AN ASSESSMENT OF RECREATIONAL MARINAS AND MARINA NEEDS ON THE MISSISSIPPI GULF COAST

COASTAL ZONE
INFORMATION CENTER

Prepared for:

BUREAU OF MARINE RESOURCES
DEPARTMENT OF WILDLIFE CONSERVATION

COASTAL ZONE
INFORMATION CENTER

Prepared by:

DEPARTMENT OF GEOGRAPHY AND AREA DEVELOPMENT
UNIVERSITY OF SOUTHERN MISSISSIPPI

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PREPARED FOR:
BUREAU OF MARINE RESOURCES
DEPARTMENT OF WILDLIFE CONSERVATION
LONG BEACH, MISSISSIPPI

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THE UNIVERSITY OF SOUTHERN MISSISSIPPI

GEOGRAPHY AND AREA DEVELOPMENT

LETTER OF TRANSMITTAL

MISSISSIPPI BUREAU OF MARINE RESOURCES:

The Department of Geography and Area Development herewith submits its report on An Assessment of Recreational Marinas and Marina Needs on the Mississippi Gulf Coast in accordance with a subgrant agreement between the Bureau of Marine Resources and the University of Southern Mississippi.

Work on this project was conducted between June 1, 1983, and May 31, 1984. Unless noted otherwise, data on registered boats in Mississippi are current through June 30, 1983; marina inventory data represent characteristics up to August 1, 1983; user questionnaire data were collected through May 15, 1984; and published reports were cited through May 31, 1984.

This report reflects excellent cooperation from public agencies, and a number of individuals and groups both inside and outside the Government deserve special gratitude and acknowledgment for their assistance. Appreciation is due to the many marina owners or managers who consented to be interviewed; boat owners occupying marina slips who completed a mailed questionnaire; Dr. Edwin W. Cake, Jr., Gulf Coast Research Laboratory, Ocean Springs, Mississippi; and Mrs. Shirley Jordan, Boat Registration, Mississippi Department of Wildlife Conservation. We are especially indebted to Mr. W. Boman Crum, Jr., Environmental Assessment Branch, United States Environmental Protection Agency, Region IV, Atlanta, Georgia, for his help in providing to us draft copies of the following EPA documents: Coastal Marinas Assessment Guidance Handbook, and Coastal Marinas Assessment: Inventory of Existing Conditions and Key Factors Task Report. Extensive use was made of both documents.

Respectfully,

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SECTION I

INTRODUCTION

SECTION I

INTRODUCTION

The intent of this assessment of marinas on the Mississippi Gulf Coast is threefold: first, to characterize the present supply of marina facilities and services and to examine selected characteristics of boat owners; second, to project growth patterns for recreational (pleasure) boats and consequent berthing facility demand; and third, to provide an overview of environmental impacts and impact mitigation associated with marina construction and use. This assessment was initiated to provide Mississippi's Bureau of Marine Resources (BMR--the state's designated CZM agency) guidance in insuring that efficient and environmentally sound marina development occurs within its management jurisdiction.

Although requested by and designed to meet the needs of the BMR, this report should also be of interest to the boating public in general, and of use to local and regional planning agencies, operators of existing marinas, and developers who may be contemplating the development of new marinas.

The focus of this report is on recreational boating and consequent demand for marina facilities and services. For the purpose of gathering data, this necessitated the need to clarify the concept of what would constitute a marina.

There exists no commonly accepted definition of a marina. Numerous definitions are found in literature treating marinas, but all tend to be based upon utilization classifications--they are pragmatic compromises specific to the needs of a particular time, place, and research objective. About the only denominators common to all definitions were that they included boats, water, and berths.

For the purpose of this study a marina constituted an operating enterprise providing wet slips for boat berthing, usually for lease or rent, and catering to the pleasure boating public. Excluded from the study were marinas devoted to servicing commercial fishing boats; berthing areas specifically designated for commercial boats within dual-purpose marinas; and some enterprises known locally as "fish camps," where long-term lease or rent of slips to saltwater boaters was not encouraged or likely to occur because of the nature of the facility or service. Fish camps which were renting or leasing slips to boats destined for ocean waters were included. Also counted in the survey were all slips in "mixed" marinas (i.e., not having designated areas for the physical separation of pleasure and commercial boats) regardless of the number of slips occupied by commercial boats.

The report is divided into seven sections. Section II, "Marina Characteristics and Distribution," is a description and analysis of Mississippi's Gulf Coast marinas. Section

III, "Marina User Characteristics," provides a brief description and analysis of results from a questionnaire sent to leasers of boat slips in public marinas. Section IV, "Recreational Boating and Berthing Demand Projections," examines national and regional boating patterns, and projects boat registrations and berthing (slip) needs on the Mississippi Gulf Coast.

Section V, "Environmental Impacts, Impact Assessment, and Planning Considerations in Marina Development," examines environmental problems and issues associated with marinas; looks at problems associated with assessing impacts; and outlines planning and siting considerations in marina location, design, and operation. Section VI, "Regulatory Responsibility," outlines federal/state/local agency roles in the site planning process. Section VII, "Recommendations," is intended to provide the BMR guidance for addressing marinas and marina-related problems in its coastal program. Finally, Sections VIII and IX include the bibliography and assorted appendices.

SECTION II

MARINA CHARACTERISTICS AND DISTRIBUTION

SECTION II

MARINA CHARACTERISTICS AND DISTRIBUTION

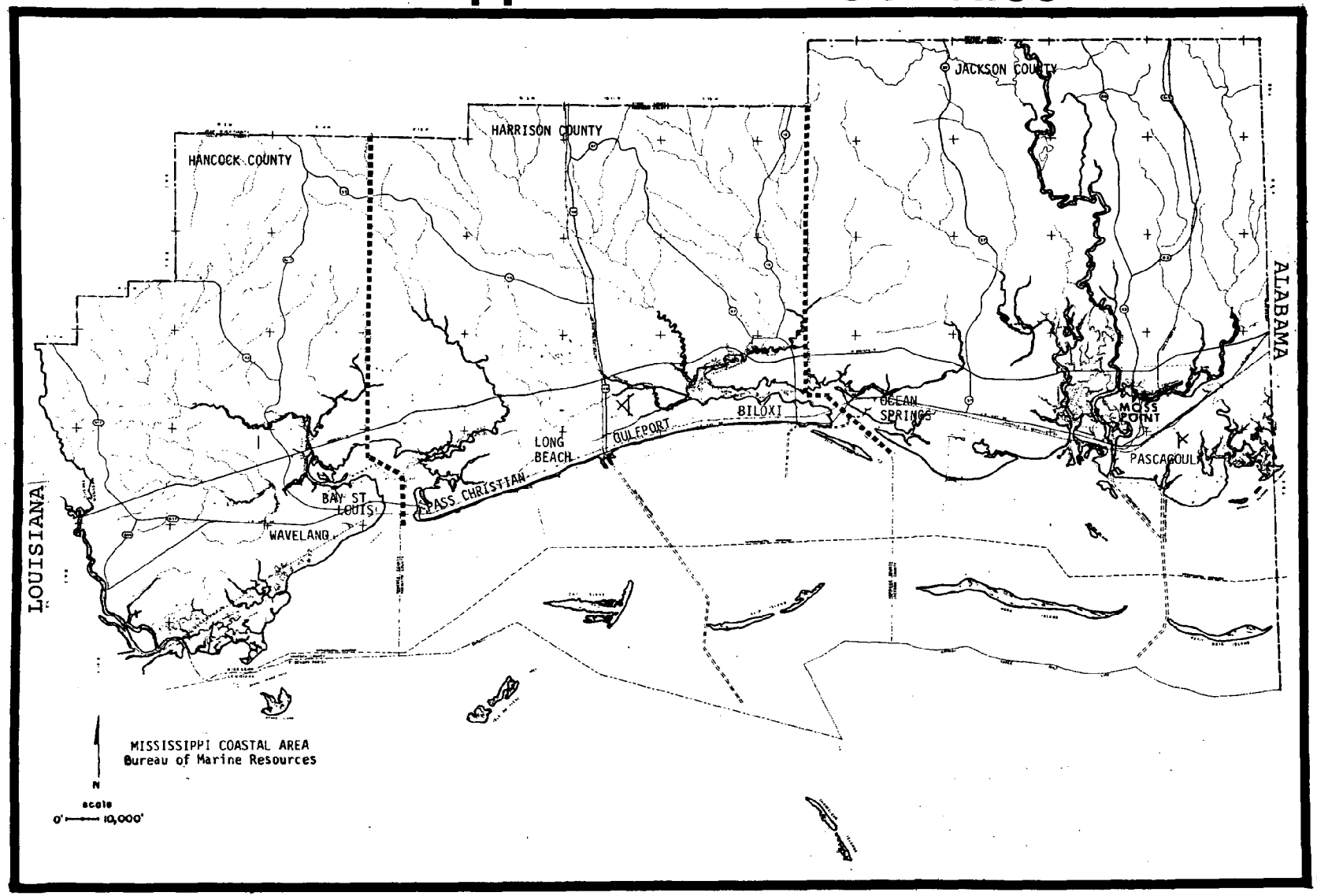
In June, July, and August 1983 a survey of marinas along the Mississippi Gulf Coat was undertaken. The purpose of the survey was to establish an inventory of recreational marinas to include facilities and services, berthing capacity, and occupancy rates. Berthing capacity and occupancy figures were to be used to project future demand for wet-slip berthing (see Section IV for slip demand and boat projections). Aggregated totals and sub-totals from the survey of individual marinas are presented in this section.

Gulf Coast Overview

The Mississippi Gulf Coast extends from just east of Pascagoula, Mississippi, westward for a distance of approximately 80 linear miles to the mouth of the Pearl River. The total coastline is approximately 359 miles in length (Fig. 1). Along this three-county coastline are located nine incorporated cities. In 1980 the population of Hancock, Harrison, and Jackson counties was 24,537, 157,665, and 118,015 respectively, for a total of 300,217 which accounted for nearly 12 percent of the state's total population. The nine coastal cities had a combined population of 176,869. This was about 60 percent of the total three-county population.

Figure 1

Mississippi Coastal Counties



The cities ranged in size from Biloxi, the largest (49,311) to Waveland, the smallest (4,186).

The coast line is bordered on the south by the Mississippi Sound, and forms two large bays (St. Louis Bay and Biloxi Bay) and a major river mouth (Pascagoula River). Bordering the Sound on the south are a line of barrier islands.

The Sound varies in depth from generally less than 10 feet adjacent to the main coast, to an average of between 15 to 20 feet near the barrier islands. Tide variations average about 1.8 feet for the coast as a whole. Within the tidal zone are 64,000 acres of tidal marshes.

The major water movement along the coast is a slow westward longshore current. Winds are generally northeasterly in January, begin to shift eastward by March until they become east-southeasterly in May. Throughout the summer, southerly winds prevail until September when the shift is back to the east then northerly for the remainder of the year (Waller, n.d.).

Marina Survey

Forty-five marinas from throughout the coastal zone comprise the survey list (Table 1). These were chosen following extensive field reconnaissance. During the field reconnaissance an attempt was made to view all facilities meeting Webster's New Collegiate Dictionary (1974) definition of a marina: "a dock or basin providing secure moorings

TABLE 1

MARINAS, MISSISSIPPI GULF COAST, 1983

County	Name of Marina	Marina Type
Jackson	Blue Herron	2
	Choctaw II	2
	Choctaw Marina	2
	Cochran	2
	Ferguson's Fish Camp	2
	Fisher	2
	Gautier	2
	Indian Point	4
	Inner Harbor (O.S.)	1
	Krebs	4
	Lake Yazoo	1
	Mary Walker	2
	O'Brian's Marina	2
	Old Oak	2
	O'Sullivan	2
	Pack's Marina	2
	Pascagoula Yacht Club	3
	Riverbend	2
	Robert's Fish Camp	2
	Shotte's	2
	Three Rivers Marina	2
	Tiki	4
	Tucei's	2
Harrison	Anatole Bay	4
	Bay View	2
	Bayou Bernard	2
	Bert Jones Yacht Basin	1
	Biloxi Small Craft	1
	Biloxi Yacht Club	3
	Broadwater	4
	Discovery Bay	4
	Gulfport Yacht Club	3
	Harbour Square	4
	Keesler Marina	4
	Kremer	2
	Long Beach	1
	Pass Christian Mun Harbor	1
	Pass Christian Yacht Club	3

(cont'd next page)

Types of Marinas: 1 - Public; 2 - Private Profit Recreation;
3 - Private Nonprofit Recreation;
4 - Ancillary

TABLE 1 (cont.)

MARINAS, MISSISSIPPI GULF COAST, 1983

County	Name of Marina	Marina Type
Hancock	Bay Marina	2
	Bay-Waveland	2
	Bordages	2
	Diamondhead	4
	Hancock County	1
	Joe's Marina	2
	La France	2
	(Bay Cove)[a]	4

[a]Began a phased opening of slips in early 1984. Data for this marina are not included in subsequent tables of this report (see also page 25).

Type or Marinas: 1 - Public; 2 - Private Profit Recreation
3 - Private Nonprofit Recreation'
4 - Ancillary

TABLE 2

MARINAS, BOATS, AND BOATING CHARACTERISTICS BY COUNTY

Survey Categories	Hancock		Harrison		Jackson		Total	
	#	%	#	%	#	%	#	%
Marina Type								
Public[a]	1	14	4	27	2		7	16
Private Profit[b]	4	57	3	20	17		24	53
Private Non-profit[c]	1	14	3	20	1		5	11
Ancillary Marina[d]	1	14	5	33	3		9	20
Total	7	100	15	100	23	100	45	100
Berthing Capacity								
Wet Slips[e]	347	100	1206	100	1215	100	2768	100
Normal occupancy	339	98	1094	91	1144	94	2577	93
Present occupancy[f]	347	100	1094	91	1011	83	2452	89
No. on waiting list	122	10	851	70	237	20	1210	100
Boat Types[g]								
Sailboats	52	15	414	38	119	12	585	24
Recreation powerboats	287	83	664	61	802	79	1753	71
Commercial boats[h]	8	2	16	1	90	9	114	5
Total	347	100	1094	100	1011	100	2452	100
Boat Lengths[g]								
Under 16'	30	9	20	2	273	27	323	13
16'-25'	169	49	299	27	250	25	718	29
26'-39'	120	34	563	52	381	38	1064	43
40' and over	28	8	212	19	107	10	347	14
Total	347	100	1094	100	1011	100	2452	100

TABLE 2 (cont.)

MARINAS, BOATS, AND BOATING CHARACTERISTICS BY COUNTY

Survey Categories	Hancock		Harrison		Jackson		Total	
	#	%	#	%	#	%	#	%
Boating Activity[i]								
Fishing		68		36		78		61
Sailing		10		40		11		20
Cruising		4		18		5		9
Skiing		18		6		6		10
Dry Storage Slip Space								
Dry-stack	0	0	187	100	0	0	187	100
Pigeonhole	188	29	193	30	273	41	654	100
Dock Facilities & Services (# marinas)								
Electric power	5		12		16		33	
Water	5		13		15		33	
Lighting	5		12		18		35	
Fuel Station	7		8		12		27	
Public address	1		11		1		13	
Phones: at dock	2		6		3		11	
in office	6		12		9		27	
Sanitary holding tank pumpout facility	1		3		0		4	
Bilge drainage	3		3		4		10	
Type of piers: fixed	7		12		19		38	
floating	0		2		1		3	

TABLE 2 (cont.)

MARINAS, BOATS, AND BOATING CHARACTERISTICS BY COUNTY

Survey Categories	Hancock		Harrison		Jackson		Total	
	#	%	#	%	#	%	#	%
Land Facilities & Services								
Average land area (acres)[j]	14.6		10.5		15.1		13.3	
Average parking spaces[k]	55		112		105		95	
Snackbar	6		10		12		28	
Restaurant	4		8		4		16	
Bait and tackle	6		6		10		22	
Boat rentals	1		4		6		11	
Boat sales	0		2		2		4	
Boat repair/maintenance[l]								
Sanding	3		5		5		13	
Painting	3		3		5		11	
Hull & engine repair	3		3		4		10	
Launch Facilities								
Ramps	7	16	9	20	19	43	35	80
Hoists	3	7	10	23	9	20	22	50
Average Marina MLT Depth (feet)	6.0		7.2		5.3		6.2	

(Source: 1983 Survey of Marinas)

Percentages may not equal 100 due to rounding
a Owned by city or county
b Directly and indirectly dependant upon wet slips for profit; e.g., slip lease and fuel sale
c Yacht club or similar venture

TABLE 2 (cont.)

MARINAS, BOATS, AND BOATING CHARACTERISTICS BY COUNTY

Survey Categories	Hancock		Harrison		Jackson		Total	
	#	%	#	%	#	%	#	%

d Slips ancillary to shore development; e.g., subdivision, condominium, hotel/motel restaurant
e Does not include slips within marinas specifically designated for commercial boats
f Apparent high slip surplus in Harrison County (Zone 2) owing to two recently completed marinas in process of beginning to lease slips
g Numbers equal occupancy rate at time of survey (June/July 1983)
h Mainly charters and shrimpers berthed in slips not designated for commercial boats
i Marina manager's estimate of major activity
j Average based on 33 marinas responding to question
k Average based on 25 marinas responding to question
l Service provided or allowed at marina

TABLE 3

MARINA CHARACTERISTICS AND DISTRIBUTION
BY ZONE

Survey Categories	Zone 1		Zone 2		Zone 3		Total	
	#	%	#	%	#	%	#	%
Marina Type								
Public[a]	2	18	3	27	2	9	7	16
Private Profit[b]	5	46	2	18	17	74	24	53
Private Non-profit[c]	2	18	2	18	1	4	5	11
Ancillary Marina[d]	2	18	4	36	3	13	9	20
Total	11	100	11	100	23	100	45	100
Berthing Capacity								
Wet Slips[e]	582	100	971	100	1215	100	2768	100
Normal occupancy	545	94	888	91	1144	94	2577	93
Present occupancy[f]	544	93	897	92	1011	83	2452	89
No. on waiting list	162	13	811	67	237	20	1210	100
Boat Types[g]								
Sailboats	113	21	353	39	119	12	585	24
Recreation powerboats	419	77	532	60	802	79	1753	71
Commercial boats[h]	12	2	12	1	90	9	114	5
Total	544	100	897	100	1011	100	2452	100
Boat Lengths[g]								
Under 16'	30	5	20	2	273	27	323	13
16'-25'	251	46	217	24	250	25	718	29
26'-39'	221	41	462	52	381	38	1064	43
40' and over	42	8	198	22	107	10	347	14
Total	544	100	897	100	1011	100	2452	100

TABLE 3 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTION
BY ZONE

Survey Categories	Zone 1 #	Zone 1 %	Zone 2 #	Zone 2 %	Zone 3 #	Zone 3 %	Total #	Total %
Boating Activity[i]								
Fishing		53		41		78		61
Sailing		28		33		11		20
Cruising		6		20		5		9
Skiing		13		6		6		10
Dry Storage Slip Space								
Dry-stack	102	55	85	45	0		187	100
Pigeonhole	242	37	139	21	273	42	654	100
Dock Facilities & Services (# marinas)								
Electric power	9		10		13		33	
Water	9		11		13		33	
Lighting	9		10		16		35	
Fuel Station	5		10		12		27	
Public address	1		11		1		13	
Phones: at dock	3		5		3		11	
in office	9		10		8		27	
Sanitary holding tank pumpout facility	2		2		0		4	
Bilge drainage	4		2		4		10	
Type of piers: fixed	10		9		19		38	
floating	0		2		1		3	

TABLE 3 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTIONS
BY ZONE

Survey Categories	Zone 1		Zone 2		Zone 3		Total	
	#	%	#	%	#	%	#	%
Land Facilities & Services								
Average land area (acres)[j]	10.7		14.3		15.1		13.3	
Average parking spaces[k]	62		135		105		95	
Snackbar	7		9		12		28	
Restaurant	5		7		4		16	
Bait and tackle	4		8		10		22	
Boat rentals	2		3		6		11	
Boat sales	2		0		2		4	
Boat repair/maintenance[l]								
Sanding	5		3		5		13	
Painting	4		2		5		11	
Hull & engine repair	4		3		3		10	
Launch Facilities								
Ramps	9	20	7	16	19	43	35	
Hoists	6	14	7	16	9	20	22	
Average Marina MLT Depth (feet)	6.3		7.2		5.3		6.2	

(Source: 1983 Survey of Marinas)

Percentages may not equal 100 due to rounding
a Owned by city or county
b Directly and indirectly dependant upon wet slips for profit; e.g., slip lease and fuel sale
c Yacht club or similar venture

TABLE 3 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTION
BY ZONE

Survey Categories	Zone 1		Zone 2		Zone 3		Total	
	#	%	#	%	#	%	#	%

d Slips ancillary to shore development; e.g., subdivision, condominium, hotel/motel restaurant
e Does not include slips within marinas specifically designated for commercial boats
f Apparent high slip surplus in Harrison County (Zone 2) owing to two recently completed marinas in process of beginning to lease slips
g Numbers equal occupancy rate at time of survey (June/July 1983)
h Mainly charters and shrimpers berthed in slips not designated for commercial boats
i Marina manager's estimate of major activity
j Average based on 33 marinas responding to question
k Average based on 25 marinas responding to question
l Service provided or allowed at marina

TABLE 4

MARINA CHARACTERISTICS AND DISTRIBUTION BY TYPE

Survey Categories	Public[a]		Private Profit[b]		Private Nonprofit[c]		Ancillary[d]		Total	
	#	%	#	%	#	%	#	%	#	%
Number of Marinas	7	16	24	53	5	11	9	20	45	100
Berthing Capacity										
Wet Slips[e]	853	100	1197	100	206	100	512	100	2768	100
Normal occupancy	851	99	1111	93	206	100	409	80	2577	93
Present occupancy[f]	833	98	1007	84	204	99	408	80	2452	89
No. on waiting list	758	63	186	15	55	5	211	17	1210	100
Boat Types[g]										
Sailboats	300	51	72	12	126	22	87	15	585	100
Recreation powerboats	508	29	877	50	78	4	290	17	1753	100
Commercial boats[h]	25	22	58	51	0	0	31	27	114	100
Total	833	100	1007	100	204	100	408	100	2452	100
Boat Lengths[g]										
Under 16'	1	0	292	29	0	0	30	7	323	13
16'-25'	218	26	312	31	73	36	115	28	718	29
26'-39'	530	64	284	28	113	55	137	34	1064	44
40' and over	84	10	119	12	18	9	126	31	347	14
Total	833	100	1007	100	204	100	408	100	2452	100

TABLE 4 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTION BY TYPE

Survey Categories	Public[a]		Private Profit[b]		Private Nonprofit[c]		Ancillary[d]		Total	
	#	%	#	%	#	%	#	%	#	%
Boating Activity[i]										
Fishing		62		76		14		54		61
Sailing		31		3		80		24		20
Cruising		7		9		2		15		9
Skiing		0		12		4		7		10
Dry Storage Slip Space										
Dry-stack	0		187	100	0		0		187	100
Pigeonhole	0		480	73	40	6	134	21	654	100
Dock Facilities & Services (# marinas)										
Electric power	6		17		4		6		33	
Water	6		17		4		6		33	
Lighting	7		18		4		6		35	
Fuel Station	5		15		2		5		27	
Public address	0		5		4		4		13	
Phones: at dock	2		5		2		2		11	
in office	8		15		4		6		27	
Sanitary holding tank pumpout facility	1		2		0		1		4	
Bilge drainage	1		8		0		1		10	
Type of piers: fixed	7		21		4		6		38	
floating	0		2		0		1		3	

TABLE 4 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTION BY TYPE

Survey Categories	Public[a]		Private Profit[b]		Private Nonprofit[c]		Ancillary[d]		Total	
	#	%	#	%	#	%	#	%	#	%
Land Facilities & Services										
Average land area (acres)[j]	19.3		11.6		5.1		21.6		13.3	
Average parking spaces[k]	45		74		154		237		95	
Snackbar	6		12		4		6		28	
Restaurant	5		7		4		0		16	
Bait and tackle	5		12		0		5		22	
Boat rentals	2		6		0		3		11	
Boat sales	2		2		0		0		4	
Boat repair/maintenance[l]										
Sanding	2		9		1		1		13	
Painting	1		9		0		1		11	
Hull & engine repair	1		6		1		2		10	
Launch Facilities										
Ramps	6	14	21	48	3	7	5	11	35	
Hoists	4	9	11	25	4	9	3	7	22	
Average Marina MLT Depth (feet)	6.1		5.3		7.7		6.0		6.2	

(Source: 1983 Survey of Marinas)

Percentages may not equal 100 due to rounding

a Owned by city or county

b Directly and indirectly dependant upon wet-slips for profit; e.g., slip lease and fuel sale

c Yacht club or similar venture

TABLE 4 (cont.)

