therefore, the beach resource is indirectly an important source of state tax revenue. Table 4.4 summarizes the total economic impact of those (residents and tourists) that use the saltwater beach resource in Florida.

Comparison of Socioeconomic Profiles: Resident Versus Tourist Beach Users

Table 4.5 compares the socioeconomic characteristics of the samples of resident and tourist beach users for the State of Florida. Resident use was evenly divided between male and female whereas male tourists dominated in the use of saltwater beaches. Tourist household income was about $5000 higher than resident users of the beach. This would be expected based upon the generally more affluent characteristic of the general tourist population relative to residents. There was not much difference in average age between tourists and residents. Remember, only those 18 years and older could be interviewed so this average age applies to those between 18 years of age and the highest age in the sample. Finally, household size was larger for tourists than residents. This tended to narrow income differences based upon per capita income where residents had $9,471 per household member compared to $10,700 for the average tourist beach user.

Table 4.4

Total Economic Impact (Direct and Induced) of Resident and Tourist Use of Florida Saltwater Beaches and Relative Economic Importance, 1984*

		Percent of State
(1) Total Sales[1]:	$4,580,626,887	2.8
(2) Total Employment[1]:	179,257	4.1
(3) Total Wages and[1] Salaries	$1,101,283,531	2.3
(4) Total State Taxes[1] (Sales, gasoline and corporate profit taxes only)	163,708,181	2.8

*See text for derivation and discussion.

Table 4.5

A Socio-Demographic Profile of Resident And Tourist Recreational Saltwater Beach Users in Florida (1984)

	RESIDENTS Percent	TOURISTS Percent
1. Sex:		
Male	49.70	71.2
Female	50.30	28.8
	Mean	Mean
2. Household Income	$26,045	$31,200
3. Age	43.50	44.68
4. Household Size	2.75	3.00

Sources: Tables 2.4 and 3.5.

Part 2

Economic Valuation of

Saltwater Beaches in Florida

Chapter 5
Economic Theory of Beach Valuation

Introduction

As indicated earlier, the fact that beaches are a common property resource presents a paradox in valuation. Since no one person owns the resource, a charge cannot be levied upon the user of this resource. One might ask why any charge should be levied upon the right to visit a beach? Doesn't everyone have an inalienable right to visit beaches without charge? But, if the right to visit beaches has a zero price, then the value of beaches is apparently zero. An owner of an apartment building who charges no rent will find that his "asset" is worthless. However, many private and government officials point to the immense value of Florida's beaches. But the question is: What is value? Many are quick to say that the expenditures made while visiting Florida's beaches, presented in Chapters 2 through 4, in some way measures the value of beaches. However, the logic here is flawed since expenditures are merely the vehicle to enable one to visit the beach. If beaches were to vanish tomorrow, people would simply spend their money on some other form of recreation. See Crutchfield (1962) for an extended discussion of this issue. The actual value of the beaches may be measured by the charge which <u>might be made</u> for the right to use the beach. There is no concern here with the policy issue of whether to charge or not to charge but how <u>technically</u> to measure the value of the beaches.

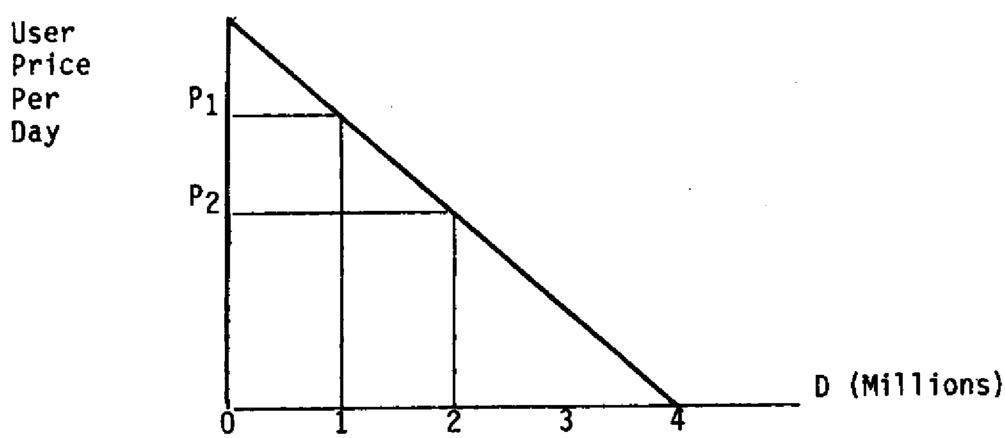
Marshallian Consumer Surplus

First, beaches are an <u>input</u> to producing recreation. The investment in a plant to produce steel is an <u>input</u> called capital. Capital is also an asset which can be rented or sold. The value of any asset (input) is determined by the flow of earnings over a period of time. Capital invested in a steel plant will produce a flow of profits. But, how did we jump from the steel business to beaches? There are ways of simulating the "earnings" produced yearly from the asset called beaches. If beaches were <u>privately</u> owned, one would expect a charge or more specifically a <u>user charge</u> for the right to use the beach. Given the reality that beaches are common property, consider Figure 5.1.

Figure 5.1 shows a hypothetical aggregate demand curve for recreational saltwater beach use. If a user charge of P_1 were placed on every recreational day, individuals would choose to "consume" one million recreational saltwater beach days. If the user charge were lowered to P_2, beach users might find Florida beaches a relatively cheaper form of recreation than say golf or tennis. Beach goers would choose to spend more days at the beach at the lower user charge if everything else remained constant (e.g. income, beach characteristics, etc.). Two million beach days would be the quantity demanded.

Figure 5.1

Hypothetical Demand for Saltwater Recreational Beach Use in Florida



Saltwater Recreational Beach Days

Under common property, no charge is made for the use of the resource; therefore, four million saltwater recreational beach days will be spent in Florida.[1] So, are we left with the conclusion that at a zero user price, beaches have no value? Beaches will have a value equal to the area under the demand curve, which is called consumer surplus. What is the rationale for this? Consumers could be asked to pay P_1 per beach day, but the price is actually zero. Similarly P_2 could be charged. Consumer's surplus is simply the difference in what could be charged consumers and the actual price. Because beaches are a common property resource and consumers thus face a zero price, consumers gain a surplus. Consider Figure 5.2, the individual's demand

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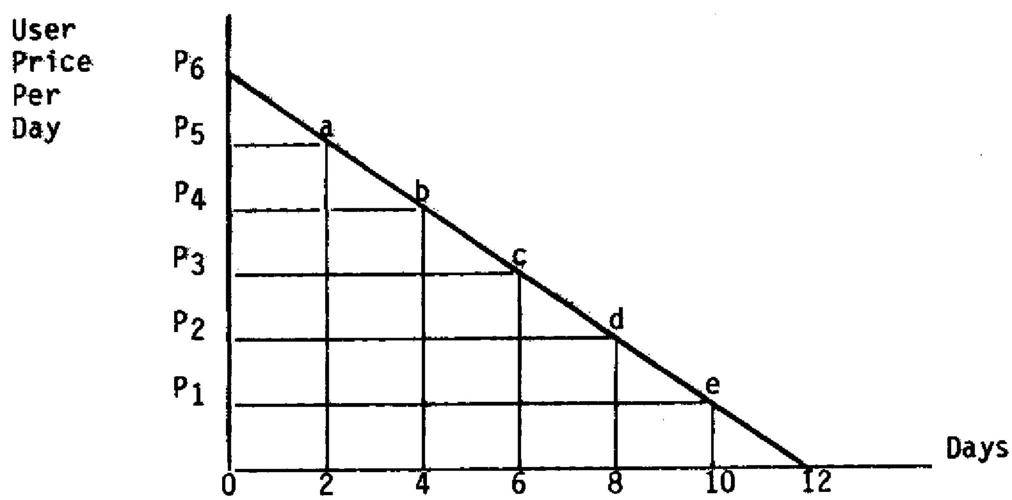
[1] A simplification here is that crowding is not a problem. If crowding exists and has a negative impact on demand for beach use, the demand curve would shift downward and to the left resulting in fewer total days.

for beach use. The individual demand curve describes the maximum amount on individual would be willing to pay for each beach day. The downward slope of the curve indicates that individuals are willing to buy more beach days at lower prices than they are at higher prices. This simple relationship expressed in two-dimensional space assumes that income, the price of other goods, etc. -- do not change.

Figure 5.2

Individual's Demand for Beach Use



Since under common property the price is zero, 12 days will be consumed by the individual beach user. At a price of P_5, one surplus will exist (the area of the triangle P_5P_6a). As the price falls, the beach user's surplus increases to P_4P_6b, P_3P_6c, and so on. At a zero price, the surplus reaches a maximum. This surplus is the equivalent of the amount of money a beach user would pay for the right to use the beach for 12 days (or the total user charge which might be extracted from him before he would cease visiting beaches entirely). Thus the area under the demand curve measures the economic value to beach users for the right to use beaches at a zero price. Economists call this consumer surplus or the user value of the beach.

The demand curve described above is what economists call the ordinary demand curve or the Marshallian demand curve. The consumer surplus derived from this curve is thus called Marshallian consumer surplus. Ordinary demand curves are important because they are the only curves that can be observed. However, when price changes involve income effects, the ordinary demand curve or Marshallian demand curve does not yield on ideal measure of consumer welfare. For example, if the price of beach day increases it will affect not only how many beach days the individual can purchase, but also the purchases of all other goods and services because of the reduced amount of disposable income. Thus, a movement along the Marshallian demand curve affects the level of satisfication or utility an individual will be able to achieve with a given income. For consumers surplus to provide an "ideal" dollar measure of individual well-being; however, the conversion between dollars and individual utility level must be constant for every point on the demand curve. Thus, if price changes have an income effect then the Marshallian consumer surplus will not be the proper measure of benefits.

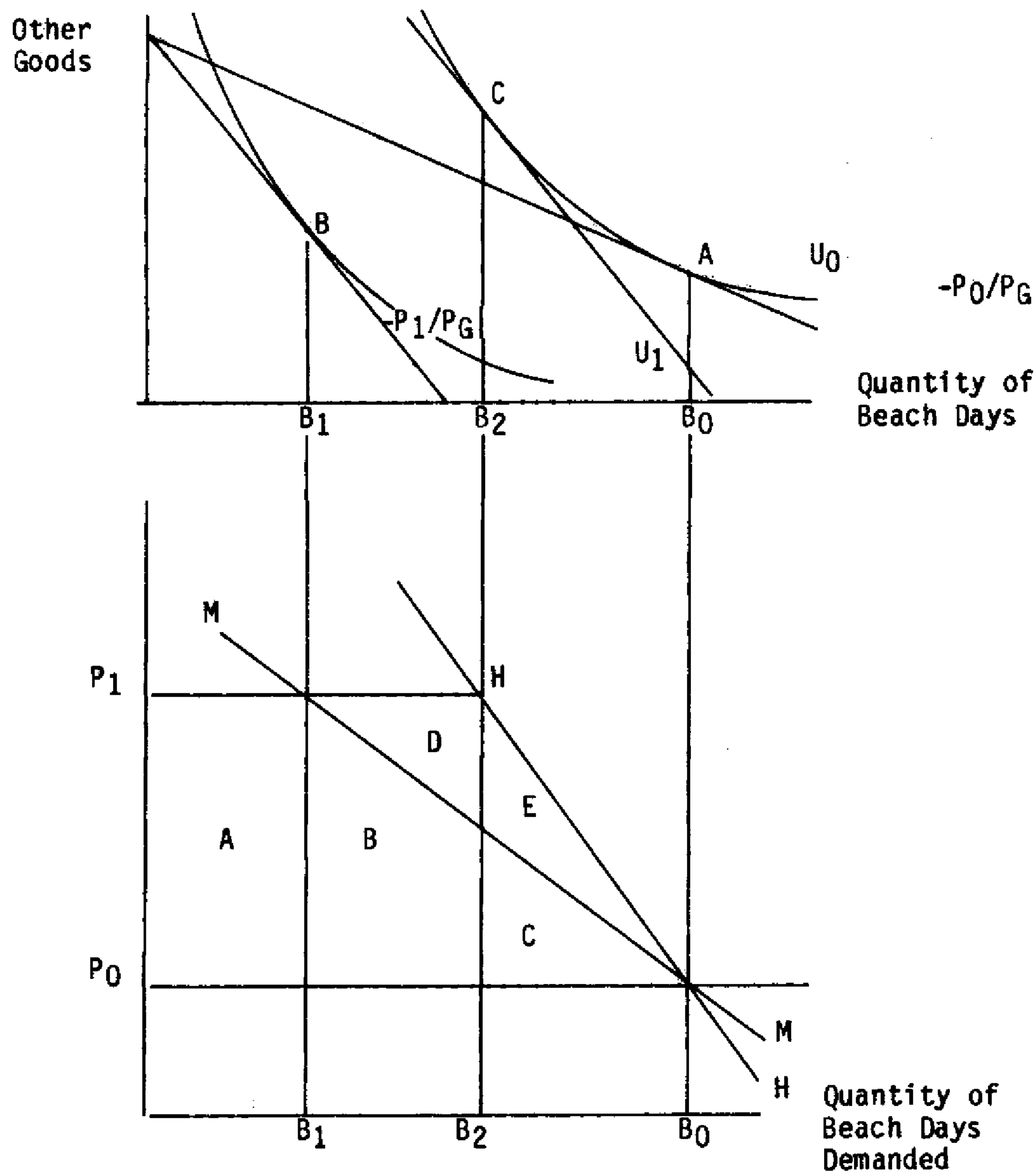
Hicksian Demand Curves and Compensating and Equivalent Variation

Hicks (1943) developed what is now called the Hicksian or income compensated demand curve. This curve yields an ideal measure of benefits because utility is held constant at all points along the demand curve. Figures 5.3 and 5.4 show the relationship between the Marshallian and Hicksian demand curves and the differences in consumer surpluses.

Figure 5.3 shows an indifference surface between the preference for beach days and all other goods. Assume that the price (unobserved) increases from P_0 to P_1 for a beach day. The budget line will move clockwise (i.e., rotate to the left) thereby moving the consumer from A to B and decreasing quantity demanded from B_0 to B_1. Marshallian consumer surplus over the range B_0 B_1 will be A + B + C. The Marshallian demand curve is MM. In the case of "normal goods," the income effect will reduce consumption in the face of a price increase. If the consumer is compensated for the lost income due to the price increase, the new budget line at "B" must be shifted to "C," the original level of utility before the price change. Thus, the compensated demand curve (HH) would result in less of a reduction in quantity demanded or from B_0 to B_2 in the face of a price increase. In the case of the compensated demand curve, consumer's surplus is increased by D + E over that obtained from the Marshallian demand curve, with a price increase as shown in Figure 5.3.

Figure 5.3

Marshallian and Hicksian Consumer's Surplus



Notice that points "C" and "A" in Figure 5.3 yield the same utility (U_0). Consumer surplus for beaches is less for point C but this is offset by increased consumer surplus received from other goods and services purchased with the compensation received. Of course, a price decrease from P_0 will result in greater consumer's surplus for the Marshallian as opposed to the income-compensated or Hickian demand curve. This can be seen by looking at prices below P_0 in Figure 5.3.

There are two perspectives in calculating consumer's surplus: (1) compensating variation (CV) and (2) equivalent variation (EV). Bockstael and McConnell (1980) define these concepts for recreational goods as follows:

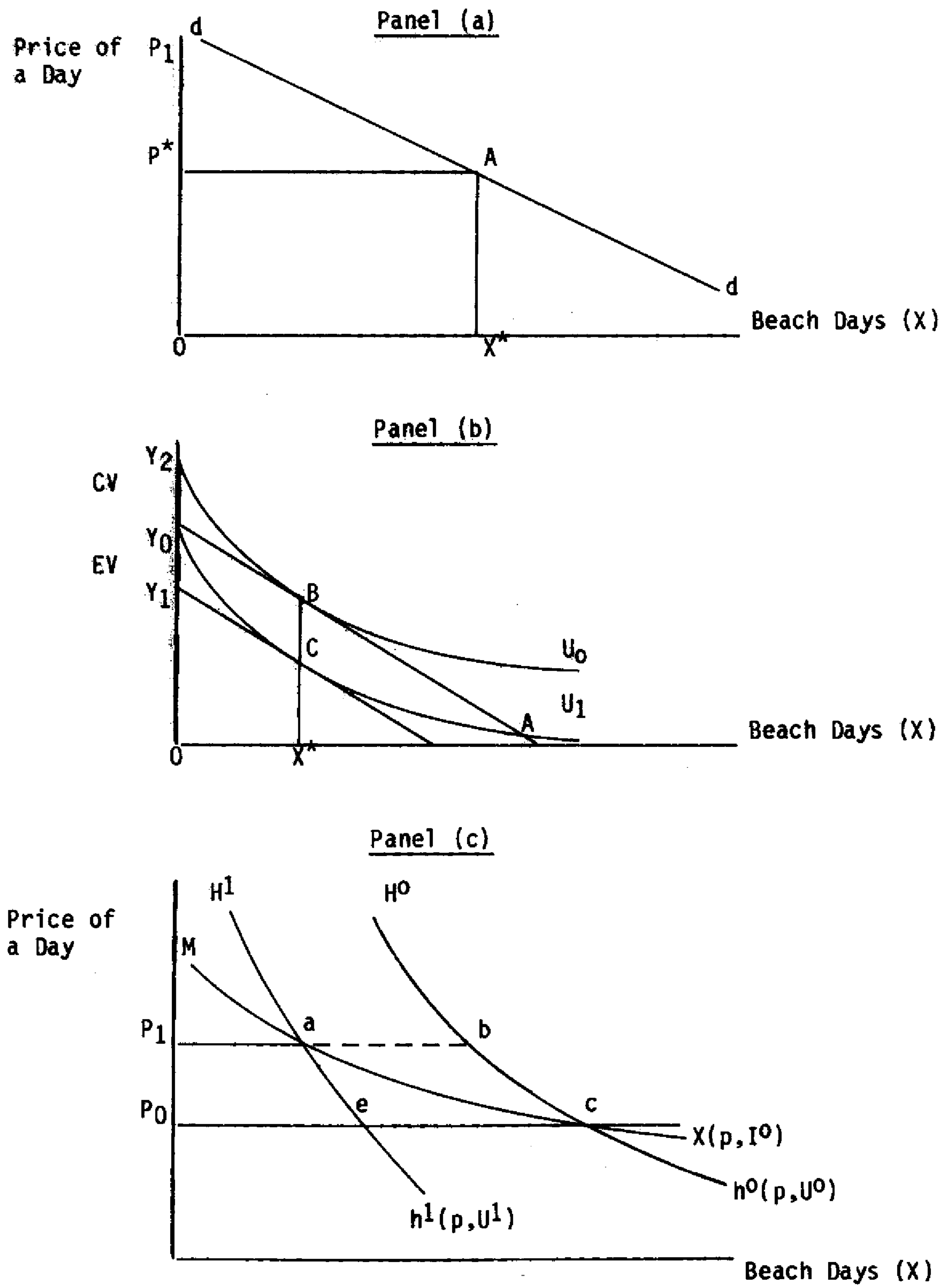
CV: The amount of compensation paid that will leave the consumer in his initial welfare position following an increase in price if he is free to buy any quantity of the commodity at the new price. This is the willingness of the consumer to sell (WTS). Or, how much money would the consumer accept as compensation for giving up his right to buy?

EV: The amount of compensation received, that will leave the consumer in his subsequent welfare position after a price decrease if he is free to buy any quantity at the old price (WTP). Or, if the good were not available on the market, how much would the consumer be willing to pay for the right to buy it?

Figure 5.4 shows consumer's surplus in the following manner. Consider panel (a). Starting from the point where X = 0, the individual gains p_1AP^* by purchasing X^*; but starting from the point where $X = X^*$, the consumer would lose this amount if the goods were returned and his money refunded. The former would be the WTP while the latter would be the WTS. That is, if the good were not available on the market (X = 0) how much would the consumer pay for the right to buy it? Or, if the good became available at price P^*, how much money would the consumer accept as compensation for giving up the right to buy it? It would appear that WPT = WTS and therefore that CV = EV. Consider the indifference curves in Panel (b) in Figure 5.4. Given an initial income or quantity of money (i.e., all other goods purchased or Y_0) and a positive price of X given by the slope of the price line Y_0A, the individual purchases OX^*, attaining point B. The maximum amount the individual will pay to continue to have the opportunity to purchase X^* at this price would be Y_0Y_1 (equal to BC). Y_0Y_1 is equivalent variation (EV). The minimum amount the

Figure 5.4

Various Measures of Consumer's Surplus



consumer would need to be compensated for the loss of this opportunity would be Y_0Y_2. This is compensating variation (CV). Given the absence of wealth or income effects - vertically parallel indifference curves - Y_0Y_1 (EV) and Y_0Y_2 (CV) are equal and the two measures yield identical results. According to Gordon and Knetsch (1979), "If...an income effect is noted, then the equality of measures will fail to hold true."...for normal goods, Y_0Y_2 (CV) will exceed Y_0Y_1 (EV). Thus, WTS or CV will exceed WTP or EV. Krutilla and Fisher (1975, pp. 31-32) state that WTP is bounded by income, but WTS is not bounded by income, and will exceed WTP in the case of a positive income effect.

In Figure 5.4, Panel (c) shows Willig's (1976) inequality comparison of consumer's surplus concepts, in which M, H^1 and H^0 denote functional Marshallian and Hicksian demand curves for CS, EV and CV, respectively. CV is equal to the area p_0p_1bc under the Hicksian curve $H^0 = h^0(p,u^0)$. EV equals area p_0p_1ae under the curve $H^1 = h^1(p,u^1)$. Marshall's CS is approximated by area p_0p_1ac under the ordinary demand curve $M = X(p,I^0)$. Thus, CV is greater than (less than) CS for a price increase (decrease). EV is less than CS for a price increase because H^1 crosses M at point a, which corresponds to the given state at higher price p_1. The relation between CV, CS and EV (for a price increase) may be summarized as follows:

Normal Goods (Postive Income Effect)

CV > CS > EV

Inferior Goods (Negative Income Effect)

EV > CS > CV

Neutral Goods (No Income Effect)

EV = CS = CV

If income effects are negligible, their is no ambiguity or bias in the measurement of consumer surplus.

Proper Measures to Use in Policy Analysis

As noted above, when income effects are present the appropriate measure of value will be either equilavent variation (EV) or compensating variation (CV). Which measure is appropriate depends on the system of property rights assigned in policy analysis and whether the policy impact is a price increase or decrease. Table 5.1 summerizes the appropriate measures of value to use when recreational beach use is influenced by income effects.

Table 5.1

Appropriate Measures of Value to Use When Recreational Beach Use Is Influenced by Income Effects

Assignment of Property Rights	Price Increase	Price Decrease
To Recreational Beach Users (WTS)	CV	EV
To Competing Users (WTP)	EV	CV

When property rights are assigned to recreational beach users this implies the use of willingness - to - sell (WTS). The appropriate measures would then be (CV) for a price increase or (EV) for a price decrease. Just the opposite is true if property rights are assigned to competing users of the beach.

Techniques to Estimate and Analyze Consumer Surplus or User Value for Recreational Activities

Using the data from the resident and tourist surveys discussed in Chapters 2 and 3, two established techniques will be employed to measure consumer surplus or user value for Florida beaches. The simplest method is known as the Contingent Valuation (CVM) where consumer surplus is estimated by directly asking individuals about their willingness to pay for a right to use a beach for a defined period of time. Three basic steps are involved: (1) the analyst establishes a market to the respondent; (2) the analyst permits the respondent to use the market to establish prices or values that reflect the respondent's individual valuation or recreational opportunities "bought" or "sold" and (3) the analyst treats the values reported by the respondent as individual values from recreation, contingent upon the existence of the described market. Consumer surplus for Florida beaches derived by the CVM may be analyzed using a technique developed by Hammack and Brown (1974) and McConnell (1977). Once consumer surplus (CS) is estimated for each individual in a sample by the CVM, the next step is to explain variations in CS using the following model:

(1) CS = f(INC, BDAYS, TASTE, PER, PYG, RD)

where

INC = household income;

BDAYS = number of beach days;

TASTE = consumer taste variables such as expenditures;

PER = a vector of beach perception variables such as crowding, parking, etc.;

PYC = a vector of physical characteristics of the beach;

RD = a vector of regional dummy variables.

It is hypothesized that INC will increase CS (i.e., demand curve will shift out); BDAYS will decrease CS (i.e., diminishing marginal utility per beach day); TASTE will increase CS (i.e., a greater commitment of expenditures means greater valuation) while PER and PYC may have varying signs depending on specification of these variables and empirical results leading to different hypotheses.

The second technique is the demand function approach where expenditure data are used as a surrogate for price. This approach has been used by Gibbs (1974) and Pearce (1968) and just recently by Green (1984). The well known Clawson (1966) travel cost approach will not be used here since it is inappropriate where so many beach sites are involved with a small sample (sometimes only one observation per beach) for the cross section of beaches in Florida. Two theoretical demand models will be employed. The first will deal with resident demand for saltwater recreational beaches or

(2) $BDAYS_i$ = f($TEPD_i$, INC, SUB, SOC, PER, PYC, RD)

where

BDAYS = number days spent at beach i per year;

TEPD = total expenditures per day at beach i (i.e., on-site costs plus travel cost);

INC = household income;

SUB = substitute activities or days at other beaches than beach i;

SOC = a vector of socioeconomic characteristics;

PER = a vector of perceptions regarding the condition of Florida beaches;

PYC = a vector of physical characteristics of Florida beaches;

RD = a vector of regional dummy variables.

The purpose of this demand model is to find the relation, if any, between the number of beach days demanded at beach i and variation in the surrogate for price, expenditures per day, plus the influence, if any, of hypothesized demand shifters. Vectors SOC, PER and PYC will be discussed in Chapter 6. It is hypothesized that for residents there will be an inverse relation between $BDAY_i$ and $TEPD_i$. If beach recreation is a "normal good" the hypothesized relation between $BDAY_i$ and INC would be positive. As discussed above, if there is a positive or negative effect compensating and equivalent variation should be estimated.

The second theoretical model will measure the tourist demand for saltwater recreational beaches. This model is an adaptation of one used by Gibbs (1974):

(3) $BDAYS_i = f(POS_i, TTC, INC, SUB, SOC, PER, PYC, TRIPS)$

where

$BDAYS_i$ = number of days spent at beach i per year;

POS = on-site cost per day at beach i where P indicates a price surrogate variable;

TTC = total travel cost to Florida adjusted for percent of days in Florida at a saltwater beach;

INC = household income;

SUB = a vector of substitute activities (other beaches and non-beach activities);

SOC = a vector of socioeconomic characteristics;

PER = a vector of perceptions regarding Florida beaches;

PYC = a vector of physical characteristics of Florida beaches;

TRIPS = number of trips to Florida.

The demand model for tourists differs somewhat from that of residents specified above. For tourists, there is a distinction between on-site cost and travel cost. It will be argued that on-site cost (POS) is a better proxy for price since these costs are directly attributable to participation in the recreational experience. A change in the cost of travel (TTC) will be viewed in a different manner for tourists coming from long distances than changes in on-site recreational cost due to the fact that a travel cost must be incurred before any recreation is consumed. Higher travel cost will leave less income to be spent on recreation. Thus, an inverse relation between BDAYS and TTC might be expected. However, there is an alternative hypothesis suggested by Gibbs. That is, as TTC increases, the recreationist may spend more days at the site per visit. The beach user may substitute days at the site for trips to the site and thus cause a positive relation between BDAYS and TTC. TRIPS is included in equation (2) so that all variables can be viewed on a per trip or visit to Florida beaches. Also, only total travel cost to Florida adjusted for percent of days spent in Florida at the beaches is included in TTC. The INC variable has the hypothesized positive sign as was discussed for residents. Vector SUB is a measure of other substitute and possibly complementary activities while in Florida for the beach using tourists. It might be expected that beaches would be highly substitutable among themselves; therefore, the more days spent at other beaches than the "i"th beach would decrease $BDAYS_i$. But, days spent on non-beach recreation might be a complement to $BDAYS_i$. That is, the more days spent in Florida on non-beach recreation (i.e., Busch Gardens) would increase the demand for BDAYS. The SOC vector contains variables such as age, etc. while the PER vector contains impressions of Florida beaches such as the availability of parking facilities and crowding. Finally, the PYC vector is a more objective description of the beach such as width, parking spaces and facilities (e.g., bathrooms, motels, lifeguards). This completes the brief theoretical exposition. Chapter 6 will deal with the empirical results of testing theoretical hypotheses.

Chapter 6

Empirical Estimation of the Saltwater Beach User Value or Consumer's Surplus

Introduction

In Chapter 5, the basic theoretical models for estimating consumer's surplus were discussed. Using the sample surveys for residents and tourists discussed in Part 1 of this report, empirical estimation of these models will be presented in this chapter. Thus, many of the hypotheses discussed in Chapter 5 regarding beach valuation will be tested. Before evaluating these results, two sets of statistics will be discussed. First, user perceptions of Florida beaches will be discussed. These were derived for residents and tourists as part of sample survey discussed in Chapter 2 and 3. Second, the physical characteristics of Florida beaches will be reviewed. The latter data set is the result of a recently completed University of West Florida Study for the Florida Department of Natural Resources (1984).

User Perceptions of Florida Beaches

Residents: The fundamental purpose of surveying perceptions of Florida beaches is to see how they might influence demand or user value (i.e., consumer's surplus derived from the demand function) for the saltwater beaches. This will be discussed below. It should be indicated that the perceptions are of those actually engaged in beach use. Therefore, these perceptions relate to 65 percent of Florida residents 18 years and older that use the beach. See Chapter 2. Also, perceptions are impressions and may not be equated with objective facts; however, they may be very important to recreational behavior. This latter point is of special significance since these are impressions that may condition future behavior.

Consider Table 6.1. Nearly 69 percent of the residents perceived that Florida beaches were moderately or severely crowded. This is not necessarily "bad" since it would depend on a preference for people oriented activities. Crowding may, under various circumstances, be a positive factor. This will be discussed below. Over one-third of the residents felt that parking was inadequate for beach use. This perception would be hypothesized to deter beach use or is not a facilitating factor. Ninety-four percent of the

Table 6.1

Perceptions of Resident Users of Florida Saltwater Beaches*
(1984)

Perceptions	Percent of Sample Respondents
A. Crowdedness	
1. Not Crowded	19.6
2. Little Crowded	11.8
3. Moderately Crowded	46.2
4. Severely Crowded	22.4
B. Parking Availability	
1. Plentiful	17.1
2. Adequate	46.6
3. Inadequate	36.3
C. Cleanliness of Coastal Water	
1. Very Clean	38.4
2. Clean Enough for Swimming	55.6
3. Not Clean Enough for Swimming	6.1
D. Over Physical Appearance of Beach	
1. Very Attractive	38.6
2. Attractive	55.0
3. Unattractive	6.4

*Survey included 114 public beaches and 48 private beaches for a total of 162 beaches in sample. There were 930 individual beach responses.

