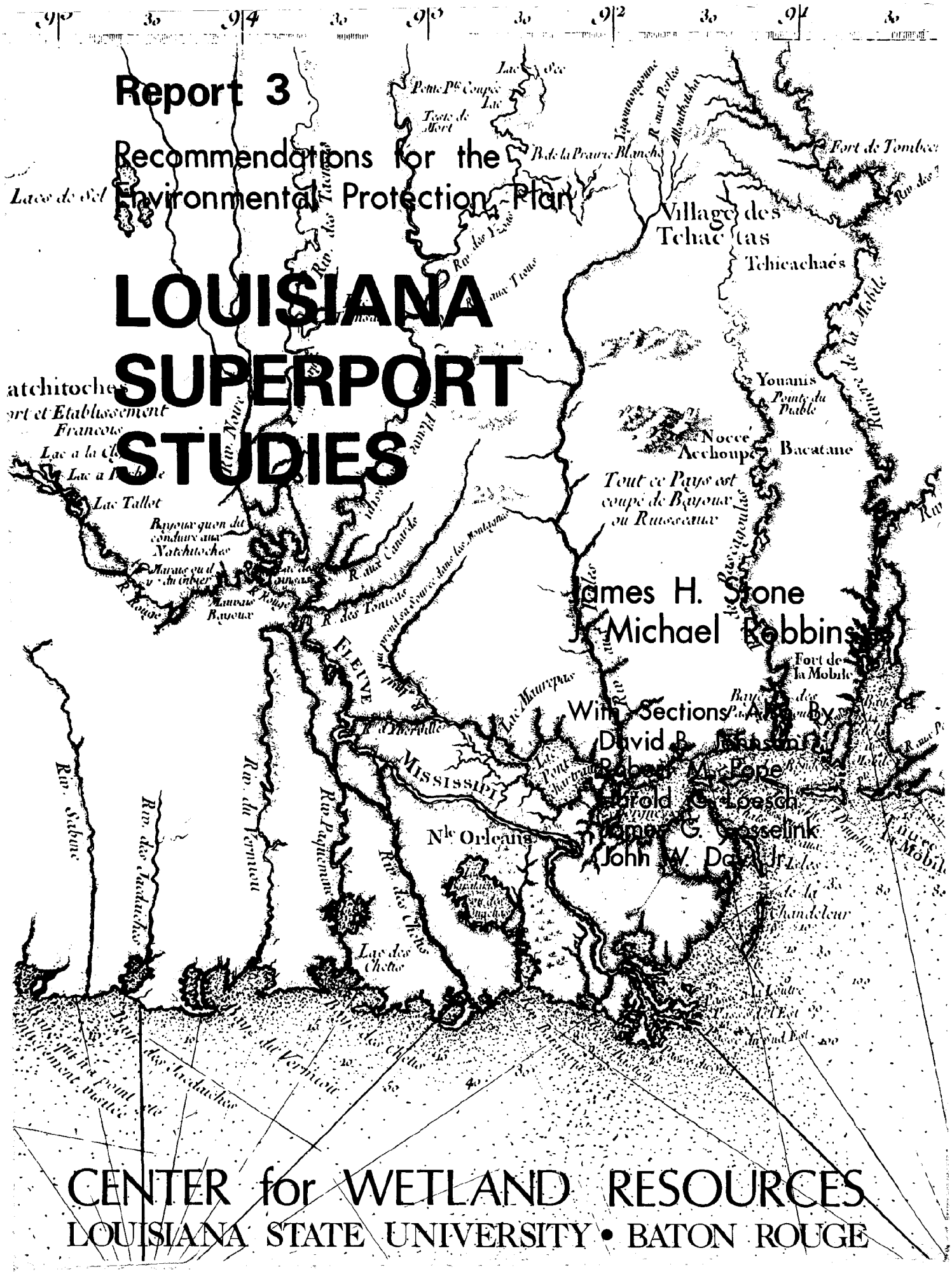

Report 3

Recommendations for the Environmental Protection Plan

LOUISIANA SUPERPORT STUDIES

James H. Stone
Jr. Michael Robbins

With Sections Also By
David B. Johnson
Robert M. Pope
Harold G. Loesch
James G. Gosselink
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CENTER for WETLAND RESOURCES
LOUISIANA STATE UNIVERSITY • BATON ROUGE

October 31, 1973

REPORT 3

RECOMMENDATIONS FOR THE
ENVIRONMENTAL PROTECTION PLAN

LOUISIANA SUPERPORT STUDIES

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COASTAL SERVICES CENTER
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FINAL REPORT SUBMITTED TO LOUISIANA DEEP DRAFT HARBOR
AND TERMINAL AUTHORITY UNDER CONTRACT NUMBER 168-20-F652/F653

ABSTRACT

Data and recommendations are provided for design of the Environmental Protection Plan required by State law to be promulgated by the Louisiana Deep Draft Harbor and Terminal Authority, i.e., the Louisiana Superport Authority.

Louisiana Revised Statute 34:3101-3114 requires that the Environmental Protection Plan contain provisions to be followed in all aspects of the Authority Development Program as follows:

(1) an inventory of all potential and actual stresses expected to occur as a result of the project,

(2) economic and ecologic data on the various sites to be used, including alternatives,

(3) positive design, construction and operational features which minimize environmental stresses and prevent gradual environmental deterioration,

(4) procedures for funding projects which compensate for environmental stresses and losses due to the project, and

(5) means for maintaining interagency cooperation and coordination.

Important physical processes that may be affected by a superport development are the weather regime, deltaic sedimentation, inshore and offshore water circulation, subsidence, and land erosion. Important physical forms and materials are barrier islands, tidal passes, water-land interfaces, wetland basin areas, natural levees, and organic and inorganic sediments.

Important biological habitats that may be affected

by superport development are offshore Gulf areas, beach spawning areas, tidal passes, open bays, lakes, ponds, intertidal and freshwater marshes, natural levees and ridges, cypress swamps, and marsh-water interface zones. Important biological functions are primary production, detritus production and movement, migration, spawning, nutrient cycling, and feeding habits. Dominant organisms in coastal Louisiana are marsh macroflora, attached algae, plankton, microorganisms, and sundry animals, such as benthic meio- and macrofauna, larval forms, nekton (including commercial and sport fishes), birds, fur bearers, and various herptiles.

Important human factors that may be affected by superport development are economic characteristics, culture or life styles, present land uses (e.g., recreational sites, preserves, refuges, state parks, rare environs, historical sites), and general aesthetics.

The major environmental stresses that may result from superport development are (1) oil or other material spills, (2) construction and operational damages, and (3) ancillary development. We strongly believe that though ancillary development promises many economic benefits it also poses the greatest environmental problem, i.e., what is the optimum proportion or ratio of economic growth and development to natural ecosystems or conservation. Regional planning based on preliminary estimates of this ratio, must begin now or the gradual environmental deterioration of coastal Louisiana will be a high probability.

Selected environmental recommendations include the following:

(1) Definitive economic-ecologic planning is necessary for ancillary development. New industry should be encouraged to establish in development corridors on natural levees along Louisiana waterways. Analytical models

for assessing environmental effects and for projecting economic growth should be refined to provide data for various alternatives.

(2) Those environmental features of coastal Louisiana identified as critical should be protected by administrative regulations. The Authority should recommend and support needed environmental regulation and adoption of comprehensive land use and coastal management planning.

(3) Construction operation and phase out activities should be rigorously controlled and monitored. Strong efforts should be made to mitigate or reestablish adversely impacted areas.

(4) Environmental cost assessing techniques should include estimates of losses for fishery or other renewable resources, recreation, and various life support functions such as waste recycling.

(5) There should be a limit on the number of superport facilities. Only one should be permitted for crude oil transfer.

(6) The offshore terminal should be located as far as possible from the shoreline in order to mitigate the dangers of oil and/or other materials spills.

(7) Onshore pipelines should be confined to existing pipeline routes and/or to corridor-development areas. Unmodified coastal wetlands should not be crossed and lateral lines should not be allowed unless existing routes are followed.

(8) The onshore terminal site should be confined to already developed land areas, or contiguous thereto.

(9) Offshore construction and operations should take special consideration of the spawning grounds of various marine species and of those critical time periods of species reproduction and migration.

(10) Onshore construction should not transect barrier islands or tidal passes. All disrupted areas should be reestablished, in so far as possible, to their former condition.

(11) The Authority should plan now for the environmental consequences of handling dry bulk and other non-oil commodities.

LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE
BATON ROUGE • LOUISIANA • 70803
Center for Wetland Resources
THE COASTAL STUDIES INSTITUTE • OFFICE OF SEA GRANT DEVELOPMENT • DEPARTMENT OF MARINE SCIENCES

October 31, 1973

Mr. P. J. Mills, Executive Director
Board of Commissioners of the
Louisiana Deep Draft Harbor and Terminal Authority
1130 International Trade Mart
New Orleans, Louisiana 70130

Dear Mr. Mills:

I am pleased to submit Report No. 3 in a series that concerns various aspects of superport development in Louisiana. The report provides data and recommendations for use in the design of an Environmental Protection Plan (EPP). This plan, by legislative statute, must be "followed in all respects by the executive director in carrying out any aspect of the Authority Development Program." The need for full consideration of environmental issues early in port planning--and throughout construction and operation phases--has been wisely and consistently recognized by the Louisiana Legislature and Superport Authority. Design and promulgation of the EPP can certainly be viewed as a pioneering effort in establishing mechanisms for cooperative environmental action by governmental, industrial, university and citizen groups. Such action can be forced or encouraged by legislation and administrative regulation, but the desired goals can only be achieved through development of effective working relationships that incorporate respect for objective and dispassionate analysis. It is hoped that design, promulgation, and amendment of the EPP will lead to such relationships and consensual decisions that are in the best interest of all Louisianians.

Sincerely,

Jack R. Van Lopik

Jack R. Van Lopik
Director
Center for Wetland Resources

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enc.

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INTRODUCTION

A. Louisiana Deep Draft Harbor and Terminal Authority

1. Identification, Description and Functions

The Louisiana Deep Draft Harbor and Terminal Authority (often referred to hereinafter as "Authority") is a political subdivision of the State, possessing full corporate powers to promote, plan, finance, develop, construct, control, manage, maintain and modify a deep draft harbor and terminal.*

The Louisiana Deep Draft Harbor and Terminal Authority is governed by a board of commissioners appointed by the Governor. The Authority is empowered to own, construct, operate and maintain docks, wharves, sheds, elevators, pipelines, pumping stations, locks, slips, laterals, basins, warehouses and all other property, structures, and works of public improvement necessary and useful for deep draft harbor and terminal purposes. It is authorized to dredge and maintain shipways, channels, slips, basins and turning basins and to establish, operate and maintain, in cooperation with the Federal

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*A deep draft harbor and terminal is considered synonymous with the term "superport." Both mean a structure, or series of structures, or facility of any type emplaced in coastal waters and designed to accommodate the cargo or passengers of deep draft vessels whose draft is greater than the depths of typical inland harbors and waterways commonly used by ocean-going traffic during the first half of the twentieth century, including all those structures and facilities functionally related thereto and necessary or useful to the operation thereof whether landward or seaward of the main structure or facility itself.

government and State of Louisiana, a deep draft harbor and terminal in and upon the waterbottoms of the Gulf of Mexico and the continental shelf. Further, it is granted the right of eminent domain, and the right to enter into leases with the United States of America, State of Louisiana, subdivisions thereof and other public and private agencies, for acquiring a lease, right-of-way or servitude over the waterbottoms of such land as may be necessary for the business of said Authority. The Deep Draft Harbor and Terminal Authority is empowered to collect tolls and fees, to borrow funds for the business of such Authority, to incur debts and issue bonds for the needs of such Authority in a manner provided by the Constitution and the laws of the United States, and the State of Louisiana, and to provide for an Environmental Protection Plan to protect the coastal environment from damage. Further, it is authorized to lease or sublease lands leased from the State of Louisiana, and to negotiate and enter into contracts or agreements with any other public or private individual or corporation including, but not limited to, contracts or agreements for construction and operation of a petroleum terminal as an interstate common carrier. And finally, the Deep Draft Harbor and Terminal Authority generally is authorized to employ the above-mentioned public and private bodies to do any and all things necessary and proper for the governing, regulation, development and control of the business of such Deep Draft Harbor and Terminal Authority.

The functions of the Authority are as follows:

- To promote the economic industrial well-being of the existing

port authorities of Louisiana and to promote interstate, national and international trade for its subdivisions and the area served by the Mississippi River and its tributaries, and to provide that existing ports take such steps individually and collectively to assure the maintenance of the economic well-being of each port authority, as well as the whole;

- To promote the industrial and petrochemical base of the Mississippi Valley Region of the United States by providing adequate deep draft port facilities for the handling of the cargoes of deep draft vessels;
- To promote, in addition to port operation, scientific, recreational, and all other uses of the deep draft harbor and terminal which shall be in the public interest;
- To accommodate and plan for the technical innovations occurring in the worldwide and domestic shipping industry to increase efficiency and the flow of commerce through the deep draft harbor and terminal;
- To protect environmental values and Louisiana's unique coastal marshland ecosystem through the adoption of an Environmental Protection Plan;
- To assert and protect Louisiana's economic, social and environmental interests in the development of any deep draft harbor and terminal outside the State of Louisiana where such development may have an impact upon the State of Louisiana;

- To constitute a political subdivision of the State of Louisiana, with such functions exercised by the board as are deemed to be governmental functions of the State of Louisiana, so that the exercise of the powers granted herein will, in all respects, be to the benefit of the people of the State, for the increase of their commerce and prosperity and for the improvement of their economic condition;
- To assure that the Authority shall not be required to pay any taxes or assessments on any property acquired or used by it under the provisions of the Act or upon the income therefrom; and any bonds issued hereunder shall be serviced from the income of said facility and shall be exempt from taxation by the State of Louisiana, and by any municipal or political subdivision of the state.

2. Enabling Legislation

The Louisiana Deep Draft and Terminal Authority was created by Act 444 of the 1972 Louisiana Legislature. This Act is codified as new Chapter 35 of Title 34, Section 3101 through 3114, of the Louisiana Revised Statutes of 1950.

3. Superport Program: Need, Scope and Location

If projected petroleum needs of the United States are correct (Gibson, 1972), and economically can be met only by increasing importation of foreign oil (Gibson, 1972), then it is assumed that one or more superports will be needed along the coast of the United States.

The first deep draft port facilities in Louisiana

probably will be designed to off-load only petroleum cargoes. It is probable that future port operations eventually will include slurried products, dry bulk shipments and other commodities. Environmental planning, therefore, should consider and adequately provide for these possibilities to assure protection of marine and coastal fisheries and other renewable natural resources and the overall coastal and marine environment.

B. Environmental Protection Plan

1. Requirement

The enabling legislation requires the existence of an Environmental Protection Plan throughout all aspects of the Authority Development Program (La. R.S. 34:3113(A)). Further, the plan must constitute an integral part of the Authority Development Program (La. R.S. 34:3113(G)).

2. Objectives and/or Purposes

Objectives and/or purposes of the Environmental Protection Plan (EPP) are stated as follows:

> "To protect environmental values and Louisiana's unique coastal marshland ecosystem through the adoption of an Environmental Protection Plan." (La. R.S. 34:3101(B)(5))

> "The Environmental Protection Plan means a written document, prepared in conformity with this law, which shall be a regulation of the Deep Draft Harbor and Terminal Authority which establishes those steps to be followed to insure the protection of the environment throughout all phases of the Authority Development Program." (La. R.S. 34:3102(3))

"The Authority is hereby empowered to take all necessary steps to protect Louisiana's unique coastal environment from any short-term or long-term damage or harm which might occur from any aspect of the Authority Development Program. (La. R.S. 34:3109(D))

3. Scope

The operational extent of the Environmental Protection Plan derives from La. R.S. 34:3113(A) which states: "the details of the Environmental Protection Plan shall be followed in ... carrying out any aspect of the authority development plan." And the authority development plan is defined by La. R.S. 34:3102(2) and is given below:

"Authority Development Program" means all the phases of growth and development through which the concept of a deep draft harbor and terminal may go, including but not limited to promoting the concept, raising funds to support the program, planning the uses of the facility, selecting a site for the physical facility and support facilities, designing the structures, constructing the facility and the support facilities, operating and maintaining the facility, expanding or renovating the facility, modification and retirement of the facility, and any other phases through which Authority development may proceed.

4. Implementation

The Environmental Protection Plan is to be formulated by the three directors (Director of the Louisiana Wild Life and Fisheries Commission, Director of the Louisiana State University Center for Wetland Resources and the Executive Director of the Louisiana Deep Draft Harbor and Terminal Authority (La. R.S. 34:3102(5)) with the

advice and consent of the board of commissioners of the Authority. The three directors are to make every effort to reach a consensus as to the best Environmental Protection Plan. If they are unable to agree, then each shall proffer his proposed Environmental Protection Plan, with comments, to the board of commissioners for consideration. After receiving and studying the recommendations, the board of commissioners shall decide which plan or combination of plans shall be promulgated. Changes in the plan may be initiated by any of the three directors or any interested party (La. R. S. 34:3113 (E)).

5. Development

The Louisiana Deep Draft Harbor and Terminal Authority employed the Henry J. Kaiser Company as general technical consultant for the Superport Project under the Authority Development Program. Louisiana State University's Center for Wetland Resources (referred to below as LSU) was contracted to prepare the scientific data on which the Environmental Protection Plan (EPP) would be based. Burk and Associates, as subcontractors to Kaiser, provided certain environmental data input for EPP. After review by Kaiser and Deep Draft Harbor and Terminal Authority, the LSU results will be presented to the three directors and used in the drafting of the Environmental Protection Plan. Deutsch, Kerrigan and Stiles, Attorneys for the Louisiana Deep Draft Harbor and Terminal Authority, will assist the three directors in drafting the Environmental Protection Plan rules and regulations, based on available materials.

Results of research done in support of the Environmental Protection Plan are considered open documents subject to public review and comment. The three directors must make every effort to reach a consensus on the Environmental Protection Plan which then will be formulated into the proper legal context.

The Environmental Protection Plan will then be presented to the board of commissioners for their "advise and consent" and promulgated by the Authority's Executive Director in accordance with the Louisiana Administrative Procedure Act (La. R. S. 49:951-966).

6. Format

Certain sections of the Environmental Protection Plan may be incomplete or undetailed because of insufficient data. However, the present law (La. R. S. 34:3113(I)) permits inclusion of these sections in the Environmental Protection Plan if valid reasons are given justifying these insufficiencies.

C. Other Jurisdictions

1. Pending Legislation

No Federal legislation or international convention has yet been adopted specifically authorizing construction and operation of a deep draft harbor and terminal beyond the territorial waters of the United States or any other coastal sovereign. However, several bills have been introduced in both Houses of Congress recently which would authorize Federal licensing power for such outer continental shelf activity. For example, H.R.-7501 & S-1751 would place licensing authority with the Secretary of the Department of the Interior. The Department of the Interior would act as the central coordinating agency for securing all other required agency permits. S-2232 would place the licensing authority under the National Oceanic and Atmospheric Administration and would further require the existence of an approved coastal management plan in the adjacent coastal State. H. R.-10701 would place licensing power in a commission, consisting of the Secretary of Transportation, the Secretary of the Interior, the Administrator of the Environmental Protection Agency, etc.

International implications as to whether a deep draft harbor and terminal located on the outer continental shelf constitutes a "reasonable use of the high seas" adjacent to the coastal sovereign presumably will be determined by the Department of State, strongly influenced by national defense considerations.

2. Present Legal Structure

Under the present legal structure in Louisiana, two alternatives exist regarding jurisdictional authority which may be asserted by Louisiana.

First, the Deep Draft Harbor and Terminal Authority could seek independently to conduct all port activities both within and beyond Louisiana's territorial jurisdiction, including activities affecting the high seas and outer continental shelf lands (La. R. S. 34:3101(B) (1, 4 and 6)).

A second alternative is to allow other public or private factions to erect, operate and maintain a deep draft harbor and terminal with the Authority controlling those activities occurring within its jurisdiction.

If the Deep Draft Harbor and Terminal Authority chooses the first alternative and seeks directly to conduct activities affecting outer continental shelf lands, then Federal permission must be obtained prior to conducting such activities. Obtaining this permission requires interaction with numerous agencies of the United States government. Most of these agencies are contained in the Department of Interior, Defense, Transportation, and Commerce. Others include the Environmental Protection Agency, the Federal Maritime Commission, and the Council on Environmental Quality.

The second alternative results if the Deep Draft Harbor and Terminal Authority does not seek Federal licensing authorizations for establishing harbor and terminal facilities on outer continental shelf lands. The Authority jurisdiction would be dependent on the provisions of whatever Federal legislation is finally adopted. Among primary Federal agencies having programs directly affecting aspects of the Authority Development Program are the Corps of Engineers (Department of Defense), the Interstate Commerce Commission, the Environemtal Protection Agency, and the Council on Environmental Quality. Primary state agencies include the State Land Office, Wild Life and Fisheries Commission, Department of Conservation, Air Control Commission, and Stream Control Commission.

Any plans conducted under the Authority Development Program concerning land-based activities should be coordinated with the local parish port authority. Other local agencies which could bear significantly on Authority Development Program planning are parish police juries and municipalities into which might expand ancillary industries associated with a deep draft harbor and terminal.

Finally, the Louisiana Deep Draft Harbor and Terminal Authority is statutorily instructed to coordinate fully all aspects of the Authority Development Program with the State agency charged with development of a coastal zone management plan for the State (La. R. S. 34:3114 (B)).

Requirements of all licensing and permitting agencies must be satisfied before varying aspects of the Authority Development Program can

be completed. Many requirements of other agencies are refined and particularized in the recommendations incorporated into this Environmental Protection Plan. Any resulting duplication should be interpreted as a centralization or reaffirmation of provisions believed applicable to the Louisiana coastal and marine environment.

CHAPTER 1

THE ENVIRONMENTAL BACKGROUND

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By Harold C. Loesch, James G. Gosselink and John W. Day, Jr.
Center for Wetland Resources
Louisiana State University

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By David B. Johnson
Department of Economics
Louisiana State University

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   Center for Wetland Resources,
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Chapter 1

THE ENVIRONMENTAL BACKGROUND

A. Requirements and Intent of Chapter

1. Statute

Louisiana Revised Statute 34:3113(J) (1) is as follows:

> "Summarize the salient feature of an inventory of all potential and actual stresses on the natural and human environment which can be reasonably expected to occur in pursuing the Authority Development Program. Consideration shall be given to stresses which have occurred in other parts of the country and the world where similar functional operations were being performed. Consideration shall be given to the peculiarities of Louisiana's coastal environment. The inventory of potential and actual stresses shall include a prediction of the stress on the coastal environment of major accidents which could logically be expected to occur throughout the Authority Development Program, even though all precautions against such accidents have been taken."

2. Principal Feature of Chapter

The most important feature required of Chapter 1 for the Environmental Protection Plan is the prediction and listing of all potential and actual environmental stresses expected as a result of the Authority Development Program.

3. Environmental Features Considered

The essential environmental features of coastal Louisiana will be identified and discussed in relation to a superport program and its related activities. Coastal Louisiana will be described in terms of the major physical and biological factors, selected socio-economical

considerations, and selected recreational features and unique environs. Environmental history of selected oil ports or terminals will be discussed in order to provide some guidelines for the Louisiana Environmental Protection Plan. The expected environmental stresses will be described, including a summary of the adequacy of baseline data for coastal Louisiana.

B. Louisiana Coastal Environment

1. Physical Factors

The most important physical factors of coastal Louisiana can be divided into three major categories. They are:

a. Processes

- Climatic regime
- Delta building
- Subsidence
- Erosion
- Water circulation (inshore and offshore)

b. Forms

- Natural levees
- Interdistributary basins
- Water-land interface
- Barrier islands
- Tidal passes

c. Materials

- Sediments

Each of these items is discussed below.

a. Processes

- Climatic regime

Average Conditions

At least two pressure ridges dominate weather conditions along coastal Louisiana. One ridge is the "Bermuda high" centered over the Bermuda-Azores area of the Atlantic, and the other is the "Mexican heat low" centered over Texas during the warm months. Pressure changes associated with these ridges set up winds that predominantly come out of the east (Table 1). For example, fall and winter winds have a strong component out of the east, 28% and 21% of all winds, respectively; but for these seasons the components from the northeast and north predominate over those from the southeast. In fall, 26% of all winds come from the northeast, but only 10% come from the southeast. During winter, 18% of all winds come from the northeast and 17% come out of the southeast; however, northwest winds increase 4% over fall season occurrences, so that overall the wind shift is still to the north. Spring and summer winds shift to the southeast. For example, 21% and 18% of all the spring and summer winds come from the southeast, whereas only 16% and 10%, respectively, come from the northeast.

Air temperatures usually reflect changes in wind direction. During fall and winter, mean air temperatures in southeast Louisiana are 69.4°F (20.9°C) and 56.7°F (13.8°C), respectively (Table 1). During spring and summer, mean air temperatures are 68.6°F (20.4°C) and 80.8°F (27.3°C), respectively (ibid.). Because the bulk of the surface waters of the Gulf of Mexico originate in tropical latitudes, coastal water temperatures are relatively higher than surface waters at similar

Table 1. A. Frequency in percent of winds from various direction in Gulf of Mexico (extracted from U. S. Naval Weather, 1970). B. Average air temperatures in °F for southeast division of Louisiana, 1931-1971 (Climatological data, Louisiana, 1931 through 1971). C. Monthly precipitation in inches, southeast division, 1931-1970. Extracted and derived from National Climatic Summary (courtesy G. Cry).

A. Winds

	Fall	Winter	Spring	Summer
NE	26	18	16	10
E	28	21	27	27
SE	10	17	21	18
NW	5	9	6	4

- - - - -

B. Air Temperatures

Monthly Average °F:

Jan.	Feb.	Mar.	Apri.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
54.9	48.4	61.7	68.9	75.2	78.7	80.7	82.2	75.2	71.3	61.7	56.8

	Winter	Spring	Summer	Fall	Annual
Seasonal Average °F	56.7	68.6	80.8	69.4	68.9

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C. Precipitation

Monthly Average:

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5.89	4.70	4.90	4.31	4.50	5.27	7.37	6.63	6.40	3.23	3.74	4.96

	Winter (DJF)	Spring (MAM)	Summer (JJA)	Fall (SON)
Seasonal Average:	5.18	4.57	6.42	4.46

latitudes, undoubtedly resulting in a great warming and increase of moisture content of the overlying air masses. Leipper (1954) gives the mean annual temperature of Gulf surface waters as 78°F (25.6°C), whereas in comparable areas at the same latitude the mean annual temperature is 74°F (23.3°C) in the western Atlantic, 73°F (22.8°C) in the eastern Atlantic, and 68°F (20.0°C) in the eastern Pacific.

Mean monthly rainfall in southeast Louisiana ranges from 3.2 inches/month (8.2 cm/mo) during October to 7.4 inches/month (18.7 cm/mo) during July. Generally, the winter and summer seasons are the rainiest, the seasonal means being 5.2 inches (13.2 cm/mo) and 6.4 inches (16.3 cm/mo), respectively. Rainfall is slightly lower during the fall and spring, 4.5 inches/month (11.3 cm/mo) and 4.6 inches/month (11.6 cm/mo), respectively (Table 1).

Humidity along the coast of Louisiana is high because of abundant rainfall and possibly because the prevailing winds have a long fetch over the warm surface waters of the Gulf. Humidity is generally highest during summer. Selected data for the New Orleans area are given in Table 2.