MARINA CHARACTERISTICS AND DISTRIBUTION BY TYPE

Survey Categories	Public[a]		Private Profit[b]		Private Nonprofit[c]		Ancillary[d]		Total	
	#	%	#	%	#	%	#	%	#	%

d Slips ancillary to shore development; e.g., subdivision, condominium, hotel/motel restaurant
e Does not include slips within marinas specifically designated for commercial boats
f Apparent high slip surplus in Harrison County (Zone 2) owing to two recently completed marinas in process of beginning to lease slips
g Numbers equal occupancy rate at time of survey (June/July 1983)
h Mainly charters and shrimpers berthed in slips not designated for commercial boats
i Marina manager's estimate of major activity
j Average based on 33 marinas responding to question
k Average based on 25 marinas responding to question
l Service provided or allowed at marina

for motorboats and yachts and often offering supply, repair, and other facilities." It quickly became apparent that not all "marinas" could or should be surveyed, for included in Webster's definition were numerous private residential slips and dock facilities, and an almost equal number of "fish camps."

The final choice of marinas was made on the basis of the criteria mentioned in the introduction. Arguments could be made for excluding several of the facilities included in the report, and perhaps one or two of the excluded ones could have been included. On the whole, however, the selection was felt to be a representative cross section of the coastal marinas. Additionally, because of the number and range in types of marina facilities, the averages reported here should not bias one or another class of marinas.

Tables 2, 3, and 4 represent the same data sets in three different ways. Table 2 shows the survey data by county. Slip numbers, occupancy values, and waiting list figures from this table were used in projecting demands in Section IV--county figures were compatible with registered boat numbers available only by county.

Table 3 shows the survey data by zone. Coastal marinas tend to nucleate in the Bay St. Louis and Pascagoula River areas, and form a linear pattern between them. County boundaries divide these patterns. On the basis of associations as perceived by an unstructured sampling of the boating public, three zones of association were established

(Figs. 2 and 3). Zone 1 includes the Pass Christian-Waveland area; Zone 2 the linear Long Beach-Ocean Springs area; and Zone 3 the Pascagoula-Moss Point-Gautier area. Data on these areas should better represent regional inventories.

Table 4 and Fig. 3 represent marinas by type. These include: (1) Public Marinas (county or city operated); (2) Private Profit (private marinas operated for profit for the recreational public); (3) Private Nonprofit (usually clubs where membership may be restricted); and, (4) Ancillary (the marina is subsidiary to the shore facility; e.g., condominium, air force base).

Summary of Data

A summary of data in each of the ten major data categories follows below. Because of the large number of data obtained from the surveys, no attempt was made to run correlations. The data should be of sufficient detail to allow the reader to combine sets for a particular purpose.

Marina Types

As might be expected, private profit marinas, numbering 24, or 53 percent of the total, was the largest single type. Ancillary marinas were second with nine. Three additional ancillary marinas were in the planning or construction phase at the time of this survey but not included in it.

By zone, private profit marinas were particularly prevalent in Zone 3 and numerically significant in Zone 1. Ancillary marinas led in Zone 2. Public marinas were about

Figure 2

Mississippi Coastal Marinas By Slip Capacity

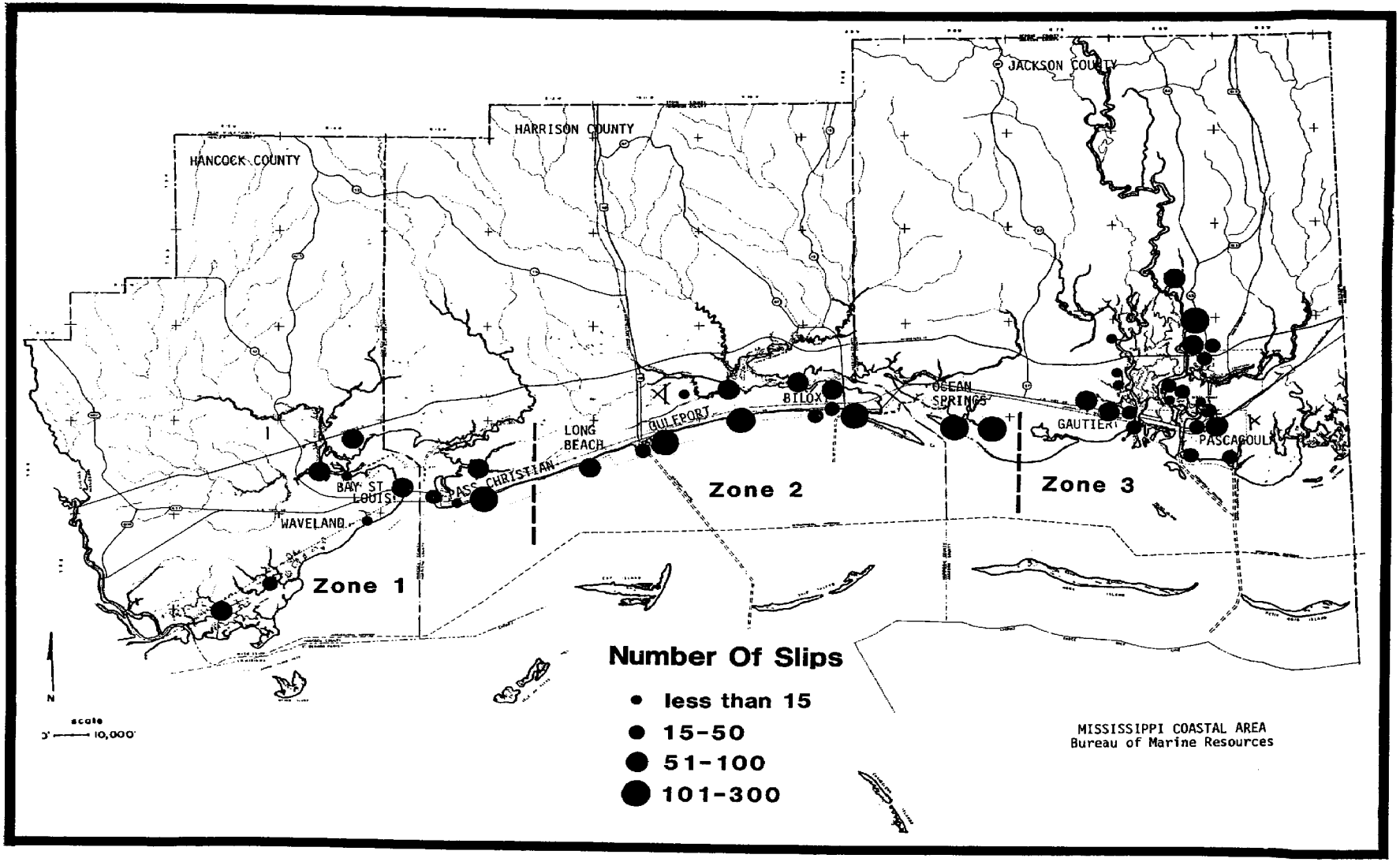
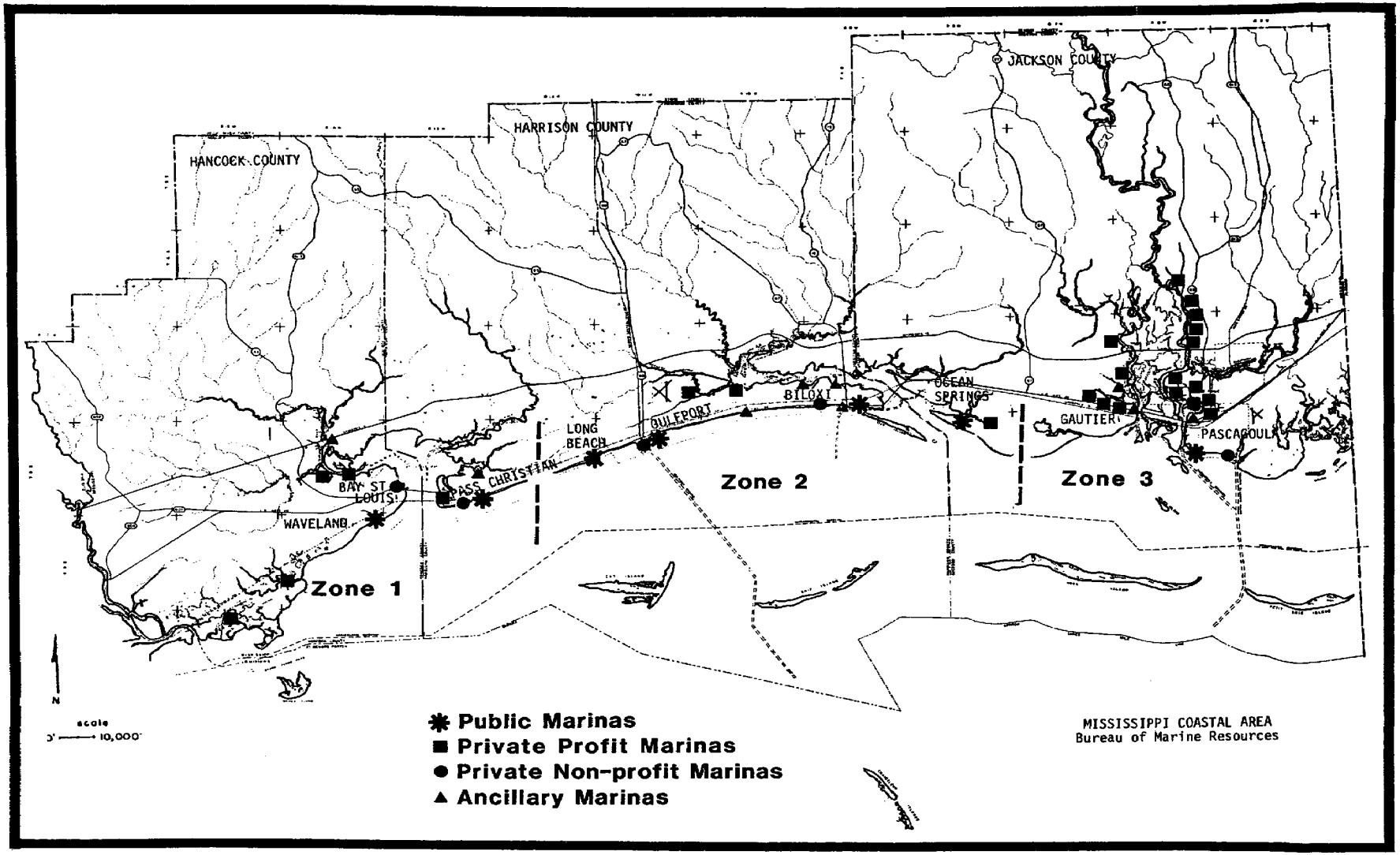


Figure 3

Mississippi Coastal Marinas By Type



even between the three zones. Of the planned ancillary marinas, two are to be located in Zone 2, and one in Zone 1.

Berthing Capacity

A total of 2,768 wet slips were inventoried. Jackson and Harrison counties accounted for 44 and 43 percent respectively. The low percentage for Hancock County is deceptive. When consideration is given to geographic distribution by zone rather than by county, Zone 1's percentage (21 percent) becomes more meaningful. With completion of the three planned marinas, totals and percentages should shift even further to Zones 1 and 2. Hancock County will receive a 320-slip marina, with the other two, containing 223 slips, going to Harrison County and Zone 2. In terms of availability, however, it should be kept in mind that these three marinas are typed as ancillary (condominium and subdivision) with limitation as to the number of slips which will be available to the general public.

A total of 1,210 names appeared on waiting lists. Care should be taken when interpreting this figure. First, most marina operators other than those of public marinas do not keep waiting lists. Of the total 1,210 persons listed as waiting for slips, 62 percent (758) were for public marinas. Second, some individuals applying for slips are reported to apply at several marinas and may thus be double listed. Third, waiting list figures for public marina slips represent only the demand for that type of marina. Care must be

taken when using such figures as those from public marinas for determining demand for condominium marinas where the market population may represent an entirely different demand structure.

Boat Types

Recreational powerboats, including inboard, outboard, and inboard/outboard, number 1,753 and account for 71 percent of all boats occupying slips potentially available for recreational craft. Five percent of the total were commercial vessels, and the remaining 24 percent sailboats.

The number of recreational powerboats was highest in Jackson County (Zone 3) but so also were the number of boats under 16' in length occupying marina slips. Sailboats in Zone 2 were more than double in number those in either of the other zones.

Boat Lengths

Boat length figures include commercial craft and boats under 16' in length. This tends to weigh the numerical and percentage figures toward the upper and lower length categories. Jackson County, for example, has over a fourth of its boats in the under 16' length and more commercial craft, most in the 40' and over category, than either of the other two counties or zones. Marinas servicing boats destined for open waters of the Sound will seldom berth boats under 16' in length. On the average, marinas will tend to berth a

greater number of boats in the 26'-39' length category.

Boating Activity

The figures for boating activity were estimates provided by marina operators. Fishing is by far the most popular activity overall. Harrison County, however, with its larger number of yacht clubs and public marinas, ranks sailing over fishing as a user activity. Boater destinations are discussed in Section III.

Dry Storage

Dry storage is a popular alternative to wet-slip berthing. It is less disruptive of the natural environment than would be the case of a wet-slip marina. Also, because boats are not continuously emerged in saltwater, they generally require less maintenance. Lease or rental fees are usually slightly higher than for wet slips, but the savings in maintenance can offset the higher costs.

Fees vary from marina to marina, but $45/month for pigeonhole storage and $50, $45, and $40/month for dry-stack levels 1, 2, and 3 respectively are about average. These compare to $1-1.25 per foot per month for wet slips in public marinas; private profit marina wet-slip charges average about $40/month or $19/month plus $1 per foot per month. A limiting feature in the use of dry-stack storage is that boats generally must be under 24' in length.

Dry storage facilities are generally not available at public marinas. Dry-stack facilities are limited to private

profit marinas with most storage capacity in Zone 1. The large number of pigeonhole spaces in Jackson County is primarily to serve small outboard motorboats.

Dock Facilities and Services

Few of the coastal marinas would classify as full-service marinas. About a quarter of all marinas have dockside electric power, water, and lighting. Beyond these, however, facilities and services are few. Ten of the 45 marinas have bilge drainage capacity and only four have sanitary pumpout facilities. The lack of these two facilities can pose serious environmental problems. Surprisingly, only one public marina reported bilge drainage or sanitary pumpout capacity. As might be expected in an area with a tide range of less than 2', piers are almost entirely of the fixed type.

Land Facilities and Services

Of the marinas for which land area could be determined, the average was 13.3 acres. Parking averaged 95 spaces for slip users. The large number of parking spaces in Jackson County is owing to two recreation complexes with outdoor camping facilities; in Harrison County one ancillary marina claimed 400 parking spaces thus inflating the number in that county. Snackbars, and bait and tackle sales were the most common services provided.

Boat repair and maintenance occurred at about a quarter of the marinas. It should be noted that far fewer marinas

had proper dry-dock facilities for conducting these activities. It was not uncommon for marina operators to simply allow boat owners to work on their boats in areas unprotected from the elements and without proper protection against environmental damage.

Launch Facilities

Eighty percent of the marinas have one or more ramps and 50 percent have some type of mechanical hoist. Ramp widths and entrance angles varied greatly as did hoist capacities. These facilities were available in all counties, zones, and by marina type.

Tide Depth

The average mean low tide depth in berthing areas was 6.2 feet. While this depth is adequate for most recreational craft, the figure does not represent variations from entrance to shoreline. Maintaining adequate depths because of siltation was reported a serious problem for many marinas.

SECTION III

PUBLIC MARINA USER CHARACTERISTICS

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PUBLIC MARINA USER CHARACTERISTICS

A survey questionnaire (Appendix B) was mailed to persons occupying public marina slips on the Mississippi Gulf Coast. The questionnaire was designed to elicit descriptive information profiling the marina users, their spatial and activity patterns, and their opinions on marina facilities and services.

The total number of occupied slips on the Mississippi Gulf Coast is approximately 2450. The name and address information was most readily available for those 833 persons in public marinas. One hundred and twenty-seven questionnaires were mailed of which 38 were returned in usable form (30 percent response rate). Several useful descriptive statistics and insights can be gained from the questionnaire results. Although some of the conclusions are intuitively obvious, this survey provides support data unavailable up to this time.

The only comparable study was a survey of the slip users of a single public marina in Gulfport, Mississippi done in the early 1980s (Harbor Square Study). The results of the Harbor Square Study are reviewed as the current study results are presented.

Marina Users Profile

The following tables indicate that most of the residents live near the coast only a short distance from their marina slips. The driving time for the majority of the respondents is less than fifteen minutes. This is comparable to the Harbor Square Study where 72 percent of the respondents lived less than 30 minutes driving time from the marina.

Most of the respondents (42.1 percent) reside and have their slips (44.7 percent) in the Biloxi-Gulfport area. This is where the larger public marinas are located. The respondent's first choices of marina sites are in the Ocean Springs and Gautier areas with a total of 47.4 percent of the sample citing these locations as preferred sites. These data support the notion that the majority of marina users are coastal residents who select marinas close to their homes. The minimization of automobile travel time to the marina appears to be a relatively more important factor in boating as opposed to other recreational activities, such as camping, where travel time to a preferred area is generally of lesser importance. The number of noncoastal residents is too few to allow firm conclusions, but they too probably prefer highly accessible marinas to minimize driving time and maximize boating time.

TABLE 5

AREA OF RESIDENCE OF RESPONDENT

	Number	Percent
Waveland - Pass Christian	2	5.3
Gulfport - Biloxi	16	42.1
Pascagoula - Moss Point	9	23.7
Leaksville - Lucedale	5	13.2
Laurel - Hattiesburg	1	2.6
Natchez - McComb	1	2.6
Jackson - Vicksburg	1	2.6
Meridian - Quitman	3	7.9

TABLE 6

SLIP LOCATION ZONE
(Question 2)

	Number	Percent
Zone 1 (Waveland - Pass Christian Area)	5	13.2
Zone 2 (Biloxi - Gulfport Area)	17	44.7
Zone 3 (Pascagoula Area)	16	42.1

TABLE 7

DRIVING TIME TO MARINA
(Question 4)

Minutes	Number	Percent
<15	20	52.6
15 - 29	8	21.1
30 - 60	1	2.6
61 - 120	3	7.9
121- 180	3	7.9
>180	3	7.0

TABLE 8

FIRST CHOICE OF SLIP LOCATIONS
(Question 5)

	Number	Percent
Waveland	2	5.3
Bay St. Louis	1	2.6
Pass Christian	1	2.6
Long Beach	2	5.3
Gulfport	3	7.9
Biloxi	5	13.2
Ocean Springs	10	26.3
Gautier	8	21.1
Pascagoula	6	15.8

Several questions attempted to profile public marina slip users and their activity patterns. The majority of respondents are powerboat owners with a boat size ranging from 16 to 25 feet.

TABLE 9

BOAT TYPE/BOAT SIZE
(Question 1)

	Number	Percent		Number	Percent
Sail	8	21.1	<16 feet	1	2.6
			16 - 25 feet	20	52.6
Power	30	78.9	26 - 39 feet	13	34.2
			>40 feet	4	10.5

Fifty percent of the respondents had an average frequency of use ranging from 13 to 36. A large portion of the sample

(31.6 percent) used their boats 49 or more times during the year. The Harbor Square Study found an average use frequency of 59 times per year.

The primary activity in terms of time spent was fishing, which accounted for an average of 67.9 percent of the activity time of the respondents.

TABLE 10

YEARLY FREQUENCY OF USE
(Question 7)

Times/Yr.	Number	Percent
less than 12	1	2.6
13 - 24	10	26.3
25 - 36	9	23.7
37 - 48	6	15.8
49 - 60	5	13.2
greater than 60	7	18.4

TABLE 11

PERCENT OF TIME ENGAGED IN EACH TYPE OF ACTIVITY
(Question 8)

Activity	Average for Sample
Fishing	67.9 percent
Cruising	31.6 percent
Skiing	.5 percent

These data indicate that the majority of public marina users are powerboat owners of medium-sized boats oriented

toward fishing. These user profile and frequency data can be used to provide insight into the nature of demand for future marina development and the aggregate demand for boat fuel, supplies, etc.

Marina Use and Services

In response to the questions related to marina use and services, the following results were obtained from the questionnaire.

TABLE 12

LENGTH OF TIME RENTING AT MARINA
(Question 3)

Years	Number	Percent
less than one	3	7.9
1-2	10	26.3
Over 2	25	65.8

Most of the respondents (65.8 percent) had been in their marina slip for over two years. This corresponds to the Harbor Square Study where 64.8 percent had been in their slips for over two years. This is a reflection of the demand for slips in public marinas. People who have slips hold on to them because of the limited availability.

Respondents were questioned about whether they lived on their boat when at the marina (Question 6). Thirty-four or 89.5 percent responded "No" and 4 or 10.5 percent responded "Yes." This question is important in estimating the need

for overnight accommodations in or near marinas. Of the thirty-four "No" responses, thirty-two of these people lived within two hours driving time of the marina. It can be expected that they return home for the night. The four persons who live on their boats drive more than two hours from home to the marina. Thus, the need for overnight accommodations, such as motels or hotels, associated with marina users appears very limited. This is reinforced by the earlier Harbor Square Study which found only 4 percent of the marina boaters use motels twice a year.

The questionnaire asked for an opinion on whether dry-stack storage facilities should be given more attention in the expansion of existing marinas and the designing of new marinas (Question 9). Fifty percent of the respondents felt that "Yes," more attention should be given to this type of boat storage in marinas. Dry-stack storage is used primarily for boats less than twenty-five feet in length. Fifty-five percent of the sample owned boats less than twenty-six feet. If these totals are indicative of the entire coastal marina user population, then the aggregate interest in dry-stack storage is very high.

Question 10 measured the willingness of these public marina occupiers to rent slips in private marinas. When asked if they would rent in a private marina, thirty (78.9 percent) responded "Yes." For the eight (21.1 percent) who responded "No," five cited the cost of a private slip, two

cited security and one had other reasons for not desiring to do so. Several of the "Yes" responses stated that the higher rental fee was a concern even though they were willing to go to a private marina.

Spatial Patterns of Users

Question 12 of the questionnaire attempted to determine the boating activity destinations of the respondents. Each respondent was requested to estimate the percentage of trips made to each of the seven zones shown on the questionnaire map.

Figures 4, 5, and 6 show the destination zones of the respondents disaggregated by their zone of origin. As would be expected most users concentrate their activities in the area nearest their marina. Although 30 percent of Zone 1 originated trips stay in Zone 1, a large percentage (33 percent) of the Zone 1 trips go to Zone 5, probably for fishing. Zone 2 respondents make 35 percent of their trips within their zone of origin. Interestingly, the percentage of trips to Zone 4 is nearly equal (34 percent) to the zone of origin percentage. Those respondents originating in Zone 3 have Zone 4 as their destination for 25 percent of their trips. They have the open Gulf of Mexico (Zone 7) for a relatively high 21 percent of their trips as well.

