Florida Assessment of Coastal Trends

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FLORIDA COASTAL MANAGEMENT PROGRAM
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Florida Assessment of Coastal Trends FACT

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✓ Denotes indicators which are new for **FACT 1997**.

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✓ Denotes indicators which are new for **FACT 1997**.

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✓ Denotes indicators which are new for **FACT 1997.**

Florida Assessment of Coastal Trends (FACT)

Executive Summary

In 1995, the Florida Coastal Management Program (FCMP) contracted with the Florida Center for Public Management to develop ***Florida Assessment of Coastal Trends (FACT 1995)***, the nation's first coastal environmental indicator system. ***FACT 1995*** added an important management tool to improve FCMP's vision in dealing with the future of Florida's coastal areas. ***FACT 1995*** provided a comprehensive perspective of the important environmental, growth management, economic, and social values associated with the coast. This system provided a means of evaluating Florida's progress in protecting its coastal areas; a basis for making strategic decisions about programs and financial resources; and information about coastal issues and problems to other decision-makers and the general public.

The process for developing ***FACT 1995*** set the substantive, conceptual and organizational structure for the initial version of ***FACT*** and for all subsequent editions. The first step in the indicator development process was to initiate an issue and sub-issue development process designed to identify the critical, strategic issues facing Florida's coastal future over the next five to twenty years. These issues and their defining sub-issues would then be used to provide the organizational framework for identifying the required indicators. On January 24, 1995 a workshop was convened and a number of coastal experts representing a range of coastal policy interests spent a day discussing coastal priorities. The principal product of their deliberations was the development of a list of nine strategic issues facing Florida's coastal areas. These issues are as follows:

- Impact of Growth in the Coastal Zone
- Disruption of Coastal Physical Processes
- Responding to Coastal Threats and Hazards
- Degradation and Restoration of Coastal Ecosystems
- Managing Fresh Water Allocation
- Sustaining the Human Uses of the Coast
- Balancing Public and Private Uses of Resources
- Preservation of Cultural and Aesthetic Resources
- Encouraging Public Awareness and Involvement

Over the next several months, appropriate indicators were developed and organized according to each issue, and these indicators comprise the body of indicators found in ***FACT 1995***. Each indicator is displayed in a standardized format that reflects the reasons for its inclusion, identifies technical information regarding its source, format, and limitations, and provides a brief analysis and/or graphical display of any trends associated with the indicator. In addition, each indicator displays certain conceptual information commonly used to characterize indicators concerning the availability of data for the indicator and the strength of the information supporting the indicator. Discussion of those conceptual frameworks and others used to support this system is included in the Introduction.

This document – ***FACT 1997*** – is the first scheduled update and revision of the original indicator system. This revision includes:

- updating the data in the indicators,
- deleting indicators with poor or nonexistent data sources,
- adding new indicators to improve the system, and
- reformatting the individual indicator sheets to improve their graphic effect.

FACT 1997, in addition to this published format, will also be made available on the Internet in electronic format.

Introduction

Overview

Many governmental agencies operate programs for years and spend millions of dollars without ever attempting to make any assessment of the impacts or documenting the status and trends of the subject of their efforts. The result can be the loss of focus for the program, the inefficient use of financial and personnel resources, and the loss of public and political support. For the past five years planning professionals at all levels of government, particularly environmental planners, have been aggressively working on redesigning their policy planning processes and actively building an intergovernmental partnership to improve their joint public policy management skills by adding measurements of progress, increasing accountability, and focusing on results.

A major area of importance is the development of environmental and growth management indicator systems. Indicators are useful tools for a wide variety of management purposes and the capacity of individual public organizations to develop policy is greatly enhanced by the availability of good indicator systems.

The multiple uses of indicators and the pivotal role they play in any serious attempt to improve public management have focused much attention on procedural and technical issues concerning the development of indicator systems at all governmental levels. International, national, and regional conferences and a variety of publications on indicators and indicator systems development have created increasingly high levels of interest, especially among state and regional agencies. In 1990, only a handful of states were using indicators in any direct sense, and only two, Florida and North Carolina, had made any explicit attempt to systematically develop and document a comprehensive environmental indicator system. Federal agencies were only beginning to develop explicit indicator systems.

That has radically changed. There is now so much indicator work going on that the situation is almost chaotic. Almost 30 states have developed or are finishing initial work on environmental indicators or closely related state of the environment documents, and virtually all states report they expect to undertake indicator development projects in the near future. At the federal level a number of interagency and intraagency organizations are at work to develop indicator systems and, perhaps more importantly, to begin the process of the redesign of federal environmental monitoring systems. Just now beginning is a movement at the local level, and even at the community level, to use indicators.

Florida Assessment of Coastal Trends (FACT)

The Florida Coastal Management Program (FCMP) provided national leadership by becoming the first state coastal program to develop an explicit indicator system when in 1995 they developed the first Florida Assessment of Coastal Trends (FACT 1995). This tool provided a comprehensive perspective of the important environmental, economic, and social values associated with the coast; a means of evaluating Florida's progress in protecting its coastal areas; a basis for making strategic decisions about programs and financial resources; and information about coastal issues and problems to other decision-makers and the general public.

The Florida Coastal Management Program contracted with the Florida Center for Public Management (FCPM) of Florida State University to assist in the design and development of this system. FCPM was charged with preparing:

> **a report containing a structured collection of environmental, growth management, economic and social indicators that collectively describe the status of Florida's coastal areas, that portray the historic trends affecting coastal Florida, and that project Florida's coastal future.**

FCPM was required to accomplish the following to successfully complete this objective:

- work intensively with Florida Coastal Management Program staff to develop a design and structure for the system that completely reflects what is needed and desired for the system, assess existing sources of indicator data and information already known and accessible to FCPM and utilize that which is appropriate,
- conduct research as needed to identify other desirable data and information needed to develop additional key indicators, and
- prepare specific technical documentation to support each indicator to include a discussion of the concept of the indicator, the source of the data, a contact person with address and phone number, the format in which the data resides, any costs associated with its acquisition, the frequency of collection of the data, the geographic coverage, an assessment of the strengths and limitations of the indicator and its data, a discussion of how the data will be collected, a brief analysis of the data, and a graphic or tabular display.

The original ***Florida Assessment of Coastal Trends (FACT 1995)*** document represented the product of these activities. Structured across its nine issue areas are 98 indicators that reflect important measurements of key environmental, social, economic, cultural, and aesthetic issues affecting Florida's coastal areas.

In 1996, the trends and conditions outlined in ***FACT 1995*** were used as the foundation for the development of the first ***Florida State of the Coast Report,*** a summary discussion of critical information regarding coastal issues in Florida.

This current document – ***Florida Assessment of Coastal Trends (FACT 1997)*** – is the first update and revision of FACT and represents a significant step forward in refining, refocusing and consolidating the original indicator system. While the general structure of ***FACT 1995*** was retained along with many of the original indicators, a number of weak or unsupportable indicators were deleted and new, more powerful data sources were identified to support new indicators.

Process for Developing *FACT 1997*

The process of developing ***FACT 1995*** included the following steps:

FACT is structured around nine strategic issues judged to be critical to the future of Florida's coast over the next 20 years. These broad strategic issues were refined into two-to-four sub-issues or components of each issue. These sub-issues then became the final framework around which indicators were developed. The nine issues and their associated sub-issues are as follows:

1) **Impact of Growth in the Coastal Zone**
   - Impacts of Population Growth
   - Patterns of Development
   - Sufficiency of Infrastructure
   - Economic Impacts
2) **Disruption of Coastal Physical Processes**
   - Alteration of Existing Natural Systems
   - Construction of Altering Structures
3) **Responding to Coastal Threats and Hazards**
   - Coastal Hazard Mitigation
   - Incompatible Living Areas
   - Industrial Impacts
4) **Degradation and Restoration of Coastal Ecosystems**
   - Habitat Change
   - Species Population Trends
   - Water Quality Trends
5) **Managing Fresh Water Allocation**
   - Fresh Water Allocated for Ecological Maintenance
   - Fresh Water Allocated to Meet Residential Needs
   - Fresh Water Allocated to Meet Commercial/Industrial Needs
   - Fresh Water Allocated to Meet Agricultural Needs
6) **Sustaining the Human Uses of the Coast**
   - Maintenance of Recreational Value
   - Sustainable Economic Use
   - Balancing Development with Coastal Resources
7) **Balancing Public and Private Uses of Resources**
   - Private Property Issues (no indicators have been developed for this sub-issue)
   - Stewardship of Coastal Resources

8) **Preservation of Cultural and Aesthetic Resources**
- Preservation of Archaeological and Historical Resources
- Preservation of Living Resources
- Conservation of Coastal Open Space

9) **Encouraging Public Awareness and Involvement**
- Public Awareness
- Public Participation

Good indicator systems require regular maintenance to remain effective. The scheduled revisitation of ***FACT 1995*** which led to this ***FACT 1997*** is responding to three major needs:
- the need to periodically update the data in the indicators to continue the demonstration of relevant trends,
- the need to periodically assess the existing measures to ensure they are the best possible indicators, and
- the need to ensure that new and emerging issues have appropriate measures.

The revision process that led to ***FACT 1997*** included the following elements:

Overall Assessment: The entire indicator system was comprehensively reviewed to identify strengths and weaknesses. Groups of indicators were reviewed to assess their joint effectiveness in supporting issue and sub-issue areas. These assessments directed attention toward new or substitute indicators for some areas and suggested deletion of others.

Individual Assessment: Each indicator was individually assessed to make a judgment regarding its contribution to the effectiveness of the system. The ability to observe, reconsider and reevaluate the indicators originally chosen allowed staff to identify the strengths and weaknesses of the indicators. Proposed indicators with no data were dropped as formal indicators. Indicators with weak data or technical flaws were similarly dropped from the system. Where a better source of data to support an existing indicator was discovered, the substitution was made.

Updating Retained Indicators: Indicators retained from the original system were updated and revised to keep them current. When available new data points were added, all tables, graphs and analysis were appropriately modified.

Addition of New Indicators: Since the development of ***FACT 1995*** new sources of data have been developed or discovered that provided indicators for some dimensions of the issues and sub-issues that had previously been unsupported. Where such data was available, new indicators were developed and provided in the ***FACT 1997.***

Reformatting: An explicit effort was made to improve the graphic impact of ***FACT 1997*** through the use of symbols to code issue groups and types of indicators (environmental, economic, cultural-aesthetic, and quality of life). (See the following section for details.)

Review: All indicators were:
- cross-reviewed by FCPM staff,
- reviewed by Florida Coastal Management Program staff,
- reviewed by the individual or organization supplying the data, and, in some cases,
- reviewed by an outside expert.

Conceptual Frameworks

The following definitions and conceptual frameworks have been used in the development of ***FACT 1995 and FACT 1997.***

Definitions. Basic indicator-related definitions include:
- **Parameter:** A property that is measured or observed.
- **Indicator:** A parameter, or a value derived from a parameter, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value.
- **Index:** A set of aggregated or weighted parameters or indicators.

Uses. It is axiomatic that environmental agencies at all levels should use indicators to make key strategic decisions concerning the success of their efforts and to make important program and budget adjustments. Startlingly, this is much too often not the case. Federal environmental agencies and their associated state agencies are driven by huge, monolithic programs which over the years have taken on importance unto themselves. Most of the measurement and reporting that occurs deals with program activities rather than measures that deal with what is actually happening. With leadership from some federal agencies and a few of the states, this is starting to change with the initiation of projects that are beginning to use results-based data and information as the foundation for making decisions.

Indicators represent components or processes of real world systems. This means that they function as models and have all of the possibilities and limitations that models offer. The numerical values of indicators tend to have special meaning to particular observers – a meaning that goes beyond the numerical value itself. For example, the number of top trophic level predator birds could be used to represent the vitality of a whole ecosystem based on the species habitat requirements. In other words, indicators generally simplify in order to make complex phenomena quantifiable in such a manner that communication is either enabled or promoted.

Indicators are only as useful as the information they are based upon. The measuring devices that are used to evaluate problems, their causes, and the steps taken to address those problems need to be selected carefully from this information and presented to decision-makers and to the general public in ways that are relevant to them and can be readily understood.

Indicators are useful tools for a wide variety of management purposes. The availability of indicator systems at the state level of government can increase the capacity of individual states to develop policy. Indicators can be used as a:

- mission-level tool to provide a broad evaluation of an agency's performance,
- measurement foundation for structuring goals,
- basis for measuring and communicating achievement and progress,
- basis for making strategic planning and budgeting decisions,
- means of evaluating the performance of individual programs and activities,
- tool in building particular constituencies,
- basis for the development of education programs, and
- tool for public relations and information dissemination.

In order to measure success and failure of environmental protection programs by their environmental results rather than by bureaucratic inputs – regulators, the regulated community, and the public should be encouraged to find the least costly, most effective ways to achieve those results within a geographic jurisdiction.

The relatively young and emerging science and art of developing indicators and indicator systems is evolving some simple conceptual tools to provide clarity and order to the process. The following presents several conceptual approaches presently in use by FCPM in describing and displaying the indicator systems with which they are associated.

Qualification Standards. For each individual indicator system being developed, it is useful to list with as much precision and completeness as possible the specific criteria used to define an acceptable indicator for that system. Described in such criteria might be such concerns as:

- the geographic scope of the indicators (national, statewide, regional, ecosystem, local),
- the selection criteria used,
- the acceptable types of indicators (environmental, program, administrative),
- the availability of data (is it available now or is it a prospective indicator?), or
- how it is intended to be used (its purpose).

By clearly identifying such standards early in the process and constantly comparing the selection of indicators against them, attention can remain focused on indicators appropriate for the system being developed.

Indicator qualification standards employed in the development of *FACT* include:

- the geographic scope of the indicators must measure an activity or condition that affects Florida's coast or its 35 coastal counties,
- the indicator must reflect an important dimension of one of the nine strategic issues, and
- any Type A indicator (see below) must meet FCPM Indicator Selection Criteria (see following page).

Selection Criteria. Ideally, each indicator finally included in an indicator system should meet a series of standards designed to ensure high and consistent quality. Listed below are the selection criteria employed by FCPM in all its indicator work. Selection criteria are of two types:

1. **essential** – criteria an indicator **must** meet, and
2. **preferable** – criteria an indicator **should** meet.

Essential Criteria include:

- **Measurable:** The indicator measures a feature of the environment that can be quantified simply using standard methodologies with a known degree of performance and precision.
- **Data quality:** The data supporting the indicators are adequately supported by sound collection methodologies, data management systems, and quality assurance procedures to ensure that the indicator is accurately represented. The data should be clearly defined, verifiable, scientifically acceptable, and easy to reproduce.
- **Importance:** The indicator must measure some aspect of environmental quality that reflects an issue of major national importance to states and to the federal government in demonstrating the current and future conditions of the environment.
- **Relevance:** The indicator should be relevant to a desired significant policy goal, issue, legal mandate, or agency mission (e.g., contaminated fish fillets for consumption advisories; species of recreational or commercial value) that provides information of obvious value that can be easily related to the public and decision-makers.
- **Representative:** Changes in the indicator are highly correlated to trends in the other parameters or systems they are selected to represent.
- **Appropriate scale:** The indicator responds to changes on an appropriate geographic (e.g., national or regional) and/or temporal (e.g., yearly) scale.
- **Trends:** The data for the indicator should have been collected over a sufficient period of time to allow some analysis of trends or should provide a baseline for future trends. The indicator should show reliability over time, bringing to light a representative trend, preferably annual.
- **Decision support:** The indicator should provide information to a level appropriate for making policy decisions. Highly specific and special parameters, useful to technical staff, will not be of much significance to policy staff or management decision-makers.

Preferable Criteria include:

- **Results:** The indicator should measure a direct environmental result (e.g., an impact on human health or ecological conditions). Indicators expressing changes in ambient conditions or changes in measures reflecting discharges or releases are acceptable, but not preferred. Process measures (e.g., permits, compliance and enforcement activities, etc.) are not acceptable.
- **Understandable:** The indicator should be simple and clear, and sufficiently non-technical to be comprehensible to the general public with brief explanation. The indicator should lend itself to effective and appealing display and presentation.
- **Sensitivity:** The indicator is able to distinguish meaningful differences in environmental conditions with an acceptable degree of resolution. Small changes in the indicator show measurable results.
- **Integrates effects/exposures:** The indicator integrates effects or exposures over time and space and responds to the cumulative impacts of multiple stressors. It is broadly applicable to many stressors and sites.
- **Data comparability:** The data supporting an indicator can be compared to existing and past measures of conditions to develop trends and define variation.
- **Cost effective/availability:** The information for an indicator is available or can be obtained with reasonable cost and effort and provides maximum information per unit effort.
- **Anticipatory:** The indicator is capable of providing an early warning of environmental change.

Hierarchy of Indicators. The "hierarchy of indicators for environmental resources" was developed to assist in the classification of measurements of pollution constituents that are subject to governmental regulation and it is most effective when it is employed for that purpose. It has more limited utility when used to classify other types of environmental concerns, particularly ecological issues. The hierarchy is thus not being used for non-environmental resource indicators, including the social, cultural and economic indicators in this edition of FACT. The ranking, where appropriate, is found in the Data Characteristics section of the indicator sheet.

Hierarchy of Indicators for Environmental Resources

Output		Outcome			
1	2	3	4	5	6
Actions to Protect Coastal Environmental Resources by Federal or State Agencies	Responses of the Community that Affect the Protection of Coastal Environmental Resources	Changes in Human Inputs that Lead to Coastal Environmental Degradation	Changes in Ambient Conditions or in the Quantities of Coastal Environmental Resources	Changes in Uptake and/or Assimilation by Coastal Biota	Changes in the Health of Humans, Biota, or Ecological Systems in Coastal Areas

Theme Icons. Measuring complex systems eventually reveals their interdependent nature. The coastal ecology, our quality of life, the economic structure, and our cultural and aesthetic values are deeply interconnected and our overall health and welfare is made up of a combination of these factors. Each indicator measures one or more of these characteristics and, in an attempt to illustrate these connections, has been labeled with a series of icons representing each component. Arguments can be made in most cases that an indicator measures some aspect of each category, but only the most direct connections were highlighted for clarity. Connections which were less evident or not truly accurate are shown in a light shading. (Note: The manatee graphic was provided by Bonnie J. Abellera.)

Ecology - represents indicators which measure some component of coastal ecology.

Economic - represents indicators which measure some component of the coastal economy.

Quality of Life - represents indicators which measure some quality of life component.

Cultural/Aesthetic - represents indicators which measure some Cultural/Aesthetic component.

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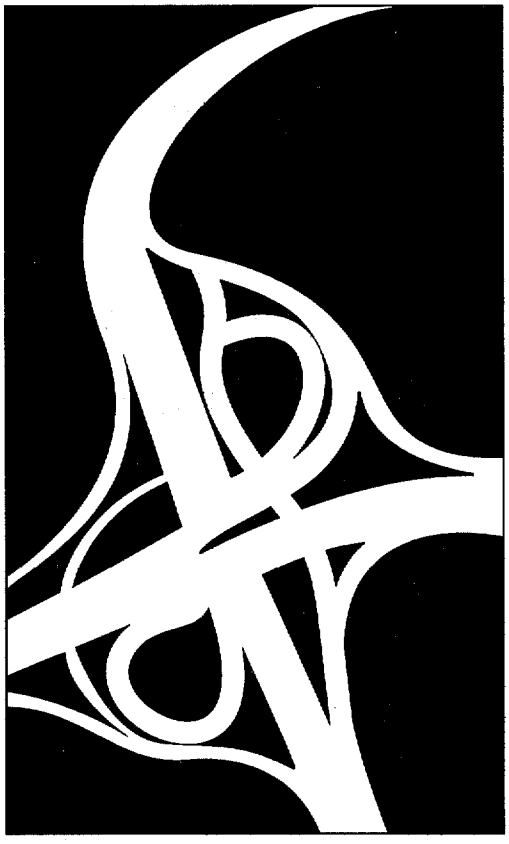
http://www.fsu.edu/~cpm/FACT97/index.html

Section A

Impact of Growth in the Coastal Zone



Impact of Growth in the Coastal Zone

Population growth and development have many implications for Florida's coastal areas. Population growth could be considered the ultimate environmental pressure as additional demands are placed upon coastal resources as the populace increases. In most cases, environmental risks to human health, quality of life, and the coastal ecology are the results of human activities. With over 75 percent of Florida's residents living within coastal counties and the anticipation of a 50 percent increase in coastal population by the year 2020, coastal growth and the demands placed upon resources becomes a primary focus for any planning process.

The patterns which development take to support this increase affect a wide variety of issues, including habitat degradation, infrastructure sufficiency, economic impacts. The need to house, feed, and transport increasing populations inevitably produces more pavement and less natural habitat. Since growth is limited on at least one side by water, coastal development often quickly extends along the coast and inland. Careful assessment of coastal ecosystems and the effects of growth upon them will be necessary if we are to protect these areas.

Population growth at current levels of consumption affects the issue of sustainability and our future. To minimize the impacts of coastal population growth, a combination of changes in lifestyle, technological processes, and land conservation must occur. The number of people and the scale, composition, and pattern of their consumption and waste generation will continue to have negative effects on the environment until sustainable measures are in place. The following list identifies the indicators that are examined in this section.

Impact of Growth in the Coastal Zone Indicators:

- Absolute population growth
- Population growth rate
- Population density
- Age of population
- Population growth within ten miles of the coast
- Population growth on barrier islands
- Seasonal residences
- Urban/Rural population
- Change in major land cover categories
- Residential building permit activity: New housing units and value reported on building permits
- Total and per capita municipal solid waste collected
- Per capita income

Other Indicators of Interest:

- Evacuation clearance time (Section C)
- Public supply water withdrawals (Section E)
- Beach visits by residents (Section I)

Absolute Population Growth

This indicator shows the population for Florida's coastal and noncoastal counties and the state as a whole from 1920 to 1990. It also includes projections of future population counts through 2020. Population growth, particularly for Florida's coastal areas, is an important indicator since it is directly linked with land use and development, use of resources, demand for services, and pollution. Population growth can be considered the ultimate environmental indicator. While our activities can be mitigated to impact the environment to a greater or lesser degree, individuals will inevitably produce increased effects on the environment as their numbers grow.

In coastal regions land is at a premium, since the water limits growth in one or more directions. Resources which are necessary for our current way of life are often limited, such as drinking water. Also, coastal areas are under additional pressure from tourism, sea-going transports, and other coastal industries. Given these constraints, examination of population projections is particularly useful in providing a perspective on the directions in which Florida's coastal areas are heading and the degree to which population pressures will affect them.

Data Characteristics

SOURCE

This information is from the Florida Statistical Abstract, produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The Abstract is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

The data are available in hard copy format. The 1996 edition of the Abstract costs $39.95 to purchase.

COLLECTION

This information is based on decennial U.S. Census figures. Projections are based on calculations by the University of Florida, Bureau of Economic and Business Research, Population Program.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

Data Analysis

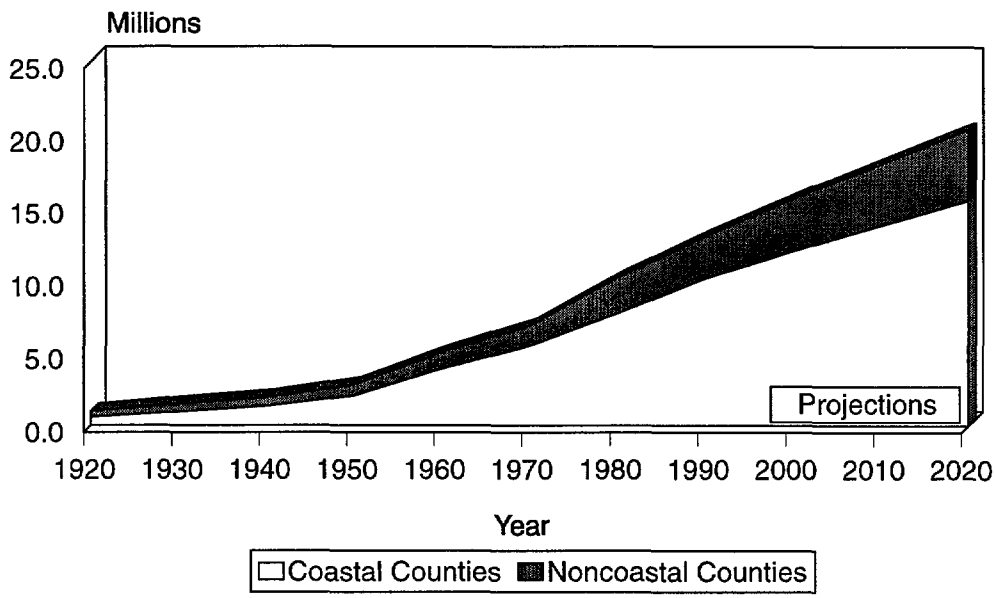
The seventy-year period presents an upward trend in growth for both Florida and the state's coastal areas. Growth during this time period could be explained by the growth of Florida's coastal areas as tourist destinations. Tourism increases the demand for services, which creates jobs and entices people to move to the state's coastal areas.

The proportion of the population residing in coastal counties increased from the 1920s to the 1970s, growing from 59 percent of the total population to over 79 percent. Future projections show the percentage of coastal population dropping to less than 76 percent by 2020, but having a total of over 15 million people (compared to 10 million in 1990); more than the state's current total population. There are many reasons people choose to live in the coastal areas of Florida, including proximity to recreational amenities (i.e., ocean and beach), aesthetic beauty, and the economic opportunities associated with port access and tourism.

Absolute Population Growth

Year	Coastal Counties	Noncoastal Counties	Florida	Percentage of Population in Coastal Counties
1920	571,515	396,955	968,470	59.0
1930	947,533	520,678	1,468,211	64.5
1940	1,307,697	589,717	1,897,414	68.9
1950	2,016,926	754,379	2,771,305	72.8
1960	3,836,111	1,115,449	4,951,560	77.5
1970	5,388,295	1,403,123	6,791,418	79.3
1980	7,664,728	2,439,855	9,746,324	78.6
1990	10,066,203	2,871,526	12,937,930	77.8
2000	11,921,200	3,606,300	15,527,500	76.8
2010	13,689,200	4,269,200	17,958,400	76.2
2020	15,430,200	4,919,500	20,349,700	75.8

Absolute Population Growth



Population Growth Rate

This indicator describes the rate at which the population of Florida's coastal areas has grown and compares this rate to the growth rate of the state as a whole. The rate is calculated by computing the difference between the population in a given year and that of ten years earlier, then dividing that difference by the population of the earlier period. The quotient, multiplied by 100, yields the percent change from one decade to another. Examination of the direction of the rate (increasing, decreasing, holding stable), and the level of the rate (high, medium or low) provides a valuable perspective on understanding the dynamics of population growth along Florida's coast. The population growth rate is useful in understanding future demographic levels. As the population of coastal areas grows, so to do the adverse impacts that humans have on the coastal environment (e.g., loss of habitat, increased stormwater runoff, and increased water use). Examining trends of population growth can help in developing management strategies for this growth so as to minimize its impacts on the coast.

Data Characteristics

This information is from the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION
The data are available in hard copy format. The 1996 edition of the *Abstract* costs $39.95 to purchase.

COLLECTION
This information is based on decennial U.S. Census figures. Projections are based on calculations by the University of Florida, Bureau of Economic and Business Research, Population Program.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

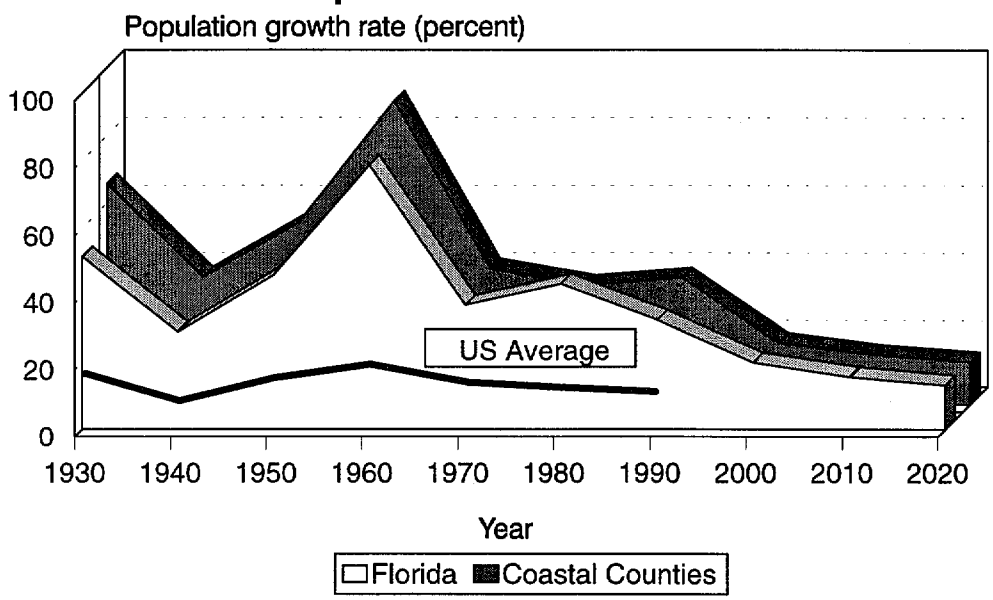
Data Analysis

The seventy-year time frame of analysis shows a peak growth rate occurring in both Florida as a whole and the state's coastal areas during the 1950's. During that decade, coastal populations almost doubled. The growth rate for both areas decreased during the 1970s and flattened out in recent years. While growth is still occurring, the rate of growth has been decreasing and is projected to decrease further in the future.

Population Growth Rate

Year	Coastal Counties	Florida
1920	(baseline)	(baseline)
1930	65.8%	51.6%
1940	38.0%	29.2%
1950	54.2%	46.1%
1960	90.2%	78.7%
1970	40.5%	37.2%
1980	35.6%	43.5%
1990	37.8%	32.7%
2000	18.4%	20.0%
2010	14.8%	15.7%
2020	12.7%	13.3%

Population Growth Rate



Population Density

This indicator describes the average number of people occupying one square mile in Florida's coastal areas and compares this density to the population densities of the non-coastal counties and in the state as a whole. The total land area of Florida is 54,190 square miles; the coastal counties account for 30,069 square miles (55.5 percent of Florida's land area) and the non-coastal counties account for the remaining 24,121 square miles (44.5 percent). The population density is derived by dividing total square miles into the total population. This is a useful indicator since population density can indirectly suggest the competition for space placed on the environment and on urban development. The ability of an area to support life becomes stressed as population densities approach it's carrying capacity. Local and regional effects include degradation of habitats and a decrease in the quality of life of its inhabitants. While this indicator displays roughly the same information as does straight population, showing population growth as a ratio of population to a fixed commodity like land can make the impact more meaningful.

Population density, particularly for Florida's coastal areas, is an important indicator since it is linked with land use and development, use of resources, demand for services, and pollution. In coastal regions land is at a premium, since the water limits growth in one or more directions. Population density is also a good reflection of the stress placed on the natural environment.

Data Characteristics

SOURCE

This information is found in the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

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COLLECTION

This information is based on decennial U.S. Census figures.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

Data Analysis

Increases in population density mirror the increases in absolute population. From 1920 to 1990 the population density in coastal counties increased almost 1,800 percent, from 19.03 to 335.21 people per square mile. This rate of increase was greater than that of the non-coastal counties (about 724 percent) and the state as a whole (over 1,300 percent). Therefore, it can be said that the population density in the coastal counties has increased faster than in the rest of the state. The primary reason is that the coast offers natural amenities, which attract people and businesses.

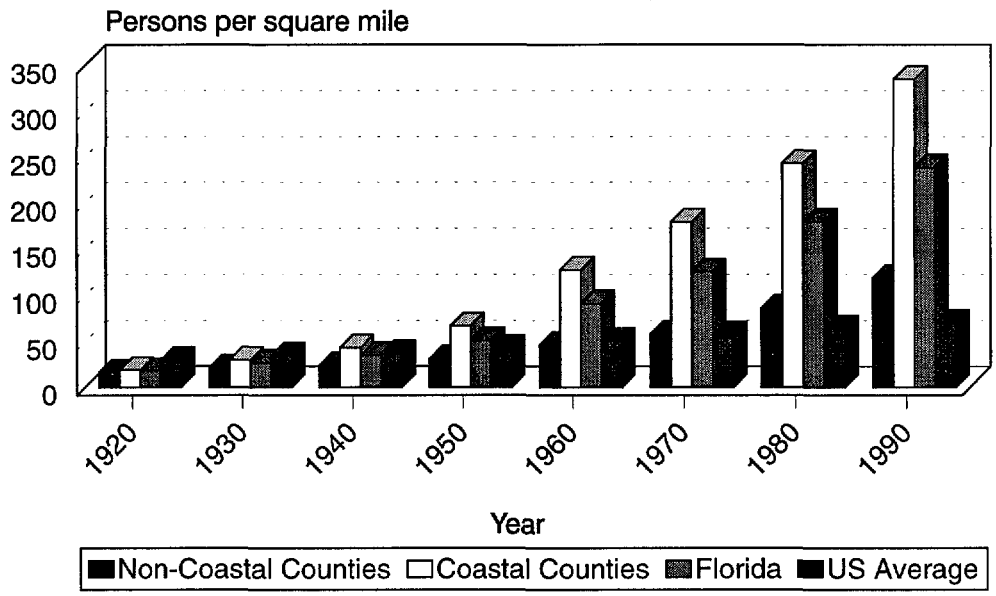
The greatest percent change in coastal county population density occurred between 1950 and 1960, when the density increased by 60.58 persons per square mile, or 90.20 percent. The largest increase in the state's overall population density also occurred between 1950 and 1960, whereas the greatest change for the non-coastal counties' population density occurred between 1970 and 1980. The smallest percentage of change in coastal

per square mile, or 35.60 percent. The non-coastal counties experienced their smallest change between 1930 and 1940, when the density increased only by 2.82 persons per square mile, or 13.06 percent. The decade of least change for the state as a whole was also 1930 to 1940, when the population density changed by 7.93 persons per square mile, or 29.25 percent. The data show that the coastal counties were growing at a faster rate than the rest of the state prior to the 1980 census, when the non-coastal counties began to experience larger increases in population density than the coastal counties.

Persons Per Square Mile

Year	Non-Coastal	Percent Change	Coastal	Percent Change	Florida	Percent Change
1920	16.45	--	19.03	--	17.88	--
1930	21.59	31.25	30.22	58.80	27.11	51.62
1940	24.41	13.06	43.55	44.11	35.04	29.25
1950	31.27	28.10	67.16	54.21	51.18	46.06
1960	46.26	47.94	127.74	90.20	91.44	78.66
1970	58.13	25.66	179.43	40.47	125.41	37.15
1980	86.31	48.48	243.31	35.60	179.98	43.51
1990	119.04	37.92	335.21	37.77	238.91	32.74

Population Density



Age of Population

Florida is often perceived as a retirement haven and, with that, as having an older average population. This perception is not necessarily accurate and is continuously changing. This indicator displays the age of the population of coastal Florida and compares it to the state as a whole.

Patterns of development are determined in part by the age composition of the population. The age of the population is important because of the varying impacts different age groups have on infrastructure and housing needs, resource use, and impacts on the environment. The needs of a population vary with its age demographics. Younger populations have different educational requirements, occupational opportunities, and recreational desires. The age structure of a population can be useful when analyzing future policy and planning goals involving infrastructure and development patterns.

Data Characteristics

SOURCE

This information is found in the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

The 1996 edition of the *Abstract* costs $39.95 to purchase.

COLLECTION

This information is based on decennial U.S. Census figures.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

Data Analysis

Analysis of each individual age group reveals that, with the exception of the 15 to 24 and 25 to 44 year old groups, the cohorts generally comprised the same proportion of the total coastal population in 1990 as they did in 1975. For example, in 1975 the 65 and over age cohort comprised 19 percent of the coastal population; in 1990 the 65 and over cohort still constituted 19 percent of the coastal population, even though the number of individuals in this group increased by 671,059 persons.

The two age groups that reflect changing proportions are the 15 to 24 year olds and the 25 to 44 year olds. From 1975 to 1985 the number of individuals in the 15 to 24 year old cohort increased by 175,268 persons, but then declined by approximately 10,000 persons between 1985 and 1990. The proportion of the coastal population represented by 15 to 24 year olds has shown a slight decreasing trend since 1980 when this cohort made up 16 percent of the coastal population. As of 1990, the 15 to 24 year old cohort made up only 12 percent of the coastal population. Conversely, the population of 25 to 44 year olds continued to increase, as did the proportion of the coastal population found in this age cohort. In 1975 this age group represented 22 percent of the coastal population. By 1990 this age cohort represented 30 percent of the coastal population, increasing by over 1,500,000 persons since 1975.

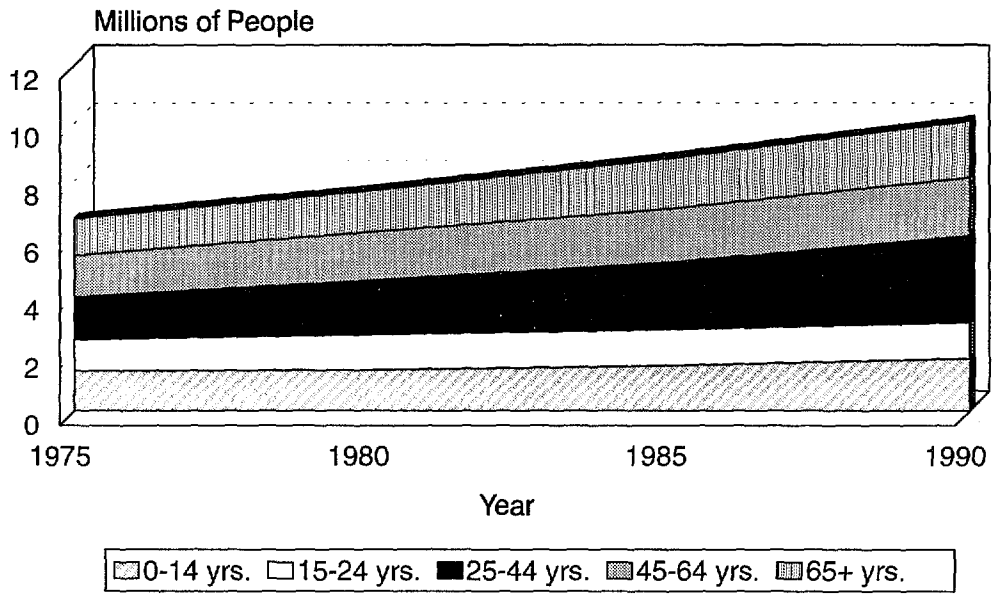
Age of Population for Coastal Counties

Age Groups	1975	1980	1985	1990
0-14	1,396,320	1,422,825	1,579,489	1,832,956
15-24	1,065,618	1,219,260	1,240,886	1,230,740
25-44	1,487,867	1,899,544	2,337,321	3,033,942
45-64	1,469,811	1,696,300	1,865,950	2,015,857
65+	1,281,649	1,425,809	1,746,948	1,952,708

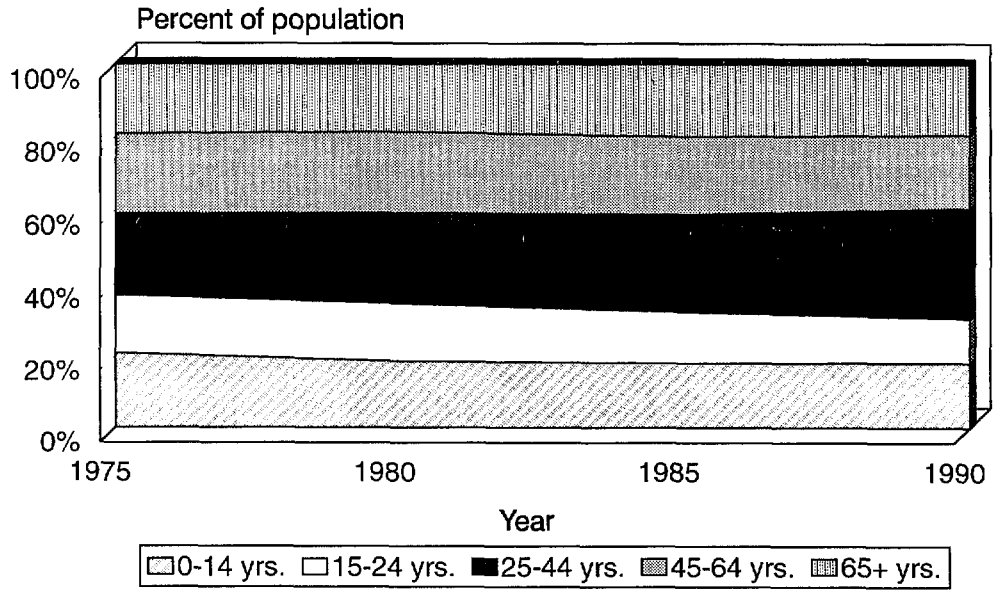
Age of Population for Florida

Age Groups	1975	1980	1985	1990
0-14	1,836,332	1,876,774	2,090,624	2,412,069
15-24	1,401,546	1,622,767	1,675,790	1,669,825
25-44	1,899,590	2,450,189	3,091,078	3,927,400
45-64	1,833,883	2,109,021	2,339,183	2,559,201
65+	1,513,879	1,687,573	2,091,257	2,369,431

Age of Population for Coastal Counties



Proportion of Population by Age in Coastal Counties



Population Growth within Ten Miles of the Coast

Florida's primary attractions are its beautiful coastline and warm winter climate. These natural attributes attract thousands of visitors and new residents to the state every year and many new residents choose to live on or near the coast. As population grows within ten miles of the coast, the environmental degradation associated with human growth and development increases, as does concern for the public's health, safety, and welfare. The areas within ten miles of the coast are more affected by hurricanes and coastal storms than any other areas within the coastal zone.

Tracking population growth within ten miles of the coast is important for preserving Florida's precious coastal resources and protecting the population in those areas from major storms. If population growth rates were monitored at a regional level it would be possible to identify areas where this growth threatens natural resources, where growth is stagnant, and where growth has exceeded the ability to get to safety during storms. Knowing the population growth rate within ten miles of the coast would allow for area-specific planning and analysis of the impacts of state and local policy.

Actual population data are available only from decennial census counts. Census data have limited use for coastal planners, as it is available only for county or census tract levels. Also, population changes are occurring so rapidly that more frequent data are desirable. Interdecennial populations are estimated by a variety of sources and the use of a Geographic Information System (GIS) enables a reliable approximation of coastal residents. As an example, the Department of Community Affairs has produced a GIS data set for the 1995 population within five miles of the coast, including barrier islands, and found that 7.8 million people, over 60 percent of Floridians, live there.

Data Characteristics

SOURCE

This information is available from Steve Grantham, Florida Department of Community Affairs, Division of Emergency Management, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 413-9891.

ACQUISITION

The data are available in hard copy format and as Geographical Information System files. The cost for obtaining this information is approximately $80 per hour. Compiling the data will require eight to sixteen hours of work. If plots are produced, an additional 24 hours or work will be necessary.

COLLECTION

The data are collected by census tract every ten years. Population is estimated for the years in between census updates. The data are collected for the entire state, but can be broken down by county and census tract.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible with some effort.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation. Estimation technologies are imperfect and can only provide information to a limited level of accuracy.

Recommendations

In order to obtain these data, a definition of the ten-mile line needs to be developed (i.e., ten miles from the natural coastline or ten miles in from barrier islands, etc.) and the appropriate GIS data set predicted periodically.

Population Growth on Barrier Islands

Barrier islands are made up of loosely compressed materials (mostly sand) and are vulnerable to forces of wind, waves, sediment transport, the effects of hurricanes, and sea level rise. Most barrier islands can be characterized as low-lying and highly susceptible to coastal flooding. These islands are composed of different and distinct ecosystems; some of these ecosystems include dunes, wetlands, maritime forests, and salt marshes. Barrier islands serve many social and natural functions: they are the first line of defense against hurricanes and coastal storms; they provide enclosures for estuaries and marshes; they are home to a variety of plant and animal life; and, they provide considerable recreational and aesthetic benefits (Beatley, 1994). Population growth on barrier islands is an important indicator because human-made development can threaten the quality of the already fragile environment. Monitoring population growth will help policymakers document the impacts of development on these islands and aid in planning future development. The primary threats to the human population of barrier islands are hurricanes and coastal storms. Monitoring population growth will assist disaster and evacuation planning for these areas.

Actual population data are available only from decennial census counts. Census data have limited use for coastal planners, as it is available only for county or census tract levels. Also, population changes are occurring so rapidly, that more frequent data are desirable. Interdecennial populations are estimated by a variety of sources and the use of a geographic information system (GIS) enables a reliable approximation of coastal residents. As an example, the Department of Community Affairs has produced a GIS data set for the 1995 population within five miles of the coast, including barrier islands, and found that 7.8 million people, over 60 percent of Floridians, live there.

Data Characteristics

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This information is available from Steve Grantham, Florida Department of Community Affairs, Division of Emergency Management, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 413-9891.

ACQUISITION

The data are available in hard copy format and as Geographical Information System files. The cost for obtaining this information is approximately $80 per hour. Compiling the data will require eight to sixteen hours of work. If plots are produced, an additional 24 hours of work will be necessary.

COLLECTION

The data are collected by census tract every ten years. Population is estimated for the years in between census updates. The data are collected for the entire state, but can be broken down by county and census tract.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible with some effort.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation. Estimation technologies are imperfect and can only provide information to a limited level of accuracy.

Recommendations

In order to obtain these data, a definition of barrier islands needs to be developed so as to include other barrier structures, such as peninsulas and spits, and the appropriate GIS data set produced periodically.

References

Beatley, Timothy, David J. Brower, and Anna K. Schwab, *An Introduction to Coastal Zone Management*, Washington DC, Island Press: 1994.

Seasonal Residences

Seasonal residences in coastal areas are an indirect indicator of the human growth rates that are not accounted for in resident population census. While not permanent, this population represents an increase in human activity that impacts the welfare of the natural environment and increases demands on services. Seasonal residences are characterized by non-permanent occupancy of the owner of the property. Generally, these residences are leased out as vacation property and are found predominantly in Florida's coastal counties. The number of seasonal residences is important since it directly impacts a county's infrastructure and tax base. By monitoring the number of seasonal residences, the coastal counties and the state may be better able to address infrastructure and policy issues related to variable population levels.

Data Characteristics

SOURCE

This information is from the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

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COLLECTION

This information is based on decennial U.S. Census figures.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

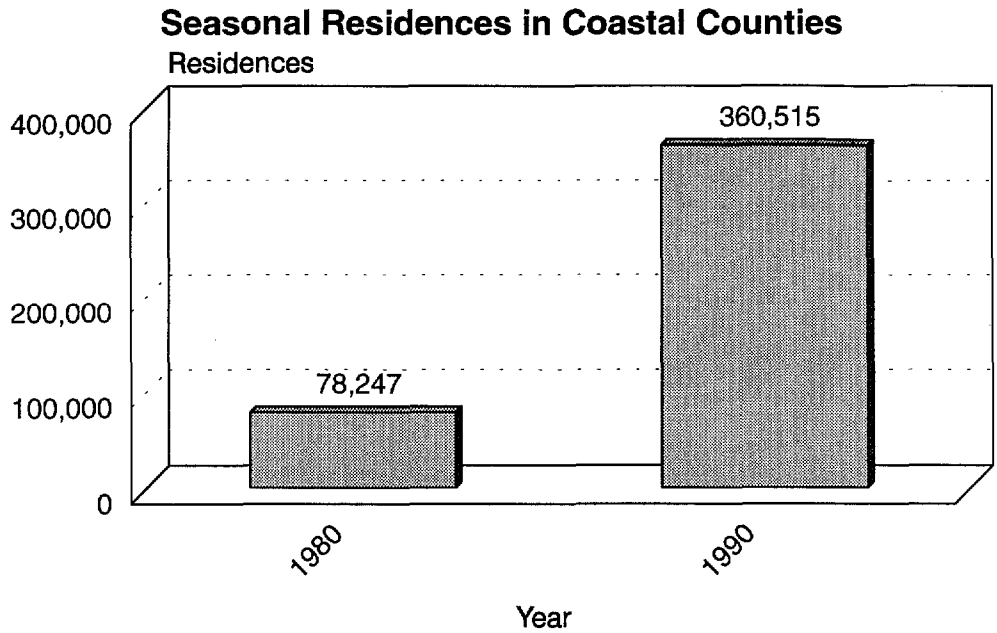
Data Limitations

These data are the best available for this indicator. These figures are estimates derived from mathematical analyses, based on census data which are collected every ten years. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation. While some flaws and biases are inherent in the census information due to the data collection process and analysis, they are not defects that reduce the utility and validity of these figures.

Currently the data are collected with data on seasonal housing and migrant worker housing and are impossible to disaggregate. Furthermore, the data have been grouped inconsistently in past years; this results in difficulties in obtaining accurate counts for strictly seasonal residences.

Data Analysis

Seasonal residences in coastal counties increased by over 360 percent in the previous decade. Six counties increased their number of seasonal residences over one thousand percent, one of those (Collier county) over two thousand percent. Only six counties did not at least double their number of seasonal residences and one of those counties (Taylor county) actually had a reduction of 19 percent.


Seasonal Residences in Coastal Counties
Residences
400,000
300,000
200,000
100,000
0
78,247
360,515
1980
1990
Year

Urban/Rural Population

This indicator describes the percentage of the population living in urban areas and the percentage of the population living in rural areas within the 35 coastal counties. An urban population is defined as all persons living in urbanized areas and in places of 2,500 or more persons outside urbanized areas. An urbanized area is comprised of an incorporated place and an adjacent densely settled surrounding area that together have a minimum population of 50,000. Population not classified as urban constitutes the rural population. Rural classification need not imply farm residence or a sparsely settled area, because a small city is rural as long as it is outside an urbanized area and has fewer than 2,500 persons (BEBR, 1994). This indicator is useful in that it documents a major change in the character of the demographics of Florida's coastal areas - the shift from a predominantly rural Florida to an urbanized Florida. It is also useful in that it is associated with changing land use patterns brought on by increased development.

Data Characteristics

SOURCE

This information is from the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

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COLLECTION

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TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

These data are the best available for this indicator. The limitations associated with the data are the same limitations inherent in census data. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

Data prior to 1950 have been adjusted to constitute a substantially consistent series based on incorporated places of 2,500 or more persons with additional areas defined as urban under special rules (BEBR, 1994).

Data Analysis

The shift from a rural to a predominantly urban state has shown a fairly steady increase since before 1920 until the 1950's when growth rapidly increased in urban centers. This shift may have been a result of increased economic activity partially aided by a growing influx of tourists and seasonal residents.

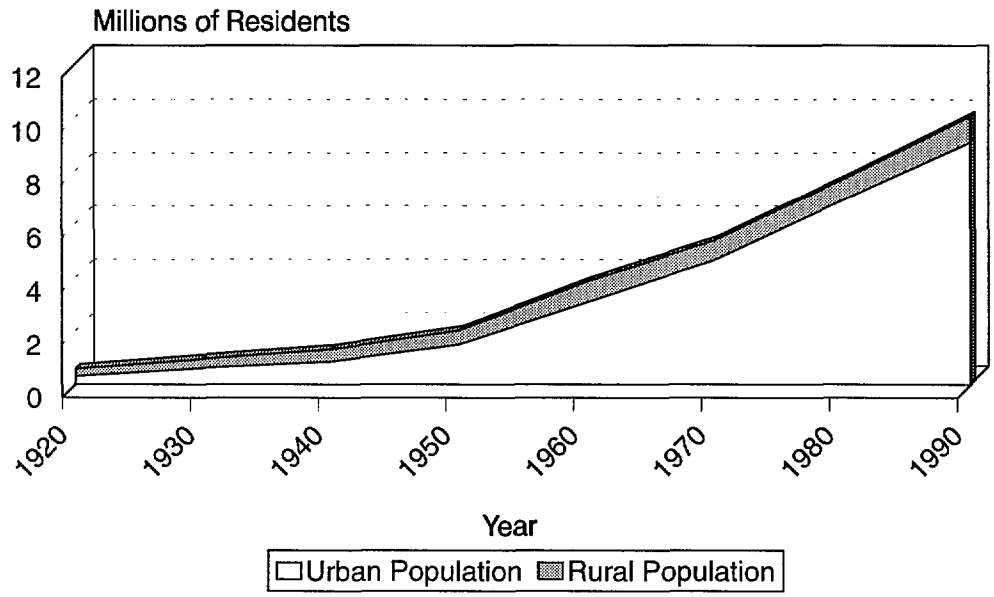
Two factors are thought to affect this pattern of population movement. First, there was a significant immigration of persons to Florida from outside the state. Most of these people located in urban areas where employment is found. A second factor concerns an increase of size of communities, which shifted formerly rural communities to an urban status.

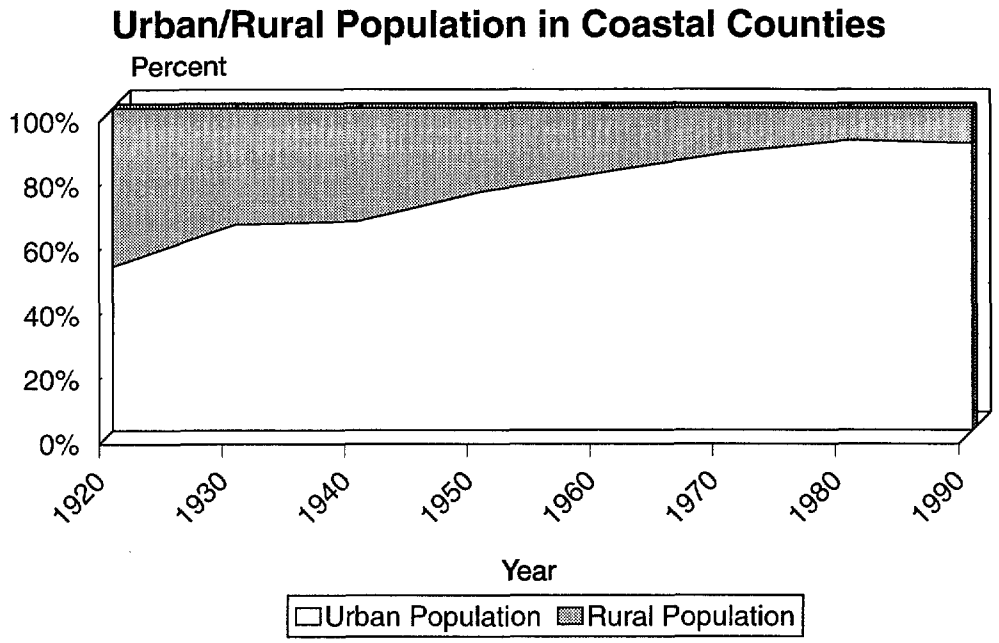
Population in rural coastal areas has continued to increase as well, but at much slower rates. The greatest rate of population growth in rural areas occurred between 1950 and 1960, when this population increased by 46.8 percent. From 1960 to 1980 the population remained relatively stable, decreasing slightly in the 1960's and increasing less than 7 percent in the 1970's. The 1980's, however, saw a new surge of population with almost 200,000 residents being added to rural communities.

Urban/Rural Population in Coastal Counties

Year	Rural Population	Percent Rural	Urban Population	Percent Urban	Total Population
1920	280,100	49	291,415	51	571,515
1930	344,176	36	603,357	64	947,533
1940	460,776	35	846,921	65	1,307,697
1950	524,027	26	1,492,899	74	2,016,926
1960	769,098	20	3,067,013	80	3,836,111
1970	734,789	14	4,653,506	86	5,388,295
1980	786,053	10	6,878,675	90	7,664,728
1990	981,228	10	9,084,975	90	10,066,203

Urban/Rural Population in Coastal Counties





References

Bureau of Economic and Business Research, College of Business Administration, University of Florida. 1994. *Florida Statistical Abstract.* Gainesville, Florida.

Change in Major Land Cover Categories

Population pressures and development have resulted in significant changes in Florida's land use and land cover. Rapid and large scale growth culminating in residential and commercial development, sprawling cities, and the need for land to support agricultural activities has decreased the remaining lands in a natural state. These natural areas provide essential functions that, when altered, impact the viability of entire species. These natural areas provide essential functions that, when altered, affect the viability of entire populations. Large habitat areas become fragmented. Once a species' habitat is changed, extirpation or extinction of the species increases in likelihood. The number of taxa on Florida's list of endangered and threatened species is second only to California in the entire nation. Change in land cover also impacts the state's air, water, and natural resources and the quality of life of Florida's citizens. Changes in water regimes occur when natural areas are paved, increasing runoff and decreasing groundwater recharge. For Florida, many of these associated problems with land cover change have been in coastal areas where intense development has taken place and changed the face of the land.

Improvements in satellite technology now provide the ability to almost continuously monitor land cover. However, high costs of data acquisition and technical difficulties involved in determining specific land types from satellite imagery limit the usefulness of satellite data for monitoring trends in landcover. Until the use of this technology is more economically and technically feasible, a useful substitute capable of providing trend data on land cover category has been assembled by the Florida Game and Fresh Water Fish Commission from a series of U.S. Forest Service reports. All data in the reports were collected using a combination of field survey and air photo interpretation techniques. These reports, however, present information on the entire state, which cannot be broken down by county. Land inventories have been conducted seven times (1936, 1949, 1959, 1970, 1980, 1987, and 1995), and provide estimates for a wide range of land uses and covers, such as the number of hectares of forest, marsh, cropland, pasture/range, and urban and other lands. Additionally, changes in critical habitat, such as longleaf pine and scrub oak, are included because of their rate of historic loss and significance in supporting entire complexes of non-threatened as well as threatened species. In the future it will be necessary for the state to closely monitor the progress of land use, to protect certain remaining land covers, and to help educate Floridians about land issues so as to ensure maintenance of the environmental values associated with the state.

Data Characteristics

SOURCE

A summary of the data from the U.S. Forest Service can be found in a report entitled *Trends in Florida Wildlife Habitat 1936-1987,"* produced by Randy Kautz. An update through 1995 is currently being prepared for publication. Mr. Kautz can be contacted at the Florida Game and Fresh Water Fish Commission, 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (850) 488-6661.

ACQUISITION

The information is available in hard copy at no cost.

COLLECTION

The information is collected statewide at irregular intervals. It has been collected for the years 1936, 1949, 1959, 1970, 1980, 1987, and 1995.

TECHNICAL

Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

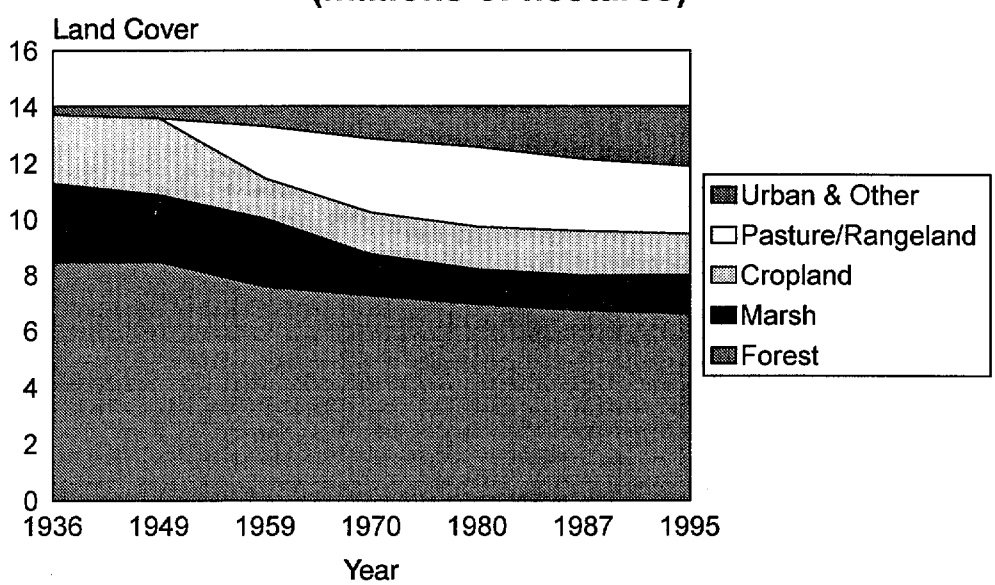
The irregularity of the data collection decreases its utility. Moreover, definitional differences in land cover may make the comparisons among land cover data difficult. In spite of the limitations, the data are the best available for long-term measurement of land cover and land use in the state. Because the data cannot be disaggregated by county, at the present time it is not possible to display land cover for just the coastal areas of the state.

Data Analysis

It is important to note that the following figures for land area pertain to the entire state of Florida, not just to the coastal counties. The land cover figures display area in millions of hectares; one hectare is equal to 2.471 acres. The data show that between 1936 and 1995, the areas occupied by forest land and marsh land decreased 21.8 percent and 51.1 percent, respectively. During the same period, the area of cropland, pasture and range lands increased a combined 58.8 percent, and the area of urban and other lands increased approximately 628.4 percent. These figures highlight the shift away from natural land cover to land cover change compatible with agricultural activities and urban development. Since 1980 only, urban land and other has shown an increase of 46.8 percent, or three percent a year.

One of the critical habitats that is strongly associated with threatened and endangered species is longleaf pine. The number of species of groundcover plants associated with longleaf has ranged from 150 to 300 per hectare, and the highest species density of amphibians and reptiles in North America has been mapped in the geographic distribution of longleaf pine (Means, 1996). Between 1936 and 1995, Florida lost 91 percent of its longleaf pine forests, primarily due to clearcutting, conversion to agricultural and urban uses, and replanting of other pine species. During the same period, 60 percent of scrub oak was lost. Concurrent with these immense losses in specific land cover, the number of species considered to be imperiled has increased.

Statewide Change in Major Land Cover Categories (millions of hectares)



*Values for Cropland and Pasture/Range were combined in 1936 and 1949.

Statewide Change in Major Land Cover Categories (millions of hectares)

Land Cover	1936	1949	1959	1970	1980	1987	1995
Forest	8.4618	8.4683	7.5675	7.2636	6.9598	6.7223	6.6133
Marsh	2.8214	2.1451	2.4540	1.4769	1.2295	1.2513	1.3789
Cropland	N/A	N/A	1.4266	1.4955	1.5373	1.5992	1.4745
Pasture/Range	N/A	N/A	1.8594	2.6326	2.8400	2.5689	2.4159
Urban & Other	0.2944	0.4326	0.7196	1.1585	1.4606	1.8852	2.1445
Total	14.0271	14.0271	14.0271	14.0271	14.0271	14.0271	14.0271

N/A = Data Not Available

Statewide Change in Critical Land Cover Categories (millions of hectares)

Land Cover	1936	1949	1959	1970	1980	1987	1995
Longleaf Pine	3.3103	2.5209	1.2434	0.6203	0.5048	0.3862	0.3019
Scrub Oak	0.5863	0.7708	0.7874	0.5423	0.4072	0.3397	0.2346

Recommendations

Data collected from satellite imagery on a statewide level should be obtained and produced in a manner that data may be made available at local or county levels. This would provide for a more accurate assessment of the land cover in each county and a good indication of the land use patterns occurring in each county.

References

Kautz, Randy. "Trends in Florida Wildlife Habitat 1936 - 1987." *Florida Scientist* 56 (1), pp. 7-24: 1993.

Kautz, Randy. (in prep) *"Trends in Florida Wildlife 1936-1995."*

Means, Bruce. 1996. "Longleaf Pine Forests, Going, Going.....", in Mary Davis, ed. *Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery.* Island Press, Washington, DC, pp. 210-229.

Residential Building Permit Activity: New Housing Units and Value Reported on Building Permits

Building permit activity is an important economic and environmental indicator. The number of units authorized by building permits reflects a considerable financial investment in the state's coastal areas. A housing unit is defined as a room or group of rooms intended for occupancy as separate living quarters. In a multi-unit building such as an apartment complex, each apartment represents one housing unit. The reported value of building permits is also an indirect economic indicator of the amount of disposable income invested in housing. The higher the value, the more money people are spending on constructing new housing or improving existing housing. It is important to note, however, that the value of building permits does not have a one-to-one correlation with the number of units authorized, since building permits are issued for improvements as well as for new construction.

Building permits can also be an indicator of the pressures that development places on available land for development and the results of growth management legislation. Legislation's ability to direct development in a way that is compatible with the natural environment can be determined in part through the number and location of building permits issued. In order to protect natural resources and/or to sustain current populations, some areas of the state have enacted stricter policies regarding the issuance of building permits. The number of permits issued can be used to monitor how much development is occurring in sensitive coastal areas.

As the population of Florida grows, so too will the amount of land that is developed. The coastal areas will likely be the focus of the majority of development in the state. Along with this development will come increased pressures on natural resources, which could potentially harm the coastal ecosystems that initially attracted development. In addition, large portions of the population and their investments in development will be at serious risk from coastal storms. Carefully managing the issuance of permits and the types of development allowed will be necessary if a sustainable balance between growth and protecting coastal ecosystems is to be reached.

Data Characteristics

SOURCE

This information is from the Florida Statistical Abstract, produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The Abstract is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

The data are available in hard copy format. The 1996 edition of the Abstract costs $39.95 to purchase.

COLLECTION

This information is based on decennial U.S. Census figures. Projections are based on calculations by the University of Florida, Bureau of Economic and Business Research, Population Program.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data are based on voluntary reports from local building officials processed by the Bureau of the Census. The number of units authorized by building permits does not necessarily reflect the actual number of units built. A certain percentage of structures receiving permits will not be completed and a small percent of privately owned housing units do not require building permits and are not included in this data. These data do not include mobile homes or conversions of non-residential units to residential units. Value figures are estimated on a cost-per-foot basis by each jurisdiction and may not be comparable with other locations. A further limitation to these data is that they do not break out additions from new structures, nor do they give any indication as to the size of the buildings.

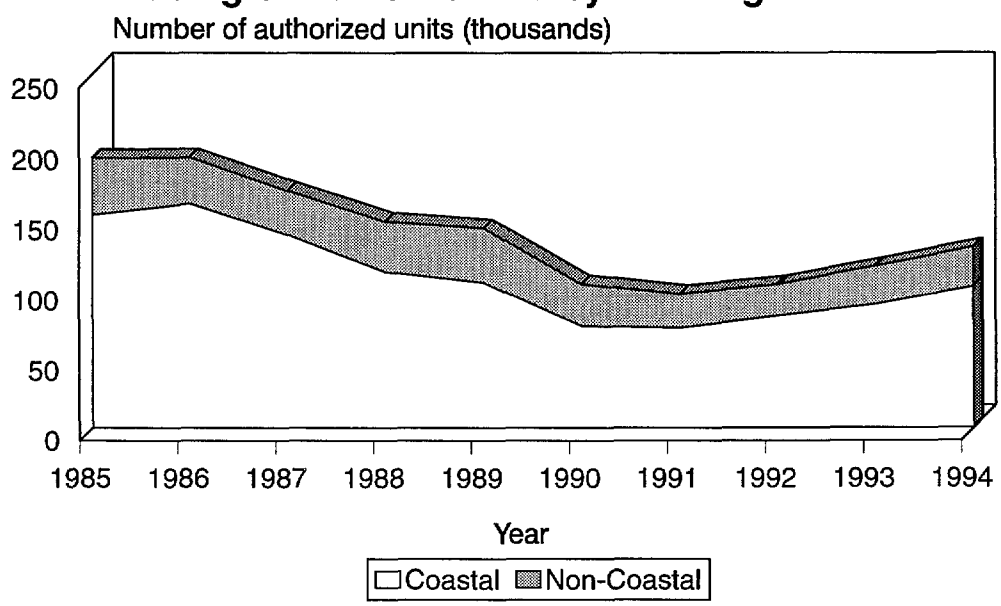
Data Analysis

The data show that, during the period between 1985 and 1991, there was a declining trend in the number of building permits issued. The decline occurred in both coastal and non-coastal counties, with fewer building permits issued in both areas. The number of units authorized by permits increased between 1991 and 1994, suggesting an increased demand for new housing.

Housing Units Authorized by Building Permits

Year	Coastal Counties	Non-Coastal Counties	Florida (Total)
1985	151,395	40,418	191,813
1986	159,593	32,693	192,286
1987	137,442	31,074	168,516
1988	111,023	35,755	146,778
1989	103,566	38,439	142,005
1990	72,394	30,041	102,435
1991	70,938	24,436	95,374
1992	79,433	22,626	102,059
1993	87,717	27,416	115,133
1994	100,415	14,718	115,133

Housing Units Authorized by Building Permits



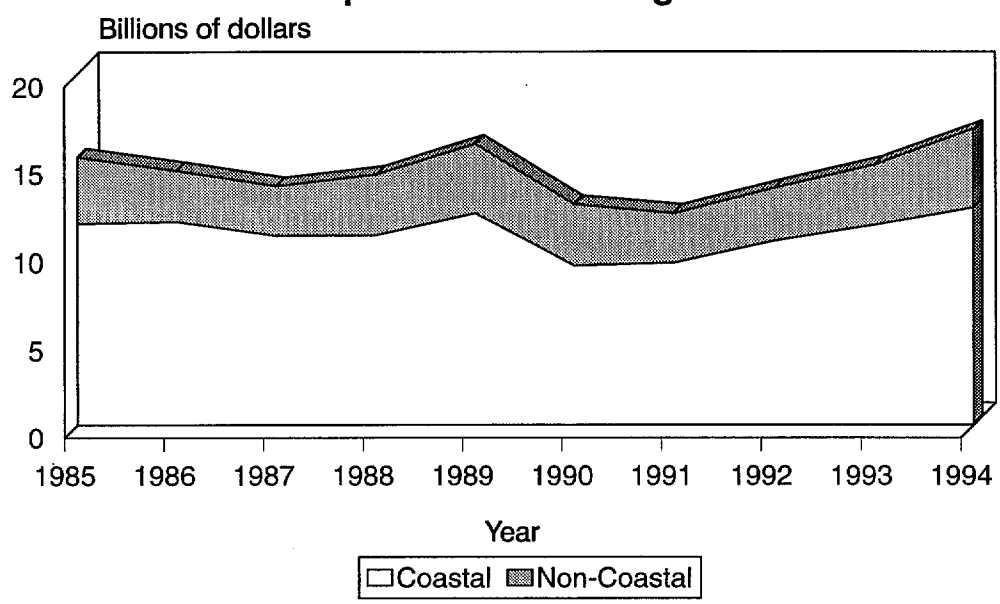
The value reported on building permits has been erratic. Except for a peak in 1989, there was a decrease in the value of permits from 1985 to 1991. However, in 1992 through 1994 the value of the permits appeared to be on the rise. The most recent increase in value may have been the result of the large amount of construction required after Hurricane Andrew. As with the number of authorized housing units, the value reported on building permits in coastal and non-coastal counties have followed the same general trend.

Value Reported on Building Permits

Thousands of dollars

Year	Coastal Counties	Non-Coastal Counties	Florida (Total)
1985	$11,436,776	$3,789,600	$15,226,376
1986	$11,542,319	$2,901,216	$14,444,535
1987	$10,738,433	$2,823,667	$13,562,100
1988	$10,772,615	$3,448,851	$14,221,466
1989	$12,025,597	$3,945,666	$15,971,263
1990	$ 9,046,326	$3,469,656	$12,515,982
1991	$ 9,213,206	$2,797,011	$12,010,217
1992	$10,450,302	$2,991,491	$13,441,793
1993	$11,348,336	$3,405,784	$14,754,120
1994	$12,325,164	$4,499,278	$16,824,442

Value Reported on Building Permits



Total and Per Capita Municipal Solid Waste Collected

The 1988 Florida Solid Waste Management Act (SWMA) revised nearly all aspects of Florida's solid waste management program. Among its many requirements, the law mandates the creation of an annual report to the legislature detailing the status of solid waste collected, its composition and management, state agency activities, and program recommendations. Counties have primary responsibility for solid waste management in Florida, but as lead agency the Florida Department of Environmental Protection (DEP) is responsible for information gathering and submission of the annual report.

There are three major methods utilized to manage municipal solid waste (MSW) in the state: landfilling, combustion, and waste reduction/recycling. As of January 1995, the state had 101 landfills, 63 of which are lined, Class I landfills. The state's current combustion plant capacity is 18,996 tons per day, making Florida the state with the most combustion capacity in the nation. Waste reduction/recycling includes the 39 composting facilities operating in 21 counties throughout the state. Starting in 1995, recyclers are required to have certification and annually report to the Florida Department of Environmental Protection (DEP). In 1995, there were 307 facilities which handled recycled material for the 198 DEP-certified recyclers in the state (DEP, 1996).

