STATISTICAL REVIEW OF THE U.S. COASTAL ZONE

Materials prepared for the

Office of Coastal Zone Management

by

The Conservation Foundation
1717 Massachusetts Avenue, N. W.
Washington, D.C. 20036

Prepared under Contract No.:
NA 80AAA02282 (OCZM)

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U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

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INTRODUCTION

The information selected for presentation in this almanac was selected on the basis of relevance to resource issues, the quality of data, and economy in production of the document. We have selected data that are nationwide or regional in scope and, to the extent feasible, available by individual states. We have selected data that are recent in time, collected by known and uniform standards, and that related to natural resources. We excluded Alaska, usually, because it is less well known, studied, and catalogued, and because it is unique in so many ways. We excluded Hawaii, usually, because it also is unique in many ways. We also excluded the Great Lakes in order to focus on the ocean coast, although it is popular these days to talk of the great lakes as part of the nation's "coastal zone".

We have organized the data tables by natural resource categories and by the categories of use of the resources. Thus, information on recreational fish catches appears in a fisheries resource category while data on cash expenditures and days spent fishing appears in a use category with other recreational information.

The information that we present is derived largely from existing publications. In some cases, we have copied material directly from original sources; distilling the most important facts. In other cases (e.g., Tables 32d, 36, 38, and 45c) we have reorganized available information and presented it in new formats to reveal fresh insights. In some instances, we have taken raw information and analyzed it by our own methods (e.g., Tables 8, 9, 20, 21, 23, and 30).

While the federal government collects a great many facts, many of them are unavailable in a form that relates specifically or comprehensively to the coastal zone. For example, the government provides insurance to homeowners in flood prone areas but detailed information is not available about the extent and type of coastal investment, the proportion of policies in high hazard zones, the extent of land use controls provided by local government for resource protection, and so forth. Similarly, the federal

government has a large investment in wetlands protection but has not produced a recent national inventory of wetland types and the extent of past losses.

On the positive side, we are able to use some of the massive amount of general statistical data which, though not specifically oriented to the coast, can be used for coastal purposes where available on a county-by-county basis. In order to make use of this information, we have compiled a list of coastal counties which we have designated as being truly coastal in character. The information on energy, agriculture, employment, and population in the coast is all based on this county list.

Each table, or set of tables is preceded by interpretative comments which may briefly state the significance of the data and select a few highlights to bring to the reader's attention. Where necessary, we have added caveats about potential problems and limitations of the data, or we have described the origins of the data.

I SHOREFRONT

The coast consists of uplands and wetlands adjacent to and interacting with oceans and estuarine waters, as well as whatever freshwater may be a part of it. In contrast to this broad ill-defined band, or zone, the shorefront is itself the edge where land and water meet. It is the line we cross going from one realm to the other.

We provide in this section some of the fundamental characteristics describing this place -- how big it is, who owns it, what do we do with it, how we have tried to protect it. Barrier islands are given considerable attention in this section, because they are so heavily influenced by the forces of the sea -- storms, tides, currents, and winds--and are therefore often poorly suited for occupancy.

1. SHORELINE LENGTH

The length of the shoreline--the boundary between the land and the sea or its estuaries--provides the basic description of the coast. Several measures of the length of the shoreline have been developed for a variety of uses. The differing measures reflect different amounts of shoreline detail. The Department of Commerce has devised two measures: 1) the "General Shoreline" which includes only those sounds and bays that have entrances wider than 30 miles, and then only to the point where they narrow to this distance. (Thus, this measure does not include the shoreline of the Chesapeake or San Francisco Bays, for example), and 2) the "Tidal Shoreline" which includes the shores of tidal waters to the head of tidewater, or to a point where tidal waters narrow to a width of 100 feet. The U.S. Army Corps of Engineers has devised a separate measure: the "National Shoreline" which also goes to the head of tidewater.

Table 1. LENGTH OF THE UNITED STATES SHORELINE.

	General Coastline[1]	Tidal Shoreline[1]	National Shoreline[2]
United States	13,443	91,154	80,577
Coterminous only	4,993	53,677	32,344
Atlantic	2,069	28,673	18,691
Gulf of Mexico	1,631	17,141	8,989
Pacific	7,623	40,298	52,897
Artic	1,060	2,521	---
Maine	228	3,478	2,500
New Hampshire	13	131	40
Massachusetts	192	1,519	1,200
Rhode Island	40	384	340
Connecticut	---	618	270
New York	127	1,850	638
New Jersey	130	1,792	469
Pennsylvania	---	89	---
Delaware	28	381	226
Maryland	31	3,190	1,939
Virginia	112	3,315	993
North Carolina	301	3,375	3,661
South Carolina	187	2,876	3,063
Georgia	100	2,344	204
Florida (Atlantic only)	580	3,331	2,316
Florida (Gulf only)	770	5,095	3,949
Florida (Atlantic and Gulf)	1,350	8,426	6,265
Alabama	53	607	352
Mississippi	44	359	247
Louisiana	397	7,721	1,943
Texas	367	3,359	2,498
California	840	3,427	1,827
Oregon	296	1,410	500
Washington	157	3,026	2,337
Alaska (Pacific only)	5,580	31,383	---
Alaska (Artic only)	1,060	2,521	---
Alaska (Pacific and Artic)	6,640	33,904	47,300
Hawaii	750	1,052	930

Sources: [1]U.S. Department of Commerce, NOAA. 1975. The Coastline of the United States; [2]U.S. Army Corps of Engineers. 1971. The National Shoreline Study.

2. SHORELINE OWNERSHIP

The ownership of the shoreline is a major factor in determining who has access from land to sea. This table summarizes the ownership of the shoreline shoreward of Mean High Water, most of which is privately owned (in the majority of states, the land seaward of Mean High Water is public property). Public ownership landward of Mean High water is at a minimum in the North Atlantic region (13%), and at a maximum in the South Atlantic region (56%). Note: "Non-federal public" ownership is land owned by the states, counties or other non-federal public entity.

Table 2. OWNERSHIP OF THE SHORELINE BY STATE.

State or Region	Federal Miles	%	Non-Federal Public Miles	%	Private Miles	%
Maine	20	*	60	2	2420	97
New Hampshire	2	5	10	25	28	70
Massachusetts	90	8	175	15	935	78
Rhode Island	10	3	50	15	280	82
Connecticut	5	2	50	19	215	80
New York	34	5	202	32	402	63
New Jersey	67	14	130	28	272	58
Delaware	12	5	46	20	168	74
Maryland	225	12	35	2	1679	87
Virginia	109	11	115	12	769	77
North Carolina[1]	573	16	59	2	1038	28
South Carolina[1]	435	14	1452	47	832	27
Georgia	29	14	23	11	153	75
Florida[1]	689	11	277	4	5203	83
Florida (Atlantic)[1]	159	7	87	4	2028	88
Florida (Gulf)[1]	530	13	190	5	3175	80
Alabama	2	*	13	4	337	96
Mississippi	33	13	43	17	171	69
Louisiana	246	13	332	17	1366	70
Texas	388	16	55	2	2055	82
California	411	22	357	20	1057	58
Oregon	83	17	158	32	238	48
Washington	155	7	107	5	2075	89
TOTAL[1]	3618	11	3749	12	21693	67
Maine to Virginia	574	7	873	11	7168	87
North Carolina to Atlantic Florida[1]	1196	13	1621	18	4051	44
Gulf Florida to Texas	1199	13	633	7	7104	79
Pacific	649	14	622	13	3370	72

[1] Some shoreline of uncertain ownership
* Less than 1%
Source: U.S. Army Corps of Engineers, 1971. The National Shoreline Study.

3. SHORELINE USES

How has the shoreline been portioned among major uses? This table provides the answer by four, broad categories. Public recreational shoreline -- including public parks, boat launch ramps and moorage facilities for recreation -- has the smallest slice. Private recreational shoreline -- including similar facilities for private use -- is next. Non-recreational shoreline -- including shoreline developed for nonrecreational activities, such as industries, residences, and harbors -- is second to largest. Undeveloped shoreline with no facilities -- including considerable recreational opportunity for those who would rough it -- has the largest slice.

Table 3. THE USES OF THE SHORELINE BY STATE.

State or Region	Public Recreation Miles	%	Private Recreation Miles	%	Nonrecreational Developed Miles	%	Undeveloped Miles	%
Maine	13	*	967	39	260	10	1260	50
New Hampshire	8	20	30	75	2	5	0	0
Massachusetts	235	20	800	67	85	7	80	7
Rhode Island	50	15	270	79	20	6	0	0
Connecticut	30	11	225	83	15	6	0	0
New York	210	33	70	11	250	39	108	17
New Jersey	290	62	35	7	12	3	132	28
Delaware	33	15	34	15	3	1	156	69
Maryland	105	5	111	6	1623	84	100	5
Virginia	50	5	56	6	155	16	732	74
North Carolina	98	3	321	9	239	7	3003	82
South Carolina	84	3	50	2	580	19	2349	77
Georgia	16	8	5	3	0	0	183	89
Florida	386	6	763	12	1445	23	3672	59
Alabama	32	9	210	60	5	1	105	30
Mississippi	31	13	106	43	10	4	101	41
Louisiana	18	*	28	1	46	2	1851	95
Texas	386	15	160	6	107	4	1845	74
California	432	24	178	10	228	12	989	54
Oregon	205	41	81	16	110	22	104	21
Washington	147	6	40	2	77	3	2073	89
TOTAL	2859	9	4542	14	5272	17	18843	60
Maine to Virginia	1024	12	2598	30	2425	28	2568	30
North Carolina to Texas	1051	6	1645	9	2432	13	13109	72
Pacific	784	17	299	6	415	20	3166	68

* Less than 1%

Source: U.S. Army Corps of Engineers, 1971. The National Shoreline Study.

4. BEACH LENGTH

Sunbathing is the core of a coastal vacation. The states are blessed with varying amounts of beaches -- from 2 to 79% of their total shoreline. The Pacific coast has the highest percentage of shoreline as beaches (55%), but states on other coasts may also have extensive beaches.

The definition of a beach in the National Shoreline Study (from which this information is taken) is somewhat variable. Most Corps Districts define a beach as an area with sand between high and low tide, but one District (Alaska) calls it an area of unconsolidated material between the low and extreme high waterlines.

Table 4. LENGTH OF BEACH BY STATE.

State	Miles of Beach	Pct. of National Shoreline in Beaches	State or Region	Miles of Beach	Pct. of National Shoreline in Beaches
Maine	60	2	Alabama	227	65
New Hampshire	25	63	Mississippi	97	39
Massachusetts	940	78	Louisiana	835	43
Rhode Island	185	54	Texas	377	15
Connecticut	145	54	California	412	23
New York	331	52	Oregon	300	60
New Jersey	215	46	Washington	1847	79
Delaware	76	34	TOTAL	10983	30
Maryland	46	2			
Virginia	294	30	Maine to Virginia	2320	27
North Carolina	1269	35	North Carolina to Atlantic Florida	3600	25
South Carolina	196	6	Florida Gulf to Texas	2504	29
Georgia	102	50	Pacific	2559	55
Florida Atlantic	390	15			
Florida Gulf	968	26			

[1] See Table 1 for "National Shoreline" lengths by State.
Source: U.S. Army Corps of Engineers. 1971. The National Shoreline Study.

5. SHORELINE EROSION

Nature continually shapes the coastline. It tears sediments away from one place (erosion), and leaves them in another (deposition). Erosion and deposition may operate in the same place but during different seasons (see below). Many areas have undergone net erosion loss in recent years. Nationwide, almost half of our shores are eroding. The North Atlantic states have the highest percentage of erosion, while the South Atlantic states have the lowest. New York is the state with the highest percentage of eroding shoreline (100%), and Washington State has the lowest percentage of eroding shoreline (4%).

Erosion is a natural hazard and presents a problem for the owners and users of many shoreline developments and facilities. In this table, there are two classes of erosion. The first is critical, and the second is noncritical. An area experiencing one or the other is significantly eroding. Critical erosion is erosion which "presents a serious problem because the rate of erosion considered in conjunction with economic, industrial, recreational, agricultural, navigational, demographic, ecological, and other relevant factors indicates that action to halt such erosion may be justified" (Source, same as table 5) Noncritical erosion does not mean insignificant: "Many noncritical eroding shores in all probability would have been classified critical if development had occurred close to the shore." (Source, same as table 5).

EROSION AND DEPOSITION OPERATE SEASONALLY. The processes of erosion and deposition can work in the same place but at different seasons. This figure shows the growth and erosion of a beach near Carmel, California by a series of dated slopes, based on actual measurements. Vertical dimension is exaggerated ten times. The dotted line shows how the berm was cut back during the following winter. (Figure courtesy of Scientific American)

Table 5. LENGTH OF ERODING SHORELINE BY STATE.

State or Region	Total Shoreline	Critically eroding Miles	%	Non critically eroding Miles	%	Significantly eroding[1] %	Not eroding Miles	%
Maine	2,500	20	*	2,475	99	99	5	*
New Hampshire	40	2	5	36	90	95	2	5
Massachusetts	1,200	135	11	1,030	86	97	35	3
Rhode Island	340	5	7	310	91	98	5	1
Connecticut	270	25	9	240	89	98	5	2
New York	638	299	47	399	53	100	0	0
New Jersey	469	122	26	110	23	49	237	51
Delaware	226	28	12	31	14	26	167	74
Maryland	1,939	180	9	1,500	77	86	259	13
Virginia	993	258	26	300	30	56	435	44
North Carolina	3,661	539	15	723	20	35	2,399	66
South Carolina	3,063	57	2	191	6	8	2,815	92
Georgia	204	7	4	37	18	22	160	78
Florida	6,266	292	5	690	11	16	5,284	84
Alabama	352	33	9	111	32	41	206	59
Mississippi	247	37	15	69	28	43	142	57
Louisiana	1,943	29	2	1,554	80	82	360	19
Texas	2,498	93	4	259	10	14	2,146	86
California	1,827	80	4	1,487	81	85	260	14
Oregon	500	64	13	102	20	33	335	67
Washington	2,337	7	*	91	4	4	2,239	96
TOTAL	31,513	2,332	7	11,685	37	45	17,496	55
Maine to Virginia	8,615	1,094	13	6,371	74	87	1,150	13
North Carolina to Georgia	6,928	603	9	951	14	22	5,374	78
Florida to Texas	11,306	484	4	2,683	24	28	8,138	72
Pacific	4,664	151	3	1,680	36	39	2,834	61

*Less than 1%

[1]Significantly eroding = critically eroding and non critically eroding.

Source: U.S. Army Corps of Engineers. 1971. The National Shoreline Study.

6. EROSION CONTROL

To September 30, 1978, $109 million have been spent for Federal/local cooperative beach protection projects authorized by The Congress and managed by the U.S. Army Corps of Engineers. The purpose of most projects has been to forestall beach erosion, a process driven by powerful natural forces that often frustrates the most advanced engineering technology. While groins, bulkheads, and seawalls are imperfect solutions because they go against nature, people who have already built too close to the sea often have no better solution. Table 6 presents the total reported costs by the Corps for beach protection but does not include elaborate inlet navigation projects with their jetties and seawalls, which could otherwise be classified as beach erosion control measures.

Table 6. EXPENDITURES ON BEACH EROSION CONTROL PROJECTS.

State	No. of Projects	Construction Costs Total Federal	Construction Costs Local Contribution[1]	Percent Local
Maine	0	---	---	---
New Hampshire	2	821,583	325,999	28
Massachusetts	8	2,360,178	1,450,245	38
Rhode Island	3	1,066,261	345,146	24
Connecticut	18	2,312,104	1,047,195	31
New York	2	19,772,153	13,872,883	41
New Jersey	5	2,945,601	1,146,325	28
Delaware	2	329,365	0	0
Maryland	1	97,750	80,648	45
Virginia	3	2,256,366	385,845	15
North Carolina	1	620,000	0	0
South Carolina	1	1,535,352	637,336	29
Georgia	1	2,137,738	2,024,856	49
Florida	13	17,998,725	9,765,976	35
Alabama	0	---	---	---
Mississippi	1	1,133,000	0	0
Louisiana	0	---	---	---
Texas	1	1,543,344	1,543,344	50
California	12	9,244,867	4,370,646	32
Oregon	0	---	---	---
Washington	1	5,868,378	225,069	4
TOTAL		72,042,165	37,221,513	34
TOTAL FEDERAL AND LOCAL		109,263,678		

[1] Operation and maintenance costs assumed by local authorities and not listed here.

Source: Adapted from U.S. Army Corps of Engineers, Chief of Engineers. FY 1978 Annual Report, Volume II, Field Reports.

7. BARRIER ISLANDS

Barrier islands pose special beach problems. These are the long low sandy islands located off mainland coasts. They are a subclassification of barrier structures which includes spits and peninsulas having many of the same planning problems as the barrier islands we list here. A few notable examples of barrier structures are: Guano Spit, 32 miles long in St. Johns County, Florida; Cape San Blas Spit, 20.4 miles long in Gulf County, Florida; Gulf Shores (Mobile Point Spit), 29.4 miles long in Baldwin County, Alabama; and Matagorda Peninsula, 51.4 miles long in Matagorda County, Texas. There are many others as well. Barrier islands range from wild and isolated to heavily urbanized. Galveston, Atlantic City, Miami Beach, and Hatteras are examples of cities located on barrier islands. Active barrier islands are fronted by ocean beaches, and often backed by extensive marshes or mangrove swamps. These islands take the brunt of the ocean's force, and so provide a buffer between the mainland and the seas. They change constantly in shape and size as well as in number, as new inlets open, or old inlets close. This dynamic feature drew the Department of the Interior to conclude that permanent human habitation of many barrier islands is hazardous.[1] This same report lists almost 300 barrier islands, from which we selected for Table 7 true barrier islands generally over 500 acres in highland area, based on an earlier report (See Table 7 for source). Some no longer appear as islands, having recently become part of the mainland. A few (the sea islands of Georgia) are not strictly barrier islands, because they are Pleistocene rather than Holocene formations; i.e., they are composed of older sediments than the true barrier islands.

[1] U.S. Department of the Interior, Heritage Conservation and Recreation Service. 1980. Alternative Policies for Protecting Barrier Islands Along the Atlantic and Gulf Coasts of the United States, and Draft Environmental Impact Statement. Washington, D.C. 20243.

Table 7. CHARACTERISTICS OF MAJOR BARRIER ISLANDS (ATLANTIC AND GULF COASTS).

State/Island Name	Length	Access	County
Atlantic Coast Barrier Islands			
Massachusetts			
Plum Island	8.4	Bridge	Essex
Monomoy Island	8.9	Boat	Barnstable
New York			
Westhampton	15.2	3 Bridges	Suffolk
Fire Island	53.4	Ferries, 2 Bridges	Suffolk
Jones Beach Island	14.5	3 Bridges	Suffolk and Nassau
Long Beach Island	9.5	3 Bridges	Nassau
New Jersey			
Sandy Hook	12.7	Bridges, Ferry, Highway	Monmouth
Island Beach	20.9	3 Bridges	Ocean
Long Beach Island	20.2	1 Bridge	Ocean
Pullen Island	4.3	Boat	Atlantic
Brigantine	8.2	1 Bridge	Atlantic
Absecon	8.3	6 Bridges	Atlantic
Peck Beach	8.4	4 Bridges	Cape May
Ludlam Beach	3.5	3 Bridges	Cape May
Seven Mile Beach	7.7	4 Bridges	Cape May
Wildwood	6.6	3 Bridges	Cape May
Delaware			
Fenwick Island (Delaware portion)	6.1	Highway	Sussex
Maryland			
Fenwick Island (Maryland portion)	8.8	2 Bridges, Highway	Worcester
Assateague Island (Maryland portion)	21.7	1 Bridge	Worcester
Virginia			
Assateague Island (Virginia portion)	13.3	1 Bridge	Accomack
Wallops Island	6.5	Causeway	Accomack
Metomkin Island	6.6	Boat	Accomack
Cedar Island	6.6	Boat	Accomack

Table 7. CHARACTERISTICS OF MAJOR BARRIER ISLANDS (ATLANTIC AND GULF COASTS) (cont.).

State/Island Name	Length	Access	County
South Carolina (cont.)			
Bull Island	7.1	Ferries	Charleston
Capers Island	3.1	Boat	Charleston
Isle of Palms	6.9	Bridge	Charleston
Folly Island	6.5	Bridge	Charleston
Kiawah Island	10.1	Bridge	Charleston
Seabrook Island	1.9	Bridge	Charleston
Edisto Island	5.8	Bridge	Charleston
Hunting Island	4.2	Bridge	Beaufort
Fripp Island	3.9	Bridge	Beaufort
Pritchards/Long Island	2.6	Boat	Beaufort
St. Phillips Island	1.2	Boat	Beaufort
Hilton Head Island	13.8	Bridge, Airport	Beaufort
Dafuskie Island	3.7	Boat	Beaufort
Georgia			
Savannah Beach	3.2	Bridge	Chatham
Tybee Island	5.6	Boat	Chatham
Wassaw Island	6.1	Boat	Chatham
Ossabaw Island	10.2	Boat	Chatham
St. Catherines Island	10.7	Boat	Bryan
Blackbeard Island	8.0	Boat	McIntosh
Sapelo Island	5.8	Ferry	McIntosh
Little St. Simons Island	7.8	Boat	McIntosh/Glynn
St. Simons Island	4.3	Causeway	Glynn
Jekyll Island	8.4	Causeway, Bridge	Glynn
Little Cumberland Island	2.8	Boat	Glynn
Cumberland Island	16.6	Ferry	Glynn
Florida			
Amelia Island	13.0	2 Bridges	Nassau
Little Talbot Island	7.0	2 Bridges	Duval
Anastasia Island	14.5	3 Bridges	St. Johns
Canaveral	53.8	Bridge, Causeway, Railroad	Volusia/Brevard
Cocoa Beach Island	39.2	8 Bridges, Causeways	Brevard
Vero Beach Island	28.5	5 Bridges, Causeways	Indian R./St. Lucie

Table 7. CHARACTERISTICS OF MAJOR BARRIER ISLANDS (ATLANTIC AND GULF COASTS) (cont.).

State/Island Name	Length	Access	County
Florida (cont.)			
Hutchison Island	22.4	4 Bridges, Causeways	St. Lucie/Martin
Jupiter Island	16.1	2 Bridges	Martin/Palm Beach
Lake Worth	12.1	2 Bridges	Palm Beach
Palm Beach	15.6	6 Bridges	Palm Beach
Boca Raton	14.5	3 Bridges	Palm Beach
Hillsboro Beach	5.5	3 Bridges	Palm Beach/Broward
Ft. Lauderdale	11.3	3 Bridges	Broward
Hollywood Beach	13.2	Bridges	Broward
Miami Beach	9.4	6 Bridges	Dade
Virginia Key	1.8	Bridge	Dade
Key Biscayne	4.8	Bridge	Dade

Number of Atlantic Coast Barrier Islands = 93

Gulf of Mexico Barrier Islands

Florida			
Cape Romano/Kice Island	4.8	Boat	Collier
Marco Island	4.6	2 Bridges	Collier
Keewaydin Group	9.3	Boat	Collier
Bonita Beach	5.6	Bridge	Collier/Lee
Lover's Key Group	2.7	2 Bridges	Lee
Estero Island	7.1	2 Bridges	Lee
Sanibel Island	11.2	Causeway, Bridge	Lee
Captiva Island	6.2	Bridge	Lee
North Captiva Island	4.2	Boat	Lee
Cayo Costa	8.0	Boat	Lee
Gasparilla Island	6.9	2 Bridges, Railroad	Lee/Charlotte
Bocilla Island	6.2	Boat	Charlotte
Manasota Key	13.3	3 Bridges	Charlotte/Sarasota
Casey Key	7.1	2 Bridges	Sarasota
Siesta Key	7.3	2 Bridges	Sarasota
Lido Key	2.3	2 Bridges	Sarasota
Longboat	10.4	2 Bridges	Sarasota/Manatee
Anna Maria Key	7.6	3 Bridges	Manatee
Mullet Key	2.6	Bridge	Pinellas
Long Key	4.1	3 Bridges	Pinellas
Treasure Island	3.5	3 Bridges	Pinellas

Table 7. CHARACTERISTICS OF MAJOR BARRIER ISLANDS (ATLANTIC AND GULF COASTS) (cont.).

State/Island Name	Length	Access	County
Florida (cont.)			
Sand Key	14.1	4 Bridges	Pinellas
Clearwater Beach Island	3.3	3 Bridges	Pinellas
Caladesi Island	2.4	Boat	Pinellas
Anclote Keys	3.4	Boat	Pinellas/Pasco
Dog Island	8.0	Ferry	Franklin
St. George Island	18.7	Bridge	Franklin
Little St. George Island	10.1	Boat	Franklin
St. Vincent Island	8.7	Boat	Franklin
Hurricane/Shell Island	5.9	Boat	Bay
Santa Rosa Island	47.9	4 Bridges	Okaloosa/Escambia
Perdido Key (Florida portion)	13.2	2 Bridges	Escambia
Alabama			
Perdido Key (Alabama portion)	1.6	2 Bridges	Baldwin
Dauphin Island	13.8	Bridge	Mobile
Little Dauphin Island	3.5	Bridge	Mobile
Mississippi			
Petit Bois (Pettibone) Island	7.0	Boat	Jackson
Horn Island	14.1	Boat	Jackson
Ship Island[1]	5.7	Tourboat	Harrison
Cat Island	3.9	Boat	Harrison
Louisiana			
Chandeleur and Breton Islands	27.8	Boat	St. Bernard/Plaquemines
Grand Isle	7.2	Bridge	Jefferson
Timbalier Island	8.3	Boat	Lafourche/Terrebone
Isles Dernieres[2]	16.2	Boat	Vermillion/Cameron/ Terrebone

Table 7. CHARACTERISTICS OF MAJOR BARRIER ISLANDS (ATLANTIC AND GULF COASTS) (cont.)

State/Island Name	Length	Access	County
Texas			
Galveston Island	28.6	Bridges	Galveston
Matagorda Island	36.2	Boat, Airfield	Calhoun
St. Joseph Island	19.3	Boat, Airfield	Aransas/Nueces
Mustang Island	18.0	Ferry, Bridges	Nueces
Padre Island North	75.1	Causeway	Nueces/Kleberg/Kenedy
Padre Island South	39.9	Causeway	Willacy/Cameron

Number of Gulf Coast Barrier Islands = 55

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[1] Two islands
[2] Eight islands
Source: Adopted from John R. Clark, et. al., July 1977. Review of Major Barrier Islands of the United States. New York: The Barrier Islands Workshop; Robert Peoples, U.S. Fish and Wildlife Service, Washington, D.C. Pers. comm.

8. BARRIER ISLANDS

Over 1500 miles of major barrier islands front the Atlantic and Gulf Coasts. These islands maintain quiet sounds, estuaries or lagoons between themselves and the mainland for fisheries, nurseries for fishes, marshes, and recreation on calmer waters. This table compares the general shoreline to the length of barrier islands fronting each state. Maryland has the highest percentage of its shoreline fronted with barrier islands, because the general shoreline measures only Maryland's ocean coast. North Carolina is second.

Table 8. LENGTH OF BARRIER ISLAND BY STATE.

State	No. of Islands[1]	Total Length (mi.)	% of General Shoreline[2]	State or Region	No. of Islands	Total Length (mi.)	% of General Shoreline
Massachusetts	2	18	9	Louisiana	11	59	15
New York	4	93	73	Texas	6	217	59
New Jersey	10	100	77	TOTAL	147	1,610	47
Delaware	1	6	21	Massachusetts to Atlantic Florida	95	1,063	50
Maryland	2	31	98	Massachusetts to Virginia	28	315	50
Virginia	9	67	60	North Carolina to Atlantic Florida	67	753	65
North Carolina	20	285	95	Florida Gulf to Texas	52	542	35
South Carolina	18	96	51				
Georgia	12	89	89				
Florida	49	560	41				
Florida Atlantic	17	283	49				
Florida Gulf	32	247	32				
Alabama	3	19	86				

[1] not additive, because some islands are in two states.
[2] U.S. Department of Commerce, NOAA. 1975. The Coastline of the United States; U.S. Army Corps of Engineers. 1971. The National Shoreline Study.

Source: Adopted from John R. Clark, et. al., July 1977. Review of Major Barrier Islands of the United States. New York: The Barrier Islands Workshop; Robert Peoples, U.S. Fish Wildlife Service, Washington, D.C. Pers. comm.

9. BARRIER ISLAND DEVELOPMENT

Barrier island change constantly in size and shape. The Department of the Interior has concluded that most are poor places for permanent human habitation.[1] Nevertheless, over one-third of the length of major barrier islands is developed. Development reaches its peak in New Jersey, and is at a minimum in Mississippi. Over one-third of the length of major barrier islands is preserved. Land which is preserved is defined as being owned by an individual or organization which has the intent and the ability to keep its property in an undeveloped state for the forseeable future. The highest proportion of preserved barrier island is on the North Atlantic coast (58%). Over one-quarter of barrier island length is currently uncommitted to either development or preservation, although some of this length is on the verge of development, because it has the facilities, such as roads, power, and sewage which will allow development. Florida has the greatest expanse in this last category.

This information is presented, as is the other information on barrier islands, as length, because we find that the estimates of island area often vary widely between sources, while sources usually agree on length.

[1] See Text to Table 7.

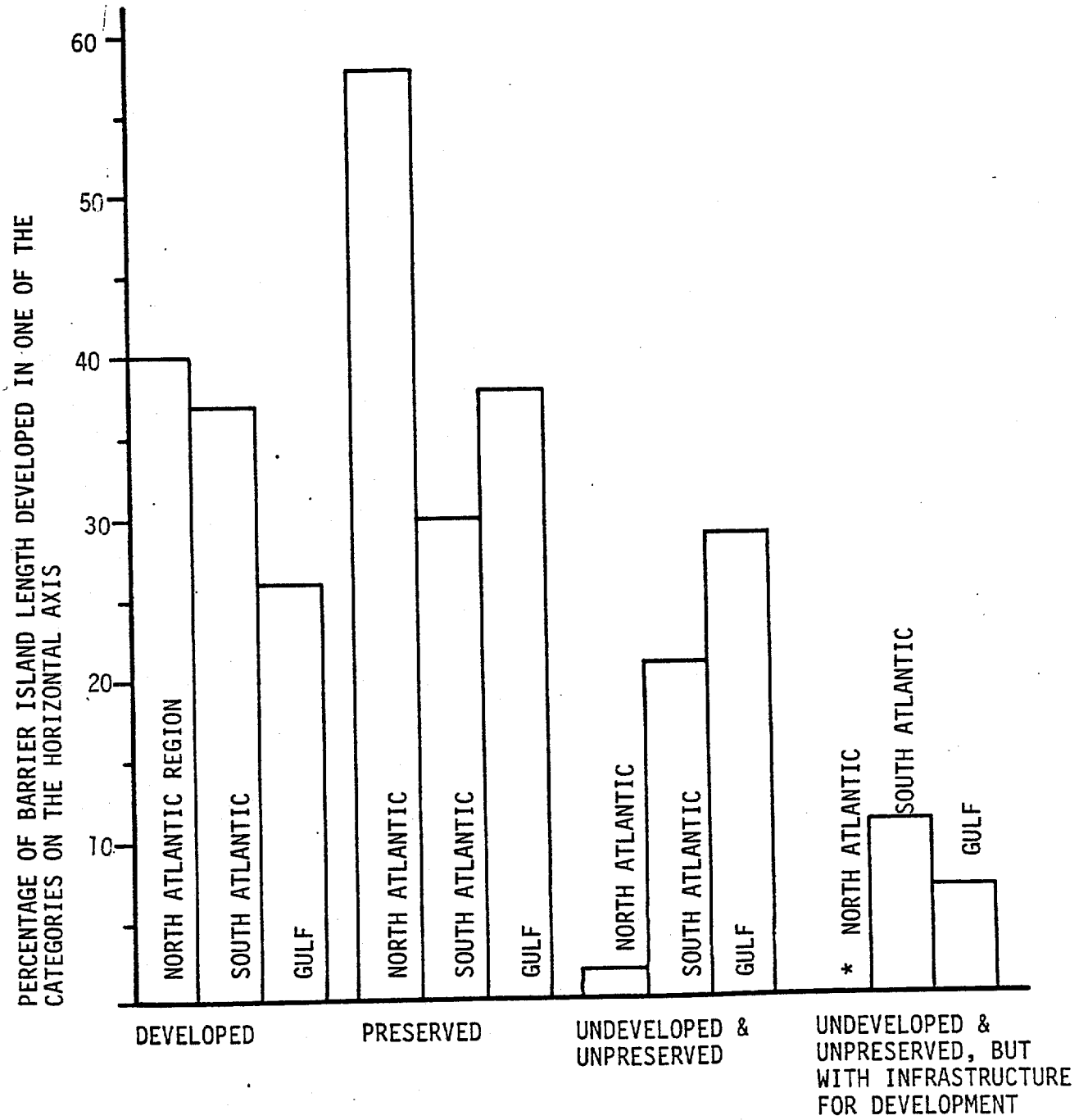
Table 9. DEVELOPMENT STATUS OF MAJOR BARRIER ISLANDS.