Coastal fog along coastal Louisiana is 2 to 4 times more frequent during December and January (Table 3). Generally, the duration of coastal heavy fog is only about 3 to 4 hours. Visibility offshore of Louisiana is reduced to less than 3 miles (4.8 kilometers) 4.3% of the time on a monthly basis. Poorest visibility occurs during winter and the spring months of March and April; visibility less than 3 miles occurs 7.9% of the time, during January and 9.6% and 8.0% of the time during March and April, respectively (Table 3). The sky is obscured by cloud cover on

Table 2. Percent frequency of specific relative humidity at selected hours for midseasonal months (U.S. Weather Bureau, National Climatic Summary, 1971).

(New Orleans records: 1949-1954)

		<30	<40	<50	≥50	≥70	≥90
Jan	6 a.m.	0	1	2	98	93	61
	3 p.m.	3	15	23	77	37	7
Apr	5 a.m.	0	1	2	98	83	53
	3 p.m.	8	26	43	57	19	7
Jul	4 a.m.	0	0	0	100	98	77
	3 p.m.	1	2	17	83	41	6
Oct	5 a.m.	0	0	3	97	90	52
	3 p.m.	11	33	47	53	13	4

Table 3. Percent frequency of fog occurrence at specific locations in Louisiana. A. Monthly occurence at Lake Charles and New Orleans. B. Intensity for Grand Isle, Block 46, offshore Louisiana (Glenn, 1972).

A.

MONTHLY OCCURRENCE OF FOG - 1964

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Lake Charles	8	2	5	4	3			1	3	5		11	42
New Orleans	10	2	3	1	1				1	1		8	27

- - - - -

B.

Month	Less Than 3 Miles	Less Than 1 Miles	Less Than 1/2 Mile	Less Than 1/4 Mile	Less Than 1/3 Mile
Jan	7.9	3.3	2.2	1.6	1.4
Feb	9.0	3.9	2.7	2.0	1.7
Mar	9.6	4.2	2.9	2.2	1.9
Apr	8.0	3.4	2.3	1.7	1.5
May	2.9	1.2	0.8	0.6	0.4
Jun	1.0	0.5	0.3	0.2	0.1
Jul	0.7	0.2	0.1	0.1	0.0
Aug	0.8	0.2	0.1	0.1	0.0
Sep	1.0	0.5	0.3	0.2	0.1
Oct	2.0	1.0	0.6	0.4	0.2
Nov	3.3	1.5	1.0	0.7	0.5
Dec	5.7	2.3	1.6	1.2	1.0
Annual	4.3	1.9	1.2	0.9	0.7

[1] Visibility reductions are caused primarily by fog.

the average from 4/10 to 6/10 of the time (Leipper, 1954).

During winter, solar radiation averages about 235 gr-cal/cm^2/day, and during spring months it increases to 435 gr-cal/cm^2/day. The rate reaches a maximum of 488 gr-cal/cm^2/day during summer and declines to 367 gr-cal/cm^2/day during the fall, (fig. 1). This seasonal pattern of solar energy undoubtedly is one of the causal factors involved in biological productivity.

Cyclones, particularly the tropical species, generally affect the northwest Gulf area from late May to early November. During the hurricane season (163 days; May through early November), the average number of tropical storms is 0.76/year; the overall probability for any one day is 0.47%. Usually hurricanes occur at least once a year, and their overall probability is 0.61% for any one day (Table 4).

- Delta building

Most of coastal Louisiana, inshore and offshore, is a river delta, formed as a result of Mississippi River sedimentation (see Figure 2). Some sixteen separate delta lobes have been formed along central and eastern coastal Louisiana during the past 6000 years (Frazier, 1967). Delta building is a cyclical process, having a predictable pattern (Morgan, 1972). Three distinct phases make up one cycle: they are the constructional phase, the abandonment phase, and the destructional phase (See Figure 3). During the constructional phase, progradation begins when a stream discharges its sediment load into rather shallow and still waters. Levees are formed on the banks of a stream during floods and heavier sediments usually accumulate at the end of the stream or delta. Additional channels and levees usually develop, and marshland areas form

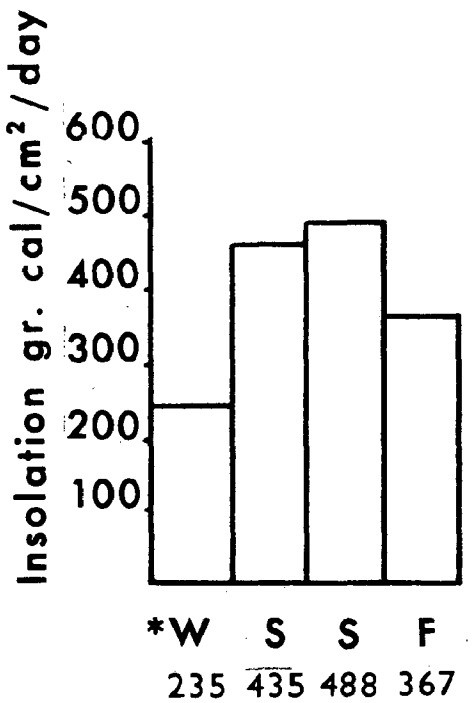


Figure 1. Annual variation in insolation along the Louisiana coast (adapted from Day, et al., 1972). Winter is December, January, and February. Spring is March, April, and May. Summer is June, July, and August. Fall is September, October, and November.

Table 4. Data on occurrence of tropical storms and hurricanes within 180 nautical miles of Louisiana coast (Glenn, 1972).

	Tropical Storms			Hurricanes		
Period of Hurricane Season	Average Number Per Year	Average Interval Between Storms, Years	Occurrence Probability On Any Day In Period	Average Number Per Year	Average Interval Between Hurricanes, Years	Occurrence Probability On Any Day In Period
May 29 - June 10 (13 Days) (Inactive Early Season)	0.03	33.3	0.23%	0.02	50.0	0.15%
June 11 - July 5 (25 Days) (Active Early Season)	0.13	7.7	0.52%	0.14	7.1	0.56%
June 6 - August 10 (36 Days) (Inactive Mid-Season)	0.14	7.1	0.39%	0.12	8.3	0.33%
Aug. 11 - Oct. 20 (71 Days) (Active Mid-Season)	0.43	2.3	0.61%	0.70	1.4	0.99%
Oct. 21 - Nov. 7 (18 Days) (Inactive Late Season)	0.03	33.3	0.17%	0.20	50.0	0.11%
Entire Season (163 Days)	0.76	1.31	0.47%	1.00	1.00	0.61%

Maximum Number of Hurricanes and Tropical Storms in Any Year: 6, 1886

Minimum number of Hurricanes and Tropical Storms in Any Year: 0, (Occurred in several years).

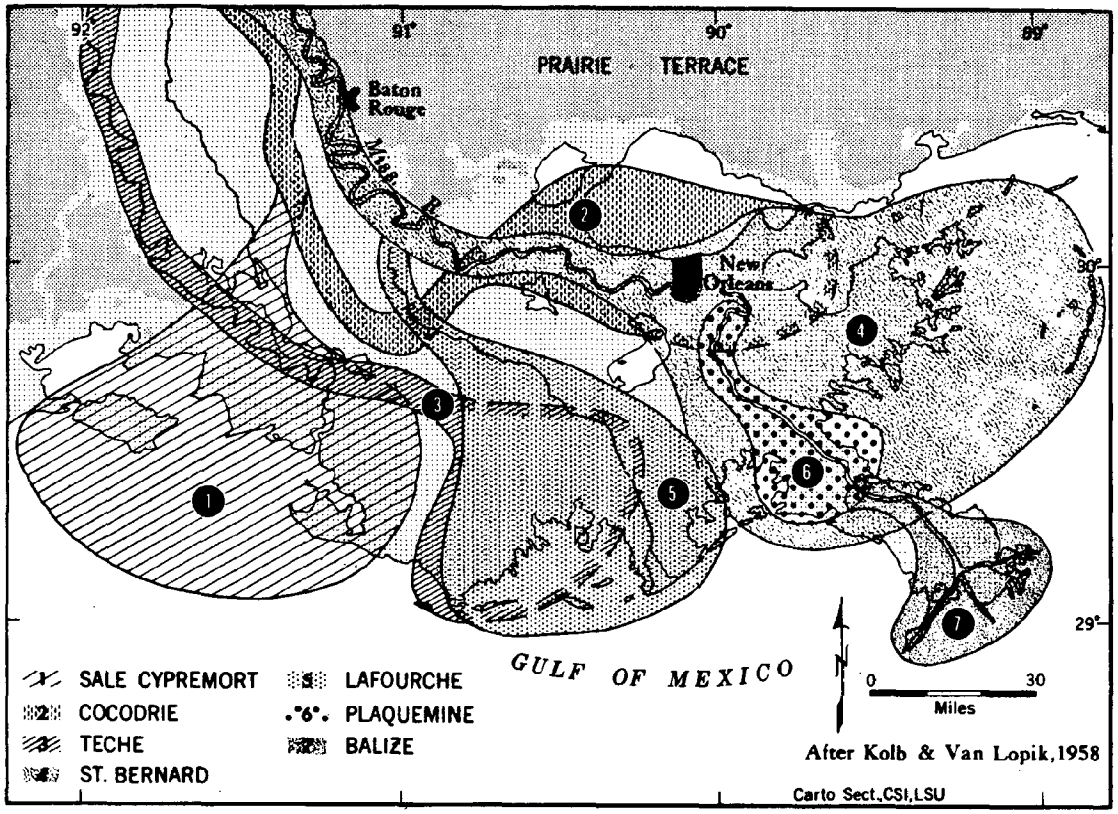


Figure 2. Chronology of deltas of Mississippi River deltaic plain (from Kolb and Van Lopik, 1958).

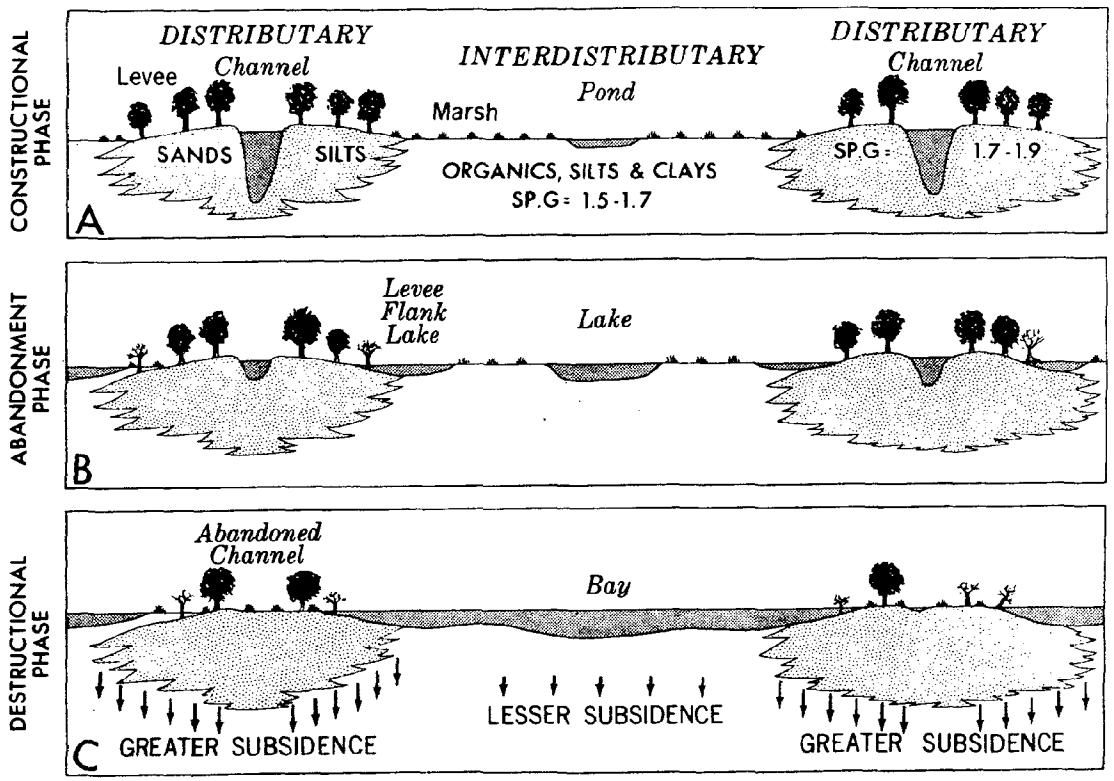


Figure 3A. Phases of delta building cycle (from Morgan, 1972).

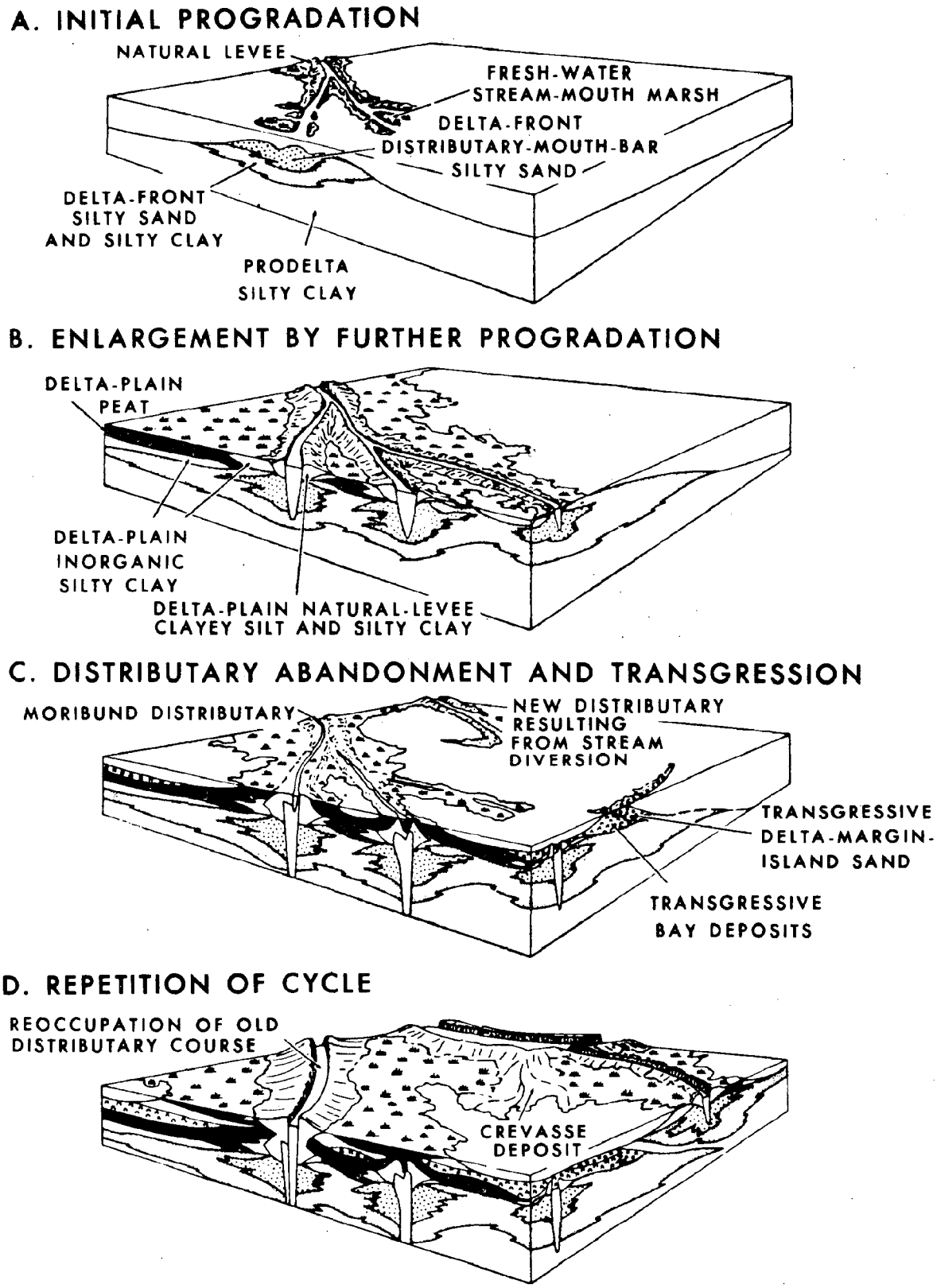


Figure 3B. Sequence of development of deltaic facies (from Frazier, 1967).

between the levees. The constructional phase is dominated by deposition of inorganic sediments. During the abandonment phase, extensive marshlands develop and subsidence takes place concurrent with the accumulation of organic material. Peats and "flotant" are formed, and elongate-open ponds develop. During the destructional phase, subsidence occurs faster than deposition and, as a result, lakes within the interdistributary basins enlarge and become interconnected. Tidal flow and exchange increase which, in turn, allows more saline waters to intrude. Bank erosion is accelerated because of increased wind fetch across the enlarging water bodies. Because subsidence is now a dominant factor along coastal Louisiana, it is generally believed that most of the deltaic plain is either in the abandonment or destructional phase (Morgan, ibid).

- Subsidence

Subsidence is the gradual lowering of land with respect to sea level and it usually occurs during the last two phases of the delta cycle. Worldwide, sea level is rising, but it generally believed that subsidence is the most important factor which accounts for changes in sea and tide level along the Louisiana coast. For example, Swanson and Thurlow (1973), present data showing subsidence rates along coastal Louisiana ranging from 4.3 cm/yr at South Pass to 1.2 cm/yr at Sabine Pass. Along Florida they found comparable rates are <0.2 cm/yr and along Texas rates range from -0.08 to 1.2 cm/yr.

- Erosion

Erosion is the result of land loss due to the action of water and wind. It is particularly evident in much of the deltaic plain of Louisiana. Wave attack along the shoreline causes significant erosion

in those areas where river deposition is inactive (Becker, 1971). Inshore, comparative map studies indicate a net land loss rate of 16.5 miles^2/yr during the last 25 to 30 years (Gagliano, et al., 1970). Figure 4 shows land loss in the various hydrologic units of coastal Louisiana (Gagliano, et al., 1971). Greatest land losses are occurring in those units east of the Atchafalaya River, which is also the area that has already been characterized (see Delta building above) as in either the abandonment or destructional phase of the delta cycle.

- Water circulation

Inshore, the water circulation of the estuarine or interdistributary basin areas is complex (Kjerfve, 1972). At one time water input to the basins occurred as an annual overflow of the natural levees. This no longer occurs because of manmade levees and/or flood control devices. Now, water input is only by means of rainfall and tidal exchange. The Mississippi River discharge, however, influences the salinities in Bastian and Barataria Bays (Gagliano, et al., 1973) and the discharge of the Atchafalaya River has a similar effect along the shoreline of the western coast of Louisiana. Most of the Louisiana estuarine basins exhibit a diurnal tidal cycle with a range of approximately 2 to 24 inches in height. Estuarine water resident times are known only for Barataria Bay and researchers (given in Stone, 1972) estimate that it takes more than 3000 days for the water to purge itself if it is located just above St. Mary's Point in Barataria. The implication of this datum is that the more northerly areas of the estuarine basins are extremely slow in purging themselves.

Offshore, littoral drift is toward the northwest along

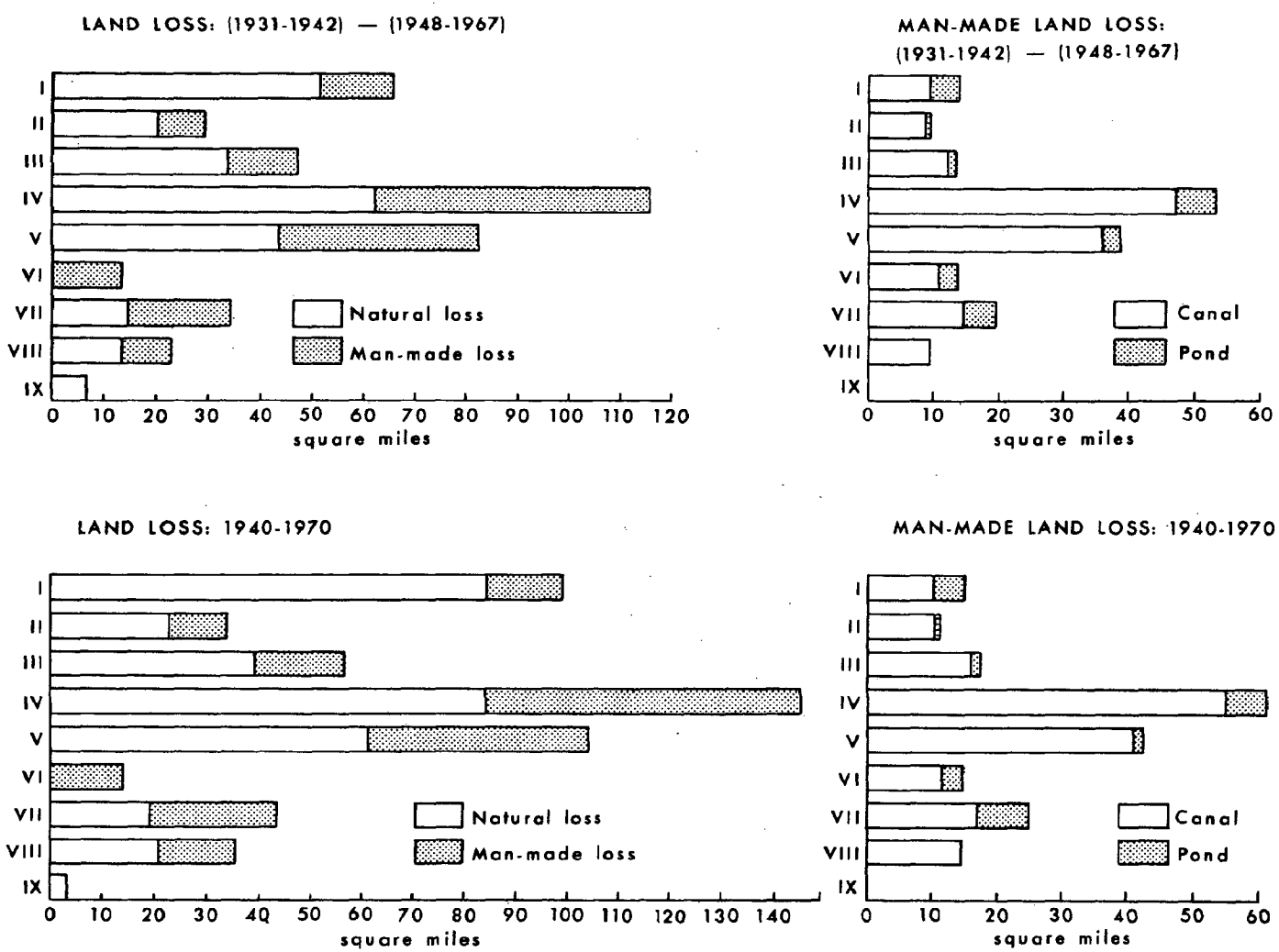


Figure 4. Comparison of total land loss and manmade loss in coastal Louisiana. The upper graphs compare average values for mapping intervals and the lower graph compares values adjusted to specific years (Gagliano, et al., 1971). See Page 36 for region locations.

the Mississippi River Delta and northeastward along Bayou Lafourche and Grande Isle, though wind conditions can change this. Along the west coast of Louisiana the littoral probably sets to the west. The surface currents just south of the Mississippi River delta have a northerly set, possibly as the result of intrusion of the Yucatan current. When this water mass reaches the delta it divides and flows to the west and east. The eastern branch forms a clockwise gyral along the continental shelf of northern Florida; it is especially well defined during late winter and spring. The western current is not so well defined but is presumably a boundary current flowing northward; the overall net direction is probably to the northwest and west-northwest as a result of modifications by winds, bottom topography, and discharge waters of the Mississippi and other rivers (see Figure 5).

b. Forms

- Natural levees

Natural levees are present along all of the rivers and bayous in coastal Louisiana. They probably form when water in a channel floods over the banks and the flow of water then escapes at right angles to the normal flow down the channel. Eddy effects probably occur at the breakpoint and as a result the water flow is slowed and the heavier particles of sand and clay settle out, thereby forming a natural levee. Progressive depositing of materials at right angles to the stream course results in a gradual slope being formed along the sides of the stream (see Figure 6; O'Niel, 1949).

- Interdistributary basins

Interdistributary basins are those areas formed between

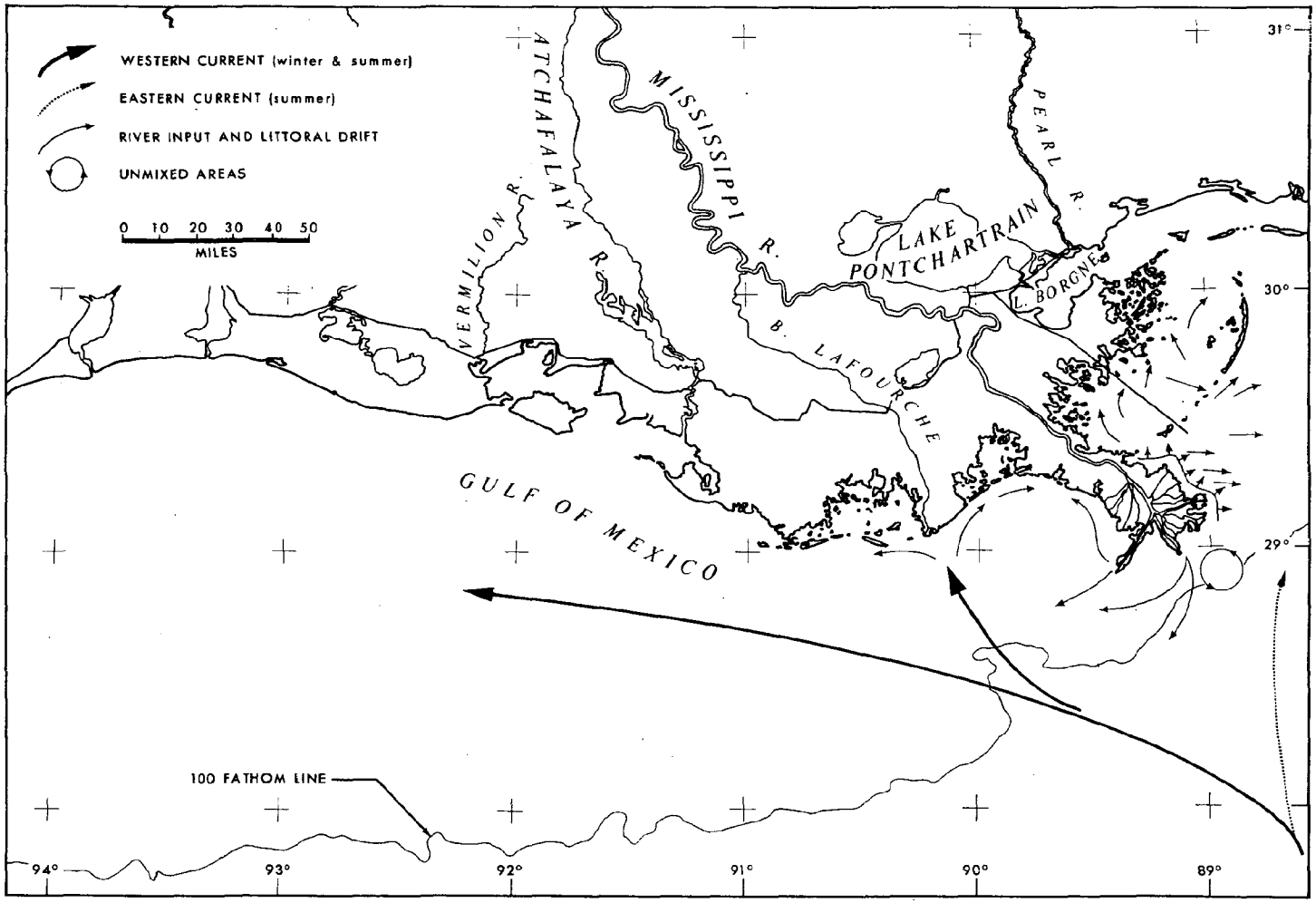
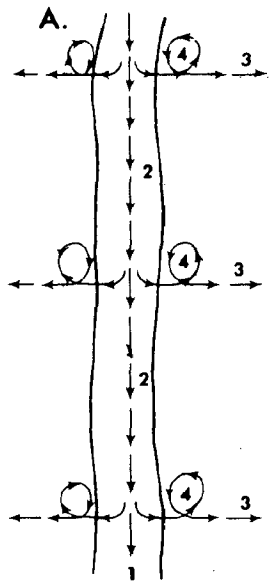


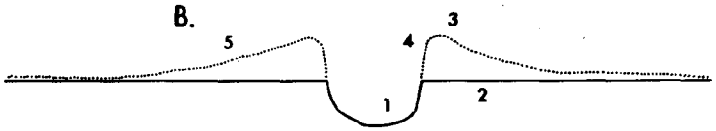
Figure 5. Generalized surface circulation along coastal Louisiana.