In aggregate the results indicate that the most frequent destination zone is Zone 4 (barrier islands) with 29 percent of the total trips (Fig. 7). The next most frequently used area is Zone 2 (20 percent). These results are due, in

Figure 4

Boater Destination Zones Originating From Zone 1

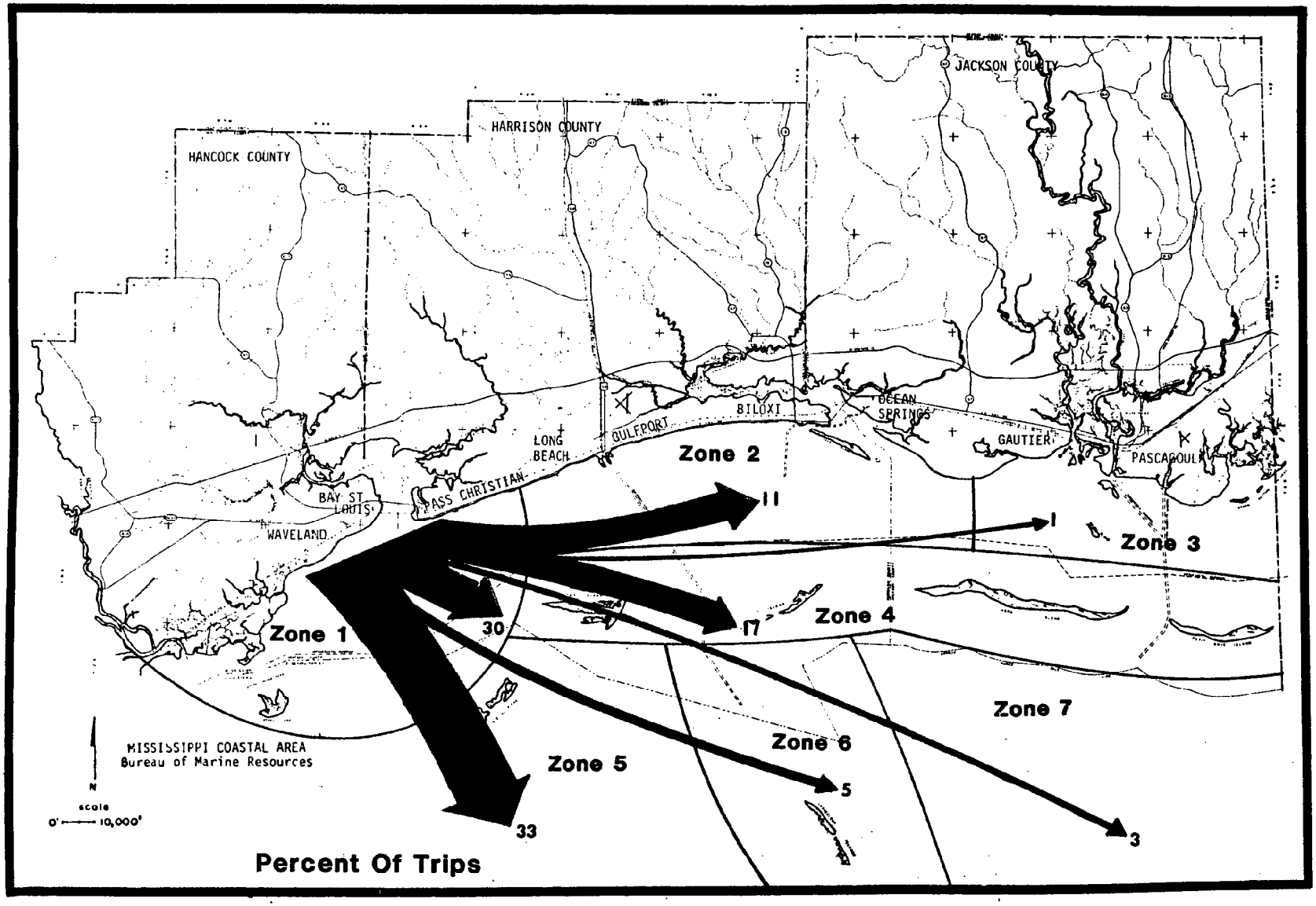


Figure 5

Boater Destination Zones Originating From Zone 2

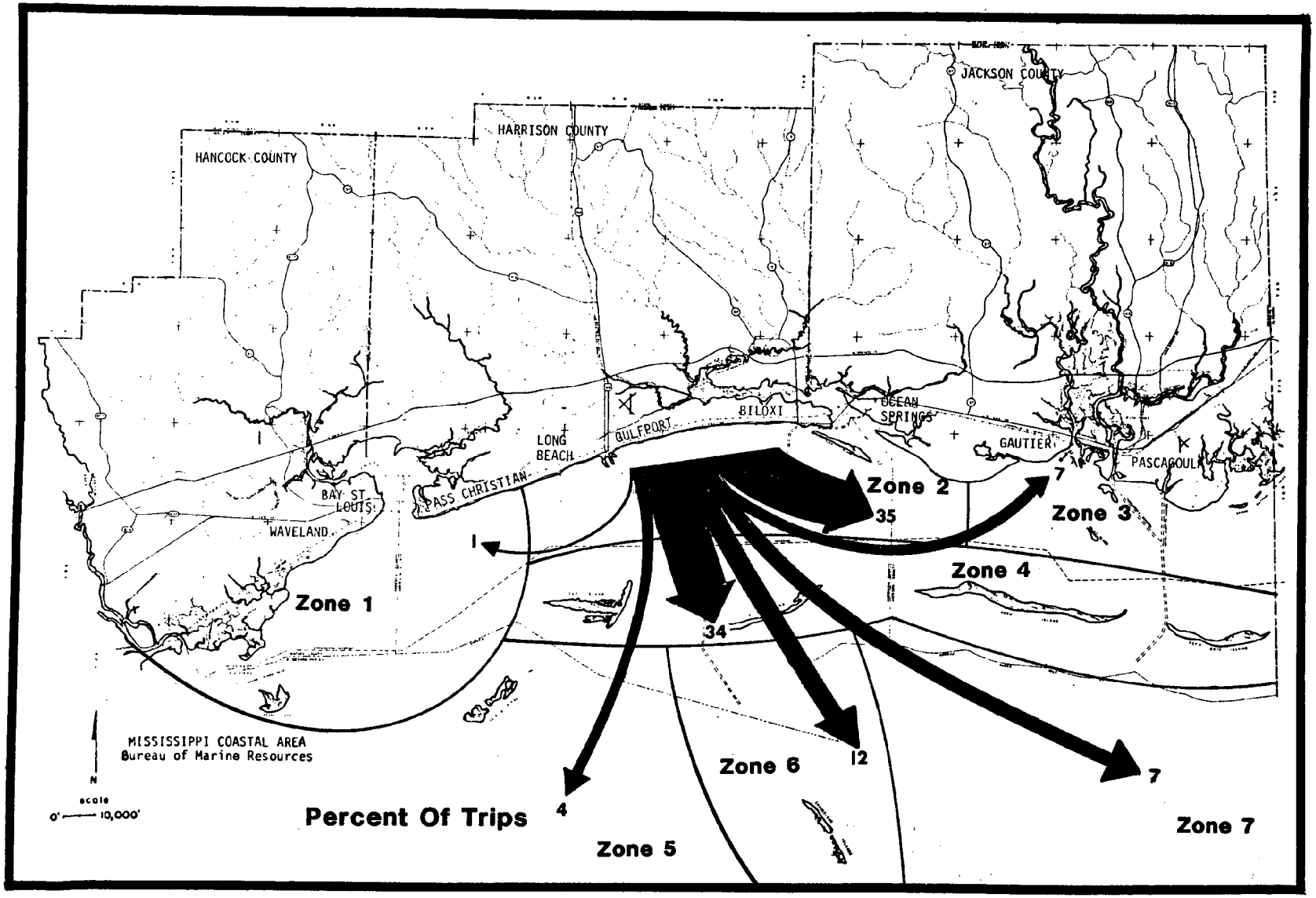


Figure 6

Boater Destination Zones Originating From Zone 3

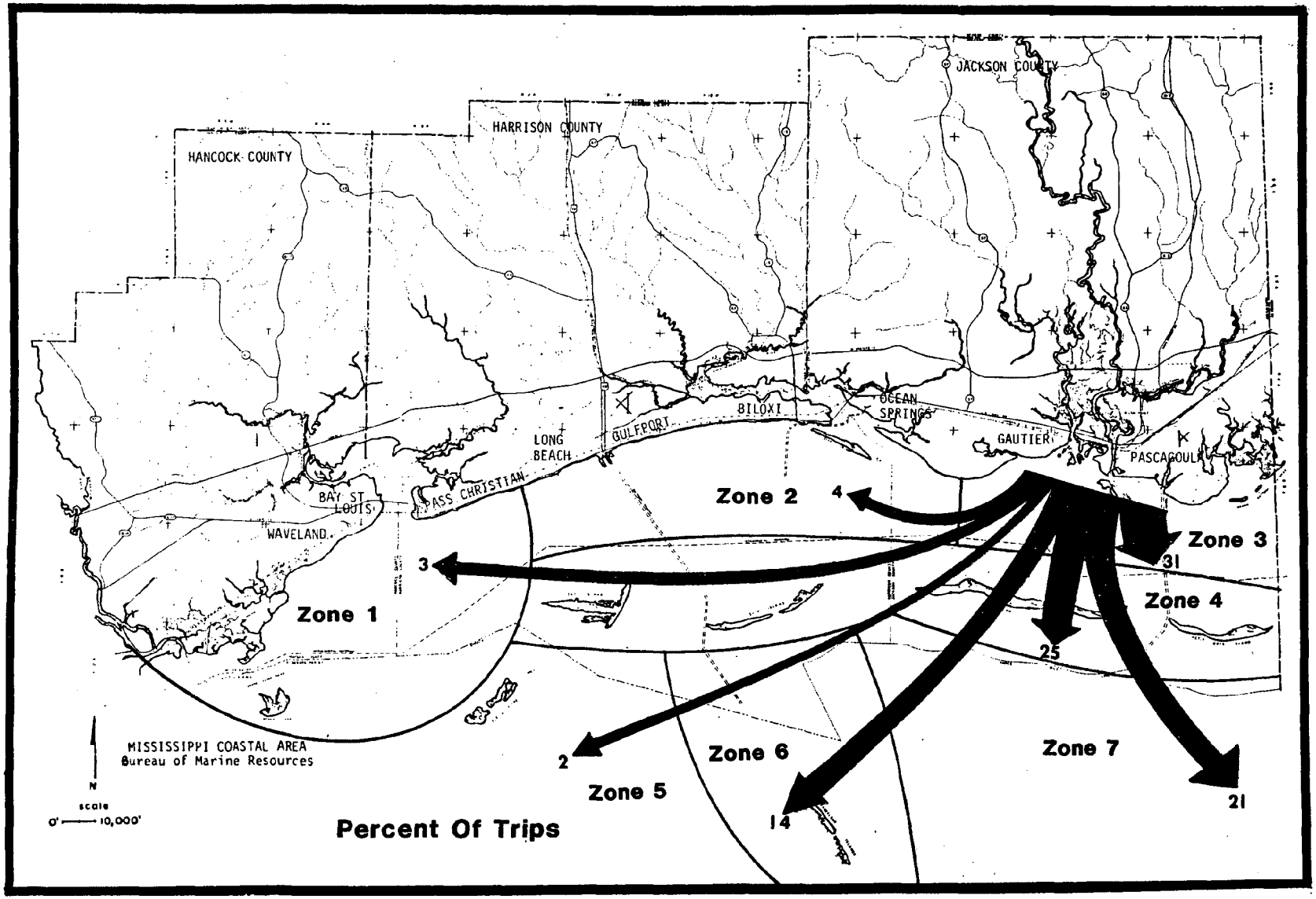
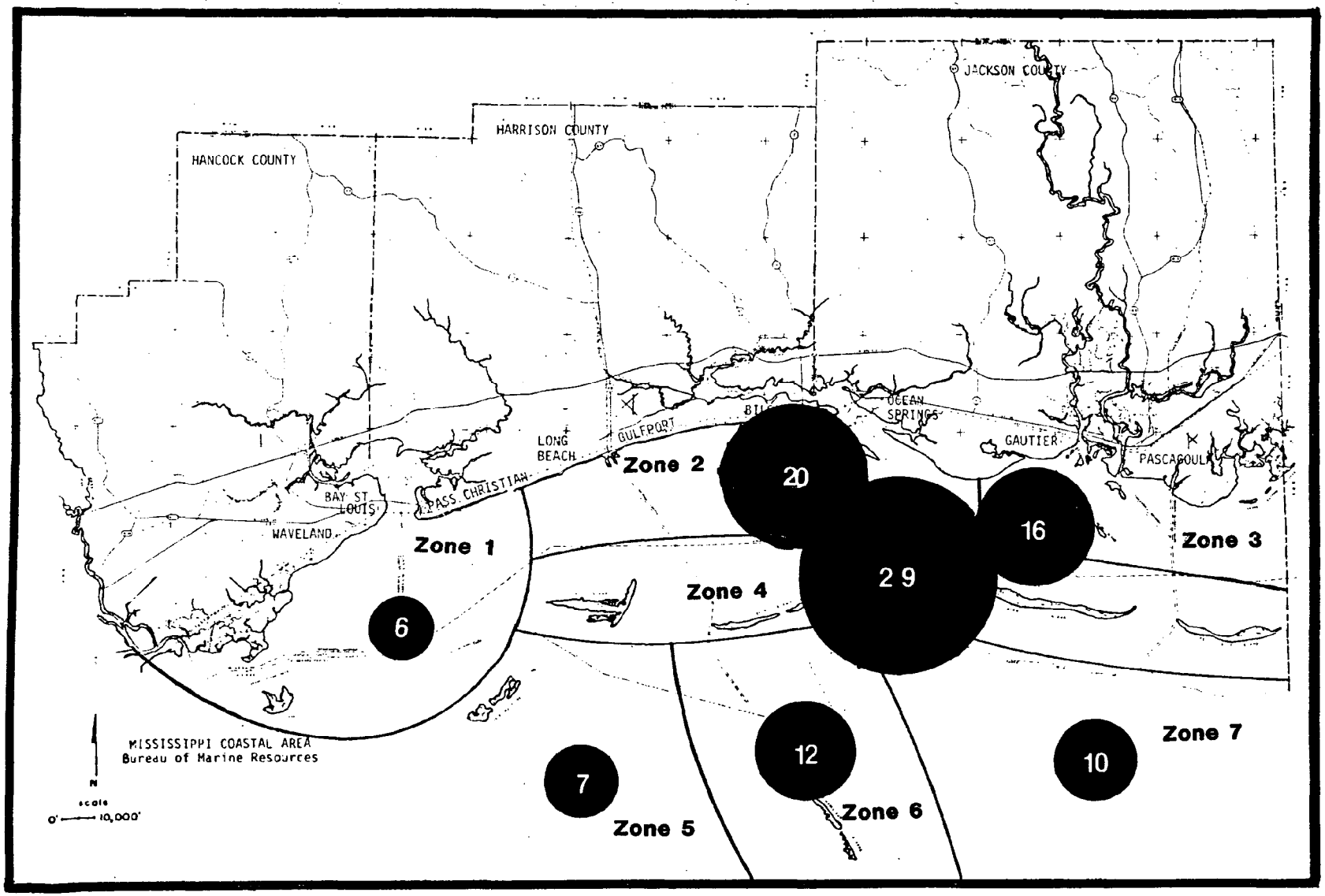


Figure 7

Total Percent Of Trips Made To Each Zone



part, to the Gulfport-Biloxi origin of most of the respondents. Zone 6 (Chandeleur Island) is the second most popular off-shore destination (12 percent) after the barrier islands of Zone 4.

Conclusions

It is not possible from this survey to determine with statistical certainty that these are characteristics and opinions of the majority of Gulf Coast slip users. However, these questionnaire data taken with the results of the Harbor Square Study and the additional information contained in this study form the basis of several conclusions concerning public marina slip users.

1. Demand for slips is very high.
2. Marina users prefer accessible locations for marinas.
3. Most marina users are coastal residents.
4. Most users own power boats 16 - 25 feet in length with a significant number of users owning boats in the 26 - 39 feet range.
5. The average frequency use is in the 30 - 40 times per year range.
6. Marina users seldom use motel/hotel accommodations.
7. Many users are interested in dry-stack storage in a marina.
8. Public marina users are willing to rent in private marinas but have moderate concerns about cost and security.

9. The barrier island area is the most popular off-shore destination for Mississippi marina users.

SECTION IV

RECREATIONAL BOATING AND BERTHING DEMAND PROJECTIONS

SECTION IV

RECREATIONAL BOATING AND BERTHING DEMAND PROJECTIONS

Recreational boating has grown dramatically in recent years. According to the National Marine Manufacturers Association (NMMA, 1982) the number of boats owned in the U.S. increased from 9,210,000 in 1972 to 12,889,000 in 1982, a rise of nearly 40 percent (Table 13). During this same decade the estimated retail expenditure on boating more than doubled (not adjusted for inflation), climbing above the $8 billion mark in 1982.

Regionally, the growth in pleasure boating has been equally dramatic. In fact, with the growth in population and personal income experienced by Southern states in recent years, the region has consistently outdistanced the remainder of the U.S. in figures relating to the increase in the popularity of recreational boating. From 1980 to 1981, for example, new boat registrations in the five Gulf South states increased by nearly 4.4 percent, well above the national figure of 3.8 percent (Table 14). By 1981, 20 percent of all boats registered in the U.S. were accounted for by the five Gulf of Mexico states (Table 15).

Mississippi Boating and Berthing Demand

These national and regional trends are also evident in

TABLE 13

NATIONAL RETAIL EXPENDITURES AND BOAT ESTIMATES, 1961-82

	Estimated Retail Expenditure on Boating		Estimated Recreational Boats	
Date	$ (billion)	% Change	Owned	% Change
1961	2.340	--	7,175,000	--
1965	2.683	--	7,865,000	--
1970	3.440	--	8,814,000	--
1971	3.610	4.9	8,981,000	1.9
1972	3.900	8.0	9,210,000	2.5
1973	4.245	8.8	9,435,000	2.4
1974	4.607	4.2	9,615,000	1.9
1975	4.800	11.1	9,740,000	1.3
1976	5.333	11.0	10,105,000	3.7
1977	5.920	13.0	10,515,000	4.1
1978	6.690	12.1	11,270,000	7.2
1979	7.500	- 1.7	11,625,000	3.1
1980	7.370	11.9	11,832,000	1.8
1981	8.250	- 1.8	12,495,000	5.6
1982	8.100		12,889,000	3.1
	Decade % Change - 107.7%		Decade % Change - 39.9%	

(Source: NMMA, 1982)

Mississippi where the number of registered boats rose from 95,521 in 1978 to 117,252 in 1982, an increase of over 22 percent in four years. Such dramatic growth, as might be expected, has put considerable pressure on the state's coastal waters where, within the three-county area, 20 percent of Mississippi's boats are registered (Boat Registration, MWCC, 1983).

TABLE 14

REGISTERED BOATS:
U.S. AND GULF COAST STATES

	1980	1981	% change
U.S.	8,555,241	8,881,312	3.81
Gulf Coast	1,653,152	1,724,045	4.29
Alabama	222,742	226,984	1.90
Florida	497,891	512,551	2.94
Louisiana	283,438	300,000	5.84
*Mississippi	102,543	117,384	14.47
Texas	546,538	567,126	3.77

(Source: Calculated from data in NMMA, 1982)

*Totals differ from those available from the Mississippi Wildlife Conservation Commission due to time frame in which data were gathered.

In order to effectively plan for future marina space demand on the Mississippi Gulf Coast, some reasonable estimate of the quantity and basic geography of such demand is necessary. Several methods for projecting slip demand have been employed in other parts of the United States.

TABLE 15

RANK IN U.S. OF REGISTERED CRAFT AND PERCENT CHANGE
1981 OVER 1980 BY STATE

	STATE	RANK IN U.S.	PERCENT CHANGE
1.	Missouri	10	+ 34.32
2.	West Virginia	39	+ 21.29
3.	Washington	14	+ 18.94
4.	Mississippi	28	+ 14.47
5.	Ohio	8	+ 12.88
6.	Oklahoma	19	+ 11.31
7.	Nebraska	36	+ 10.54
8.	South Dakota	41	+ 9.67
9.	New Jersey	27	+ 8.24
10.	Michigan	1	+ 7.53
11.	Arkansas	12	+ 6.62
12.	Colorado	35	+ 6.56
13.	Arizona	31	+ 5.86
14.	Louisiana	9	+ 5.84
15.	Vermont	45	+ 5.07
16.	South Carolina	16	+ 4.37
17.	Delaware	40	+ 3.88
18.	Texas	4	+ 3.77
19.	California	3	+ 3.76
20.	Utah	37	+ 3.40
21.	Nevada	44	+ 3.07
22.	Indiana	23	+ 3.01
23.	Florida	5	+ 2.94
24.	Oregon	25	+ 2.33
25.	Minnesota	2	+ 2.24
26.	Pennsylvania	18	+ 2.19
27.	Alabama	13	+ 1.90
28.	Idaho	34	+ 1.54
29.	Massachusetts	22	+ 1.40
30.	Maine	29	+ 1.21
31.	Iowa	21	+ 1.09
32.	Virginia	24	+ 0.84
33.	Kansas	32	+ 0.62
34.	Tennessee	20	+ 0.50
35.	Connecticut	33	+ 0.35
36.	Kentucky	30	+ 0.35
37.	North Carolina	17	+ 0.28
38.	Georgia	15	+ 0.17
39.	Hawaii	50	- 0.32
40.	Maryland	26	- 0.46
41.	Illinois	11	- 1.36
42.	Montana	42	- 2.07
43.	Wisconsin	6	- 2.43
44.	New York	7	- 3.76
45.	North Dakota	43	- 6.09
46.	Dist. of Columbia	52	- 7.76
47.	Alaska	38	- 8.74
48.	Rhode Island	47	- 12.29
49.	Wyoming	49	- 14.39
50.	New Mexico	46	- 40.24
51.	New Hampshire	51	- 73.14

Each of these methods has a number of virtues and shortcomings. The method adopted in this study is to relate marina slip demand to boat registration and to project future boat registration based on historical registration data available from the Boat Registration, Mississippi Wildlife Conservation Commission (Table 16). These data are preferred as a basis for projecting future ownership and slip demand levels for several reasons:

1) Registration totals represent actual data, not estimates;
2) Registration data are periodically gathered providing a means of updating the projections given here;
3) The data allow distinctions to be made in boat types and sizes; and
4) The data are directly comparable to national boat registration statistics.

Although these data are preferable to other procedures, some problems with the data should be mentioned. When a boat is first registered in a given county it is always renewed in the same county as long as the boat is registered in the state. Thus, a boat registered in Wayne County (noncoastal) could well be owned by someone in coastal Harrison County. The degree to which this flaws the existing data is unknown. The assumption is that it probably leads to an underestimation of the number of boats actually present in the coastal counties.

These data also lack the historical depth needed for accurate projections. Ideally, to project twenty years into the future data are needed for at least twenty years in the past. Mississippi boat registration data in any consistent and retrievable form are available only as far back as 1978, making long range projections tenuous and underscoring the need to update them when new data become available.

TABLE 16

REGISTERED BOATS 16' AND OVER BY COUNTY

Date	Hancock Actual	Harrison Actual	Jackson Actual	Tri-County Actual
11/78	937	3863	3930	8,730
4/79	1003	4035	4098	9,136
1/80	1156	4506	4548	10,210
8/80	1008	3767	3771	8,546
1/81	1102	4016	4046	9,164
9/81	1290	4480	4535	10,305
1/82	1371	4586	4649	10,606
8/82	1218	4096	4092	9,406
11/82	1270	4285	4215	9,770
2/83	1304	4416	4356	10,076

(Source: From unpublished data, MWCC, 1983)

Despite these shortcomings the registration data are preferred to population, income, or other potential ecological correlates. Population as a predictor of boat ownership, and thus slip demand, has been rigorously questioned in at least one major study (Conner, Metcalf, & Eddy, 1978). One problem lies in the fact that population is not sensitive

to other changes such as economic cycles. The major objection to the use of population at the local level, however, is that the population figures themselves, especially for future dates, often represent "best-guess" estimates. To use these estimates to derive estimates of boat ownership would compound the potential error. A similar critique can be leveled at income as a predictor.

In order to direct these projections toward the goal of examining future demand for marina space, baseline data were limited to boats 16 feet and over. There is no reaon to believe that boats less than 16 feet in length place substantial pressure on existing marina space. Also, according to officials at the Mississippi Wildlife Conservation Commission (Jordan, 1983), data for this size category are liable to be the least accurate since many owners of small boats never register them.

No one method of projecting future numbers from past numbers is universally accepted. This is especially true when the historical period is short. The strategy adopted here was to prepare "planning estimates" by obtaining the mean of results from a series of fifteen different projection techniques (see Appendix C for formulas). Each technique was used to project boat registrations in each coastal county for February 1985, February 1990, February 1995, and February 2000. These dates were arbitrarily selected to provide a basis for projecting short, medium, and long term needs.

Table 17 shows the planning estimates for each county and for the region as a whole, obtained by adding together the results for the three counties. By 1985, for example, over 10,000 boats may be registered in the tri-county area. This figure is derived from the individual totals for Hancock, Harrison, and Jackson counties. It is estimated that Harrison County will maintain and even extend its edge in the number of registrations. More important, however, is the fact that Hancock County is expected to increase its proportion of the tri-county boat registrations from 14 percent in 1985 to 20 percent in 2000. Thus, relative to the other two counties, rapid growth in boat registration can be expected in Hancock County.

TABLE 17

PLANNING ESTIMATES: PROJECTIONS OF 16' + BOATS ON MISSISSIPPI GULF COAST

	Date			
	2/85	2/90	2/95	2/100
3-County [1]	10,612	11,945	13,266	14,565
Hancock [2]	1,452	1,884	4,364	2,941
Harrison [2]	4,622	5,151	5,667	6,140
Jackson [2]	4,538	4,910	5,236	5,484

[1] Totals of means from separate projections by county from techniques described in Appendix C.

[2] Mean of fifteen separate projections from techniques described in Appendix C.

When projecting future totals it is statistically more acceptable to speak of ranges and the confidence one should place on these ranges. To establish ranges and confidence levels for projections, a measure of dispersion around the mean, the standard deviation, was used. The standard deviation is a measure of the degree to which the mean truly represents the set of data. Once standard deviations are derived they allow one to establish ranges to estimates and rational confidence limits. This is true because from a statistical point of view it is known how often results should be expected to differ from established means. The ranges of estimates here are based on deviations above or below the planning estimates. These ranges are referred to as "planning ranges." Table 18 shows the planning ranges at the 68 percent confidence level--that is, one can be 68 percent confident that the actual registration figures for the dates given will fall between the figures. To be more confident one must allow for more deviation. Table 19 shows the planning ranges at the 90 percent confidence level for the tri-county area. Clearly there comes a point where enormous ranges are achieved and the 100 percent confidence level reached. This would not be useful, however, as it would provide no significant insight into the problem. Indeed, there is some question whether the 90 percent confidence level as illustrated in Table 19 is useful in the case of these projections. It is also obvious that as one

goes further out in time, range becomes wider, and projections more tenuous and less meaningful. In short, the reliability of the projection diminishes over the time. Once again the need to update these projections when new registration data are available is apparent.