Landfilled solid waste includes waste which is deposited in Class I, II, or III landfills, and Construction and Demolition (C&D) debris disposal facilities. Class I landfills receive an average of 20 tons or more of solid waste per day, whereas Class II landfills receive less than 20 tons per day. Waste deposited in Class III landfills is non-hazardous, non-putrescible, and more narrowly defined than the MSW wastes received by Class I and II landfills. Class III landfills receive only yard trash, construction and demolition debris, waste tires, asbestos, carpet, cardboard, paper, glass, plastic, furniture other than appliances, and other approved materials which are not expected to produce leachate which poses a threat to public health or the environment. C&D facilities manage debris which is not water soluble and non-hazardous in nature, including but not limited to steel, glass, brick concrete, asphalt material, pipe, gypsum wallboard, and lumber, from the construction or destruction of a structure. It also includes rocks, soils, trees, and other vegetative matter which normally results from land clearing or development operations.

Though once a relatively inexpensive method of waste disposal, landfills have become increasingly expensive due to the lack of available land and environmental constraints. The scarcity of suitable land in coastal counties increases the cost of land to serve as a landfill site. Expanding urban areas also causes problems with siting landfills, as most people do not want a landfill near their home. Environmental regulations limiting destruction of wetlands and restricting disposal of solid wastes in areas where water contamination is possible have also limited the areas that can serve as potential landfill sites. As the use of reduction/recycling and combustion increases, the amount of MSW which needs to be landfilled decreases.

This indicator is valuable because it shows the trend in the amount of MSW collected, which is necessary for infrastructure planning needs.

Data Characteristics

SOURCE

Information on MSW is available in the *Solid Waste Management Annual Report* to the legislature. The data can be obtained from Peter Goren, Waste Reduction Section, Florida Department of Environmental Protection, 2600 Blair Stone Road, Mail Station 4570, Tallahassee, Florida 32399-2400, or at (850) 488-0300.

The population information used for the calculations of per capita waste generation is from the *Florida Statistical Abstract,* produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The *Abstract* is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION
The solid waste information is available in hard copy format at no cost and is available on the Internet at **http://www.dep.state.fl.us/waste/programs.htm**. The population data are available in hard copy format. The 1996 edition of the *Abstract* costs $39.95 to purchase.

COLLECTION
The data are collected annually by state fiscal year through 1995 for each county through surveys and then compiled into statewide totals. Data collection after 1995 is based on the calendar year. Beginning in 1995, recycling data for 12 of 19 material types have been collected directly by the state from recyclers via the Recovered Materials Dealers certification and reporting program rather than the surveys.

TECHNICAL
Hierarchy of Indicators: 3
Pressure/State/Response: Pressure
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

There is no way to account for waste that does not pass through a waste management center. In many cases the waste may be improperly or illegally disposed of or may be composted by private individuals. Some counties have done studies to document composting programs and this tonnage is counted as recycled.

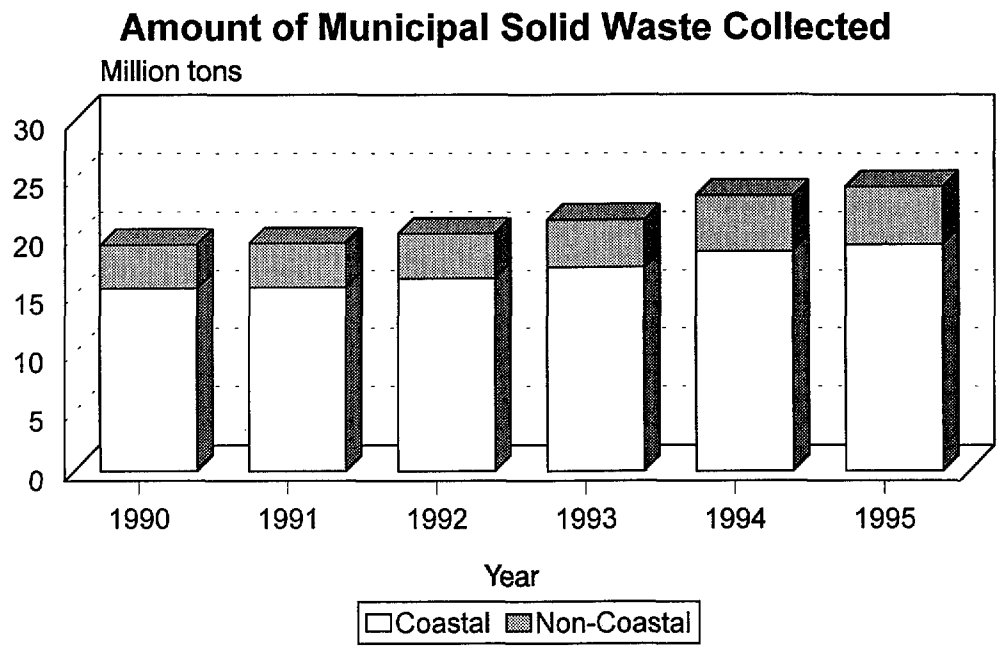
The population figures for 1995 are derived from a separate table within the *Florida Statistical Abstract* and may have been calculated in a different manner than the 1990-1994 population figures.

Data Analysis

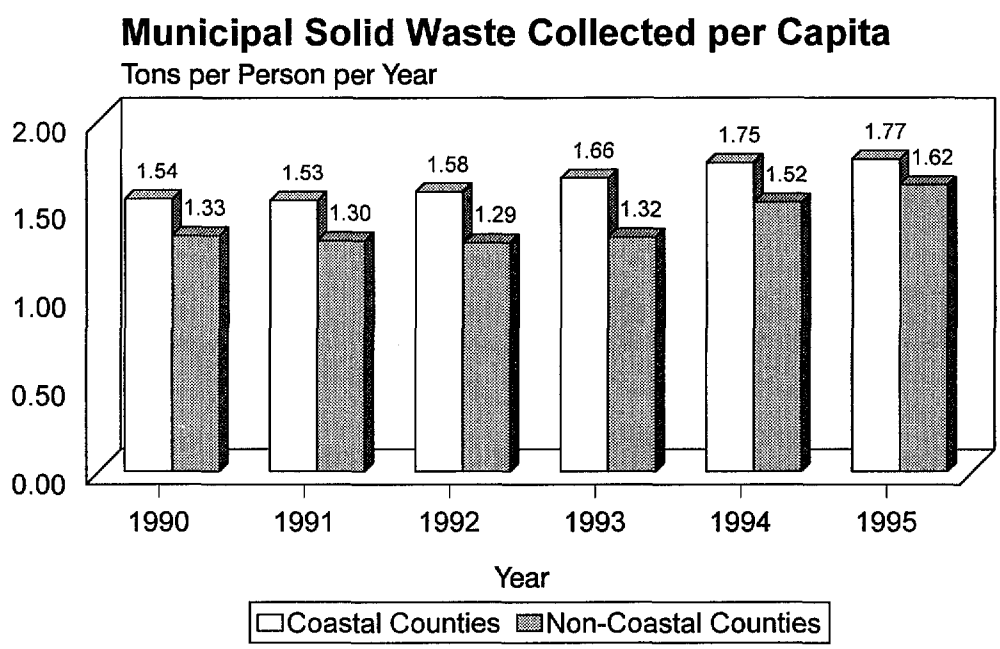
Between 1990 and 1995, Florida's coastal counties collected about 80 percent of the state's total MSW. This is not surprising, since over 77 percent of the state's population currently resides in the coastal counties. Between 1991 and 1995, MSW collected by the coastal counties increased between five and eight percent, while the population has changed less than two percent annually. The amount of MSW collected by the non-coastal counties has been more irregular. From 1990 to 1992 the amount of MSW collected increased an average of only 1.1 percent per year. Between 1992 and 1993 the amount of MSW collected increased by 4.7 percent and then by 14.7 percent from 1993 to 1994. While the generation of MSW continued to increase from 1994 to 1995, it increased at only 3.5 percent, slowing dramatically from the previous year.

Municipal Solid Waste Collected (tons)

Year	Coastal Counties	Non-Coastal Counties	Florida
1990	15,551,739	3,806,473	19,358,212
1991	15,636,223	3,847,340	19,483,563
1992	16,400,660	3,892,397	20,293,057
1993	17,412,714	4,067,582	21,480,296
1994	18,769,391	4,791,542	23,560,933
1995	19,345,640	4,966,117	24,311,757



Per capita waste generation in coastal counties has been higher than per capita waste generation in non-coastal counties. A possible explanation for this is the large number of tourists who visit coastal counties each year and contribute to the waste stream, but are not counted in the population figures. The trend for both coastal and non-coastal counties has been one of slow increase with some fluctuation, although the rate of increase has been somewhat faster for the non-coastal counties. From 1990 to 1995 per capita MSW generation in coastal counties increased by 14.9 percent. Per capita MSW generation in non-coastal counties increased by 21.8 percent during the same period.



From 1990 to 1995 there was a decrease in the amount of waste placed in Florida's landfills, while the amount of waste processed by recycling and combustion facilities increased. In coastal counties in 1990 and 1991, landfills processed a larger proportion of waste than the recycling and combustion facilities combined. In 1995, nearly ten percent more total waste was processed by recycling facilities than by landfills in the coastal counties. Over 25 percent of the waste collected in coastal counties was processed by combustion plants.

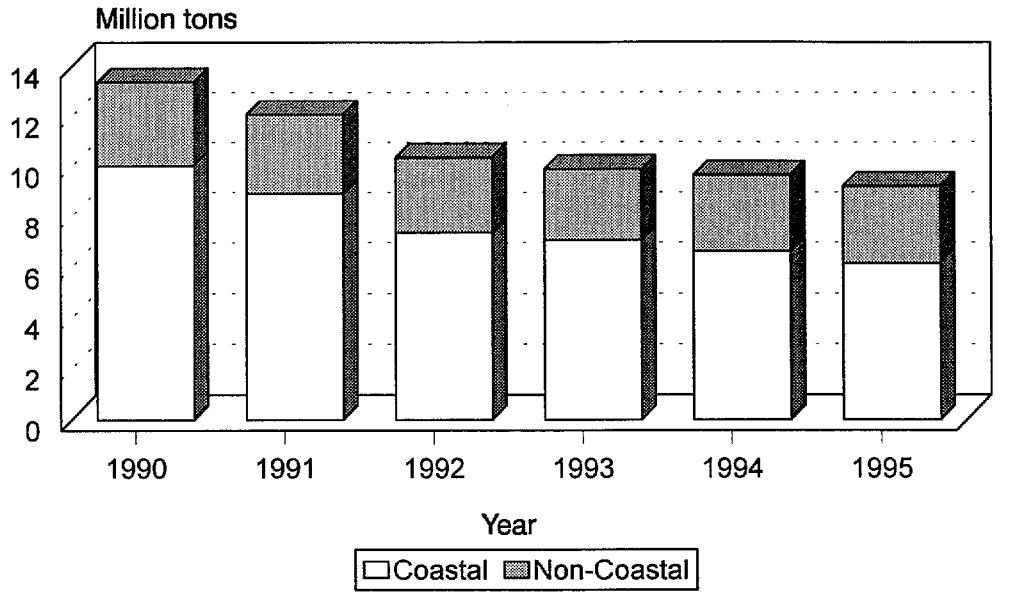
The processing of MSW in non-coastal counties followed a trend similar to that of the coastal counties. However, landfills remained the dominant form of waste disposal in non-coastal counties, with over half of the waste going to landfills, although the amount of waste recycled in non-coastal counties almost quadrupled during the same period. Combustion facilities have been less popular in non-coastal counties, with less than five percent of these counties' waste processed via combustion between 1990 and 1995.

Amount of Municipal Solid Waste Processed (tons)

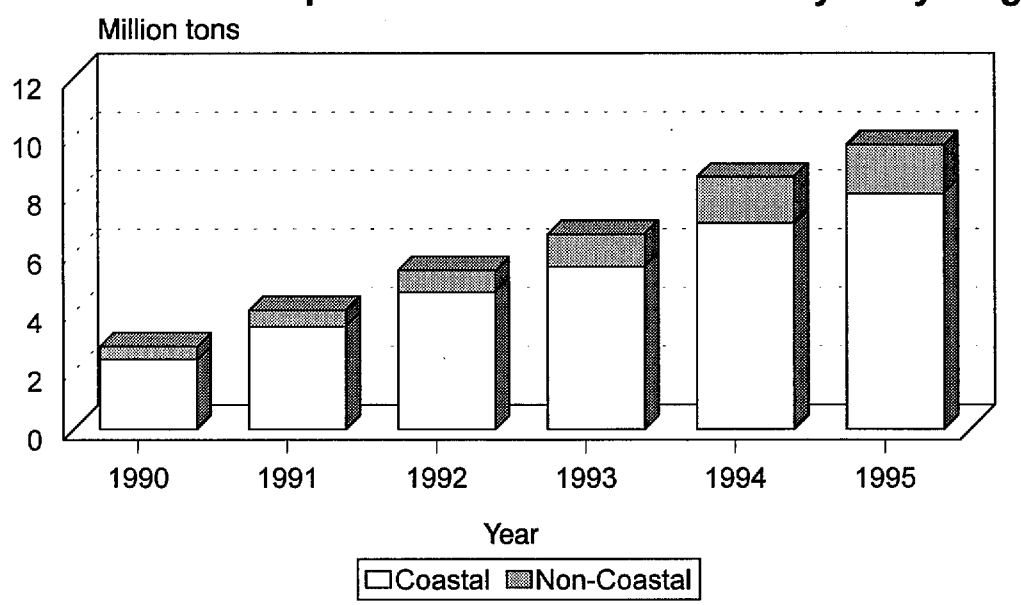
Year/Process	Landfill	Recycling	Combustion	Total
1990				
Coastal	10,048,394 (64.6)	2,382,690 (15.3)	3,120,655 (20.1)	15,551,739
Non-Coastal	3,354,133 (88.1)	444,715 (11.7)	7,625 (0.2)	3,806,473
State (Total)	13,402,527 (69.2)	2,827,405 (14.6)	3,128,280 (16.2)	19,358,212
1991				
Coastal	8,924,729 (57.1)	3,513,510 (22.5)	3,197,984 (20.5)	15,636,223
Non-Coastal	3,162,057 (82.2)	545,790 (14.2)	139,493 (3.6)	3,847,340
State (Total)	12,086,786 (62.0)	4,059,300 (20.8)	3,337,477 (17.1)	19,483,563
1992				
Coastal	7,359,803 (44.9)	4,672,884 (28.5)	4,367,973 (26.6)	16,400,660
Non-Coastal	3,009,363 (77.3)	743,214 (19.1)	139,820 (3.6)	3,892,397
State (Total)	10,369,166 (51.1)	5,416,098 (26.7)	4,507,793 (22.2)	20,293,057
1993				
Coastal	7,070,293 (40.6)	5,540,478 (31.8)	4,801,943 (27.6)	17,412,714
Non-Coastal	2,833,938 (69.4)	1,104,079 (27.0)	129,565 (3.6)	4,067,582
State (Total)	9,904,231 (46.1)	6,644,557 (30.9)	4,931,508 (23.0)	21,480,296
1994				
Coastal	6,633,693 (35.3)	7,031,892 (37.5)	5,103,806 (27.2)	18,769,391
Non-Coastal	3,028,157 (63.2)	1,575,905 (32.9)	187,480 (3.9)	4,791,542
State (Total)	9,661,850 (41.0)	8,607,797 (36.5)	5,291,286 (22.5)	23,560,933
1995				
Coastal	6,161,498 (31.8)	8,028,016 (41.5)	5,156,126 (26.7)	19,345,640
Non-Coastal	3,052,972 (61.5)	1,686,673 (34.0)	226,472 (4.6)	4,966,117
State (Total)	9,214,470 (37.9)	9,714,689 (40.0)	5,382,598 (22.1)	24,311,757

Numbers in parentheses represent the percentage of the total waste that was processed in that manner.

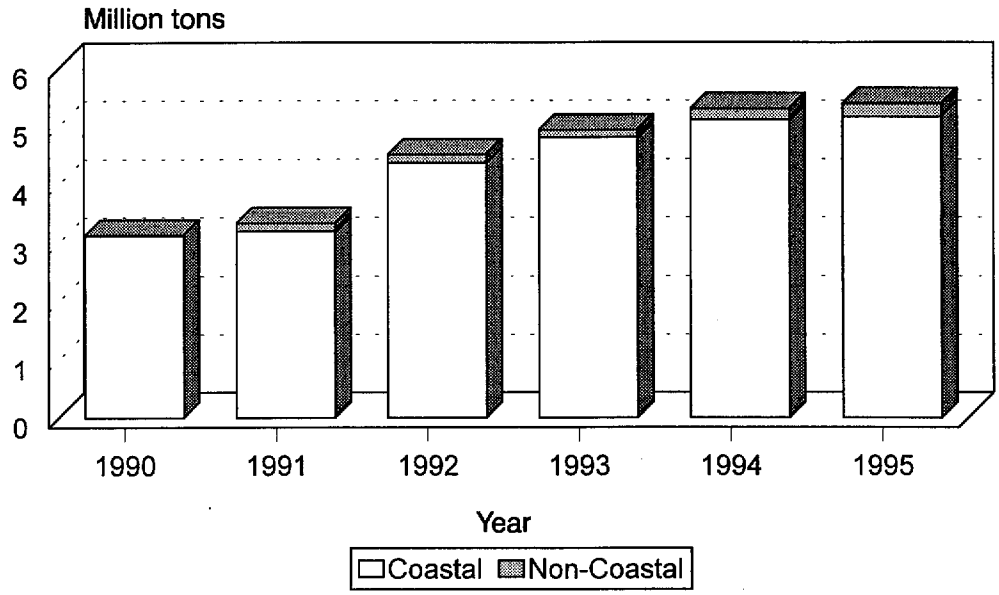
Amount of Municipal Solid Waste Processed in Landfills



Amount of Municipal Solid Waste Processed by Recycling



Amount of Municipal Solid Waste Processed in Combustion Facilities

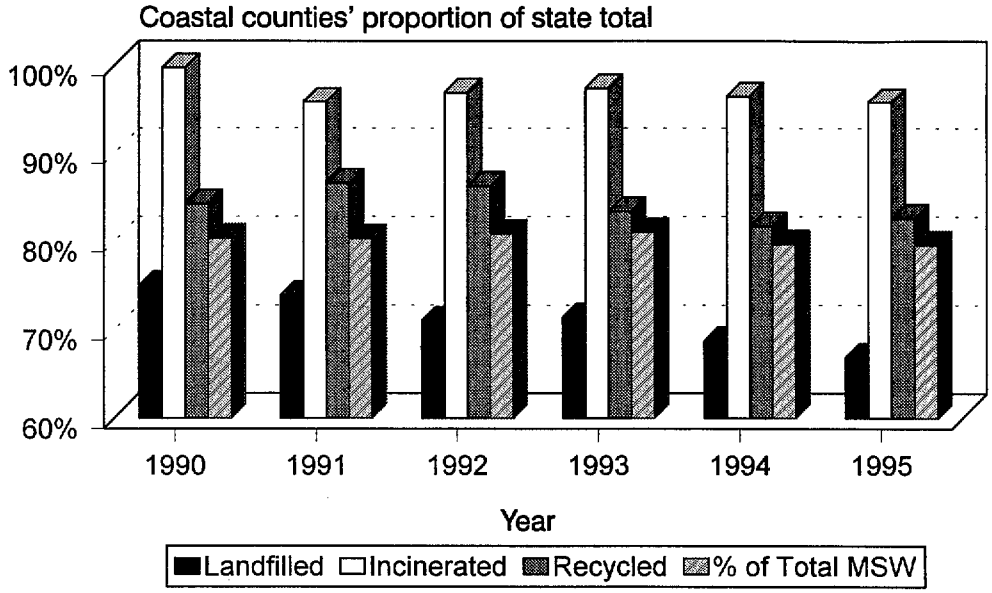


From 1990 to 1995, the proportion of waste landfilled in coastal vs. non-coastal counties decreased by approximately eight percent. For the same period, the proportion of waste incinerated decreased by about four percent. The proportion of waste recycled in coastal counties increased by approximately two percent. The total proportion of waste in coastal counties has remained fairly constant at approximately 80 percent of the state's total MSW from 1990 to 1995.

Proportional Share of Waste in Florida by Disposal Method

Year	Landfilled		Incinerated		Recycled		Total	
	Coastal	Non-Coastal	Coastal	Non-Coastal	Coastal	Non-Coastal	Coastal	Non-Coastal
1990	75.0%	25.0%	99.8%	0.2%	84.3%	15.7%	80.3%	19.7%
1991	73.8%	26.2%	95.8%	4.2%	86.6%	13.4%	80.3%	19.7%
1992	71.0%	29.0%	96.9%	3.1%	86.3%	13.7%	80.8%	19.2%
1993	71.4%	28.6%	97.4%	2.6%	83.4%	16.6%	81.0%	19.0%
1994	68.7%	31.3%	96.5%	3.5%	81.7%	18.3%	79.7%	20.3%
1995	66.9%	33.1%	95.8%	4.2%	82.6%	17.4%	79.6%	20.4%

Coastal County Proportional Share of Waste in Florida by Disposal Method



Per Capita Income

Per capita income is a measure of the wealth of an area's population as well as an indicator of the economic health of that region. Increases in income can create greater disposable income, which often results in increased consumption of goods and services, along with a host of other associated effects. These effects include greater demands on waste facilities, increased traffic and construction, and increased use of resources. Alternatively, wealthier populations often have more to expend on recreation, charities, and provide a larger tax base. Per capita income does not suggest where additional income is spent or where such a population places its priorities, but increasing values do suggest a more stable, healthy economy.

Per capita income is determined by dividing the total income of county residents by the total population of the counties. These values are then normalized to 1993 dollars using the Consumer Price Index to provide a comparable figure over time.

Data Characteristics

SOURCE
This information is from the Florida Statistical Abstract, produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611-7145, or at (352) 392-0171. The Abstract is available at most major libraries. It may be purchased from the Bureau of Economic and Business Research.

Consumer Price Index information also comes from the Florida Statistical Abstract. Calculations are based on 1982-84 = 100.

ACQUISITION
The data are available in hard copy format. The 1996 edition of the Abstract costs $39.95 to purchase.

COLLECTION
This information is based on decennial U.S. Census figures.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The population figures used to calculate per capita income are estimates derived from mathematical analyses based on census data collected every ten years. While some flaws and biases are inherent in the census information due to the data collection process and mathematical analysis, they are not defects that reduce the utility and validity of these figures.

The limitations for normalizing the data to 1993 are those which are inherent to the Consumer Price Index's calculation.

Data Analysis

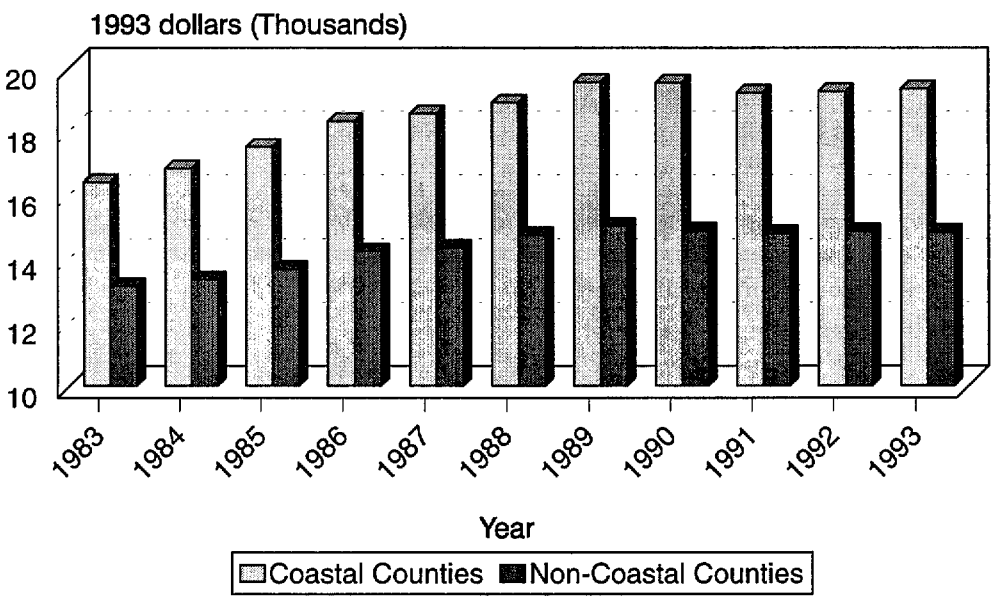
Between 1983 and 1993, the per capita income in coastal counties was consistently higher (twenty to twenty-five percent higher) than the per capita income in non-coastal counties. An explanation for this is that the urban populations consistently receive higher salaries than rural communities. Much of the state's urban population resides within the coastal counties, which subsequently maintain these higher average salaries. This could also be an indication of a higher cost of living and property values in coastal versus non-coastal counties.

The per capita income for both coastal and non-coastal counties has shown a trend of fairly steady increase, but income figures for 1991 through 1993 have not increased at as high a rate. When figures are normalized to 1993 levels, there is actually a decrease in 1991 for coastal counties and in 1991 and 1992 for non-coastal counties.

Per Capita Income in Coastal and Non-Coastal Counties

Per Capita Income	Coastal Annual Average	Non-coastal	CPI	1993 Values Coastal	1993 Values Non-Coastal
1983	$11,298	$9,045	99.6	$16,391	$13,122
1984	12,092	9,586	103.9	16,817	13,331
1985	13,021	10,171	107.6	17,487	13,660
1986	13,880	10,780	109.6	18,300	14,213
1987	14,578	11,268	113.6	18,543	14,333
1988	15,463	12,061	118.3	18,887	14,732
1989	16,761	12,881	124.0	19,532	15,011
1990	17,648	13,449	130.7	19,512	14,869
1991	18,102	13,937	136.2	19,205	14,786
1992	18,681	14,420	140.3	19,240	14,852
1993	19,330	14,834	144.5	19,330	14,834

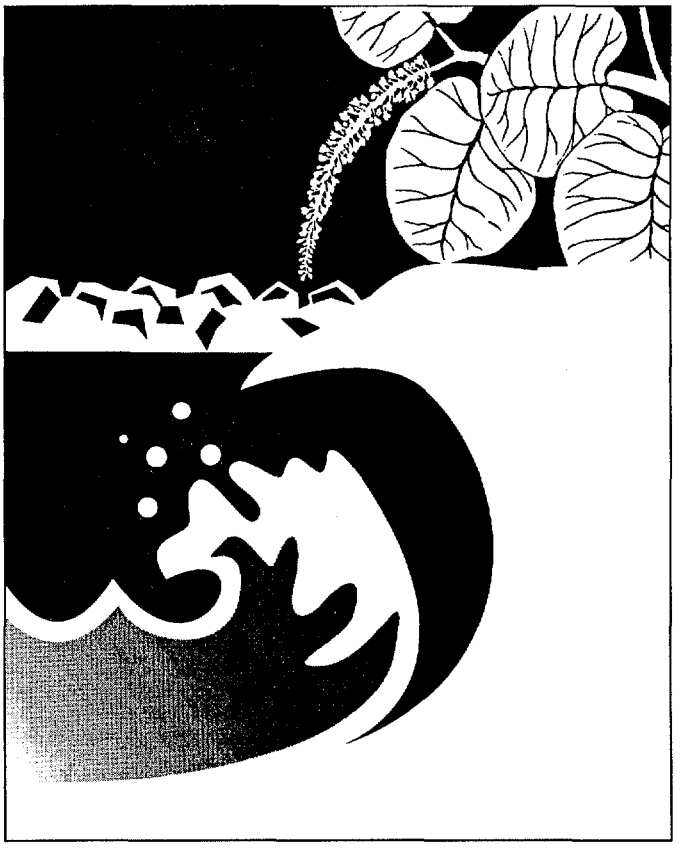
Per Capita Income in Coastal and Non-Coastal Counties



Note: Income axis does not start at zero for reasons of clarity.

Section B

Disruption of Coastal Physical Processes



DISRUPTION OF COASTAL PHYSICAL PROCESSES

Florida's coastline is a dynamic system; together, physical and biological processes form and define the state's unique environment. Barrier islands, common landforms in Florida, serve an integral role in the local and state economy. For example, barrier islands often enclose the productive estuarine ecosystems that anchor the shellfish industry. Barrier islands are also prime destinations for beach visitors and nature enthusiasts. Care must be taken to ensure that Florida's coast retains its beauty and economic value.

The demand for property along the coast is high; residents seek to situate themselves near the beach. The implementation of erosion control mechanisms on the coast can protect structures from adverse effects associated with chronic erosion and severe coastal storms. However, control mechanisms are not benign; they often redistribute erosion elsewhere, requiring a continuing reliance upon the construction, maintenance, and replacement of erosion control devices. One alternative to structural erosion control mechanisms is beach renourishment. Renourishment, though costly, may not have the same negative impacts often associated with control structures like seawalls and jetties. However, renourishment is an iterative process; eroded sand must continually be replenished to maintain the integrity of the beach. Further, sand for renourishment is often dredged from offshore bars. This practice can damage offshore environments. Inlet management plans may prove to be a successful alternative. Instead of introducing sand from outside of the system, inlet management incorporates other mechanisms such as sand bypassing from areas of sand accretion to areas where coastal structures have interfered with the long shore transport and deposition of sand (and caused erosion).

Another technique that has been used to enhance the coastal economy is the implementation of artificial reefs. Originally initiated by the fishing industry, artificial reefs provide habitat for many aquatic species. The materials that are used to create artificial reefs have improved over time; coastal managers seek to optimize the benefits of reefs (i.e., providing habitat) while minimizing associated negative effects like the splintering of reef materials and leaching of unwanted substances into surrounding waters.

This chapter considers (1) the condition of physical processes on Florida's coast and (2) measures that have been taken to either enhance or preserve coastal characteristics. The coast is Florida's greatest asset. Although some physical processes like erosion are controlled, some processes are not well understood at this juncture. For example, the rate of sea level rise is expected to accelerate in the next 100 years. While it is not possible to predict the exact mean sea level a century from now, the implications for the coastal environment should be considered. Recognizing the potential effects of altering coastal physical process today allows for future flexibility and expeditious response to changes that may occur. The following is a list of indicators that are examined in this chapter, and a list of indicators in other chapters that may provide additional information regarding coastal physical processes.

Disruption of Coastal Physical Processes Indicators:

- Miles of eroding coastline
- Undeveloped coastal barrier habitats
- Miles of renourished beaches
- Volume of ocean dredged material disposed of off Florida's coast
- Number of permits for coastal armoring
- Number of permitted artificial reefs

Other Indicators of Interest:

- Coral reef community dynamics (Section D)
- Strategic habitat conservation areas (Section D)
- Existing wetland habitat and conservation lands (Section D)
- Developed and agricultural land along the coast (Section G)

Miles of Eroding Coastline

The process of erosion affects many miles of Florida's coastline. While the erosion and accretion of sand are naturally occurring phenomena, they exist, without disturbance, in a dynamic equilibrium. Construction adjacent to the coastline has accelerated erosion in some areas and caused the accretion and shoaling of sand in others.

Beach erosion endangers public and private property. Many areas in Florida experience significant erosion but are not candidates for restoration because no structures are situated nearby. Alternatively, there are many areas where erosion is less dramatic, but because the threat to surrounding development is high, restoration is desired. Erosion is considered to be a critical problem if it threatens human interests. There are two classifications of erosion: critically eroding beaches are areas where substantial development or recreational interests are threatened; non-critically eroding beaches are areas where the erosion processes, although substantial, do not currently threaten any development, recreational interests, wildlife habitat, or important cultural resources.

Data Characteristics

SOURCE

The information can be obtained from Mr. Ralph R. Clark, who compiled a report entitled *A Statewide Inventory and Identification of the Beach Erosion Problem Areas in Florida.* Mr. Clark can be reached at the Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000, or at (850) 487-4469 extension 174. Beach profile data may be found on the internet. The website is **http:\\www.bcs.tlh.fl.us**. The bureau intends to add erosion length information to the website by December 1997.

ACQUISITION

Erosion length and some rate information is available. Interested parties must pay for reproduction costs pursuant to state law.

COLLECTION

Data regarding the length of erosion from 1989 to 1993 were published in the aforementioned report. Erosion length information is expected to be available on the internet by the end of 1997. Beach profile data are available on the internet from 1971 to 1997. Shoreline surveys are available on the internet from the mid 1800s to the present.

TECHNICAL

Hierarchy of Indicator: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

While the quality of erosion rate data is very high due to on-site visits, aerial photography, and remote sensing, the cause and effect relationship of erosion may be less clearly defined. Erosion rates are indicative of not just one natural phenomenon, but are an effect of many different processes. Care must be taken to consider the influence of single severe storm events on erosion rates. Annual analyses may not be as insightful as studies of longer time periods.

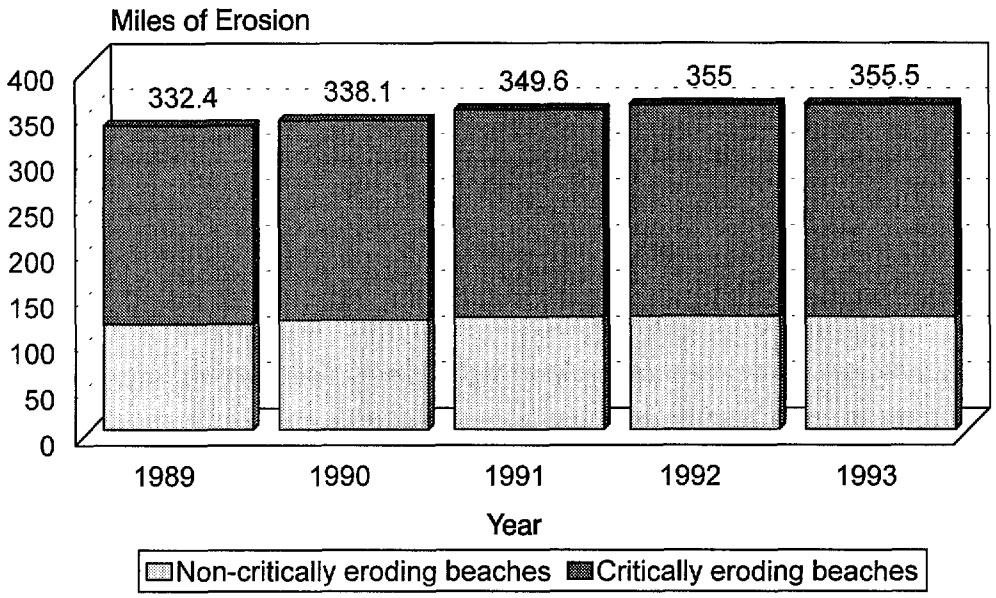
Data Analysis

Between 1989 and 1993, the amount of eroding shoreline increased from 332 to 356 miles. This represents an increase of nearly 7 percent in five years. Erosion increases are apparent in both critically and non-critically eroding beaches. Critically eroding areas increased from 218 to 233 miles, and non-critically eroding areas grew from 115 to 123 miles.

Miles of Eroding Beaches

	1989	1990	1991	1992	1993
Miles of non-critically eroding beaches	114.8	119.3	122.1	123.1	122.6
Miles of critically eroding beaches	217.6	218.8	227.5	231.9	232.9
Total	332.4	338.1	349.6	355.0	355.5

Miles of Eroding Beaches



Undeveloped Coastal Barrier Habitats

Coastal upland habitats are unique because of the influence of coastal processes such as erosion, deposition, longshore drift, salt spray, storms, and long shore drift. In addition to the familiar beach dune habitat, one may find hardwood forests, sand pine scrub forests, grasslands, interdune swales (marshes), and, in the Florida Keys, rockland hammocks. The specially adapted plants stabilize the dry, sandy soils found along the coast, protecting inland areas from the effects of coastal processes. These plants depend on the animals which live among them to help maintain the natural balance. In fact, species which naturally inhabit the coast have evolved together to easily recover from catastrophes such as hurricanes.

Development for residential and resort use is the greatest threat to these habitats due to their prime scenic locations. Although low-lying shoreline habitats are protected by regulation, most of the other habitats may be developed. Most of the other major threats to these habitats are associated with development. Foot traffic and visitor overuse, off-road vehicle traffic, and plant and artifact collection disrupt these habitats by harming vegetation which stabilizes the sandy soil and retains water which otherwise easily drains away from the surface. Maintaining natural sand sources requires large areas of shoreline and river systems to retain their natural characteristics.

The coastal environment is complicated because the same management practices or natural disturbances can have vastly different effects depending on the type of natural community. For example, fire and coastal storms can serve an integral role in the maintenance of and productivity of sand pine forests. However, fire can destroy an oak hammock (areas of low, closed canopy forest) and it may be replaced by another type of plant community such as sand pine scrub. Forest management is not only complicated by concerns about nearby residences and other development, but also by the varied effects it can have on the landscape.

Agricultural use of the coast can destroy or help maintain natural communities, again depending on the type of natural community. Certain timber cutting practices, when combined with planting sand pines, can lead to regeneration of fairly natural sand pine forests. Yet agriculture is often associated with draining natural wetlands and planting monoculture crops, which may not provide useful habitat. Thus, when making judgments about appropriate land uses and management practices, coastal ecosystems require a very detailed assessment.

The amount of coastal upland habitat remaining thus indicates the amount of coastline where natural coastal processes are undisturbed as well as undeveloped. The indicator most directly reflects the ecological value of remaining habitat and the scenic and recreational benefits associated with those habitats, but because the coastal region provides such important protection to inland areas from coastal processes, it also reflects economic value of storm protection as well.

Land surveyed for this indicator includes both barrier islands and high-energy shoreline (typically sandy beaches) in areas without barrier islands. In the case of barrier islands, the entire landscape was surveyed. In the case of mainland coastline, the 1989-92 survey includes land on the first coastal terrace (subject to frequent salt spray influence), often using a road boundary.

Data Characteristics

SOURCE

Land conditions on barrier islands were surveyed by the U.S. Geological Survey using aerial photography data from two time periods, 1945-55 and 1972-75. Data are analyzed in Harry F. Lins, Jr., *Patterns and Trends of Land Use and Land Cover on Atlantic and Gulf Coast Barrier Islands,* U.S. Geological Survey Professional Paper 1156, 1980.

Current information on the status of coastal upland lands is maintained by the Florida Natural Areas Inventory. Data from an intensive survey of coastal upland habitat is presented in: Ann F. Johnson and James W. Muller, *An Assessment of Florida's Remaining Coastal Upland Natural Communities: Final Summary Report,* March 1993.

For further information, contact Barbara Lenczewski (850-224-8207) at Florida Natural Areas Inventory, 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida, 32303.

ACQUISITION
Current information is available in hard copy and electronic format from the Florida Natural Areas Inventory, with the price (if any) determined by the nature of the specific data request. The data used in this indicator was provided at no cost in hardcopy. The U.S. Geological Survey report is available from the Florida State University library.

COLLECTION
This data was collected during an intensive statewide survey in 1989-1992. Although future statewide surveys depend on grant funding, the Florida Natural Areas Inventory (FNAI) maintains its database of public and private lands which includes this data; the database is updated to reflect known changes in the ownership and development status of the land. Thus, a reasonable approximation of this data can be extracted from their database on request when FNAI resources permit.

TECHNICAL
Hierarchy of Indicator: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations
The U.S. Geological Survey data includes only barrier islands and excludes mainland coastal habitat and the Florida Keys. Its land cover data can not be readily translated into habitat determinations. For instance, forest cover may indicate natural communities or single species pine plantations. Barren land may represent natural communities or cleared land.

The Florida Natural Areas Inventory data includes nearly all upland coastal habitats. However, it excludes coastal wetland habitats (with the exception of interdune swales) and open water. In some areas of mainland coastal areas the entire coastal habitat may not have been included due to use of a road boundary.

Data Analysis
Long term analysis of the loss of coastal habitat is complicated by changing definitions, methods and technologies available to scientists. Mapping coverage by the two data sources differs, although not so much that the results cannot be compared. The FNAI database is greater; in addition to barrier islands, the Florida Keys and certain areas of mainland coastal areas with coastal upland communities are included.

Both the FNAI and USGS mapping criteria eliminate small parcels. The FNAI database typically considers only parcels with areas greater than 20 acres, although exceptions are made for certain types of habitat where smaller parcels may be considered valuable. The USGS maps exclude all linear features which are not at least 660 feet wide and consider a residential or commercial area only if it covers at least 10 acres.

Land Cover of Barrier Islands (1945-55, 1972-75)

Years	Forest	Open	Natural Upland Subtotal	Developed	Agricultural/ range	Wetland/ water	Total
1945-55	69,505	52,835	122,340	32,007	3,650	356,908	514,905
1972-75	56,001	38,687	94,688	101,988	3,697	318,560	518,933

Consolidated from USGS data.

The earlier U.S. Geological Survey (USGS) data used photographs of lesser optical quality without planimetric control, leading to inaccuracies which are not present in the 1972-75 photographic data set. Both USGS surveys estimate acreage of land cover, rather than estimating the acreage of natural communities present, the practice used in the Florida Natural Areas Inventory (FNAI) database.

The USGS data includes estimates of developed and wetland acreage, which helps illustrate trends in development between 1945-55 and 1972-75. The USGS study concluded that urban or built-up land increases on the Florida Atlantic were probably due to conversion from forest land (18,000 acres lost), wetlands (14,000 acres

lost), and open land (10,000 acres lost). Development along the Florida Gulf coast was probably at the expense of wetlands (23,000 acres lost) and open land (4,000 acres lost).

Remaining Coastal Upland Natural Communities (1989-92)

	Forest	Open	Total
Public ownership	36,991	33,879	70,161
Private ownership	9,425	8,625	18,759
Total	46,416	42,503	88,920

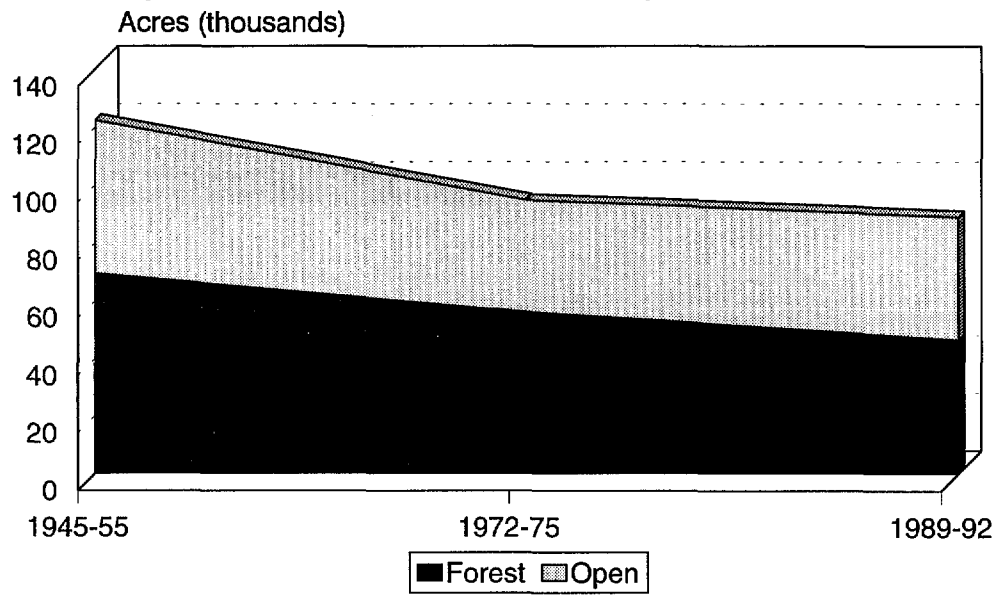
Note: Forest includes maritime hammock, mesic flatwood, sand pine scrub, tropical hammock, rockland hammock, xeric hammock, and coastal berm communities. Open includes beach dune, coastal grassland, coastal strand, all other scrub, coastal interdunal swale, and coastal rock barren communities.

Since no reliable pre-development maps are available indicating the natural communities covering barrier islands and other coastal areas, current estimates of lost coastal habitat are uncertain, but it is certain that vast areas of coastal uplands and wetlands have been developed. Between 1945-55 and 1972-75, the USGS estimated that about 18,000 acres of forest and 10,000 acres of open land were lost to development on the Florida Atlantic. On the Gulf side, USGS estimated about 4,000 acres of open land lost to development. By comparing the 1989-92 survey to the 1945-55 survey, one can estimate that a *minimum* of 35,000 acres of coastal upland habitats have been lost to development. The true number may be twice as high, considering that the 1989-92 survey covers a greater area of the coast, the likelihood that pre-1945 development on barrier islands was likely concentrated in upland areas, and the constantly changing shape and area of sandy coastlines.

Based on the available data sources, it is even more difficult to estimate the loss of coastal wetland habitats to development. Between 1945-55 and 1972-75, the USGS estimated that 14,000 acres of wetlands on the Florida Atlantic and 23,000 acres on the Gulf were lost to development. The 1989-92 study did not assess most wetland habitats, so it is not known what the current amount of remaining wetlands are present in these coastal areas.

Since most remaining coastal upland natural communities are in public hands, it could be assumed that relatively little further development will occur on large, undeveloped tracts of land. However, of the 70,000 acres of publicly owned land, about 21,000 acres are on military bases and are thus subject to partial development.

Coastal Upland Natural Communities (estimated land cover)



References

Florida Natural Areas Inventory and Department of Natural Resources, *Guide to the Natural Communities of Florida*, February 1990.

Huck, R.B., "Management of Natural Communities of Choctawhatchee Sand Pine [*Pinus clausa* (Engelm.) Sarg. var. *immuginata* Ward] in the Florida Panhandle," *Resource Management Notes*, Vol. 8, No. 2, Florida Park Service, Florida Department of Environmental Protection, Tallahassee, Florida, Winter 1996/97.

Kruer, Curtis R., *An Assessment of Florida's Remaining Coastal Upland Natural Communities: Florida Keys,* Florida Natural Areas Inventory, April 1992.

Lins, Harry F., Jr., *Patterns and Trends of Land Use and Land Cover on Atlantic and Gulf Coast Barrier Islands,* U.S. Geological Survey Professional Paper 1156, 1980.

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Johnson, Ann F., James W. Muller, and Kelly A. Bettinger, *An Assessment of Florida's Remaining Coastal Upland Natural Communities: Panhandle,* Florida Natural Areas Inventory, August 1992.

Johnson, Ann F., James W. Muller, and Kelly A. Bettinger, *An Assessment of Florida's Remaining Coastal Upland Natural Communities: Southeast Florida,* Florida Natural Areas Inventory, April 1993.

Miles of Renourished Beaches

Florida is famous for its beautiful beaches. Their beauty is an integral component of the state's lucrative tourism industry. Many of the most frequented beaches, such as the stretch from West Palm Beach southward to Key Biscayne, are threatened by erosion. Beach restoration and renourishment are management techniques that maintain Florida's lavish beaches and also protect coastal structures from storm events. Restoration is the initial placement of sand on an eroded beach; renourishment is the periodic replacement of sand after subsequent erosion. Restoration and renourishment provide a protective barrier and a means of retaining the economic value of beaches.

Beach renourishment provides enhanced recreation and protection of coastal structures. Beach renourishment can significantly reduce damage to structures by increasing their distance from the shoreline and providing a buffer to dissipate wave energy. Beach renourishment, other than for strictly recreational values, is mostly undertaken when critical erosion has progressed to the point of imminently endangering property and/or significantly reducing the economic value of the beach. The amount of renourishment activity may indicate (1) the degree of erosion occurring along Florida's coastline, and (2) the relative preference of renourishment as compared to other management methods (e.g., seawalls).

Beach renourishment is not, however, an entirely benign solution. Sand for renourishment is often dredged from offshore bars that are out of the immediate coastal system; this can negatively affect the offshore environment. Further, beach renourishment provides merely a temporary cure. As sand is eroded, beaches must continually be replenished. Inlet management plans may prove to be a successful alternative. Instead of introducing sand from outside of the system, inlet management incorporates other mechanisms such as sand bypassing from areas of accretion to areas of erosion (where coastal structures have interfered with the long shore transport of sand).

Since the beginning of the Beach Erosion Control Program in 1964, the Florida Legislature has appropriated $197,859,259 for beach preservation and erosion control. These funds are matched by local government and federal dollars. Over $60,000,000 have been appropriated for beach restoration projects, and over $40,000,000 have been appropriated for beach renourishment projects. In addition, $31,800,000 were appropriated for Hurricane Opal recovery. Some of these dollars were used for beach restoration, however, they are not included in the beach restoration total.

Data Characteristics

SOURCE
The information can be obtained from Paden Woodruff, who can be reached at the Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000, or at (850) 487-1262 extension 103.

ACQUISITION
State law requires that all reproduction costs be covered.

COLLECTION
Data for renourishment for all of Florida from 1989 to 1993 were included in a report entitled *Status of Comprehensive Beach Management Planning.* Updated data may be obtained from the Bureau of Beaches and Coastal Systems.

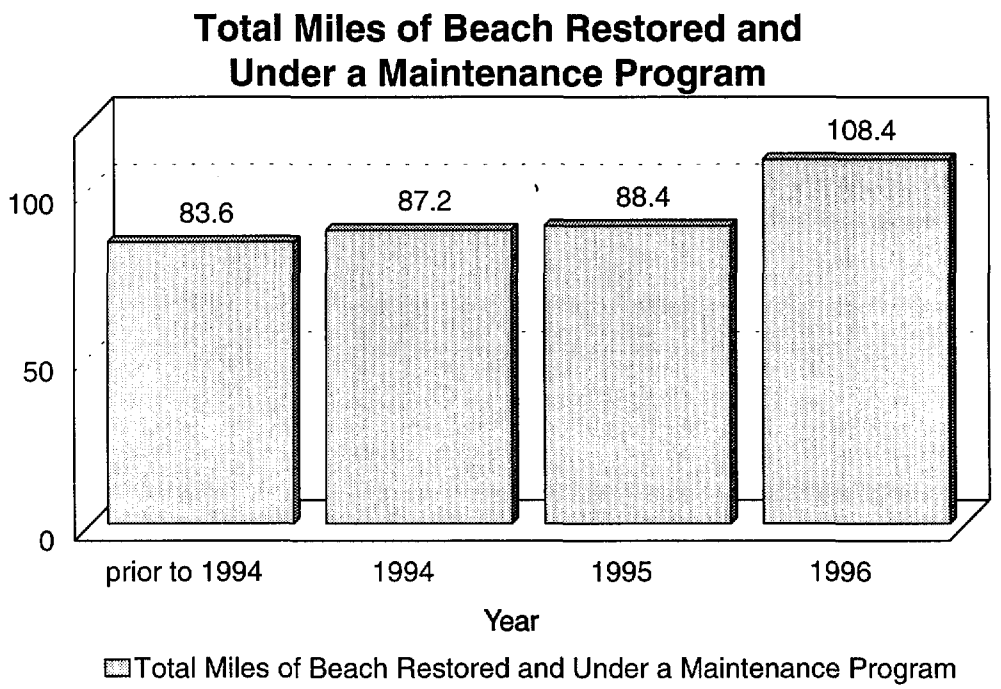
TECHNICAL
Hierarchy of Indicator: 2
Pressure/State/Response: Response
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Beach renourishment is only one method used to protect the coastline. Examples of other methods include the construction of breakwaters and jetties.

Data Analysis

Prior to 1994, 83.6 miles of beaches were restored and are undergo periodic maintenance. Another 24.8 miles were added between 1994 to 1996. A total of 108.4 miles of beach have been restored and are under a maintenance program.



Volume of Ocean Dredged Material Disposed of Off Florida's Coast

Eight permanent ocean dredged material sites are designated off Florida's coast. Specifically, dredged material sites are found at the following locations: (1) Fernandina Beach, (2) Jacksonville, (3) Canaveral, (4) Ft. Pierce, (5) Miami, (6) Tampa, (7) Pensacola, and (8) Pensacola Inshore. These areas have been set aside as receptor sites for dredged material from channel dredge projects. Additional sites were formerly labeled "interim-designated" or "interim approved," pending approval from the U.S. Environmental Protection Agency (EPA). The Water Resources Development Act of 1992 stipulated that only permanent sites can be used for disposal of ocean dredged material as of January 1, 1997. Prior to any new or previously interim site being used, an environmental impact statement and public review must be completed by EPA.

In some cases, dredge materials can be used to renourish Florida's beaches. For example, beach quality sand is the only dredged material that may be disposed of at the Pensacola Inshore site.

Data Characteristics

SOURCE

The volume of disposed material is monitored by the U.S. Army Corps of Engineers and the disposal sites are designed by EPA. Information on disposal sites may be obtained from Chris McArthur at EPA Region IV, Coastal and Water Quality Branch, 61 Forsyth St., SW, Atlanta, Georgia 30303, or at (404) 562-9391. The contacts at the Army Corps of Engineers are Mark Wolff, Jacksonville District, P.O. Box 4970, CESAJ-CO-ON, Jacksonville, Florida 32232-0019, or at (904) 791-1131 and Susan Rees, Mobile District, Post Office Box 2288, PD-EC, Mobile, Alabama 36628-0001, or at (205) 690-2724.

ACQUISITION

The volume of material which is disposed of in designated sites is monitored during dredging projects, and data are available upon completion of each particular project. Data on the amount of disposed material can be obtained at no cost from the Army Corps of Engineers after particular post-construction surveys are completed.

COLLECTION

Information on the amount of disposed material is available after each post-construction survey or can be collected annually for each of the disposal sites.

TECHNICAL

Hierarchy of Indicator: 3
Pressure/State/Response: Pressure
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Data are only available regarding the volume of material disposed; data are not available regarding the total acreage of submerged lands affected. The quality and accessibility of the data for each site vary considerably; data are approximations.

Data Analysis

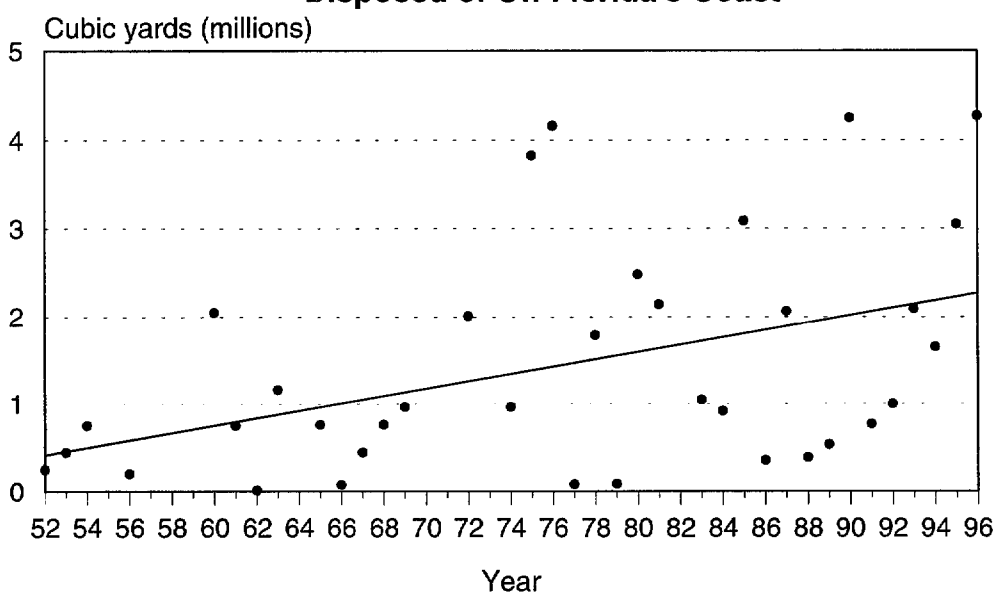
Disposal volumes range from a low of 247,000 cubic yards in 1952 to a high of 4,269,000 cubic yards in 1990.

Volume of Ocean Dredged Material Disposed of Off Florida's Coast*

Year	Volume (Millions of Cubic Yards)	Year	Volume (Millions of Cubic Yards)	Year	Volume (Millions of Cubic Yards)
1952	0.247	**1969**	0.962	**1985***	3.084
1953	0.444	**1972***	2.007	**1986**	0.352
1954	0.749	**1974**	0.962	**1987**	2.064
1956	0.198	**1975**	3.826	**1988**	0.385
1960	2.047	**1976**	4.159	**1989**	0.533
1961	0.747	**1977**	0.078	**1990***	4.247
1962	0.012	**1978**	1.786	**1991**	0.767
1963	1.158	**1979**	0.084	**1992**	0.997
1965	0.758	**1980**	2.480	**1993**	2.089
1966	0.074	**1981***	2.142	**1994**	1.652
1967	0.442	**1983**	1.044	**1995**	3.047
1968	0.760	**1984**	0.917	**1996**	4.269

* 1981 includes data from the two previous years.
1972, 1985, & 1990 include data from the previous year.

Volume of Ocean Dredged Material Disposed of Off Florida's Coast*



Number of Permits for Coastal Armoring

Armoring refers to coastal protection measures such as seawalls, bulkheads, and other similar structures. These structures are designed to prevent erosion in a defined area and protect against coastal storms. The effectiveness of armoring of the coastline is fair; armoring protects certain locations, however, may have adverse effects in others.

Armoring can negatively affect adjacent property. Seawalls and other armoring structures are not able to absorb the energy of waves and currents as well as unaltered coastline. Wave energy may be deflected to either side of the structure or to the shoreline in front of the structure; this may accelerate erosion in these areas. Owners of adjacent property often erect armoring structures to ameliorate the additional wave energy. The cycle continues, transforming the natural coastline to one riddled with armoring structures.

Data Characteristics

SOURCE
Data are available from the Bureau of Beaches and Coastal Systems within Florida's Department of Environmental Protection. The information is not easily accessed because of the immense size and design of the database. The Bureau of Beaches and Coastal Systems plans to make the data available on the internet in the near future. The bureau may be reached at (850)488-3181.

ACQUISITION
The information is available at no cost.

COLLECTION
Data are collected by the Bureau of Beaches and Coastal Systems. All armoring structures must obtain a permit from the Department of Environmental Protection; they compile the data in a central database.

TECHNICAL
Data Accessibility: Data are available, but not usable in the current format.

Data Limitations

The number of permits issued for coastal armoring indicates the degree to which counties rely upon armoring structures for the protection of property. This indicator presents the number of permits issued, however, the data do not necessarily indicate the construction of the structure. The number of permits does not directly indicate the amount of armoring.

Number of Permitted Artificial Reefs

Artificial reefs provide a concentrated habitat for a vast number of species attracted to underwater formations. In most cases, the placement of these structures was initiated by the sport fishing industry to bolster fish populations. Changes in the materials used for artificial reefs reflect an improved understanding of their affects in marine environments. Whereas old refrigerators and discarded tires where formerly used, decommissioned vessels and bridge rubble have become favored in recent years. There is currently a movement to allow only prefabricated concrete structures to be used as reefs to prevent some of the problems (e.g., pollution, floating debris, or movement of the reef) associated with other commonly used materials.

Data Characteristics

SOURCE

Data for artificial reefs in Florida through 1991 can be obtained from Florida Sea Grant College, Building 803, University of Florida, Gainesville, Florida 32611, or at (352) 392-5870. Don Pybas compiles and publishes the *Atlas of Artificial Reefs in Florida*; this document lists all new artificial reefs in Florida by year. Currently in its fifth edition, the atlas is updated in five-year intervals. An updated version will be available by December 1997.

ACQUISITION

Data are collected by the Florida Department of Environmental Protection (DEP), Office of Fisheries and Management, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000, or at (850) 922-4340. Data are compiled in a periodic report that is published by Florida Sea Grant College, Building 803, University of Florida, Gainesville, Florida 32611, or at (352) 392-5870. The report is entitled *Atlas of Artificial Reefs in Florida*; it may be purchased for $10.

COLLECTION

The data are updated and tabulated for each county in five-year intervals.

TECHNICAL

Data Accessibility: Data are manually connected and are accessible.

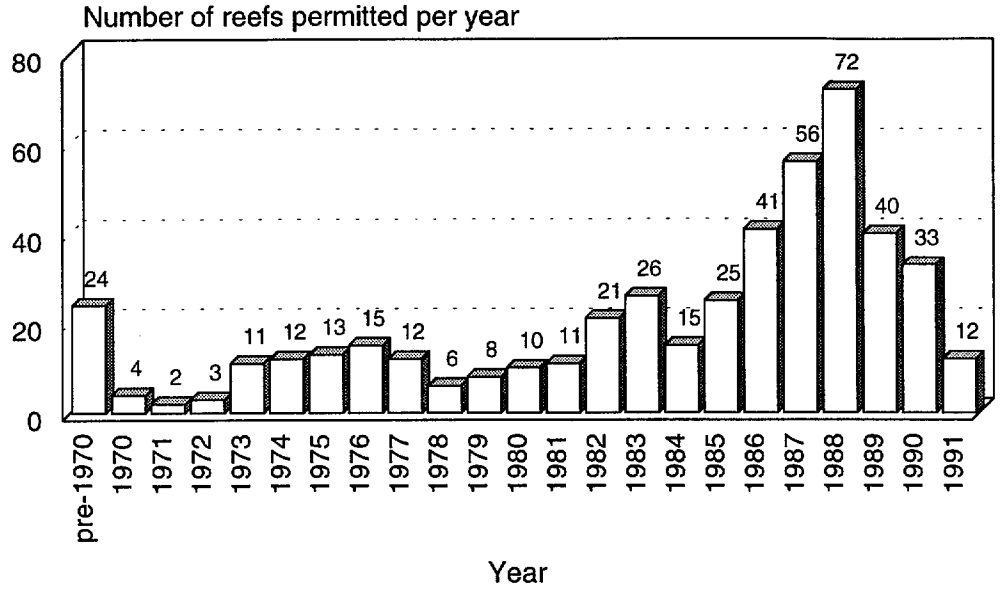
Data Limitations

There are several limitations to these data. The compiled data represent only those artificial reefs actually permitted. The data do not include any reefs which may have been constructed without a permit from DEP, or those reefs that were permitted but never constructed. Thus, the actual number of artificial reefs is unknown and is probably considerably larger than the reported number of reefs. While the data are available every five years, they are not readily available for intermediate years. Those data may be obtained only from the respective counties permitting the reefs.

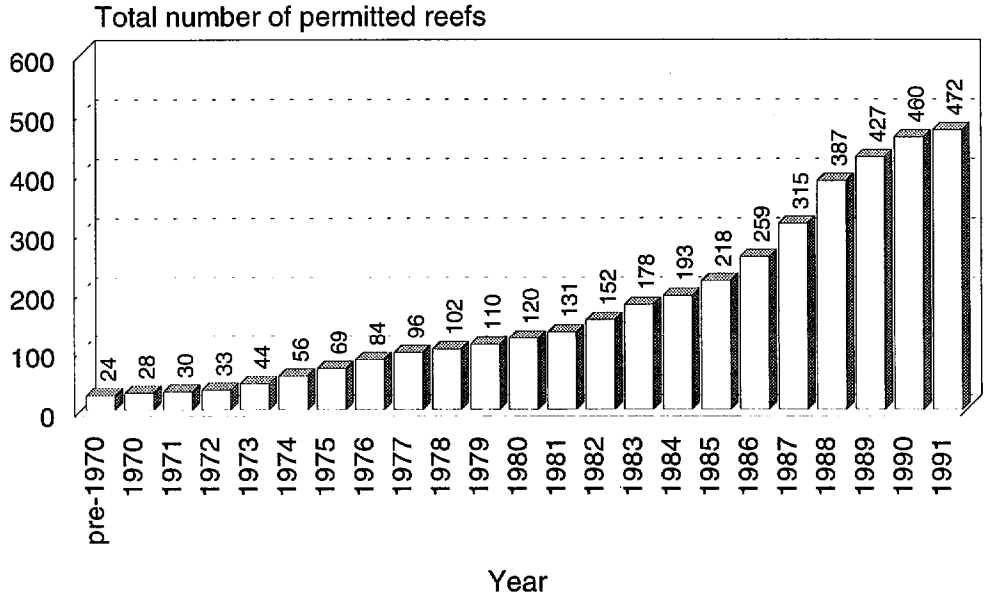
Data Analysis

The data show a generally upward trend in the number of permitted reefs from 1971 to 1991. Prior to 1971 there existed only 19 known sites. From 1978 to 1988 a substantial increase, from 6 to 72 permitted reefs, was recorded. A significant drop in the numbers of permits occurred from 1988 through 1991; during these years the number of newly-constructed reefs dropped from 72 to 12. The decrease in permits can be explained by the U.S. Army Corps of Engineers' enforcement of a liability insurance requirement of $1,000,000 per reef. This, in effect, made it impossible for the private sector to continue to sponsor the construction of reefs. Since 1989 all reefs have been constructed by local governments.

Number of Permitted Artificial Reefs Constructed in Florida per Year

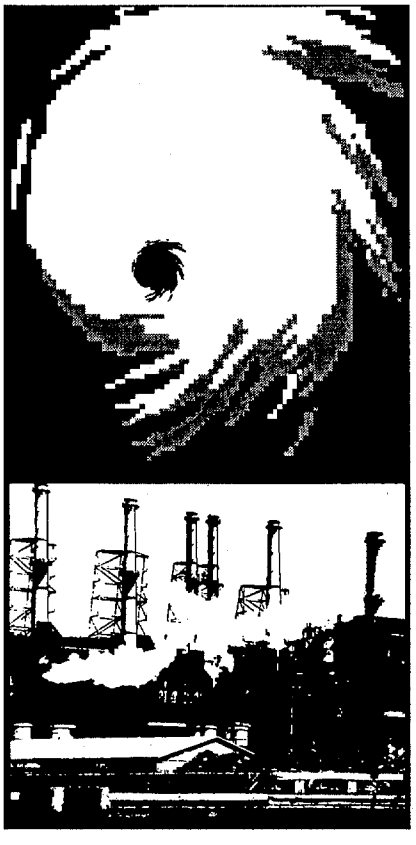


Total Number of Permitted Artificial Reefs in Florida



Section C

Responding to Coastal Threats and Hazards



Responding to Coastal Threats and Hazards

Hurricane Andrew cost an estimated $30 billion dollars in insured and uninsured losses, devastating the environment, entire communities, and the insurance industry (DCA, 1995). Many families were left homeless and many insurers were left bankrupt. The aftermath of Hurricane Andrew has brought to the forefront issues of hazard mitigation and preparation, populations at risk along Florida's coast, risk sharing, and personal responsibility.

Over three-quarters of Florida's population live in coastal counties. The population is a mixture of those who have experienced first hand the threat of coastal storms and those who have no experience in preparation and evacuation in case of such weather. Furthermore, because of the large concentrated population in these areas it is important to monitor both natural and human-caused coastal threats and hazards as well as the level of preparation being conducted by government and citizens to reduce the potential harm to the population at risk.

The indicators in this issue area all deal in some way with how Floridians respond to threats and hazards, either natural or human-induced, that affect coastal counties. Natural events include tropical storms, hurricanes, and other natural phenomena that lead to flooding and/or high winds. Human-induced events include oil and hazardous material spills, and shipping accidents. The following list identifies the indicators that are examined in this chapter.

Coastal Threats and Hazards Indicators:

- Change in storm evacuation clearance times
- Insured value of property in coastal hazard areas
- Number of residents with hurricane experience
- Population at risk to hurricane-induced flooding
- Reported oil/hazardous material spills
- Population in proximity to nuclear power plants

Other Indicators of Interest:

- Population growth within ten miles of the coast (Section A)
- Beach closings and advisories (Section D)

References

Department of Community Affairs (DCA). 1995. "National Hurricane Program, State of Florida." October 1, 1994. September 30, 1995.

Change in Storm Evacuation Clearance Times

Prior to the landfall of a hurricane, evacuation orders are given to residents determined to be at risk of death or injury from storm surge flooding and high winds. The affected population is determined by a variety of factors including hurricane characteristics, the size of the population needed to be moved to safety, risk attributes associated with residential location, evacuation routes, and shelter access. Evacuation clearance time is determined by the number of residents to be evacuated, the expected behavior of those residents, roadway network characteristics, and hurricane shelter availability. Because of the high regional clearance times statewide, it is difficult to issue evacuation orders that will completely clear the area prior to the arrival of gale force winds.

As evacuation times rise, the coastal population is at greater risk of death or injury during hurricanes. By not directing population or public expenditures away from coastal high hazard areas, the coastal population grows and exasperates the problem of evacuation. Populations within the category 1 hurricane evacuation/surge zone (sustained winds of 74 to 95 miles per hour) face a greater risk than those outside of this zone due to their immediate vulnerability to storm surge flooding. The number of people within this zone is already significant, and continued growth increases the population at risk. With longer evacuation times, either fewer people can be evacuated within a certain time frame or the evacuation order must be given earlier. When evacuation orders are given early and a hurricane does not make landfall, the public may become skeptical of the validity of the orders, which may affect the response during the next order. If the orders are not given earlier, fewer people can evacuate thus placing a greater number of people at risk. Evacuation time is critical to the safety of the public and serves to indicate the potential for hazardous situations. *Regional Hurricane Evacuation Study: Technical Data Reports* indicate that many of the state's coastal urban areas have long evacuation clearance times. This may be a problem; however, no consistent information is available to show how these evacuation clearance times are changing from year to year.

The *Technical Data Reports* contain several different analyses that are necessary to determine clearance times. The hazards analysis discusses and provides data on the potential threat from hurricanes. From this, the vulnerability analysis determines the populations and facilities at risk. The behavioral analysis assesses how the population reacts and where they will go with the approach of a hurricane and the issuance of an evacuation order. The shelter analysis compares shelter inventory, capacity, and demand. The transportation analysis combines all these analyses with an assessment of the evacuation roadway capacities to determine the amount of time necessary for the population to clear the area.

As can be seen, the overall complexity of such an analysis, involving different factors and population sizes for each area, makes it difficult to establish an overall goal that all areas can adhere to. Presently, there is no specific criteria or threshold by which evacuation clearance times are measured. In accordance with Rule 9J-5.012(2)(e) of the Florida Administrative Code, all coastal cities and counties have been given the objective to "maintain or reduce" hurricane evacuation times.

The data presented here are a compilation from regional evacuation studies and *Technical Data Reports* undertaken between 1986 and 1995. Population figures and clearance times are based on storm surge areas. A storm surge area may be defined as the area that would be impacted by wind driven water. Vulnerability will be a culmination of the size of the population, the number of structures, their ability to withstand hazardous weather, the time necessary to evacuate, and the presence of shelter. In addition, a critical factor is how informed and knowledgeable people in coastal locations are of the potential dangers associated with an approaching storm. This indicator presents the available clearance times for each coastal county for each category of storm. The preparation of future technical reports will allow for analysis of the percent or hourly change in evacuation clearance times.

Data Characteristics

SOURCE

The *Hurricane Evacuation Study: Technical Data Reports* are available from each county emergency management office. The studies were either conducted by the RPCs or by the Army Corps of Engineers (ACOE) as a contractor. In addition, Chapter 9J-5, section 102(2)e.1 of the Florida Administrative Code requires local governments to inventory and analyze evacuation times in their comprehensive plans. A summary of the key data from the reports, the clearance time, vulnerable population, shelter capacity, shelter demand, and shelter status, has been developed by the Hurricane Preparedness Section of the Department of Community Affairs/Division of Emergency Management.

ACQUISITION

A summary of clearance times is available from Ms. Wendy Stewart, Staff Assistant, Florida DCA/DEM, 2555 Shumard Oak Boulevard, Tallahassee, Florida, 32399-2100, or at (850) 413-9944.

COLLECTION

The data have been collected and modeled at varying time periods for all Florida counties.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Studies are rendered when funding is made available through local or state government, FEMA, the Corps of Engineers, or other sources. Consequently, studies are completed at different time interval across all counties; this limits trend analysis as well as inter-county comparisons. In addition the methodology and assumptions, although generally consistent, do vary depending on when the study was conducted and by whom the study was conducted. The primary variables include surge inundation areas, population data, storm scenarios, evacuation areas, behavioral characteristics of evacuating populations, and roadway network and traffic control data. Each variable contains many sub-variables, many of which are dependent upon assumptions that have not been universally agreed upon. Moreover, the definition and determination of clearance time is not consistent across all reports.

Data Analysis

No historical trends can be established since there is only one set of clearance times for coastal counties currently available. Additionally, as described in the data limitations section, many of the variables used to calculate evacuation clearance times were determined in different years using various methodologies. Overall, clearance times were higher for more populated southern counties due to limited options being available regarding the direction of evacuation and the long distances necessary to get out of harm's way. For a Category 1 hurricane, the clearance time was the lowest for Charlotte County and the highest for Dade County, both counties in the south. For a Category 2 hurricane, the lowest clearance time was 9 hours, predominately for northern counties in the state. The highest clearance times were for Dade County (18) and Collier (17) and Monroe (17) in the southern part of the state. For a Category 3 hurricane, the highest clearance times remain in the south in Monroe (40) and Lee (24) Counties. For Category 4 and 5 storms, clearance times were higher overall in southern counties. Evacuations will occur among several counties in a region. Subsequently, multi-county clearance times may be beneficial to look at in addition to single county times.