A. 1. Embryo pass.
2. Normal current direction at low water.
3. Current flow at right angle to stream during high water.
4. Eddy occurs where flow is at right at right angle to normal.

B. 1. New stream channel.
2. Level of mud flat.
3. The rate of flow decreases at eddy.
4. Natural levee formed from deposits of heavy silt at site of eddy.
5. Back slope of levee is gradual as lighter elements of silt deposit progressively.

C. 1. Older stream channel.
2. Natural levee.
3. Vegetation on crest of levee retards flow of water resulting in heavier deposits which form higher levee crest.
4. Back slope at this stage is more abrupt.



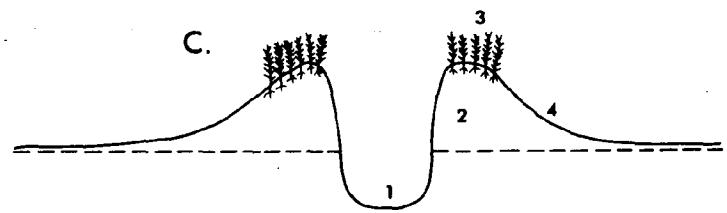


Figure 6. Hypothetical steps in levee construction (adapted from O'Niel, 1949).

the natural levees of the transcoastal streams and/or rivers along coastal Louisiana. They become well developed during the abandonment phase of the delta cycle. They form the physical basis for the associated marsh flora and fauna and are more or less self-contained units (see Figure 7). These hydrologic units have been proposed as management units (Gagliano, et al., 1972) for future land use and/or as fishery resource units (Lindall, 1972).

- Water-land interface

During destructional phase of the delta cycle subsidence rates are greater than the accumulation of organic debris and, as a result, the water area between natural levees increases. In addition, the water-land interface ratio changes and it is probable that this ratio is directly involved with the productivity of a basin. The theory being that more land is exposed to water and therefore more nutrients are available to primary production and also more area for habitat space is available to animals. Preliminary data tend to support this position as a positive relationship (r_d=0.71) exists between the fishery production per unit area of each hydrologic unit and the water-land interface area, as expressed by the number of miles of shoreline (Table 5).

- Barrier islands

Along the shoreline of the estuarine areas of central and eastern Louisiana there are islands which form a barrier between the interdistributary basins (estuaries) and the open ocean. They are formed, presumably, by wave attack on sand bars at the mouths of abandoned distributaries. The sand is transported laterally and accumulates to form delta-margin islands. This type of island is common along low-coast estuaries (Frazier, 1967; Russell, 1967).

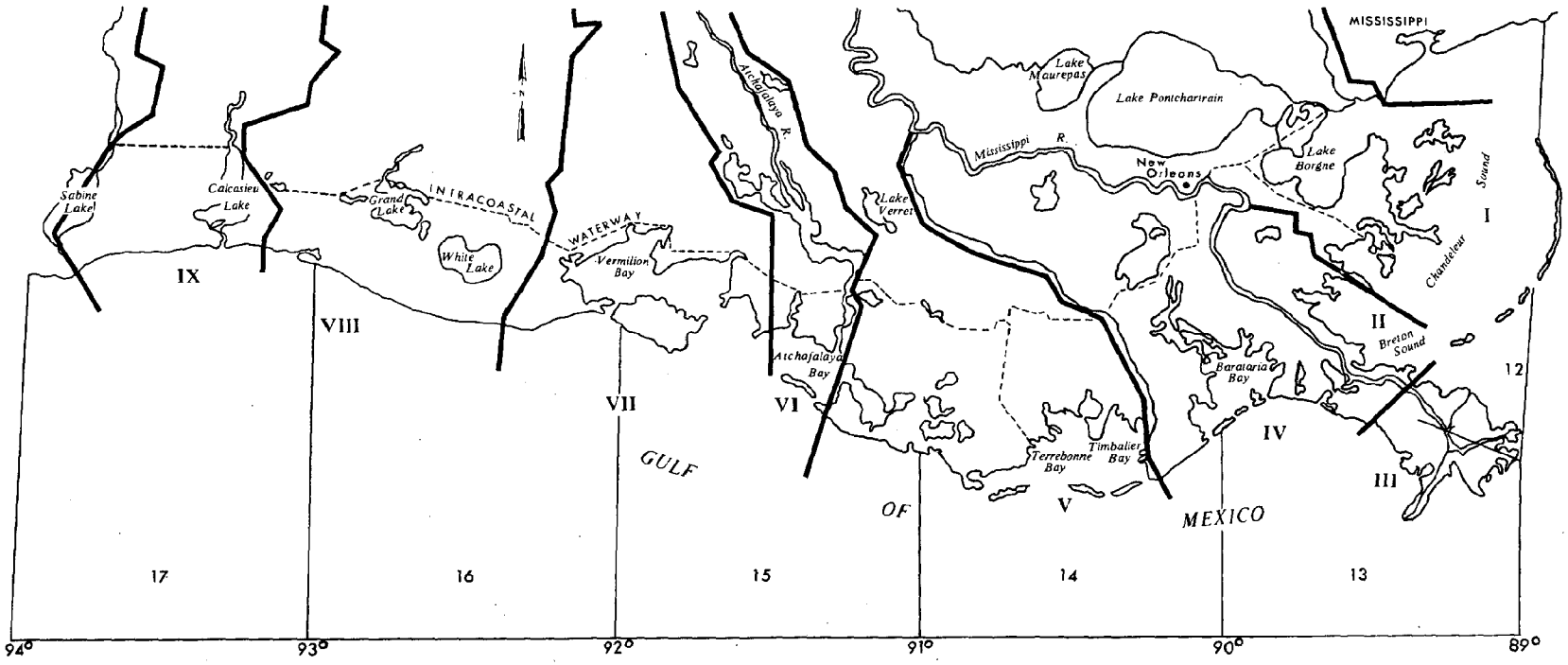


Figure 7. Coastal zone of Louisiana showing natural catchment basins (hydrologic units I-IX) offshore commercial fishing grids (12-17) and major bays, lakes, and rivers (adapted from (Lindall, et al., 1972).

Table 5. Statistical Relationship between the Number of Shoreline Miles Per Hydrologic Unit of Coastal Louisiana and Fishery Harvest Per Unit.

No.	Hydrologic Unit		No. Miles of Shoreline*	Rank	No. Pounds of Fish Harvest/ Acre x 10^6 **	Rank
I & II	Chandeleur and Breton Sounds	4805 2739	6544	3	193	2
III	Mississippi Delta		2981	4	36	6
IV	Barataria		6625	2	371	1
V	Terrebonne		8582	1	100	3
VI	Atchafalaya		515	8	34	7
VII	Vermilion		1915	5	47	5
VIII	Mermentau		1111	6	14	8
IX	Calcasieu		917	7	48	4

*** Rank - Difference Coefficient $(r_d) = 1 - \frac{6\Sigma\,(\text{difference of ranks})^2}{N(N^2-1)}$ N = no. in sample

$r_d = 0.71$ (r_d^2 = 50% data explained)

Sources: * Becker, R.E. (1972), "Measurement of Coastal Louisiana's Shoreline." Rept. 15, Coastal Resources Unit, Center for Wetland Resources, La. State Univ., Baton Rouge, 70803.

** Lindall, et al. (1972), "Louisiana Coastal Zone: Analyses of Resources and Resource Development Needs in Connection with Estuarine Ecology, Sections 10 and 13, Fishery Resources and their needs". Nat'l. Mar. Fishery Serv., St. Petersburg Beach, Fla.

*** Tate and Clelland (1957), "Nonparametric and Shortcut Statistics", Interstate Printers and Publishers, Inc.

- Tidal passes

Tidal passes are found between the barrier islands and then serve as a locus for the exchange of water, nutrients and organisms between the interdistributary basins (estuaries) and the open ocean.

c. Materials

- Sediments

Sediments in Louisiana estuaries are made up mainly of the clay-forming mineral, montmorillonite. The organic content of the sediments is high throughout the estuaries but it is usually more concentrated in the northern sections (Figure 8; Chabreck, 1972; Ho, 1971), which is probably the result of incomplete tidal exchange and differential tidal exchange (Ketchum, 1963). Most sediments usually show two distinct color layers, an upper gray layer which is aerobic and usually very thin (≈1 cm) and a lower, dark brown to black, layer which is anaerobic and quite thick (up to >2 meters). The absence of the top layer, during anaerobic conditions (lack of oxygen), sets up conditions for the transfer of nutrients, such as phosphates, from the sediments into the solution (Mortimer, 1941-42). Offshore the sediments are mostly muds but heavier sand material is usually found close to the shoreline or probably the point of its deposition (see Figure 9; Curray, 1970).

2. Biological Factors

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The biological factors of coastal Louisiana are greatly influenced by the climatic regime. A geographic location of approximately 30°N latitude makes for an almost subtropical climate; there are usually about 270 days or more in coastal Louisiana without a killing frost (see Figure 10; Cry, 1968). Rainfall is abundant (about 60 inches/yr) and

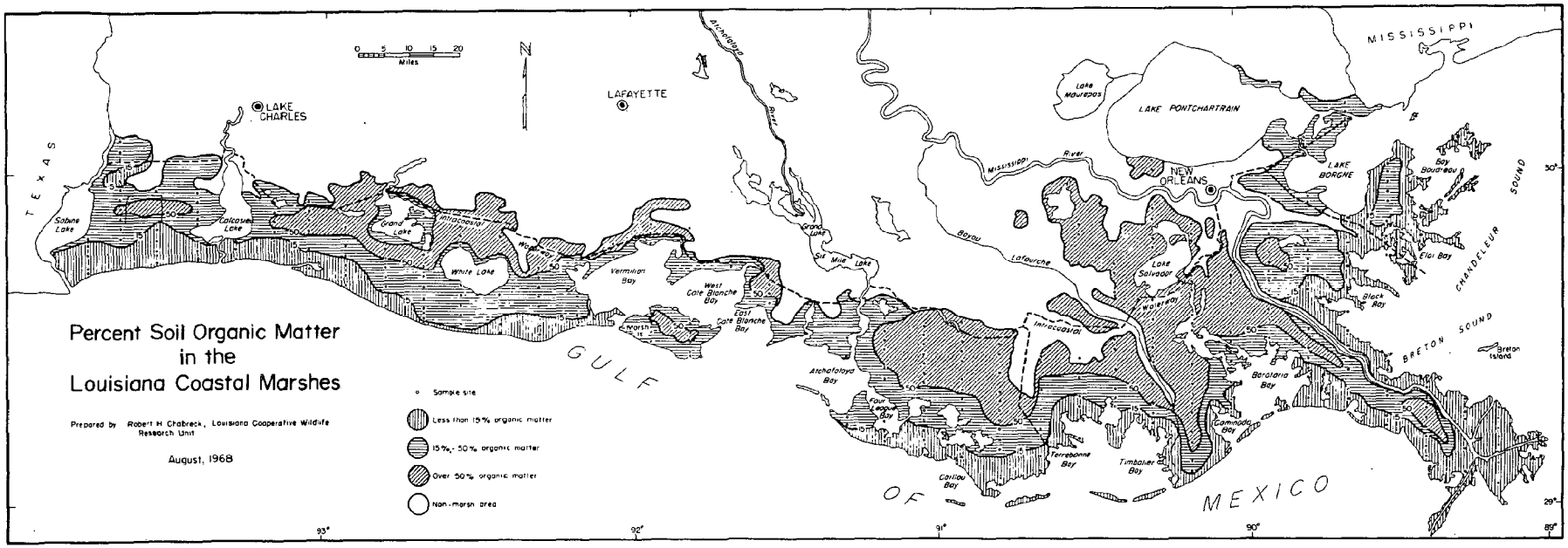

Figure 8. Percent soil organic content in coastal Louisiana (Chabreck, 1972).

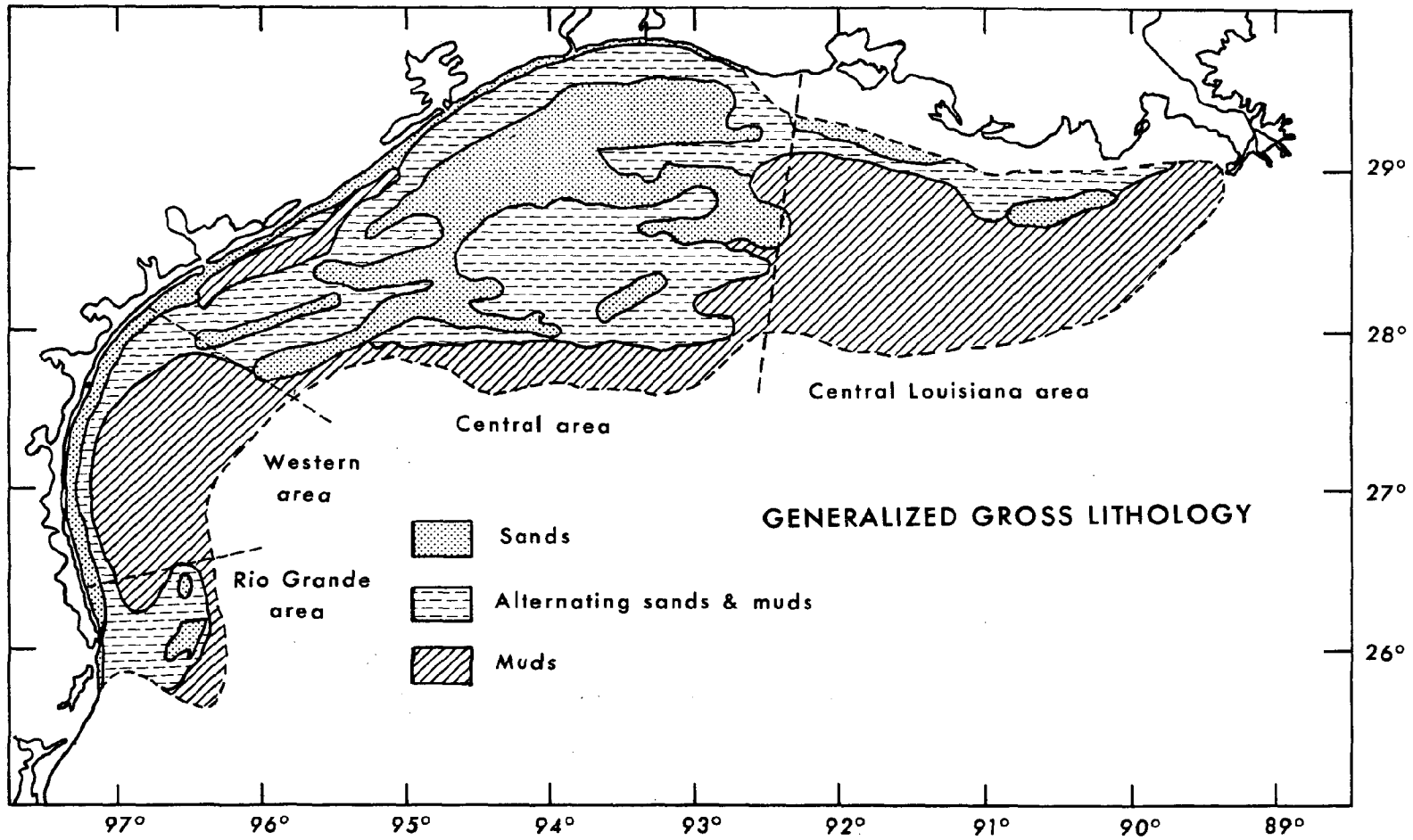

Figure 9. Generalized gross lithology of sediments on the shelf and upper continental slope. Mud is used here as the unconsolidated equivalent of shale (from Curray, 1970).

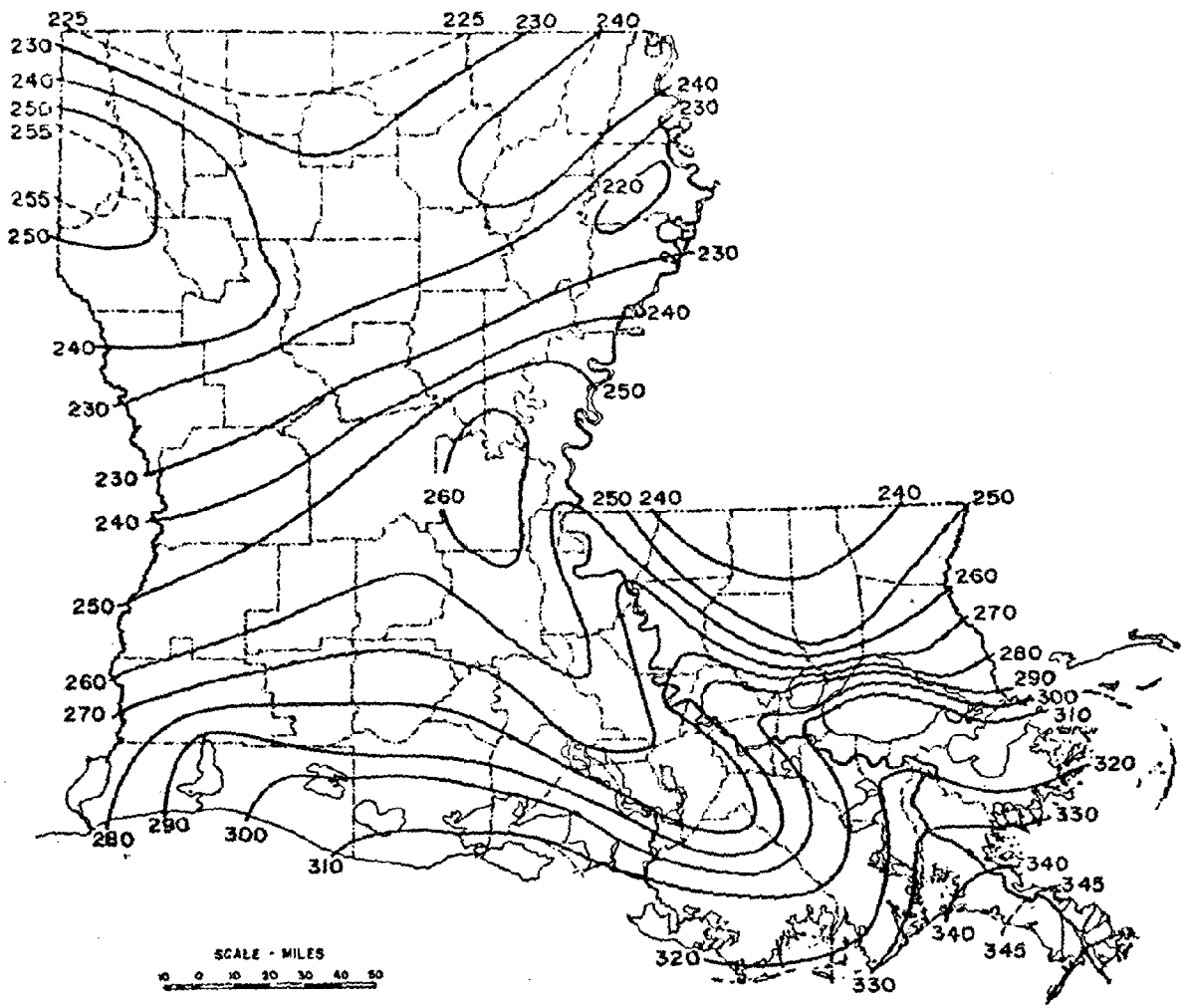

Figure 10. Annual distribution of number of days without killing frosts in Louisiana (Cry, 1968).

about equally distributed throughout the year. High humidity is characteristic of southerly winds with a long fetch across the warm Gulf of Mexico waters. Air temperatures usually reflect changes in the wind which usually blows from the east with a north component during winter and a south component during summer. Cyclones and/or hurricanes are an almost annual occurrence in coastal Louisiana.

The most important biological factors of coastal Louisiana can be divided into three major categories; they are:

a. Habitats

- Gulf offshore
- Beach spawning areas zone
- Tidal passes
- Open bays, lakes, and ponds
- Intertidal marsh

  Saline

  Intermediate

  Brackish
- Freshwater marsh
- Natural levees and ridges
- Cypress swamp
- Marsh-water interface zone

b. Functions

- Primary production
- Detritus production and movement
- Migration
- Spawning

- Nutrient cycles
- Feeding habits

c. Organisms

- Plants

  Marsh macroflora

  Attached algae

  Plankton

- Microorganisms
- Animals

  Benthic meiofauna, macrofauna

  Planktonic (including larvae of nektonic fish, etc.)

  Nektonic fauna (fishes), commercial fisheries, sport fish species

  Birds, including waterfowl

  Mammals (fur-bearing)

  Herptiles (alligator)

Each of these items is discussed below.

a. Habitats

- Gulf offshore

This is a region with silty-sand substrate and little benthic vegetation. Food webs are based on phytoplankton. On the bottom, many burrowing organisms of the filter feeder type are found. Many important sport fishes concentrate around the offshore oil platforms. Pelagic predatory big game fishes are found in the open Gulf area along the continental shelf. The continental shelf (depth less than 200 meters) is narrow near the mouth of the Mississippi River and over 100 miles wide in

southwestern Louisiana. This region is important winter spawning grounds for sport and commercial fishes and invertebrates such as menhaden, Atlantic croaker, mullet, brown and white shrimp (Arnold, 1958). It is also rich in shrimp production (Barrett and Gillespie, 1973; Guidry and White, 1973). This zone is also year-round habitat for rare and wide ranging fishes such as Ocean sunfish, oarfish, swordfish, king mackeral and sea mammals such as seals and whales. Demersal fish are seasonally abundant in different areas (Moore,et al., 1970). Many fishes with the estuarine-marine life cycle migrate to deep offshore waters in the fall and winter.

- Beach spawning areas zone

This is an intertidal region continually buffeted by waves, tides and currents. It possesses a rich floral and faunal community adapted to periodic exposure to the atmosphere. Psammon organisms live between the interstitial spaces in sand grains. Many molluscs, annelids and crustaceans of the burrowing type inhabit this zone. It is a critical area for juvenile pompano, Gulf kingfish, banded drum, longnose killifish and rough silversides (Hoese, 1965). It is used for nesting and rearing of young by shore and water birds such as brown pelicans, boobies, terns and gulls.

- Tidal passes

These are critical zones for the movement of organisms, nutrients, minerals and detritus between inshore and offshore regions. Depths in the passes generally exceed ten feet, bottom substrata are hard clay or sand and tidal currents often are very strong. Post larval fish and shrimp move through passes in early spring into the estuarine nursery grounds. Movement back offshore through the passes

occurs in the fall and winter for the purpose of spawning or overwintering (Haven, 1959).

- Open bays, lakes and ponds

The open water regions of bays are important regions for oyster beds in intermediate salinities (Tarver and Dugan, 1973; Pollard, 1973). Most organisms in these areas are benthic. These areas are characteristically turbid and shallow with a clayey-silt bottom. Bay anchovy and croaker are the abundant industrial fish in these areas (Dunham, 1972).

- Intertidal marsh (saline)

This zone is the region where much of the detritus which fuels estuarine systems is produced (Day, et al., 1973; Darnell, 1963). Biological productivity is very high in this area and the region supports a greater biomass and abundance of organisms than deeper water area (Kirby, 1971). Detritus produced by decomposition of shoreline emergent vegetation is transferred from this region by tides to consumer organisms in the open bays and offshore. This area contains a great proportion of the rich marsh-water interface where tidal flushing cycles nutrients, detritus and organism (Ho, 1973). Organisms living in the marsh are concentrated along the edge of these intertidal areas (Rogers, 1969; Harry Bennett, personal communication). Sediments in these areas are usually very soft with high proportions of organic matter. This is also the primary habitat for shallow shoreline fishes such as tidewater silversides, killifishes, sleepers, gobies, oysterfishes (Wagner, 1973). Oystergrass (*Spartina alterniflora*) is the dominant vegetation in this area. Marsh periwinkles (*Littorina irrorata*) and mussels (*Modiolus* sp.)

dominate the macrobenthic organism (Day, et al., 1973). Blue crabs are found in this area and are commercially important throughout intermediate, brackish and even fresh marsh areas (Adkins, 1972). About 22.1 percent of the total four million acres of marshland in coastal Louisiana is saline marsh (Chabreck, 1972).

- Intertidal marsh (intermediate)

This habitat is dominated by wiregrass (Spartina patens). Small ridges along bayous in these areas are vegetated by marsh elder (Iva sp.) and buckbrush (Baccharis sp.). Fiddler crabs (Uca sp.) forage along the shorelines. This habitat is seasonally inhabited by the same organisms as in the saline intertidal marsh. About 16.3 percent of the total four million acres of marshalnd in coastal Louisiana is intermediate marsh (Chabreck, 1972).

- Intertidal marsh (brackish)

This region lies at the upper extremity of salt water and tidal intrusion. This low salinity zone is vital as a nursery area for important sport and commercial fishes such as spotted seatrout, Gulf menhaden, red drum, Atlantic croaker and black drum (Wagner, 1973). Sediments in these areas are high in peat and other organic materials. Rangia sp. are also commonly found in this marsh type and in freshwater areas (Tarver and Dugan, 1973). Dominant vegetative species are wiregrass (Spartina patens), black rush (Juncus roemerianus) and three corner grass (Scirpus sp.). Primary range for muskrat occurs here. About 30.7 percent of the total four million acres of marshland in coastal Louisiana is brackish marsh (Chabreck, 1972).

- Freshwater marsh

This region lies at the upper ends of the interdistributary

basins and is prime habitat for alligator, bullfrog, nutria and many species of waterfowl. Dominant vegetation is maiden cane (Panicum hemitomon), water hyacinth (Eichornia crassipes), bulltongue (Sagittoria sp.) and alligatorweed (Alternanthera philoeroides). Organic soils with deep peat deposits are common here and floating marsh (flotant) occurs where a vegetative mat develops over deeper water areas. Elevation is no greater than one foot above sea level. About 30.8 percent of the total four million acres of marshland in coastal Louisiana is freshwater marsh (Chabreck, 1972).