Source: FSU Beach Survey Study

residents were well satisfied with coastal water with respect to swimming. Of course, water quality is the province of the Florida Department of Environmental Regulations while beaches are the purview of the Florida Department of Natural Resources. Finally, nearly 94 percent of the residents felt that the physical appearance of beaches in Florida were either "very attractive" or "attractive." Assuming crowding is a negative factor, it would appear that the lack of parking and overcrowding would reduce the "value" of the beach recreational experience. This will be pursued below.

Tourists: The same perception attributes as obtained from residents were also obtained from tourists. The results are shown in Table 6.2. In contrast to residents, only a little over 43 percent felt that the saltwater beaches were moderately or severely overcrowded. Florida is a large state with nearly 1000 miles of coastline. For tourists from relatively small northeastern states such as Massachusetts or Rhode Island, crowding may be a very relative phenomenon. This may be an important reason for the decided difference in crowding perceptions between residents and tourists. Again, tourists disagreed with residents with respect to parking where only a little under 12 percent felt that parking was inadequate. Tourists were also more impressed with the high standard of coastal water quality in Florida than residents. Only 2.7 percent of the tourists felt that the coastal water was not swimmable (compared to 6.1 percent for residents). Tourists were slightly more impressed with the physical appearance of Florida beaches than residents. On a comparative basis, it would appear that tourists perceived Florida beaches to be much "better" than residents with respect to the selected attributes. First, it must be remembered that tourists did not necessarily visit the same beaches as residents. Second, 70.4 percent of the beaches visited by residents were public (see footnote to Table 6.1) while 61.5 percent were public for tourists. Private beaches may be better equipped (e.g., parking facilities) than public beaches. Therefore, the impressions of the two groups (residents compared to tourists) may be biased by these two factors. On the other hand, these are two random samples of impressions by the different groups. The responses or perceptions are quite different among residents and tourists with respect to crowding and parking. Tourists felt less crowded and that parking was reasonably good relative to the residents of Florida. These topics will be discussed below.

Table 6.2

Perception of Tourist Users
of Florida Saltwater Beaches*
(1984)

Perceptions	Percent of Sample Respondents
A. Crowdedness	
1. Little	56.8
2. Moderately	36.0
3. Severely	7.2
B. Parking Availability	
1. Plentiful	56.1
2. Adequate	32.5
3. Inadequate	11.4
C. Cleanliness of Coastal Water	
1. Very Clean	76.5
2. Just Swimmable	20.8
3. Not Swimmable	2.7
D. Overall Physical Appearance of Beach	
1. Very attractive	64.2
2. Attractive	31.5
3. Unattractive	4.3

*Survey included 91 public beaches and 57 private beaches for a total of 148 beaches in the sample. There were 1,115 beach responses.

Source: FSU Beach Survey Study

Since perceptions can serve as demand shifters as discussed in Chapter 5, the following variables were created for statistical analysis to be presented later in this chapter:

CROWD*: 1. Little
2. Moderate
3. Severe

PARK: 1. Plentiful
2. Adequate
3. Inadequate

PHYAP: 1. Very Attractive
2. Attractive
3. Unattractive

CWATER: 1. Very Clean
2. Just swimmable
3. Not Swimmable

*For residents, a one was assigned to "not crowded." See Table 6.1.

Each variable is trichotomous and thereby discrete, but can be used for purposes of statistical analyses of demand.

The Physical Characteristics of Florida Beaches

The Florida Department of Natural Resources contracted with the University of West Florida to do a recreational analysis of public saltwater beaches in Florida. A sample of the kind of data obtained in this study is shown in Table 6.3 for selected beaches in Pinellas County. In the matrix, SUPPLY covers many of the physical characteristics of the beaches such as length, width, access points, and parking facilities. The beach data set covers all public beaches in all but a few counties in Florida. From Jefferson to Pasco Counties, these beach areas were not surveyed because they tend to be isolated and get little, if any, use. Monroe County (including the Florida Keys) was also not surveyed since there are so many pockets of beaches, many of which have no name along the Keyes. The University of West Florida data were divided into five general categories as follows:

1. Beach Dimensions
2. Beach Use or Crowding
3. Parking Facilities

Table 6.3

RECREATIONAL PUBLIC BEACH ANALYSIS MATRIX : PINELLAS COUNTY

Reference Section *	A		C	D-1	D-2	D-3	E	F	G	H-1	H-2	H-3	I-1	I-2	J-1	J-2	J-3	J-4	K-1	K-2	L	M
			SUPPLY							LIMITING FACTORS					DEMAND				PROJECTED DEMAND			
BEACH NAMES:	RURAL / URBAN	TOURIST / RESIDENT	FACILITIES (see below)	DIMENSIONS: LENGTH (feet)	WIDTH (feet)	AREA (acres)	ACCESS POINTS	DAILY BEACH USE (pers./day)	PARKING SPACES	PARKING CAPACITY (persons/day) - LOW	- HIGH	AVE. PARKING CAPACITY (persons/day)	AREA CARRYING CAPACITY (persons/day)	LINEAR CAPACITY (persons/day)	RESIDENT DEMAND (persons/day)	TOURIST DEMAND (persons /day)	TOTAL DEMAND (persons/day)	PEAK DEMAND (persons/day)	1990 DEMAND (persons/day)	2000 DEMAND (persons/day)	RECOMMENDATION +	MANAGEMENT ISSUES (see below)
ARCHIBALD MEMORIAL BEACH	U	T	1,2-6,9,14,16-19, 21,23,25	600	400	5.6	1	150	115	230	690	460	2400	200	50	111	161	290	181	227	1	-
CALADESI ISLAND STATE PARK	R	T	1,2,4,5,6,7-12, 14-16,17,19,21,23	13,600	300	607	*	400	300	600	1800	1200	20,400	4533	131	296	427	773	480	605	2	-
CLEARWATER BEACH PARK (NORTH)	R	T	1,2,4-12,14-19,21, 22,23,25	1,100	200	4.82	4	1500	612	1224	3672	2448	2200	366	490	1111	1601	2895	1799	2268	3	C
CLEARWATER BEACH PARK (SOUTH)	U	T	1,2,4-7,9,15-10,22, 23,25	3,100	400	2754	24	4500	1112	2224	6672	4448	12,400	1033	1468	3334	4802	8683	5395	6802	4	P,C
FORT DESOTO PARK	R	T	1,2,4,6-9,11-22,15	28,400	500	900	U.R.	4506	3241	6482	19446	12,964	71,000	9466	1469	339	4808	8695	5401	6811	5	-
HONNEYMOON ISLAND STATE PARK	R	T	1,3-5,7-11,14-19, 21,23-25	5,280	200	407	1	700	650	1300	3900	2600	5280	1760	228	519	747	1351	839	1059	6	A
HOWARD PARK	U	T	1,2,4,5,16-19, 21-23,25	1,000	250	128	1	1479	383	766	2298	1532	250	333	482	1096	1578	2854	1772	2235	7	P,C
JOHNS PASS BEACH AND PARK	U	T	1,2,10,16,17,20,25	500	400	4.7	1	80	80	160	480	320	2000	166	29	65	94	170	105	133	8	-
MADIERA BEACH PARK	R	T	1-5,7,9,14,16-19, 24,25	100	300	1.5	3	500	104	208	624	416	150	33	163	370	533	964	599	755	9	P,C
PASS-A-GRILL BEACH PARK	R	T	1,2,3-7,9,14-19, 22,24,25	5,500	120	15.15	U.R.	4000	600	1200	3600	2400	3300	1834	1304	2963	4267	7718	4795	6045	10	P,C
REDINGTON SHORE BCH.	U	T	1,2,4,16-17	400	100	3.5	1	1239	172	344	1032	688	400	133	403	918	1321	2390	1485	1872	11	P,C
ST. PETERSBURG MUNICIPAL BEACH	U	T	1,2,4-7,16,19,23,25	500	406	6.22	1	385	155	310	930	620	2111	173	125	285	410	742	461	582	12	C
SUNSET BEACH	R	R	1,7,16,19,20	-	-	17.4				UNDEVELOPED				NO OTHER INFORMATION AVAILABLE								
TREASURE ISLAND BEACH	U	T	1,2,5,9,10,14,16- 19,23,25	19,080	685	181.3	27	2500	80	160	480	320	136178	6626	815	1852	2667	4823	2996	3778	14	P
UPHAM BEACH	U	T	1,2,16,17,19,25	1,700	500	23.4	5	800	124	248	744	496	8500	566	260	593	853	1543	958	1209	15	P,C

FACILITIES: * Water access U.R. - Unrestricted access

1.Parking 2.Mass Transit 3.Entrance Fee 4.Restrooms 5.Showers 6.Food/Concession 7.Picnicing 8.Firepits 9.Handicapped Facilities 10.Walkovers 11.Nature Trails 12.Boating Facilities 13.Overnight Camping 14.Marked Access 15.Lifeguard/FirstAid 16.Swimming 17.Shelling 18.Surfing 19.Fishing 20.Fishing Pier 21.Group Facilities 22.Bicycle Facilities 23.Shelter 24.Scuba Diving 25.Restaurant,Bars,Motels Nearby

MANAGEMENT ISSUES:
A:Access
P:Parking
F-#:Facilities
C:Carrying Capacity

* (REFER to the Recreation Methodology for a complete Matrix description of columns A-M)

Source: University of West Florida

4. Access Points

5. Facilities Availability

As discussed in Chapter 5, the physical characteristics of the beach may influence the demand for beach days. These physical characteristics may be demand shifters. The principal problem with the data is creating the kinds of variables for statistical analyses. The following variables were created:

Beach Dimensions

L = Length (feet)

W = Width (feet)

LW = Square feet

Beach Use or Crowding

$$CR = \frac{LW}{\text{Persons/day}}$$

$$PU = \frac{\text{Persons/day}}{\text{Estimated carrying capacity}}$$

PS = parking spaces

$$PK1 = \frac{\text{parking spaces}}{LW}$$

$$PK2 = \frac{\text{parking spaces}}{\text{Persons/day}}$$

APC = average parking capacity

Access Points

AP = number of beach access points

$$AP2 = \frac{\text{Access Points}}{\text{L (feet)}}$$

$$AP3 = \frac{\text{Access Points}}{\text{Persons/day}}$$

Facilities Availability

UWI = unweighted index or simply the total number of different facilities available.

$$WI = \sum_{i=1}^{n} W_i \, fi$$

where

W_i = mean weight given to an individual facility where 5 = extremely important; 4 = very important; 3 = average importance; 2 = not that important and 1 = very little importance at beach i;

f_i = 1 for each facility at beach i;

n = number of facilities available at beach i.

There are probably many other ways of specifying the physical characteristics of beaches. However, these specified variables will be discussed first within the context of an individual beach as an example and then within the context of the sample means and medians.

Consider Treasure Island Beach in Table 6.3. This beach is 19,880 ft. long (L) and 685 feet wide (W) with a square footage of 13,617,800. With respect to crowding, each person per day has 5,447 square feet (13,617,800 ÷ 2500). Only 1.84 percent of this beach's carrying capacity is being utilized (2500 ÷ 136,178). The carrying capacity is computed by dividing square feet available by 100. For urban public beaches, the University of West Florida indicated that 100 square feet per person is the threshold below which a beach user's enjoyment would decrease.[1] Based upon this criterion, Treasure Island Beach is not very "crowded." This beach has 80 parking spaces (PS); .0000059 parking spaces per square foot of beach (PK1); .032 parking spaces per person (PK2) and an average parking capacity of 320 (APC). APC represents an average of 2.0 persons per car per parking space per day with a single turnover in parking space use (i.e., PS x 4). Treasure Island Beach has 27 access points (AP); .00136 access points per linear foot of beach (AP2) and .011 access points per person per day (AP3). With respect to facilities, these are listed at the bottom of Table 6.3. Although a beach may have 25 "facilities," entrance fee (3) and swimming (16) were not considered facilities by the authors so a maximum score per beach would be 23. The "score" for Treasure Island Beach is 11 (UWI) as enumerated in Table 6.3. Finally, if the 10 facilities are weighted using the mean of W_i, this beach has a score of 34. This is explained in Appendix A.5.

Next, the physical characteristics of the beaches obtained from the University of West Florida were matched with the beaches visited by the resident and tourist samples discussed in Chapters 2 and 3 respectively. Thus, not all Florida beaches were used. The inclusion of a beach depended on whether observations were available on visitors' socioeconomic characteristics and perceptions of the beach discussed above. This is a necessary requisite for empirical testing of the models presented in Chapter 5.

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[1] No rationale was given by the University of West Florida for the choice of 100 square feet at the threshold. No studies were referenced. This assumption was tested and the results are presented in this chapter.

Consider Table 6.4 which summarizes the matching data dealing with beach characteristics encountered by individuals in the resident and tourist samples discussed in Chapters 2 and 3. The University of West Florida study contained 202 public beaches. The resident survey covered 114 of these beaches while the tourist survey included 91 of these beaches. Therefore, about 50 percent of the saltwater beaches surveyed by The University of West Florida are shown in terms of average and median characteristics in Table 6.4. The average beach was 13,819 feet long and over 208 feet in width for residents. Tourists visited slightly longer and wider beaches than residents; therefore, the average square footage per beach was larger for tourists than residents. In the example above, Treasure Island Beach was over four times as large as the typical "tourist beach" in Florida as measured by square feet. Further, Table 6.4 indicates that residents, on the average, have over 754 square feet per person compared to 818 square feet per tourist of beach. Median values are much lower, but are still in excess of the so-called "threshold level" of 100 square feet for urban beaches discussed above. This will be analyzed in greater detail below and in Chapter 7. In general, Florida beaches are vastly underutilized as PU (i.e., percent utilized) is under 1 percent for mean and median. With respect to parking, residents have 1,355 spaces per beach while tourists visited beaches with 1,345 spaces per beach using the averages in Table 6.4. The median parking spaces per beach is about half of the mean parking spaces and probably more reflective of the typical beach. The reason for this is that the University of West Florida sub-divided many beaches such as Daytona and Miami whereas they were aggregated into one large beach for purposes of this study. Such large beaches will affect the mean but not the median parking spaces. Parking spaces per square foot of beach turned out to be a small number with little variation. Remember, Treasure Island Beach had 80 parking spaces and 13.6 million square feet of beach. On the average, there is .406 parking spaces for every person that uses the beach in the case of residents and slightly less (i.e., .364) for tourists. The median was about a third of a parking space per beach user for both residents and tourists.

Access points to public beaches are usually considered as rather important. The measurement of this variable was complicated by the reported data which was either a specific number of access points or U.R. - unrestricted. In Table 6.2, both Ft. Desota Parks and Pass-A-Grill Beach Park

Table 6.4

Means and Medians
of Physical Characteristics
of Florida Beaches
(Public Beaches)

	Residents		Tourists	
Variable	Mean	Median	Mean	Median
Beach Dimensions				
Length (L)	13,819	5,498	15,526	5,701
Width (W)	208.85	175.0	215	200
Square Feet (LW)	2,550,653	1,025,785	3,210,085	900,322
Beach Use				
Crowding (CR)	757.84	425.92	817.97	426.06
Percent Utilized (PU)	.61	.306	.613	.276
Parking Facilities				
Parking Spaces (PS)	1,355.3	612.38	1,344.9	612.48
PS per LW (PK1)	.001	.001	.001	.001
PS per Person (PK2)	.406	.310	.364	.310
Average Parking Capacity (APC)	6,490.41	2,448.13	7,200.95	2,448.78
Access Points				
Number of Access Points (AP)	4,383.47	5.70	5,702.72	14.92
AP per Linear Foot (AP2)	.198	.002	.198	.002
AP per Person (AP3)	1.589	.003	2.238	.003
Facilities Availability				
Number of Facilities (UWI)	14.78	14.73	15.06	14.85
Weighted Facilities (WI)	44.54	46.42	45.66	46.91
Sample Size	804	804	969	969

Source: The University of West Florida

have unrestricted entry. The latter park has 5,500 linear feet of beach; therefore, this beach was evaluated to have 5,500 "access points." Thus, the AP variable may be highly biased upward. The median AP is obviously more representative of beaches with restrictive entry showing 5.7 and 14.92 access points per beach for residents and tourists respectively. Access points per linear foot and per person are alternative specifications for the access point variable. These variables are large for their means relative to the median largely because of the way unrestricted (UR) beaches were treated as discussed above.

Finally, facilities are usually considered extremely important to the beach experience. As indicated in Table 6.3, Treasure Island Beach has 11 of the possible 23 facilities listed at the bottom of the table. Remember, entrance fees and swimming were not considered "facilities" by the authors of this report. The typical beach for both tourists and residents had about 15 of these 23 facilities and both mean and median agreed. Obviously, facilities vary in qualitative importance to beach users since they range from the availability of lifeguards to firepit equipment. To obtain some ranking of these beach facilities, the authors asked a cross section of students at Florida State University to assign a numerical weight to each of the 23 facilities. The students assigned a highest rank of 5 if the facility was "extremely important" and a lowest rank of 1 if the facility was of "very little importance." See Appendix A.5 for a better description of this survey. The authors realize that university students may have different preferences than the resident or tourist population; however, this ad hoc procedure did seem reasonable in light of the fact that budget limitations precludes two more surveys (residents and tourists) just to weight the facilities variable. The students ranked the top ten facilities to be the following:

1. Parking
2. Lifeguard/First Aid
3. Restrooms
4. Handicapped facilities
5. Showers
6. Restaurants, Bars, Motels
7. Shelters
8. Marked Access to Beach
9. Surfing
10. Boat facilities

This did not seem an outrageous priority system. Nature trails, firepits and mass transit to the beach were some of the least desirable beach characteristics. After the ranking of facilities was determined, the first 3 were assigned a 5; the next 4 a 4; the next 3 a 3; the next 10 a 2 and the final 3 a 5. According to Table 6.4, the average beach had a WI of about a 45 for both tourists and residents. The medians were approximately 45. This is a "facilities score" for the typical beach. The score may be <u>increased</u> by a combination of <u>increasing</u> the number of facilities and/or having facilities that have relatively high weights. As an example, Treasure Island Beach has a WI of 34. This beach scored less than the average beach with respect to facilities because the absolute number of facilities of 11 is below the mean (15) and its mix of facilities was not that favorable in that it lacked lifeguards/first aid and restrooms. The authors admit that this is a very crude index of facilities and more research is needed in this area.

Relation of Beach Perceptions to Physical Characteristics

In the previous sections of this chapter, perceptions and physical characteristics of saltwater beaches in Florida have been reviewed. What people perceive about a beach may be hypothesized to influence both the demand function for beach days and the willingness to pay for beach use. These concepts were discussed in Chapter 5 and are empirically analyzed below. Of the four perceptions discussed above (See Table 6.2), two can be compared with more objective measurement from the physical characteristics section (See Table 6.4). These are crowding and parking. CROWD is trichotomous perception variable running from 1 (little crowded) to 3 (severely crowded). This variable was statistically related to CR or square feet of beach per person. The following Pearson correlation coefficients were found:

CROWD with CR

Variable	Tourist	Residents
Correlation	-.1551	-.0983
Sample Size	(921)	(804)
Probability of being zero	(P = .001)	(P = .005)

For both residents and tourists, as the perception of crowding increased (i.e., 1, 2, 3) the square feet of beach per person <u>declined</u>. Thus, tourist and resident perceptions of crowding are inversely correlated with an objective measure of crowding, CR or square feet of beach per user. <u>This is</u>

consistent with expectations. The value in parentheses under the correlation coefficient is the sample size while P is the probability level. When P = .001, it means that the probability of observing the correlation coefficient at random is only 1 in 1000 if the real coefficient is zero in the population. Put differently, both correlation coefficients have a high degree of statistical significance.

With respect to parking, PARK runs from 1 as plentiful to 3 as inadequate. Unfortunately this parking perception was positively correlated with PS, parking spaces and PK1, parking spaces per square foot for tourists. This is contrary to expectations. PARK was inversely related to PK2 and APC, but not statistically significant at the 5 percent level. For residents, there were no statistically significant relation between parking perceptions and objective measures. The authors have no explanation for this statistical finding and suggest further research into this critical area.

Contingent Valuation Method: Beach Valuation

In Chapter 5, the contingent valuation method (CVM) was extensively discussed. In this chapter, the empirical results will be presented. To estimate the total user value or consumer surplus for resident and tourist beach users the following question was asked each beach visitor in the sample surveys discussed above:

> Because of beach erosion and other beach related problems, suppose it became necessary for beach users to agree to buy an annual pass. The money collected would pay for the preservation of the beach. What is the maximum amount you would pay for the annual beach pass in addition to any present beach fees?

In theory, this question will measure the dollar value of the consumer surplus from a resource that has a zero user price or a minimal price since some do pay beach access fees. This is equivalent variation as discussed in Chapter 5. But, how accurate is a hypothetical question such as the one posed above? Perhaps the source of bias in such a question results from "gamesmanship." People who are asked hypothetically what they would be willing to pay for the right to use beaches may recognize two different incentives to distort their responses. Perceiving that they will not acutally have to pay and that their responses may favorably influence the supply of beaches, people may overstate their willingness to pay reflecting what they would like to see done rather than how they would behave in an actual market. On the other hand, if people believe that their responses will influence actual fees charged in the future they may be more concerned about keeping their estimates low than revealing their true values. Most evidence to date suggests that responses to willingness to pay questions tend to have a downward bias. Bishop and Heberlein (1979) report that willingness to pay questions may yield only one-third the value obtained when actual cash offers are used which removes the experiment from the realm of the hypothetical. Since the question asked residents and tourists for annual willingness to pay, the figure was converted to the standard consumer surplus per day by dividing by total annual beach days. Table 6.5 shows the results for both residents and tourists.

Residents and tourists were willing to pay $1.31 and $1.45 per day respectively for an annual beach pass for the purposes of beach preservation as indicated in Table 6.5. These are the means of the willingness to pay per day. The sample distribution is shown since the median willingness to pay per day is $.33 and $.50 for residents and tourists respectively. Based upon the sample distributions, the maximum willingness to pay per day would be about $9.08 (.8 X 3 x $3.23 plus $1.31) for over 99 percent of the population of resident beach users adjusting for skewness of the distribution.[2] The corresponding maximum amount for tourists would be $7.64 for the population. In the sample of 804 residents, willingness to pay per day varied from 0-$45 (i.e., range); however, 29 percent of residents refused to pay anything per day. This may be a reflection of the gamesmanship of the hypothetical question. That is, individuals may anticipate that a fee might be imposed for public beach use and down play their eagerness to pay. The tourist sample of 968 individuals had a range of willingness to pay per day from zero to $25 where 38 percent indicated they would not be willing to pay anything for a beach recreational pass. The results obtained here may be compared to other studies by Curtis and Shows (1982, 1984). They asked the following question:

> "How much would you be willing to pay for
> the use of the beach for a whole day?"

During 1981-82, Delray Beach exhibited the following values:

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[2] The maximum was obtained by adding 3 times the standard deviation times a .8 skewness adjustment to the mean.

Table 6.5

Willingness to Pay Per Day (WTPPD)
for Saltwater Beach Use:
Residents and Tourists

Statistic	Residents	Tourist
Mean	$1.31	$1.45
Standard Deviation	3.23	2.57
Median	$ .33	2.57
Range	0 - $45	0 - $25
Percent Not Willing to Pay Anything	29%	38%
Sample Size	804	968

Source: FSU Beach Study

	Willingness to pay per day	
	Tourists	Residents
Value (average of Summer and winter)	\$2.15	\$1.88

Curtis and Shows (1982) state "... when asked this question, residents would reply that 'they pay taxes and should not be expected to pay for Florida Beaches'. This further strengthens the view that the estimates of willingness to pay are biased downward" (p. 26). Curtis and Shows (1984) asked the same question to those individuals using Jacksonville Beach and found that tourist would pay \$4.88 per day for the right to use the beach while residents would pay \$4.44 in 1983. Although these values are somewhat higher than the ones reported in this study (See Table 6.5), they are in agreement with the findings for all Florida that tourists would be willing to pay more per day than residents to use the beach. Curtis and Shows did not attempt to explain variations in willingness to pay per individual. This is the subject matter of the next section.

Explaining Variations in Willingness to Pay or Consumer Surplus

The theoretical model for analyzing variations in willingness to pay was discussed at some length in Chapter 5. As a reminder, the following equation was specified:

$$(1)\quad CS = f(\overset{+}{INC}, \overset{-}{BDAYS}, \overset{+}{TASTE}, \overset{-}{SUBST}, \overset{-}{PER}, \overset{+}{PYC}\ \overset{+}{RD})$$

where:

CS = consumer surplus or willingness to pay per day;

INC = household income;

BDAYS = number of saltwater beach days;

SUBST = a vector of substitute days at other beaches;

TASTE = expenditures related to beach recreation per day;

PER = vector of beach perceptions;

PYC = a vector of physical beach characteristics;

RD = a vector of regional dummy variables within Florida.

The signs above the variables in equation (1) are as hypothesized in Chapter 5. INC is expected to shift the demand curve for beach use outward and raise consumer surplus. As BDAYS increase along the demand curve, marginal and average consumer surplus per day should fall. Expenditures per day are included to reflect TASTE. If one spends more money on beach related activities, it is hypothesized that CS per day will be higher for that individual than those spending less ceteris paribus. Hammack and Brown (1974) state, "We see no a priori reason why cost cannot be a proxy measure for taste... one may make larger expenditures, purchase a richer set of characteristics, and value the hunting experience more" (pp. 20-30). SUBST is days spent at other beaches than the one for which the observation pertains and is hypothesized to have a negative sign. With an income constraint, the more days spent at other beaches the less days are available for the i'th beach. PER is a vector of demand shifters containing CROWD; PARK; PHYAP, and CWATER as discussed above. These are all perception variables with some a priori signs.

The following a priori signs are expected:

CROWD : Negative
PARK : Negative
PHYAP : Negative
CWATER : Negative

These are all trichotomous variables as discussed above under perceptions. Finally, the vector PYC contains (1) beach dimensions (L; W; LW); (2) beach crowding (CR; PU); (3) beach parking facilities (PS; PK1; PK2; APC); (4) beach access points (AP; AP2; AP3) and (5) beach facilities available (UWI; WI). Finally, three regional dummy variables representing North, Southwest and Southeast Florida were included to capture intra-state differences ceteris paribus. All these variables were discussed above. Equation (1) was estimated by OLS using all the variables discussed above. Many combinations of equation (1) were estimated since multiple specification of variables in the PYC vector existed (i.e., only one of the parking variables such as APC or PK1 were entered into the regression at the same time). The preliminary regression runs are not shown here because of lack of space, but are available from the authors. Variables were held in the regressions if the t-value was 1.4 or more to enlarge the scope of variables presented. Table 6.6 shows the final regression results for residents and tourists. Consider the final resident equation.

Various forms of the willingness to pay function were estimated, but the log-log function had the highest R^2 with more variables statistically

Table 6.6

Estimiation of Willingness to Pay Equations
Dependent Variable: LWTPPD*

Independent Variables[1]	Residents	Tourists
Constant	-2.55 (-3.20)	-1.563 (-.238)
LINC	.14071 (2.30)	.08443 (1.69)
LBDAYS	-.41285 -13.13)	-.31786 (-12.03)
LTEPD[2]	.13817 (5.51)	N.A.
LOSEPD[3]	N.A.	.0355 (1.47)
LDOTHB[4]	NSS[5]	-.2094 (-8.94)
CROWD	NSS[5]	.1437 3.64
LWIDTH	.09256 (1.61)	-.14413 (-3.60)
LCR	.0619 (1.90)	NSS[5]
LWI	.2020 (1.57)	.14163 (1.4)
$\overline{R}^2$	.2952	.2058
F	53.35	36.76
N	751	967

*Logarithm of willingness to pay per day or CS; 1. "L" stands for logarithm; 2. total expenditures per day; 3. on site expenditures per day; 4. days at other beaches; 5. not statistically significant or t-value less than 1.4; t-values in parentheses.

significant at the 5 percent level. For residents, higher INC and TEPD (total expenditures per day including travel cost), a proxy for TASTE, increased CS or willingness to pay as hypothesized. The greater number of BDAYS demanded lowered average willingness to pay per day along the demand curve. This variable had the highest t-value in the resident equation. For residents, none of the perception variables influence willingness to pay. This is somewhat surprising since residents were more critical of Florida saltwater beaches than tourists. See Tables 6.1 and 6.2 for comparison. In fact, the trichotomous perception variables discussed above were apparently not related to CS except CROWD in the tourist equation and the sign may be "perverse." For residents, wider beaches (WIDTH) with higher weighted facility scores (WI) and more square feet per beach user (CR) tended to raise willingness to pay as expected. The $\bar{R}^2$ for the final resident equation was .2952 is generally condsidered good for cross-section studies.

In the tourist equation shown in Table 6.6, INC and OSEPD (on-site expenditures per day) were positively related to willingness to pay but at the 9 percent and 14 percent level respectively. In contrast to residents, on-site cost of the beach were used for tourist since travel cost is not beach-specific, but for a total vacation in Florida. Travel cost was included in cost per day or TEPD for residents since a beach visit was usually one day and therefore travel cost was more beach specific. This will be discussed at greater length below under demand functions. As hypothesized, BDAYS was inversely related to CS for tourists as well as residents. In contrast to residents, and increase in days at other beaches, DOTHB, decreased the willingness to pay for tourists. This is interpreted as a substitution effect. In contrast to residents, tourists were willing to pay more for beach with reduced width and where there was a perception of increased crowding. The perception variable, CROWD, was positive and statistically significant at the one percent level for tourist. As with residents, tourist were willing to pay more for an increase in "weighted facilities." Although WI was only statistically at the 16 percent level, more research is needed in specifying and quantifying the role of beach facilities in increasing the value of the recreational experience.

The major difference between the resident and tourist willingness to pay equation is the impact of crowding and beach width. Residents were crowding adverse which may be the "usual" hypotheses. That is, as CR increased (i.e., square feet per beach user) and crowding was thereby reduced resident CS rose. CR was not a statistically significant variable in the tourist equation; however, their perception of crowding (i.e., CROWD) increased CS. This may appear as a perverse finding; however, the literature is unclear as to the role of crowding in changing the value of the recreational experience. The Outdoor Recreation Resources Review Commission (1962) found that a broad spectrum of recreationists were generally satisfied with visitor density levels they experienced, and that in fact, 20 percent of the respondents felt that encountering more people would be acceptable. Burch and Wenger (1967) actually found that campers seek out opportunities to associate with each other. Manning and Cialia (1980) found a positive relation between satisfaction ratings (for fishermen, floaters and swimmers using a river) and total number of other users seen (i.e., crowding). The same authors explored what is called the "product shift hypothesis." That is, recreationists who had been participating in their respective activities for a greater number of years (e.g., Florida residents) would be more likely to recognize and resist subtle products shifts (i.e., more crowding) than relative newcomers (e.g., Florida Tourists). Finally Table 6.2 shows that most tourists regarded Florida Beaches as either "little" or "moderately" crowded (i.e., nearly 93 percent). As the CROWD variable increased this may of course raise CS since there were more people with whom to associate or by which to be seen in a social setting. Few tourist regarded Florida beaches as "severely" crowded and this may be a function of their experiences with northern beaches that have less square feet per person (i.e., more crowded). Further investigation of this hypothesis is beyond the scope of this report.