Clearance Times for Each Category of Storm by Coastal County

County	Category 1 Storm	Category 2 Storm	Category 3 Storm	Category 4 Storm	Category 5 Storm
Bay	11	11	11	12	12
Escambia	16	16	16	19	19
Okaloosa	16	16	16	19	19
Santa Rosa	10	10	10	12	12
Walton	13	13	13	14	14
Franklin	10	10	10	10	10
Gulf	9	9	9	9	9
Jefferson	9	9	9	9	9
Wakulla	11	11	11	11	11
Dixie	9	9	9	9	9
Taylor	9	9	9	9	9
Citrus	11	14	15	15	15
Hernando	13	13	13	18	18
Levy	9	9	9	9	9
Duval	9	9	11	14	14
Flagler	9	9	9	9	9
Nassau	9	9	10	10	10
St. Johns	9	9	11	11	11
Brevard	11	11	13	13	13
Volusia	9	9	9	9	9
Hillsborough	10	13	13	14	17
Manatee	9	10	11	11	11
Pasco	10	10	11	13	13
Pinellas	10	13	13	14	17
Charlotte	3	11	15	15	15
Collier	11	17	20	20	20
Lee	8	10	24	27	27
Sarasota	12	12	12	12	12
Indian River	9	9	12	12	12
Martin	10	10	15	19	19
Palm Beach	12	12	13	16	16
St. Lucie	9	9	10	10	10
Broward	13	13	18	21	21
Dade	18	18	18	18	18
Monroe	17	17	40	40	40

Recommendations

Because local governments are required to update their comprehensive plan every five years, which necessitates the calculation of updated evacuation times, the regional planning councils should establish a consistent procedure for updating the *Technical Data Reports*. Currently, there is no regular schedule for updating the *Technical Data Reports*; instead the RPCs or the ACOE has been updating the reports as funding becomes available and as time permits. The Florida Coastal Management Program and the RPCs should work together to establish a regular funding mechanism for these studies.

Insured Value of Property in Coastal Hazard Areas

The size of the population in coastal high hazard areas is a good indicator of a potential risk to human health. Additionally, the insured value of property in coastal hazard areas is also an indicator of risk to property. Homeowners insure their property for many reasons including the threat of damage from hurricanes and coastal storms. Recent hurricane events demonstrate that insured losses can be significant and create a tremendous burden for homeowners, private insurers, and local, state, and federal governments. As insured value of property in coastal hazard areas rises, the state is faced with increasing responsibility for the fiscal impacts caused by harsh weather. For example, Florida has numerous mobile homes in the coastal areas, all of which are extremely susceptible to the effects of hurricane force winds. Mobile homes are just one example of vulnerable properties whose density and construction need to be controlled in high hazard areas. Historically, definitions of what constitutes the coastal high hazard area have varied. The Florida Administrative Code (see 9J-5.003(19)) currently defines the coastal high hazard area as the evacuation zone for a category 1 hurricane as established in the regional hurricane evacuation study applicable to the local government.

There are two readily available sources of information on insured coastal properties: the National Flood Insurance Program and the Florida Hurricane Catastrophe Fund.

The Federal Emergency Management Act's Federal Insurance Administration administers the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to residents of communities that adopt and enforce floodplain management ordinances which represent sound land use practices. One of the goals of the NFIP is to reduce the buildup in hazardous areas, thereby reducing the risk to life and property. A flood policy is needed because homeowners' policies do not cover flooding. For flood insurance to be made available in a community, the community agrees to require permits for development in flood hazard areas and to ensure that proper materials and methods are used in new construction.

Hurricane Andrew cost an estimated $30 billion dollars in insured and uninsured losses (DCA, 1995). Since then, many insurers have been unwilling or unable to provide insurance to Florida residents and commercial residential owners. Florida Statute 215.555 (1993 Special Session) established the Florida Hurricane Catastrophe Fund (FHCF) to provide additional residential insurance capacity to protect insurer solvency and to reduce catastrophic exposure. The FHCF helps to make insurance available to residential property owners by sharing the risk and providing reimbursement to insurers for a portion of their potential hurricane and windstorm-related losses. The FHCF is different from the NFIP in that it does not directly insure anyone for a specific type of loss. The FHCF acts as a reinsurer by paying the insurance company's "claim" if the company's losses exceed a set retention. According to Florida Statute 215.555, the FHCF will "reimburse the insurer for 45 percent, 75 percent, or 90 percent of its losses from each covered event in excess of the insurer's retention, plus 5 percent of the reimbursed losses to cover loss adjustment expenses."

This indicator reflects the insured value of property in coastal high hazard areas. Future data collection will show any increase in the amount of insurance purchased and, indirectly, the amount of insurance risk in the coastal zone.

Data Characteristics

SOURCE

Current information on the NFIP may be obtained from Charles Speights, Disaster Recovery Administrator for the State of Florida, Department Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399, or at (850) 413-9960, or 413-9945. Current information on the Florida Hurricane Catastrophe Fund may be obtained from Joan Lazar, Assistant Chief, Florida State Board of Administration-Florida Hurricane Catastrophe Fund, 1801 Hermitage Blvd., Tallahassee, Florida 32308, or at (850) 413-1340.

ACQUISITION
Hard copies of the NFIP data are available at no cost. Hard copies of the FHCF data are available for 15 cents per page.

COLLECTION
Data from both sources is available annually. The FHCF is reported by law once a year. Data is available for 1995 and 1996 from the NFIP; however, due to time constraints only 1996 is presented here.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data is not all inclusive. For example, commercial exposure under FHCF only includes residential commercial, such as condominiums and apartment buildings.

Data Analysis

An analysis of the data from the National Flood Insurance Program (NFIP) is not possible since only one year of data was available. The following table presents the number of policies and the amount of insurance coverage for each coastal county. Future data availability will allow for an analysis of any trends associated with flood insurance in coastal counties.

National Flood Insurance Program 1996, by Coastal County

County	Number of Policies	Coverage	County	Number of Policies	Coverage
Bay	17,046	1,614,682,000	Levy	999	65,081,400
Brevard	44,349	4,818,785,000	Manatee	31,603	3,327,516,300
Broward	381,718	41,599,382,700	Martin	14,210	1,898,832,100
Charlotte	27,915	2,885,146,500	Monroe	34,003	4,095,647,500
Citrus	5,541	452,919,400	Nassau	5,311	675,312,500
Collier	62,726	6,960,081,700	Okaloosa	12,740	1,326,133,600
Dade	285,833	30,807296,200	Palm Beach	128,385	16,163,745
Dixie	512	25,669,900	Pasco	26,484	2,181,382,600
Duval	15,855	2,117,942,600	Pinellas	117,818	11,361,397,600
Escambia	10,289	1,167,136,400	Santa Rosa	4,209	620,909,400
Flagler	4,129	478,087,200	Sarasota	47,030	5,055,381,500
Franklin	2,218	283,658,400	St. Johns	19,172	2,353,336,600
Gulf	1,031	100,183,700	St. Lucie	17,317	1,498,450,700
Hernando	2,530	231,362,700	Taylor	406	26,166,200
Hillsborough	37,973	4,577,972,200	Volusia	33,115	3,196,951,200
Indian River	19,221	2,304,356,700	Wakulla	921	74,393,200
Jefferson	31	2,158,500	Walton	6,371	696,545,900
Lee	93,104	9,882,087,100	**TOTAL**	1,512,115	$148,778,510,945

The following table presents 1996 coastal county data from the FHCF. The 1995 totals for coastal counties are also included. Residential and commercial residential showed increases in the amount of insured value over the two years. Mobile home coverage showed a two percent decrease. Continued data collection will be needed before further analysis can be made.

Florida Hurricane Catastrophe Fund
1996 Coastal County Exposure
(in dollars, with percent change and totals from 1995)

Coastal County	Residential	Commercial Residential	Mobile Home	Total Exposure
Bay	5,851,257,075	761,995,185	245,393,228	6,858,645,488
Brevard	22,974,712,119	2,088,660,332	1,035,512,358	26,098,884,809
Broward	70,365,308,362	10,073,152,067	731,182,707	81,169,643,136
Charlotte	8,656,012,859	641,627,212	575,387,489	9,873,027,560
Citrus	5,326,275,036	186,341,331	461,010,641	5,973,627,008
Collier	14,982,204,117	3,779,144,850	474,876,302	19,236,225,269
Dade	73,273,969,102	9,009,519,114	252,780,672	82,536,268,888
Dixie	183,138,622	6,609,313	53,949,962	243,697,897
Duval	29,946,053,855	2,077,511,618	457,209,387	32,480,774,860
Escambia	10,928,548,577	724,231,788	178,982,590	11,831,762,955
Flagler	2,805,628,020	157,374,866	73,042,772	3,036,045,658
Franklin	516,002,660	42,580,038	23,059,899	581,642,597
Gulf	450,204,594	11,741,548	30,261,303	492,207,445
Hernando	6,212,612,614	124,916,462	571,457,216	6,908,986,292
Hillsborough	38,812,484,656	2,472,937,245	1,094,798,521	42,380,220,422
Indian River	6,741,343,977	1,114,605,032	333,067,663	8,189,016,672
Jefferson	277,216,852	12,106,577	41,487,131	330,810,560
Lee	23,435,510,774	3,299,603,555	1,955,645,415	28,690,759,744
Levy	662,279,458	31,042,414	152,361,864	845,683,736
Manatee	9,727,034,765	1,342,806,581	1,065,928,958	12,135,770,304
Martin	8,280,026,679	1,253,610,365	378,948,449	9,912,585,493
Monroe	4,468,761,543	346,399,380	317,316,455	5,132,477,378
Nassau	2,050,163,732	208,555,340	180,069,388	2,438,788,460
Okaloosa	7,908,801,188	1,175,393,735	94,553,762	9,178,748,685
Palm Beach	70,724,597,847	8,900,259,062	553,847,275	80,178,704,184
Pasco	13,474,466,036	567,719,223	1,495,308,024	15,537,493,283
Pinellas	42,319,163,807	5,514,848,412	1,650,722,616	49,484,734,835
Santa Rosa	17,521,594,958	708,075,183	195,266,377	18,424,936,518
Sarasota	6,579,765,163	750,708,932	186,650,891	7,517,124,986
St. Johns	5,082,367,200	249,746,151	132,223,695	5,464,337,046
St. Lucie	19,590,140,003	2,594,484,534	1,114,410,906	23,299,035,443
Taylor	415,034,037	8,492,700	55,123,164	478,649,901
Volusia	20,079,071,576	2,218,061,765	914,099,075	23,211,232,416
Wakulla	513,077,102	10,153,420	82,181,203	605,411,725
Walton	1,148,869,069	118,318,432	78,033,027	1,345,220,528
Total 1996	552,283,698,034	62,583,333,762	17,236,150,385	632,103,182,181
Total 1995	521,035,230,700	55,405,925,918	17,708,537,823	594,149,694,441
Percent Change	+5.9%	+12.9%	-2.6%	+6.3%

References

Department of Community Affairs (DCA). 1995. "National Hurricane Program, State of Florida." October 1, 1994-September 30, 1995.

Number of Residents With Hurricane Experience

Preparedness is a key component of emergency management. Considering the fact that 36 percent of all twentieth century U.S. hurricanes have hit Florida (Hebert et al., 1995), hurricane preparedness is an important issue for the state's residents and public officials. One component of this issue is hurricane experience and the concern that the rapid growth of the state's population, particularly along the coast, results in a significant proportion of residents that have not had experience with a hurricane.

The residents of a given county are considered to have hurricane experience if they were living in that county at the time of a major hurricane (defined as category 3, 4, or 5 on the Saffir/Simpson Hurricane Scale). However, there are conflicting schools of thought on the role experience plays in hurricane preparedness and evacuation behavior. The notion of "having experience" is difficult to measure in a meaningful way. On the one hand, many people think they have experienced major hurricane conditions, when in fact they have not (Leik et al., 1981). This misconception, referred to as "false experience," may result in some residents not taking appropriate action when a major hurricane is nearing landfall; because of this "experience-adjustment paradox," coastal newcomers may actually be more likely to evacuate than more long-term coastal residents (Windham et al., 1977). This viewpoint is contrary to the notion that residents with hurricane experience are likely to be better prepared and more responsive to evacuation orders for the next hurricane than those without hurricane experience. These conflicting views do little to help predict which residents will be best prepared if a major hurricane makes landfall, and it is worth noting that no consistent relationship between evacuation behavior and hurricane experience has been empirically documented (Baker, 1991).

The fact that most people overestimate their hurricane experience had led to concern that a false sense of security will negatively affect people's responses in future hurricane situations (Jarrell et al., 1992). In fact, it has been suggested that hurricane education replace hurricane experience as a more useful tool for both coastal residents and disaster preparedness groups (Jarrell et al., 1992).

Data Characteristics

SOURCE

Publications from the hurricane conferences may be obtained from the National Hurricane Conference, 864 East Park Avenue, Tallahassee, Florida 32301, or at (850) 561-1163. NOAA *Technical Memorandum* NWS-NHC-46 may be ordered from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151, or at (703) 487-4650 (reference item number PB 93105971). Dr. Earl J. Baker may be contacted at the Department of Geography, The Florida State University, Tallahassee, Florida 32306. For information on the Florida Coastal Issues Survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

ACQUISITION

The National Hurricane Conference publications are available in hard copy format at no cost, as is the article by Dr. Baker. The NOAA technical memorandum costs $39 plus shipping/handling. Information on the Florida Coastal Issues Survey is available in hard copy format at no cost.

COLLECTION

The hurricane experience data are compiled by county at varying frequency, depending upon the landfall of hurricanes in the state. The Florida Coastal Issues Survey data were collected during the summer and autumn of 1996, and future data collection via the survey is likely.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The hurricane experience estimates are based on a formula using historical population and last occurrence of a hurricane for each coastal county; the population estimates are therefore limited to the ten-year intervals of the census data. Using population figures may overestimate the percentage of people in each county who actually participated in some type of hurricane preparedness activity; however, those non-participatory individuals would still be considered experienced. Using population figures does not, however, account for tourists who may have been visiting an area when a hurricane hit. The data also fail to consider any immigrants who experienced a hurricane prior to their residence in Florida. Although the number of residents with hurricane experience is constantly changing as people move in and out of the state and the numbers of births and deaths fluctuate, these fluctuations probably have little impact on the overall estimate of five percent experience for coastal residents as of 1990.

Regarding the data from the Florida Coastal Issues Survey, there are some limitations inherent in any survey methodology, although the survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described below.

Data Analysis

When the definition of hurricane experience is applied to Florida's coastal counties, the estimated proportion of 1990 residents with hurricane experience ranges from a low of zero percent for some (12) counties to a high of 84 percent (for Gulf County) (Sheets, 1992). For the state as a whole, approximately five percent of the coastal county population was considered experienced as of 1990 (Jarrell et al., 1992).

Given the low levels of hurricane-experienced coastal Florida residents, it is interesting to look at responses to some of the questions from the Florida Coastal Issues Survey. This survey was conducted by the Survey Research Laboratory at Florida State University during the summer and autumn of 1996. The survey results consist of 1,002 completed telephone interviews of randomly-selected adults (age 18 and older) living in Florida. The data reflect a 95 percent confidence level and a sampling error of four percent; this means that for any question, 95 percent of the time the results will fall within ±4% of the results that would have been obtained had the entire population of Florida been surveyed.

The sample consisted of 450 males and 552 females. There were 757 coastal county respondents and 245 non-coastal county respondents. The sample is representative of Florida residents age 18 and older who are accessible by telephone. Like the data for Florida residents statewide, the data for coastal and non-coastal county residents reflect a 95 percent confidence level and a sampling error of four percent; unlike the statewide figures, however, the data for the coastal subset or the non-coastal subset are not truly representative of coastal or non-coastal county residents, because sampling was not designed to be representative at those levels.

As displayed below, when asked whether they had ever been ordered or advised to evacuate because of a hurricane or tropical storm, nearly 24 percent of coastal county residents responded that they had.

Ordered or Advised to Evacuate?	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	23.6%	10.6%	20.5%
no	76.4%	89.4%	79.5%

Over 27 percent of coastal county residents also responded affirmatively when asked whether their home or property had ever been damaged by a hurricane or tropical storm. The following data compare the coastal residents' responses to those of non-coastal residents and the state as a whole.

Property Damage?	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	27.3%	21.2%	25.8%
no	72.7%	78.4%	74.1%
don't know	0.0%	0.4%	0.1%

Although events like hearing evacuation orders or sustaining damage from a storm seem like hurricane experiences, only around 20 percent of the coastal survey respondents who answered those questions affirmatively actually would be considered hurricane-experienced by the criteria of the strict definition. This discrepancy further illustrates the point about false experiences, the possible danger of reduced response in future hurricanes, and the need for hurricane education.

When survey respondents were asked whether they felt they needed more information on hurricane preparedness and safety, only 22 percent (168 people) of coastal county respondents answered "yes." Of those 168 people, about 91 percent stated they would be interested in printed information, 85 percent said they would be interested in obtaining information from a TV or radio program, and 51 percent replied that they would be interested in attending a public information session on hurricane preparedness and safety.

Recommendations

The National Hurricane Center methodology and definition of experience could be used to annually update the estimates of residents with hurricane experience. Annual population figures can be estimated by interpolation or extrapolation of decennial census figures.

An alternative would be to survey residents annually to ask them if they have hurricane experience. This would result in estimates of perceived preparedness which, as reflected in the above data, would likely be higher than the experience estimates resulting from strict application of the National Hurricane Center definition.

References

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Windham, Gerald O., Ellen I. Posey, Peggy J. Ross, and Barbara G. Spencer. 1977. Reactions to Storm Threat During Hurricane Eloise. Cited in Earl J. Baker. "Hurricane Evacuation Behavior." *International Journal of Mass Emergencies and Disasters*, 9(2). August 1991, pp. 287-310.

Population at Risk to Hurricane-Induced Flooding

Historically, Florida residents have dealt with a number of severe weather conditions related to hurricanes. Between 1900 and 1995, 58 hurricanes made landfall in Florida; 23 which have been classified as major (level 3, 4, or 5). In 1985, a series of storms (Elena, Juan, and Kate) jolted the panhandle, resulting in death, damage to coastal structures, destruction of numerous seawalls, and damage to coastal highways. In August, 1992, Hurricane Andrew made landfall in South Dade County. The Hurricane was classified as a category 4 storm with sustained wind speeds of 145 miles per hour. The Hurricane produced approximately 7 inches of rain, a maximum storm tide of 16.9 feet, and left behind $30 billion dollars worth of property damage (DCA, 1995). A total of 60,000 homes were destroyed and a quarter of a million people were left homeless in Dade County. Approximately 40 deaths were attributable to the Hurricane. In 1994, two tropical storms (Alberto and Beryl) caused 100-year flooding events in the state panhandle. The flooding was so extreme that Presidential declarations of "emergency" and "disaster" were made (DCA, 1995). Finally, Hurricane Opal in October, 1995 hit Florida with Category IV storm surges that resulted in $3 billion dollars worth of damage.

Hurricane Andrew brought to the forefront the need for increased preparation in the event of catastrophic weather events. Florida has 1,350 miles of general coastline, and 8,436 miles of tidal shoreline, which includes the outer coast, offshore islands, sounds, bays, rivers and creeks. Out of the total state population (1995 estimate), 73% live in these coastal areas and approximately 33 percent live within a category five storm tide inundation zone (DCA, 1995). Florida is very susceptible to storm induced flooding. The average elevation throughout the state is approximately 100 feet above mean sea level (msl) (1995). The flooding created by hurricanes is a threat to the life and property of coastal residents. The most critical threat is to those residents within the category 1 hurricane evacuation zone developed by the National Hurricane Center. This zone shows all areas that would be inundated with water from a landfalling category 1 hurricane, defined as having sustained winds of 74 to 95 miles per hour. The category 1 hurricane evacuation zone generally includes all of Florida's barrier islands, even those with areas of elevation above the category 1 level. A disastrous weather situation is particularly acute for the vulnerable populations in South Florida. Limited options are available regarding the direction of evacuation and the long distances necessary to get out of harm's way.

As previously related, populations within the category 1 hurricane evacuation zone face a greater risk than those outside of this zone due to their immediate vulnerability to the lowest class of hurricanes. The population at risk includes residential property owners (including seasonal), tourists and visitors who may be using facilities in the coastal area, and the mobile home population. The number of people within this zone is already significantly high, and continued growth increases the population at risk with no previous experience of potential injury and loss from storm events. The storm surge vulnerability for all of the state's 35 coastal counties has been determined by the SLOSH (Sea, Lake and Overland Surges from Hurricanes) model. SLOSH is a numerical computer model that is used to calculate storm surge elevations and produce maps of predicted inundation areas for given categories of hurricanes. This indicator is used to measure the increase in populations at risk to hurricane induced flooding, and thereby help to promote disaster preparedness and mitigation at the appropriate level.

Data Characteristics

SOURCE

The Florida Department of Community Affairs has compiled a data report of the vulnerable populations in each county based on evacuation zones delineated by the local emergency management office. The data includes the year of the latest hurricane evacuation study, year of the latest SLOSH model, clearance times, surge limits, shelter capacity, shelter demand, shelter status, and special shelter needs. The data may be obtained from Mr. Robert Collins, Hurricane Preparedness Planning Manager, Division of Emergency Management, Department of Community Affairs, 2555 Shumard Oak Boulevard, Tallahassee, Florida 32399-2100, or at (850) 413-9952.

ACQUISITION

Hard copies of the reports are available at no charge.

COLLECTION

The report reflects data from several sources. A series of county population estimates have been produced by the University of Florida's Bureau of Economic and Business Research's Division of Population Studies. Information on population at risk is from the eleven regional *Hurricane Evacuation Study: Technical Data Reports,* updated where necessary with locally derived information that is commonly found in the comprehensive plans of local governments. The *Technical Data Reports* are updated on an irregular basis; some reports have not been updated since 1986.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data have not been collected with the same frequency or over consistent time periods across all counties; this limits trend analysis as well as inter-county comparisons. In addition the methodology and assumptions, although generally consistent, do contain variations depending on the time and by whom the study was conducted. For example, the dates of last hurricane evacuation study and last SLOSH model for each county range from 1986 to 1996. Hurricane evacuation study are currently being updated for many counties and regions of Florida.

Vulnerable Populations by County, 1986-1996

County	Category One Hurricane	Category Two Hurricane	Category Three Hurricane	Category Four Hurricane	Category Five Hurricane	Year of Latest Hurricane Study	Year of Latest Slosh Model
Bay	108,721	108,721	108,721	117,967	117,967	1986	1986
Brevard	191,696	191,696	202,719	202,719	202,719	1989	1987
Broward	116,154	116,154	155,750	225,751	225,751	1995	1995
Charlotte	47,742	109,899	140,758	158,174	158,174	1995	1995
Citrus	58,800	67,600	73,100	73,100	73,100	1996	1994
Collier	100,586	153,518	199,146	207,190	207,190	1995	1995
Dade	306,633	537,320	537,320	879,572	879,572	1995	1995
Dixie	13,400	13,400	14,700	14,700	14,700	1996	1994
Duval	82,585	82,585	110,648	202,493	202,493	1988	1988
Escambia	66,750	66,750	75,501	75,501	75,501	1986	1986
Flagler	11,515	11,515	17,336	18,047	18,047	1988	1988
Franklin	7,821	9,029	9,090	11,300	11,300	1994	1994
Gulf	7,412	7,412	9,341	12,400	12,400	1994	1994
Hernando	51,900	51,900	51,900	76,500	76,500	1996	1994
Hillsborough	159,354	236,236	295,636	347,322	382,273	1992	1992
Indian River	47,382	47,382	63,352	63,352	63,352	1994	1990
Jefferson	4,200	4,200	5,400	5,400	5,400	1994	1994
Lee	164,913	296,115	378,593	408,439	408,439	1995	1991
Levy	20,200	20,200	22,600	22,600	22,600	1996	1994
Manatee	75,672	84,299	98,123	112,072	129,062	1992	1992
Martin	55,967	55,967	80,095	91,161	91,161	1994	1994
Monroe	59,865	59,865	104,806	104,806	104,806	1995	1989
Nassau	24,411	24,411	27,600	36,783	36,783	1988	1988
Okaloosa	78,871	78,871	78,871	91,183	91,183	1986	1986
Palm Beach	205,893	205,893	271,993	302,052	302,052	1994	1994
Pasco	109,254	136,575	172,562	187,840	199,777	1992	1991
Pinellas	287,961	388,045	474,504	552,534	588,684	1992	1991
Santa Rosa	29,355	29,355	29,355	31,711	31,711	1986	1986
Sarasota	88,506	109,743	145,898	235,458	235,458	1995	1991
St. Johns	28,950	28,950	54,440	78,125	78,125	1988	1988
St. Lucie	97,157	97,157	106,568	106,568	106,568	1994	1994
Taylor	9,500	9,500	11,800	11,800	11,800	1996	1994
Volusia	113,507	113,507	166,408	166,408	166,408	1989	1987
Wakulla	11,271	11,271	11,271	15,550	15,550	1994	1994
Walton	28,030	28,030	28,030	31,711	31,711	1986	1986

Data Analysis

No trends can be established since there is only one set of vulnerable population figures available for each county. Additionally, as described in the data limitations section, the vulnerable populations of each county were determined in different years using various methodologies.

Recommendations

Because local governments are required to update their comprehensive plans every five years, which necessitates the calculation of updated population at risk of inundation estimates, the regional planning councils (RPCs) should establish a consistent procedure for updating the *Technical Data Reports*. Currently, there is no regular schedule for updating the *Technical Data Reports*; instead the RPCs or the Army Corps of Engineers have been updating the reports as funding becomes available and as time permits. The 1995 *National Hurricane Program State of Florida* recommended that the Legislature "appropriate funds to the Department of Community Affairs to accelerate the updating of the regional hurricane evacuation studies, regional inland shelter studies and regional hurricane loss and contingency planning studies" (DCA, 1995, 17).

References

Department of Community Affairs (DCA). 1995. "National Hurricane Program, State of Florida." October 1, 1994 - September 30, 1995.

Reported oil/hazardous material spills

The spilling of oil and hazardous material in coastal waters is associated with shipping and mineral extraction activities. The potential discharge of oil and hazardous material by these industrial operations represents a hazard to coastal populations and all coastal life. Under Chapters 376 and 403, *Florida Statutes*, the Florida Department of Environmental Protection is required to respond to discharges or release of pollutants. These pollutants include oil of any kind and in any form, gasoline, pesticides, ammonia, chlorine, any derivatives thereof, and those hazardous substances in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

Oil and hazardous waste discharges affecting coastal waters may represent a potential or imminent hazard to the public health, welfare and safety, or the environmental. The greater the number of spills, the greater the threat to human health, in addition to the threats to ecosystem health, tourism, and water quality.

Data Characteristics

SOURCE
Information on oil/hazardous material spills is available from Carolann De Ford Bowen, Florida Department of Environmental Protection, Bureau of Emergency Response, 3900 Commonwealth Blvd., M.S. 659, Tallahassee, Florida 32399-3000, or at (850) 488-2974.

ACQUISITION
There is an official report which may be obtained for associated copy and computer access costs.

COLLECTION
The data have been collected statewide since the mid-1970s and are updated annually.

TECHNICAL
Hierarchy of Indicators: 3
Pressure/State/Response: Pressure
Data Accessibility: Data are electronically collected and are accessible.

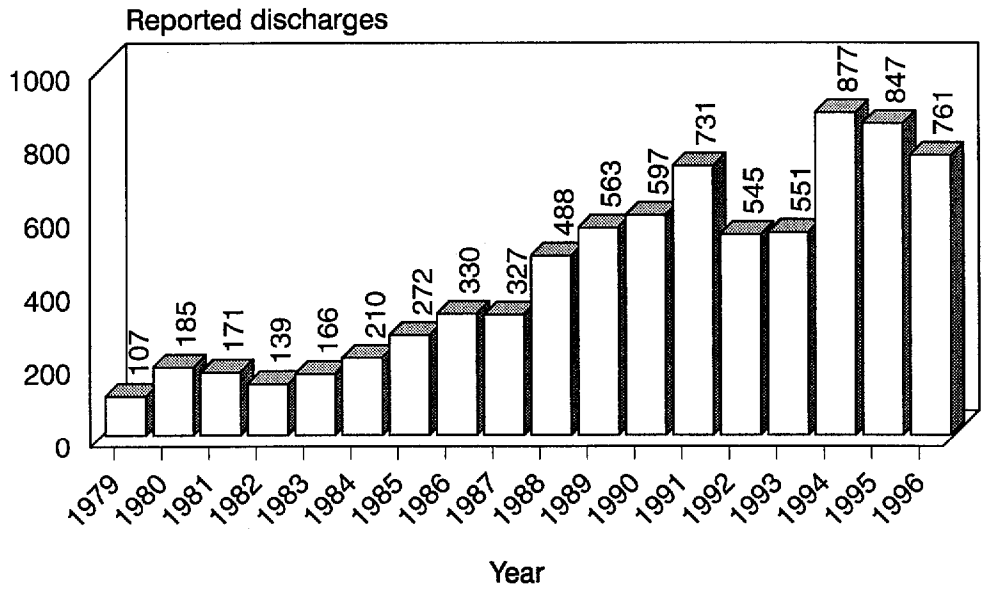
Data Limitations

This information does not assess the toxicity or the magnitude of each spill, although the spills were categorized as minor, moderate and major until 1990. Since 1990, the numbers do not include discharges by category due to changes in the definition of these categories. There is a possibility that some spills go unreported.

Data Analysis

The number of oil/hazardous material spills increased dramatically from 1982 to 1994; the increase was 530 percent. The reasons for this increase are uncertain. An explanation for this drastic increase may be that the public has become more environmentally conscientious and actively participates in protection of natural resources. Therefore, more oil/hazardous material spills are being reported. In 1992 , there was a decrease in the number of oil/hazardous material spills reported, which remained relatively stable in 1993. This may be a result of several regulatory reforms that were instituted in the early 1990s after the Exxon Valdez oil spill in Alaska. Even though this pressures facilitiés that store, handle, or transfer pollutants across the coastal waters of the state to be more aware of their statutory obligation to protect the environment, the number of spills reported in the past three years have been the highest ever.

Number of Reported Oil/Hazardous Material Spills Affecting the Coastal Zone



Population in proximity to Nuclear Power Plants

Nuclear power supplies approximately 18 percent of the Florida's power needs. Studies of risk perception consistently indicate that the public rates the risk of a nuclear plant disaster higher than what has been scientifically determined. The state has three nuclear power plants: Turkey Point (Dade County) and St. Lucie (St. Lucie County) owned by Florida Power and Light, and Crystal River (Citrus County) owned by Florida Power Corporation. Each of these plants is located directly on the coast to take advantage of the availability of water for reactor cooling purposes. The location of these plants represents a potential radiological hazard to coastal populations. A 10-mile radius Emergency Planning Zone (EPZ) exists around each plant as designated by the federal Nuclear Regulatory Commission due to the potential for release of radioactive material. The state and the utility corporations plan and prepare for radiological emergencies that may affect the populations within the EPZs. The State of Florida Radiological Emergency Management Plan for Nuclear Power Plants contains population estimates for the EPZs and describes planning and procedures for radiological emergencies. Because the population within an EPZ is likely to be directly affected by a radiological emergency, population growth within an EPZ represents increased risk to the population based simply on the location of their residence.

Data Characteristics

SOURCE

Information on the population within the EPZs is available from Bill LeBlanc, Division of Emergency Management, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399, or at (850) 413-9896.

ACQUISITION

The data are available in hard copy at no cost.

COLLECTION

The data are updated for each plant every 10 years based on the U.S. census.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

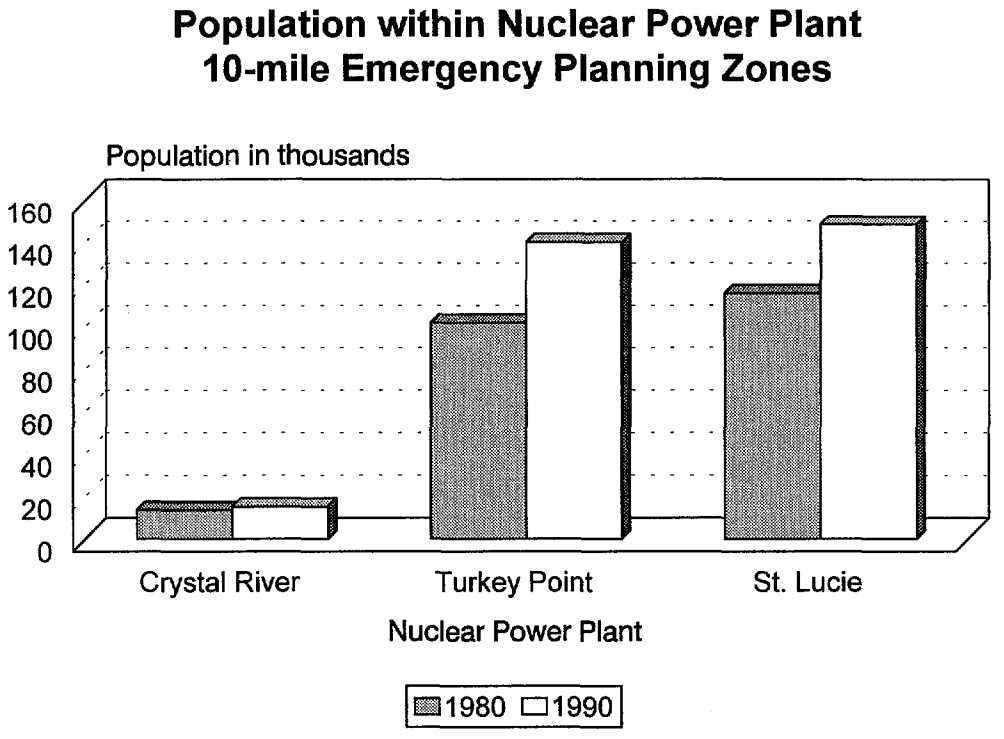
Data Limitations

Because the data are only collected every 10 years, the information quickly becomes out-dated. In addition, the data only represent residential populations and do not include commercial and other non-residential uses of EPZ areas.

Although the data are readily available, the indicator could be improved. The utility corporations should be required to annually update population figures for the EPZs using methods that estimate the actual population instead of methods that interpolate or extrapolate census information. This could be accomplished by having the local government building departments track building permits from an established base year population.

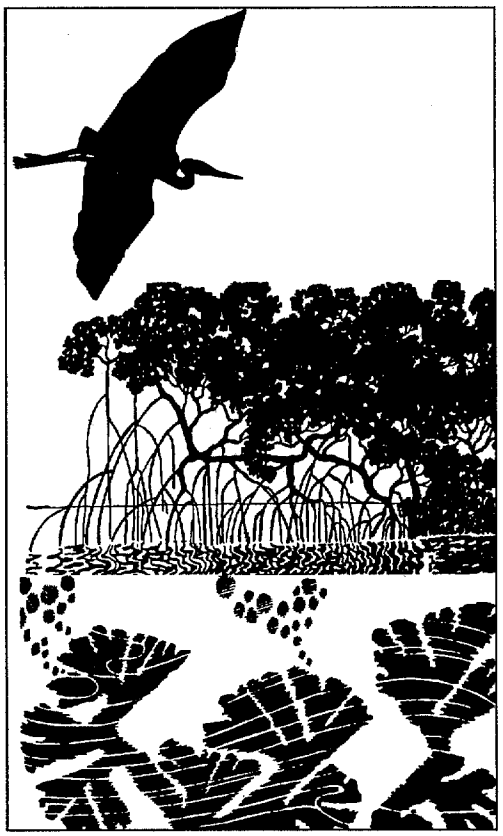
Data Analysis

In each of the three EPZs, population figures increased from 1980 to 1990, thus indicating a greater population under threat from radiological emergencies. The lack of annual observations prevents observations of population changes correlated to specific events. Historically, Dade County and St. Lucie County have been high growth counties, while Citrus County has been a low growth county. This trend is likely to persist in the near future. However, preliminary estimates suggest that the population decreased around Turkey Point because of the destruction of Homestead due to Hurricane Andrew in 1992.



Section D

Degradation and Restoration of Coastal Ecosystems



Degradation and Restoration of Coastal Ecosystems

Traditionally, management has been directed toward maintaining populations of individual species, however, people are recognizing the importance of conserving biological diversity. Biological diversity is the variety of life at all levels, which not only includes the array of plants and animals, but also the communities, ecosystems, or landscapes in which they occur. A coastal ecosystem is comprised of the biological community together with its physical environment. The degradation and restoration of coastal ecosystems are considered important because as these systems become degraded, the overall environmental health of Florida will be compromised. Similarly, the restoration of natural areas has far reaching impacts for both humans and other living species in Florida.

The Degradation and Restoration of Coastal Ecosystems issue area provides a broad view of the relative health and present status of components of the marine, estuarine, freshwater, and upland ecosystems present in Florida's 35 coastal counties. The primary concerns are change in habitat , species population trends, and water quality trends. Changes in habitat characteristics frequently have extensive impacts on the function and viability of natural systems. Species population trends are directly related to and responsive to environmental conditions. Water quality trends are important for all living species and can also impact natural systems. This responsiveness may facilitate the development of indicators reflecting ecosystem health

Degradation and Restoration of Coastal Ecosystems Indicators:

- Change in strategic habitat conservation areas
- Change in existing wetland habitat and conservation lands
- Change in existing upland habitat and conservation lands
- Change in coral reef community dynamics
- Change in acreage of invasive non-indigenous (exotic) aquatic plants
- Change in acreage of invasive non-indigenous (exotic) upland plants
- Documented marine mammal strandings
- Estimated manatee population and documented deaths
- Sea turtle nesting activity
- Southern bald eagle population
- Reddish egret population
- Number of wood stork nests
- Number of eastern brown pelican nests
- Acreage of seagrass
- Number of beach closings and advisories
- Acreage of shellfishing waters by classification
- Onsite treatment and disposal systems installed

Other Indicators of Interest:

- Change in major land cover categories (Section A)
- Miles of eroding coastline (Section B)
- Volume of ocean dredged material disposed of off Florida's coast (Section B)
- Discharge of treated domestic and industrial wastewater (Section E)
- Management status of Coastal Habitat (Section G)

Change in Strategic Habitat Conservation Areas

Florida is recognized as one of North America's most important reservoirs of biological diversity. The existence of numerous endemic species in Florida makes conservation and management activities of great importance to global biodiversity protection efforts. As development pressures increase in Florida, habitat areas that are specific to coastal counties are rapidly disappearing or at risk of decline. These dwindling coastal habitat areas are important to many rare species including sea turtles, shorebirds, plovers, various taxa of beach mice, migratory birds, and communities of longleaf pine. One way to preserve some components of coastal Florida's wildlife and threatened plant communities is by establishing protection for strategic areas of habitat.

Strategic Habitat Conservation Areas (SHCAs) delineate habitat areas in Florida that should be conserved and added to current conservation lands if key components of the state's biological diversity are to be maintained. The strategic areas are private lands that are recommended for additional protection and are needed to help sustain populations of key species. By means of a computerized Geographic Information System (GIS), distribution maps are created of the habitat areas for selected species of wildlife, threatened species of plants, and rare plant communities. Conservation of coastal habitat areas will require new initiatives along several broad fronts as well as renewed efforts in the implementation of traditional land acquisition and management strategies.

This indicator tracks the amount of important habitat in coastal counties that has been converted to a permanent conservation status or is proposed for strategic habitat conservation.

Data Characteristics

SOURCE

This information is from the report Closing the Gaps in Florida's Wildlife Habitat Conservation System. A copy can be obtained by contacting Randy Kautz at the Office of Environmental Services, Florida Game and Fresh Water Fish Commission, 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (850) 488-6661.

ACQUISITION

The data can be obtained in hard copy format at no cost. The maps presented in the report are available in a variety of scales and in digital formats for use with computer mapping software.

COLLECTION

The data are collected statewide from a variety of sources. Conservation lands are lands capable of providing long-term protection for rare species and include lands such as national parks, forests, wildlife refuges, and portions of military lands; state preserves, reserves, parks, and forests; state-owned wildlife management areas; water management district lands; county-owned nature preserves; and, lands owned by groups such as The Nature Conservancy, National Audubon Society, Florida Audubon Society, and other conservation entities (Cox et al., 1994). Lands proposed for conservation are private or public lands that either need purchasing or conserved through such tools as conservation easements or land-use agreements. Great reliance was placed on a land-cover map developed from Landsat satellite data collected between 1985 and 1989. The first year of data available from *Closing the Gaps* was 1994. Future updates of the *Closing the Gaps* report are anticipated at three to five-year intervals.

TECHNICAL

Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The indicator is presently used as a benchmark since only one year of data is available. The Landsat satellite imagery data are reliable in that the information is collected very consistently, though some time gaps will be involved with the use of satellite data from the 1980's. Additionally, the interpretation of the data, manipulation of the data, and use of data and maps generated by other agencies at different scales could include some degree of error. The Florida Game and Fresh Water Fish Commission plan to update the Strategic Habitat Conservation Areas by July 1, 1997.

1994 Strategic Habitat Conservation Areas by Acreage[1]

County	Existing Conservation Lands	Proposed SHCAs
Bay	35,321 (7.19)	14,573 (2.99)
Brevard	181,051 (27.16)	99,788 (14.95)
Broward	483,626 (63.52)	5,681 (0.74)
Citrus	74,841 (19.22)	41.743 (10.71)
Charlotte	69,407 (15.61)	143,754 (32.37)
Collier	594,035 (46.21)	488,072 (37.96)
Dade	698,269 (56.33)	23,959 (1.93)
Dixie	41,743 (9.35)	48,412 (10.82)
Duval	65,208 (13.06)	36,309 (7.24)
Escambia	15,560 (3.69)	247 (0.07)
Flagler	2,223 (0.74)	183,027 (59.12)
Franklin	75,335 (21.55)	108,927 (31.18)
Gulf	34,086 (9.56)	49,400 (13.88)
Hernando	61,750 (20.11)	10,374 (3.40)
Hillsborough	25,688 (3.93)	44,213 (6.79)
Indian River	60,762 (19.04)	19,266 (6.02)
Jefferson	30,628 (8.05)	74,594 (19.62)
Lee	21,489 (4.28)	120,783 (23.97)
Levy	74,841 (10.44)	129,181 (18.01)
Manatee	22,477 (4.83)	14,326 (3.07)
Martin	20,007 (5.65)	31,369 (8.85)
Monroe	579,215 (91.46)	18,772 (2.98)
Nassau	6,422 (1.52)	39,767 (9.54)
Okaloosa	20,853 (53.44)	16,055 (2.66)
Palm Beach	333,697 (26.72)	26,182 (2.09)
Pasco	50,388 (10.72)	58,539 (12.42)
Pinellas	3,211 (1.76)	6,916 (3.97)
St. Johns	13,585 (3.42)	45,448 (11.32)
St. Lucie	5,187 (0.01)	27,417 (7.60)
Santa Rosa	208,715 (31.89)	26,923 (4.13)
Sarasota	43,719 (12.23)	21,983 (6.14)
Taylor	62,491 (9.48)	80,275 (12.17)
Volusia	69,160 (9.56)	181,051 (25.04)
Wakulla	271,206 (69.24)	21,489 (5.50)
Walton	184,756 (27.15)	99,788 (14.67)
TOTAL	4,541,022 (20.52)	2,358,603 (12.4)

[1] The percentage of total area of each county is provided in parenthesis.

Data Analysis

As shown in the table, Florida's system of publicly owned conservation lands covers 4.54 million acres, or roughly 20 percent of the land area of coastal counties. These lands represent a foundation for the protection of ecologically sensitive and important communities and species.

An additional 2.35 million acres, or an estimated 12.4% of lands in coastal counties are proposed Strategic Habitat Conservation Areas. As more data become available in the future, this indicator will relate the amount of important habitat in coastal counties that has been converted to a permanent conservation status. These lands can be purchased through state and local government land acquisition programs or protected through conservation easements. In addition, the indicator will be able to show the amount of land in the Strategic Habitat Conservation Areas that has been degraded by private activities and is no longer desirable or available as permanent conservation areas.

References

Cox, James, Randy Kautz, Maureen MacLaughlin, and Terry Gilbert. 1994. *Closing the Gaps in Florida's Wildlife Habitat Conservation System.* Office of Environmental Services, Florida Game and Fresh Water Fish Commission.

Change in Existing Wetland Habitat and Conservation Lands

Massive changes in land use are altering patterns of land cover that may threaten the United States' air, water, and natural resources. In the years ahead, Florida will need to closely monitor the progress of land use so as to ensure that the biodiversity associated with different land cover is not compromised. As development pressures increase in Florida's coastal counties, wetland habitat areas are rapidly disappearing or being degraded. These areas are important to many species including brown pelicans, wood storks, egrets, herons, pelagics, shrimp, lobster, and crabs. Protecting wetlands as conservation lands is one way to preserve some components of coastal Florida's threatened wildlife and plant communities. This indicator relates the total acreage and the acreage conserved for specific wetland types. The specific wetland types presented have been recommended by the environmental community for additional protection because of their unique roles in sustaining populations of key species and, in some cases, the small amount of acreage remaining (Cox et al., 1994).

Wetlands account for nearly one-third of all the acreage in Florida and provide a wide range of benefits to the environment. Wetlands serve as a habitat for fish, wildlife, and large populations of migratory birds; as a buffer in moderating the effects of floods; and as a sink deposit for storing nutrients and runoff, thereby reducing sediment loads and reducing erosion. Wetlands also provide various recreational opportunities and are an aesthetic value for humans that influence people's quality of life (i.e., bird watchers).

The loss of wetlands has been documented for decades, while remaining wetlands have been degraded due to land conversion and impacts from development. Many of their natural functions and benefits have been diminished. Thus, trends in wetland acreage provide a useful indication of the existing acreage of wetlands, the rate of change, and whether one type of wetland is being impacted more than another. The wetland habitat types discussed in this indicator are salt marsh, mangrove swamp, cypress swamp, freshwater marsh, and hardwood swamp.

Coastal salt marshes are herbaceous and shrubby wetlands that occur statewide in brackish waters. In tropical climates, salt marshes may be interspersed within mangrove areas, as both habitats can exist in the intertidal zone. Salt marshes are highly productive areas that provide nursery grounds for juvenile benthic and pelagic species and are a source of organic material for nearshore ecosystems. Wading and shore birds may also be found in these wetland habitats.

Cypress swamps are regularly inundated wetlands that provide forested borders along water bodies or occur in depressions. Mangrove swamps occur in brackish waters along protected and low-energy shorelines of the Gulf and Atlantic coasts of southern Florida. This type of community is composed of a freeze-sensitive tree species that is distributed south of a line from Cedar Key on the Gulf coast to St. Augustine on the Atlantic coast. The three major species of mangrove (black, red, and white) are mapped in a single class for the purposes of this indicator. Mangrove swamps are highly productive areas that provide nursery grounds for juvenile benthic and pelagic species and are a source of organic material for nearshore ecosystems. Wading and shore birds also may feed and nest in these wetland habitats.

Hardwood swamp and freshwater marsh are two other examples of freshwater habitats in Florida that have limited acreage remaining. Freshwater marsh are dominated by a wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas of variable water depths and inundation regimes. Mixed hardwood swamps are wetland-adapted trees that consist of either pure stands of hardwoods (black gum, water tupelo, red maple, etc.) or as mixtures of hardwoods and cypress (Cox et al., 1994).

Data Characteristics

SOURCE

Data to support this indicator are found in the report *Closing the Gaps in Florida's Wildlife Habitat Conservation System*. A copy can be obtained by contacting Randy Kautz at the Office of Environmental Services, Florida Game and Fresh Water Fish Commission, 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (850) 488-6661.

ACQUISITION
The data can be obtained in hard copy format at no cost. The maps presented in the report are available in a variety of scales and in digital formats for use in computer mapping packages.

COLLECTION
Great reliance was placed on a land-cover map developed from Landsat satellite data collected between 1985 and 1989. A total of 22 land-cover types were developed using known land classifications, including those developed by the Soil Conservation Service and Florida Natural Areas Inventory. Classifications consist of 17 natural vegetation types, 1 class for water, and 4 additional classes associated with disturbed areas. The land-cover map was compared for accuracy with aerial photography and field reports.

The data on conservation lands are collected statewide from a variety of sources. Conservation lands are lands capable of providing long-term protection for rare species and include national parks, forests, wildlife refuges, and portions of military lands; state preserves, reserves, parks, and forests; state-owned wildlife management areas; water management district lands; county-owned nature preserves; and certain private lands owned by groups such as The Nature Conservancy, National Audubon Society, Florida Audubon Society, and other conservation entities (Cox et al., 1994).

The first year of data available from *Closing the Gaps* was 1994. Future updates of the *Closing the Gaps* report are anticipated at three to five year intervals.

TECHNICAL
Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations
The indicator is presently used as a benchmark since only one year of data is available. The Landsat satellite imagery data are reliable in that the information is collected consistently, though some time lapse are involved with the use of satellite data from the 1980's. Additionally, the interpretation of the data, manipulation of the data, and use of data and maps generated by other agencies at different scales could include some degree of error in measurement. The Florida Game and Fresh Water Fish Commission plans to update the data by October 1, 1998.

Data Analysis
There are 1,989 square kilometers (km^2), or 491,283 acres, of coastal salt marsh habitat remaining in Florida. Of that area, 60 percent is presently in conservation lands. Of the 856,596 acres of cypress swamp habitat in coastal counties only 39 percent is in conservation lands. Mangrove swamp has the most protected acreage of the selected wetland types. Of the 554,515 acres of mangrove swamp habitat presently existing in Florida's coastal counties, 79 percent (1,771 km^2) are in conservation lands. Freshwater marsh and hardwood swamps have the smallest amount of coastal acreage of the selected wetland types. Freshwater marsh has a high percentage of land in conservation (76 percent), while hardwood swamp has the smallest percentage of lands being conserved (25 percent). Overall, 56 percent of the total acreage of these specific habitats are in conservation.

Coastal County Wetland Habitat Area in Florida (1994)

Habitat Type	Total Acreage	Acreage in Conservation Lands (%)
salt marsh	491,283	294,671 (60%)
mangrove swamp	554,515	437,437 (79%)
cypress swamp	856,596	331,968 (39%)
freshwater marsh	7,568	5,755 (76%)
hardwood swamp	3,723	941 (25%)
Total	1,913,685	1,070,769 (56%)

References
Cox, James, Randy Kautz, Maureen MacLaughlin, and Terry Gilbert. 1994. *Closing the Gaps in Florida's Wildlife Habitat Conservation System.* Office of Environmental Services, Florida Game and Fresh Water Commission.

Change in Existing Upland Habitat and Conservation Lands

As development pressures continue in Florida's coastal counties, remaining habitat areas face increased degradation and fragmentation. The decline in coastal habitats is important to many federal and state listed rare and endangered species as well as species not presently under regulatory protection. These species may include beach mice, gopher tortoises, plovers, sea turtles, and migratory birds. Protecting upland areas by designating them as conservation lands is one way to preserve some components of coastal Florida's wildlife and rare plant communities. Coastal upland habitat conservation areas in Florida are lands that should be conserved and added to current conservation lands if key components of the state's biological diversity are to be maintained. The upland areas not currently in conservation are private lands that are recommended for additional protection in order to help sustain populations of key species(Cox et al., 1994). Some types of upland, such as sand pine scrub and xeric oak scrub, also have small amounts of remaining habitat in the state and are therefore recommended for conservation.

Florida's coastal counties are composed of many different habitat types, including the upland habitats that are essential to the survival of numerous indigenous plant and animal species. Thus, trends in upland habitat acreage provide a useful indication of the existing acreage, the rate of change, and whether one type of upland is being impacted more than another. The upland habitat types discussed in this indicator are coastal strand, tropical hardwood hammock, hardwood hammock, pine rocklands, sand pine scrub, and xeric oak scrub.

Coastal strand occurs on well-drained sandy soil and includes the zoned vegetation typical of the upper beach, dunes, and coastal rock formations. This habitat generally occurs in a narrow band parallel to the open waters of the Gulf of Mexico and the Atlantic Ocean, and along some of the shores of bays and sounds throughout Florida. Typical plant species include sea oats, beach morning glory, saw palmetto, and wax myrtle. Animal species dependent upon this habitat include various taxa of beach mice and the snowy plover.

Tropical hardwood hammock communities are sparsely distributed along coastal uplands south of Sarasota and Vero Beach. These cold-sensitive tropical communities have high species diversity and can contain over 35 species of trees and 65 shrub species. Tropical hammock in the Florida Keys may also contain several plants, including mahogany, thatch palms, manchineel, and lignum vitae, which are extremely rare within the contiguous United States.

Hardwood hammock habitat may occur statewide on fairly rich sandy soils. Variations in local soil-moisture regimes, soil types, and geographic locations may result in species composition differences throughout the state. This upland habitat has four major types: mesic, xeric, coastal, and hydric hammocks.

Pine rocklands are present only in Dade County and the Florida Keys, with the largest remaining patch on Long Pine Key in Everglades National Park and on Big Pine and Cudjoe keys in the Florida Keys. Sixty-seven animals and plant species have been found in this specific habitat type.

Sand pine scrub's natural habitat is almost entirely restricted to within the state of Florida. This vegetation type occurs on sand deposits along former shorelines and islands of ancient seas. The plant community is dominated by an overstory of sand pine and an understory of myrtle oak, Chapman's oak, sand-live oak, and scrub holly. Xeric oak scrub is a hardwood community typically consisting of clumped patches of low growing oaks interspersed with bare areas of white sand (Cox et al., 1994).

Data Characteristics

SOURCE

This information is from the report *Closing the Gaps in Florida's Wildlife Habitat Conservation System.* A copy can be obtained by contacting Randy Kautz at the Office of Environmental Services, Florida Game and Fresh Water Fish Commission, 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (850) 488-6661.

ACQUISITION
The data can be obtained in hard copy format at no cost. The maps presented in the report are available in a variety of scales and in digital formats for use in computer mapping packages.

COLLECTION
Great reliance was placed on a land-cover map developed from Landsat satellite data collected between 1985 and 1989. A total of 22 land-cover types was developed using known land classifications, including those developed by the Soil Conservation Service and Florida Natural Areas Inventory. Classifications consist of 17 natural vegetation types, 1 class for water, and 4 additional classes associated with disturbed areas. The land-cover map was compared for accuracy with aerial photography and field reports.

The data on conservation lands are collected statewide from a variety of sources. Conservation lands are lands capable of providing long-term protection for rare species and include national parks, forests, wildlife refuges, and portions of military lands; state preserves, reserves, parks, and forests; state-owned wildlife management areas; water management district lands; county-owned nature preserves; and certain private lands owned by groups such as The Nature Conservancy, National Audubon Society, Florida Audubon Society, and other conservation entities (Cox et al., 1994).

The first year of data available from *Closing the Gaps* was 1994. Future updates of the *Closing the Gaps* reports are anticipated at three to five year intervals.

TECHNICAL
Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations
The indicator is presently used as a benchmark since only one year of data is available. The Landsat satellite imagery data are reliable in that the information is collected very consistently, though some time gaps will be involved with the use of satellite data from the 1980's. Additionally, the interpretation of the data, manipulation of the data, and use of data and maps generated by other agencies at different scales could include some degree of error in measurement. The Florida Game and Fresh Water Fish Commission plan to update the data by October 1, 1998.

Data Analysis
Of the nearly 1 million acres of hardwood hammock habitat remaining in coastal counties, only 28 percent is in conservation lands. Fifty-four km^2, or 13,338 acres, of tropical hammock habitat presently exist in Florida's coastal counties, half of which is in conservation lands. There are 41 square kilometers (km^2), or roughly 10,000 acres, of coastal strand habitat remaining in Florida's coastal counties. Of that area, 51 percent is presently in conservation lands. Less than 13,000 acres of pine rockland remains in South Florida. Roughly 86 percent of this rare habitat is in conservation. Total acreage of sand pine and xeric oak scrub is small (245 and 235 acres respectively). At least 2/3 of each land type remains unprotected. Overall, 29 percent of the selected habitat types are in conservation.

Coastal County Upland Habitat Area in Florida (1994)

Habitat Type	Total Acreage	Acreage in Conservation Lands (%)
hardwood hammock	971,698	272,441 (28%)
tropical hammock	13,338	6,669 (50%)
coastal strand	10,127	5,187 (51%)
pine rocklands	12,765	11,082 (86%)
sand pine scrub	245	59 (24%)
xeric oak scrub	235	78 (33%)
TOTAL	1,008,408	295,513 (29%)

References
Cox, James, Randy Kautz, Maureen MacLaughlin, and Terry Gilbert. 1994. *Closing the Gaps in Florida's Wildlife Habitat Conservation System*. Office of Environmental Services, Florida Game and Freshwater Commission.

Change in Coral Reef Community Dynamics

Coral reefs are important to coastal ecosystems for several reasons. These massive, calcareous structures are "underwater rainforests"; the most biologically diverse marine ecosystems in the world. They provide shelter to mobile aquatic animal species and have unusually high gross primary production which is recycled within the reefs. The principal producer organisms are microscopic algae called zooxanthellae that live within the coral tissues. This symbiotic relationship enhances the biological activity of the community in terms of the abundance and the diversity of plants and animals found on the reefs. Reefs are also important as natural breakwaters to storm surges and large wave forces. A loss of coral reefs could result, among other things, in increased erosion of the coast and loss of significant fisheries.

The principal causes of reef loss are habitat degradation and over-exploitation of fisheries. Coral is extremely fragile and can lose years of growth in just minutes from being affected. Examples of toxics that affect reefs include oil pollution from boats and marinas, compounds that leach from bottom boat paints, and urban runoff pollution. Urban runoff pollution contains nutrients from sewage and fertilizers that reduce water quality and cause increased incidences of coral diseases and algal blooms. Healthy coral reefs also require sufficient light, which is inhibited from reaching coral when water turbidity is increased. Chronic turbidity starves the symbiotic algae of light and kills them. Exceeding the carrying capacity of a particular area for snorkeling and diving, the physical destruction caused by ship and boat groundings, and massive storms and winter cold fronts also contribute to reef degradation.

From 1989 to 1995, this indicator focused on three different aspects of coral reef community dynamics: number of stony coral and octocoral species, diversity, and evenness. Stony coral have a skeleton composed of calcium carbonate crystals. Octocoral species are a subclass of anthozoans that include common marine forms such as sea fans, whip corals, and pipe corals. They have eight tentacles and eight complete mesenteries on either side of a tentacle base. The species diversity index (H'n) is a computation that accounts for the number of species and the distribution of individuals among the species. For example, two data collection samples each have 10 species and 100 individuals. In the first sample, one species has 91 individuals, and the remaining nine species has one individual each. In the second sample, each species each has 10 individuals belonging to that species. The relative index values for these collections would show that the second sample has a much higher species diversity index value.

The evenness index (J'n) is a ratio of how a sample compares to the optimal species diversity for the number of species that were observed in the study area. The computation for evenness requires knowledge of the number of species and the species diversity index value. The diversity index value is divided by the log base 2 of the number of species in the study area. Values near one imply a high level of evenness where all the individuals are equally distributed among the taxa. The term taxa is used to define organism categories that are debatable as to being species x or species y.

Due to changes in budgeting and priorities, the three monitoring sites in the Dry Tortugas were completed in 1995, and 40 new coral reef sites were examined in 1996 in the Florida Keys National Marine Sanctuary. The Sanctuary is 2,800 square nautical miles, extends on both sides of the Florida Keys, and is the second largest marine sanctuary in the United States. This new Sanctuary-wide reef project is an effort to detect *ecosystem* change not measurable in single-location surveys. Data will be used to determine an overall net reef decline in percent cover; stony coral species richness; overall net increase in measurable reef community parameters; significant changes in individual reefs compared to the entire ecosystem (decreases in one location balanced by increases elsewhere); and, changes that are linked to specific regions of the landscape (Wheaton, 1996). Data are currently available only on the number of stony coral taxa for each of the reef sites.

Data Characteristics

SOURCE

The source for this information is Walt Jaap, Florida Marine Research Institute, 100 Eighth Avenue SE, St. Petersburg, Florida 33701-5095, or at (813) 896-8626.

ACQUISITION

The data are available in hard copy. There are no costs associated with the acquisition of these data.

COLLECTION

Sampling in the Dry Tortugas National Park occurred from 1989 to 1995 at three coral reef community sites located about 60 miles west of Key West. Techniques used included a population count in permanently marked quadrats made of PVC pipe. Quadrat sampling includes counting and identifying the organisms, and mapping the distribution of the taxa of interest within the quadrat. Sampling methods in 40 new reef sites utilize videographic survey techniques.

TECHNICAL

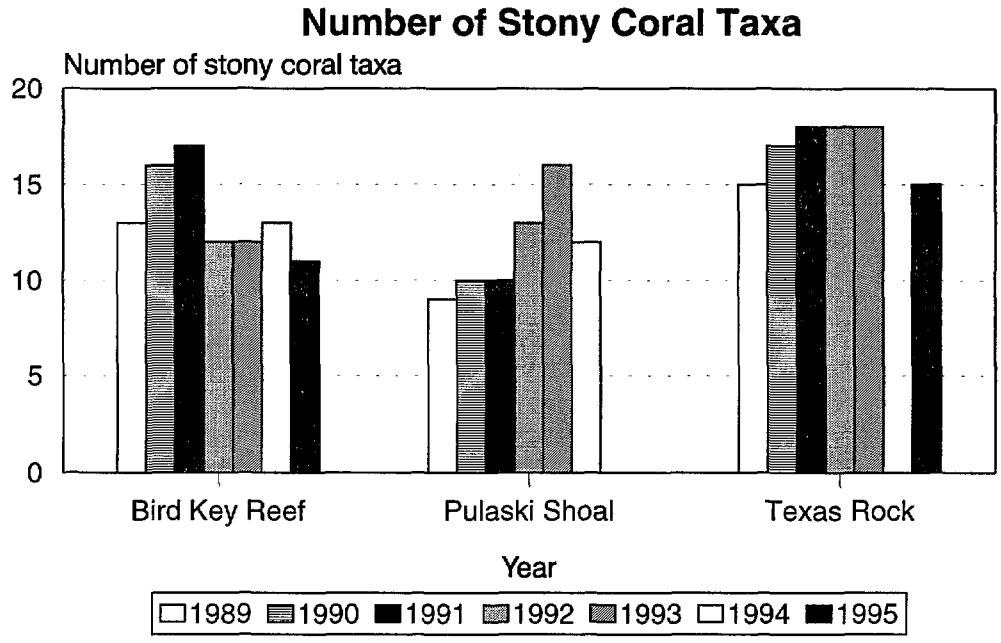
Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Data from the previous three reef sites and the 40 new reef sites are not exactly comparable due to changes in measurement methodology. However, data limitations will be greatly reduced with the increase from three to 40 sample sites and with ongoing data collection. The ability to assess any trends into the functioning and status of reef communities is limited at the current level of study since only one year of data are available and data collection on the previous sites has ceased.

Data Analysis

Final data from benthic coral reef monitoring at Bird Key Reef, Pulaski Shoal, and Texas Rock, are presented here. The number of stony coral taxa at the three sites remained relatively stable between 1989 and 1995. With the last year of data collection, one reef site (Bird Key) had experienced a decline in the number of species. Pulaski Shoal showed an increase and Texas Rock exhibited no net change. Due to bad weather and/or vessel engine problems, data collection for Texas Rock in 1994 and Pulaski Shoal in 1995 did not take place.



The number of octocoral species, species diversity, and species evenness are presented in the table below. Species diversity in the study areas remained generally stable. Bird Key Reef experienced a noticeable loss in octocoral diversity between 1991 and 1992 while Texas Rock experienced the largest fluctuations annually in its octocoral diversity. Stony coral diversity was stable for all three sites.

All three sites were relatively stable in octocoral evenness and stony coral evenness throughout the study period. The stony coral evenness values were higher than octocoral, suggesting relative equitability in apportionment of colonies among stony coral taxa. The octocoral evenness values were relatively lower than other species as a result of a high abundance of a single species, *P. bipinnata* (Jaap & Wheaton, 1995). The stability of these areas indicates that there were no significant disturbances during the study period.

Benthic Coral Reef Monitoring at the Dry Tortugas

	Number Octocoral Species	Octocoral Diversity (H'n)	Octocoral Evenness (J'n)	Stony Coral Diversity (H'n)	Stony Coral Evenness (J'n)
Bird Key Reef					
1989	7	0.68	0.35	2.09	0.81
1990	6	0.58	0.32	2.20	0.79
1991	8	0.94	0.45	2.20	0.78
1992	7	0.58	0.30	2.08	0.84
1993	7	0.58	0.30	2.09	0.84
1994	8	0.65	0.31	2.09	0.81
1995	8	0.66	0.32	2.00	0.83
Pulaski Shoal					
1989	21	2.24	0.74	1.85	0.84
1990	21	2.49	0.82	1.73	0.75
1991	20	2.45	0.82	1.79	0.78
1992	24	2.60	0.82	1.91	0.75
1993	24	2.50	0.79	2.05	0.74
1994	21	2.26	0.74	1.92	0.77
Texas Rock					
1989	5	1.35	0.84	2.33	0.86
1990	4	1.07	0.77	2.45	0.87
1991	4	0.73	0.53	2.45	0.85
1992	4	0.90	0.65	2.39	0.83
1993	4	1.03	0.75	2.41	0.83
1994	5	1.40	0.87	N/A	N/A
1995	4	1.03	0.74	2.37	0.88

N/A = Data Not Available

The following table shows data collected at the forty new reef sites in 1996. The reefs are defined as either hardbottom, patch reef, offshore shallow, and offshore deep. Since this is the first year of data collection, no trends can yet be established.

Florida Keys National Marine Sanctuary
Coral Reef Site Analysis, 1996

Sites	Number Stony Coral Taxa	Sites	Number Stony Coral Taxa
Hard Bottom Sites		**Offshore Deep Sites**	
Rattle Snake Key (9H1)	9	Carysfort (9D1)	27
El Radabob (9H2)	9	Molasses (9D3)	25
Dove Key (9H3)	9	Conch (9D4)	25
Long Key (7H2)	19	Alligator (7D1)	21
Moser Channel (5H1)	13	Tennessee (7D2)	31
Molasses Keys (5H2)	7	Sombrero (5D1)	27
Sugarloaf (5H3)	16	Looe Key (5D2)	27
Content Key (3H1)	13	Eastern Sambo (5D3)	32
		Western Sambo (5D4)	27
Offshore Shallow Sites			
Carysfort (9S1)	16	Rock Key (5D5)	28
Grecian Rocks (9S2)	28	Sand Key (2D1)	28
Molasses (9S3)	22		
		Patch Reef Sites	
Conch (9S4)	15	Turtle Reef (9P1)	31
Alligator (7S1)	18	Porter Patch (9P3)	24
Tennessee (7S2)	22	Admiral (9P4)	16
Sombrero (5S1)	21	West Turtle Shoal (7P1)	26
Looe Key (5S2)	21	Dustan Rocks (7P2)	26
Eastern Sambo (5S3)	12	West Washer Woman (5P1)	24
Western Sambo (5S4)	23	Western Head (5P2)	35
Rock Key (5S5)	18	Cliff Green (5P3)	33
Sand Key (2S1)	28	Smith Shoal (2P1)	22

Future data collection in the National Marine Sanctuary will include a coral cover value based on point count analyses of video images for each of the forty sites.

References

Jaap, Walter C. 1995. *Monitoring Methods for Assessing Coral Reef Biota and Habitat Condition.* Summary Document for a Symposium Sponsored by the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration. Florida Department of Environmental Protection, Florida Marine Research Institute.

Jaap, Walter C. and Jennifer Wheaton. 1995. *Benthic Coral Reef Monitoring at the Dry Tortugas National Park 1 October 1994 to 30 September 1995.* Florida Department of Environmental Protection, Florida Marine Research Institute.

Voss, Gilbert L. 1988. *Coral Reefs of Florida.* Sarasota, Florida: Pineapple Press.

Wheaton, Jennifer. 1996. *Florida Keys National Marine Sanctuary Water Quality Protection Plan, Coral Reef and Hardbottom Monitoring Project.* Florida Department of Environmental Protection, Florida Marine Research Institute.

Change in Acreage of Invasive Non-Indigenous (Exotic) Aquatic Plants

Many ecosystems, particularly those in tropical and subtropical regions, are vulnerable to disturbance and invasion by introduced non-indigenous plant species. Such invasions have social, economic, and environmental impacts because they threaten unique and irreplaceable ecosystems. Because of its warm climate and abundance of aquatic habitats, Florida is particularly susceptible to infestations of exotic aquatic and wetland plants. Florida's large exotic aquarium plant and ornamental foliage industry imports millions of non-native species each year; many of those have escaped or been accidentally introduced. Control efforts on non-indigenous aquatic plants cost Florida taxpayers $10.6 million in fiscal year 1995-96 and are projected to cost $15 million in 1996-97. Two non-indigenous aquatic plant species of particular concern in Florida are hydrilla and water hyacinth. Extensive public resources are also devoted to management of water lettuce (*Pistia stratiotes*).

Hydrilla *(Hydrilla verticillata)* was brought into the United States from Sri Lanka by aquarium plant horticulturists in the early 1950s. Hydrilla is present in fresh waters of Asia, Europe, Africa, Australia, and the United States. Hydrilla provided the aquarium industry with a plant that could grow under the low light conditions typically found in aquariums. Because of its ability to grow in low light conditions, its rapid growth rate, and a high capacity for survival, hydrilla has become a serious aquatic weed in Florida. Hydrilla grows rapidly enough to fill waterways quickly, resist management techniques, and out-compete native submerged aquatic plant communities, thereby reducing plant diversity. Dense infestations of hydrilla can reduce dissolved oxygen levels, increasing the potential for fish kills. Long-term hydrilla infestations accelerate eutrophication by causing increased sedimentation. The spread of hydrilla limits recreational and commercial boating, wildlife use, and flood control in affected water bodies.

Water hyacinth *(Eichhornia crassipes)*, a native of South America, was imported into and is a major weed species in 53 countries. This floating pest was introduced into Florida in the 1880s, and by the early 1960s it covered more than 125,000 acres of public lakes and navigable rivers. Since then, efforts by the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers have reduced water hyacinth to approximately 1,000 acres. The growth rate of water hyacinth is among the highest of any plant. In Florida, water hyacinth populations can double in as little as twelve days by sending off short runner stems which develop new plants. It also reproduces by seed. Water hyacinth blocks waterways and limits boat traffic, recreation, flood control, and wildlife use. By shading and crowding out native aquatic plants, this invasive species reduces biological diversity in aquatic ecosystems.

Data Characteristics

SOURCE

This information can be obtained from Jeffrey D. Schardt, Environmental Programs Administrator, at the Bureau of Aquatic Plant Management, Florida Department of Environmental Protection, Innovation Park, Collins Building, 2051 East Dirac Drive, Tallahassee, Florida 32310, or at (850) 488-5631.

ACQUISITION

The data can be obtained in hard copy format at no cost.

COLLECTION

These estimates are collected on an annual basis, statewide in most counties. Data are represented by waterbody, and the waterbodies are aggregated by county.

TECHNICAL

Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The data represent public waterbodies (accessible by public boat ramp) and are consistently collected. Due to the various sources of potential error, data is rounded to the nearest hundred acres. Survey limitations include the following:

- Not every county is surveyed. For example, for coastal counties during the 1986-1995 period displayed below, there are no data on acreage of hydrilla or water hyacinth for Martin and Monroe counties; Broward, Dade, and St. Lucie counties were not surveyed from 1990 to 1996; and several counties (with low recent levels of infestation) reported no data in 1996. Thus, the area covered by the survey varies from year to year. The survey has never covered the entire state.

- A waterbody that spans more than one county is assigned to just one county for the purposes of tabulating acreage of exotic plant species. This may result in overestimation or underestimation of species' acreage when separating the data out to the level of coastal vs. non-coastal counties.

- Some exotics are found in both upland and wetland areas. This indicator, when combined with *Invasive Non-Indigenous (Exotic) Upland Species*, measures a large portion of the coastal ecosystem but is not all-inclusive even as a set.