TABLE 18

PLANNING RANGES FOR 16' + BOAT REGISTRATIONS
ON MISSISSIPPI GULF COAST AT 68 PERCENT CONFIDENCE LEVEL

Projected Date	Hancock	Harrison	Jackson	Tri-County
2/1985	1355-1549	4515-4729	4379-4697	10,375-10,847
2/1990	1610-2158	4858-5444	4500-5320	11,282-12,608
2/1995	1856-2872	5137-6197	4511-5959	12,043-14,489
2/2000	2078-3804	5330-6950	4402-6566	12,597-16,531

Range = Planning Estimate (from Table 17) plus and minus one standard deviation.

TABLE 19

PLANNING RANGES FOR 16' + BOAT REGISTRATIONS
IN 3-COUNTY AREA AT 90 PERCENT CONFIDENCE LEVEL

Date	Tri-County		
2/85	10,146	-	11,075
2/90	10,646	-	13,244
2/95	10,869	-	15,663
2/100	10,710	-	18,420

Range = Planning Estimate (from Table 17) plus and minus 1.96 x standard deviation.

The purpose of deriving the planning estimates (Table 17) was to forecast the potential demand for marina space. Surveys conducted in the summer of 1983 revealed nearly 2800 existing wet slips in the tri-county area (Table 2). In addition, waiting lists contained over 1200 names. But this probably underestimates the total number of people desiring wet slips because many marinas do not compile waiting lists, and patrons are often discouraged from placing their names in a queue that could take years to reach.

For the purpose of this study, reliance was placed on the more conservative, documented waiting list number of 1210 for the tri-county region. When this figure is added to the number of existing slip spaces we arrive at a measure of the "potential demand for berthing space." Table 20 shows the potential demand for berthing space in each county and in the tri-county region.

TABLE 20

WET SLIPS AND POTENTIAL DEMAND

	Existing Wet Slips	# on Waiting List	Potential Demand For Berthing Space Total
Hancock	347	122	469
Harrison	1206	851	2057
Jackson	1215	237	1452
Tri-County	2768	1210	3978

Potential demand for future dates is projected as a ratio of existing 16' plus boat registrations to existing potential demand (Table 21). The ratio is derived by dividing the potential demand (Table 20) by the actual number of registered boats in each county in the 16'+ class (Table 16). These percentages are then projected unchanged into the future and multiplied by the number of projected boat registrations in each county for the derived dates. This technique obviously assumes that the ratio of registered boats to potential demand will remain constant over time. While this is unlikely, there is presently no evidence to indicate whether or how this ratio may change.

The potential demand for berthing space projections for each county and for the tri-county region are given in Table 22. Two points must be remembered when interpreting these data. First, the waiting lists probably underestimate the level of unsatisfied demand for berthing space. Thus, when projected over time, the amount of underestimation increases. Second, potential demand projections are sensitive to the boat registration projections and their reliability is based on the reliability of the registration projections. When boat registrations are updated, the potential demand projections should be adjusted as well. One final comment is that the relationship between demand and availability is poorly understood. Thus, the existence of new, more accessible berthing opportunities may, in fact, drive up the demand for

TABLE 21

POTENTIAL DEMAND AS RATIO OF REGISTERED BOATS

	Potential Demand (# Slips + Waiting Lists)	Potential Demand as % of 16'+ boat registration as of 2/83
Hancock	469	35.97%
Harrison	2057	46.58%
Jackson	1452	33.33%
Tri-County	3978	39.47%

TABLE 22

POTENTIAL DEMAND FOR BERTHING SPACE[1]

	Hancock	Harrison	Jackson		Total Tri-County
2/85	522	2167	1513	=	4202
2/90	678	2415	1637	=	4730
2/95	850	2656	1745	=	5251
2/100	1058	2878	1828	=	5764

[1]Planning Estimates (Table 17) for each county X actual potential demand as % of 16'+ registrations on 2/83 (Table 21).

even more resources, making these figures conservative and altering the ratios used to derive these estimates.

In the tri-county region, then, an anticipated demand for 5764 berthing spaces can be expected by the year 2000. The number of new berthing spaces required to satisfy the projected potential demand is 2996. Thus, over 187 new wet slips a year would be needed to meet the current potential demand level when that level is projected over the next 16 years.

SECTION V

ENVIRONMENTAL IMPACTS, IMPACT ASSESSMENT, AND PLANNING CONSIDERATIONS IN MARINA DEVELOPMENT

SECTION V

ENVIRONMENTAL IMPACTS, IMPACT ASSESSMENT, AND PLANNING CONSIDERATIONS IN MARINA DEVELOPMENT

The significance and complexity of the issues surrounding marina development in environmentally sensitive areas is apparent from the large volume of recent literature treating the subject. Prior to the 1960s almost nothing was known about the effects of boating or marinas on marine or freshwater ecosystems. Through the decade of the sixties a few studies appeared which examined impacts from boats and boating activities. Following enactment of the National Environmental Policy Act in 1970, the Coastal Zone Management Act in 1972, and numerous pieces of companion legislation during the same period, research began in earnest to examine a host of environmental issues surrounding boating activities and marina development. For the most part, however, these were qualitative discussions of component boat and marina impacts on the marine ecosystem.

For coastal zone managers and planners in general, and marina engineers, developers, and operators in specific, guidance on issues surrounding the permitting, planning, and development of marinas remained unaddressed. Recognizing this need, the United States Environmental Protection Agency (USEPA) initiated a study in 1982 which assessed environmental

impacts for the purpose of providing "guidance for assuring that coastal marinas are developed and operated in an environmentally acceptable manner" (USEPA, 1984). Drafts of the assessment of environmental issues (USEPA, 1983) and the guidance document for marina development and operation (USEPA, 1984) have been published.

For this report, major concerns, problem areas, and guidance issues are identified in summary fashion. Those readers who must deal with marina-related problems in detail are directed to the two USEPA reports. Unless indicated otherwise, information contained in this section was obtained from the USEPA reports.

The discussion which follows examines (1) environmental impacts, (2) impact assessment techniques, and (3) marina planning.

Environmental Impacts

Environmental impacts associated with the development of marinas may be grouped into four major areas of concern. These include (1) direct habitat alteration, (2) impacts on natural resources, (3) impacts on water quality, and (4) socio-economic impacts (Tables 23 and 24). Specific impacts include those associated with dredging and spoil disposal, shoreline and protective structures, wastewater discharge and runoff, and boat operation and maintenance.

Dredging and Spoil Disposal

Dredge and fill projects, involving the excavation and

TABLE 23

MAJOR IMPACT CATEGORIES, SPECIFIC IMPACTS AND SOURCES OF IMPACTS RELEVANT TO COASTAL MARINAS

Impacts	Sources
WATER QUALITY RESOURCES	
Turbidity	MSD
Dissolved oxygen	Bilge water
Coliform (total and fecal)	Wastewater disposal
Nutrients	Dredging
Metals	Pilings
Hydrocarbons	Fueling
Other pollutants	Boat washing
	Boat exhaust
AQUATIC HABITAT RESOURCES	
Shellfish beds	Dredging and filling
Grass beds	Boating activity
Benthos	Structures
Nursery areas	Water quality alteration
Manatees	Hydrological modification
Sea turtles	
Endangered Species	
TERRESTRIAL HABITAT RESOURCES	
Rookery areas	Clearing
Endangered species	Grading
Turtle nesting areas	Fill
Adjacent to wilderness/wildlife management areas	Spoil
	Noise
	General activity
WETLAND HABITAT RESOURCES	
All wetland resoruces	Dredging and filling
	Boat wakes
	Hydrological modification
	Structures
SOCIO-ECONOMIC RESOURCES	
Historical	Construction
Archaeological	Location
Area marina resources	Size
Area economic resources	Services provided
Land use	

TABLE 23 (cont.)

MAJOR IMAPCT CATEGORIES, SPECIFIC IMPACTS AND SOURCES OF IMPACTS RELEVANT TO COASTAL MARINAS

Impacts	Sources
NAVIGATION RESOURCES	
All navigation resources	Traffic Number of slips Location of structures
AESTHETIC RESOURCES	
Noise Odor Visual	Boat maintenance Engines Construction Pile driving Dredging/spoil disposal Structures Maintenance Litter Wastewater disposal
GROUNDWATER RESOURCES	
Nitrogen Coliform Metals Other Pollutants	Wastewater disposal Spoil

(Source: USEPA, 1984)

TABLE 24

MARINA ENVIRONMENTAL IMPACT MATRIX

FACILITY COMPONENTS* / IMPACT CATEGORIES**	Alteration of Natural Areas***	Alteration of Water Circulation Patterns***	Turbidity	Release of Sewage	Oil Spills	Land Runoff	Erosion	Shoaling	Dissolved Oxygen Depletion	Air Pollution	Copper Pollution
Access Channels	●	●	●				●	●	●		
Boat Basins	●	●	●				●	●	●		
Piers and Docks	●	●	●								
Boat Moorings											
Launching Ramps	●					●	●				
Bulkheads	●	●	●				●	●			
Breakwaters	●	●	●				●	●			
Marine Sanitation Devices				●					●		
Pumpout Facilities	●			●					●		
Fuel Docks	●				●						
Boats			●		●		●	●		●	●
Access Roads	●	●				●	●				
Parking Lots and Cars	●					●	●			●	
Dry Storage Areas	●					●	●				
Club Houses	●					●					
Storm Sewer Outfalls			●	●	●	●			●		
Septic Tanks				●					●		
Dredging	●	●	●				●	●	●		
Spoil Disposal	●	●	●			●	●	●	●		
Boat Repair & Maintenance Areas	●				●	●					●

* All facility components are not necessarily involved in each marina.
** All impact categories are not necessarily produced at each marina.
*** Impacts may be either positive or negative.

Dots indicate a potentially significant relationship between the facility component and impact category during either construction or operation. The component may be either a source or a cause for that impact.

(Source: Boozer, 1979)

relocation of submerged bottom sediment, are common in Gulf coastal areas where natural shoreline conditions do not provide deep-water, well-flushed, protected harbors for larger pleasure boats. The degree of impact from dredge and fill activities depend upon the quality of site-specific habitats, existing water quality, and the nature of surrounding man-induced activities.

Physical Impacts

Habitat Loss

Of the total dredging activity in coastal areas, marina-related projects are of relatively minor significance. Locally, however, the loss of habitat through construction and dredging can have a disruptive impact on the physical environment. This includes the destruction of valuable breeding and feeding areas (Chapman, 1968), and the filling of submerged and tidal areas (Zieman, 1982).

Estuarine Impacts

Physical alterations in estuarine areas from dredging activities can have both adverse or beneficial effects on the local ecology. Potential adverse effects include habitat loss (Chapman, 1968), the reduction of benthic resources (Taylor, 1973), and the alteration of estuarine circulation patterns from spoil disposal mounds (Chapman, 1968; Taylor, 1973).

Positive or beneficial effects can result in instances where circulation is improved in brackish water areas

resulting in more productive nursery grounds (Chapman, 1968).

Water Quality

Dredging and soil disposal activities affect water quality through alterations in turbidity and dissolved oxygen content, and pollution.

Turbidity

Natural turbidity rates vary in Gulf coastal waters from highly turbid to comparatively clear. Dredging activities which result in the suspension of solids in the water column should be interpreted against ambient turbidity levels (Strom and Stickel, 1968; Chapman, 1968). Where increase in turbidity levels are temporary and localized due to dredging, they are not conceded to have a significant impact because many organisms can avoid these areas. When suspended solids settle out, the resulting silt can bury organisms, destroy seagrass, and change circulation patterns. These impacts can be serious and prolonged (USEPA, 1983).

Dissolved Oxygen

The values of dissolved oxygen (DO) in water during dredging is affected by resuspended oxidizable organic material, circulation, and ambient DO levels (Taylor, 1973). Flushing rates in dredged canals or basins affect DO values and create or allow anaerobic areas to occur. Finger canals are particularly prone to low DO levels, and improperly cut canals and marina basins deeper than entrance channels

result in anaerobic waters. Spoil containing free sulfides occur in poorly circulated areas, and, when dredged and disposed as spoil, will affect both fauna and flora because of its toxicity (USEPA, 1983).

Pollutants

Results from studies addressing the release of pollutants through dredging activities are inconclusive as to the amount of pollutants produced (USEPA, 1983). It is agreed, however, that the resuspension of pollutants held in sediments can occur during dredging (Taylor, 1973; USEPA, 1983). These include nutrients, certain organic acids, pesticides, bacteria and viruses, heavy metals, and hydrocarbons. Commercial benthic and pelagic fish species with concentrations of these pollutants can affect humans when consumed.

Biological Impacts

Direct impacts from dredging on fauna and flora result from changes in turbidity levels and siltation. And because dredging alters habitat, species change may occur locally.

Turbidity

As stated previously, turbidity, as measured by suspended solids, occurs naturally. As such ambient turbidity levels are an accepted part of an ecosystem. An increase in turbidity (i.e., from dredging) above ambient levels can impact marine animals. Because the quantitative effect of increased turbidity is dependent upon local conditions,

kinds and numbers of fauna and flora present, and their stage in the life cycle, only qualitative statements on impacts are possible here.

Research has shown that filter-feeding invertebrates can be affected by increased turbidity levels, such as in the case of oysters whose growth may be decreased by reduced pumping rates (Johnston, 1981). Fish egg development may also be delayed and mollusc eggs and larvae development affected (USEPA, 1983). Although motile fish can usually escape high turbidity levels, it is possible for suspended solids to clog gill filaments and suffocate fish (Johnston, 1981). Zooplankton populations can be affected through reduced food intake. Turbidity levels (increased) decrease the depth of the euphotic zone, reducing plant photosynthesis and thus affect the marine food chain (USEPA, 1983).

Siltation Effects

Effects on marine life of siltation are generally greater in degree than those associated with increases in turbidity levels. Included here is the burial of sessile organisms, smothering of eggs or larvae, spawning area eliminated, and the destruction of other habitats, particularly grassbeds (USEPA, 1983). Land habitats and organisms are as likely to be effected by siltation through improper spoil disposal as are water communities.

Modification of Habitat

Dredging and spoil disposal physically alter the

environment. This in turn can result in the creation of new and different communities of organisms. Not all habitat modifications are harmful, however. Fish populations, for example, are reported to have actually increased in some canals (Taylor and Saloman, 1968, in USEPA, 1983).

Noise

Equipment used in dredging operations produces noise. A USEPA study (1978b as quoted in USEPA, 1983) found that

> effects categories involved hearing acuity, masking of auditory signals, behavioral changes, and physiological stress responses. In general, noise at given levels can reduce wildlife hearing sensitivity; mask social signals; induce panicking, crowding, and aversive behavior; disrupt breeding and nesting habitats and possibly migration patterns; and change blood pressure/chemistry, hormones, and reproductivity. Some animals have been able to adapt to noise source and to differentiate dangerous ones from others.

Shoreline and Protective Structures

Jetties, groins, breakwaters, bulkheads, rivetments, ramps, piers, and piles are common features of marinas. Alterations of the environment can be expected to occur when placing these structures. And as long as a marina remains in operation, alterations are permanent. However, with proper planning, design, and maintenance, consequent negative impacts can be minimized and new habitats created which may prove beneficial to the local marine environment.

Physical Impacts

The physical alteration of shorelines occurs mainly from

the effects of breakwaters, bulkheads, groins, and jetties on wave action. This, in turn, involves changes in circulation, siltation, erosion, and turbidity.

Solid and shore-attached breakwaters can cause shoreline sand accretion along the updrift angle of the breakwater and possible erosion on the downdrift side of the structures. Groins may also cause scouring of downshore areas which are deprived of littoral drift sand. Inlet channels protected by jetties can experience sand accumulation and require dredging. Finally, foreshore erosion can result from waves reflected off bulkheads (USEPA, 1983).

Chemical Impacts

Chemical impacts from shoreline structures may involve toxic and nutrient resuspensions, dissolved oxygen, and sediment turbidity. Dredging-related chemical alterations on water quality were discussed earlier. Other water quality impacts may result from chemicals (creosote, copper, zinc, etc.) which leach into waters from pilings, bulkheads, and other structures treated with preservatives (USEPA, 1983).

Biological Impacts

Biological impacts from shoreline structures are numerous and complex. Some impacts adversely affect the local ecology; others may be considered beneficial. Alterations generally result from changes in turbidity levels, and the euthophic zone, siltation and erosion, habitat loss or

alteration, air quality, and noise levels.

Turbidity levels can be increased during all stages of construction. The effects were addressed earlier. Structures obstruct sunlight which in turn affects the photosynthetic processes. Construction activities and in-place structures may cause siltation and erosion which in turn alter habitats and otherwise affect marine organisms.

Altered envionments can provide new habitats which may be more productive than under altered conditions. Structures can serve as artifical reefs for a variety of organisms, although in the case of some insects, isopod crustacians and borers, some may not be as desirable as others.

Air quality from construction or operation equipment air emissions and noise from the same equipment may disrupt or affect nearby bird populations. Terrestrial organisms can be temporarily affected by pile driving operations (USEPA, 1983).

Wastewater Discharge and Runoff

The contribution of sewage pollution and runoff by marinas to coastal waters is relatively minor when compared to the total from all sources. But boats and marinas do contribute, and on a local basis may reduce water quality to the extent that marine organisms are damaged, habitats altered, and human enjoyment of the surroundings impaired.

Provided local waters are not overly polluted from other sources, small quantities of pollution from boats and

marinas may be acceptable provided water circulation adequately disperses the pollutants. The actual or potential impact on waters will depend upon local conditions: water depth, circulation, marine organisms present, etc.

Wastewater Discharge from Boats

The discharge of fecal material from boats may cause significant problems. In addition to being visually repulsive (Chmura and Ross, 1978), it can increase biological oxygen demand (BOD) in receiving waters, and, most serious of all, contribute disease-causing viruses and bacteria (pathogens).

Research on the affects of fresh fecal pollution from boats has yet to conclusively quantify the problem. It is apparent, however, that fresh fecal pollution from boats may pose localized environmental problems (e.g., contamination of shellfish) and that this pollution, regardless of source, is a hazard to public health (see USEPA, 1983, for a review of the literature).

Wastewater Discharge from Shoreside Facilities

For marinas served by municipal or rural wastewater collection and treatment facilities, the potential for pollution from this source is insignificant. For marinas and associated developments relying on septic tanks as a disposal system, the problem is potentially serious. The effectiveness of septic tanks is dependent upon such local features as slope, soil depth, soil permability, groundwater

level, and distance to open receiving waters. "Failures of septic tank systems are generally due to overloading, characteristics of the soil (either impervious or too pervious soils) or high groundwater" (USEPA, 1975, as quoted in USEPA, 1983).

Runoff

Potentially harmful runoff products from marina shore facilities include: heavy metals, sediment, oil, pesticides, and nutrients. These substances may be toxic to marine organisms or reduce their ability to reproduce.

Heavy metals are generally not hazardous to marine organisms in their pure state, but when combined with other compounds, they can become toxic. Copper, for example, is used in anti-fouling paints, and when sprayed on or scraped off boats can enter waterbodies through runoff (USEPA, 1983).

Coast Guard and USEPA regulations prohibit discharge of oily substances which cause a visible sheen or film on water. Enforcement is difficult, however, since oily substances can be traced to numerous sources, e.g., fuel spills, oil from parking lots, etc.

Pesticides, sprayed to control plant and animal populations around marinas or other developments, may find their way into water bodies through runoff. These can be toxic to, or accumulated by, shellfish, crabs, fish, and shrimp, all of which may be consumed by humans. They are sublethal

to many other marine organisms although they can affect maturation, molting, reduce temperature endurance and salinity changes, etc. Among other potentially harmful runoff products are detergents, excess nutrients, and sediments (USEPA, 1983).

Boat Operation and Maintenance

Boat operation and maintenance effect marine life, in some cases subtly and in others in more obvious manners. Of note here are boat wake impacts; boat and propeller contact with the bottom or waterborne organisms; impacts of boat activity on wildlife population; and impacts associated with outboard exhaust and other associated engine pollutants.

Physical Impacts of Boat Operation

The most serious impact of boats and boat motors on marine life occurs when direct contact is made between the two. Damage to seagrass beds (cutting) is the most common problem in the southeastern United States. Collision with turtles and manatees occur but mainly in localized areas (USEPA, 1983).

Boats able to penetrate secluded coastal areas may also disturb wildlife populations. If sufficiently frequent, nesting success may be reduced or wildlife may seek--if available--new locations to habitat.

Wave and wake turbulence can impact the environment. Waves from moving boats may cause shoreline erosion. The extent depends upon wake magnitude, shoreline soils,

topography, and vegetative cover. Wake turbulence may affect oyster production, destroy rooted aquatic vegetation, and increase the amount of suspended sediment (USEPA, 1983).

Boat Operation and Maintenance Pollutants

The quality of pollutant discharge into the water from boat motors varies with motor features and operating variables. These include intake and exhaust design, deflector design, size, recycling apparatus, gas-oil fuel ratios, tuning and speed of operation. The substances discharged include hydrocarbons, lead, and carbon monoxide/dioxide. The release of hydrocarbons can also occur in bilge pumping and from docks and fuel loading areas.

Detergents from boat washing, and other pollutants from such maintenance activities as sanding and painting, and fiberglass repair, may also find their way to the water. Most major brands of antifouling paints contain low amounts of polychlorinated biphenyls (PCBs); problems occur in paints containing high levels of PCBs (USEPA, 1983).

Pollutant Impacts

The introduction of hydrocarbons from nonoperating outboard motors within marinas is usually not of sufficient magnitude to cause significant harm to marine organisms, although they definitely are pollutants (USEPA, 1983). Motors in operation are the more serious threat to marine organisms.

Motor exhaust is toxic to zooplankton and small forage

fish, and small amounts of petroleum may adversely affect mussels and oysters. Fuels may also impart undesirable tastes and smell in fish, and taint fish flesh. Among the heavy metals, lead is a significant pollutant as it is very toxic to most plants and moderately toxic to mammals. The toxicity of lead in water is affected by organic materials, the presence of other metals, pH, and hardness of the water.

Detergents introduced into water from boat and cloths washing affects water quality. Increased nutrient levels from detergents can decrease DO concentrations and increase plankton blooms. Water-based detergent compounds are highly toxic to fish and shellfish; solvent-based compounds are toxic to crustaceans. The greater the flushing capacity of marina waters, the lower the potential of harm from detergents.

The increase in pleasure boating activities in recent years has substantially increased the amount of associated litter. Aesthetically, litter is not pleasing to the eye. Beyond it being an eyesore, litter, particularly plastic, is ingested by birds, fish, mammals, turtles, and invertebrates. The effects can be intestinal blockage, reduce hunger sensations, cause ulcerations, and contribute synthetic chemicals to body tissues. Finally, plastics, nets, and monofilament lines can entangle wildlife, leading to drowning, starvation, or strangulation (USEPA, 1983).

Impact Assessment Techniques

Potential environmental impacts from marine construction and operation were outlined above. From that listing it was readily apparent that impacts could be complex or simple, widespread or local. For the developer and regulatory (permitting) decision-maker there exists the very real problem of determining data needs on impacts as they relate to the planning, design, construction, and operation of marinas. Data needs will usually be a function of marina type and complexity, site location, and surrounding environmetal conditions.

For both the developer and regulatory decision-maker, the ability to obtain data relevant to a marina project is limited by both time and cost considerations. In some cases, data are available through various agencies or organizations, or can be readily obtained through field investigations; other data may be beyond the normal expectation and ability of a developer (or his agent) to acquire or process.

Regulatory agency requirements for information relevant to marinas must be met. There should be a clear understanding among agencies, and between agencies and developers as to requirements and responsibilities. As an aid to the marina developer, design engineer, and agency officials, an outline of techniques applicable to the assessment of impacts is included in Table 25. The source for the table is the USEPA (1984) document, Coastal Marinas Assessment

Guidance Handbook. The document provides textual descriptions of various methods and models and should be referred to by interested parties.