State or Region	Developed Miles	%	Preserved Miles	%	Undeveloped and Unpreserved Miles	%	Undeveloped and unpreserved but with infrastructure for development extant Miles	%
Massachusetts	1.8	10	15.5	90	0	0	0	0
New York	38.2	41	54.5	59	0	0	0	0
New Jersey	70.0	70	24.9	24	3.8	4	2.1	2
Delaware	3.0	49	2.3	38	0.8	13	0	0
Maryland	8.8	29	21.7	71	0	0	0	0
Virginia	3.0	4	64.4	96	0	0	0	0
North Carolina	94.7	33	119.8	42	47.1	17	23.8	8
South Carolina	33.2	35	34.5	36	21.4	22	6.9	7
Georgia	15.3	18	41.4	49	28.2	33	0	0
Florida	247.7	44	89.7	16	142.9	26	75.8	14
Florida Atlantic	135.9	48	28.3	10	64.2	23	54.3	19
Florida Gulf	103.8	43	45.4	19	72.7	30	21.5	9
Alabama	6.1	32	0.5	3	11.6	61	0.7	4
Mississippi	0	0	26.8	87	3.9	13	0	0
Louisiana	6.3	11	28.0	47	25.2	42	0	0
Texas	29.0	13	116.4	54	55.1	25	16.6	8
TOTAL	549.1	34	624.4	38	334.0	20	123.8	8
Atlantic	403.9	38	407.3	38	165.5	16	87.1	8
North Atlantic	124.8	40	183.3	58	4.6	1	2.1	*
South Atlantic	279.1	37	224.0	30	160.9	21	85.0	11
Gulf	145.2	25	217.1	38	168.5	30	38.8	7

* Less than 1%

Source: Adopted from John R. Clark. July 1977. Review of Major Barrier Islands of the United States. New York: The Barrier Islands Workshop; Robert Peoples, U.S. Fish and Wildlife Service, Washington, D.C. pers. comm.

9. BARRIER ISLAND DEVELOPMENT (Cont.)



BARRIER ISLAND DEVELOPMENT by type of development and region. (by Ruth Ann Hill). * Less than 1%

II PHYSICAL CHARACTERISTICS

Physical characteristics set a broad framework within which man, other animals, and plants must adapt and live. The flow of rivers to the sea dilutes in-rushing salt water, and the combination of the two forms estuaries (see Section VI). The salinity regime in an estuary changes in response to changes in river discharge. As river discharge varies, the salinity that a sedentary animal will experience also varies.

Sea level changes daily due to solar and lunar tides. Animals that live within the zone continually covered and uncovered by ebbing and flooding tides--the intertidal zone--are adapted to living now under water, and then under the air for long periods of time. Fifteen thousand years ago, sea level was 400 feet lower than it is today.

The range of temperatures at some places along the coast is large --over 50 degrees F at some places. People and animals who use the sea year round must make provisions for this wide range of temperatures.

10. RIVER DISCHARGES

Water which evaporates from the oceans and lakes forms the clouds which release rain or snow over land masses. Precipitation runs off the land and finds its way to rivers which flow to the coast. This water cycle has many implications. First, the positioning of salinity gradients in estuaries is controlled in part by river flow. Second, terrestial runoff carries pollutants -- ranging from sediments to fertilizer to pesticides, and other compounds -- into estuaries and the ocean. Third, many organisms have intricate adaptations to reproduction in the expected estuarine flow regimes. Thus, the flow of rivers to the sea is an important physical characteristic.

The information presented in Table 10 refers to the average flow of rivers discharging to coastal waters where those coastal waters are adjacent to the coterminous United States. Thus the St. Lawrence River, for example, which drains the United States is not listed. The flow of each river is highly variable. For example, the mean discharge of the Susquehanna River is about 40,000 cubic feet per second (cfs), but during Hurricane Agnes in June, 1972, its flow exceeded 1,000,000 cfs.

The three rivers with the largest average discharge to the sea in the coterminous United States are (1) The Mississippi at 650,000 cfs (37% of the U.S. total), (2) the Columbia river at 281,200 cfs (16% of the U.S. total), and (3) the Mobile River at 63,160 cfs (4% of the U.S. total).

Table 10. RIVER AND BASIN DISCHARGE TO THE SEAS.

Basin or River	Area Discharge (cfs)[1]	Area Discharge as a % of U.S. Discharge to Atlantic Ocean	River Discharge (cfs)[1]	River Discharge as a % of Basin Total
Passamaquoddy Bay to Penobscot Bay	23,500	6.5		
Penobscot River			16,750	71.3
St. George River to Cape Cod Bay	41,020	11.4		
Kennebec River			11,210	27.3
Androscoggin River			7,229	17.6
Saco River			4,040	9.8
Merrimack River			9,183	22.4
Cape Cod to New York-Connecticut State Line	34,810	9.7		
Connecticut River			21,400	61.5
Housatonic River			3,799	10.9
New York-Connecticut State Line to Cape May	32,770	9.1		

Table 10. RIVER AND BASIN DISCHARGE TO THE SEAS (cont.)

Basin or River	Area Discharge (cfs)	Area Discharge as a % of U.S. Discharge to Atlantic Ocean	River Discharge (cfs)	River Discharge as a % of Basin Total
Hudson River and smaller streams			22,700	69.3
Cape May to Cape Henry	101,200	28.2		
Delaware River			19,900	19.7
Susquehanna River			40,290	39.8
Potomac River			13,700	13.5
James River			10,030	9.9
Cape Henry to Neuse River	27,500	7.7		
Chowan River			4,626	16.8
Roanoke River			8,620	31.3
Pamlico River			4,693	17.1
Neuse River			5,703	20.7
Cove Sound to Black River	28,440	7.9		
Cape Fear River			9,475	33.3
Pee Dee River			15,270	53.7
Santee River to Sapelo Island	35,290	9.8		
Savannah River			10,280	29.1
Ogeechee River			3,513	10.0
Altamaha River to Cape Kennedy	25,860	7.2		
Altamaha River			12,140	46.9
St. Johns River			8,868	34.3
Cape Kennedy to Cape Sable	9,000	2.5		
Atlantic Ocean Total	359,400			

Basin or River	Area Discharge (cfs)	Area Discharge as a % of U.S. Discharge to Gulf of Mexico	River Discharge (cfs)	River Discharge as a % of Basin Total
Cape Sable to Alligator Creek	2,500	0.3		
Peace River to New River	27,200	3.1		
Suwanee River			680	39.3
Apalachicola River	26,700	3.0		
Wetappo Creek to Perdido River	25,100	2.8		
Choctawhatchee River			7,360	29.3

Table 10. RIVER AND BASIN DISCHARGE TO THE SEAS (cont.)

Basin or River	Area Discharge (cfs)	Area Discharge as a % of U.S. Discharge to Gulf of Mexico	River Discharge (cfs)	River Discharge as a % of Basin Total
Escambia River			6,880	27.4
Mobile Bay	64,200	7.2		
Mobile Bay			63,160	98.4
Pascagoula River to Pearl River	31,200	3.5		
Pascagoula River			15,200	48.7
Pearl River			12.900	41.3
Mississippi River	650,000	73.3		
Vermillion, Mermentau and Calcasie Rivers	10,800	1.2		
Sabine River to Rio Grande	49,700	5.6		
Sabine River			9,050	18.2
Neches River			8,240	16.6
Trinity River			7,490	15.1
Brazos River			6,220	12.5
Colorado River			3,000	6.0
Guadalupe and San Antonio Rivers			2,350	4.7
Nueces River			820	1.6
Rio Grande			660	1.3
Gulf of Mexico Total	887,400			

Basin or River	Area Discharge (cfs)	Area Discharge as a % of U.S. Discharge to Pacific Ocean	River Discharge (cfs)	River Discharge as a % of Basin Total
Colorado River	200	0.04		
Tia Juana River to Ventura River	500	0.1		
San Jose Creek to Pesadero Creek	2,400	0.5		
San Francisco Bay	30,400	6.1		
Lagunitas Creek to Smith River	42,100	8.4		
Eel River			9,120	21.7
Klamath River			17,100	40.6
Smith River			4,360	10.4

Table 10. RIVER AND BASIN DISCHARGE TO THE SEAS (cont.)

Basin or River	Area Discharge (cfs)	Area Discharge as a % of U.S. Discharge to Pacific Ocean	River Discharge (cfs)	River Discharge as a % of Basin Total
Oregon Coastal Area	53,300	10.7		
Rogue River			11,000	20.6
Umpqua River			10,700	20.1
Columbia River	281,200	56.4		
Naselle River to Nooksack River	89,100	17.8		
Chehalis River			7,730	8.7
Queets River			4,120	4.6
Snohomish River			8,800	9.9
Skagit River			16,350	18.4
Nooksack River			3,720	4.2
Pacific Ocean Total	499,200			
Coterminous United States Total	1,746,000			

[1] cfs is cubic feet per second which equals 448.8 gallons per minute

Source: Alfonso Wilson and Kathleen T. Iseri. 1969. River Discharge to the Sea from the Shores of the Conterminous United States, Alaska, and Puerto Rico. U.S. Department of the Interior, U.S. Geological Survey, Hydrologic Investigations Atlas HA-282.

11. SEA LEVEL CHANGES

The sea has been slowly and relentlessly rising from polar ice melt. Changes in relative sealevel along U.S. coasts are due not only to the change in height of sealevel, but also to the changes in the level of the land. From both causes, relative sealevel is rising -- at over 2 feet per century at Galveston, Texas; but, in isolated cases, decreasing at over 4 feet per century in Juneau, Alaska.

Many of our nation's coasts have shallow slopes that rise gradually. Relatively small changes in sealevel in these areas can drastically alter the extent of exposed or submerged lands. For example, on a coast with a 1 degree slope, a 20-inch vertical drop in sealevel would move the shoreline over 30 yards seaward.

Table 11. CHANGES IN SEA LEVEL OBSERVED AT SELECTED COASTAL POINTS.

	cm/ decade	inches/ century		cm/ decade	inches/ century
Northeast Coast			Southeast Coast		
Portland, ME	2.2	8.66	Charleston, SC	3.8	14.96
Eastport, ME	3.3	12.99	Savannah, GA	3.1	12.20
Boston, MA	2.8	11.02	Miami Beach, FL	2.6	10.24
Woods Hole, MA	3.3	12.99	Gulf Coast		
Newport, RI	3.0	11.81	Key West, FL	2.3	9.06
New London, CT	2.6	10.24	Pensacola, FL	2.7	10.63
Montauk, NY	2.6	10.24	Galveston, TX	6.3	24.80
New York, NY	2.9	11.42	Pacific Coast		
Sandy Hook, NJ	4.9	19.29	La Jolla, CA	1.7	6.69
Atlantic City, NJ	4.1	16.14	Los Angelos, CA	0.5	1.97
Lewes, DE	3.7	14.57	San Francisco, CA	1.3	5.12
Philadelphia, PA	2.8	11.02	Astoria, OR	-0.1	-0.39
Annapolis, MD	4.2	16.54	Seattle, WA	1.9	7.48
Solomons, MD	4.0	15.75	Friday Harbor, WA	1.0	3.94
Norfolk, VA	4.7	18.50	Juneau, AK	-13.4	-52.76
			Ketchikan, AK	-0.2	-0.79

Source: Modified from Steacy D. Hicks, March 20, 1978. An average geopotential Sea Level Series for the United States. J. Geophysical Research, Vol. 83, 1377-1379.

ATLANTIC COAST SHORELINE HAS VARIED GREATLY in the past and will undoubtedly continue to in the future. This illustration compares the shoreline of 15,000 and 11,000 years ago with the probable shoreline if all the ice at the poles were to melt. Confirmation that the continental shelf was once laid bare is found in discoveries of elephant teeth (triangles), freshwater peat (dots) and the shallow-water formations called oolites (circles).

WORLDWIDE CHANGES IN SEA LEVEL can be inferred from the radiocarbon ages of shallow-water marine organisms and the depth at which they were recovered. Samples are from the Atlantic shelf of North America, the Texas shelf and other parts of the world. The depth inconsistency of the Texas samples implies that the shelf there has been uplifted. (Figures courtesy of Scientific American).

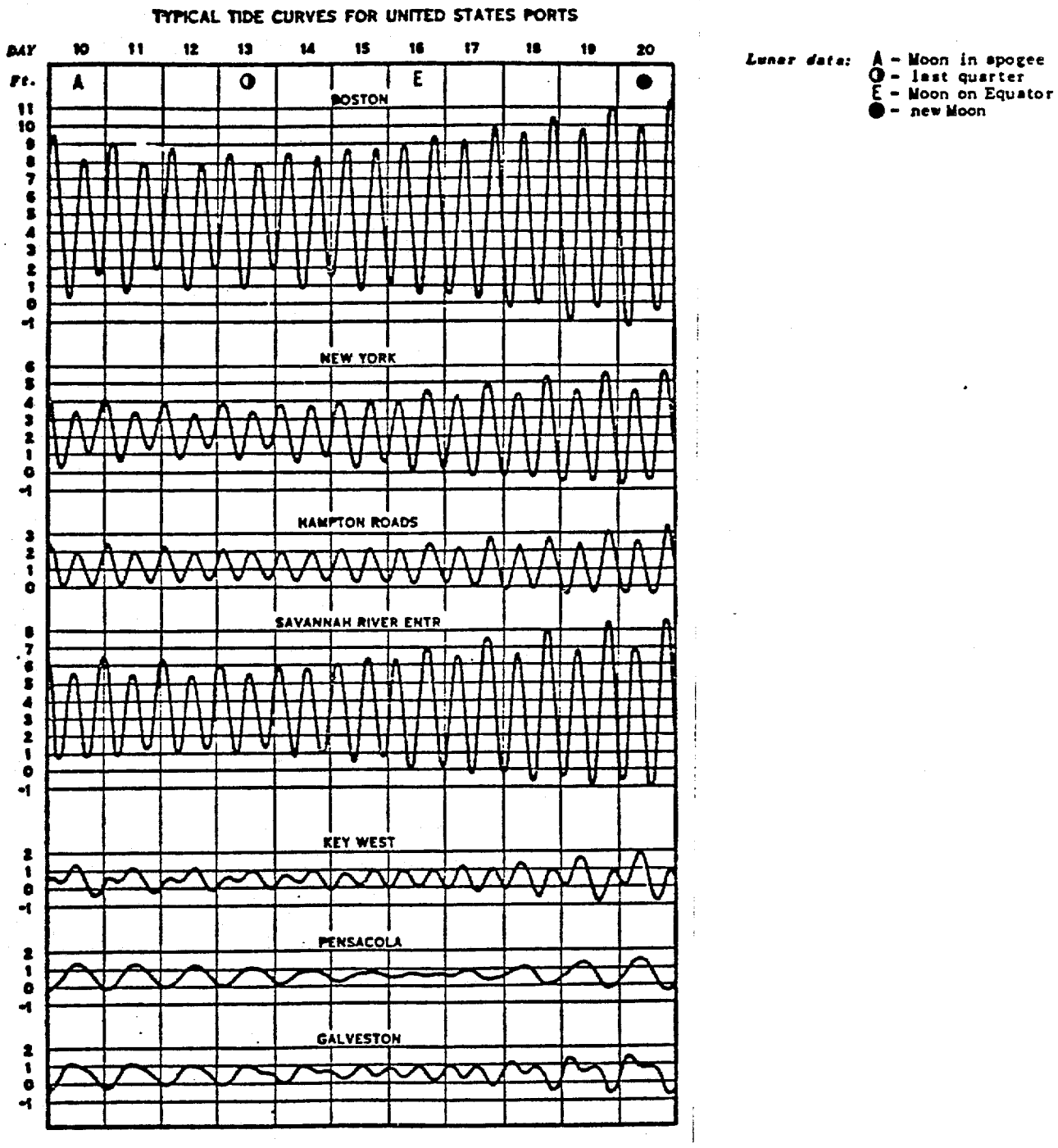
12. TIDE RANGES

The ebb and flood of the tide is one of the fascinating characteristics of the coast. Tides flood and drain many coastal wetlands and other intertidal areas, alternately subjecting the plants and animals to ocean waters, and the air. They produce currents (which often exceed three knots) in coastal waters which can be a detriment or an advantage to the mariner.

Tides are produced by the pull of the sun and the moon on the earth, and by the centrifugal force which produces a high tide on the side of the planet opposite the sun and the moon. The effect of the sun is about one-half that of the moon (0.46), because of the greater distance from the sun to the earth. In some places, the tide are semidiurnal, that is, there are two high and two low tides per day. In other places, the tides are diurnal, that is, there is only one high and one low tide per day. In either case, the tidal patttern repeats itself every 24 hours and 50 minutes (the length of a lunar cycle). When the sun and the moon are in line, which is the case during new and full moons, they produce high high tides, and low low tides termed "spring tides." When the sun and the moon are perpendicular to one another, they produce lower high tides, and higher low tides termed "neap tides." There are about two weeks between spring tides, and about two weeks between neap tides. Freshwater flow, winds, and extremes of barometric pressure can alter the expected tide pattern.

In this table, "mean range" is the difference between mean high and mean low waters. "Spring range" is the average range of tides which are the result of new and full moons. "Diurnal range" is the difference in height between mean higher high water, and mean lower low water in areas subject to diurnal tides. Of the stations given here, the maximum mean range is 26.1 feet in Anchorage, Alaska, or in the coterminous United States the maximum mean range is 18.2 feet in Eastport, Maine. The Bay of Fundy in Nova Scotia, Canada has the highest mean tide range in the world -- 38.4 feet -- and a spring tide range in excess of 43 feet.

12. TIDE RANGES (Cont.)



THE PATTERN OF TIDE at various places along the coast. Note that the largest amplitude of tides is near new or full moons. Pensacola tides are diurnal tides -- one high and one low tide per day. The patterns depicted above Pensacola are semi-diurnal tide patterns -- two highs and two lows per day. The pattern at Galveston is a mixed pattern -- sometimes diurnal and sometimes semi-diurnal. (Figure from same source as Table 12.)

Table 12. TIDE RANGES FOR SELECTED COASTAL POINTS.

	Mean (ft)	Spring (ft)
Maine		
Eastport	18.2	20.7
Bar Harbor	10.5	12.1
Portland	9.0	10.4
New Hampshire		
Portsmouth	7.8	9.0
Massachusetts		
Boston	9.0	10.4
Woods Hole (Oceanographic Institution)	1.8	2.2
Cape Cod Lighthouse	7.6	8.8
Rhode Island		
Newport	3.5	4.4
Block Island (Old Harbor)	2.9	3.6
Connecticut		
New London (State Pier)	2.6	3.1
New Haven (Harbor entrance)	6.2	7.1
New York		
Port Chester	7.2	8.5
Brooklyn Bridge	4.3	5.2
Port Jefferson	6.6	7.6
Fire Island Breakwater	4.1	5.0
New Jersey		
Sandy Hook	4.6	5.6
Atlantic City (Steel Pier)	4.1	5.0
Cape May Harbor	4.4	5.3
Delaware		
Rehoboth Beach	3.9	4.7
Cape Henlopen	4.1	4.9
Maryland		
Ocean City	3.4	4.1
Maryland (cont.)		
Crisfield (Little Annemessex River)	2.0	2.4
Baltimore (Fort McHenry)	1.1	1.3
Annapolis	0.9	1.0
St. Mary's City	1.5	1.7
Virginia		
Assateague Beach (Tom's Cove)	3.6	4.4
Ship Shoal Inlet	4.0	4.8
Tangier Sound Light	1.6	1.9
Alexandria	2.8	3.2
Norfolk	2.8	3.4
Virginia Beach	3.4	4.1
North Carolina		
Kitty Hawk (Ocean)	3.2	3.8
Cape Hatteras	3.6	4.3
Albemarle and Pamlico Sounds		
Oracoke Inlet	1.9	2.3
Beaufort (Pivers Island	3.0	3.6
Wilmington	4.2	4.5
South Carolina		
Myrtle Beach	5.1	6.0
Georgetown Lighthouse	3.8	4.4
Charleston (Customhouse Wharf)	5.2	6.1
Folly Island	5.2	6.1
Parris Island (Beaufort River)	7.1	8.3
Georgia		
Savannah	7.4	8.6
Sapelo Island	6.8	8.0
Jekyll Point	6.6	7.7
Florida (Atlantic Coast and Keys)		
Jacksonville (Dredge Depot)	2.0	2.3

Table 12. TIDE RANGES FOR SELECTED COASTAL POINTS (cont.)

	Mean (ft)	Spring (ft)
Florida (cont.)		
Cape Canaveral	3.5	4.1
Ft. Lauderdale (Bahia Mar Yacht Club)	2.3	2.8
Miami Beach	2.5	3.0
Key West	1.3	1.6
(Gulf Coast)	Mean (ft)	Diurnal (ft)
Everglades City	2.0	2.6
Naples	2.1	2.8
Sarasota	--	2.1
Clearwater	1.8	2.6
Apalachicola	--	1.7
Pensacola	--	1.3
Alabama		
Mobile	--	1.5
Mississippi		
Biloxi	--	1.8
Louisiana		
Chandeleur Light	--	1.2
Timbalier Island	--	1.2
Mermentau River (entrance)	--	2.5
Texas		
Sabine Bank (Lighthouse)	--	2.8
Galveston (Galveston Channel)	--	1.4

	Mean (ft)	Diurnal (ft)
Texas (cont.)		
Pass Cavallo	--	1.4
Aransas Pass Channel	--	1.4
Port Isabel	--	1.3
(Pacific Coast)		
Washington State		
Seattle	7.6	11.3
Friday Harbor, San Juan Island	4.5	7.7
Bay City, Grays Harbor	7.1	9.2
Oregon		
Coos Bay	5.6	7.3
Astoria	6.5	8.2
California		
Cape Mendocino	4.0	5.7
Alcatraz Island	4.1	5.8
Carmel Cove, Carmel Bay	3.5	5.2
Santa Barbara	3.6	5.3
Los Angeles (Outer Harbor)	3.8	5.4
San Clemente	3.7	5.3
Point Loma	3.7	5.3
Alaska		
Sitka	7.7	9.9
Juneau	13.8	16.4
Port Valdez	9.7	12.0
Anchorage	26.1	29.0
Hawaii		
Honolulu	1.2	1.9

Source: U.S. Department of Commerce, NOAA, NOS, Tide Tables: 1978 High and Low Water Predictions East Coast of North and South America (Including Greenland); Tide Tables: 1978 High and Low Water Predictions West Coast of North and South America (Including the Hawaiian Islands).

13. SEA TEMPERATURE

Ocean temperature near the poles, the tropics, and in the depths of the ocean does not fluctuate much on an annual basis. The temperate zone oceans on the other hand vary enormously on an annual basis. A 57-year record of temperatures at Charleston, South Carolina, reveals a 41 degree F difference between mean February and mean August sea temperatures. The same location has a 49 degree F difference between recorded maximum and minimum water temperatures. The east coast and west coast differ a good deal in the variability of temperature. The six stations in California show a 34 degree difference between recorded maximum and minimum temperatures within the entire state. Many single locations on the Atlantic or Gulf coasts display a 40 degree difference between mean temperatures, and a 50 degree difference between extreme temperatures.

Temperature variations are important, because they dictate a very broad range of temperature adaptations that long-lived temperate zone animals must have. These temperature fluctuations are sufficiently regular, that many animals use them for proximate cues in their reproduction and migration cycles as well as in other activities.

Ocean temperatures are determined by the amount of sun that an area receives, as well as the length of time over which it receives sunlight. Ocean currents that may reach an area also influence temperature. The warm Gulf Stream current, and the cool California current markedly effect the temperature along the Atlantic and Pacific coasts.

CENTRIGRADE AND FAHRENHEIT EQUIVALENTS.

°C	°F
0	32
5	41
10	50
15	59
20	68
25	77
30	86
35	95
40	104

General Formulae: °F = 9/5 °C + 32
°C = 5/9 (°F - 32)

[1] from 1887 to 1893 is not used here
[2] no data collected 1947 to 1953
[3] to 1877
Source: U.S. Department of Commerce, NOAA, Tidal Datums and Information Branch, Tides and Water Levels Division.

Table 13. SEA SURFACE WATER TEMPERATURES FOR SELECTED COASTAL POINTS (°F).[4]

	FEBRUARY			AUGUST			
	max.	coldest monthly average	min.	max.	warmest monthly average	min.	year of first record
Eastport, ME	40	30.7	28	57	54.5	46	1929
Portsmouth, NH	40	31.6	30	69	64.6	50	1944
Boston, MA	52	29.8	28	75	70.7	50	1921
Woods Hole, MA	39	29.5	27	77	73.2	66	1944
Newport, RI	42	32.5	28	78	72.4	64	1955
New London, CT	43	33.6	31	80	75.8	67	1947
Bridgeport, CT	48	33.0	30	86	81.4	70	1964
Montauk, NY	41	30.3	29	79	72.6	62	1947
Willets Pt., NY	46	29.5	28	81	75.1	64	1931
NY (The Battery), NY	44	31.3	29	79	77.2	66	1926
Sandy Hook, NJ	45	30.7	28	83	78.0	68	1944[1]
Atlantic City, NJ	44	29.8	28	80	76.1	57	1911
Cape May, NJ	45	34.0	28	80	75.9	66	1965
Philadelphia, PA	46	32.5	--	86	82.8	--	1922[2]
Lewes, DE	47	31.5	29	83	77.5	67	1947
Solomons, MD	46	33.1	30	87	82.8	72	1937
Baltimore, MD	45	32.4	31	86	82.0	71	1914
Washington, DC	52	33.8	32	90	85.1	73	1944
Kiptopeke Beach, VA	51	34.1	28	85	81.0	68	1951
Myrtle Beach, SC	60	44.1	40	89	85.0	73	1951
Charleston, SC	63	44.8	40	89	85.8	76	1921
Ft. Pulaski, GA	64	45.8	41	89	86.2	78	1939
Fernandina, FL	70	50.9	44	90	86.0	75	1944
Miami Beach, FL	79	64.0	58	92	88.8	82	1939
St. Petersburg, FL	76	55.4	50	90	87.4	80	1946
Pensacola, FL	75	49.3	42	92	87.3	78	1923
Dauphin Is., AL	69	46.4	45	91	86.8	77	1966
Galveston, TX	66	46.4	44	92	87.9	80	1957
Port Mansfield, TX	72	53.1	48	88	85.7	78	1963
Newport Beach, CA	63	55.9	54	78	72.7	58	1955
Los Angeles Harbor CA	69	52.7	51	77	72.4	61	1923
Avila Beach, CA	63	51.2	46	70	64.6	54	1945
Santa Monica, CA	63	54.1	51	74	70.8	60	1945
San Francisco, CA	58	48.4	44	66	63.4	50	1921
San Francisco, CA	59	49.5	47	68	62.1	56	1855[3]
Crescent City, CA	57	46.0	44	65	61.1	48	1933
Astoria, OR	50	36.0	32	75	71.6	58	1925
Neah Bay, WA	51	42.2	38	62	55.8	47	1935
Port Townsend, WA	48	40.1	39	56	54.4	45	1973
Seattle, WA	51	43.7	42	64	59.1	52	1922

[4] See footnotes on previous page

III WATER QUALITY

The quality of coastal water is important to us even if we can't drink it, because we swim in it, harvest shellfish from it, and live near it. We have degraded coastal water quality by dumping sewage, discharging chemical wastes, and spilling oil and other toxic substances into it. These contaminants are taken up and concentrated in the body tissue of shellfish and juvenile fishes and require the closing of shellfishing areas. They spoil our beaches and erode the beauty of the coast.

The statistics presented in this section outline the character and magnitude of water quality problems; for example, the ability of some organisms to concentrate elements by two-million fold, the extent of ocean dumpings, closings of shellfish beds, and characteristics of oil spills.

14. SHELLFISH WATERS

The National Shellfish Register compiles information from state agencies on the status of the states' shellfish beds. In this classification, open waters are waters that are approved for the direct market harvesting of shellfish. These waters are below designated hazardous levels of pathogenic microorganisms and/or industrial wastes, as determined by sanitary survey. Conditional waters are normally open waters subject to periodic closures. Restricted waters may be harvested if the shellfish are moved to open waters and allowed to purge themselves of contaminants. Closed waters are closed to all shellfishing because of the current or probable future occurrence of hazardous levels of contaminants. Most often, these contaminants are bacteria from sewage discharges.

The Pacific Coast states -- California, Oregon, and Washington -- have the highest percentage of closed waters (60.6% of the acreage classified here). Pennsylvania through Virginia have the lowest percentage -- 8.7%. Note though that not all waters are classified here.

Table 14. CONDITION OF SHELLFISH WATERS (ACRES), 1974.

State	Open	Conditional	Restricted	Closed
Maine	930,325	6,531	6,728	101,281
New Hampshire				
Massachusetts	310,881	325	4,091	29,060
Rhode Island	96,019	10,836		20,134
Connecticut	248,751	2,227		68,956
Subtotal	1,585,976	19,929	10,819	219,431
New York	477,241	266		151,096
New Jersey	244,695	7,544	23,370	119,581
Subtotal	721,936	7,810	23,370	270,677
Pennsylvania				
Delaware	205,153	153		28,251
Maryland	1,213,576			111,319
Virginia	1,315,209	724		120,271
Subtotal	2,733,938	877		259,841
North Carolina	1,379,563			604,038
South Carolina	199,323	1,344		74,917
Georgia	49,494			154,473
Florida	663,126	84,099		1,024,966
Alabama	81,937	187,513		85,589
Mississippi	76,232			27,678
Subtotal	2,449,675	272,956		1,971,661
Louisiana	2,000,117			464,161
Texas	822,447			285,168
Subtotal	2,822,564			749,329
California	11,178	4,718		263,045
Oregon	7,075	7,693		13,305
Washington	155,655	21,313		42,382
Subtotal	173,908	33,724		318,732
Grand Totals	10,487,997	335,296	34,189	3,789,671

Source: U.S. Environmental Protection Agency, Office of Enforcement, "National Shellfish Register of Classified Estuarine Waters-1974," EPA-330/1-75-002 (Denver, Colorado, December, 1975), p. 17.

15. BIOCONCENTRATION

Some marine organisms are filter feeders, and filter large volumes of water as they feed, extracting nutrients. In the process of filtering or contacting this water they concentrate certain elements, sometimes to an extraordinary degree. A scallop, for example, can concentrate cadmium by over 2 million times. In other words, a scallop may have a concentration of cadmium in its body 2 million times higher than the surrounding water. Phytoplankton are small plants that float in the upper layers of the ocean. They too concentrate certain elements, and these elevated concentrations may be passed on to the numerous animals that feed on the phytoplankton.