Before leaving this section on willingness to pay, it may be instructive to look at carrying capacity standards for the beach. The Florida Department of Natural Resources, Division of Recreation and Parks uses 200 square feet/person/day as the average area needed to obtain a "worthwhile recreational experience on rural beaches." For urban public beaches, the University of West Florida (1984) uses 100 square feet/person/day. McConnell (1977) has analyzed the economics of the Bureau of Outdoor Recreation (BOR) standard which suggests that each person have 75 square feet of beach. In the sample of residents, 6 percent and 10 percent of the sample experienced less than 75 and 100 square feet of beach/person/day respectively. For tourists, the sample percentages were 5 and 10 percent for less than 75 and 100 square feet/person/day. Thus, the residents were quite similar to the tourist in terms of the percent exposed to unacceptable beach standards. Using the DNR criterion (i.e., 200 square feet/person/day) 31 percent of the residents and 34 percent of the tourists were exposed to sub-standard beach space. To test these standards, the following hypothesis was formed: The willingness to pay for beach use will be reduced (i.e., consumer's surplus) if square feet of beach/person/day falls below standards discussed above. Or, willingness to pay will be increased if a beach is above the minimum standard. To test this latter form of the hypothesis, the following dummy variables were specified:

CRD1	DCR75	0 below 75 ft^2 1 75 f^2 and above
CRD2	DCR100	0 below 100 f^2 1 100 f^2 and above
CRD3	DCR200	0 below 200 f^2 1 200 f^2 and above

These dummy variables were placed in the two willingness to pay equations shown in Table 6.6 and the variables CR and CROWD were deleted. The results are shown in Table 6.7. The respecification of the willingness to pay function did not appreciably change most of the original variables shown in 6.6. The major finding was that residents were sensitive to the 75, 100 and 200 feet thresholds as specified in the dummy variables discussed above. That is, residents were willing to pay more for the recreational beach experience if the square feet per person exceeded 75, 100 and 200 feet, indicating a preference for less crowded beach conditions. For residents, the coefficient on two of the dummy variables (DCR 75, DCR 100) were not significantly different. This would indicate that a precise standard is difficult to stipulate. The standard could be as low as 75 square feet and as high as 100 square feet and yield the same willingness to pay. The beach standards on crowding had no influence on willingness to pay for tourist in contrast to residents. All t-values were less than unity and statistically insignificant. More research on beach standards for crowding is necessary based upon the preliminary results presented here. More extensive analysis will be performed in Chapter 7.

Table 6.7

Empirical Test of Carrying Capacity: A Test of Beach Standards Using Willingness to Pay*

	Residents			Tourists		
Independent Variables	75 f^2	100 f^2	200 f^2	75 f^2	100 f^2	200 f^2
Constant	-2.259 (-2.91)	-2.259 (-2.96)	-2.438 (-3.09)	.0281 (.0427)	.0322 (.0489)	.0753 (.1142)
LINC	.1332 (2.19)	.1332 (2.16)	.1373 (2.25)	(.0859) (1.66)	.0841 (1.67)	.0835 (1.65)
LBDAYS	-.4101 -13.07)	-.4074 -12.97)	-.4126 -13.11)	-.3101 (-11.68)	-.3106 (-11.71)	-.3125 (-11.74)
LTEPD	.1334 (5.30)	.1370 (5.46)	.1365 (5.43)	N/A	N/A	N/A
LOSEPD	N/A	N/A	N/A	.0336 (1.38)	.0338 (1.38)	.0354 (1.45)
LDOTHB	NSS	NSS	NSS	-.2033 (-8.64)	-.2031 (-8.63)	-.2035 (-8.65)
LWIDTH	.0608 (1.06)	.0800 (1.37)	.0908 (1.57)	-.1383 (-3.35)	-.1397 (-3.28)	-.1290 (-3.17)
LWI	.1967 (1.53)	.1818 (1.40)	.2574 (1.96)	.1147 (1.26)	.1175 (1.29)	.1089 (1.19)
DCR75	.3591 (2.57)	N/A	N/A	.0441 (.3846)	N/A	N/A
DCR100	N/A	.3615 (2.15)	N/A	N/A	.0333 (.350)	N/A
DCR200		N/A	.1392 (1.67)	N/A	N/A	-.0480 (-.892)
$\overline{R}^2$	.2980	.2961	.2944	.1950	.1949	.1955
F	54.05	53.59	53.15	34.41	34.41	34.53
N	751	751	751	967	967	967

*See Table 6.6 and text for explanation of variables

The Demand Function: Empirical Results

Tourists: In Chapter 5, a theoretical demand function for beach days was specified. The purpose of the demand function was to explain variations in beach days among residents and then among tourists. It was hypothesized that for tourist $BDAYS_i$ (i.e., number of days spent on beach i per year) was positively related to INC and OTHD or other days spent on non-beach related activities in Florida. INC is self explanatory while OTHD may be a complement in the bundle of recreational activities in which one is engaged in Florida, therefore, the positive relationship. Also, it was further hypothesized following Gibbs (1975) that total travel cost or TTC may be positively related to $BDAYS_i$. As TTC increases, the beach user will spend more recreational days since he has such a large investment in just getting to the site per trip. The price variable is designated POS or price as on-site cost which is hypothesized to be inversely related to $BDAYS_i$. DOTHB or days at other beaches is a substitute for the i'th beach and should be inversely related to $BDAYS_i$. Age and age square were entered into the demand function to see if beach demand was influenced by a change in age among the sample of tourists. The vectors of perceptions and physical characteristics were also included in the demand as shifters. As in the regression results reported above, only the results that had the best statistical fit and t-values above 1.4 are reported here although preliminary regression runs are available from the authors. Table 6.8 shows the statistical beach demand functions with and without the number of trips to Florida variable for the tourist sample. The linear form of the demand function yielded the best overall fit. The original Gibbs model argued that $BDAYS_i$ per trip to a vacation spot would increase as the investment cost in travel or TTC increased. The first equation in Table 6.8 does not include the number of trips to Florida, TRIPS, made by the tourist; therefore, the equation is not specified on a per trip basis. A more plausible hypothesis is that $BDAYS_i$ will be higher the greater the investment cost in travel per unit of time. In the case under study, the unit of time is one year. The second equation holds trips constant as a separate independent variable; therefore, this treatment corresponds to the per trip or Gibbs hypothesis. A comparison of the two equations shows that the addition of the TRIPS variable did not change the coefficients to any degree. In fact, the TRIPS variable was statistically significant at only the 22 percent level. For this sample of tourist beach users, the first equation without trips

Table 6.8

Estimated Demand Function for Beach Tourists*
Dependent Variable: $BDAYS_i$

Independent Variables	Without Trips	With Trips
Constant	7.6496 (2.32)	8.0940 (2.44)
POS	-.02157 (-2.80)	-.02187 (-2.84)
INC	.0000447 (2.05)	.0000451 (2.07)
TTC	.01244 (11.27)	.01364 (9.22)
OTHD	.036011 (2.39)	.04039 (2.61)
DOTHB	-.25256 (-6.17)	-.24249 (-5.81)
AGE	-.37155 (-2.46)	-.3759 (-2.49)
AGE SQ	.005154 (3.14)	.005201 (3.17)
PARK	-1.49398 (-2.57)	-1.5186 (2.61)
CROWD	1.93449 (3.05)	1.9681 (3.11)
TRIPS	N/A	-.4403 (-1.22)
$\overline{R}^2$	.1477	.1481
F	21.22	19.25
N	1051	1051
Elasticities at Variable Means		
Price	-.1780	-.1756
Income	.2714	.2690
Cross (Days at Other Beaches)	-.1603	-.1669
Cross (Days at Other Activities)	.0747	.0666

*All t-values are in parentheses. See text for definition of variables.

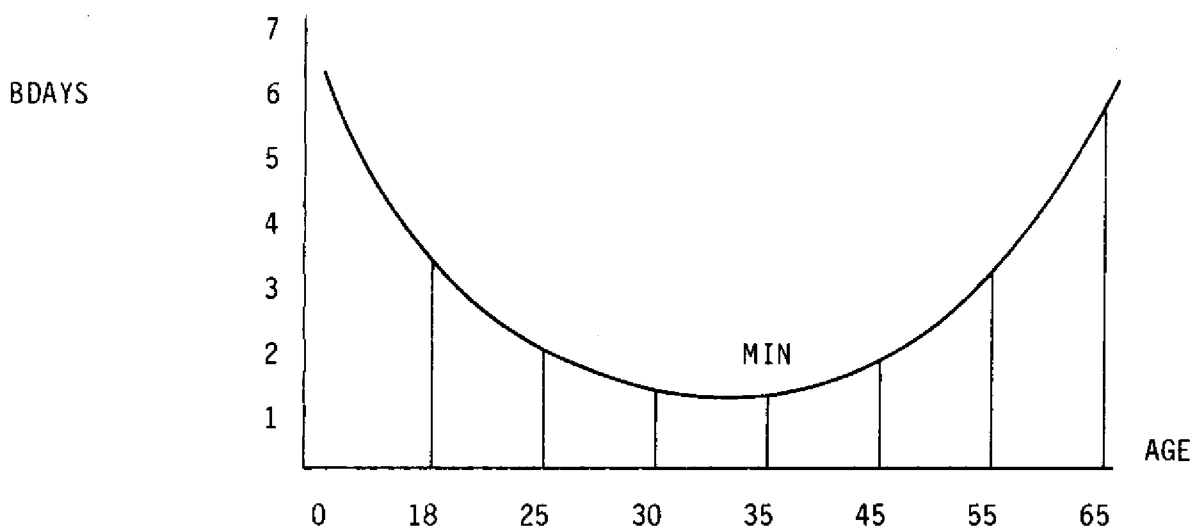
performed fairly well. The price (POS) and income (INC) variables exhibited a negative and positive sign respectively as hypothesized and were both statistically significant at the 1 percent level. Total travel cost or TTC was a very significant variable in determining $BDAYS_i$. The positive sign conforms to the hypothesis that substantial investment in travel to the recreational site will provide incentive to demand more recreational beach days so that the average cost per unit of recreation will be lower. Travel cost should not be considered as sunken cost, but as ex ante variable cost that provide the beach user with choices before the recreational activity is undertaken. The result indicates that as investment in recreational travel increases so also does the demand for more on-site recreational days. The two perception variables, PARK and CROWD, did enter the demand function and were statistically significant at the 1 percent level. As expected, PARK had the hypothesized negative sign indicating that as parking went from "plentiful" to "inadequate" the demand for beach days decreased. As in the case of the willingness to pay function discussed above, the variable CROWD had a positive influence on demand. As argued above, people may be attracted to other people as long as crowding is not severe and few tourist felt beaches in Florida were severely crowded. Days at other recreational activities (OTHD) had a positive sign while days at other beaches (DOTHB) exhibited a negative sign which is consistent with the complementarity and substitution hypotheses discussed above. Figure 6.1 shows the impact of AGE and AGE SQ on beach demand. As age increases from 18 to 36, BDAYS falls and then rises beyond age 36. Thus, more BDAYS are demanded by teenagers and young adults and those in their later years among tourists. Florida saltwater beaches are a favorite target of college students and those with more vacation time in later years or retired individuals. Thus, it may not be surprising that the mid-thirties are years of work and little leisure and reflects itself in tourist beach demand.

In any demand function, the question arises as to price, income and cross elasticities.[3] The tourist demand function was very price inelastic for

[3] Price elasticity is the percent change in quantity demanded in response to a percent change in price; Income elasticity is the percent change in demand to a percent change in price while a cross elasticity is the percent change in demand in response to a percent change in the price of a substitute or complement. In this analysis, a cross elasticity is the percent change in demand in response to the percent change in the demand for substitutes and complements. This specification was used due to the lack of price data on substitutes and complements.

Figure 6.1

Relation between Age and Days Recreated at the Beach for Florida Tourists



Equation: B DAYS = 8.551911 + .0052007 AGE SQ - .375915 AGE

(Derived from Table 6.8 with all independent variables at means)

Tabular Data

AGE	BDAYS
18	3.47
25	2.40
30	1.95
36	1.76
45	2.17
55	3.61
65	6.09

beach days (-.1780). That is, a 10 percent increase in POS or on-site cost would decrease quantity demanded, $BDAYS_i$, by only 1.78 percent. Thus, tourists are not very sensitive in terms of beach days to changes in on-site costs. The income elasticity for tourist using the Florida beaches was .2714. Based upon this finding, it would appear that rising affluence of the tourist visiting Florida would increase the demand for beach days, but very inelastically. The income elasticity is important in forecasting future demand for the beach resource. At present, the Florida Department of Natural Resources does forecast the demand for saltwater beaches in terms of user occasions. The forecast is based solely on the growth in resident and tourist populations over time. To the extent that a positive income elasticity exists (even though inelastic), these forecasts may be biased downward since increasing real income is not considered in making the projections. See Outdoor Recreation in Florida (1981). The cross elasticity for other beaches is inelastic (-.1603) and negative as hypothesized. That is, the demand for other beaches "crowds out" the demand for the i'th beach *ceteris paribus*. Finally, days at other activities were considered possible complementary goods with beach recreation. The cross elasticity was .0746 or extremely inelastic.

Residents: Table 6.9 shows the empirical results for the final beach equation for Florida residents. Compared to the tourist demand function, very few variables entered the resident demand function for beaches. Residents do not have large trip cost. Furthermore, trip cost are, for the most part, directed at the beach recreational experience. Therefore, it is not necessary to separate these cost from on-site cost as was the case for tourists using the Gibbs (1975) model. Thus, the price variable is total expenditures per day or TEPD. Only TEPD and INC plus one demographic dummy variable, WHITE, entered the final resident demand equation for saltwater beaches. It should be pointed out that both vectors of perceptions and physical characteristics were unsuccessful as independent variables in explaining the resident demand for beach days. CR or square feet of beach per person was not a statistically significant variable, for example, despite the fact that over 22 percent of the residents felt the beaches were "severely crowded" (See Table 6.1). These findings support the contention that more research is needed into the concept of carrying capacity for a beach. The best form of the resident demand function was log-linear as measured by $\bar{R}2$. WHITE is a dummy variable where

Table 6.9

Estimated Demand Function for Beach Residents*
Dependent Variable: LBDAYS

Independent Variables	Public Beaches Only	Public and Private Beaches
Constant	.5179 (.734)	.8196 (1.23)
LTEPD	-.2906 (-10.62)	-.2782 (-10.81)
LINC	.2046 (2.88)	.1653 (2.46)
LWHITE	.3733 (2.19)	.4474 (2.78)
$\overline{R}^2$	.139	.129
F	41.37	43.90
N	751	870
Elasticities		
Price	-.2906	-.2782
Income	.2046	.1653

*t-values in parentheses. See text for definition of variables.

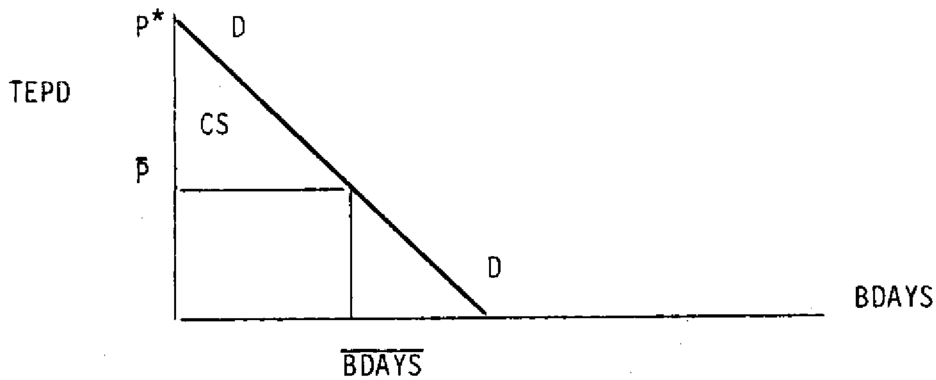
1 = white race and 0 = non-white. The coefficient was positive meaning that whites prefer more recreational beach days than non-whites. As discussed in Chapter 2, beach users have a higher percentage of whites than the general resident population (See Table 2.4). Two equations are shown in Table 6.9. The first restricts the sample to only public beaches since an inventory of beach physical characteristics from the University of West Florida (1984) only pertains to public beaches. Since the vector of physical characteristics failed to enter the equation, the larger sample was used since only three independent variables proved statistically significant at 1 percent level. This sample included some private beaches. The reader should note that the resident demand equation for public beaches only is not greatly different when private beach are added leading to the conclusion that the underlying demand determinants for public and private beaches are basically the same with about the same quantitative impact. The R^2's were not very high, but not unexpected for cross section regressions. The price elasticity for residents (-.2906) was inelastic, but more elastic than the tourist price elasticity (-.1780). It is plausible that residents have more substitutes than tourists who must recreate during a short visit to Florida and are naturally less aware of substitute recreational activities in Florida. The resident income elasticity of .2046 is lower than the .2714 which was found for tourists. As income increases, residents may not increase their demand as rapidly for beach days as tourists since they may be more satiated with beach experiences due to proximity and length of time in Florida. However, increasing resident affluence is related to increasing beach demand and should be considered when making projections of user occasions.

Consumer's Surplus, Compensating Variation and Equivalent Variation: Empirical Results from Estimated Demand Functions

As discussed in Chapter 6, the purpose of this section is to use the estimated demand functions for residents and tourists to calculate consumer surplus (CS), compensating variation (CV) and equivalent variation (EV) for a saltwater beach day per person using techniques developed by Willig (1976) and Hausman (1981) and applied by Green (1984). These estimates from the demand equation will be compared with those obtained from the CVM or willingness to pay study discussed above. In preliminary analysis, it was found that the linear in logarithm form of the resident demand function yielded extremely

Figure 6.2

Calculation of Consumer Surplus
from the Demand Function
for Florida Saltwater Beaches*
(Linear Equation)



$$BDAYS = \Omega - \beta\ TEPD + \gamma INC$$

$$\underline{CS} = (P^* - \bar{P})\ (BDAYS)\ (.5)$$

$$\underline{CV}\ (\bar{P},\ P^*,\ INC) = e^{\gamma(P^* - P)}\qquad [INC + \frac{1}{\gamma}\ (\Omega + \frac{\beta}{\gamma} + \ \bar{P}] -$$

$$\frac{1}{\gamma}\ (\Omega + \frac{\beta}{\gamma} + \ P^*) - INC$$

$$EV\ (\bar{P},\ P^*,\ INC) = INC - e\ (\bar{P},\ v')$$

$$e\ (\bar{P},\ v') = (e^{\gamma\bar{P}}\ v') - \frac{1}{\gamma}\ (\beta\bar{P} + \frac{\beta}{\gamma}\ + \Omega\ )$$

$$v' = v'\ (P^*,\ INC) = e^{-\gamma P^*}\ [INC + \frac{1}{\gamma}\ (\beta P^* + \frac{\beta}{\gamma} + \Omega\ )]$$

*Symbols are defined in text; demand equation and graph above.

Source: Willig (1976); Hausman (1981) and Green (1984) large values per day. Thus, the linear version of both the resident and tourist demand functions will be employed in this analysis. Figure 6.2 shows the conceptualization of consumer surplus and the appropriate equations for calculating CS, CV and EV. The demand curve in Figure 6.2 is linear and can be derived by substituting the arithmetic means of the independent variables in the BDAYS demand function and then solving for price or TEPD in terms of BDAYS. The intercept of the demand function is equal to P^*. Since TEPD is being used as a proxy for price, the typical number of days spent must be obtained to solve the demand equation for the "average price" or $\bar{P}$. Analysis of the distribution of days spent at the beach per individual indicated that the mean was very unrepresentative of the distribution due to extreme values. More specifically, the results indicated the following measures of central tendency for residents and tourists:

Group	Mean BDAYS (Per Individual)	Median BDAYS (Per Individual)
Residents	23.509	9.51
Tourists	6.3035	3.54

Two criteria governed the decision to use the median BDAYS as "typical." First, the mean was biased upward due to extreme values, thereby making the mean a suspect measure of central tendency. Second, the use of the median will give lower estimates of consumer surplus; therefore, the results should be considered in the conservative direction.

To compute CS, CV and EV for residents, the following linear demand function was estimated (See Table 6.9 for logarithmic version):

$$\text{(1)}\quad BDAYS = \underset{(2.19)}{13.904} - \underset{(-5.71)}{.2224}\ TEPD + \underset{(2.58)}{.00028}\ INC + \underset{(1.35)}{8.2454}\ WHITE$$

$$\bar{R}^2 = .037 \qquad F = 9.668 \qquad N = 870$$

t-values are in parentheses and relevant arithmetic means are as follows:

INC = \$26,870.69

WHITE = .9299

If WHITE is substituted into (1), the following linear demand function is obtained which is shown in general form below the graph in Figure 6.2:

$$\text{(2)}\quad BDAYS = 21.5714 - .2224\ TEPD + .000288\ INC$$

where, Ω = 21.5714

β = -.2224

γ = .000288

Substituting the mean value of INC in (2) and solving for TEPD in terms of BDAYS, the following demand curve is obtained:

(3) TEPD = \$131.79 - 4.4964 BDAYS

Substituting the median days of 9.51 in (3), the average price or $\bar{P}$ may be obtained or \$89.03. The "choke price", P^*, is equal to \$131.79, the demand equation intercept term. Using the simple equation for consumer surplus (CS) given in Figure 6.2, the following value was obtained (for residents):

(4) CS = (\$131.79 - 89.03) (9.51) (.5) = \$203.32

This is the shaded area in Figure 6.2. Next, two other adjustments are necessary to derive CS per person per day. First, CS must be divided by median days (\$203.32 ÷ 9.51) to derive \$21.38 per day per household. The reader should notice that even though BDAYS are for one individual, expenditures and income are on a household basis. For the resident sample, there were 2.09 participants per household. Thus, the second adjustment is to convert CS per household day to CS per person per day or \$10.23 (\$21.38 ÷ 2.09).

The tourist demand equation was taken from Table 6.8 since it is already in linear form. The following arithmetic means for the independent variables in the tourist demand function where inserted in that function (i.e., TRIPS included) in Table 6.8:

TTC	=	\$258.9933
DOTHB	=	4.1675
OTHD	=	11.6594
AGE	=	44.3882
AGESQ	=	2200.5842
PARK	=	1.5519
CROWD	=	1.5209
TRIPS	=	1.7412

This yielded the following tourist demand function:

(5) BDAYS = 5.71513 - .02187 POS + .0000451 INC

where, Ω = 5.71513

β = -.02187

γ = .0000451

Substituting the mean value of INC or \$37,930.54 in (5) and solving for POS in terms of BDAYS, the following tourist demand curve is obtained:

(6) POS = \$339.54 - 45.7247 BDAYS

Substituting the median days of 3.54 in (6), the average price of $\bar{P}$ may be obtained or \$177.68. The "choke price", P^*, is equal to \$339.54 or the intercept of the demand equation in Figure 6.2. The total household consumer surplus is computed as follows (for tourists):

(7) CS = (\$339.54 - 177.68) (3.54) (.5) = \$286.49

Finally, to obtain CS per person per day, the value obtained in (7) must be divided first by 3.54 to obtain \$80.93 and then by the number in the household who participate or 2.76. This yields a CS per person per day of \$29.32.

Returning once again to Figure 6.2, the formulas for computing CV and EV with a linear demand function are given below the BDAYS demand function. To compute CV and EV, the following parameters are needed: Ω; β and γ. The following variables are needed: P^*; $\bar{P}$; INC. These parameters and variables have been computed above for both residents and tourists. When these values are inserted into the equations in Figure 6.2 for CV and EV, the comparative results may be summarized in Table 6.10. The rather amazing aspects about Table 6.10 is the similarity in quantitative results of CS, CV and EV. Notice that even though the results for all three concepts are similar the basic inequality discussed in Chapter 5 holds:

(8) $CV > CS > EV$

The reason for the near equivalency of these concepts is the low income effect or the small income elasticity discussed above. Finally, Table 6.11 shows a comparison of consumer surplus derived by the willingness to pay method and directly from the demand function. In the case of the willingness to pay for residents, there is a considerable difference between the mean value of \$1.31 and that estimated from the demand function of \$10.23. However, as discussed before, it is well known that WTP is seriously biased downward. The only article dealing with this bias is by Bishop and Heberlein (1979) and this was a specific study of goose permits. They found, as expected, a serious bias downward for WTP (i.e., hypothetical question) compared to actual cash offers. Table 6.11 reflects an adjustment upward of the WTP for beach use based solely on the Bishop and Heberlein study. These

Table 6.10

A Comparison of Consumer Surplus, Compensating Variation and Equivalent Variation Per Person Per Day for Residents and Tourists Recreational Saltwater Beach Users in Florida, 1984

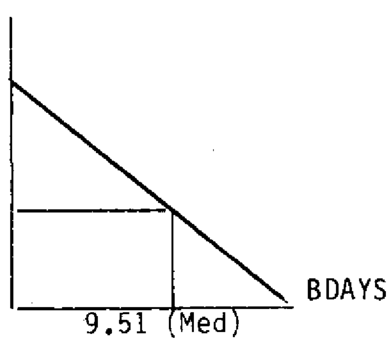
Group	Compensating Variation	Consumer Surplus	Equivalent Variation
Residents	\$10.31	\$10.23	\$10.18
Tourists	\$29.45	\$29.32	\$29.29

NOTES:

Residents (Household Size: 2.09)

$P^* = \$131.79$

$\bar{P} = \$\ 89.03$



INC = \$26,870.69

Ω = \$21.5714

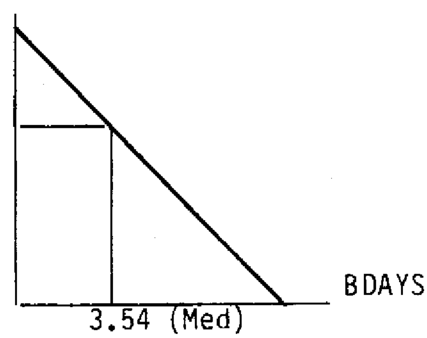
β = -.2224

γ = .000288

Tourists (Household Size: 2.76)

$P^* = \$339.54$

$\bar{P} = \$177.68$



INC = \$37,930.54

Ω = \$5.71513

β = -.02187

γ = .0000451

Source: Figure 6.2

Table 6.11

Comparison of Various Estimates of Consumer Surplus Per Person Per Day for Resident and Tourist Beach Users, 1984

	Willingness to Pay			Demand
Category	Mean[1]	Adjusted Mean A[2]	Adjusted Mean B[3]	Function CS[4]
Residents	$1.31	$3.93	$6.31	$10.23
Tourist	$1.46	$4.38	$7.03	$29.32

1. Table 6.5.

2. Mean x 3.003 (cash offer ÷ willingness to pay). See Bishop and Heberlein (1979)

3. Mean x 4.816 (Willingness to sell ÷ willingness to pay). See Bishop and Heberlein (1979).

4. Table 6.10.

the WTP for beach use based solely on the Bishop and Heberlein study. These adjustments are illustrative only and cannot be considered in any way the exact bias of beach WTP. Resident willingness to pay became $3.93 in a convervative adjustment and $6.31 in a more liberal adjustment up to willingness to sell. Remember that CV is equivalent to willingness to sell. Thus, $6.31 is to be compared with $10.31 in Table 6.11. For residents, there appears to be more consistency among the two approaches in terms of results. The two methods greatly diverge in the case of tourists where the demand function approach yields CS about 4 times as great as adjusted willingness to pay in Table 6.11 (adjusted mean B). These results must be viewed as tentative and need for more research into nonmarket goods is quite apparent. Until then, the reader can select from the estimates presented in this report, but should qualify estimates as very preliminary. One final issue is the plausibility of the results. Would beach users really pay approximately $10 and $29 per day per person for residents and tourists respectively? An immediate answer of "no" might be premature. Beaches are essentially common property and individuals are very familiar with a zero entrance fee. Yet, beaches attract both residents and tourists. If beaches were all held by private owners, daily fees could be considerable. The fees for private beaches are really no indicator since substitute public beaches are available at zero price. What would privately produced oranges, for example, be worth if free oranges were available down the street? Also, the large percent of those visiting the beach that would be willing to pay zero would clearly be unrealistic if all beaches were private. See Table 6.5. Thus, the estimates of CS via the demand function must be considered as plausible especially under a system of <u>complete private beach ownership</u>!

The Asset Value of the Beach

So far, estimates of consumer surplus for resident and tourist beach users have been presented. For residents and tourists the values represent an estimate of the annual benefits received. These values are flows of benefits for a particular time period attributable to an asset - Florida's beaches. The value of an asset is defined as follows:

(9) $$V = \frac{R^1}{(1+n)^{to}} + \frac{R^2}{(1+n)^{t1}} + \cdots \frac{Rk}{(1+n)^{tk}}$$

where,

V = value of the asset

R = return to the asset

n = discount rate

t = time

k = number of periods

$t = 0, 1, \ldots k$

If the return, R, flows for a large number of periods ($k \to \infty$), then (9) can be simplified where returns are constant into the future ($R1 = R2 = Rk$).

$$(10)\quad V = \frac{R}{n}$$

The return to the asset (i.e., beaches) is consumer surplus. Equation (10) can be estimated using willingness to pay and a discount rate of 10 percent.

Willingness to Pay (R per year)

Residents:	WTP x DAYS	
	$1.31 x 76,597,407 (Chapter 2) =	$100,342,603
Tourists:	$1.46 x 69,391,408 (Chapter 3) =	101,311,456
	Total $ =	$201,654,059

$$(11)\quad V = \frac{\$201{,}654{,}059}{.10} = \$2.0165 \text{ Billion}$$

Demand Function (R per year)

Residents:	$10.23 x 76,597,407 =	$ 783,591,474
Tourists:	$29.32 x 69,391,408 =	2,034,556,083
	Total R =	$2,818,147,557

$$(12)\quad \frac{\$2{,}818{,}147{,}557}{.10} = \$28.1814 \text{ Billion}$$

Therefore, the value of the saltwater beaches of Florida in terms of an asset may vary from $2.0165 billion based upon willingness to pay to $28.1814 billion based upon the demand function approach. This topic will receive further discussion in Chapter 7 dealing with beach-related policy issues. Growth in the number of beach users (i.e., population effect) and the fact that the consumption of beach services increases with income (See Tables 6.8

and 6.9 for income elasticities) may lead to larger annual benefits as population and real income grow. The asset value range calculated here is therefore conservative.