- Natural levees and ridges

The natural levees and ridges occur along the flanks of active and abandoned river distributaries at elevations ranging from about two to ten feet. These ridges were formed by annual overbank flooding of distributaries. These features run in a lacework pattern from north to south through the coastal area and are flanked on each side by fresh marsh. Slightly further into the basin systems, subsidence has occurred long enough so that freshwater lakes are formed. The levees and ridges are vegetated by live oak (Quercus virginiana), willow (Salix nigra), hackberry (Celtis laevigata), cottonwood (Populus deltoides), and roseau (Phragmites communis). These areas support populations of white-tail deer, grey squirrel, and swamp rabbit. They also act as buffers against storm surges and block salinity intrusion into fresh water marshes (Chabreck, 1970).

- Cypress swamp

The bald cypress (Taxodium distichum) and tupelo gum (Nyssa aquatica) swamps occur between the fresh marshes and interdistributary levees in the upper ends of the basin systems. These areas

are seasonally flooded and dry depending on amounts of rainfall. Animals common in this habitat are nutria, mink, otter, white ibis, great blue heron. Rare and endangered species include anhingas and bald eagle.

- Marsh-water interface zone

Biologically, the marsh-water interface zone is probably the most important area of the marsh. Primary production of marsh grasses is highest in this zone, almost twice the rate found inland about 150 feet. Epiphyte algae also exhibit a higher production rate near the streamside (Table 6A; Day,et al., 1973). The small animals (meiobenthos and macrofauna) found in and above the sediments near the marsh grass show a greater biomass within 150 feet of the interface zone than samples taken about 900 feet away (Table 6B; Day,et al., 1973). White and brown shrimp are more densely distributed in shallow waters with large amounts of organic detritus and in shoreline areas that are unaltered (Loesch, 1965; Mock, 1966). Fishes in the marsh-estuaries also appear to be more densely distributed in the interface zone as Wagner (1973) found an isolated pond yielded about 3.3 times fish biomass per unit area than a pond in more open waters.

b. Functions

- Primary production

Primary production is the accumulation of organic matter by green plants per unit of time. In coastal Louisiana primary production operates at four levels: marsh grasses, epiphytes, benthic algae, and phytoplankton. Rates of production in coastal Louisiana are among the highest ever measured in coastal areas of the world (Table 7 ; Day, et al., 1973).

Table 6A. Primary Production in the Barataria Bay Area of Louisiana in g dry wt/m^2/year.

Marsh		Production Gross	Production Net*
Grass:	Streamside	14000	2960
	Inland (50 m)	9750	1484
	Average over marsh	8418**	1518**
Epiphytes:	Streamside	103.9	60†
	Inland (2 m)	27.3	-18.4†
	Average (to 2 m)	32.2	25.8
Water			
Phytoplankton		598	418
Benthos		698	488

* Net production is less respiration of plants
** Takes into consideration bare areas on marsh
† Community net production for epiphytes

Table 6B. Distribution of numbers and biomass of macrofauna in the marsh at Airport Lake, La. No. before slash is biomass in number/m^2 (Extracted from Day, et al., 1973).

Organism	Distance into Marsh From Water Edge 300m	Average Biomass To 50m
Polychaetes		
Aug.	.3/16	.14
Oct.	0	.18
Dec.	0	.20
		$\bar{x}$ = .17
Neritina		
Aug.	0	1.16
Oct.	0	1.15
Dec.	0	3.18
		$\bar{x}$ = 1.83
Sesarma		
Aug.	0	.88
Oct.	0	1.03
Dec.	0	.67
		$\bar{x}$ = .86
Fiddler		
Aug.	0	2.50
Oct.	0	4.68
Dec.	0	.45
		$\bar{x}$ = 2.54
Blue Crab		
Aug.	0	0
Oct.	0	.61
Dec.	0	.005
		$\bar{x}$ = .20
Littorina		
Aug.	0	8.16
Oct.	0	5.81
Dec.	0	3.95
		$\bar{x}$ = 5.98
Melampus		
Aug.	4.3/680	3.64
Oct.	.7/52	1.30
Dec.	0	1.05
		$\bar{x}$ = 1.99
Modiolus		
Aug.	0	2.43
Oct.	0	4.21
Dec.	0	2.94
		$\bar{x}$ = 3.19

Table 7. Value of Primary Production in Coastal Louisiana (Day, et al., 1973).

	Gross Production	Net Production
	$Kcal/m^2/yr$	
Marsh	9865	8071
Inside water	5184	3624
Continental shelf	2392	1672
	Kcal/yr	
Marsh ($4x10^6$ acres)	$1.59x10^{14}$	$1.3x10^{14}$
Inside water ($3.5x10^6$ acres)	$0.73x10^{14}$	$0.51x10^{14}$
Continental shelf ($12.8x10^6$ acres)	$1.23x10^{14}$	$0.86x10^{14}$
TOTAL	$3.55x10^{14}$	$2.67x10^{14}$

- Detritus production and movement

Generally marsh grasses are annual plants and they die back during the winter and are washed into the bays and offshore areas during the following spring tides. This dead plant material is called detritus and it is used as a food by the principal fishery species of coastal Louisiana (Day, et al., 1973).

- Migration

The life cycle of estuarine organisms is based on the migratory movements of the juveniles and adults. Juveniles move into the estuaries from the open ocean presumably for food and a protective habitat or home. Adults move out of the estuaries into the open ocean to avoid the physiological stresses of fresh water and to spawn the next generation. These migrations follow the tidal movements through the tidal passes and also perhaps the littoral currents that move along the shoreline (Truesdale, unpublished data).

- Spawning

Most estuarine organisms complete their reproductive cycle in the open ocean. Their spawning is generally restricted to specific areas, though much research is needed to quantify this aspect. Winter spawning grounds of the Gulf menhaden are shown in Figure 11.

- Nutrient cycles

Generally the most important substances in an ecosystem are often those present in the least concentrations or those limited by the rate of use. In the salt marshes of coastal Louisiana, monospecific stands of marsh grass (Spartina spp.) dominate primary production and this reaction is generally limited by available nutrients. However, on

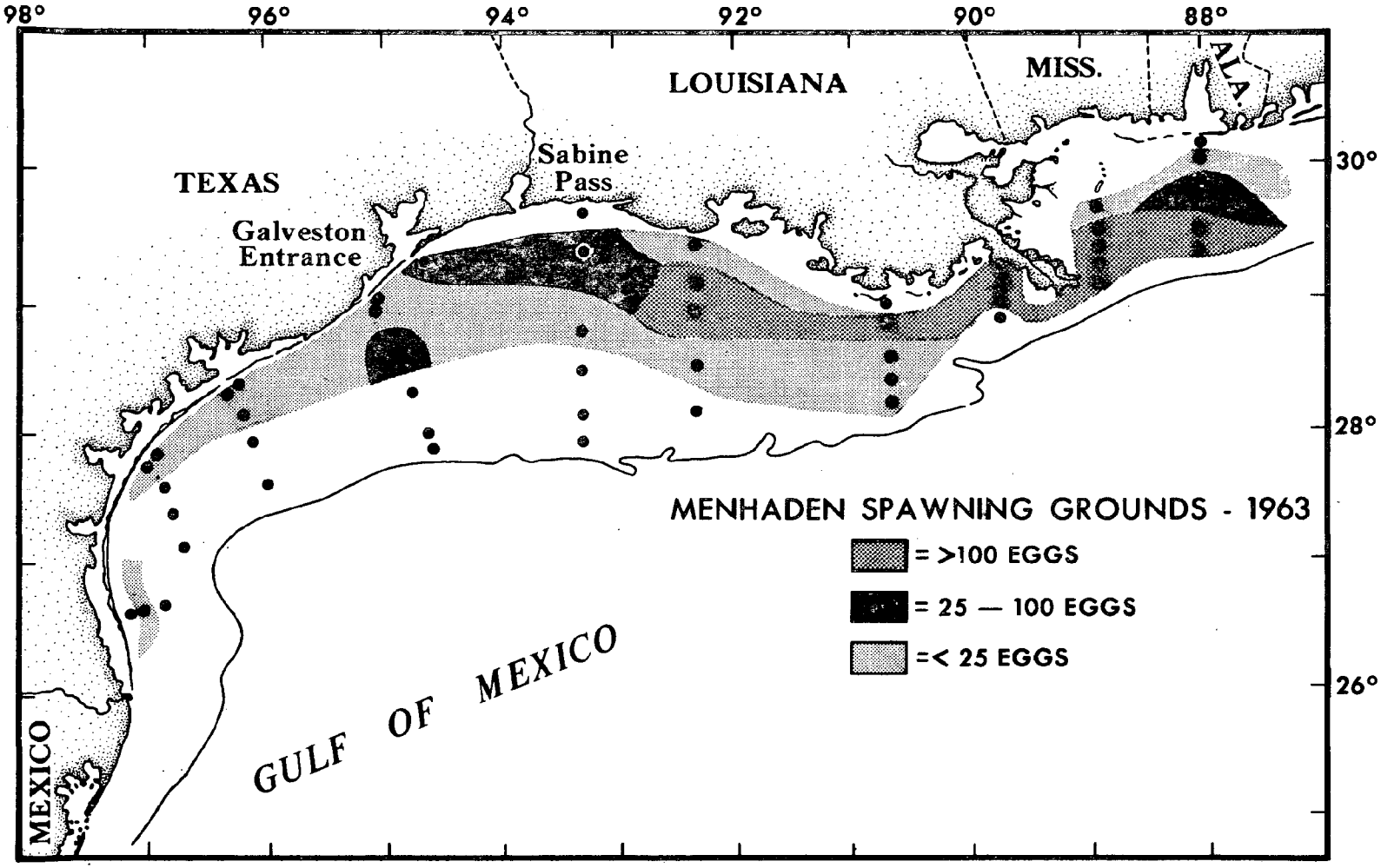

Figure 11A. The winter spawning grounds of the Gulf menhaden (adapted from Reintjes, 1970).

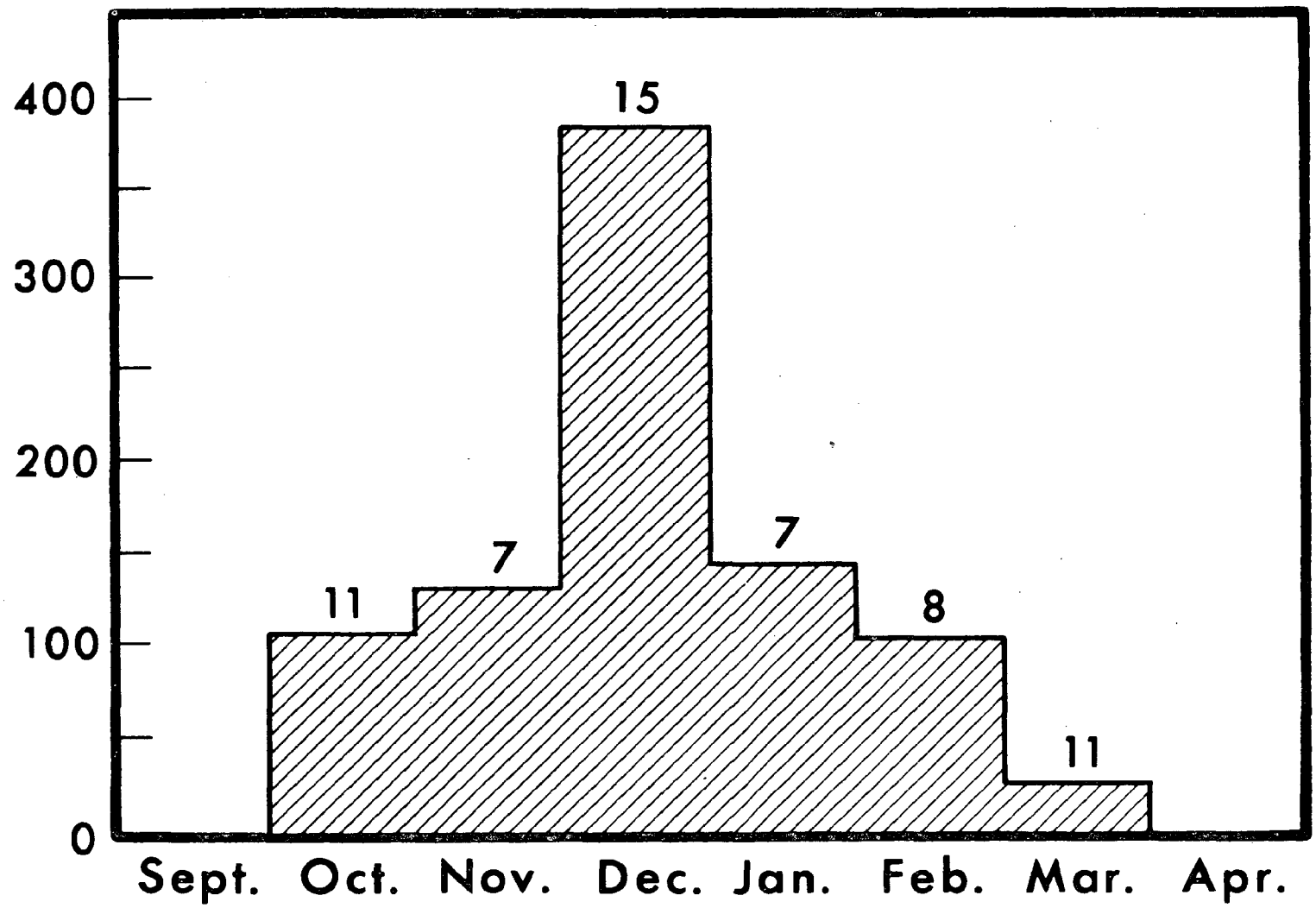

Figure 11B. Distribution of menhaden eggs in the northern and western Gulf of Mexico, 1963. The numbers represent the number of collections containing eggs (adapted from Reintjes, 1970).

the coastal marshes there is usually an excess of essential elements (Ho, 1972). The excess is probably a result of exchange with the clay minerals (montmorillonite) which makes up the sediments. These sediments form ion exchange beds that hold the reserve of nutrient material in equilibrium with the water. Pomeroy (1970) estimates that a 1-meter-thick layer of sediments in estuaries contains over a 500-year supply of phosphorus. The Spartina grass also aids in nutrient cycling as it acts as a pump moving the phosphorus and other elements (carbon and nitrogen) out of the deeper sediments into the water by means of bacterial degradation of the grass and then the subsequent digestion of the bacteria by detrital feeders. This aspect of cycling is done mainly by biological processes.

- Feeding habits

The primary food base for animals of the Louisiana coast is organic detritus which has a complex origin from the marsh grasses. The major consumer species, though highly dependent on detritus, are, however, opportunistic in that they cannot be assigned to a specific feeding (or functional) level and most can and do utilize alternative foods depending on the time, place and availability. This shifting of feeding habits presumably makes for more stable populations. Darnell (1961) suggests that the Lake Pontchartrain community consists of only two trophic (functional) levels: those which feed on organic detritus and those with a wide range of food preferences (see Figure 12).

It is likely that the characteristics of the food-web of Lake Pontchartrain is comparable to the generalized food-web structure of the coastal Louisiana.

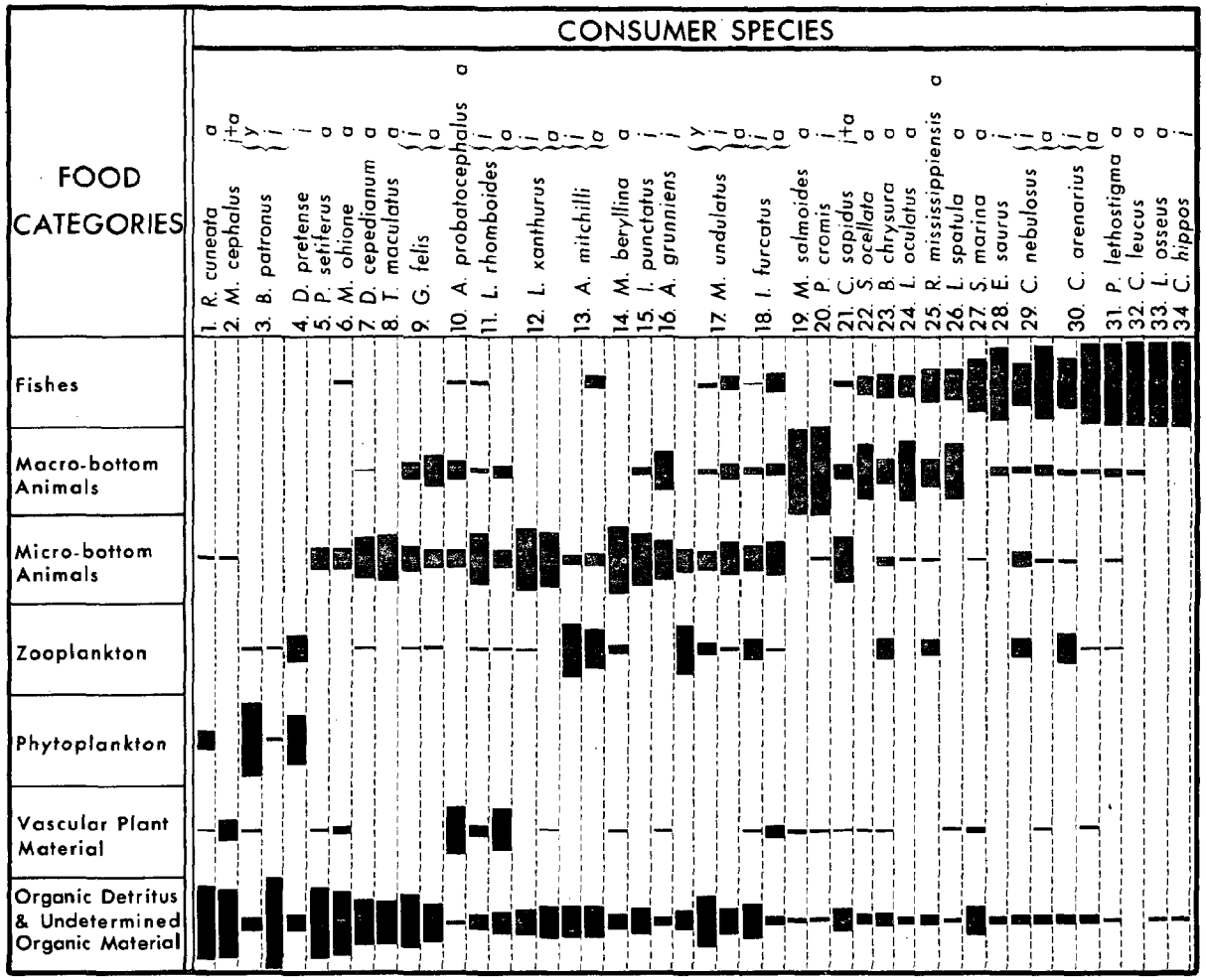

Figure 12. Trophic spectra for the most important consumer species in the Lake Pontchartrain community (adapted from Darnell, 1961).

c. Organisms

The organisms common to coastal Louisiana are outlined below. The references cited provide some specifics on them.

- Plants

  Marsh macroflora - vascular plants, submerged and emergent; multicellular algae (examples: Bastrichia, Ulva, Enteromorpha) (Kirby, 1972; Chabreck, 1970; Stowe, 1972)

  Attached algae - algae attached to other vegetation and living on the sediments of marshes and water bodies (Stowe, 1972)

  Plankton - floating, microscopic algae (Day, et al., 1973)

- Microorganisms

  Bacteria, yeast, protozoa, fungi and other unicellular organisms (Meyers, 1971; Meyers, et al., 1970 and 1971; Hood, 1972 and 1973; Crowe, 1972; Day, et al., 1973)

- Animals

  Benthic meiofauna and macrofauna - animals which inhabit the marsh and water sediments (Rogers, 1970; Day, et al., 1973)

  Planktonic animals - those small organisms which drift in the water columns, including those with weak swimming ability (example: Acartia, larvae of nektonic fish) (Gillespie, 1971; Cuzon du Rest, 1963)

  Nektonic animals - organisms swimming actively in the

water, including commercial fish and shellfish species and sport fish (Wagner, 1973; Foreman, 1968)

Birds (including resilient and migratory waterfowl) (Day, et al., 1973; Lowery, 1960)

Mammals (including fur bearers) (O'Niel, 1949; Palmisano, 1971)

Herptiles (including amphibians and reptiles) (Chabreck, 1971)

3. Selected Socio-economic Considerations

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a. Summary

The superport area - which includes St. Bernard, Plaquemines, Jefferson, Lafourche, Terrebonne, St. Mary, St. James and St. Charles - has grown substantially faster than the State of Louisiana and the nation during the 1960-1970 period and during the 1940-1970 period. Only St. James Parish has had a relatively small growth rate. The superport area has a high proportion of urban population due to Jefferson and St. Bernard parishes but the area most likely to be directly affected by the superport has a relatively lower growth rate and lower urbanization. Population projections suggest that the area's growth rate will be slower in the next two decades.

The superport can be expected to increase the growth rates and to increase urbanization. Generally this should be viewed as a favorable development because citizens obviously prefer the amenities offered by urban areas and the resulting economies of scale should enable state and local public agencies to offer a greater quantity and better quality of public services to the citizens of the area. However, state and local officials should start to plan now so that the increased population and economic development can be easily integrated.

The residents of the superport area are geographically stable when compared with the state and nation. The area has approximately 15 percent black population and a relatively large percentage of French-speaking residents. Population projections suggest that the percentage

of black residents will be decreasing slightly during the 1970 to 1985 period. The construction of the superport and related development should result in a further decrease in the percentage of black residents and a decrease in the percentage of French-speaking residents.

The educational level of the area is considerably below national averages. Perhaps one of the most significant advantages of the superport and related developments is that it will increase the population base so that additional economies of scale in the educational systems can be realized and so that the state and local tax base can be increased.

Almost 90 percent of families in the superport area receive their income from wages or salaries which is above the state and national averages. The superport area has about the same percentage of families receiving public welfare as the nation but is well below the state average. Incomes are higher and more evenly distributed in each of the superport parishes than in the state. When compared with the nation, the median family income of the superport parishes, except Jefferson and St. Bernard, are lower. St. James, Jefferson and St. Bernard parishes have had consistently high unemployment rates. The unemployment rates for the area are most severe among craftsmen, operators and unskilled laborers which are likely to be the very occupations most in demand during construction and operation of the superport and its induced development.

b. Area Covered by Study

This socio-economic study will include data on six eastern Louisiana Gulf coast parishes. From east to west the parishes are St. Bernard, Plaquemines, Jefferson, Lafourche, Terrebonne, and St. Mary.

Two inland parishes, St. James and St. Charles, were also included due to possible related economic development within these parishes and the relative growth impact which would be experienced by these parishes (see Figure 13).

Even the most cursory study would convince one that, although these parishes are closely connected culturally and economically as well as geographically, the area is anything but homogeneous. Of particular importance is the fact that portions of Jefferson and St. Bernard parishes are an integral part of the New Orleans metropolitan area.

c. Population Data

Table 8 presents population data on the superport parishes and the growth of urban and rural population. The ten year period growth rates presented are the geometric means of the annual rates over the indicated period. Based on the Census Bureau definition of urban and rural this table also contains the percentage of population living in urban areas in 1970.

The area as a whole has grown substantially faster in the last ten years (1960-1970) than either the state or the nation. Only Plaquemines and St. James parishes did not exceed the Louisiana and United States population growth rates. By far the greatest growth was experienced by Jefferson and St. Bernard parishes which had more than twice the national growth rate and almost five times the state average. Lafourche and Plaquemines have gone against state, national and area trends by having rural growth rates in excess of their urban rates.

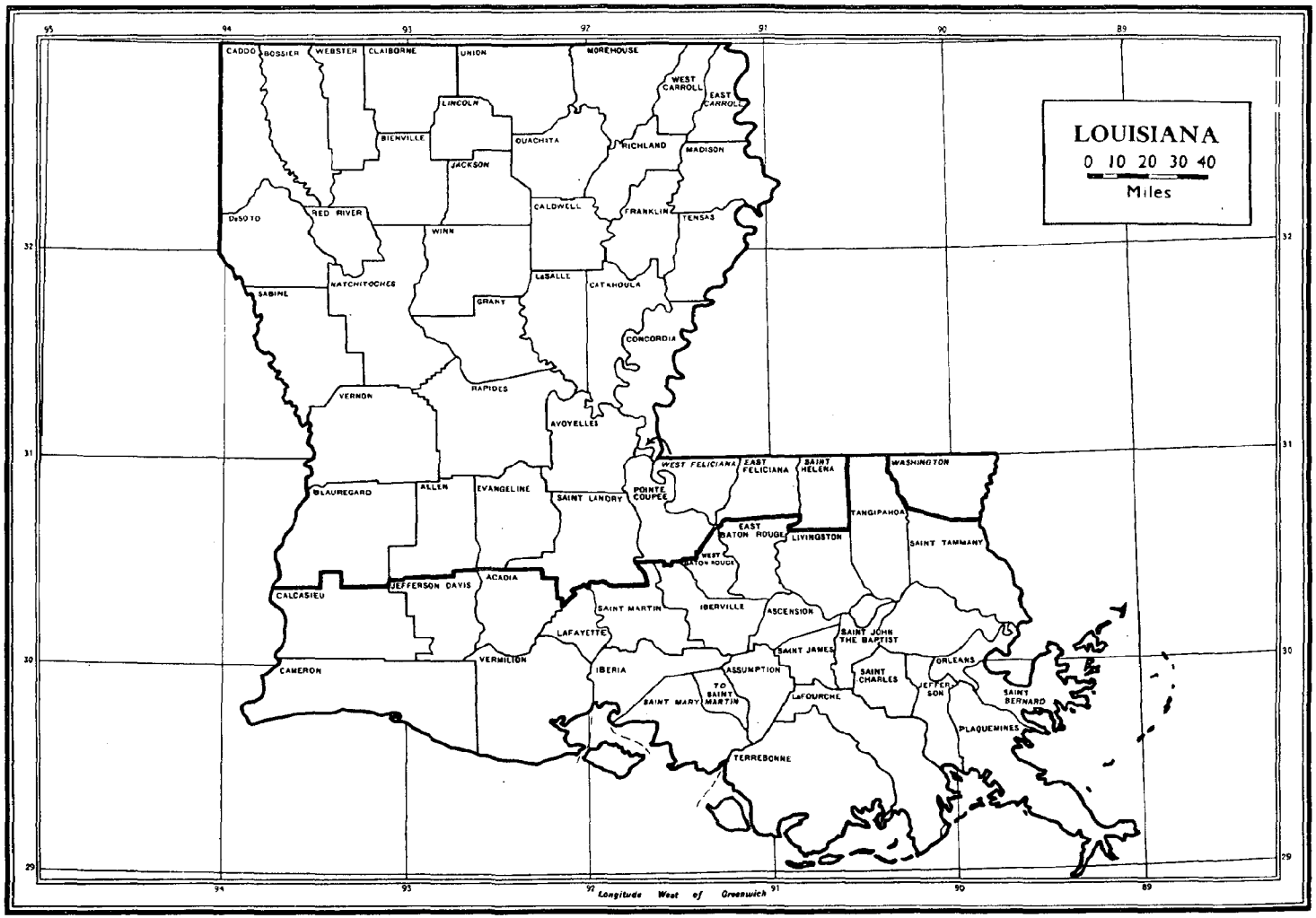

Figure 13. Parishes of Louisiana.