The levels concentrated in shellfish or other biota can potentially be used as an indicator of recent average levels of an element or a pollutant in seawater. Bioconcentration is also important to human health because food species may concentrate pollutants to a level harmful to humans that eat them.

Table 15a. BIOCENCENTRATION OF METALS BY SHELLFISH.

	Enrichment factors		
	Scallop	Oyster	Mussel
Silver	2,300	18,700	330
Cadmium	2,260,000	318,000	100,000
Chromium	200,000	60,000	320,000
Copper	3,000	13,700	3,000
Iron	291,500	68,200	196,000
Manganese	55,500	4,000	13,500
Molybdenum	90	30	60
Nickel	12,000	4,000	14,000
Lead	5,300	3,300	4,000
Vanadium	4,500	1,500	2,500
Zinc	28,000	110,300	9,100

Source: R.R. Brooks and M.G. Rumsby. 1965. The Biochemistry of Trace Element Uptake by some New Zealand Bivalves. Limology and Oceanography 10:521-527.

Table 15b. BIOCENCENTRATION OF METALS BY PHYTOPLANKTON.

Element	Enrichment Factor	Element	Enrichment Factor
Aluminum	10,000	Manganese	4,000
Beryllium	1,000	Nickel	5,000
Cerium	90,000	Niobium	1,000
Chromium	2,000	Plutonium	2,600
Cobalt	1,000	Scandium	2,000
Copper	30,000	Silver	20,000
Iron	40,000	Zinc	20,000
Lead	40,000	Zirconium	60,000

Source: F.G. Lowman, et al., 1971. In Radioactivity in the Marine Environment", National Academy of Sciences, Washington. p. 161 In P.G. Brewer, 1975. Minor Elements in Sea Water In Chemical Oceanography. [eds.] J.P. Riley and G. Skirrow Academic Press, N.Y., p. 430.

16. BIOCONTAMINATION

Given that some marine organisms concentrate various compounds, their use as monitoring tools is enticing. They sample water continuously and for long periods without cost. Dr. Edward Goldberg at the Scripps Institution of Oceanography and others have capitalized on this feature in their "Mussel Watch" program. They have established 100 sampling location around the country, and collect mussels or oysters at intervals. Here, we identify "hot spots," or locations where levels of contaminants were higher than those sampled elsewhere for the sampled species. Note that oysters are usually more effective bioaccumalators than mussels.[1]

[1] Phillip Butler, pers. comm.

Table 16a. BIOCONTAMINATION -- MUSSEL WATCH HOT SPOTS

Location	Contaminant	Cause
	HEAVY METALS	
South San Francisco Bay	Silver 2.3 ppm[2]	
Savannah River, and Charleston, South Carolina[4]	Silver 2.1-4.3 ppm Nickel 3.3-4.2 ppm Zinc 2660-4060 ppm Copper 192-220 ppm Cadmium 2.7-3.7 ppm	
New York to New Hampshire	Cadmium 1.2 to 6.2 ppm Copper 4.3 to 11 ppm	
Lake Sabine, Louisiana[4]	Copper 410 ppm Zinc 7080 ppm Silver 6.0 ppm	
	HALOGENATED HYDROCARBONS	
San Francisco to San Diego especially San Pedro	DDE[1] 17,000 ppb[3] DDD[1] 1,200 ppb	historical sewage outfall from manufacturing which is now discontinued
South San Francisco Bay, California	PCB 590 ppb	Numerous industrial sources
Rincon Point, California	PCB 130 ppb	
Point Fermin, California	PCB 250 ppb	
San Pedro Harbor, California	PCB 440-8700 ppb	
San Diego Harbor, California	PCB 360-1400 ppb	
Boston to New York	PCB to 838 ppb	
St. Augustine, Florida	PCB 149 ppb	
Narragansett Bay, Rhode Island	PCB 281-626 ppb	
	PETROLEUM HYDROCARBONS	
Espirito Santo Bay, Texas[4] Matagorda Bay, Texas[4] Galveston Bay, Texas[4] Boundary Bay, Washington	Contained aromatic compounds characteristic of petroleum and which are not natural constituents of organisms	

[1] Breakdown product of DDT, a biocide. [2]ppm is parts per million (1 ppm equals one millionth of a gram per gram of organism dry weight). [3]ppb is parts per billion (1 ppb equals one billionth of a gram per gram of organism dry weight). [4]oysters, all others are mussels.
Source: E.D. Goldberg, et al. 1978. The Mussel Watch Environmental Conservation, 5(2):1-25.

Fishes contact compounds in seawater either via their gills, from their food, or by transmission from their parents. If a compound is fat soluble, fishes can store it, and so fish too are useful monitoring tools. Information on three chlorinated hydrocarbons is presented here. PCB's are used as insulators in electric devices. They are no longer manufactured. DDT and Dieldrin are now in restricted use in the U.S.; they are both long-lived pesticides.

Connecticut, California, and Maryland rank highest in the percentage of samples with PCB, DDT, and Dieldrin residues respectively. Washington state, Delaware, and Georgia rank highest in the average concentration of residues (in those samples with residues) of PCB, DDT, and Dieldrin respectively.

Table 16b. BIOCONTAMINATION -- THE OCCURRENCE OF BIOCIDE RESIDUES IN JUVENILE ESTUARINE FISHES BY STATE -- 1972-1976.

	PCB		DDT		DIELDRIN		
	% samples with residues	Average concentration[1]	% samples with residues	Average concentration[1]	% samples with residues	Average concentration	No. of Estuaries sampled
Rhode Island	75	330	28	21	--	--	1
Connecticut	87	323	31	41	8	15	4
New York	63	262	72	76	4	24	3
Delaware	51	780	75	213	4	59	3
Maryland	36	306	58	108	25	30	8
Virginia	38	439	67	64	4	10	3
North Carolina	9	242	48	36	2	20	19
South Carolina	1	182	29	19	--	--	6
Georgia	3	323	10	22	3	60	9
Florida	26	83	52	24	18	10	11
Alabama	23	163	69	35	--	--	3
Mississippi	0	--	29	75	10	17	4
Louisiana	2	256	12	38	2	15	14
Texas	24	135	67	49	12	20	9
California	31	229	87	77	2	34	7
Oregon	10	182	26	24	--	--	5
Washington	17	1674	4	23	--	--	6

[1] The arithmetic average in parts per billion of geometric means of positive samples in all collection years.

Source: P.A. Butler and R.I. Schutzmann. 1978. Residues of Pesticides and PCB's in Estuarine Fish, 1972-76 - National Pesticide Monitoring Program. Pesticides Monitoring Journal, 12(2):51-59.

17. OCEAN DISPOSAL

Many of the Nation's most difficult waste disposal problems have been solved by ocean dumping, an activity that has been a source of controversy for the last 10 years. The greatest trouble has been over the practice of New York City to dump sewage sludge in the shallow waters offshore from Sandy Hook, New Jersey. This sludge has blighted an area of many square miles of ocean bottom displacing marine bottom life and has occasionally washed up on Long Island beaches where it has been termed "black mayonnaise" because of its appearance and consistency.

Table 17. TYPES AND AMOUNT OF OCEAN DISPOSAL BY GEOGRAPHIC AREA (IN APPROX. TONS) -- 1973-1978.

WASTE TYPE	1973	1974	(A) 1975	ATLANTIC 1976	1977	1978
Industrial Waste	3,642,000	3,642,000	3,322,300	2,633,200	1,783,600	2,548,000*
Sewage Sludge	4,893,900	5,010,000	5,039,600	5,134,000	5,270,900	5,535,000**
Construction and Demolition Debris	973,700	770,400	395,900	314,600	379,000	241,000
Solid Waste	0	0	0	0	<100	0
Explosives	0	0	0	0	0	0
Incinerated (Wood)	10,800	15,800	6,200	8,700	15,100	18,000
Incinerated (Chemicals)	0	0	0	0	0	0
TOTALS	9,526,200	9,438,200	8,764,000	8,227,400	7,311,700	8,342,000

* 1978 increase over 1977 due to plant shut down during a strike in 1976-77 at NL industries (a permittee).

** 1978 increase primarily due to upgrading of sewage treatment plants to secondary treatment in NYC, Middlesex Co. and Joint Mtg. of Essex & Union Cos.

WASTE TYPE	1973	1974	(B) 1975	GULF 1976	1977	1978
Industrial Waste	1,408,000	937,700	119,600	100,300	60,200	173
Sewage Sludge	0	0	0	0	0	0
Construction and Demolition Debris	0	0	0	0	0	0
Solid Waste	0	0	0	0	0	0
Explosives	0	0	0	0	0	0
Incinerated (Wood)	0	0	0	0	0	0
Incinerated (Chemicals)	0	12,300	4,100	0	17,600	0
TOTALS	1,408,000	950,000	123,700	100,300	77,800	173

WASTE TYPE	1973	1974	(C) PACIFIC 1975	1976	1977	1978
Industrial Waste	0	0	0	0	0	0
Sewage Sludge	0	0	0	0	0	0
Construction and Demolition Debris	0	0	0	0	0	0
Solid Waste	240	200	0	0	0	0
Explosives	0	0	0	0	0	0
Incinerated (Wood)	0	0	0	0	0	0
Incinerated (Chemicals)	0	0	0	0	12,100	0
TOTALS	240	200	0	0	12,100	0

WASTE TYPE	TOTALS OF A, B, AND C					
	1973	1974	1975	1976	1977	1978
Industrial Waste	5,050,800	4,579,700	3,441,900	2,733,500	1,843,800	2,548,173
Sewage Sludge	4,808,900	5,010,000	5,039,600	5,270,900	5,134,000	5,535,000
Construction and Demolition Debris	973,700	770,440	395,900	314,600	379,000	0
Solid Waste	240	200	0	0	<100	0
Explosives	0	0	0	0	0	0
Incinerated (Wood)	10,800	15,800	6,200	8,700	15,100	18,000
Incinerated (Chemicals)	0	12,300	4,100	0	29,700	0
TOTAL	10,934,440	10,388,400	8,887,700	8,327,700	7,401,600	8,101,173

Source: Environmental Protection Agency, Office of Waste Water Programs. June 1979. Annual Report to Congress January-December 1978, Washington, D.C.

18. OIL SPILLS

The Federal Water Pollution Control Act requires that any discharge of oil or hazardous substance in harmful quantities, be reported to the "appropriate agency of the United States Government." The Coast Guard has been designated as that agency by Executive Order 11735. Tables 18a to 18h summarize some of the information that has been reported to the Coast Guard. Table 18i reports hydrocarbon spills during outer continental shelf activities (including pipeline spills, production spills, and spills from collisions) in the Gulf of Mexico. Table 18b is derived from the U.S. Geological Survey.

The Coast Guard not only records coastal spills, but also spills on inland waters. In some cases it has been possible to exclude inland spills from the data reported here. Tables 18d, f, e and i detail information which is applicable only to coastal waters. In the other cases, although the absolute numbers would change if it were possible to eliminate inland spills, the rank and the percentage of particular events quite probably would not.

These tables show that while most spills are small in volume, a very few large spills contribute most of the spilled volume. Most spillage occurs on the Gulf Coast (numbers and volume), in ports and harbors (by number), and far offshore by volume. The leading source of spills is classified "unknown" or "miscellaneous" (by number) and is "hull or tank rupture or leak" (by volume). The largest volume per spill is associated with pipelines, while offshore production and miscellaneous or unknown sources have the smallest volume per spill.

Table 18a. OIL SPILLS BY YEAR REPORTED BY THE UNITED STATES COAST GUARD -- 1972-1977.[1]

Year	Thousands of Gallons	Number of Spills
1972	16,764	8,380
1973	20,481	11,003
1974	16,916	11,435
1975	14,967	10,141
1976	23,125	10,660
1977	17,623[5]	10,620[5]

Table 18b. OIL SPILLS REPORTED DURING OUTER CONTINENTAL SHELF OPERATIONS IN THE GULF OF MEXICO.[2]

	Spills of 50 Bbl. or More			Spills of Less Than 50 Bbl.	
	Number	Barrels Spilled		Number	Barrels Spilled
Year		Largest	Total		
1970	7	53,000	84,325	--	--
1971	11	450	1,285	1,245	1,493
1972	2	100	150	1,159	1,032
1973	4	9,935	22,175	1,171	921
1974	8	19,833	22,721	1,129	667
1975	2	166	266	1,126	711
1976	3	4,000	4,714	948	522
1977	4	300	670	864	611
1978	3	900	1,139	873	581
TOTAL	44	--	137,445	8,515	6,538

Total Spilled 143,983 barrels or 6,047,286 gallons

Table 18c. OIL SPILLS BY COAST -- 1975-1977.[1]

Coast	Number of Spills	%	Gallons Spilled	%
Atlantic	7,322	31	11,981,278	31
Gulf	10,575	45	14,930,794	39
Pacific	5,397[5]	23	11,625,877[5]	30
TOTAL	23,294	100	38,537,949	100

Table 18d. OIL SPILLS BY LOCATION -- 1976 and 1977.[1]

	Number of Spills	%	Gallons Spilled	%
River Channels	3,305	21	2,816,468	9
Ports and Harbors	6,649	43	3,058,634	10
Beaches & Nonnavigable Waters	888	6	6,880,809	22
0 to 3 miles offshore	3,386	22	1,072,631	3
3 to 12 miles offshore	703	5	47,500	*
12 miles + offshore	692[5]	4	17,325,083[5]	56
TOTALS	15,590	100	31,201,125	100

Table 18e. OIL SPILLS BY COAST AND LOCATION -- 1976 and 1977.[1]

	Number of Spills	Pct.	Volume of Spills (Gallons)	Pct.	Gallons Per Spill
Atlantic					
Total	4,627		10,515,589		2,273
River Channels	1,457	31	829,559	8	569
Ports & Harbors	2,336	50	1,194,674	11	511
Beaches & Nonnavigable Waters	340	7	517,149	5	1,521
0 to 3 miles offshore	403	9	404,361	4	1,003
3 to 12 miles offshore	81	2	12,667	*	156
12 + miles offshore	43	*	7,557,179	72	175,748
Pacific					
Total	3,629		11,184,954		3,082
River Channels	422	12	96,236	*	228
Ports & Harbors	2,275	63	1,149,484	10	505
Beaches & Nonnavigable Waters	223	6	243,778	2	1,093
0 to 3 miles offshore	688	19	86,500	*	126
3 to 12 miles offshore	64	2	4,175	*	65
12 + miles offshore	31	*	9,604,781[3]	86	309,832
Gulf					
Total	7,260		9,500,582		1,309
River Channels	1,426	20	1,890,673	20	1,326
Ports & Harbors	2,038	28	714,476	8	351
Beaches & Nonnavigable Waters	325	4	6,119,882	64	18,830
0 to 3 miles offshore	2,295	32	581,770	6	254
3 to 12 miles offshore	558	8	30,658	*	55
12 + miles offshore	618	9	163,123	2	264

THE WRECK OF THE ARGO MERCHANT. The Argo Merchant, a Liberian tanker, ran aground 28 miles southeast of Nantucket Island carrying 7.3 million gallons of heavy industrial fuel oil. This grounding occurred in December, 1976. (photo courtesy of U.S. Coast Guard)

Table 18f. OIL SPILLS BY SOURCE (VOLUME AND NUMBER) -- 1975-1977.[1]

Source	Number of Spills	% of Total Number	Volume of Spills (Gallons)	% of Total Volume	Gallons Per Spill
Vessels	9,679	31[5]	28,871,528[5]	52	2,982
Land Vehicles	1,215	4	1,941,003	4	1,598
Non Transportation Facilities	4,385	14	12,100,987	2	2,759
Offshore Production	3,639	12	433,546	1	119
Pipelines	1,672	5	9,350,683	17	5,592
Marine Facilities	1,609	5	879,593	2	547
Land Facilities	505	2	640,593	1	1,269
Misc. or Unknown	8,717	28	970,586	2	111
TOTAL	31,421	100	55,188,519	100	1,756

Table 18g. OIL SPILLS BY LEADING CAUSES (VOLUME) -- 1975-1977.[1]

Cause[4]	Gallons Spilled
Hull/Tank Rupture/Leak	25,876,701[5]
Other Structural Failure	10,614,536
Pipe Rupture/Leak	6,942,916
Transportation Pipeline Rupture/Leak	3,123,443
Unknown/Miscellaneous	1,397,778
Tank Overflow	1,110,311
Other Equipment Failure	1,077,496
Other Personnel Error	864,088
Improper Handling Operation	798,088
Valve Failure	741,103

Table 18h. OIL SPILLS BY LEADING CAUSES (NUMBER) -- 1975-1977.[1]

Cause	Number of Spills
Unknown/Miscellaneous	10,632
Other Equipment Failure	2,792
Tank Overflow	2,534
Pipe Rupture/Leak	2,402
Hull/Tank Rupture/Leak	2,375[5]
Improper Handling Operation	1,625
Other Personnel Error	1,433
Transportation Pipeline Rupture/Leak	1,308
Other Structural Failure	1,284
Valve Failure	1,008

* less than 1%

Source: [1]U.S. Department of Transportation, U.S. Coast Guard. 1978. Polluting Incidents in and around U.S. Waters: Calendar Year 1977 30 pp.; _____ 1977, Calendar Year 1976 31 pp.; _____ 1976, Calendar Year 1975. 24 pp.

[2]U.S. Department of Interior, Geological Survey-Conservation Division. 1979. Outer Continental Shelf Statistics Calendar Year 1978.

[3]Excludes one spill of 9.6 million gallons in international waters off Hawaii.

[4]Railroad/Highway/Aircraft Accidents were the cause of 1,495,129 gallons of oil spill in 1976 and 1977. It was not reported as a cause in 1975.

[5]Includes one 9.6 million gallon spill from the Hawaiian Patriot spill that did not reach the U.S. 200 mile limit.

PELICANS RECOVER FROM OIL SPILL. These birds were soaked with oil by the wreck of the Ocean Eagle in San Juan harbor, Puerto Rico. (photo courtesy of U.S. Coast Guard by CPHOT John Lehman, U.S.C.G.)

IV COUNTY PROFILES

People, cities, and businesses are attracted to the U.S. coast. Currently, 27 percent of our population, and 28 percent of our businesses are in coastal counties. Yet only 6 percent of our land area is in the coastal counties. The coast supports less agriculture than one might expect -- 4% of our farms are in coastal counties.

These tables describe, state by state, the amount of employment and business, farms and farm acreage, and metropolitan and non-metropolitan population in the coastal counties of each state. The selection of counties as "coastal" is somewhat arbitrary because the terms for selection vary greatly according to the purposes of the compiler. Our criteria for designation and our list of coastal counties are given in Table 19 and its accompanying text. These counties define the land portion of the coast.

19. COASTAL COUNTIES

Large amounts of statistical information are available for individual whole counties but very little for coastal parts of the counties, separately. The best that one can do for most of the data sets is to treat all counties that touch on coastal waters as coastal entities. Thus, one must first identify counties that one considers to be coastal and compile a list for each state. Because some coastal counties have large areas far from coastal waters this procedure will err slightly by including some areas which are not coastal. In states that have no large rivers (e.g., Maine, New Hampshire, and Alabama) this is a simple task. But states with large rivers (e.g., New York, Virginia, and Oregon) present a more difficult problem, because one must decide how far up the rivers to go. The list of coastal counties that we present is one which includes counties which we find to have substantial shoreline along, or physical interactions with saline waters. As with any list of coastal counties, ours is somewhat arbitrary. The reader will find that this list of coastal counties is shorter than many and could be categorized as a list of "maritime counties." Tables 20, 21, 22, 23 and 51 are based on this list of coastal counties.

Table 19. COASTAL COUNTIES -- NAMES AND 1976 POPULATION.

Alabama	
Baldwin	69,600
Mobile*	344,300
67 Counties	
2 Coastal Counties	
California	
Alameda*	1,097,100
Contra Costa*	598,700
Del Norte	15,900
Humboldt	105,900
Los Angeles*, [1]	7,003,800
Marin*	221,400
Mendocino	59,100
Monterey	271,500
Napa	91,400
Orange*	1,755,600
San Diego*	1,616,500
San Francisco*	663,600
San Luis Obispo	131,600
San Mateo*	584,100
Santa Barbara*	284,200
Santa Clara*	1,194,600
Santa Cruz	162,900
Solano*	193,800
Sonoma	255,200
Ventura	450,900
58 Counties	
20 Coastal Counties	
Connecticut	
Fairfield*	800,200
Middlesex	125,200
New Haven*	759,400
New London	243,900
8 Counties	
4 Coastal Counties	
Delaware	
Kent	91,900
New Castle*	400,400
Sussex	89,600
3 Counties	
3 Coastal Counties	
Florida	
Bay	90,200
Brevard	231,400
Broward*	850,200
Charlotte	42,800
Citrus	38,300
Collier	64,100
Dade*	1,438,500
Dixie	6,600
Duval*	556,500
Escambia*	226,500
Flagler	7,500
Franklin	7,700
Gulf*	10,400
Hernando	30,000
Hillsborough*	581,500
Indian River	45,500
Lee	159,600
Levy	16,600
Manatee	123,700
Martin	46,800
Monroe	50,100
Nassau	29,900
Okaloosa	103,600
Palm Beach*	466,200
Pasco	137,100
Pinellas*	646,200
St. Johns	39,800
St. Lucie	69,300
Santa Rosa*	48,100
Sarasota	162,600
Taylor	14,200
Volusia	209,500
Wakulla	9,000
Walton	17,700
67 Counties	
34 Coastal Counties	
Georgia	
Bryan	8,300
Camden	11,900
Charlton	6,600
Chatham*	188,000
Glynn	48,900

Table 19. COASTAL COUNTIES -- NAMES AND 1976 POPULATION (cont.).

Georgia (cont.)	
Liberty	23,800
McIntosh	8,300
159 Counties	
1 Consolidated Government	
7 Coastal Counties	
Louisiana	
Cameron	9,100
Iberia	62,700
Jefferson*	413,400
Lafourche	74,800
Orleans*	564,100
Plaquemines	26,300
St. Bernard*	60,100
St. Charles	33,300
St. John the Baptist	25,900
St. Mary	61,600
St. Tammany	81,900
Tangipahoa	73,000
Terrebone	85,800
Vermillion	45,300
Washington	42,900
64 Parishes	
15 Coastal Parishes	
Maine	
Cumberland*	204,400
Hancock	39,400
Knox	32,400
Lincoln	23,800
Sagadohoc	26,100
Waldo	27,000
16 Counties	
8 Coastal Counties	
Maryland	
Anne Arundel*	350,000
Baltimore*	642,300
Calvert	28,000
Cecil	55,200
Charles	62,500
Dorchester	30,200
Harford	140,200
Maryland (cont.)	
Kent	16,700
Queen Annes	21,600
St. Marys	52,500
Somerset	19,800
Talbot	25,800
Wicomico	59,600
Worcester	27,200
23 Counties	
14 Coastal Counties	
Baltimore City*	818,600
1 Independent City	
1 Coastal Independent City	
Massachusetts	
Barnstable	132,800
Bristol*	469,300
Dukes	7,800
Essex*	627,800
Nantucket	5,500
Norfolk*	618,200
Plymouth*	380,700
Suffolk*	714,400
14 Counties	
8 Coastal Counties	
Mississippi	
Hancock	19,100
Harrison	145,500
Jackson	110,900
82 Counties	
3 Coastal Counties	
New Hampshire	
Rockingham	166,600
10 Counties	
1 Coastal County	
New Jersey	
Atlantic*	190,600
Bergen*	878,400
Cape May	74,700
Cumberland	132,400
Hudson*	574,100

Table 19. COASTAL COUNTIES -- NAMES AND 1976 POPULATION (cont.).

New Jersey (cont.)	
Middlesex	592,300
Monmouth	490,500
Ocean	305,600
Salem*	62,600
Union*	517,000
21 Counties	
10 Coastal Counties	
New York	
Bronx*	1,329,200
Kings*,[2]	2,381,600
Nassau*	1,404,400
New York*	1,407,100
Queens*	1,968,900
Richmond*	328,800
Rockland*	254,300
Suffolk*	127,500
Westchester*	879,300
62 Counties	
9 Coastal Counties	
North Carolina	
Beaufort	39,900
Bertie	20,900
Brunswick	32,900
Camden	5,700
Carteret	36,400
Chowan	11,500
Craven	69,100
Currituck	10,200
Dare	9,600
Hyde	5,700
New Hanover	95,900
Onslow	115,100
Pamlico	9,600
Pasquotank	28,300
Pender	21,000
Perquimans	8,700
Tyrell	3,900
Washington	14,900
100 Counties	
18 Coastal Counties	
Oregon	
Clatsop	39,200
Columbia	32,400
Coos	60,100
Curry	14,400
Douglas	82,800
Lane*	242,800
Lincoln	28,100
Tillamook	18,600
36 Counties	
8 Coastal Counties	
Rhode Island	
Bristol*	45,700
Kent*	149,700
Newport	81,700
Providence*	572,100
Washington	86,500
5 Counties	
5 Coastal Counties	
South Carolina	
Beaufort	60,100
Charleston*	263,000
Colleton	29,500
Georgetown	38,200
Horry	88,900
Jasper	13,200
46 Counties	
6 Coastal Counties	
Texas	
Aransas	10,800
Brazoria	130,700
Calhoun	17,800
Cameron	174,200
Chambers	13,300
Galveston*	189,800
Harris*	2,067,900
Jackson	12,900
Jefferson	245,200
Kenedy[4]	600
Kleberg	33,000

Table 19. COASTAL COUNTIES -- NAMES AND 1976 POPULATION (cont.)

Texas (cont.)	
Matagorda	29,000
Nueces*	251,900
Refugio	9,100
San Patricio	51,300
Willacy	16,800
254 Counties	
16 Coastal Counties	
Virginia	
Accomack	31,200
Caroline	16,300
Charles City	6,500
Essex	8,000
Gloucester	17,100
Isle of Wight	20,100
James City	20,900
King and Queen	6,000
King George	9,500
King William	8,200
Lancaster	9,800
Mathews	8,100
Middlesex	7,000
New Kent	7,300
Northampton	15,400
Northumberland	9,600
Prince George	20,800
Richmond	6,600
Surry	6,000
Westmoreland	13,400
York*	31,300
95 Counties	
21 Coastal Counties	
Virginia (cont.)	
Chesapeake*	108,100
Hampton*	126,700
Hopewell	23,900
Newport News*	142,100
Norfolk*	284,100
Portsmouth*	108,600
Suffolk	46,400
Virginia Beach*	224,200
Williamsburg	11,600
38 Independent Cities	
9 Coastal Independent Cities	
Washington	
Clallam	42,300
Grays Harbor	61,600
Island	36,400
Jefferson	12,400
King*	1,148,100
Mason	24,400
Pacific	16,000
Pierce*	420,800
San Juan	5,600
Skagit	55,800
Snohomish*	269,500
Thurston	97,200
Wahkiakum	3,700
Whatcom	91,500
39 Counties	
14 Coastal Counties	

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* Metropolitan county
[1] Most populous coastal county
[2] Second most populous coastal county
[3] Second least populous coastal county
[4] Least populous coastal county
Source: Adapted from U.S. Department of Commerce, Bureau of the Census. 1977. Current Population Reports, Series P-25.

21a. EMPLOYMENT AND BUSINESS

Business is attracted to the coast for many reasons, among them: access to bulk transportation facilities and marine resources. Based on our list of coastal counties (Table 19), 28 percent of all American businesses and employees are located in the coast. Outside of the completely coastal states (Rhode Island and Delaware), California has the greatest proportion of its businesses and employees in coastal counties (more than 75 percent), while North Carolina and Georgia have the lowest proportion of their businesses and employees in the coast (about 6 percent).

Table 21a. EMPLOYMENT AND BUSINESS ESTABLISHMENTS.

State	Coastal Employees (in 100's)[1]	% of State Total	Coastal Businesses (in 100's)[1]	% of State Total
Maine	1,270	47	115	51
New Hampshire	335	14	33	18
Massachusetts	5,988	32	422	38
Rhode Island	2,920	100	202	100
Connecticut	6,080	60	392	63
New York	37,532	68	2,473	68
New Jersey	11,735	53	759	54
Delaware	1,904	100	111	100
Maryland	6,056	56	364	53
Virginia	3,180	24	219	25
North Carolina	1,032	6	87	9
South Carolina	1,172	14	96	19
Georgia	878	6	60	6
Florida	13,140	56	1,036	58
Alabama	1,078	12	76	12
Mississippi	741	14	44	11
Louisiana	4,878	49	302	44
Texas	12,158	32	658	26
California	53,512	85	3,419	79
Oregon	1,201	19	116	22
Washington	6,460	69	498	65
All Coastal States	177,141	63.8	11,675	61.6
United States	626,478	28.3[2]	41,428	28.2[2]

[1] As of March 12, 1976
[2] % of nation's employees or businesses in coastal counties
Source: U.S. Department of Commerce, Bureau of the Census, County Business Patterns: 1976.

20. AGRICULTURE

Coastal regions, especially the coastal plain from New Jersey through Texas, provide large flat areas that are amenable to agriculture. Agriculture effects coastal waters because the fertilizers, herbicides, and pesticides necessary for agriculture most easily enter coastal waters when applied in coastal counties. In addition, agriculture has historically impacted coastal resources by converting wetlands to agricultural purposes. As with any use of the land, agriculture changes the natural land forms and characteristics. For these reasons agricultural activity is important to coastal managers.

Table 20. AGRICULTURE IN COASTAL COUNTIES.

State	No. of Farms[1]	% of Farms[2]	Farm Acreage[1]	% of Acreage[2]	% of area in Farms[1]	Acres[3]	Acres[4]
Maine	2,226	34.6	437,713	28.7	8.8	196.6	236.7
New Hampshire	372	15.0	45,829	9.0	10.4	123.2	210.0
Massachusetts	1,662	37.0	174,981	29.1	10.2	105.3	133.8
Rhode Island	597	100.0	61,068	100.0	9.1	102.3	102.3
Connecticut	1,356	39.6	151,867	34.5	10.4	112.0	128.6
New York	1,066	2.4	66,904	0.7	4.9	62.8	215.4
New Jersey	2,929	39.5	344,317	35.8	15.4	117.6	129.8
Delaware	3,400	100.0	630,605	100.0	49.7	185.5	185.5
Maryland	8,473	56.0	1,489,238	57.0	35.7	175.8	173.7
Virginia	5,150	9.7	1,207,571	12.5	26.7	234.5	183.7
North Carolina	8,193	9.0	1,321,727	11.8	23.9	161.3	123.2
South Carolina	3,947	13.5	802,029	13.0	24.2	203.2	211.0
Georgia	534	1.0	168,965	1.2	7.1	316.4	252.7
Florida	13,010	40.1	5,098,284	38.6	27.7	391.9	406.6
Alabama	2,109	3.7	406,832	3.4	22.6	192.9	209.1
Mississippi	685	1.3	110,507	0.8	9.6	161.3	266.7
Louisiana	5,800	17.0	1,589,947	17.0	21.9	274.1	274.8
Texas	8,923	5.1	6,654,449	5.0	74.5	745.8	770.9
California	21,147	31.2	9,431,361	28.2	41.2	446.0	493.3
Oregon	4,995	18.7	1,177,533	6.5	11.2	235.7	681.8
Washington	7,597	25.8	698,346	4.2	5.9	91.9	566.5
Total Coastal Counties	104,171	15.0	32,070,073	10.3	27.4	307.9	448.3
Coastal States	696,128	100.0	312,105,501	100.0	(116,844,291)[5]		
All U.S.	2,314,013		1,017,030,357		44.9		439.5

[1] Coastal
[2] Coastal as a percentage of the state
[3] Per coastal farm
[4] Per farm
[5] Total coastal county area in acres
Source: Adapted from Q.S. Department of Commerce. Bureau of the Census. Census of Agriculture: 1974.