Data Analysis

During the period 1986 to 1996, coastal county acreage of both hydrilla and water hyacinth peaked in 1987, but by 1988 acreage had dropped to below the 1986 levels. Hydrilla decreased 70 percent during the period and ranged from a high of about 15,000 acres in 1987 to a low of about 4,300 acres in 1995. Water hyacinth acreage followed a similar trend, decreasing 65 percent between 1986 and 1996 and ranging from a high of about 3,900 acres in 1987 to a low of 635 acres in 1990. In 1991, hydrilla infested over 40 percent of the entire state's public lakes and rivers, making it the most abundant fresh water plant in Florida public waters at that time. As noted above, it is possible that some of the change in measured hydrilla infestation is due to changes in the total area surveyed.

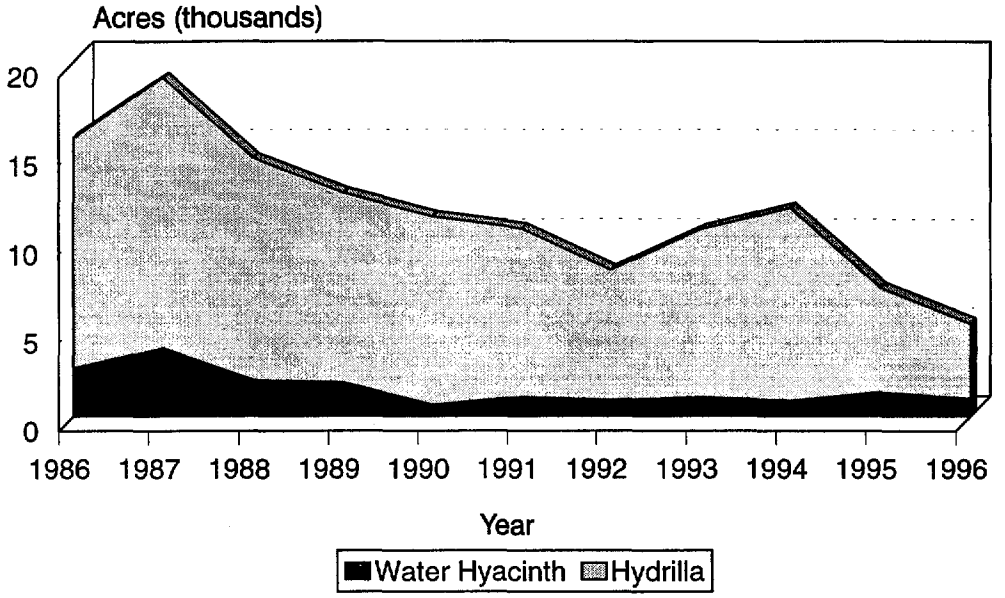
For Florida's coastal counties and for the state as a whole, state and federal management efforts have reduced the acreage of each of these plants in infested waters. Aggregates of plant acreage, however, may mask changes in individual waterbodies and counties. For example, in Palm Beach County, yearly hydrilla acreage decreased from over 1,000 acres in 1986 and 1987, to less than 500 acres in 1988 and 1989, to less than 100 acres between 1990 and 1996. In contrast, Gulf County's hydrilla acreage increased from 0 acres (1986-1989), to 100 or fewer acres (1990-1992), to 1,000 or more acres (1993-1995), and back to 100 or fewer acres (1996).

Estimated Acreage of Hydrilla and Water Hyacinth Infestation

Year	Water Hyacinth	Hydrilla
1986	2,700	13,000
1987	3,900	15,200
1988	2,000	12,500
1989	1,900	10,700
1990	600	10,600
1991	1,100	9,500
1992	1,000	7,400
1993	1,100	9,500
1994	900	10,900
1995	1,300	6,000
1996	1,000	4,300

Data rounded to nearest hundred acres.

Estimated Acreage of Hydrilla and Water Hyacinth Infestation



Change in Acreage of Invasive Non-Indigenous (Exotic) Upland Plants

Many ecosystems, particularly those in tropical and subtropical regions, are vulnerable to disturbance and invasion by introduced non-indigenous plant species. Such invasions have social, economic, and environmental impacts and focus attention on the threats these plants place on unique and irreplaceable ecosystems. Melaleuca, Brazilian pepper, Australian pine, and Chinese tallow are four of the many problem upland exotic plants in Florida.

Melaleuca was introduced into Florida as an ornamental at the beginning of this century. Later, it was purposely introduced into the Everglades in an ill-advised attempt to turn "useless swamps" into valuable land. During the last several decades, melaleuca has rapidly expanded its range into wetland habitats and urban and rural landscapes. Melaleuca infestations have increased fifty-fold at many sites over a period of 25 years. Melaleuca infests pine flatwoods, hardwood bottomlands, cypress forests, fresh water marshes, sawgrass prairies, and mangrove communities as well as improved pastureland, natural rangeland, idle farmland, urban areas, and other areas.

The Brazilian pepper tree is an aggressive perennial weed in southern Florida. Introduced as an ornamental in Florida, Brazilian pepper forms dense, ten-meter high thickets in poorly managed pastures, abandoned agricultural land, along roadsides, on canal banks, and in pine woods and hammocks. The tangled branches make it difficult to clear the land. In Everglades National Park, its rapid invasion threatens the destruction of part of the natural ecosystem. It covers thousands of acres in south and central Florida, the Florida keys, and other islands off the state's east and west coasts.

Australian pine has invaded large sections of the remaining undeveloped portions of the barrier islands along the Atlantic and Gulf coasts in south Florida. This exotic poses the greatest threat to native beach plant communities of southern Florida. It is resistant to salt spray and can grow close to the high tide line. The species tends to invade newly exposed sand and calcareous rubble, such as newly accreted beaches, areas where dredge spoil has been dumped, and beaches where storms have destroyed existing vegetation. It has been suggested that the Australian pine may interfere with the nesting of the American crocodile and sea turtles.

The Chinese tallow, native to eastern Asia, is a popular landscaping plant that has become naturalized in numerous places in Florida. Chinese tallow possesses the classic characteristics of most invasive pest species: it grows quickly, fruits when young, produces abundant seeds, resists native insects and diseases, grows in a wide range of soils, invades disturbed habitats, and is promoted and distributed by humans for its attractive ornamental qualities. Furthermore, the high content of tannins and allelopathic chemicals in the Chinese tallow are toxic to native fish, aquatic invertebrates, and macrofauna.

This indicator measures the change in acreage of exotic upland species and, thereby, the potential pressures placed on native plants.

Data Characteristics

SOURCE

Information on melaleuca, Brazilian pepper, and Australian pine is in the report *An Assessment of Invasive Non-Indigenous Species in Florida's Public Lands*, obtained from Don Schmitz, Wetland and Upland Alien Plant Coordinator, Bureau of Aquatic Plant Management, Florida Department of Environmental Protection (DEP), Collins Building, 2051 East Dirac Drive, Tallahassee, Florida 32310, or at (850) 488-5631. Chinese tallow information can be obtained from Greg Jubinsky, Environmental Administrator, Bureau of Aquatic Plant Management, Florida Department of Environmental Protection, 3917 Commonwealth Boulevard, MS-710, Tallahassee, Florida 32399-3000, or at (850) 487-2600.

ACQUISITION

Information can be obtained in a hard copy format at no cost for melaleuca, Brazilian pepper, Australian pine and Chinese tallow.

COLLECTION

The data on melaleuca, Brazilian pepper, and Australian pine are collected on an annual basis, statewide. The Florida Exotic Pest Plant Council is currently developing an exotic species database, and county acreage figures for all four of the plants addressed in this indicator should be available by the end of 1998.

TECHNICAL
Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The biggest limitations to the data are that the information was collected statewide, not by county, and that there are currently no acreage figures available on Chinese tallow. Also, some exotics are found in both upland and wetland areas. This indicator, when combined with *Invasive Non-Indigenous (Exotic) Upland Species*, measures a large portion of the coastal ecosystem but is not all-inclusive even as a set. The data in this indicator should be used as a benchmark until further data are available.

Data Analysis

Melaleuca is among the most problematic of 33 major exotic pest plant species that are destroying the biological diversity of Florida's natural wetland and upland areas. Most threatened among these is Florida's Everglades. Congressionally mandated efforts to establish more natural hydrologic cycles, improve water quality, and preserve unique species will cost millions of dollars over the next decade. Melaleuca, already present on 448,824 acres in southern Florida, threatens these efforts to restore this natural resource. Melaleuca also occurs in southern California and Hawaii and could survive in most coastal areas along the Gulf Coast.

In the south Florida region (from the north rim of Lake Okeechobee south to Florida Bay), melaleuca has infested 448,824 acres, the Brazilian pepper over 600,000 acres, and the Australian pine 373,723 acres. Generally, melaleuca, Brazilian pepper, and the Australian pine are found from mid-Brevard County transecting to mid-Pinellas County and extending to the southern border of Florida. The acreage estimates presented here are not a comprehensive assessment because the area north of Lake Okeechobee has not yet been assessed.

In the last decade the Chinese tallow tree has aggressively invaded many wetlands, lakes, and river margins, as well as disturbed and undisturbed uplands. Several small trees have been observed in tidal estuarine and coastal wetlands. Originally introduced into South Carolina, it is now naturalized in the southern coastal plain from South Carolina to Florida and west to Texas. According to a 1993 survey by DEP, the tree was found in 38 of the 67 counties in Florida (57 percent). Of those 38 counties, 25 counties had trees that were primarily associated with ornamental landscapes with only occasional outlier trees. Thirteen counties had numerous populations of trees present that were outside of the ornamental landscape and numbered more than fifty trees per cluster. Preliminary observations during the spring and summer of 1994 indicate a substantial increase in numbers of individuals in existing populations and considerable increase in new infestations. An acreage estimate on Chinese tallow is not available at this time.

Exotic Upland Plant Infestation in South Florida, 1994

Species	Infested Acres
Melaleuca	448,824
Brazilian pepper	602,504*
Australian pine	373,723

*Not including Everglades National Park estimates of an additional 101,000 acres of Brazilian pepper.

Recommendations

The Florida Department of Environmental Protection's Bureau of Aquatic Plant Management should collect acreage totals annually for each county in Florida. This would allow for accurate identification of improving and worsening problem areas.

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Documented Marine Mammal Strandings

Every year marine mammals, predominantly dolphins, whales, and manatees, are found stranded on the Florida coast. Strandings include dead or live animals that wash up on the shore. The animals are generally taken to a marine zoological park for rehabilitation. The reasons marine mammals beach themselves are unknown. The majority of strandings are simply a result of natural mortality. However, the presence of pollutants in marine mammal tissue has led some to speculate that increasing amounts of toxins in the ocean may be related to this phenomenon. This indicator is a measure of the number of marine mammals, excluding manatees, that are found stranded on the Florida coast each year.

Stranding is a natural process and has been occurring since long before pollutants were introduced to the oceans by humans. The role of pollutants in strandings has not yet been determined because of a lack of data. The sensitivity of marine mammals to pollutants is not known and thus the role of pollutants in strandings has not been determined. However, if stranded marine mammals have elevated toxin levels in their tissues, the number of strandings may be an indicator of ocean health.

Data Characteristics

SOURCE

Information on marine mammal strandings is available through Dr. Daniel K. Odell, coordinator of the Southeastern United States Marine Mammal Stranding Network, which maintains the Marine Mammal Stranding database. Dr. Odell can be contacted at Sea World of Florida, 7007 Sea World Drive, Orlando, Florida 32821-8097, or at (407) 363-2662.

ACQUISITION

Stranding reports and tabulations are available through electronic data transfer or in hard copy. There are no costs associated with the acquisition of these data.

COLLECTION

The Southeastern United States Marine Mammal Stranding Network tracks marine mammal strandings from Texas to North Carolina, Puerto Rico, and the U.S. Virgin Islands. The information is continually updated and tabulated quarterly. The main database is housed in the Smithsonian Institute in Washington, D.C. The southeastern region encompasses the coastal zones mentioned above, but this indicator only considers the Florida coast.

TECHNICAL

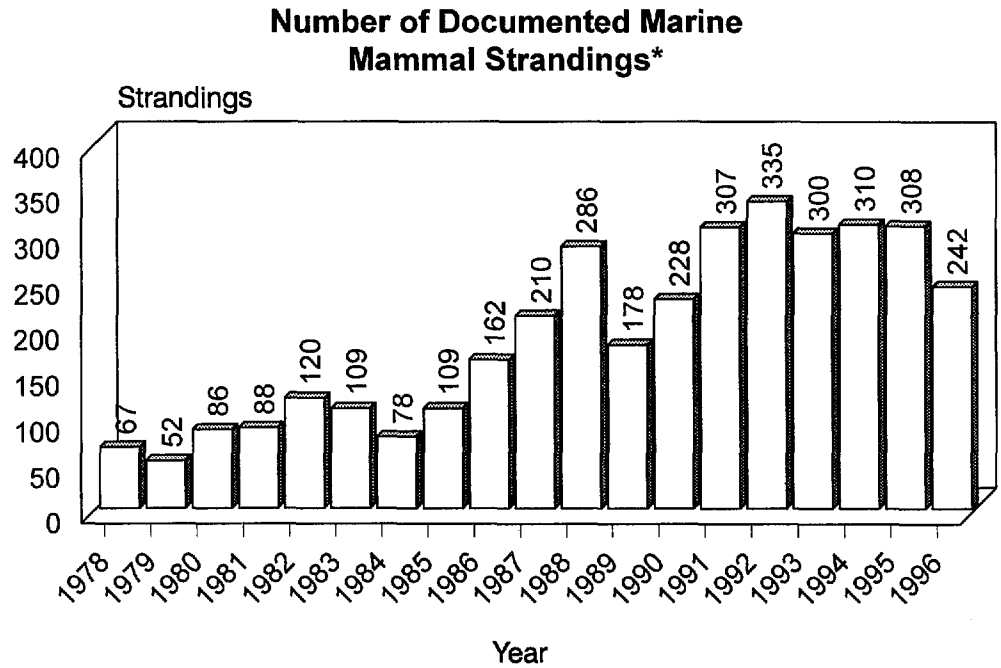
Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Often, marine mammal strandings on Florida's coast go undetected because of the remoteness of the site or because of the incomplete coverage of the state's volunteer network. Increases in strandings observed since the early days of the Network are due in part to increased awareness of and participation in the program and are not necessarily due to increased strandings statewide. While these limitations exist, these data are the best information available on marine mammal strandings on the Florida coast. The data have become more accurate and will continue to improve as the Network expands.

Data Analysis

The seventeen year period of record shows a general upward trend in the number of documented marine mammal strandings. From 1978 to 1982, strandings increased by 79 percent, from 67 reported strandings to 120. A slight decline in strandings following 1982 preceded an increase in strandings from 78 in 1984 to 286 strandings in 1988, a 266 percent increase. The slight increase in 1987 and the significant increase in 1988 are due to the east coast dolphin dieoff. The 178 strandings recorded in 1989 reflected a 38 percent decrease from the 1988 figure, and since 1991 the numbers have been around 300 per year. The increases in the 90's are in part due to the increased awareness of strandings on the part of the federal government as a result of the 1987-88 dieoff. The causes of marine mammal strandings and the fluctuations in the number of strandings from year to year are not known.



*Excludes manatees

Note: The 1996 data include all reports received through 17 January 1997.
The number is close to, but probably slightly below, the actual number of strandings reported.

Estimated Manatee Population and Documented Deaths

The West Indian manatee, *Trichechus manatus*, is a large, slow-moving, gray-brown aquatic mammal. It was designated Florida's state aquatic mammal in 1975. Manatees feed exclusively on aquatic plants, and the adults average about 1,000 pounds in weight and ten feet in length. Manatee population counts indicate the number of manatees frequenting Florida's coastal waters. Shifts in manatee population totals may indicate degradation of the coastal environment, as manatees are grazers that feed on nearshore seagrasses and other submerged vegetation. As the food source becomes degraded or less abundant, manatees will suffer.

Population analyses show a negative growth rate and list the main factors affecting population projections as adult survival and fecundity. A ten percent increase in adult mortality would drive the population to extinction over a 1000-year time scale, whereas a ten percent decrease in adult mortality would allow slow population growth. A ten percent decrease in reproduction would also result in extinction (Marmontel, et al, 1997).

Manatee deaths are caused by a variety of factors. The Manatee Salvage Data Base, maintained by the Florida Marine Research Institute (FMRI), delineates six primary categories of manatee mortality, as follows:

- Watercraft collision: More than half the watercraft collision deaths are caused by blunt trauma from impact with a boat; the rest are caused by propeller cuts.
- Flood gate/canal lock: Manatees may be crushed or caused to be drowned.
- Other human related: Deaths attributable to human activity other than watercraft collision and floodgate/canal lock deaths (e.g., drowning from or infection caused by entanglement in crab traps or fishing nets).
- Perinatal: Manatees 150 centimeters (about five feet) or smaller (newborn manatees) whose deaths are not attributable to a human cause are considered perinatal deaths.
- Other natural: Deaths caused by cold stress, bacteria, or other parasites.
- Undetermined: Nearly all undetermined deaths are carcasses that are too badly decomposed to allow for a clear determination of cause of death. This category also includes the rare event of a verified manatee death in which the carcass disappears before it could be recovered.

Given its dependence on a high quality marine habitat and its status as an endangered species, the manatee is important as an indicator of the environmental health of coastal Florida's nearshore and transitional habitats.

Data Characteristics

SOURCE

Data on manatee populations can be obtained from Dr. Bruce Ackerman, Florida Marine Research Institute, Florida Department of Environmental Protection, 100 8th Avenue, S.E., St. Petersburg, Florida, 33701, or at (813) 896-8626. Data on manatee deaths are compiled in the Manatee Salvage Data Base, managed by the Florida Marine Research Institute. For a summary report of these data contact Dr. Scott D. Wright, Florida Marine Research Institute, Marine Mammal Pathobiology Laboratory, 3700 54th Avenue South, St. Petersburg, Florida 33711, or at (813) 893-2904. Up to date information can be found via the Internet at **http://www.dep.state.fl.us /psm/webpages/mortal.htm**.

ACQUISITION

Both the population and mortality summary data can be obtained in hard copy format at no cost.

COLLECTION

Manatee count data are collected for the state three times each winter via statewide aerial survey. Manatee mortality data are compiled annually. Cause of death is determined through necropsies performed by the Florida Marine Research Institute.

TECHNICAL
Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

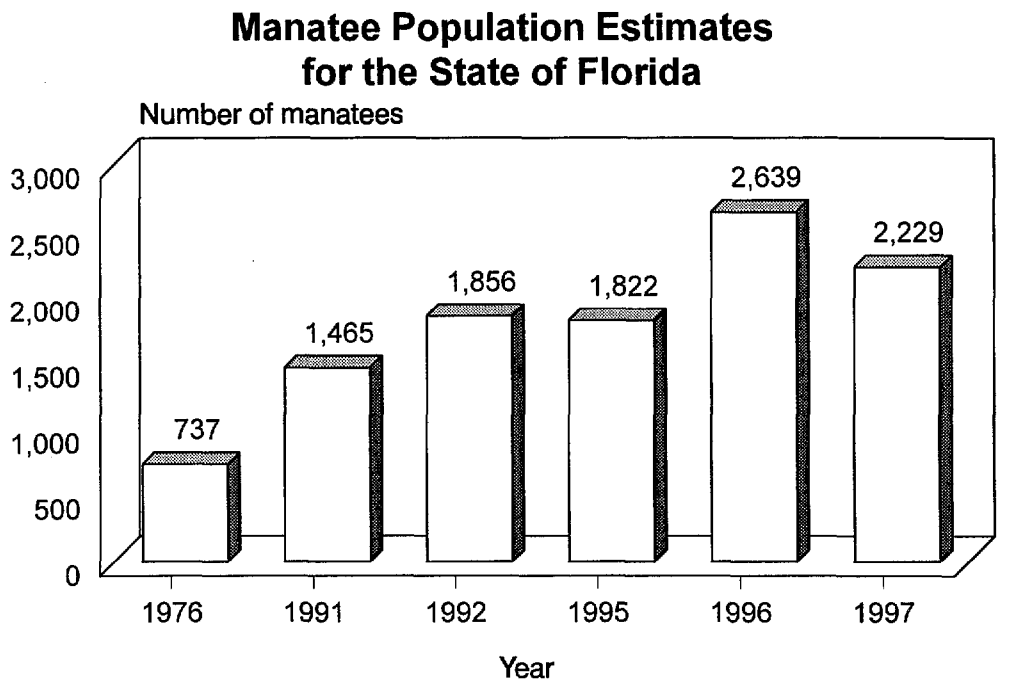
Data Limitations

Manatee population counts were done in 1976, 1991, 1992, 1995, 1996, and 1997. This irregular collection pattern limits the comparisons that can be made between the counts. Data on numbers of manatees counted are the actual figures, but they should be considered to be underestimates due to the limitations inherent in an aerial survey. Manatees move freely year-round, which adds to the difficulty of obtaining an accurate count.

The data pertaining to manatee deaths are dependent upon volunteer reporting, so these figures are likely to be underestimates. While the data on manatee populations are available on a statewide basis only, the data on manatee mortality are broken down by county. The total number of manatee deaths presented here is pertain only to coastal counties (where 93 percent of documented manatee deaths have occurred).

Data Analysis

The number of manatees counted increased between 1976 and 1997, from 737 to 2,229. This increase is probably partly due to actual increases in the population size, but may also be due to better counting techniques. From year to year, the number counted varies due to counting conditions as well as changes in the actual manatee population. It is believed that the decrease from 1996 to 1997 is due to actual population decrease as well as more difficult counting conditions.



The numbers of documented manatee deaths have followed a generally increasing trend with periodic declines. The changes in the numbers of documented manatee deaths could be attributed to better reporting, an increased population with normal mortality patterns, or fluctuations in mortality.

Between 1974 and 1996, the single greatest identifiable cause of death was collisions with watercraft (23% over the twenty-two year period). Although the number of manatees which died due to watercraft collisions continues to increase, the rate of increase has decreased during the past decade.

Other human related deaths (including flood gates/canal locks) account for only a small percentage (an average of 5.7 percent over the twenty-two year period of record) of the total deaths and the annual number of these deaths

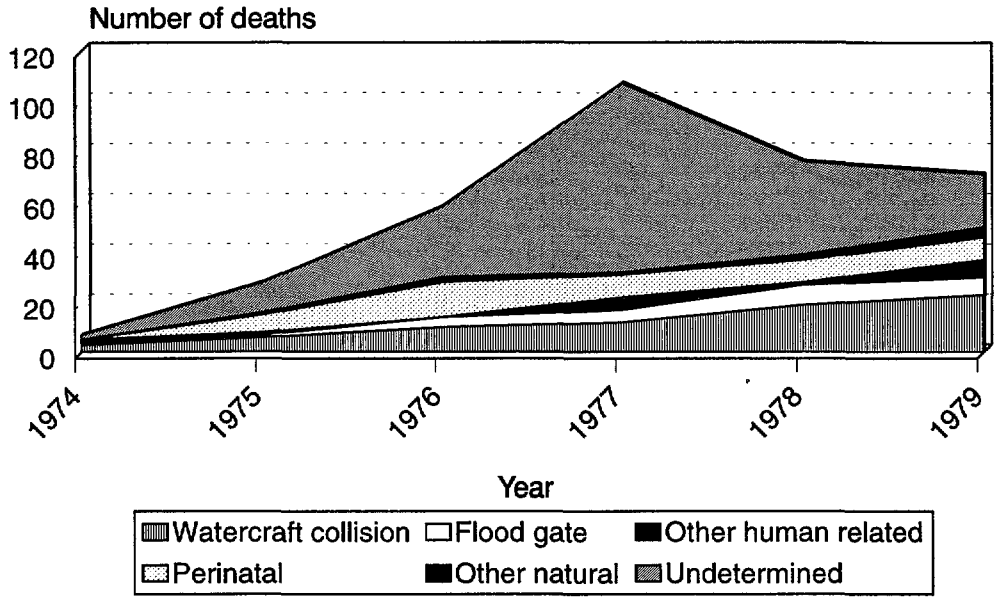
has remained fairly constant. The numbers of perinatal deaths have shown a steadily increasing trend, while the numbers of other natural deaths have fluctuated but generally increased. Undetermined deaths account for 32 percent of all documented manatee deaths over the twenty-two year period, although the number varies widely from year to year.

Number of Documented Manatee Deaths in Coastal Counties

Year	Cause of Death						
	Watercraft Collision	Flood gate/ Canal lock	Other human	Perinatal	Other natural	Undetermined	Total
1974	3	0	2	0	0	2	7
1975	6	1	1	7	1	12	28
1976	10	4	0	14	2	28	58
1977	12	5	5	9	1	75	107
1978	19	8	1	9	2	37	76
1979	23	7	7	9	4	21	71
1980	14	6	1	12	4	19	56
1981	22	1	4	12	9	64	112
1982	19	3	0	14	41	34	111
1983	13	2	5	17	6	28	71
1984	29	1	1	25	22	41	119
1985	32	2	3	21	19	35	112
1986	33	3	1	26	11	43	117
1987	39	4	2	29	14	20	108
1988	41	6	4	30	24	23	128
1989	45	3	5	38	32	39	162
1990	46	3	4	43	63	40	199
1991	51	6	6	49	14	39	165
1992	33	3	6	43	20	44	149
1993	33	3	6	39	24	32	137
1994	45	6	5	45	37	38	176
1995	42	5	5	53	33	54	192
1996	59	8	0	61	118	160	406
Total	669	90	74	605	501	928	2,867

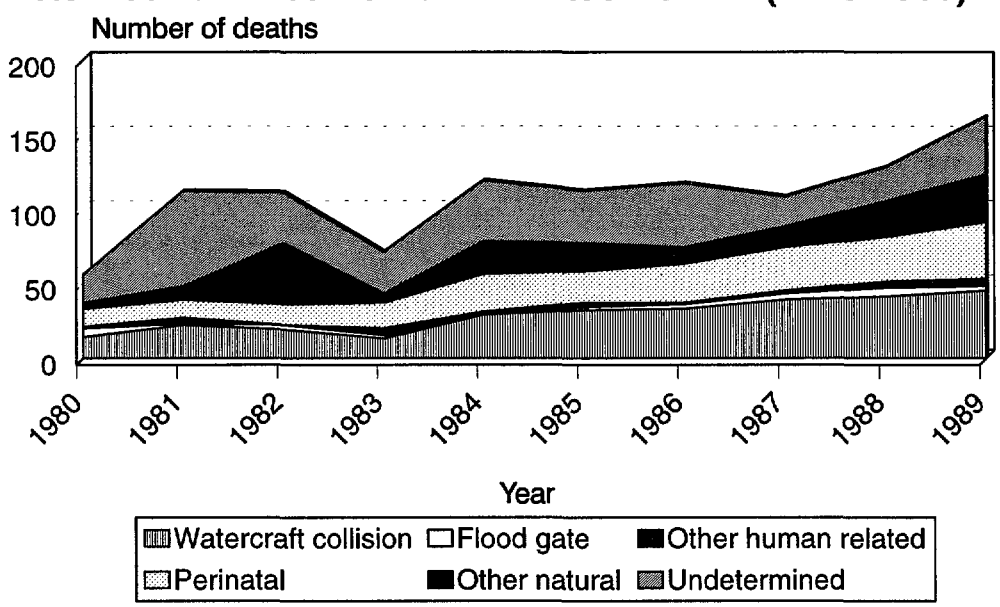
Source: Florida Department of Environmental Protection, Florida Marine Research Institute. 1997. Manatee Salvage Data Base. Summary Report.

Number of Documented Manatee Deaths (1974-1979)



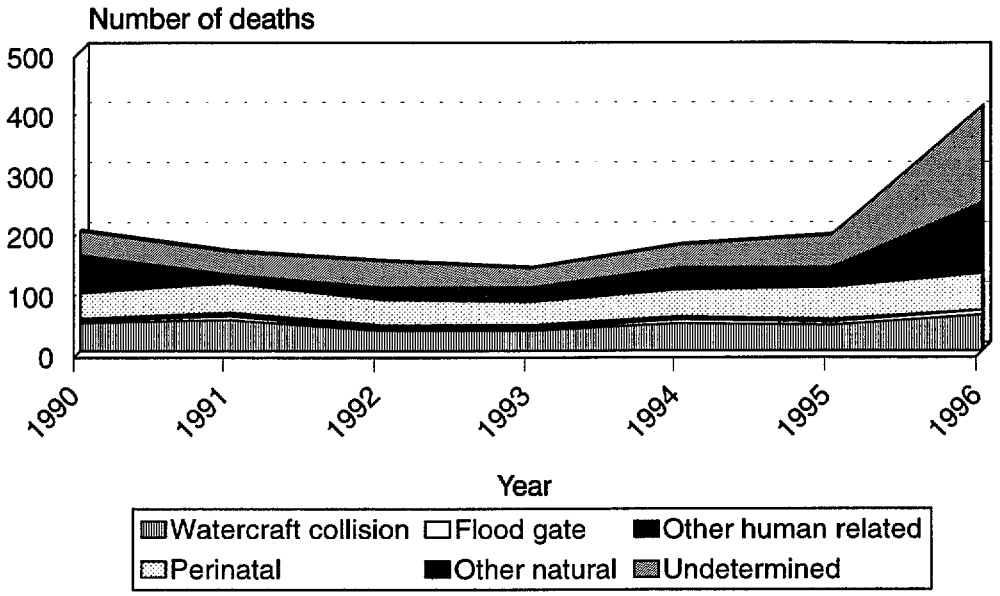
Note: Scale on each graph varies to maximize detail

Number of Documented Manatee Deaths (1980-1989)



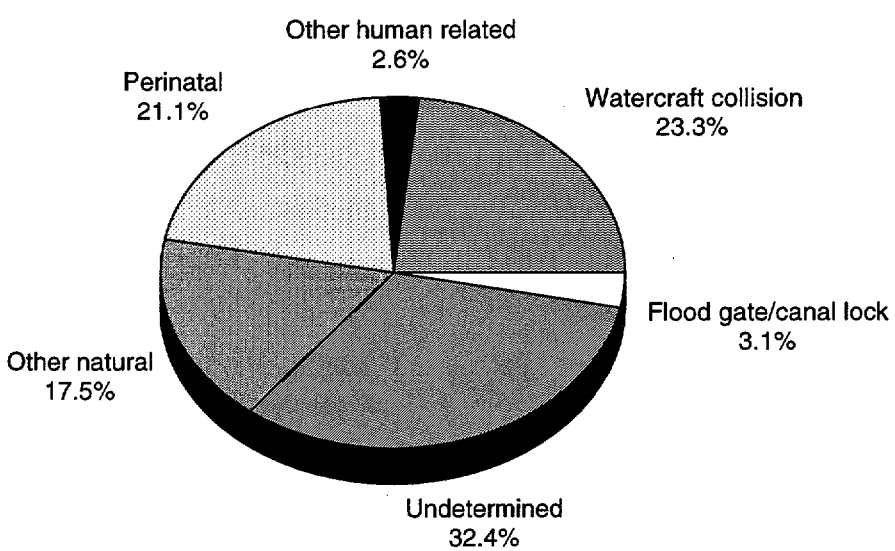
Note: Scale on each graph varies to maximize detail

Number of Documented Manatee Deaths (1990-1996)



Note: Scale on each graph varies to maximize detail

Manatee Mortality in Coastal Counties by Cause of Death, 1974-1996



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Sea Turtle Nesting Activity

Sea turtles are large air-breathing reptiles with long, paddle-shaped foreflippers. They are remarkably adapted for life in the sea, with a streamlined shape and powerful foreflippers which allow them to dive to great depths and travel long distances. Although sea turtles spend the majority of their time in the ocean, the females must lay their eggs on sandy beaches. Research on sea turtles has focused primarily on nesting females and hatchlings because they are the easiest to find and study. Information on the reproductive cycle and migration patterns has been collected from the thousands of sea turtles that have been tagged by researchers. More recently, satellite tracking has been utilized to gather information about other phases of the sea turtles' lives (Van Meter, 1992).

There are three species of sea turtles that regularly nest on Florida's extensive coast: the loggerhead (Caretta caretta), the green turtle (*Chelonia mydas*), and the leatherback (*Dermochelys coriacea*). Two other species, the hawksbill (*Eretmochelys imbricata*) and Kemp's ridley (*Lepidochelys kempi*), are considered to nest only rarely on Florida beaches. The loggerhead population that nests in the southeastern United States (primarily in Florida) is the second largest in the world and accounts for 35 to 40 percent of loggerhead nesting worldwide (Meylan et al., 1995). Florida's east coast from New Smyrna Beach to Boca Raton accounts for approximately 80 percent of the nesting activity on the east coast of the United States (Van Meter, 1992). Florida's green turtle nesting population is one of the largest remaining in the Caribbean Sea and western Atlantic Ocean. The only site in the continental United States where the leatherback turtle regularly nests is Florida.

All of the marine turtles that nest on Florida's beaches are protected under the Florida Statutes (Chapter 370.12) and the federal Endangered Species Act. Many federal, state, local, and private groups are working to protect sea turtles and aid in the recovery of turtle populations. These groups fund research on sea turtles, fund the purchase and management of critical habitat, and sponsor programs to educate and involve local citizens in protecting turtles. Continued support of ongoing conservation efforts, land acquisition, and public education is needed in order to protect sea turtles and reverse the decline in their populations.

This indicator provides data on the number of nests identified in survey efforts statewide. Two data sources are available from the Department of Environmental Protection, Marine Research Institute. The Florida Index Nesting Beach Survey database provides the best trend data since 1989. Longer term, but less standardized, data is available from the Florida Marine Turtle Nesting Summary database.

Data Characteristics

SOURCE

The Florida Index Nesting Beach Survey data are available from Blair Witherington, Florida Marine Research Institute, Florida Department of Environmental Protection, 19100 S.E. Federal Highway, Tequesta, Florida 33469 or at (407) 575-5455.

Additional data, including the report *Sea Turtle Nesting Activity in the State of Florida*, 1979-1992, may be obtained by contacting: Anne Meylan, Florida Marine Research Institute, Florida Department of Environmental Protection, 100 Eighth Avenue, S.E., St. Petersburg, Florida 33701-5095, or at (813) 896-8626, extension 1104.

ACQUISITION

The survey data are available in hard copy format at no cost.

COLLECTION

The data are obtained primarily through early-morning surveys of tracks on beaches that are used as nesting sites by sea turtles. In some cases, observers were present during the night and actually witnessed nesting activities. Species identification and assessment of nesting success were usually based on a surveyor's evaluation of features of the track and nest (e.g., track width, track configuration, size of the body pit). Both nests and false crawl (abandoned nestings) totals are available.

TECHNICAL
Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Begun in 1989, the Florida Index Nesting Beach Survey is a 10-year, standardized survey; its purpose is to consistently measure nesting totals throughout the state over time. The Index Nesting Beaches represent approximately 80 percent of the Florida statewide sea turtle nesting and cover 198 miles (24 percent) of Florida beaches, including 186 miles (48 percent) of east coast beaches. The index surveys are conducted during the same 16 week period (May 15 through August 31) and on the same beaches (27 total) each year. The few exceptions include the following:

- For 1989, Flagler Beach State Recreation Area, 1.3 kilometers of Juno Beach, and 0.2 kilometers of John U. Lloyd State Recreation Area are not included in the index survey.

- For 1989 and 1990, the weeks of 1,2, 15, and 16 are not included in the index survey for Ft. Clinch State Park, Amelia Islant, Little Talbot Island, Atlantic-Jacksonville Beach, Guana River State Park, and Fort Matanzas National Park.

The Florida Department of Environmental Protection also maintains a more comprehensive statewide turtle nesting database. This database, however, is not as useful for observing trends as it reflects heterogeneous data collection efforts and varying levels of surveyor experience. It has the advantage of covering a sixteen-year period. However, methodologies and survey efforts changed significantly over this period (e.g., survey effort increased several-fold during this time period). There are some limitations inherent in any survey methodology, although the Florida Coastal Issues Survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described above.

Data Analysis

Nesting activity (defined here as the numbers of nests counted) of all three species of sea turtles has remained relatively stable since 1991, although a slight increase in Loggerhead nests may be represented by the Florida Index Nesting Beach Survey (INBS) data. The smaller number of nests recorded in 1989 and 1990 may be a result of incomplete survey coverage during those years.

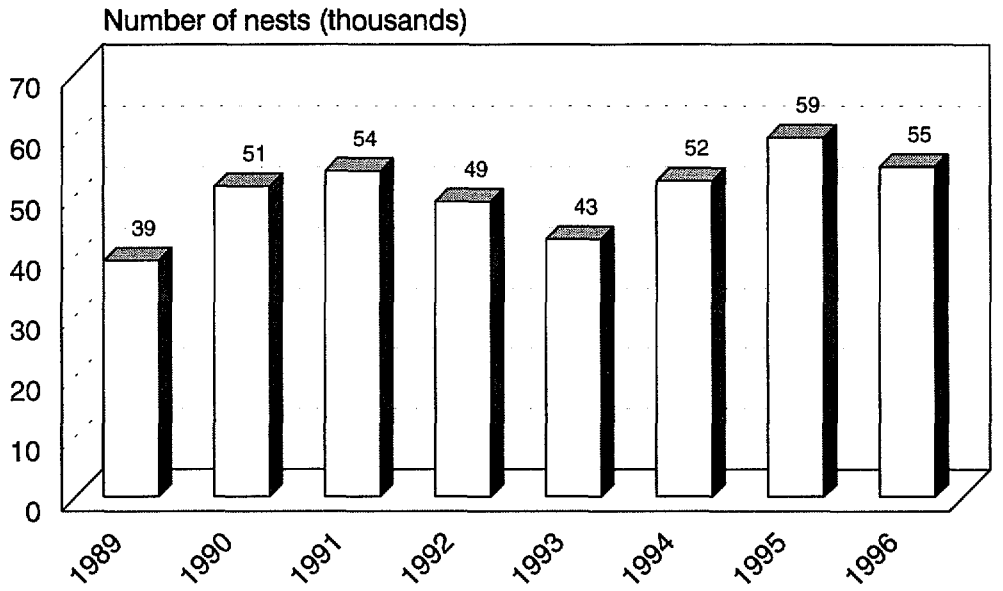
Sea Turtle Nests in Florida Index Nesting Beach Survey

Year	Loggerhead Turtle	Green Turtle	Leatherback Turtle
1989	39,172	466	44
1990	51,413	1,747	30
1991	53,899	397	69
1992	48,875	1,988	63
1993	42,689	272	48
1994	52,283	2,804	81
1995	59,379	359	85
1996	54,559	2,138	76

These figures should not be represented as an estimate of the overall number of turtle nests in the state. For instance, in 1994 the Florida Marine Turtle Nesting Summary (MTNS) database recorded 71,756 Loggerhead Turtle nests, 3,797 Green Turtle nests, and 259 Leatherback Turtle nests. Thus, in 1994 the INBS accounted for 73 percent of known Loggerhead nests, 74 percent of known Green Turtle nests, and 31 percent of known Leatherback nests. It is likely that some nests go undetected as well. A smaller percentage of leatherback nests are represented in the INBS data because leatherbacks begin nesting in March. INBS data are collected May 15 to August 31 in order to target the principal nesting period of the two more common species. Based on the MTNS

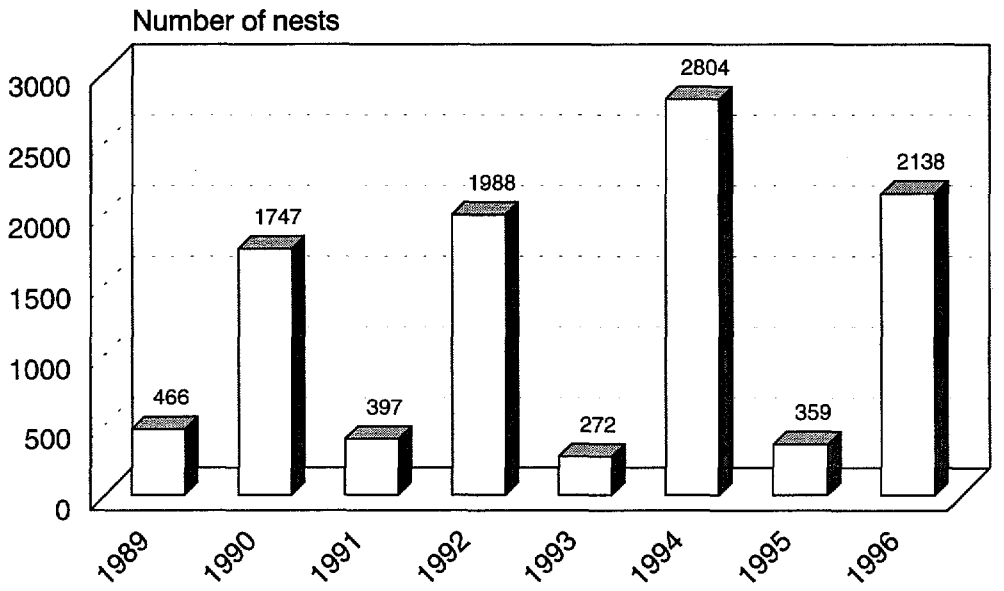
database, it is believed that nesting by all three species of sea turtles has increased over the past two decades. One factor that may contribute to the overall increase in nesting activity is the ongoing protection efforts focused on these species.

Loggerhead Turtle Nest Index

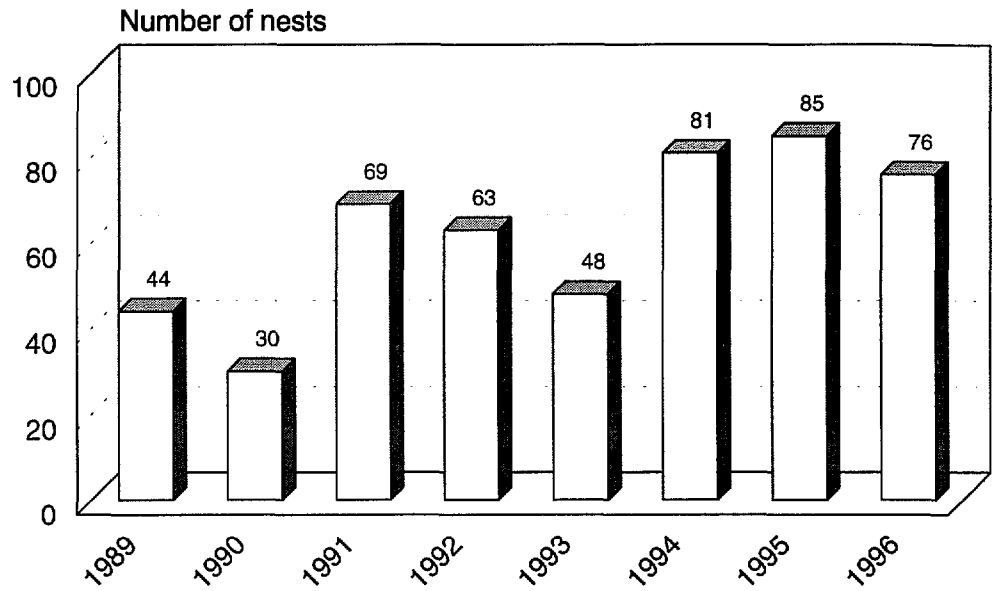


1989: Incomplete geographic coverage.
1989, 1990: Incomplete surveys at some sites.

Green Turtle Nest Index



Leatherback Turtle Nest Index



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Southern Bald Eagle Population

Florida supports more breeding southern bald eagles (Haliaeetus leucocephalus leucocephalus) than any other state in the U.S. (Nesbitt, 1995). These eagles are "dependent upon mature trees in which to nest and roost and perch" (Nesbitt, 1995). In addition, because eagles are at the top of the food chain and therefore susceptible to the bioaccumulation of pollutants, these animals will be among the first to respond to the changes that result from development of Florida's wild lands (FGFWFC, 1995). The southern bald eagle is therefore important as an indicator of the state's coastal environmental health and the declining abundance of coastal habitat.

Little is known about post-fledging survival of young eagles and post-nesting behavior of adult eagles. The survey effort focuses on nesting eagle populations. An active territory is defined as an area where there has been a nest and adult eagles are in attendance (either in a tree or simply within the territory); within a given territory, only one nest is active at a time. A successful nest is one which has produced at least one chick that has survived to fledging. Young are defined as chicks that are big enough to survive and fledge and fly off, not as chicks that have merely hatched (Nesbitt, 1995).

Data Characteristics

SOURCE

Annual reports are maintained by the Florida Game and Fresh Water Fish Commission, Bureau of Wildlife Research. They are available from Dr. Brad Gruver at 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (904) 488-3831. The raw data can be obtained from Steve Nesbitt at the Florida Game and Fresh Water Fish Commission, Wildlife Research Laboratory, 4005 South Main Street, Gainesville, Florida 32601, or at (352) 955-2230.

ACQUISITION

Data can be obtained in hard copy or on floppy disk in dBase format at no cost.

COLLECTION

The Florida Game and Fresh Water Fish Commission has been collecting southern bald eagle data for the state since 1973. Known territories are surveyed at least twice each nesting season using fixed-wing aircraft. Data are displayed for each Florida county that has ever contained a known bald eagle territory. Nesting population figures for each year represent periods that span from July 1 of one year to June 30 of the next year.

TECHNICAL

Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The data are consistently collected over time, at intervals specific to this species' breeding behavior, and should provide an excellent measure of the health of Florida's coastal environment. However, since data are collected via aerial survey, the figures reflect the inherent limitations of all aerial surveys as well as occasional individual responses to the presence of aircraft (e.g., some eagles assume an incubation posture in response to the presence of the survey plane). In addition, since the methodology employed involves the search of known eagle territories (i.e., it is not a systematic statewide search), the data represent a conservative estimate of nesting bald eagle populations (FGFWFC, 1988).

Data Analysis

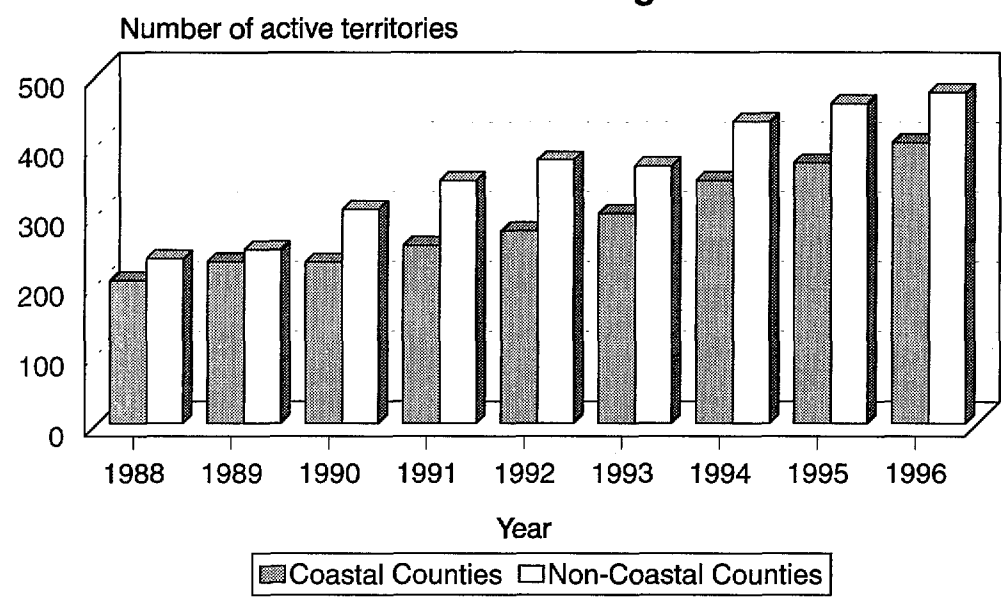
Florida's southern bald eagle population levels have increased to the point where, in August 1995, this subspecies was re-classified as threatened (as opposed to the former classification of endangered) by the federal government (Nesbitt, 1995). The eagles' reproductive productivity, however, has been consistently higher in Florida's non-coastal counties than in the coastal areas: from 1988 to 1996 the average number of active territories was 24 percent higher in non-coastal counties and the average number of successful nests was 32 percent higher than in the coastal counties. The average number of young per successful nest has remained close to 1.5 for both coastal and non-coastal counties. Between 1988 and 1996, the number of active bald eagle territories in the coastal counties increased 97 percent and the number of successful nests increased 123 percent. Escambia, Nassau and Walton counties are the only coastal counties in Florida that have never documented the existence of an active bald eagle nest (Nesbitt, 1995).

Southern Bald Eagle Reproductive Productivity in Florida

	Number of Active Territories			Number of Successful Nest			Young per Successful Nest		
Year *	Coastal	Non-Coastal	State Total	Coastal	Non-Coastal	State Total	Coastal	Non-Coastal	State Total
1988	204	235	439	143	163	306	1.48	1.67	1.58
1989	231	248	479	154	186	340	1.42	1.56	1.50
1990	230	306	536	156	210	366	1.61	1.59	1.60
1991	254	347	601	159	229	388	1.49	1.55	1.52
1992	275	377	652	180	288	468	1.60	1.53	1.56
1993	300	368	668	191	257	448	1.46	1.55	1.51
1994	347	432	779	260	331	591	1.63	1.59	1.61
1995	373	458	831	272	349	621	1.59	1.62	1.61
1996	402	474	876	319	406	725	1.59	1.52	1.55

* The years listed represent the end of the respective year-long survey periods (i.e., 1988 refers to the period between July 1, 1987 and June 30, 1988, etc.).

Number of Active Southern Bald Eagle Territories in Florida



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Reddish Egret Population

The reddish egret (*Egretta rufescens*) is a medium-sized heron that nests exclusively on coastal islands and forages on "broad, barren sand or mud flats, usually in water less than 15 cm [about 6 inches] deep" (Paul, 1996: 286). This species is the rarest heron in the United States: about 2,000 breeding pairs were estimated to exist in 1991, and about three-quarters of those were in Texas. The reddish egret is recovering from near extermination (due to plume hunting) in the early 1900s, and in recent decades it has been steadily re-occupying its former range. Habitat loss is now the biggest human threat to this species, although disturbance of foraging and nesting birds is again emerging as a problem. The reddish egret is listed as a "Category 2" candidate species for listing by the U.S. Fish and Wildlife Service and a species of special concern by the State of Florida (Paul, 1996).

In Florida, these birds occur along both coasts, with about two-thirds of the population located in Florida Bay and the Keys. Nesting occurs entirely on islands (on the ground, in low bushes, and in trees). Although population trends of reddish egrets in Florida do mirror availability of habitat, the cessation of plume hunting has had the single greatest effect on the increases in this species' numbers (Paul, 1997). Given its dependence on a high quality coastal habitat, the reddish egret is one of a number of species whose population trends and distribution could collectively characterize habitat conditions along the coast of Florida (Paul, 1997).

Naturalists have observed reddish egrets in Florida since the early 1800s, and data have been sporadically collected by various entities. Since the beginning of the twentieth century, the National Audubon Society has been collecting reddish egret data in an attempt to monitor species population trends.

Data Characteristics

SOURCE

Data are available in the fifth volume of the series *Rare and Endangered Biota of Florida*. This book may be purchased by contacting the publisher, University Press of Florida, at 15 N.W. 15th Street, Gainesville, Florida 32611, or at (352) 392-1351. The chapter on reddish egrets was prepared by Richard T. Paul. Mr. Paul was also the preparer of an October 1991 status report on reddish egrets for the U.S. Fish & Wildlife Service (Paul, 1991). This report may be obtained by contacting the Field Supervisor at the Office of Ecological Services, U.S. Fish & Wildlife Service, 17629 El Camino Real, Suite 211, Houston, Texas 77058, or at (281) 286-8282 (phone) or (281) 488-5882 (fax). Rich Paul may be contacted at the National Audubon Society, Tampa Bay Sanctuaries, 410 Ware Boulevard, Suite 500, Tampa, Florida 33619, or at (813) 623-6826 (phone) or rpaul@audubon.org (e-mail).

ACQUISITION

The *Rare and Endangered Biota of Florida* series is available in hard copy format. The volume on birds may be purchased from the publisher for $65 or may be borrowed from a library at no cost. The 1991 status report is available in hard copy format, and single copies may be obtained at no cost.

COLLECTION

The data are collected sporadically for different nesting sites in Florida. Surveys are performed by boat or on the ground, and nesting sites generally range from the Tampa Bay area to the lower Keys on the west coast and from Merritt Island to the Keys on the east coast.

TECHNICAL

Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data are collected intermittently for different sections of Florida, and the figures are extrapolated to yield estimates for the entire state. Attempts at systematic surveys have been sporadic in Florida, and the data have been collected by different people, sometimes at different points in the nesting season. It is important to remember that statewide population figures are estimates, not actual counts.

Data Analysis

Florida's current population of reddish egrets is thought to number about ten percent of the population that existed before plume hunting peaked around 1880 (Paul, 1996: 284). In the twentieth century, no nesting in Florida was known before 1938, when one nest was found in Florida Bay. Until 1970, there was no nesting outside Florida Bay and the Florida Keys. Clearly, the reddish egret appears to be increasing in number, although the exact rate and magnitude of increase are difficult to quantify.

In considering the following population estimates, it is important to distinguish between numbers of breeding pairs and numbers of birds. "Birds" includes immature individuals, whereas "breeding pairs" reflects pairs of nesting adults. Numbers of birds should not be assumed to simply reflect twice the breeding population.

Estimated Reddish Egret Population in Florida

Year	Estimated Population
1938	1 breeding pair
1944	50 birds
1954	not more than 150 birds
1959	not more than 200 birds
1974	300 birds
1977	150 breeding pairs
1980	250 - 300 breeding pairs (estimate from 1977 revised upwards)
1984	at least 300 breeding pairs
1990	350 - 400 breeding pairs
1996	400 breeding pairs

References

Paul, Richard T. 1991. *Status Report - Egretta rufescens (Gmelin). Reddish Egret.* U.S. Fish & Wildlife Service, Houston, Texas.

Paul, Richard T. 1996. "Reddish Egret." In Ashton, Ray E., Jr., series ed. *Rare and Endangered Biota of Florida. Volume V. Birds.* Edited by James A. Rodgers, Jr., Herbert W. Kale II, and Henry T. Smith. University Press of Florida: Gainesville, Florida.

Paul, Richard T. 1997. Personal communication. March 14, 1997.

Number of Wood Stork Nests

The wood stork, *Mycteria americana*, is one of the largest Florida wading birds, reaching a height of more than four feet with a wing span of about five feet. It is the only native North American stork, is listed as an endangered species in Florida, and has been federally listed as endangered since 1984. In the United States, there were an estimated 20,000 breeding pairs in the 1930s, 10,000 pairs in 1960, and 5,000 breeding pairs existing in 1978 (USFWS, 1996). There were 59 wood stork colonies known to be active in Florida during the late 1980s and early 1990s. The average colony size in 1995 ranged from 8 to 864 nests (Rodgers, 1995).

Wood stork nests and rookeries are typically found in or near fresh water and brackish wetlands. This species requires higher concentrations of fish and more foraging area than other wading birds due to a unique feeding technique of sweeping its bill from side to side and snapping it shut very quickly when it touches a fish. During breeding season, storks will forage in an area of 700 square miles. Wood storks are dependent not only on an ample supply of tidal fish, but also small reptiles and amphibians. Without the proper nutritional base to support nesting efforts, wood storks will not nest.

The loss or reduction in mangroves or cypress trees also contribute to a disruption in nesting effort. Mangroves are the preferred nesting habitat of wood storks in south Florida, and in northern Florida they prefer cypress trees in upland fresh water swamps and ponds. Recent research has indicated that the productivity of individual colonies of wood storks may be affected if the acreage of disturbed lands increases within a radius of 30 miles of a nesting colony (Campbell and Landry, 1995).

A decline of wood stork nests in Florida's coastal counties may be indicative of a combination of changing environmental conditions. Given its dependence on a high quality habitat and its status as an endangered species, the wood stork is important as an indicator of the state's coastal environmental health and the declining abundance of coastal habitat.

Data Characteristics

SOURCE
The data are available by contacting Linda Finger of the United States Department of the Interior, Fish and Wildlife Service, 6620 Southpoint Drive South, Suite 310, Jacksonville, Florida 32216-0912, or at (904) 232-2580.

ACQUISITION
The data can be obtained in hard copy format at no cost.

COLLECTION
The United States Department of the Interior, Fish and Wildlife Service has contracted with the Florida Game and Fresh Water Fish Commission to collect wood stork nesting population figures. Data will be collected for three consecutive years (1993-1995), then the population will be monitored for five years. Thereafter, three years of data collection will again take place. Data collection began in 1993 and are estimated based on aerial surveys. Areas selected for observation are based on the historical presence of wood storks and areas that wood storks would likely inhabit.

TECHNICAL
Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data are reliable and are consistently collected, thereby providing a reasonable measure of the health of the wood stork's coastal environment; however, there are several limitations. The number of nests must be estimated due to the inherent limitations of an aerial survey. Because the survey is conducted one time per year, the result may be an underestimation of nests, as the "nesting peak" may vary between areas.

Data Analysis

In 1993 there were an estimated 2,963 wood stork nests in Florida's coastal counties. In 1994 the estimate declined to 2,023 nests, and in 1995 the number rebounded to 3,760 nests. Large fluctuations are characteristic of wood stork nesting populations. Wood storks will abandon the nest if the nest is not protected from predators by deep water and if shallow water is not nearby for ready food consumption. Both criteria change when the water level fluctuates.

Of the eleven coastal counties that had wood stork nests present in 1993, six experienced an increase and five experienced a decrease in the number of nests by 1995. In 1995, Brevard, Martin, and Palm Beach counties experienced increases partly or wholly attributable to new colonies located during the census. Brevard, Collier, Hernando, Hillsborough, and Pasco counties showed significant gains in the number of nests between 1993 and 1995. Manatee, St. Johns, and St. Lucie counties showed significant losses in the number of nests between 1993 and 1995. Overall, the estimated number of wood stork nests increased 27 percent during the three-year period. With only three years of data available it is still too early to determine a significant trend in Florida's coastal counties. Additional years of collection will be needed to establish the health and viability of the coastal wood stork population. The last column presents the average for each county with at least two years of data available. An increase (+) or decrease (-) between 1994-95 is also shown.

Estimated Wood Stork Nests by Coastal County, 1993 - 1995

Coastal County	1993	1994	1995	Average 1993-95
Brevard	505	345	723	524 (+)
Collier	426	450	864	580 (+)
Dade	40	N/A	N/A	N/A
Duval	345	330	445	373 (+)
Hernando	12	16	175	67 (+)
Hillsborough	N/A	8	115	41 (+)
Indian River	225	110	230	188 (+)
Manatee	140	N/A	33	57 (+)
Martin	N/A	N/A	65	N/A
Monroe	N/A	160	105	88 (-)
Palm Beach	N/A	N/A	27	N/A
Pasco	180	169	410	253 (+)
Sarasota	520	170	500	396 (+)
St. Johns	170	N/A	60	76 (+)
St. Lucie	400	265	8	224 (-)
TOTAL	2,963	2,023	3,760	2,915 (+)

N/A=No active nests or data not available

References

Campbell, Kyle and Shawn Landry. 1995. *Florida's Wetland and Fresh Water Ecosystems.* Florida Center for Community Design and Research, University South Florida. **[http://www.arch.usf.edu:80/fcfguide/chap5/chap5-2.htm]**.

Rodgers, James. 1995. *Census of Wood Stork Colonies in Florida.* Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

U.S. Fish and Wildlife Service. 1996. "Wood Stork." in *Endangered and Threatened Species of the Southeastern United States (The Red Book)* Region 4 (As of 1/96). **[http://www.fws.gov/~r9endspp/i/b/sab5z.html]**.

Number of Eastern Brown Pelican Nests

Given its status as a threatened species in Florida and its dependence on a high quality coastal habitat, the eastern brown pelican (*Pelicanus occidentalis carolinensis*) is important as an indicator of the state's coastal environmental health and the declining abundance of coastal habitat. Mangroves are the preferred nesting substrate in Florida. Loss of or reduction in nesting substrate may result in a decline in nesting effort. The loss of mangroves to freezes in the 1980s and development have impacted the numbers of nesting brown pelicans in Florida. Chemical pollution of coastal habitat can also reduce the number of pelican nest. Development has also impacted alternate nesting substrates, which may further explain declines in nesting efforts. Additionally, without the proper nutritional base to support nesting efforts, pelicans will not nest.

Given the brown pelican's need for quality habitat, the presence of nests is an indication that high quality habitat is available. The recent declining trends in numbers of eastern brown pelican nests may indicate degradation of nesting substrates or fluctuations in the food supply and a need for remedial actions along some areas of the Florida coast.

Data Characteristics

SOURCE

Annual reports are maintained by the Florida Game and Fresh Water Fish Commission, Bureau of Wildlife Research. They are available from Dr. Brad Gruver at 620 South Meridian Street, Tallahassee, Florida 32399-1600, or at (850) 488-3831. The raw data can be obtained from Steve Nesbitt at the Florida Game and Fresh Water Fish Commission, Wildlife Research Laboratory, 4005 South Main Street, Gainesville, Florida 32601, or at (352) 955-2230.

ACQUISITION

Reports are produced in hard copy format, and raw data are available on floppy disk in database format at no cost.

COLLECTION

The Florida Game and Fresh Water Fish Commission has been collecting brown pelican nesting data since 1968. Known nesting sites are surveyed from fixed-wing aircraft near the expected peak of the nesting season. In 1983 data collection efforts were changed to a biennial survey; however, concern over the brown pelican's nesting effort and success prompted a return to annual nesting surveys in 1991.

TECHNICAL

Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The data have been consistently collected over time, surveying all sites known to have had nesting brown pelicans since 1968. Estimates of the number of nests are subject to the inherent limitations of aerial surveys such as the variability in observers' ability to distinguish among species and the difficulty in getting specific nest counts through aerial viewing. In addition, seasonal and annual differences in the timing and intensity of nesting, relative to the surveys, affect the number of nests counted for each colony site. This can lead to an underestimation of total nests in any one year, as the "nesting peak" may vary over time and between areas.

Data Analysis

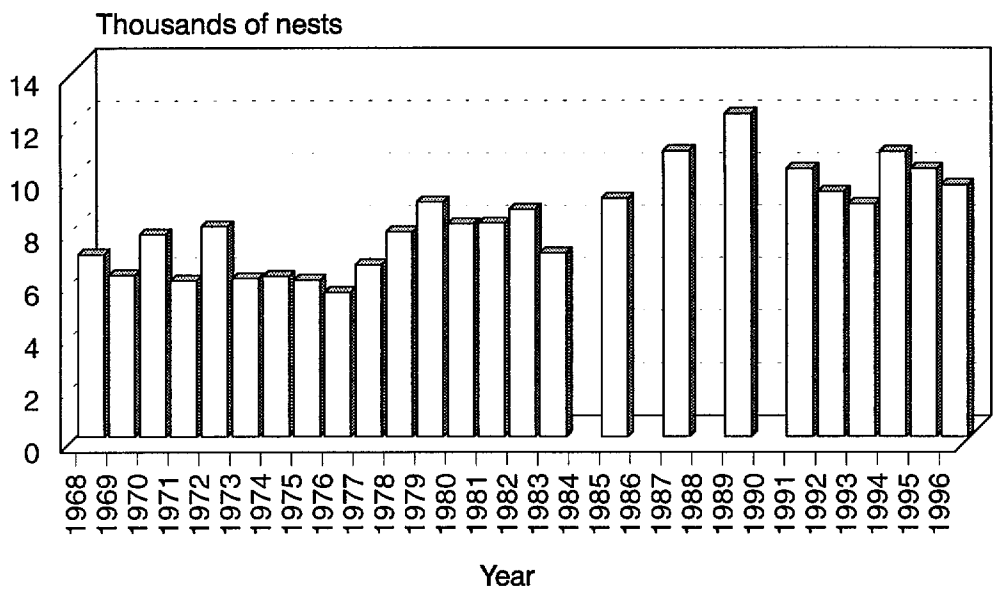
Between 1968 and 1989, numbers of active brown pelican nests followed a generally increasing trend. This is most likely attributable to actual increases in nesting populations, as the survey effort remained stable during that period. The number of nests declined from a high of 12,310 in 1989 to 8,866 in 1993. This decline in nesting effort may be a result of the mangrove-destroying freezes of the 1980s. Pelicans have been forced to use alternative types of vegetation or nest on the ground due to the degradation of the nesting substrate. The number of nests increased to 10,858 in 1994, an increase of over 22 percent from the previous year. Between 1994 and 1996 the number of nests decreased nearly 12 percent, to a total of 9,598 nests in 1996.

Estimated Number of Eastern Brown Pelican Nests

Year*	Number of Active Nests	Year*	Number of Active Nests
1968	6,936	**1983**	6,980
1969	6,133	**1984**	N/A
1970	7,690	**1985**	9,078
1971	5,923	**1986**	N/A
1972	7,990	**1987**	10,882
1973	6,010	**1988**	N/A
1974	6,090	**1989**	12,310
1975	5,950	**1990**	N/A
1976	5,491	**1991**	10,208
1977	6,532	**1992**	9,335
1978	7,780	**1993**	8,866
1979	8,942	**1994**	10,858
1980	8,095	**1995**	10,227
1981	8,125	**1996**	9,598
1982	8,666		

* The years listed represent the end of the respective year-long survey periods (i.e., 1978 refers to the period between July 1, 1977 and June 30, 1978, etc.).
N/A = not applicable (nesting surveys were not conducted during these years)

Estimated Number of Eastern Brown Pelican Nests



Acreage of Seagrass

The term "seagrass" is used to describe a group of species of grass-like plants that grow in shallow coastal waters. In Florida, the three predominant species are commonly known as turtle-grass(*Thalassia testudinum*), shoal-grass (*Halodule wrightii*), and manatee-grass (*Syringodium filiforme*). Seagrasses may exist as small, patchy beds or as large, dense meadows. The species differ in their tolerance of environmental variables such as water depth, current strength, and level of salinity. Seagrasses provide food for waterfowl, manatees, and green sea turtles and are essential habitat for shellfish and finfish. They also affect nutrient cycling, sediment stability, and water turbidity.

A number of phenomena may have adverse effects on seagrasses and can disrupt the delicate balance within these communities. As a result of human population growth in coastal areas, there is more suspended solids and turbidity in the water, so estuaries are experiencing a deterioration of ambient water quality. Turbidity obstructs the sunlight from reaching the seagrass, there by prohibiting growth. This results in oxygen-deficient water, reduced water column transparency, and a decline in the entire ecosystem. Human causes of seagrass degradation include water pollution, activities such as dredging and filling, and events such as scarring (which occurs most frequently from boat propellers). Declines in seagrasses are being documented worldwide.

The habitat requirements of seagrasses are used to characterize water quality because of seagrasses' widespread distribution, important ecological role, and sensitivity to water quality parameters. Seagrasses are particularly vulnerable to reduced water clarity (transparency), so their distribution (both depth and extent) is a good indicator of this water quality parameter.

Data Characteristics

SOURCE

Information on the total acreage of seagrass can be obtained by contacting Frank Sargent at the Florida Marine Research Institute, Florida Department of Environmental Protection, 100 Eighth Avenue, S.E., St. Petersburg, Florida 33701-5095, or at (813) 896-8626 (SUNCOM 523-1011).

Information on the acreage of seagrass in Tampa Bay and Charlotte Harbor can be obtained by contacting Raymond C. Kurz at the Surface Water Improvement and Management Department, Southwest Florida Water Management District, 7601 U.S. Highway 301 North, Tampa, Florida 33637, or at (813) 985-7481.

Information on the acreage of seagrass in Sarasota Bay can be obtained by contacting Dave Tomasko at the Surface Water Improvement and Management Department, Southwest Florida Water Management District, 115 Corporation Way, Venice, Florida 34292, or at (941) 486-1212.

Information on the acreage of seagrass in the Indian River Lagoon System can be obtained by contacting Bob Day at the Indian River Lagoon National Estuary Program, 1900 South Harbor City Boulevard North, Suite 109, Melbourne, Florida 32901, or at (407) 984-4950.

ACQUISITION

The data can be obtained in hard copy format at no cost.

COLLECTION

Because of the expense, seagrass mapping programs are generally completed in two- to five-year cycles by the water management districts, if at all. For example, the Southwest Florida Water Management District, South Florida Water Management District (east coast only), and St. Johns River Water Management District are involved in seagrass mapping projects. Currently, the Northwest Florida Water Management District and the Suwannee Water Management District are not involved in seagrass estimates. Some regions in the state are mapped in five to ten year cycles as joint efforts between federal agencies and/or the state. These projects include the Big Bend seagrass project by the U.S. Minerals Management and the Florida Keys National Marine Sanctuary coral Reef and Hardbottom Monitoring Project by National Oceanic and Atmospheric Administration (NOAA) and the Florida Department of Environmental Protection/ Florida Marine Research Institute (DEP/FMRI).

Seagrass data by the Florida Marine Research Institute are from the Panhandle, Big Bend, Tampa Bay, Lemon Bay, Charlotte Harbor, South Florida, Palm Beach County, Hobe Sound, Indian River Lagoon, and Mosquito Lagoon. Data for the Panhandle were interpreted in 1993 by the Florida Department of Environmental Protection (DEP) from 1984-1985 using color aerial photography. Data for the Big Bend were interpreted in 1984 by the U.S. Department of the Interior Mineral Management Service using natural color aerial photography. Tampa Bay data were interpreted in 1992 by the Southwest Florida Water Management District using natural color aerial photography. Lemon Bay data were compiled in 1988 by Mangrove Systems, Inc. using aerial photography and were digitized into ERDAS. Charlotte Harbor to Estero Bay data were compiled by DEP and the Florida Department of Transportation using aerial photography. South Florida data were compiled from several sources at DEP using aerial photography. Palm Beach data were compiled by Palm Beach County using Auto-CAD and ARC/INFO. Hobe Sound data were provided to DEP by the Jupiter Inlet Aquatic Preserve Manager. Indian River Lagoon data were interpreted by the St. Johns River Water Management District using color infrared aerials. Mosquito Lagoon data were interpreted from 1986 Landsat-TM imagery by the Bionetics Division of Kennedy Space Center and converted from image format to an ARC/INFO coverage by DEP in 1994. Additional areas of current and/or future seagrass mapping projects include the Florida Keys National Marine Sanctuary, Florida Bay, Biscayne Bay, and the area from Anclote Key to the Florida-Alabama border. The projects that should be completed by 1997 are: Florida Key National Marine Sanctuary- FMRI, Florida Bay- FRMI, Biscayne Bay- FMRI, Big Bend- United States Geological Survey (USGS), Panhandle- USGS, and the Indian River Lagoon- St. John's River Water Management District (Sargent, 1997).

TECHNICAL

Hierarchy of Indicators: 6
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Currently, the data on acreage of seagrass are inconsistently and infrequently collected. Data collection is done on a regional basis; however these regions do not cover the entire state, and the timing cycle of collection varies among these regions. In addition, the acreage estimate in this indicator does not include seagrass acreage for Duval, Flagler, Nassau, or St. Johns counties (Florida's four northeastern-most coastal counties) because of unsuitable habitat for seagrass beds.

Sources of Data for Estimating Total Acreage of Seagrass

Coverage	Counties Included	Date	Scale	Source
Bendgrass	Citrus, Hernando, Jefferson, Levy, Pasco, Pinellas, Taylor	1983	1:40,000	Minerals Management Service (MMS)
Chargrass	Charlotte, Collier, Lee, Manatee, Sarasota	1982, 1987	1:24,000	Florida Dept. of Transportation, Florida Dept. of Environmental Protection, Mangrove Systems, Inc., FMRI
IRLgrass	Brevard, Broward, Indian River, Martin, St. Lucie, Volusia	1992	1:24,000	St. Johns River Water Management District
Palmgrass	Martin, Palm Beach	1990	1:24,000	Palm Beach County
Pangrass	Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa, Wakulla, Walton	1982-1985	1:24,000	FMRI
SFgrass	Dade, Monroe	1982-1986	1:40,000	Marszalek, Dade County, MMS, FMRI
Tbaygrass	Hillsborough, Manatee, Pinellas, Sarasota	1990	1:24,000	Southwest Florida Water Management District, FMRI

* Identifying name for seagrass-coverage data in the Marine Resources Geographic Information System at the Florida Marine Research Institute (FMRI).
Source: FMRI Technical Report TR-1

Different programs run in different yearly cycles. This means that total seagrass acreage will never be current for the entire state in one year. The data will always be after the fact. Most mapping programs take one to two years to be completed after the aerial photography was obtained.

As data become available in the future, changes in acreage of seagrass will be seen. This is significant because seagrass can be used to characterize water quality. These are the most accurate data currently available. In addition to the above limitations, it should be noted that seagrass mapping is done using aerial photography. Typically, aerial photography can only penetrate water 30 to 45 feet in depth. Any seagrasses growing beyond these depths are not mapped. In addition, water clarity can limit the amount of penetration, thus reducing the accuracy of the mapping effort. Current mapping programs are structured in such a way as to maximize all conditions pertinent to a successful program and enhance accuracy.