Chapter 7
The Relation of Economic Impact and Valuation Information to Policy Issues Associated With Saltwater Beaches

Introduction

The purpose of this Chapter is to relate the research findings in Chapters 1-6 to selected policy issues surrounding the saltwater beaches of Florida. Obviously, the authors have no solutions for these individual policy issues since this report is a fundamental research document on Florida beaches. But, the material developed here will hopefully serve as a valuable input to policy deliberations. Therefore, it will be illustrated below as to how economic data and concepts can help in policy determination.

Regional Economic Impact of Particular Beaches

The allocations of scarce government resources to beach renourishment, parking, access points or the clean-up of undesirable oil spills, for example, are based on the principle that beaches create income and jobs for Floridians as well as state taxes. These resources are part of Florida's economic base. Also, within Florida, there are many counties and municipalities that are involved in beach programs. For example, the City of Delray Beach has hired engineering firms to monitor the Delray Beach renourishment project. Thus, many local areas within Florida may want to know the economic importance of the beaches.

Curtis and Shows (1982, 1984) have done separate studies for Delray Beach (Palm Beach County) and Jacksonville Beach (Duval County). Resources may not always be available to do an independent study of each beach. What is suggested here is a feasible method to estimate the economic impact of an existing beach on the county in which it exists using material and data from this study plus some readily available published and unpublished data. To accomplish this objective, the data base on resident and tourists developed for this study was first analyzed to see if any systematic factors were related to beach user expenditures per day within the State of Florida. In essence, the demand function discussed and estimated in Chapter 6 was reformulated. The following hypothesis with respect to tourists visiting Florida was specified:

(1) POS = f(PCINC; BDAYS; DOTHB; OTHD; TTC)

where

POS = on-site expenditures/day;

PCINC = per capita income;

BDAYS = days at a particular beach;

DOTHD = days at other beaches;

OTHD = other non-beach related vacation days;

TTC = total beach-related travel cost to Florida.

These indepentent variables were selected after preliminary regression analysis which included AGE; AGESQ; and physical characteristics such as beach size, access points, square feet per person, etc. as well as perception variables such as crowding, physical appearance, etc. None of these variables was statistically significant at the 5 percent level. Equation (1) was estimated in linear form using ordinary least-squares. This is shown in Table 7.1 along with the estimated expenditure equation for residents which in final form included the following variables:

(2) TEPPPD = f(PCINC; BDAYS; DOTHB, AGE, AGESQ)

where

TEPPPD = total beach related expenditures including travel cost/day;

PCINC = per capita income;

BDAYS = days at a particular beach;

DOTHB = days at other beaches;

AGE = age;

AGESQ = age squared.

Consider the estimated tourist expenditure equation first. PCINC is positively related to on-site expenditures (POS) as the reader might expect. BDAYS, DOTHB and OTHD are negatively related to expenditures per day. Holding income constant, the more days spent on vacation will tend to lower expenditures per day. If a tourist designates a fixed amount of his income for a vacation to Florida, the only way the recreationist may expand his trip is to spend less per day. This is one interpretation of the negative signs on all "days" variables shown in Table 7.1. The sign on total travel cost is positive. This is not unexpected given the results from the demand function in Chapter 6 (See Table 6.8). If tourist come from long distances and incur large travel costs, they may regard this as an investment expenditure in

Table 7.1

Estimated Beach Expenditure Equations for Residents and Tourists for Florida Saltwater Beaches (Linear Equations)

Tourist Dependent Variable: On-Site Cost/Day (POS)
Resident Dependent Variable: Total Cost/Day (TEPPPD)

Independent Variables	Tourists	Residents*
Constant	9.8644 (9.158)	-15.947 (-2.088)
PCINC	.0007926 (15.196)	.0005273 (5.161)
BDAYS	-.20064 (-4.103)	-.08236 (-4.049)
DOTHB	-.34657 (-5.392)	-.07599 (-3.253)
OTHD	-.50096 (-2.175)	N/A
TCC	.007013 (3.773)	N/A
AGE	N/A	1.3720 (3.832)
AGESQ	N/A	-.01527 (-4.059)
$\bar{R}^2$	.2011	.0911
F	56.89	14.92
N	1111	750
Mean Dependent Variable	$20.4989	$13.882

*public beaches only

recreation. Tourists can either extend their trips to fully utilize the "investment in travel" or spend more per day. The Gibbs model discussed in Chapter 6 relies on the former hypothesis while the empirical results shown in Table 7.1 would support the latter hypothesis. Both hypotheses are apparently validated by the data since higher travel cost increases both BDAYS (see Table 6.8) and POS - on-site expenditures. Thus, basic economic variables influence tourist beach-related expenditure. The physical characteristics of the beach were found not to be statistical determinants of expenditures.

With respect to the resident expenditure function, the findings were very similar to the tourist expenditure function. Income was positively related to expenditures per day while days were inversely related to expenditures per day (including travel cost). One demographic variable was important in the case of resident spending. Young adults and elderly people spend less per day. Using the coefficients on the AGE and AGESQ variables, a resident beach user at age 45 spends $30.82 per day which is the maximum expenditure for any age.[1] Low per day expenditures might be expected from teenagers and young adults. Florida's age structure might influence the finding that those over 45 years spend less since they retire sometimes near a beach where expenditures can be minimized.

To illustrate the potential usefulness of the expenditure equations, five prominent Florida beaches were selected for analysis. From the total resident and tourist samples, the observations on the variables in Table 7.1 were obtained for each of the five illustrative beaches. These beach-specific samples were then used to predict expenditures per day for tourists and residents using equations from Table 7.1. The predictions could then be compared with the sample means for expenditures per day to get some idea of the predictive power of the equations within the sample. The general results indicated that the predictive equation did much better for tourists than residents. Consider Clearwater Beach in Pinellas County as an example of this procedure.

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[1] TEPD = 1.3720 AGE - .01527 AGE^2. The maximum expenditure is $a^2/4B$ and the corresponding age is a/2b where a = 1.3720 and b = .01527. See Table 7.1.

Clearwater Beach

Residents		Tourists	
Variable	Sample Average	Variable	Sample Average
PCINC	$10,584.68	PCINC	$12,807.70
BDAYS	14.56	BDAYS	8.37
DOTHB	10.08	DOTHB	4.27
AGE	42.87	OTHD	19.63
AGE SQ	2101.03	TTC	291.50
N	64	N	59

The values of these sample means above were inserted in the equations in Table 7.1 to obtain a predicted daily expenditure of $14.40 and $17.92 for residents and tourist expenditures per day at Clearwater Beach in Pinellas County respectively. The researcher can rely on the sample data to predict expenditures per day or obtain some of the independent variables from separate surveys. This would especially be needed for smaller beaches where no or few observations exist within the existing data set developed in preparing this report. As shown in Table 7.2, the expenditure equation under predicted the sample expenditures per day. Table 7.2 also shows the results of this experiment for four other prominent beaches in Florida.

After obtaining estimates of the average daily expenditures by both tourists and residents which are beach related, the researcher may desire to estimate the total dollar impact per year of the i'th beach on the j'th county. Total beach days must be estimated for three distinct groups in the j'th county impacted by the i'th beach. Beach days will be expressed as Daily Beach Use (persons/day)(DBU) as used by The University of West Florida. See Table 6.3. The three important beach users are the following:

DBU_T = Daily Beach Use (persons/day) for out of state visitors or tourists;

DBU_{OC} = Daily Beach Use (persons/day) for out of county visitors that are state residents;

DBU_{IC} = Daily Beach Use (persons/day) for in county residents.

Table 7.2

Predicted Versus Actual Beach Related Expenditures Per Day for Residents and Tourists at Selected Florida Saltwater Beaches, 1984

Beach	Sample Size	Actual Expenditures/Day[1]	Predicted Expenditures/Day[2]	Percent Deviation from Actual
Clearwater				
Residents	64	$18.90	$14.40	-23.8
Tourists	62	19.65	17.92	-8.8
Ft. Lauderdale				
Residents	45	$8.73	$14.97	+71.5
Tourists	59	23.98	23.46	-2.2
Daytona				
Residents	67	$25.64	$15.41	-40.0
Tourists	115	19.50	19.14	-1.8
Jacksonville				
Residents	28	$12.54	$12.41	-1.03
Tourists	25	27.61	22.90	-17.1
Pensacola				
Residents	22	$8.36	$12.23	+46.3
Tourists	23	20.49	17.25	-15.8

[1] Sample average expenditure per day

[2] Predicted obtained from inserting the mean of the independent variables of the expenditure equations in Table 7.1. The means are specific to the sample observation from the individual beach.

The reason for this division of beach users is that one must distinguish between export or exogenous forces as discussed in Chapter 3 and endogenous or local demand. DBU_T and DBU_{OC} represent exogenous forces at the county level. Two sources of data may be used to estimate these three variables for the i'th beach in j'th county. The University of West Florida has total daily beach use by beach and county. Table 6.3 shows an example of such data. Total daily beach use (persons/day) (TDBU) may be divided into the above three classifications using the following formulas:

(3) $DBU_T = TDBU \left\{\frac{TD}{TD + RD}\right\}$

(4) $DBU_{OC} = \{TDBU - DBU_T\}\left\{\frac{UO_{OC}}{UO_{OC} + UO_{IN}}\right\}$

(5) $DBU_{IN} = TDBU - DBU_T - DBU_{OC}$

where

TD = Tourist demand (persons/day)

RD = Resident demand D(persons/day)

UO_{OC} = Out county user-occasions[2]

UO_{IN} = In county user-occasions

User occasions may be obtained from the Division of Parks and Recreation, DNR for saltwater beaches for any county in Florida. County level data on user occasions is usually not published so that direct contact with the Florida Department of National Resources is necessary. Also, user occasions refer to all beaches in a county but should yield a rough division between in-county and outside the county users for saltwater beaches once the tourist user occasions are reduced by 39 percent. (See Chapter 3.)

A numerical illustration may highlight this procedure discussed above. Once again, consider Clearwater Beach in Pinellas County as an example. The University of West Florida Study shows the following information on Clearwater Beach.

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[2] A user-occasion is generated each time an individual participates in a given outdoor recreation activity.

$TDBU = 6000$ person/day

$TD = 4445$ persons/day[3]

$RD = 1958$ persons/day

According to the Florida Department of Natural Resources, the following data for 1983 on saltwater beach use are available for Pinellas County:

$UO_{OC} = 2,745,700$

$UO_{IC} = 3,093,300$

Equations (3) through (5) may now be solved for Clearwater Beach in Pinellas County.

(6) $DBU = 6000\{\frac{4,445}{4,445+1,958}\} = 4,148$

(7) $DBU_{OC} = \{6000-4,148\}\{\frac{2,745,700}{2,745,700 + 3,093,300}\} = 871$

(8) $DBU_{IN} = 6000-4,148-871 = 981$

Therefore, beach users are divided into the three groups necessary to conduct the economic impact analysis. It should be pointed out that the analysis pertains to the county level; however, beaches may include more than one county. In this case, some additional estimation is usually necessary. All of the estimates obtained above refer to the number of beach users per day. If the economic impact is done for one year, these estimates must be multiplied by 365. The total dollar impact for the i'th beach may be obtained using the following formula:

(9) Residents: $DBU_{IC} \times 365 \times TEPD$ = Dollar Impact

(10) Out of County

Residents: $DBU_{OC} \times 365 \times TEPD \times M$ = Dollar Impact

(11) Tourists: $DBU_{T} \times 365 \times POS \times M$ = Dollar Impact

where DBU_{IC}; DBU_{OC} and DBU_{T} are as defined above while TEPD = resident daily expenditures and POS = tourist on-site daily expenditures while M = regional multiplier. Regional multipliers may be obtained from the University of Florida Bureau of Business and Economic Analysis' Fiscal Impact Model (1984). County multipliers run from 1.2 to 1.7 with an average of 1.5.

Thus, the total dollar impact of Clearwater Beach on Pinellas County may be estimated using the information developed above along with the "predicted" expenditures per day in Table 7.2.

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[3] Tourist plus resident demand may not equal total daily beach use since figures were derived from two different sources.

Economic Impact of Clearwater Beach on Pinellas County (1984)

Residents:	981 x 365 x $14.40 =	$5,156,136
Out of County Residents:	71 x 365 x $14.40 x 1.5 =	6,866,964
Tourists:	4,148 x 365 x $17.92 x 1,5 =	40,696,858
	Total Impact	$52,719,958

Thus, the total Clearwater Beach-related economic impact on Pinellas County is over $52.7 million. Using the sales to employment ratios in Chapters 2 and 3, these sales might generate 1,962 jobs from tourists and residents from outside the county and 168 jobs from the beach-related spending of local residents. The total jobs created as a result of the beach resource would be an estimated 2,130. The economic impact of a beach in an important policy input especially where government is asking for economic justification to allocate monies to various beach programs that will be discussed below.

Economic Valuation

Although expenditures on beach-related activities are important to small regions and the state, projects must be justified on the basis of the economic benefits accruing to beach users. The calculation of such benefits has been discussed in Chapter 6 of this report. Projects are usually beach specific; however, the benefits or consumer surplus calculated in Chapter 6 are for a typical or average beach in Florida. There are two approaches to estimating beach-specific user value or consumer surplus. First, an intensive study may be conducted of the beach in question. These studies cost between $30,000 to $50,000 and can be extremely valuable to the U.S. Corps of Engineeers, for example, in calculating benefit-cost ratios. Using the willingness to pay technique (i.e., survey questionnaire), Curtis and Shows (1982) found that annual recreational benefits from Delray Beach were over $3 million compared to beach nourishment cost of $922,798 or a benefit-cost ratio of 3.29 (at a 7 percent discount rate). In computing benefits, the material and data in this study may be used in conjunction with published data to either check on the more intensive study or make benefit estimates at a small cost. For example, a preliminary benefit-cost ratio may be computed prior to more intensive beach specific studies. Two examples will be explored.

Assume that a researcher, for example, wants to know the annual benefits from the use of Clearwater beach in Pinellas County and Daytona beach in Volusia county. First, the value of a recreational beach day for both tourists and residents must be estimated. Table 6.6 contains the regression results for the resident willingness to pay function. To estimate the willingness to pay (WTP) per day for the above beaches, the following variables are necessary for each beach for Florida residents:

Florida Residents

Variable	Clearwater (Sample Geometric Means) N=64	Daytona (Sample Geometric Means) N=67
INC: Household Income	$25,084.36	$25,745.11
BDAYS: Beach Days Per Person/Year	7.81	5.38
TEPPPD: Total Expenditures/ Person/Day	$6.14	$8.92
WI: Weighted Index of Facilities*	59.03	46.99
CR: Square feet/person*	146.64	509.28
WIDTH: Width of the Beach*	199.94	300.06

* quantities are not means, but refer to beach site.

Of course, the above listed independent variables are necessary to estimate WTP per day for the two example beaches. From the resident sample survey discussed above (see Chapter 2), the sub-sample size is given under each beach. Notice that all the variables are not subject to "sample variability." In fact, only INC, BDAYS and TEPPPD are averages of a rather small sample. Also, residents can be sub-divided into county and out of county Floridians as discussed under economic impact above. Using published data from the Florida Division of Recreation and Parks, the researcher can quickly ascertain whether resident beach visitors are primarily from the county containing the beach. In this case, INC or household income can be obtained from 1980 Census

Handbook: Florida Counties (1984). The sample above for BDAYS and TEPPPD may be used or supplemented with an on-site survey which would be less extensive than those conducted by Curtis and Shows for example. WI, CR, and WIDTH are physical characteristics of the beach and are available from the University of West Florida Study (1984). See Table 6.3 for an example. The results of using the willingness to pay approach for the two example beaches are shown in Table 7.3. The tourist willingness to pay per day may be estimated in the same manner. The estimating equation may be obtained from Table 6.6. The necessary information to implement this equation is the following:

Florida Tourists

Variable	Clearwater (Sample Means) N=62	Daytona (Sample Means) N=115
INC: Household Income	$32,532.66	$34,544.37
BDAYS: Beach Days Per Person/Year	4.90	3.42
DOTHB: Beach Days at other Beaches	2.09	1.60
WI: Weighted Index of Facilities*	59.02	46.99
WIDTH: Width of the Beach*	199.93	300.06
CROWD: Crowding Perception	1.806	1.765
POS: On-site Expenditures/Day	$11.41	$15.17

*Not means, but beach site characteristics.

INC may be obtained from the beach specific sample or from the Florida Division of Tourism for larger counties. BDAYS and DOTHB can be obtained from the sample or by direct survey techniques. WI and WIDTH are physical characteristics that can be obtained from the same sources mentioned above. Unless there is any reason to expect that tourists have changed their perception of crowding, the sample mean can be used. One caveat is in order before estimated total benefits are discussed for a particular beach. It has been suggested that some limited survey work might be done to obtain information on sample variables. The investigator may want to rely on sample

Table 7.3

Predicted and Actual Willingess
to Pay Per Day Plus Predicted Consumer Surplus
from the Demand Function for
Clearwater and Daytona Beaches, 1984

(a) Willingness to Pay

Beach	Predicted	Sample Average	Percent Error from Sample
Clearwater			
Residents	$.91	.96	-5.2
Tourists	$1.17	1.25	-6.4
Daytona			
Residents	1.20	1.05	+14.3
Tourists	1.28	1.20	6.7

(b) Demand Functions

	Predicted
Clearwater	
Residents	$ 6.00
Tourists	29.71
Daytona	
Residents	$ 3.75
Tourists	25.67

Source: See discussion in text.

values if the sample size is sufficient thereby eliminating the cost of further sampling. Further, the researcher may use the sample willingness to pay found at the individual beach. This may or may not be reliable depending on sample size. Or, one may want to use the estimating equation since the results are based upon a cross-section of all kinds of beaches and variables indicate the possible causal factors behind willingness to pay at a particular beach compared to the typical or average beach in Florida. Of course, one may wish to follow the Curtis and Shows procedure of a beach-specific survey. Their survey questionnaire is only one page but sampling takes place over a one year period. The time factor itself may prompt the use of the procedure outlined above which could be implemented in a few weeks at most.

On the basis of the discussion in Chapter 6, it may be felt that the CVM or survey of willingness to pay is too biased downward. In this case, the demand functions developed in Chapter 6 may also be used to estimate consumer surplus for a particular beach. Again, Clearwater and Daytona will be used as examples.

The resident demand equation can be obtained from Table 6.9. Only two variables shift this function and they are the following:

Variable	Clearwater (Sample Means) N=64	Daytona (Sample Means) N=115
INC: Household Income	\$25,120.97	\$25,753.97
WHITE: Percent White that Use Beach	.938	.925

These variables can be obtained from the individual beach sample; published data (e.g., household income) or simplified surveys (e.g., percent white that use the beach). The demand shifters listed above may be inserted into the demand equation to obtain a demand curve for beach use by residents. This is shown for Daytona beach as follows:

(12) BDAYS = \$29.156 - .2224TEPD

Equation (12) was solved for TEPD in terms of BDAYS with the following results:

(13) TEPD = \$130.16 - 4.4643 BDAYS

Since $P^* = \$130.16$, only the median number of beach days must be obtained. This may come from the sample or limited survey. The sample median beach days is 4.75. Inserting this value in (13) and solving for P, the consumer surplus (CS) may be estimated using the formula in Table 6.2. Remembering that annual CS is for the household, the investigator must divide by median days and household size (sample average = 2.851) to obtain CS per person/day for Daytona Beach or $3.75. It is left to the reader to carry out the same procedure for Clearwater Beach.

The tourist demand function is more involved in terms of number independent variables.

Variable	Clearwater (Sample Means) N=62	Daytona (Sample Means) N=115
INC: Household Income	$32,580.64	$34,565.22
TCC: Total Travel Cost	291.50	182.47
DOTHB: Other Beach Days	4.274	2.325
OTHD: Day at Non-beach Activities	19.629	6.748
AGE: Age	46.581	44.235
AGE SQ: Age Squared	2421.548	2204.417
PARK: Parking Perception	1.935	1.635
CROWD: Crowding Perception	1.806	1.765
TRIPS: Trips	1.791	.461

Following the same procedure outlined for residents (i.e., inserting the independent variables in the demand function for tourists and solving for POS in terms of BDAYS), consumer surplus per day was estimated at $29.71 and $25.67 for Clearwater and Daytona beaches respectively as indicated in Table 7.3

Research Findings and Policy Implications

In this section, the research findings will be considered in light of various policy issues related to saltwater beaches. This will provide a bridge between this research and critical policy areas. Of course, it will be up to the reader to judge the applicability and usefulness of economic data and information to beach policy issues. Six policy areas have been selected for comment. These are by no means all inclusive. However, they do cover some prominent issues. The following policy issues will be discussed:

1. Beach Renourishment
2. Oil Spills
3. Beach Front Acquisition
4. Beach Access
5. Beach Carrying Capacity and the Overcrowding Issues
6. Coastal Setback Lines

1. Beach Renourishment

Curtis and Shows (1982, 1984) have done two site-specific studies on beach nourishment in Florida. These two studies are for Delray and Jacksonville Beaches. Many beaches are continually eroding due to poorly designed structures close to the water; hurricanes and natural processes that are constantly changing the shoreline of Florida, eroding some beaches and building up others even along undeveloped shoreline. In a typical beach renourishment project sand is obtained offshore, if available, or from inlets and bays where appropriate and placed along eroded shoreline. In effect, beach renourishment restores the beach to an earlier stage of the natural erosion-accretion process. The principal benefits of beach renourishment are enhanced recreational use of the beach and increased storm protection for upland properties. The question arises as to whether these benefits are sufficient to justify the cost. In Chapter 6, much effort was devoted to quantifying the value the beach user places on a recreational day.

Consider a hypothetical example. Assume a beach is at present severely eroded and is being considered for beach renourishment. It is estimated that 4,000 people visit the beach yearly and on average spend 10 days annually at the beach. This yields an estimate of 40,000 total recreational beach days spent on the severely eroded beach. For purposes of simplification, it is assumed that as the beach eroded beach users were deterred from the hypothetical beach to other beaches. It has been demonstrated that crowding lowers the willingess to pay for resident beach users; therefore, it might not be expected that the same number of beach users would be present before as compared to after the erosion process. More will be said about the crowding issue below. Further, assume that the 40,000 recreational days are evenly divided between residents and tourists. Using the demand function approach, the consumer surplus per day is $10.23 for residents and $29.32 for tourists for an average of $19.78. See Table 6.10. Thus, beach users derive $791,200 ($19.78 X 40,000) in annual recreational benefits on a severely eroded beach. These are the benefits without the project. Remember, the demand equation presented in Chapter 6 plus the willingness to pay equation in the same chapter can be used to derive estimates of consumer surplus for a specific beach as discussed in the first two sections of this Chapter. The next step is to estimate what benefits can be expected from a beach renourishment project. What is needed are estimates of how many beach users either attended the beach before the erosion took place or a projection of the number of users the beach would support (i.e., demand for beach days) without erosion. Historical records may be consulted or non-eroded beaches near the eroded beach may yield such estimates. Using historical records would be conservative since beach use in especially Florida is increasing due to population increases and rising affluence. See Chapter 6 on income elasticity and the role of household income in expanding beach use. For purposes of illustration, assume that after beach renourishment 10,000 beach users will visit the beach spending 100,000 days (10,000 X 10 days per person). If the value of a beach day does not change, the annual recreational benefits will increase after the project (i.e., renourishment) to $1,978,000 annually. These computations are shown in Table 7.4. Subtracting the After Erosion Benefits of $791,200 from the Before Erosion Benefits created by the beach renourishment project of $1,978,000 yields $1,186,800 in annual benefits directly attributable to the project. For such beach renourishment projects, this report has provided estimates and a methodology for establishing daily beach values. It is important to distinguish just what incremental benefits are directly attributable to the beach renourishment project. Curtis and Shows (1982) in their work on Delray Beach attribute all recreational benefits to historical beach renourishment cost. This would imply that in the absence of the renourishment no one would use the beach. This is a questionable implication and illustrates another research problem. That is, how does beach erosion impact recreational behavior? However, Curtis and Shows (1984) in

Table 7.4

An Example of the Use of Saltwater Beach Willingness To Pay in Estimating Economic Benefits from Erosion Control

Hypothetical Beach

Before Erosion (after project)

Beach Users: 10,000
Average Beach Days Per User: 10
Total Days: 100,000
Willingness to Pay Per Day Per Person: $19.78
Total Annual Benefits = $19.78 x 100,000 Days = $1,978,000

After Erosion Problems (before project)

Beach Users: 4,000
Average Beach Days Per User: 10
Total Days: 40,000
Total Annual Benefits = $19.78 x 40,000 Days = $791,200

Net Economic Benefits Via Beach Nourishment Programs

Before $1,978,000 less After $791,200

Benefit Attributable to Renourishment Project	$1,186,800

their beach renourishment study of Jacksonville Beach use the concept of "carrying capacity" to attack the problem of calculating incremental benefits attributable to the project. They argue that carrying capacity (i.e., square feet of beach divided by a per person standard which is discussed under crowding below) would be reduced by 75 percent without the project; therefore, the incremental benefits of the project are 75 percent of present annual benefit with the project. As the University of West Florida Study (1984) indicates, demand is usually a small percent of carrying capacity. For Jacksonville Beach, daily use is 3,192 persons compared to an estimated carrying capacity of 45,936 persons/day in their study. Thus, use is only 6.9 percent of capacity. The two studies by Curtis and Shows (1982, 1984) do indicate that incremental benefits of beach renourishment projects are indeed difficult to calculate unless the researcher has a baseline on use before serious erosion has taken place. A mechanical projection from this baseline of beach demand assuming no erosion compared to the historical record might be a starting point in calculating benefits specifically attributable to the project. This will remain a critical policy issue that needs more research work.

2. Oil Spills

Florida imports large amounts of refined and finished petroleum products, primarily from U.S. oil companies. This creates the potential for oil spills that could pollute recreational saltwater beaches. In response to the demand for oil, the Federal government started a program of outer continential shelf (OCS) oil leasing which included large areas off the coast of Florida. Drilling off the coast of Florida for oil may present an additional environmental problem to Florida beaches. The hazards of oil spills are not without precedent.

In 1969, Union Oil Company reported oil seepage into the Santa Barbara Channel estimated at over 3.25 million gallons of oil in the first hundred days. In order to place the Santa Barbara spill in perspective, it may be compared to the Torrey Canyon incident. In that case, about 30 million gallons of crude oil were spilled in the English Channel. In the Torrey Canyon spill, about 140 miles of British and French beaches were oil polluted whereas about 30 miles of California beaches were oil covered due to the Santa

Barbara incident. With the beach crisis produced by oil slicks in Santa Barbara, Mead and Sorensen (1970) were asked to derive the recreational value of the beaches.

Unfortunately, there were no previous studies of beach values to rely upon. Should an oil spill occur along the Florida Coast, the research contained in this report could be used for beach-specific valuation. This has been discussed in the section of this Chapter dealing with the estimation of consumer surplus via the CVM or demand functions. In connection with beach values, Mead and Sorensen used a unique variation of the survey or CVM. It is of interest to compare their results with some of the estimates of daily beach values estimated in this report. They asked a representative sample of respondents to compare the enjoyment they receive from an average visit to the beach with the enjoyment they received from an average movie. They were asked to refine their comparison in terms of proportional levels of enjoyment. The results may be surprising:

1. 59.5 percent said they enjoyed a typical beach visit twice or more than twice as much as a typical movie;
2. 27.8 percent said they enjoyed the beach visit "more" but less than twice as much;
3. The remainder valued the beach visit less (3.9 percent) or less than half as much (8.8 percent)[4].

Assigning weights to the proportional values indicated by those that made the comparison, Mead and Sorensen determined that a typical visit to the beach is, by weighted average, 1.74 times as enjoyable as a typical movie. They were then able to derive the value of a particular beach by the following formula:

Recreational Value of a Beach = (Price of a Movie) X 1.74 x Number Beach Days

This would be an estimate of the flow of recreational value for a 12 month period.

The present market price of a movie is about $3.50. Multiplying the present price of a movie times the Santa Barbara "markup" for beach recreation, it is estimated that a visit to the beach is worth $6.09. The

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[4] Tourist plus resident demand may not equal total daily beach use since figures were derived from two different sources.

value was computed for residents only; therefore, the following comparison can be made:

Santa Barbara Residents	\$ 6.09/Beach Day
Florida Residents	
CVM (Table 6.11)	\$ 1.31/Beach Day
Demand Function (Table 6.11)	\$10.23/Beach Day

It would appear that Santa Barbara estimate is closer to the demand function approach used in Chapter 6 of this report. Of special significance, this report will provide baseline values for Florida beaches before the oil spill. Surveys conducted after the oil spill are likely to be charged with bias by polluters since the surveys are of injured parties (pollutees). Thus, such baseline studies prior to pollution disasters are of considerable value.

One final point is in order. There appears to be an increasing legal acceptance of consumer surplus as a measure of recreational damages. Although settled out of court, the Santa Barbara case included lost consumer surplus as alleged damages. In Florida, the Sapp Battery Case includes consumer surplus losses for recreational freshwater fishing. The court ruled that these losses were legally recognizable; therefore, the measure of value takes on increasing importance for legal action to recover public losses from an oil spill should one occur.

3. Beachfront Acquisition

It is often argued that the State of Florida must acquire additional beach front to prevent overcrowding or provide for projected population increases of both residents and tourists. Once again, recreational beach values are involved in this issue. In Chapter 6, it was estimated that the recreational value of Florida beaches ranged from \$2 billion (based upon willingness to pay) to \$28 billion (based upon demand functions). DNR (1980) has estimated that there are 2,708 acres of saltwater beaches in Florida. Thus, the recreation value of Florida beaches may range from \$738,552 per acre to as high as \$7.4 million per acre. If an average of these two estimates is employed, beach recreational value might average \$4 million per acre. This would, of course, vary from beach to beach. This can be illustrated by reviewing Table 7.5.

Table 7.5

Selected Properties Under Consideration: Save Our Coast Program of Florida

Name	County	Acres	Appraised Value (mil.)	Value Per Acre
Dog Island	Franklin	1,300	$ 1.84	1,415
Posner Track	Broward	13	16.20	1,246,154
Bahia Honda	Monroe	32	1.96	61,250
Burpett Tract	Sarasota	8.6	.548	63,721
Conch Island	St. Johns	482	11.6	24,066
Fort Pierce	St. Lucie	4.7	1.27	270,213
Harbor Lights	Pasco	46	3.20	69,565
Hutchinson Island	St. Lucie*	400	1.50	3,750
Hutchinson Island	Martin**	74	23.60	318,919
Lighthouse Point	Volusia	99.4	2.15	21,630
North Beach	Broward	50.0	43.0	860,000

* Blind Creek

** Martin County

Source: Florida Department of Natural Resources

Table 7.5 shows the appraised value per acre for various "beaches" that are under consideration for the "Save Our Coast Program." The appraised value per acre varies considerably from site to site. The precise appraisal process is not known to the authors; however, such appraisals must be related to comparable properties or business alternatives which are more likely to be development oriented. The Posner Tract in Broward County comes closest to the estimated recreational value per acre of $4 million. The estimate pertains exclusively to beaches and not to freshwater and tidal marshes, mangroves, etc. When "beach land" contains extensive marshes, etc., the value per acre is likely to be lower than other acquisitions. The Posner Tract is Atlantic beachfront of almost complete beach; therefore, it would have higher recreational use than, for example, the Dog Island parcel.