SAN FRANCISCO, CALIFORNIA FROM 50,000 FEET. Of the states which are not entirely coastal, California has the highest proportion of its employees and businesses in the coastal counties. This is an infrared view of California taken by a U-2 aircraft in part of a NASA effort to analyze earth resources. (photo courtesy of NASA)

21. POPULATION CHARACTERISTICS

Many of our largest cities are in coastal counties, and so it is not surprising that a large fraction of the American public lives in this narrow strip. This population makes demands for living space, recreation, and waste disposal, and these demands must be met largely within the coastal counties and waters.

We break coastal population into population living in metropolitan (as determined by the Bureau of the Census), and non-metropolitan counties. This division reveals a number of interesting trends. Between 1960 and 1970, population growth in the coast exceeded that in the rest of the nation by 58 percent. Between 1970 and 1976, however, population growth in the coast trailed population growth in the nation by 32 percent. These tables show that this trend is the result of decreases in population in the metropolitan areas of the Northeast, and the Mid-Atlantic. Coastal non-metropolitan counties have, since 1960, outstripped national growth.

We find that 27.1 percent of all Americans lived in coastal counties in 1976. The Department of Commerce (Bureau of the Census, Statistical Abstract of the United States, 1979) concludes that 53 percent of the 1976 population of the United States was coastal. The difference arises from two sources. First, we do not include counties around the Great Lakes. Excluding the Great Lakes from the Commerce figures would leave 39 percent of the population in the coast. The remaining difference arises from our differences in defining coastal counties. Theirs includes any county or independent city entirely or substantially within 50 miles of U.S. coastal shorelines, whereas ours included only those that touch on saline waters. Therefore, our county list is shorter (see Table 19). By any measure, many Americans live in the narrow strip of land that constitutes the U.S. coast.

Table 21b. COASTAL COUNTY POPULATION BY STATE -- 1960, 1970, 1976.

State	1960	1970	1976	% Change In the Coast 60-70	% Change In the Coast 70-76	% Change In the State 60-70	% Change In the State 70-76
Maine	439,851	464,883	509,700	5.7	9.6	2.4	8.0
New Hampshire	99,029	138,951	166,600	40.3	19.9	21.5	12.1
Massachusetts	2,597,027	2,862,093	2,956,500	10.2	3.3	10.5	1.8
Rhode Island	859,488	949,723	936,000	10.5	-1.1	10.1	-1.1
Connecticut	1,588,514	1,882,926	1,928,700	18.5	2.4	19.6	2.3
New York	10,694,633	11,574,982	10,081,100	8.2	-12.9	8.7	-1.0
New Jersey	3,146,738	3,718,552	3,818,200	18.2	2.7	18.2	2.6
Delaware	446,292	548,104	581,900	22.8	6.2	22.8	6.2
Maryland	2,026,229	2,293,907	2,350,200	13.2	2.5	26.5	5.2
Virginia*	688,158	1,327,372	1,356,400	92.9	2.2	17.2	8.7
North Carolina	441,605	477,404	538,400	8.1	12.8	11.5	7.5
South Carolina	403,667	441,785	492,900	9.4	11.6	8.7	9.8
Georgia	272,618	286,837	295,800	5.2	3.1	16.4	8.6
Florida	3,776,208	5,379,329	6,577,400	42.5	22.3	37.1	23.0
Alabama	363,389	376,690	413,900	3.7	9.9	5.4	6.1
Mississippi	189,050	239,944	275,500	26.9	14.8	1.8	6.7
Louisiana	1,335,181	1,546,663	1,660,200	15.8	7.3	11.8	6.4
Texas	2,258,833	2,828,725	3,254,300	25.2	15.0	16.9	12.5
California	12,320,082	15,724,192	16,757,800	27.6	6.6	27.0	0.1
Oregon	393,635	455,570	508,400	15.7	11.6	18.2	11.5
Washington	1,756,506	2,220,278	2,284,800	26.4	2.9	19.5	0.1
Total Coastal	46,096,733	55,738,910	57,744,700	20.9	3.6	16.8	5.2
National[1]	179,108,000	202,728,000	213,377,000	---	---	13.2[2]	5.3[2]
Total % Coastal	25.7	27.5	27.1	---	---	---	---
Coastal States	94,936,612	110,925,225	116,741,069	---	---	---	---

Table 21c. COASTAL COUNTY NONMETROPOLITAN POPULATION BY STATE -- 1960, 1970, 1976.

State	1960	1970	1976	% Change 1960-1970	% Change 1970-1976
Maine	257,100	272,355	305,300	5.9	12.1
New Hampshire	99,029	138,951	166,600	40.3	19.9
Massachusetts	79,674	106,547	146,100	33.7	37.1
Rhode Island	140,945	179,934	168,200	27.7	-6.5
Connecticut	274,610	345,164	369,100	25.7	6.9
New York	0	0	0	--	--
New Jersey	1,031,903	1,435,060	1,595,500	39.1	11.2
Delaware	138,846	162,248	181,500	16.9	11.9
Maryland	388,143	469,667	539,300	21.0	14.8
Virginia*	271,284	331,142	331,300	22.1	0.0
North Carolina	441,605	477,404	538,400	8.1	12.8
South Carolina	187,285	194,135	229,900	3.7	18.4
Georgia	84,319	99,021	107,800	17.4	8.9
Florida	897,869	1,358,150	1,811,800	51.3	33.4
Alabama	49,088	59,382	69,600	21.0	17.2
Mississippi	189,050	239,944	275,500	26.9	14.8
Louisiana	466,701	564,439	622,600	20.9	10.3
Texas	653,738	679,457	744,700	3.9	9.6
California	949,739	1,305,379	1,544,400	37.4	18.3
Oregon	230,745	242,212	265,600	5.0	9.7
Washington	327,703	387,382	446,400	18.2	15.2
Total Coastal	7,159,376	9,047,973	10,459,600	26.4	15.6
National Total	51,373,000	53,503,000	57,714,000	4.1[2]	7.9[2]
% Coastal	13.9	16.9	18.1		

Table 21d. COASTAL COUNTY METROPOLITAN POPULATION BY STATE -- 1960, 1970, 1976.

State	1960	1970	1976	% Change 1960-1970	% Change 1970-1976
Maine	182,751	192,528	204,400	5.4	6.2
New Hampshire	0	0	0	--	--
Massachusetts	2,517,353	2,755,546	2,810,400	9.5	2.0
Rhode Island	718,543	769,789	767,800	7.1	-0.3
Connecticut	1,313,904	1,537,762	1,559,600	17.0	1.4
New York	10,694,633	11,574,982	10,081,100	8.2	-12.9
New Jersey	2,114,835	2,283,492	2,222,700	8.0	-2.7
Delaware	307,446	385,856	400,400	25.5	3.8
Maryland	1,638,086	1,824,240	1,810,900	11.4	-0.7
Virginia*	416,874	996,230	1,025,100	139.0	2.9
North Carolina	0	0	0	--	--
South Carolina	216,382	247,650	263,000	14.5	6.2
Georgia	188,299	187,816	188,000	-0.3	0.1
Florida	2,878,339	4,021,179	4,765,600	39.7	18.5
Alabama	314,301	317,308	344,300	1.0	8.5
Mississippi	0	0	0	--	--
Louisiana	868,480	982,224	1,037,600	13.1	5.6
Texas	1,605,095	2,149,268	2,509,600	33.9	16.8
California	11,370,343	14,418,813	15,213,400	26.8	5.5
Oregon	162,890	213,358	242,800	31.0	13.8
Washington	1,428,803	1,832,896	1,838,400	28.3	0.3
Total Coastal	38,937,357	46,690,937	47,285,100	19.9	1.3
National Total[1]	127,079,000	148,730,000	155,860,000	17.0[2]	4.8[2]
% Coastal	30.6	31.4	30.3		

Table 21e. COASTAL COUNTY POPULATION BY REGIONS -- 1960, 1970, 1976.

	1960	1970	1976	% Change 1960-1970	% Change 1970-1976
		All Coastal Counties			
Northeast[3]	16,278,542	17,873,558	16,578,600	9.8	-7.3
Mid Atlantic[4]	6,307,417	7,887,935	8,106,700	25.1	2.8
South Atlantic[5]	4,894,098	6,585,355	7,904,500	34.6	20.0
Gulf	4,146,453	4,992,022	5,603,900	20.4	12.3
Pacific	14,470,223	18,400,040	19,551,000	27.1	6.3
		Metropolitan			
Northeast	15,427,184	16,830,607	15,423,300	9.1	-8.4
Mid Atlantic	4,477,241	5,489,818	5,459,100	22.6	-0.6
South Atlantic	3,283,020	4,456,645	5,216,600	35.8	17.1
Gulf	2,787,876	3,448,800	3,891,500	23.7	12.8
Pacific	12,962,036	16,465,067	17,294,600	27.0	5.0
		Nonmetropolitan			
Northeast	851,358	1,042,951	1,155,300	22.5	10.8
Mid Atlantic	1,830,176	2,398,117	2,647,600	31.0	10.4
South Atlantic	1,611,078	2,128,710	2,687,900	32.1	26.3
Gulf	1,358,577	1,543,222	1,712,400	13.6	11.0
Pacific	1,508,187	1,934,973	2,256,400	28.3	16.6

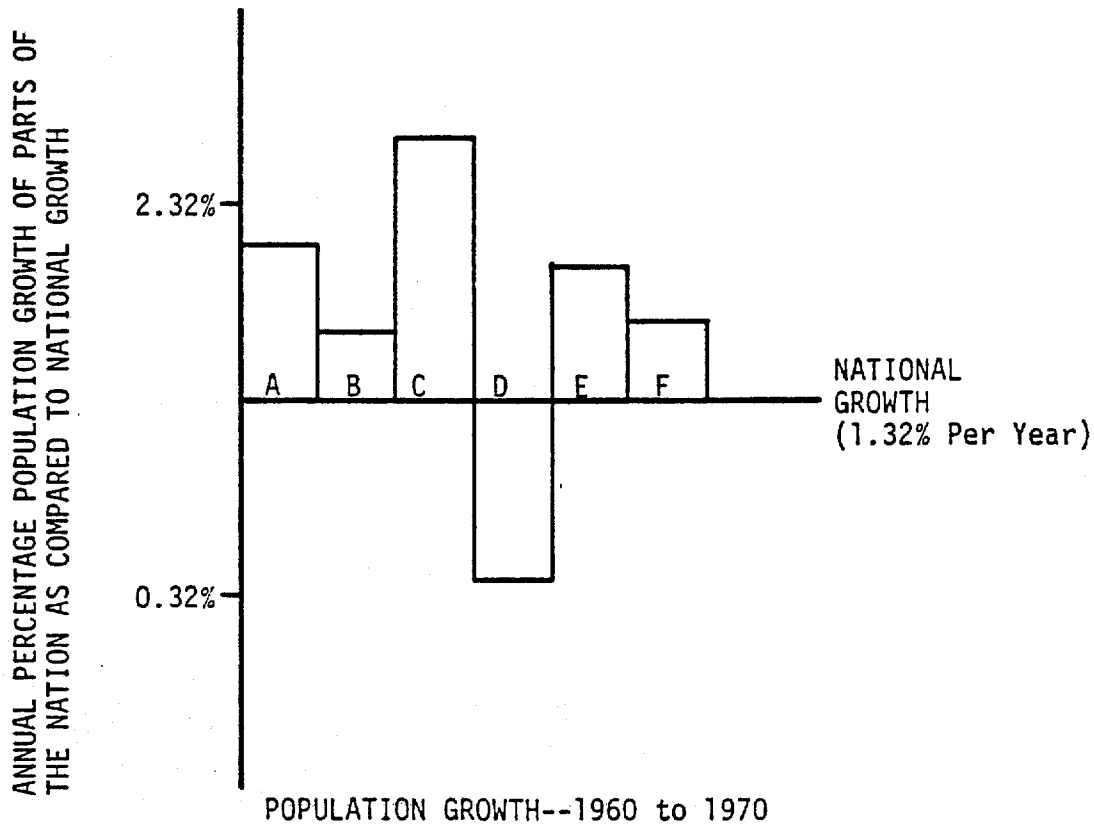
* There were jurisdictional changes between 1960 and 1976
[1] Exclusive of Alaska and Hawaii
[2] % increase in the National Total
[3] Maine to New York
[4] New Jersey to Virginia
[5] North Carolina to Florida
[6] Alabama to Texas
[7] California to Washington
Coastal States Totals (1970-110,925,225; 1976-116,741,069; 1960-94,936,612)

Source: 1960 and 1970 is adapted from U.S. Department of Commerce, Bureau of the Census, Census of Population: 1970, Vol. I, Part A; 1976 is adapted from Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25.

Table 21f. COASTAL POPULATION CHARACTERISTICS BY STATE -- 1976.

State	% of Population in Coastal Counties (1976)	% Nonmetro-politan (1976)	State	% of Population in Coastal Counties (1976)	% Nonmetro-politan (1976)
ME	47.6	59.9	SC	17.3	46.6
NH	20.1	100.0	GA	5.9	36.4
MA	51.1	4.9	FL	78.8	27.5
RI	100.0	18.0	AL	11.3	16.8
CT	62.2	19.1	MS	11.6	100.0
NY	55.8	0.0	LA	42.8	37.5
NJ	51.9	41.8	TX	25.8	22.9
DE	100.0	31.2	CA	83.9	9.2
MD	57.0	22.9	OR	21.9	52.2
VA	26.8	24.4	WA	66.9	19.5
NC	9.9	100.0	Total		
			Coastal	49.5	18.1
			National	27.1	37.0

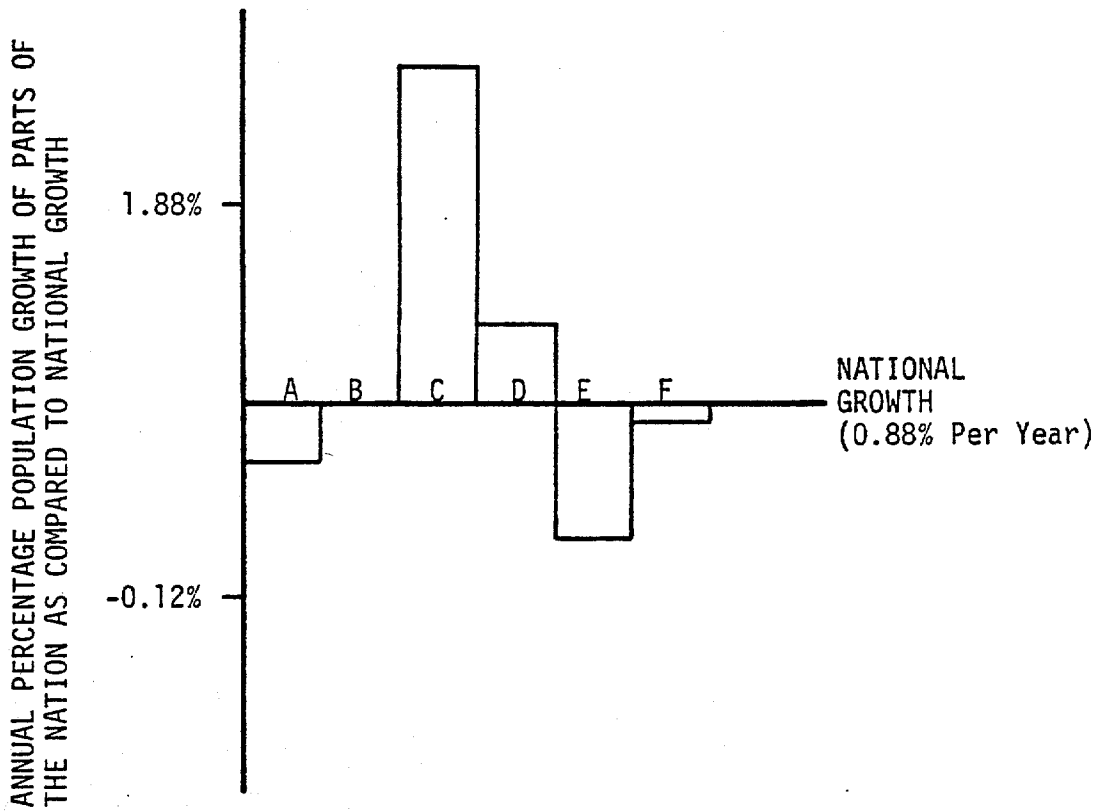
POPULATION GROWTH OF PARTS OF THE NATION AS COMPARED TO THE NATION AS A WHOLE



POPULATION GROWTH OF PARTS OF THE NATION AS COMPARED TO THE NATION AS A WHOLE

Here, we compare the growth rate of parts of the United States to the nation as a whole. The tic marks along the vertical axis mark growth rates 1% greater, and 1% less than annual national growth rate. Note that a 2% annual growth rate (which is about the rate of the Nonmetropolitan coastal counties) means that the population will double in about 35 years. The parts of the nation whose growth is shown here are:

A. Coastal Counties (as listed in Table 19)
B. Coastal States (as listed in Table 19)
C. Nonmetropolitan coastal counties (as listed in Table 19)
D. National nonmetropolitan counties
E. Metropolitan coastal counties (as listed in Table 19)
F. Metropolitan counties nationwide.



POPULATION GROWTH--1970 to 1976.

THE CHESAPEAKE BAY TO NEW YORK CITY FROM OUTER SPACE. This six photograph montage was taken from an Earth Resources Technology Satellite-1 (ERTS-1) at an altitude of 562 statute miles. Many notable geographic landmarks are obvious: The Barriers islands along the coast of New Jersey, and the Delmarva peninsula; the Susquehanna and Potomac Rivers flowing into the Chesapeake Bay; the Delaware river broadening out into the Delaware Bay; and the Appalachian Mountains of Pennsylvania. (photo courtesy of NASA)

V ENERGY

Energy is crucial for the functioning of our society. Here, we describe state by state, the distribution of two types of energy resources in the coast. First, in Table 22 and 23 we describe nuclear and nonnuclear electrical generating facilities which are located in the coast. These facilities have requirements which the coast and coastal waters can meet. However, they often negatively effect the environment in which they are located. Estuarine locations, particularly, have a high potential for impacts. Society will have to decide how to balance expected environmental costs against the benefits of coastal locations--keeping in mind the advantages and disadvantages of the alternatives.

Another form of energy which impacts the coast is the offshore production of gas and oil. The quantities produced offshore are large. In 1978, 13% of domestic crude oil, and 26% of domestic natural gas were produced offshore. The acquisition of this energy has substantial potential to impact the coastal environment.

22. ELECTRICAL POWER

Given the demands of coastal population and business, energy generation in the coast is a necessity. Coastal counties, adjacent to enormous supplies of cooling water, provide the technological criteria essential to the installation of electrical generating facilities. This table lists all sources of electrical generating capacity -- nuclear, hydroelectric, coal, oil, gas and geyser. Each of these has its own peculiar effects on the coast. The information given here is based on the county list given in Table 19.

The Northeast and Mid-Atlantic regions have large amounts of capacity installed within the coastal counties (63 and 64% of the state totals respectively). The Gulf Coast (excluding Florida) has the lowest percentage of it capacity installed in coastal counties (26%). Georgia has the smallest percentage of its electrical generating capacity in the coast of any state with 7 percent of the total in coastal counties.

Note that because several plants are typically located at one site, the number of sites of electrical plants is considerably less than the number of plants.

THERMAL DISCHARGES from power plants unprotected by closed cycle cooling may cause heavy stress to estuarine ecosystems (Moss Landing, California) (Photo by John Clark)

Table 22. COASTAL ELECTRICAL GENERATING CAPACITY BY STATE (ALL SOURCES).

State	Number of Plants	Capacity (Megawatts)	Percentage of States' Plants	Capacity
Maine	62	1,691	41	83
New Hampshire	10	635	22	41
Massachusetts	81	5,845	44	61
Rhode Island	8	249	100	100
Connecticut	53	5,751	61	93
New York	153	17,923	31	57
New Jersey	79	8,985	66	72
Delaware	23	1,632	100	100
Maryland	85	6,946	88	76
Virginia	41	3,937	38	38
North Carolina	17	2,671	10	17
South Carolina	27	2,288	14	19
Georgia	23	1,076	13	7
Florida	264	25,441	85	91
Alabama	10	1,950	7	11
Mississippi	9	1,797	25	33
Louisiana	45	6,043	37	48
Texas	98	12,489	27	25
California	208	26,205	38	70
Oregon	34	1,076	17	11
Washington	77	2,212	30	12
All Coastal	1,407	136,842	37	45
All United States[1]	9,174	578,666	15[2]	24[2]
Region				
Northeast	367	32,094	38	63
Mid Atlantic	228	21,500	65	64
South Atlantic	331	31,476	39	44
Gulf	162	22,279	24	26
Pacific	319	29,493	32	45

[1] Excluding Alaska and Hawaii
[2] Coastal county plants or capacity as a percentage of the nations total.
Source: Adapted from Kenneth J. Shanks. April, 1979. Inventory of Power Plants in the United States. U.S. Department of Energy, Office of Energy Data and Interpretation.

23. NUCLEAR POWER

The coast provides technologically feasible sites for nuclear power plants, because of the access to massive amounts of cooling water typical of the coast. We give the name and location of existing and projected nuclear power plants, along with figures on the capacity (in Megawatts = MW), the maximum ΔT (the maximum increase in temperature of the effluent water in °F), and the rate of water intake in cubic feet per second (cfs). A nuclear power plant is deemed coastal if it occurs in one of the coastal counties listed in Table 19. It may be instructive to compare these to the figures on temperature in Table 13, and river discharge in Table 10.

If construction proceeds as projected, 11 of 21 coastal states plan to increase the percentage of their electrical generating capacity based on coastal nuclear power. At present, Maine has the highest percentage of its capacity installed as coastal nuclear power with 42 percent.

Note that because several plants are typically located at one site, the number of sites of nuclear power plants is considerably less than the number of plants.

Table 23. NUCLEAR POWER PLANTS IN THE COASTAL ZONE.

State	Location	Plant Name	MW	Max. Δ T	Intake (cfs)	Status	Coastal Nuclear Power and % of States: Existing Capacity	Coastal Nuclear Power and % of States: Projected Capacity
ME	Wiscasset	Yankee	864	25	950	Op.	42	32
NH	Seabrook	Seabrook 1[b]	2200	45	1733	12/82	0	57
		" 2[b]				12/84		
MA	Plymouth	Pilgrim 1	678	29	720	Op.		
		" 2[c]	1180			6/85	7	16
RI	N. Kingston	Rome Pt. 1	2300			11/86	0	90
		" 2				11/88		
CT	Haddam Neck	Haddam	662	22	870	Op.	35	45
	Waterford	Millstone 1	662	22	935	Op.		
		" 2	910	23	1150	Op.		
		" 3	1156			5/86	3	
NY	Brookhaven	Shoreham	844	20	1275	9/80	7	11
	Buchanan	Indian Pt 1	275	15	695	Op.		
		" 2	1013	15	1950	Op.		
		" 3	1013	16	1920	Op.		
	Suffolk Co.	Jamesport 1[b]	1191			7/88		
		" 2[b]	1191			7/90		
NJ	Lacey Twp.	Oyster Creek	550	20	960	Op.	14	34
		Forked R.[b]	1251			12/83		
	Salem	Salem 1	1170	14	5100	Op.		
		" 2[a]	1115			79		
	Salem Co.	Hope Creek 1[b]	1067			9/84		
		" 2[b]	1067			5/86		
MD	Lusby	Calvert Cliffs 1	918	10	5490	Op.	20	13
		" 2	911			Op.		
VA	Williamsburg	Surry 1	847.5	14	--	Op.	16	10
		"	847.5			Op.		
NC	Southport	Brunswick 1	866.7	14	4000	Op	11	6
		" 2	866.7			Op.		
FL	Florida City	Turkey Pt 3	760	15	--	Op.	12	11
		" 4	760			Op.		
	Fort Pierce	St. Lucie 1	850			Op.		
		" 2[b]	850			4/83		
	Crystal R.	Crystal R. 3	890	17	1520	Op.		
LA	St. Charles Co.	Waterford 3[a]	1165			4/81	0	5
TX	Matagorda Co.	South Tx. 1	1250			10/80	0	3
		" 2	1250			3/82		
CA	San Clemente	San Onofre 1	450	19	793	Op.	1	12
		" 2[a]	1181	20	2213	11/81		
		" 3[a]	1181			11/83		
	Diablo Canyon	Diablo Canyon 1[a]	1136	20	3684	79		
		" 2[a]	1159			79		
		" 3	1181			1/83		
	Humbolt Bay	Humbolt Bay 3	65.3			Op.		
OR	Ranier	Trojan 1	1216.0			Op.	12	9
WA	Grays Harbor	Satsop 1[b]	1240			1/84		
	County	Satsop 2[b]	1240			7/85	0	8

Source: Adapted from Kenneth J. Shanks. April, 1979. Inventory of Power Plants in the United States. U.S. Department of Energy, Office of Energy Data and Interpretation.
John Clark and Willard Brownell, 1973. Electric Power Plants in the Coastal Zone: Environmental Issues. American Littoral Society Special Publication No. 7. Highlands, NJ.
Plant Status, New York Times, Oct. 23, 1979, Page B7.

Footnotes
[a]operation Permit pending
[b]construction Permit pending
[c]construction Permit pending

24. OFFSHORE OIL AND GAS

Oil and gas are produced offshore in great quantities. In 1978 over 13 percent of domestically produced oil and over 26 percent of domestically produced natural gas came from offshore wells. Offshore waters have two divisions. The Outer Continental Shelf (OCS) includes shelf waters beyond state territorial waters. The OCS is under federal jurisdiction and has an area of 875,000 square miles. Oil and gas produced shoreward of the boundary are produced on state lands. In Texas and West Florida, the state lands extend 3 marine leagues offshore (about 10 miles), and everywhere else the state lands extend to only three miles offshore. The seaward limit of the OCS is not well defined legally, but extends roughly to include all submergd lands that lie under less than 200 meters of water (about 650 feet).

The U.S. Department of the Interior determines which areas will be bid upon. A bidder proposes some combination of royalties, and bonus for the right to drill for specified minerals. In addition, he is charged a rental fee which is set by the Department of the Interior. The U.S. Geological Survey, on the basis of exploratory findings selects that bid which it believes will produce the most revenue. Minimum royalties have been 16-2/3% of the production value of minerals taken from the lease. Annual rental and minimum royalty has been $3-10 per acre. A lease is typically about 5,000 acres. Through this bidding and royalty system, the federal government has received 70% of the total production value of the oil and gas produced on the OCS from 1953 through 1978. In some years, however, the revenue paid by the drilling companies to the federal government has been greater than the production value of the minerals, due to (among other reasons) large bonuses paid for the lease initially, compensated for by oil and gas obtained at a later date.

Most of the U.S. offshore (state and federal) oil and gas has been produced off the coast of Louisiana.

Note that some conversion factors pertaining to oil and gas may be found in Table 53f.

AN OIL PLATFORM in the Gulf of Mexico off Louisiana. (photo courtesy of U.S. Coast Guard)

Table 24a. REVENUE AND PRODUCTION VALUE OF OUTER CONTINENTAL SHELF LEASES.

Year	Total Revenue (in Thousand $)	Total Production Value (in Thousand $)	% Cumulative Revenue of Cumulative Production Value
1953	2,358	5,037	47
1954	147,660	14,370	774
1955	117,197	27,061	575
1956	11,716	39,498	324
1957	14,840	61,073	200
1958	20,150	96,471	129
1959	118,829	150,473	110
1960	323,782	200,970	127
1961	51,345	273,636	93
1962	564,570	376,676	102
1963	98,963	450,866	87
1964	194,939	506,784	76
1965	146,445	594,223	65
1966	354,466	801,725	60
1967	675,859	947,215	63
1968	1,558,052	1,179,912	77
1969	362,029	1,443,870	66
1970	1,238,961	1,707,593	68
1971	456,012	2,135,677	59
1972	2,624,958	2,229,179	69
1973	3,494,981	2,486,865	80
1974	5,598,758	3,570,054	94
1975	1,723,325	3,924,915	86
1976	2,967,860	4,402,440	83
1977	2,509,742	5,774,056	76
1978	2,941,112	7,096,500	70
TOTAL	28,318,912 [1]	40,497,138 [1]	70

[1] Columns do not add to totals, because of rounding after addition.

Table 24b. PRODUCING OUTER CONTINENTAL SHELF OIL AND GAS LEASES (BY YEAR AND ADJACENT STATE).

	California		Texas		Louisiana		Total	
Year	No.	Acres	No.	Acres	No.	Acres	No.	Acres
1954	0	0	0	0	58	240,028	58	240,028
1955	0	0	4	5,760	102	432,316	106	438,076
1960	0	0	13	23,040	285	1,141,959	298	1,164,999
1965	0	0	13	37,620	406	1,632,544	419	1,670,164
1970	10	42,256	34	146,340	557	2,329,365	601	25,117,961
1971	12	53,776	34	146,340	596	2,497,933	642	2,698,049
1972	16	76,816	39	166,320	636	2,659,880	691	2,903,016
1973	17	82,576	42	174,960	660	2,769,934	719	3,027,470
1974	29	145,012	44	186,480	668	2,803,654	741	3,135,146
1975	14	63,617	44	189,630	725	2,987,540	783	3,240,787
1976	14	63,617	70	330,414	749	3,082,564	833	3,476,595
1977	24	121,672	92	454,278	780	3,317,335	896	3,893,285
1978	24	121,672	121	615,583	786	3,366,831	931	4,104,086

Table 24c. TOTAL OFFSHORE OIL PRODUCTION BY STATE THROUGH 1978.

	State Lands		OCS Lands		State %
Adjacent State	Thousands of Barrels	% of State's Total Offshore	Thousands of Barrels	% of State's Total Offshore	of Total Offshore Prod.
Alaska	663,445	100	0	0	7.9
California	1,670,050	90	185,561	10	22.1
Louisiana	1,165,074	20	4,660,298	80	69.5
Texas	17,960	43	23,808	57	0.5

Table 24d. TOTAL OFFSHORE GAS PRODUCTION BY STATE THROUGH 1978.

Adjacent State	Millions of Cubic Feet	% of State's Total Offshore	Millions of Cubic Feet	% of State's Total Offshore	State % of Total Offshore Prod.
Alaska	733,690	100	0	0	1.4
California	628,737	90	69,860	10	1.4
Louisiana	8,786,472	19	37,458,119	81	90.5
Texas	1,825,685	53	1,619,004	47	6.7

THE OUTER CONTINENTAL SHELF. Spottail pinfish and gorgonians (soft coral) at a depth of about 100 feet 30 miles off the coast of North Carolina. This rock outcrop is an unusual "island" on the shelf off the Atlantic Coast (Photo by Mark Hooper).

Table 24e. OFFSHORE PRODUCTION OF CRUDE OIL AND CONDENSATES BY YEAR.

Year	Total U.S. Production (millions of barrels)	Total Offshore Production (millions of barrels)	% from OCS Lands	% from State Lands	% of Domestic Production from Offshore Sources
1954	2,315	48.6	7	93	2.10
1955	2,484	59.1	11	89	2.38
1956	2,617	73.4	15	85	2.80
1957	2,617	83.7	19	81	3.20
1958	2,449	86.2	29	71	3.52
1959	2,575	100.1	36	64	3.89
1960	2,574	116.8	43	57	4.54
1961	2,622	133.4	48	52	5.09
1962	2,676	162.2	55	45	6.06
1963	2,753	188.1	56	44	6.83
1964	2,787	214.8	57	43	7.71
1965	2,849	242.7	60	40	8.52
1966	3,028	300.3	63	37	9.92
1967	3,216	368.2	60	40	11.45
1968	3,329	471.2	57	43	14.15
1969	3,372	525.8	59	41	15.59
1970	3,517	575.7	63	37	16.37
1971	3,454	615.1	68	32	17.81
1972	3,456	614.8	67	33	17.79
1973	3,361	582.7	68	32	17.34
1974	3,203	532.7	68	32	16.63
1975	3,057	495.3	67	33	16.20
1976	2,968	462.9	68	32	15.60
1977	2,985	438.7	69	31	14.70
1978	3,150	416.6	70	30	13.23
1954-1978	73,414	7,909.1	61	39	10.77

Table 24f. OFFSHORE PRODUCTION OF NATURAL GAS BY YEAR.