Data Analysis

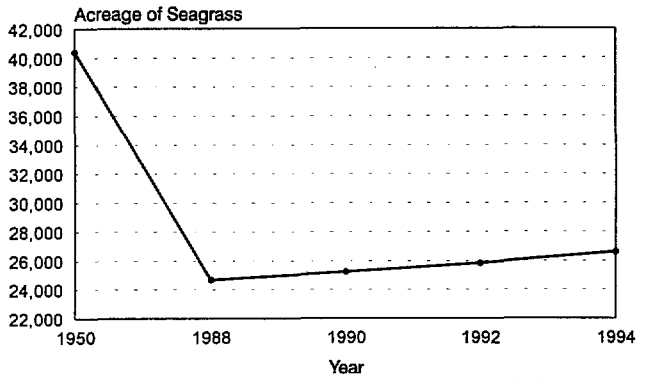
The total acreage of seagrass the in Florida coastal counties that are surveyed is approximately 2,658,290 acres. This estimate is derived by adding all of the acreage figures from the various seagrass mapping projects conducted in coastal counties around the state. This figure does not include seagrasses in Duval, Flagler, Nassau, and St. Johns counties. The figure includes hardbottom communities where seagrass coverage is notable in addition to sparse seagrasses in the Florida Keys. This total should be used as a benchmark until future data are available. It should also be noted that this figure may be a slightly conservative estimate, as there are many regions where some species of seagrasses grow in deep water on a seasonal basis over large areas and therefore may not have been detected when the area was being mapped. Over fifty percent of Florida's seagrass acreage is in Monroe County.

While determining the trend of seagrass growth is not possible because of the lack of present data, examining the different seagrass acreage for the four National Estuary Programs in the state should display a general direction of seagrass coverage, if not a trend of total seagrass growth. The four National Estuary Programs in the state of Florida are: Tampa Bay National Estuary Program, Charlotte Harbor National Estuary Program, Sarasota Bay National Estuary Program, and the Indian River Lagoon National Estuary Program. The following charts show the trends in seagrass coverage for the National Estuary Programs in Florida.

Seagrass Coverage in Tampa Bay

Year	Seagrass Acreage	Percent Change in Seagrass Coverage
1950	40,400	
1988	24,681	-38.9%
1990	25,235	2.2%
1992	25,827	2.3%
1994	26,608	3.1%

Sources: Tampa Bay National Estuary Program, Technical Publication #07-93. 1995.
Kurz, Raymond C. (1997). Personal communication.
Southwest Florida Water Management District.

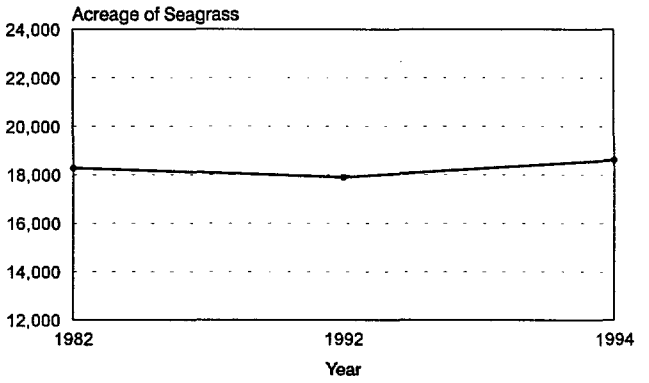


Note: The graph is not equally distributed because of the lack of information between 1950 and 1988.

Seagrass Coverage in Charlotte Harbor

Year	Seagrass Acreage	Percent Change in Seagrass Coverage
1982	18,284	
1992	17,898	-2.1%
1994	18,615	4.0%

Source: Kurz, Raymond C. (1997). Personal communication. Southwest Florida Water Management District.

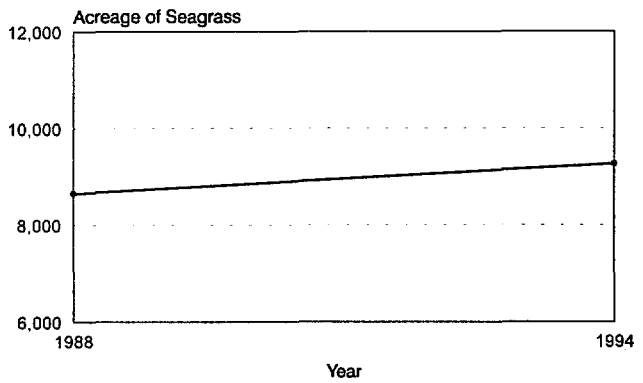


Note: The graph is not equally distributed because of the lack of information between 1982 and 1992.

Seagrass Coverage in Sarasota Bay

Year	Seagrass Acreage	Percent Change in Seagrass Coverage
1988	8,650	
1994	9,264	7.1%

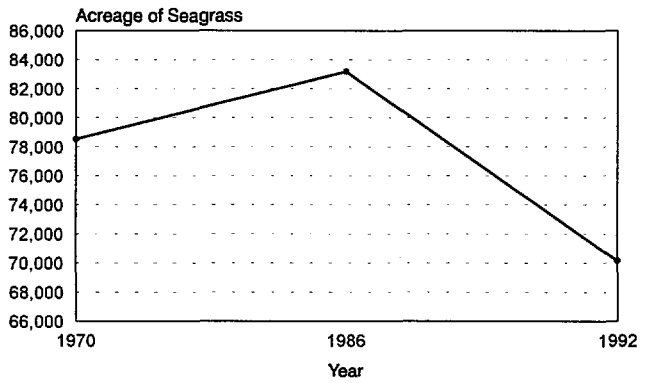
Source: Tomasko, David. (1997). Personal communication. Southwest Florida Water Management District.



Seagrass Coverage throughout the Indian River Lagoon Complex

Year	Seagrass Acreage	Percent Change in Seagrass Coverage
1970-76	78,519	
1986	83,170	5.9%
1992	70,139	-18.6%

Source: Woodward-Clyde Consultants, *Historical Imagery Inventory and Seagrass Assessment Indian River Lagoon*, Indian River Lagoon National Estuary Program. Melbourne Florida. 1994.
Note: In the report, other submerged aquatic vegetation beds were included with seagrass beds.



Note: The graph is not equally distributed because of lack of information. The acreage representing 1970-76 is graphed as 1970.

Tampa Bay

Tampa Bay is Florida's largest estuary, and it is an urban estuary. Urban areas within the watershed include the metropolitan areas of Tampa and St. Petersburg. Dredge and fill activities "...have resulted in direct loss of seagrass in Tampa Bay" (Janicki, et, al, 1995). It is likely that "...Increased light attenuation due to elevated chlorophyll and suspended solids in the water column has also contributed significantly to reduce seagrass growth and eventual declines" (Janicki, et, al, 1995). These occurrences were determined to be the causes for the drastic reduction of seagrass acreage between 1950 and 1988. Overall, seagrass coverage in Tampa Bay has been increasing steadily for the past several years due, in part, to improvements in wastewater treatment which has resulted in a reduction in nutrient (such as nitrogen and phosphorous) loads to the bay (Kurz, 1997).

Charlotte Harbor

Charlotte Harbor is the second largest open water estuary in the state created by the inflow of the Myakka, Peace and Caloosahatchee rivers into the Gulf of Mexico. The Charlotte Harbor National Estuary Program was established in July 6, 1995, so historical information is limited. Trends in Charlotte Harbor are probably less impacted by eutrophication processes and more by the changes in water clarity associated with stream flow from two major rivers emptying into the harbor (Kurz, 1997).

Sarasota Bay

There were two areas that experienced the biggest increase of seagrass acreage. In the area around the city of Sarasota, there was an increase of 191 acres between 1988 and 1994. The other area that showed the majority of the growth was surrounding Tidy Island. Tidy Island is in the northern part of the Sarasota Bay that is influenced by the Manatee County Wastewater Treatment Plant. The plant successfully reduced its wastewater-related nitrogen loads, so seagrasses have flourished. Seagrass coverage around Tidy Island increased by 352 acres between 1988 and 1994 (Tomasko, 1997).

Indian River Lagoon System

The Indian River Lagoon Complex covers from Ponce De Leon Inlet in Volusia County to Jupiter Inlet in Palm Beach County. The area includes Mosquito Lagoon, Banana River, North Indian River, North Central Indian River, South Central Indian River, and South Indian River. During the period from 1970 to 1992, a fairly consistent pattern of submerged aquatic vegetation distribution has occurred in the Indian River Lagoon system. More than 70% of the vegetation occurs in the northern end of the system north of a line connecting Cocoa to Cocoa Beach The seagrass acreage was higher in 1986 than in the preceding or succeeding period. Almost all of the apparent decrease in acreage from 1986 to 1992 results from declines in the North Indian River just north of the south end of Merritt Island (Woodward-Clyde, 1994). A large storm event in 1991 produced highly colored and turbid water in much of this area for a period exceeding one month. Great mortality of above-ground submerged vegetation biomass has been reported following the storm (Woodward-Clyde, 1994), and the 1992 decrease in acreage also may be a result of the declines following that storm.

Assessment

While examining the four National Estuary Programs in Florida will not provide a trend of the total acreage of seagrass, it does suggest a direction the acreage of seagrass is heading. Three of the four National Estuary Programs have experienced increases in the total acreage of seagrass over the past years. This is probably the result of these areas being part of the National Estuary Program. All of these areas are of critical state concern and the programs in these areas are confronting the issue of seagrass loss. Positive steps are taking place now and more data will be available in the future.

Recommendations

Currently the data on acreage of seagrass are inconsistently and infrequently collected. The primary reason for this infrequent collection is the expense of gathering the data. Currently, funding for data collection is provided by the water management districts and/or by federal agencies. Collection of the data is done on a regional basis; however these regions do not cover the entire state, and the timing cycle of collection varies among these regions. It is recommended that the funding for these projects be increased so that coverage can be comprehensive. It is also recommended that there is consistent funding for statewide analysis and coordination.

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Number of Beach Closings and Advisories

From public health, environmental, and economic standpoints, coastal water quality is an important issue in the state of Florida. The environmental impacts of coastal water pollution can be far reaching, including long-term degradation of marine and benthic habitats as well as marine animal fatalities. Furthermore, every day a beach is closed increases the adverse economic consequences, such as lost jobs, lost tourism dollars, and impeded economic growth (NRDC, 1995).

The primary cause of beach closings is high levels of bacteria from human and animal wastes that enter coastal waters from municipal sewage treatment plants, combined sewer overflows, sanitary sewer overflows, urban stormwater systems, and as polluted runoff from land. Sewage-contaminated waters can contain a variety of diseases, including gastroenteritis, dysentery, and hepatitis. Testing is conducted by measuring for "indicator organisms" such as fecal coliform or enterococcus that indicate the presence of harmful pathogens. Other causes of beach closings include heavy rain and oil spills. Heavy rain tends to increase pollution from overloaded sewage and stormwater systems and increase polluted runoff from urban and rural areas. For Florida, pollutants and debris causing beach closings are also attributable to the destruction caused by hurricanes.

The State of Florida does not explicitly require any monitoring of ocean and bay coastal waters; however, bacteria standards have been set by the Florida Department of Environmental Protection (DEP) specifically for marine waters designated for swimming. Of Florida's 34 coastal counties with swimming beaches, only eleven currently conduct monitoring on an inconsistent basis for swimmer safety.

This indicator provides information on the number of days of beach closures and advisories. The Natural Resources Defense Council (NRDC) followed three guidelines in compiling these data: (1) Closings and advisories are not differentiated in the data listings; (2) Permanent closings (beaches closed for an entire summer or longer) and extended closings (beaches closed for six weeks or more) are noted, but not included in the totals; and (3) Closings or advisories issued for an individual beach for one day are counted as one closing/advisory. Starting with the 1994 data, the reason for the beach closure/advisory is included with the data.

Data Characteristics

SOURCE

This information is found in *Testing the Waters,* published annually by the Natural Resources Defense Council. Copies of these reports may be obtained by contacting the Natural Resources Defense Council Publications Department, 40 West 20th Street, New York, New York 10011, or at (212) 727-4486.

ACQUISITION

Previous years of the *Testing the Waters* reports are available in hard copy format for a cost of $7.50 plus shipping and handling. The most recent report, *Testing the Waters VI,* marks the first time a *Testing the Waters* report is available via the Internet. It may be accessed at: **http://www.nrdc.org/nrdcpro/ttw/titinx.html** The hard copy cost is $10.50 plus shipping and handling. *Testing the Waters VII* is scheduled for release via the Internet in July 1997.

COLLECTION

The NRDC data are collected from coastal state and local governments through the use of questionnaires and from state 305(b) reports. The NRDC compiles this information annually; however, each reporting unit's frequency of collection varies.

TECHNICAL

Hierarchy of Indicators: 1
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

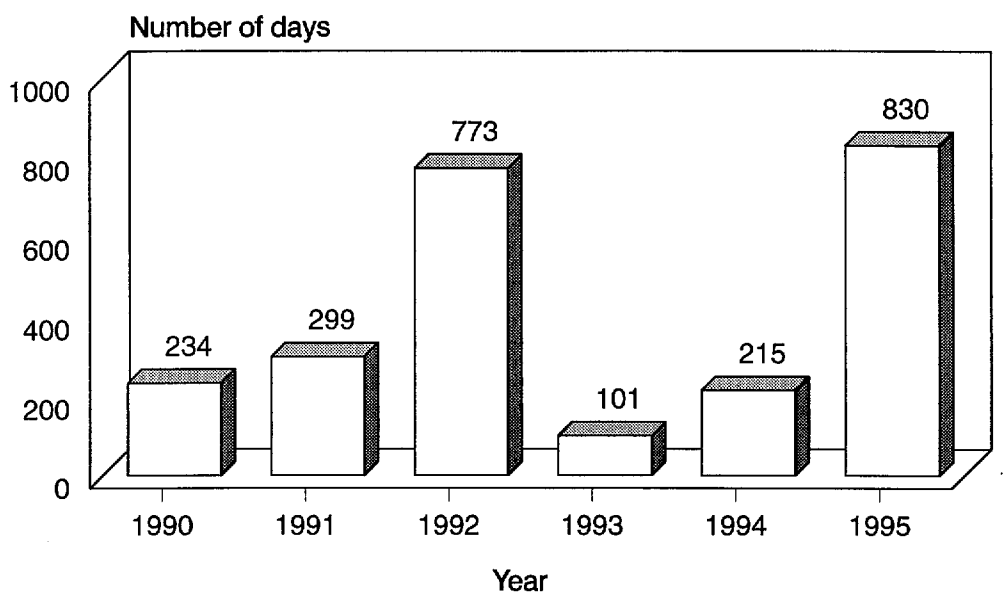
Data Limitations

There are several limitations evident in using the data to establish a trend. The data presented herein reflect only eleven of the 34 coastal counties in Florida with swimming beaches. The data received are sometimes incomplete and inconsistent among reporting units. The data may also be for the previous year, since some respondents do not return the information in time for inclusion in the current annual report. In some cases, a beach is closed and remains closed until the next sampling date (which may be the following month or longer). More frequent sampling might reduce the number of closing/advisory days in these instances. At the present time, there is no uniform bacteria standard or testing procedure to monitor coastal water pollution. Therefore, each state or local municipality adopts its own standards and testing procedures. Since beach water monitoring is not required, the data presented only reflect a portion of Florida's coastal areas that do monitor. Since monitoring and closure practices vary between different parts of the state, it is difficult to know whether a locality with a high number of closings has more vigilant health officials or more coastal pollution.

Data Analysis

The data for the number of days of beach closures/advisories do not indicate any clear trend in coastal water quality for the Florida counties represented. However, the most immediate element noticeable is the connection between beach closings and hurricane-related weather. The years of Hurricane Andrew (1992) and Hurricane Opal (1995) posted the highest number of beach closure/advisory days. The data for the number of days of beach closures/advisories came from eight coastal counties in 1995, one less than in 1994. The majority of the beach closings/advisories came from Okaloosa County (475), primarily from debris and other pollution attributable to Hurricane Opal. Dade County had 145 closings, due predominately to sewer-line breaks. The total number of beach closures/advisories reported for 1995 was the highest recorded in Florida this decade. The 830 closings were nearly four times the 1994 total of 215.

Beach Closure/Advisory Days



Note: Permanent closings (beaches closed for the entire summer or longer) and extended closings (beaches closed for six weeks or more) are not included in the totals.

As mentioned previously, the principal reasons for closing or placing advisories on beaches in 1995 were sewer-line breaks and debris and pollution from Hurricane Opal. Closings due to stormwater runoff dropped from the 1994 high of 126 to 67. Many Florida areas that monitor coastal water quality still do not have stormwater management practices adequate to prevent pollution. Furthermore, the absence of historical data makes it impossible to ascertain whether the reporting areas have improved their stormwater management practices. The noted rise in closings due to hurricane debris may be a sign of overdeveloped beach areas and/or a lack of building code enforcement adequate for resistance of some hurricane-force winds.

Number of Days by Reason for Beach Closures/Advisories, 1994 and 1995

Reason	1994	1995
Heavy Rainfall/Sewer Overflow	1	24
Rainfall (preemptive)	55	23
Stormwater Runoff	181	67
High Bacteria	208	100
STP Malfunctions	220	12
Septic Tank Discharge	261	N/A
Polluted Runoff	302	N/A
Hurricane Related	N/A	469
Sewer Line Leak/Break	N/A	135

Note: The values presented in the above graph do not add to the totals reported for each year because of double counting (i.e., some beaches were listed with two reasons for closure, and both reasons are reflected in the above graph). N/A means there were no closures reported in this category. STP means sewage treatment plant.

Recommendations

Local officials in Florida have cited a lack of funds as the major impediment to instituting routine water monitoring programs (NRDC, 1996). Additionally, simply monitoring coastal water quality and closing beaches when there is a public health threat will not solve Florida's coastal pollution problem. The reasons for closing the beaches need to be analyzed so that the sources of coastal pollution can be addressed and remedied in order to prevent future problems.

References

Natural Resources Defense Council (NRDC). 1995. *Testing the Waters V: Politics and Pollution at U.S. Beaches.* New York: NRDC.

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Acreage of shellfishing waters by classification

The Florida Department of Environmental Protection (DEP) Shellfish Environmental Assessment Section classifies shellfishing waters into six categories based on sanitary, hydrographic, meteorological, and bacteriological surveys. The categories are 1) approved; 2) conditionally approved; 3) restricted; 4) conditionally restricted; 5) prohibited; and 6) unclassified.

Approved Area Normally open to shellfish harvesting; may be temporarily closed under extraordinary circumstances such as red tide, hurricanes and sewage spills.

Conditionally Approved Area Periodically closed to shellfish harvesting based on pollution events, such as rainfall or increased river flow.

Restricted Area Normally open to relaying or controlled purification, allowed only by special permit and supervision; may be temporarily closed under extraordinary circumstances such as red tides, hurricanes and sewage spills.

Conditionally Restricted Area Periodically, relay and controlled purification activity is temporarily suspended based on pollution events, such as rainfall or increased river flow.

Prohibited Shellfish harvesting is not permitted due to actual or potential pollution. This classification is least desirable, and is used only when standards are exceeded for Approved, Conditionally Approved, Restricted and Conditionally Restricted classification management schemes.

Unclassified Shellfish harvesting is not permitted pending bacteriological and sanitary surveys.

Because monitoring for all human pathogens discharged into coastal water is not feasible, an indicator group of bacteria is used to assess the likelihood that human pathogens are present. Fecal coliform is the indicator group of bacteria used by DEP. Few fecal coliform are pathogenic; however, the presence of fecal coliform bacteria in coastal waters indicates feces from warm-blooded animals is present and human pathogens are also likely to be present. The numbers of bacteria are expressed in the units of Most Probable Number (MPN) per 100 milliliters (ml). There are two bacteriological standards for shellfish harvesting areas classification. For areas to be classified Approved or Conditionally Approved, the level of fecal coliform in sub-surface water must have the fecal coliform median or mean not exceed 14 MPN/100 ml, and no more than ten percent may exceed 43 MPN/100 ml. For areas to be classified Restricted or Conditionally Restricted, the fecal coliform median or mean must not exceed 88 MPN/100 ml, and no more than ten percent may exceed 260 MPN/100 ml.

Many of Florida's shellfishing waters have been affected by increased urbanization along the shoreline, and some of these waters have been closed to harvesting of shellfish because of degraded water quality conditions. Waterbodies that have restricted or prohibited classifications pose risks to the economic well being of coastal communities, and possibly to environmental health. Tracking the numbers of shellfishing waters in each classification can provide an indication of water quality trends in waters that are regularly used for shellfishing.

Data Characteristics

SOURCE

The information is compiled by Bob Thompson, Bureau of Marine Resource Regulation and Development, Florida Department of Environmental Protection, who can be contacted at 3900 Commonwealth Boulevard, MS 205, Tallahassee, Florida 32399-3000, or at (850) 488-5471.

ACQUISITION

The data can be obtained in hard copy format at no cost.

COLLECTION

The bacteriological water quality of shellfish areas in Florida is monitored at least monthly, and annual reports summarize sanitary conditions. Hydrography, meteorology, pollution source, and bacteriological surveys are documented in comprehensive reports written every five years. These comprehensive reports are the basis for updating shellfish harvesting area classifications in the Florida Administrative Code. Physical, chemical, and bacteriological water quality data are available for all shellfish harvesting areas currently open. AutoCAD, a computer mapping system, is used to make maps that illustrate the six shellfish classification categories.

TECHNICAL

Hierarchy of Indicators: 4
Pressure/State/Response: State
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The term "shellfish" in this context is limited to oysters, clams and mussels. Shellfishing waters classifications represent the condition of only those portions of coastal waters that support shellfishing, not all state waters. Shellfish classifications are determined by water quality, which is affected by both human (e.g., stormwater runoff) and natural (e.g., rainfall) activities. Thus, restrictions do not always indicate that a human source of pollution is the cause of a problem, since natural events such as high river events or Tropical storms where there is excessive rainfall can have as much influence as discharges from anthropogenic sources.

Data Analysis

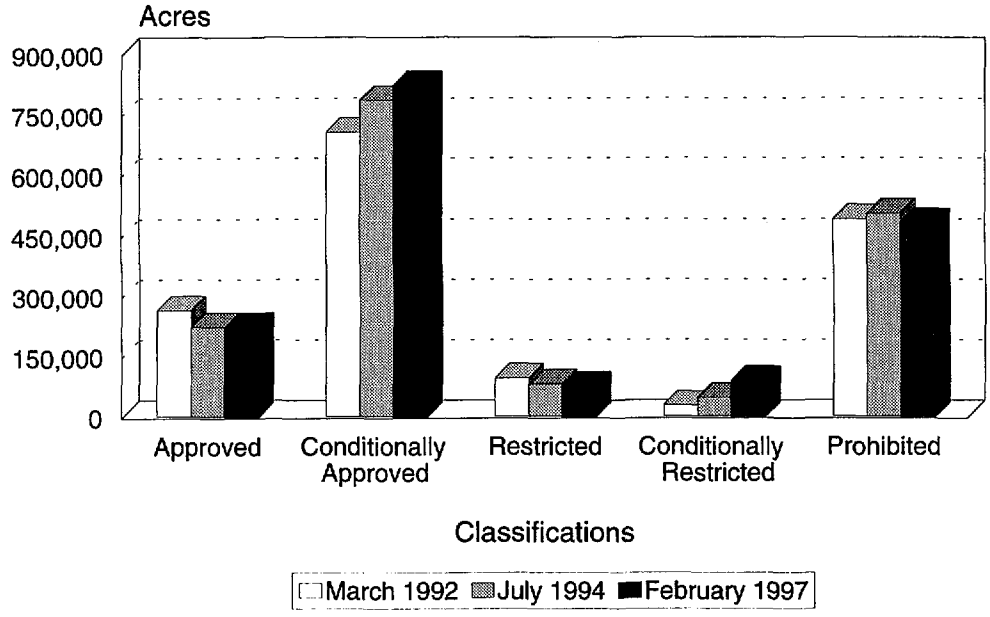
By February, 1997, a total of 1,679,512 acres of shellfish harvesting areas were classified statewide. This was 99,750 more acres than were classified in 1992, a 6.0 percent increase. Only 220,007 acres, or 13.1 percent of the classified waters, were approved for harvesting as of February, 1994. While in 1992, there were 263,550 acres, which comprised of 16.7 percent of the classified waters. There was a decrease in the amount of acres approved for harvesting,, and a decrease in the percentage for the category. As of February, 1997, there were 820,294 acres, or 47.91 percent, in a conditionally approved category; this was an increase from the 704,421 acres conditionally approved in 1992. The acreage of restricted shellfishing waters has decreased since 1992. Where as, the conditionally restricted areas have sharply increased. Roughly 29 percent, or 478,954 acres, were classified as prohibited in 1997.

It is apparent that even though the total acreage of classified shellfishing waters has increased, the number of approved acres has decreased. The two categories which have increased since 1992 are conditionally approved, and conditionally restricted. This increase of the conditional classifications is indicative of major river events and storms having more of a role in degrading water quality in an area due to non-point stormwater runoff.The data are from the Florida Coastal Issues Survey, which was conducted by the Survey Research Laboratory at Florida State University. For further information or data from the survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

Acres of Shellfishing Waters By Classification

Classification	March, 1992		July, 1994		February, 1997	
Approved	263,550	(16.7%)	222,604	(13.6%)	220,007	(13.1%)
Conditionally Approved	704,421	(44.6%)	785,228	(47.9%)	820,294	(48.8%)
Restricted	94,982	(6.1%)	80,274	(4.9%)	72,819	(4.3%)
Conditionally Restricted	27,261	(1.7%)	46,646	(2.9%)	87,438	(5.2%)
Prohibited	489,548	(31.0%)	504,189	(30.8%)	478,954	(28.5%)
Total Acreage	1,579,762		1,638,941		1,679,512	

Acreage of Shellfish Harvesting Areas by Classification



Onsite sewage treatment and disposal systems installed

Onsite sewage treatment and disposal systems are facilities constructed on individual sites used to provide wastewater disposal where municipal sewerage is not available. Such systems usually consist of a septic tank and a subsurface infiltration system. Within the septic tank, sedimentation and some anaerobic digestion of solids occur. The remaining partially treated wastewater, referred to as septic tank effluent, is then discharged to the subsurface infiltration system and percolates through the surrounding soil. As the effluent moves through the soil, it is further treated by naturally occurring chemical, biological, and physical processes.

In many cases, when septic tanks are properly planned, designed, constructed, and operated, onsite systems are effective wastewater treatment systems. As the number and density of septic systems increase throughout Florida, however, there are serious concerns that the use of onsite systems is having adverse impacts on ground and surface waters in the state. In fact, there is the potential for contamination of ground and surface waters when onsite systems do not remove enough of the nutrients, toxics, and pathogens that exist in the wastewater.

The potential for ground and surface water contamination is of particular concern in coastal counties, due to the fact that some areas surrounding the coast have a significant portion of the population utilizing septic tanks in soils with limited capacity for this use.

Data Characteristics

SOURCE
Information on the number of onsite sewage treatment and disposal systems installed can be obtained from Kevin Sherman, Florida Department of Health, Onsite Sewage Program, 1317 Winewood Blvd., Tallahassee, Florida 32399, or at (850) 488-4070.

ACQUISITION
The installation data are available in hard copy format at no cost.

COLLECTION
Information on the number of onsite sewage treatment and disposal systems installed is available on an annual basis by county since 1971.

TECHNICAL
Hierarchy of Indicators: 2
Pressure/State/Response: State
Data Accessibility: Data are manually collected and is accessible.

Data Limitations

A limitation inherent in the data is the lack of consideration of soil suitability and septic tank density. This makes it difficult to definitively determine the impacts of increasing or decreasing septic tank use. For example, relatively high numbers of systems in suitable soil may equal a low impact, while relatively low numbers in unsuitable areas may equal a high impact. Furthermore, the number of septic tanks installed does not give an accurate picture of the total number of septic tanks in use over the years because it does not account for septic tank abandonments. The number of septic tank abandonments in coastal counties is believed to be small; however, as a consequence of municipal sewage expansion, septic tank abandonments may become a significant issue.

Data Analysis

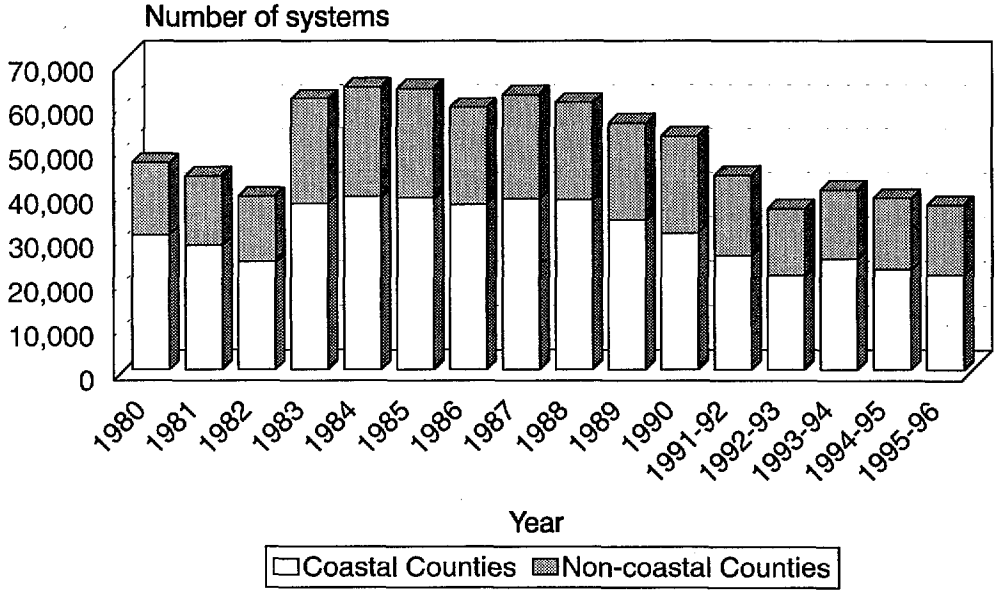
The number of onsite sewage treatment and disposal systems installed in coastal counties have decreased from 1980 to 1996. There were, however, some fluctuations over the years, most likely due to economic factors which influence construction starts. The percentage of onsite sewage treatment and disposal systems installed in coastal counties compared to Florida has also decreased. In 1980, installation of onsite sewage treatment and disposal systems in coastal counties comprised about 65 percent of the total installations throughout the state. In 1996, the percentage dropped to approximately 58 percent.

Total Number of Onsite Sewage Treatment and Disposal Systems Installed

Year	Coastal Counties	Non-Coastal Counties	Total Installations
1980	30,408 (.65)	16,314 (.35)	46,722
1981	28,126 (.64)	15,591 (.36)	43,717
1982	24,372 (.62)	14,765 (.38)	39,137
1983	37,544 (.61)	23,743 (.39)	61,287
1984	39,120 (.61)	24,869 (.39)	63,989
1985	38,831 (.61)	24,827 (.39)	63,658
1986	37,274 (.63)	21,969 (.37)	59,243
1987	38,624 (.62)	23,630 (.38)	62,254
1988	38,409 (.64)	22,037 (.36)	60,446
1989	33,828 (.61)	21,866 (.39)	55,694
1990	30,822 (.58)	21,890 (.42)	52,712
1991-92	25,791 (.59)	18,079 (.41)	43,870
1992-93	21,327 (.59)	14,997 (.41)	36,324
1993-94	25,063 (.62)	15,591 (.38)	40,654
1994-95	22,611 (.58)	16,181 (.42)	38,792
1995-96	21,425 (.58)	15,796 (.42)	37,221

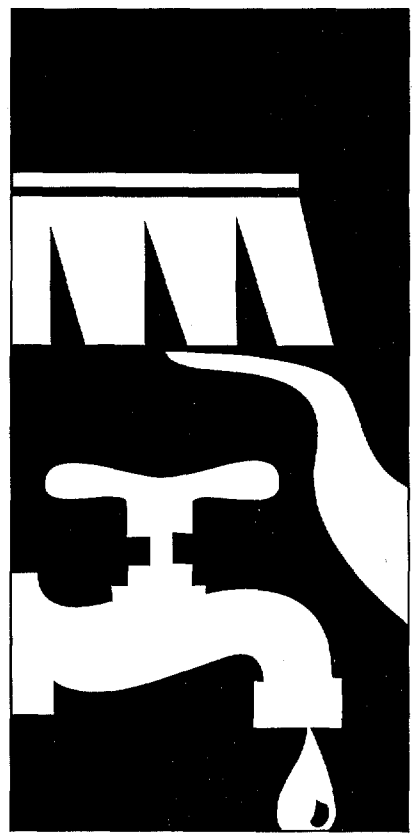
The numbers in paranthesis represent the percentage of the total installations.

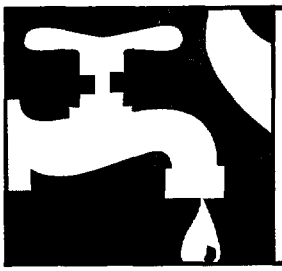
Total Number of Onsite Sewage Treatment and Disposal Systems Installed



Section E

Managing Fresh Water Allocation





MANAGING FRESH WATER ALLOCATION

Florida is characterized by abundant ground and surface water resources. Indeed, the obvious predominance of water resources may cause some to erroneously conclude that the state's water supply is largely untapped. Contrarily, demand for water resources often exceeds supply; metropolitan areas increasingly must rely upon the import of water resources from adjacent communities. As Florida continues to grow, expanding urban areas will attempt to secure water resources throughout the state. Transfer of water resources between water management districts is a legally permissible, yet, highly controversial alternative. The use of water resources, if not thoughtfully managed, can degrade aquatic communities and their surrounding environment.

Florida has experienced dramatic population growth since the middle of this century; withdrawals of water have concomitantly increased. During the period of growth, the state's tourism industry has flourished. The tourism industry is dependent upon the state's attractive, healthy natural systems. The future management of water in Florida must address a critical question: how to provide a sufficient water supply to facilitate economic growth without compromising the integrity of the state's unique environment.

This chapter considers two issues: (1) the withdrawals of water by particular users, and (2) measures that have been initiated to provide additional water resources. The state's lucrative agricultural industry is a primary water user. Industry, commercial activities, and potable water supply are other users that demand large quantities of water. Innovative conservation methods have been implemented to optimally use water; for example, Florida's water management districts encourage the reuse of treated wastewater. Reuse of water is likely to increase as the use of extensive tertiary wastewater treatment becomes more financially feasible. Advanced irrigation techniques also can reduce a significant proportion of Florida's water consumption. The following lists identify: (1) the indicators that are examined in this chapter, and (2) indicators in other chapters that relate to water management.

Managing Fresh Water Allocation Indicators:

- Total fresh water withdrawals
- Discharge of treated domestic and industrial wastewater
- Reuse of reclaimed water
- Public supply water withdrawals
- Domestic self-supplied water withdrawals
- Per capita water supply withdrawals
- Number of potable water treatment facilities
- Commercial-industrial water withdrawals
- Thermoelectric power generation water withdrawals
- Agriculture water withdrawals

Other Indicators of Interest:

- Absolute population growth (Section A)
- Change in strategic habitat conservation areas (Section D)
- Change in existing upland habitat and conservation lands (Section D)
- Change in existing wetland habitat and conservation lands (Section D)

Total Fresh Water Withdrawals

Water resources in Florida support the state's economy; they provide potable water to the state's growing population and satiate the demands of agriculture and industry. In addition, water resources provide critical habitat for Florida's diverse flora and fauna. Satisfying the demands of all water users is perhaps Florida's greatest challenge.

This indicator includes fresh water withdrawn in coastal counties for the following uses: public supply, self-supplied domestic, commercial-industrial self-supplied, agriculture, and thermoelectric power generation. Most of the saline water withdrawn for commercial-industrial uses and thermoelectric power generation is not consumed but is used as non-contact cooling water. Therefore, it is not included in these figures. Some saline water is used for public water supply after treatment; these figures are included in the data. The change in total water withdrawn reflects changing demands on water resources.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles information regarding fresh water withdrawals per day. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains these data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and Florida's water management districts. The publication is prepared by Richard L. Marella; he can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts, and it is compiled and published by USGS every five years.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Data are compiled and published only for every fifth year. If an interim year has above or below normal precipitation, the year's water use value may be skewed. Data used to calculate this information are not always based on actual meter readings but reflect consumptive use permit files, monthly operating reports, direct contacts, advanced modeling, and other indirect methods. For example, indvidual wells need not have a consumption use permit or a meter. Thus, the amount of water withdrawn in these instances is merely an approximation.

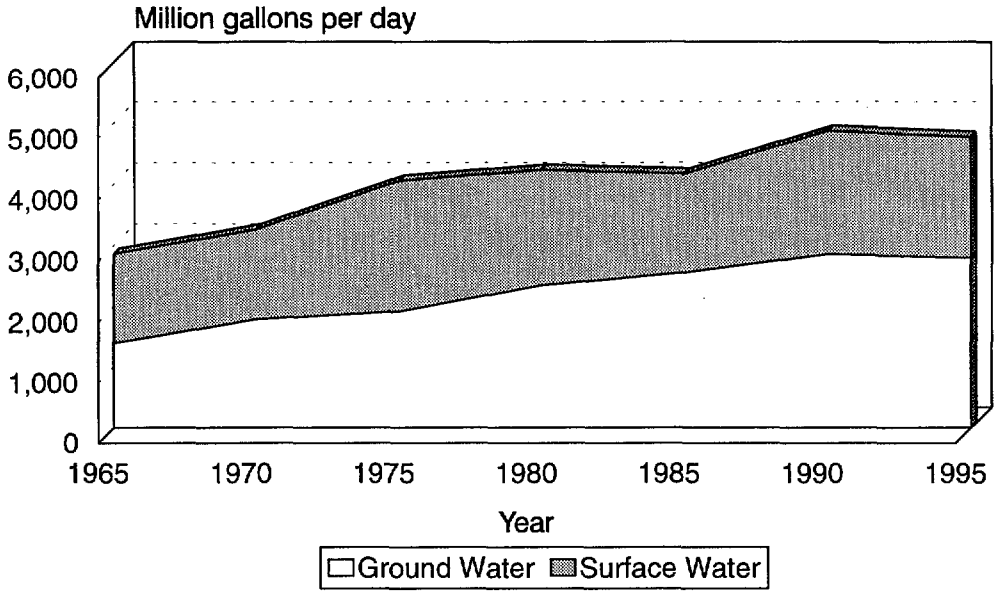
Data Analysis

Total fresh ground water withdrawals have increased since 1965. In this same time period the population in Florida's coastal counties has increased dramatically. Ground water usage steadily increased from 1,399 million gallons per day (mgd) in 1965 to 2,855 mgd in 1990, (a 104 percent increase). In 1995, however, fresh ground water withdrawals decreased slightly to 2,794 mgd. The use of surface water has fluctuated during the period of record, with the greatest use of surface water occurring in 1975 when 2,139 mgd were withdrawn. Total fresh water withdrawals decreased from 4,866 mgd in 1990 to 4,776 mgd in 1995. This may be because of more precise accounting measures or water conservation.

Total Fresh Water Withdrawals in Coastal Counties by Source

Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	1,399.49	1,458.17	2,857.66
1970	1,784.63	1,474.59	3,259.22
1975	1,911.98	2,139.71	4,051.69
1980	2,344.55	1,882.57	4,227.12
1985	2,550.22	1,611.74	4,161.96
1990	2,855.52	2,011.47	4,866.99
1995	2,794.33	1,972.34	4,776.67

Total Fresh Water Withdrawals in Coastal Counties



Discharge of Treated Domestic and Industrial Wastewater

Florida is characterized by productive aquifers and abundant surface water resources. Water resources in Florida's coastal counties provide drinking water and support agriculture, tourism, industry, and the state's varied biotic systems. Florida's population has increased dramatically during the past few decades; the increased population demands additional water resources. As a result, many water resources have decreased in quantity and quality. Florida's population is expected to grow at a rate of three percent annually; most of this growth will occur in coastal counties. Diminished water resources may be further stressed.

Identification of the location and amount of wastewater being discharged to ground and surface waters in coastal Florida can aid in the assessment of the quantity and quality of water resources. Due to technological advances, wastewater discharges can be viewed as a potential resource for coastal communities. To ensure that the discharge of treated wastewater does not compromise the integrity of water bodies, water managers must thoughtfully manage the resources. For example, in regions where the aquifer is shallow and unconfined, the discharged water must be of a quality that does not result in contamination of ground water.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles this information. USGS has published a report, *Estimated Discharge of Treated Wastewater in Florida, 1990,* which contains the data. The publication was prepared by Richard L. Marella, who can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004. The Water Resources Division also has 1995 data, however, the most recent iteration of *Estimated Discharge of Treated Wastewater in Florida* is not yet available. The report will be available later this year.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. Data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts. The data are compiled and published by USGS every five years.

TECHNICAL

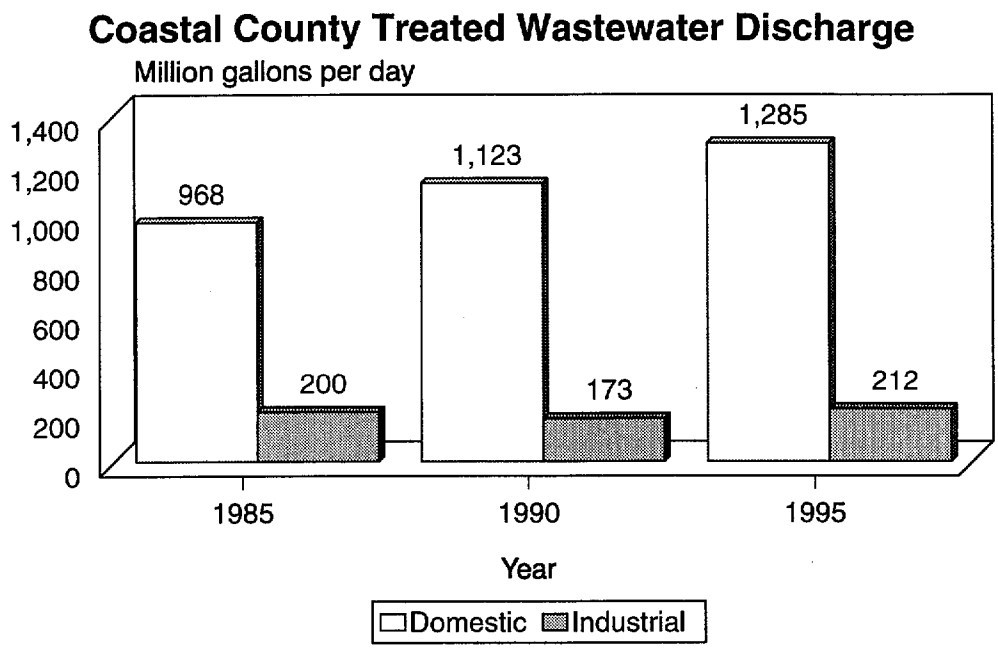
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Discharge data are provided only for every fifth year. Data on the discharge of treated wastewater effluent were obtained from the monthly operating reports that are submitted to DEP by the treatment facilities. These data are based on an inventory of 1,062 of the 5,096 domestic and industrial wastewater facilities that are regulated by DEP. The treatment systems inventoried were estimated to account for more than 90 percent of the discharge of treated wastewater during 1990.

Data Analysis

In 1985 domestic wastewater discharge in coastal areas was 968 million gallons per day (mgd), and industrial wastewater discharge was 200 mgd. By 1990 domestic wastewater withdrawals increased to 1,123 mgd, while industrial wastewater discharges fell to 173 mgd. In 1995, wastewater discharges were highest: domestic wastewater discharge was 1,285 mgd, and industrial wastewater discharge was 212 mgd.


Coastal County Treated Wastewater Discharge
Million gallons per day
1,400
1,200
1,000
800
600
400
200
0
968
200
1,123
173
1,285
212
1985
1990
1995
Year
Domestic
Industrial

Reuse of Reclaimed Water

Water is a limiting resource throughout a large portion of Florida. Many communities either import their drinking water from other communities or employ expensive desalinization treatment on local water resources. As Florida's population increases, the demand for fresh, potable water also increases. Without proactive planning and management, this could lead to more widespread, severe, and prolonged water shortages. Almost 80 percent of the twelve million residents in Florida live near the coast; further growth along the coast is expected in the future. Near the coast, ground water supplies are vulnerable to overdraft, contamination, and saltwater intrusion.

Florida does not have large, rapidly flowing streams that can assimilate large discharges of wastewater. The state's many streams tend to be small, slow flowing, warm water bodies. They flow into lakes or coastal waters that are prone to excessive growth of algae and exotic aquatic plants. Florida's surface water resources are a critical component of the state's tourism industry; to maintain and expand Florida's economy, the integrity of surface water resources must be maintained.

Advances in the technology of wastewater treatment facilities protect Florida's surface waters. With limited opportunities to discharge treated wastewater into surface waters, many communities are implementing programs that seek to reuse reclaimed water. Reclaimed water has undergone, at a minimum, secondary treatment. Florida promotes reuse of reclaimed water and water conservation as major state objectives. Reuse can aid in the effort to meet the water requirements of Florida's growing population.

Data Characteristics

SOURCE

Information on amounts of reused treated wastewater by county can be obtained from the *Annual Reuse Report* that is produced by each of the five water management districts in the state. The contacts for each of the water management districts follow.

- Southwest Florida Water Management District: Mark Hammond at (904) 796-7211
- South Florida Water Management District: Mark Elsner at (407) 686-8800
- Suwannee River Water Management District: Bill Kirk at (904) 362-1001
- St. Johns River Water Management District: Donald Brandes at (904) 329-4126
- Northwest Florida Water Management District: Guy Gowen at (904) 539-5999

Additional information on statewide wastewater reuse is available in the 1990 and 1992 *Reuse Inventory* reports. These reports contain data broken down by facility, reuse category, and other parameters. Data are available for each facility, and the facilities are grouped by county; however, data are not totaled for each county. These reports may be obtained from David York, Domestic Waste Section, Florida Department of Environmental Protection (DEP), Twin Towers, 2600 Blair Stone Road, MS-3540, Tallahassee, Florida 32399-2400, or at (850) 488-4524.

ACQUISITION

Data can be obtained at no cost.

COLLECTION

The water management districts collect data on the amount of reused treated wastewater from each facility by county within their respective districts. This information was initiallly collected for the period from October 1993 to September 1994. The water management districts are now required to collect this information annually. DEP collects data on the number and type of known reuse facilities. This information is collected statewide and disaggregated by individual facility. Appendix B of the Reuse Inventory reports shows the existing flow of reuse water by facility. To date, this inventory was conducted in 1990 and 1992. Beginning this year, DEP intends to conduct the inventory on an annual basis.

TECHNICAL
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The water management districts' flow data are collected by polling facility owners/operators, and DEP's Reuse Inventory data are derived from questionnaires mailed to reuse facility owners and/or operators. Therefore, the data are subject to the inherent limitations of all survey methods of data collection. In addition, only facilities with capacities of at least 0.1 million gallons per day (mgd) are included in the summary data. Furthermore, prior to 1994, these data were not collected annually.

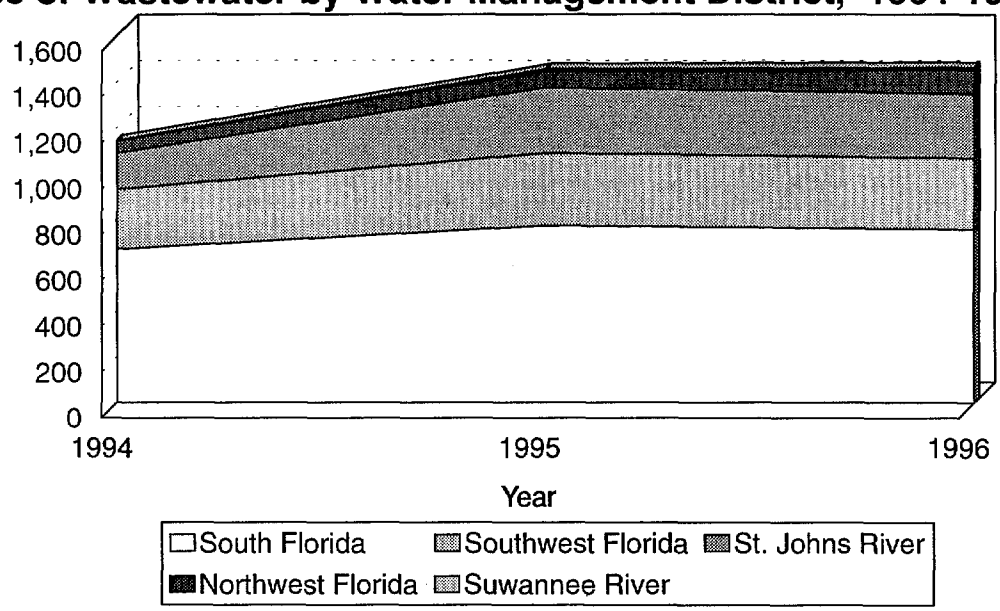
Data Analysis

The coastal counties in the South Florida Water Management District (Broward, Collier, Dade, Lee, Martin, Monroe, Palm Beach, and St. Lucie) had the largest amount of water reuse. Total plant flow was about 756 mgd in 1996. The coastal counties in the Southwest Florida Water Management District (Charlotte, Citrus, Hernando, Hillsborough, Levy, Manatee, Pasco, Pinellas, and Sarasota) had the second largest amount of water reuse; total plant flow was approximately 309 mgd in 1996. The coastal counties in the St. Johns River Water Management District (Brevard, Duval, Flagler, Indian River, Nassau, St. Johns, and Volusia) had the third highest water reuse with a total plant flow of 159 mgd. The coastal counties in the Northwest Florida Water Management District (Bay, Escambia, Franklin, Gulf, Jefferson, Okaloosa, Santa Rosa, Wakulla, and Walton) had the fourth highest water reuse; total plant flow was nearly 104 mgd in 1996. In 1996, the coastal counties in the Suwannee River Water Management District (Dixie, Levy, and Taylor) had the lowest amount of water reuse with a total plant flow of about 11 mgd.

Reuse of Wastewater by Water Management District, 1994-1996

Water Management District	Total Plant Flow (mgd) 1994	Total Plant Flow (mgd) 1995	Total Plant Flow (mgd) 1996
South Florida	669.78	772.52	755.79
Southwest Florida	260.36	314.75	309.15
St. Johns River	159.17	286.13	281.49
Northwest Florida	52.40	71.09	104.73
Suwannee River	1.68	10.63	10.53

Reuse of Wastewater by Water Management District, 1994-1996



Public Supply Water Withdrawals

Water resources in Florida's coastal counties provide potable water to the state's population, and support the state's agriculture, industry, and biotic systems. Demand for water has increased substantially over the past few decades; Florida's water resources have often diminished in quality and quality as a result of efforts to provide an adequate supply. Florida's population is expected to grow at a rate of three percent annually, and most of the growth will likely be concentrated in coastal areas. This anticipated growth underlies the primary challenge of water management in the future: to supply water for economic development and preserve the integrity of Florida's environment.

Public supply refers to water supplied by a public or private water system that is distributed for: domestic/residential purposes, commercial-industrial uses, firefighting, and other uses. The Florida Department of Environmental Protection (DEP) considers a water system a public supplier if it serves more than 25 people or has 15 year-round service connections. For the purposes of data collection, however, the United States Geological Survey's (USGS) public supply withdrawal data reflect systems that serve 400 or more people or withdraw at least 10,000 gallons per day.

The increase in water withdrawals for public supply purposes is a direct indicator of increasing demand on water resources. If withdrawals exceed water recharge, the potential for saltwater intrusion and low flows in surface water bodies increases. Low flows in surface water bodies may have significant impacts on surrounding communities. For example, competition for dissolved oxygen and habitat will increase as the water level drops. Depending on the depth and rate of flow in a waterbody, the water temperature may change; this could impair the ability of water to hold dissolved oxygen. As a result, the aquatic community may lose species intolerant of environmental changes. Species that thrive in the altered ecosystem may displace intolerant species.

Data Characteristics

SOURCE

The Water Resources Division of USGS compiles this information. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains these data. The report is prepared in cooperation with DEP and Florida's water management districts. The publication is prepared by Richard L. Marella, who can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The data are collected statewide throughout the year by DEP and the water management districts; USGS compiles and publishes the information every five years. Some of the public supply water use values have been adjusted or modified from previously published data. Most of the modifications were a result of either eliminating double counting of water withdrawals or adding utilities that were missed in the original inventory.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

USGS collects data annually for public supply water withdrawals; however, the data are published only every fifth year. Anomalies during interim years may be apparent. If a given year has above or below normal precipitation, the year's water use value may be skewed. Another limitation is that data do not reflect the import and export of water. Many coastal counties import water from either adjacent coastal counties or inland wellfields.

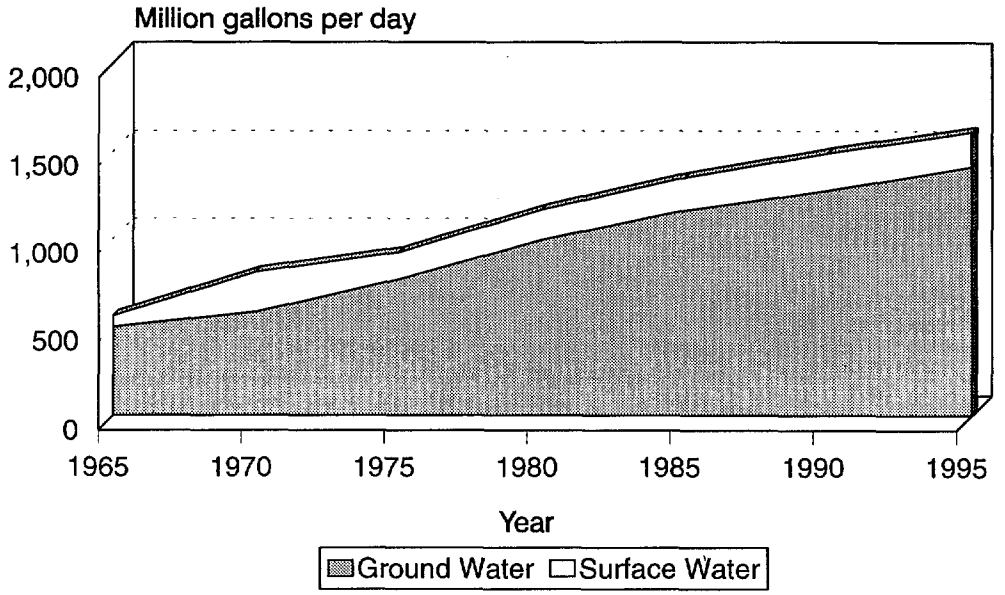
Data Analysis

Public supply fresh water withdrawals in 1965 totaled approximately 561 million gallons per day (mgd). Public supply fresh water withdrawals have steadily increased since 1965; withdrawals peaked in 1995 at nearly 1,607 mgd.

Public Supply Fresh Withdrawals in Coastal Counties

Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	495.79	64.80	560.59
1970	582.86	225.88	808.74
1975	766.99	155.15	922.14
1980	992.11	173.77	1,165.88
1985	1,159.24	189.08	1,348.32
1990	1,274.74	213.76	1,488.50
1995	1,410.52	196.09	1,606.61

Public Supply Fresh Water Withdrawals in Coastal Counties



Domestic Self-Supplied Water Withdrawals

Florida's coastal counties depend on their water resources for drinking water, agriculture, industry, and to support the state's diverse ecological communities. Self-supplied domestic water use is water provided by individual domestic wells or by small utility systems serving less than 400 people. Essentially all water withdrawn for self-supplied domestic use is from ground water, primarily because this source more likely provides high quality water. Excessive withdrawals have the potential to adversely affect the quality and quantity of ground water.

The demand for large quantities of high quality water increases as population grows. A decrease in water consumption may reflect efficient use of resources. By evaluating trends in domestic self-supplied water withdrawals, water resource managers will be better able to ascertain which areas are under the greatest pressure. In addition, water use trends can provide resource managers and policy makers information needed to prioritize funding for capital improvements and public education programs.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles this information. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains these data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and Florida's water management districts. The publication is prepared by Richard L. Marella, who can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts, and it is compiled for the above-mentioned publication every five years by USGS.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The data are compiled on a statewide basis every five years. Data on quantities of water withdrawn are displayed only for every fifth year; anomalies may exist for a given year. If a particular year has above or below normal precipitation, the water use value may be skewed for that year. A major limitation of the data provided is that individual self-supplied domestic wells are not metered and need not obtain a consumptive use permit. Withdrawal figures are estimates.

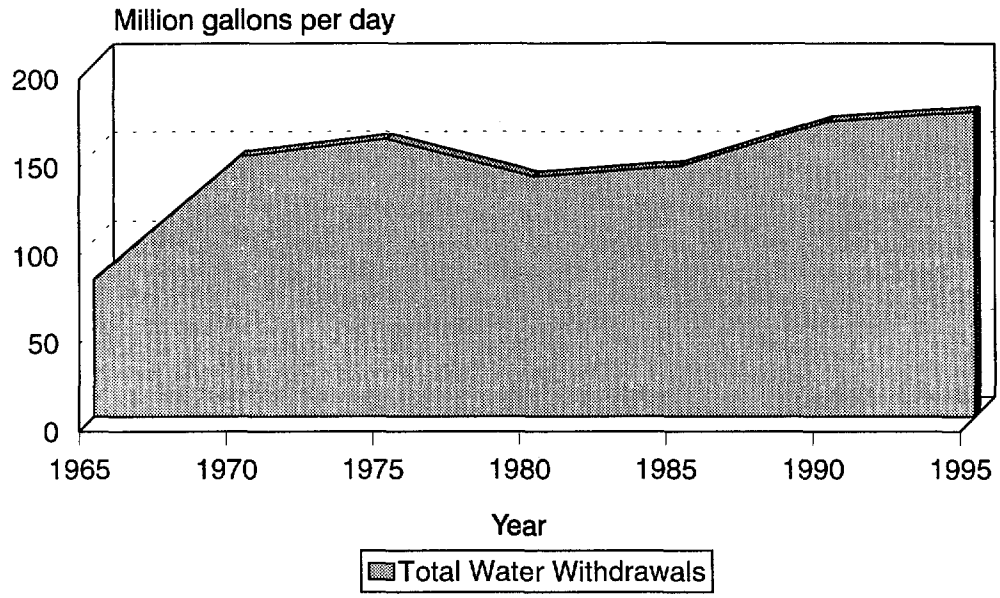
Data Analysis

Between 1965 and 1975, self-supplied domestic fresh water use followed a generally increasing trend. This may be attributable to migration into rural areas not served by public utilities. Between 1975 and 1980 withdrawals decreased by over 13 percent; total withdrawal again followed an increasing trend during the period between 1980 and 1995.

Self-Supplied Domestic Fresh Water Withdrawals in Coastal Counties

Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	78.11	0.00	78.11
1970	147.65	0.00	147.65
1975	156.20	1.20	157.40
1980	136.15	0.00	136.15
1985	142.04	0.00	142.04
1990	165.63	1.50	167.13
1995	172.92	0.00	172.92

Self-Supplied Domestic Fresh Water Withdrawals in Coastal Counties



Per Capita Water Supply Withdrawals

Water resources in Florida support the state's economy; they provide potable water to the state's growing population and satiate the demands of agriculture and industry. In addition, water resources provide critical habitat for Florida's diverse flora and fauna. Satisfying the demands of all water users is perhaps Florida's greatest challenge.

This indicator considers the amount of water that is used per capita per day (in gallons per day (gpd)). The indicator summarizes the total withdrawals for public supply and domestic self-supplied uses. Populations in coastal counties are used to determine the per capita water supply withdrawals over time. Changes in per capita withdrawals over time may delineate the degree to which conservation measures have been incorporated in Florida's coastal counties.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles information regarding fresh water withdrawals per day. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains the data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and Florida's water management districts. The publication is prepared by Richard L. Marella; he can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004. Information regarding Florida's population is available in the *Florida Stateistical Abstract*, which is produced annually by the Bureau of Economic and Business Research, College of Business Administration, University of Florida, 221 Matherly Hall, P.O. Box 117145, Gainesville, Florida 32611, or at (352) 392-0171. The document is available at most libraries. It may be purchased from the Bureau of Economic and Business Research.

ACQUISITION

The water withdrawals data can be obtained from the Water Resources Division of USGS; data are made available through a cooperative agreement between USGS and DEP. Population data are available from the Bureau of Business Research. The *Florida Statistical Abstract* may be purchased for $39.95.

COLLECTION

The water withdrawals data are collected statewide throughout the year by both DEP and the water management districts. Water withdrawals data are compiled and published by USGS every five years. Population data are based on decennial U.S. Census figures.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

The data display general per capita water use for all coastal counties. Individual coastal counties may be characterized by either higher or lower per capita water use. Withdrawals data are compiled and published only for every fifth year. If an interim year has above or below normal precipitation, the year's water use value may be skewed. Data used to calculate this information are not always based on actual meter readings but reflect consumptive use permit files, monthly operating reports, direct contacts, advanced modeling, and other indirect methods. Although census data are the most precise information regarding population, the data are imperfect. The collection methodologies and analysis of the population figures may lead to some double counting, undercounting, or misrepresentation.

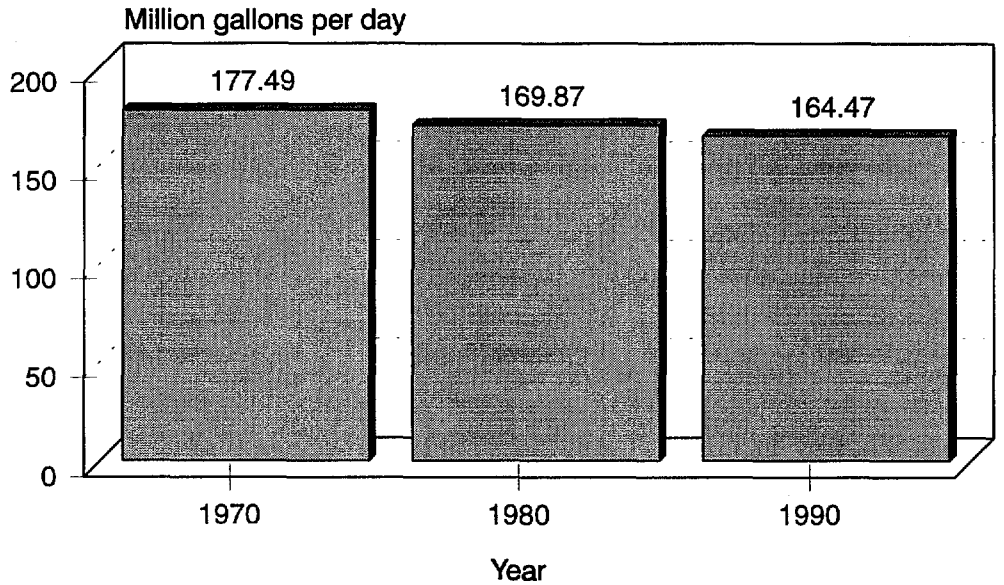
Data Analysis

Per capita water withdrawals have decreased from 177 gpd in 1970 to 164 gpd in 1990. This is likely due to the incorporation of conservation measures and advances in technology.

Per Capital Water Supply Withdrawals

Year	Per Capita Water Supply Withdrawals (gpd)
1970	177.49
1980	169.87
1990	164.47

Per Capita Water Supply Withdrawals



Number of Potable Water Treatment Facilities

The majority of Florida's residents reside in coastal counties. Fresh water resources support Florida's population, agriculture, industry, and biotic systems. The quality of water resources in Florida varies. For example, ground water resources in north Florida are generally higher quality than ground water resources in south Florida. South Florida ground water resources tend to be higher in pH and organics. These differences in water quality are, for the most part, naturally occurring; however, human activities such as excessive aquifer withdrawals can further reduce water quality.

All fresh water resources that are used for potable water supply require some degree of treatment (i.e., disinfection). The amount of treatment required depends on the ambient quality of the resource. Reverse osmosis, ion exchange, nanofiltration, and electrodialysis are treatment processes that are used to improve the quality of water resources. Reverse osmosis and nanofiltration are membrane processes; these treatment technologies reduce the amount of organics in water. Organics contribute to water taste and are a precursor of trihalomethane, which is a carcinogen. Reverse osmosis and electrodialysis are used to decrease salinity; electrodialysis can also decrease the amount of iron in water. Ion exchange is a chemical treatment process that reduces the hardness of water.

An increase in the number of potable water treatment facilities may be caused by a variety of factors. Possible causes include increased water quality standards and increased water treatment technology (and decreased costs). Treatment of water resources is also used to supplement groundwater withdrawals in locations where demand exceeds aquifer productivity. Population growth generates the demand for additional treatment facilities.

Data Characteristics

SOURCE
Data were obtained from the Florida Department of Environmental Protection's drinking water database. For information regarding specific treatment facilities, individuals should contact the local water program and/or water supplier in the region of interest.

ACQUISITION
Interested individuals should contact either the local water program and/or water supplier in the region of interest. Local drinking water programs permit particular treatment methods and inspect the facilities.

COLLECTION
These data are collected in the state throughout the year.

TECHNICAL
Hierarchy of Indicator: 2
Pressure/State/Response: Response
Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

This indicator delineates the number of potable water treatment facilities in coastal counties of Florida. However, it does not explain the ambient quality of water prior to treatment. Individuals interested in obtaining this information should contact the local drinking water programs in particular regions of interest.

Data Analysis

Currently, there are 117 reverse osmosis facilities, 396 ion exchange facilities, 13 nanofiltration facilities, and 1 electrodialysis facility in coastal counties.

Commercial-Industrial Water Withdrawals

Florida's coastal counties depend on their water resources for drinking water, agriculture, industry, and to support the state's varied environments. Burgeoning population growth in Florida's coastal communities has occurred during the past two decades. Commercial and industrial activities have increased concurrently with the population. To accommodate the growth, Florida's water resources have been siphoned; in some cases, water resources have decreased in quantity and quality. The state is expected to grow at a rate of three percent annually, with most of the growth concentrated in coastal areas. Water resources that have been diminished and degraded must be managed to guard against further deterioration.

Increases in water withdrawals for commercial-industrial purposes are a direct indicator of increasing demand on water resources. If withdrawals exceed water recharge, the potential for saltwater intrusion and low flows in surface water bodies increases. Low flows in surface water bodies may have significant impacts on riparian and aquatic communities. Depending on the depth and rate of flow in a waterbody, the water temperature may change, affecting the ability of water to hold dissolved oxygen. As a result, the aquatic community may lose species that are intolerant of environmental changes. Opportunistic species that can readily adapt to environmental changes may displace other species.

Commercial-industrial water withdrawals include surface and ground waters used by the military, government, schools, prisons, hospitals, recreational entities, manufacturers, mining facilities, and processing facilities. For the purposes of this indicator, information on all these users is included. Decreases in total water withdrawal may reflect the ability to more efficiently conserve and use limited resources. It may also indicate the availability of water resources for other uses (e.g., in-stream flows).

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles this information. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains the data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and the state's water management districts. The publication is prepared by Richard L. Marella, who can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts, and it is compiled for the above-mentioned publication every five years by USGS.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Data on quantities of water withdrawn are only displayed for every fifth year; anomalies may exist for any interim years. For example, if a given year has above or below normal precipitation, the water use value may be skewed for that year.

Data Analysis

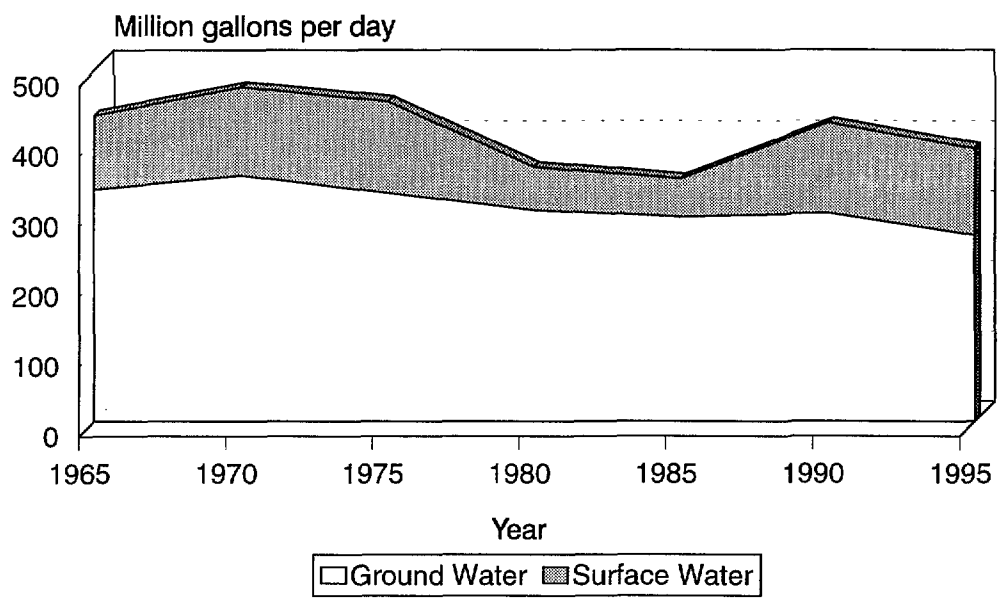
From 1965 to 1970, commercial-industrial self-supplied water withdrawals increased, and then declined until 1985. Withdrawals again increased between 1985 and 1990. In 1990 the commercial-industrial self-supplied withdrawal

of water for the entire state was 770 million gallons per day (mgd), or about 11 percent of the fresh water used daily. The commercial-industrial self-supplied withdrawal of water in coastal counties was 425 mgd. The increase in commercial-industrial self-supplied water withdrawals from 1985 to 1990 may be attributable to expansion of existing facilities or the opening of new facilities. Total self-supplied commercial-industrial fresh water withdrawals in coastal counties fell from 425 mgd in 1990 to 388 mgd in 1995. Decreases in commercial-industrial self-supplied water withdrawals could be attributed to several factors. First, many commercial and industrial facilities once had their own private wells, but have switched over to public supply systems. Second, the larger commercial and industrial facilities are using water more efficiently and have adopted better conservation measures. Third, there has been a general change in Florida's economy from the industrial-commercial sector and toward the service sector.

Self-Supplied Commercial-Industrial Fresh Water Withdrawals in Coastal Counties by Source

Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	330.8	105.9	436.7
1970	350.5	125.7	476.2
1975	325.9	130.4	456.3
1980	301.0	61.3	362.3
1985	291.4	53.9	345.3
1990	297.0	128.3	425.3
1995	265.8	122.7	388.5

Self-Supplied Commercial-Industrial Fresh Water Withdrawals in Coastal Counties



Thermoelectric Power Generation Water Withdrawals

Thermoelectric power generation uses water for cooling and other plant operation and maintenance requirements. Water is used in the once-through cooling process, and also is used to augment existing cooling ponds. Water that is used at these facilities is supplied by surface water resources or a public-supply water system.

The demand for electricity increases concomitantly with population growth. This could lead to increased withdrawals of water for thermoelectric power generation. Water supplies used for power generation typically are sent through the plant and then returned back to the source waters. The water returned is at a higher temperature than the source waters; this can alter the composition of species within the aquatic system. As more water is used for cooling purposes, the area impacted by returned water may increase. The effects of water returned to source waters should be examined carefully in order to identify and implement optimal mitigation methods.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles this information. Every five years USGS publishes a report, *Water Withdrawals, Use, and Trends in Florida*, which contains these data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and Florida's water management districts. The publication is prepared by Richard L. Marella; he can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and the Florida Department of Environmental Protection.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts, and it is compiled and published by USGS every five years.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Withdrawals data are provided only for every fifth year. Anomalies may occur during interim years. If a given year has above or below normal precipitation, the year's water use value may be skewed. Withdrawal estimates represent only the amount of water withdrawn, not the amount of water consumed that is no longer available to the environment.