Finally, estimates of beach recreational value can be used to allocate limited state dollars among alternative sites. Table 7.6 is an example of such analyses. Economic optimization would be one possible way to spend the state's money. Consider the following two hypothetical examples in Table 7.6. To simplify the optimization procedure, the two sites have been made equal in acreage. This assumption could easily be relaxed. Site A is in South Florida and the potential per year after acquisition are estimated at 10,000. Site B in Northern Florida is estimated to have potentially less utilization. On the basis of potential development pressure, Site A in South Florida would be given a priority with respect to acquisition. Something is missing here! That is, what is the value of a beach day? Assume that by any one of the valuation techniques discussed above, a beach day is worth $25 at Site A and $15 at Site B. These data generate a recreational value per acre of $5,000 and $1,500 at Sites A and B respectively. It would appear that the per acre recreational benefits would still favor Site A in South Florida. However, the cost of acquiring recreation land for the state must be considered. The cost per acre is much higher for Site A than Site B ($10,000 versus $1,000) as shown in Table 7.6. Item 8 in Table 7 shows that for every state dollar spent on Site A it will return 50 cents in recreational value. Site B will return $1.50 for every $1.00 of state money spent. On economic grounds, Site B in Northern Florida is clearly superior. This analysis combines two elements; development pressure and environmental beauty. The development pressure is represented by the beach days expected while the scenic value (i.e., environmental amenities) may be captured by the recreational value per beach

Table 7.6

A Hypothetical Benefit-Cost Analysis of Alternative Beach Sites for Acquisition

Characteristics	Site A	Site B
1. Acreage	10	10
2. Location	South Florida	North Florida
3. Beach Days (per year)	10,000	1,000
4. Value Per User Occasions to User	$ 5	$ 15
5. Total Recreational Value (per year) (3 x 4)	$50,000	$15,000
6. Recreational Value Per Acre	$ 5,000	$ 1,500
7. Cost Per Acre to Acquire	$10,000	$ 1,000
8. Recreational Benefits Per Average Cost (6 ÷ 7)	.5	1.50

day. The benefit-cost analysis considers the high cost of acquisition in South Florida. The reader should be reminded that all values are hypothetical and that actual acquisition alternatives placed within this framework could yield drastically different results. However, this section does indicate how recreational values might be employed along with projected beach usage (i.e., beach days) to evaluate beach front acquisition on economic grounds.

4. Beach Access

In the analysis in both Chapters 6 and this Chapter, an attempt was made to evaluate the impact, if any, of beach access points on willingness to pay; beach days demanded and expenditures. Also, beach access could be restricted not only by the number of access points, but also by parking facilities. Parking was also evaluated in the same manner as access points. As discussed in Chapter 6, the access points variable was complicated since many saltwater beaches had unrestricted access. In this case, every linear foot of beach was treated as an access point. This variable was called AP. In addition, AP was placed on a per linear foot and per person basis in an attempt to measure or form some index of the relation between AP and beach length and attendance. These variables were called AP2 and AP3 and the means and medians are shown in Table 6.4 (Chapter 6). The statistical results indicated that AP, AP2 and AP3 were not related to willingness to pay; beach demand or expenditures by beach participants. Beach access is a two fold policy issue. First, is there any access to a public beach? This was not addressed in this report. Second, are the existing beach access points adequate? The hypothesis formed here was that increasing access would raise the value of the recreational experience as measured by willingness to pay or beach days demanded. There were no statistical results consistent with this hypothesis. An avenue for future study is to restrict the sample to only those beaches having well defined access points (i.e., eliminating all beach designated UR - unrestricted). This may eliminate some fairly important beaches such as Ft. Lauderdale or Fort Myers as examples. Finally, given the beaches under study, access could be presently "adequate;" therefore, the statistical findings (i.e., no statistical association) would be consistent with this hypothesis.

The second dimension of beach access is parking facilities. In this case, parking spaces (PS); parking spaces per square foot of beach (PK1);

parking spaces per person (PK2) and average parking capacity (APC) were formed as parking variables. None of these physical variables entered the willingness to pay, demand or expenditure functions at an acceptable level of statistical significance. However, even though the physical measures of parking were not statistically significant, the perception variable, PARK, was statistically significant at the one percent level in the tourist demand function shown in Table 6.8 (Chapter 6). This finding indicates that as the perception of parking went from "plentiful" to "inadequate" the demand for beach days decreased. As indicated in Chapter 6, there was no statistical significant correlation (i.e., 5 percent level) between parking perception and the physical measures of parking. These results might seem to indicate that pure physical measures of parking are inadequate indicators of perceptions. For example, The University of West Florida measured "Average Parking Capacity" (APC) using 2 persons per car and one single turnover in the space per day. This number is calculated by multiplying the number of parking spaces by 4. Thus, PS, PK1 and PK2 are scaled down versions of APC. It is suggested that parking behavioral patterns may vary by beach and the characteristics of users; therefore, physical measures of parking may not reflect consumer reactions as the PARK variable apparently did. Both access points and parking facilities may be much more complicated variables with respect to beach user behavior than presently realized. This is a subject for further research effort since this subject is important to policy formation.

5. Beach Carrying Capacity and the Overcrowding Issue

One of the most vexing problems of beach management is assuring "adequate" beach capacity for users. The conventional wisdom argues that "overcrowding" at beaches leads to disutility from the beach experience and a general dissatisfaction by the populace with beach managers. As indicated in Chapter 2, 65 percent of Florida's population 18 years and older are beach users sometime during the year. Thus, beach managers attempt to provide "needed" capacity to voting residents and the economically important tourist population.

In Chapter 6, it was found that resident willingness to pay for beach use was inversely related to a physical measure of crowding or square feet per person/day. However, tourists were relatively insensitive to the same measure of crowding. Various measures of the "optimal" square feet per person/day have been suggested and are reviewed in McConnell (1977) to compute carrying capacity. Carrying capacity of a beach is the total square feet of beach divided by the optimal standard. State standards for recreational facilities in general and beaches in particular vary considerably from 25 (e.g., Vermont) to 200 (e.g. 200) square feet per person/day. As indicated in Chapter 6, the University of West Florida (1984) recommends 100 square feet and 200 square feet per person/day for urban and rural beaches respectively. The National Recreation and Park Association (1983) indicate "Beach area should have 50 sq. ft. of land and 50 sq. ft. of water per user (p. 61)." Thus, there is considerable variation in beach standards in which to compute carrying capacity. It is intended here to look a little more closely at the concept and possible quantification of a beach standard for Florida saltwater beaches. Currently, the Florida Department of Natural Resources, Division of Recreation and Parks, uses 200 square feet per person/day as the average area needed to obtain a "worthwhile recreational experience." The analysis will be restricted to the resident sample of beach users since tourists exhibited no adverse reactions to "crowding." The resident sample contained 751 beach observations. Using the same sample in Chapter 6 (Table 6.7), it was found that the dummy variables representing 75, 100 and 200 square feet of beach per person/day were statistically significant at the 5 percent level up to 100 feet. No individual in the sample visited a beach with less than 20 square feet per person/day. Instead of dealing with the large intervals between dummy variables, it was decided to study the marginal willingness to pay by respecifying the dummy variable on crowding in 10 square feet intervals from 20-200 square feet per person/day. This would allow an analysis of the estimated coefficients, willingness to pay and t-values or levels of statistical significance. It is hypothesized that the beach consumer's marginal recreational value will rise as beach square footage per person/day increases and then remain constant or even decline. The latter point is plausible since beach users may want to see other people or be seen and therefore gain less value from an empty beach. More formally, the equation for testing will be the following:

(9) $LWTPPD = f\ (LINC;\ LBDAYS;\ LTEPD;\ LWIDTH;\ DCR_i)$

where (all variables in logarithms except DCR)

WTPPD = willingness to pay per day

INC = houshold income/year

BDAYS = beach days/year

TEPD = total expenditures per day

WIDTH = width of the beach

$\sum_{i=1}^{19} DCR_i$ = series of dummy variables starting with i = 1 at 20 sq. ft. per person/day or 0 = less than 20 and 1 = 20 or greater progressing at <u>10 sq. ft. intervals</u> until i = 19 or 0 = less than 200; 1 = more than 200

Using OLS, 19 equations were estimated with the same independent variables except DCR which was redefined at 10 square feet intervals as indicated above. The total results of all 19 equations will not be presented here since the focus is upon the parameter for DRC_i. The results are shown in Table 7.7. As hypothesized the coefficient of DRC_i increases and then decreases reaching a maximum at between 50-60 square feet per person per day and is associated with a marginal willingness to pay of \$1.61. At this beach standard, the t-values are statistically significant at the 5 percent level. However, it is of interest that the largest t-value appears at 90 square feet per person. That is, the marginal willingness to pay of \$1.47 has the highest level of statistical significance. The statistical results on the coefficient of DRC_i are subject to considerable statistical variability as shown in Figure 7.1. The distribution of coefficients does not look exactly symmetrical; however, the lack of observations below 20 square feet per person may contribute to this. As an approximation, a parabolic function was fitted by least-squares to the distribution of coefficients given in Table 7.7 and is shown in Figure 7.1.

(10) $$C = \underset{(9.759)}{.00778\ SF} - \underset{(-7.82)}{.000039275\ (SF)^2}$$

$\bar{R}^2 = .877$; F = 69.037; N = 19

where

C = dummy variable coefficient, DCR_i

SF = square feet per person/day

Table 7.7

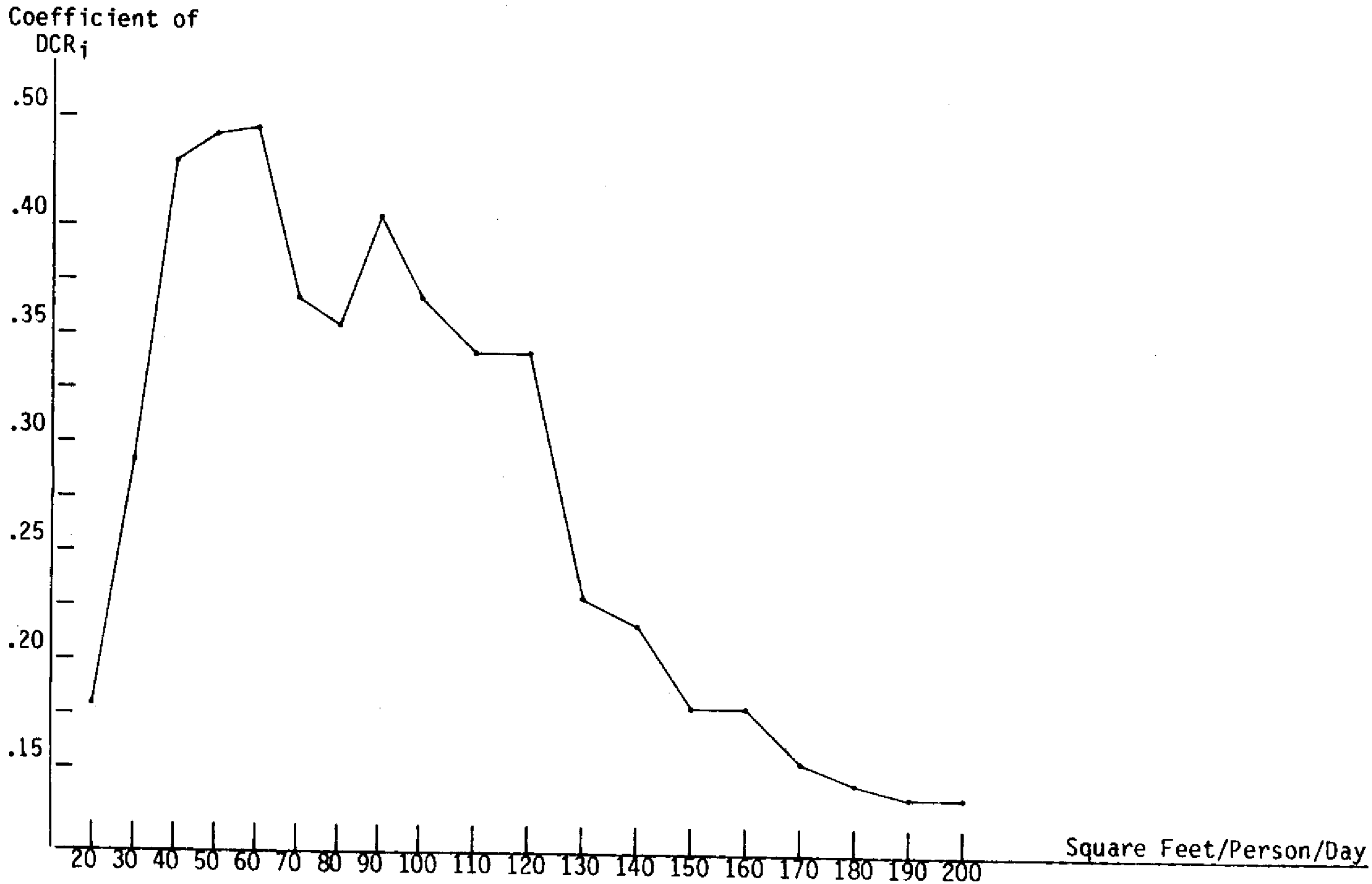
Variation in DCR_i Parameter, t-Values and Corresponding Marginal Willingness to Pay As Square Feet Per Person Per Day Is Increased

	Square Feet Per Person Per Day (i'th equation)	Estimated Coefficient of DCR_i[2]	Marginal Willingness to Pay[1]	t-Value of Estimated Coefficient[2]
1.	20	.17906	$1.20	.4549
2.	30	.30384	1.36	.8677
3.	40	.44821	1.57	1.8151
4.	50	.47513	1.61	2.0140
5.	60	.47513	1.61	2.0140
6.	70	.36149	1.44	2.1539
7.	80	.34032	1.44	2.0754
8.	90	.38668	1.47	2.5770*
9.	100	.35908	1.43	2.5695
10.	110	.32744	1.39	2.3676
11.	120	.32743	1.39	2.3676
12.	130	.22348	1.25	2.1079
13.	140	.21823	1.24	2.0859
14.	150	.16789	1.18	1.9183
15.	160	.16256	1.17	1.8725
16.	170	.15213	1.16	1.7588
17.	180	.15059	1.16	1.8007
18.	190	.13924	1.15	1.6726
19.	200	.13924	1.15	1.6726

* Highest t-value
1. Highest value of coefficient in box
2. t-values that are statistically significant at 5 percent level

Figure 7.1

Relation between Estimated Coefficients of DCR_i Variable and Square Feet Per Person Per Day



Equation (1) was forced through the origin to conform to the hypothesis that no space or square feet per person will result in zero marginal willingness to pay. Equation (10) was a fairly good fit to the data explaining near 88 percent of the variation in "C". Other mathematical forms would most likely involve nonlinear least-squares. This possibility was considered for future research but is not covered here since it is somewhat beyond the scope of this inquiry given the budget constraint and the other limitations. One of the reasons for approximating the distribution of coefficients was to compute the maximum coefficient and associated square-feet per person/day.

$$(11) \quad \text{Max C} = \frac{(.00778)^2}{4(.000039275)} = .3853$$

$$(12) \quad \text{Optimal SF} = \frac{.00778}{2(.000039275)} = 99.05$$

Equation (11) yields a maximum coefficient of .3853 which is approximately the same as the coefficient in Table 7.7 having the greatest statistical significance. The optimal square feet per person/day is slightly over 99. This analysis has led to the conclusion that a standard as low as 50 and as high as 100 square feet per person per day does not seem unreasonable based upon willingness to pay as a measure of recreational value of saltwater beaches in Florida. It would appear that ad hoc standards do have a foundation in econometric analysis of this problem. It is of interest that McConnell (1977) concluded that 52 square feet per person/day was optimal for six saltwater beaches in Rhode Island using willingness to pay as a measure of recreational value, but a somewhat different theoretical model.

Finally, although tourists were not sensitive to the measure of crowding discussed above, they actually experienced increased recreational value as "crowds" increased. As discussed in Chapter 6, this may, in part, be a function of the high ratings given Florida beaches by tourists (i.e, only 7.2 percent of the tourists using the beach felt the beaches were severely crowded). Hecock (1970) found that crowding is not dependent solely upon the number of visitors, but average distance between groups. He states,

> "Comparison of the crowding index of beaches for various types of users indicates that only one type of group is influenced, either positively or negatively by crowding

(Table 6). Teenagers and college students seem to express a strong positive reaction to crowding and indeed thrive upon the close social and physical proximity to other teenagers and college students." (p. 246)

Although Florida beaches are a mecca for college students, it was felt that with a mean beach tourist's age at nearly 45 (See Chapter 3, Table 3.5), in Florida the youth effect was not as strong as the relative spaciousness of its beaches when compared to those experienced by tourists from northern states.

The usage of beach standards and carrying capacity has turned out to be a fascinating one. However, it would appear that whatever standard is adopted beach carrying capacity in Florida is very large compared to even peak demand as reported by The University of West Florida. The following are some examples:

Beach	Carrying Capacity (Persons/Day)	Peak Demand (Persons/Day)	Percent of Carrying Capacity
Jacksonville	45,936	12,572	27.4
Ft. Lauderdale (North Beach)	18,480	7,676	41.5
Treasure Island	136,178	4,823	3.5
Panama City	125,400	6,913	5.5
Pensacola	27,456	1,417	5.2

Still, beaches such as Daytona and New Smyrna Beaches in Volusia County on the East Coast of Florida approach or exceed carrying capacity which brings back this issue of beach standards and crowding.

6. The Coastal Setback Line Issue

Shows and Curtis (1976) have reviewed the issue of the economic impact of Florida's coastal setback line (SBL). The purpose of a SBL is to protect private property from storms but also to preserve beaches for recreational benefits for residents and tourists. Shows and Curtis state, "The measurement of beach preservation benefits of the SBL are hampered because some of these benefits flow to the public at very low or zero prices. No one knows what the dollar value of sandy beaches are in Florida" (p. 2). This, of course, is one of the purposes of this report so it is very relevant to the SBL issue. If all coastal development is located far inland, transportation costs to and from the beach will likely be excessive, the cost of access increasing with distance. On the other hand, if development encroaches on the beaches themselves, beach area is reduced, view may be impaired and risk due to storm and beach erosion are increased. In theory, there is an optimal location of beach development landward of the shoreline which would maximize the total benefits of the beaches, net of all costs. The application of this theory to the SBL is a significant public issue. In the absence of a SBL, encroachment may occur and beach losses would be measured by the value of beach lost. In another case, a SBL may allow beach nourishment to occur within a short period of time, in which case, the coastal SBL serves to prevent encroachment on the newly constructed beach area. The willingness to pay and demand functions for beaches should aid in determining the recreational value of protecting the beach through a coastal SBL. Although the State of Florida need not consider economic criteria in establishing a SBL from a legal point of view, the U.S. Army Corp of Engineers must compute a benefit-cost ratio in beach renourishment which was discussed above in this chapter. The Corp must establish a SBL to compute economic benefits from beach renourishment. It is at this point that the economic value of the beach re-emerges.

Finally, Smith and Belloit (1979) argue that recreational benefits from potential increases in beachfront obtained by forcing development further inland via a SBL to be insignificant in the case of Martin County for the following reasons:

1. Existing development and current development use very little of the land seaward of the coastal SBL;
2. There is currently sufficient public beach and vast amounts of private undeveloped beachfront;
3. The additional beach exposed by forcing some development landward would still be the property of the reparian owner.

This is in sharp contrast to those recreational benefits claimed by Shows and Curtis (1976) from the SBL in Bay County. The coastal SBL is a lively policy issue which creates a need for considering recreational benefits, if any, from

Florida saltwater beaches. The Corp of Engineers has a legal obligation to consider economic benefits while the State of Florida should not ignore economic considerations especially since it interacts on a funding basis with the Corp. It is hoped that this comprehensive study will be flexible enough to be an input into many beach-related policy issues as discussed earlier, including the coastal construction setback line.

Appendix A.1
Resident Beach User Survey Instrument
(part of a larger survey)

Now let's turn from politics to your recreational activities.

25. Did you visit or use any coastal or saltwater beaches over the last 12 months in Florida?	1. Yes 2. No → Skip to Question 33

---

26. How many days in total did you spend at the beaches you visited over the last 12 months?

    26a. What coastal or saltwater beaches have you visited or used in Florida the most over the last 12 months?

    1 ______________________________

    2 ______________________________

    3 ______________________________

27. Beach 1

    a. In which county is (NAME OF BEACH) located?

    ____

    b. How many days in total did you spend at (NAME OF BEACH) over the last 12 months? Count any fraction of a day as a full day.

c. How would you rate (NAME OF BEACH) as to crowdedness? Would you say it usually is not crowded at all, a little crowded, moderately crowded, or severely crowded?	1. Not crowded 2. Little 3. Moderately 4. Severely 8. DK
d. Would you rate parking availability at (NAME OF BEACH) as plentiful, adequate or inadequate?	1. Plentiful 2. Adequate 3. Inadequate 8. DK
e. How about the cleanliness of the coastal water at (NAME OF BEACH). Is it usually:	1. Very clean 2. Clean enough for swimming 3. Not clean enough for swimming 8. DK

f. And the overall physical appearance of (NAME OF BEACH). Is it usually:

1. Very attractive
2. Attractive
3. Unattractive
8. DK

---

28. Beach 2

a. In which county is (NAME OF BEACH) located?

____

b. How many days in total did you spend at (NAME OF BEACH) over the last 12 months? Count any fraction of a day as a full day.

c. How would you rate (NAME OF BEACH) as to crowdedness? Would you say it is usually not crowded at all, a little crowded, moderately crowded, or severely crowded?

1. Not crowded
2. Little
3. Moderately
4. Severely
8. DK

d. Would you rate parking availability at (NAME OF BEACH) as plentiful, adequate or inadequate?

1. Plentiful
2. Adequate
3. Inadequate
8. DK

e. How about cleanliness of the coastal water at (NAME OF BEACH). Is it usually:

1. Very clean
2. Clean enough for swimming
3. Not clean enough for swimming
8. DK

f. And the overall physical appearance of (NAME OF BEACH). Is it usually:

1. Very attractive
2. Attractive
3. Unattractive
8. DK

---

29. Beach 3

a. In which county is (NAME OF BEACH) located?

____

b. How many days in total did you spend at (NAME OF BEACH) over the last 12 months? Count any fraction of a day as a full day.

c. How would you rate (NAME OF BEACH) as to crowdedness. Would you say it usually is not crowded at all, a little crowded, moderately crowded, or severely crowded?

1. Not crowded
2. Little
3. Moderately
4. Severely
8. DK

d. Would you rate parking availablilty at (NAME OF BEACH) as plentiful, adequate or inadequate?

1. Plentiful
2. Adequate
3. Inadequate
8. DK

e. How about the cleanliness of the coastal water at (NAME OF BEACH). Is it usually:

1. Very clean
2. Clean enough for swimming
3. Not clean enough for swimming
8. DK

f. And the overall physical appearance of (NAME OF BEACH). Is it usually:

1. Very attractive
2. Attractive
3. Unattractive
8. DK

---

30. We would also like to know how much you spent for you and members of your household only over the past 12 months while visiting Florida's coastal beaches. How much did you spend on...

a. Hotel/Motel or campfees $______________

b. Food and drink $______________

c. Travel to and from beach $______________

d. Beach access fees $______________

e. Other beach related expenses $______________

Total Annual Household Expenditures $______________

---

31. How many times did you leave the beach and return during a typical day?

____

---

32. On average, what percent of a day's activities (including nighttime entertainment) was spent on the beach? Would you say....

1. 25%
2. half a day
3. 75%
4. full day
8. DK

---

33. Because of beach erosion and other beach related problems, suppose it became necessary for beach users to agree to buy an annual pass which allows you to visit all public beaches in Florida. The money collected would pay for the preservation of the beach. What is the maximum amount you would pay for the annual beach pass in addition to any present beach fees? $______________ per year.

Socioeconomic Background

46. And in what year were you born? (CODE LAST 2 DIGITS) __ __

---

47. Have you lived in Florida all your life?

1. Yes → Skip to question 50
2. No

48. In what year did you move to Florida? (CODE LAST 2 DIGITS) __ __

49. From what state did you move? ____________________________

---

53. What is your race?

1. White
2. Black
3. Some other group ______________
8. DK

---

57. Now, consider all sources of income for everyone living with you in 1983 before taxes. Please stop me when I get to your income level.
READ CATAGORIES

1. Under $5,000
2. $5,000-10,000
3. $10,000-15,000
4. $15,000-20,000
5. $20,000-25,000
6. $25,000-30,000
7. $30,000-40,000
8. Over $40,000
9. Refused
0. DK

---

58. How many people live in your household including children?

Could you please give me your name just so I know who I spoke to in this household? That completes our survey. Thank you for your time and help. Good bye.
PRINT NAME ON LAST PAGE OF QUESTIONNAIRE

DO NOT ASK

59. Sex of respondent

1. Male
2. Female

Appendix A.2
A Description of the Method Used to Estimate Beach-Related State Tax Revenue

Sales Tax

The State of Florida taxes most retail sales items and some services at a 5 percent rate. In order to avoid double counting we estimated sales taxes by the following formula:

$$\text{Sales Tax} = \frac{\text{sales}}{1.05} \times .05$$

Sales taxes were estimated for all expenditure categories except Beach Access Fees since most of these fees were collected by local government agencies and these fees are not subject to the sales tax.

Gasoline Tax

Florida collects $.04 per gallon in state taxes. We estimated the gasoline tax by first deriving the gallons consumed. Gallons consumed is derived by dividing the total sales estimated by the average price per gallon of gasoline ($1.15). The number of gallons consumed are then multplied by the $.04 per gallon to obtain our estimate of state gasoline taxes generated by beach activities.

Corporate Profit Taxes

The State of Florida taxes corporate profits at a five percent rate with a $5,000 exemption. To the extent that businesses which service saltwater beach users are incorporated, an amount of corporate profits taxes is generated to the state. We approximated this amount by first assuming that all businesses serving beach users are incorporated. Second, since the $5,000 exemption could not be accounted for, we used a four percent tax rate. This one percent reduction in the tax rate should partially offest the upward bias imparted by the assumption that all businesses are incorporated as well as the $5,000 exemption per firm. The reader should remember that the corporate tax figures presented in this study are merely approximations to the extent of corporate taxes generated by saltwater recreational beach users.

Corporate profit taxes were calculated according to the following formula:

$$\text{Corporate Profit Taxes} = \frac{\text{profit}}{\text{sales}} \times \text{sales} \times .04$$

The profit to sales ratios were taken from the U.S. Treasury Department, Internal Revenue Service publication Corporate Income Tax Return, Statistics of Income (Dec. 1981) and are as follows:

		Profit to Sales Ratio
1.	Hotels and Other Lodging Places	.0564
2.	Eating and Drinking Places	.028
3.	Automotive Dealers and Service Stations	.0064
4.	General Retail	.2170

Appendix A.3

Tourist Beach User Survey
Instrument and
Beach Location Map

Sea Grant Beach Study
Florida State University
Tourist Saltwater Beach Users

Screening Question:

1. Did you visit or use any coastal or saltwater beaches over the last 12 months in Florida?

Col. #	
1.	No
2.	Yes, But could not complete interview
3.	Yes

Interviewer Instructions:

Please place tick mark in appropriate column after each contact. Once an interview is completed fill in totals for each column, Interviewer's Name, Date of Interview, Time of Interview and Location of Interview.

1 NO (Did not Use Beach)	2 YES (But Not Interviewed)	3 Yes (Interviewed)
Total: ____________	____________	____________

Interviewer: ____________ Date: __/__/__ Time: _____ Location _________

Trip and Travel Information:

2. Where is your home? ______________ ______________ ________
City State Zip

3. How many individual trips including this most recent one did you make to Florida and use or visit coastal beaches over the last 12 months?

____
trips to Florida

4. (a) Of the number of trips made to Florida in the last 12 months (Question 3), how many were made exclusively by air?

____
number

(b) Of the remaining trips by auto, On Average, how many round trip miles were driven from your home to the Place of Lodging in Florida, on those trips to Florida on which you used or visited coastal beaches?

____
round trip miles

(c) On average, how many miles were driven from your Place of Lodging in Florida to the beach?

____
miles

5. How many total days did you spend in Florida over the last 12 months?

____
days

Beaches Visited, Days and Characteristics of Beach:

6. What coastal or saltwater beaches have you visited or used in Florida over the last 12 months?

	Name of Beach	County	Days Visited	Crowding	Parking	Coastal Water	Physical Appearance
1.							
2.							
3.							
4.							
5.							

Beach 1

a. In which county is (NAME OF BEACH) located?

Show Map Write in Name of Beach Code Beach Number

b. How many days in total did you spend at (Name of Beach) over the last 12 months? Count any fraction of a day as a full day.

c. How would you rate (NAME OF BEACH) as to crowdedness. Would you say it usually is a little crowded, moderately crowded, or severely crowded?

1. Little 2. Moderately 3. Severely

d. Would you rate parking availability at (NAME OF BEACH) as plentiful, adequate, or inadequate?

1. Plentiful 2. Adequate 3. Inadequate

e. How about the cleanliness of the coastal water at (NAME OF BEACH). Is it usually:

1. Very clean 2. Just swimmable 3. Not swimmable

f. And the overall physical appearance of (NAME OF BEACH). IS it usually:

1. Very attractive
2. Attractive
3. Unattractive

Repeat for Each Beach Visited

7. On average, how many times did you leave the beach and return during the same day?

_____ times

8. On average, what percent of a days activities (including nighttime entertainment) were spent on the beach. Would you say . . .

1. 25%
2. half a day
3. 75%
4. full day

_____ 1 - 4

9. We would also like to know how much you spent for <u>you and members of your household only over the past 12 months</u> while visiting Florida's coastal beaches. How much did you spend on . . .

a. Hotel/Motel or campfees $_____
b. Food and drink $_____
c. Travel to and from beach $_____
d. Beach access fees $_____
e. Other beach related expenditures $_____

Interviewer adds (a-e)

Total Annual Household Expenditures $_____

10. Because of beach erosion and other beach related problems, suppose it became necessary for beach users to agree to buy an annual pass. The money collected would pay for the preservation of the beach. What is the maximum amount you would pay for the annual beach pass in addition to any present beach fees?

$_____ per year.