TABLE 25

IMPACT ASSESSMENT TECHNIQUES

Water Quality Resources Measurement Techniques

Impact	Assessment Technique	Unit of Measurement	Reference[a]	Time Frame[b]
Turbidity	Secchi disk[c]	Centimeters	1-6	In situ
	Jackson candle turbidimeter	Jackson turbidity units	1-6	In situ
	Nephelometric turbidimeter	Nephelometric turbidity units	1-6	In situ
	Quantum photometer	µeinsteins/m2/sec photosynehetically available radiation	1-6	In situ
Dissolved Oxygen	Membrane electrode method (oxygen meter)	mg/1	1-6	In situ
	Iodometric method (Winkler) and modifications	mg/1	1-6	In situ
Coliforms	Most probable number technique (MPN)	colonies/100 ml	1-6	1-2 days
	Membrane filter technique		1-6	1-2 days
Nutrients (nitrogen/phosphorus)	Ion chromatography	mg/1 in water	1-6	1-2 days
	Wet chemistry method	mg/kg in sediments	1-6	1-2 days
Metals	Atomic absorption spectroscopy (AA) (all metals)	µg/1 in water µg/kg in sediments	1-6	2-3 days
	Wet chemistry methods (all metals except barium)		1-6	2-3 days
	Inductively-coupled argon plasma (atomic emission spectroscopy) (ICAP) (all metals except mercury)		1-6	2-3 days
	Ion chromatography (potassium, sodium, iron, copper, nickel, cobalt, zinc, lead, calcium, arsenic and magnesium only)		1-6	2-3 days
Pesticides/PCBs & Hydrocarbons	Gas chromatrography	µg/1 in water µg/kg in sediments	5-7	1-2 days
	Gas chromatrography/mass spectroscopy		5-7	1-2 days
	Liquid chromatography		5-7	1-2 days

TABLE 25 (cont.)

Water Quality Resources Measurement Techniques

Impact	Assessment Technique	Unit of Measurement	Reference[a]	Time Frame[b]
Oil and Grease	Gravimetric method	mg/l in water mg/kg in sediments	1-6	1-2 days
	Infrared spectroscopy		1-6	1-2 days
Detergents	Colorimetric method (ultraviolet spectroscopy)	mg/l in water mg/kg in sediments	1-6	1-2 days
Sediments	Grain size analyses (mean grain size, sorting coefficient, skewness and Kurtosis of grain size distribution)	phi (Φ) units or μm	6,8,9	2 days
	Elutriate analyses		9-11	3-4 days

[a] 1) NESP, 1975; 2) States et al., 1978; 3) Henderson, 1982; 4) USEPA, 1979b; 5) APHA, 1980; 6) ASTM, 1983; 7) Federal Register, 1979; 8) Folk, 1974; 9) Pequegnat et al., 1981; 10) USEPA, 1979a; 11) Plumb, 1981.

[b] Time frames are based on estimated laboratory time to complete one analysis. Individual laboratories may require longer processing periods. Field sampling time will vary with individual site conditions.

[c] The techniques do not measure turbidity per se, however, the relative turbidity of two sampling sites may be inferred through use of these techniques.

TABLE 25 - (cont.)

TERRESTRIAL HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Vegetation	Plot, quadrat or transect methods	1-5	4-6 days
	Dry matter production (biomass)	6-9	3-5 days
	Plotless techniques (closest individual, nearest neighbor, random pairs, Bitterlich or quarter methods).	10,11	2-4 days
	Remote sensing (aerial or satellite photography)	12	10-20 days
	Vegetation mapping	6-11	6-8 days
Birds (including rookery areas)	Territory mapping (spot-mapping)	1-11,12-16	8-10 days (in breeding season)
	Roadside count	1-11,12-16	3-4 days (fall and winter)
	Plot method-winter	1-11,12-16	8-10 days (Dec through Feb)
	Strip census	1-11,12-16	3-4 days (seasonally)
	Aerial photos[c]	1-11,12-16	3 days (in winter)
	Aerial visual sample census	1-11,12-16	2-3 days (in spring)
	Nest counts	1-11,12-16	1-2 days (in spring)
	Mark and recapture	16	2 weeks (approximately)
	Auditory index	1-11,12-16	2-12 days (in spring)
	Line transect method (King method)	1-11,12-16	2-3 days (in fall)
	Temporal census	1-11,12-16	1-3 evenings per roost
	Radar	1-11,12-16	several days in migrating season
	Radio-location	1-11,12-16	day and night, all seasons, up to 1 year
Mammals	Drive count (large animals)	1-16	1 day
	Temporal census (large animals)	1-16	2-3 days during migration
	Total capture	1-16	very time consuming; varies with area sampled
	Strip census (King method)	1-16	3-4 days
	Time-Area count	1-16	4-5 days during main activity periods
	Roadside count	1-16	1-2 days
	Bounded count	1-16	10-20 days
	Pellet count	1-16	3-4 days
	Marking	1-16	7-10 days
	Mark and recapture	1-16	8-10 days
	Reduction of rate of capture	1-16	4-5 days
	Selective reduction or increase	1-16	1-2 days per animal

TABLE 25- (cont.)

TERRESTRIAL HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Mammals (cont'd)	Radio-telemetry	1-16	up to 1 year
	Infrared scanning (aerial)	1-16	1-2 days
	Aerial photos or counts[c]	1-16	8-10 days
Invertebrates/ Herptiles	Pitfall traps	17-22	2-3 days
	Sweep net collections	17-22	2-3 weeks
	Light trapping	17-22	2-3 weeks
	Malaise trap collecting	17-22	2 weeks
	Drop trap (grasslands)	17-22	2-3 weeks
Soils	Soil mapping (pits, cores, augers)	1-22	3-4 days
	Physical analyses (compaction, porosity, permeability)	1-22	2 days/sample
	Chemical analyses	1-22	2-3 days
	Textural analyses (grain size, soil type, soil description, water content)	1-22	7-10 days
Endangered Species	Presence of endangered species may be ascertained through the use of previously cited methodology	-	-
	Contact local experts, U.S. Fish and Wildlife, state agencies	Appendix 1	1 or more days
	Reference state and federal endangered species lists	-	1 day
Turtle Nesting Areas	Nest counts	-	2-4 days
	Nest removal	-	as necessary
Adjacent Wilderness/ Wildlife Management Areas	Impacts may be inferred from use of previously described techniques	-	-

[a] 1) NESP, 1975; 2) States et al., 1978; 3) Henderson, 1982; 4) Husch et al., 1972; 5) Odum, 1971; 6) Brown, 1954; 7) Cain and Castro, 1959; 8) Phillips, 1959; 9) Curtis and Cottam, 1962; 10) Greig-Smith, 1964; 11) Ohmann, 1973; 12) Ford, 1979; 13) Franzreb, 1977; 14) Kendeigh, 1944; 15) Parnell and Soots, 1979; 16) Taber and McTaggart-Cowan, 1971; 17) Cochran, 1953; 18) Hanson et al., 1953; 19) Morris, 1960; 20) Southwood et al., 1966; 21) Andrewartha, 1971; 22) ASTM, 1976.

[b] Time frames are estimated based on minimal field time and do not include analysis of data collected unless otherwise specified.

TABLE 25- (cont.)

AESTHETIC RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	Unit of Measurement	Reference[a]	Time Frame[b]
Visual	Data Collection Techniques:			
	Systematic observer survey	-	1,2	in situ
	Eye-level photography	-	1,2	in situ
	Written record of visual impressions	-	1,2	in situ
	Remote sensing[c]	-	1-3	10 days
	Mapping	-	1,2	1 or more days
	Evaluation Methods:			
	Qualitative Classification schemes	-	1,4	1 or more days
	Quantitative			
	Independent	-	5-7	1 or more days
	Comprehensive	-	8-11	1 or more days
Noise	Precision sound level meters	Sound level (L) in decibels (dB)	12,13	in situ
	Vibration meters		12,13	in situ
	Recorders		12,13	in situ
	Computer modeling and analytical techniques		14	several days once all data has been collected
Taste	Taste threshold test performed by panel	Rating system	15	1 day
Odor	Threshold odor test performed by odor judgement panel	Rating system	15	in situ
	Scentometer		15	in situ

[a] 1) Roy Mann Associates, Inc., 1975; 2) Henderson, 1982; 3) Ford, 1979; 4) Litton et al., 1974; 5) Burnham, 1974; 6) Sargent, 1967; 7) Leopold, 1969; 8) Leopold, 1971; 9) Dee, 1972; 10) Shafer and Mietz, 1970; 11) Golden et al., 1979; 12) Peterson and Gross, 1974; 13) Englund and Berry, 1974; 14) USEPA, 1978; 15) Jain, et al., 1974.

[b] Time frames dependent upon availability of data, personnel.

TABLE 25 - (cont.)

GROUNDWATER RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	Unit of Measurement	Reference[a]	Time Frame[b]
Nutrients (nitrogen/phosphorus)	Ion chromatography	mg/l	1-6	1-2 days
	Wet chemistry methods			1-2 days
Coliforms	Most probable number technique (MPN)	colonies/100 ml	1-6	1-2 days
	Membrane filter technique			1-2 days
Metals	Atomic absorption spectroscopy (AA) (all metals)	µg/l	1-6	2-3 days
	Wet chemistry methods (all metals except barium)			2-3 days
	Inductively-coupled argon plasma atomic emission spectroscopy (ICAP) (all metals except mercury)			2-3 days
	Ion chromatography (potassium, sodium, iron, copper, nickel, cobalt, zinc, lead, calcium, arsenic and magnesium only)			2-3 days
Pesticides/PCBs	Gas chromatography	µg/l	5-7	1-2 days
	Gas chromatography/mass spectroscopy			1-2 days
	Liquid chromatography			1-2 days
Oil and Grease	Gravimetric method	µg/l	1-6	1-2 days
	Infrared spectroscopy			1-2 days
Detergents	Colorimetric method (ultraviolet spectroscopy)	µg/l	1-6	1-2 days
DATA EVALUATION TECHNIQUES				
Groundwater Contamination	Predictive numerical models		8	Several days once all data has been collected
Groundwater field studies	Well monitoring		9-11	

a 1)NESP, 1975; 2)States et al., 1978; 3)Henderson, 1982; 4)USEPA, 1979b; 5)APHA, 1980; 6)ASTM, 1980; 7)Federal Register, 1979; 8)Bachmat et al., 1980; 9)Chow, 1966; 10)Davis and DeWiest, 1966; 11)Soil Conservation Service, 1972.

b Time frames are based on estimated laboratory time to complete one test. Individual laboratories may require longer processing periods.

TABLE 25 - (cont.)

NAVIGATION RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Circulation	Dye and drogue studies/ field observations	1-3,5	in situ
	Aerial photography/ground-truthing	4,7	10 days
	Hydrographic study	6	Several days once all data has been collected
Wave Conditions	Field observations	-	in situ
	Wave ray tracing	8	2-3 days
	Refraction and diffraction diagram analysis	9,10	1-2 days
	Hydraulic modeling	10	Several days once all data has been collected
Other Physical Factors	Analyze available data	-	Several days once all data has been collected
	Interview local residents	-	in situ
	Diver observation	-	in situ
Soils/Sediments	Soil investigations - test piles - direct soil evaluation	11,12	2 days 2 days
Depth	Soundings	6	in situ
Wind Direction/ Velocity	Anemometer	-	in situ

a 1)Feverstein and Selleck, 1963; 2)Wilson, 1968; 3)Scott et al., 1969; 4)Ford, 1979; 5) Marcus and Swearingen, 1983; 6)U.S. Coast and Geodetic Survey Charts; 7)Blades, 1982; 8)Kinsman et al., 1979; 9)ASCE, 1969; 10)Zabawa and Ostrom, 1980; 11)Plumb, 1981; 12)USEPA, 1979b

b Time frame dependent upon availability of data, personnel.

TABLE 25 - (cont.)

WETLAND HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Vegetation	Plot, quadrat or transect methods	1-11	4-6 days
	Plotless techniques (closest individual, nearest neighbor, random pairs, Bitterlich or quarter methods)	1-11	2-4 days
	Remote sensing (aerial or satellite photography)	12	10-20 days
	Vegetation mapping	6-11	6-8 days
	Dry matter production (biomass)	1-11	3-5 days
Soils	Soil mapping (pits, cores, augers)	1,15	3-4 days
	Textural analyses (grain size, soil type, soil description, water content)	1	7-10 days
	Chemical analyses	1,15	2-3 days
	Litter loss rates	13	several days once field data has been collected
	Cellulose decomposition	13	
	Bacteria	14	
	Physical analyses (compaction, porosity, permeability)	1,15	2 days/sample
Erosion	Shoreline profiles	16-18	in situ
	Boating activity inventory	16-18	in situ
	Electronic wave guage	16-18	in situ
	Wind speed gauge and compass	16-18	in situ
	Empirical, site specific wind wave energy models	16-18	in situ under varying wind conditions
Birds	Aerial photographs	19-24	1-5 days
	Aerial visual sample census	19-24	1 or more days
	Nest counts	19-24	1 or more days
	Mark and recapture	19-24	1 or more days, very time consuming
	Auditory index	19-24	2-4 days
	Temporal census	19-24	1-3 evenings per roost, September
	Radar	19-24	migratory seasons
	Radio-location telemetry	19-24	day and night, all seasons, to 1 year

TABLE 25 - (cont.)

WETLAND HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Mammals	Temporal census	19-24 (see also terrestrial)	2-3 days during migration
	Total capture	19-24	very time consuming; varies with area sampled
	Time-area count	19-24	1 hr/count for several days
	Mark and recapture	25	2 days minimum
	Marking	25	2 days minimum, no specific time
	Reduction of rate of capture	25	2 or more nights
	Selective reduction or increase	25	2 separate samples (1-2 days/animal)
	Radio-telemetry	25	up to 1 year
	Aerial photography/counts[c]	25	8-10 days
Vertebrates/ Invertebrates	Sweep net collections	20-21	2-3 weeks
	Light trapping	20-21	2-3 weeks
	Malaise trapping	20-21	2 weeks
	General collecting	20-21	6-8 days
Endangered Species	Presence of endangered species may be ascertained through the use of previously cited methodology	-	-
	Contact local experts, U.S. Fish and Wildlife, state agencies	Appendix 1	1 or more days
	Reference state and federal endangered species lists	-	1 day

[a] 1) NESP, 1975; 2) States et al., 1978; 3) Henderson, 1982; 4) Husch et al., 1972; 5) Odum, 1971; 6) Brown, 1954; 7) Cain and Castro, 1959; 8) Phillips, 1959; 9) Curtis and Cottam, 1962; 10) Greig-Smith, 1964; 11) Ohmann, 1973; 12) Ford, 1979; 13) Phillipson, 1970; 14) Parkinson et al., 1971; 15) ASTM, 1976; 16) Zabawa and Ostrom, 1980; 17) Sverdrup and Munk, 1947; 18) USACOE, 1973; 19) Kendeigh, 1944; 20) Giles, 1971; 21) NESP, 1975; 22) Franzreb, 1977; 23) Parnell and Soots, 1979; 24) States et al., 1978; 25) Taber and McTaggart-Cowan, 1971.

[b] Time frames are estimated based on minimal field time and do not include analysis of data collected unless other wise specified.

TABLE 25- (cont.)

AQUATIC HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame Per Sample[b]
Shellfish Beds	Direct counts (no. of individuals per unit area) or size measurement	1	2-3 days
	Size frequency distribution	2	2-3 days
	Condition index	3,4	3-4 days
	Flow-through or static bioassays	5-9	7-10 days
	Chemical uptake analyses	8-11	4-7 days
	Bacteriological quality analyses	8	3-4 days
Grassbeds	Aerial photography in concert with groundtruthing	12	3-4 days
	Community survey	13-16	3-4 days
	Community productivity	17-21	8-10 days
	1) measured by uptake of radioactive carbon (14C);		
	2) measured by marking the blades and measuring the growth increment after a growth period of several weeks;		7-10 days
	3) measured by statistical estimates based on length and width of the longest 5% of the leaf population of a given area.		3-4 days
Benthos	Numerical assessment (quantitative study)	5,22-25	Sampling could take several days per collection sample processing; analysis may take weeks to months per collection.
	Faunal survey (qualitative study)	22-25	Sampling could take several days per collection. Sample processing may take several weeks per collection.
	Bioassay (effluent or sediment elutriate testing)	5,6,7,9,26,27	Several weeks for collection, testing and data analysis.
Nursery Areas	Numerical assessment (quantitative study)	5,23-25	Sampling could take several days per collection. Sample processing and analysis could take several more weeks per collection.

TABLE 25 - (cont.)

AQUATIC HABITAT RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame Per Sample[b]
Nursery Areas (cont'd)	Faunal survey (qualitative study)	22-25	Sampling could take several days per collection. Sample processing could take a few weeks per collection.
	Bioassay (effluent or sediment elutriate testing)	5-7,9,26,27	Several weeks for collection, testing and data analysis.
Manatees	Observation and counts	-	Report observations as they occur.
Sea Turtles	Observation and counts	-	Report observations as they occur.
	Tangle nets	-	Netting conducted daily or weekly in frequented areas
Endangered Species	Presence of other endangered species may be ascertained through the use of previously cited methodology.	-	Report observations and disposition as they occur
	Contact local experts, U.S. Fish and Wildlife, state agencies	Appendix 1	1 or more days
	Reference state and federal endangered species lists	1	1 day

[a] 1) Van Dolah et al., 1979; 2) Gray et al., 1978; 3) Lawrance and Scott, 1982; 4) Scott and Lawrance, 1982; 5) USEPA, 1973; 6) Cairns and Dickson, 1973; 7) Cairns et al., 1978; 8) NAS, 1980; 9) APHA, 1980; 10) SCDHEC, 1981; 11) Pan et al., 1982; 12) Thompson, 1976; 13) Phillips, 1960; 14) Livingston et al., 1976; 15) McRoy and Helfferich, 1977; 16) Phillips and McRoy, 1979; 17) Patriquin, 1973; 18) Zieman, 1974-75; 19) Penhale, 1975; 20) Capone et al., 1979; 21) Kemp et al., 1981; 22) Holme and McIntyre, 1971); 23) NESP, 1975; 24) USGS, 1977; 25) APHA, 1980; 26) Plumb, 1981; 27) USEPA, 1979b.

[b] Time frames are estimated based on minimal field time and do not include analysis of data collected, unless otherwise specified.

TABLE 25 - (cont.)

SOCIOECONOMIC RESOURCES
MEASUREMENT TECHNIQUES

Impact	Assessment Technique	References[a]	Time Frame[b]
Cultural Historical	Reference the National Register of Historic Places	-	1 day
	Interview local collectors	-	2-3 days
	Contact appropriate State Historic Preservation Officer	(Appen 1)	1 day
Archaeological	Reference the National Register of Historic Places	-	1 day
	Interview local collectors	-	2-3 days
	Contact appropriate State Historic Preservation Officer	(Appen 1)	1 day
	Archaeologicl Survey: Surface reconnaissance	1,2	several weeks for collection, testing and data analysis
	Excavation	1,2	
	Laboratory analysis of artifacts	1,2	
Economic Resources/ Land Use	*Contact local Planning Board	-	1 day
	*Review existing mapped data	5	1-2 days
	*Visual site survey	-	1-2 days
	Aerial reconnaissance	4	1-2 weeks
	Comparative cost analysis	1	Several weeks for collection, data analysis
	Input-output analysis	1,6-8	Several weeks for collection, data analysis
	Spatial interaction analysis (The gravity model)	1	Several weeks for collection, data analysis
	Activity complex analysis	1	Several weeks for collection, data analysis
	Numerical ecological classification system	1	Several weeks for collection, data analysis

a 1)Henderson, 1982; 2)Willey, 1966; 3)Isard, 1972; 4)Ford, 1979; 5)U.S. Coast and Geodetic Survey Charts; 6)Nelson et al., 1980; 7)Crompton and Ditton, 1975; 8)Nissan and Williams, 1980.

bTime frame dependent upon availability of data, personnel.

Marina Planning

Marina planning, design, construction, and operation will greatly affect the kind and degree of environmental impacts which can be expected to occur. Proper consideration to these four procedural steps will also affect the economic viability of the operation.

Three published works provide considerable details on these four steps. They include two studies by the United States Environmental Protection Agency (USEPA, 1983 and USEPA, 1984) and one by the United States Army Corps of Engineers (USACOE, 1974). The USACOE document is oriented toward engineering features of marinas; the USEPA documents address issues relevant to resource managers, planners, and developers.

The following outlines planning and siting considerations relevant to those who may be involved in locating and designing new marinas. The USEPA (1983) document is the source for parts 1, 2, and 3; for part 4, layout criteria, see USACOE (1974). Included are general planning considerations, site investigation considerations, and marina layout criteria.

1. General Planning Considerations

   Here attention is given to the type of marina and facilities needed, and site location factors if a site has yet to be chosen.

A. Types of Marinas

This is usually determined in the initial feasibility study. Type will range from public to condominium-associated marinas.

B. Marina Access

Regardless of type or location, marinas must have adequate land access and provide safe boat passage to open waters. Acceptable travel times from residence to the marina is important. Winding channels, and hazardous and long routes to water use areas are generally considered unacceptable. Availability of, or accessibility to, such utilities as electricity, potable water, telephone, gas, sewer, and garbage removal is important.

C. Facilities Area Requirements

Area for facilities include both water and land (Table 26). Water area is dependent on type, number and size of boats, type of mooring, launching ramps, maneuvering area, pier services (fueling), etc. Land area requirements depend upon marina function and associated services and facilities. These range from parking areas and security, to motels and boat sales. See part 4, Layout Planning, for details on facilities and services.

D. Aesthetics

In addition to clean and pleasant surroundings,

TABLE 26

MARINA SERVICES AND FACILITIES

MARINA SERVICES

Water Related	Land Related
Boat launching	Boat sales
Mooring service	Boat repairs
Water taxi service	Marina supply sales
Transient boat service	General supply sales
Waste collection	Trailer storage
Fueling	Parking
Boat towing	Overnight accommodations
Fire and rescue services	Food service
Navigation and weather information	Concessions
	Utility service
	Recreational services

MARINA FACILITIES

Water Related	Land Related
Open and covered mooring	Boat building and repair
Boat launch ramp	Dry Boat storage
Marine railway	Trailer storage
Crane lift	Restaurant
Drydock	Motel
Fueling pier	Picnic areas
Anchorage areas	Convenience store
Marine service station	Boat washing
Entrance and exit channels	Parking
Swimming area	Swimming Pool
Water skiing course	Camping
Basin flushing system	Beach area
Storm and wave protection	Club Room
	Marine supply sales
	Public toilets and showers
	Recreational facilities

(Source: USEPA, 1984)

also considered are air and water quality, noise and wind conditions.

E. General Site Locations

Marinas are generally located in estuaries, embayments, or riversides, along open shorelines, and lowland areas above tide zone. Marinas in intertidal lowlands and salt marshes are discouraged. Areas with maximum natural protection are preferred. Site locations can affect construction costs in providing safety and in minimizing environmental impacts.

2. Site Investigation

Upon narrowing the choice of possible sites, specific locations are examined for physical and natural conditions as they may influence marina development, operation, and use.

A. Physical Considerations

Included here are water depth, bottom conditions, hydrography, soils, and shore conditions. Water depths adequate to meet boat needs are desired. Dredging in areas too shallow or placing protective structures in waters too deep are costly. Natural depth needs vary with boat types to be served. Sailboats, for example, generally need greater channel depths than do powerboats.

Bottom conditions include siltation rates which

in turn are influenced by hydrography and the nature of underlying soils. Hydrographic investigations can determine siltation, erosion, marine clay deposits, and shoaling rates. Soil tests evaluate pile placement and foundation needs. Shoreline topography should be suitable to provide protection from flooding, erosion, strong winds, etc.

B. Weather Conditions

Local weather conditions can be important in marina location. Precipitation usually presents no serious problem provided planning is made for adequate surface drainage. Winds, on the other hand, may require special planning. All structures should be designed to withstand wind loading. Surface wind velocities will vary from exposed to sheltered locations. Marinas handling sailboats must plan for channel ingress and egress. Where fog conditions prevail, channels and main fairways must be as straight as possible.

C. Wave Conditions

Marinas on ocean fronts are subject to sea swells and must plan for these conditions. Waves should not exceed 2 to 4 feet in height in entrance channels or 1 to 1.5 feet in berthing area. Within basins, where naturally occurring waves or boat-produced waves may cause problems, the site location should

provide for wave heights to decrease as they approach the shore. Tidal conditions seldom render the use of a marina impractical. However, tide ranges, particularly low tide (MLT) must be considered in planning for marinas in shallow water locations.

3. Site Development

Site development information is used to develop project costs.

A. Marina Capacity

Marina capacity can be determined by marketing analysis. Answers sought in the market analysis include boat types, lengths, and numbers to be accommodated. These will vary by type of marina.

B. Marina Orientation

This includes the layout of the marina. A successful layout provides for good access, services, and capacity at a low cost by minimizing the need for protection facilities, dredging, and other structures which lessen environmental impacts.

(1) Mooring Facilities

Must be planned around their use and function. Moorings can be fixed or floating, open or enclosed, or single or double berth. Potable water, waste removal facilities, and electrical power may be required. Mooring locations should allow for easy evacuation, maneuvering, and protection from waves.

(2) Basin Circulation

Inadequate circulation of water through or within channels, canals, and basins result in increased maintenance costs (e.g., dredging of sediment build-up) and environmental damage to marine life. Planning should exclude deadend canals, include two openings for basin marinas, and basins should be shallower than surrounding waters.