Year	Total U.S. Production (billions of cubic feet)	Total Offshore Production (billions of cubic feet)	% from OCS Lands	% from State Lands	% Offshore OCS & State
1954	8,743	84.8	66	34	0.97
1955	9,405	128.2	63	37	1.36
1956	10,082	143.4	58	42	1.42
1957	10,680	174.3	47	53	1.63
1958	11,030	258.0	49	51	2.34
1959	11,620	353.4	59	41	3.04
1960	12,771	440.5	62	38	3.45
1961	13,254	478.1	67	33	3.61
1962	13,877	640.3	71	29	4.61
1963	14,667	763.3	74	26	5.20
1964	15,462	849.8	73	27	5.50
1965	16,040	939.4	69	31	5.86
1966	17,207	1,373.2	73	27	7.98
1967	18,171	1,837.8	65	35	10.11
1968	19,322	2,321.3	66	34	12.01
1969	20,698	2,844.7	69	31	13.74
1970	21,921	3,218.1	75	25	14.68
1971	22,493	3,750.7	74	26	16.67
1972	22,532	3,757.4	81	19	16.68
1973	22,647	3,975.3	83	17	17.55
1974	21,601	4,229.8	83	17	19.58
1975	20,109	4,257.5	81	19	21.17
1976	19,952	4,296.3	84	16	21.53
1977	20,025	4,540.0	82	18	22.67
1978	19,597	5,104.1	86	14	26.05
1954-1978	413,906	50,759.7	78	22	12.26

Source: Adapted from U.S. Department of the Interior, Geological Survey-Conservation Division. Outer Continental Shelf Statistics-Calendar Year 1978.

VI ESTUARINE AND WETLAND RESOURCES.

"An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measureably diluted with fresh water derived from land drainage."[1] These areas are associated with tremendous primary and secondary productivity. Many commercial and recreational fishes live in estuaries either for their entire lives, or for important parts of their lives.

Typically, estuaries are bordered by wetlands. Coastal saline wetlands are areas that are subject to periodic immersion, and so their habitat, productivity, and other attributes are part of the marine environment. It is widely believed that they are key parts of the marine environment. Further, many terrestial species have coastal wetlands as a part of their habitat.

Estuaries lengthen the shoreline, and therefore provide points of access to the coastal waters for many people.

[1] Donald W. Pritchard. 1967. "What is an estuary: Physical Viewpoint." In Estuaries, edited by George H. Lauff. AAAS. Washington, D.C.

25. ESTUARINE AREAS

The total area of coastal estuaries is over 15 million acres. This is about one-half of the area of the state of New York. In 1967 the U.S. Fish and Wildlife Service considered almost half of the estuarine area to be "important habitat" for fish and wildlife. In the twenty years preceding this report, the area of this important habitat had decreased by almost 8 percent. California experienced the greatest decrease as the San Francisco-Suisun Bay lost 192,000 out of 294,000 estuarine acres between 1950 and 1967 until filling was virtually stopped by state action. Maryland, Georgia, and Virginia each lost less than 1 percent of their important estuarine habitat in the years 1947 to 1967.

Table 25. FISH AND WILDLIFE ESTUARINE HABITAT LOST -- 1947-1967.

	Acres of Estuaries			
State	Total Area	Basic Area of Important Habitat	Area of Basic Habitat Lost by Dredging and Filling	Percent Loss of Habitat
Alabama	530,000	132,800	2,000	1.5
California	552,100	381,900	255,800	67.0
Connecticut	31,600	20,300	2,100	10.3
Delaware	395,500	152,400	8,500	5.6
Florida	1,051,200	796,200	59,700	7.5
Georgia	170,800	125,000	800	0.6
Louisiana	3,545,100	2,076,900	65,400	3.1
Maine	39,400	15,300	1,000	6.5
Maryland	1,406,100	376,300	1,000	0.3
Massachusetts	207,000	31,000	2,000	6.5
Mississippi	251,200	76,300	1,700	2.2
New Hampshire	12,400	10,000	1,000	10.0
New Jersey	778,400	411,300	53,900	13.1
New York	376,600	132,500	19,800	15.0
North Carolina	2,206,600	793,700	8,000	1.0
Oregon	57,600	20,200	700	3.5
Rhode Island	94,700	14,700	900	6.1
South Carolina	427,900	269,400	4,300	1.6
Texas	1,344,000	328,100	68,100	8.2
Virginia	1,670,000	428,100	2,400	0.6
Washington	193,800	95,500	4,300	4.5
TOTAL	15,347,000	7,115,900	563,000	7.9

Source: Modified from U.S. Fish and Wildlife Service Tabulation, p. 30, hearings on estuarine areas, House Merchant Marine and Fisheries subcommittee on fisheries and wildlife conservation, March 6, 8, 9, 1967.

26. WETLAND TYPES AND LOSS

The Soil Conservation Service has estimated the original, natural wetlands of this country at 127 million acres.[1]

In 1956, the Interior Department published a wetlands survey, which was the product of state and federal investigations of portions of states. They classified wetlands into 20 types. Types 1 through 11 are noncoastal. The remainder are coastal and are defined in Table 27. These wetland types are, despite their shortcomings, now widely used although a new classification system has recently been developed by the Fish and Wildlife Service.[2]

Experienced wetland scientists have estimated the acreage of wetland types at various times in the past, and from these figures, gross wetland loss can be imprecisely determined. These figures can present a misleading picture of a very dynamic system, however. For example, it appears that mangroves (Type 20) have sustained no losses between 1954 and 1978. However, in 1954, the mangrove stands in the Florida Keys and Bay had been devastated by a series of hurricanes, and the inventory that year followed a succession of wet years. Between 1954 and 1978, there was revegetation of mangroves at some sites but considerable natural and man-induced losses at other locations, particularly the filling of mangrove swamps on the southwest Florida coast for housing developments. However, the digging of new drainage canals, the reopening of old canals, and the development of waterways for recreation craft has resulted in saline intrusion and the extension of the mangrove forest northward into the Everglades.[3] A very dynamic story is hidden behind two numbers. (R. Macomber, U.S. Army Corps of Engineers, pers. comm.)

[1] Wetlands of the United States. Circular 39, 1956.

[2] L.M. Cowardin, V. Carter, F.C. Golet, E.T. LaRoe, 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services. 103 pp.

[3] The Trees of South Florida: The Natural Environments and Their Succession, Frank C. Craighead, Sr., 1971.

Table 26. EXISTING COASTAL WETLANDS AND WETLANDS LOSS BY TYPE -- 1780, 1954, 1978.

	Existing Wetlands (millions of acres)			Acres of Wetland Lost Annually	
Wetland Types	1780	1954	1978	1780 to 1954	1954 to 1978
12 to 14	6.0	4.0	2.0	11,500	83,000
15 to 18	4.5	3.7	3.2	4,800	20,800
20	0.5	0.5	0.5	0	0
TOTAL	11.0	8.2	5.7	10,300	103,800

Source: R. Macomber, U.S. Army Corps of Engineers, pers. comm.;

27. WETLAND TYPES

Table 27. WETLAND TYPE DESCRIPTIONS.

Type	Name	Water Depth	Dominant Plants
12	Coastal shallow fresh[1] marshes	Up to 6 inches at high tide	Diverse freshwater and brackish species including many grasses, reeds, rushes and sedges
13	Coastal deep fresh marshes	Up to 3 feet at high tide	Diverse freshwater and brackish species
14	Coastal open freshwater	Up to depths of 10 feet	Pondweeds, milfoils, wildcelery, wigeongrass, and others
15	Coastal salt flats	A few inches at high tide	Glassworts, saltwort and seablite
16	Coastal salt meadows	A few inches at monthly high tide	Saltmeadow cordgrass, and saltgrass
17	Irregularly flooded salt marshes	Up to a few inches at times	Needlerush
18	Regularly flooded salt marshes	Up to 2 feet at daily high tide	Saltmarsh cordgrass
20	Mangrove swamps	Up to 2 feet	Mangroves (four species)

[1] Includes low brackish estuaries where mean salinities are below 10%.
Source: U.S. Department of the Interior. Fish and Wildlife Service. 1971. Wetlands of the United States. Their extent and their value to waterfowl and other wildlife. Circular 39.

MARSH near Bogue Inlet, North Carolina (Photo by Mark Hooper).

28. WETLAND AREA

The 1954 wetlands survey of the U.S. Fish and Wildlife Service determined that there were over 7 million acres of coastal wetlands. Almost half of this area was in Louisiana. In general, the data for this survey were collected by examination of maps and field checks or by relying on the knowledge of local state and federal agents. These data generally exclude wetlands less than 40 acres in size.

Table 28. 1954 ESTIMATES OF COASTAL WETLANDS BY STATE AND TYPE

State	Acres of Wetland Type 12&13	15&16	17	18	Total
Maine[1]	11,549	16,178	---	1,455	29,182
New Hampshire	400	5,285	---	375	6,060
Massachusetts[1]	3,435	34,520	---	7,940	45,895
Rhode Island	195	1,360	---	645	2,200
Connecticut	6,442	7,496	---	2,037	15,975
New York[1]	9,010	24,855	---	11,530	45,395
New Jersey[1]	69,750	150,440	---	20,870	241,060
Delaware	20,714	49,578	---	43,756	114,048
Maryland	70,330	64,790	53,050	15,890	204,060
Virginia	---	20,250	24,700	86,100	210,250
North Carolina	47,500	---	100,450	58,400	206,350
South Carolina	80,400	---	91,000	345,000	516,400
Georgia	31,700	650	74,850	285,650	392,850
Florida	38,800	39,600	302,900	46,100	950,400
				20-523,000	
Alabama	17,350	---	12,100	---	29,450
Mississippi	28,463	1,758	5,790	18,398	54,409
Louisiana	2,951,262	33,000	15,400	520,800	3,520,462
Texas	44,114	528,053	18,378	18,888	609,433
California	10,730	23,497	---	83,605	117,832
Oregon	10,250	1,125	---	1,895	13,270
Washington	---	8,340	---	6,795	15,135
TOTAL	3,452,394	1,010,775	698,618	1,576,129	7,260,916

Source: [1]George P. Spinner. 1959. A plan for the marine resources of the Atlantic coastal zone. New York: American Geographical Society, remaining states from 1954 wetland surveys published by the U.S. Department of the Interior, U.S. Bureau of Sport Fisheries and Game.

29. WETLAND AREA

Since the 1954 wetlands survey of the U.S. Fish and Wildlife Service, many of the states have conducted their own surveys. These surveys were conducted for a variety of reasons, by a variety of methods, and used a variety of criteria. For example, some states surveyed every wetland, regardless of size, while others included only those over 40 acres in size. Because of this diversity, these results should not be compared to those in Table 28 for the purpose of determining changes in the area of wetland. Each state defined its own wetland types, and in order to list them together, we have superimposed the categories shown below. The "Salt to Brackish" category is a subdivision of the other two categories. The "All Coastal" and "All Tidal" categories are probably equivalent, and reflect each state's own designation. Louisiana has the greatest wetland acreage followed by Florida, Georgia, and Texas (in that order).

Table 29. MOST RECENT STATE ESTIMATES OF COASTAL WETLANDS (ACRES).

State	Salt to Brackish	All Coastal	All Tidal
Maine	16,909	28,303	---
New Hampshire	---	---	7,500
Massachusetts	43,280	---	---
Rhode Island	3,668	15,635	---
Connecticut	---	---	15,387
New York	---	---	23,500
New Jersey	---	---	245,000
Delaware	74,516	83,450	---
Maryland	165,379	211,647	---
Virginia	164,886	---	212,874
North Carolina	158,850	206,350	---
South Carolina	369,463	515,235	---
Georgia	---	---	475,000
Florida	981,803	2,254,160	---
Alabama	16,004	121,603	---
Mississippi	63,982	64,805	---
Louisiana	2,066,763	3,910,664	---
Texas	374,912	412,516	---
California	---	126,000	---
Washington	---	15,135	---
Oregon	18,823	29,933	---
TOTAL	4,519,238	7,995,436	979,261

Coastal and Tidal 8,974,697

Source

ME Frederick B. Hurley, pers. comm., Department of Inland Fisheries and Wildlife. Augusta, Maine.

NH C.H.J. Breeding, et. al., October, 1974. Soil Surveys of New Hampshire Tidal Marshes, University of New Hampshire Agricultural Experiment Station, Res. Rpt. No. 40.

MA W.P. MacConnell, 1975. Bulletin 630, Massachusetts Cooperative Extension Center, University of Massachusetts, Amherst.

RI W.P. MacConnell, 1974. Remote Sensing Land Use and Vegetative Cover in Rhode Island, Cooperative Extension Service, University of Rhode Island, Kingston.

CT Robert Leach, pers. comm., Connecticut Department of Environmental Protection.

NY John Ren Kavinsky, pers. comm., New York Department of Environmental Conservation, Division of Marine Resources, Tidal Wetlands Bureau.

NJ Thomas F. Hampton, undated memorandum, Properties Affected by the Wetlands order and Procedural Rules and Regulations. New Jersey Department of Environmental Protection, Division of Marine Resources, Trenton.

DE F.C. Darber, et. al., 1976. An Atlas of Delaware's Wetland and Estuarine Resources. Delaware Coastal Management Program, Technical Report No. 2.

MD Elder Ghigiarelli, pers. comm., Maryland Department of Natural Resources, Coastal Zone Unit, Annapolis.

VA Arthur F. Harris, pers. comm., Virginia Institute of Marine Science, Gloucester Point.

NC Kenneth A. Wilson, April, 1962. North Carolina Wetlands, Their Distribution and Management. North Carolina Wildlife Resources Comm., Raleigh.

SC Ralph W. Tiner, Jr., 1979. An Inventory of South Carolina's Coastal Marshes. South Carolina Wildlife and Marine Resources Department, Marine Resources Center, Charleston Technical Report No. 23.

GA Fred Marland, pers. comm., Georgia Department of Natural Resources, Marshland Protection Brunswick, Georgia.

FL Anonymous, March, 1978. Statistical Inventory of Key Biophysical Elements in Florida's Coastal Zone. Florida Department of Environmental Regulation, Division of Environmental Programs, Bureau of Coastal Zone Planning, Tallahassee.

AL B.A. Vittor and J.P. Stout, 1975. Delineation of Ecological Critical Areas in the Alabama Coastal Zone. Marine Environmental Science Consortium, Dauphin Island.

MS Lionel Electeris, 1973. The Marshes of Mississippi, pp. 147-190. In J.Y. Christmas [ed.] Cooperative Gulf of Mexico Inventory and Study, Mississippi.

LA William S. Perret, et. al., 1971. Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana Phase I, Area Description. Louisiana Wildlife and Fisheries Commission.

TX John Batterton, pers. comm., Texas Bureau of Economic Geology.

CA Bruce M. Browning, pers. comm., California Department of Fish and Game, Coastal Wetlands Program, Sacramento.

OR G.J. Atkins and C.A. Jefferson, August 1973. Coastal Wetlands of Oregon. Oregon Coastal Conservation and Development Commission, Florence.

WA No recent data, information transferred from Table 28.

30. DREDGE AND FILL PERMITS AND VIOLATIONS

Based on records from October 1977 through September 1978, when a violation of federal dredge and fill law (Section 404 of the Clean Water Act) is reported, 28 percent of the projects receive an after-the-fact permit, 60 percent are found not to require a permit, and 12 percent are submitted for litigation. When an application is submitted, 16 percent are withdrawn or cancelled, and 1 percent are denied. Sometimes the applications are withdrawn or cancelled by the applicant, because "we work with the applicant and in some cases where issuance is unlikely we might 'discourage' the applicant from further processing because the permit would not likely be approved."[1] Therefore, the distinction between the withdrawn and denied categories is not as clear cut as it might be.

These data are based on the reports of coastal districts, which cover large areas. When we queried district offices as to the percentage of permits which were issued in either coastal or tidal waters, we were told that it was more than three quarters. Of the offices that were contacted, only the Mobile, Alabama district quoted a lower figure -- 35 percent.

These data are applicable to wetlands, because a portion of the dredging and filling takes place within wetlands. The Corps has no record of what this portion is.

[1] Pers. comm. Curtis L. Clark, U.S. Army Corps of Engineers. April, 1980.

Table 30a. DREDGE & FILL PERMITS (A TO C) AND REPORTED VIOLATIONS (D TO G) FROM ALL COASTAL DISTRICTS.

	Section 10 Permits		Section 404 Permits		Section 10 & 404 Permits		All Permits	
Action[1]	#	%	#	%	#	%	#	%
A	857	14	279	22	951	18	2,087	16
B	52	*	19	2	84	2	155	1
C	5,436	86	958	76	4,241	80	10,635	83
D	297	32	71	17	212	29	580	28
E	535	57	297	72	422	57	1,254	60
F	104	11	44	11	107	14	255	12
G	936	100	412	100	741	100	2,082	100

Table 30b. DREDGE & FILL PERMITS (A TO C) AND REPORTED VIOLATIONS (D TO G) -- Districts New England and New York, New York

Action[1]	Section 10 Permits #	%	Section 404 Permits #	%	Section 10 & 404 Permits #	%	All Permits #	%
A	76	16	23	10	172	31	271	21
B	5	1	2	*	10	2	17	1
C	400	83	215	90	378	68	993	78
D	70	32	8	47	81	38	159	35
E	86	39	9	53	93	43	188	41
F	65	29	0	0	42	19	107	24
G	221	100	17	100	216	100	454	100

Table 30c. DREDGE & FILL PERMITS (A TO C) AND REPORTED VIOLATIONS (D TO G) -- Districts Philadelphia, Pennsylvania through Savannah, Georgia

Action[1]	Section 10 Permits #	%	Section 404 Permits #	%	Section 10 & 404 Permits #	%	All Permits #	%
A	187	12	86	21	374	23	647	18
B	22	1	9	2	37	2	68	2
C	1,383	87	315	77	1,228	75	2,926	80
D	101	48	32	17	87	30	220	32
E	107	50	131	71	187	64	425	62
F	4	2	21	11	19	6	44	6
G	212	100	184	100	293	100	689	100

Table 30d. DREDGE & FILL PERMITS (A TO C) AND REPORTED VIOLATIONS (D TO G) -- Districts Jacksonville, Florida through Galveston, Texas

Action[1]	Section 10 Permits #	%	Section 404 Permits #	%	Section 10 & 404 Permits #	%	All Permits #	%
A	416	12	107	24	302	11	825	13
B	20	*	7	2	28.	1	55	*
C	2,904	87	333	74	2,316	88	5,553	86
D	49	32	20	20	25	18	94	24
E	78	51	67	66	75	55	220	56
F	25	16	14	14	37	27	76	19
G	152	100	101	100	137	100	390	100

Table 30e. DREDGE & FILL PERMITS (A TO C) AND REPORTED VIOLATIONS (D TO G) -- Districts Los Angelos, California through Seattle, Washington

	Section 10 Permits		Section 404 Permits		Section 10 & 404 Permits		All Permits	
Action[1]	#	%	#	%	#	%	#	%
A	178	19	63	40	103	24	344	23
B	5	*	1	*	9	2	15	*
C	749	80	95	60	319	74	1,163	76
D	77	22	11	10	19	20	107	19
E	264	75	90	82	67	71	421	76
F	10	3	9	8	9	9	28	5
G	351	100	110	100	95	100	556	100

[1]	Action	Meaning
Application	A	Cancelled or withdrawn
"	B	Denied
"	C	Permit or Letter of Permission issued
Violations	D	After the fact applications accepted
"	E	Permit not necessary, or reported violation already under permit
"	F	Submitted for litigation
"	G	Sum of D, E and F

* Less than 1%
Source: U.S. Army Corps of Engineers data.

SOME DREDGE AND FILL PERMITS ALLOW DREDGING OF VALUABLE WETLANDS. This photograph is from Davis, North Carolina (Conservation Foundation photo by M. Fahay).

31. WETLAND ANIMALS

The 1954 wetlands survey of the U.S. Fish and Wildlife Service listed 25 species of game and fur animals which make use of coastal wetlands. The report also discussed more generally the use of wetlands by migratory birds. These species were discussed because they are widely known or used directly by man. Numerous other animals, both terrestial and aquatic, are found in wetlands, or depend in some way on wetlands. Some of these are listed in Table 39. The wetland types are described in Table 27.

Table 31a. USE OF WETLAND TYPES BY GAME AND FUR ANIMALS.

Species:	Number of States Reporting Use in Wetland Type								
	12	13	14	15	16	17	18	19	20
Small Game:									
Gallinules	7	7	6	1	1	1	1	--	--
Grouse, Sage	1	1	--	--	1	--	1	1	--
Mourning dove	1	1	--	2	--	--	--	--	--
Pheasant	7	2	--	--	2	--	1	--	--
Quail, Bobwhite	4	--	--	--	1	--	--	--	--
Rails	12	11	4	5	9	8	10	--	1
Rabbit, Cottontail	9	2	--	--	--	--	--	--	--
Rabbit, Swamp	4	3	--	1	4	3	3	--	--
Snipe	10	5	--	3	4	3	4	3	--
Woodcock	5	1	--	--	--	--	--	--	--
Big Game:									
White-tailed deer	6	5	--	1	1	1	2	--	--
Black-tailed deer	1	1	--	1	2	--	2	2	--
Fur Animals:									
Beaver	4	4	1	--	1	--	2	1	--
Bobcat	1	1	--	--	--	--	--	--	--
Fox (Red and Gray)	10	5	--	1	8	2	7	1	--
Mink	16	13	9	--	4	4	7	3	--
Muskrat	16	16	11	1	10	5	11	3	--
Nutria	1	1	1	--	--	1	--	--	--
Opossum	4	--	--	--	--	1	--	--	--
Otter	13	12	10	--	5	--	5	1	--
Raccoon	17	12	11	2	11	6	10	5	--
Skunk	4	4	1	1	1	1	1	1	--
Weasel	2	2	--	--	--	--	--	--	--
Alligator	3	3	1	--	1	1	--	--	--

Table 31b. NUMBER OF GAME AND FUR SPECIES USING WETLANDS BY STATE.

State	Number of Species Using Wetland Type								
	12	13	14	15	16	17	18	19	20
Alabama	5	2	--	--	--	6	--	--	--
California	4	4	4	--	--	--	1	1	--
Connecticut	8	6	5	--	5	--	4	--	--
Delaware	9	4	3	--	4	--	4	--	--
Florida	7	6	1	1	--	4	4	--	1
Georgia	12	3	3	2	4	5	5	--	--
Louisiana	19	19	4	4	6	5	3	--	--
Maine	5	4	4	--	3	--	3	3	--
Maryland	4	2	2	--	2	2	2	2	--
Massachusetts	10	9	4	--	3	--	3	--	--
Mississippi	11	7	5	4	6	6	5	1	--
New Hampshire	9	6	4	--	8	--	6	5	--
New Jersey	9	7	4	--	7	--	7	5	--
New York	8	6	5	--	7	--	6	1	--
North Carolina	5	2	1	--	--	4	2	--	--
Oregon	6	6	--	--	6	--	6	6	--
Rhode Island	8	6	4	--	--	--	--	--	--
South Carolina	7	4	3	1	2	3	3	--	--
Texas	4	4	--	--	--	--	--	--	--
Virginia	12	10	4	5	5	3	3	--	--
Washington	--	--	--	2	2	--	5	3	--

Source: U.S. Department of the Interior, Fish and Wildlife Service. Wetlands of the United States: Their extent and their value to waterfowl and other wildlife. Circular 39.

VII LIVING RESOURCES

In 1880 the fisheries of the United States and Alaska brought in 1.7 billion pounds of fish whose value was 39 million dollars. By 1979, the weight of the catch had increased by 3.7 times, and the value of the catch had increaed by 57 times. The 6 billion dollar a year commercial fishery provides high quality protein to eat, and oils for a variety of commercial uses.

The recreational fishery provides additional fishes for food and also for recreation. In 1970, the recreational catch was 24% of the total catch. The fisheries are a resource which is susceptible to human interference whether it be overfishing, pollution, or placing dams in the path of fish migrating upstream to spawn such as the shad and salmon.

Other species live in the coast too. Table 39 provides an example of a species which is making a comeback from near extinction, while Table 40 lists species which are presently close to extinction.

32. FISHERIES HISTORY

The retail value of the domestic fisheries landings in 1979 was over six billion dollars. This catch is heavily derived from nearshore waters. The catch of six species (Table 32b) has historically accounted for about half the value of the fishery. These species are either entirely, or partially (usually for the purpose of reproduction, or as a nursery for juveniles) estuarine dwelling, although only some species of shrimp are ever estuarine dwelling. For the fishery as a whole, about half of the catch (by value) is caught within 3 miles of shore. The percentage caught within 3 miles of shore by weight is even greater. In 1975, for example, 60% of the weight of the catch came from within 3 miles of shore. (Source same as table)

Annual domestic fishery landings from 1950 to 1977 have weighed about 5 billion pounds. In 1978, the catch reached 6 billion pounds. Whether the 1978 and 1979 catches are a product of the recently initiated 200-mile Fishery Conservation zone (The Fishery Conservation and Management Act) is unknown. However, recent increases are in species not managed under the FCMA. The dockside value of the catch has grown from 99 million dollars in 1940 to over 1800 million in 1978. Commercial fisheries have historically provided employment to over 200,000 people. The recent year of greatest income for fishermen (adjusted for inflation) was 1973. A GNP deflator was used to adjust for inflation.

Table 32a. HISTORY OF DOMESTIC FISHERY LANDINGS.

Year	Retail Value (in millions of dollars)	Dockside Value (in millions of dollars)	Catch Weight (in billions of pounds)	Percentage of Catch Caught within 3 miles of shore (by dockside value)
1979	6,352	2,234	6.3	49
1978	5,994	1,854	6.0	46
1977	5,437	1,515	5.2	49
1976	3,754	1,353	5.3	47
1975	3,008	971	4.8	47
1974	3,004	899	4.9	51
1973	2,801	907	4.7	49
1972	2,129	704	4.7	41
1971	1,968	643	5.0	46
1970	1,850	613	4.9	--
1960	--	354	4.9	--
1950	--	347	4.9	--
1940	--	99	4.1	--
1930[1]	--	104	3.3	--
1920	--	78	2.2	--
1908	--	51	1.8	--
1900	--	43	1.8	--
1880	--	39	1.6	--

[1] catch of 1920 and earlier refer to U.S. catch without Alaska.

Source: 1930-1880: U.S. Department of Commerce, U.S. Bureau of the Census, 1960. Historical Statistics of the United States Colonial Times to 1957.

THE HOLLY F. MURPHY AND CAPTAIN STACY II, two trawlers, berthed at Morehead City, California. The booms on each boat hold the trawls open. (photo by Mark Hooper)

Table 32b. HISTORY OF COMMERCIAL LANDINGS OF SELECTED SPECIES (IN MILLIONS OF DOLLARS).

Year	Menhaden	Shrimp	Salmon	Blue Crabs	Oysters	Clams	Total
1979	109	472	413	31	66	79	1170
1978	98	386	255	28	61	74	902
1977	68	355	221	27	53	74	798
1976	67	331	196	23	53	63	733
1975	49	226	116	19	43	41	494
1974	66	178	121	19	34	39	457
1973	73	219	125	17	35	35	504
1972	31	193	63	14	34	32	367
1971	36	167	78	12	30	31	354
1970	34	130	99	10	29	29	331

Table 32c. HISTORY OF FISHERIES EMPLOYMENT.

Year	Number Employed as Fishermen	Number Employed in Processing and Wholesaling	Total
1975	168,013	92,310	260,323
1970	140,538	86,813	227,351
1965	128,565	86,864	215,429
1960	130,431	93,625	224,056
1950	161,463	102,015	263,478
1940	124,795	90,215	215,010
1930	119,716	78,996	198,712

Table 32d. VALUE OF THE CATCH IN CONSTANT DOLLARS PER FISHERMAN.

Year	No. Fisherman	Dockside Value (in millions of dollars)	Constant Dollar Value (in millions of 1972 dollars)	Dockside Value Per Fisherman	Constant Dollar Value Per Fisherman
1975	168,000	971	763	5,780	4,543
1974	161,000	899	775	5,584	4,814
1973	149,000	907	857	6,087	5,754
1972	139,000	704	704	5,065	5,065
1970	141,000	613	671	4,347	4,757
1965	129,000	446	600	3,457	4,653
1960	130,000	354	515	2,723	3,964
1955	144,000	347	568	2,410	3,950
1950	161,000	99	185	615	1,147

Source: U.S. Department of Commerce, NOAA, NMFS. 1973. Fishery Statistics of the United States 1970. NMFS Statistical Digest No. 64; _____ Fisheries of the United States, Annual Reports for the Years 1979 to 1971. NMFS Current Fisheries Statistics 8000, 7800, 7500, 7200, 6900, 6700, 6400, 6100, 5900; U.S. Department of Commerce; U.S. Bureau of the Census, 1979. Statistical Abstract of the United States: 1979.

33. RECORD CATCHES

In recent decades the value of the catch has increased, but the weight of the catch has remained fairly constant. However, the peak weight of the catch is long past in many states. Only five states have recorded peak catches in the 1970's (Virginia, Alabama, Mississippi, Louisiana and Oregon), while 3 states (Rhode Island, New York, Maryland) recorded their peak catches in the last century.

Table 33. CURRENT CATCH COMPARED TO RECORD CATCH BY STATE.

State	Year of Record Catch (Pounds)	$\frac{\text{1978 Catch}}{\text{Record Catch}} \times 100\%$
Maine	1950	53.4
New Hampshire	--	--
Massachusetts	1948	58.0
Rhode Island	1899	65.4
Connecticut	1930	5.7
New York	1880	10.8
New Jersey	1956	30.3
Delaware	1953	0.3
Maryland	1890	42.2
Virginia	1972	80.9
North Carolina	1959	87.4
South Carolina	1965	77.4
Georgia	1927	36.7
Florida	1938	71.0
Alabama	1973	79.4
Mississippi	1971	94.2
Louisiana	1978	100.0
Texas	1960	43.6
California	1936	41.0
Oregon	1978	100.0
Washington	1941	70.1

Source: U.S. Department of Commerce, NOAA, NMFS. 1979. Fisheries of the United States, 1978. NMFS, Current Fisheries Statistics, No. 7800.

35. FISHERIES PORTS

San Pedro, California was the leading fisheries port in the nation both by value and weight of the catch from 1976 through 1978 (3 year average). San Pedro achieves this status because it is the port of record for much of the fish caught in the Pacific Ocean. New Bedford, and Gloucester are the leading North Atlantic ports; Key West and Beaufort-Morehead City are the leading South Atlantic ports. Among Gulf Coast ports Brownsville-Port Isabel, Texas and Cameron, Louisiana lead (these ports are listed by value and weight, respectively.) While there are many ports in the country, the top twenty account for about half of the weight and value of the catch. We have combined three years worth of data rather than present just the most recent data to smooth out temporary increases and decreases of ports.

Table 35a. TOP 20 U.S. FISHERIES PORTS -- 1976-1978 BY VALUE OF CATCH.

Port	Millions of Dollars (3 year average)	Percentage of Total U.S. Catch Value	Cumulative Percent
San Pedro, CA	106.1	6.7	6.7
Dutch Harbor, AK	69.8	4.4	11.1
Kodiak, AK	67.7	4.3	15.4
San Diego, CA	47.7	3.0	18.5
New Bedford, MA	45.6	2.9	21.4
Brownsville-Port Isabel, TX	39.3	2.5	23.9
Dulac-Chavin, LA	37.5	2.3	26.2
Aransas Pass-Rockport, TX	35.3	2.2	28.5
Freeport, TX	25.6	1.6	30.1
Ketchikan, AK	25.1	1.6	31.7
Cameron, LA	24.9	1.5	33.3
Bayou La Batre, AL	24.1	1.5	34.8
Gloucester, MA	22.3	1.4	36.3
Empire-Venice, LA	20.3	1.2	37.5
Cape May-Wildwood, NJ	20.1	1.2	38.8
Petersburg, AK	18.7	1.1	40.0
Akutan, AK	18.5	1.1	41.2
Key West, FL	18.3	1.1	42.4
Golden Meadow-Leeville, LA	17.8	1.1	45.5
Eureka, CA	16.6	1.0	44.5

TABLE 35b. TOP 20 U.S. FISHERIES PORTS -- 1976-1978 BY WEIGHT OF CATCH.