11. How many adults, age 18 or over, in your household accompanied you to Florida's beaches?

_____ number

12. How many children in your household accompanied you to Florida's beaches?

_____ number

13. What year were you born? ________

13. What is your household income?

(1) $0 - $ 9,999
(2) $10,000 - $19,999
(3) $20,000 - $29,999
(4) $30,000 - $39,999
(5) $40,000 - $49,999
(6) $50,000 - $59,999
(7) over $60,000

(1-7)

14. What is your occupation?

(1) Professional, Executive
(2) Manager, White Collar
(3) Blue Collar
(4) Student/Homemaker/Military
(5) Retired/semi-retired
(6) Unemployed
(7) Other

(1-7)

15. Sex:

(1) Male
(2) Female

(1-2)

Instructions for Tourist Beach Users Questionnaire

Page 1

Question 1

Question 1 is the screening question to determine whether or not the tourist contacted has visited or used a coastal or saltwater beach in Florida. The interviewer simply places a tic mark in the appropriate column after each contact. Once an interview is completed, Column 3 should have one tic mark. Notice column 2 is available to cover those cases where tourists indicate they have visited or used Florida's beaches but could not complete the interview or refused to be interviewed.

Page 2

Questions 2-5 ask the respondent about trip and travel information.

Question 2

Fill in respondents home (city, state, and zip code). If from a foreign country just write in city and country.

Example:	Montreal	Canada	
	City	State	Zip

Question 3

Question 3 asks the respondent how many trips were made to Florida over the last 12 months on which they used or visited a coastal or saltwater beach. It does not ask total trips to Florida but only those in which they used or visited a beach. A trip to Florida might be one day or one month. A person could make several trips to Florida. We only want to know about those trips on which they spent at least one day at the beach.

Question 4

Question 4 has three parts asking more detail about the number of trips given in Question 3. Parts (a) & (b) divide the number of trips by mode of travel. Part (a) asks how many trips were made by air. Part (b) assumes the remaining trips were made by auto and asks the respondent on average how many round trip miles were driven from the respondent's home to the place of lodging in Florida. Part (c) asks the respondent how far on average they drove from the place of lodging to the beach.

Example: (Hypothetical tourist)

A person from N.Y., N.Y. visits Florida five times in the last 12 months. On four of those trips he or she spent at least one day at the beach. One trip was made by air the remaining three trips by auto. (Remember the fifth trip is not important here since on that trip the beach was not visited).

On the first trip by auto the respondent traveled from N.Y., N.Y. to Miami, FL which is approximately 1,500 miles. On the second trip the respondent traveled from N.Y., N.Y. to Panama City, FL which is approximately 1100 miles. The third trip by auto consisted of travel from N.Y., N.Y. to Naples, FL which is approximately 1,500 miles. (All mileage given so far is one-way mileage). When in Miami and Panama City the respondent stayed at a hotel on the beach while at Naples the hotel was located 5 miles from the beach. The trip made by air was to Sarasota, FL and the respondent stayed in a hotel on the beach.

Here is how the above person's respones should be recorded for Question 3-4.

Question 3 — 4 trips to Florida

Question 4

(a) — 1 number

(b) 1500 x 2 = 3000
1000 x 2 = 2000
1500 x 2 = 3000
3 | 8000
1666 — 1666 round trip miles

(c) 0 + 0 + 0 + 5 = 5 — 1.25 miles

5 ÷ 4 = 1.25

Note:

For those who make many trips the interviewer might simply record the information in the margins and calculate average later.

Question 5

Question 5 asks how many total days did the respondent spend in Florida over the last 12 months. This answer should include days for all trips whether or not they visited a beach. We want to know the total number of days they were in Florida over the last 12 months.

Question 6

Question 6 may be a time consumer if people visited a large number of beaches. We do not at this time have any prior knowledge as to how many beaches tourists visit or if they know the beach names or county names. The maps should be of assistance in identifying beaches and county names. We expect people will know city names which can be translated into county names. Should the interviewer have problems identifying the exact county, the city name should be written in the county square. If beach name is unknown write in name of city or nearest city.

Question 7

Question 7 asks the respondent how many times he or she left the beach and returned during the same day on average. If the respondent stayed all day without leaving-returning then this would be coded as a zero. Remember we are asking on average and a repondent may have spent 10 days at the beach, some days they stayed all day other days they may spend a few hours or a few minutes on the beach in the moring and a few hours in the afternoon. Do not count trips to the bathroom or walking off the beach across the street for a drink as leaving - returning.

Question 8

People have available to them a variety of activities while in Florida. On any given day a person may spend a few hours at the beach, a few hours at restaurants, lounges and bars, a few hours visiting the zoo or shopping at the malls or seeing a movie or play. Some may play golf, tennis, walk, go boating or simply lounge around the hotel or visit friends. What we want to know is approximately what portion of a days activity is usually spent on the beach on those days when a beach is visited. One person might have an 18 hour active day while another person might only have an 8 hour day of activities. From each of these people we only want to know what percent of their day of activities is spent at the beach.

Question 9

Question 9 asks the respondent how much they spent for themselves and members of their household only over the past 12 months while visiting Florida's coastal beaches. A few respondents will have made muliple trips to Florida and will require more effort in interviewing and maybe a lack of memory on the respondent part. However, we expect this to be minimal given our experience with saltwater fishermen.

Part (e) - Other related expenditures should include such items as suntan oil, beach towels, umbrella rental, parking fees, sunglasses, beach chairs, etc.

Question 10

Question 10 is a hypothetical situation attempting to establish a market for beach use. In Florida beach eroision is a serious problem and is very costly to renourish beaches. Question 10 confronts the beach user with the problem faced by the state in preserving Florida beaches and attempts to find out what people would be willing to pay annually to be able to utilize the beach.

Question 11-15

Questions 11-15 are designed to give us a socio-demographic profile for beach users.

Questions 11 & 12

Question 11 asks, how many adults, age 18 or over, in your household accompanied the respondent who made more than one trip or spent more than one day at a beach. It might be the case that different numbers of adults accompanied the respondent on each visit. The interviews should attempt to find out on average how many adults (in the respondents household) accompanied them to Florida's beaches.

Question 12 same question as Question 11 only this time with respect to children.

Question 13

Question 13 asks the respondent what year he or she was born. The Policy Sciences finds that respondents are more willing to give date of birth than age.

Question 14

Question 14 asks for household income. This should include income from all members of the household. Show card (back of map) and ask respondent for number corresponding to the income range they belong in (1-7). Code number on line to right.

Question 15

Question 15 asks for respondents occupation not the head of households. Code numbers 1-7 to the right in space provided.

Question 16

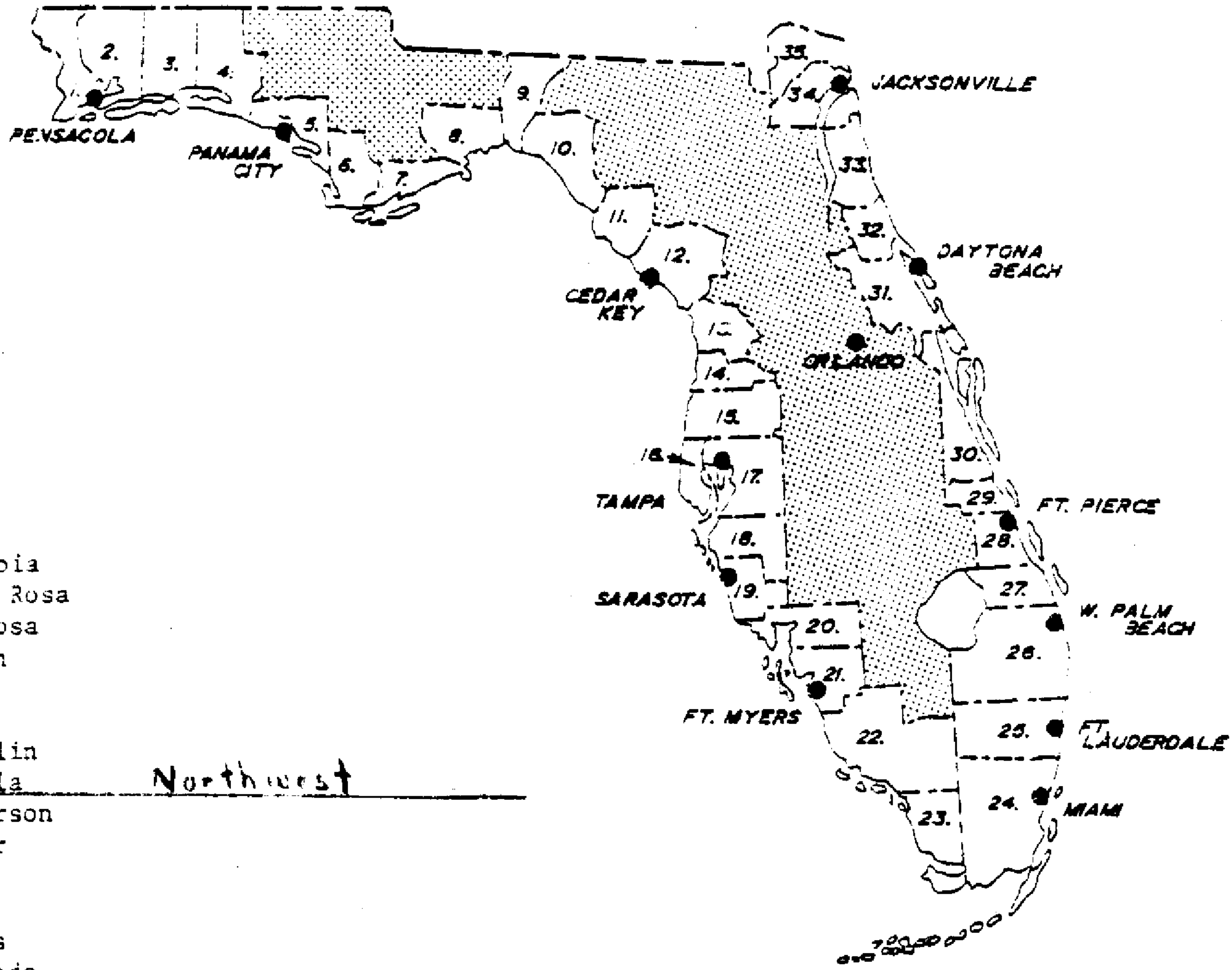
Question 16 asks interviewer to record sex of respondent (1) for Male (2) for female.

SEAGRANT – FLORIDA STATE UNIVERSITY

BEACH STUDY

MAPS OF FLORIDA'S COASTAL COUNTIES

COASTAL COUNTIES OF FLORIDA



1. Escambia
2. Santa Rosa
3. Okaloosa
4. Walton
5. Bay
6. Gulf
7. Franklin
8. Wakulla — Northwest

9. Jefferson
10. Taylor
11. Dixie
12. Levy
13. Citrus
14. Hernando
15. Pasco
16. Pinellas
17. Hillsborough — West Central

18. Manatee
19. Sarasota
20. Charlotte
21. Lee
22. Collier
23. Monroe — Southwest

24. Dade
25. Broward
26. Palm Beach — Southeast

27. Martin
28. St. Lucie
29. Indian River
30. Brevard — East Central

31. Volusia
32. Flagler
33. St. Johns
34. Duval
35. Nassau — Northeast

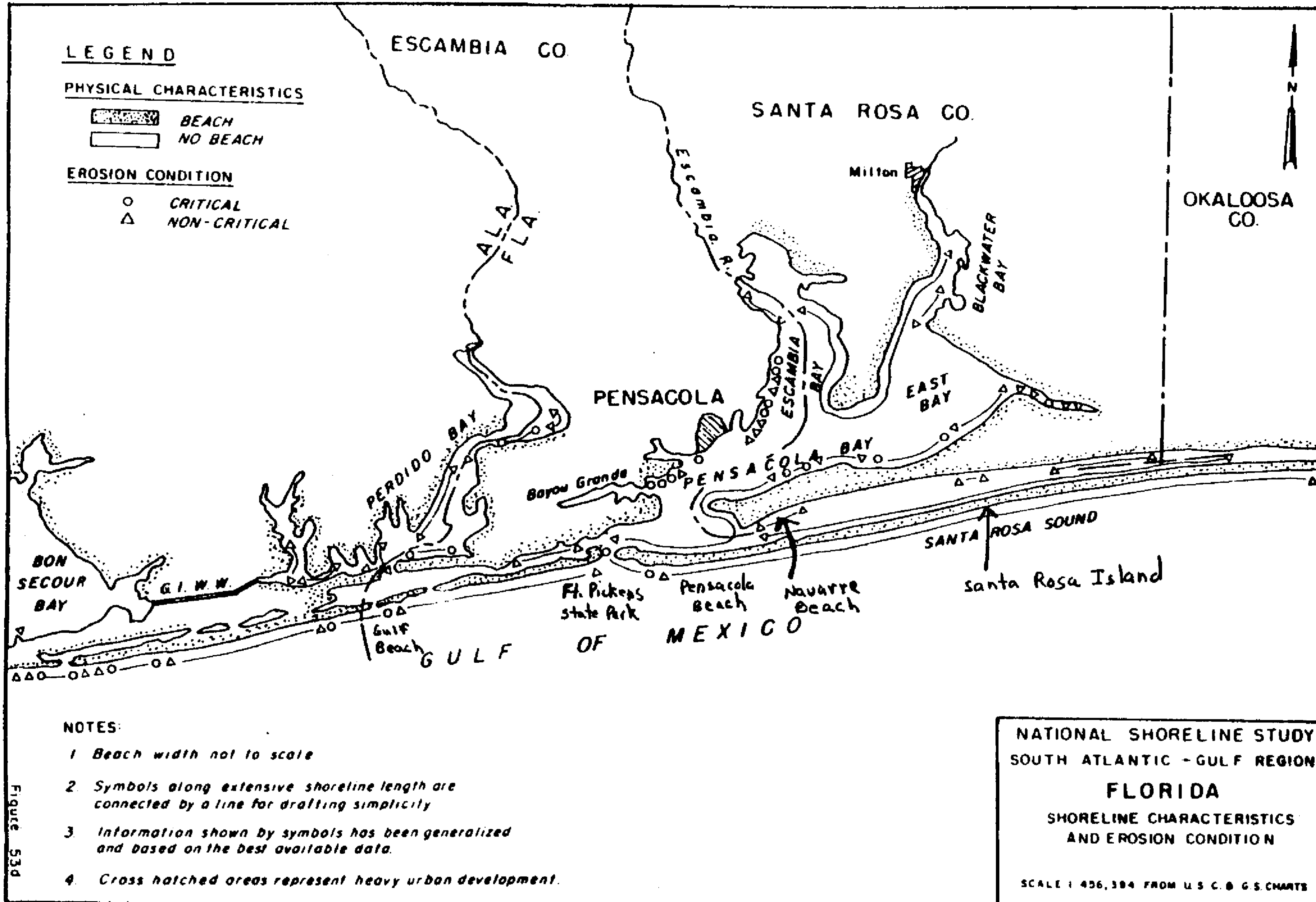


Figure 53d

Figure 53

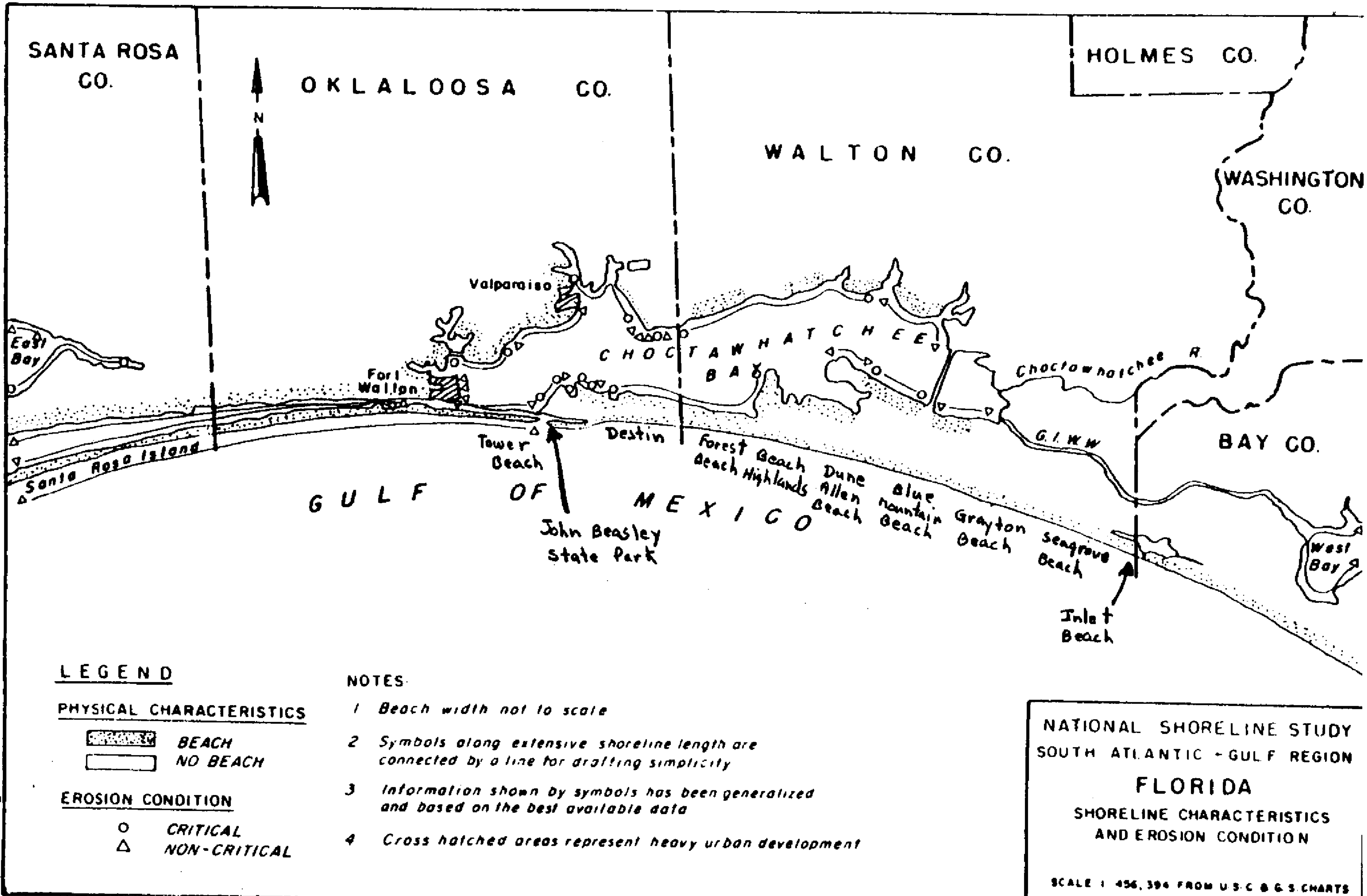
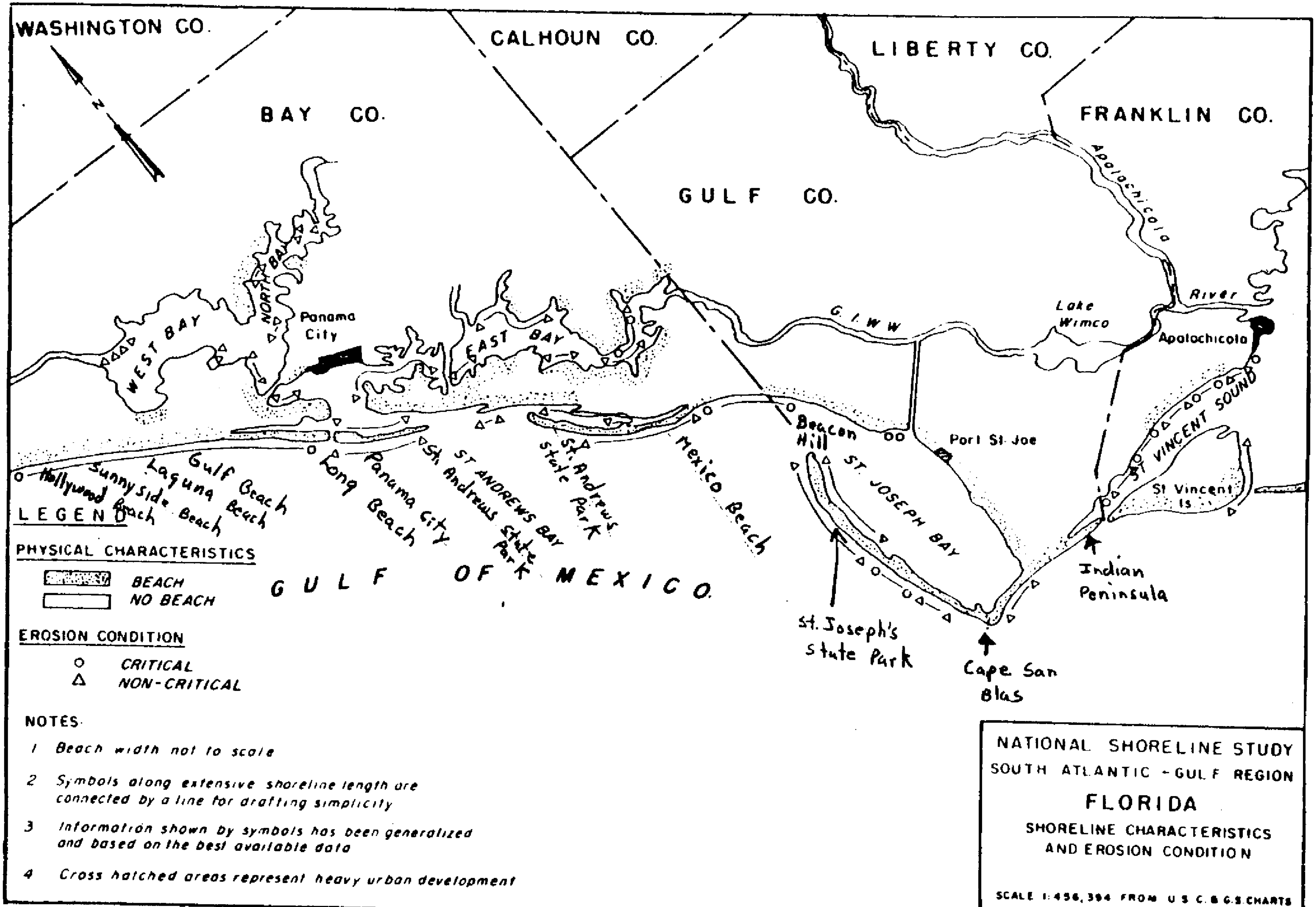


Figure 50d

Figure 50d



WASHINGTON CO.
CALHOUN CO.
LIBERTY CO.
FRANKLIN CO.
BAY CO.
GULF CO.
N
Apalachicola
River
G.I.W.W.
Lake Wimco
Apalachicola
Panama City
WEST BAY
NORTH BAY
EAST BAY
Port St. Joe
Beacon Hill
ST. JOSEPH BAY
ST. VINCENT SOUND
St. Vincent Is.
Indian Peninsula
Cape San Blas
St. Joseph's State Park
Mexico Beach
St. Andrews State Park
ST. ANDREWS BAY
St. Andrews State Park
Panama City
Long Beach
Gulf Beach
Laguna Beach
Sunnyside Beach
Hollywood Beach
GULF OF MEXICO
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
○ CRITICAL
△ NON-CRITICAL
NOTES
1 Beach width not to scale
2 Symbols along extensive shoreline length are connected by a line for drafting simplicity
3 Information shown by symbols has been generalized and based on the best available data
4 Cross hatched areas represent heavy urban development
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS AND EROSION CONDITION
SCALE 1:456,394 FROM U.S. C.&G.S. CHARTS