(3) Entrance Locations

Oriented to provide safe passage into and out of marina. Straight channels following natural courses when possible. Channel width sufficient to permit passage of boats in opposite direction. For sailboats, channels should be perpendicular to prevailing winds.

C. Marina Protection Facilities

Artificial structures may be needed to provide protection from wave action, shoaling, and sedimentation. Because of development costs and impacts of the structures on the environment, detailed planning is needed to assess their effectiveness.

(1) Wave Attenuation

Breakwaters may be required to provide shelter for boats when marina sites are located along open shorelines. Breakwaters can be floating

or solid. The former is less expensive and more environmentally acceptable (allows better current flow).

(2) Shoaling

Structures which change normal movement of water and waves along the shore will influence littoral movement. Site planning should consider probable effects of structures on shoaling.

(3) Sedimentation

Planners or engineers must evaluate the marina site carefully to determine possible extent of bottom sediment movement which may require costly maintenance dredging.

(a) Dredging Requirements

Once in operation, the most common dredging practices in marinas is to remove sediment from problem areas near docks or in channels.

(b) Dredged Materials

The proper placement of dredged materials is a concern for existing marinas and ones under construction. Usually recommended that dredged materials be adequately contained above the mean high water level. Use of dredges for reclamation of wetlands

is restricted, and the disposal of dredges at sea is discouraged. Properly placed dredge material to create habitat areas and new marsh lands is encouraged.

(c) Dredging Alternatives

Alternatives to dredging are encouraged. These consist of expanded use of dry storage; upland locations with canals to open water; and the construction of piers into deeper water.

4. Layout Criteria for Marinas

Proper siting of the various components of a marina will affect the soundness of the overall plan. The amount of land and water space available for development will restrict the number of boats and support facilities which an area can accommodate.

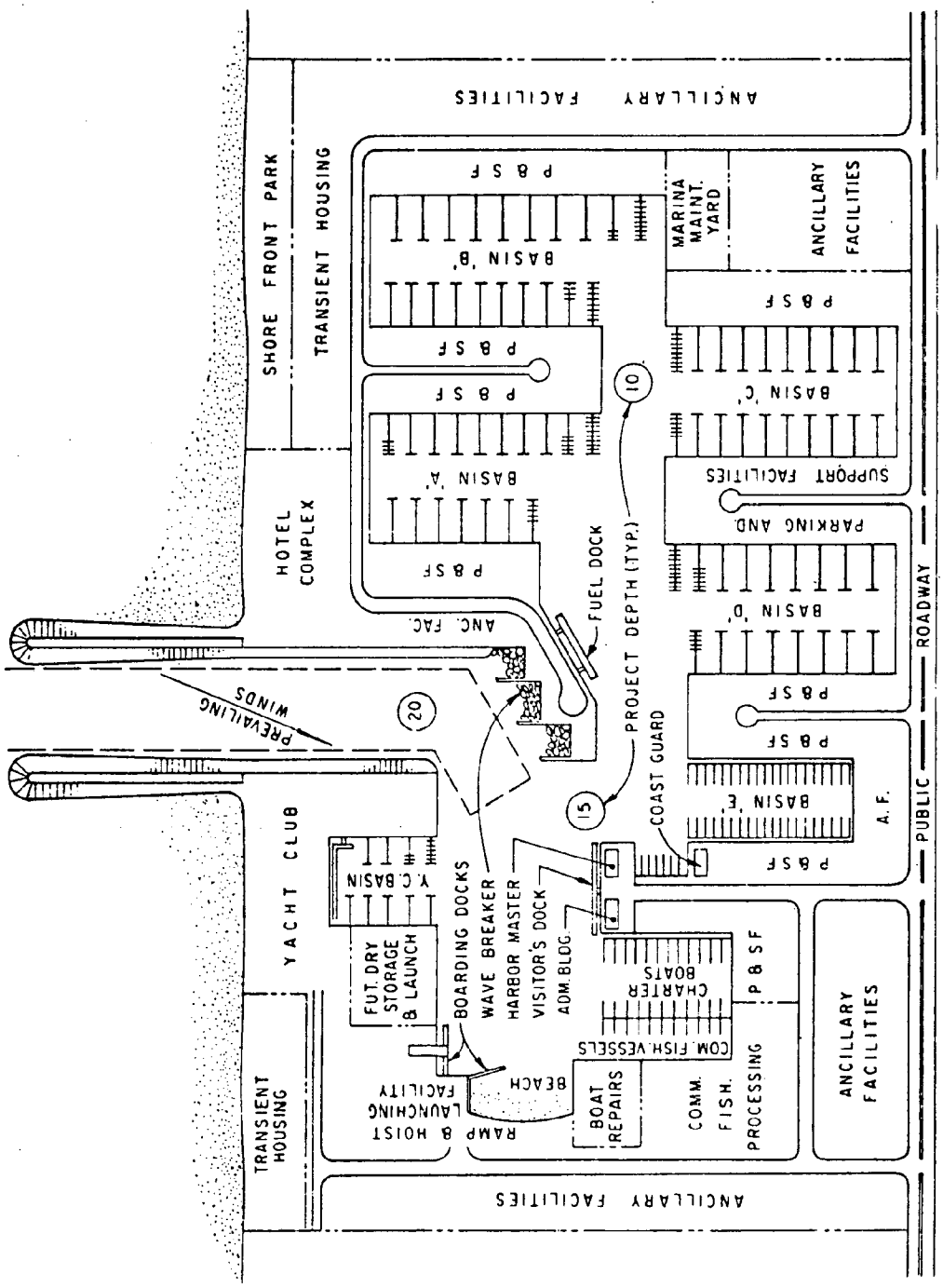
A. Layout Planning

(1) Boats

Recreational motorboats, sailboats, commercial craft, charter boats, and rental boats may all or in part require berthing in marinas. Berth-basins will usually be designed to provide greater depths and maneuvering area near the basin entrance (Fig. 8). Larger recreational motorboats should be berthed near the entrance where greater depths and maneuvering area

Figure 8

SCHEMATIC LAYOUT OF A MARINA SHOWING DESIRABLE INTERRELATION OF FACILITIES



(Source: USACOE, 1974)

requirements can be met. Smaller craft should be berthed in the inner parts of the harbor where water depths are shallower. Sailboats with auxilliary power can be berthed in motorboat areas; those with greater drafts near the entrance and those with shallower draft in inner areas. Sailboats without auxillary power should be berthed in slips open to leeward of the prevailing wind. Commercial craft usually fall in the same category as large recreational craft with regard to water requirements. However, the berthing of the two should be separated because of different adjacent land use requirements. Commercial craft require special hoists and other facilities for moving and processing fish. The public should be excluded from these working areas. Charter boats must have onshore facilities for selling their service, controlling the boarding and debarking of clients, and parking cars. Viewing areas may also be provided, as will fish-cleaning stations.

Rental boats should be berthed in the same area, not mixed with recreational boats, near office handling the rentals, and have a car parking area separate from the slip rental parking area.

(2) Ramps and Hoists

Ramps and hoists for launching trailered craft should be separated from the berthing area as far as possible. When possible, launching ramp should have direct access to main water body, not harbor area (Figs. 9 and 10).

(3) Boat Fueling and Pumpout Facilities

The best location for a fueling dock is near entrance and in an area protected from waves. Land space will be required for buried fuel storage tanks and these should be accessible for fuel distributing vehicles. Pumpout stations should be located in the same area as the fuel station for management purposes, but not so near that boat traffic interferes with the other's operation.

(4) Vehicle Parking

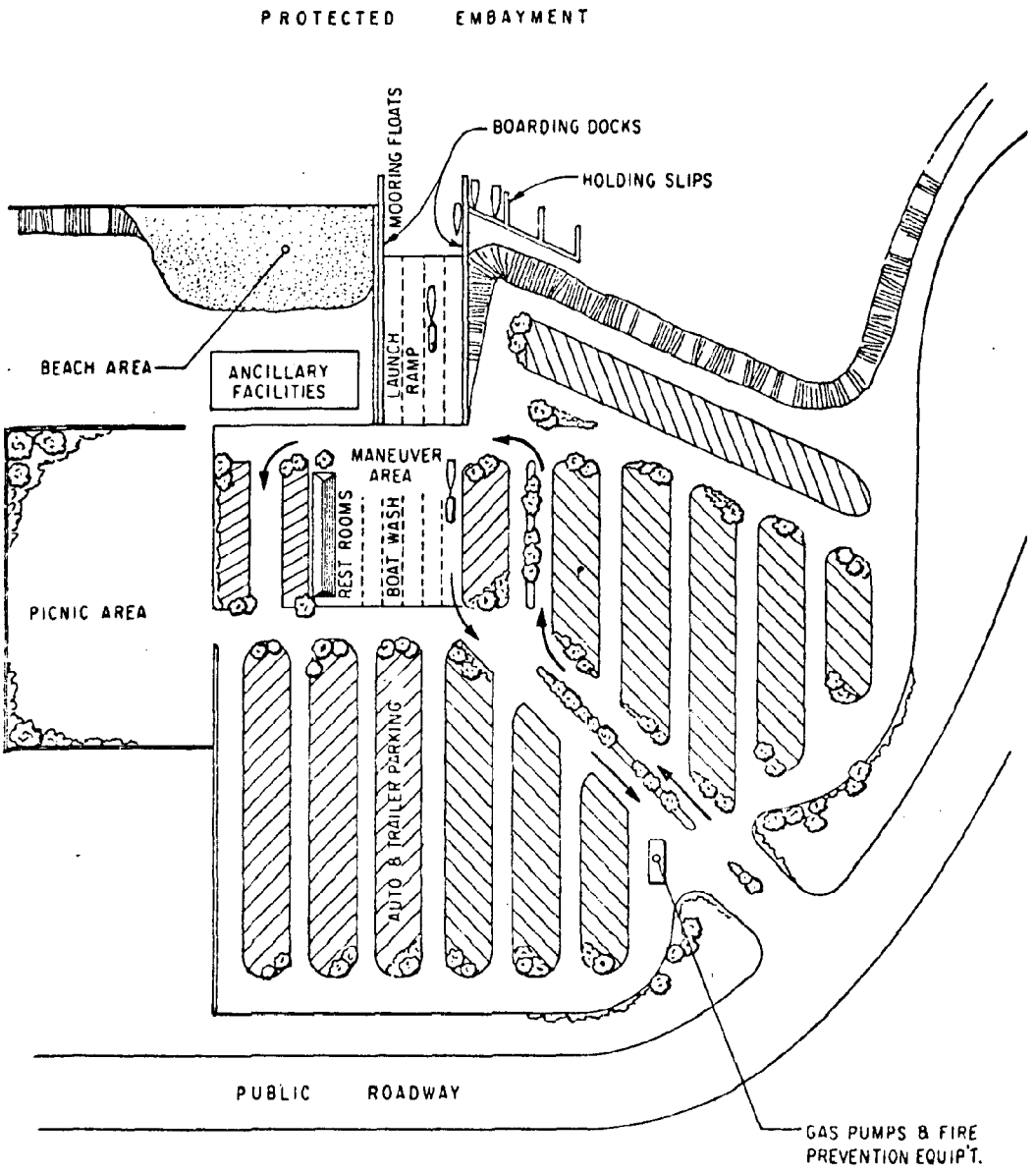
Lots should be located so that no parking space in any lot is more than 500 feet from the head of the pier for that particular lot. Parking for ancillary facilities should be adjacent to those of slip users. This will allow for overflow to be absorbed by one or the other of the lots.

(5) Boat Repair and Servicing Yards

These should be located in remote parts of the

Figure 9

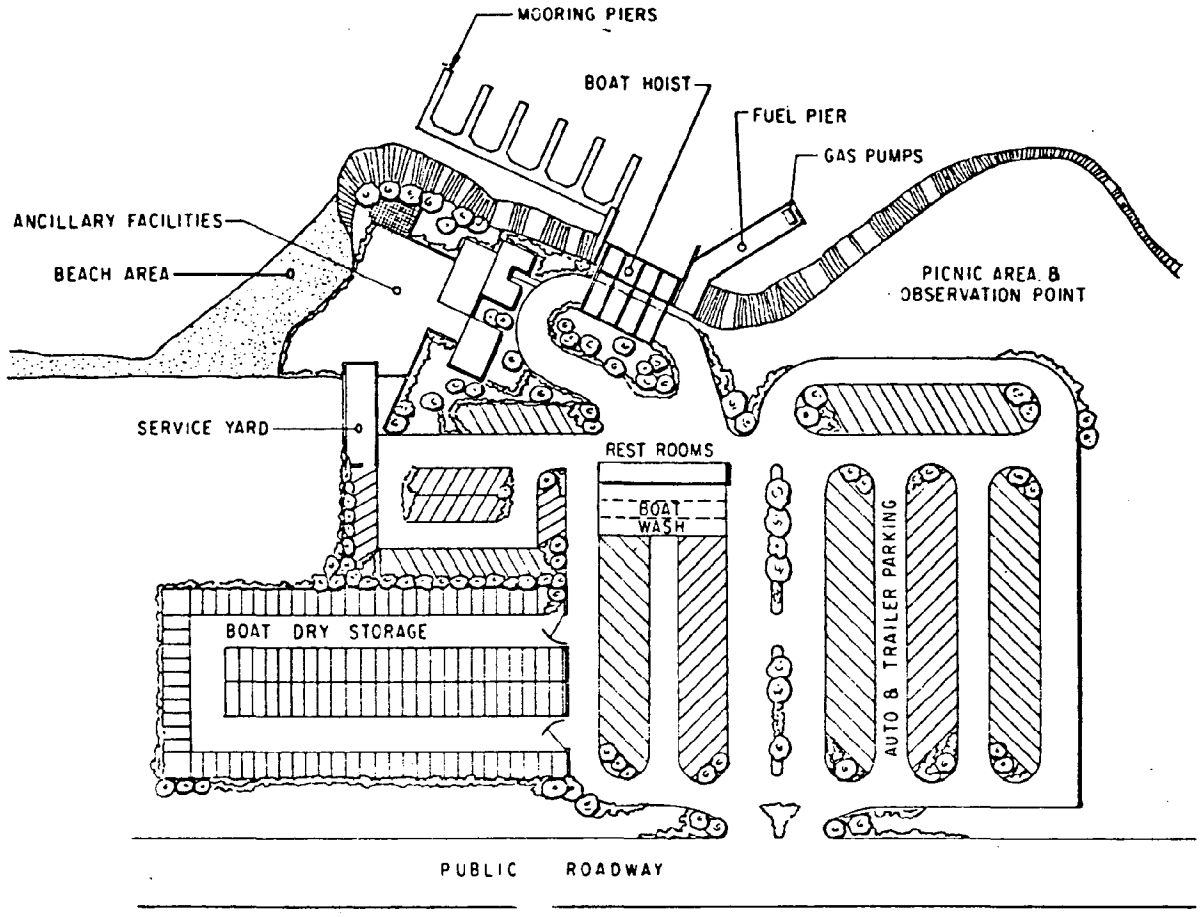
LAYOUT OF A TYPICAL LAUNCHING RAMP FACILITY



(Source: USACOE, 1974)

Figure 10

HOIST-LAUNCHING FACILITY WITH
DRY STORAGE YARD



(Source: USACOE, 1974)

marina harbor, but with adequate access for larger craft. The yard should be readily accessible to large tractor-trailers for hauling boats to be launched (Fig. 11).

(6) Dry Storage

Dry storage facilities should be located in accordance with criteria that apply to launching ramps. Launching and retrievals are generally accomplished by hoist rather than ramp.

(7) Boat Sales and Chandlery Facilities

These should be located along main access route to the harbor. Although often located outside the marina proper, they should be accessible by the walking public.

(8) Administrative Complex

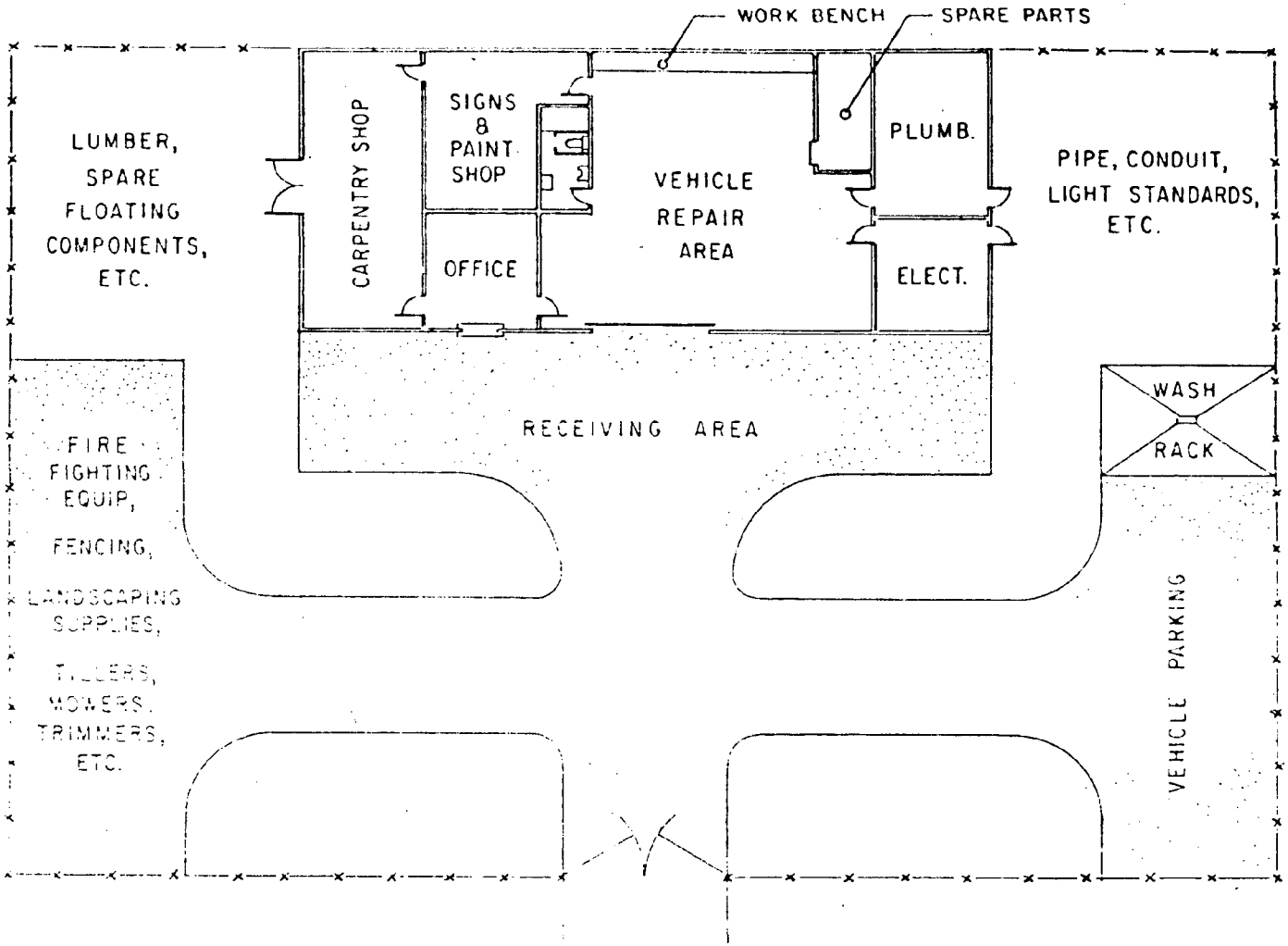
This should be located near the entrance to the harbor and guest docks. The harbormaster's office should be part of or close to the administrative complex and have a good view of boats passing through the entrance. A good view of berthing area is also recommended.

B. Space Allocation

The following analysis and description of space requirements in a marina was extracted in its entirety from the USACOE (1974) document on design, construction, and operation of small craft harbors.

Figure 11

TYPICAL MAINTENANCE BUILDING AND YARD LAYOUT



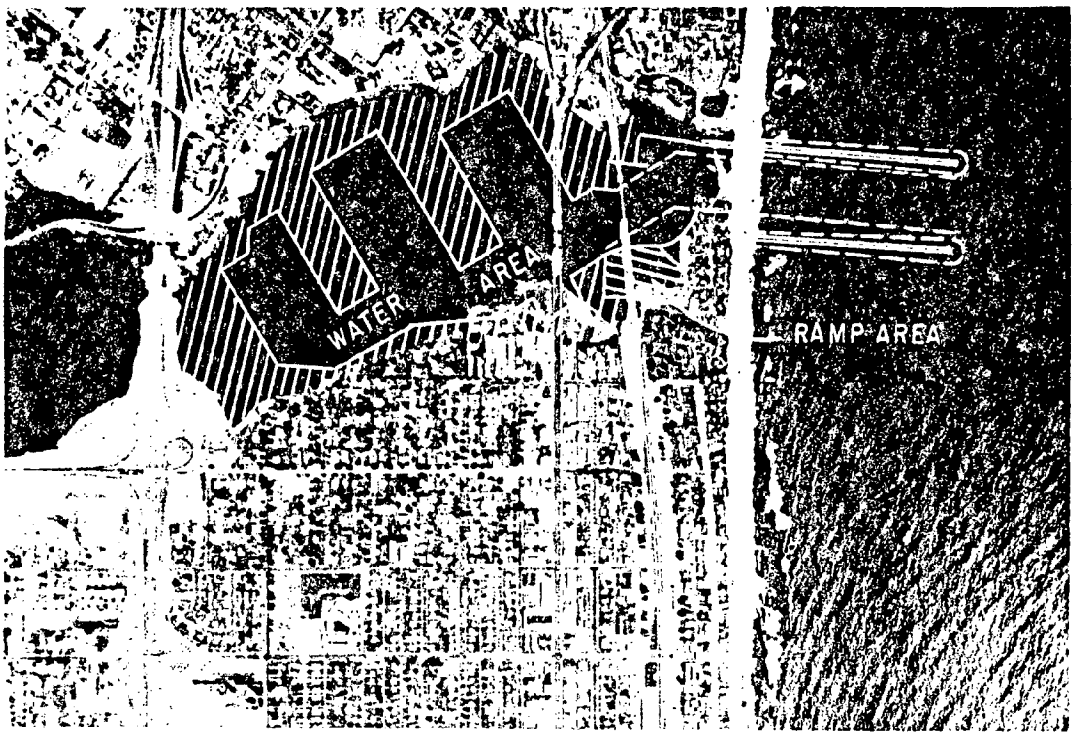
(Source: USACOE, 1974)

The total area available to the harbor development often places a restriction on the number of boats that the harbor can accommodate and on the size and scope of the ancillary activity it can support. Several general relationships, found valid for most harbors, may help the planner to make tentative allocations of space, which can later be adjusted to definite dimensions in the final planning stages. Such allocations are important in making adequate allowance for future expansion (Fig. 12).

The average harbor with all-slip moorage can berth about 15 to 20 boats per acre of navigable water area, including main interior channel, fairways, and slip area, but not the entrance channel. This general rule applies only when the average boat length is 30 to 35 feet and where good basin geometry can be obtained. Because of the wider fingers needed for two-boat slips, they will occupy almost the same area as that required for single-boat slips. When bow-and-stern moorings are used in lieu of slips, about 2 to 4 times as much water area (depending on the water depth) will be required, exclusive of fairways and channels. Single-point moorings required about 6 times the area occupied by the same number of bow-and-stern moorings if full-circle clearance is provided.

Figure 12

SPACE ALLOCATION FOR A TYPICAL MARINA



Available Area = 140 Acres (Two Bridges to be Removed)
Want 3-Lane Launching Ramp
Parking = 3 x 1.33 Acres = 4 Acres
Ramp, Road, Wash Area = 1 Acre
Available For Marina - 135 Acres
Let W = Water Area of Berthing Basins & Channels
Then $W + 4\left(\frac{W}{6}\right) = 135$ *Acres*
$W = 81$ *Acres*
(This Leaves 54 Acres For Back-up Land to be Filled)
Approx. Berthing Capacity = 81 x 20 = 1620 Boats
Daily Launching Capacity = 3 x 50 = 150 Boats
1770
Entrance Channel Width = 300 + 100 = 400 Ft.

(Source: USACOE, 1974)

For the normal distribution of boats, a minimum of three vehicle spaces in the parking lot will be required for every four boats in the berthing area. About 90 cars can be parked in an acre, so that roughly one-sixth of an acre of parking lot is required for each acre of water area in the harbor. Where the average size of the berthed craft is large--and many are used for social occasions and multi-family cruising--the ratio may have to be increased to a maximum of about three spaces per berth. An average launching ramp or hoist will launch and retrieve about 50 trailered boats on a peak day, and because of staggered usage, car-trailer parking spaces will be required for only 80 percent of the peak-day ramp or hoist traffic. About 30 car-trailer units can be parked in an acre if pullthrough parking at 45 degrees is provided. This works out to 1.33 acres of parking lot per ramp lane or hoist.