Port	Millions of Pounds (3 year average)	Percentage of Total U.S. Catch Weight	Cumulative Percent
San Pedro, CA	494.4	8.9	8.9
Cameron, LA	432.7	7.8	16.7
Pascagoula-Moss Pt., MS	275.2	4.9	21.7
Empire-Venice, LA	232.4	4.2	25.9
Dulac-Chauvin, LA	230.3	4.1	30.1
Kodiak, AK	169.5	3.0	33.2
Gloucester, MA	160.1	2.9	36.1
San Diego, CA	131.0	2.3	38.4
Dutch Harbor, AK	105.8	1.9	40.3
Beaufort-Morehead City, NC	96.1	1.7	42.1
New Bedford, MA	70.7	1.2	43.4
Pt. Judith, RI	55.3[2]	1.0	44.4
Ketchikan, AK	55.2[1]	1.0	45.4
Biloxi, MS	47.6	0.8	46.2
Cape May-Wildwood, NJ	45.1	0.8	47.0
Eureka, CA	42.8	0.7	47.8
Rockland, ME	40.1[2]	0.7	48.5
Bellingham, WA	35.5[1]	0.6	49.2
Portland, ME	34.5	0.6	49.8
Astoria, OR	34.2	0.6	50.4

[1] Based on 1977 and 1978
[2] Based on 1978
Source: U.S. Department of Commerce, NOAA, NMFS. Fisheries of the United States, Annual Reports for the Years 1978 through 1976. NMFS Current Fisheries Statistics 7800, 7500, 7200.

36. COMMERCIAL FISHERIES

Not only does the commercial fisheries catch vary between states, but so does the catch per fisherman. New York has the lowest weight of catch per fisherman, while Mississippi has the highest weight of catch per fisherman; 39 times that of a New York fisherman. The range in value of catch per fisherman is also broad. A Texas fisherman lands a catch worth 6.8 times that of a Maryland fisherman.

In order to determine catch per fisherman, we combined full and part-time fisherman by counting each part-time fisherman as one-half of a full-time fisherman. A full-time fisherman is defined as someone who receives more than half his annual income from fishing. Part-time fisherman receive less than half their annual income from fishing. It was not possible to make this distinction for California, or most other Pacific fishermen.

Table 36. COMMERCIAL CATCH PER FISHERMAN -- 1974.

	Full Time	Part Time	Weight of Catch (Thousands of Pounds)	Value of Catch (Thousands) of Dollars)	Thousands of Pounds Per Fisherman	Thousands of Dollars Per Fisherman
Maine	6,863	11,330	138,352	48,499	11.04	3.87
New Hampshire	98	406	3,146	1,277	10.45	4.24
Massachusetts	4,420	4,812	273,753	82,873	40.10	12.14
Rhode Island	1,505	1,687	79,483	18,899	33.84	8.05
Connecticut	392	722	3,629	2,584	4.82	3.43
New York	3,176	9,385	37,422	28,263	4.76	3.59
New Jersey	1,947	1,134	143,582	19,812	57.11	7.88
Delaware	205	349	7,055	1,717	18.59	4.52
Maryland	4,459	11,774	64,317	22,898	6.22	2.21
Virginia	4,556	3,530	444,827	33,076	70.37	5.23
North Carolina	2,832	1,908	238,301	20,000	62.94	5.28
South Carolina	1,304	467	20,079	13,117	13.06	8.53
Georgia	1,304	459	17,750	11,947	11.57	7.79
Florida (Atlantic)	2,168	642	56,943	18,512	22.88	7.44
Florida (Gulf)	6,699	1,793	115,836	56,531	15.25	7.44
Alabama	1,615	180	31,564	21,016	18.51	12.33
Mississippi	1,442	406	305,758	14,347	185.87	8.72
Louisiana	9,101	2,247	1,114,898	86,028	109.04	8.41
Texas	5,945	520	85,980	92,659	13.86	14.93
California	16,681	---	874,978	134,737	52.45	8.08
Oregon	4,486	18	86,229	26,015	19.18	5.79
Washington	10,505	339	146,021	61,581	13.68	5.77
TOTAL	91,703	54,108				

Source: Adapted from U.S. Department of Commerce, NOAA, NMFS. Fisheries Statistics of the United States 1974. Statistical Digest No. 6700.

37. RECREATIONAL FISHERIES

Many people participate in the recreational fishery, and much of their catch is at some point in its life cycle estuarine dwelling. These tables give characteristics of the recreational catch for selected estuarine species. Sea trout were landed in largest numbers of any of these species in 1960, 1965, and again in 1970. Croaker, and flatfishes also comprise a large proportion of estuarine species landed. The data were collected by the National Oceanic and Atmospheric Administration (NOAA, a part of the Department of Commerce). No study was made of the 1975 fishery, but studies are forthcoming for the 1979 and 1980 fisheries. An individual is counted as an angler for each species that he or she catches. For this reason, addition of the total number of anglers is not a meaningful statistic.

The data for participants in the recreational fishery is given under the Recreational heading (Section 9).

Table 37a. ESTUARINE RECREATIONAL FISHERIES -- NUMBER OF FISH BY YEAR.

	1970	1965	1960
		(THOUSANDS OF FISH)	
Bluefish	36,458	30,525	23,814
Catfish	56,265	41,739	32,695
Croaker	66,016	51,134	45,577
Black Drum	14,710	5,676	9,577
Red Drum	18,164	11,195	15,277
American Eel	3,111	4,118	2,079
Flatfish*	52,078	48,432	44,895
Mullet	4,283	18,448	19,240
Chinook Salmon	912	856	468
Coho Salmon	1,447	1,384	364
Sea Trout	96,825	87,615	83,836
Striped Bass	16,268	18,251	12,402
Steelhead	724	427	675
TOTAL	367,261	319,800	290,899

37d. ESTUARINE RECREATIONAL FISHERIES -- NUMBER OF FISH PER ANGLER.

	1970	1965	1960
Bluefish	25.3	32.0	26.5
Catfish	43.3	61.5	40.7
Croaker	48.1	42.6	48.8
Black Drum	30.8	17.8	20.6
Red Drum	21.0	14.4	23.9
American Eel	8.6	12.6	13.1
Flatfish*	20.4	22.3	22.8
Mullet	60.3	71.5	209.1
Chinook Salmon	4.2	4.6	3.7
Coho Salmon	4.5	4.5	2.7
Sea Trout	53.6	61.9	66.1
Striped Bass	17.2	21.1	18.1
Steelhead	6.2	11.2	10.2

* The flatfish category includes winter and summer flounder, but excludes Pacific flatfishes.

Source: Adapted from U.S. Department of Commerce, NOAA, NMFS. The 1970 Saltwater Angling Survey. Current Fisheries Statistics 6200; U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife. 1968. The 1965 Salt-water Angling Survey. Resource Publication 67; U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife. The 1960 Salt-Water Angling Survey. Circular 153.

38. RECREATIONAL FISHERIES

The 1970 recreational catch yielded 1.58 billion pounds of fishes. The commercial catch for 1970 was 4.9 billion pounds. Thus, recreational fisheries accounted for 24% of the total catch in 1970. The highest proportion of the recreational catch was landed in the South Atlantic Region. Within any given region, about 15 species or species groups will account for 95% of the fish caught (the 1970 survey lists 79 species or species groups in all). In a given region the most common fish landed typically accounts for 20% of the catch. In total, the Spotted Seatrout, the Croaker, and Catfishes were the three most commonly caught species.

Table 38. LEADING SPECIES IN THE 1970 RECREATIONAL FISH CATCH (BY NUMBER OF FISH CAUGHT) BY REGION.

Maine through New York	%	Cumulative %	New Jersey to Cape Hatteras, North Carolina	%	Cumulative %
Atlantic Mackerels	29	29	Spot	20	20
Winter Flounders	18	47	Puffers	16	36
Puffers	9	57	Atlantic Mackerels	11	47
Bluefish	9	66	Perches	9	56
Summer Flounders	7	73	Bluefish	7	63
Striped bass	4	77	Striped Bass	6	69
Tautog	4	80	Weakfish	6	75
Cods	3	83	Winter Flounders	4	79
Porgies	2	86	Searobins	4	83
Searobins	2	88	Croakers	3	85
Kingfishes	2	91	Summer Flounders	2	88
Conner	2	93	Black sea basses	2	90
American Eel	2	95	Yellow Perch	2	92
TOTAL Number Caught	117,014,000		Miscellaneous	2	94
TOTAL Pounds Caught	267,451,000		Catfishes	1	95
	(17% of Total)		TOTAL Number Caught	168,209,000	
			TOTAL Weight Caught	246,267,000	
				(16% of Total)	

Table 38. LEADING SPECIES IN THE 1970 RECREATIONAL FISH CATCH (BY NUMBER OF FISH CAUGHT) BY REGION (cont.).

Cape Hatteras, North Carolina through Florida Keys

	%	Cumulative %
Grunts	12	12
Porgies	9	21
Kingfishes	8	29
Spotted Seatrout	8	36
Bluefish	7	43
Spot	7	50
Catfishes	6	56
Yellowtail Snapper	6	62
Puffers	5	67
Croakers	5	72
Jacks	4	75
Black Seabasses	4	79
Black Drum	3	82
Spanish Mackerels	3	85
Red Drum	3	88
Groupers	2	90
King Mackerel	2	92
Summer Flounders	2	94
Snook	1	95
TOTAL Number Caught	184,177,000	
TOTAL Pounds Caught	403,913,000 (26% of Total)	

Florida Keys through Mississippi River Delta

	%	Cumulative %
Croakers	19	19
Spotted Seatrout	15	34
Catfishes	14	49
Sand Seatrout	12	60
Porgies	7	67
Kingfishes	6	74
Grunts	5	78
Red Drum	4	82
Summer Flounders	2	84
Black Drum	2	87
Mullets	2	89
Red Snapper	2	90
Groupers	2	92
King Mackerel	1	94
Spanish Mackerels	1	95
TOTAL Number Caught	188,888,000	
TOTAL Pounds Caught	334,120,000 (21% of Total)	

Mississippi River Delta through Mexico

	%	Cumulative %
Spotted Seatrout	25	25
Catfishes	16	41
Croakers	14	55
Grunts	12	67
Sand Seatrout	8	75
Red Drum	6	81
Black Drum	5	87
Kingfishes	3	90
Summer Flounders	2	92
Porgies	2	94
Snappers	1	95
TOTAL Number Caught	97,708,000	
TOTAL Pounds Caught	151,608,000 (10% of Total)	

Mexico through Pt. Concepcion, California

	%	Cumulative
Pacific Basses	19	19
Surfperches	18	37
Bonitos	11	48
Rockfishes	9	58
California corbina	8	65
Croakers	7	72
California halibut	7	79
Barracudas	5	83
Miscellaneous	3	86
Sculpins and cabezon	2	88
Tunas	2	91
California yellowtail	2	92
Jack mackerel	2	94
Pacific flatfishes	1	95
TOTAL Number Caught	37,221,000	
TOTAL Weight Caught	94,234,000 (6% of Total)	

Table 38. LEADING SPECIES IN THE RECREATIONAL FISH CATCH (BY NUMBER OF FISH CAUGHT) BY REGION (cont.).

Pt. Concepcion through Alaska
(excluding Canada)

	%	Cumulative %
Smelts	18	18
Rockfishes	12	30
Pacific Flatfishes	9	39
Striped Bass	8	47
Sculpins and Cabezon	8	55
Surfperches	7	62
Miscellaneous	7	69
Coho Salmon	6	75
Cutthroat Trout	5	80
Chinook Salmon	4	83
Ling Cod	3	86
Steelhead	3	89
Cods	2	92
Sablefish	2	94
Croakers	1	95
TOTAL Number Caught	24,100,000	
TOTAL Pounds Caught	79,230,000 (5% of Total)	

Source: Adapted from U.S. Department of Commerce, NOAA, NMFS. 1970 Salt-Water Angling Survey. Current Fisheries Statistics 6200.

39. COLONIAL BIRDS

Herons were almost hunted to extinction early in this century for their feathers. They reestablished themselves, but are again in decline. This most recent decline may be due to loss of wetlands habitat (Source same as table). Herons live in colonies as do a number of other species. Associated with these colonies are a number of other species. (The birds belonging to each of these groups are given in the footnote to this table.)

The numbers of colonies listed here are a conservative count of coastal or near coastal colonies. They are thought to include all large colonies (more than 250 nests) and most medium colonies (50 to 250 nests). Many small colonies were found, but many were missed.

Of course, many other species of birds dwell in coastal habitats, or can otherwise be found at the coast. Many bird guides list coastal species, and the Audubon Society Christmas counts (published annually in the July issue of American Birds) census some bird populations at specific coastal locations.

Table 39. COASTAL COLONIES OF HERONS AND THEIR ALLIES.[1]

State	Number of Coastal Colonies
Maine	20
New Hampshire	--
Massachusetts	14
Rhode Island	3
Connecticut	1
New York	21
New Jersey	18
Delaware	2
Maryland	29
Virginia	35
North Carolina	38
South Carolina	23
Georgia	28
Florida (Atlantic Coast and Keys)	73
Alabama	2
Mississippi	12
Louisiana	146
Texas	120

[1] Species of herons and allies included in census of Atlantic Coast Colonies.

Great blue heron**,*
Great white heron
Green heron
Little blue heron**,*
Cattle egret*,**
Reddish egret**,*
Great egret**,*
Snowy egret**,*
Louisiana heron*,**
Black-crowned night heron*,**
Yellow-crowned night heron*,**
Wood Stork
Glossy ibis**
White ibis*,**
Roseate Spoonbill**,*
White faced ibis*,**

Note: Only those species above the line are listed in the Atlantic Coast Census

* Listed in the Texas Colonial Waterbird Census.
** Listed in the Louisiana, Mississippi and Alabama survey.

Associated colonial and noncolonial species found breeding in Atlantic Coast heron colonies.

Brown pelican*,**
Double-crested cormorant
Anhinga*,**
Least bittern
Scarlet ibis[a]
Common eider
Bald eagle
Osprey
American oystercatcher**
Great black-backed gull
Herring gull
Laughing gull*,**
Gull-billed tern*,**
Forster's tern*,**
Common tern**
Least tern*,**
Royal tern*,**
Sandwich tern*,**
Black skimmer*,**
White Pelican*
Olivaceous cormorant*,**
Sooty tern*,**
Caspian tern*,**

[a]single record and not considered a regular nester.

[2] Only Mobile County.

Source: R.G. Osborn and T.W. Custer. 1978. Herons and Their Allies: Atlas of Atlantic Colonies, 1975 and 1976. U.S. Fish and Wildlife Service, Office of Biological Services. 211 pp.; Gene W. Blaclock et al. 1978. Texas Colonial Waterbird Census, 1973-1976. Texas Parks and Wildlife Department, FA Report Series No. 15; J.W. Portnoy. 1977. Nesting colonies of seabirds and wading birds--coastal Louisiana, Mississippi, and Alabama. U.S. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-77/07. 126 pp.

COMMON EGRET in flight. (Photo by Mark Hooper).

BABY HERONS in the nest. (Photo by Irving Hooper).

40. ENDANGERED SPECIES

A species is the collection of populations of interbreeding, or potentially interbreeding organisms. Throughout time, species have evolved, and gone extinct for a great number of reasons. In some cases, man has accelerated this process of extinction by hunting, environmental contamination or other habitat alteration. The Endangered Species Act was passed in December 1973 in order to minimize man's extinction of species. Under the Act protection is afforded to plants, mammals, fishes, birds, amphibians, reptiles, and invertebrates (except for certain pest insects). It classifies species close to extinction as either endangered or threatened, and prescribes acts to promote their conservation. An endangered species is defined in the act as "any species [or subspecies] which is in danger of extinction throughout all or a significant part of its range." A threatened species is "any species [or subspecies] which is likely to become an endangered species within the forseeable future throughout all or a significant part of its range." The decision to place a species into one of these classifications rests primarily with the Department of Interior (although some species are under the jurisdiction of the Commerce Department) in consultation with the states, other federal agencies, and interested persons or organizations. These species are listed in the Federal Register.

The species given here are or were found in coastal counties. This list was provided by Dr. John Nagy and Mr. Charles E. Calef of the Brookhaven National Laboratory. He used a county list very similar to ours. The species in this table are only those actually listed (as opposed to proposed or candidate species) as of January 1, 1980.

The following notation is used in this table:

E Endangered
T Threatened
B Either E or T depending on location
E* Extirpated from coastal counties.

ALLIGATORS ARE AN ENDANGERED SPECIES. They lay one clutch of eggs per year which incubate for 90 days. This 7.5 foot long mother alligator is opening her nest. She has about 27 eggs inside and will carry roughly one-third of the hatchlings to the water in her mouth. The rest will make it on their own. Hunting has reduced alligators to their endangered status. (Okeefenokee National Wildlife Refuge in Georgia) (Photo by Eugene Meyers).

Table 40. ENDANGERED SPECIES.

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
MAMMALS																					
1) Myotis sodalis Bat, Indiana				E	E	E	E		E												
2) Ursus arctos horribilis Bear, Grizzly																			T*	T*	T*
3) Felis concolor couguar Cougar, Eastern	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*									
4) Odocoileus virginianus clavium Deer, Key														E							
5) Odocoileus virginianus leucurus Deer, White-tailed, Columbian																				E	E
6) Vulpes macrotis mutica Fox, Kit, San Joaquin																			E		
7) Panthera onca Jaguar																		E*	E*		
8) Felis yagouaroundi cacomitli Jaguarundi																		E			
9) Trichechus manatus Manatee, West Indian (Florida)											E*	E*	E*	E*	E*	E*	E*	E*			
10) Felis wiedii Margay																		E*			
11) Reithrodontomys raviventris Mouse, Harvest, Salt Marsh																			E		

MAMMALS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
12) Felis pardalis Ocelot																	E*	E			
13) Enhydra lutris nereis Otter, Sea, Southern																			T	T	T
14) Felis concolor coryi Panther, Florida												E*	E*	E	E	E	E				
15) Dipodomys heermanni morroensis Rat, Kangaroo Morro Bay																			E		
16) Monachus tropicalis Seal, Monk, Caribbean (West Indian)														E*							
17) Sciurus niger cinereus Squirrel, Fox, Delmarva Peninsula								E*	E	E											
18) Balaenoptera musculus Whale, Blue	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E
19) Balaenoptera physalus Whale, Finback	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E
20) Eschrichtius gibbosus Whale, Gray	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*					E	E	E
21) Megaptera novaeangliae Whale, Humpback	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E
22) Eubalaena spp. Whale, Right	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E
23) Balaenoptera borealis Whale, Sei	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E
24) Physeter catodon Whale, Sperm	E	E	E	E	E	E	E	E	E	E	E	E	E	E					E	E	E

MAMMALS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
25) Canis lupus Wolf, Gray	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*					E*		E*	E*
26) Canis rufus Wolf, Red												E*	E*	E*	E*	E*	E*	E*			
BIRDS																					
1) Gymnogyps californianus Condor, California																			E	E*	
2) Grus canadensis pulla Crane, Sandhill, Mississippi																E					
3) Grus americana Crane, Whooping																	E*	E			
4) Numenius borealis Curlew, Eskimo	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*					E*	E*			
5) Haliaeetus leucocephalus Eagle, Bald	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	T	T
6) Falco peregrinus anatum Falcon, Peregrine, American	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E*	E	E	E	E
7) Falco peregrinus tundrius Falcon, Peregrine, Artic	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
8) Branta canadensis leucopareia Goose, Canada, Aleutian																			E	E	
9) Rostrhamus sociabilis plumbeus Kite, Florida Everglade (Snail Hawk)														E							

BIRDS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
10) Pelecanus occidentalis Pelican, Brown										E*	E	E	E	E	E	E	E	E	E	E	E
11) Tympanuchus cupido attwateri Prairie chicken, Greater, Attwater's																	E*	E			
12) Rallus longirostris obsoletus Rail, Clapper, California																			E		
13) Rallus longirostris levipes Rail, Clapper, Light-Footed																			E		
14) Lanius ludovicianus mearnsi Shrike, Loggerhead, San Clemente																			E		
15) Ammospiza maritima mirabilis Sparrow, Cape Sable														E							
16) Amphispiza belli clementae Sparrow, Sage, San Clemente																			T		
17) Ammospiza maritima nigrescens Sparrow, Seaside, Dusky														E							
18) Melospiza melodia graminea Sparrow, Song, Santa Barbara																			E*		
19) Sterna albifrons browni Tern, Least, California																			E		
20) Vermivora bachmanii Warbler Bachman's										E*	E*	E*	E*	E*	E*	E*	E*				
21) Campephilus principalis Woodpecker, Ivory-Billed											E*	E*	E*	E*	E*	E*	E*	E*			

BIRDS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
22) Picoides (Dendrocopus) borealis Woodpecker, Red-Cockaded									E	E	E	E	E	E	E	E	E	E			
PLANTS																					
1) Arabis macdonaldiana Rockcress, Mc Donald's																			E		
2) Erysimum capitatum var. angustatum Wallflower, Contra Costa																			E		
3) Echinocereus reichenbachii var. albertii Cactus, Black Lace																		E			
4) Dudleya traskiae Liveforever, Santa Barbara Island																			E		
5) Arctostaphylos hookeri ssp. ravenii Manzanita, Raven's (Presidio)																			E		
6) Rhododendron chapmanii (minus var. chapmanii) Rhododendron, Chapman														E							
7) Lotus scoparius ssp. traskiae Broom, San Clemente																			E		
8) Pogogyne abramsii Pogogyne, San Diego																			E		
9) Harperocallis flava Harper's Beauty														E							
10) Malacothamnus clementinus Bushmallow, San Clemente Island																			E		

PLANTS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
11) Oenothera deltoides ssp. howellii Evening-Primrose, Antioch Dunes																			E		
12) Orcuttia mucronata Grass, Orcutt, Crampton's																			E		
13) Delphinium kinkiense Larkspur, San Clemente Island																			E		
14) Castilleja grisea (hololeuca ssp. grisea) Indian Paintbrush, San Clemente Island																			E		
15) Cordylanthus maritimus ssp. maritimus Bird's-Beak, Salt Marsh																			E	E*	
REPTILES																					
1) Alligator mississippiensis Alligator, American											E	B	T	T	E	E	T	B			
2) Crocodylus acutus Crocodile, American														E							
3) Crotaphytus silus Lizard, Leopard, Blunt-nosed																			E		
4) Klauberina riversiana Lizard, Night, Island																			T		
5) Thamnophis sirtalis tetrataenia Snake, Garter, San Francisco																			E		
6) Drymarchon corais couperi Snake, Indigo, Eastern												T*	T	T	T*	T*					

REPTILES (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
7) Nerodia (Natrix) fasciata taeniata Snake, Water-, Salt Marsh, Atlantic														T							
8) Chelonia mydas Turtle, Sea, Green	T	T	T	T	T	T	T	T	T	T	T	T	T	E	T	T	T	T	T	T	T
9) Eretmochelys imbricata Turtle, Sea, Hawksbill	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
10) Dermochelys coriacea Turtle, Sea, Leatherback	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
11) Caretta caretta Turtle, Sea, Loggerhead	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
12) Lepidochelys kempii Turtle, Sea, Ridley, Kemp's (Atlantic)	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
13) Lepidochelys olivacea Turtle, Sea, Ridley, Olive (Pacific)	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
INSECTS																					
1) Shijimiaeoides battoides allyni Butterfly, Blue, El Segundo																			E		
2) Lycaeides argyrognomon lotis Butterfly, Blue, Lotis																			E		
3) Icaricia icarioides missionensis Butterfly, Blue, Mission																			E		
4) Pseudophilotes enoptes smithi Butterfly, Blue, Smith's																			E		

INSECTS (Cont.)	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
5) Callophrys mossii bayensis Butterfly, Elfin, San Bruno																			E		
6) Apodemia mormo langei Butterfly, Metalmark, Lange's																			E		
7) Papilio andraemon bonhotei Butterfly, Swallowtail, Bahama														T							
8) Papilio aristodemus ponceanus Butterfly, Swallowtail, Schaus'														T							
FISH																					
1) Etheostoma sellare Darter, Maryland									E												
2) Etheostoma okaloosae Darter, Okaloosa														E							
3) Gasterosterus aculeatus williamsonii Stickleback, Threespine, Unarmored																			E		
4) Acipenser brevirostrum Sturgeon, Shortnose	E	E	E	E	E	E	E	E	E	E	E	E	E	E							
AMPHIBIANS																					
1) Hyla andersonii Frog, Tree-, Pine Barrens, (Florida population)														E							
2) Ambystoma macrodactylum croceum Salamander, Long-Toed, Santa Cruz																			E		

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	CA	OR	WA
AMPHIBIANS (Cont.)																					
3) Bufo houstonensis Toad, Houston																		E			
SNAILS																					
1) Orthalicus reses Snail, Tree, Stock Island														E							
CLAMS																					
NO LISTED SPECIES FOR COASTAL COUNTIES OF CONTERMINOUS U.S.																					
CRUSTACEANS																					
NO LISTED SPECIES FOR COASTAL COUNTIES OF CONTERMINOUS U.S.																					
OTHERS																					
NO LISTED SPECIES FOR COASTAL COUNTIES OF CONTERMINOUS U.S.																					

VIII NATURAL AREAS

Coastal county nonmetropolitan population growth outstripped other population growth between 1960 and 1976 (see the tables and figures in Section II). Population growth in these areas places demands on the development of the more natural areas of the coast. These natural areas provide not only for the preservation of wildlife, but also for recreational opportunities for millions of people. In this section, we show the results of federal efforts, as well as the efforts of two private groups to conserve natural areas in the coast. Although the amounts preserved seem large--4.6 million acres of federal coastal property, and nearly 200,000 acres of private conservancy property--these acres are less than 4% of the total area of the coastal counties.

41. NATIONAL PARKS

The enabling legislation of the National Park System (1916) establishes the purpose of the service "to conserve the scenery and the natural and historic objects therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for future generations."

Of the 321 units in the National Park System, 41 are on the Atlantic Gulf and Pacific Coasts of the contiguous 48 states. These areas occupy over 3.4 million acres and were visited by over 65 million people in 1978. The recent trend shows an annual increase in visitation of 6.5% annually.

The gasoline shortage of 1979 led to a decrease in visits to the National Park system of 7.6%. The trend through 1978 had suggested that coastal park visitation would double in the next 11 years, but future increases are dependent on the availability of gasoline. Even with reduced energy use, the coastal parks will remain a public recreation resource of major significance.

The acronyms describing each park type are given in full name in Table 41c.

Table 41a. COASTAL NATIONAL PARKS, ACREAGE AND VISITATION.

	Acres	1978 Visitors (in thousands)	Average Annual % Increase 1970-1978
Acadia NP, ME	38,631	3,130.0	1.4
Assateague Island NS, MD-VA	39,631	2,135.9	2.9
Biscayne NM, FL	103,642	177.4	9.3 [1]
Boston NHP, MA	---	2,749.0	-- [9]
Cabrillo NM, CA	144	1,338.2	0.8
Canaveral NS, FL	57,627	882.6	9.4 [5]
Cape Cod NS, MA	44,596	5,025.9	2.6
Cape Hatteras, NS, NC	30,319	2,043.3	5.0
Cape Lookout NS, NC	28,400	54.3	16.4 [6]
Castillo De San Marcos NM, FL	20	774.6	4.2
Channel Islands NP, CA	124,740	56.1	5.4
Colonial NHP, VA	9,462	10,804.2	2.4
Cumberland Island NS, GA	36,978	36.4	25.6 [5]
De Soto NMe, FL	30	142.2	0.7
Everglades NP, FL	1,398,800	1,136.1	-1.5
Fire Island NS, NY	19,579	637.1	3.9
Ft. Caroline NMe, FL	139	168.0	6.8
Ft. Clatsop NMe, OR	130	88.7	-3.8
Ft. Frederica NM, GA	214	42.0	5.4
Ft. Jefferson NM, FL	47,125	18.7	3.9
Ft. Matanzas NM, FL	299	293.5	4.3
Ft. McHenry NM, MD	43	527.8	-1.0
Ft. Point NHS, CA	29	806.0	6.1 [1]
Ft. Pulaski NM, GA	5,615	348.9	3.9

Table 41a. COASTAL NATIONAL PARKS, ACREAGE AND VISITATION (cont.)

	Acres	1978 Visitors (in thousands)	Average Annual % Increase 1970-1978
Ft. Raleigh NHS, NC	157	349.2	2.2
Ft. Sumter NM, SC	64	204.9	1.7
Gateway NRA, NY-NJ	26,172	9,017.5	3.4[4]
Golden Gate NRA, CA	38,677	8,960.9	23.0[3]
Gulf Islands NS, FL-MS	139,775	3,971.6	15.2[2]
Jean Lafitte NHP, LA	20,000	304.5	1.7
Mar-A-Lago NHS, FL	17	---[7]	--[7]
Olympic NP, WA	908,781	2,996.6	3.0
Padre Island NS, TX	133,918	867.0	2.1
Point Reyes NS, CA	67,265	1,945.8	5.5
Redwood NP, CA	109,028	513.4	8.6
St. Croix Island NM, Me	35	---	--[2]
Sagamore Hill NHS, NY	78	187.3	2.7
Salem Maritime NHS, MA	9	300.2	.5
San Juan Island NHP, WA	1,752	76.4	9.5
Statue of Liberty NM, NY-NJ	58	1,507.9	3.3
Wright Brothers NM,NC	431	483.5	-.2

Table 41b. COASTAL NATIONAL PARKS SIZE AND VISITS BY REGION.

	# Areas	Acreage	Visitors (in thousands)	Average Annual % Increase 1970-1978
Atlantic	26	442,216	41,881.4	3.0
Gulf	6	1,739,648	6,440.1	9.5
Pacific	9	1,250,546	16,782.1	14.1
All	41	3,432,410	65,103.6	6.7

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[1] first data 1972
[2] first data 1973
[3] first data 1974
[4] first data 1975
[5] first data 1976
[6] first data 1977
[7] not open to public
[8] no Federal facilities
[9] first data 1978

Table 41c. COASTAL NATIONAL PARKS -- SIZE AND VISITS BY CLASS OF PARK.

	# Areas	Acreage	Visitor in (thousands)	Average Annual % Increase 1970-1978
National Park (NP)	5	2,579,980	7,832.2	2.1
National Seashore (NS)	10	598,088	17,599.9	6.5
National Monument (NM)	12	157,690	5,717.4	2.4
National Historic Park (NHP)	4	22,214	13,934.1	2.4
National Memorial (NMe)	3	299	398.9	2.3
National Recreation Area (NRA)	2	64,849	17,978.4	13.2
National Historic Site (NHS)	5	290	1,642.7	3.9

Source adapted from: U.S. Department of the Interior, National Park Service. 1971, 1973, 1975, 1976. Public Use of the National Parks, annual report; _____. 1978. National Park Statistical Abstract.

42. NATIONAL WILDLIFE REFUGES

The National Wildlife Refuge System was established in 1965.[1] Wildlife Refuges are the product of legislation which consolidated the authority of the Department of the Interior to administer lands for the conservation of fish and wildlife, including habitats of threatened or endangered species. As of 1978 over 100 refuges containing over 1 million acres have been acquired for this purpose in the coastal area. Florida, with 17, has the most coastal refuges. These refuges, in addition to providing sanctuary for wildlife, serve as parks. There were over 13 million visits to coastal refuges in 1978.