Data Analysis

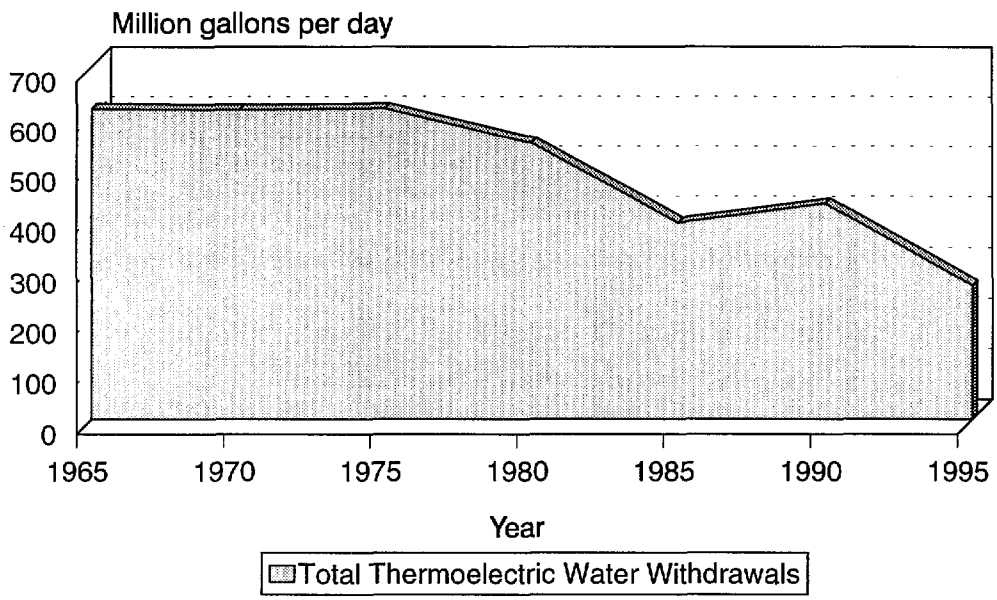
In 1995, thermoelectric power generators withdrew 519 million gallons of fresh water per day (mgd). Approximately 266 mgd were in coastal counties. This figure includes surface and ground waters used for non-contract cooling power generators. Between 1965 and 1985 thermoelectric power generator water withdrawals declined by 37 percent. This trend may be linked to increased efficiency and reuse of cooling waters. By reducing the amount of water withdrawn for thermoelectric power generation processes, associated adverse environmental impacts also decrease.

Fresh water withdrawals for thermodynamic use from ground water increased from less than 6 mgd in 1965 to nearly 14 mgd in 1995. These withdrawals accounted for less than 0.5 percent of the total amount of ground water used in 1995. Fresh water withdrawals from surface waters decreased significantly between 1975 and 1995. This reduction in water use was attributed to technological innovation.

Thermoelectric Power Generation Water Withdrawals in Coastal Counties

Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	5.75	610.00	615.75
1970	2.59	611.00	613.59
1975	11.57	604.40	615.97
1980	12.80	533.60	546.40
1985	8.33	379.66	387.99
1990	13.84	412.11	425.95
1995	13.68	252.42	266.10

Thermoelectric Power Generation Water Withdrawals in Coastal Counties



Agriculture Water Withdrawals

Water resources in Florida provide drinking water and support agriculture, industry, and the state's unique ecological systems. Agricultural water withdrawals comprise the largest proportion of total water withdrawals. Advances in irrigation techniques can diminish the amount of water required to support Florida's lucrative agricultural industry.

Best management practices can reduce the deleterious effects often associated with agricultural runoff. Agricultural water uses include the irrigation of grasses, ornamentals, and commercial crops. Non-irrigation uses include providing drinking water for livestock and fish farming.

Increases in water withdrawals for agricultural purposes are a direct indicator of increasing demand on water resources. If withdrawals exceed water recharge, the potential for saltwater intrusion and reduced flows in surface water bodies increases. Low flows in surface water bodies may have significant impacts on riparian species, and aquatic communities may lose species intolerant of environmental changes. Opportunistic species that can readily adapt to environmental changes may displace intolerant species.

Data Characteristics

SOURCE

The Water Resources Division of the United States Geological Survey (USGS) compiles this information. Every five years USGS publishes a report entitled *Water Withdrawals, Use, and Trends in Florida* which contains these data. The report is prepared in cooperation with the Florida Department of Environmental Protection (DEP) and Florida's water management districts. The publication is prepared by Richard L. Marella, who can be contacted at USGS, 227 North Bronough Street, Suite 3015, Tallahassee, Florida 32301, or at (850) 942-9500, extension 3004.

ACQUISITION

This information can be obtained from the Water Resources Division of USGS. The data are made available through a cooperative agreement between USGS and DEP.

COLLECTION

The information is collected statewide throughout the year by both DEP and the water management districts, and it is compiled by USGS for the above-mentioned publication every five years.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

Data are compiled on a statewide basis approximately every five years. Anomalies may exist for during interim years. For example, if a given year has above or below normal precipitation, the year's water use value may be skewed. Data for this indicator are calculated by multiplying the number of acres irrigated by the quantity of irrigation water required to optimally grow each crop; values are then adjusted by computer modeling. Though these figures are estimates, they are believed to be quite accurate. For earlier years the figures are somewhat less accurate, primarily because the methods of data collection and modeling have improved over the years. Another limitation is that the data do not indicate the amount of water saved due to conservation efforts and technological advance. Finally, not all water management districts require irrigators to meter and record their water use. Because data collection is not required by all water management districts, the data do not reflect all agricultural withdrawals.

Data Analysis

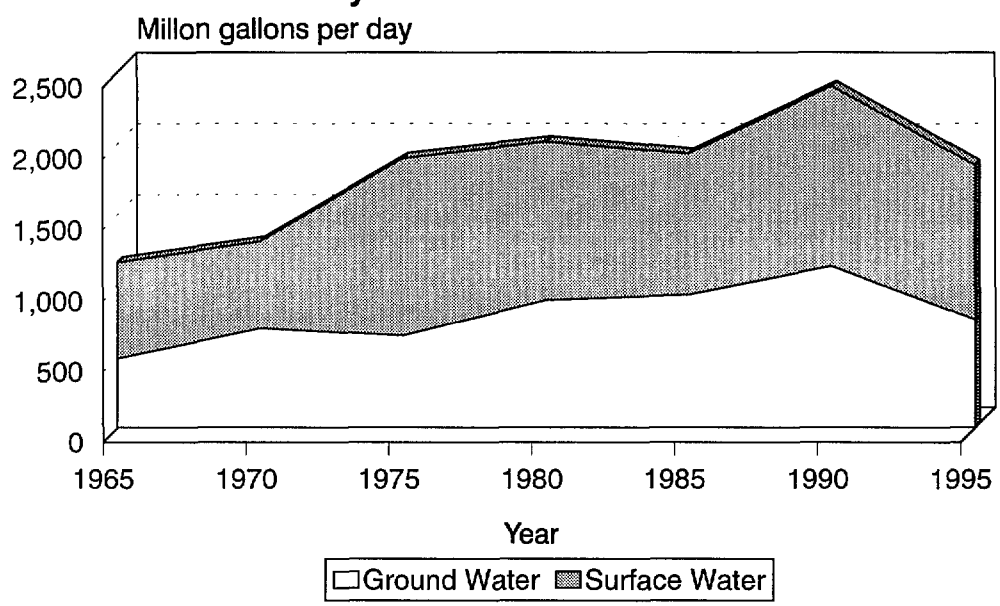
Total agricultural water supply withdrawals more than doubled between 1965 and 1990, increasing from over 1,166 million gallons per day (mgd) to nearly 2,405 mgd. During this period, ground water withdrawals increased

133 percent and surface water withdrawals increased nearly 87 percent. In 1995, however, the total agricultural water supply withdrawals decreased to 1,815 mgd; this total is lower than 1975 total withdrawals. The most dramatic change observed between any two consecutive periods was for surface water withdrawals between 1970 and 1975; during this period, withdrawals increased 104 percent.

Agricultural Fresh Water Withdrawals by Coastal Counties

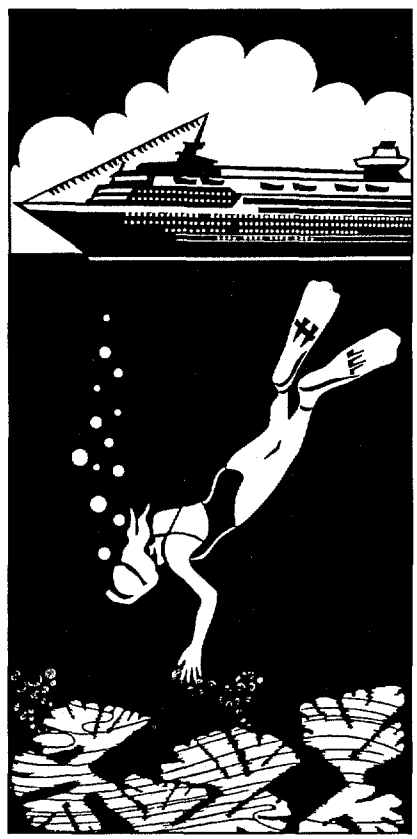
Year	Ground Water (mgd)	Surface Water (mgd)	Total Withdrawal (mgd)
1965	489.22	677.47	1,166.69
1970	701.75	611.88	1,313.63
1975	651.35	1,248.55	1,899.90
1980	902.18	1,113.93	2,016.11
1985	941.37	989.73	1,931.10
1990	1,140.54	1,264.41	2,404.95
1995	765.56	1,015.45	1,815.01

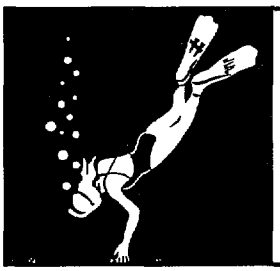
Agricultural Fresh Water Withdrawals by Coastal Counties



Section F

Sustaining the Human Uses of the Coast





Sustaining Human Uses of the Coast

Florida's coast is one of its most valued resources and visitors and residents make enormous investments each year in activities oriented toward it. These activities also create a great deal of pressure on its fragile ecosystems and other resources. Commercial and recreational fishing, boating, beach visits, and other coastal-dependent activities all add up to take their toll. Should Florida's coast deteriorate, its recreational and commercial uses would be compromised and Florida's long-term health and productivity will be adversely impacted. At the same time, access to these resources must be balanced with their preservation in a manner that will provide enjoyment and productivity for future generations.

With over 78 percent of Florida residents living in the 35 coastal counties, it is evident that the quality of life and economic opportunities offered by the coast are of great importance. The demands on the coast for recreational activities and economic uses require close monitoring of the ability of the coast to support these activities.

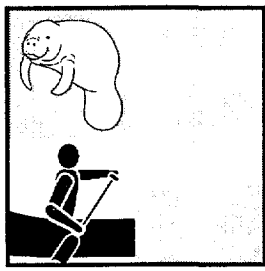
The indicators in this section address the importance of safeguarding the attributes which are most valued for coastal activities. The primary concerns are maintenance of recreational value and sustaining economic use. The maintenance of recreational values is important for activities such as boating, diving, fishing, swimming, and bathing. Sustainable economic use focuses on maintaining properties important for commercial use such as tourism, commercial ports, transport of goods, commercial fishing, and cruise boat sailings. The following list identifies the indicators that are examined in this section.

Sustaining Human Uses of the Coast Indicators:

- Coastal recreation activity by residents
- Coastal recreation activity by tourists
- Recreational saltwater fishing trips
- Registered recreational vessels
- Number of marina boat slips
- Number of boat launches
- Public access areas along sandy beaches
- Revenue generated by the tourist development tax
- Cargo handled at seaports
- Number of cruise boat passengers
- Registered commercial vessels
- Value of foreign trade through seaports
- Saltwater fish landings
- Catch per angler day on headboats
- Value of commercial marine fisheries landings

Other Indicators of Interest:

- Absolute population growth (Section A)
- Acreage of shellfishing waters by classification (Section D)
- Management status of coastal habitats (Section G)
- Beach visits by residents (Section I)



Coastal Recreation Activity by Residents

An increase in leisure time and a rise in disposable income have allowed more Americans to spend time at the shore. Florida's residents place a high value on coastal recreation. Among the numerous activities enjoyed along the coast are boating, fishing, swimming, walking, beachcombing, sunbathing, sightseeing, and surfing (Beatley et al., 1994).

Coastal recreation activity by residents is one indication of the value residents place on the recreational aspects of the coast. This indicator also reflects the pressures exerted on the coastal resources due to human use. These measures allow the state to determine how much money should be invested in the state's coastal areas for improvement.

Data Characteristics

SOURCE

A survey of coastal recreation activity is presented in the State Comprehensive Outdoor Recreation Plan and its predecessor documents which have been published in 1965, 1971, 1976, 1987, 1981, 1989, and 1994. Copies of these reports are available from Lew Scruggs or Lyle Fowler at the Florida Department of Environmental Protection, Division of Recreation and Parks, Office of Park Planning, MS 525, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, or at (850) 488-2300.

ACQUISITION

The data are available in hard copy at cost of duplication. Availability of electronic format data is limited and should be discussed with staff.

COLLECTION

Data is collected by survey prior to development of the State Comprehensive Outdoor Recreation Plan, which should be issued on a five-year schedule in the future. Survey methods have varied considerably and are discussed further below.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

As is evident from the data presented below, the survey methods and structure have changed considerably over time. To further complicate the situation, the survey methods and structure are not documented in every publication and what documentation is presented is often inadequate for determining the comparability of the data points. For instance, in 1970 the survey is described as follows:

> In order to accurately ascertain the magnitude of these two sources of demand in Florida, during 1970 randomly selected interviews of over 3,000 residents (adults and children) and tourists (automobile and plane) were conducted in relation to all aspects of outdoor recreation participation. In addition, residents were asked for their estimates of future (one year) recreation participation. From these interviews, a resident and a tourist per capita participation rate was established, which, when coupled with population and tourist projections to 1975 and 2000, produced reasonably accurate demand projections for those years. (DNR, 1971)

In 1992-93, 3,169 residents were contacted by telephone and asked abut the number of times they participated in 26 selected outdoor recreation activities during the previous two months, and in which county the activity had occurred. (DNR, 1994) This survey method probably produces reliable data (at least for the purposes of trend evaluation) since it is examined to ensure that respondents accurately reflect the age, sex, race and ethnic composition of each region's actual population. In comparison, the tourist survey may not reflect the actual tourist population or properly adjust for survey biases. This methodology was also used in the 1985-86 survey of 6,937 residents. (DNR, 1987) This survey data was evidently reused for the 1987 estimate, but adjusted for a different estimated population. (DNR, 1989) Previous surveys used mail-back surveys (DNR, 1981) and one-month surveys of annual activities (DNR, 1976) which are considerably less reliable due to problems with response rates and recall by interviewees.

Furthermore, as demonstrated below, the categories of outdoor recreation varied from year to year until being standardized in the 1978-79 survey. Given the enormous variation in "RV/Trailer Camping" and other categories, it is likely that changes in survey wording and methods affected the results significantly.

Further information about the surveys was not available from the Office of Park Planning because the surveys are used to generate recreation facility demand estimates and have not been maintained for other uses. Although the data provide poor trend data, they may be useful for some purposes. The Office of Park Planning considers the 1978-79 survey and more recent surveys to be comparable in methods and results and thus those are presented as trend data. The user is cautioned to recognize that changes illustrated by these data may in fact reflect changes in methodology rather than actual trends.

Data Analysis

Considering the limitations in the data presented above, evaluation of trends cannot be considered prior to the 1978-79 survey. In general, the data suggest an increase in coastal recreation user-occasions by residents. A user-occasion occurs each time an individual participates in a single outdoor recreational activity.

Among the various coastal recreation activities, beach activities are consistently recorded as the most popular type of resident activity through all surveys. Boat fishing is apparently more popular than shore fishing. Other boating activities are not as popular as fishing. Natural and cultural appreciation is somewhat more popular than fishing, with visits to historical and architectural sites, nature study, and hiking being of roughly equal importance. Natural and cultural appreciation activities may be increasing in popularity, although it should be noted that an unknown percentage of these activities are non-coastal in nature since these data cannot be separated by coastal and non-coastal activities. Camping figures are difficult to interpret (considering that a "user-occasion" may or may not represent several days of camping), but evidently tent camping may be less popular than RV/trailer camping.

Comparing tourists to residents, it is apparent that greater use of coastal recreation activities is made by tourists than by residents, although the earliest surveys suggest that prior to 1978 residents made greater use of coastal recreation than tourists. Furthermore, when comparing types of coastal activities, it is evident that while beach activities are most important to tourists, for residents beach activities are roughly equal to other coastal recreation activities. Residents make greater use of more developed coastal activities such as hiking, camping (particularly tent camping), and boating activities which often require public facilities.

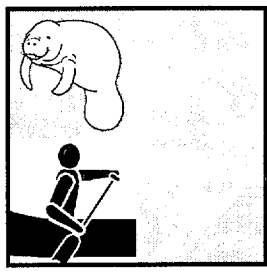
Coastal Recreation Activity by Residents

Thousand resident user-occasions

	1992-93	1987	1985-86	1978-79	1974-75	1970	1961
Saltwater Recreation							
Beach Activities	30,512	40,634	38,001	28,127	146,206	102,499	
Swimming						64,234	63,600
Sailing					7,350		
Surfing					5,755	9,773	
Fishing					55,685	40,531	32,500
Boat	8,162	12,697	11,926	5,918			
Non-Boat	4,652	6,855	6,390	4,988			
Boat Ramp Use[1]	5,237	7,202	6,780	3,690	16,895	20,234	
Partially Coastal Recreation							
Nature Study	6,859	4,900	4,559	3,513	31,207	28,532	5,100
Hiking	8,887	5,612	5,263	3,482	15,542	22,229	3,000
Visiting Arch/Hist Sites	8,943	3,228	3,042	2,860	6,037	6,191	5,400
Camping[2]						5,104	4,200
RV/Trailer	8,651	1,485	1,384	1,905	4,477		
Tent[3]	2,086	1,612	1,508	1,085	5,206	269	
Boating							27,300
Total	83,989	84,225	78,853	55,568	294,360	299,596	141,100

References

Beatley, Timothy, David J. Brower, and Anna K. Schwab. 1994. *An Introduction to Coastal Zone Management.* Island Press.



Coastal Recreation Activity by Tourists

An increase in leisure time and a rise in disposable income have allowed more Americans to spend time at the shore. Each year, thousands of tourists come to Florida to vacation. Most of these tourists will visit the beach to take advantage of coastal recreational activities. Among the numerous activities enjoyed along the coast are boating, fishing, swimming, walking, beachcombing, sunbathing, sightseeing, and surfing (Beatley et al., 1994).

Coastal recreation activity by tourists indicates the value that tourists place on the recreational aspects of the coast. This indicator also reflects the pressures exerted on the coastal resources due to human use. These measures allow the state to determine how much money should be invested in the state's coastal areas for improvement and for the purpose of attracting visitors.

Data Characteristics

SOURCE

A survey of coastal recreation activity is presented in the State Comprehensive Outdoor Recreation Plan and its predecessor documents which have been published in 1965, 1971, 1976, 1987, 1981, 1989, and 1994. Copies of these reports are available from Lew Scruggs or Lyle Fowler at the Florida Department of Environmental Protection, Division of Recreation and Parks, Office of Park Planning, MS 525, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, or at (850) 488-2300.

ACQUISITION

The data are available in hard copy at cost of duplication. Availability of electronic format data is limited and should be discussed with staff.

COLLECTION

Data are collected by survey prior to development of the State Comprehensive Outdoor Recreation Plan, which should be issued on a five-year schedule in the future. Survey methods have varied considerably and are discussed further below.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

As is evident from the data presented below, the survey methods and structure have changed considerably over time. To further complicate the situation, the survey methods and structure are not documented in every publication and what documentation is presented is often inadequate for determining the comparability of the data points. For instance, in 1970 the survey is described as follows:

> In order to accurately ascertain the magnitude of these two sources of demand in Florida, during 1970 randomly selected interviews of over 3,000 residents (adults and children) and tourists (automobile and plane) were conducted in relation to all aspects of outdoor recreation participation. In addition, residents were asked for their estimates of future (one year) recreation participation. From these interviews, a resident and a tourist per capita participation rate was established, which, when coupled with population and tourist projections to 1975 and 2000, produced reasonably accurate demand projections for those years. (DNR, 1971)

The tourist survey of 1974-75 isolated 500 tourists each in August and February. (DNR, 1976) The survey coverage improved in 1978-79, including 6,000 tourists intercepted in six bi-monthly waves. These data were evidently adjusted for estimated tourist visitation rates by counties. (DNR, 1981) In 1985-86, 9,020 tourists were interviewed over a 12-month period at airports and highway exit points. This survey data was evidently reused for the 1987 estimate, but adjusted for different estimated tourist visitation rates. (DNR, 1987; DNR, 1989) In 1992-

93, 2,500 tourists were interviewed over a 12-month period at airports and highway exit points (somewhat different sites than in previous surveys) and was adjusted for estimated tourist visitation rates. (DNR, 1994) Thus, many important factors varied from survey to survey and thus make it difficult to compare the figures from one year to the next.

Furthermore, as demonstrated below, the categories of outdoor recreation varied from year to year until being standardized in the 1978-79 survey. Given the enormous variation in "RV/Trailer Camping" and other categories, it is likely that changes in survey wording and methods affected the results significantly.

Further information about the surveys was not available from the Office of Park Planning because the surveys are used to generate recreation facility demand estimates and have not been maintained for other uses. Although the data provide poor trend data, they may be useful for some purposes. The Office of Park Planning considers the 1978-79 survey and more recent surveys to be comparable in methods and results and thus those are presented as trend data. The user is cautioned to recognize that changes illustrated by these data may in fact reflect changes in methodology rather than actual trends.

Data Analysis

Considering the limitations in the data presented above, evaluation of trends cannot be considered prior to the 1978-79 survey. In general, the data suggest a decline in coastal recreation user-occasions by tourists. A user-occasion occurs each time an individual participates in a single outdoor recreational activity.

Among the various coastal recreation activities, beach activities are consistently recorded as the most popular type of tourist activity through all surveys. Fishing is apparently of roughly equal popularity from shore or boat. Other boating activities are not as popular as fishing. Natural and cultural appreciation is probably equally as popular as fishing, with visits to historical and architectural sites being roughly equal in number to nature study and hiking. Camping figures are difficult to interpret (considering that a "user-occasion" may or may not represent several days of camping), but evidently tent camping is considerably less popular than RV/trailer camping.

Comparing tourists to residents, it is apparent that greater use of coastal recreation activities is made by tourists than by residents, although the earliest surveys suggest that prior to 1978 residents made greater use of coastal recreation than tourists. Furthermore, when comparing types of coastal activities, it is evident that while beach activities are most important to tourists, for residents beach activities are roughly equal to other coastal recreation activities. Residents make greater use of more developed coastal activities such as hiking, camping (particularly tent camping), and boating activities which often require public facilities.

Coastal Recreation Activity by Tourists

Thousand tourist user-occasions

	1992-93	1987	1985-86	1978-79	1974-75	1970	1961
Saltwater Recreation							
Beach Activities	74,616	78,048	93,931	87,214	114,320	92,091	
Swimming						61,705	64,400
Sailing					3,789		
Surfing					3,590	3,085	
Fishing					18,680	27,924	11,600
Boat	19,877	5,144	5,991	4,983			
Non-Boat	4,405	3,973	4,848	8,049			
Boat Ramp Use[1]	1,610	1,903	2,216	2,040	1,892	8,416	
Partially Coastal Recreation							
Nature Study	2,215	2,984	3,543	7,650	7,517	5,447	5,100
Hiking	3,668	2,730	3,644	8,561	7,790	12,137	
Visiting Arch/Hist Sites	5,379	5,525	6,715	11,875	13,151	14,522	5,500
Camping[2]						25,568	300
RV/Trailer	5,659	8,619	10,170	38,549	15,272		
Tent[3]	825	1,546	1,927	2,795	8,756	1,346	
Boating							5,500
Total	118,254	110,472	132,985	171,716	194,757	252,241	92,400

[1]In 1970, category named "saltwater boating."
[2]In 1970, category named "designated site camping."
[3]In 1970, category named "primitive site camping."

References

Beatley, Timothy, David J. Brower, and Anna K. Schwab. 1994. *An Introduction to Coastal Zone Management.* Island Press.

Recreational Saltwater Fishing Trips

Florida has an abundance of both fresh and salt waterbodies for recreational or sport fishing. The availability of water and its virtually unlimited access from any point within the state allow almost anyone who wants to fish the opportunity to do so. Those who engage in fishing use a variety of methods. Recreational fishing includes conventional methods such as rod and reel casting and highly specialized forms such as cast-netting, spearfishing, floundering, crabbing, and gathering oysters and other shellfish.

Sport fishing has significant impacts on the state's economy through the creation of other industries to support sport fishing. Some of the industries created include fish camps, individual boat rentals and related services, luxurious charter boats, and piers (some of which charge for admission). Additionally, local tackle shops and other businesses generate substantial revenue by selling fishing equipment.

A saltwater fishing license is required for certain types of fishing, such as individuals fishing in a private boat. However, the compliance rate is low. According to a Florida Sea Grant study, an estimated 860,000 resident anglers should have purchased saltwater licenses in 1991-92 (Milon & Thunberg, 1993). However, only 540,000 licenses (63 percent) were sold. Likewise, an estimated 1 million tourists should have purchased licenses (Bell, 1993) but only 270,000 licenses (27 percent) were sold. Furthermore, the Florida Sea Grant study estimated 2.3 million total resident anglers (Milon & Thunberg, 1993). Thus, the 540,000 licenses sold actually represents only 23 percent of total Florida saltwater anglers (many of whom are not legally obligated to purchase a license, e.g. for beach fishing).

Data on the number of marine recreational fishing trips were not collected in a systematic manner on a continuing basis until 1979. The Marine Recreational Fishery Statistics Survey (MRFSS) actually includes two independent, but complementary, surveys: a telephone survey of households in coastal counties and an intercept (i.e., interview) survey of anglers at fishing access sites. The telephone survey is primarily used to collect reliable data on recreational fishing effort. However, information on the actual catch such as species identity, number and size of fish caught can not be reliably collected by telephone. These data are obtained from anglers intercepted by trained interviewers stationed at fishing access sites. Data from the two surveys are combined to produce estimates of fishing effort, catch, and participation.

Data Characteristics

SOURCE

The Marine Recreational Fishery Statistics Survey (MRFSS) is available from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, 1315 East-West Highway, Room 12340, Silver Spring, MD, 20910, or via internet at **http://remora.ssp.nmfs.gov/mrfss/index.html**. Headboat data are available from Robert Dixon, Research Fisheries Biologist, Beaufort Laboratory, National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516-9722, or at (919) 728-8719.

Information on recreational fishing licenses may be obtained from Virginia Vail, Chief, Office of Fisheries Management, Division of Marine Resources, Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, MS-240, Tallahassee, Florida 32399-3000, or at (850) 922-4340.

ACQUISITION

The data are available via internet at no cost.

COLLECTION
The MRFSS is updated annually and available about half a year later. Headboat data are available on a similar schedule.

TECHNICAL
Hierarchy of Indicator: 2
Pressure/State/Response: Pressure
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Annual saltwater recreational fishing trips data are estimated using a combination of a telephone survey of households in coastal regions and an intercept survey of anglers at the end of fishing trips. These limitations are discussed in detail at the MRFSS web site. The MRFSS does not include trips from private piers, shoreline, or docks. It is, therefore, an underestimate of total trips. Headboat trips are estimated from mandatory reporting by headboat operators. The data is available as angler days and a factor of 1.5 angler trips per angler day was used. This number was derived from 1995 data and is not believed to vary significantly. Since headboat trips are a small portion (2 to 3 percent) of total recreational trips, the error is not significant when compared to the statistical error in the MRFSS.

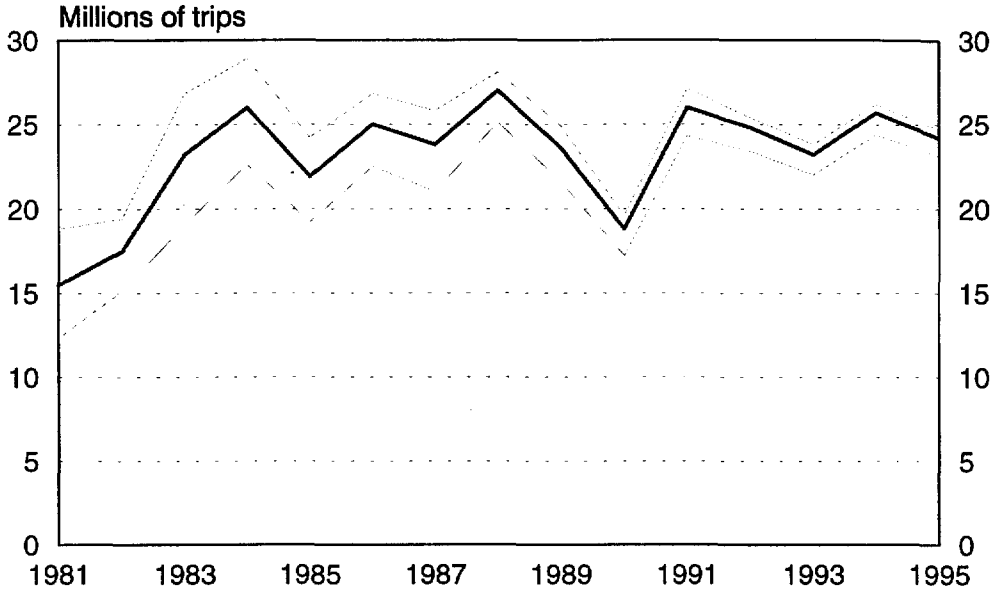
Data Analysis

The number of angler trips is not a measure of effort, because trip length may vary and the targeted species may change from year to year. Thus, these data cannot be used with the total catch weight to determine a catch per unit effort because such a comparison would require a more detailed data set including time, fishing method, and catch of targeted species. Such a comparison is possible with the headboat data set and is presented in a separate indicator.

Estimated Annual Saltwater Recreational Fishing Trips

	Trips (millions)	Standard Error
1981	15.5	11.0 %
1982	17.5	5.7
1983	23.2	8.1
1984	26.0	5.9
1985	21.9	5.5
1986	25.0	3.6
1987	23.8	4.4
1988	27.0	2.2
1989	23.6	2.8
1990	18.8	2.3
1991	26.0	2.2
1992	24.8	1.4
1993	23.2	1.2
1994	25.7	1.1
1995	24.2	1.1

Estimated Annual Saltwater Recreational Fishing Trips



Gray lines indicated 95 percent confidence interval of statistics.

The statistical accuracy of the MRFSS has improved dramatically since the early 1980s, as indicated by the decline in percentage standard error. However statistically accurate the survey may be, other studies suggest the actual number of fishing trips may be significantly different from the MRFSS estimates. Thus, although the MRFSS is a useful measure of the trend (particularly as its statistical accuracy has improved), it may not be a correct estimate of the actual number of fishing trips.

The MRFSS is combined with the headboat data to include both residential and tourist fishers. According to two studies of recreational fishing in Florida, the number of saltwater fishing trips are expected to increase gradually to about 51.7 million by 2010 from 31.9 million trips in 1991 (note that these two studies use different methods and estimate about six million more fishing trips than the MRFSS and headboat data). Most of the increase is expected to be accounted for by tourists: the number of fishing trips by tourists is projected to increase from 11.9 to 23.7 million days and the number of fishing trips by residents is projected to increase from 20.0 to 28.0 million trips between 1991 and 2010 (Bell, 1993; Milon and Thunberg, 1993).

References

Milon, J. Walter and Eric M. Thunberg. 1993. *A Regional Analysis of Current and Future Florida Resident Participation in Marine Recreational Fishing.* Florida Department of Natural Resources, Florida Sea Grant College Program. Gainesville, Florida.

Bell, Frederick W. 1993. *Current and Projected Tourist Demand for Saltwater Recreational Fisheries in Florida.* Florida Department of Natural Resources, Florida Sea Grant College Program. Gainesville, Florida.

Registered Recreational Vessels

Florida offers an abundance of navigable waters which range in size and character. The Gulf of Mexico and Atlantic Ocean provide unlimited coastal and deep sea waters, and there are also numerous intracoastal and inland waterbodies throughout the state. This abundance of navigable waters has provided many opportunities for commercial and recreational boating. Thousands of people have registered boats with the state, and boating has become one of the most popular recreational uses of the coast. Although commercial boating accounts for a significant portion of boating activity, only recreational boating will be considered here.

In addition to a one-time titling requirement, recreational vessels must be registered every year if they are operated on the waters of the state. The number and size of recreational vessels registered with the state are excellent reflections of the demand for recreational boating, which has several impacts on the economy and environment. The direct economic impact of boating was $330 billion in gross sales for 1994 (Bendle, 1995). Boating also has indirect economic impacts via the jobs created to support the industry (e.g., trailer manufacturing, marinas and shipyards, marine services, and boating equipment and accessory manufacturing). Environmental impacts associated with boating include oil and gasoline spills, sewage discharges, and chemicals released during painting and sanding operations.

Recreational boating can require a substantial investment in equipment, and considerable time and effort are necessary to maintain the equipment and acquire boating skills. Thus, many people are unable to purchase a boat, and some who do purchase a boat buy a small to mid-sized craft because those require less investment and training and do not need to be docked at a marina. In addition, some people who have the resources to purchase a larger boat buy mid-sized vessels because these are best-suited for their activities (e.g., water sports).

Each size of boat requires different capital investments. Larger boats (26'+) are more difficult to move by car and may require docking facilities and marina services. Often, larger boats also require channel dredging and navigation aids such as charts and maps. Mid-sized boats also require some capital investment; boats over 12' must have access to a boat ramp and also require some marina services. Canoes and boats under 12' have very few capital requirements, as they are easily transported and do not require boat ramps.

This information will help the state in its decision to invest in capital improvements needed for various sizes of boats. The state will be able to invest in those capital improvements most demanded because it can link demand to trends in the number and size of boats registered. Thus, the state can maintain opportunities for recreational boating by supplying the services most needed to facilitate recreational boating.

Data Characteristics

SOURCE
Information about the number and size of registered boats is available through Sally Cole at the Florida Department of Highway Safety and Motor Vehicles, Bureau of Vessel Titles and Registrations, Neil Kirkman Building, Tallahassee, Florida 32399-0518, or at (850) 488-1195.

ACQUISITION
The data are available in hard copy format at no cost.

COLLECTION
The information is continually updated and tabulated annually by county.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data are quite accurate in reflecting the numbers of boats that are registered in the state each year. However, non-motor powered boats and vessels used exclusively on private lakes and ponds are exempt from registration. While the number of registration-exempt vessels is unknown, the Florida Department of Environmental Protection estimates that statewide, 300,000 to 400,000 boats fall into this category. Most of those boats would be characterized as recreational, although the estimate does include some commercial vessels.

In addition to the registration-exempt vessels, a few boats which should be registered with the state may be used on the waters even though they are not registered.

Data Analysis

The following data pertain only to the five smallest size categories of boats. Two additional size categories also exist (65' - 109'11" and 110'+), but since those vessel registrations comprise such a small percentage of the total, those figures are not displayed here. In addition, a final category (canoes over 16' or motorized) is not included here. Dealer registrations, which tend to comprise less than 1% of all vessel registrations, have also been excluded from these figures.

The data for coastal counties show a general upward trend in the number of vessels registered for the period reflected below. The data show that 16' - 25'11" boats are favored by coastal county boat owners and the 12' - 15'11" boats are also popular, though the gap between the two sizes has been increasing (the larger boats being favored). The number of registered 16' - 25'11" vessels increased rapidly from 1985 to 1990, remained fairly constant for several years, and increased again between 1993 and 1996; in contrast, the number of 12' - 15'11" boats showed little overall change from 1985 to 1996, and actually decreased nearly 12% between 1989 and 1996. The reason for the increase in 16' - 25'11" boat registrations is not known, though it may be due to a rise in income and, consequently, purchase power. Because of the limitations of 12' - 15'11" vessels in open water (i.e., they usually cannot safely venture far beyond protected bays and coves, the mouth of rivers, and the "flats"), vessels in this size category cannot be expected to rise in popularity as much in coastal counties as in non-coastal counties.

The data for non-coastal counties show a decisive upward trend for boats 16' - 25'11": registrations increased 81% between 1985 and 1996 for this category. For boats historically favored by non-coastal counties (12' - 15'11"), the numbers of registrations have fluctuated and reflect an overall decrease of 6% from 1985 to 1996. The non-coastal counties reflect a trend which is opposite that evident for coastal counties: the gap between 12' - 15'11" boats and 16' - 25'11" has been closing since 1985; for those two size categories, the numbers of larger vessels have been getting closer and closer to the registrations for the smaller vessels. The increased demand in non-coastal counties for 16' - 25'11" vessels may possibly reflect a shift in the use of vessels: water sports requiring the power of mid-sized boats (e.g., water skiing) may be becoming more popular than traditional activities such as fresh water fishing, as boats become increasingly viewed as "toys."

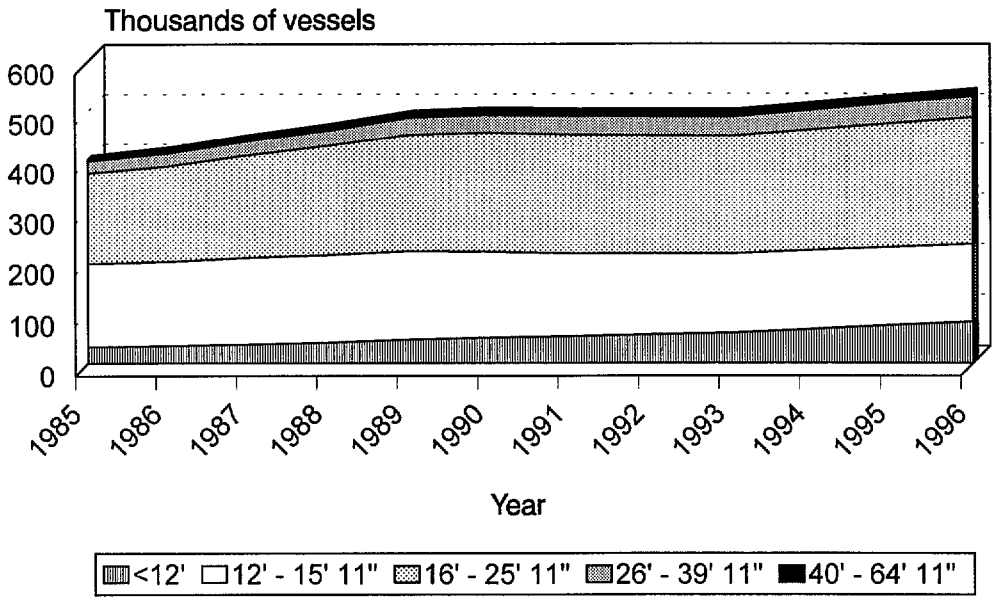
Registered Recreational Vessels in Coastal Counties

Year*	≤12'	12' - 15'11"	16' - 25'11"	26' - 39'11"	40' - 64'11"	Total**
1985	31,873	162,914	179,874	23,667	3,384	401,712
1986	34,550	164,154	190,231	25,842	4,044	418,821
1987	37,318	169,201	204,399	28,662	4,585	444,165
1988	40,773	170,604	218,353	31,457	5,118	466,305
1989	46,590	172,768	232,736	34,271	5,671	492,036
1990	50,355	167,554	238,167	36,147	6,082	498,305
1991	53,482	161,492	237,392	37,154	6,363	495,883
1992	56,101	158,478	236,065	38,059	6,597	495,300
1993	59,495	154,921	235,012	38,270	6,621	494,319
1994	66,629	154,980	240,474	39,509	6,795	508,387
1995	74,227	153,702	247,140	41,028	6,958	523,055
1996	81,711	152,505	252,767	42,384	7,101	536,468

*The years listed represent the end of the respective fiscal years (e.g., 1985 represents the fiscal year from July 1, 1984 to June 30, 1985).

**Totals do not include figures for three additional categories of boats. See first paragraph under Data Analysis for explanation.

Registered Recreational Vessels in Coastal Counties



Note: Data for three additional categories of vessels are not displayed here due to the comparatively small numbers of registered vessels in those categories.

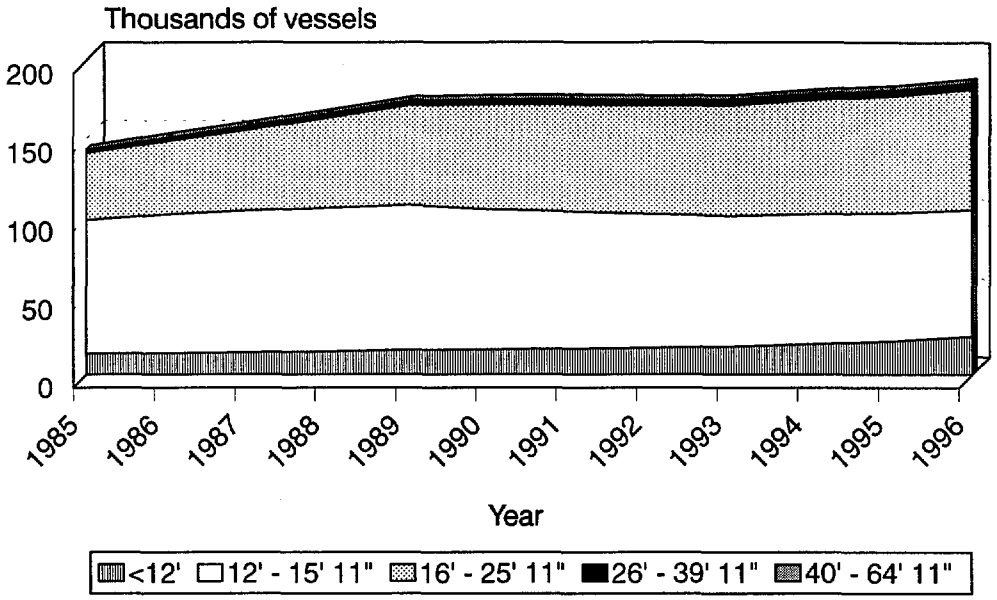
Registered Recreational Vessels in Non-Coastal Counties

Year*	<12'	12' - 15' 11"	16' - 25' 11"	26' - 39' 11"	40' - 64' 11"	Total**
1985	13,248	85,278	42,495	1,819	209	143,049
1986	13,819	88,287	46,450	2,056	252	150,864
1987	14,108	90,139	51,491	2,225	281	158,244
1988	14,693	91,296	57,143	2,410	331	165,873
1989	15,728	92,164	63,353	2,649	340	174,234
1990	15,926	89,232	66,682	2,859	370	175,069
1991	16,622	87,011	68,197	3,056	427	175,313
1992	17,025	84,952	69,110	3,081	464	174,632
1993	17,768	83,118	70,234	3,142	508	174,770
1994	19,499	82,476	72,724	3,245	524	178,468
1995	21,437	81,167	74,646	3,353	533	181,136
1996	24,495	80,322	76,923	3,558	545	185,843

*The years listed represent the end of the respective fiscal years (e.g., 1985 represents the fiscal year from July 1, 1984 to June 30, 1985).

**Totals do not include figures for three additional categories of boats. See first paragraph under Data Analysis for explanation.

Registered Recreational Vessels in Non-Coastal Counties



Note: The data for vessels 40' - 64'11" do not show on graph because of the small numbers of vessels in this category. In addition, data for three additional categories of vessels are not displayed here due to the comparatively small numbers of registered vessels in those categories.

Recommendations

The method of data collection merely counts the number and size of boats registered in each county; the data do not reflect where the boats are used. This information could be very helpful to the state in its decision of where to invest in capital improvements for recreational boating. While those who own boats in coastal counties are more likely to use the coast, those who own boats in non-coastal counties may also use their boats in the coastal counties and vice versa. Thus, the state is not currently obtaining accurate information pertaining to where the capital investments should be made.

Some direction could be provided via a survey conducted by the state. This survey could be conducted each year by asking boaters their favored spots and where they anticipate using their boats. The survey could be attached to the registration form and could be sent in with the registration fee. The data could then be tabulated by county.

References

Bendle, Bradley J. 1995. Presentation during a public workshop regarding boating and marina discharge, sponsored by the Indian River Lagoon National Estuary Program and the Florida Coastal Management Program, February 24, 1995. Florida Department of Environmental Protection: Tallahassee, Florida.

Number of Marina Boat Slips

Marinas have been found to contribute 4,580 jobs and $452 million to Florida's economy (Bendle, 1995). As boating increases in popularity, the need for marinas increases. Many large boats require docking facilities because it is too costly or not possible to pull the boats by automobile to a launch site or boat ramp. As more people purchase and use larger boats, the demand for marina boat slips will increase. As the number of marinas increase, so will the economic impact of these facilities. The number of marina boat slips can be used as an indirect indicator of the economic impact of the state's marinas on Florida's economy.

Data Characteristics

SOURCE

The numbers of marina boat slips in the state are available from Lew Scruggs or Lyle Fowler at the Florida Department of Environmental Protection, Division of Recreation and Parks, Office of Park Planning, MS 525, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, or at (850) 488-2300.

ACQUISITION

Availability and format of data should be discussed with staff.

COLLECTION

A statewide inventory of recreational facilities has been conducted on an irregular schedule (usually every two years) to support the planning process for the State Comprehensive Outdoor Recreation Plan and other needs. The method and level of effort have varied some what over the past several surveys. The last update was completed in the summer of 1995. The data are included in the Florida Recreation and Parks Facility Inventory, and the information is maintained as part of an inventory of outdoor recreation resources and facilities throughout the state. Data are broken down by type of facility, agency (federal, state, county, municipality, corporation, private club, or non-profit organization), statewide planning region, and county. Figures for both public and private facilities are available.

Data from 1982 are available in a report (Table 3.15: Capacity for Wet Slips and Dry Racks by Region and County of Florida, 1982, Column 1: Wet Slips) in the Division of Recreation and Parks, Office of Park Planning (Bell and Leeworthy, 1984).

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data were supplied by each site's administering agency or manager, and users of the data are cautioned that site-specific information may not accurately reflect the existence of the site or its features. In addition, the administrations of some agencies overlap; thus, some sites could possibly be counted twice (although that is less likely for this indicator than with some of the other data available from the database).

In 1995, a more extensive effort was made to survey private facilities. Thus, it is difficult to compare previous years' data with those from 1995.

Data Analysis

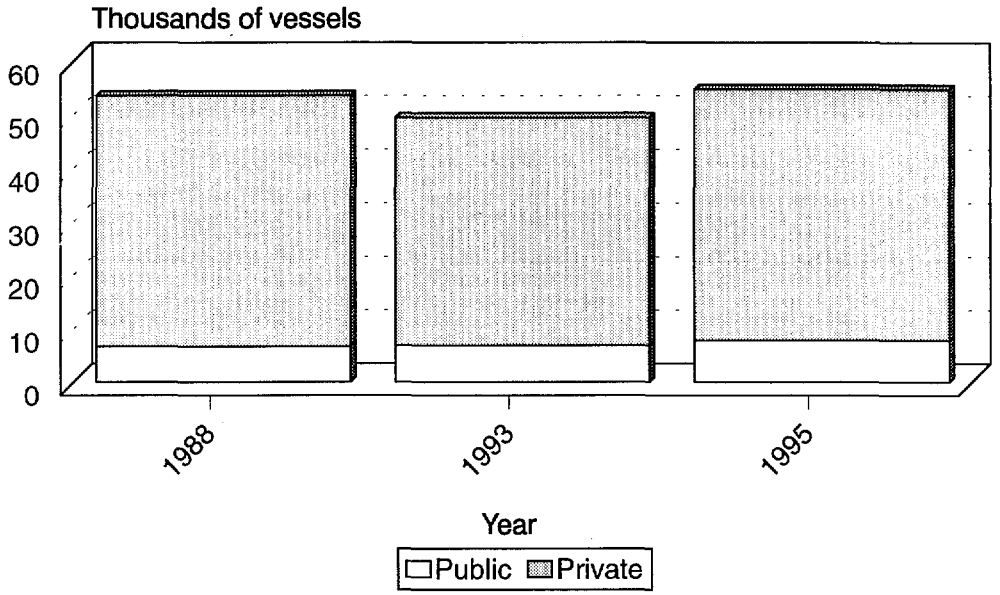
Considering the changing type and level of effort made to collect data on private boat slips, it is not possible to determine whether the number of boat slips has changed. Public boat slip data is considered more reliable, and if public and private boat slip supply is correlated, then the data suggests that the number of boat slips has increased between 1988 and 1995. However, the higher figures reported by the 1982 survey suggests that a number of boat slips may remain uncounted by the Florida Recreation and Parks Facility Inventory.

Boat Slips in Coastal Counties

	Total	Public Boat Slips Saltwater	Public Boat Slips Freshwater	Private Boat Slips Saltwater	Private Boat Slips Freshwater
1982	58,457	n.a.	n.a.	n.a.	n.a.
1988	53,448	6,312	326	42,989	3,821
1993	49,393	6,463	396	38,716	3,818
1995	54,645	7,355	462	41,644	5,184

Note: Data from 1980 is from a separate source and may not be comparable to more recent data.

Boat Slips in Coastal Counties



References

Bendle, Bradley J. 1995. Presentation during a public workshop regarding boating and marina discharge, sponsored by the Indian River Lagoon National Estuary Program and the Florida Coastal Management Program, February 24, 1995. Florida Department of Environmental Protection: Tallahassee, Florida.

Bell, Frederick W., and Vernon R. Leeworthy. 1984. *Estimation of the Demand and Supply of Marina Services in the State of Florida.* Bureau of State Lands Management, Florida Department of Natural Resources: Tallahassee, Florida.

Number of Boat Launches

Boating in Florida is a year-round pastime for approximately four million residents and tourists. Boaters access the water through marinas, private docks, and boat ramps. Marinas and private docks are addressed in a separate indicator. Studies suggest that boat ramps are used by about two-thirds to three quarters of Florida's registered boat owners. However, over fifty percent of those surveyed believe there is a need for more public ramps and that existing ramps need improvements (Bell, 1995).

Data Characteristics

SOURCE

The numbers of boat launches in the state are available from Lew Scruggs or Lyle Fowler at the Florida Department of Environmental Protection, Division of Recreation and Parks, Office of Park Planning, MS 525, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, or at (850) 488-2300.

ACQUISITION

The data are available in hard copy at no cost. Availability of electronic format data is problematic and should be discussed with staff.

COLLECTION

A statewide inventory of recreational facilities has been conducted on an irregular schedule (usually every two years) to support the planning process for the State Comprehensive Outdoor Recreation Plan and other needs. The method and level of effort have varied some what over the past several surveys. The last update was completed in the summer of 1995. The data are included in the Florida Recreation and Parks Facility Inventory, and the information is maintained as part of an inventory of outdoor recreation resources and facilities throughout the state. Data are broken down by type of facility, agency (federal, state, county, or municipal), owner (corporation, private club, or non-profit organization), statewide planning region, and county. Figures for both public and private facilities are available.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

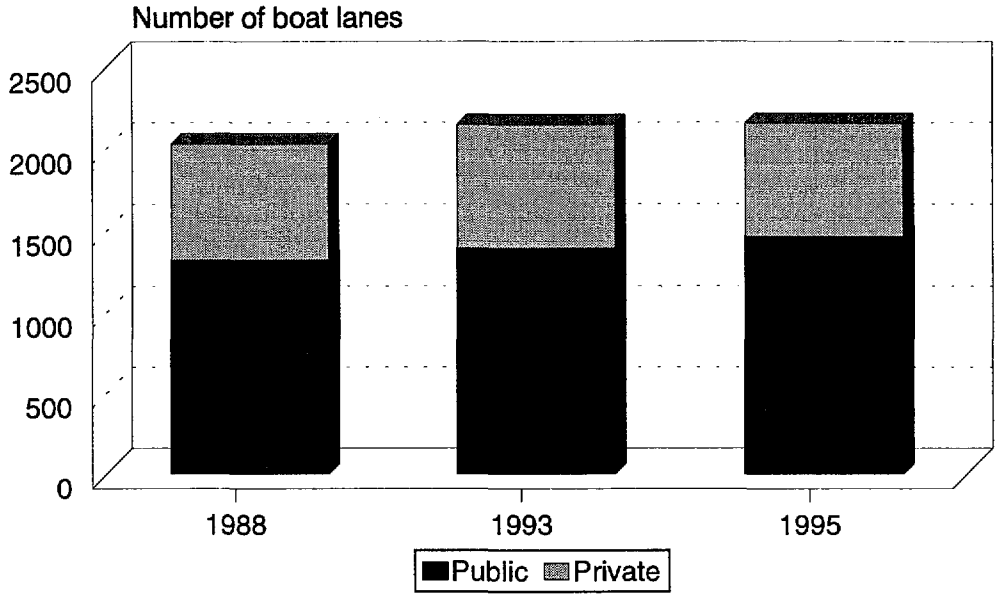
The data were supplied by each site's administering agency or manager, and users of the data are cautioned that site-specific information may not accurately reflect the existence of the site or its features. In addition, the administrations of some agencies overlap; thus, some sites could possibly be counted twice (although that is less likely for this indicator than with some of the other data available from the database).

In 1995, a more extensive effort was made to survey private facilities. Thus, it is difficult to compare previous years' data with those from 1995.

Data Analysis

Between 1988 and 1995, the number of boat ramp lanes in coastal counties increased by about 6 percent. The increase can be attributed entirely to an 11 percent increase in public boat ramp lanes as the number of private boat launch lanes in the inventory actually decreased. One study projects that Florida will need 2,729 boat lanes by the year 2000 (using the 30-minute scenario; Bell, 1995).

Boat Launch Lanes in Coastal Counties



Boat Launch Lanes in Coastal Counties

		Public Boat Launch Lanes		Private Boat Launch Lanes	
	Total	Saltwater	Freshwater	Saltwater	Freshwater
1988	**2,025**	727	586	504	208
1993	**2,142**	777	608	501	256
1995	**2,150**	836	624	471	219

References

Bell, Frederick W. 1995. *Estimation of the Present and Projected Demand and Supply of Boat Ramps for Florida's Coastal Regions and Counties.* Florida Sea Grant College Program publication TP-77. Gainesville, Florida.

Public Access Areas Along Sandy Beaches

Although the public owns the beaches up to the high tide mark, access to the beach is often restricted by privately owned property above the beach. Public access points, such as parks, trails, boardwalks, or street ends may be the only feasible means for the public to access the beach. Such public access areas are often (but not always) recreational amenities, including parking, restrooms, picnic areas, or other facilities. Information on public access to the beach is used in determining whether public funds should be used for beach protection and restoration projects and could be used to guide coastal development to ensure adequate public access to the beach.

Data Characteristics

SOURCE

Information concerning public access points can be obtained from Phil Flood, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, or at (850) 487-1262.

ACQUISITION

The data on number of access points are available in hard copy format at no cost.

COLLECTION

The information was collected statewide in 1993. The data are available for each coastal county. The study conducted in 1993 could be repeated for approximately $100,000. A more in-depth study to determine the percentage of beach frontage which may be reached by the public through existing public access points is estimated to cost about $200,000.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

This inventory provides information about the location and beach frontage of publicly owned properties in Florida. However, it does not provide the detailed information that would be needed to determine how much beach is actually accessible to the public. For instance, a street end provides access to at least 1/2 mile of beach frontage under ideal conditions. In some communities, however, there may be several street ends per mile of beach frontage. Thus, the actual amount of beach frontage accessible from each site cannot be reliably estimated from this data. Furthermore, the quality of the access area may not be sufficient to permit realistic access for most people. For instance, a public access point in a private neighborhood with no public parking may only be useful for people who live within walking distance.

Data Analysis

The 1993 inventory of beachfront properties under public ownership by the Division of Beaches and Shores, Florida Department of Environmental Protection, determined that nearly 1,700 public owned properties contain over 343 miles of shoreline representing nearly 42 percent of all sandy beaches found within Florida. However, the vast majority of these sites are small areas such as street ends and pedestrian walkways containing little or no support facilities.

Beachfront Properties Under Public Ownership

	Number of Sites	Beach Frontage (feet)
Street end	897	54,322
Pedestrian walkway	313	5,394
Public park	295	1,468,738
Undeveloped lot(s)	135	86,252
Other	52	198,633
Total	1,692	1,813,339

The 343 miles of public owned beachfront properties suggests that the public has recreational access to approximately 42 percent of the 825 miles of sandy beaches in Florida. Some portion of those miles of access are of limited use to the public if parking is unavailable in the vicinity or obstacles are present along the beach. As noted above, many access points provide the public with reasonable access to beach frontage which is much greater than the actual frontage of the property itself. Therefore, the actual amount of beach which is reasonably accessible to public use is probably significantly greater than 343 miles, but cannot be reliably estimated.

References

Beatley, Timothy, David J. Brower, and Anna K. Schwab. 1994. *An Introduction to Coastal Zone Management.* Island Press.

Revenue Generated by the Tourist Development Tax

Florida's economy is greatly dependent on activities related to tourism. The tourist dollars generated and brought into the state each year account for a significant portion of the state's revenue. Many businesses, particularly along the coast, are tourist-oriented and rely on revenue generated from tourists as their primary income.

Currently, there is no tax in the state that is levied specifically and exclusively on tourists. The general sales tax applies to goods and services that tourists and residents consume. Florida Statute 125.0104, otherwise known as the Local Option Tourist Development Act, gives counties the option to levy a tax on lease or rental charges from hotels, motels, rooming houses, and apartments. Currently 41 counties in Florida levy this "bed tax," which ranges from one to five percent (above the established sales tax rate) of each dollar spent. The money generated from this tax is then distributed to various sectors of the state; some of the funds go to beach enhancement, roads, and police protection. Thus, the revenue generated by this tourist development tax represents a portion of the money available to coastal counties to improve their beaches and coastal areas.

Data Characteristics

SOURCE

Information about the tourist development tax may be obtained from Chip Coggins, Senior Market Research Analyst, who can be reached at the Florida Tourism Industry Marketing Corporation, P.O. Box 1100, Tallahassee, Florida 32302-1100, or at (850) 488-5607.

ACQUISITION

Data from 1995 and prior years can be found in the Annual Florida Visitor Study. This was a publication of the Florida Department of Commerce, which terminated operations in December 1996. Some of the data reporting responsibilities have been absorbed by the Florida Tourism Industry Marketing Corporation. New publication schedules were not available at the time this analysis was prepared.

COLLECTION

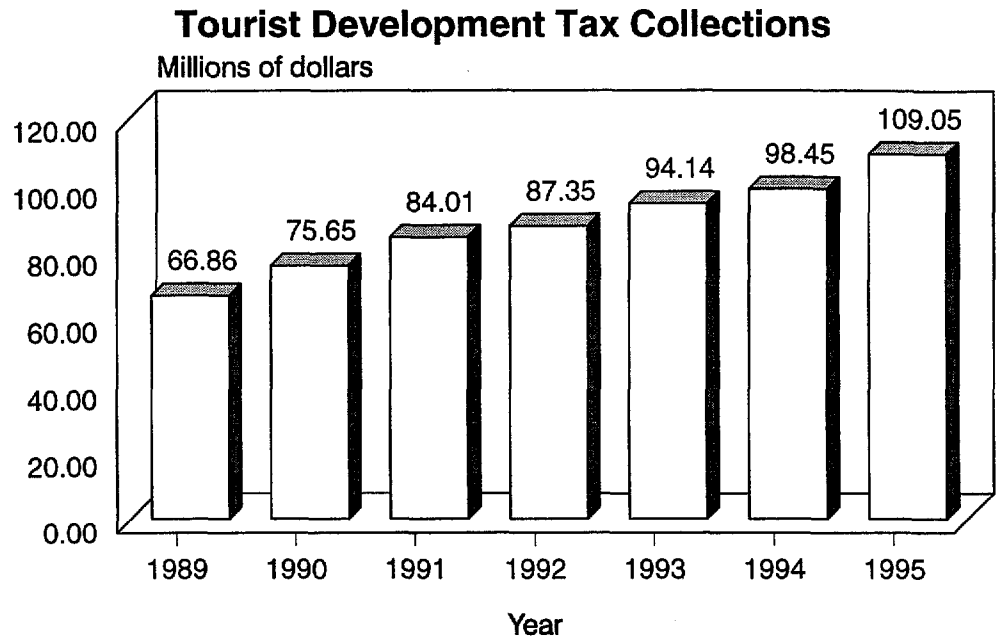
The data are tabulated monthly for each county and updated annually.

Data Limitations

Currently it is impossible to separate the revenue generated by tourists from that generated by residents or business travelers; therefore, these data overestimate the amount of money generated by tourists in the state's lodging facilities. Concurrently, these data underestimate the total amount of money generated by tourism since they do not include other activities that tourists pursue while vacationing in Florida, such as amusement parks, boat rentals, and other recreational activities. This indicator represents only the amount of tax revenue generated by hotels, motels, rooming houses, and apartments in the state.

Data Analysis

The number of counties levying the tourist development tax has been increasing in recent years. This factor may account for the majority of the upward trend in revenue generated by coastal counties from the tourist tax. Tax collections have gone from $66,862,457 in 1989 to $109,052,899 in 1995, a 64 percent increase or roughly $7 million dollars in additional revenue a year. Other factors contributing to the steady increase may include an increase in the numbers of tourists visiting coastal areas, an increase in the number of accommodations, or an increase in the tax to a higher percentage by participating counties. In 1995, there was a 0.4 percent increase in the number of hotel and motel rooms and the occupancy rates increased 2.1 percent (Coggins, 1996). Bay (+10 percent), Volusia (+7.6 percent), Dade (+13.2 percent), and Broward (+15.4 percent) each reported significant increases in tourist development tax revenues over 1994. According to the 1995 Visitor Study, these counties were some of the top destinations reported in surveys of air and auto visitors to Florida. Duval reported the largest increase (+80.6 percent) over the previous year's bed tax revenues.



References

Coggins, Chip (editor). 1996. *Florida Visitor Study 1995.* Florida Department of Commerce, Tallahassee, Florida.

Cargo Handled at Seaports

The state of Florida is particularly attractive to the shipping industry because of its proximity to foreign markets and waterways. These amenities have attracted a significant amount of port business which has had a decisive effect on the state's economy. At recent levels of activity, it is estimated that the ports (including trade and cruise activity) and port-dependent businesses create over 300,000 jobs and generate $600 million in state and local tax revenues (FSTEDC, 1994).

There are currently 14 publicly-owned, deepwater seaports in the state. The current ports are:

The South Atlantic Ports

- Port of Fernandina
- Port of Jacksonville
- Port Canaveral
- Port of Fort Pierce
- Port of Palm Beach
- Port Everglades
- Port of Miami
- Port of Key West

The Gulf Coast Ports

- Port of Pensacola
- Port of Panama City
- Port St. Joe
- Port Manatee
- Port of St. Petersburg
- Port of Tampa

Historically, several other ports have operated and been recorded in statistical histories. This indicator measures the weight of cargo handled at Florida seaports and is an indirect indicator of the trend of port activity in Florida.

Data Characteristics

SOURCE

Information on waterborne commerce is available from Peggy Galliano or Thomas G. Mire, Chief, Quality Control, Products, and Services Office, Waterborne Commerce Statistics Center, U.S. Army Corps of Engineers, P.O. Box 61280, New Orleans, LA 61280 or (800) 362-3412, ext. 1424. Further information can be obtained from Nancy Leikauf, Director of Communications, Florida Ports Council, P.O. Box 10137, Tallahassee, Florida 32302, or at (850) 222-8028.

ACQUISITION

The data was provided at no cost in hard copy.

COLLECTION

The data are collected and compiled by each port on different schedules.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data reflects cargo handled at the largest seaports in the United States and may not include cargo at smaller seaports in Florida. The seaports included in the data vary from year to year depending on their relative ranking against other seaports in the U.S. The error caused by this incomplete data set is not likely to be significant. Data from 1962 is lost and unavailable.

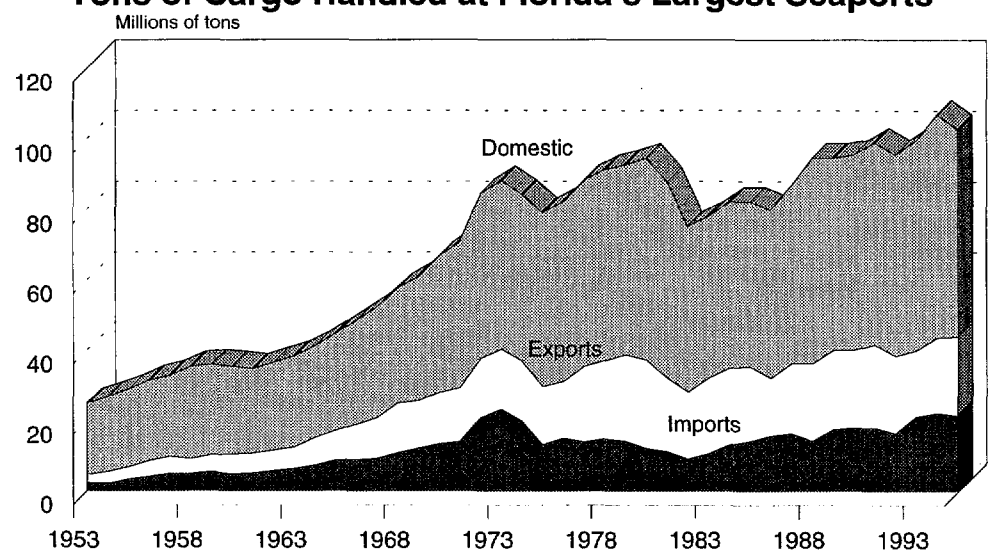
Data Analysis

Florida's largest seaports have handled hundreds of millions of tons of cargo since 1953, the earliest year for which data is available. Total cargo increased from about 30 million tons in the mid-1950s to over 100 million tons in the mid-1990s. In the late 1950s, domestic cargo accounted for about 70 percent of all cargo by weight, with the remainder divided roughly equally between imports and exports. By the mid-1990s, however, foreign trade accounted for over 40 percent of all cargo handled by Florida's largest seaports.

Tons of Cargo Handled at Florida's Largest Seaports

	Domestic	Imports	Exports		Domestic	Imports	Exports
1953	20,157,091	2,413,835	2,539,609	1975	49,457,587	13,270,840	16,427,853
1954	21,224,013	2,387,663	3,302,508	1976	51,063,815	15,217,137	16,026,892
1955	22,023,470	3,634,110	3,397,726	1977	52,980,564	14,142,239	21,265,529
1956	22,811,159	4,417,666	4,272,591	1978	54,319,829	15,028,052	22,107,069
1957	23,018,657	5,172,342	4,685,575	1979	54,092,891	14,400,007	24,312,701
1958	26,125,265	5,161,740	4,052,357	1980	57,325,358	12,293,917	25,000,050
1959	25,556,666	5,733,202	4,709,429	1981	55,755,832	11,441,277	20,796,738
1960	24,889,118	4,990,300	5,590,282	1982	47,224,843	9,258,086	18,879,218
1961	23,977,033	5,406,116	5,404,130	1983	45,938,353	10,692,109	21,537,977
1962	no data	no data	no data	1984	47,203,040	13,282,861	21,661,140
1963	25,779,253	6,592,287	6,005,570	1985	46,926,289	14,296,874	21,126,258
1964	25,955,726	7,521,859	7,724,199	1986	47,802,918	15,803,782	16,382,916
1965	27,463,550	8,855,615	8,397,456	1987	50,726,850	16,625,939	19,796,066
1966	29,646,647	9,067,532	9,874,852	1988	58,419,862	14,402,788	21,894,789
1967	31,451,537	9,482,528	11,369,837	1989	54,551,519	17,684,626	22,342,427
1968	32,732,299	10,982,284	14,131,457	1990	55,521,035	18,246,340	21,897,153
1969	35,286,791	12,315,941	13,523,891	1991	57,412,710	18,206,077	23,456,511
1970	38,789,226	13,610,100	14,376,417	1992	57,175,293	16,619,357	21,788,816
1971	41,613,238	14,194,067	15,093,028	1993	59,561,809	21,277,836	18,684,356
1972	47,115,615	20,854,623	16,790,287	1994	63,273,433	22,325,743	21,383,354
1973	47,963,269	23,405,155	16,888,111	1995	58,938,009	21,621,931	22,292,813
1974	47,448,676	20,113,804	16,894,306				

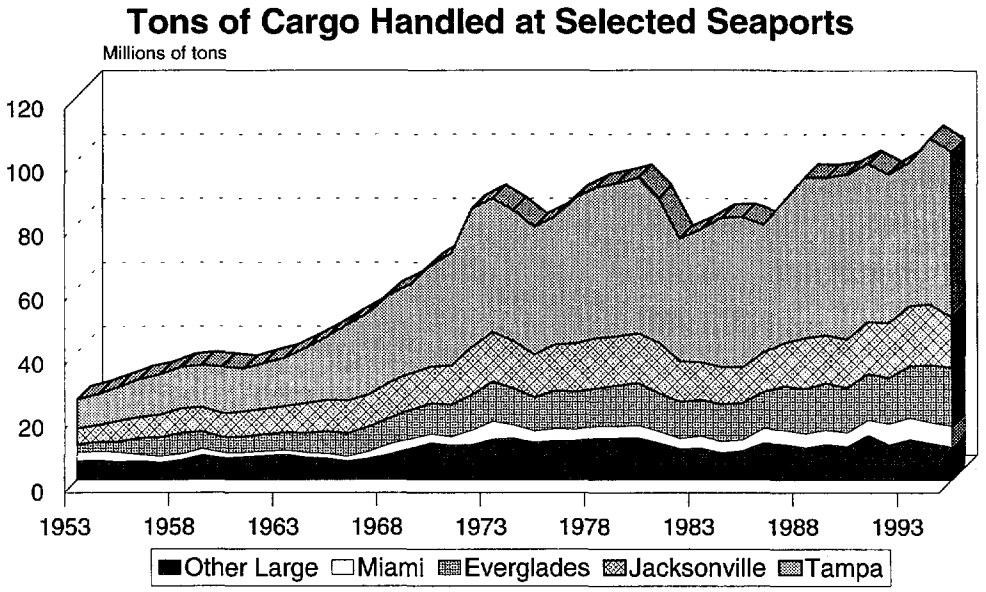
Tons of Cargo Handled at Florida's Largest Seaports



Cargo handled at Florida's largest seaports, as well as at many of its smaller seaports, has risen between 1953 and 1995. Among the various seaports, the distribution of cargo has remained relatively stable. The share carried by Miami has remained between 3 and 6 percent since 1956; Everglades' share has remained between 13 and 18 percent since 1956. Tampa's share (50 percent in 1995) has risen by an average of 0.4 percent per year since 1953, Jacksonville's share (15 percent) has decreased by about 0.15 percent per year, and the share handled by Florida's other large ports (10 percent) has decreased by about 0.25 percent per year.

Tons of Cargo Handled at Selected Seaports

	Jacksonville	Miami	Everglades	Tampa	Other Large	Total
1953	4,992,309	2,621,899	2,471,191	9,061,058	5,964,078	25,110,535
1954	5,267,749	2,619,778	2,884,258	9,812,962	6,329,437	26,914,184
1955	6,475,480	2,881,301	3,341,908	10,656,046	5,700,571	29,055,306
1956	6,588,181	1,922,490	5,104,537	11,927,530	5,958,678	31,501,416
1957	7,095,751	1,861,493	5,810,903	12,579,555	5,528,872	32,876,574
1958	7,736,879	1,809,167	6,465,413	12,989,979	6,337,924	35,339,362
1959	7,698,212	1,882,484	5,313,810	13,334,688	7,770,103	35,999,297
1960	7,450,977	1,611,638	4,693,240	14,786,470	6,927,375	35,469,700
1961	7,915,238	1,262,000	4,877,968	13,509,626	7,222,447	34,787,279
1962	no data	no data	no data	no data	no data	no data
1963	8,220,899	1,327,267	5,535,906	15,305,570	7,987,468	38,377,110
1964	9,281,866	1,357,616	6,121,862	17,389,921	7,050,519	41,201,784
1965	9,755,088	1,399,514	6,937,119	19,829,071	6,795,829	44,716,621
1966	10,295,556	1,377,514	7,135,333	23,915,622	5,865,006	48,589,031
1967	10,113,722	2,132,029	7,710,806	25,607,506	6,739,839	52,303,902
1968	11,199,240	3,112,600	8,058,561	27,436,709	8,038,930	57,846,040
1969	11,413,072	2,943,535	9,077,656	27,921,404	9,770,956	61,126,623
1970	11,563,807	2,798,916	9,572,271	31,356,522	11,484,227	66,775,743
1971	12,448,895	2,643,596	10,065,815	34,975,145	10,766,882	70,900,333
1972	14,885,935	4,483,676	11,182,662	43,230,138	10,978,114	84,760,525
1973	15,513,590	5,569,009	12,541,730	41,923,222	12,708,984	88,256,535
1974	14,794,938	4,141,407	11,556,518	40,918,807	13,045,116	84,456,786
1975	13,495,764	3,585,001	10,522,161	39,857,660	11,695,694	79,156,280
1976	14,397,951	3,708,755	12,020,700	39,904,415	12,276,023	82,307,844
1977	15,108,032	3,504,543	11,828,434	45,619,951	12,327,372	88,388,332
1978	15,712,893	3,667,050	11,963,825	47,077,047	13,034,135	91,454,950
1979	15,278,008	3,576,771	13,030,616	47,884,590	13,035,614	92,805,599
1980	15,644,000	3,929,398	13,287,691	48,625,160	13,133,076	94,619,325
1981	15,843,690	3,626,326	12,031,182	44,978,668	11,513,981	87,993,847
1982	12,892,163	3,160,063	11,487,539	38,079,856	9,742,526	75,362,147
1983	11,760,221	3,651,093	11,463,317	41,434,462	9,859,346	78,168,439
1984	11,849,955	3,443,090	11,822,277	46,517,226	8,514,493	82,147,041
1985	11,332,178	3,254,256	11,648,543	46,904,727	9,209,717	82,349,421
1986	12,441,812	4,481,641	11,536,078	39,909,011	11,621,074	79,989,616
1987	13,483,675	4,260,060	14,045,487	44,303,389	11,056,244	87,148,855
1988	15,805,551	4,341,902	14,207,239	50,252,299	10,110,448	94,717,439
1989	15,002,231	4,492,466	14,684,674	49,280,790	11,118,411	94,578,572
1990	15,119,932	4,295,555	14,144,648	51,577,974	10,526,419	95,664,528
1991	16,320,800	4,719,717	14,498,908	49,548,191	13,987,682	99,075,298
1992	17,208,707	6,451,331	14,507,888	46,434,233	10,981,307	95,583,466
1993	18,849,849	6,695,979	16,297,269	44,992,777	12,688,127	99,524,001
1994	18,910,150	6,514,924	18,135,257	51,902,190	11,520,009	106,982,530
1995	15,692,999	6,578,860	18,367,389	51,911,335	10,302,170	102,852,753



References

Florida Seaport Transportation and Economic Development Council (FSTEDC). 1994. *A Five-Year Plan to Accomplish the Mission of Florida's Seaports.* Tallahassee, Florida.