Table 8. Population Characteristics of Superport Parishes, Louisiana, and United States, Ten Year Intervals, 1940-1970.

	Population				Average Annual Rate of Growth 1960-1970			Percent Urban	Average Annual Rate of Population Growth
	1940	1950	1960	1970	Total	Urban	Rural	1970	1940-1970
Jefferson	50427	103873	208769	337568	4.92	5.12	1.34	95.8	6.54
Lafourche	38615	42209	55381	68941	2.21	1.54	2.67	38.8	1.95
Plaquemines	12318	14239	22545	25225	1.13	-0.80	2.05	28.3	2.42
St. Bernard	7280	11087	32186	51185	4.75	8.19	-4.76	91.3	6.72
St. Charles	12321	13363	21219	29550	3.37	5.54	2.67	27.2	2.96
St. James	16596	15334	18369	19733	.72	7.06	-1.15	32.8	.58
St. Mary	31458	35848	48833	60752	2.21	3.16	.65	65.2	2.22
Terrebonne	35880	43328	60771	76049	2.26	2.37	2.16	52.6	2.53
Superport Area	204895	279281	468073	669003	3.63	1.05	1.24	77.3	4.02
Louisiana	2363880	2683516	3257002	3641306	1.01	1.56	.31	66.1	1.45
United States	--	--	--	--	2.14	2.77	-0.03	73.5	1.43

Source: U.S. Bureau of the Census. Census of Population: 1960, Vol. I, Characteristics of the Population, Part 20, Louisiana.
U.S. Bureau of the Census. U.S. Census of Population, 1970, Vol. I, Characteristics of the Population, Part A, Number of Inhabitants, Section 1: United States, Alabama-Mississippi.

Urban population in Plaquemines actually declined. Particularly rapid urbanization may be noted in St. Bernard and St. James parishes both of which had declines in rural residents while experiencing unusually rapid urban growth.

The thirty-year growth trends (1940-1970) are not dissimilar to the ten year figures. Jefferson's and St. Bernard's growth rates far exceeded those of the state and nation, as well as those of the other parishes in this study. St. James had by far the lowest thirty-year growth rate caused by a decrease during the 1940-1950 period followed by a slow growth since that decade. The growth rates for the entire study area during the thirty-year period are greater than those of the United States or of Louisiana.

Percentage of population living in urban areas indicates that the study area has about the same degree of urbanization as the nation and is substantially more urbanized than the rest of the state. The New Orleans metropolitan parishes, Jefferson and St. Bernard, are, not surprisingly, the most urbanized and are approaching complete urbanization. Although St. James has had very large increases in urban vs. rural population, its urban base was so small that it still has the smallest portion of urban population. If Jefferson and St. Bernard were removed from the study, the percentage of urban population would drop to less than 45 percent which is far below either the state or national averages.

In summary, Table 8 shows that the superport area has a high population growth rate and that this is true of all but two parishes, Plaquemines and St. James; the New Orleans metropolitan area, however, is growing faster than the rest of the area. The study area has a high

proportion of urban population due to Jefferson and St. Bernard parishes, but the area most likely to be directly affected by the superport (Lafourche, Terrebonne, St. James) have relatively lower growth rates and lower urbanization.

Table 9 projects the population of the superport parishes into the future using the Cohort-Survival method. Due to the importance of these future population figures, a simplified explanation of the Cohort-Survival method is presented.

To begin the projection a profile of the current population is required. Such a profile requires population figures in three categories: age, race and sex. For practical purposes four tables of the numbers of inhabitants at various ages are needed: one for white males, one for non-white males, one for white females, and one for nonwhite females.

The next question is: what will happen to the people in each category over the next period, say 5 years? There are only three possible dispositions for any person: he will migrate out of the area, he will die, or he will continue to live in the area. Since age, race and sex form the primary determinates of mortality and of out-migration, it is possible to estimate how many of each group will remain in the subsequent periods. Since, for the individual, race and sex are considered immutable, the people who remain will simply move into the next age category.

Two final factors must be considered when determining the population for the next period. The lowest age group will be increased by new births. Since fertility is dependent primarily upon the race and age of the mother, birth may be estimated from the current profile. The final factor which will affect the population in the future is migration into the area. The number of incoming migrants, by age, race and sex

Table 9. Population and Density Projections, Superport Parishes and Louisiana, 1970-1985.

	Year	Jefferson	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. Mary	Terrebonne	Superport Area Total	State
Projected Population:											
	1970	337568	68941	25225	51185	29550	19733	60752	76049	669003	3641666
	1975	390631	71906	26173	63518	33492	19566	65086	80522	750894	3780588
	1980	454338	75593	27412	80482	38280	19399	69904	85823	851231	3954789
	1985	526291	79175	28424	101947	43907	19262	75184	91361	965551	4146327
Projected Annual Rate of Increase:											
	1970-75	2.96%	.85%	.79%	4.41%	2.54%	-0.17%	1.38%	1.15%	2.34%	.75%
	1975-80	3.02%	1.00%	.93%	4.85%	2.87%	-0.17%	1.44%	1.28%	2.54%	.90%
	1980-85	2.98%	.93%	.78%	4.84%	2.78%	-0.14%	1.47%	1.54%	2.55%	.94%
Projected Population Density Per Square Mile:											
	1970	555	49	13	98	76	76	99	57	94	75
	1975	642	51	13	112	86	75	106	60	106	78
	1980	747	54	14	154	98	75	114	64	119	81
	1985	865	57	14	195	113	74	122	68	136	85

Source: (1) Population Projections by Age, Race, and Sex for Louisiana and Its Parishes 1970-1985 by Roger L. Burford and Sylvia G. Murzyn. Occasional Paper Number 10, Division of Research, College of Business Administration, Louisiana State Univ., Baton Rouge, June 1972.
(2) Land Area from: James Calhoun, Ed. Louisiana Almanac (Gretna: Pelican Publishing Company, 1973), pp 138-160.
(3) Densities and growth rates calculated by authors.

must be estimated by historical trends and available knowledge of factors which may affect future patterns.

When each of the above factors has been applied to the current profile of population, it becomes possible to estimate the size of each element in the future sex-race-age profile. The same Cohort-Survival method may, of course, be applied to this new profile to extend the project another period into the future.

The results of any form of population projection are more dependent on the assumptions of future fertility, mortality, and migration than on the method used. Since mortality rates do not, in general, vary greatly over short periods, they were held constant. Also, mortality rates were assumed not to vary geographically so that general mortality tables for the United States in 1967 could be used.

Birth rates must be considered a greater source of inaccuracy because historically they have been subject to wide variation over relatively short periods. On the other hand, there is little reason to believe that fertility will vary from the historically low rates of 1970. Birth rates vary not only with time but with area of the nation. Thus, a different set of race-sex-age specific fertility figures were employed for each parish. Except in nation-wide projections where laws may be used to keep migration stable, migration seems the least predictable factor. The authors of the projection used here studied the history of each parish and then used historical trends unless there was reason to believe that the determining factors would be different in the future. It must be remembered, however, that nothing less than perfect prophecy could allow the completely accurate prediction of future migration

patterns. For example, the location of the superport will affect migration significantly.

Table 9 generally reflects the same growth patterns shown in Table 8 but the area's average growth rate is expected to slow somewhat. Every parish is expected to have a lower rate of growth in each of the future periods than in either the 1960-1970 or the 1940-1970 periods. St. James Parish is actually expected to decline in population beginning in the 1970-1975 time range. However, this projection must be modified if the superport is constructed.

The densities which result from the population projections are also presented in Table 9. Jefferson is by far the most densely populated parish and is expected to remain so; St. Bernard is the second most populated parish with no change expected. Plaquemines is the least dense with only about 13 people per square mile, and this will increase to only 14 by 1985. Again, we must keep in mind that secondary development stimulated by the superport will alter these projections.

Table 10 provides information on the relative mobility of the population in the superport parishes, Louisiana and the United States. Basically it shows the movement of people residing in the superport parishes in 1970 as compared with their residence in 1965. Approximately 53 percent of the population residing in the United States in 1970 lived in the same house they occupied in 1965. The same ratio was 55.8 percent for Louisiana and 56 percent for the superport area. All superport parishes except Jefferson and Plaquemines exceed the national average in geographic stability. However, Plaquemines Parish is surprisingly low; only 39 percent of the 1970 residents lived in the same house in 1965.

Table 10. Residence of 1970 Population in 1965 by Superport Parish, State of Louisiana, and United States.

	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Total Population, 5 yrs and older	302,876	100.00	60,968	100.00	22,398	100.00	46,314	100.00	26,207	100.00
Lived in same house in 1965	151,605	50.05	37,340	61.24	8,807	39.32	26,822	57.91	15,516	59.20
Lived in different house in U.S.	127,711	42.16	21,436	35.15	10,574	47.20	17,267	37.28	9,011	34.38
Lived in same parish	52,702	17.40	15,191	24.91	6,474	28.90	6,630	14.31	4,072	15.53
Lived in different parish (Co)	75,009	24.76	6,245	10.24	4,100	18.30	10,637	22.96	4,939	18.84
Moved from within state	50,819	16.77	4,602	7.54	2,527	11.28	8,955	19.33	3,164	12.07
Moved from different state	24,190	7.98	1,643	2.69	1,573	7.02	1,682	3.63	1,775	6.77
In Armed Forces	1,504	.49	103	.16	132	.58	141	.30	105	.40
Attending College	2,198	.72	100	.16	43	.19	66	.14	82	.31
Northeast	1,790	.59	138	.22	98	.43	33	.07	51	.19
North Central	3,729	1.23	197	.32	179	.79	143	.30	237	.90
South	15,758	5.20	1,083	1.77	1,108	4.94	1,375	2.96	1,331	5.07
West	2,913	.96	225	.36	188	.83	131	.28	156	.59
Abroad	2,397	.79	186	.30	104	.46	149	.32	131	.49
Moved 1965 residence (not reported)	21,163	6.98	2,006	3.29	2,913	13.00	2,076	4.48	1,549	5.91

	St. James		St. Mary		Terrebonne		Superport Area	State	U.S.
	Pop.	%	Pop.		Pop.	%	%	%	%
Total Population, 5 yrs and older	17,561	100.00	53,440	100.00	67,116	100.00	100.00	100.00	100.00
Lived in same house in 1965	13,692	77.92	28,618	53.55	41,647	62.05	55.96	55.80	53.0
Lived in different house in U.S.	3,063	17.44	21,361	39.97	21,257	31.67	38.81	36.98	40.4
Lived in same parish	2,139	12.18	14,011	26.21	14,008	20.87	19.30	22.04	23.3
Lived in Different parish (Co)	294	5.26	7,350	13.75	7,249	10.80	19.51	14.94	17.1
Moved from within state	761	4.33	4,484	8.39	4,416	6.57	13.35	8.18	8.4
Moved from different state	163	.92	2,866	5.36	2,833	4.22	6.15	6.75	8.6
In Armed Forces	35	.19	186	.34	157	.23	.39	.39	
Attending College	--	--	54	.10	74	.11	.43	.50	
Northeast	12	.06	104	.19	40	.05	.37	.49	
North Central	--	--	267	.49	392	.58	.86	.99	
South	94	.53	2,131	3.98	2,090	3.11	4.18	4.40	
West	57	.32	364	.68	311	.46	.72	.86	
Abroad	15	.08	372	.69	288	.42	.66	.76	1.4
Moved 1965 residence (not reported)	791	4.50	3,089	5.78	3,924	5.84	4.57	6.44	5.2

However, of the 61 percent which moved, 29 percent moved from another location in Plaquemines and 11 percent moved from within the state. In fact, Louisiana ranks low in the percentage of 1970 residents that had lived in other states in 1965--8.6 percent of residents in the United States had lived in a state different from their residence in 1965, whereas only 6.8 percent in the state and 6.2 percent in the superport area had lived in a different state. Not one parish exceeded the national average in this category. Jefferson and Plaquemines had the highest percentage of previously out-of-state residents with 8 percent and 7 percent, respectively.

One must conclude that by national standards, the residents of the superport area are geographically stable. Within the superport area, Jefferson and Plaquemines parishes experienced the greatest mobility.

d. Ethnic and Racial Characteristics of Population

Table 11 reveals the number of residents who were born outside the United States and those natives with at least one foreign parent. The most noticeable fact is that, although the proportion of the population in these groups is somewhat larger than the state average, it is well below the national average. Over 16 percent of the national population fall into one of these two categories, while only 5.1 percent of those in the study area are so classified. The pattern of country of origin of immigrants in the superport area is very similar to that for the state. This pattern differs from the national pattern mainly in that that superport parishes have a substantially greater percentage of individuals from Italy and Latin America. A generally lower percentage is from Central and Eastern Europe.

Table 11. Country of Origin, Superport Parishes, Louisiana, and United States, 1970.

	Jefferson	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. Mary	Terrebonne	Superport Area: Area Total	Superport Area: Area Percentage	State Percent	Nation Percentage
Total Population	337568	68941	25225	51185	29550	19733	60752	76049	669003	100.0	100.0	100.0
Native of native parentage	312772	67673	24038	47331	28920	19596	59302	74605	634237	94.8	96.2	95.3
Native of foreign or mixed parentage	18439	1078	862	3149	492	100	1076	1167	26363	3.9	2.7	11.8
Foreign born	6356	190	325	705	134	37	374	277	8393	1.2	1.1	4.7
Total Foreign Stock	24795	1268	1187	3854	630	137	1450	1444	34765	100.0	100.0	100.0
United Kingdom	1384	118	43	212	38	--	37	139	1971	5.7	6.6	7.3
Ireland	550	43	7	39	4	15	59	--	717	2.1	2.3	4.3
Sweden	183	7	12	17	7	--	--	9	235	.7	.9	2.4
Germany	2258	108	91	207	52	17	238	153	3124	9.0	10.2	10.8
Poland	399	28	38	27	7	--	18	30	547	1.6	2.0	7.1
Czeckoslovakia	133	--	9	7	--	--	--	6	155	.4	.7	2.3
Austria	290	7	9	57	--	--	29	28	368	1.1	1.2	2.9
Hungary	222	--	18	15	--	--	13	6	274	.8	.9	1.8
U.S.S.R.	478	7		37	--	8	19	7	557	1.6	2.2	5.8
Italy	5924	293	187	152	192	40	352	207	7349	21.1	20.8	12.6
Canada	880	92	44	94	39	10	50	92	1301	3.7	4.4	9.0
Mexico	648	110	36	134	21	--	74	116	1139	3.3	3.4	7.0
Cuba	1275	7	21	21	--	--	22	95	1441	4.1	4.8	1.7
Other America	4449	77	68	619	21	7	56	77	5374	15.5	13.0	2.9
All other and not reported	5722	371	604	843	249	40	483	479	8791	25.3	26.5	22.1

Source: Bureau of the Census, Census of Population, 1970. General Social and Economic Characteristics, Final Report PC(1)-C1: United States Summary.

Data on the three main ethnic and racial groups for each of the study parishes are presented in Table 12. By far the largest of these groups are the French-speaking residents. Unfortunately data on this group are available for only four of the eight parishes in this study. Of the four parishes, only Jefferson does not have a majority of French-speaking residents. Almost 40 percent of the population in the four parishes and over 80 percent of Lafourche Parish are French speaking.

Although the study area has a slightly higher proportion of blacks than the nation, the percentage is well below that for either the state or for the south. The area has about 15 percent black population. St. James has almost one-half black population, whereas only 5 percent of St. Bernard is black.

Persons of Spanish language heritage are by far the smallest of minority-ethnic groups with 3 percent of the superport area population. Two parishes, St. Charles and St. James, do not have enough residents in this category to be listed by the Census Bureau. Two other parishes have less than 1 percent. St. Bernard has the highest fraction of Spanish heritage with 9.2 percent. Only St. Bernard has more people with Spanish background than blacks.

The future of these ethnic and racial groups is not easy to predict. The number of French-speaking people in Louisiana has been declining, but efforts are now being made to preserve this group. Employing the methodology used in Table 9, projections of percentage of total population which will be nonwhite are given in Table 13. The portion of the population which is nonwhite is projected to decline slowly in each parish in the superport area.

Table 12. Major Ethnic and Racial Groups, Superport Parishes, 1970.

	Jefferson	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. Mary	Terrebonne	Total Superport Area	Louis-iana	United States
Total Population	337568	68941	25225	51185	29550	19733	60752	76049	669003		
Number French speaking	54277	57596	N/A	N/A	N/A	N/A	38089	47401	197363	N/A	N/A
Percent of population	16.1	83.5					62.7	62.3	38.17*		
Number Black	42046	7716	5778	2708	7774	9321	17056	11423			
Percent of population	12.5	13.4	22.9	5.3	26.3	48.7	28.1	15.0	15.2	29.8	11.1
Number Spanish language	12294	612	528	4695	<400	<400	545	937	19611		
Percent of population	3.94	.9	2.1	9.2	--	--	.9	1.2	2.9	1.9	4.0

Source: U.S. Bureau of the Census, U.S. Census of Population, 1970. General Social and Economic Characteristics, Final Report PC(1)-C20, Louisiana.
Council for the Development of French in Louisiana

Note: The Census Bureau does not give number of Spanish language heritage residents when less than 400.

*of four known parishes

Table 13. Projection of Percentage of Non-white Population, Superport Parishes and Louisiana, Five-year Intervals, 1970-1985

	Jefferson	Lafourche	Plaquemines	St. Bernard	St. Charles	St. James	St. Mary	Terrebonne	Superport Area	Louisiana
Percent non-white population										
1970	12.8%	11.4%	25.3%	5.5%	27.2%	47.7%	28.6%	18.1%	15.2%	30.7%
1975	12.4%	11.5%	24.0%	4.6%	26.9%	47.7%	28.0%	17.7%	14.9%	29.8%
1980	12.0%	11.4%	22.4%	3.7%	26.7%	47.6%	26.9%	16.9%	14.7%	29.0%
1985	11.6%	11.4%	21.0%	3.0%	26.5%	47.5%	25.9%	16.2%	14.3%	28.1%

Source: Population Projections by Age, Race, and Sex for Louisiana and Its Parishes, by Roger L. Burford and Sylvia G. Murzyn. Occasional paper No. 10, Division of Research, College of Business Administration, La. State Univ., Baton Rouge, June 1972.

e. Educational Attainment

Basic statistics on years of school completed by residents in the superport parishes are contained in Table 14. Relative to national standards, the educational level in this area is unusually low. Almost 55 percent of the residents have not completed high school. The median educational level is 10.1 years which is below both the nation (12.1) and the state (10.8). Almost 12 percent of adult males have not completed 5 years of school which is twice the national average. Only 10.9 percent of males and 6.0 percent of females have completed 4 years of college.

Jefferson Parish has the best record among the superport parishes and it ranks close to the national average in most categories. Over half of its population are high school graduates and more than 15 percent of males (7.1 percent of females) have finished 4 years of college. Only 5.9 percent of Jefferson's residents do not have at least 5 years of elementary education.

St. Bernard and St. Charles are second to Jefferson in educational attainment. St. Charles seems to have the better educated males of the two, with a median level of 11.2 years and 45.1 percent having completed high school. About 13 percent of St. Charles males have not completed 5 years of school. St. Charles' females are not as well educated. They have a median level of 10.7 years, with 41.5 percent high school graduates. In St. Bernard the females generally have a higher degree of educational attainment than those in St. Charles, but the degree of educational attainment for males is less than St. Charles in median years of school and percent of high school graduates. St. Bernard has a smaller proportion of individuals with less than 5 years

Table 14. Years of School Completed, Superport Parishes, Louisiana, and Nation, 1970.

	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Superport Area Total		State	Nation
	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	% Pop.	Number	Percent	% Pop.	% Pop.
Male, 25 yrs and over	80940	100.0	15150	100.0	6033	100.0	12095	100.0	6517	100.0	3931	100.0	13539	100.0	16532	100.0	154737	100.0	100.0	100.0
No. school yrs completed	1365	1.7	1307	8.6	281	4.7	160	1.3	130	2.0	150	3.8	835	6.2	1109	6.7	5337	3.4	3.9	1.6
Elementary: 1-4 yrs	4194	5.2	2425	16.0	651	10.8	734	6.1	690	10.6	467	11.9	1668	12.3	2355	14.2	13184	8.5	9.2	4.4
5-7 yrs	11192	13.8	3373	22.3	1199	19.9	2116	17.5	1044	16.0	842	21.4	2553	18.9	3146	19.0	25465	16.5	16.7	10.5
8 yrs	6719	8.3	1111	7.3	678	11.2	1515	12.5	582	8.9	316	8.0	1073	7.9	1450	8.8	13444	8.7	8.7	12.9
High School: 1-3 yrs	13933	17.2	2121	14.0	1084	18.0	2346	19.4	1131	17.7	628	16.0	2298	17.0	2603	15.7	28654	18.5	19.2	18.6
4 yrs	21503	26.6	3029	19.9	1441	23.9	3592	29.7	1953	29.7	1077	27.4	3208	23.7	3754	22.7	39557	25.6	24.7	27.7
College: 1-3 yrs	9757	12.0	758	5.0	356	5.9	998	8.5	490	7.5	222	5.6	1031	7.6	1065	6.4	13812	8.9	8.5	10.1
4 or more	12274	15.2	1026	6.8	343	5.7	634	5.2	497	7.6	229	5.8	873	6.4	1050	6.3	16927	10.9	9.1	13.5
Median School yrs completed	12.1		8.4		9.6		10.9		11.2		9.9		9.8		9.2		10.1		10.8 yrs	12.1 yrs
Percent High School graduates	53.8		31.8		35.5		43.2		45.1		38.9		37.8		35.5		45.4		42.3	51.3
Female, 25 yrs and over	86357	100.0	16071	100.0	5472	100.0	12873	100.0	6788	100.0	3931	100.0	13539	100.0	17068	100.0	160099	100.0		100.0
No. school yrs completed	1452	1.7	1199	7.4	258	4.7	235	1.8	269	4.0	150	3.8	835	6.2	1028	6.0	5426	3.4		1.6
Elementary: 1-4 yrs	3651	4.2	2029	12.6	485	8.4	528	4.1	482	7.1	467	11.9	1668	12.3	1874	11.0	11184	7.0		3.4
5-7 yrs	10846	12.6	4038	25.1	1033	18.9	2028	15.7	1222	18.0	842	21.4	2553	18.8	3327	19.5	25889	16.2		9.6
8 yrs	7521	8.7	1380	8.5	558	10.2	1396	10.8	623	9.2	316	8.0	1073	7.9	1409	8.2	14276	8.9		12.6
High School: 1-3 yrs	18480	21.4	2455	15.3	1175	21.5	3306	25.7	1375	20.3	628	16.0	2298	17.0	3341	19.6	33058	20.6		20.1
4 or more	29658	34.3	3442	21.4	1440	26.3	4495	34.9	2043	30.1	1077	27.4	3208	23.7	4240	24.8	47603	29.7		34.1
College: 1-3 yrs	8574	9.9	776	4.8	324	5.9	595	4.6	482	7.1	222	5.6	1031	7.6	975	5.9	12979	8.1		10.5
4 or more	6175	7.1	752	4.7	199	3.6	290	2.2	292	4.3	229	5.8	873	6.4	874	5.1	9684	6.0		8.1
Median School yrs completed	12.0		8.6		10.0		11.0		10.7		9.9		9.8		9.8		10.1			12.1 yrs
Percent High School graduates	51.4		30.9		35.9		41.8		41.5		38.9		37.8		35.7		46.3			52.7

Source: Bureau of the Census, Census of Population, 1970. General Social and Economic Characteristics, Final Report PC(1)-C20 Louisiana.

*Data on educational achievement in the state includes both males and females 25 years and older.

of school than does St. Charles.

The parish with the poorest educational record is Lafourche where most adults have less than 9 years of school and less than one-third are high school graduates. Almost a fourth of the males in Lafourche have not completed the fourth grade.

Some caution must be exercised in interpreting these data because the age profile of the parishes vary and this affects the data on educational attainment. Jefferson Parish, for example, is experiencing a rapid population growth rate which tends to result in a population of younger people who have received more years of schooling, whereas Lafourche Parish, which is growing less rapidly, will tend to have a relatively larger population of older individuals who have less education. Thus, an individual of a given age in Lafourche Parish may have the same probability of educational attainment as one living in Jefferson Parish but the data presented in Table 13 would not reveal this.

Table 15 partially fills the gap in Table 14. The top half of Table 15 shows the distribution of total enrollment among those in 3-34 year age bracket. This distribution is significantly affected by overall age distribution in the parish, the number of college enrollees, and the availability of nursery schools. The lower half of Table 15 shows the percentage of total population in each age group which is enrolled in school. Note that both the superport area and Louisiana compare more favorably with national data than in Table 14.

f. Income Data

Family income by general type is presented in Table 16. The percentages in the columns sum to more than one hundred percent due to the fact that many families receive more than one type of income. The

Table 15. School Enrollment by Type of School and Age, 1970.

	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Superport Area		Louisiana	United States
	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	Pop	no.	% Pop		
Total Enrolled, 3-34 yrs	104659	100.0	21813	100.0	7553	100.00	16740	100.0	9744	100.0	6794	100.0	17112	100.0	23156	100.0	207571	100.0	100.0	100.0
Nursery School	2157	2.1	127	.6	40	.5	229	1.4	56	.6	--	--	123	.7	147	.6	2879	1.4	N/A	N/A
Public	123		56		16		19		39				56		83		392			
Kindergarten	4704	4.5	1549	7.1	283	3.7	1086	6.5	232	2.4	137	2.0	524	3.1	706	3.0	9221	4.4	4.1	4.4
Public	453		1365		128		893		49		29		146		175		3238			
Elementary, 1-8 yrs	67491	64.5	13641	62.5	5234	69.3	10357	61.9	6834	70.1	4490	66.1	12428	72.6	16241	70.0	136716	65.9	62.6	50.1
Public	46978		12264		3609		8312		6014		3622		11421		14845		107065			
High School, 1-4 yrs	22940	21.9	4572	21.0	1761	23.3	4067	24.3	2332	23.9	1822	26.8	3704	21.6	5151	22.2	46349	22.3	24.3	22.3
Public	15443		4213		1126		3522		2205		1695		3436		4739		36379			
College	7367	7.0	1924	8.8	235	3.1	1001	6.0	290	3.0	345	5.1	333	1.9	908	3.9	12403	6.0	9.0	7.9
Percent of Total Population in Each Age Group Enrolled	152.3		52.2		48.7		56.2		54.4		56.0		46.2		48.7				N/A	57.2
3 and 4 yrs old	14.2		5.3		3.9		10.6		7.3		3.6		5.3		6.2				N/A	N/A
5 and 6 yrs old	70.7		77.0		57.3		88.9		58.7		47.9		54.9		53.0				65.7	72.4
7 to 13 yrs old	98.3		96.7		94.0		97.5		96.8		94.9		92.2		95.5				96.1	97.3
14 and 15 yrs old	97.0		93.5		99.6		94.9		95.1		90.5		91.8		89.8				93.3	95.9
16 and 17 yrs old	86.0		80.1		83.2		90.0		94.5		89.9		71.3		78.3				85.3	89.3
18 and 19 yrs old	49.4		53.3		41.4		49.2		45.7		70.4		30.7		40.7				50.9	56.6
20 and 21 yrs old	21.9		22.6		10.4		17.3		12.5		27.9		7.6		10.9				25.8	21.3
22 to 24 yrs old	9.4		9.4		2.9		7.7		4.3		8.8		1.6		4.6				11.4	
25 to 34 yrs old	4.4		3.0		1.9		4.7		2.6		1.3		1.7		2.7				4.3	6.1

Source: Bureau of the Census, Census of Population, 1970. General Social and Economic Characteristics, Final Report PC(1)-C20, Louisiana and PC(1)-C1 United States.