Figure 47d

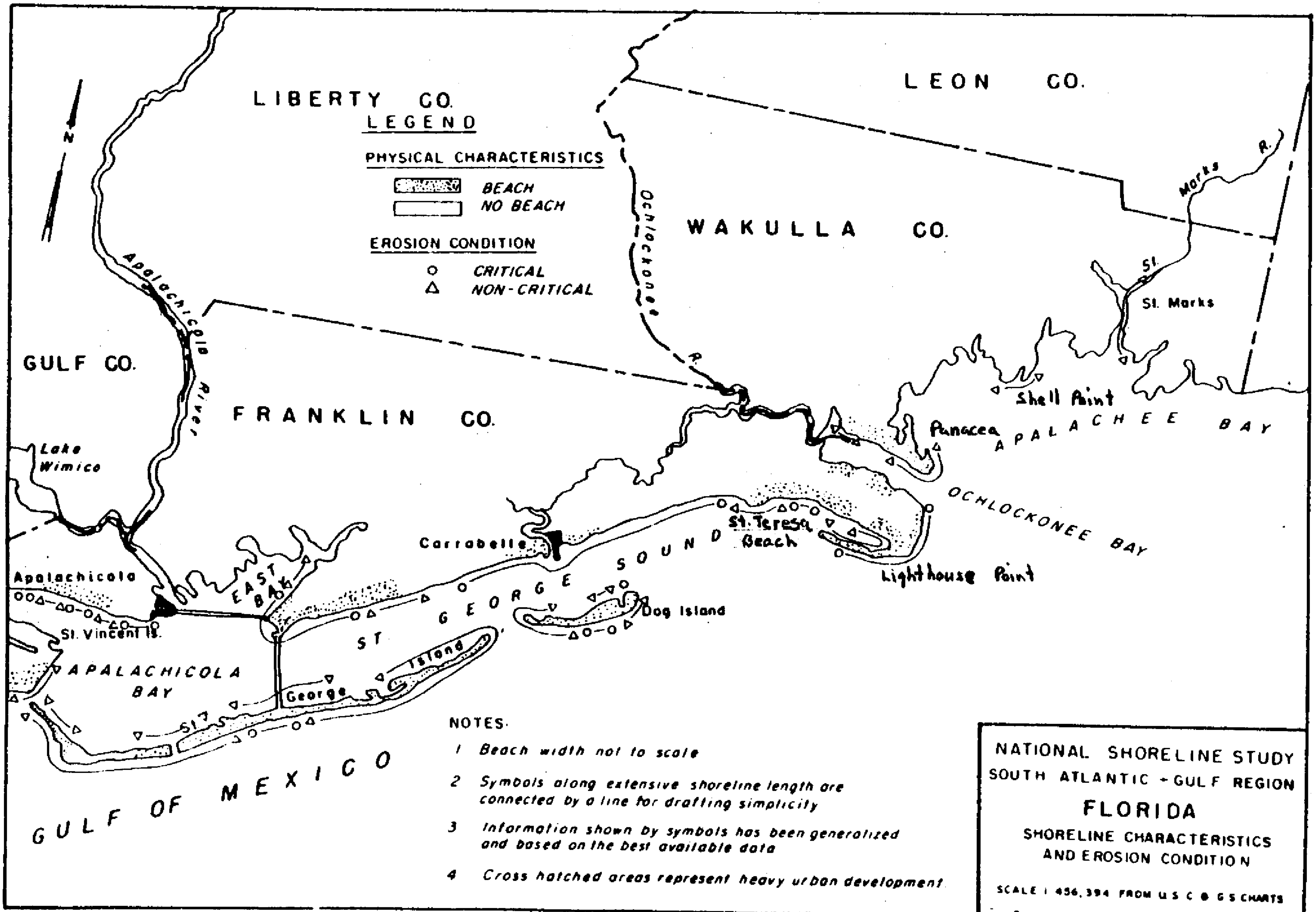
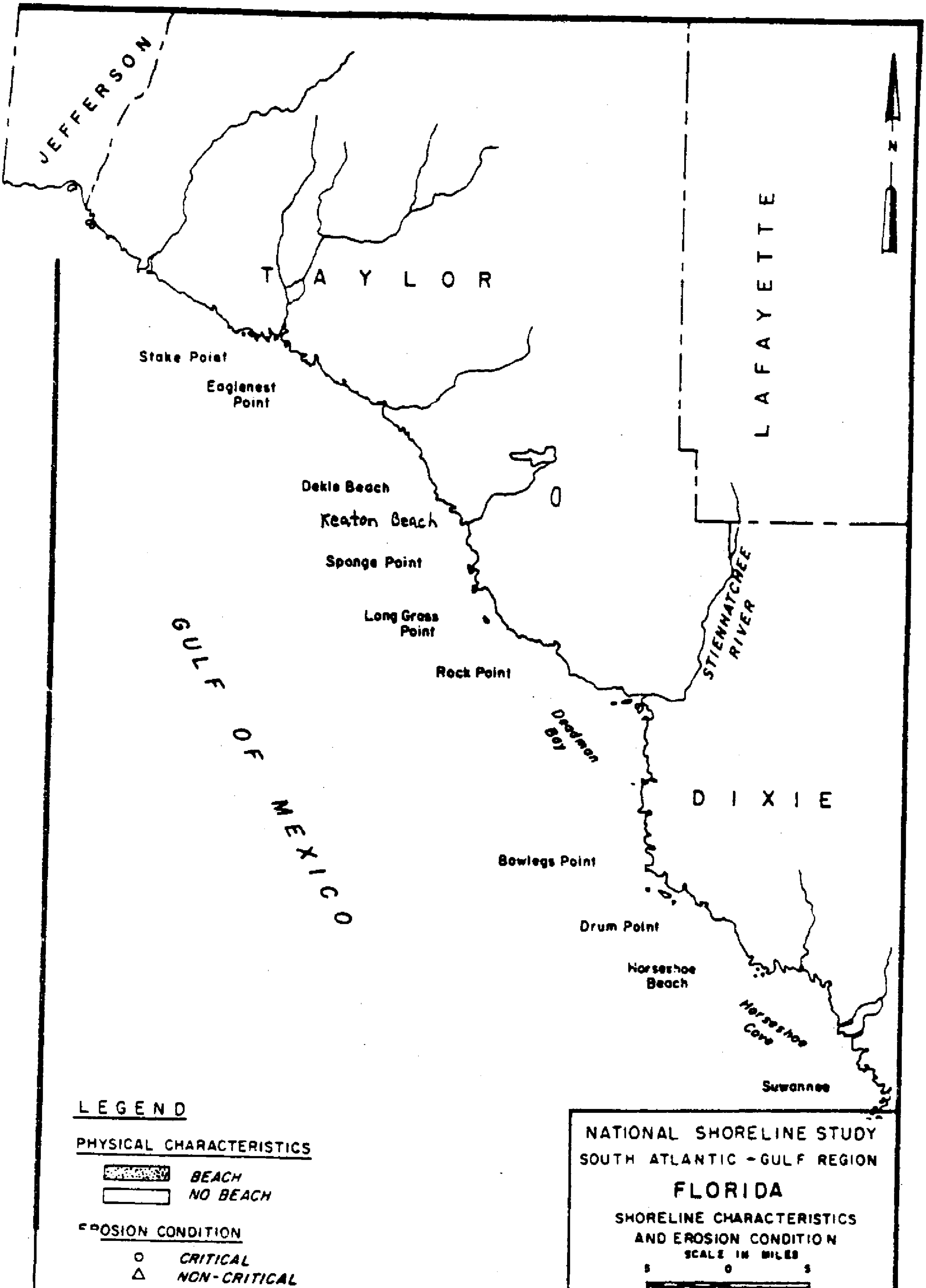
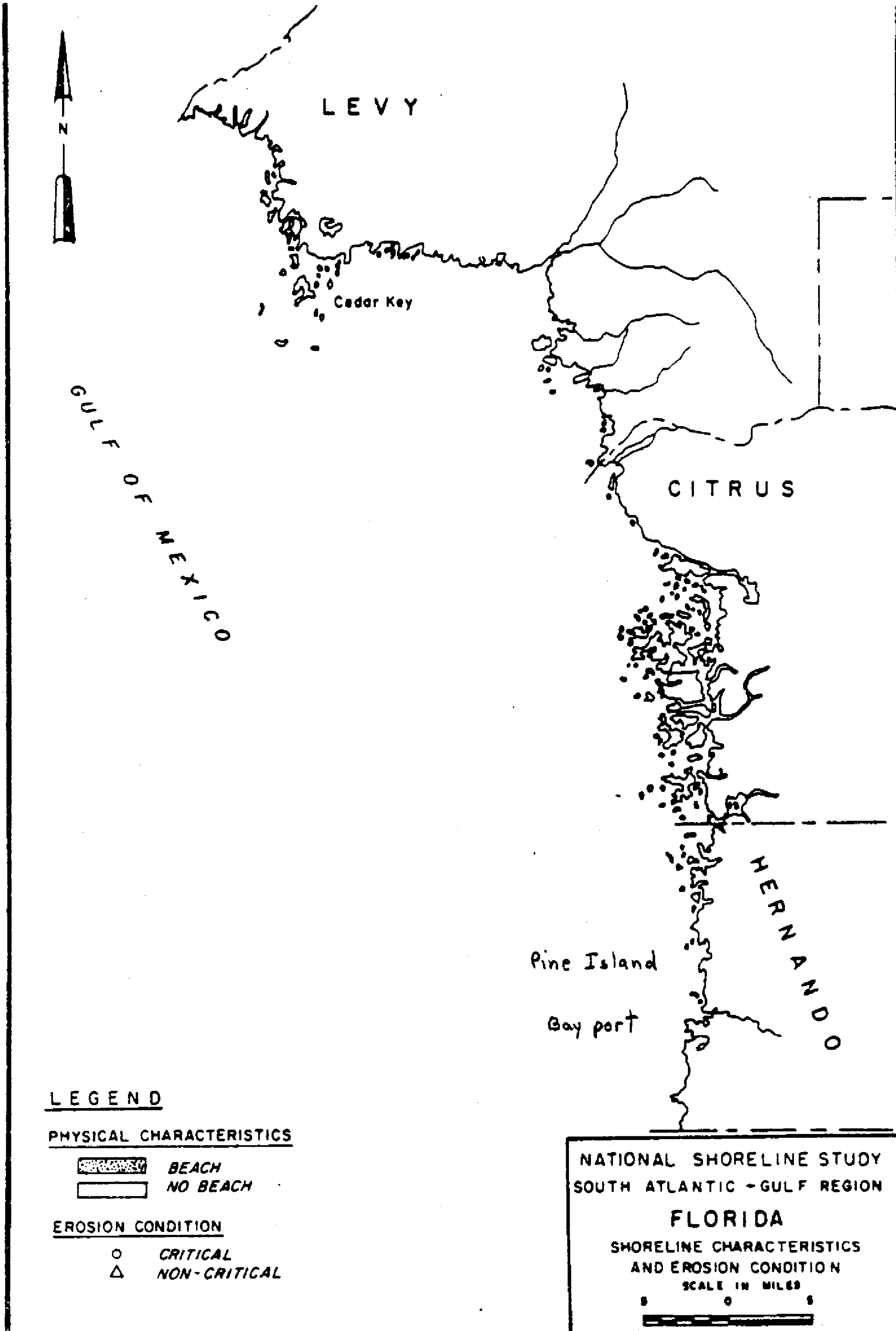
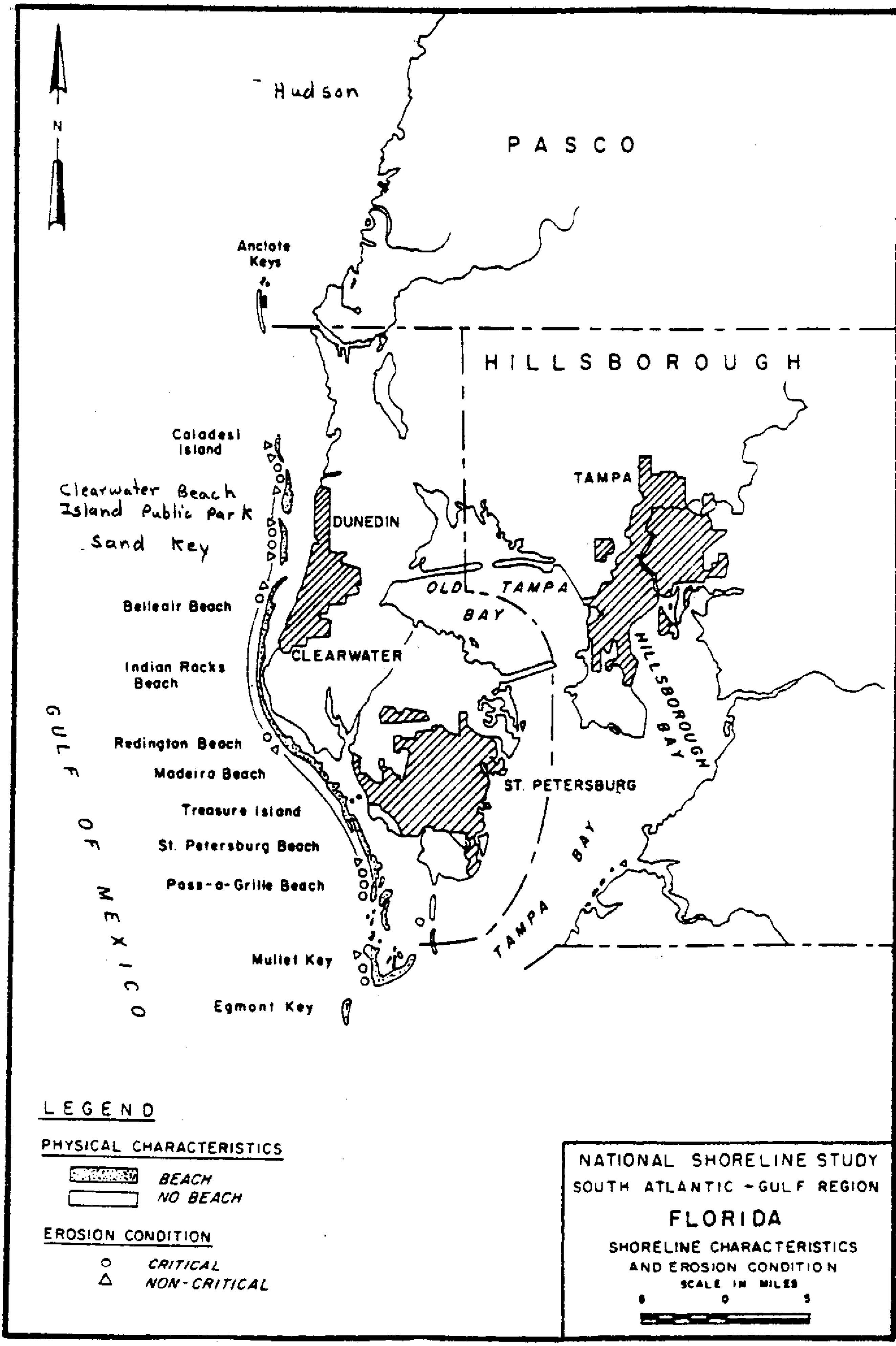

LIBERTY CO.
LEON CO.
WAKULLA CO.
GULF CO.
FRANKLIN CO.
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
○ CRITICAL
△ NON-CRITICAL
N
Apalachicola River
Ochlockonee R.
St. Marks R.
St. Marks
Shell Point
Panacea
APALACHEE BAY
OCHLOCKONEE BAY
Lighthouse Point
St. Teresa Beach
ST GEORGE SOUND
Dog Island
Carrabelle
EAST BAY
ST George Island
Lake Wimico
Apalachicola
St. Vincent Is.
APALACHICOLA BAY
GULF OF MEXICO
NOTES.
1 Beach width not to scale
2 Symbols along extensive shoreline length are connected by a line for drafting simplicity
3 Information shown by symbols has been generalized and based on the best available data
4 Cross hatched areas represent heavy urban development
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE 1:456,394 FROM U S C & G S CHARTS

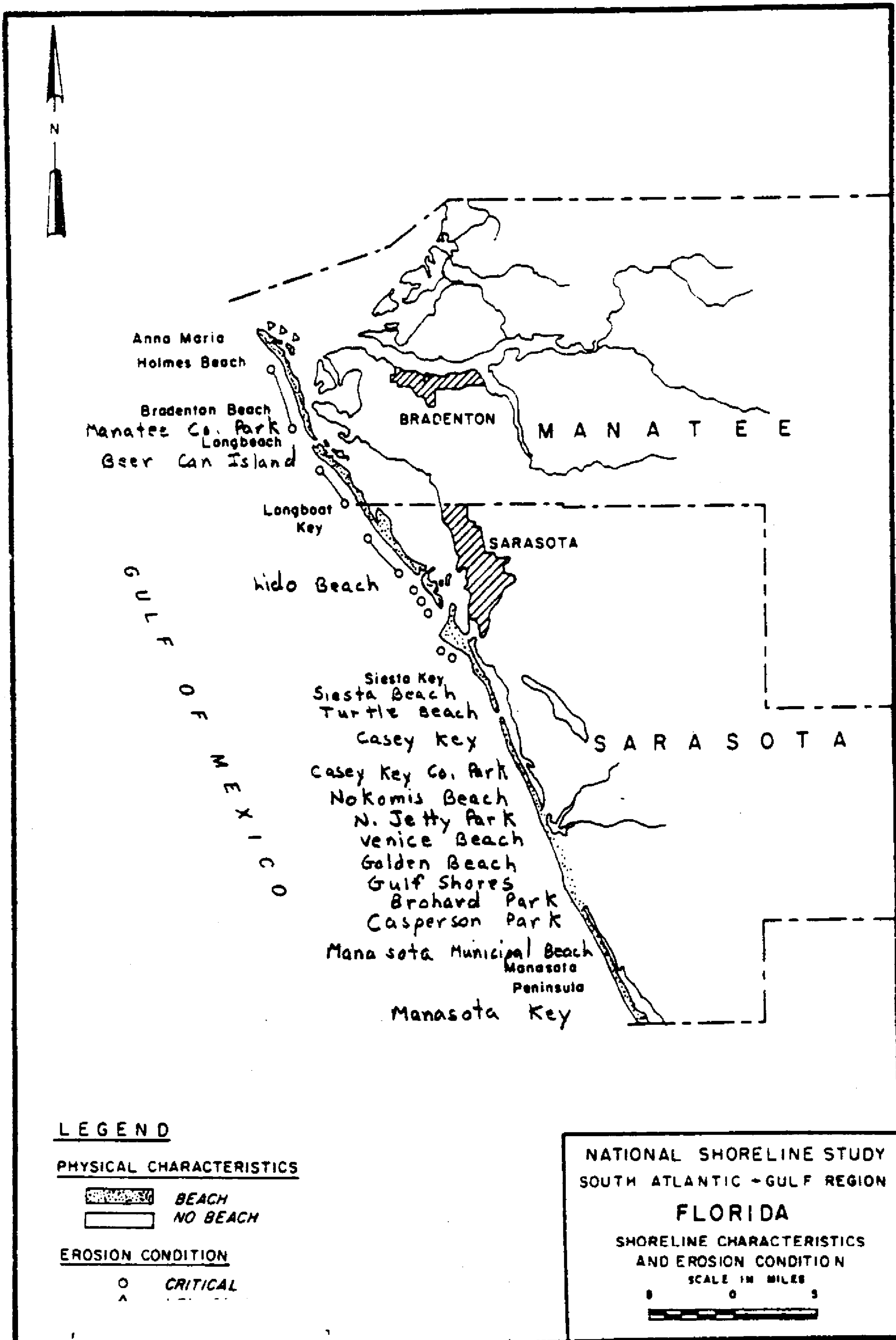
Figure 44d

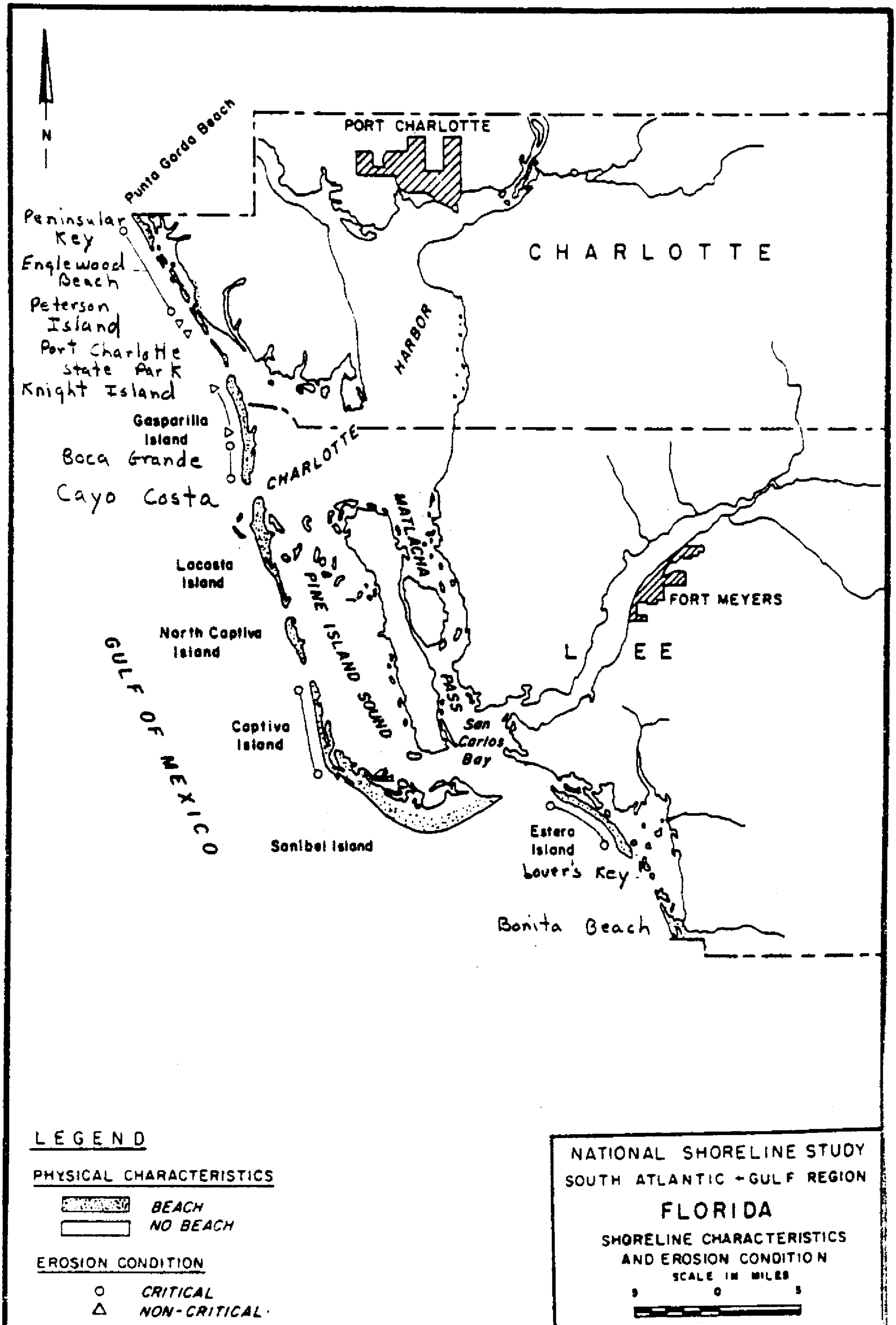

JEFFERSON
TAYLOR
LAFAYETTE
N
Stake Point
Eaglenest Point
Dekle Beach
Keaton Beach
Sponge Point
Long Grass Point
Rock Point
GULF OF MEXICO
Deadman Bay
STIENHATCHEE RIVER
DIXIE
Bowlegs Point
Drum Point
Horseshoe Beach
Horseshoe Cove
Suwannee
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5

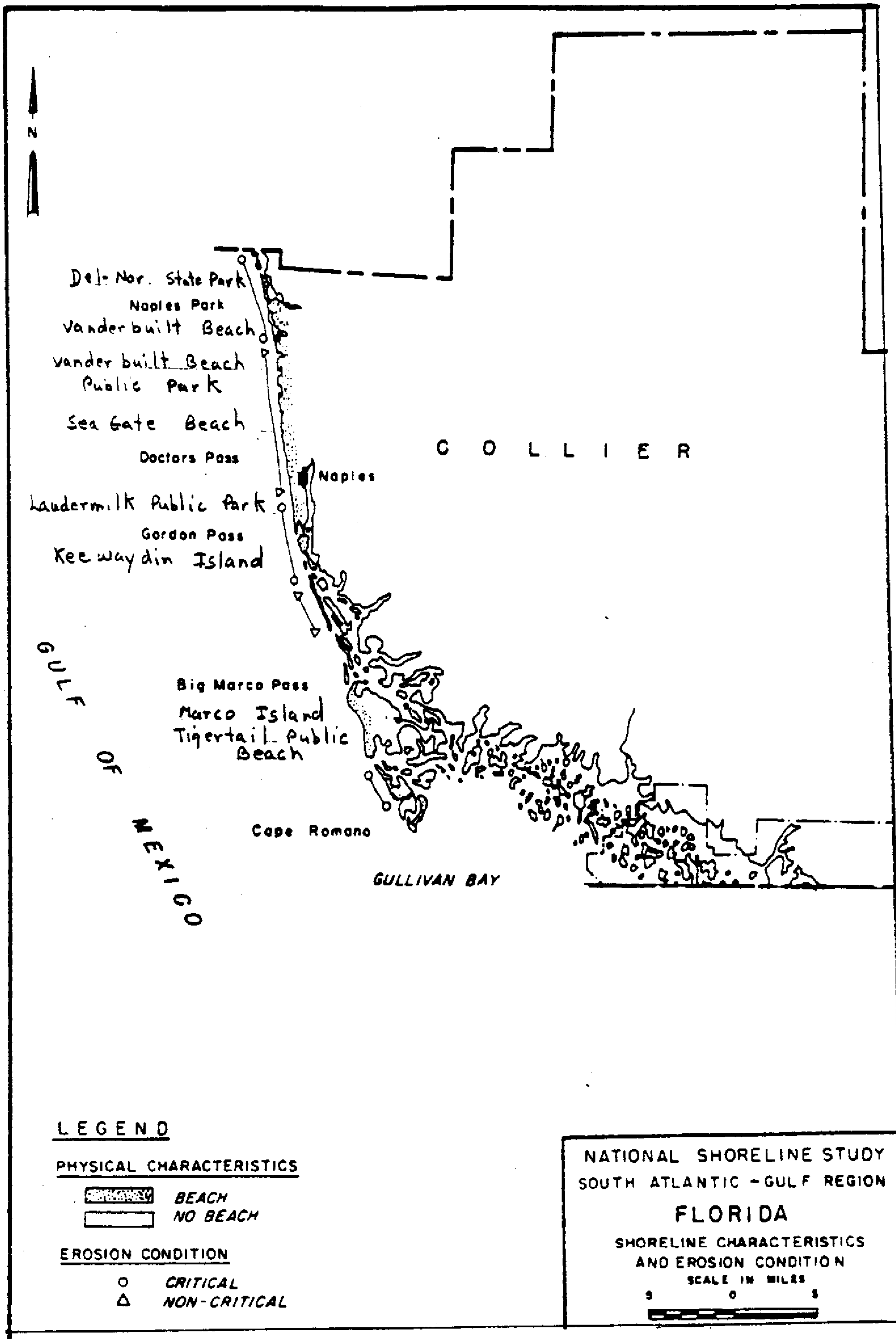

N
LEVY
Cedar Key
GULF OF MEXICO
CITRUS
HERNANDO
Pine Island
Bay port
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5
0
5

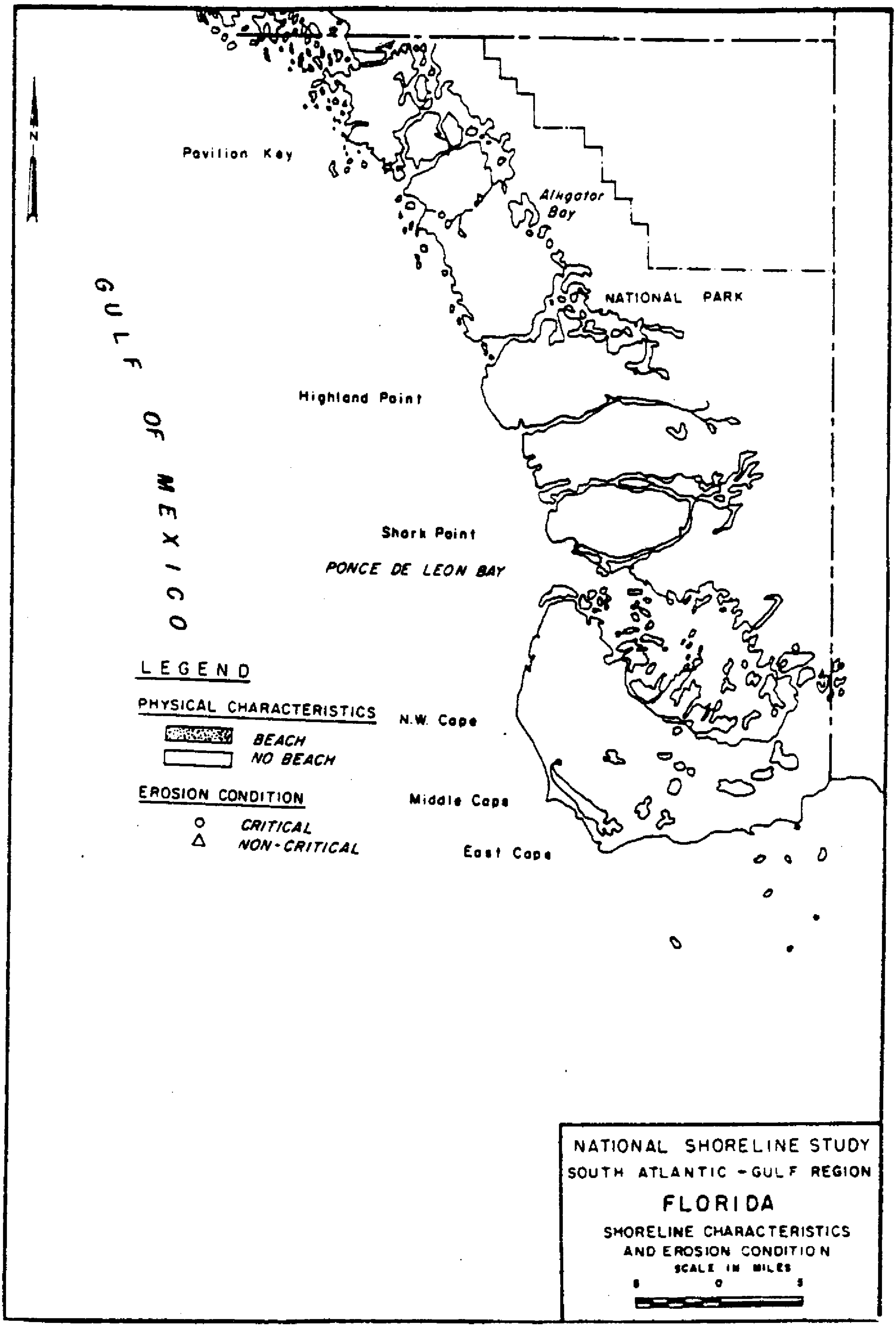


N
Hudson
PASCO
Anclote Keys
HILLSBOROUGH
Caladesi Island
Clearwater Beach Island Public Park
Sand Key
TAMPA
DUNEDIN
OLD TAMPA BAY
Belleair Beach
CLEARWATER
Indian Rocks Beach
HILLSBOROUGH BAY
GULF OF MEXICO
Redington Beach
Madeira Beach
ST. PETERSBURG
Treasure Island
St. Petersburg Beach
TAMPA BAY
Pass-a-Grille Beach
Mullet Key
Egmont Key
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5
0
5

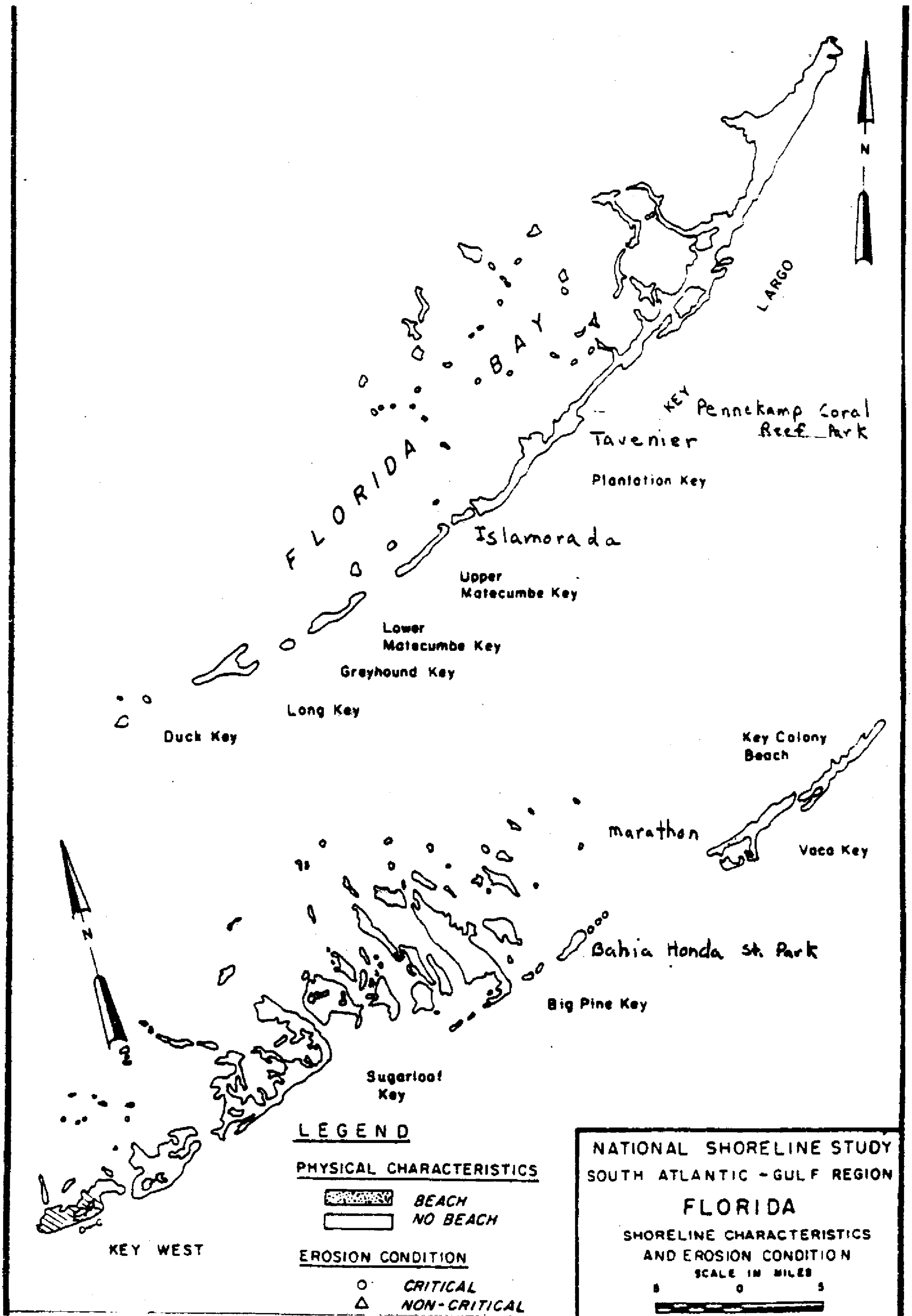

N
Anna Maria
Holmes Beach
Bradenton Beach
Manatee Co. Park
Longbeach
Beer Can Island
Longboat Key
BRADENTON
MANATEE
SARASOTA
GULF OF MEXICO
Lido Beach
Siesta Key
Siesta Beach
Turtle Beach
Casey Key
Casey Key Co. Park
Nokomis Beach
N. Jetty Park
Venice Beach
Golden Beach
Gulf Shores
Brohard Park
Casperson Park
Manasota Municipal Beach
Manasota Peninsula
Manasota Key
SARASOTA
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5


N
PORT CHARLOTTE
Punta Gorda Beach
Peninsular Key
Englewood Beach
Peterson Island
Port Charlotte State Park
Knight Island
Gasparilla Island
Boca Grande
Cayo Costa
CHARLOTTE
HARBOR
CHARLOTTE
MATLACHA
PASS
PINE ISLAND SOUND
Lacosta Island
North Captiva Island
Captiva Island
Sanibel Island
San Carlos Bay
GULF OF MEXICO
FORT MEYERS
LEE
Estero Island
Lover's Key
Bonita Beach
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5