Number of Cruise Boat Passengers

Florida's seaports contribute to the state's economic vitality through trade and tourism. The most notable tourist activity is the operation of cruise boats, which is a major component of Florida's port activities. The cruises offered to passengers include transatlantic crossings, multi-day cruises, weekend cruises, and one- and two-day cruises. Florida's cruises are quite popular; with the world's three busiest cruise ports, Florida serves about 79 percent of all North American homeport passenger movements. (FSTEDC, 1996)

With additional investment in capacity underway, Florida's ports expect to see a further increase in cruise boat activity. Thus, tracking the number of cruise boat passengers is a good indicator of the usefulness of port expansion to meet this demand as well as reflecting the economic value of the state's ports.

Data Characteristics

SOURCE
Information on cruise boat passengers may be obtained from Nancy Leikauf, Director of Communications, Florida Ports Council, PO Box 10137, Tallahassee, Florida, 32302; (850) 222-8028.

ACQUISITION
The data are available in hard copy format at no cost.

COLLECTION
The data are collected on a regular basis and tabulated annually by individual ports.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Passengers are counted as the embark and disembark. This makes it difficult to accurately estimate the total number of passengers served by the cruise boats as passengers who take a round-trip cruise are counted twice, but those who take a one-way cruise are counted only once. The Florida Seaport Transportation and Economic Development Council presented passenger data for several years, but does not currently provide such data. Passenger embarkments and disembarkments is a better indicator for some purposes since it reflects the level of service effort on a per person basis. This data better reflects the services required for passengers who spend time in more than one Florida port, such as Key West, a popular stopover point for cruises with terminals elsewhere in Florida.

The data distinguish between one-day and multi-day trips, but otherwise do not adjust for the price or length of the trip. This is useful for indicating the level of services required by cruise boats (multi-day trips require more extensive services) but does not provide a reliable estimate of the economic impact of the cruise industry.

Data Analysis

From 1989 through 1995, the number of embarkments and disembarkments by cruise boat passengers increased by about 7 percent, with a peak in 1993. However, for the more lucrative multi-day cruise segment, the increase has been about 37 percent. Some of this change may be attributable to changes in the passengers included in the survey (Key West seems to have only been included since 1993).

Number of Cruise Passenger Embarkments and Disembarkments, Statewide

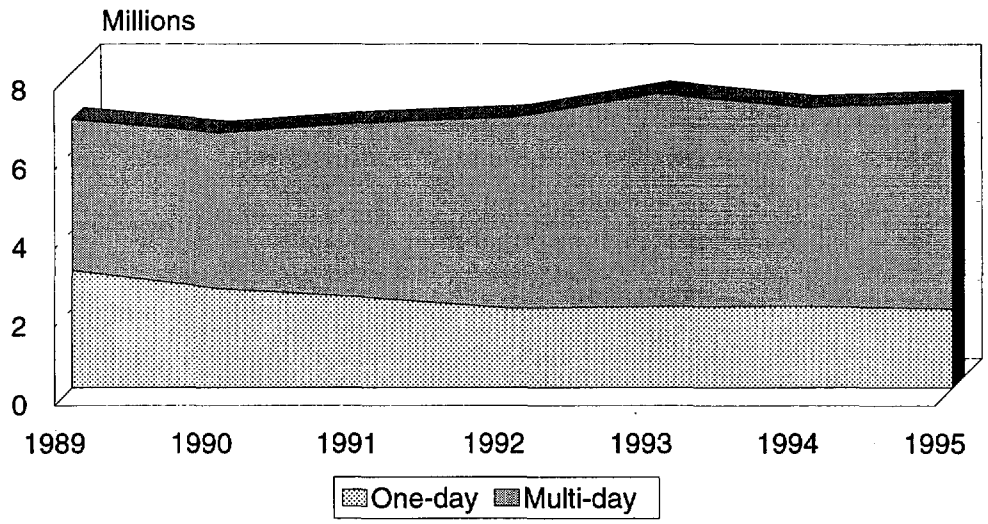
	One-day	Multi-day	Total
1989	2,978	3,844	6,822
1990	2,512	3,959	6,471
1991	2,293	4,440	6,733
1992	2,019	4,849	6,868
1993	2,061	5,418	7,479
1994	2,073	5,051	7,124
1995	2,004	5,268	7,272

Number of Cruise Passenger Embarkments and Disembarkments, by Port

	Miami		Everglades		Canaveral		Palm Beach		St. Pete/ Manatee*		Tampa	Key West
	One-day	Multi-day	One-day	Multi-day	One-day	Multi-day	One-day	Multi-day	One-day	Multi-day	Multi-Day	Multi-Day
1989	767	2,333	1,200	700	370	590	258	20	383	11	190	
1990	468	2,267	1,446	672	142	807	257	67	200	80	65	
1991	500	2,535	1,500	800	65	1,004	228	46			55	
1992	186	2,910	1,534	754	10	1,073	287	39	2		73	
1993		2,843	1,570	820	151	910	340			65	299	476
1994	376	2,599	1,441	774		940	257			64	276	398
1995	403	2,649	1,278	850		1,115	322			69	192	393

* - St. Petersburg, 1989-92; Manatee, 1993-1995.

Number of Cruise Boat Passengers



Reference

Florida Seaport Transportation and Economic Development Council (FSTEDC). 1996. A Five-Year Plan to Accomplish the Mission of Florida's Seaports: 1996/1997-2000/2001. Tallahassee, Florida. (Also used material from 1991-95 reports provided by the Florida Ports Council).

Registered Commercial Vessels

Florida offers an abundance of navigable waters that range in size and character. The Gulf of Mexico and Atlantic Ocean provide unlimited coastal and deep sea waters, and there are also numerous intracoastal and inland waterbodies throughout the state. This abundance of navigable waters provides many opportunities to commercial and recreational boaters. There are thousands of boats registered with the state, and commercial boating has become a major force in Florida's economy. Although recreational boating accounts for a substantial number of registered boats in the state, only commercial boating will be considered here.

Commercial boating includes boats used for fishing and boats which are rented to tourists. Aside from charter boats, most of the larger commercial boats are used for fishing. The larger commercial vessels require permanent docking facilities, and most require some dredging and navigational aids. Even the smaller commercial vessels may require docks because an enterprise may own more than one vessel; thus, the vessels are not transported to and from the area of business.

In addition to a one-time titling requirement, commercial vessels must be registered every year if they are operated on the waters of the state. The number and size of commercial boats registered with the state are excellent indicators of the demand for commercial boating. This information will help the state in its decision to invest in capital improvements needed for various sizes of boats. The state will be able to invest in those capital improvements most demanded because it can link demand to trends in the number and size of boats registered. Thus, the state can maintain opportunities for commercial boating by supplying services most needed to facilitate this activity.

Commercial boating has both direct and indirect impacts on the economy. Environmental impacts include oil and gasoline spills, sewage discharges, chemicals released during painting and sanding operations, and impacts on fish species populations from commercial fishing.

Data Characteristics

SOURCE
Information about the number and size of registered boats is available through Sally Cole at the Florida Department of Highway Safety and Motor Vehicles, Bureau of Vessel Titles and Registrations, Neil Kirkman Building, Tallahassee, Florida 32399-0518, or at (850) 488-1195.

ACQUISITION
The data can be obtained in hard copy format at no cost.

COLLECTION
The information is continually updated and tabulated annually.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data are quite accurate in reflecting the numbers of boats that are registered in the state each year. However, non-motor powered boats and vessels used exclusively on private lakes and ponds are exempt from registration. While the number of registration-exempt vessels is unknown, the Florida Department of Environmental Protection estimates that statewide, 300,000 to 400,000 boats fall into this category. Most of those boats would be characterized as non-commercial, although the estimate does include some commercial vessels. In addition to the registration-exempt vessels, a few boats which should be registered with the state may be used on the waters even though they are not registered.

A limitation of this indicator is that the method of data collection merely counts the number and size of boats registered in each county; the data do not reflect where the boats are used. Though those who own boats in coastal counties are more likely to use the coast than those who own boats in non-coastal counties, those who own boats in non-coastal counties may use their boats in the coastal counties and vice versa. Thus, the state is not given accurate information pertaining to where the capital investments should be made. Also, since boats which are rented to tourists for recreational activities are counted as commercial boats, the figures may underestimate the demand for recreational boating and overestimate the demand for commercial-oriented boating. Hence, the state might be less inclined to invest in amenities attractive to tourists and recreational boaters such as public restrooms and park areas near docks.

Data Analysis

The following data pertain only to the five smallest size categories of boats. Two additional size categories also exist (65' - 109'11" and 110'+), but since those vessel registrations comprise such a small percentage of the total, those figures are not displayed here. In addition, a final category (canoes over 16' or motorized) is not included here. Dealer registrations, which tend to comprise less than 1% of all vessel registrations, have also been excluded from these figures.

During the period from 1985 to 1996, there was an overall increase in the numbers of commercial vessels registered in coastal counties for all the sizes displayed below except the 12' - 15'11" vessels. The increase was 13.1% for the 16' - 25'11" vessels, 14.7% for the 26' - 39'11" craft, and 23.8% for the 40' - 64'11" boats. The number of registered vessels decreased 11.0% for the 12' - 15'11" vessels and increased 208% for watercraft smaller than 12'. The boats located in coastal counties are likely to be fishing vessels which represent businesses that might be reluctant to sell their vessels because the boats may be their primary capital investment. The boats in coastal counties also tend to be larger than the boats in non-coastal counties: in 1996 there were nearly twenty-two times as many 26' - 39'11" vessels in coastal counties than in non-coastal counties, and over twenty-eight times as many 40' - 64'11" vessels in the coastal counties. These larger vessels require a substantial investment and cannot be sold as quickly as other smaller, more moveable vessels.

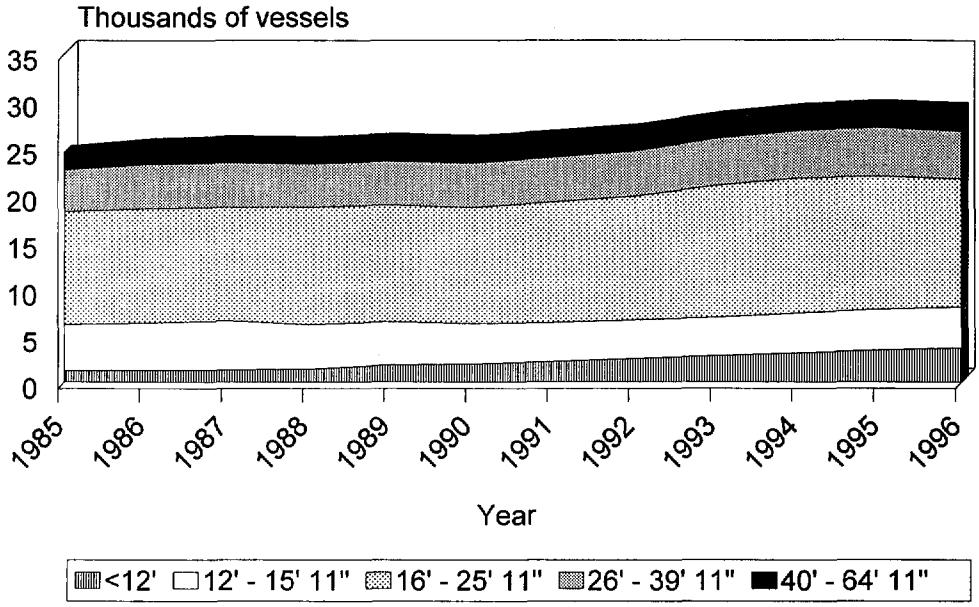
The vessel registration in non-coastal counties differs significantly from that of coastal counties. The most popular size vessel is 12' - 15'11", in contrast to the 16' - 25'11" vessel size favored in coastal counties. In non-coastal counties, the total numbers of boats sized 26' - 39'11" and 40' - 64'11" comprise less than 7% of the total numbers of registrations represented here, whereas these vessels account for more than 26% of the registered commercial vessels in the coastal counties. Most vessels in non-coastal counties probably serve tourists who wish to rent a boat.

Registered Commercial Vessels in Coastal Counties

Year*	<12'	12' - 15'11"	16' - 25'11"	26' - 39'11"	40' - 64'11"	Total**
1985	1,175	4,969	12,020	4,421	1,896	24,481
1986	1,221	5,069	12,207	4,689	2,053	25,239
1987	1,218	5,313	12,115	4,712	2,132	25,490
1988	1,332	4,808	12,467	4,585	2,157	25,349
1989	1,782	4,670	12,417	4,623	2,241	25,733
1990	1,892	4,361	12,341	4,698	2,244	25,536
1991	2,170	4,176	12,836	4,729	2,181	26,092
1992	2,468	4,150	13,166	4,786	2,179	26,749
1993	2,784	4,106	14,021	4,985	2,160	28,056
1994	3,099	4,287	14,340	4,979	2,188	28,893
1995	3,408	4,354	14,198	5,125	2,279	29,364
1996	3,615	4,420	13,600	5,070	2,348	29,053

*The years listed represent the end of the respective fiscal years (e.g., 1985 represents the fiscal year from July 1, 1984 to June 30, 1985).
**Totals do not include figures for three additional categories of boats. See first paragraph under Data Analysis for explanation.

Registered Commercial Vessels in Coastal Counties



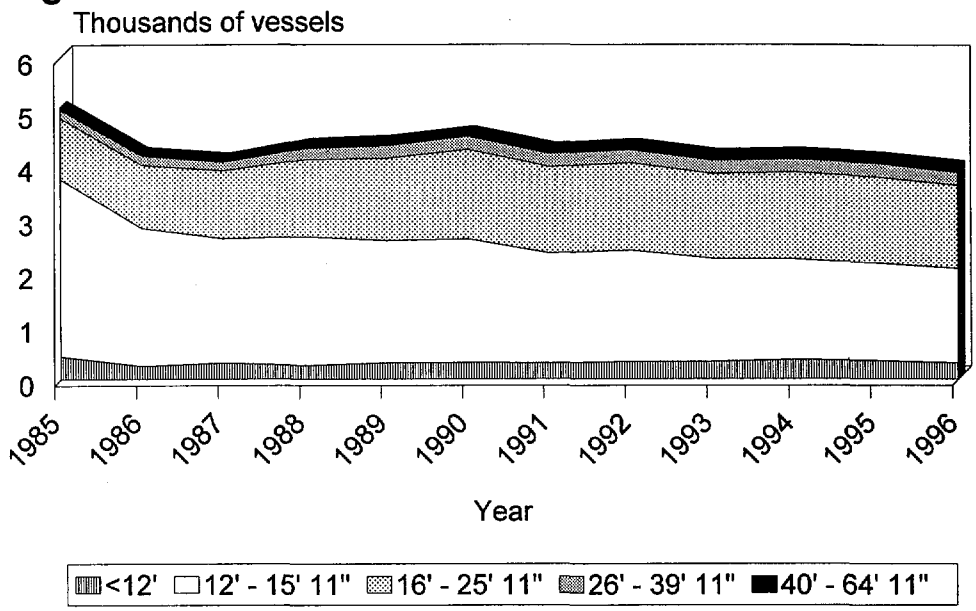
Note: Data for three additional categories of vessels are not displayed here due to the comparatively small numbers of registered vessels in those categories.

Registered Commercial Vessels in Non-Coastal Counties

Year	<12'	12' - 15' 11"	16' - 25' 11"	26' - 39' 11"	40' - 64' 11"	Total**
1985	418	3,309	1,147	159	45	5,078
1986	239	2,574	1,172	172	41	4,198
1987	298	2,321	1,261	155	57	4,092
1988	246	2,409	1,430	209	72	4,366
1989	294	2,289	1,529	240	72	4,424
1990	301	2,310	1,666	249	70	4,596
1991	288	2,062	1,606	243	84	4,283
1992	318	2,086	1,624	241	91	4,360
1993	322	1,923	1,575	249	96	4,165
1994	354	1,888	1,615	238	97	4,192
1995	336	1,818	1,616	249	92	4,111
1996	296	1,761	1,552	240	102	3,951

The years listed represent the end of the respective fiscal years (e.g., 1985 represents the fiscal year from July 1, 1984 to June 30, 1985).
**Totals do not include figures for three additional categories of boats. See first paragraph under Data Analysis for explanation.

Registered Commercial Vessels in Non-Coastal Counties



Note: Data for three additional categories of vessels are not displayed here due to the comparatively small numbers of registered vessels in those categories.

Value of Foreign Trade Through Seaports

Florida is particularly attractive to the shipping industry because of its proximity to foreign markets and waterways. These amenities have attracted a significant amount of port business, which has had a decisive effect on the state's economy. There are fourteen seaports in Florida, including: (1) Port of Fernandina, (2) Port of Jacksonville, (3) Port Canaveral, (4) Port of Fort Pierce, (5) Port of Palm Beach, (6) Port Everglades, (7) Port of Miami, (8) Port of Key West, (9) Port of Pensacola, (10) Port of Panama City, (11) Port St. Joe, (12) Port Manatee, (13) Port of St. Petersburg, and (14) Port of Tampa.

These fourteen seaports trade in both domestic and international cargo. The value of foreign trade is relatively easy to estimate because of customs regulations; it is more difficult to estimate the value of domestic cargo.

The value of foreign trade through seaports is an indirect indicator of the magnitude of seaport activity on the state's economy. However, it should be recognized that goods exported through Florida's seaports are not necessarily produced in the state and goods imported through Florida's seaports are not necessarily used in Florida. Thus, an increase in trade value may or may not reflect an increase in trade-related businesses for the state.

Data Characteristics

SOURCE
Information on Florida's seaports may be obtained from Nancy Leikauf, Director of Communications, Florida Ports Council, P.O. Box 10137, Tallahassee, Florida, 32302 or at (850) 222-8028.

ACQUISITION
The data was provided in hardcopy free of charge.

COLLECTION
The data are collected on a regular basis by port and compiled annually by the Governor's Office of Tourism, Trade, and Economic Development (formerly the Department of Commerce, Bureau of Economic Analysis).

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

The data reflect foreign trade only; domestic trade value is not easily measured. The source notes that these data differ considerably from the dollar values of cargo reported by the individual ports, which are often much higher.

Data Analysis

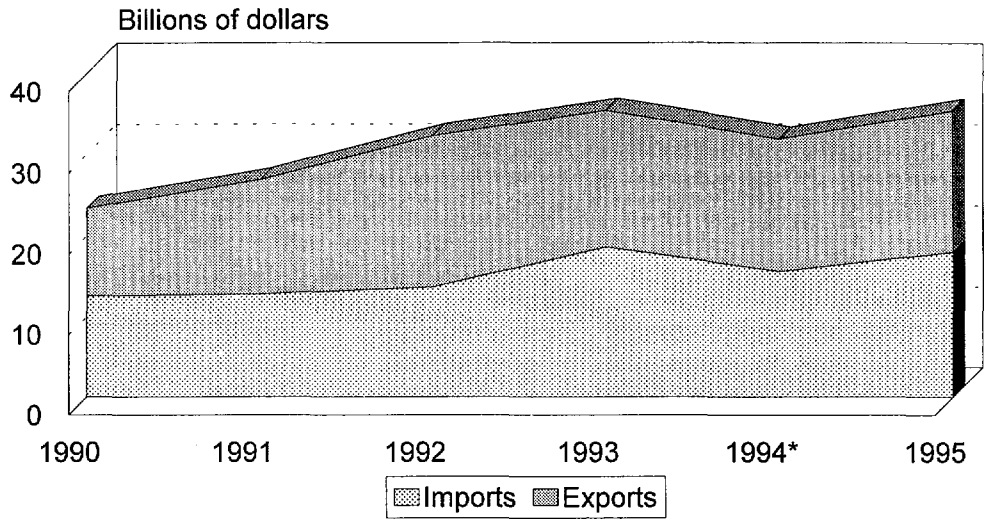
In years with comparable data, Florida's waterborne foreign trade has increased 10-20% in value each year. This rate of increase substantially outpaces inflation and national economic growth, reflecting healthy and growing seaports.

Dollar Value of Florida's Waterborne Foreign Trade

	Imports	Exports	Total
1990	12.6	10.8	23.4
1991	12.8	14.1	26.9
1992	13.7	18.6	32.3
1993	18.6	16.8	35.4
1994	15.6*	16.3*	31.9*
1995	18.0	17.4	35.3

Billions of dollars, not adjusted for inflation.
* - Data source or methodology apparently changed in 1994.

Dollar Value of Florida's Waterborne Foreign Trade



* - Data source or methodology apparently changed in 1994.

References

Florida Seaport Transportation and Economic Development Council (FSTEDC). 1996. *A Five-Year Plan to Accomplish the Mission of Florida's Seaports: 1996/1997-2000/2001.* Tallahassee, Florida. (Also used material from 1991-95 reports provided by the Florida Ports Council.)

Saltwater Fish Landings

Commercial and recreational marine fishing in Florida is an indicator of the health of Florida's marine resources as well as a potential stress on those resources. Commercial fishing has always been an important aspect of the state economy. Florida's expansive coastline provides a multitude of diverse and rewarding saltwater fishing experiences for recreational anglers, residents and tourists alike. Pursuit of the social, psychological, and physical benefits of recreational fishing has created an industry focused on supplying the goods and services necessary to meet angler demand as well as ensuring satisfying recreational experiences. The expenditures of anglers have a significant economic impact, affecting local, state, and national economies. Finfish are caught by both commercial and recreational fishers, historically in roughly equal amounts. Shrimp and other invertebrates are primarily harvested by commercial fishers and are considered in a separate indicator.

In order to maintain an understanding of the health of marine fisheries, state and federal agencies monitor the amount of fish caught. The collection of U.S. commercial fisheries landings data is a joint state and federal responsibility. In Florida, all sales of seafood products from Florida waters be reported to the Florida Department of Environmental Protection (DEP) by sales transaction on a monthly basis. The National Marine Fisheries Service (NMFS) and its predecessor agencies, the U.S. Fish Commission and Bureau of Commercial Fisheries, began collecting fisheries landings data in 1880. Landings data were collected during surveys of a limited number of states and years between 1880 and 1951. Comprehensive surveys of all coastal states have been conducted since 1951. Annual commercial fish landings reflect, to a certain degree, the public's demand and preference for specific types of seafood. Annual landings also represent a pressure on coastal fisheries that impacts the entire coastal system.

Data on marine recreational fisheries were not collected in a systematic manner on a continuing basis until 1979. The Marine Recreational Fishery Statistics Survey (MRFSS) actually includes two independent, but complementary, surveys: a telephone survey of households in coastal counties and an intercept (i.e., interview) survey of anglers at fishing access sites. The telephone survey is primarily used to collect reliable data on recreational fishing effort. However, information on the actual catch such as species identity, number and size of fish caught can not be reliably collected by telephone. These data are obtained from anglers intercepted by trained interviewers stationed at fishing access sites. Data from the two surveys are combined to produce estimates of fishing effort, catch, and participation.

Fishing may be a leading factor behind the decline of several fish species populations in Florida's waters. Assessing trends in fish landings helps management efforts aimed at reducing the pressures on marine fisheries. The data presented in this indicator includes a large part of, but by no means all, of fish affected by fishing. Several key species (or species groups) are important members of marine food webs and are highlighted in this indicator. Some species, like the spotted seatrout, inhabit nearshore grass flats and estuarine areas, whereas king and Spanish mackerel are nearshore pelagic (ocean going) species. Bluefish are a pelagic species that come into beach areas to feed.

Data Characteristics

SOURCE

The Fisheries Statistics Section of the Florida Department of Environmental Protection's Florida Marine Research Institute (FMRI) collects and analyzes information on commercial fishing. These data are stored in the FMRI Marine Fisheries Information System and are available at 100 8th Avenue, S.E., St. Petersburg, Florida 33701-5095, or at (813) 896-8626 or SUNCOM 523-1011. Commercial fishing data are also available from the National Marine Fisheries Service (NMFS), Fisheries Statistics and Economics Division, 1315 East-West Highway, Room 12340, Silver Spring, MD, 20910, or via internet at **http://remora.ssp.nmfs.gov/commercial/landings/index.html**.

FMRI provided data from 1986 to present. Commercial fisheries data at NMFS are available from 1951 to present, but only 1951 to 1985 were used in producing this report. Cross-checking the data for 1986 and 1987

is not known, but as the difference was not considered significant to this study the problem was not further investigated.

Individual species data in the NMFS database are not consistently organized from 1951 to present; at times, some species names changed or were classified into general categories. Thus, individual species data could not be consistently extracted from the database from 1951 to present. The cutoff date of 1981 was chosen because recreational fisheries data is not available prior to that date.

The Marine Recreational Fishery Statistics Survey is available from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, 1315 East-West Highway, Room 12340, Silver Spring, MD, 20910, or via internet at **http://remora.ssp.nmfs.gov/mrfss/index.html**. Headboat data are available from Robert Dixon, Research Fisheries Biologist, Beaufort Laboratory, National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516-9722, or at (919) 728-8719.

ACQUISITION
The data are available in hard copy and electronic formats at no cost.

COLLECTION
Commercial landings data are computerized from trip ticket information submitted to DEP by Florida wholesale and retail dealers, and the figures are compiled into annual reports providing summaries for each species by coast, county, and month. Florida's Marine Fisheries Trip Ticket Program is funded primarily through license fees paid by commercial fishers. Annual data is often incomplete until four to six months into the following year.

Recreational landings data are estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS) based on two complimentary surveys conducted in "waves" covering the entire year. One survey intercepts anglers at the dock or shore, the other is a random phone survey of coastal counties. Data on headboat (large partyboats) landings is collected separately. The Southeast Headboat Survey is a catch-effort census collected in mandatory trip reports filled out by the ship operators. Headboat landings represent a relatively small portion of the total landings (3 to 7 percent of recreational catch).

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

This indicator is an indirect measure of the impacts that fishing activity has on the marine environment. It is difficult to estimate the level of effort made by most recreational and commercial fishing activity, so calculating catch per unit effort requires further analysis.

Commercial marine fisheries landings data depend on self-reporting by the regulated community and are subject to various sources of error and inaccuracy. The data are subject to change as revised or additional data are received. Complete 1996 data is not expected until late 1997. As federal statutes prohibit public disclosure of landings (or other information) that would allow identification of the data contributors and possibly put them at a competitive disadvantage, landings reported by individual species may, in some instances, be misleading due to data confidentiality. Landings are reported in pounds of round (live) weight for all species or groups except univalve and bivalve mollusks, such as clams, oysters and scallops, which are reported as pounds of meats (excludes shell weight). Landings do not include aquaculture products except for clams and oysters.

For recreational fishing, the total number of fish caught is estimated (by state, time period, mode, and area) from the estimated number of fishing trips and the mean number of fish caught per trip. The estimated number of fishing trips is derived from telephone interviews with residents of coastal counties. The fish catch data is derived from interviews with anglers at the end of fishing trips. A number of assumptions are then used to estimate the total number of fishing trips (including residents of non-coastal counties), the total catch (including fish caught but not available for inspection during the interview), and otherwise account for difficulties that arise due to the sample size and interview limitations. These limitations are discussed in detail at the MRFSS web site.

Headboat data are a relatively small portion of total data. Compliance with the reporting requirements has decreased in recent years, requiring the survey to estimate the missing data, which could result in errors.

Landings are not the same as total catch. Bag limits plus catch and release fishing are becoming more common. This may obscure the trends in species abundance.

Data Analysis

During the 1970s and 1980s, saltwater fish landings by the commercial fishing industry remained relatively stable (actually increasing slightly) at about 115 million tons per year. The recent trend for recreational fishing catch is more difficult to determine because the survey had significant uncertainty during its early years and there has been wide variation from year to year over the past decade. Total fisheries landings from 1981 through 1992 averaged about 190 million tons per year and showed a slight increasing trend prior to the net ban; since 1992 total fisheries landings have been decreasing at an annual rate of about 13 percent. This decrease is notable in the commercial fisheries landings, but any indirect effect of the net ban on recreational fisheries is unclear.

Saltwater Fish Landings

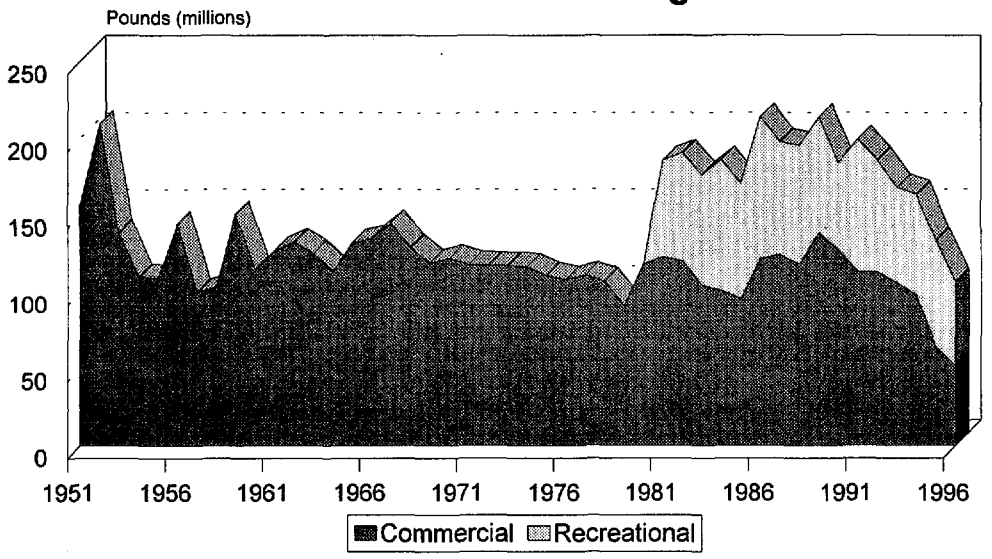
Thousands of pounds

	Commercial		Commercial	Recreational[1]
1951	156,970	1974	116,302	
1952	209,595	1975	110,736	
1953	138,490	1976	108,050	
1954	109,978	1977	110,939	
1955	109,294	1978	106,959	
1956	144,196	1979	90,921	
1957	99,719	1980	118,252	
1958	103,335	1981	122,899	62,687
1959	150,547	1982	120,075	70,409
1960	114,651	1983	104,514	71,440
1961	127,180	1984	100,689	85,045
1962	132,600	1985	95,530	74,556
1963	125,229	1986	121,624	92,018
1964	113,401	1987	124,420	73,031
1965	131,904	1988	118,204	76,921
1966	134,630	1989	138,728	74,999
1967	144,615	1990	127,359	56,538
1968	129,054	1991	113,212	86,055
1969	119,109	1992	113,007	72,773
1970	121,929	1993	105,980	61,901
1971	117,899	1994	97,612	66,051
1972	117,338	1995	63,943	69,312
1973	117,444	1996[2]	51,960	54,590

[1]No data available prior to 1981.

[2]Preliminary figures (2/26/97) and no headboat data.

Saltwater Fish Landings



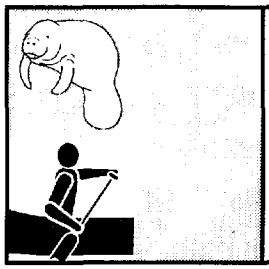
The general decline in the total fish landings is reflected in each of the selected species (or species groups) presented in this indicator, with the exception of king mackerel. Trends evident from the data include the net ban (which explains the sudden decrease in commercial mullet harvests), and the increase in demand for shark fins in Asian markets (note the reduced recreational landings which closely follow the increase in commercial landings). Note that the recreational landings data from the early 1980s is less statistically valid than in later years.

Recreational and Commercial Fish Landings, Selected Species

Thousands of pounds

	Bluefish		Sharks[1]		Spotted Seatrout		Mullet[1]		Grouper/ Sea Bass[1]		King Mackerel		Spanish Mackerel	
	Rec	Com	Rec	Com	Rec	Com	Rec	Com	Rec	Com	Rec	Com	Rec	Com
1981	6,190	2,934	2,251	658	3,123	2,709	851	31,650	4,329	11,002	4,124	7,931	1,770	7,724
1982	3,137	3,166	1,585	692	247	2,742	3,575	26,848	4,901	13,279	5,804	6,615	842	7,046
1983	3,801	2,223	1,566	910	4,879	2,352	2,694	24,285	8,706	10,615	6,893	4,448	957	8,035
1984	3,128	678	869	1,362	6,993	1,918	6,073	20,078	12,138	10,380	5,314	3,531	860	5,873
1985	1,362	1,200	3,023	1,573	4,152	1,501	5,114	19,809	11,468	11,074	3,183	3,404	702	6,160
1986	1,656	1,623	2,448	2,649	7,783	1,568	4,994	23,599	9,840	12,477	3,246	4,128	6,505	6,329
1987	2,044	1,993	1,703	4,859	4,637	1,665	1,873	23,687	6,776	12,621	4,591	3,115	2,509	6,161
1988	2,374	2,024	1,740	5,603	6,255	1,679	2,740	24,260	9,380	9,663	4,894	3,011	2,354	5,210
1989	2,511	1,511	1,149	7,209	7,123	1,364	1,523	27,939	8,646	13,343	4,556	2,054	1,428	5,845
1990	771	1,464	1,959	7,501	2,418	1,005	1,381	26,983	4,676	10,623	4,982	2,706	1,981	4,364
1991	2,164	1,860	975	6,552	4,575	1,052	4,262	22,817	5,629	10,469	6,315	2,057	2,820	6,257
1992	1,605	1,407	943	6,021	3,366	924	4,012	21,363	6,458	10,065	6,305	2,544	3,452	5,625
1993	1,405	1,390	520	3,708	2,559	773	1,828	21,051	6,193	11,996	6,337	3,683	2,016	6,444
1994	757	1,171	813	5,048	2,765	893	2,398	15,535	5,775	10,190	6,140	2,440	1,849	5,517
1995	869	759	536	6,006	2,998	537	1,468	6,251	5,883	9,635	7,512	2,770	1,225	4,224
1996[2]	481	192	556	4,751	1,901	71	1,210	6,024	3,793	8,864	7,881	3,369	1,672	2,454

[1] Includes multiple species in one group.
[2] Preliminary figures (2/26/97) and no headboat data.



Catch Per Angler Day on Headboats

Commercial and recreational marine fishing in Florida is an indicator of the health of Florida's marine resources as well as a potential stress on those resources. Other indicators provide an indication of the scale of fishing by measuring the quantity of seafood harvested, the commercial value of seafood harvested, and the number of recreational fishing trips. This indicator provides limited data on the amount of effort required to catch fish in Florida waters and is thus a unique indicator of the health of marine fisheries.

Headboats, also known as party boats, are commercial for-hire fishing boats which provide anglers with the opportunity to fish offshore without having to use their own boats or hire a charterboat. Since 1981, the National Marine Fisheries Services has surveyed headboat operators to determine the catch and effort. Although headboat fishing is a small percentage of the total finfish harvest (3-7 percent by weight), this data set provides a catch estimate and a relatively consistent measure of fishing effort.

Fishing may be a factor behind the decline of several fish species populations in Florida's waters. Assessing trends in catch per angler day helps management efforts aimed at reducing the pressures on marine fisheries. The data presented in this indicator include fish species which are caught from headboats, which are a significant, but by no means complete, indicator of the health of marine fisheries in general.

Data Characteristics

SOURCE
The headboat survey data are available from Robert Dixon, Research Fisheries Biologist, Beaufort Laboratory, National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516-9722, or at (919) 728-8719.

ACQUISITION
The data are available in hard copy or electronic format at no cost.

COLLECTION
The Southeast Headboat Survey is a catch-effort census collected in mandatory trip reports filled out by the vessel operators. Headboat landings represent a relatively small portion of the total landings (3 to 7 percent of recreational landings).

TECHNICAL
Hierarchy of Indicator: 6
Pressure/State/Response: Pressure
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Compliance with the reporting requirements has decreased in recent years, requiring the survey to estimate the missing data, which could result in errors.

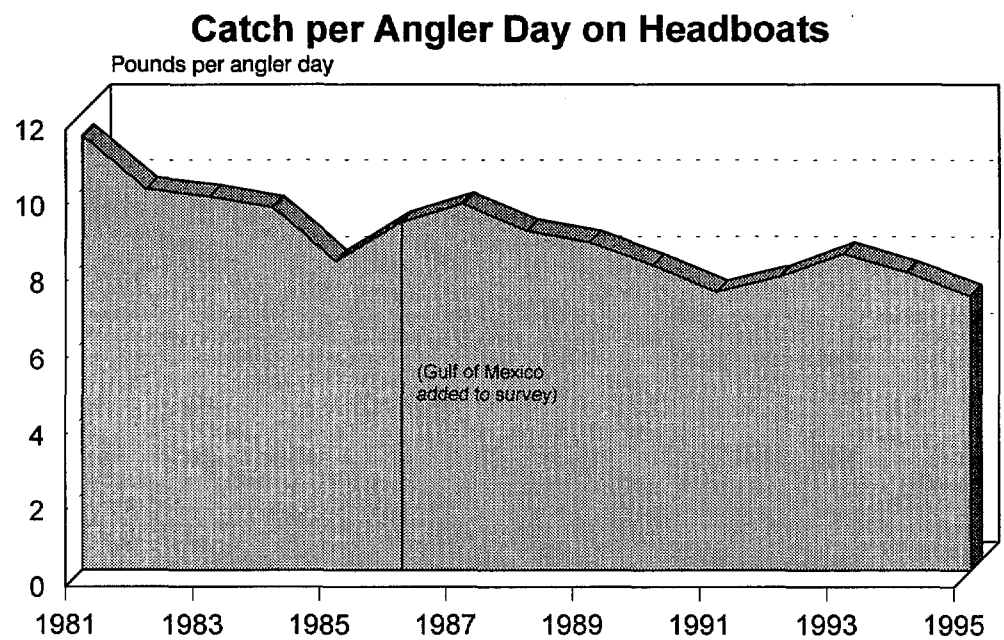
Data Analysis

The data indicate that the landings (by weight) per angler day has been steadily decreasing. According to Robert Dixon, this is because total mortality rates (headboat, charterboat, private fishermen, and commercial combined) have been steadily increasing. He believes that maximum sustainable yields have been exceeded for some species, especially reef fishes, which are slow growing and genetically long lived. Until recently there were few regulations to limit fishing and many of the present regulations may not be adequate to reverse the trend.

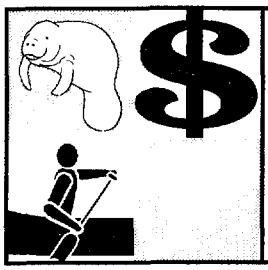
Catch per Angler Day on Headboats

	Finfish (lbs)	Angler Days	Pounds per Angler Day
1981	3,393,369	298,883	11.4
1982	2,938,636	293,133	10.0
1983	2,725,417	277,863	9.8
1984	2,753,207	288,994	9.5
1985	2,269,025	280,845	8.1
1986	5,049,355	557,135	9.1
1987	5,255,018	550,090	9.6
1988	4,433,834	497,723	8.9
1989	4,501,234	525,189	8.6
1990	4,298,545	536,795	8.0
1991	3,301,292	454,334	7.3
1992	3,456,003	449,325	7.7
1993	3,674,404	444,871	8.3
1994	3,498,801	446,858	7.8
1995	2,830,020	392,476	7.2

The NMFS headboat survey covered only the Atlantic coast from 1981 through 1985. In 1986, the Gulf of Mexico was added to the survey. This change does not seem to have had much effect on the trend of pounds per angler day; if anything, it may have slowed the trend because it seems that the catch is higher in the Gulf of Mexico than in the Atlantic.



It should be noted that "angler day" is a statistical term which reflects a full day of fishing. A typical day of fishing includes 4-6 hours of fishing and transit time (so the total day may include 10-12 hours). Some trips are shorter (or longer) and NMFS converts those trips into fractions of angler days.



SUSTAINING THE HUMAN USES OF THE COAST

Value of Commercial Marine Fisheries Landings

Commercial and recreational marine fishing in Florida is an indicator of the value of Florida's marine resources as well as a potential stress on those resources. Commercial fishing has always been an important aspect of the state economy. Finfish are caught by both commercial and recreational fishers, historically in roughly equal amounts. Shrimp and other invertebrates are primarily harvested by commercial fishers and are considered in a separate indicator. Recreational fishing is also an economic resource to Florida, but there is no ongoing survey of recreational fishing value.

In order to maintain an understanding of the health of marine fisheries, state and federal agencies monitor the amount of fish caught. The collection of U.S. commercial fisheries landings data is a joint state and federal responsibility. In Florida, all sales (including sale price) of seafood products from Florida waters be reported to the Florida Department of Environmental Protection (DEP) by sales transaction on a monthly basis. The National Marine Fisheries Service (NMFS) and its predecessor agencies, the U.S. Fish Commission and Bureau of Commercial Fisheries, began collecting fisheries landings data in 1880. Landings data were collected during surveys of a limited number of states and years between 1880 and 1951. Comprehensive surveys of all coastal states have been conducted since 1951. The value of commercial marine fisheries landings reflect an important part of the value of Florida's coastal resources.

Landings data for fish is presented in another indicator, but total landings data is also presented here for comparison to the value of landings. Landings data is also presented for shrimp and invertebrates as it is not presented in the finfish landings indicator. Harvest of invertebrates, particularly shrimp, can result in large by-catch. Commercial by-catch includes fish parts discarded after marketable parts are removed (i.e., shark fins) and unwanted fish killed during the harvest (i.e., fish drowned in shrimp nets).

The Marine Fisheries Information System maintains a database including the species, weight, price, county of landing, and month for each commercial fishing trip. Several key species are also highlighted in this indicator, including bluefish, shark, spotted seatrout, mullet, grouper/sea bass, king mackerel, Spanish mackerel, blue crab, spiny lobster, and pink shrimp. The role of these species varies, from apex predators like the shark to scavengers and prey like the blue crab. Some species, like the blue crab and spotted seatrout, inhabit nearshore grass flats and estuarine areas, whereas reef fish and lobsters are found mainly on offshore reefs. King and Spanish mackerel are nearshore pelagic (ocean going) species, while sharks are found from inshore areas to the open ocean. Bluefish are a pelagic species that come into beach areas to feed.

Data Characteristics

SOURCE

The Fisheries Statistics Section of the Florida Department of Environmental Protection's Florida Marine Research Institute (FMRI) collects and analyzes information on commercial fishing. These data are stored in the FMRI Marine Fisheries Information System and are available at 100 8th Avenue, S.E., St. Petersburg, Florida 33701-5095, or at (813) 896-8626 or SUNCOM 523-1011. Commercial fishing data are also available from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, 1315 East-West Highway, Room 12340, Silver Spring, MD, 20910, or via internet at **http://remora.ssp.nmfs.gov/commercial/ landings/index.html**.

FMRI provided data from 1986 to present. NMFS data are available from 1951 to present, but only 1951 to 1985 were used in producing this report. Cross-checking the data for 1986 and 1987 determined that the two databases have almost, but not exactly, identical data. The source of the difference is not known, but as the difference was not considered significant to this study the problem was not further investigated.

Individual species data in the NMFS database are not consistently organized from 1951 to present; at times, some species names changed or were classified into general categories. Thus, individual species data could not be consistently extracted from the database from 1951 to present. The cutoff date of 1981 was chosen because recreational fisheries data is not available prior to that date.

ACQUISITION
The data are available in electronic (via internet from NMFS) and hard copy (FMRI) formats at no cost.

COLLECTION
Commercial landings data are computerized from trip ticket information submitted to DEP by Florida wholesale and retail dealers, and the figures are compiled into annual reports providing summaries for each species by coast, county, and month. Florida's Marine Fisheries Trip Ticket Program is funded primarily through license fees paid by commercial fishers. Annual data is often incomplete until four to six months into the following year.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

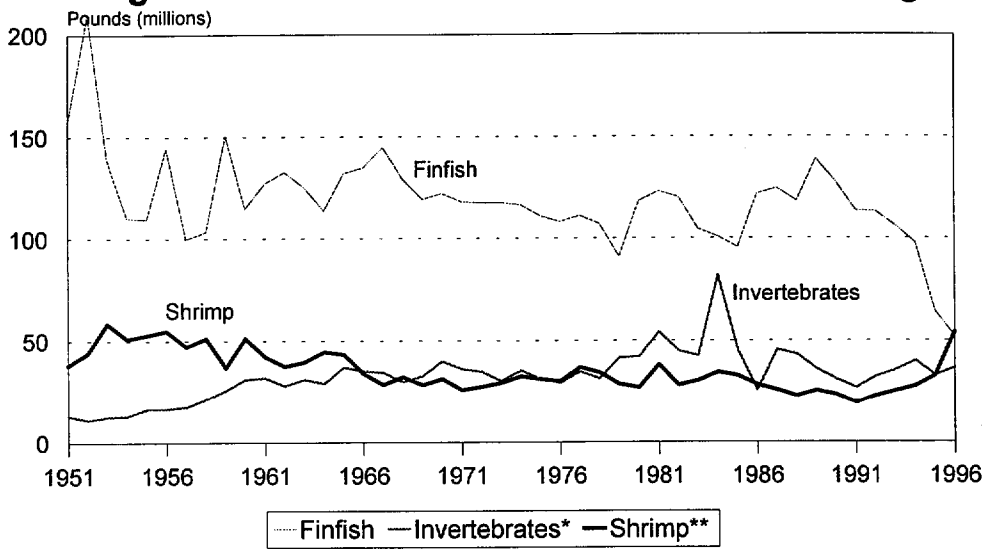
Marine fisheries landings data depends on self-reporting by the regulated community and is thus subject to various sources of error and inaccuracy. The data are subject to change as revised or additional data are received. Complete 1996 data is not expected until late 1997. As federal statutes prohibit public disclosure of landings (or other information) that would allow identification of the data contributors and possibly put them at a competitive disadvantage, landings reported by individual species may, in some instances, be misleading due to data confidentiality. Landings are reported in pounds of round (live) weight for all species or groups except univalve and bivalve mollusks, such as clams, oysters and scallops, which are reported as pounds of meats (excludes shell weight). Landings do not include aquaculture products except for clams and oysters.

Data Analysis

Due to increasing prices and the increasing harvest of some species (especially invertebrates other than shrimp), the value of commerce marine fisheries landings has increased since 1951. The value of commercial marine fisheries landings has increased at an annual rate of 2.2 percent during the 1951-1996 time period, when measured in constant 1995 dollars. In the 1950s, shrimping was the highest value fishery followed by finfish. Invertebrate sales were quite limited. The three fisheries began to converge during the late 1960s. Since the 1980s, the three fisheries are roughly equal in market value (although the fluctuation has been considerable). Over the entire period (1951-96), landings of invertebrates have increased at a rate of 1.7 percent per year. However, the trend has apparently changed; since 1987 harvests have declined at a rate of 2.1 percent per year. Increasing invertebrate harvests can probably be related most closely to price increases, although other market and technological factors may be important.

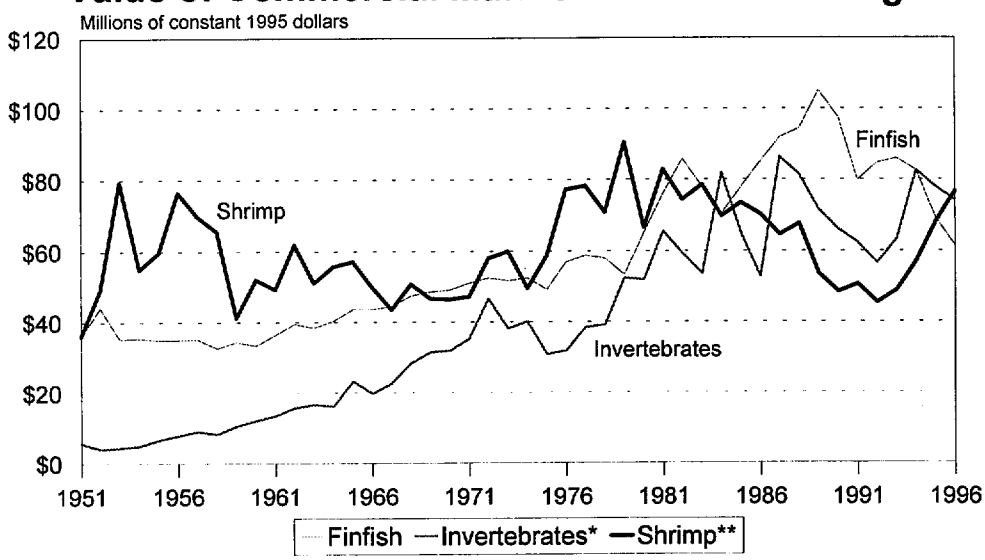
Although prices and the total harvest value increased for both shrimp and finfish, the total landings for shrimp and finfish decreased over the 1951-96 period. Except for a recent increase in landings, the decline in shrimp landings has been relatively constant at about 1.4 percent per year from 1951-96. However, due to price increases, the total harvest value increased somewhat but has been quite erratic at times.

Weight of Commercial Marine Fisheries Landings



*Does Not Include Shrimp
**Includes Bait Shrimp

Value of Commercial Marine Fisheries Landings



*Does Not Include Shrimp
**Includes Bait Shrimp

Value and Weight of Commercial Marine Fisheries Landings

Weight in thousands of pounds.
Value in thousands of constant 1995 dollars, adjusted using the Producer Price Index for Food (Bureau of Labor Statistics).

	Finfish		Invertebrates		Shrimp		Total
	Weight	Value	Weight	Value	Weight	Value	Value
1951	156,970	$36,031	12,918	$5,752	37,989	$36,083	$77,866
1952	209,595	44,093	10,941	4,105	44,025	49,171	97,369
1953	138,490	35,175	12,467	4,384	58,471	79,343	118,902
1954	109,978	35,434	12,830	4,957	50,878	54,831	95,222
1955	109,294	34,897	16,148	6,741	52,734	59,636	101,273
1956	144,196	35,024	16,393	7,860	54,810	76,465	119,349
1957	99,719	35,165	17,281	9,095	47,100	69,785	114,045
1958	103,335	32,623	21,259	8,227	51,111	65,456	106,306
1959	150,547	34,397	25,640	10,511	36,764	41,192	86,100
1960	114,651	33,331	31,039	12,128	51,257	52,030	97,489
1961	127,180	36,391	31,836	13,445	42,084	49,308	99,144
1962	132,600	39,465	27,885	15,659	37,334	61,786	116,910
1963	125,229	38,424	31,044	16,601	39,448	51,133	106,158
1964	113,401	40,295	28,990	16,103	44,457	55,730	112,127
1965	131,904	43,582	36,829	23,207	43,154	57,113	123,903
1966	134,630	43,612	35,057	19,722	33,918	49,867	113,202
1967	144,615	44,382	34,416	22,529	28,384	43,477	110,388
1968	129,054	47,461	29,764	28,351	32,077	50,694	126,505
1969	119,109	48,551	32,626	31,416	28,152	46,608	126,575
1970	121,929	49,100	39,613	31,925	31,172	46,395	127,420
1971	117,899	51,017	35,943	35,186	25,658	47,209	133,412
1972	117,338	52,520	34,605	46,637	27,169	57,945	157,102
1973	117,444	51,705	30,021	38,143	29,190	59,918	149,766
1974	116,302	52,523	35,330	40,169	32,453	49,551	142,244
1975	110,736	49,185	30,987	30,804	31,056	58,699	138,688
1976	108,050	56,845	29,109	31,825	29,852	77,204	165,874
1977	110,939	58,744	34,701	38,430	36,705	78,252	175,426
1978	106,959	57,912	31,204	39,129	34,096	70,787	167,828
1979	90,921	53,306	41,228	52,435	28,464	90,483	196,224
1980	118,252	64,996	41,835	51,923	26,758	66,453	183,372
1981	122,899	75,889	54,045	65,376	38,011	82,779	224,044
1982	120,075	85,853	44,759	59,359	28,074	74,361	219,572
1983	104,514	77,946	42,359	53,631	30,225	78,449	210,026
1984	100,689	70,318	81,982	81,858	34,310	69,708	221,884
1985	95,530	77,791	45,212	64,841	32,590	73,443	216,075
1986	121,624	85,007	25,584	52,820	28,245	70,232	208,059
1987	124,420	91,841	45,409	86,374	25,575	64,463	242,678
1988	118,204	94,362	43,003	81,271	22,473	67,635	243,268
1989	138,728	104,979	35,880	71,493	25,202	53,599	230,070
1990	127,359	97,412	30,921	65,952	23,104	48,461	211,825
1991	113,212	79,794	26,627	62,262	19,023	50,611	192,667
1992	113,007	84,627	32,217	56,480	22,515	45,477	186,584
1993	105,980	85,935	35,230	63,273	25,084	48,942	198,150
1994	97,612	82,522	39,788	82,522	27,373	57,082	222,125
1995	63,943	69,050	32,745	77,828	32,587	68,004	214,881
1996[3]	51,960	61,347	36,450	74,207	53,967	76,537	212,092

[1] Excluding shrimp.
[2] Including bait shrimp.
[3] Preliminary figures (2/26/97).

Weight of Commercial Landings, Selected Species

Weight in thousands of pounds.

	Menhaden	Shark	Spotted Seatrout	Mullet	Grouper/Sea Bass	King Mackerel	Spanish Mackerel	Blue Crab	Spiny Lobster	Pink Shrimp
1981	2,934	658	2,709	31,650	11,002	7,931	7,724	18,294	5,894	27,369
1982	3,166	692	2,742	26,848	13,279	6,615	7,046	14,318	6,497	17,688
1983	2,223	910	2,352	24,285	10,615	4,448	8,035	16,364	4,317	19,261
1984	678	1,362	1,918	20,078	10,380	3,531	5,873	19,678	6,252	22,695
1985	1,200	1,573	1,501	19,809	11,074	3,404	6,160	16,002	5,739	24,064
1986	1,623	2,649	1,568	23,599	12,477	4,128	6,329	11,248	5,029	14,036
1987	1,993	4,859	1,665	23,687	12,621	3,115	6,161	18,420	6,092	12,453
1988	2,024	5,603	1,679	24,260	9,663	3,011	5,210	15,299	6,798	9,294
1989	1,511	7,209	1,364	27,939	13,343	2,054	5,845	13,047	7,810	9,255
1990	1,464	7,501	1,005	26,983	10,623	2,706	4,364	14,173	5,994	8,422
1991	1,860	6,552	1,052	22,817	10,469	2,057	6,257	10,067	7,024	8,559
1992	1,407	6,021	924	21,363	10,065	2,544	5,625	15,101	5,337	8,077
1993	1,390	3,708	773	21,051	11,996	3,683	6,444	12,598	5,382	11,432
1994	1,171	5,048	893	15,535	10,190	2,440	5,517	14,014	7,104	9,721
1995	759	6,006	537	6,251	9,635	2,770	4,224	12,242	7,024	14,740
1996[1]	192	4,751	71	6,024	8,864	3,369	2,454	17,939	7,743	19,574

[1] Preliminary figures (2/26/97).

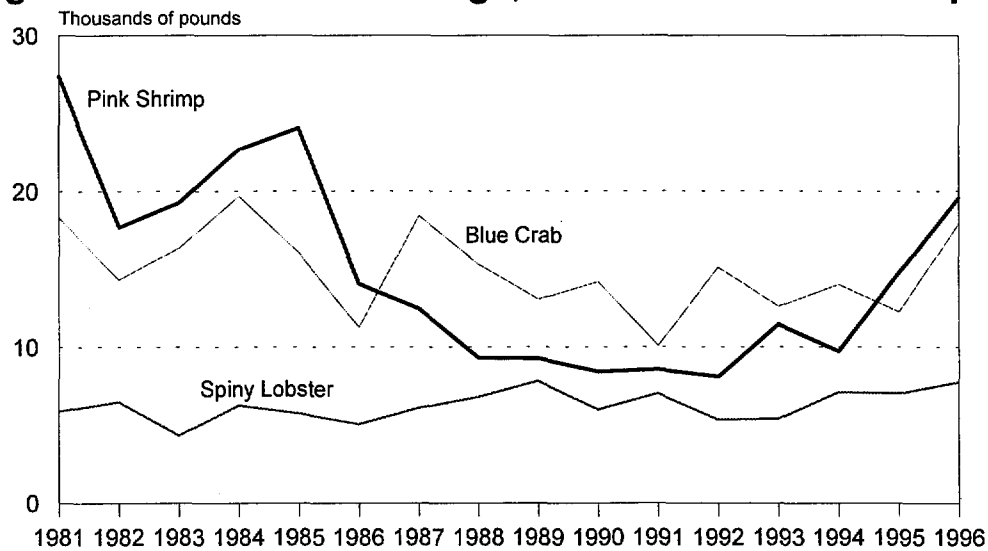
Value of Commercial Landings, Selected Species

Value in thousands of constant 1995 dollars, adjusted using the Producer Price Index for Food (Bureau of Labor Statistics).

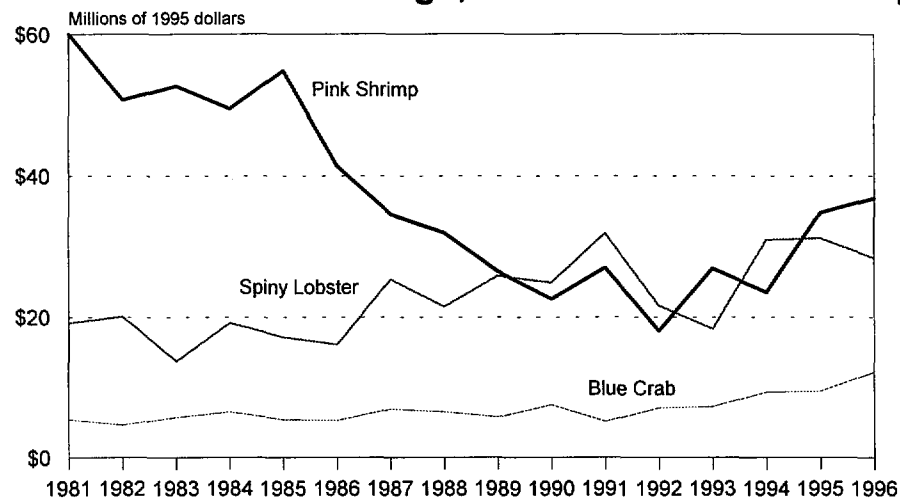
	Menhaden	Shark	Spotted Seatrout	Mullet	Grouper/Sea Bass	King Mackerel	Spanish Mackerel	Blue Crab	Spiny Lobster	Pink Shrimp
1981	$710	$363	$2,708	$9,420	$15,220	$8,856	$3,196	$5,455	$19,166	$60,013
1982	849	378	3,094	7,769	17,398	8,140	2,924	4,706	20,080	50,746
1983	551	538	2,712	7,671	16,289	5,568	3,028	5,787	13,726	52,679
1984	161	692	2,146	6,371	17,435	3,468	2,079	6,549	19,194	49,453
1985	304	927	1,719	6,658	21,059	4,435	1,082	5,461	17,146	54,831
1986	379	1,258	1,843	9,224	21,182	5,019	2,385	5,301	16,079	41,403
1987	492	2,263	2,066	9,931	22,338	4,017	2,584	6,953	25,328	34,544
1988	542	2,638	2,028	12,326	16,973	3,568	2,720	6,534	21,444	31,943
1989	413	4,998	1,645	15,223	20,686	2,569	2,646	5,811	25,847	26,462
1990	437	4,861	1,407	13,781	17,481	2,872	1,853	7,564	24,876	22,551
1991	442	5,060	1,584	12,719	16,649	2,267	2,819	5,185	31,857	26,971
1992	374	6,744	1,161	14,032	17,653	3,161	1,933	7,113	21,616	18,031
1993	533	3,535	1,001	13,369	20,699	3,620	2,335	7,282	18,317	26,864
1994	478	5,016	1,093	12,231	18,947	3,526	2,373	9,309	30,960	23,509
1995	270	5,819	764	5,409	16,826	3,876	2,007	9,484	31,187	34,778
1996[1]	84	4,416	129	5,607	16,539	4,048	1,173	12,157	28,336	36,822

[1] Preliminary figures (2/26/97).

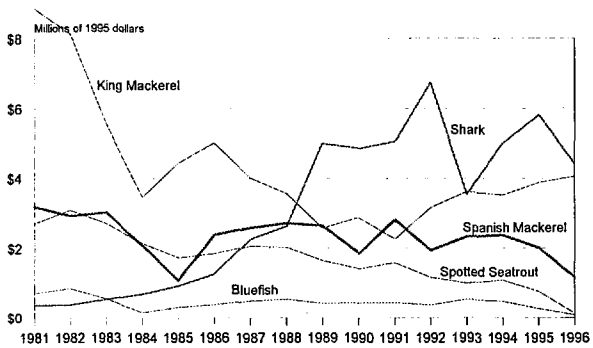
Weight of Commercial Landings, Selected Invertebrate Species

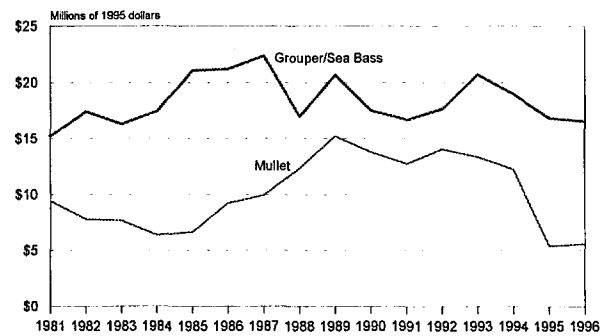


Value of Commercial Landings, Selected Invertebrate Species



Value of Commercial Landings, Selected Finfish Species





Three species of invertebrates were selected for analysis: blue crab, spiny lobster, and pink shrimp. Blue crab shows the least interesting trend, with a gradually increasing value and erratic landing weights. Spiny lobster shows an increasing value but generally flat landing weight trend. Pink shrimp shows the most notable features, a decrease in landings value of more than 50 percent and a sudden drop in landings weight in the late 1980s. The shrimp harvests may have begun rebounding in 1995.

Finfish are presented in two graphs, divided into major and minor commercial species (or species groups). There is no clear trend for weight or value for grouper/sea bass species. Mullet species landings fluctuated widely through 1992 and the value of mullet harvests increased dramatically during the late 1980s. However, the net ban has resulted in landings reduced by 75 percent or more, although the value of mullet landings has only fallen slightly below the value of landings in the early 1980s.

Among the five minor commercial species presented, Spanish mackerel and bluefish show no clear trends. Spotted seatrout and king mackerel show landings declining by value and weight, probably due at least in part to regulations imposed in 1989 to protect those species. Shark landings have increased dramatically by weight and value due to increased marketing efforts, acceptance of shark meat by consumers, and, to a greater degree, high prices offered by the Asian market for dried shark fins.

Recommendations

No annual data are available to estimate the economic value of recreational fishing. Occasional data are available from a variety of studies. Two recent studies funded by Florida Sea Grant estimated total annual expenditures for saltwater fishing at $2.6 billion in 1991-92, divided approximately evenly between resident recreational anglers and tourists (Bell, 1993; Milon and Thunberg, 1993). According to the authors of these studies, it would be possible to update those figures on a regular basis at relatively little cost. If it is assumed that expenditures per trip or some other factor remain unchanged except for inflation, annual data from the Marine Recreational Fishing Statistical Survey could be used to update the models without conducting a full survey. A full survey could be done occasionally to verify that the models remain accurate. The U.S. Marine Fisheries Service will complete a study of saltwater fishing value for southeastern states in 1998 which will be comparable to the Sea Grant studies.

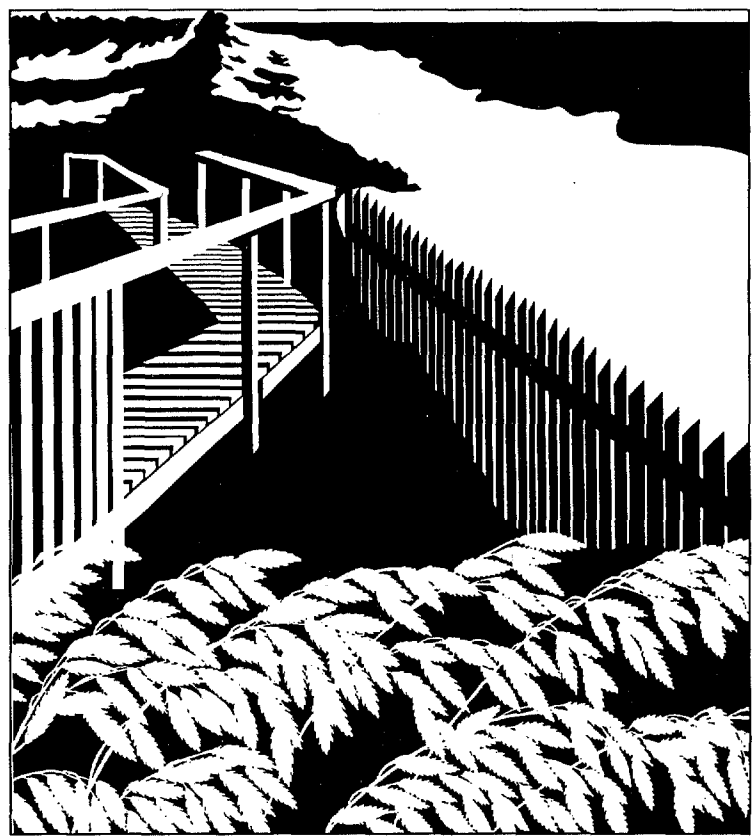
References

Milon, J. Walter and Eric M. Thunberg. 1993. *A Regional Analysis of Current and Future Florida Resident Participation in Marine Recreational Fishing*. Florida Department of Natural Resources, Florida Sea Grant College Program. Gainesville, Florida.

Bell, Frederick W. 1993. *Current and Projected Tourist Demand for Saltwater Recreational Fisheries in Florida*. Florida Department of Natural Resources, Florida Sea Grant College Program. Gainesville, Florida.

Section G

Balancing Public and Private Uses of Resources



Balancing Public and Private Uses of the Coast

From the perspective of ecological sustainability, the coastal region is far more than a strip of sandy beach along the shore. It involves a complex combination of very different ecosystems, including upland forests, coastal wetlands, and sandy grasslands. These ecosystems are important because they are part of the physical and biological system that protects the coast from hurricane damage, filters and cleans water, provides nursery areas to marine fish and invertebrates, and provide beauty which is enjoyed by many along the coast.

Florida places enormous demands on its coastal resources, and these demands often come into conflict. Public interests in recreation, sustaining the many economic benefits of the coast, and ensuring a sustainable coastal ecosystem may come into conflict with private landowners' interests. By right of law, the public owns the water and the beach up to the high tide line. A major point of concern is whether the public has practical access to those coastal resources. The right to develop private land along the coast must be balanced with the public's right to access publicly owned beaches. At this time, there is no reliable indicator of where this balance stands.

This issue addresses the rights of the general public to access the beach, the actions of the public to conserve lands, and the rights of private property owners to build along the coast. As the state grows and the demand for permits along the coast increases, it becomes increasingly more important for the state to become involved. The primary concerns are private property issues and stewardship of coastal resources. Private property issues pertain to development along the coast; however, no indicators have been developed for this sub-issue. The stewardship of coastal resources refers to state lands and the many state programs adopted to acquire land for public use and for public access points.

An additional area of competing interests along the coast is the use of offshore resources. The number of submerged land leases suggests the potential for offshore drilling for oil and natural gas, which is of concern due to the potential for pollution, large spills, and aesthetic problems. The economic benefits of these activities must be balanced with the public interests in a safe and healthy coast.

Balancing public and private interests is a difficult process which must ultimately produce a set of compromises. Rights of the coastal landowner and access to coastal resources by others needs to be addressed in a fair and open-minded way to ensure that the coast can be enjoyed by all for generations to come. The following list identifies the indicators that are examined in this section.

Balancing Public and Private Uses of the Coast Indicators:

- Submerged Land Leases
- Management Status of Coastal Habitats

Other Indicators of Interest:

- Absolute population growth (Section A)
- Existing wetland habitat and conservation lands (Section D)
- Existing upland habitat and conservation lands (Section D)
- Public access areas along sandy beaches (Section F)
- Beach visits by residents (Section I)

Submerged Land Leases

Florida's sovereign submerged lands are those public trust lands below navigable water that the United States Congress transferred to the state of Florida in 1845 as Florida was granted statehood. Lands below navigable water means all lands within the boundaries of each of the respective states which are covered by tidal or non-tidal waters that are navigable under the laws of the United States. Florida's sovereign submerged land area extends three miles into the Atlantic Ocean and nine miles into the Gulf of Mexico. Submerged lands are held in trust for the use and benefit of the citizens of the state, as set forth in the state constitution. The sale and private use of such lands is allowable, as long as it is in the public interest. Florida's total land area is approximately 37.5 million acres. According to the Florida Department of Environmental Protection (DEP), the state's sovereign submerged land area totals approximately 7.7 million acres (DEP, 1994).

Some of the submerged lands in Florida have been designated as aquatic preserves because of their unique biological, aesthetic, or scientific value. Aquatic preserves receive a higher level of care. The Florida Aquatic Preserve Act of 1975 states that state-owned submerged lands that have special value will be permanently placed in preservation status. Florida's 42 aquatic preserves comprise approximately 2.4 million of the estimated 7.7 million acres of sovereign submerged lands (DEP, 1994).

Public and private entities must obtain permission to conduct activities on submerged lands. The most commonly requested uses are the construction of docking facilities for single-family houses, multi-family developments, yacht clubs, marinas, and dredging and other activities that preempt public access, but occur on sovereign submerged lands. Some types of activities require the applicant to pay a fee. The two primary types of submerged land fees are lease application fees and annual lease fees (DEP, 1994).

It is believed that the fee rates do not reflect the true costs of managing these lands. The use of submerged lands can have adverse environmental impacts. The effect of one permitted use may be insignificant; however, the cumulative impacts are not. Furthermore, some submerged lands are used without the payment of any fees. It is important to keep a record of the number of leases that the state gives out as well as the revenue generated through the use of sovereign submerged lands (Rose, unpublished). The Division of State Lands is required to maintain official records of all submerged lands leases issued and to collect lease fees associated with those leases. Each lease carries a designated "type code" which identifies the primary use of the leased lands.

Data Characteristics

SOURCE

Information on the number of submerged land leases and area (square footage) of land under lease can be obtained from Delmas Barber, Bureau of Land Management, Submerged Land Section, Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, MS-130, Tallahassee, Florida 32399-3000, or at (850) 488-2297. Revenue figures may be obtained from Doris Brown at the above address and phone number.

ACQUISITION

The data can be obtained at no cost.

COLLECTION

The information is updated as leases are granted. Data reflecting several parameters (number of leases, area, waterbody, primary use, county, etc.) are available upon request. Area of land under lease is available in square feet and was converted to acres for the purposes of this indicator.

TECHNICAL

Data Accessibility: Data are electronically collected and are accessible.