[1] U.S. House of Representatives, Committee on Merchant Marine and Fisheries. 1972. A Compilation of Federal Laws relating to Conservation and Development of our Nation's Fish and Wildlife Resources, Environmental Quality, and Oceanography. pp. 36-37.

Table 42a. NATIONAL WILDLIFE REFUGES -- ACQUISITION COSTS AND ACREAGE BY STATE.

State	Total Number of Refuges	Number of Coastal Refuges	Acquisition Costs of Coastal Refuges (in thousands)	Area of Coastal Refuges (in acres)
Maine	6	6	1,118	26,661
New Hampshire	1	0	---	---
Massachusetts	7	6	889	10,783
Rhode Island	4	4	0	543
Connecticut	1	1	2	183
New York	9	7	178	5,681
New Jersey	4	4	9,528	35,430
Delaware	2	2	3,891	24,062
Maryland	5	4	3,171	21,391
Virginia	8	5	260	23,695
North Carolina	8	5	839	90,304
South Carolina	5	3	893	53,371
Georgia	8	6	824	35,100
Florida	21	17	10,237	277,033
Alabama	4	0	---	---
Mississippi	6	1	7,335	8,814
Louisiana	7	5	285	232,478
Texas	11	6	10,158	164,317
California	21	6	4,613	17,009
Oregon	16	4	469	8,836
Washington	16	9	4,019	16,219
TOTAL	170	101	58,707	1,051,910

Source: U.S. Department of the Interior, Fish and Wildlife Service. Annual Report of Lands under control of the U.S. Fish and Wildlife Service as of September 30, 1978.

Table 42b. NATIONAL WILDLIFE REFUGES -- VISITS BY STATE.

State	Visits for Consumptive Wildlife Recreation[1]	Total Visits	No. Refuges Reporting	No. Coastal Refuges
Maine	4,537	33,775	2	6
New Hampshire	---	---	0	0
Massachusetts	105,612	1,280,362	4	6
Rhode Island	6,591	47,121	4	4
Connecticut	0	400	1	1
New York	13	5,421	1	7
New Jersey	25,806	322,358	2	4
Delaware	6,997	87,965	2	2
Maryland	12,222	145,646	2	4
Virginia	489,626	1,767,765	3	5
North Carolina	187,533	1,532,741	4	5
South Carolina	12,661	53,496	1	3
Georgia	30,431	58,016	6	6
Florida	714,194	7,078,804	10	17
Alabama	---	---	0	0
Mississippi	---	---	0	1
Louisiana	53,704	67,830	4	5
Texas	62,281	652,458	5	6
California	0	1,346	3	6
Oregon	3,300	12,772	3	4
Washington	36,633	629,536	6	9
TOTAL	1,913,141	13,777,812	62	101

Table 42c. NATIONAL WILDLIFE REFUGES -- VISITS BY REGION

Region	Visits for Consumptive Wildlife Recreation	Total Visits	No. Refuges Reporting	No. Coastal Refuges
Maine to Virginia	651,404	3,690,813	21	39
North Carolina to Texas	1,060,804	9,443,345	30	43
Pacific	39,933	643,654	11	19

[1] includes hunting, fishing, clamming, crabbing, and other

Source: U.S. Department of the Interior, Fish and Wildlife Service. National Wildlife Refuge--Public Use Report--Visits--FY '78.

42d. ENDANGERED SPECIES

The conservation of species threatened with extinction is a primary goal of the National Wildlife Refuge System. This table displays the states which have a coastal refuge reporting the occurence of a given endangered species. In contrast, table 40 gives the state-by-state breakdown of endangered species in the coastal counties. Because the National Wildlife Refuge list of endangered species is not an exhaustive list of species actually on the refuges, the comparison of the lists shows the absence of many endangered species that occur in coastal counties from the coastal National Wildlife Refuges. Additionally, some of these species may not occur within a coastal National Wildlife Refuge.

Table 42d. ENDANGERED AND THREATENED SPECIES REPORTED ON NATIONAL WILDLIFE REFUGES.

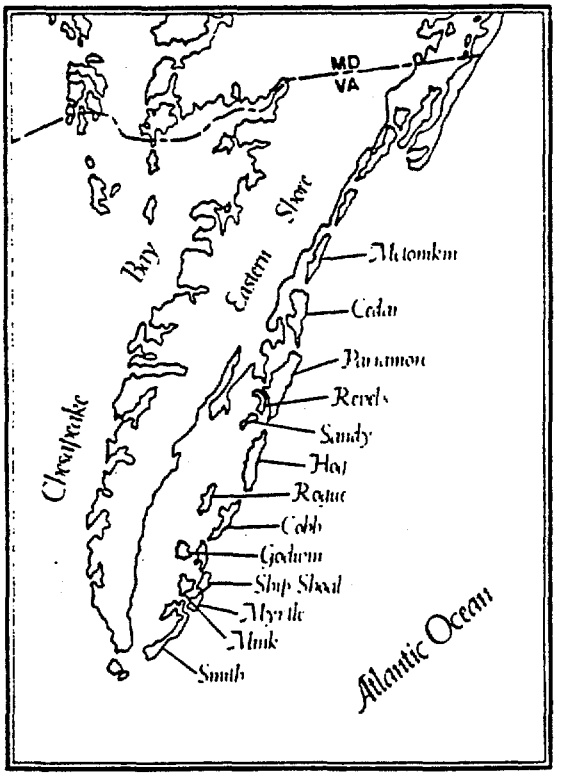
Species	States with the Species on a Coastal National Wildlife Refuge
American Alligator (T-Threatened)	GA, FL, LA, TX
American Alligator	NC, SC
American Crocodile	FL
Atlantic Ridley Turtle	MA, GA, FL
Attwaters Greater Prairie Chicken	TX
Bald Eagle (T)	OR, WA
Bald Eagle	ME, MA, RI, NJ, DE, MD, VA, NC, SC, GA, FL, TX, CA
California Brown Pelican	CA, OR, WA
California Least Tern	CA
Columbian White-tailed Deer	OR, WA
Delmarva Peninsula Fox Squirrel	MD, VA
Dusky Seaside Sparrow	FL,
Eastern Brown Pelican	NC, SC, GA, FL, TX
Eastern Indigo Snake (T)	FL
Everglade Kite	FL
Florida Manatee	FL
Florida Panther	FL
Green Sea Turtle (T)	FL
Hawksbill Turtle	FL
Humpback Whale	CA
Jaguarundi	TX
Key Deer	FL
Leatherback Sea Turtle	MA, FL
Light-footed Clapper Rail	CA
Loggerhead Sea Turtle (T)	MD, VA, NC, SC, GA, FL
Mississippi Sandhill Crane	MS
Ocelot	TX
Peregrine Falcon	ME, MA, NJ, DE, VA, NC, GA, FL, LA, TX, CA, OR, WA
Red-cockaded Woodpecker	MD, VA, NC, GA, FL
Red Wolf	LA, TX
Santa Cruz Long-Toed Salamander	CA
Whooping Crane	TX

Source: U.S. Fish and Wildlife Service; Memorandum from the Associate Director, Wildlife Resources, U.S. Fish and Wildlife Service, June 7, 1979.

43. PRIVATE CONSERVANCIES

Private groups hold over 100 coastal properties for the purpose of preservation. The coastal properties of The Nature Conservancy and the Audubon Society are listed here. The largest single property is The Nature Conservancy holding on Santa Cruz Island, California which is 55,000 acres and provides habitat for seven endangered or threatened species. West coast sanctuaries account for seventeen of these sanctuaries while sanctuaries in Maine number thirty four.

One of the outstanding properties held by The Nature Conservancy is The Virginia Coastal Reserve. This reserve is 35,000 acres of 13 barrier islands off the eastern shore of Virginia. These islands are shown below.



THE VIRGINIA COASTAL RESERVE. These 13 barrier islands make up the reserve which is owned by The Nature Conservancy. (from The Nature Conservancy).

Table 43. PRIVATE CONSERVANCY HOLDINGS -- NUMBERS AND ACREAGE BY STATE.

State	The Nature Conservancy Number	The Nature Conservancy Acres	Audubon Society Number	Audubon Society Acres
Maine	28	2,878	6	906
Connecticut	4	117	1	200
New York	12	432	1	267
Maryland	1	16	1	58
Virginia	2	33,760	--	--
North Carolina	3	7,306	1	3,500
South Carolina	1	23,777	1	250
Florida	12	5,060	6	4,149
Louisiana	--	--	1	26,800
Texas	2	2,383	9	10,617
California	7	61,315	2	2,700
Oregon	3	608	--	--
Washington	5	431	--	--
TOTAL	80	138,083	30	49,553

Total 110 Sanctuaries
187,636 Private Sanctuary Acres

Source: The Nature Conservancy, 1800 North Kent Street, Arlington, VA, 22209; The National Audubon Society Sanctuary Director, Miles Wildlife Sanctuary, West Cornwall Road, Sharon, CT, 06069.

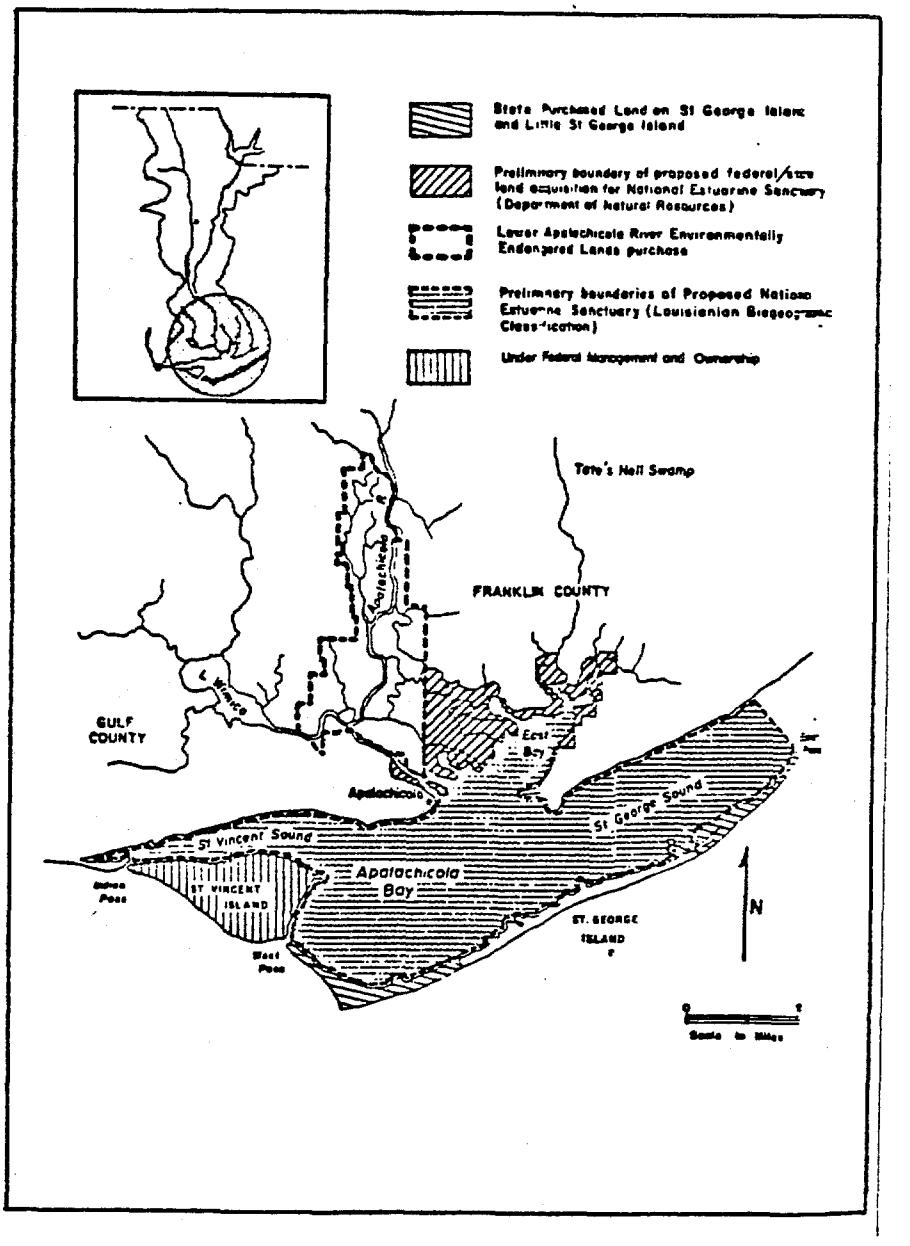
44. ESTUARINE SANCTUARIES

The Estuarine Sanctuaries system operated by the Coastal Zone Management Office of The National Oceanic and Atmospheric Administration (Department of Commerce) is the only federal program directed exclusively to the nation's estuaries. The five listed below are the only seacoast sanctuaries in the coterminous United States. The authorizing legislation for Estuarine Sanctuaries was passed in October, 1972. The Sanctuaries are established and added to the system for the purpose of providing "living laboratories" for scientific research, and public education to be operated by the individual states.

Table 44. FEDERAL ESTUARINE SANCTUARIES -- LOCATIONS AND SIZES.[1,2]

Name and Location	Acreage
Sapelo Island McIntosh County, Georgia	7,400
South Slough Coos Bay, Coos County, Oregon	4,200
Rookery Bay Collier County, Florida	8,500
Apalachicola River/Bay Franklin County, Florida	193,000
Elkhorn Slough Monterey County, California	1,510

[1] Source: U.S. Department of Commerce, NOAA, Estuarine Sanctuary Program
[2] Additional Federal Estuarine Sanctuaries are located in Hawaii, (5900 acres) and, Ohio (637 acres).



APALACHICOLA BAY ESTUARINE SANCTUARY. This sanctuary is the nation's largest. It occupies over 300 square miles in the Florida panhandle. (from Florida Department of Administration, Division of State Planning, Bureau of Land and Water Management, April, 1977. The Apalachicola River and Bay System: A Florida Resource.)

IX RECREATION

The nation's ocean beaches and waters and its estuaries, sounds and bays comprise an enormous recreational asset. Millions of saltwater fishermen spend billions of dollars and many days fishing every year. Millions of others swim or boat in the coastal area. The continued ability of these people to enjoy the coast depends upon their ease of access to aesthetically pleasing areas where they can find waters whose quality exceeds certain minimal requirements and which contain a reasonable abundance of desirable fishes.

45. RECREATIONAL FISHING

Twenty-two million fishermen spent 4.5 billion dollars on saltwater recreational fishing in 1975. As can be seen in the accompanying figure, a dramatic increase in these expenditures has occurred since 1955. Tables 45a, b, and c describe participation and economic aspects of recreational fishing (Tables 37 and 38 summarize the catch of these fishermen.)

Table 45a. SALTWATER RECREATIONAL FISHING -- PARTICIPATION AND EXPENSES.

	Number of Fishermen[1]	Expenditures[f]	Number of days of Participation	Passenger Miles
1955	4,557,000	488,939,000	58,621,000	2,904,001,000
1960	6,292,000	626,191,000	80,602,000	3,404,945,000
1965	8,305,000	799,656,000	95,837,000	4,138,307,000
1970	9,460,000	1,224,705,000	113,694,000	5,459,276,000
1975[b]	16,307,000	3,450,358,000	207,212,000	a
1975[c]	22,687,000	4,508,311,000	260,617,000	a
1975[d]	25,372,000		240,019,000	

Table 45b. SALTWATER RECREATIONAL FISHING -- PER CAPITA ACTIVITY.

	Expenditures Per Participant[f]	Days of Participation Per Fisherman	Automobile Miles Per Fisherman
1955	107	12.9	637
1960	100	12.8	541
1965	96	11.5	498
1970	129	12.0	577
1975[b]	212	12.7	a
1975[c]	199	11.5	a
1975[d]	a	9.5	a

FISHING ON BIRD SHOAL, NORTH CAROLINA. (Following Page) This angler is trying his luck on Bird Shoal. This island near Beaufort, North Carolina, was preserved by the efforts of The Nature Conservancy in conjunction with the local citizenry. (Photo by Irving Hooper)

Table 45c. SALTWATER RECREATIONAL FISHING -- CONSTANT DOLLAR EXPENDITURES (ADJUSTED TO THE 1972 DOLLAR).

	Expenditures	Expenditures Per Fisherman
1955	801,802,000	175.9
1960	911,884,000	144.9
1965	1,075,963,000	129.6
1970	1,340,526,000	141.7
1975[b]	2,711,479,000	166.3
1975[c]	3,542,877,000	156.2
1975[d]	a	a

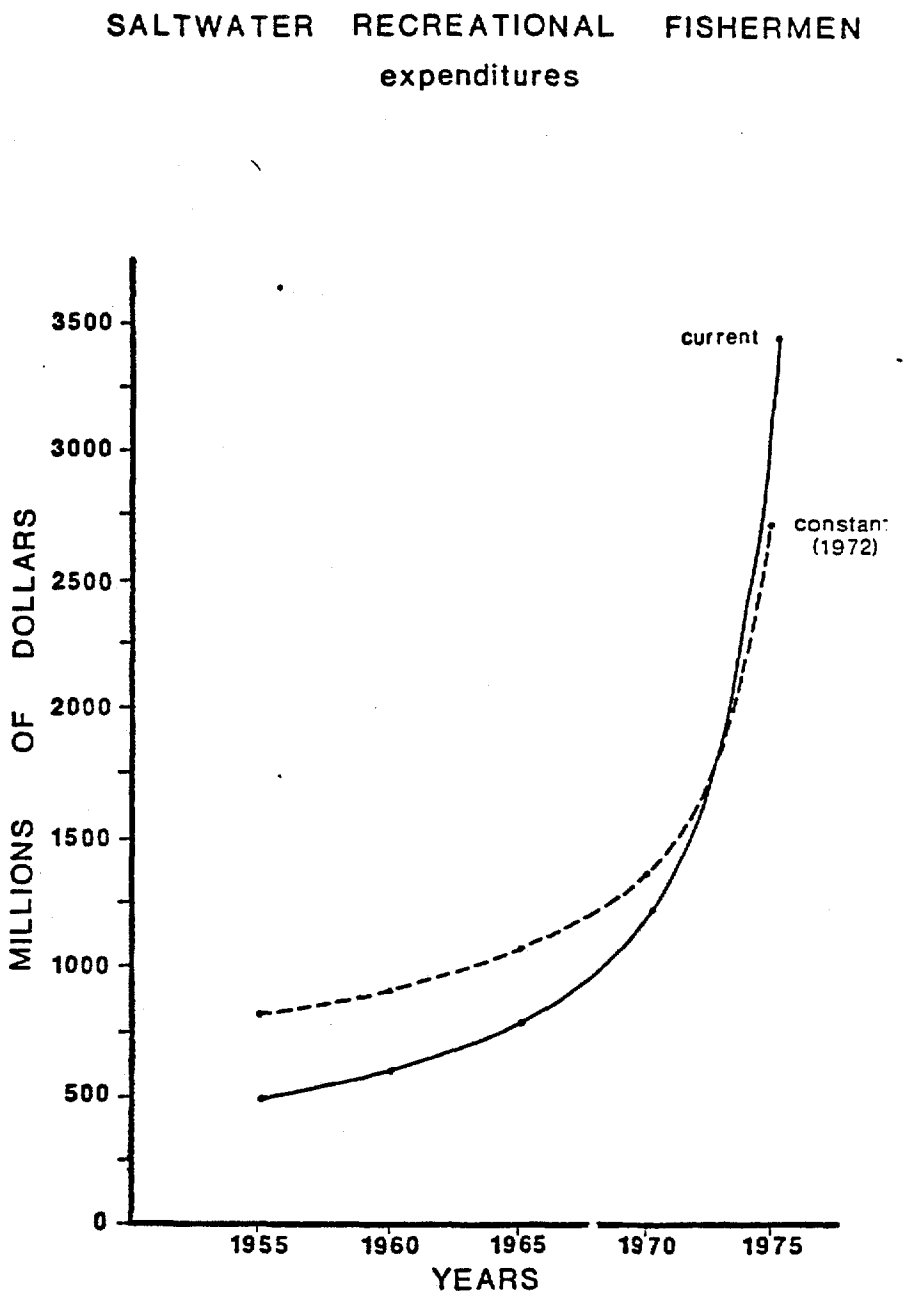
---

[1] The definition of a fisherman varied from year to year. This table outlines those differences.

A fisherman includes	1975	1970	Previous to 1970	1955
those over:	9 yrs. old	12 yrs. old	12 yrs. old	12 yrs. old
participating:	1 dy. or more	3 dys. or more	3 dys. or more	3 dys. or more
spending:	$0.00 or more	$7.50 or more	$5.00 or more	$5.00 or more
fishing in all saltwater states:	including Alaska and Hawaii	including Alaska and Hawaii	including Alaska and Hawaii	excluding Alaska and Hawaii

[a] not available
[b] excluding sea run fishes
[c] includes sea run fishes
[d] clamming, crabbing and shell collecting
[e] a fisherman had to meet either the participation or spending requirements.
[f] in dollars of the year indicated

Source: U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife; 1970 National Survey of Fishing and Hunting, Resource Publication Number 95, 108 pp; U.S. Department of the Interior, Fish and Wildlife Service. 1975 National Survey of Hunting Fishing and Wildlife Associated Recreation. 98 pp; U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States.



Dramatic increases in fishing expenditures have occurred during the 70's even accounting for inflation. (By Ruth Ann Hill)

46. BOATING, SWIMMING, WATER SKIING

Swimming represents one of the most popular forms of recreation at the shore. On the average, Americans swam almost five days each at the coast, and the Department of Commerce expects us to spend even more time swimming in the future. Pleasure boating and water skiing are also very popular activities. The figures here describe recreational activity in Bureau of Economic Analysis zones contiguous to the shore rather than at the shore. Since these zones are often large, these figures include some activity in noncoastal areas.

Table 46. COASTAL RECREATION -- BOATING, SWIMMING, AND WATER SKIING (DAYS IN THOUSANDS).

Region	Boating[1] Days	% Increase[3]	Swimming[2] Days	% Increase[3]	Water Skiing Days	% Increase[3]
New England						
ME-CT	5,551	20	35,052	13	2,203	20
Mid-Atlantic						
NY-DE	10,688	23	71,421	14	4,189	26
South Atlantic						
MD-FL	12,664	19	42,661	14	6,622	16
Gulf						
AL-TX	5,539	18	19,371	12	2,962	14
Pacific						
CA-WA	14,603	21	63,626	16	8,826	13
TOTAL	49,045	21	232,232	14	24,803	17

[1] other than water skiing
[2] other than pool swimming
[3] % increase expected 72-78

Source: Modified from Robert J. Kalter, Recreation Activities in the Nation's Estuarine Zone. In Estuarine Control & Assessment, Volume I. EPA. Report Number 400/1-77-007A March, 1977. Office of Water Planning and Standards, pp. 83-94. Department of Commerce, Bureau of Economic Analysis, Zones Contiguous to Shore.

SUNBATHING represents an immensely popular form of recreation. This is Miami Beach (Photo by Miami Beach Visitor and Convention Authority).

X. HURRICANES

Hurricanes are powerful storms with winds exceeding seventy three miles per hour that lash the coasts and the interior of the United States. In addition to their winds and rains, they may be accompanied by storm surges which can completely wash over low-lying areas. Since Galveston was devastated by a hurricane in 1900 which killed 6,000 people, the trend has been toward reports of increased property damage, and decreased loss of life. The two major hurricanes in 1979 caused $2.6 billion in property damage and claimed ten casualties.

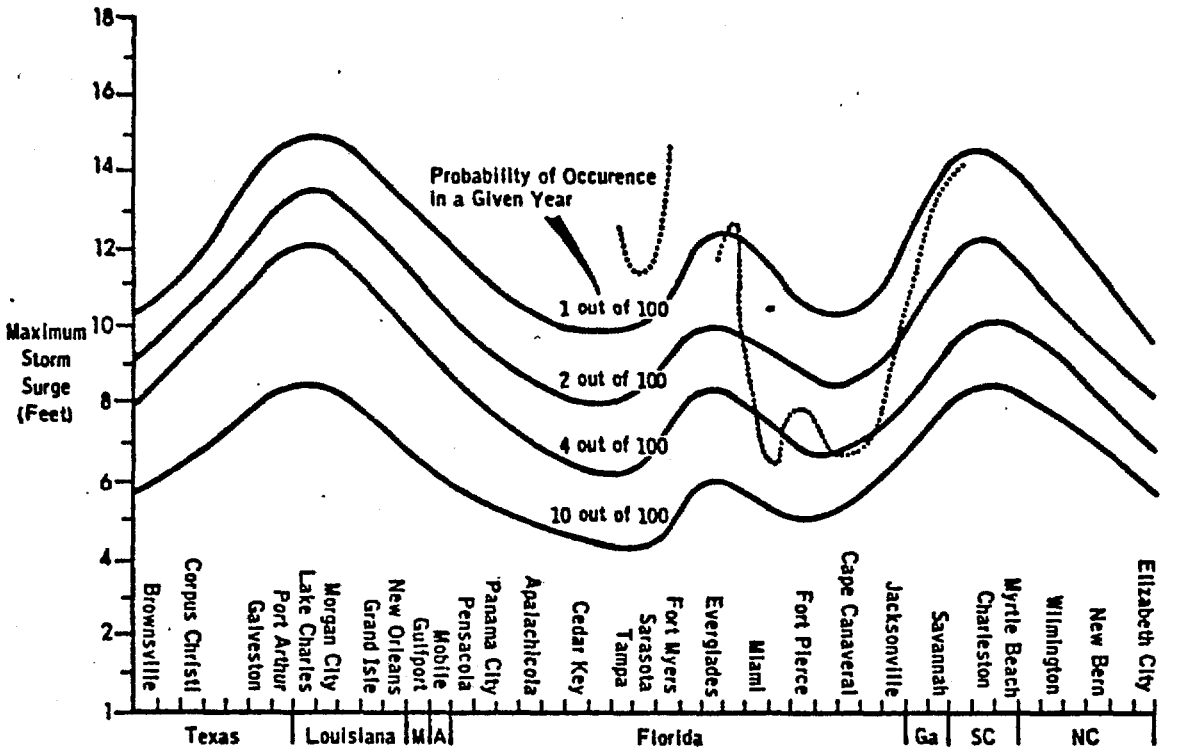
Hurricane season typically extends from early June through October, with a few storms in November, although one aberrant hurricane struck the coast in February.

47. HURRICANES

Table 47. DAMAGES AND DEATHS FROM MAJOR HURRICANES IN THE UNITED STATES -- 1954-1979.

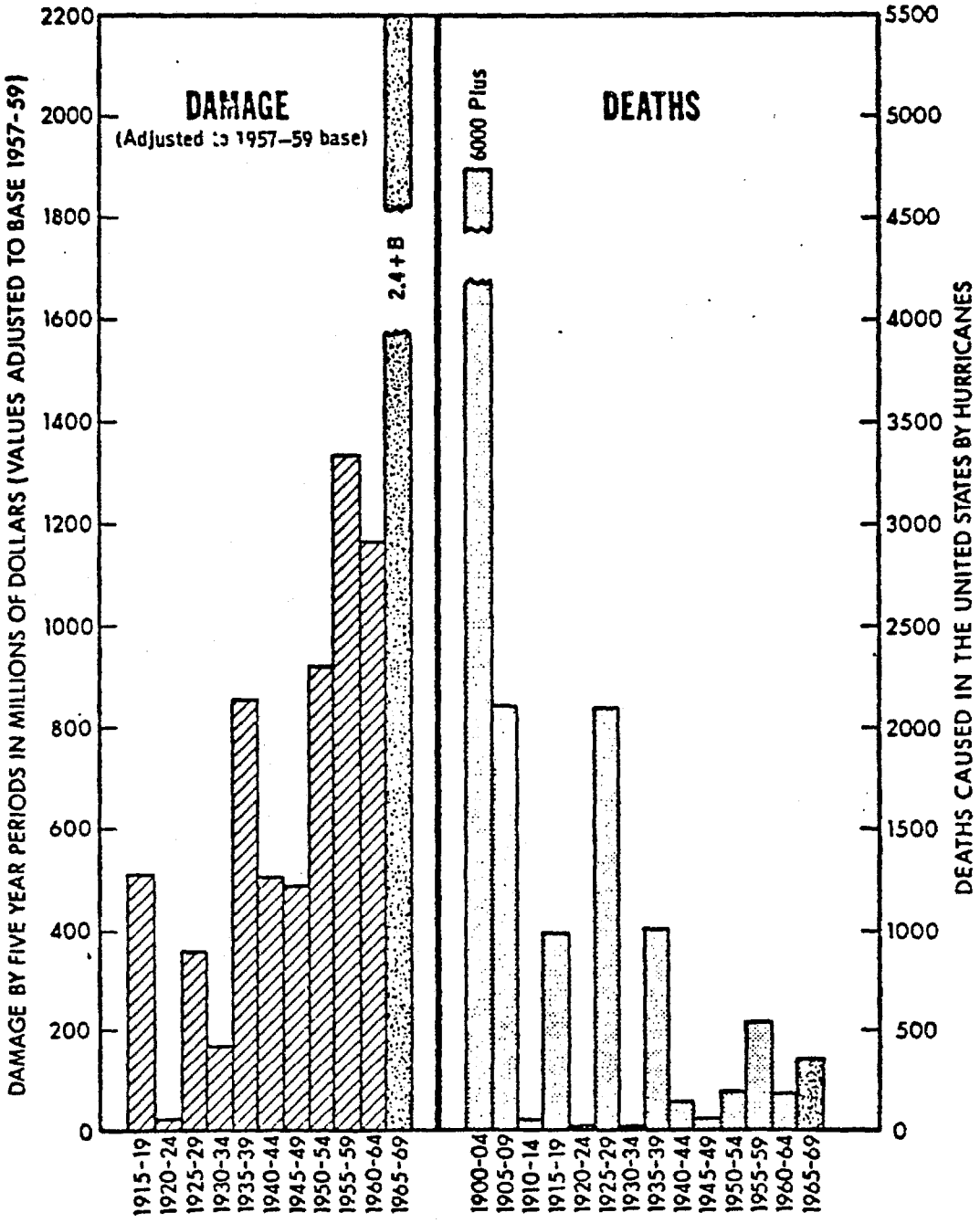
Name of Hurricane	Time (Month-Year)	Damages (Millions)	Deaths (Number)	Region of Losses
Carol	Aug 54	$461	60	Northeast
Hazel	Oct 54	281	95	Southeast/ Northeast
Diane	Aug 55	832	184	Northeast
Audrey	Jun 57	150	390	Gulf
Donna	Sep 60	387	50	Southeast/ Northeast
Carla	Sep 61	408	46	Gulf
Betsy	Sep 65	1,420	75	Southeast/ Gulf
Beulah	Sep 67	200	15	Gulf
Camille	Aug 69	1,421	256	Gulf/ Northeast
Celia	Aug 70	453	11	Gulf
Agnes	Jun 72	2,100	122	Northeast
Carmen	Sep 74	150	1	Gulf
Eloise	Sep 75	550	21	Gulf/ Northeast
David	Sep 79	320	5	Southeast/ Northeast
Frederic	Sep 79	2,300	5	Gulf

Source: Dacy and Kunreuther (1969), The Economics of Natural Disasters, Years 1954-1965; U.S. Army Corps of Engineers, Hurricane Reports, 1966-1978; Platt, R. and McMillan, G. (1978), Paul Hebert, National Hurricane Center, pers. comm.