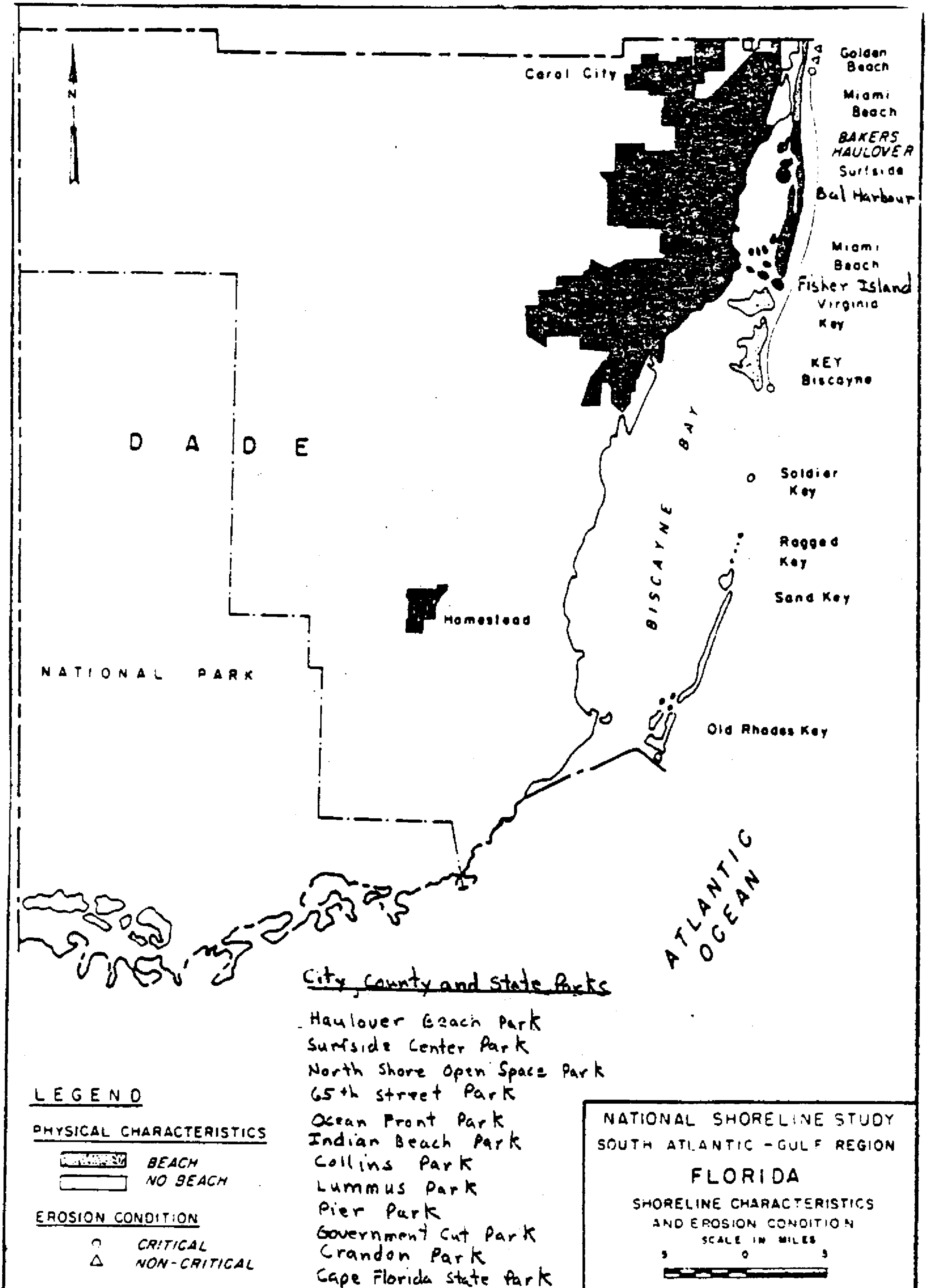

N
Del-Nor. State Park
Naples Park
Vanderbuilt Beach
Vanderbuilt Beach Public Park
Sea Gate Beach
Doctors Pass
Naples
Laudermilk Public Park
Gordon Pass
Keewaydin Island
COLLIER
GULF OF MEXICO
Big Marco Pass
Marco Island
Tigertail Public Beach
Cape Romano
GULLIVAN BAY
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5

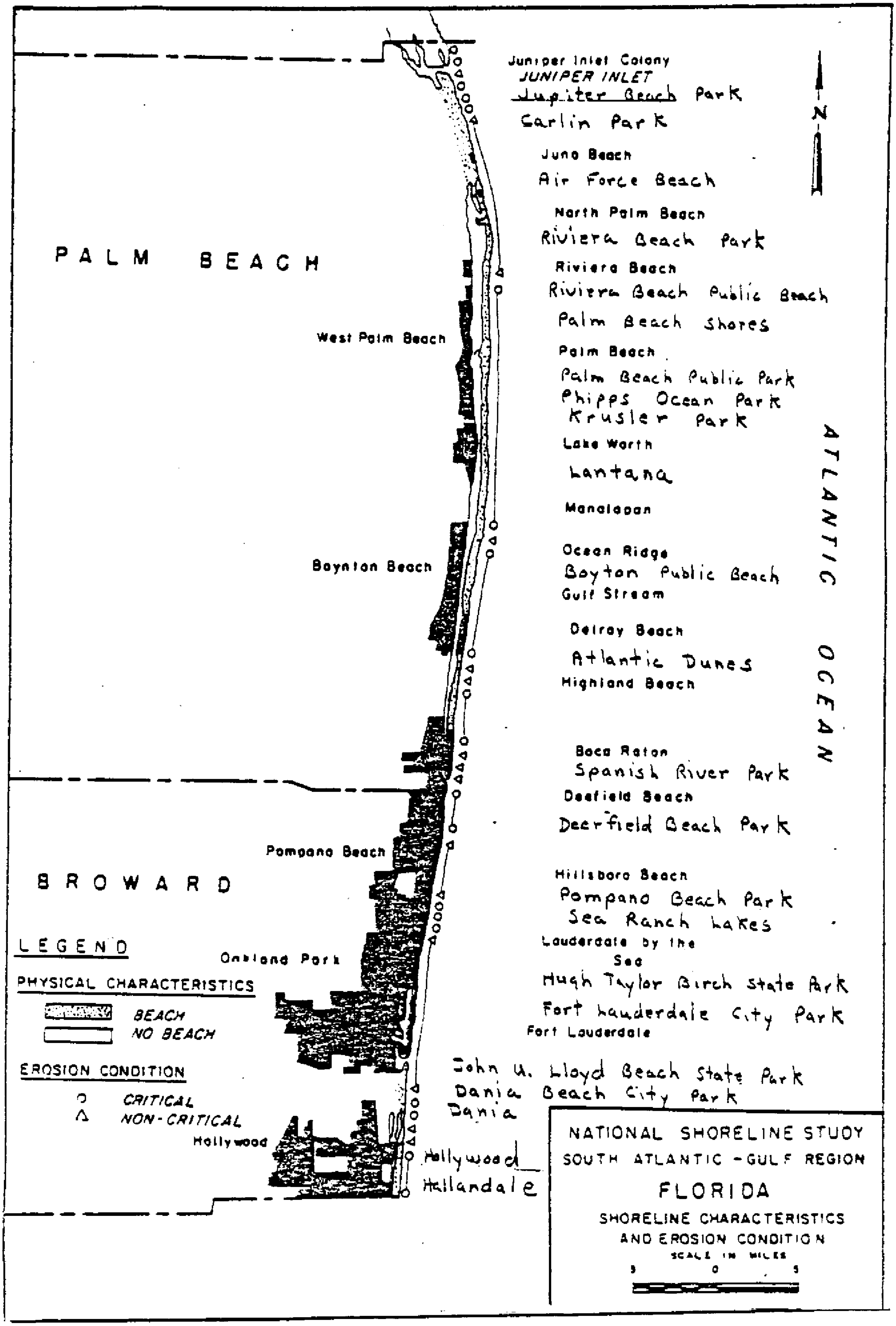


Pavilion Key
Alligator Bay
NATIONAL PARK
GULF OF MEXICO
Highland Point
Shark Point
PONCE DE LEON BAY
N.W. Cape
Middle Cape
East Cape
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
0
5



N
LARGO
KEY
Pennekamp Coral Reef Park
Tavenier
Plantation Key
FLORIDA BAY
Islamorada
Upper Matecumbe Key
Lower Matecumbe Key
Greyhound Key
Long Key
Duck Key
Key Colony Beach
marathon
Vaca Key
Bahia Honda St. Park
Big Pine Key
Sugarloaf Key
KEY WEST
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS AND EROSION CONDITION
SCALE IN MILES
5 0 5


Carol City
N
Golden Beach
Miami Beach
BAKERS HAULOVER
Surfside
Bal Harbour
Miami Beach
Fisher Island
Virginia Key
KEY Biscayne
D A D E
BISCAYNE BAY
Soldier Key
Ragged Key
Sand Key
Homestead
NATIONAL PARK
Old Rhodes Key
ATLANTIC OCEAN
City, County and State Parks
Haulover Beach Park
Surfside Center Park
North Shore Open Space Park
65th street Park
Ocean Front Park
Indian Beach Park
Collins Park
Lummus Park
Pier Park
Government Cut Park
Crandon Park
Cape Florida State Park
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5


Juniper Inlet Colony
JUNIPER INLET
Jupiter Beach Park
Carlin Park
Juno Beach
Air Force Beach
North Palm Beach
Riviera Beach Park
Riviera Beach
Riviera Beach Public Beach
Palm Beach Shores
Palm Beach
Palm Beach Public Park
Phipps Ocean Park
Krusler Park
Lake Worth
Lantana
Manalapan
Ocean Ridge
Boyton Public Beach
Gulf Stream
Delray Beach
Atlantic Dunes
Highland Beach
Boca Raton
Spanish River Park
Deerfield Beach
Deerfield Beach Park
Hillsboro Beach
Pompano Beach Park
Sea Ranch Lakes
Lauderdale by the Sea
Hugh Taylor Birch State Park
Fort Lauderdale City Park
Fort Lauderdale
John U. Lloyd Beach State Park
Dania Beach City Park
Dania
Hollywood
Hallandale
PALM BEACH
West Palm Beach
Boynton Beach
Pompano Beach
BROWARD
Oakland Park
Hollywood
ATLANTIC OCEAN
N
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES
5 0 5

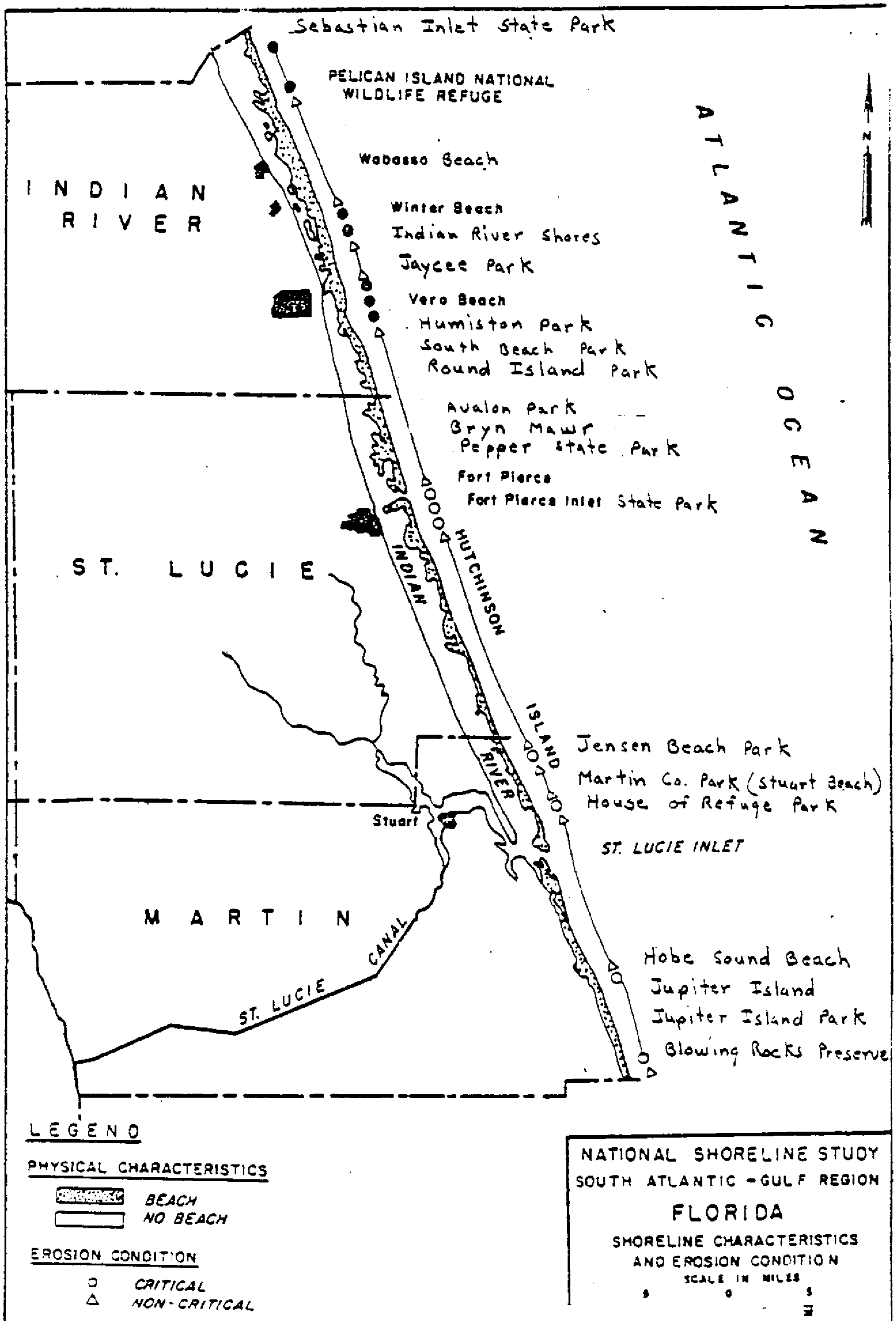
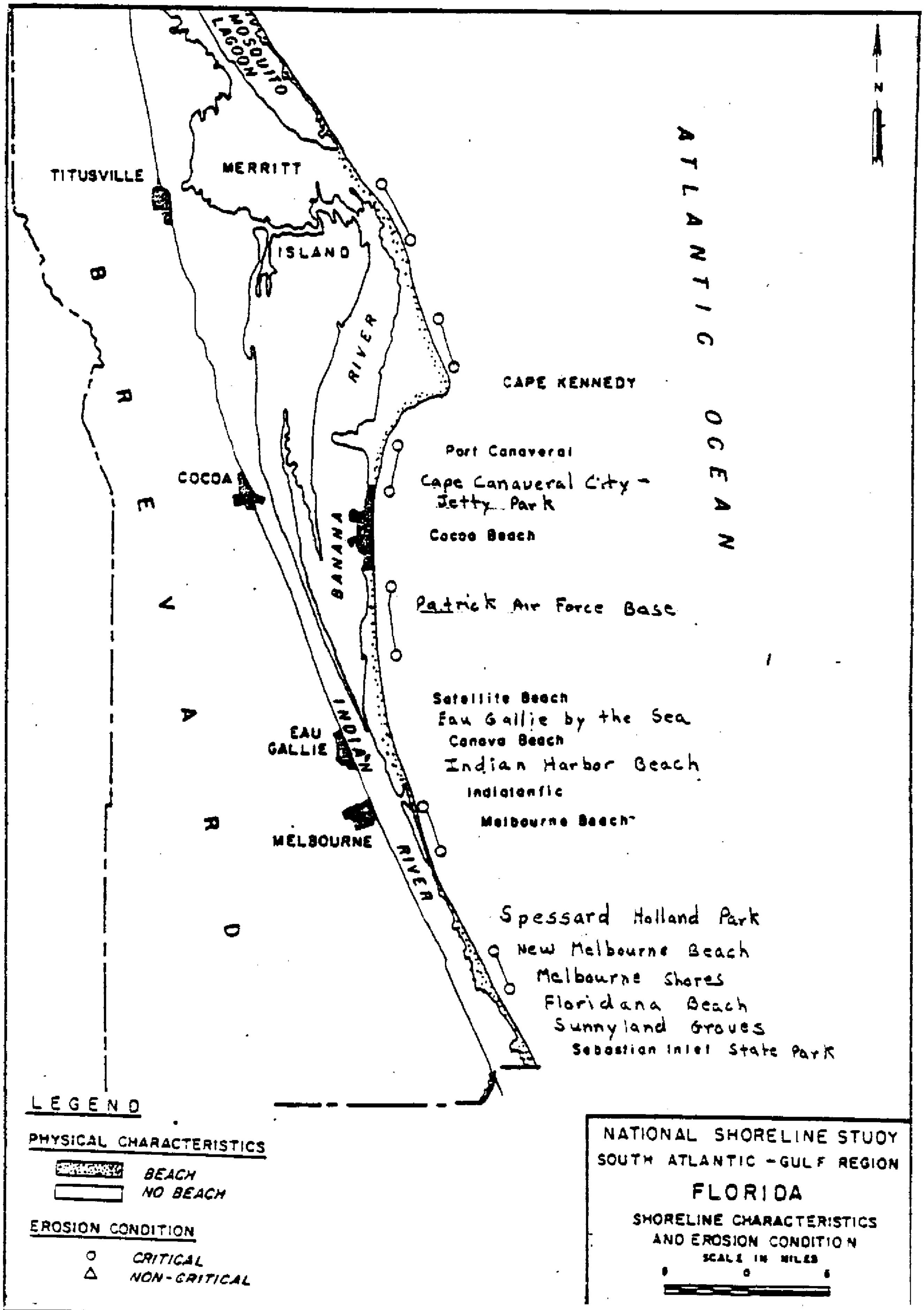
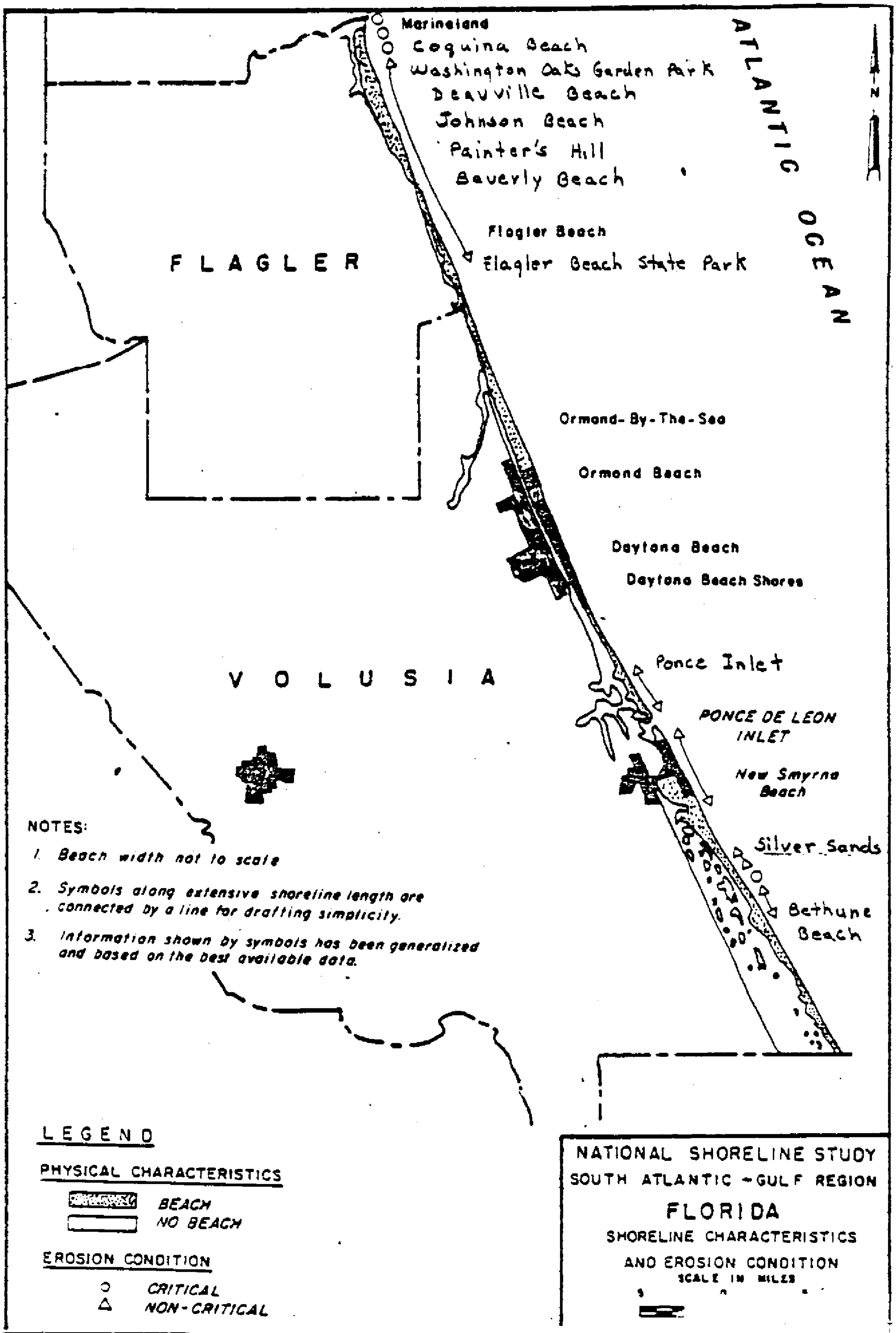

Sebastian Inlet State Park
PELICAN ISLAND NATIONAL WILDLIFE REFUGE
Wabasso Beach
Winter Beach
Indian River Shores
Jaycee Park
Vero Beach
Humiston Park
South Beach Park
Round Island Park
Avalon Park
Bryn Mawr
Pepper State Park
Fort Pierce
Fort Pierce Inlet State Park
Jensen Beach Park
Martin Co. Park (Stuart Beach)
House of Refuge Park
ST. LUCIE INLET
Hobe Sound Beach
Jupiter Island
Jupiter Island Park
Blowing Rocks Preserve
INDIAN RIVER
ST. LUCIE
MARTIN
ATLANTIC OCEAN
INDIAN RIVER
HUTCHINSON ISLAND
Stuart
ST. LUCIE CANAL
N
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS AND EROSION CONDITION
SCALE IN MILES
5 0 5

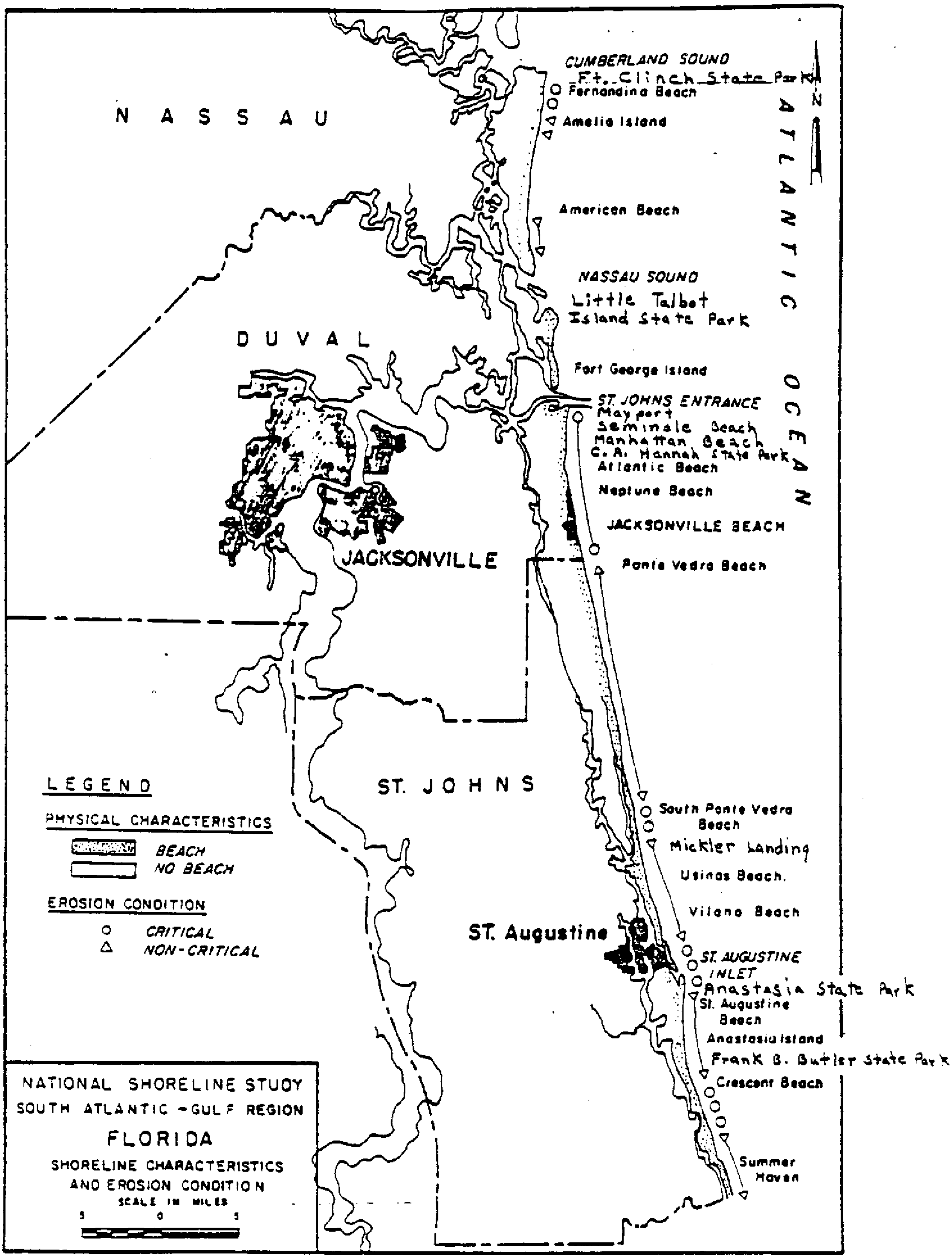
Figure IId



MOSQUITO LAGOON
ATLANTIC OCEAN
TITUSVILLE
MERRITT
ISLAND
BREVARD
RIVER
CAPE KENNEDY
Port Canaveral
Cape Canaveral City - Jetty Park
COCOA
Cocoa Beach
BANANA
Patrick Air Force Base
Satellite Beach
Eau Gallie by the Sea
EAU GALLIE
Canova Beach
INDIAN
Indian Harbor Beach
Indialantic
Melbourne Beach
MELBOURNE
RIVER
Spessard Holland Park
New Melbourne Beach
Melbourne Shores
Floridana Beach
Sunnyland Groves
Sebastian Inlet State Park
N
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS AND EROSION CONDITION
SCALE IN MILES



Marineland
Coquina Beach
Washington Oaks Garden Park
Deauville Beach
Johnson Beach
Painter's Hill
Beverly Beach
ATLANTIC OCEAN
N
Flagler Beach
Flagler Beach State Park
FLAGLER
Ormond-By-The-Sea
Ormond Beach
Daytona Beach
Daytona Beach Shores
Ponce Inlet
VOLUSIA
PONCE DE LEON INLET
New Smyrna Beach
Silver Sands
Bethune Beach
NOTES:
1. Beach width not to scale
2. Symbols along extensive shoreline length are connected by a line for drafting simplicity.
3. Information shown by symbols has been generalized and based on the best available data.
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS
AND EROSION CONDITION
SCALE IN MILES


CUMBERLAND SOUND
Ft. Clinch State Park
Fernandina Beach
Amelia Island
N A S S A U
American Beach
NASSAU SOUND
Little Talbot Island State Park
D U V A L
Fort George Island
ST. JOHNS ENTRANCE
Mayport
Seminole Beach
Manhattan Beach
C. A. Hannah State Park
Atlantic Beach
Neptune Beach
JACKSONVILLE BEACH
JACKSONVILLE
Ponte Vedra Beach
ATLANTIC OCEAN
N
ST. JOHNS
South Ponte Vedra Beach
Mickler Landing
Usinas Beach.
Vilano Beach
ST. Augustine
ST. AUGUSTINE INLET
Anastasia State Park
St. Augustine Beach
Anastasia Island
Frank B. Butler State Park
Crescent Beach
Summer Haven
LEGEND
PHYSICAL CHARACTERISTICS
BEACH
NO BEACH
EROSION CONDITION
CRITICAL
NON-CRITICAL
NATIONAL SHORELINE STUDY
SOUTH ATLANTIC - GULF REGION
FLORIDA
SHORELINE CHARACTERISTICS AND EROSION CONDITION
SCALE IN MILES
5 0 5

Appendix A.4: Direct and Induced Tax Revenue Calculations

Table A.4.1

Estimated Direct State Tax Revenues Generated By Touris Saltwater Beach Users In Florida Jan. - Dec. 1984*

Spending Category	Sales Tax	Gasoline Tax	Corporate Profits Tax	Total
Lodging	$ 17,694,452	x	$ 839,233	$ 18,533,685
Food & Drink	34,776,596	x	821,202	35,597,798
Travel	1,105,195	$ 775,575	5,735	1,886,505
Beach Access Fees	x	x	x	x
Other	1,249,098	x	222,204	1,471,302
Total	$ 54,825,341	$ 775,575	$ 1,888,374	$ 57,489,290

* Only Sales, Gasoline, and Corporate Profit Taxes could be estimated from survey information.

Table A.4.2

Derivation of Induced State Tax Revenue

Induced wages	÷	wages / sales tax	=	Induced Sales Tax
$ 573,684,272	÷	16.9745	=	$ 33,796,829
Induced wages	÷	wages / gasoline tax	=	Induced Gasoline Tax
$ 573,684,272	÷	159.56219	=	$ 3,595,365
Induced wages	÷	wages / corporate profits tax	=	Induced Corporate Profits Tax
$ 573,684,272	÷	153.985782	=	$ 3,725,566
				Total Induced Taxes
				$41,117,760

Sources: Total Florida Wages 1983 $61,078735,294 from Employment Secruity. Denise Gorden, Personnel Communications

Sales Tax, Gasoline Tax, and Corporate Profits Tax from Report of Florida Comptroller.

Appendix A.5

Procedure Use to Compute a Weighted Index of Beach Facilities

A survey of beach facilities importance was conducted at Florida State University using a sample of approximately 200 students. They were asked to fill out the survey instrument included in this appendix. Only responses of students that had been to the Florida beaches within the last 3 years were used. Each one of the 23 facilities received a score running from 5 (extremely important) to 1 (very little importance). A mean or average score for each facility was then obtained. To simplify the procedure, a facility was assigned a unit number score (i.e., whole number) based up the following distribution of means:

Distribution (Mean Value of Facility)	Whole Number Assigned (Weight Given Facility)
3.8 - 5	5
3.2 - 3.7	4
2.7 - 3.19	3
2.5 - 2.69	2
1 - 2.49	1

The assigned whole number for each facility is shown on the questionnaire in this appendix. This procedure was thought adequate to discern the relative importance of various beach facilities.

Survey Questionnaire
Florida's Beaches

Instructions: We are attempting to get some idea of the relative importance of saltwater beach facilities and characteristics in using Florida beaches. Please answer the following:

1. |_____| I have been to a Florida beach in the last three years.

2. |_____| I have not been to a Florida beach in the last three years.

Importance of Facilities

5 points: extremely important
4 points: very important
3 points: average importance
2 points: not that important
1 point : very little importance

Facilities/Characteristics	Points (Assigned weight)
Parking (1)	5
Mass Transit to beach (2)	1
Restrooms (4)	5
Showers (5)	4
Food/Concessions (6)	2
Picnicking facilities (7)	3
Firepits (8)	1
Handicapped Facilities (9)	4
Walkovers* (10)	2
Nature Trails (11)	2
Boat Facilities (12)	3
Overnight Camping (13)	2
Marked Access to beach (14)	3
Lifeguard/First Aid (15)	5
Shelling (17)	2
Surfing (18)	3
Fishing (19)	2
Fishing Pier (20)	2
Group Facilities (21)	2
Bicycle Facilities (22)	2
Shelter (23)	4
Scuba Diving (24)	2
Restaurants, Bars, Motels Nearby (25)	4

*Safety corridor for crossing roads from parking lots to beaches.

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