Note: Percentages add to more than 100 percent due to the fact many families have more than one source of income.

Table 16. Family Income, by Type, 1969.

	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Superport Area		Louisiana	United States
	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop	no.	% Pop		
All Families	84099	100.0	16279	100.0	5900	100.0	12645	100.0	6738	100.0	4013	100.0	14002	100.0	17298	100.0	160974	100.0	100.0	100.0
w/wage or salary income	76514	91.0	13848	85.1	5262	89.2	11656	92.2	5948	88.3	3366	83.9	12517	89.4	15025	86.9	144136	89.5	83.8	86.2
w/mean or salary income	$10,485		8137		8654		9834		9195		8127		8397		8507					
w/nonfarm self-employment income	9297	11.0	2389	14.7	711	12.05	1248	9.9	764	11.3	281	7.0	1208	8.6	2047	11.3	17945	11.1	9.9	10.7
w/mean nonfarm self-employment income	$ 8424		7017		5657		6009		5623		6227		6511		8243					
w/farm self-employment income	477	.6	541	3.3	131	2.2	66	.5	44	.6	139	3.5	198	1.4	243	1.4	1839	1.1	3.4	4.6
w/mean self-employment income	$ 2477		3766		2253		7177		2550		6746		2982		4109					
w/social security income	11375	13.5	2292	14.1	792	13.4	1686	13.3	926	13.7	808	21.9	2094	14.9	2385	13.8	22358	13.9	18.3	19.7
w/mean social security income	$ 1539		1445		1375		1468		1646		1532		1368		1340					
w/public assistance or public welfare income	$ 3508	4.2	1038	6.4	433	7.3	617	4.9	402	6.0	564	14.0	1191	8.5	980	5.7	8733	5.4	10.6	5.3
w/mean public assistance or public welfare income	$ 781		831		767		860		995		990		867		815					
w/other income	26479	31.5	3766	23.1	1198	20.3	3478	27.5	1680	24.9	784	19.5	2802	20.0	3021	17.5	43208	26.8	24.2	35.1
w/mean other income	$ 2333		1705		1635		1402		1653		1665		2112		1954					

Source: Bureau of the Census, Census of Population, 1970. General Social and Economic Characteristics, Final Report PC(1)-C20 Louisiana and PC(1)-C1 United States.

Note: Percentages add to more than 100 percent due to the fact many families have more than one source of income.

most important finding is that almost 90 percent of families have wage or salary income. This is well above the state (83.8) or national (86.2) average. All superport parishes exceed the state percentage of wage earning families and only Lafourche and St. James fall short of the national figure. The New Orleans metropolitan area has the highest percentage of families with wage or salary income and the highest mean family incomes from this source. Only Jefferson Parish exceeds the national mean family wage and salary income.

Slightly over 11 percent of superport area families receive nonfarm self-employment income, possibly reflecting self-employment in the fishing industry. Lafourche has the greatest fraction in this category, whereas St. James, where such income is least common, has less than one-half of the Lafourche percentage. In every parish the mean family income from nonfarm self-employment is exceeded by the mean wage or salary income.

Only about 1 percent of families receive farm self-employment income. This is less than the 4.6 percent average in the United States or the 3.4 percent for the entire state. This figure varies more than any other type of income--the range being from 0.5 percent in highly urbanized St. Bernard, to 3.5 percent in St. James. Mean average self-employment farm income is well below either salary or nonfarm self-employment income, but part of this deficit may be accounted for by the fact that money income often greatly understates real farm income.

The number of families receiving income from Social Security is well below the norms for the state or nation. Only St. James exceeds the United States average. All of the other parishes range between 13

and 15 percent.

Family income for public welfare follows almost the same pattern as Social Security. St. James has by far the highest percentage of families in this group, with all other parishes between 4.2 percent (Jefferson) and 8.5 percent (St. Mary). The superport area has about the same percentage of families receiving public assistance (5.4) as the nation (5.3) and is well below the Louisiana average (10.6 percent).

Table 17 presents data on average incomes and income distribution in the superport area. Incomes are higher and more evenly distributed in each of the eight parishes than in the state as a whole. When compared with the United States a different picture emerges. Only in Jefferson and St. Bernard does the median family income exceed that of the nation. The most striking difference from the rest of the nation is that, although median family income is lower in this area, the percentage of families with less than $5,000 a year in income is also lower.

Lafourche Parish is by far the poorest parish in the area with a median family income of less than $7,900. More than one-fourth of families in Lafourche Parish have less than $5,000 annual income.

It is difficult to determine the degree of equality of income distribution by looking at a schedule such as the one in Table 17. In order to compare different income distributions, several tools have been developed. The most frequently used tool is the Lorenz curve which relates the percentage of families to the percentage of income earned by the families. The question which the Lorenz curve seeks to answer is: What percent of all income goes to the lowest ten percent of the population? What percent to the lowest 20 percent? What percent to the lowest 50

Table 17. Distribution of Income by Parish, State, and United States, 1969.

	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Study Area		State	United States
Total Families	84,099	100.0	16,279	100.0	5,900	100.0	12,645	100.0	6,738	100.0	4,013	100.0	14,002	100.0	17,298	100.0	161,181	100.00	100.0	100.0
Less than $1,000	1,951	2.3	436	2.7	220	3.7	276	2.2	197	2.9	100	2.5	404	2.9	562	3.2	4,146	2.6	4.8	2.5
$1,000 to $1,999	1,978	2.3	765	4.7	312	5.3	292	2.3	290	4.3	317	7.9	820	5.6	815	4.7	5,589	3.5	6.9	3.4
$2,000 to $2,999	2,515	3.0	936	5.7	195	3.3	364	2.9	365	5.4	260	6.5	949	6.8	746	4.3	6,330	3.9	7.2	4.4
$3,000 to $3,999	2,835	3.4	979	6.0	297	5.0	472	3.7	328	4.9	297	7.4	856	6.1	983	5.7	7,037	4.4	7.0	4.9
$4,000 to $4,999	3,332	4.0	1,104	6.8	304	5.1	531	4.2	409	6.1	203	5.1	801	5.7	833	4.8	7,517	4.7	6.7	5.1
$5,000 to $5,999	4,002	4.8	1,203	7.4	468	7.9	573	4.5	463	6.9	250	6.2	1,064	7.6	1,349	7.8	9,377	5.8	6.9	5.7
$6,000 to $6,999	4,661	5.5	1,420	8.7	410	6.9	762	6.0	297	4.4	219	5.5	975	7.0	1,411	8.2	10,155	6.3	6.9	6.8
$7,000 to $7,999	5,931	7.0	1,423	8.7	494	8.4	1,032	8.1	439	6.5	340	8.4	972	7.0	1,365	7.9	11,976	7.4	6.9	6.7
$8,000 to $8,999	6,733	8.0	1,520	9.3	416	7.0	1,307	10.3	574	8.5	417	10.4	1,094	7.8	1,729	10.0	13,790	8.5	7.0	7.1
$9,000 to $9,999	6,585	7.8	1,304	8.0	500	8.5	1,119	8.8	547	8.1	351	8.7	967	6.9	1,538	8.9	12,911	8.0	6.0	6.3
$10,000 to $11,999	13,065	15.5	1,733	10.6	898	15.2	2,139	16.9	1,019	15.1	496	12.4	1,949	13.9	2,057	11.9	23,556	14.6	20.8	26.6
$12,000 to $14,999	13,403	15.9	1,763	10.8	703	11.9	1,909	15.1	965	14.3	392	9.8	1,526	10.9	2,009	11.6	22,670	14.1	9.9	16.0
$15,000 to $24,999	13,489	16.0	1,244	7.6	591	10.0	1,613	12.8	690	10.2	313	7.8	1,324	9.5	1,474	8.5	20,838	12.9		
$25,000 to $49,999	2,991	3.6	274	1.7	87	1.5	209	1.6	126	1.9	48	1.2	248	1.7	342	2.0	4,325	2.7		
$50,000 or more	638	.8	95	.6	5	.1	54	.4	24	.4	10	.2	53	.4	85	.5	964	.6	2.9	4.6
Median Family Income	$10,235		7,855		8,601		9,638		9,004		8,049		8,146		8,338		9,319		$7,530	$9,590
Mean Family Income	11,377		8,728		9,023		10,319		9,469		8,260		8,811		9,081					
Total Unrelated Individuals	$14,633		3,295		1,156		1,333		1,173		727		2,680		2,884					
Median Income	3,547		1,524		3,615		1,958		1,834		1,504		1,907		1,799				$1,726	$2,489
Mean Income	4,838		2,452		5,082		3,262		3,747		2,293		3,440		2,898					
Total Families and Unrelated Individuals	$48,732		19,574		7,056		13,978		7,911		4,740		16,682		20,182					
Median Income	9,404		6,870		7,886		9,128		8,276		7,214		7,159		7,579					
Mean Income	10,408		7,672		8,377		9,646		8,620		7,345		7,948		8,198					
Gini Ratio	.3547		.3788		.3457		.3170		.3570		.3685		.3806		.3685				.4269	

Source: Bureau of the Census, Census of Population 1970. General social and economic characteristics, Final Report PC(1)-C20, Louisiana.

Gini data from: Tom S. Sale, III. "A Study of the Size, Distribution of Income: The Case of Louisiana, 1950-1970." (Unpublished Ph.D. dissertation, La. State Univ., 1972.)

percent, etc.?

The Lorenz curve is depicted in Figure 14. It plots percentage of families, ranked from poorest families up, on the horizontal axis and percentage of total income they receive on the vertical axis. If there existed perfect income equality, the Lorenz curve would be a 45° line through the origin. A Lorenz curve which deviates from, or falls below, this 45° line measures the relative inequality in family income distribution. In Figure 14, for example, the lowest 50 percent of the families have 20 percent of total income.

The information provided in a Lorenz curve may be summarized by a single number known as the Gini coefficient. The Gini coefficient is computed by means of the following formula:

$$G = \frac{\text{Area in region A}}{\text{Area in region A + B}}$$

The greater the inequality the higher the value of the Gini coefficient. Values of the Gini coefficient are provided for each parish and the State in Table 17. All parishes in the superport area have a lower Gini coefficient than the State which means they have a more equal income distribution.

g. Employment Data

Table 18 presents the number and distribution of workers in major industries during 1970. In effect it provides an employment profile of the superport parishes and the State. The industries in which a significantly greater percentage of workers were employed in the superport parishes relative to the State are:

1) Mining

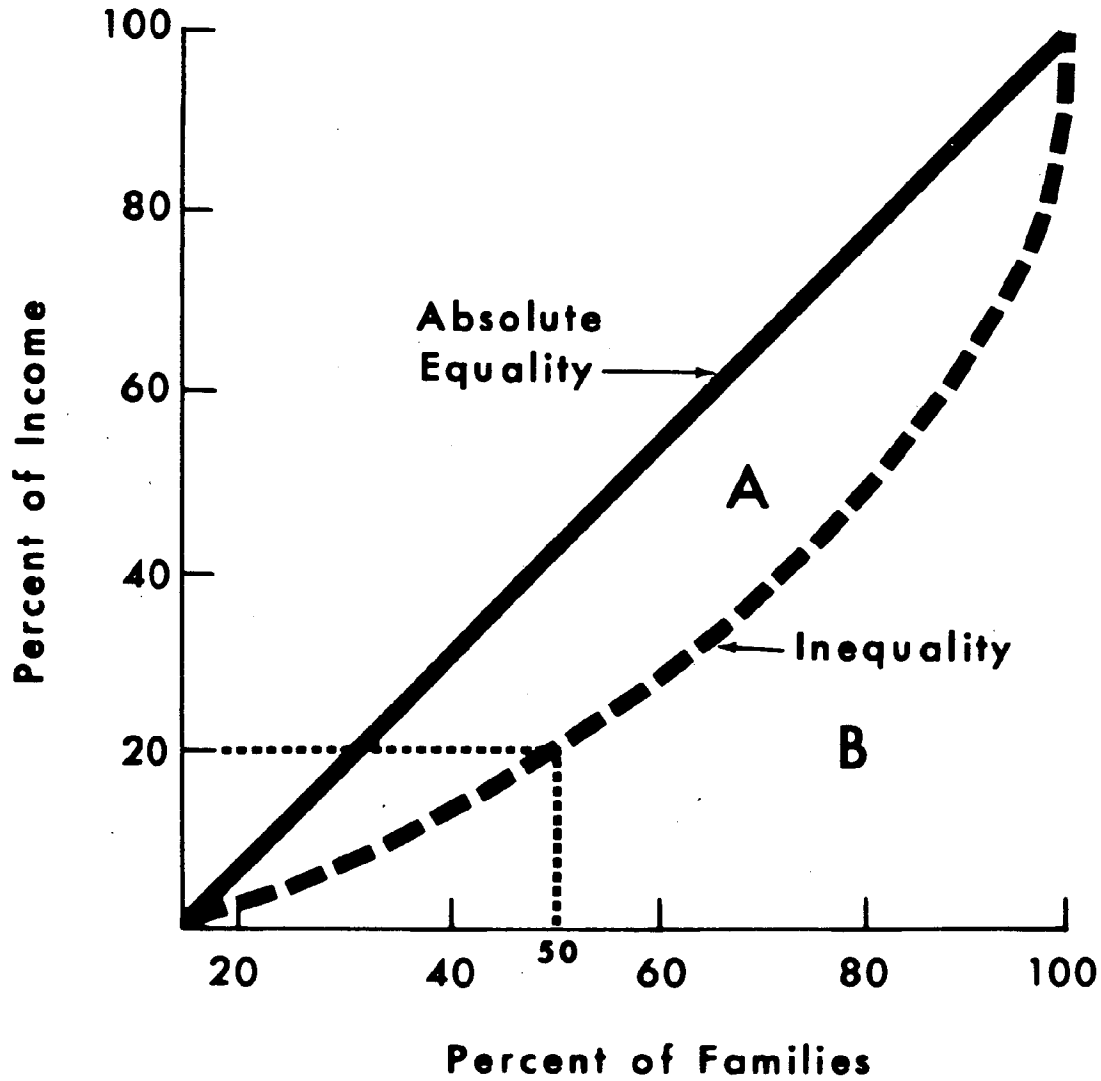

Figure 14. Hypothetical Lorenz curve.

Table 18. Industry of Employed Persons for Superport Parishes, 1970.

Industry	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Superport Area		Louisiana	
	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%	Emp.	%
TOTAL EMPLOYED, 16 Yrs and Over	122,345	100.00	20,964	100.00	7,905	100.00	17,521	100.00	8,910	100.00	4,976	100.00	19,130	100.00	22,958	100.00	226,709	100.00	1,158,268	100.00
Agriculture, Forestry, & Fisheries	1,129	.92	1,362	6.50	371	4.69	225	1.28	205	2.30	511	10.27	1,120	5.85	1,036	4.51	5,959	2.63	47,999	4.14
Mining	4,810	3.93	2,191	10.45	1,596	20.19	356	2.03	261	2.93	18	.36	2,347	12.27	4,255	18.53	15,834	6.98	46,584	4.02
Construction	10,608	8.67	1,789	8.53	1,015	12.84	1,785	10.19	723	8.11	313	6.29	1,491	7.79	1,465	6.38	19,189	8.46	96,609	8.34
Manufacturing	19,323	15.79	3,193	15.23	827	10.46	3,777	21.56	2,881	32.33	2,197	44.15	2,647	13.84	2,698	11.75	37,543	16.56	184,024	15.89
Furniture, Lumber & Wood Products	325	.27	40	.19	76	.96	31	.11	19	.21	35	.70	46	.24	22	.10	594	.26	17,237	1.49
Metal Industries	2,830	2.31	121	.58	55	.70	1,200	6.85	77	.86	80	1.61	492	2.57	184	.80	5,039	2.22	22,419	1.94
Machinery, Except Electrical	870	.71	157	.75	34	.43	121	.69	23	.26	34	.68	171	.89	534	2.33	1,944	.86	6,686	.58
Elect. Mach., Equip., & Supplies	299	.24	3	.01	--	0.00	17	.10	17	.19	--	0.00	5	.03	6	.03	347	.15	5,870	.51
Transportation Equipment	4,841	3.96	1,252	5.97	72	.91	333	1.90	493	5.53	483	9.71	553	2.89	552	2.40	8,579	3.78	17,558	1.52
Other Durable Goods	1,995	1.63	92	.44	52	.66	310	1.77	140	1.57	48	.96	201	1.05	184	.80	3,022	1.33	14,700	1.27
Food and Kindred Products	2,606	2.13	833	3.97	104	1.32	672	3.84	55	.62	577	11.60	370	1.93	747	3.25	5,964	2.63	22,314	1.93
Textiles & Fabricated Products	684	.56	28	.13	20	.25	152	.87	43	.48	66	1.33	6	.03	5	.02	1,004	.44	8,698	.75
Print., Publ., & Allied Indust.	1,033	.84	69	.33	11	.14	181	1.03	30	.34	14	.28	108	.56	79	.34	1,525	.67	8,149	.70
Chemicals and Allied Products	1,546	1.26	195	.93	269	3.40	116	.66	1,488	16.70	703	14.13	538	2.81	121	.53	4,976	2.19	25,223	2.18
Other Nondurable Goods (incl. not specified mfg. industry)	2,294	1.88	403	1.92	134	1.70	644	3.68	496	5.57	157	3.16	157	.82	264	1.15	4,549	2.01	35,170	3.04
Railroads & Railway Express Serv.	1,587	1.30	21	.10	29	.37	134	.76	59	.66	19	.38	44	.23	27	.12	1,920	.85	8,202	.71
Trucking Service & Warehousing	1,695	1.39	101	.48	66	.83	380	2.17	128	1.44	20	.40	284	1.48	368	1.60	3,042	1.34	13,680	1.18
Other Transportation	5,667	4.63	1,435	2.95	618	7.82	840	4.79	456	5.12	77	1.55	1,165	6.09	1,324	5.77	11,582	5.11	32,627	2.82
Communications	2,321	1.90	167	.80	56	.71	389	2.22	36	.40	13	.26	157	.82	318	1.39	3,457	1.52	15,082	1.30
Utilities & Sanitary Services	2,961	2.42	321	1.53	255	3.23	452	2.58	168	1.89	86	1.73	512	2.68	443	1.93	5,198	2.29	26,146	2.26
Wholesale Trade	9,270	7.58	748	3.57	221	2.80	1,084	6.19	348	3.91	88	1.77	860	4.50	849	3.70	13,468	5.94	55,832	4.82
Food, Bakery, and Dairy Stores	3,719	3.04	757	3.61	231	2.92	622	3.55	235	2.64	114	2.29	591	3.09	702	3.06	6,971	3.07	32,798	2.83
Eating & Drinking Places	439	.36	582	2.78	158	2.00	397	2.27	407	4.57	59	1.19	656	3.43	754	3.28	3,452	1.52	32,754	2.83
General Merchandise Retailing	495	.40	441	2.10	76	.96	520	2.97	216	2.42	40	.80	334	1.75	719	3.13	2,841	1.25	28,587	2.47
Motor Vehicle Retail. & Serv. Sta.	552	.45	646	3.08	108	1.37	418	2.39	166	1.86	69	1.39	512	2.68	559	2.43	3,030	1.34	28,385	2.45
Other Retail Trade	995	.81	1,169	5.58	247	3.12	997	5.69	309	3.47	127	2.55	925	4.84	1,267	5.52	6,036	2.66	65,929	5.69
Banking & Credit Agencies	204	.17	225	1.07	92	1.16	355	2.03	108	1.21	23	.46	226	1.18	286	1.25	1,519	.67	18,588	1.60
Insur., Real Estate, & Other Finance	282	.23	287	1.37	89	1.13	632	3.61	153	1.72	96	1.93	394	2.06	401	1.75	2,334	1.03	31,962	2.76
Business and Repair Services	555	.45	513	2.45	261	3.30	479	2.73	344	3.86	61	1.23	777	4.06	902	3.93	3,892	1.72	34,819	3.01
Private Households	869	.71	574	2.74	83	1.05	52	.30	230	2.58	85	1.71	698	3.65	486	2.12	3,077	1.36	41,875	3.62
Other Personal Services	472	.39	497	2.37	163	2.06	449	2.56	199	2.33	70	1.41	476	2.49	615	2.68	2,941	1.30	42,215	3.64
Entertainment & Recreation Serv.	146	.12	148	.71	64	.81	83	.47	27	.30	4	.08	148	.77	163	.71	783	.35	8,256	.71
Hospitals	387	.32	391	1.87	86	1.09	282	1.61	115	1.29	108	2.17	344	1.80	352	1.53	2,065	.91	40,212	3.47
Health Services, Except Hospitals	278	.23	290	1.38	79	1.00	214	1.22	57	.53	47	.94	222	1.16	217	.95	1,404	.62	20,589	1.78
Ele., Sec. Schools, & Colleges, Gov't.	819	.67	1,634	7.79	281	3.55	501	2.86	509	5.71	420	8.44	790	4.13	988	4.30	5,942	2.62	73,895	6.38
Ele., Sec. Schools, & Colleges, Priv.	244	.20	345	1.65	174	2.20	225	1.28	110	1.23	29	.58	270	1.41	474	2.06	1,871	.83	23,049	1.99
Other Educ. and Kindred Services	55	.04	55	.26	22	.28	41	.23	12	.13	26	.52	55	.29	96	.42	363	.16	4,847	.42
Welfare, Religious, & Nonprofit Organ.	175	.14	157	.75	95	1.20	210	1.20	92	1.03	51	1.02	139	.73	80	.35	999	.44	16,719	1.44
Legal, Engr., & Misc. Profess. Serv.	350	.29	425	2.03	69	.87	501	2.86	134	1.50	63	1.27	390	2.04	432	1.88	2,364	1.04	30,365	2.62
Public Administration	462	.38	500	2.39	473	5.98	1,121	6.40	222	2.49	142	2.85	555	2.90	682	2.97	4,157	1.83	53,520	4.62

2) Manufacturing of transportation equipment

3) Other transportation services (water)

The industries in which a significantly smaller percentage of workers were employed relative to the State are:

1) Agriculture, forestry and fisheries

[The area figure is distorted by the very small percentage of Jefferson Parish residents employed in this industry classification.]

2) All retail establishments

3) Banking, credit, and insurance

4) Repair services

5) Household services

6) Recreation

7) Education

8) Public administration

There are considerable variances among parishes which may best be discerned directly from Table 18.

Table 19 presents unemployment rates for the eight superport parishes and the State. The data are limited because they include only those jobs covered by unemployment insurance but they are the best available. Plaquemines Parish has had a consistently low rate of unemployment, whereas St. James Parish has had a consistently high rate. Generally, all superport parishes, with the exception of St. James, have been below the state unemployment average.

The last occupations of unemployed residents (1970) in the superport parishes are presented in Table 20. The data would be more meaningful if it were related to the percentage of employment in the listed

Table 19. Unemployment Rates of Superport Parishes and State of Louisiana, 1965-1972.

Year	Jefferson*	Lafourche	Plaquemines	St. Bernard*	St. Charles	St. James	St. Mary	Terrebonne	Louisiana
65	4.0	NA	NA	4.0	3.3	5.6	NA	NA	5.0
66	3.2	NA	2.6	3.2	2.4	4.7	NA	3.0	4.3
67	4.1	2.8	2.5	4.1	3.4	5.3	2.6	3.2	4.7
68	4.3	2.9	2.9	4.3	3.0	4.6	2.5	3.3	4.8
69	4.6	3.6	2.7	4.6	3.9	6.0	2.6	3.5	5.0
70	5.8	4.1	2.8	5.8	4.5	6.0	3.0	3.6	6.2
71	6.3	4.0	2.8	6.3	5.3	6.4	4.0	3.4	6.6
72	5.7	3.6	2.8	5.7	4.6	6.0	4.8	3.1	5.9

*The unemployment rates of Jefferson and St. Bernard Parishes are identical because they are part of the New Orleans SMSA.

Source: Louisiana Department of Employment Security

Table 20. Last Occupation of Experienced Unemployed Residents of the Superport Parishes, 1970.

Last Occupation of Experienced Unemployed	Jefferson		Lafourche		Plaquemines		St. Bernard		St. Charles		St. James		St. Mary		Terrebonne		Superport Area		Louisiana	
	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%	Empl.	%
Male, 16 years old and over	2,592	100.00	548	100.00	165	100.00	501	100.00	261	100.00	204	100.00	451	100.00	481	100.00	5,203	100.00	35,925	100.00
Professional, Technical, and Managerial	301	11.64	10	1.82	5	3.03	70	13.97	9	3.45	--	0.00	71	15.74	19	3.95	485	9.32	2,580	7.18
Sales Workers	149	5.76	8	1.46	--	0.00	13	2.59	--	0.00	--	0.00	4	.89	19	3.95	193	3.71	1,043	2.90
Clerical and Kindred Workers	176	6.81	16	2.92	--	0.00	31	6.19	6	2.30	--	0.00	10	2.22	15	3.12	254	4.88	1,642	4.57
Craftsmen, Foremen, and Kindred Workers	782	30.24	121	22.08	39	23.64	161	32.14	79	30.27	64	31.37	60	13.30	63	13.10	1,369	26.31	9,420	26.22
Operatives, Including Transport	601	23.24	219	39.96	70	42.42	122	24.35	77	29.50	28	13.73	130	28.82	190	39.50	1,437	27.62	9,533	26.54
Laborers, Except Farm	400	15.47	88	16.06	46	27.88	66	13.17	71	27.20	76	37.25	102	22.62	141	29.31	990	19.03	6,884	19.16
Farm Workers	5	.19	47	8.58	--	0.00	--	0.00	6	2.30	25	12.25	31	6.87	10	2.08	124	2.38	1,558	4.34
Service Workers, Including Private Household	172	6.65	22	4.01	5	3.03	38	7.58	13	4.98	11	5.39	43	9.53	24	4.99	328	6.30	3,007	8.37
Female, 16 years old and over	1,697	100.00	307	100.00	126	100.00	327	100.00	90	100.00	91	100.00	395	100.00	250	100.00	3,283	100.00	23,164	100.00
Professional, Technical, and Managerial	136	8.01	15	4.89	22	17.46	5	1.53	22	24.44	4	4.40	26	6.58	14	5.60	244	7.43	1,820	7.86
Sales Workers	159	9.37	14	4.56	--	0.00	19	5.81	20	22.22	--	0.00	32	8.10	37	14.80	281	8.56	1,891	8.16
Clerical and Kindred Workers	620	36.54	34	11.07	46	36.51	143	43.73	26	28.89	13	14.29	72	18.23	64	25.60	1,018	31.01	5,520	23.83
Operatives, Including Transport	211	12.43	64	20.85	11	8.73	89	27.22	--	0.00	7	7.69	51	12.91	28	11.20	461	14.04	3,216	13.88
Other Blue-Collar Workers	67	3.99	18	5.86	5	3.97	9	2.75	--	0.00	6	6.59	31	7.85	15	6.00	151	4.60	969	4.18
Farm Workers	--	0.00	--	0.00	6	4.76	--	0.00	--	0.00	--	0.00	57	14.43	--	0.00	63	1.92	380	1.64
Service Workers, Except Private Household	314	18.50	103	33.55	27	21.43	40	12.23	22	24.40	32	35.16	69	17.47	73	29.20	680	20.71	5,126	22.13
Private Household Workers	109	6.42	19	6.19	9	7.14	8	2.45	--	0.00	15	16.48	31	7.85	15	6.00	206	6.27	3,183	13.74

occupations. Then we could determine the various ratios of unemployed/employed for each occupation in each parish. However, time constraints prohibited us from doing this. It is significant, however, that 73 percent of unemployed male workers in the superport area had previously worked as craftsmen, operators and unskilled laborers (values underlined in Table 20). These would be the very occupations most in demand during superport construction, and to a considerable extent, by the secondary economic expansion in the petro-chemical industries generated by the superport.