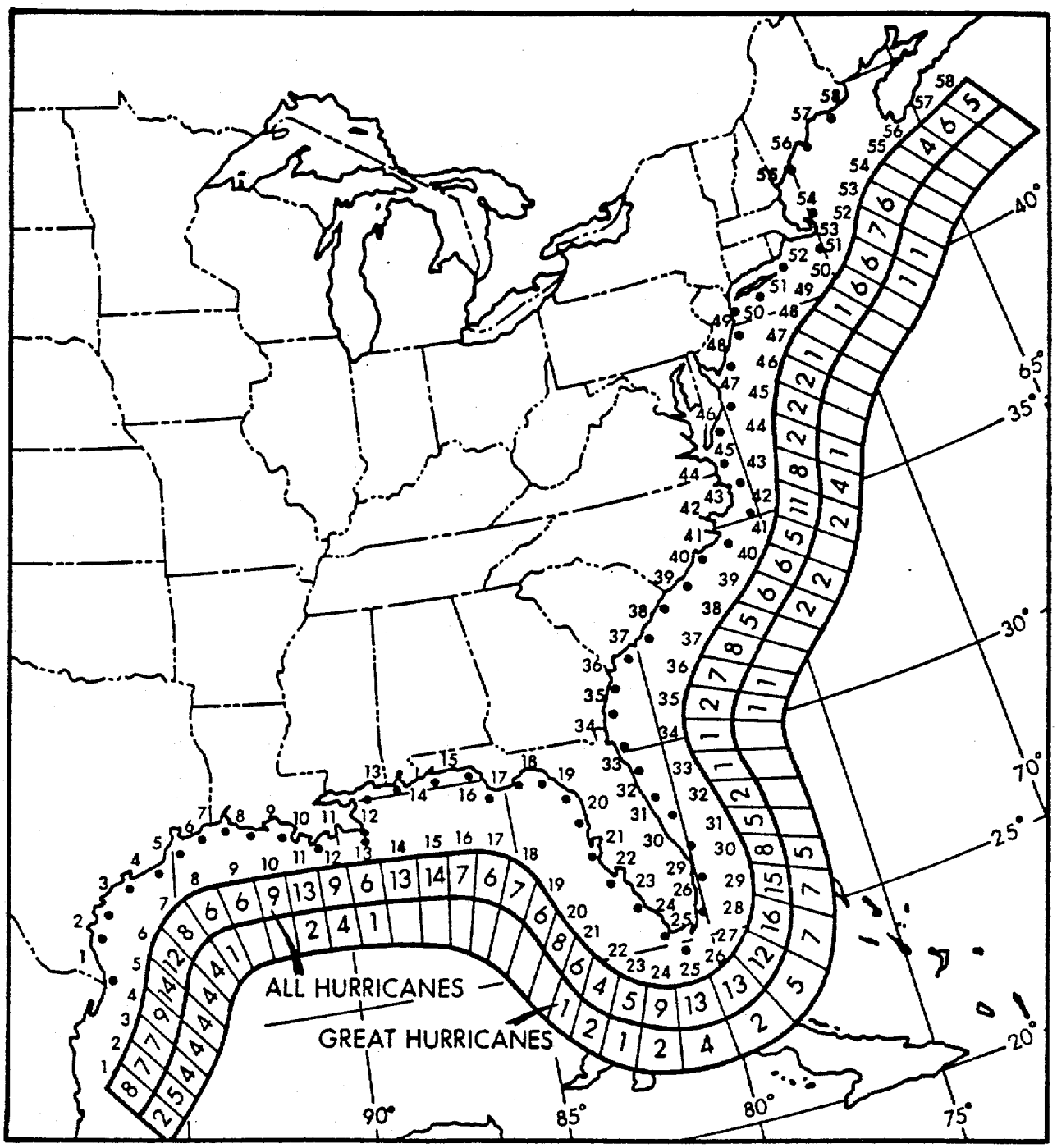


STORM SURGES often accompany hurricanes. This figure shows the probability of storm surges of a given height at a given location. The Texas-Louisiana border, the southern tip of Florida, and the coast of South Carolina are most likely to have the highest storm surges. The solid lines are based on U.S. Army Corps of Engineers and University of Florida probability estimates of annual occurrence of a storm surge on an open beach area; dotted lines based on National Oceanic and Atmospheric Administration data, probability of occurrence is 1 out of 100.

Note: Greater heights are possible in bays and estuaries. Furthermore, about 3 feet should be added to account for wave runups, also, the effect of the astronomical tide must be taken into consideration. (from U.S. Department of Commerce, NOAA, Office of Coastal Zone Management, November 1976. Natural Hazard Management in Coastal Areas)



DEATH AND DAMAGES FROM HURRICANES in the United States. Recent years have seen an increase in hurricane damages, and a decrease in deaths caused by hurricanes. (from U.S. Department of Commerce, NOAA, Office of Coastal Zone Management, November 1976. Natural Hazard Management in Coastal Areas)



HURRICANE PROBABILITY MAP. The probability (given as a percentage) that a hurricane (winds exceeding 73 miles per hour) or great hurricane (winds in excess of 125 mph) will occur in any one year in a 50 mile segment of the United States Coastline. These probabilities are based on records from 1871 to the present. (from U.S. Department of Commerce, NOAA, Office of Coastal Zone Management, November 1976. Natural Hazard Management in Coastal Areas)

HURRICANE BEACHED FREIGHTERS. Hurricane Camille beached these large freighters at Gulfport, Miss. (Photo by U.S. Coast Guard).

XI PORTS

Port facilities are vital facilities for export and import. Walk to any major port and see the huge amounts of material going in and out--grain from Kansas, coal from West Virginia, oil from Saudi Arabia, iron ore from Venezuela. Ports also provide many jobs as well as a commercial link, and so public port authorities oversee some aspects of their development.

The U.S. Army Corps of Engineers is responsible for providing and maintaining access to ports. Since there exist considerable economies of scale in shipping (It is less expensive to ship 1 ton of say coal in a large boat than in a smaller boat) many harbors are being dredged and maintained to greater depths than previously.

48. PORT EXPENDITURES—PORT AUTHORITIES

Port development has been funded by both public and private funds. The public funding is typically through local or state port authorities. These quasi-public agencies receive funding through bonds based on municipal collateral, and on collateral based on their own revenue (75%), and from federal, state, and local sources. Their revenue comes from fees charged for port use, and services, as well as rent. The Maritime Administration (part of the Department of Commerce) collects information on public expenditures at 110 ports by survey. These figures indicate that almost five billion dollars have been spent on construction and modernization of pier and wharf facilities in the 33 years preceeding 1979. It is widely believed that private expenditures are equal to or greater than this sum, but specific figures are not available. It is worth noting that the recent trend has been towards the construction of new facilities particularly for bulk and container cargoes rather than towards modernization and rehabilitation of existing facilities. Oil facilities have been privately constructed, and are not reflected here in public expenditures.

Nationally, the port of New York has benefited from more public investment than any other port (over 700 million dollars). Baltimore is second nationally. (1946-1978) On the Gulf coast, New Orleans Louisiana leads with over 180 million dollars in port authority expenditures, and Long Beach, California leads on the Pacific Coast with over 230 million spent by its port authority.

Table 48. PORT DEVELOPMENT EXPENDITURES BY PUBLIC PORT AUTHORITIES (IN THOUSANDS) -- 1946-1978.

State Port	1966-1972[2] Total Expenditures	% New	% MR[1]	1973-1978[2] Total Expenditures	% New	% MR	1946-1978[3] Total Expenditures
Maine							
Portland	4,048	0	100	1,047	64	36	9,082
Searsport	-	-	-	-	-	-	35
New Hampshire							
Portsmouth	-	-	-	2,298	100	-	4,706
Massachusetts							
Boston	69,930	92	8	8,093	-	100	135,498
Fall River	-	-	-	1,756	33	67	3,139
Rhode Island							
Providence	-	-	-	-	-	-	4,030
Connecticut							
New Haven	1,692	72	28	6,700	83	17	17,212
New London	870	0	100	-	-	-	1,470
New York/New Jersey							
Port of New York & vicinity	109,516	90	10	110,250	96	4	705,444
Delaware							
Wilmington				9,168	20	80	25,215
Maryland							
Baltimore	131,046	92	8	59,715	74	26	274,680
Cambridge	-	-	-	-	-	-	1,190
Virginia							
Newport News	20,900	73	27	1,483	81	19	48,635
Norfolk	-	-	-	23,675	76	24	108,129
North Carolina							
Morehead City	19,473	100	*1	10,230	100	0	36,800
Wilmington	17,353	95	5	9,352	82	18	40,613
South Carolina							
Charleston	9,296	100	0	30,750	91	9	66,497
Georgetown	1,585	100	0	375	100	0	3,460
Port Royal	-	-	-	-	-	-	1,500
Georgia							
Brunswick	-	-	-	-	-	-	3,047
Savannah	19,600	100	0	44,279	90	10	94,526
Florida							
Fort Pierce	-	-	-	69	0	100	1,789
Jacksonville	32,670	63	37	13,730	100	0	54,903
Miami	6,910	100	0	13,015	98	2	26,207
Palm Beach	535	25	75	7,911	93	7	10,870
Panama City	3,139	100	0	-	-	-	3,889
Pensacola	2,500	100	0	1,641	96	4	11,141
Port Canaveral	1,300	100	0	8,295	100	0	10,825
Tampa	47,557	96	4	36,548	100	*	89,130

Table 48. PORT DEVELOPMENT EXPENDITURES BY PUBLIC PORT AUTHORITIES (IN THOUSANDS) -- 1946-1978.

State Port	1966-1972[2] Total Expenditures	% New	% MR	1973-1978[3] Total Expenditures	% New	% MR	1946-1978[3] Total Expenditures
Alabama							
Mobile	6,301	17	83	55,192	40	60	95,750
Mississippi							
Gulfport	-	-	-	12,252	100	0	18,452
Pascagoula	10,050	71	29	3,036	0	100	27,111
Louisiana							
Baton Rouge	3,170	31	69	-	-	-	46,269
New Orleans	37,304	64	36	51,852	80	20	187,480
Texas							
Beaumont	-	-	-	11,413	63	37	34,708
Corpus Christi	5,106	76	24	17,106	89	11	61,104
Freeport	1,215	94	6	-	-	-	6,983
Galveston	19,400	81	19	40,100	90	10	84,174
Houston	14,941	50	50	44,774	93	7	116,953
Port Arthur	13,584	100	*1	2,264	88	12	12,010
Port Isabel	-	-	-	-	-	-	33
California							
Hueneme	6,801	84	16	-	-	-	6,899
Humbolt Bay	-	-	-	-	-	-	560
Long Beach	41,455	51	49	39,723	49	51	236,197
Los Angeles	33,424	89	11	36,088	86	14	170,436
Redwood City	-	-	-	-	-	-	1,694
San Diego	11,081	100	0	-	-	-	35,864
San Francisco	32,786	56	44	27,870	50	50	92,510
Ventura	-	-	-	-	-	-	1,398
Oregon							
Coos Bay	-	-	-	9,000	44	56	9,705
Portland	17,245	95	5	60,600	77	23	105,679
Washington							
Anacortes	120	100	0	-	-	-	1,470
Bellingham	3,238	4	96	400	0	100	6,648
Everett	3,883	91	9	6,000	100	0	11,543
Gray's Harbor	9,721	97	3	2,720	100	0	12,823
Olympia	106	0	100	2,247	0	100	3,650
Port Angeles	721	95	5	-	-	-	1,101
Seattle	66,314	86	14	36,947	54	46	136,876
Tacoma	22,187	96	4	24,000	88	12	53,333
Vancouver	-	-	-	-	-	-	1,105

Sources: * Less than 1%. [1]Modernization and Rehabilitation. [2]Department of Commerce, Maratime Administration March 1974. North American Port Development Expenditure Survey. [3]Department of Commerce, Maratime Administration December 14, 1979. North American Port Development Expenditure Survey (Unpublished Final Draft), provided by Bob Wardwell, MARAD.

49. PORT EXPENDITURES—CORPS

The Army Corps of Engineers is responsible for maintaining access to the nation's ports. This requires the expenditures of money--approved project by congress--on navigation projects. The figures presented here are the expenditures made to September 30, 1978.

Paralleling the pattern of expenditures of port authorities, the Port of New York has had the highest construction expense. Along the Gulf coast, Baton Rouge/New Orleans, Louisiana has had the highest construction expense, but on the Pacific Coast, Portland/Vancouver, Oregon and Washington has had the highest construction expense.

Table 49. EXPENDITURES OF THE CORPS OF ENGINEERS -- NAVIGATION PROJECTS.

State	Port	Construction	Operation & Maintenance
ME	Portland	9,588,710	1,915,357
	Searsport	572,568	12,912
NH	Portsmouth	5,384,043	481,859
MA	Boston	25,313,083	6,358,852
	Fall River	5,550,091	1,395,947
CT	New Haven	4,205,246	6,564,471
	New London	622,994	278,034
RI	Providence	25,417,022	3,687,995
NY/NJ	Port of NY & vicinity	198,761,688	104,964,671
DE/PA	Delaware R.	57,879,028	191,964,671
DE	Wilmington	1,954,725	16,792,568
MD	Baltimore	38,071,275	20,783,208
	Cambridge	195,974	53,728
VA	Norfolk/Newport News	40,665,225	40,822,404
NC	Morehead City	6,527,364	16,842,494
	Wilmington	1,840,958	2,575,374
SC	Charleston	10,037,813	53,630,099
	Georgetown	7,061,755	23,489,069
	Port Royal	1,786,100	4,863,540
GA	Brunswick	4,235,968	19,842,149
	Savannah	42,222,721	82,560,940
FL	Fort Pierce	356,056	2,225,915
	Jacksonville	47,265,962	29,480,251
	Miami	24,412,096	2,115,476
	Palm Beach	6,904,021	2,796,616
	Panama City	1,638,045	3,760,538
	Pensacola	1,469,693	3,555,612
	Port Canaveral	7,341,910	11,561,432
	Tampa	57,704,688	10,456,731

Table 49. EXPENDITURES OF THE CORPS OF ENGINEERS -- NAVIGATION PROJECTS (cont.)

State	Port	Construction	Operation & Maintenance
AL	Mobile	15,698,837	40,705,964
MS	Gulfport	904,775	18,102,275
	Pascagoula	6,572,985	13,818,331
LA	Baton Rouge/New Orleans	114,222,690	249,534,627
TX	Beaumont/Port Arthur	56,136,815	78,394,758
	Corpus Christi	38,870,873	37,770,855
	Freeport	2,566,959	20,116,667
	Galveston	29,096,392	40,734,104
	Houston	35,760,382	62,003,392
CA	Hueneme	978,426	15,225
	Humbolt Bay	9,342,509	27,932,343
	Los Angeles/Long Beach	34,896,831	3,176,894
	Redwood City	1,672,722	3,452,270
	San Francisco	2,091,647	40,046,543
	San Diego	26,409,734	1,478,264
	Ventura	1,711,539	5,336,584
OR	Coos Bay	29,193,673	31,765,842
OR/WA	Portland/Vancouver	48,189,597	146,292,913
WA	Anacortes	1,047,607	427,886
	Bellingham	2,570,683	62,966
	Everett	1,775,744	3,653,303
	Gray's Harbor	5,030,851	48,867,436
	Olympia	464,782	584,652
	Port Angeles	470,873	47,327
	Seattle	7,497,942	38,151,837
	Tacoma	2,435,500	1,279,534

Source: Adapted from U.S. Army Corps of Engineers, Chief of Engineers. FY 1978 Annual Report, Volume II -- Field Reports.

50. PORT COMMERCE

Enormous amounts of commerce pass through coastal ports. Incoming oil, and automobiles, and outgoing grain. Many other materials and products pass through these ports. It is worth noting that regionally, the ports with the largest construction expenditure (Table 49) or port authority expense also have the largest reported commerce--New York, New Orleans, Los Angeles, and Long Beach, California.

Table 50. COMMERCE AT SELECTED PORTS -- 1977.

State	Port	Tons - 2,000 lbs.
ME	Portland	18,326,110
	Searsport	1,497,184
NH	Portsmouth	3,499,854
MA	Boston	25,975,275
	Fall River	5,285,473
CT	New Haven	11,119,383
	New London	3,074,590
RI	Providence	8,642,484
NY/NJ	Port of New York & vicinity	185,292,125
DE	Wilmington	2,917,774
MD	Baltimore	44,756,359
	Cambridge	109,406
VA	Norfolk	43,862,200
	Newport News	8,730,346
NC	Morehead City	2,904,715
	Wilmington	9,504,953
SC	Charleston	10,629,971
	Georgetown	1,798,340
	Port Royal	173,488
GA	Brunswick	1 889,696
	Savannah	9,875,678
FL	Fort Pierce	180,727
	Jacksonville	15,108,032
	Miami	3,504,543
	Palm Beach	681,978
	Panama City	1,393,065
	Pensacola	3,105,287
	Port Canaveral	2,807,463
	Tampa	45,619,951

Table 50. COMMERCE AT SELECTED PORTS -- 1977 (cont.).

State	Port	Tons - 2,000 lbs.
AL	Mobile	35,943,893
MS	Gulfport	1,094,796
	Pascagoula	23,832,891
LA	Baton Rouge	70,008,229
	New Orleans	162,991,985
TX	Beaumont	48,918,843
	Port Arthur	30,753,732
	Corpus Christi	46,871,695
	Freeport	15,332,518
	Galveston	9,563,626
	Houston	104,291,267
CA	Hueneme	1,875,743
	Humbolt Bay	1,644,573
	Los Angeles	31,325,506
	Long Beach	32,985,424
	Redwood City	410,293
	San Francisco	1,931,693
OR	Coos Bay	7,599,421
OR/WA	Portland	21,400,262
	Vancouver	2,832,673
WA	Anacortes	8,968,313
	Bellingham	1,718,417
	Everett	4,589,002
	Gray's Harbor	2,646,192
	Olympia	536,458
	Port Angeles	3,283,012
	Seattle	16,432,876
	Tacoma	10,699,337

Source: U.S. Army Corps of Engineers, Chief of Engineers. FY 1978 Annual Report, Volume I--Summary and Highlights, pp. 95-98.

XII APPENDIX

51. COASTAL AREAS

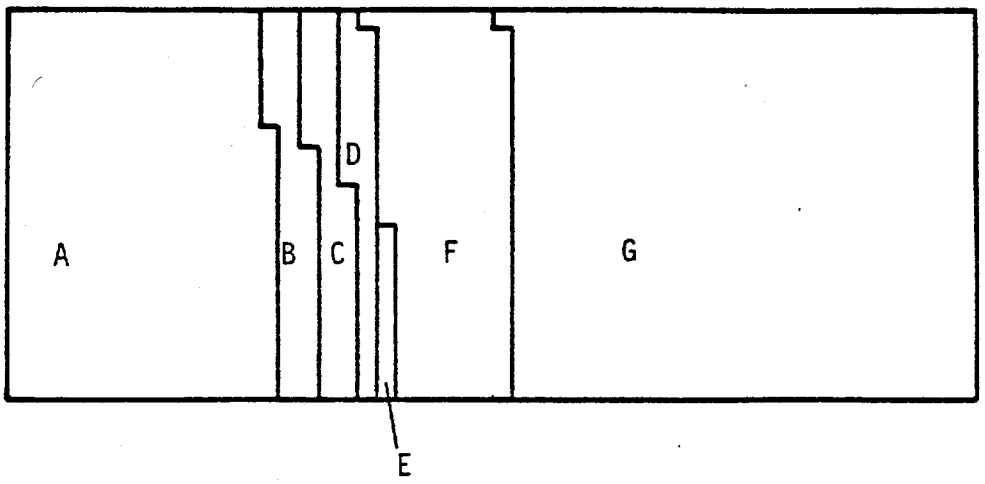
Here, we compare the area of coastal features to one another. This information is summarized from earlier tables. One potentially important classification that is not presented here, nor is it available elsewhere, is the area of nonfederal coastal parks.

The areas in the accompanying figure are shown to be mutually exclusive, but this is not the case. Many acres of wetlands and estuaries are also recorded in other categories such as parks. If we could eliminate the duplication of acreage in several categories, the percentage of uncommited area would increase.

Table 51. COMPARATIVE COASTAL AREAS.

	Square Miles	Acres	% of Lower 48	% of Maritime Counties
United States	3,615,123	2,313,678,720	120.0	--
Lower 48	3,022,261	1,934,247,040	100.0	--
Maritime Counties	182,569	116,844,291	6.0	100.0
Maritime County Farms	50,039	32,025,073	1.7	27.4
Salt to Brackish Marshes	7,061	4,519,238	0.23	3.9
Coastal & Tidal Marshes	13,999	8,959,562	0.46	7.67
Outer Continental Shelf	875,000	560,000,000	29.0	479.3
Leased OCS	15,619	9,996,196	0.517	1.78[1]
Oil, Gas, Salt & Sulphur Producing OCS	6,412	4,104,086	0.212	0.733[1]
Coastal National Parks	5,363	3,432,418	0.177	2.9
Coastal National Wildlife Refuges	1,644	1,051,910	.054	0.9
Estuaries	23,980	15,347,000	0.793	13.1

[1] percent of Outer Continental Shelf



LAND USE IN THE COASTAL COUNTIES. the large rectangle represents the area of the coastal counties of the lower 48 states (Listed in Table 19). The subunits within this rectangle represent the area committed to various features as follows:

A. Farms (Table 20)
B. Salt to brackish Marshes (Table 29)
C. Coastal Marshes not in B (Table 29)
D. Coastal National Parks (Table 41)
E. Coastal National Wildlife Refuges (Table 42)
F. Estuaries (Table 26)
G. Other

Note that many of these features overlap. That is, there are many acres of marsh within the National Wildlife Refuges, for example. If we could remove the overlap, the area of G would increase.

52. ELEMENTS OF SEAWATER

This table gives some of the elemental components of standard seawater. These elements are in these concentrations the salts in saltwater. Salinity, the concentration of salts in water, comprises 35 parts per thousand in normal seawater. The concentration of salts varies as seawater is diluted by freshwater runoff, especially in estuaries and nearshore waters. The concentration of some of these elements, or the form that the elements take can be altered as a function of biological or industrial processes.

Methodological advances have very recently cast doubt on the concentration of elements which are found in small quantities such as Arsenic, Selenium, and Tin. This is especially true of transition elements, heavy metals, and metalloids. Revisions are currently underway, and should appear in about 1982 in Chemical Oceanography.

Table 52. CONCENTRATION OF CERTAIN ELEMENTS IN SEA WATER.

Element	Total concentration micrograms per liter of seawater (ppb)	Element	Total concentration micrograms per liter of seawater (ppb)
Hydrogen	110,000,000	Gallium	0.03
Lithium	180	Germanium	0.05
Boron	4,440	Arsenic	3.7
Carbon	28,000	Selenium	0.2
Nitrogen	150,000	Bromine	67,000
Oxygen	880,000,000	Krypton	0.2
Fluorine	1,300	Rubidium	120
Neon	0.12	Strontium	80,000
Sodium	10,770,000	Zirconium	0.03
Magnesium	1,290,000	Niobium	0.01
Aluminum	2	Molybdenum	10
Silicon	2,000,000	Silver	0.04
Phosphorous	60	Cadmium	0.1
Sulfur	905,000	Tin	0.01
Chlorine	18,800,000	Antimony	0.24
Argon	4.3	Iodine	60
Potassium	380,000	Xenon	0.05
Calcium	412,000	Cesium	0.4
Titanium	1	Barium	2
Vanadium	2.5	Tungsten	0.1
Chromium	0.3	Gold	0.004
Manganese	0.2	Mercury	0.03
Iron	2	Thallium	0.01
Cobalt	0.05	Lead	0.03
Nickel	1.7	Bismuth	0.02
Copper	0.5	Thorium	0.01
Zinc	4.9	Uranium	3.2

Source: Peter G. Brewer, 1975. Minor elements in seawater In J.P. Riley and G. Skirrow [eds.] Chemical Oceanography Volume I 2d edition.

53. CONVERSION FACTORS

Conversion factors for common units are presented in these tables. The units across the top of the table are the starting units, and the units in the column on the left are the final units. The body of the table is the factor by which the starting unit is multiplied to obtain the final product. For example, how many square miles are there in 1,000 acres? From Table 50b. multiply 1,000 by 1/640 and find that 1,000 acres is 1.56 square miles. Conversion of metric units is simply a matter of moving decimal points as the unit prefixes change. For example, 59 centimeters is 0.59 meters.

Table 53a. LENGTH CONVERSION FACTORS.

	Centimeter	Inch	Foot	Yard	Meter	Kilometer	Mile
Cm.	1*	2.54*	30.48*	91.44*	100*	10^5	1.609×10^5
In.	0.394	1*	12*	36*	39.37	3.973×10^4	63,360*
Ft.	3.28×10^{-2}	1/12	1*	3*	3.281	3.28×10^3	5,280*
Yd.	1.094×10^{-2}	1/12	1/12	1*	1.094	1.094×10^3	1,760*
Meter	0.01*	2.54×10^{-2}*	0.305	0.914	1*	1,000*	1.609×10^3
Km.	1×10^{-5}*	2.54×10^{-5}*	3.05×10^{-4}	9.14×10^{-4}	$1 * 10^{-3}$	1*	1.609
Mi.	6.214×10^{-6}	1/12	1/12	1/12	6.214×10^{-4}	6.214×10^{-1}	1*

Table 53b. AREA CONVERSION FACTORS.

	Ft^2	Yd^2	Acres	Hectares	Km^2	Mi^2
Sq.ft.	1*	9*	43,560*	1.076×10^{-5}	1.076×10^7	$2,788 \times 10^7$
Sq.yds.	1/12	1*	4,840*	1.196×10^4	1.196×10^6	3.098×10^6
Acres	2.296×10^{-5}	2.066×10^{-4}	1*	2.471	247.105	640*
Hectares	9.297×10^{-6}	8.361×10^{-5}	0.4047	1*	100*	258.999
Sq.km.	9.297×10^{-8}	8.361×10^{-7}	4.047×10^{-3}	0.01*	1*	2,590
Sq.mi.	3.589×10^{-8}	3.228×10^{-7}	1/12	3.86×10^{-3}	0.386	1*

Table 53c. VOLUME CONVERSION FACTORS.

	Liter	Gallon (U.S.)	Cubic Foot	Barrel (oil)
Liter	1*	3.785	28.316	158.987
Gallon	2.642x10-1	1*	7.481	42*
Cubic foot	3.532x10-2	1.337x10-1	1*	5.682
Barrel(oil)	6.290x10-3	2.381x10-2	0.1777	1*

Table 53d. MASS CONVERSION FACTORS.

	Gm.	Lbs.	Kg.	Short Tn.	Metric Tn.
Gm	1*	453.6	1,000*	9.070x105	106*
Lbs	2.205x103	1*	2.205	2,000*	2.205x103
Kg	10-3*	0.4535	1*	9.070x102	1,000*
Short Tn.	1.103x10-6	5x10-4	1.103x10-3	1*	1.102
Metric Tn.	1x10-6*	4.536x10-4	1x10-3	9.070x10-1	1*

Table 53e. HYDROCARBON WEIGHT AND ENERGY EQUIVALENTS

Weight equivalents

1 Barrel of Crude Oil (Domestic) = 295 pounds (42 gallons)
1 Barrel of Gasoline = 259 pounds (42 gallons)
1 Barrel of Liquified Petroleum Gas = 190 pounds (42 gallons)

Energy equivalents

1 Barrel of Crude Petroleum has the energy value of 5604 cu. ft. of Natural Gas-Dry
1 Barrel of Crude Petroleum has the energy value of 0.228 short tons of Anthracite Coal
1 Short Ton of Anthracite Coal has the energy value of 4.379 barrels of Crude Petroleum
1 Short Ton of Anthracite Coal has the energy value of 24,541 cu. ft. of Natural Gas-Dry
1 Barrel of Gasoline has the energy value of 0.90 barrels of Crude Petroleum
1 Barrel of Gasoline has the energy value of 5070 cu. ft. of Natural Gas-Dry
1000 cu. ft. of Natural Gas-Dry has the energy value of 0.178 barrels of Crude Petroleum
1000 cu. ft. of Natural Gas-Dry has the energy value of 0.041 short tons of Anthracite Coal

* Exactly
Source: ASTM-IP Petroleum Measurement Tables

Table 53f. METRIC PREFIXES.

Prefix	Factor by which unit is multiplied
giga	10^9
mega	10^6
kilo	10^3
hecto	10^2
deka	10
deci	10^{-1}
centi	10^{-2}
milli	10^{-3}
micro	10^{-6}
nano	10^{-9}
pico	10^{-12}

54. STATE RANKS

How do the states compare in their coastal characteristics? This table ranks the states in 17 important categories. Louisiana ranks first most often. It leads in the percentage of the shoreline undeveloped, the area of estuaries, the area of wetlands, and the weight of the 1978 fisheries catch. In all cases, the states are ranked from highest (1) to lowest (21). The letters at the head of each column are interpreted below.

Column	Ranked Based on	From Table
A	Length of general coastline	1
B	Length of tidal shoreline	1
C	Percentage of privately owned shoreline	2
D	Percentage of undeveloped shoreline	3
E	Percentage of shoreline as beaches	4
F	Percentage of noneroding shoreline	5
G	Percentage of general shoreline length fronted by barrier islands	8
H	Percentage of coastal county area in farms	20
I	Percentage of population in coastal counties	21f
J	Percentage of electrical generating capacity in coastal counties	22
K	Area of estuaries	25
L	Area of coastal wetlands	28
M	Area of Coastal National Wildlife Refuges	42a
N	Weight of the 1978 fisheries catch	34
O	Value of the 1978 fisheries catch	34
P	Weight of the 1978 fisheries catch per fisherman	36
Q	Value of the 1978 fisheries catch per fisherman	36

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footnotes

* ties are ranked according to the average rank that the states would receive if they were not tied. Thus, for example if three states are tied for the first rank, they would all be ranked second.

Table 54. STATE RANKS

State	STATE RANK IN CATEGORY:							
	A	B	C	D	E	F	G	H
Maine	7	3	1	11	20	20	--	18
New Hampshire	20	21	14	20*	4	16	--	13.5*
Massachusetts	8	14	9	17	2	17	13	15
Rhode Island	17	18	6	20*	6	19	--	17
Connecticut	21	16	8	20*	7	18	--	13.5*
New York	12	12	16	16	8	21	6	21
New Jersey	11	13	17	14	10	11	5	11
Delaware	19	19	12	8	14	6	11	2
Maryland	18	8	4	18	21	15	1	4
Virginia	13	7	10	7	15	12	8	6
North Carolina	5	5	20	4	13	8	2	8
South Carolina	9	10	21	5	19	2	9	7
Georgia	14	11	11	2	9	5	4	19
Florida	1	1	5	9	17	4	10	5
Alabama	15	17	2	13	3	9	3	9
Mississippi	16	20	15	12	12	10	--	16
Louisiana	3	2	13	1	11	13	12	10
Texas	4	6	7	6	18	3	7	1
California	2	4	18	10	16	14	--	3
Oregon	6	15	19	15	5	7	--	12
Washington	10	9	3	3	1	1	--	20

Table 54. STATE RANKS

	STATE RANK IN CATEGORY:								
State	I	J	K	L	M	N	O	P	Q
Maine	11	5	19	16	8	7	7	17	18
New Hampshire	16	12	21	20	20.5*	21	20	18	17
Massachusetts	10	9	14	13	14	5	3	7	3
Rhode Island	1.5*	1.5*	17	21	18	13	15	8	8
Connecticut	6	3	20	17	19	19	19	20	20
New York	8	10	12	14	17	15	13	21	19
New Jersey	9	7	7	6	6	9	10	5	9
Delaware	1.5*	1.5*	11	11	9	20	21	10	16
Maryland	7	6	4	9	11	14	14	19	21
Virginia	13	13	3	7	10	3	8	3	15
North Carolina	20	17	2	8	4	6	11	4	14
South Carolina	17	16	10	4	5	17	17	15	5
Georgia	21	21	16	5	7	18	18	16	10
Florida	4	4	6	2	1	8	5	12	11
Alabama	19	19.5*	9	15	20.5*	16	12	11	2
Mississippi	18	14	13	12	16	4	16	1	4
Louisiana	12	11	1	1	2	1	2	2	6
Texas	14	15	5	3	3	12	4	13	1
California	3	8	8	10	12	2	1	6	7
Oregon	15	19.5*	18	19	15	11	9	9	12
Washington	5	18	15	18	13	10	6	14	13

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