Data Limitations

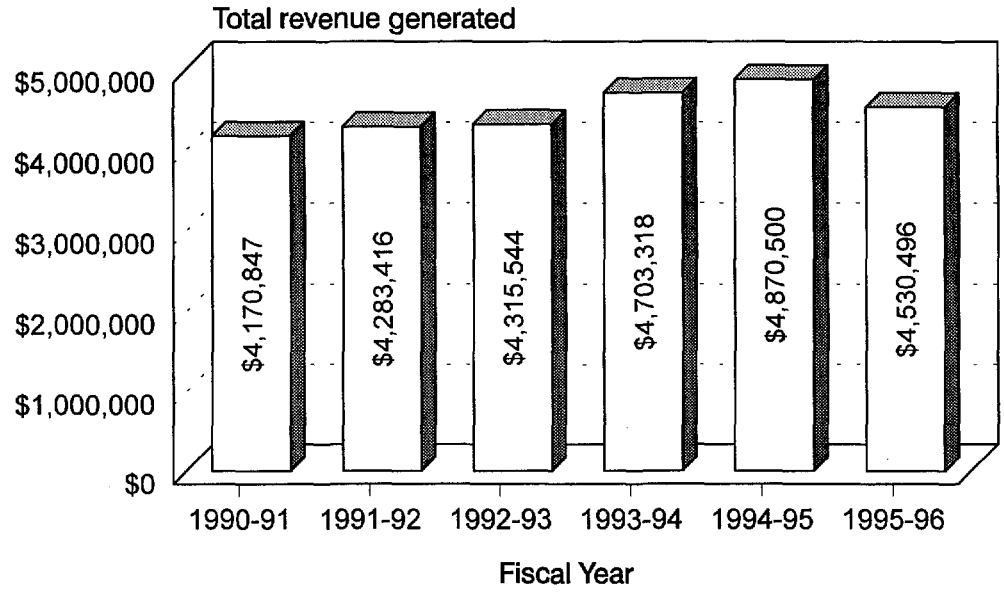
Although the number of leases issued each year is available upon request, this indicator displays the total number of leases existing each year (i.e., these acreage data are cumulative). For example, the acreage under lease in 1992 includes all new leases executed since 1991, plus all the acreage for leases granted prior to 1992 which were not canceled or terminated by 1992. In addition, although acreage data are available for whatever periods one requests (e.g., fiscal year, calendar year, etc.), the acreage figures below pertain to calendar years, not fiscal years like the revenue data.

Data Analysis

In 1993, the total number of submerged land leases was 1,183. In 1995, this number was 1,419, and in 1996 it was 1,499. This represents an increase of 316 leases (27 percent) between 1993 and 1996. Furthermore, of 1,280 applications for grandfathered "leases," approximately 617 will come under "lease" on January 1, 1998.

The total revenue generated also increased from fiscal year 1990-91 to fiscal year 1995-96, by $359,649. This was an increase of 8.6 percent.

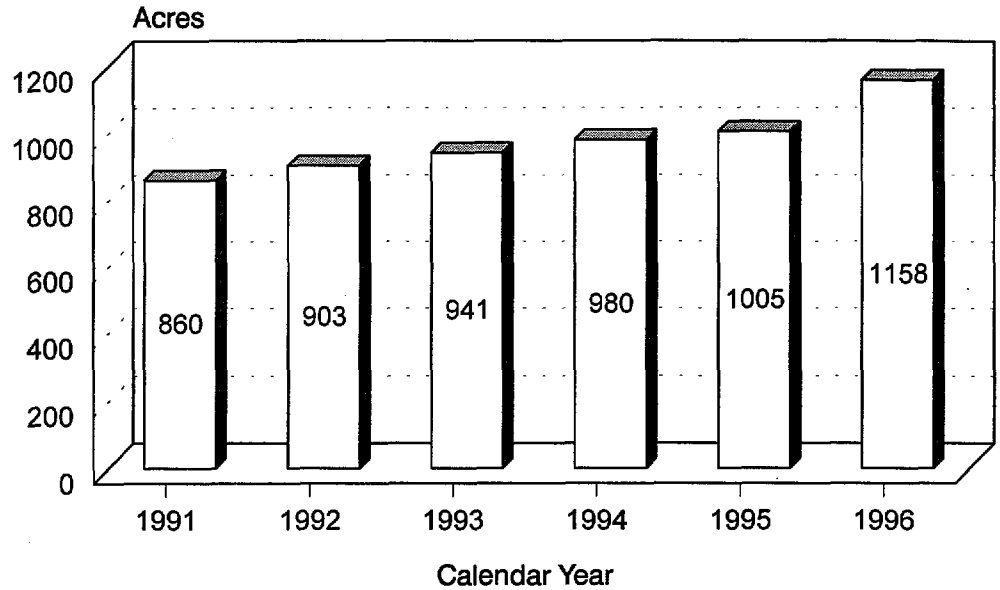
Total Revenue Generated Through the Use of Sovereign Submerged Lands



Acreage of leased sovereign submerged lands for calendar years 1991 through 1996 is displayed below. It is important to note that acreage for each year is cumulative: that is, each year's acreage is the sum of the acreage of land whose lease was fully executed in that year, plus the acreage of all land leased prior to that year (as long as the lease was not canceled or terminated in that year).

Acreage of sovereign submerged land under lease increased fairly steadily between 1991 and 1995 (an average of 4 percent per year), and increased by over 15 percent between 1995 and 1996. The total acreage of land under lease increased nearly 35 percent between 1991 and 1996.

Acreage of Leased Sovereign Submerged Lands



Although the above acreage figures comprise only 0.015% of the state's total sovereign submerged land area, these figures should be viewed in the context of the following additional information: the 7.7 million acres figure for Florida's total sovereign submerged land area includes the area extending nine miles into the Gulf and three miles into the Atlantic; in practice, however, only nearshore lands are leased, and very often leased facilities do not extend far into the water; in addition, many hundreds of easements which do not require leases also occupy sovereign submerged land area. Because of these and other factors, it is important not to draw the conclusion that these data are an indicator of the amount of Florida's undisturbed coast.

References

Florida Department of Environmental Protection (DEP). 1994. *Performance Audit of Submerged Lands Program.* Tallahassee, Florida.

Rose, Pat. Unpublished manuscript. "Our Wonderfully Diverse Submerged Lands: We Own Them! But Will They Be Worth Having?". Florida Department of Environmental Protection. Tallahassee, Florida. Florida Department of Environmental Protection (DEP). 1994. Performance Audit of Submerged Lands Program. Tallahassee, Florida.

Management Status of Coastal Habitat

Coastal areas are among the most crowded and developed in the world. Florida is no exception as rapid population growth along the Florida coast threatens natural habitats by increasing development pressures in these areas and fragmenting what remains of natural environments. Additionally, public access to beach areas is threatened by private developments that do not provide access points.

One way to provide public access and protect habitat areas is to purchase, manage, and protect land in the coastal areas. These lands may be purchased and managed for a variety of purposes; today, most projects are managed for multiple uses, including recreation, habitat, and perhaps economic use. Some of these lands provide additional public access to coastal resources by providing park facilities and public rights to cross land between roads and the shoreline. In other cases, public acquisition of coastal land necessarily limits human uses of land. Public land acquisition may not increase public access if the land is acquired to protect a sensitive species or habitat area that needs to be protected from human interference (Chapter 259.032(11)(a)).

Foreseeing the need to conserve land threatened by rapid growth, the state initiated a bold program to acquire the most threatened areas through the Preservation 2000 Act of 1990. Preservation 2000 set aside $3 billion dollars over a 10-year period for the purpose of land acquisition throughout the state. The annual funding of $300 million is provided through the sale of state revenue bonds. The Florida Department of Environmental Protection's (FDEP) Conservation and Recreation Lands Program (CARL) receives 50 percent of the funds. The Save Our Rivers (SOR) program of the five water management districts receives 30 percent of the funds. The other 20 percent of Preservation 2000 funds are split between the Florida Department of Community Affairs and other state divisions and programs that have identified lands for purchase. In order to offset any local financial burden, the Florida Legislature has also appropriated funds for qualifying counties who are eligible for reimbursement for actual tax loss if the Preservation 2000 acquisition reduces the tax base and development options of coastal communities. Some federal programs have also provided for acquisition and conservation of land in the state through direct purchases, access to lands on military bases, and financial help to the state.

Acres of managed lands is an important indication of coastal lands available for public use and lands that have been set aside for protection. The indicator addressed here includes acres of managed lands as well as a more focused area of managed lands within a five mile buffer either side of the coastline. Aquatic preserves and submerged lands are excluded from this analysis.

Data Characteristics

SOURCE

The data on the acres of managed lands, lands sought for acquisition and protection under CARL and SOR programs, and Areas of Conservation Interest (ACI) can be obtained from Dr. Barbara Lenczewski or Sally Jue at the Florida Natural Areas Inventory (FNAI), 1018 Thomasville Road, Suite 200-C, Tallahassee, Florida 32303, or at (850) 224-8207.

Information concerning state land acquisition can be obtained from Ruark Cleary, Florida Department of Environmental Protection (DEP), Division of State Lands, 3900 Commonwealth Boulevard, MS 100, Tallahassee, Florida 32399-3000, or at (850) 488-6242.

ACQUISITION

The data on acres of managed land and land sought for conservation interest are available from the Florida Natural Areas Inventory (FNAI) in hard copy format and GIS (Geographic Information System) tapes with the price (if any) determined by the nature of the specific data request.

COLLECTION
Data on managed lands within each county are continually updated by the Florida Natural Areas Inventory (FNAI). Boundary and acreage information is compiled by FNAI from the various federal, state, local and private managing agencies. For a managed area to be tracked by FNAI, some portion of the property must contain significant natural resources that may or may not be under active protective management. FNAI is the source of boundaries for the State's CARL projects. Boundary information for SOR projects is compiled by FNAI from the individual water management districts.

A five-mile wide strip on either side of the Florida coastline was analyzed for acreage of conservation land, excluding aquatic preserves and submerged lands. The strip used a definition by the Florida Marine Research Institute and followed the shoreline into bays, estuaries, and other tidal waters. No historical data for the five-mile buffer is available from FNAI due to the nature of their database. In order for this indicator to be maintained over time and for a trend to develop, a request for data must be made to FNAI each year to update the figures. FNAI can provide county-by-county report of the acreage within the five-mile buffer depending on time and cost considerations.

TECHNICAL
Hierarchy of Indicators: 1
Pressure/State/Response: Response
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

Any listing of managed lands is quickly out of date due to new acquisitions. The FNAI data are comprehensive and updated quarterly, yet each managing/purchasing agency may have the most up-to-date information on recent purchases. Finally, the FNAI database includes some, but not all, lands owned by local governments. It is important to remember that while these data are the best available and contain all major managed areas, they are not exhaustive.

Data Analysis

It is estimated that about 1.6 million acres of land within five miles of the coast are good quality natural habitat. Of these lands, approximately 816,000 acres are protected and managed for use by the public and/or for use as natural habitat. By far the majority of these managed lands (768,344 acres) are held by local, state, and federal land agencies such as the Florida Department of Environmental Protection and the U.S. Department of Interior. Most of these lands are protected from significant future development. However, about 44,000 acres of land are held by the military and a portion of those lands may be developed or otherwise altered from their natural condition if the need arises. About 4,000 acres are owned by private conservation groups and are considered within this category because they are permanently dedicated to public purposes. About 121,000 acres of this land has been acquired using CARL funds.

Almost as much valuable habitat along the coast is owned by private individuals or corporations. Over 800,000 acres of privately owned land within the five mile zone on either side of the coastline are considered to be Areas of Conservation Interest (ACI) by the Florida Natural Areas Inventory. This means that the land and its animal and plant life remain sufficiently natural in composition to be considered worthy of consideration for conservation. For instance, a plowed agricultural field would not be considered an area of conservation interest but a forest with a variety of tree and other plant species meeting certain criteria would be so designated. About 290,000 acres of natural land is being considered for acquisition by the state under the CARL program.

About 74,000 acres of land are categorized within the Save Our Rivers program and are included in the following table under **Total Managed and Protected Lands**. However, privately owned lands within the project areas which have not been purchased yet are also included in this category. This inflates the total acreage for managed and protected lands.

Data on acres of non-conservation land were not available so it was not possible to calculate the total acreage of conservation and non-conservation land within five miles of the coastline. Thus, it is not known what the percentage of lands of natural interest are in proportion to all lands of the coastline. Land not measured in this indicator includes developed land, agricultural land, and other land which is not considered to have significant natural value for conservation (i.e., barren land previously seriously disturbed).

Management Status of Habitat Within Five Miles of Coastline

Ownership Status	Total Acres
Managed and Protected Lands	
Public	768,344
Private	4,296
Military	43,855
Total Managed and Protected Lands[1]	816,495 (51%)
Private Unprotected Lands	
Proposed for CARL Acquisition	289,838
Other Areas of Conservation Interest (ACI)[2]	510,018
Total Private Unprotected Lands[3]	799,856 (49%)
Total Areas Of Natural Interest	1,616,351

As assessed by Florida Natural Areas Inventory in April, 1997 using recently updated data. Does not include aquatic preserves.

[1] Land not yet purchased within SOR projects is included within this total.

[2] As designated by the Florida Natural Areas Inventory.

[3] Land proposed for acquisition by the Save Our Rivers program is not included in this total.

Further data available through FNAI on managed lands includes a summary of conservation lands for the entire state. The *Florida Conservation Lands* (1997) includes the lands managed by federal, state, and local governments as well as private entities. The federal and state categories of land management include the acres managed by each primary managing agency (USDA Forest Service, DEP Division of Marine Resources, etc.), allowing for a closer analysis of the agencies that are increasing management area and responsibilities. The document contains information on each property in conservation as well as its location. A series of county maps are included, making it easy for users to quickly assess which public conservation lands are in a specific area or county.

The following table shows the conservation land managing agency, the acres being managed, and the change in acres being managed from the previous year. The proportional responsibility of land management is comparable between federal agencies with 4,198,968 acres (53 percent) and state agencies with 3,486,237 acres (45 percent). Local conservation lands represent roughly two percent of the total land being managed. However, as noted in the data limitations, it is important to remember that the FNAI database is not exhaustive and does not represent all local managed areas. Though these data are the best available, the percentage of local lands in conservation could very well be larger.

Private conservation lands increased 427 acres since 1996 to nearly 99,000 acres. Total land management in the state increased nearly 300,000 acres since 1996, primarily within state (+199,797 acres) and local (+41,953) management agencies. The percent of Florida lands that are currently in conservation is 22.5 percent

Summary of Florida Conservation Lands, March 1997 (with change in acres since February, 1996)

Conservation Lands Manager	Area in acres[1,2]	Change in Acres
Size in Acres of State of Florida	34,647,040	
Federal Conservation Lands		
USDA Forest Service	1,142,261	+ 5,465
USDI Fish and Wildlife Service	481,490	+ 5,075
USDI National Park Service	1,886,732	+ 3,264
US Dept. of Defense[3]	683,856	+ 3,265
US Other	4,629	+ 367
Total Federally Managed	4,198,968	+ 17,436
State Conservation Lands		
DACS Division of Forestry	676,604	+ 80,467
DEP Division of Recreation and Parks	366,513	+ 4,870
DEP Division of Marine Resources	125,287	+ 20,092
DEP Office of Greenways and Trails	69,067	No change
Game and Fresh Water Fish Commission	1,307,876	+ 74,703
Dept. of Military Affairs	62,340	No change
State Universities	11,524	+ 300
Water Management Districts	867,026	+ 19,365
Total State Managed	3,486,237	+199,797
Local (County & Municipal) Conservation Lands	121,493	+ 41,953
Total State, Federal, and Local	7,806,698	
Private Conservation Lands	98,679	+ 427
Total Change in Acreage from 1996		+259,613
Percent of Florida in Public Conservation Lands	22.5%	

--Florida Natural Areas Inventory. 1997. *Florida Conservation Lands*, p. iv.

[1] Acreages are counted once under the primary managing agency even though many times there are several owners and/or managers. For example, if a property is owned by a water management district but the lead managing agency is FGFWFC, then acres for this property are included under FGFWFC and are not included in the water management district total.

[2] Acreages listed include terrestrial wetlands such as the Everglades but exclude 3,375,658 acres of submerged marine, lake, or river bottom (such as state aquatic preserves or Florida Bay) that are part of certain managed areas.

[3] While the primary function of DOD lands is national defense, they can also be important conservation lands. This is also true of Camp Blanding, which is managed by the Florida Dept. of Military Affairs.

Recommendations

The Florida Natural Areas Inventory (FNAI) has a large amount of data available. However, a consistent source of funding is needed to expand data collection efforts, keep the data current, make the data readily available in different formats, and provide an analysis of what the data mean. The Florida Coastal Management Program should work with the Division of State Lands and FNAI to enhance the creation of published reports on coastal land management, categories and quality of purchased and unpurchased land, as well as the management goals for each acquisition. All Areas of Conservation Interest (ACI) within the state have now been documented, primarily through the use of aerial surveying. The next step should be a series of field surveys of the ACIs in order to get ground-truthed information on the remaining natural areas in the state. Classification of communities in coastal uplands and wetlands with field surveys throughout the coastal counties would be valuable for further tracking of biological indicators and trends.

References

Florida Natural Areas Inventory (FNAI). 1997. *Florida Conservation Lands*, Jon Blanchard and Sally Jue.
Florida Natural Areas Inventory (FNAI). 1996. *Managed Conservation Lands Report*, Robert A. Hattaway, Ph.D.

Section H

Preservation of Cultural and Aesthetic Resources

Preservation of Cultural and Aesthetic Resources

Throughout Florida there has long been an effort to combine protection of the environment, protection of cultural and historical sites, and maintenance of vital economic growth. There are many reasons for a community to actively preserve its cultural and aesthetic resources. Museums and cultural events serve as a connection from the past to the present and allow for active participation. All create job opportunities, attract visitors, and add to the mixture of an economy on both the local and state level. Additionally, many active citizens as well as governmental entities have worked together not only to discover historical resources but to protect and restore many of them through participatory activities such as grant writing.

Preserving the history and culture of coastal communities is important because of the effects that development practices can have. Cultural representations are an expression of community and are vital to a strong social fabric. Archaeological and historical sites destroyed by natural or human-induced alterations represent a loss of irretrievable resources. Monitoring these sites can help minimize such losses as well as aid in planning for the preservation of existing sites as well as sites that will be identified in the future. Living cultural resources and coastal parks show the value that the community associates with natural vistas and historical or architecturally important developments.

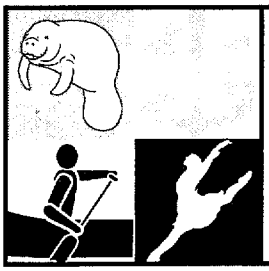
Indicators selected for this issue area should measure either directly or indirectly the public's desire to preserve and maintain the state's historical, cultural, and aesthetic treasures. The state's resources include museums, cultural events, archaeological discoveries, and historic buildings. Measures that determine the protection and vitality of such resources are what is desired for supporting this issue area. The following list identifies the indicators that are examined in this chapter.

Preservation of Cultural and Aesthetic Resources Indicators:

- Number of archaeological sites discovered annually
- Number of sites placed on the national register of historic places
- Museums and cultural/historical events
- Amount of grant money awarded for restoration of historic properties

Other Indicators of Interest:

- Number of tourist visits to coastal areas (Section F)
- Revenue generated by the tourist development tax (Section F)



PRESERVATION OF CULTURAL AND AESTHETIC RESOURCES

Number of Archaeological Sites Discovered Annually

Florida's historic structures and archaeological sites are major contributors to the quality of life enjoyed by the citizens and visitors of the state. These places possess substantial economic value, contribute to urban revitalization, serve as sources of recreation, and provide important tangible links to Florida's heritage. State and federal laws mandate that the state maintain an inventory of all known historic structures and archaeological sites. There are currently over 18,000 known archaeological sites contained in the Florida Master Site File. However, these represent only a small part of Florida's heritage, since less than ten percent of the area of most Florida counties has been surveyed by a qualified archaeologist.

Coastal areas were settled earlier than other parts of Florida, and a high proportion of the recorded sites are located in the immediate coastal zone. Care should be taken to protect all potential historical resources, as they can never be replaced. The recording of all newly-discovered sites is of prime importance since they can provide archaeologists with new information. This indicator is to be used not as a site inventory but as an indirect indicator of the public's desire to preserve and maintain the state's archaeological treasures.

Data Characteristics

SOURCE

All information regarding archaeological and historic sites can be obtained by contacting the Florida Master Site File, Division of Historical Resources, R.A. Gray Building, 500 Bronough Street, Tallahassee, Florida 32399-0250, or at (850) 487-2299. Fax communication is possible to the Site File at (850) 921-0372, and e-mail should be direct to *fmsfile@mail.dos.state.fl.us.* Those desiring more details on current policies of the Florida Master Site File can obtain a copy of the most recent two page flier, *Guidelines for Users of the Florida Master Site File.*

ACQUISITION

All information contained in the Site File, paper or electronic, is public. Much of the information is available only in paper documents, and there is a charge of $0.15 per page for large amounts of photocopying. Electronic data can be accessed by sorting according to various criteria, such as location or date of entry. Electronic data are available at the cost of blank recording medium (for example, 3.5 inch diskette). Due to staffing limitations, request involving substantial research may have to be done on a self-service basis.

COLLECTION

Most historic and archaeological data are gathered using surveys recorded during field visits. The information is later transferred to a computer database.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

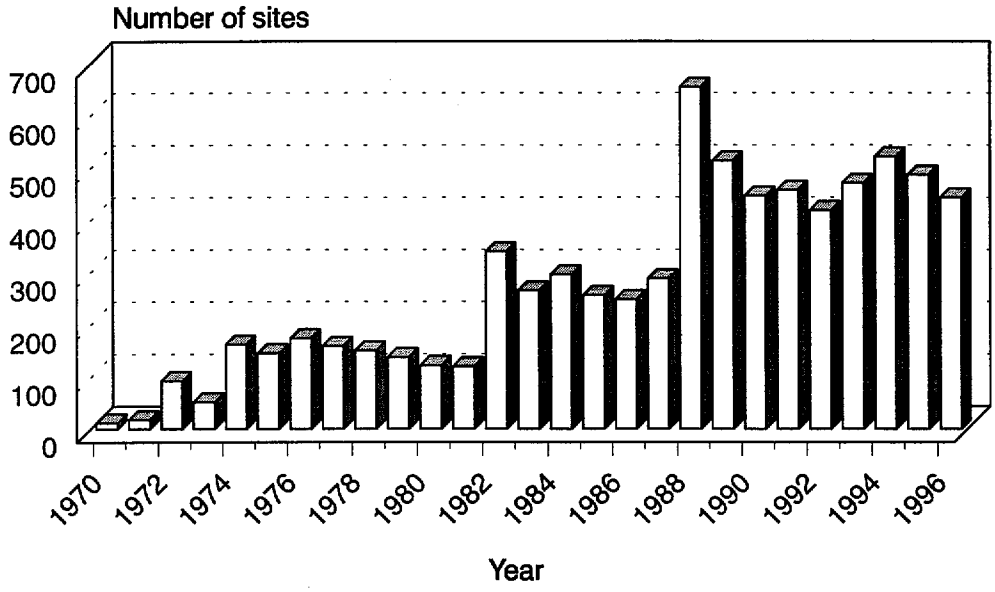
Data Limitations

A limitation of the data is that not all archaeological sites present within the coastal counties are reported, because not all of the sites are known. Another limitation is that the date a site is placed in the File does not necessarily correspond to the date the site was discovered. Therefore, a site that was uncovered in 1980 may not show up in the Master Site File until 1981. The Master Site File is the most complete source of accurate information available; however, it is not a registry of sites officially determined to be historically or scientifically significant. It is a list of *known* sites and historical structures that are documented to be 50 years old and which often deserve to be considered when potentially damaging projects may cause a negative impact, or when scientific or heritage values have been associated with the site.

Data Analysis

The data show an average increase in the number of annual discoveries. The 1996 total (444) was the lowest since 1992. The average of the 1990's has been 464, as compared to the 1980's average of 310. The largest number of discoveries in a single year was 1988 (655). There are several reasons for the variable nature of the data. The three most common ways a site is uncovered and placed on the list are development, academic interest, and/or local government survey projects connected with state requirements for local government comprehensive planning. Thus, in any given year there may have been more activity or research that led to a greater number of site discoveries. While the data do not provide any information on the impact these sites have on Florida's coastal counties, they do provide an inventory of known archaeological sites.

Number of Archaeological Sites Discovered Annually



Year	Number of Sites	Year	Number of Sites
1970	12	**1984**	296
1971	18	**1985**	256
1972	93	**1986**	248
1973	52	**1987**	288
1974	162	**1988**	655
1975	145	**1989**	514
1976	174	**1990**	447
1977	159	**1991**	458
1978	150	**1992**	419
1979	137	**1993**	471
1980	122	**1994**	522
1981	120	**1995**	487
1982	340	**1996**	444
1983	265	**TOTAL**	7,454

Number of Sites Listed in the National Register of Historic Places

Florida's historical structures, archaeological sites, and historical museums are major contributors to the quality of life enjoyed by Florida residents. They are also of substantial economic value because they attract visitors to the local area and the state in general, and they contribute to the urban revitalization of many local communities. Likewise, many sites serve as sources of recreation for residents and tourists. Perhaps most significantly, they provide important tangible links to learning about Florida's heritage.

Most areas of the state historically settled by humans are located in the coastal counties; therefore, a greater number of the known historical sites are located in the coastal zone. Care has been taken to protect many of these historical resources since they can never be replaced. In addition, the recording of all newly-discovered sites is of prime importance since they can provide historians with new information and clues to Florida's past.

This indicator is to be used not as a site inventory but as an indirect indicator of the public's desire to preserve and maintain the state's historical treasures. The National Register of Historic Places is an official listing of historically significant sites and properties throughout the country. It is maintained by the National Park Service of the U.S. Department of the Interior and includes districts, sites, buildings, structures, and objects identified as significant in American history, architecture, archaeology, engineering, and culture. To be listed in the National Register of Historic Places, a site must be nominated and must meet specific quality criteria. This list is not a mere count; a site must reflect significance and be of a certain age as well as meeting other requirements.

Data Characteristics

SOURCE

Information regarding archaeological and historic sites in Florida proposed for or included in the National Register of Historic Places can be obtained by contacting Barbara Mattick, Historic Preservationist Supervisor, at the Florida Department of State, Bureau of Historic Preservation, R.A. Gray Building, 500 Bronough Street, Tallahassee, Florida 32399-0250, or at (850) 487-2333. Information on the National Register is also accessible through the National Park Service Website. The Website allows users to search by state and by county. The Website address is: **http://www.nps.gov**

ACQUISITION

Information contained in the National Register can be obtained in either hard copy format or through electronic transfer. The data can be arranged by specific sorting codes such as location or date of entry. No cost is associated with obtaining this information.

COLLECTION

Most historic data are gathered throughout the counties using surveys recorded during field visits. The information is later transferred to a computer database.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

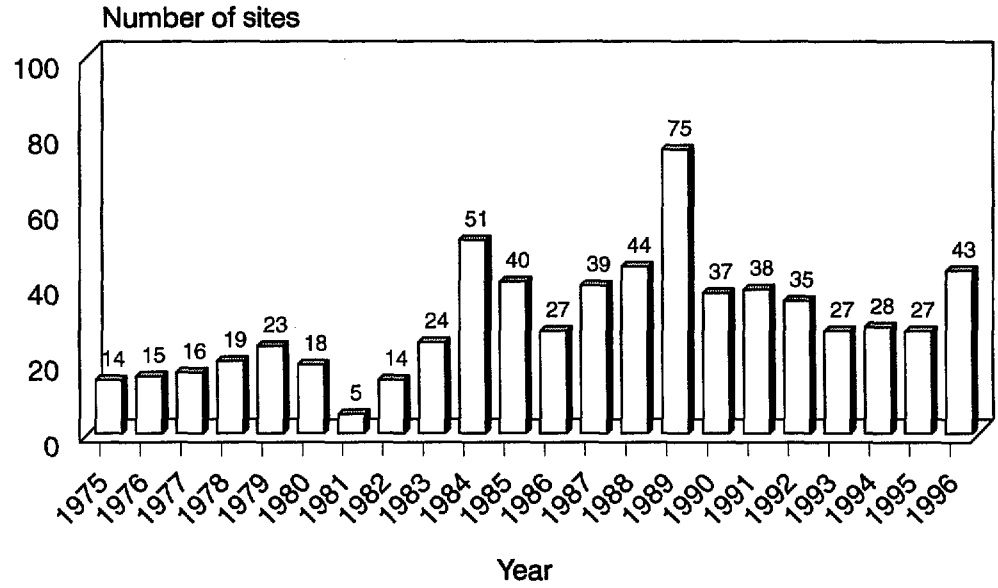
Data Limitations

The National Register is one of the most complete sources of accurate information available on historic properties. However, this registry is not a comprehensive assessment. Because a site must meet qualitative criteria, some sites of historical value may not be nominated for inclusion in the registry.

Data Analysis

The data show no definitive trend for the number of recorded sites. The most common practice by which a site is nominated for inclusion in the Register is through academic interest and/or local government legislation. Thus, in any given year there may have been more interest or research that led to a greater number of site nominations. Between 1975 and 1996, 659 sites in Florida's coastal counties were listed in the National Register of Historic Places. The year 1989 had the most activity with 75 historic sites registered. For the ten-year period from 1987 to 1996, there was an average of 39 sites registered per year. This is a substantial increase over the previous ten-year period (1977-1986), which recorded an average of 23 historical sites registered per year.

Number of Sites Listed in the National Register of Historic Places per Year in Florida's Coastal Counties



Museums and Cultural/Historical Events

Florida's museums and cultural/historical events (e.g., festivals) are major contributors to the quality of life enjoyed by the citizens and visitors of the state. These attractions provide substantial economic benefits by providing local jobs, being part of the local tax base, and bringing tourism dollars to the local economy. These activities contribute to urban revitalization of many Florida cities. Museums and events also serve as sources of recreation and provide Floridians with important tangible links to their heritage. Those links promote knowledge and appreciation of Florida through the collection, presentation, exhibition and interpretation of objects related to Florida's history and are also instrumental in interpreting Florida's social and cultural heritage to visitors.

Many of the state's cultural and historical events occur in the coastal counties where a majority of the state's archaeological sites have been discovered. With the tremendous population growth of the state taking place in coastal areas, it is becoming increasingly important to monitor and protect from destruction both existing and undiscovered cultural and historical sites. Historical museums and events, through ticket sales and associated indirect economic activity, substantially aid both local and state economies. Moreover, the preservation of Florida's history adds to the quality of life of Florida's citizens. Interest in museums and events also may lead to increased grant money available for historical preservation. The number of visitors to museums and events can serve as an indicator of an increased appreciation of cultural resources and the public's interest in maintaining these resources.

Data Characteristics

SOURCE

A listing of non-profit museums, is compiled and published annually in *The Official Museum Directory*, by the American Association of Museums, 1225 I Street, Suite 200, Washington, D.C. 20005, or at (202) 289-1818. A copy of the Directory can be obtained from Mr. Bob McNeal, Senior Curator at the Museum of Florida History, R. A. Gray Building, 500 South Bronough Street, Tallahassee, Florida 32399, or at (850) 488-1484. The report is currently in its 27th edition. The most comprehensive listing of festivals is available in *Florida Festivals: Who, What, When, and Where*, which is published annually by the Pinellas County Arts Council (PCAC). The report on Florida Festivals is available by writing them at 400 Pierce Blvd., Clearwater, FL, 34616, or calling (813) 464-3327. A third source of information is the Florida Association of Museums (FAM) Directory, which publishes a directly similar in content to *The Official Museum Directory.* The Florida Association of Museums (FAM) Directory is available by contacting Malinda Horton, Executive Director, Post Office Box 10951, Tallahassee, Florida 32302-2951 or at (850) 222-6028.

ACQUISITION

The *Official Museum Directory* is available in hard copy format. No costs are associated with its acquisition. The report on Florida Festivals is available from the PCAC for $12.00 plus shipping and handling. The Florida Association of Museums (FAM) Directory is available to non-members for a minor cost. The information is also available via the Internet at Website: **http://www.flamuseums.org/fam/florida.map?107,135**

COLLECTION

The information on museums and cultural and historical events is updated continually and published annually. Listings are by individual cities, thereby allowing collection by coastal areas. Visitation data are obtained from each facility through ticket sales or entrance counters. The festival data is available by date and location and includes estimates of attendance.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

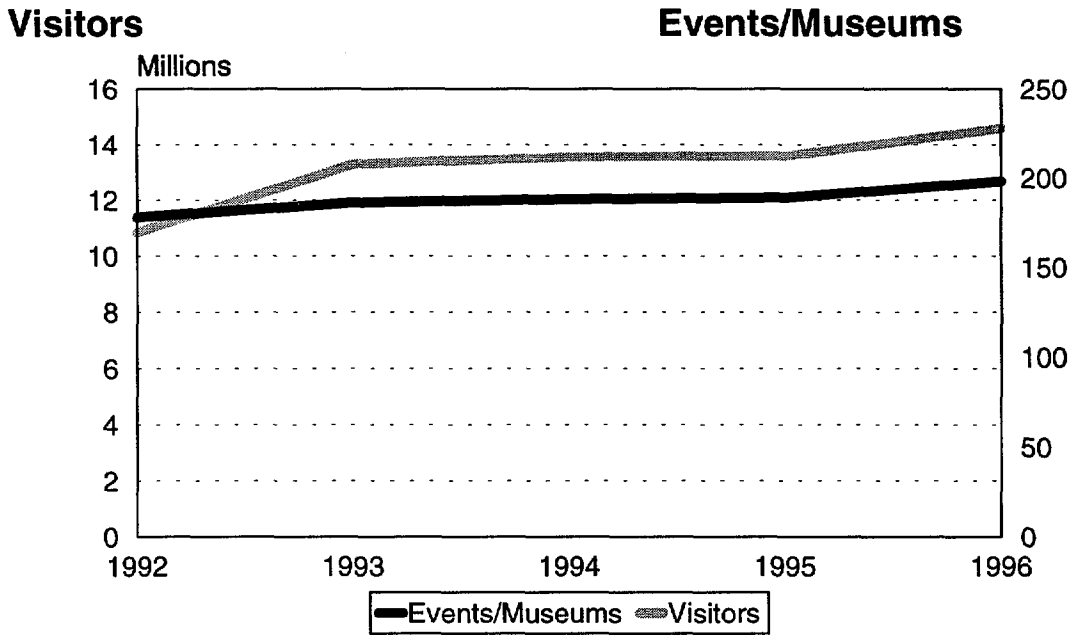
The directory published by the American Association of Museums was chosen to measure the trends in this indicator. Future efforts may need to compare the listings in all three publications for a more complete picture of the number of events and museums and visitor attendance.

The American Association of Museums lists historic sites and non-profit museums. A museum for profit is not included. In some instances the published attendance record represents an estimated number of visitors for that facility for that calendar year. Additionally, the attendance records for some of the museums and events in coastal counties were not given. Thus, the published total visitor data most likely errs on the side of omission and should be treated as estimates.

Data Analysis

The number of coastal historical events and museums have been gradually increasing from 178 in 1992 to 198 in 1996, or 5 a year. The number of visitors to Florida's coastal museums and events have increased from nearly 11 million in 1992 to 14.5 million in 1996; an increase of 35% during the 4-year period. The increase in visitation may be a result of a number of factors, including a change in admission pricing, inflationary factors, or longer periods of favorable travel weather. The increase may simply be an improvement over previous years in reporting of visitor estimates.

Annual Number of Events/Museums
Annual Number of Visitors
1992-1996



	1992	1993	1994	1995	1996
Events/ Museums	178	186	188	189	198
Visitors	10,845,479	13,282,974	13,560,118	13,594,168	14,600,606

Amount of Grant Money Awarded for Restoration of Historic Properties

Many historical landmarks in Florida are in danger of being lost through demolition because of a lack of funds to assist their restoration or rehabilitation. Such properties include former courthouses, railroad stations, banks, theaters, hotels, office buildings, residences, and other public and private structures that are of outstanding historical or architectural significance. Since Florida's coastline has been densely populated earlier than other parts of the state, the coastal counties contain many of the oldest and most historically important structures. Coastal areas also remain under the greatest amount of development pressure today.

The existence of these irreplaceable local landmarks and their historic values contributes to the quality of life and cultural awareness in the communities in which they are located. These places help connect the traditional values reflected in many of Florida's small towns with the modern and fast-paced lifestyle of today. When rehabilitated as community centers, theaters, museums, classrooms, government offices, and other places of public use, these landmarks can directly benefit many people as well as contribute to the revitalization of older downtown areas and neighborhoods. Without assistance, some of the listed historic buildings will further deteriorate and possibly be lost. Additionally, many Florida residents and visitors would have less opportunity to learn about Florida's heritage or to develop an understanding of the important events, realize the ethnic diversity, and share common experiences which make up the history of our state. This indicator reflects the amount of funding that has been granted to protect and preserve many of Florida's cultural resources.

Data Characteristics

SOURCE

All information regarding the Historic Grant Program can be obtained from the Grants and Education Section, Bureau of Historic Preservation, Division of Historical Resources, Florida Department of State, R. A. Gray Building, 500 South Bronough Street, Tallahassee, Florida 32399-0250, or at (850) 487-2333.

ACQUISITION

The information on the amount of grant money distributed annually is available by electronic transfer and in hard copy format. No cost is associated with the acquisition of the information.

COLLECTION

All information regarding the state's Historic Grant Program is continuously updated and entered into a comprehensive database.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

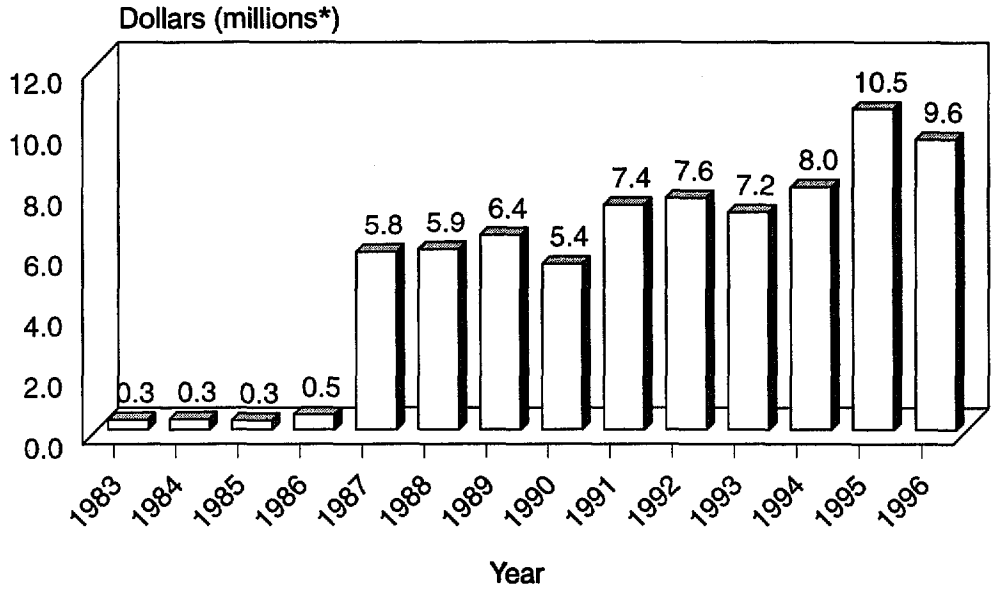
Distribution of financial grants are dependent on local government activity. In order to be awarded any support from federal, state, and non-profit funding sources, local agencies need to take the initiative of identifying qualifying structures and preparing applications for financial support. There may exist many projects which would qualify for and benefit greatly from financial support, but since application for funding is not made, these projects are not included in the selection process.

Data Analysis

The demand for grant assistance reflects an important increase in interest and commitment on the part of local governments, state agencies, and non-profit organizations toward the protection, preservation, and reuse of significant historic structures. Since the beginning of the program, the amount of money awarded yearly to coastal counties has increased from $323,046 in fiscal year 1983 to $9,556,338 in fiscal year 1996. The largest amount of cumulative funds was in FY 1995 when $10.5 million was awarded. Annual funding activities have collected well over $5 million dollars since 1987. The most significant increase in the amount awarded occurred in fiscal year

1987, when the legislature appropriated special project funds to the grant fund. The rise in the amount of money awarded may be a result of several factors, including an increase in the number of applications and improvement in the quality of applications. While the amount of money awarded is also a function of the amount of money available, the data also provides an indication of the perceived importance of this program and the properties themselves at both the state and local levels.

Amount of Grant Money Awarded for Historic Preservation Activities in Coastal Counties, FY 1983-1996



*figures have been rounded to the nearest 0.1 million dollars

Section I

Encouraging Public Awareness and Involvement

Encouraging Public Awareness and Involvement

The Florida coast has an abundance of natural resources. However, continued prosperity depends on our ability to protect this natural heritage and learn to use it in ways that do not diminish it. Environmental stewardship calls upon everyone to assume responsibility for protecting the integrity of natural resources and ecosystems. Without personal and collective commitment, without an ethic based on acceptance of responsibility, efforts to sustain natural resources, the environment, and the quality of life cannot succeed.

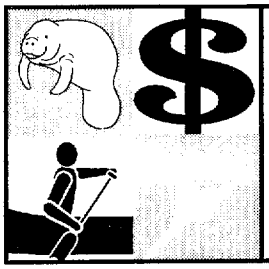
Public involvement is important because as the understanding of coastal issues increases, it is likely that more protection will be afforded to coastal resources. This issue addresses the level of awareness of both residents and tourists concerning coastal issues and people's level of participation in coastal issues. Public awareness refers to educational programs regarding coastal issues and policy interest. Public awareness addresses the attitudes of citizen involvement in the creation, implementation, and monitoring of coastal policy and the level of participation in voluntary coastal interest groups, activities, and programs. The data for all of the indicators in this section were from a survey constructed to gauge the general public's opinions, attitude, and knowledge about coastal issues.

Encouraging Public Awareness and Involvement Indicators:

- Public support for purchase of coastal lands
- Public concern for beach access
- Public preparedness for hurricanes
- Public concern for seafood safety
- Public participation in coastal policy
- Membership in coastal advocacy groups
- Beach visits by residents
- Participation in the Florida coastal cleanup

Other Indicators of Interest:

- Change in Strategic habitat conservation areas (Section D)
- Change in existing wetland habitat and conservation lands (Section D)
- Change in existing upland habitat and conservation lands (Section D)
- Management status of coastal habitat (Section G)
- Museums and cultural/historical events (Section H)



Encouraging Public Awareness and Involvement

Public Support for Purchase of Coastal Lands

Coastal lands are an important resource for Florida's residents, providing recreation opportunities and access to wildlife and natural scenery, preservation of endangered species, and preservation of Florida's natural history. The urbanization of Florida's coast has diminished the quantity of land that is available for these purposes. The state has responded with the Conservation and Recreation Lands Program, Save Our Rivers, Save Our Coasts and other programs which have acquired over 1.8 million acres of land, much of which has been coastal lands. These programs are dependent on public support for investment of state funds in public land purchases. Changes in the levels of support for purchases of coastal lands should be followed by appropriate governmental fiscal actions.

Data Characteristics

SOURCE

The data are from the Florida Coastal Issues Survey, which was conducted by the Survey Research Laboratory at Florida State University. For further information or data from the survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

ACQUISITION

The survey data are available in hard copy format at no cost.

COLLECTION

The data were collected during the summer and autumn of 1996, and future data collection via the survey is likely. The results consist of 1,002 completed telephone interviews of randomly-selected adults (age 18 and older) living in Florida. The data reflect a 95 percent confidence level and a sampling error of 4 percent; this means that 95 times out of 100, the results of a question will fall within ±8 percent of the answers that would have been given if the entire population of Florida had been surveyed.

The sample consisted of 450 males and 552 females. There were 757 coastal county respondents and 245 non-coastal county respondents. The sample is representative of Florida residents age 18 and older who are accessible by telephone. Like the data for Florida residents statewide, the data for coastal and non-coastal county residents reflect a 95 percent confidence level and a sampling error of 4 percent; unlike the statewide figures, however, the data for the coastal subset or the non-coastal subset are not truly representative of all coastal or non-coastal county residents, because sampling was not designed to be representative at those levels.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

Data Limitations

There are some limitations inherent in any survey methodology, although the Florida Coastal Issues Survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described above.

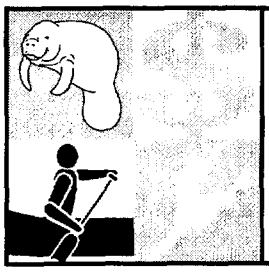
Data Analysis

Two of the survey questions addressed the issue of public support for the purchase of coastal lands. When asked "Should Florida's government continue to use state funds to purchase coastal lands?", about half the sample responded affirmatively, one quarter said "no," and one quarter stated that they didn't know. As displayed below, the responses of the coastal and non-coastal county residents were very similar.

Continue Using State Funds for Coastal Lands Purchase?	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	51.5%	53.5%	52.0%
no	25.5%	27.3%	25.9%
don't know	23.0%	19.2%	22.1%

People who answered "yes" to the above question were asked a second one on this subject: "Do you feel the level of funding for the purchasing of coastal lands should be increased, decreased, or kept at the same level?". Again, the responses of coastal county residents were very similar to those of non-coastal residents: about one third stated that funding should be increased, nearly half stated funding should be held at the same level, and only a small percentage stated they felt the level of funding should be decreased. About one fifth of respondents who supported continued state funding stated they did not know whether the level should be increased, decreased, or kept the same.

Opinion of Funding Level	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
increased	30.3%	30.5%	30.3%
decreased	3.1%	4.6%	3.5%
kept the same	44.6%	48.9%	45.7%
don't know	22.1%	16.0%	20.5%



Public Concern for Beach Access

The beach is an important resource for Florida's residents, providing recreation opportunities and access to wildlife and natural scenery. The urbanization of Florida's coast has resulted in decreased access due to shoreline development. The public is facing increasing difficulty in finding access points to beach areas that traditionally were easily accessible. Responses to the problem have included public purchase of land and public development exactions for the preservation of access to the beach. Decision-makers are faced with the difficult task of balancing the public's right to access the beach and private landowners' sovereignty over their land. Changes in the level of concern for beach access should be followed by appropriate governmental regulatory and fiscal actions.

Data Characteristics

SOURCE

The data are from the Florida Coastal Issues Survey, which was conducted by the Survey Research Laboratory at Florida State University. For further information or data from the survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

ACQUISITION

The survey data are available in hard copy format at no cost.

COLLECTION

The data were collected during the summer and autumn of 1996, and future data collection via the survey is likely. The results consist of 1,002 completed telephone interviews of randomly-selected adults (age 18 and older) living in Florida. The data reflect a 95 percent confidence level and a sampling error of 4 percent; this means that 95 times out of 100, the results of a question will fall within ±8 percent of the answers that would have been given if the entire population of Florida had been surveyed.

The sample consisted of 450 males and 552 females. There were 757 coastal county respondents and 245 non-coastal county respondents. The sample is representative of Florida residents age 18 and older who are accessible by telephone. Like the data for Florida residents statewide, the data for coastal and non-coastal county residents reflect a 95 percent confidence level and a sampling error of 4 percent; unlike the statewide figures, however, the data for the coastal subset or the non-coastal subset are not truly representative of all coastal or non-coastal county residents, because sampling was not designed to be representative at those levels.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

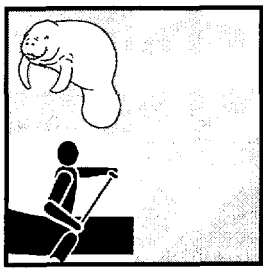
Data Limitations

There are some limitations inherent in any survey methodology, although the Florida Coastal Issues Survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described above.

Data Analysis

When asked to describe their ability to get to and use the beach, about 80 percent of the Florida residents surveyed responded that access was adequate or very adequate. Coastal county residents were more likely than non-coastal residents to say that access was very adequate, but they were also slightly more likely to say that access was very inadequate. Non-coastal county residents were more than twice as likely as coastal residents to have no opinion on the matter. A summary of the responses is displayed in the table below.

Ability to Get to and Use the Beach	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
very adequate	36.2%	24.1%	33.2%
adequate	46.1%	52.7%	47.7%
inadequate	8.3%	11.8%	9.2%
very inadequate	6.5%	4.9%	6.1%
no opinion	2.9%	6.5%	3.8%



Encouraging Public Awareness and Involvement

Public Preparedness for Hurricanes

Preparedness is a key component of emergency management. Considering the fact that 36% of all twentieth century U.S. hurricanes have hit Florida (Hebert et al., 1995), hurricane preparedness is an important issue for the state's residents and public officials.

With hurricane season occurring from June 1 to November 30 of each year, Florida residents face annual risks to property and personal safety from hurricanes. These risks can be mitigated through appropriate preparation by residents. Preparation includes finding out about evacuation routes and shelters, maintaining supplies such as flashlights, radios, and batteries, and knowing the appropriate source for weather and emergency reports. Moreover, these preparations should occur far in advance of any hurricane, preferably prior to the arrival of the hurricane season.

There are additional actions residents should take when a hurricane watch is issued; however, this indicator focuses on long-range preparation activities and does not reflect those more immediate activities.

Data Characteristics

SOURCE
For information on the Florida Coastal Issues Survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

ACQUISITION
The survey data are available in hard copy format at no cost.

COLLECTION
The data were collected during the summer and autumn of 1996, and future data collection via the survey is likely.

TECHNICAL
Data Accessibility: Data are manually collected and are accessible.

Data Limitations

There are some limitations inherent in any survey methodology, although the Florida Coastal Issues Survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described below. A limitation more specific to this particular indicator is that the self-reported responses reflect individuals' perceived preparedness and not necessarily their actual knowledge of their evacuation route or shelter (i.e., some people may think they know how to evacuate or where to find shelter but in reality their ideas are based on inaccurate information). Further, there are some limitations in interpreting awareness of evacuation routes and shelters. Evacuation orders usually apply only to people who live in areas expected to flood due to a hurricane and to people who live in mobile homes. There are flood-free areas in all of Florida's coastal counties, so not everyone in a coastal county needs to evacuate. Moreover, evacuation refers to leaving one's home to go someplace safer, not necessarily leaving the coastal county and going well inland. Mobile home residents who don't live in flood-prone areas might only go to a mobile home park clubhouse or across town or to a friend's house. Thus, although knowing evacuation routes is important for some people, it may not be essential to all (Baker, 1997).

Data Analysis

The Florida Coastal Issues Survey was conducted by the Survey Research Laboratory at Florida State University during the summer and autumn of 1996. The survey results consist of 1,002 completed telephone interviews of randomly-selected adults (age 18 and older) living in Florida. The data reflect a 95 percent confidence level and a sampling error of 4 percent; this means that 95 times out of 100, the results of a question will fall within ±4 percent of the answers that would have been given if the entire population of Florida had been surveyed.

The sample consisted of 450 males and 552 females. There were 757 coastal county respondents and 245 non-coastal county respondents. The sample is representative of Florida residents age 18 and older who are accessible by telephone. Like the data for Florida residents statewide, the data for coastal and non-coastal county residents reflect a 95 percent confidence level and a sampling error of 4 percent; unlike the statewide figures, however, the data for the coastal subset or the non-coastal subset are not truly representative of coastal or non-coastal county residents, because sampling was not designed to be representative at those levels.

Two of the survey questions addressed the existence of long-range hurricane preparedness: "Do you know the hurricane evacuation route for the area in which you live?" and " Do you know where the hurricane evacuation shelter for your area is?". As displayed below, when asked whether they knew their hurricane evacuation route, nearly two-thirds of coastal county residents responded affirmatively, as opposed to just over two-fifths of the non-coastal county residents. About one-third of coastal residents and one-half of non-coastal residents stated they did not know the hurricane evacuation route for their area. For the sample as a whole, about three out of every five people stated that they knew their evacuation route.

Know Hurricane Evacuation Route	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	65.7%	42.9%	60.1%
no	30.6%	47.8%	34.8%
no evacuation route	2.8%	7.8%	4.0%
don't know	0.9%	1.6%	1.1%

In response to the question about knowledge of hurricane shelters, responses of coastal residents were much more similar to those of non-coastal county residents: about 58 percent of coastal residents and 51 percent of non-coastal residents stated that they did know the location of the hurricane shelter for their area. Overall, it appears that over two-fifths of the state's residents do not know where their hurricane shelter is.

Know Location of Hurricane Evacuation Shelter	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	57.6%	51.4%	56.1%
no	40.3%	44.9%	41.4%
no evacuation shelter	1.6%	3.7%	2.1%
don't know	0.5%	0.0%	0.4%

Given the numbers of respondents who stated they did not know their hurricane route and/or shelter, it is interesting to note that, when the entire sample was asked whether they felt they needed more information on hurricane preparedness and safety, both coastal and non-coastal county residents answered "yes" less than 25 percent of the time and "no" more than 75 percent of the time. The respondents who answered affirmatively were asked three additional questions about the modes of information acquisition they would be interested in. Following is a summary of those results.

Interest in Information on Hurricane Preparedness and Safety by Respondents Needing Additional Information

Interested in Which Types of Information?	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
	Printed information (e.g., pamphlet)		
yes	90.5%	86.0%	89.3%
no	8.3%	10.5%	8.9%
no opinion	1.2%	3.5%	1.8%
	Television or radio program		
yes	85.1%	87.7%	85.8%
no	14.9%	10.5%	13.8%
don't know	0.0%	1.8%	0.4%
	Public information session		
yes	51.2%	49.1%	50.7%
no	48.2%	47.4%	48.0%
don't know	0.6%	3.5%	1.3%

As reflected in the above chart, coastal and non-coastal county residents indicated similar levels of interest in the different forms of information. More people (89 percent) stated they would be interested in receiving printed information than in watching a television program or listening to a radio program (86 percent), and only about half the respondents stated they would be interested in attending a public information session on hurricane preparedness and safety.

References

Baker, Jay, Ph.D. Personal communication. Department of Geography, Florida State University. May, 1997.

Hebert, Paul J., Jerry D. Jarrell, and Max Mayfield. 1995. "The Deadliest, Costliest, and Most Intense United States Hurricanes of This Century (and Other Frequently Requested Hurricane Facts)." In *Hurricanes... Different Faces in Different Places* (excerpts from the 17th Annual National Hurricane Conference). Compiled by Lawrence S. Tait, National Hurricane Conference, Tallahassee, Florida. 104 pp.

Public Concern for Seafood Safety

Seafood is an important part of Floridians' diet, both nutritionally and culturally. Floridians enjoy fresh, easily obtained, and inexpensive seafood whether they catch it themselves or purchase it from commercial vendors. Changes in seafood quality can occur from natural or human-induced changes in water quality; in addition, seafood quality can be affected by processing and shipping activities. These changes may be perceived by the public, resulting in corresponding public responses such as demands for increased regulation and reduction of seafood purchases. The perception of decreased safety could negatively affect the economy and could result in a reduction of the quality of life for residents.

Data Characteristics

SOURCE

The data are from the Florida Coastal Issues Survey, which was conducted by the Survey Research Laboratory at Florida State University. For further information or data from the survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

ACQUISITION

The survey data are available in hard copy format at no cost.

COLLECTION

The data were collected during the summer and autumn of 1996, and future data collection via the survey is likely. The results consist of 1,002 completed telephone interviews of randomly-selected adults (age 18 and older) living in Florida. The data reflect a 95 percent confidence level and a sampling error of 4 percent; this means that 95 times out of 100, the results of a question will fall within ±8 percent of the answers that would have been given if the entire population of Florida had been surveyed.

The sample consisted of 450 males and 552 females. There were 757 coastal county respondents and 245 non-coastal county respondents. The sample is representative of Florida residents age 18 and older who are accessible by telephone. Like the data for Florida residents statewide, the data for coastal and non-coastal county residents reflect a 95 percent confidence level and a sampling error of 4 percent; unlike the statewide figures, however, the data for the coastal subset or the non-coastal subset are not truly representative of all coastal or non-coastal county residents, because sampling was not designed to be representative at those levels.

TECHNICAL

Data Accessibility: Data are manually collected and are accessible.

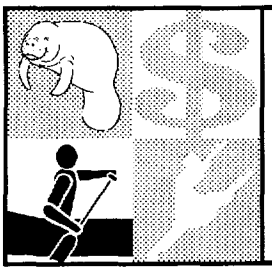
Data Limitations

There are some limitations inherent in any survey methodology, although the Florida Coastal Issues Survey was designed and implemented by professionals who specialize in ensuring the randomness and representativeness of the sample, unambiguousness of the questionnaire, etc. Users of the survey data should be mindful of the range of results applicable to each question based on the sampling error and confidence interval as described above.

Data Analysis

The survey question that addressed public concern about possible adverse health effects from Florida's seafood was "How concerned are you about bad health effects from eating Florida seafood? Are you very concerned, somewhat concerned, or not concerned at all?". As displayed in the following table, the responses of coastal and non-coastal county residents were very similar, and the distribution of responses was fairly even across the response choices. About one-third of the respondents indicated that they were very concerned, one-third stated they were somewhat concerned, and one-third indicated they were not concerned about the possibility of experiencing bad health effects from eating Florida seafood.

Seafood Health Concerns	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
very concerned	35.4%	31.4%	34.4%
somewhat concerned	32.5%	35.5%	33.2%
not concerned	30.5%	30.2%	30.4%
no opinion	1.6%	2.9%	1.9%



Encouraging Public Awareness and Involvement

Public Participation in Coastal Policy

Public participation in the policy-making process is important for several reasons. Public participation reinforces the democratic ideals of our country, legitimizes the roles of government and decision-makers, and eases implementation by creating a sense of ownership over policy. Public participation also creates the opportunity for two-way education: decision-makers educate the public and the public educates decision-makers. Each of these reasons serves to emphasize the importance of creating and fostering opportunities for the public to attend meetings and make their voices heard.

Coastal policy-makers can take advantage of the benefits outlined above as long as an atmosphere of open public participation exists. If public participation in coastal policy issues is lacking, however, it is likely that coastal initiatives will suffer from lack of support and difficulty of implementation. Changes in the level of participation by the public should be followed by appropriate government actions. Signs that participation is decreasing should be followed by vigorous attempts to mobilize the public by informing them why their participation is important and desired and by providing additional opportunities for the public to interact with policy-makers. Signs that participation is rising should be reinforced by legitimization of the public's input and the continued support of existing participation programs.

Data Characteristics

SOURCE

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ACQUISITION

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COLLECTION

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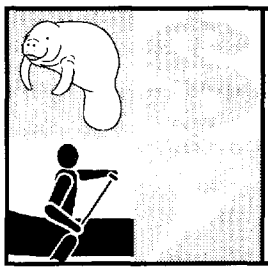
Data Analysis

Survey respondents were asked either one or two questions pertaining to participation in coastal public policy. When asked "During the last year [August 1995 - August 1996], how many public hearings, meetings, or other forms of participation have you been involved with that deal with policies directly related to Florida's coast?", the distribution of answers was similar for the coastal and non-coastal county respondents. Approximately 9 out of every 10 people questioned stated that they had not been involved in any such activity during the past year. The distribution of responses is summarized in the following table.

Frequency of Public Participation in Coastal Policy	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
none	88.4%	92.7%	89.4%
1	3.0%	2.4%	2.9%
2	3.6%	2.4%	3.3%
3	2.0%	1.2%	1.8%
4	0.3%	0.0%	0.2%
5 - 10	1.7%	0.0%	1.3%
> 10	0.6%	0.4%	0.6%
don't know	0.4%	0.8%	0.5%

Respondents indicating a participation frequency of 1 or greater were asked a second question: "Which type of activity were you involved in the most?". The distribution of responses is summarized below.

Policy-Oriented Activity Involved in the Most	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
workshops	32.1%	25.0%	31.0%
community panels	23.8%	25.0%	24.0%
signed petitions	15.5%	12.5%	15.0%
phone calls	11.9%	6.3%	11.0%
marches/demonstrations	4.8%	12.5%	6.0%
letter writing	3.6%	6.3%	4.0%
teaching a class	1.2%	0.0%	1.0%
other	2.4%	12.5%	4.0%
don't know	4.8%	0.0%	4.0%



Membership in Coastal Advocacy Groups

Florida is host to approximately 200 local, regional, national, and international organizations involved in education, advocacy, and group activities concerning environmental issues. Determining the number of organizations that address coastal issues is difficult, however. These organizations typically sponsor recreational and educational events, engage in public policy debate, and provide technical assistance and specialized knowledge. Public membership in these organizations indicates awareness of and concern for coastal issues. Specifically, public membership shows the strength and breadth of support for coastal policy issues and physical resources, provides an additional source of revenue for land purchase, research, education and other activities and actions usually sponsored by the government, focuses public attention through activities and education, and affects public policy by providing political support. An educated public is important for the successful development and implementation of coastal policy. This indicator will show the change in membership in coastal advocacy organizations, which affects the activities listed above.

Data Characteristics

SOURCE

The data are from the Florida Coastal Issues Survey, which was conducted by the Survey Research Laboratory at Florida State University. For further information or data from the survey, contact the Florida Coastal Management Program, Florida Department of Community Affairs, 2555 Shumard Oak Blvd., Tallahassee, Florida 32399-2100, or at (850) 922-5438.

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Data Analysis

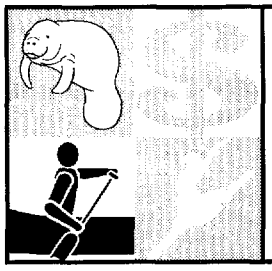
Survey respondents were asked one or three questions pertaining to membership in coastal advocacy groups. When asked "Do you currently belong to any non-profit groups that are involved in coastal environmental, educational or recreational activities?", a total of 79 people responded affirmatively. About 8 percent of the coastal county and 7 percent of the non-coastal county respondents stated that they did belong to a group of that type. Over 90 percent of the respondents indicated that they did not belong to any non-profit coastal-oriented group.

Membership in a Coastal-Oriented Non-Profit Group	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
yes	8.3%	6.9%	8.0%
no	91.3%	93.1%	91.7%
don't know	0.4%	0.0%	0.3%

The 79 respondents who stated they belonged to a group were asked two additional questions. When asked "How many groups of this type do you belong to?", about 65 percent of the respondents said they belonged to only one group and 20 percent indicated they belonged to two groups. A summary of the responses is displayed in the following table. Note that the frequencies are absolute numbers of respondents in each category, not percentages of respondents.

Number of Groups Belonged to	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
1	37	14	51
2	15	1	16
3	4	2	6
4	1	0	1
5 - 10	1	0	1
> 10	2	0	2
don't know	2	0	2
total	62	17	79

The 79 respondents were also asked to give the name of the main group to which they belonged. A total of four groups were named by more than 1 respondent: Greenpeace, Sierra Club, Save the Manatees, and Manatee Research Team. All other respondents named a group that was not named by any other respondent.



Beach Visits by Residents

The beach is an important resource for Florida's residents, providing recreation opportunities and access to wildlife and natural scenery. This indicator differs from state estimates of beach visitations in that it uses self-reporting of state residents and does not include tourist visits. This is important for understanding how residents are using the beach resource and for assessing residents' potential support for programs to enhance beach characteristics.

Data Characteristics

SOURCE

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Data Analysis

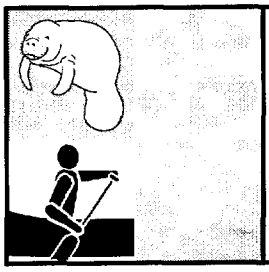
Survey respondents were asked two questions pertaining to beach visits: "How many times have you visited a Florida beach within the last year [between August 1995 and August 1996]?" and "What is your favorite activity at the coast?". Actual numbers of beach visits were recorded for each respondent, but for the purposes of this indicator, numbers of visits were grouped into the ranges reflected in the following table.

Number of Beach Visits in Past Year	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
none	14.3%	21.6%	16.1%
1 - 5	28.2%	43.0%	31.8%
6 - 10	13.4%	17.5%	14.4%
11 - 20	14.1%	9.4%	13.0%
21 - 40	8.8%	4.4%	7.8%
41 - 99	9.2%	0.4%	7.2%
≥ 100	9.8%	2.4%	8.1%
don't know	2.0%	1.2%	1.8%

As displayed above, non-coastal county residents were more likely than coastal residents to have not visited the beach at all during the twelve months preceding the survey. Non-coastal residents were more likely to have visited the beach between 1 and 10 times during the year, while coastal residents were more likely to have visited the beach 11 or more times during the year. Projecting the survey responses to the residents of the entire state, and assuming the twelve-month period addressed would not differ from any other year in the near future, it would be expected that about half the state's residents would visit a Florida beach between 0 and 5 times per year and half would visit a beach more than 5 times per year.

Survey respondents were also asked to name their favorite activity at the coast. Those responses are summarized in the following table.

Favorite Activity at the Coast	Coastal County Residents	Non-Coastal County Residents	Florida Residents Overall
swimming	25.2%	30.6%	26.5%
walking/jogging/running	16.7%	13.2%	15.8%
sunbathing	13.1%	16.5%	13.9%
fishing	8.5%	11.6%	9.2%
relaxing/sitting/reading	6.7%	6.6%	6.7%
boating	5.5%	2.1%	4.7%
playing at the beach	4.3%	2.1%	3.8%
surfing	1.6%	3.3%	2.0%
snorkeling/scuba diving	2.0%	0.0%	1.5%
picnics/cookouts	2.0%	0.0%	1.5%
jet skiing/water skiing	1.3%	0.8%	1.2%
beachcombing	0.9%	1.7%	1.1%
biking	0.4%	0.4%	0.4%
work/clam farming	0.1%	0.0%	0.1%
none	7.0%	4.5%	6.4%
other	1.6%	1.7%	1.6%
don't know	3.0%	5.0%	3.5%



Encouraging Public Awareness and Involvement

Participation in the Florida Coastal Cleanup

Public participation efforts to keep beaches free of litter are vital for the maintenance of beach aesthetics and removes potential hazards, such as plastics and fish line, from marine habitats. Residents and tourists are more likely to use and enjoy beaches that are free of litter. In addition, participation by the public in beach cleanup activities heightens the connection between the public and the state's natural resources, resulting in greater care and concern for beach resources. The Center for Marine Conservation sponsors the annual Florida Coastal Cleanup, a voluntary public program to remove litter and debris from beaches, which has been steadily attended since 1988. The cleanup takes place annually on the third Saturday of September. The number of volunteers participating in the Florida Coastal Cleanup provides indication of the level of public participation and concern for the state's beach resources.

Data Characteristics

SOURCE

Information on participation in the Florida Coastal Cleanup is available from Bruce Ryan, Center for Marine Conservation, One Beach Drive SE, Suite 304, St. Petersburg, Florida 33701, or at (813) 895-2188. The Center may also be reached at 1-800-CMC-FLORida.

ACQUISITION

The information is available in hard copy. There are no costs associated with the acquisition of the data.

COLLECTION

Information on number of volunteers, miles cleaned, and tons collected is available for the years 1988-1996. Since 1992, the data have been broken down by county; however, prior to 1992 the data are available only as state totals.

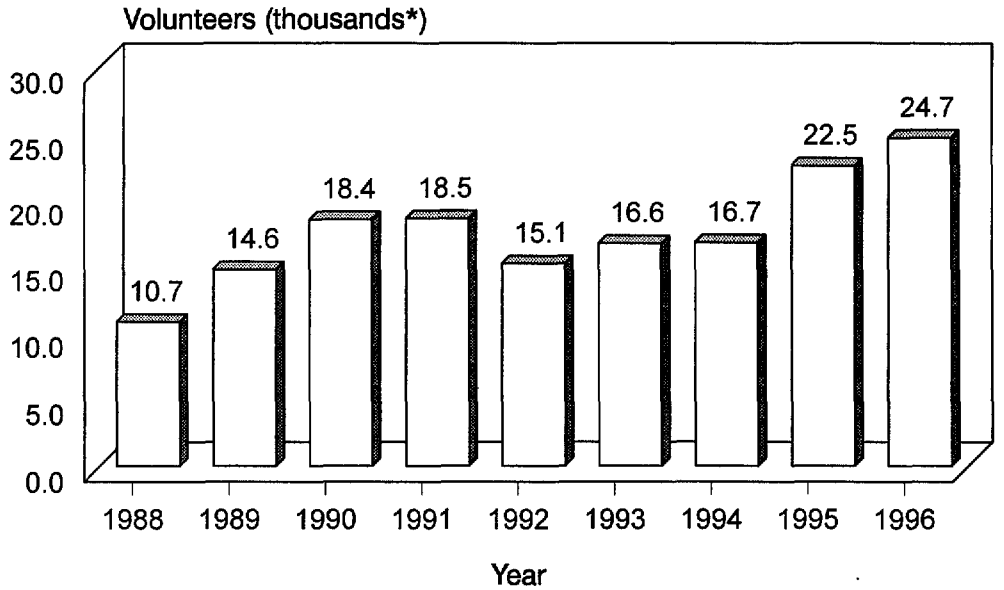
Data Limitations

The number of participants is determined from actual sign-ins; thus, it will not capture participants who do not formally register. Also, the Florida Coastal Cleanup is held once per year and does not reflect individual and local government efforts to clean the beach. In addition, it is possible that non-residents also participate, so the numbers of volunteers may overestimate participation by Florida residents. Finally, bad weather on the day of cleanup can be a limiting factor in participation and area covered.

Data Analysis

Since 1989, participation in the Florida Coastal Cleanup has remained relatively stable with a noticeable increase in participation in 1995 and 1996. Fluctuations in attendance at the cleanups is likely to vary based on the amount of advertising conducted, weather, and other environmental conditions. Attendance increased 73% from the first year of the cleanup (1988) to the peak attendance year of 1991, most likely due to increased awareness and popularity of the program. Some of the decline in attendance beginning in 1992 may be explained by the low number of participants in Dade and Broward counties following Hurricane Andrew. Attendance reached an all-time high in 1996 with 24,660 volunteers. The miles covered also hit an all-time low. From 1988 to 1995, roughly 1,650 tons of trash were picked up along Florida's coast, indicating the positive impact of the cleanup efforts as well as the continual problem of managing human use of the marine environment.

Number of Volunteers in the Florida Coastal Cleanup



*figures have been rounded to the nearest 0.1 thousand volunteers

Number of Volunteers, Miles Cleaned, and Tons of Trash Collected, 1988-1996

Year	Number of Volunteers	Miles Cleaned	Tons Collected
1988	10,676	914.6	194
1989	14,632	911	197.72
1990	18,413	1,050	199.83
1991	18,488	1,203	180
1992	15,076	1,307.26	151.97
1993	16,603	1,188.7	183
1994	16,670	1,267	167
1995	22,528	1,573	212
1996	24,660	822	172
AVERAGE	17,527	1,137	184

Section J

Indicators No Longer Included In FACT

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For the convenience of previous readers of FACT, the following is a list of indicators which were removed from the indicator system due to a lack of indicator-quality data. These indicators may be included in future editions if data becomes available. It is our hope that these issues will remain topics of conversation until data becomes available or better measurements are developed. This list does not include the original titles of the indicators which underwent title changes.

Impact of Growth in the Coastal Zone

- Proportion of State's Municipal Solid Waste Attributed to Coastal Counties
- Municipal Solid Waste Processed by Recycling, Landfill, and Waste-to-Energy Facilities

Disruption of Coastal Physical Processes

- Groundings on Coral Reefs and Seagrass Beds
- Miles of Coastal Armoring
- Number of Threatened Coastal Structures

Responding to Coastal Threats and Hazards

- Navigational Shipping Accidents

Degradation and Restoration of Coastal Ecosystems

- Changes in Mangrove and Salt Marsh Species Distribution and Abundance
- Changes in Beach Mice Ranges
- Globally Rare Species
- Northward Range Extension of Tropical Fishes and Invertebrates
- Number of Waterbodies with Fish Consumption Advisories Due to Bioaccumulation of Mercury

Managing Fresh Water Resources

- Permitted Aquifer Storage and Recovery Facilities

Sustaining the Human Use of the Coast

- Number of Tourist Visits to Coastal Areas
- Number of Tourists that Would Return to Coastal Areas
- Recreational Saltwater Fishing Value
- Miles of Developed Coastal Areas
- Number of Power Plants

Balancing Public and Private Uses of the Coast

- Developed and Agricultural Land Along the Coast
- Public Access Points Along the Coast
- Beachfront Properties Under Public Ownership
- Undeveloped Coastal Properties

Preservation of Cultural and Aesthetic Resources

- Acreage of Coastal Open Space
- Coastal Parks: Number and Shoreline Miles
- Miles of Scenic Coastal Highways

Encouraging Public Awareness and Involvement

- Public Participation in Marine Wildlife Based Ecotourism

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