4. Selected Data on Commercial Fisheries in Superport Region

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a. Summary

The following summary gives some of the important data contained in the chapter but it is not intended to be a substitute for a thorough reading of the chapter. The validity and relevance of the conclusions are determined by the sources and treatment of the data and the reader should be thoroughly familiar with these. Also, many important data could not be summarized.

(1) Employment in the Fishery Industry

The employment in fishing and fish processing and packaging has decreased from 3500 employees in 1960 to 2800 in 1972 and employment in the fishery industry had decreased from 0.93 percent in 1966 to 0.76 percent in 1971. Although the data understate employment in the fishing industry, the trend is definitely downward, except for St. Mary and Terrebonne Parishes. Given the fact that fish landings have increased in quantity, this negative trend in employment must be due to out-of-area fish processing and to capital investment which has increased employee productivity.

(2) Fish Landings

Louisiana landings account for 10 percent of the total value of commercial fish landings in the nation, 24 percent of shrimp landings, 15 percent of oysters, 56 percent of menhaden and 10 percent of crabs. Hence, fish constitute a valuable economic resource to the state and to the nation and must not be ignored in assessing possible environmental damage resulting from a proposed deep draft terminal.

In assessing potential damages one must first determine the value of fish in waters located in the proximity of the superport. However, because fish are common property resources, there is no economic mechanism which reflects or indicates the value of fish in the ocean. Fish are valued only when they are landed and this value, in the long run, represents only the value of labor and capital expended on catching the fish and delivering them to dockside. However, these are the only data available and while they do not indicate the value of fish in the ocean, they enable one to determine the relative economic significance of the fisheries within parishes and within water bodies.

The current price per pound of all major species increased between 1958 and 1971, but the real prices (eliminating inflationary effects) of shrimp and menhaden decreased. In terms of total value of landings, shrimp are the most significant catch with an average annual value over the 14-year period of $18 million; menhaden are second with $5 million and oysters third with $3 million. Terrebonne Parish accounts for 27 percent of the total value of landings and Lafourche Parish accounts for 24 percent.

Data on sources of fish catch again illuminate the importance of shrimp and menhaden in the superport area. Nearly $55 million worth of shrimp and $11 million of menhaden were taken from waters in the eastern half of coastal Louisiana in 1971. The most valuable offshore grid areas (Figure 15) are those located at the eastern end (10) and the central part (15) of Louisiana. They produced $13 million and $16 million respectively in 1971. Nearly 68 percent of all menhaden caught in the superport area are taken from Grid 15.

The three most productive coastal water bodies are: (1) Breton Sound which produced $84 million in 1971 or 8.6 percent of total superport area value over 1963-71 period, (2) Barataria and Caminada Bays produced $5 million in 1971 or 7.6 percent of total area value in 1963-71, and (3) Timbalier Bay which yielded $3 million in 1971 or 3.5 percent of total area value for 1963-71.

In terms of revenue produced per surface area, Adams Bay is the most productive with $164 average per year from 1963 to 1971, and in 1971 it yielded $400 per surface acre. Barataria and Caminada Bays produced $53 per surface acre (1963-71) and $83 per surface acre in 1971. Next highest are Lake Pelto ($26 per surface acre in 1963-71 and $42 in 1971), followed by Lake Barre ($22, $38), Breton Sound ($19, $21) and Caillou Bay ($18, $27).

All coastal water bodies together yielded $7.60 of revenue per surface acre per year from 1963 to 1971 and $10.78 per surface acre in 1971. Shrimp were the most valuable catch per acre and produced $4.18 per year, 1963-71, and $6.37 in 1971. Oysters produced $1.93, and $2.54 and menhaden yield was $0.87 and $0.88 per surface acre.

b. An Overview of Problem

One possible effect of the proposed deep draft terminal is that it might negatively affect the fishery industry in Louisiana through oil spills, dredging, increased effluents, etc. The following data are provided to acquaint the reader with the fishing industry in Louisiana and to provide data for an environmental cost-benefit analysis. Part c presents data on employment in Louisiana fisheries and related industries in the eight "superport" parishes. Throughout this study the superport

parishes are considered Jefferson, Lafourche, Plaquemine, St. Bernard, St. Mary, St. Charles, St. James and Terrebonne. Part d describes the principal commercial species, their life cycle and their relative economic importance. Part e relates the problems of common property resources to the fisheries and the difficulties produced for cost-benefit analysis. Part f presents volume and value data on fishery landings in the superport parishes. Part g contains data on the volume and value of fish catches by grid areas in the coastal zone and part h contains projections of quantities, prices and values of major species from 1970 to 2000.

In 1972 Louisiana led the nation in the number of pounds of fish landed by commercial fishermen. The 1972 catch was more than one billion pounds which represented 22.7 percent of the total volume landed in the United States (U.S. Department of Commerce, 1972). This represented a decrease of 326 million pounds from 1971, equivalent to a 5.4 percent decrease in the national total. In terms of value, the 1972 Louisiana landings ranked fourth behind California, Texas and Alaska. The total value of Louisiana landings was $72 million or 10.2 percent of the national total. The decrease in value from the 1971 landings amounted to $714,000.

c. Employment in Louisiana Fisheries and Related Industries

(1) The Data

One important indicator of the importance of the fishery industry on the Louisiana economy is the employment and total wages generated in this industry. The data do not cover the entire state and are limited to the eight "superport" parishes with one exception. Because our preliminary studies indicated that a considerable quantity of fish

caught in other parishes were processed in Orleans Parish we decided to include that parish. Column 8 in Tables 21 and 22 show total data for the "superport" parishes without Orleans, whereas Column 9 shows total data for the eight superport parishes plus Orleans.

Data for each parish include average monthly employment, total annual wages for each industry and a calculated "average annual wage" for each of the three major industries. This will enable the reader to compare wages of workers among industries and parishes. Employment and wages were gathered for three industrial categories conforming to the Standard Industrial Classification (SIC) coding system. These include Fisheries (SIC 09), Canned and Cured Seafoods (SIC 2031), and Fresh or Frozen Packaged Fish (SIC 2036). The data are based on quarterly tax reports received from employers subject to the Louisiana Employment Security Law.

One particular problem arises in the use of such data and it should be noted by the reader. Prior to January 1, 1972, the Louisiana Employment Security Law excluded the self-employed, and those working for employers with fewer than four employees. As a result, the data on Fisheries (09) can be expected to understate both the employment totals and total wages since many fishermen are either self-employed or are members of employment units having less than four employees.

Table 22 presents employment in fishing and fish processing and packaging in percentages of total employment in each parish from 1966 to 1971. In this way it is easy for the reader to ascertain the changes in the relative importance of fisheries vis-a-vis total employment in each parish.

Table 21. Total and Average Wages and Employment in Fisheries (09), Canned and Cured Seafoods (2031) and Fish Processing and Packaging (2036) Industries in Superport Parishes, 1960-1972*.

	Industry	Jefferson	Lafourche	Orleans	Plaquemines	St. Bernard	St. Mary	Terrebonne	Total w/o Orleans	Total w/Orleans
1960	Employment (09)	8	122	130	122	3	235	94	584	714
	(2031, 2036)	797	205	212	189	99	282	967	2539	2751
	Total Wages (09)	26143	315829	691022	498096	2291	212945	276140	1331444	2022466
	(2031, 2036)	1394741	117246	365482	215066	39909	137862	1301592	3344278	3709760
	Average Wages (09)	3268	2589	5316	4083	764	906	2938	2780	2833
	(2031, 2036)	1750	572	1724	1138	403	489	1346	1317	1348
1961	Employment (09)	11	72	108	151	5	134	70	443	551
	(2031, 2036)	714	189	185	134	100	236	782	2155	2340
	Total Wages (09)	36970	252740	574236	602404	2945	133611	178538	1207208	1781444
	(2031, 2036)	1185909	109385	376422	203572	35318	122346	1051903	2708433	3084855
	Average Wages (09)	3361	3510	5317	3989	589	997	2551	2725	3233
	(2031, 2036)	1661	579	2035	1519	353	518	1345	1267	1318
1962	Employment (09)	15	72	8	124	12	112	72	407	415
	(2031, 2036)	750	101	195	16	154	239	756	2016	2211
	Total Wages (09)	46852	293499	49805	623161	3916	143803	273135	1384366	1434171
	(2031, 2036)	1336192	74967	426068	43095	52912	132593	1064230	2703989	3130057
	Average Wages (09)	3123	4076	6226	5025	326	1284	3794	3401	3456
	(2031, 2036)	1782	742	2185	2693	3436	555	1408	1341	1416
1963	Employment (09)	15	81	8	118	12	107	92	425	433
	(2031, 2036)	721	78	214	15	728	261	798	2001	2215
	Total Wages (09)	44894	356187	67664	517255	9812	155128	388137	1538863	1539077
	(2031, 2036)	1332260	82685	476929	52834	62655	157910	1206184	2894528	3371457
	Average Wages (09)	2993	4397	8458	4384	818	1450	4219	3621	3554
	(2031, 2036)	1848	1060	2229	3522	490	605	1512	1651	1522
1964	Employment (09)	90	104	11	154	14	109	134	605	616
	(2031, 2036)	686	107	287	22	103	271	715	1904	2191
	Total Wages (09)	541199	386886	74213	846362	12447	129350	488113	2404357	2478570
	(2031, 2036)	1241733	110616	1010509	59814	48458	160904	1062044	2683569	3694078
	Average Wages (09)	6013	3720	6747	5496	889	1187	3643	3974	4023
	(2031, 2036)	1810	1034	3521	2719	471	594	1485	1409	1686

Table 21. (con't)

	Industry	Jefferson	Lafourche	Orleans	Plaquemines	St. Bernard	St. Mary	Terrebonne	Total w/o Orleans	Total w/Orleans
1965	Employment (09)	92	84	6	156	4	183	170	689	695
	(2031, 2036)	686	120	282	26	121	253	739	1945	2227
	Total Wages (09)	596393	339489	70324	687139	6847	266866	806385	2703119	2773443
	(2031, 2036)	1486471	152761	858455	68875	60250	165315	1149298	3082970	3941425
	Average Wages (09)	6483	4042	5860	4405	1712	1458	4743	3923	3991
	(2031, 2036)	2167	1273	3044	2649	498	653	1555	1585	1770
1966	Employment (09)	101	67	6	121	6	157	108	560	566
	(2031, 2036)	646	123	337	22	135	213	677	2014	2351
	Total Wages (09)	689407	276394	56721	426799	8628	203265	463288	2695164	2751885
	(2031, 2036)	1316790	114608	1045232	55582	64828	149410	1054414	2755632	3800864
	Average Wages (09)	6826	4125	9454	3527	1438	1295	4290	4812	4862
	(2031, 2036)	2038	932	3102	2526	480	701	1557	1368	1617
1967	Employment (09)	86	90	--	110	6	139	88	519	519
	(2031, 2036)	609	164	313	26	178	200	814	1991	2304
	Total Wages (09)	679445	479203	--	443962	9210	197300	424689	2233809	2233809
	(2031, 2036)	1521678	196459	1046963	91522	81142	140103	1267162	3298066	4345029
	Average Wages (09)	7901	5324	--	4036	1535	1419	4826	4304	4304
	(2031, 2036)	2499	1198	3345	3520	456	701	1557	1656	1826
1968	Employment (09)	84	98	--	84	6	136	69	477	477
	(2031, 2036)	581	72	270	27	127	152	729	1688	1958
	Total Wages (09)	736872	557563	--	344608	12211	202276	341605	2195135	2195135
	(2031, 2036)	1608557	113582	1164165	74850	89298	102720	1295768	3284775	4448940
	Average Wages (09)	8772	5689		4102	2035	1487	4951	4602	4602
	(2031, 2036)	2769	1578	4312	2772	703	676	1777	1946	2272
1969	Employment (09)	77	94	--	72	6	138	72	459	459
	(2031, 2036)	635	79	207	--	228	147	656	1745	1952
	Total Wages (09)	821114	586119	--	391190	14966	294311	445226	2552926	2552926
	(2031, 2036)	1612363	157690	973774	--	122018	108179	1343978	3344228	4318002
	Average Wages (09)	10664	6235	--	5433	2494	2133	5003	5562	5562
	(2031, 2036)	2539	1996	4704	--	535	736	2049	1916	2212

Table 21. (con't)

	Industry	Jefferson	Lafourche	Orleans	Plaquemines	St. Bernard	St. Mary	Terrebonne	Total w/o Orleans	Total w/Orleans
1970	Employment (09)	80	72	--	88	8	141	73	462	462
	(2031, 2036)	567	81	147	--	191	240	769	1848	1995
	Total Wages (09)	786741	505641	--	501958	17649	341480	446581	2600050	2600050
	(2031, 2036)	1723436	188591	708713	--	95177	206456	1645413	3859073	4567786
	Average Wages (09)	9834	7023	--	5704	2206	2422	6118	5628	5628
	(2031, 2036)	3041	2328	4821	--	498	860	2140	2088	2290
1971	Employment (09)	70	103	--	105	13	135	92	518	518
	(2031, 2036)	562	69	298	--	155	238	615	1639	1937
	Total Wages (09)	712680	643223	--	627317	32452	452018	651918	3119608	3119608
	(2031, 2036)	1723436	184168	1510171	--	115822	215969	1469370	3708765	5218936
	Average Wages (09)	10181	6245	--	5974	2496	3348	7086	6022	6022
	(2031, 2036)	3067	2669	5068	--	747	907	2389	2263	2694
1972	Employment (09)	77	261	--	106	13	222	143	822	822
	(2031, 2036)	583	59	383	--	135	226	612	1615	1998
	Total Wages (09)	851800	2434528	--	598550	27110	440941	1244831	5597760	5597760
	(2031, 2036)	1673570	188813	1639854	--	130721	215009	1364490	3572503	5212457
	Average Wages (09)	11062	9328	--	5647	2085	1986	8705	6810	6810
	(2031, 2036)	2871	3200	4282	--	968	951	2230	2212	2608

*St. Charles and St. James Parishes are considered to be superport parishes but were ommitted because they have virtually zero employment in sic 90, 2031, and 2036.

Sources: see text for source and explanation of data

Table 22. Fisheries (09), Canned and Cured Seafoods (2031) and Fish Processing and Packaging (2036). Employment as Percent of Total Employment by Parish* and by Area, 1966-1071.

	Industry	Jefferson	Lafourche	Orleans	Plaquemines	St. Bernard	St. Mary	Terrebonne	Total w/o Orleans	Total w/Orleans
1966	Aver. Quarterly Parish Employment	53823	9615	206523	6736	7036	13989	14095	105294	311817
	Fishing (09)	.19	.70	.01	1.80	.08	1.12	.77	.53	.18
	Fish Processing and Pkg (2031, 2036)	1.20	1.28	.17	.33	1.92	1.15	4.80	1.91	.75
	All Fishing and Processing as % Total	1.39	1.98	.18	2.13	2.00	2.27	5.58	2.44	.93
1967	Aver. Quarterly Parish Employment	55654	9695	203726	7287	7406	14775	14362	109179	312905
	Fishing (09)	.16	.93	--	1.51	.08	.94	.62	.47	.16
	Fish Processing and Pkg (2031, 2036)	1.10	1.70	.16	.36	2.40	1.35	5.67	1.82	.73
	All Fishing and Processing as % Total	1.26	2.63	.16	1.87	2.48	2.29	6.29	2.29	.89
1968	Aver. Quarterly Parish Employment	59516	9938	203987	7684	7061	15302	15116	111617	315604
	Fishing (09)	.15	.99	--	1.10	.08	.89	.46	.43	.15
	Fish Processing and Pkg (2031, 2036)	.98	.73	.14	.36	1.80	.99	4.83	1.51	.62
	All Fishing and Processing as % Total	1.13	1.72	.14	1.46	1.88	1.88	5.29	1.94	.77
1969	Aver. Quarterly Parish Employment	63172	9839	202402	8244	7475	16076	16004	120810	323212
	Fishing (09)	.13	.96	--	.88	.08	.86	.45	.38	.14
	Fish Processing and Pkg (2031, 2036)	1.01	.81	.11	--	3.03	.91	4.10	1.44	.60
	All Fishing and Processing as % Total	1.14	1.77	.11	.88	3.11	1.77	4.55	1.82	.74
1970	Aver. Quarterly Parish Employment	65679	9627	200129	8716	7503	16064	16980	124591	324698
	Fishing (09)	.13	.75	--	1.01	.10	.87	.43	.37	.14
	Fish Processing and Pkg (2031, 2036)	.87	.85	.08	--	2.55	1.49	4.53	1.48	.61
	All Fishing and Processing as % Total	1.00	1.60	.08	1.01	2.65	2.36	4.96	1.85	.75

Table 22. (con't)

	Industry	Jefferson	Lafourche	Orleans	Plaquemines	St. Bernard	St. Mary	Terrebonne	Total w/o Orleans	Total w/Orleans
1971	Aver. Quarterly Parish Employment	68059	9844	197814	8437	7385	15317	17699	126741	324555
	Fishing (09)	.11	1.05	--	1.25	.17	.88	.52	.41	.16
	Fish Processing and Pkg (2031, 2036)	.83	.70	.15	—	2.10	1.55	3.48	1.29	.60
	All Fishing and Processing as % Total	.94	1.75	.15	1.25	2.27	2.43	4.00	1.70	.76

*St. Charles and St. James Parishes are considered to be superport parishes but were ommitted because they have virtually zero employment in sic 90, 2031, and 2036.

Sources: see text for source and explanation of data

(2) What the Data Show

Employment in the fishing industry (SIC 09) (all parishes) has increased modestly from 714 in 1960 to 822 in 1972, or 1.0 percent per year. Total wages in the fishery industry increased $3.58 million ($2.09 million in constant 1960 dollars*), from $2.02 million in 1960 to $5.60 million ($4.24 in constant dollars) in 1972. This represents an average annual growth rate for real wages** of 6.2 percent. The average wage increased $3,977 ($2,326) from $2,833 in 1960 to $6,810 ($5,159) in 1972, at an average annual real growth rate of 2.5 percent.

Employment in the fish processing and packaging (SIC 2031 and 2036) industries actually decreased from 2,751 employees in 1960 to 1,998 employees in 1972 or a negative growth rate of 2 percent. Total wages, increased only $1.26 million ($0.24) from $3.71 million in 1960 to $5.21 million ($3.95) in 1972 which is approximately a real growth rate of 1/2 of 1 percent per year. Average wages increased $1,260 ($628), from $1,348 in 1960 to $2,608 ($1,976) in 1972, or an annual real growth rate in per employee wages of 3 percent. Lafourche Parish has more employees and a larger annual wage bill in the fishery industry than do the other parishes. However, fish packaging and processing are not significant in Lafourche but they are in Jefferson, Orleans, and Terrebonne.

Table 22 shows that employment in the fishing industry

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*The GNP deflator was employed to obtain constant dollars; thus, the figures in brackets compensate for increases which are assumed to be caused by inflation.

**Real wages are money wages discounted by changes in the price level (GNP deflator).

(SIC 09) accounts for less than 1 percent of total employment in all parishes except Lafource and Plaquemines. The percentage of employment in the fishing industry is declining in all parishes except Lafourche and Plaquemines; for the total superport area (excluding Orleans) it decreased from 0.53 percent of total employment in 1966 to 0.41 percent in 1971.

Employment in fish processing and packaging (SIC 2031, 2036) is more important than in the fishery industry, especially in Terrebonne and St. Bernard where 3.5 and 2.1 percent of the work force are employed in these industries. Except for Lafourche, St. Bernard, and St. Mary parishes, the percentage of persons employed in the processing and packaging industries is decreasing. For the superport region (excluding Orleans) the percentage has decreased from 1.91 percent in 1966 to 1.29 percent in 1971. Total employment in SIC 01, 2031 and 2036 has decreased from 2.44 percent in 1966 to 1.70 percent in 1971. Thus, one must conclude on the basis of available data that in the superport area, employment in fishing and related industries is decreasing in both absolute and relative importance but real income is increasing at an annual growth rate of 6 percent.

d. Principal Fishery Species

This study divides the data on the commercial fishery catch into five categories: shrimp, oysters, menhaden, crabs, and "other species." The first four categories comprise "the most important and highly valued commercial species" (Perret, et al., 1971). Quantitatively, in terms of both aggregate dollar value and in terms of pounds landed, these species comprise a significant portion of the total catch landed in Louisiana.

Second, these species are significant estuary-dependent fishery resources (Environmental Protection Agency, 1971). Any force that would alter the state of the estuary system in Louisiana would subsequently have repercussions on these species and would therefore have an impact on the economy as well. Each of these major species merits additional consideration.

(1) Shrimp

Three species of shrimp are taken from Louisiana waters. Of these species the brown shrimp (Penaeus aztecus) is the most abundant. In a sample collected for the Cooperative Gulf of Mexico Estuarine Study (CGMES), there were 55,827 brown shrimp taken by trawls and seines. This accounted for 62% of the commercial invertebrate catch in the sample (Perret, et al., 1971). The second most important species of shrimp caught in Louisiana is the white shrimp (Penaeus setiferus). There were 22,925 white shrimp collected in the CGMES study, accounting for 25% of the commercial invertebrate sample catch (ibid). The final species is the pink shrimp (Penaeus duorarum). The relatively small number of pink shrimp collected in the CGMES study, 156 total specimens, indicates the minor importance of the species in terms of the total catch.

In 1972 Louisiana ranked second nationally behind Texas in both production and value of the shrimp catch.

There were 83 million pounds of shrimp landed in Louisiana in 1972. This represented 21.6% of the total for the nation. The value of Louisiana shrimp, $46.9 million, accounted for 24.3% of the national total (Department of Commerce, 1972).

The life cycle of shrimp depends heavily on an estuary system such as that found in Louisiana. Adult shrimp in this area spawn

offshore in the Gulf of Mexico in waters of varying depths depending on the species. White shrimp spawn in waters from 4 to 17 fathoms deep while brown shrimp spawn at depths of 10 to 60 fathoms. For brown shrimp there are normally two spawning seasons, one in early spring and the other in the fall. White shrimp, on the other hand, are able to spawn four times in a single season in Louisiana waters (Lindall, et al., 1972).

Within a few hours after spawning the eggs hatch and the shrimp undergo larval development. This development takes place over the course of several days. Upon reaching the post larval stage the shrimp migrate toward coastal waters, seeking the protection of the estuarine nursery. Within the estuary the shrimp metamorphosize and reach a juvenile stage rapidly. In a few months time they mature and return to the Gulf waters where the life cycle is completed (ibid).

So important is the estuary to the production of shrimp that the Environmental Protection Agency has noted "it is currently assumed that none of the major commercial species would continue to exist in commercial quantities if estuaries were unavailable for development (Environmental Protection Agency, 1971). The EPA has further suggested that "the filling and diking of estuarine areas can be considered to reduce commercial shrimp stocks in direct relationship to the estuarine area and volume removed." Furthermore the ecological effects of pesticides, particularly DDT, pose serious threats to shrimp while they are within estuarines. It does not appear that shrimp have developed an immunity to such chemicals, whereas some types of freshwater fish have been found to have developed an immunity to pesticides (ibid). The future production of shrimp in Louisiana therefore depends on maintenance of a proper estuarine environment.

(2) Oysters

The Virginia oyster (Crassostrea virginica) is the primary species caught in Louisiana.

In 1971, there were 10,527,382 pounds of oysters landed in Louisiana. This figure represents the weight of the meat, excluding the shell. The value of this catch was $4,637,295, or 15.2 percent of the national total (Department of Commerce, 1972).

The life cycle of the oyster commences with the fertilization of eggs which are released during spawning. Fertilized eggs develop into larvae which feed upon planktonic organisms carried by the water currents (Lindall,et al., 1972). The larvae float freely for a time over a period of 9 to 25 days. During this time the larvae develop a shell of calcium carbonate and settle to the bottom, where they begin their normal growth. After 6 to 9 months, the young oysters are frequently moved to growing beds (Environmental Protection Agency, 1971).

The State of Louisiana owns 664,491 acres of natural oyster seed grounds in the area east of the Mississippi River delta. This includes parts of Breton Sound, Chandeleur Sound and Mississippi Sound. On the western side of the delta the State owns 16,453 acres of seed ground reservations. From these state controlled waters, small oysters are transferred to private leases where they grow to commercial size in 18 to 30 months (Lindall, 1972).

The oyster has frequently been the victim of disruptive changes in its ecological environment. For example, between 1890 and 1930, an oyster industry developed on the Pacific Coast. As the result of toxic waste effluents from paper mills, the oysters were decimated and the industry

almost vanished. In the nineteenth century an oyster industry developed in Puritan and Jamaica Bays in New York. Pollution led to the demise of these areas as well. The Environmental Protection Agency has noted:

> "The record of the oyster industry in the United States consists of a continuing series of disasters, usually associated with man-made changes in the estuaries. The Pacific Coast experience has had variations in virtually every other prime oyster region of the country with (1) a form of pollution fatal to the oysters, (2) a level of pollution which has rendered the oyster unfit for consumption, (3) a loss through dredging and siltation of adequate clutch material for the spats, (4) disease, (5) predators, or (6) some combination of these and unidentified causes" (Environmental Protection Agency, 1971).

(3) Menhaden

The menhaden (Brevoortia patronus) occurs in large numbers in the waters of the Gulf of Mexico off the coast of Louisiana. In 1971 there were 1.2 billion pounds of menhaden landed in Louisiana (Louisiana Landings, 1971). This catch had a total value of $20,014,923. This represents 56.5 percent of the total national catch by volume of all species of menhaden; it constitutes 77 percent of Gulf menhaden (Louisiana Landings, 1971; Department of Commerce, 1972). In Plaquemines and Terrebonne parishes in 1971 there were 409,823,700 pounds of menhaden landed which were valued at $6,603,633 (in current dollars) (Data on landings by parish were provided by the National Marine Fisheries Service, New Orleans, Louisiana).

The menhaden is a small fish related to the herring and sardine. Most of the specimens caught are less than 12 inches in length and weigh less than one pound. Menhaden are a particularly important industrial fish in that they supply about 75 percent of all fish meal, 80 percent of marine oils and 80 percent of all fish solubles produced in the U. S. (Firth, 1969).

The Louisiana estuary system is vital to the growth and development of Gulf menhaden. The eggs of the menhaden are spawned at sea along the continental shelf, hatching in the ocean in about two days. From there the larvae move into the estuaries where they undergo a change from a selective particulate feeder to a non-selective filter-feeding omnivore. Once in the estuary their consumption of food changes from zooplankton to natural vegetation in the form of plankton. In feeding upon natural vegetation they form an important link in the food web. Menhaden, in turn, become the prey of larger species including bluefish, striped bass, bluefin tuna and sharks (Environmental Protection Agency, 1971).