Land area required for harbor service facilities, ancillary facilities, and roads varies from one harbor to another. The minimum requirement is an area roughly equal to the parking area required for berths and operational launchings. This will generally provide enough space only for harbor support facilities and roads. To obtain a good

revenue versus cost balance it is usually necessary to supplement slip rentals with leaseholds for ancillary facilities; with the additional parking area required, the minimum leasehold and supplemental parking area needed for the extra services that convert a simple smallcraft harbor into a complete marina, is about twice the area needed for boatowner parking alone. Thus, once the parking area requirements for slips and launching has been determined, it should be multiplied by 4 to obtain the total minimum land area required for a complete marina. Any additional land that can be obtained may be put to beneficial use later, as a good marina will upgrade its surroundings and attract more revenue-producing ancillary development.

SECTION VI

REGULATORY RESPONSIBILITIES

SECTION VI

REGULATORY RESPONSIBILITIES

Mississippi administers control over coastal marina development through authority contained in the Mississippi Coastal Program. The Bureau of Marine Resources (BMR) administers the program and implements the requirements of the Coastal Wetlands Protection law. The wetlands law, together with several other state laws included in the program, prohibits the conduct of any regulated activity (e.g., dredge, fill, and the erection of certain structures) within the coastal zone unless a permit (see permit application in Appendix D) has been issued or the activity is covered by a valid exclusion.

This section outlines the permitting and review process and parties involved, examines siting design, and construction criteria for marina development, and looks at local regulations which could affect marina development.

Permit Process

In addition to the developer who must initiate a permit application and the public who may comment upon it, three levels of government may be involved in the permitting and review process: federal, state, and local.

Five agencies of the federal government are routinely involved in the application and review process. These

include the Department of Army, Corps of Engineers (USACOE); U.S. Environmental Protection Agency (USEPA); U.S. Department of Interior, Fish and Wildlife Service (USFWS); U.S. Department of Commerce, National Marine Fisheries Service (USNMFS); and the U.S. Coast Guard (USCG). The USACOE is the sole federal marina permitting agency. The other four agencies review applications, although the USEPA holds veto power over applications on environmental grounds.

In Mississippi, three agencies are directly involved in the permit process and three agencies in the review process. The permit process involves the Mississippi Department of Wildlife Conservation, Bureau of Marine Resources (BMR), the Bureau of Pollution Control (BPC), and the Secretary of State when a request is made for a state land lease. The review agencies include the Mississippi Department of Archives and History; Department of Health, Shellfish Sanitation Office; and the Department of Wildlife Conservation, Bureau of Marine Resources, Wetlands Division.

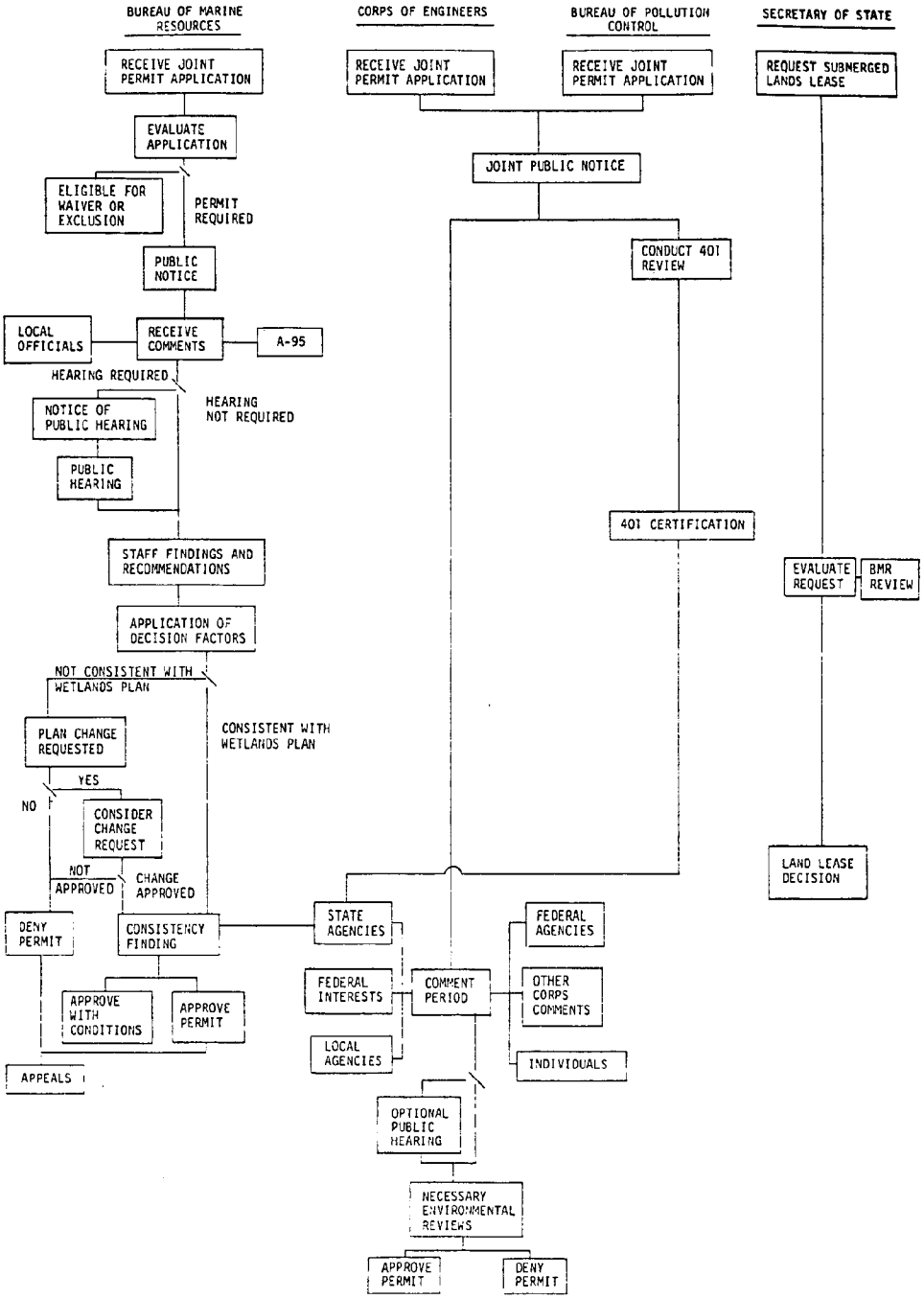
At the local level, the Southern Mississippi Planning and Development District acts as the "clearinghouse" in the A-95 review process. Local municipalities are not involved in permitting insofar as federal and state regulations are concerned, nor are they usually asked to review permit applications. Where local ordinances, regulations, or codes exist, developers must be in conformance with them as they pertain to all or portions of the marina.

A chart of the permit process as it relates to Mississippi is shown in Fig. 13, and summarized below.

1. BMR reviews a joint application for completeness and determines if it is eligible for a waiver or exclusion.
2. If a wetland permit is required, a public notice is issued by the BMR and comments invited. This process is carried out through the A-95 Clearinghouse review process.
3. Following review of the application, a finding of consistency is made by the BMR and transmitted, with other state comments to the USACOE.
4. The permit is then either approved, approved with conditions, or denied.
5. If a revision to the wetland use plan is required, a separate review process is initiated. Permits will not be approved when revisions are not granted.
6. An applicant may also be required to obtain a submerged land lease from the Mississippi Secretary of State in addition to the wetland permit before a marina can be developed.
7. The issuance of a dredge and fill permit (Section 404) by the USACOE cannot be made until and unless all other federal, state (include BPC Section 401 certification), and local approvals are obtained.

Figure 13

PERMIT PROCESS



Siting, Design, and Construction Criteria

The Mississippi Coastal Program (MCP) has 11 categories which are used in the evaluation of a marina permit. These are outlined below. Federal and state evaluation criteria by agency and major impact category are shown in Table 27.

1. Marinas shall be located in areas where minimal initial and maintenance dredging will be required.
2. Design shall not disrupt currents or restrict the tidal flow.
3. Marinas shall be located at least 1,000 feet from shellfish harvesting areas or seagrass beds.
4. More efficient utilization of existing marina space is preferable to new marina construction. Open dockage extending to deep water is preferable to the excavation of boat basins. Excavation of basins in uplands is preferable to excavation in coastal wetlands.
5. Turning basins and navigation channels shall not be designed to create sumps that would result in long-term degradation of water quality. For example, the depth of boat basins and access channels shall not exceed that of the receiving body of water, and shall not be located in areas of poor circulation.
6. Marinas shall not be sited in areas of known high siltation and high shoaling rates.

TABLE 27

MISSISSIPPI

FEDERAL AND STATE MARINA PERMITTING AGENCIES AND EVALUATION CRITERIA FOR MAJOR IMPACT CATEGORIES

	Agency			
	Department of the Army, Corps of Engineers Mobile District Action: Joint permit application submittal required; approval or denial authority. Time frame: 45-90 days When to contact: After site selection.	Department of Wildlife Conservation Action: Joint permit application submittal required; approval or denial authority. Time frame: 90 days When to contact: After site selection.	Department of Natural Resources Action: Joint permit application submittal required; grant or deny water quality certification. When to contact: After site selection.	Secretary of State Action: Request state land lease; grant or deny lease. When to contact: After site selection.
Major Impact Category	Evaluation Criteria			
Water Quality Resources	1. Evaluate for compliance with applicable effluent limitation, water quality standards and management practices during construction, operation and maintenance of the proposed facility.	1. Open dockage extending to deep water is preferable to the excavation of boat basins. 2. Turning basins and navigation channels shall not be designed to create sumps that would result in long-term degradation of water quality. For example, the depth of boat basins and access channels shall not exceed that of the receiving body of water, and shall not be located in areas of poor circulation. 3. Boat basin shall provide for water circulation by being designed for tidal flushing with angled sides, or similar means.	1. Marina construction and use must not exceed the Department's established water quality standards (refer to Inventory of Existing Conditions and Identification of Key Factors for Guidance Development document for listing of standards).	
Aquatic Resources	1. Evaluate potential direct and indirect loss of and damage to fish (aquatic) resources due to the activity proposed.	1. Marinas shall be located at least 1,000 feet from shellfish harvesting areas or seagrass beds. 2. Evaluate for disruption of currents or restriction of tidal flow, changes in salinity regimes or changes in related nutrient and aquatic life distribution patterns.		

TABLE 27 (cont.)

MISSISSIPPI

FEDERAL AND STATE MARINA PERMITTING AGENCIES AND EVALUATION CRITERIA FOR MAJOR IMPACT CATEGORIES

	Agency			
	Department of the Army, Corps of Engineers Mobile District Action: Joint permit application submittal required; approval or denial authority. Time frame: 45-90 days When to contact: After site selection.	Department of Wildlife Conservation Action: Joint permit application submittal required; approval or denial authority. Time frame: 90 days When to contact: After site selection.	Department of Natural Resources Action: Joint permit application submittal required; grant or deny water quality certification. When to contact: After site selection.	Secretary of State Action: Request state land lease; grant or deny lease. When to contact: After site selection.
Major Impact Category	Evaluation Criteria			
Terrestrial Resources	1. Evaluate potential direct and indirect loss of and damage to wildlife resources due to the activity proposed.			
Wetlands Resources	1. The unnecessary alteration or destruction of wetlands will be discouraged as contrary to the public interest. 2. Application will be reviewed to determine whether the coast line or base line might be altered. If so, coordination with Attorney General is necessary.	1. Excavation of basins in uplands is preferable to excavation in coastal wetlands. 2. Location must be consistant with wetland use plan. 3. Statement describing environmental effects, assessing impacts and describing measures to be taken to reduce detrimental impacts to wetlands during and after activity must be submitted.		
Socio-Economic Resources	1. Probable impact of the proposed activity and its intended use on the public interest (including on nearby properties) is evaluated. 2. Evaluate extent of public and private need. 3. Consideration is given to effect the proposed activity may have on the enhancement, preservation or development of historic, scenic and recreational values.	1. More efficient utilization of existing marina space is preferable to new marina construction. Innovative solutions to increased demands for new mooring, dockage, and storage space, including dry stack storage, alternative slip mooring configurations are encouraged.		

TABLE 27 (cont.)

MISSISSIPPI

FEDERAL AND STATE MARINA PERMITTING AGENCIES AND EVALUATION CRITERIA FOR MAJOR IMPACT CATEGORIES

Agency

	Department of the Army, Corps of Engineers Mobile District. Action: Joint permit application submittal required; approval or denial authority. Time frame: 45-90 days. When to contact: After site selection.	Department of Wildlife Conservation. Action: Joint permit application submittal required; approval or denial authority. Time frame: 90 days. When to contact: After site selection.	Department of Natural Resources. Action: Joint permit application submittal required; grant or deny water quality certification. When to contact: After site selection.	Secretary of State. Action: Request state land lease; grant or deny lease. When to contact: After site selection.
Major Impact Category	Evaluation Criteria			
Navigation Resources	1. Evaluate for undue interference with public access to, or use of, navigable waters. 2. Review for possible interference with a Federal project in navigable waters.	1. Indented boatslips with angled sides shall be used in preference to keyhole boatslips.		
Aesthetic Resources	1. Impact on public interest with respect to consideration of scenic values and wild and scenic rivers is investigated.	1. Review with respect to preservation of natural scenic qualities.	1. Marina construction and use must not exceed the Department's established water quality standard for toxic substances, color, taste and odor-producing substances (Refer to Inventory of Existing Conditions and Identification of Key Factors for Guidance Development) document for listing of standards.	
Groundwater Resources	1. The potential for impacts to wetland recharge areas and potable water supplies is considered.			

(Source: USEPA, 1984)

7. Permanent spoil disposal sites shall be set aside in non-wetlands areas for use in initial construction and future maintenance.
8. Indented boatslips with angled sides shall be used in preference to keyhole boatslips.
9. Boat basins shall provide for water circulation by being designed for tidal flushing with angled sides, or similar means.
10. Innovative solutions to increased demands for new mooring, dockage, and storage space, including dry stack storage, alternative slip mooring configurations are encouraged.
11. Bulkheads, seawalls, breakwaters, jetties and groins, dredged material disposal, and filling other than dredged material disposal which pertain to marinas, are addressed under other headings of the MCP.

The coastal location for a marina must be consistent with the wetland use plan. All development of private marinas is restricted to "C" Districts (Commercial Fishing and Recreational Marinas) as delineated in the wetland use plan. Development or expansion of public municipal marinas is an exception to the permit process and location criteria stated above.

In drafting the MCP wetland use plan, only those areas then containing commercial fishing and recreational marinas were classified as "C" Districts. The significance of this

is that any proposal for the development of a marina is necessarily limited to nonpermitted wetland use areas. Applicants seeking a permit to construct a marina must request a change to the wetland use plan. This is not unlike a variance in the case of municipal zoning ordinances. As with municipal zoning, the problem of granting is not in the concept but in the criteria and uniformity by which variances are granted.

Local Regulations Affecting Marina Development

Regulation and permit requirements originating at local levels of government are generally intended to complement state and federal regulations applicable to a given area. These are generally more broad in scope and detailed in technical coverage in order to take into account those characteristics that may have a special impact on local construction and development. Standards for marina design, construction, and maintenance may be set forth in these ordinances, regulations, and codes. For example, zoning for marina districts, and the specification of minimum deck loading criteria for fixed structures by a building and safety agency.

Regulation and permit categories with applicability to marinas in Hancock, Harrison, and Jackson counties are shown in Table 28. In research for this study, departments administering zoning ordinance were contacted as to whether or not marinas were specifically addressed in their documents.

TABLE 28

COUNTY AND CITY ORDINANCES, REGULATIONS, AND CODES

Unit of Government	Zoning Ordinance	Subdivision Regulation	Flood Prevention Ordinance	Building Code	Housing Code	Plumbing Code	Electrical Code	Gas Code
HANCOCK CO.	No	Yes	Yes	No	No	No	No	No
Bay St. Louis	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waveland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HARRISON CO.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Biloxi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gulfport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Long Beach	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pass Christian	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JACKSON CO.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Moss Point	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ocean Springs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pascagoula	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(Source: SMPDD, 1980)

All of the cities and one county, Jackson, had zoning ordinances.

No ordinance had a specific zoning district for marinas. However, marinas were permitted within a number of districts, usually as a "permitted conditional use" rather than a "permitted use." A permitted use must meet the general requirements for a particular district; permitted conditional use imposes conditions beyond those of a permitted use.

Typical of the zoning ordinances reviewed was that for the City of Biloxi. As a permitted use, marina/yacht clubs were allowed only in the A-1 Agricultural District. As a permitted conditional use, marina/yacht clubs were allowed in all districts with the exception of Commercial Central Business District districts (C-4-CBD-I-III).

Fish camps were allowed as a "permitted accessory use" in A-1 Agricultural Districts but nowhere else. Fish camps, but not marinas, were defined in the ordinance: "a camp providing fishing facilities and overnight accommodations for guests but does not include permanent residential dwellings, other than that of the owner or operator" (City of Biloxi, 1982). It is not known by this definition whether or not wet-slip berthing is meant to be included as a "facility." This is significant in that it is not uncommon for marinas to include "camping" facilities.

Clear definitions of what constitutes marinas, yacht

clubs, and fishing camps should be included in all zoning ordinances. An example of a marina definition as it appears in the New Orleans, Louisiana, zoning ordinance is as follows (Anderson, 1976):

> Marina: a place for docking or storage of pleasure boats or providing services to pleasure boats and the occupants thereof, including minor servicing and repair to boats while in the water, sale of fuel and supplies, or provision of lodging, food, beverages, and entertainment as accessory uses. A yacht club shall be considered a marina, but a hotel, motel, or similar use, where docking of boats and provision of services thereto, is incidental to other activities shall not be considered a marina, nor shall boatdocks accessory to a multiple dwelling where no boat related services are rendered.

Zoning and other ordinances, regulations, and codes commonly ignore or attempt to side-step marinas as a land and water use. Mississippi is apparently no exception. Because marinas are generally considered a commercial use for zoning purposes (Anderson, 1977), zoning administrators should reexamine their ordinances to determine the compatibility of marinas (as defined) as a permitted, conditional, or accessory use within particular zoning districts.

SECTION VII

RECOMMENDATIONS

SECTION VII

RECOMMENDATIONS

Seven broad areas of concern pose special problems in assessing and permitting marina development. These include: (1) the special problems associated with projecting cumulative impacts; (2) direct removal or alteration of wetlands; (3) the effect of development on aquatic biota; (4) the alteration of water quality; (5) socioeconomic impacts; (6) problems associated with effective decision-making processes; and (7) difficulties in complying with existing standards and regulations.

In guiding marina development, four broad areas are of concern to the developer and decision-maker. These include (1) siting, (2) impact assessment techniques, (3) impact mitigation, and (4) regulatory/planning processes. These four are discussed below together with recommendations for consideration by the Mississippi Bureau of Marine Resources in its management of marina development (for a comprehensive discussion of guidance development, see USEPA, 1984).

Siting

The development of a marina involves five steps which typically occur in two phases. The steps include: (1) market area analysis; (2) market strategy; (3) marina site identification; (4) feasibility analysis and preliminary

design; and, (5) final design and marina development. Steps 1-3 generally occur in the initial broad screening evaluation; steps 4 and 5 are carried out as a detailed site specific evaluation.

A market analysis is usually the first step taken by a developer to assure the economic success of the proposal project. Need and demand for the marina, including services and facilities, are determined through surveys of similar existing marinas (public marinas, yacht clubs, condominiums, etc.), boat sales (motorboats, sailboats, size, etc.), and recreational water use (skiing, fishing, sailing, etc.).

The market analysis is usually followed by a refinement of the original concept and the formulation of a market strategy. Included here would be the actual proposed services and facilities, and number, size, and type of boats to be accommodated. The identification of a site suitable for the proposed marina concludes the initial screening process, but is the crucial step in the development process.

Once a site, or several possible sites, has been identified, the suitability of the site for a marina must be undertaken. This involves an in-depth feasibility analysis, preliminary design outline, and consideration of regulatory siting criteria. The extent of modifications to the site as they relate to environmental impacts must be considered. If mitigative measures are required the developer must be made aware of them. If these are not practical (i.e., costly),

the developer can search for an alternative site or modify the original design to meet feasible siting criteria. In general, the environmental/cost limitations associated with specific sites can be overcome through acceptable design modifications. A model of an initial screening checklist is shown in Table 29. If the proposed development and site is considered to be feasible with regard to need, environmental issues, cost, and institutional regulations, then the preliminary screening is finalized and the application process initiated.

RECOMMENDATION 1: Initiate a mandatory preapplication conference with the developer.

Prior to the filing of a permit application, the developer should consult with an agent of the BMR concerning the proposed development. It is the intent of this requirement that the developer may familiarize himself with all regulations (federal, state, and local) and be afforded the opportunity of being advised by the BMR of major areas of concern which may arise either with the site or the project.

RECOMMENDATION 2: Divise a comprehensive initial screening checklist to be completed by the developer or his agent and submitted to the BMR prior to the filing of a permit application.

When possible a sketch plan should accompany the completed checklist. Findings from the developer's market analysis and strategy are not included in Table 29, but this information should accompany or be incorporated into the checklist. Because of the potential environmental consequences

TABLE 29

COASTAL MARINA SCREENING CHECKLIST

Project Description

1. Location: municipality _____ county _____

   body of water _____ latitude/longitude _____

2. Type of marina: open water _____ dredged basin _____ locked harbor _____

3. Intended use: public _____ private _____ both _____

4. Size: upland area (acres) _____ submerged area (acres) _____

   number of slips _____ range in slip size (feet) _____

5. Type of boat: sail ____ power _____ both _____

6. Services and facilities:

   A. Services: launching ramp _____ fuel _____ pumpout _____
   engine repair _____ hull repair _____ propeller repair _____

   B. Other Facilities: ship's store _____ residential _____
   hotel _____ development _____
   restaurant _____ access road/utilities _____

7. Hydrographic conditions:

   A. Tidal Range (feet): _____

   B. Natural depth of waters at site (feet): minimum _____ maximum _____

   C. Completed project depth at marina (feet): minimum _____ maximum _____

Screening Checklist

In completing the following checklist, all aspects of the project as addressed above should be considered. Checks in the "Yes" column indicate potential permitting issues. Checks in the "Unknown" column indicate that additional information should be obtained.

		Yes	No	Unknown
1.	Will dredging be required for: access channel?	___	___	_____
	boat basin?	___	___	_____
2.	Will filling be required: on wetlands?	___	___	_____
	in open water?	___	___	_____
3.	Will dredged material disposal at locations other than currently permitted public disposal areas be required?	___	___	_____
4.	Will structures such as bulkheads, revetments, etc. be required?	___	___	_____
5.	Will the water body at the site be characterized by low flushing rates (dead-end channel or canal, upper reaches of estuary or tidal creek, low tidal range or low net flow)?	___	___	_____
6.	Does the water body presently fail to meet state water quality standards for existing use classifications?	___	___	_____
7.	Is the site located within 1 mile of a designated wildlife refuge, wilderness area or other area specially designated for the protection of fish or wildlife?	___	___	_____
8.	Are any rare, threatened, endangered or otherwise designated unique or outstanding aquatic or terrestrial species or their habitats known to be present at the site? (Contact state wildlife agency, US Fish and Wildlife Service and National Marine Fisheries Service).	___	___	_____
9.	Do shellfish beds occur within 2000 feet of the site or within 1000 feet of access channels?	___	___	_____

TABLE 29
(cont.)
Screening Checklist
(continued)

	Yes	No	Unknown
10. Are grassbeds located within 1000 feet of the marina or access channels?	___	___	___
11. Is the site in an area of recognized historic, archaeological or scenic value? (Contact State Historic Preservation Officer).	___	___	___
12. Are local residents or landowners opposed to the project or unaware of the project?	___	___	___
13. Will any proposed activity be inconsistent with state coastal zone management plans or local management plans, ordinances or zoning requirements? (Contact state and local coastal zone management offices and local planning office).	___	___	___
14. Will the project obstruct public land access to navigable waters?	___	___	___
15. Will the project require structures which would extend into or otherwise obstruct existing channels or will the project require placing structures closer than 100 feet from a Corps of Engineers maintained channel or basin with an authorized depth of 21 feet or greater (a major federal project)?	___	___	___

associated with a marina development, plus the fact that public access may be curtailed, cause of need should be documented. Care should be taken by the developer to substantiate need on the basis of data relevant to the type and size of marina proposed. Data on the demand for slips (waiting lists) from public marina sources are only indirectly relevant to demand projections for, say, a marina associated with a condominium or subdivision.

Upon completion of the checklist, and following a site visit by an agent of the BMR and the developer or his agent, approval is made, denied or made pending modification of the preapplication plan.

RECOMMENDATION 3: Encourage expansion of existing public marinas with particular emphasis on those in Harrison County where demand projections indicate the greatest need.

Although demand appears greatest for berthing in public marinas, and expansion of these facilities, where feasible, should be encouraged, needs can also be met through the development of well-managed private facilities. It should be noted, however, that private profit marinas generate a large portion of their profit from gas, and bait and tackle sales, and owners may discourage the rent or lease of slips to sailboat owners.

RECOMMENDATION 4: Maintain present policy of allowing a dispersed pattern of marina development along the coast.

This is discussed in more detail in Recommendation 12. Alternatives to a dispersed pattern would include: (1) concentrated centralization involving one huge marina complex, usually located in the center of a region; (2) deconcentrated centralization which provides for the development of a number of individual marinas in one central location; and, (3) concentrated decentralization which incorporates the concepts of 1 or 2 above, but in three or four distinct locations along the coast.

Patterns of concentrated development require the availability of large tracts of land within which marinas can be developed. These patterns do not appear politically or economically feasible for Mississippi at this time.

Impact Assessment Techniques

The potential for impacts and the significance of impacts are a function of the marine location and the design and operational characteristics of the marina. Impacts will not be the same for every marina. The denial of a permit for the development of a marina more often than not is based on environmental impacts which cannot be cost-effectively mitigated.

Section 18 of Mississippi's Joint Application and Notification form (Appendix D) requires the developer to provide, as an attachment,

> . . . an appropriate report or statement assessing environmental impacts of the proposed activity and

> the final project dependent on it. The project's effects on the wetlands and the effects on the life dependent on them should be addressed. Also provide a complete description of any measures to be taken to reduce detrimental off-site effects to the coastal wetlands during and after the proposed activity.

This requirement makes it incumbent upon the developer to supply decision-makers with information which may be beyond the ability of the developer to obtain or assess.

> RECOMMENDATION 5: Develop a document which identifies existing sources of environmental data and outlines methodologies or techniques which can be applied to identify and secure data pertinent to an adequate assessment of a marina project.

Developers should not be required to provide an "unreasonable" assessment of environmental impacts. Data should be readily available or easily obtainable. When data requirements are unclear, sources of existing data unknown, and methodologies for collecting data and techniques for assessing them unfamiliar to the developer, the usual result is the provision of a set of documentations of little use to the decision-maker. A document such as recommended above would allow the BMR to develop a "fair" set of impact requirements and provide the developer with a "reasonable" expectation of securing the data. An example of a document of this type was prepared for the USACOE (1983) for Biscayne Bay, Dade County, Florida.

Impact Mitigation

Impacts may be mitigated through (USEPA, 1984):

1. Avoiding the impact altogether by not taking a certain action or parts of an action;

2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
5. Compensating for the impact by replacing or providing substitute resources or environments.

RECOMMENDATION 6: Compile a list of mitigative measures as requirements or as acceptable alternatives for the developer in the design, construction, and operation of a marina.

Mitigative measures are meant to serve as a guide to help insure that marinas are developed in an environmentally acceptable manner. For example, a rectangular basin with a two-channel entrance (good flushing) preferred over a rectangular basin with an asymmetrical single entrance (moderate flushing), and the requirement of silt screens or similar containment methods during dredging.

RECOMMENDATION 7: Examine the feasibility of a sliding scale lease arrangement for state submerged land which encourages public access by providing a discount from the base leasing fee when public access is part of a marina.

Such a plan has been recommended for the State of Florida (1983). Higher lease fees could also be charged for marina development in designated high use areas (ocean front locations).

Regulatory/Planning Processes

Authority and responsibilities of the BMR are set forth in the state's Wetland Law and further described by state regulations in the Mississippi Coastal Program. The overall permit process for marina development is coordinated through a joint permit process carried out by the BMR, Mississippi Bureau of Pollution Control (BPC), and the USACOE. Applicants for marina permits are provided some general criteria defining the basis of decision-making. Flow charts describing the permit process are available and applicants are advised of the time limits for permit review. BMR personnel assist applicants throughout the permitting process. This includes site evaluation and recommendations for mitigative measures. Monitoring and compliance are to be carried out by BMR field personnel.

As with most of the permitting programs among the southeastern states (USEPA, 1984), Mississippi addresses both water quality and wetland impacts. However, only Mississippi and North Carolina have designed their programs from a planning perspective to address most of the resources which can be expected to be impacted by marina development. Other states regulate development on a case-by-case permit review procedure. Only in Mississippi have specific use areas been designated (wetland use plan). This regional approach does not eliminate the need for site-by-site review and approval, but it does save time and expense for both

developers and the BMR by decreasing the number of applications for inappropriate sites.

In concept, Mississippi's permit process appears adequate. In fact, as in the case of the wetland use plan, the state provides an innovative tool in the decision-making process that other states may find advantageous to implement. The recommendations which follow are directed more at strengthening the decision-making process as it now exists than to the suggestion of major modifications in the Coastal Management Program.

RECOMMENDTION 8: Modify present permit application process to allow fast-tracking for "no problem" marinas.

Marinas proposed for less sensitive areas, areas already significantly impacted, or ones where findings indicate only minor impact could be fast-tracked. That is, they would receive faster and less comprehensive review in the permitting process. It is recommended that the determination of "no problem" marinas be made from, and at the time, the screening checklist is submitted in the preapplication phase of the permitting process.

RECOMMENDATION 9: Require detailed site-specific design plans for those marinas which do not classify as "no problem" marinas.

As a part of the permit application, detailed plans of the proposed development should be submitted for projects which possess the likelihood of significantly impacting the environment. Technical information required in the plan should be applicable to all "problem" marina projects. The

plan should not be too unlike those found in subdivision regulations. Although denial of a project could be made on the basis of the submitted plan, the objective is to provide an instrument which can be properly evaluated. From the plan the developer and the decision-maker can work out acceptable changes or modifications which will mitigate damage to the environment.

Information required for a permit as outlined in the Mississippi Coastal Program does not appear consistent with that required in the application itself. MCP requirements are the more detailed of the two and should form the base for the recommendation outlined above. A review of several recently received applications for marina permits indicate that the applicants provided only that information requested on the application form. As a whole, the completed applications did not contain sufficient information as to provide for even minimal evaluation.

RECOMMENDATION 10: Provide for follow-up of permits through monitoring and compliance.

Final approval of a project does not guarantee compliance with regulatory program objectives. The objective of monitoring projects through the construction phase and into operation is to provide a means of effectively assessing the design and operating scheme as proposed in the permit application. Monitoring can be accomplished by the regulatory agency or the developer. In either case, those features of the marina to be monitored must be specified.

RECOMMENDATION 11: Clearly establish and describe decision-making criteria to be used to evaluate siting criteria and mitigation measures associated with marina development.

In order to establish consistency in the decision-making process, criteria upon which decisions are to be based must be established and described. This is a requirement for any legally defensible permit decision. Developers will also have a better understanding of what actions are permittable, and thus less likely to propose inappropriate actions.

Mississippi's Coastal Program (MCP) document was prepared to fulfill requirements of the Coastal Zone Management Act of 1972. It is a complex legal document which can be quite confusing to the general reader. It is recommended that a short public information type booklet or brochure be prepared which clearly establishes and describes the decision-making criteria used in evaluating siting factors and mitigative measures associated with marina development. This would include all information pertinent to marina permitting contained within the present MCP (1980 and 1983 revised) document. It should also contain information which may help clarify issues or problems surrounding marinas. This includes information resulting from any actions taken on the recommendations suggested in this report. If more detailed siting criteria are forthcoming and mitigative measures accepted as policy, appropriate changes to Section 2, Part III.C., Chapter 8, of the MCP (1983 revised) regulatory document must be made.

RECOMMENDATION 12: Pending implementation of Recommendations 1, 2, and 9, permit marinas as a regulated activity in "G" Districts: General Use.

Marinas are currently an allowed use only in "C" Districts: Commercial Fishing and Recreational Marinas. Land/water areas designated as "C" Districts for the expansion of existing marinas or the location of new marinas are not provided for; i.e., only existing marinas comprise "C" Districts. A few activities and jurisdictions are excluded from the need to secure a state permit for regulated activities. Included here are port authorities and development commissions and their activities which may include public marinas. Proposals for new marinas which do not qualify for exclusion must apply for revision in the wetland use plan to allow for the siting of the project.

The only consistency in the MCP regarding new marina projects is that they are not allowed unless they can show cause for a revision in the wetland use plan. This leads to consistent inconsistency unless all revision requests are approved. If the latter is true, then approval should be made to allow marinas as a permitted use in other districts.

To allow marinas as a permitted use in "G" Districts: General Use, is not inconsistent with past policy. Provided need can be shown, public access provided for--or mitigation required for loss of public access--, and environmental damage minimized, marinas should be considered a water-dependent, permitted use.

RECOMMENDATION 13: Work with local officials to clarify the definition of marinas as permitted, permitted assessory, and permitted conditional use within existing zoning districts.

Municipal zoning ordinances should address the permitting of marinas in zoning districts in more detailed fashion than is currently the case. A differentiation of types of marina facilities allowable in designated zoning districts would provide for greater permitting consistency within a single municipality, between municipalities, and between municipalities and the Mississippi Bureau of Marine Resources.

RECOMMENDATION 14: Tighten regulations relating to occupancy and sub-leasing of slips in public marinas.

The perception of present lease arrangements in public marinas among dozens of persons interviewed during this research is that sub-leasing is common practice. This may or may not be fact. Indeed, it may be allowed in some marinas. Allowing sub-leasing to occur, however, by law or in practice, discourages individuals from applying for slips and gives a negative image of management operations.

APPENDIX

MARINA SURVEY QUESTIONNAIRE

RECREATIONAL MARINA SURVEY

Name of Marina:

Location of Marina:

Type of Marina:

Public _____
Private for profit _____
Private nonprofit _____
Ancillary to shore development _____

Wet Slips:

Total slips _____
Normal occupancy rate _____
Current occupancy rate _____
Number on waiting list _____

Number of boats in marina by type:

Recreation powerboats _____
All sailboats _____
Commercial boats _____

Number of all boats by size:

Under 16' _____
16'-25' _____
26'-39' _____
40'+ _____

Number of covered slips: _____

Live-aboards allowed: yes_____ no_____

Dry Storage:

Dry-stack covered storage capacity _____
Maximum boat size _____
Number on waiting list _____

Pigeonhole capacity _____
Maximum boat size _____

Trailered boat capacity _____

Marina boating activities (in %):

Fishing	_____
Cruising	_____
Sailing	_____
Skiing	_____
Other	_____

Wet tie-ups other than slips (type):

Dock facilities and services:

Power supply	yes_____	no_____	
Water supply	yes_____	no_____	
Lighting	yes_____	no_____	
Fuel station	yes_____	no_____	
Public address	yes_____	no_____	
Phones: at dock	yes_____	no_____	
in office	yes_____	no_____	
Sanitary holding tank pumpout facility	yes_____	no_____	
Bilge drainage	yes_____	no_____	
Security provided by:	city___	county___	private____
Garbage collection by:	city___	county___	private____
Type of piers: fixed			_____
floating			_____

Land facilities and services:

Parking (# spaces)		_____
Snackbar	yes_____	no_____
Restaurant	yes_____	no_____
Bait and tackle	yes_____	no_____
Boat rentals	yes_____	no_____
Boat sales	yes_____	no_____
Boat repair & maintenance	yes_____	no_____
Sanding	yes_____	no_____
Painting	yes_____	no_____
Hull & engine repair	yes_____	no_____
Other	yes_____	no_____

Average basin or open marina water depth at MLT: _____

APPENDIX B

USER CHARACTERISTICS QUESTIONNAIRE

USER CHARACTERISTICS QUESTIONNAIRE

The Department of Geography, University of Southern Mississippi, is conducting a survey for the Mississippi Bureau of Marine Resources to determine current and future demand for marina slips on the State's gulf coast. To aid us in this research we are sending out this brief questionnaire to a sample group of individuals whose names appear on one or more marina waiting lists. Your response to the questions will remain confidential. Any publication of this information will be for the sample group as a whole.

A stamped, return envelop is enclosed for your convenience. Thank you for your help.

Residence: City_____; State_____

1. What type and size of boat do you own? (check one for each)
   a. ____sail 1. ____<16 ft. 3. ____26-39 ft.
   b. ____power 2. ____16-25 ft. 4. ____40+ ft.
   c. ____other

2. When not in use, do you usually keep your boat: (check one)
   a. ____at home b. ____commercial dry storage site on coast
   c. ____other site on coast d. ____other site not on coast

3. How long does it take to launch site from where boat is stored? (check one)
   a. ____<15 minutes b. ____15-29 minutes c. ____30 min.-1 hour
   d. ____1-2 hours e. ____2-3 hours f. ____3 hours or more

4. Do you launch your boat at a private or public launch site? (check one)
   a. ____ private b. ____public

5. At what general locations on the coast do you usually launch your boat? (check two locations only; use 1 and 2)
   a. ____Waveland b. ____Long Beach c. ____Ocean Springs
   d. ____Bay St. Louis e. ____Gulfport f. ____Gautier
   g. ____Pass Christian h. ____Biloxi i. ____Pascagoula

6. How long have you been waiting for a marina slip? (check one)
   a. ____< one year b. ____1-2 years c. ____over 2 years

7. If you had your choice, would you prefer: (check one)
   a. ____wet slip at a marina b. ____dry-stak storage slip at a marina

8. Would you be willing to rent a slip in a private marina if one was available?
   a. ____yes b. ____no

   If no to above, give primary reasons. (check in priority as 1, 2, etc.)
   a. ____rental fee b. ____boat security c. ____quality of services
   d. ____poor locations e. ____other

9. Average yearly frequency of boat use in Gulf waters. (check one)
   a. ____< 12 times a year d. ____37-48 times per year
   b. ____13-24 times per year e. ____49-60 times per year
   c. ____25-36 times per year f. ____over 60 times per year

10. Do you live on your boat while on the coast? (check one)
    a. ____yes b. ____no

11. What percent of your time do you spend in the following use activities while on the coast? (provide percent)
    a. ____fishing b. ____cruising or sailing c. ____skiing

12. Which of the following services or facilities would you be willing <u>to do without</u> if a slip was available to you:
    a. ____parking e. ____slip-side water and electric service
    b. ____hoist or ramp f. ____fuel
    c. ____ramp g. ____ice and fishing supplies
    d. ____dry dock and boat repair

13. Would you be willing to buy a waterfront condominium if a marina slip came with it? (check one)
    a. ____yes b. ____no c. ____not sure

14. If you had your preference, give top three locations of where you would like to have a marina slip for your boat. (place numbers 1, 2 and 3)

a. ____Waveland	b. ____Bay St. Louis	c. ____Pass Christian
d. ____Long Beach	e. ____Gulfport	f. ____Biloxi
g. ____Ocean Springs	h. ____Gautier	i. ____Pascagoula

15. Would you be willing to occupy a marina slip in:

a. St. Louis Bay	____yes	____no
b. Back Bay of Biloxi	____yes	____no
c. In Pascagoula Bay	____yes	____no

16. On the map below the coast has been divided into zones which indicate boating destinations. Give percentage of trips made to various zones (e.g., 70% Zone 1; 30% Zone 2)

a. ____Zone 1	b. ____Zone 2	c. ____Zone 3
d. ____Zone 4	e. ____Zone 5	f. ____Zone 6
g. ____Zone 7		

APPENDIX C

PROJECTION TECHNIQUES

PROJECTION TECHNIQUES

The following fifteen techniques were used to project boat registrations from historic registration data in each county.

Technique 1. Linear regression equation.

$B = a + cY$ where B = estimated number of boats
a = a constant
c = a constant
Y = number of years since data collection began

Technique 2. Proportional change by time period.

$B = (mnR) + R$ where B = estimated number of boats
m = percent change in registrations per month during data collection period
n = number of months in time period
R = registrations at end of preceding time period

Technique 3. Proportional change for whole time period.

$B = (mpT) + T$ where B = estimated number of boats
m = percent change in registrations per month during data collection period
p = number of months since beginning of data collection period
T = registrations at beginning of data collection period

Technique 4. County proportion of total state registrations by linear trend.

$B = rX$ where B = estimated number of boats
r = mean percentage of state's boats registered in county
X = total state registrations estimated from linear regression equation

Technique 5. County proportion of total state registrations by proportional change.

$B = rU$ where B = estimated number of boats
r = mean percentage of state's boats registered in county
U = total state registrations projected by proportional change for the whole time period

Technique 6. Trend in county proportion of total state registration by linear trend.

$B = sX$ where B = estimated number of boats
s = trend in county registrations during data collection period
X = total state registrations estimated from linear regression equation

Technique 7. Trend in county proportion of total state registrations by proportional change.

$B = sU$ where B = estimated number of boats
s = trend in county registrations during data collection period
U = total state registrations projected by proportional change for the whole time period

Technique 8. County proportion of linear regression equation for all county boats.

$B = dV$ where B = estimated number of boats
d = mean percentage of county's boats over 16 feet in data collection period
V = total county registrations estimated from linear regression equation

Technique 9. Trend in county proportion of linear regression equation for all county boats.

$B = sV$ where B = estimated number of boats
s = trend in percentage of county's boats over 16 feet in data collection period
V = total county registrations estimated from linear regression equation

Technique 10. County proportion of all county boats estimated by relationship to state registrations.

$B = deW$ where B = estimated number of boats
d = mean percentage of county's boats over 16 feet in data collection period
e = percentage of all county registrations to state total
W = state registrations in all sizes

Technique 11. Trend in county proportion of all county boats estimated by trend of relationship to state registrations.

$B = seW$ where B = estimated number of boats
s = trend in percentage of county's boats over 16 feet in data collection period
e = percentage of all county boats to state total
W = state registrations in all sizes

Technique 12. Proportion of boats in county to linear regression of coastal counties' registrations.

$B = pL$ where B = estimated number of boats
p = mean percentage of coastal counties' boats registered in county

L = total coastal county registration estimated from linear regression equation

Technique 13. County proportion of coastal counties' registrations based on relationship to state registrations based on relationship to state registrations.

$B = pK$ where B = estimated number of boats

p = mean percentage of coastal counties' boats registered in county

K = total coastal county registrations estimated from linear regression on total state registrations

Technique 14. Trend in county proportion of linear regression of coastal counties' registrations.

$B = qL$ where B = estimated number of boats

q = trend in county registrations to coastal counties' registrations during data collection period

L = total coastal county registrations estimated by linear regression equation

Technique 15. Trend in county proportion of coastal counties' registrations based on relationship to state registrations.

$B = qK$ where B = estimated number of boats

q = trend in county registrations to coastal counties' registrations during data collection period

K = total coastal county registrations estimated from linear regression on total state registrations

APPENDIX D

WETLAND PERMIT APPLICATION

JOINT APPLICATION AND NOTIFICATION

U.S. DEPARTMENT OF ARMY, CORPS OF ENGINEERS
MISSISSIPPI DEPT. OF WILDLIFE CONSERVATION, BUREAU OF MARINE RESOURCES
MISSISSIPPI DEPT. OF NATURAL RESOURCES, BUREAU OF POLLUTION CONTROL

This form is to be used for proposed activities in waters of the United States and Mississippi and for the erection of structures on suitable sites for water dependent industry. Note that some items, as indicated, apply only to projects located in the coastal area of Hancock, Harrison and Jackson Counties.

1. Date

_____
month day year

2. Applicant (mailing address and telephone)

3. Official use only
COE _____
BMR _____
BPC _____
A95 _____

DATE RECEIVED
_____

4. Project location

Street Address _____ City/Community _____
Name of Waterway _____ Latitude _____ Longitude _____ (if known)
Geographic location Section _____ Township _____ Range _____ County _____

5. Project description New work _____ Maintenance work _____

Dredging
_____ Channel length _____ width _____ existing depth _____ proposed depth _____
_____ Canal length _____ width _____ existing depth _____ proposed depth _____
_____ Boat slip length _____ width _____ existing depth _____ proposed depth _____
_____ Marina length _____ width _____ existing depth _____ proposed depth _____
_____ Other (Explain) _____

Cubic yards of material to be removed _____ Type of material _____
Location of spoil disposal area _____
Dimensions of spoil area _____ Method of excavation _____
How will excavated material be contained? _____

Construction of structures
_____ Bulkhead total length _____ height above water _____
_____ Pier length _____ width _____ height _____
_____ Boat ramp length _____ width _____ slope _____
_____ Other (explain) _____
_____ Structures on designated sites for water dependent industry (Coastal area only)
Explain in item 11 or include as an attachment.

Filling
Dimensions of fill area _____
Cubic yards to fill _____ Type of fill _____

Other regulated activities (i.e. Seismic exploration, burning or clearing of marsh) Explain.
_____
_____
_____

page 1

6. Additional information relating to the proposed activity

Does project area contain any marsh vegetation? Yes _____ No _____ (If yes explain) _____

Is any portion of the activity for which authorization is sought now complete? Yes ___ No ___ (If yes explain)

_____ Month and year activity took place _____

If project is for maintenance work of existing structures or existing channels, describe legal authorization for the existing work. Provide permit number, dates or other form of authorization _____

Has any agency denied approval for the activity described herein or for any activity that is directly related to the activity described herein? Yes _____ No _____ (If yes explain _____

7. Project schedule

Proposed start date _____ Proposed completion date _____

Expected completion date (or development timetable) for any projects dependent on the activity described herein. _____

8. Estimated cost of the project _____

9. Describe the purpose of the project. Describe the relationship between the project and any secondary or future development the project is designed to support. _____

Intended use: Private _____ Commercial _____ Public _____ Other (Explain) _____

10. Describe the public benefits of the proposed activity and of the projects dependent on the proposed activity. Also describe the extent of public use of the proposed project.

11. Remarks

12. Provide the names and addresses of the adjacent property owners. Also identify the property owners on the plan view of the drawing described in Attachment "A".

1. 2.

13. List all approvals or certifications received or applied for from Federal, state or local agencies for any structures, construction, discharges, desposits or other activities described in this application. Note that the signature in Item 14 certifies that application has been made to or that permits are not required from the following agencies. If permits are not required place NA in space for Type Approval.

Agency	Type Approval	Application Date	Approval Date
Bureau of Pollution Control			
Bureau of Marine Resources			
U.S. Army Corps of Engineers			
City/County _____			
Other _____			

14. Certification and signatures

Application is hereby made for authorization to conduct the activities described herein. I agree to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable state water quality standards or other environmental protection standards both during construction and after the project is completed. I also agree to provide entry to the project site for inspectors from the environmental protection agencies for the purpose of making preliminary analyses of the site and monitoring permitted works. I certify that I am familiar with and responsible for the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.

_____ _____

Signature of Applicant or Agent Date

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowlingly and willingly falsifies, conceals, or covers up by any trick, scheme or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

15. Mississippi Coastal Program Certification (Coastal area only)

I certify that the proposed project for which authorization is sought complies with the approved Mississippi Coastal Program and will be conducted in a manner consistent with the program.

_____ _____

Signature of Applicant or Agent Date

16. Fees

Payable to State of Mississippi $10.00 Application fee $35.00 Cost of public notice fee	State of Mississippi fee to be included with Application to the Bureau of Marine Resources for Hancock, Harrison and Jackson Counties only.
Payable to Treasurer of the United States $10.00 Non-commercial projects $100.00 Commercial projects	Do not submit fee with application. Fee acceptable only at time of issuance of permit.

17. Send one completed copy of this application form to each agency listed below:

Bureau Director Bureau of Marine Resources P. O. Drawer 959 Long Beach, MS 39560	Bureau Director Bureau of Pollution Control P. O. Box 10385 Jackson, MS 39205

If project is in Hancock, Harrison or Jackson Counties send one completed copy of this application and appropriate fees listed in item 16 to:

District Engineer U.S. Army Engineer District, Mobile Attn: SAMOP-S P. O. Box 2288 Mobile, Alabama 36628	District Engineer U.S. Army Engineer District, Vicksburg Attn: LMKOD-FE P. O. Box 60 Vicksburg, Mississippi 39180

18. In addition to the completed application form the following attachments are required:

Attachment "A" Drawings
Provide a vicinity map showing the location of the proposed site along with a written description of how to reach the site from major highways or landmarks. Provide accurate drawings of the project site with proposed activities shown in detail. All drawings must be to scale or with dimensions noted on drawings and must show a plan view and cross section or elevation. Use 8½" x 11" white paper or drawing sheet attached.

Attachment "B" Authorized Agent
If applicant desires to have an agent or consultant act in his behalf for permit coordination, a signed authorization designating said agent must be provided with the application forms. The authorized agent named may sign the application forms and the consistency statement.

Attachment "C" Environmental Assessment (Coastal area only)
Provide an appropriate report or statement assessing environmental impacts of the proposed activity and the final project dependent on it. The project's effects on the wetlands and the effects on the life dependent on them should be addressed. Also provide a complete description of any measures to be taken to reduce detrimental off-site effects to the coastal wetlands during and after the proposed activity.

Attachment "D" Variance or Revisions to Mississippi Coastal Program (Coastal area only)
If the applicant is requesting a variance to the guidelines in Section 2, Part III, or a revision to the Coastal Wetlands Use Plan in Section 2, Part IV of the Rules, Regulations, Guidelines and Procedures of the Mississippi Coastal Program a written request and justification must be provided.

SECTION VIII

BIBLIOGRAPHY

SECTION VIII

BIBLIOGRAPHY

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