The general condition of the estuary is important with respect to menhaden. For example, in polluted waters, menhaden become susceptible to various parasitic infections which, although usually not fatal, do reduce resistance to other inimical forces and may also reduce fertility. The reduction in future stocks of menhaden attributable to a decrease in the quality of estuaries may not have a detrimental effect on total revenues from menhaden fishing. This depends on the demand for menhaden, primarily among industrial users. If the demand for menhaden is sufficiently inelastic, total revenues may increase rather than decline. (A good is considered to have an inclusive demand when an increase in the price per unit of the good results in an increase in total revenue spent on the good. There are many factors which determine elastuity, including the availability of suitable substitutes.) Although the revenues to fishermen may be increased, this increase in market price will be reflected as an increased cost to industrial users. The industrial user faces three primary choices. He may either absorb the cost (unlikely in a competitive

industry), thus reducing profits while maintaining his output. Second, he may reduce his output with subsequent reductions in employment. Finally, he may pass the cost on to consumers in the form of higher prices and a subsequent reduction in the quantity demanded of the product. This is a simple example of how environmental forces may indirectly affect the economy. At best this is only a partial example at a particular point in time. In actuality there are a multiplicity of interacting forces at work over a number of time periods.

(4) Crabs

The blue crab (Callinectes sapidus) constitutes the majority of crabs taken from Louisiana waters. In 1971 there were 12,185,718 pounds of hard shell blue crabs landed in Louisiana. This catch had a value of $1,255,873 (Louisiana Landings, 1971). This represented 8.4 percent of the national catch by volume and 10.1 percent by value (ibid and Department of Commerce, 1972). In addition there were 126,709 pounds of soft shell and peeler crabs valued at $125,770 landed in Louisiana in 1971. The overwhelming majority (over 90 percent) of both hard shell and soft shell blue crabs are taken in inland water bodies (Lindall, et al., 1972).

Blue crabs are estuarine-dependent as are the other species discussed above. They are subject to a number of ecological dangers including poisoning from commercial pesticides such as DDT. In addition, dredging and channeling can have an adverse effect by increasing the degree of siltation and turbidity in the water ibid . Finally, industrial effluents may have a toxic effect on the crab population. All of these factors may seriously alter the estuarine environment of the blue crab.

Table 23

Louisiana Commercial Fisheries
Relative National Importance

		Pounds (Millions)	% of National	Value (Millions $)	% of National
I.	Total Fish				
	U.S.	4,716	100.0	$706	100.0
	Louisiana	1,071	22.7	72	10.2
II.	Shrimp				
	U.S.	384	100.0	$193	100.0
	Louisiana	83	21.6	46.9	24.3
III.	Oysters				
	U.S.	55.6	100.0	$ 30.5	100.0
	Louisiana	10.5	18.9	4.6	15.2
IV.	Menhaden				
	U.S.	2,189	100.0	$ 36.0	100.0
	Louisiana	1,237	56.5	20.0	55.6
V.	Crabs				
	U.S.	145.2	100.0	$ 1.3	100.0
	Louisiana	12.2	8.4	1.3	10.1

(5) Other Species

In this category are a variety of freshwater and saltwater species. Included in "Other Species" are bowfin, buffalo fish, carp, catfish and bullheads, paddlefish, sheepshead, shad, cabio, croaker, drum, flounder, grouper, jewfish, whiting, mullet, pompano, sawfish, sea catfish, sea trout, sharks, snapper, Spanish mackeral, spot, tripletail, warsaw, crayfish, squid, turtles and frogs. In this group there is also a category for unclassified fish that at times becomes increasingly large and dominates the "Other Species" category. The above categories conform with those used in data collection by the National Marine Fisheries Service.

For purposes of this study, the values for "Other Species" are the residuals that remain after subtracting the totals for the four enumerated categories (shrimp, oysters, menhaden and crabs) from the totals for all species.

e. Fisheries and the Problems of a Common Property Resource

The data on fish landings and areas of catch are presented so as to inform the reader of the relative importance of major species in each parish and in each grid area and to provide input for future cost-benefit studies. Before these data can be correctly interpreted, however, the reader must understand the problems produced by common property resources.

Cost-benefit analyses are meaningful only if the monetary values employed in the calculations accurately reflect the opportunity values of the resources involved. This means that if given resources could produce one automobile or ten TV sets, the market price of the automobile should be ten times greater than the market price of the TV set. The real value of resources used in producing one good is not the monetary price of that

resource, but the quantity of other goods, both present and future, which these resources could otherwise produce. One of the most important functions of the free market price system is to reflect this real value. There are many factors in the economy which produce distortions so that the market monetary price of a resource is greater or less than the real value. Generally, these distortions are not significant enough to cause concern but, in the case of fisheries and other common property resources, the problems are too significant to be ignored.

The price of a resource, if it is to reflect its real value, must include the costs of labor and capital expended on its production or extraction, plus a scarcity value which reflects the fact it is not being used in other endeavors during current or future time periods. The value of a natural resource _in situ_ is dependent only on the scarcity value because no labor or capital is expended on it.

The problem of a common property resource, such as fish, is generally illustrated by the medieval practice of common land tenure. Where the ownership of cattle was private, but the resource on which they fed was common, each cattle raiser would let his cattle feed on the land until the last blade of grass was gone. The individual cattle owner had no incentive to conserve pasture land because if he attempted to do so, his neighbor's cattle would eat the last blade of grass. The pasture which _is_ scarce and valuable to society is valued at nothing by the users of the pasture; or to state it another way, common property resources are free goods for the individual users and scarce goods for society.

There are other aspects of this problem which merit attention. Because the users of the pasture are not charged a price for grazing cattle

on the common pasture, they will add additional cattle on it until the marginal benefit to them is equal to the price they pay which, in the case of common property resource, is zero. This means that consumers of meat and hides are not charged a price for the resource (pasture) that went into producing these goods. This, in turn, means that the price of meats and hides, relative to other goods, will be lower. Consumers will consume more meats and hides, thus placing a greater burden on pasture land which means that some forests will be turned into pastures and future generations will have fewer trees. Thus, conservationalists and ecologists would be correct in stating that over-consumption of meats and hides was causing a future shortage of trees. However, the cause of this shortage should not be misplaced. It is not due to market failure and it is not due to monopolies or trusts; rather, it is caused by the failure of social institutions which in this case is the failure of the social customs and institutions to establish and protect private property rights. As is the case of the medieval pasture, when and if property rights are established the problem of the commons disappears.

Actually, a close reading of history suggests that the "common" property was seldom commonly owned, except for a very brief period during the medieval age. For example, in some primitive cultures, the chief or person possessing "magical powers" performed the functions of manager and owner. Even during the medieval ages, most manors regulated access to the "commons."

What relevance does this analysis have to the fisheries? Fish in the oceans are similar to the common pasture because individuals cannot

obtain property rights in them. They are common property and tend to be overly exploited because no price has to be paid to grow them. Fish constitute a valuable economic resource to the country, but to the individual fisherman they are free for the taking. The fish that are left in the ocean by a fisherman today are valueless to him because tomorrow they or their offspring may be caught by another fisherman. It is a typical example of the problem of common property:

> Social wealth that appears to be free to all is valued by none because he who is foolish enough to wait for the resource to multiply (e.g. fish) or for demand to increase (unregulated oil pool) will only find that it has been taken by another.

Unfortunately, fish in the ocean or the ocean itself cannot be converted into private property rights as easily as common pasture. Perhaps private property rights in oyster beds could be allocated on the basis of an auction or bid system. This would not solve the problem for migrating fish, however, and the state may need to auction off the rights to catch a certain number of species each season. Even assuming that government managers knew the correct amount of fish to be auctioned off each year the problem would not be solved because other governments may permit fishermen residing in their country an unlimited access to the fish in open seas. Perhaps regional auctioning is required.

The problem which common property poses for cost-benefit analysis is that it prohibits the market from revealing the value of the common property resource which in this case is the value of fish in the sea. Let's refer to the example of the common pasture. If an economist was to obtain data on the value of the cattle brought to the meat packer, these data would represent the value of the labor of the cattle raiser,

the costs of transportation, etc. but it would not include the value of grazing on the pasture land. It is this omission which makes the market value of the cattle less than the social value. Most relevant to cost-benefit analysis is the fact that the economist could not use these values as representing the value of the pasture because they include only the costs of labor, transportation and other capital costs. The value of the pasture is not increased because the farmer pays no price for it and he treats it as a free good. There is no way he could determine the market value of the commons given the existence of the common property institution. This is also true of fish. Because the individual fisherman does not pay a price for the use of the natural resource (fish), its value is not reflected in the value of fish landings. The landing value of fish reflects, on the supply side of the market, only the costs of labor and capital equipment; it does not include the scarcity value of fish as a natural resource.

The sections following present data on the total value, quantity, and price of major fish species. However, these data should not be interpreted as representing the in situ value of fish which is, of course, the primary environmental concern. It does represent the value of other resources used in catching fish and delivering them to dockside and it does provide an indication of the economic importance of the fishery industry in the superport area. Perhaps the most important function of the data is that they show the relative distribution of fish catches by water body and by major type of fish. It is also a "second best" source of data given the commonality of the seas.

f. Landings by Parish

(1) The Data

The data on fishery landings presented in this study cover eight Louisiana coastal parishes. These parishes were chosen because of their proximity to possible superport locations and industrial development directly related to superport. These parishes include Jefferson, Lafourche, Plaquemines, St. Bernard, St. Charles, St. James, St. Mary and Terrebonne.

The National Marine Fisheries Service definition of landings is employed. Commercial landings represent the "quantities of fish, shellfish, and other aquatic plants and animals brought ashore and sold"(Department of Commerce, 1972). In this study the weight of menhaden, shrimp, crabs, and "other species" are given in "round weights." This is the weight of the fish or shell-fish as taken from the water. It is synonymous with "live weight." Oysters, however, are measured by the weight of the meat exclusive of the shell. The shrimp weights and value are given in terms of "heads on" as they are taken from the water.

Prices used in this study are "ex vessel" prices which represent the price received by a fisherman for fish or shellfish landed at the dock. Exvessel prices multiplied by live weight (meat weight in case of oysters) gives the value of landings of a particular species. This value is measured in current dollars, thus reflecting the influence of inflation. Ideally this value figure should reflect prices in a given base year (Ex. 1967=100). However, due to time and manpower constraints, this has not been done for this study.

Table 24 presents the annual average price per pound of

landings in the superport area from 1958 to 1971.

Tables 25 through 32 contain data on the value and volume of landings in the Louisiana Superport parishes from 1958 to 1971. These figures are obtained by dividing the total value of each of the five fishery categories by the total volume of landings of each respective species for each year. The data may be used to get some idea of the historic movement in prices. Time constraints prohibited an analysis of price changes.

(2) The Data Show

(a) General

Due to changing regional, national and world demand and supply conditions the data are subject to fluctuations and trends are difficult to discern. Because it is difficult to anticipate the uses to which the data might be put, the raw data are provided so that the reader may easily compute relationships which he finds helpful.

(b) Total Landings in Superport Area (Tables 24 and 25)

Table 24 provides useful information on current and real price trends for each major species from 1958 to 1971. Current prices are merely the dollar prices existing at the time the fish were landed. Real prices are obtained by dividing the current prices by the Consumer Price Index (FOOD) which had its base (100) in 1967. Thus, real prices tend to eliminate the effect of inflation by expressing all prices in 1967 dollar sums.

Shrimp and oysters are the most valuable species per pound. The current dollar price of shrimp was $0.335 per pound in 1958 and $0.435 per pound in 1971. However, this increase was entirely the

Table 24. Fishery Landings in Superport Parishes. Real* and Current Price Per Pound, by Species, 1958-1971.

	Value per Pound	Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Current Prices	.3350	.3142	.0149	.0650	.0954	.1088
	Real Prices	.3785	.3550	.0168	.0734	.1077	.1229
1959	Current Prices	.2273	.2773	.0135	.0727	.0539	.0609
	Real Prices	.2609	.3183	.0154	.0834	.0618	.0699
1960	Current Prices	.2597	.2767	.0108	.0680	.1050	.0588
	Real Prices	.2951	.3144	.0122	.0772	.1193	.0668
1961	Current Prices	.2832	.2909	.0156	.0486	.1601	.0532
	Real Prices	.3178	.3264	.0175	.0545	.1796	.0597
1962	Current Prices	.3431	.3205	.0116	.0420	.1430	.0445
	Real Prices	.3816	.3565	.0129	.0467	.1590	.0494
1963	Current Prices	.2693	.3184	.0124	.0490	.0998	.0534
	Real Prices	.2952	.3491	.0135	.0537	.1094	.0585
1964	Current Prices	.3124	.2489	.0150	.0826	.1347	.0567
	Real Prices	.3380	.2693	.0162	.0893	.1457	.0613
1965	Current Prices	.3105	.2748	.0172	.0804	.1861	.0552
	Real Prices	.3289	.2911	.0182	.0851	.1971	.0584
1966	Current Prices	.3838	.4444	.0171	.0754	.0845	.0780
	Real Prices	.3872	.4484	.0172	.0760	.0852	.0787
1967	Current Prices	.3109	.4368	.0120	.0827	.0538	.0794
	Real Prices	.3109	.4368	.0120	.0827	.0538	.0794
1968	Current Prices	.3614	.3989	.0124	.1036	.0470	.0844
	Real Prices	.3488	.3850	.0119	.1000	.0453	.0814
1969	Current Prices	.5357	.4263	.0176	.1033	.0763	.0878
	Real Prices	.4919	.3914	.0161	.0948	.0700	.0806
1970	Current Prices	.3603	.4160	.0197	.0952	.0603	.0747
	Real Prices	.3135	.3620	.0171	.0828	.0524	.0650
1971	Current Prices	.4348	.4379	.0162	.1062	.0641	.0691
	Real Prices	.3672	.3698	.0136	.0896	.0541	.0583

*Real price is obtained by dividing current price by the consumer price index for food; 1967 = 100
It eliminates the effects of inflation on price changes.

result of inflation. As shown by the real price, the real value per pound of shrimp decreased between 1958 and 1971, while the real price per pound of oysters increased about $0.015. The price of menhaden and other species decreased in real sums and only crabs have experienced a real price increase.

Once again it must be pointed out that the prices in Table 24 and the values in Table 25 do not reflect the value of fish in the sea. In the long run, they reflect the costs of labor and capital expended in transferring them from the sea to the docks, subject to periodic fluctuations in demand and supply conditions.

As shown in Table 25 the total value of fish landings in superport parishes from 1958 through 1971 was nearly $403 million with a yearly average of nearly $29 million. (Value means price (X) quantity. Real value means real price (X) quantity or current dollar value adjusted for price changes.) In 1971, the total value was $50.7 million which was almost triple the 1958 value. In real sums, the 1971 value was slightly more than double the 1958 value. Thus, one must conclude that the real value of fish landings in the superport parishes increased significantly between 1958 and 1971.

The most important species, by value, is shrimp with a total value of $257 million landed in the 1958-71 period. This is 64 percent of the value of total landings during this period. With the exception of menhaden, the value of shrimp increased at a faster rate than any other species. Menhaden is the second most valuable species ($71 million for 1958-1971) but its growth rate is phenomenal. The value of menhaden increased by nearly 600 percent in current dollars and 400 percent in constant dollars from 1958 to 1971. This increase is due entirely to

Table 25. Value and Quantity of Fishery Landings. Total for Superport Parishes. 1958-1971.

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	11,798,896	2,425,917	1,431,139	588,035	1,461,732	17,705,719
	Quantity (lbs.)	35,212,600	7,719,500	95,409,300	9,046,100	15,307,600	162,695,100
1959	Value ($)	11,100,699	2,469,916	2,853,255	667,650	1,093,692	18,185,212
	Quantity (lbs.)	48,824,800	8,905,200	211,352,200	9,172,800	20,282,700	298,537,200
1960	Value ($)	13,658,736	2,288,149	2,955,701	629,417	1,265,289	20,797,292
	Quantity (lbs.)	52,577,300	8,267,700	271,165,300	9,243,700	12,040,500	353,294,500
1961	Value ($)	7,464,847	2,796,946	3,870,727	696,113	1,497,582	16,326,215
	Quantity (lbs.)	26,351,300	9,612,600	247,179,000	14,316,700	9,353,200	306,812,800
1962	Value ($)	12,799,537	2,948,324	5,150,195	506,112	1,408,795	22,812,963
	Quantity (lbs.)	37,229,200	9,198,900	443,982,300	12,022,700	9,851,000	512,284,100
1963	Value ($)	16,536,736	3,184,108	5,004,867	493,293	1,504,068	26,723,072
	Quantity (lbs.)	61,389,100	9,997,800	403,305,800	10,046,800	15,070,800	499,810,300
1964	Value ($)	15,752,738	2,586,586	5,912,069	408,156	2,256,914	26,916,463
	Quantity (lbs.)	50,419,100	10,390,500	392,021,700	4,939,800	16,747,700	474,518,800
1965	Value ($)	16,302,281	2,135,014	7,489,238	654,276	1,612,385	28,193,194
	Quantity (lbs.)	52,492,000	7,769,100	433,490,000	8,132,900	8,663,900	510,547,900
1966	Value ($)	20,322,195	1,834,995	5,034,224	536,361	1,680,028	29,407,803
	Quantity (lbs.)	52,944,600	4,128,400	292,862,400	7,105,100	19,862,500	376,903,000
1967	Value ($)	20,230,695	3,230,417	2,995,952	516,562	1,910,839	28,884,465
	Quantity (lbs.)	65,053,600	7,395,600	249,247,500	6,238,700	35,483,800	363,419,200
1968	Value ($)	21,162,465	4,773,123	3,226,572	760,362	1,795,821	31,718,343
	Quantity (lbs.)	58,554,000	11,964,400	259,407,900	7,337,900	38,187,000	375,451,200
1969	Value ($)	27,818,263	3,423,791	6,453,873	969,437	2,688,790	41,354,154
	Quantity (lbs.)	51,923,400	8,030,700	366,005,700	9,376,600	35,234,900	470,571,300
1970	Value ($)	28,221,705	3,239,304	8,859,930	850.100	2,082,696	43,253,735
	Quantity (lbs.)	78,308,400	7,785,400	449,286,500	8,928,600	34,531,500	578,840,400
1971	Value ($)	33,608,117	4,144,726	9,773,734	1,078,401	2,070,278	50,675,256
	Quantity (lbs.)	77,283,100	9,464,100	603,212,500	10,145,900	32,269,900	732,375,500
Total Value		256,777,910	41,481,316	71,011,476	9,354,275	24,328,909	402,953,886
Average Value		18,341,279	2,962,951	5,072,248	668,162	1,737,779	28,782,420
Total Weight		748,562,500	120,629,900	4,717,928,000	116,643,700	302,887,000	6,016,069,700
Average Weight		53,468,750	8,616,400	336,994,900	8,331,700	21,634,800	429,718,700

the increase in quantity because the real price actually decreased between 1958 and 1971. In 1958, the value of menhaden was 12 percent of the value of shrimp but in 1971 it was 30 percent.

Oysters, by value, were less than one-half as important as menhaden in 1971. During the entire 1958-71 period they contributed $41.5 million to total revenue. The current dollar value of oysters increased 70 percent during the study period but in real sums they increased by only 28 percent. The real price of oysters increased slightly during this time period, so the slow growth of value was due entirely to the slow growth in quantity harvested.

The quantity of crabs increased only 12 percent between 1958 and 1971 but the constant dollar price increased slightly so that there was a real increase in the value of crabs landed equal to 38 percent.

(c) Jefferson Parish (Table 26)

Landings in Jefferson Parish for the 14 year period were $66 million or 16 percent of the total superport area. For 1971 they were $6 million or 12 percent of the superport area. By value shrimp are the most important and account for 80 percent of total value of all species landed in Jefferson from 1958-71. Crabs which account for 36 percent of total crab value in the superport area are its most important relative commodity. However, the quantity of the crab landings has been decreasing since the early 1960's and the quantity caught in 1971 is 36 percent less than the quantity caught in 1958.

(d) Lafourche Parish (Table 27)

The value of landings in Lafourche Parish were 16 percent of the total superport area for the period 1958-71, and they were 19.5

Table 26. Value and Quantity of Fishery Landings by Parish of Superport Parishes, 1958-1971.

JEFFERSON PARISH

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	2,708,691	224,834		336,204	54,929	3,324,658
	Quantity (lbs.)	8,202,600	850,300		4,421,800	332,500	13,807,200
1959	Value ($)	2,574,575	373,446		383,355	49,610	3,380,986
	Quantity (lbs.)	11,843,500	1,576,565		4,481,100	365,100	18,266,300
1960	Value ($)	3,077,622	321,336		328,950	87,919	3,815,827
	Quantity (lbs.)	11,997,200	1,359,900		4,516,200	563,400	18,136,700
1961	Value ($)	1,783,884	493,093		381,163	148,747	2,806,887
	Quantity (lbs.)	6,115,400	1,487,700		5,811,400	1,536,900	11,951,400
1962	Value ($)	2,973,498	655,493		233,367	179,500	4,041,858
	Quantity (lbs.)	8,014,000	2,124,500		4,102,200	1,196,000	15,436,700
1963	Value ($)	3,311,655	897,825		190,095	150,205	4,549,780
	Quantity (lbs.)	14,042,200	2,931,300		3,306,900	853,900	21,134,300
1964	Value ($)	3,278,855	412,625		84,845	130,468	3,906,793
	Quantity (lbs.)	10,246,700	2,008,100		1,080,700	871,200	14,206,700
1965	Value ($)	3,997,930	715,369		104,273	133,453	4,951,025
	Quantity (lbs.)	12,547,400	2,780,700		1,046,400	832,700	17,207,200
1966	Value ($)	4,300,268	275,200		130,466	162,023	4,867,957
	Quantity (lbs.)	11,304,300	704,800		1,586,500	1,124,000	14,719,600
1967	Value ($)	4,586,324	714,501		160,428	147,117	5,608,370
	Quantity (lbs.)	14,821,100	1,846,000		1,757,900	994,100	19,419,100
1968	Value ($)	4,244,655	1,372,805		240,309	126,207	5,983,976
	Quantity (lbs.)	13,101,800	3,482,900		2,231,600	858,600	19,674,900
1969	Value ($)	5,469,820	765,039		274,069	199,736	6,708,664
	Quantity (lbs.)	15,113,100	1,751,500		2,365,400	910,200	20,140,200
1970	Value ($)	5,058,610	800,176		202,824	156,946	6,218,556
	Quantity (lbs.)	15,240,100	1,916,800		1,905,400	1,026,400	20,088,700
1971	Value ($)	5,371,986	333,594		314,188	89,950	6,109,718
	Quantity (lbs.)	13,631,700	930,300		2,798,400	570,000	17,360,400
Total Value		52,738,373	8,355,335		3,364,536	1,816,810	66,275,055
Average Value		3,767,027	596,810		240,324	129,772	4,733,933
Total Weight		166,221,100	25,751,400		41,411,900	12,035,000	255,419,400
Average Weight		11,872,936	1,839,386		2,957,993	859,643	17,529,957
Landings in Jefferson Parish as Percent of Total Superport Area, 1971.							
Percent Total Value		15.98	8.05		29.13	4.34	12.06
Percent Total Weight		17.64	9.83		27.58	1.77	2.37
Landings in Jefferson Parish as Percent of Average Superport Area, 1958-1971.							
Percent Average Value		20.54	20.14		35.92	7.47	16.44
Percent Average Weight		22.21	21.35		35.50	3.97	4.08

Table 27. Value and Quantity of Fishery Landings by Parish of Superport Parishes, 1958-1971.

LAFOURCHE PARISH

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	2,273,348	200,046		37,480	87,219	2,598,093
	Quantity (lbs.)	6,600,100	773,900		937,000	622,900	8,933,900
1959	Value ($)	2,334,097	214,017		47,215	77,420	2,783,749
	Quantity (lbs.)	10,177,500	906,700		944,300	647,700	12,676,200
1960	Value ($)	2,663,731	284,381		33,755	103,862	3,086,729
	Quantity (lbs.)	9,891,700	1,174,000		675,100	538,200	12,279,000
1961	Value ($)	1,537,056	291,209		16,087	237,375	2,081,727
	Quantity (lbs.)	5,423,400	1,311,100		321,700	2,135,300	9,191,500
1962	Value ($)	2,673,802	167,771		42,990	183,112	3,067,675
	Quantity (lbs.)	7,393,700	567,300		859,900	3,336,500	12,157,400
1963	Value ($)	3,581,364	66,042		28,000	323,272	3,998,678
	Quantity (lbs.)	13,990,000	192,500		559,500	8,445,700	23,187,700
1964	Value ($)	2,645,932	655,400		14,322	462,529	3,778,183
	Quantity (lbs.)	8,674,700	2,374,000		238,700	9,597,500	20,884,900
1965	Value ($)	2,818,898	29,100		14,130	315,609	3,177,737
	Quantity (lbs.)	9,022,700	96,600		235,500	1,320,960	10,675,800
1966	Value ($)	3,731,935	73,800		27,890	431,913	4,265,538
	Quantity (lbs.)	9,415,100	161,400		398,300	16,177,000	26,151,800
1967	Value ($)	3,925,885	198,039		30,014	671,527	4,825,465
	Quantity (lbs.)	12,409,000	630,900		424,400	25,131,100	38,595,400
1968	Value ($)	4,575,286	399,892		30,243	476,624	5,582,045
	Quantity (lbs.)	11,413,600	1,140,100		363,900	26,766,100	39,683,700
1969	Value ($)	5,705,306	319,112		23,900	689,978	6,738,296
	Quantity (lbs.)	12,824,900	733,500		265,600	29,892,200	43,716,200
1970	Value ($)	6,652,672	160,600		14,200	686,547	7,514,019
	Quantity (lbs.)	15,679,600	404,800		156,700	27,500,000	43,741,100
1971	Value ($)	8,159,105	1,031,267		65,693	620,471	9,876,536
	Quantity (lbs.)	15,831,600	2,363,900		847,100	20,500,200	39,542,800
Total Value		53,390,417	4,090,676		425,919	5,467,458	63,374,470
Average Value		3,813,601	292,191		30,423	390,533	4,526,748
Total Weight		148,747,600	12,830,700		7,227,700	172,611,400	341,417,400
Average Weight		10,624,832	916,479		516,264	12,329,400	24,387,000

Landings in Lafourche Parish as Percent of Total Superport Area, 1971.

Percent Total Value	24.28	24.88		6.09	29.97	19.49
Percent Total Weight	20.49	24.98		8.35	63 53	5.40

Landings in Lafourche Parish as Percent of Average Superport Area, 1958-1971.

Percent Total Value	20.79	9.86		4.49	22.47	15.72
Percent Average Weight	19.87	10.64		6.20	56.99	5.68

percent for 1971.

Landings of shrimp, which increased faster than for the superport area, are the most important ($53 million) followed by other species. Oysters were harvested in unusually high quantity in 1971 and accounted for nearly 25 percent of the superport area, whereas for the 14 year period they accounted for only 10 percent of the value in the superport area.

The "other species" classification is unusually high for Lafourche Parish for it accounts for 51 percent of total value of landings in that parish.

(e) Plaquemines Parish (Table 28)

For the total period, the value received from menhaden landings slightly exceeds the value of the shrimp catch. However, the quantity of menhaden has been decreasing since the early 1960's so that in 1971 the value of shrimp was nearly twice as great as the value of menhaden landed in Plaquemines Parish, but in 1971 only 28 percent were landed.

Oysters are the third most important species but their quantity is subject to severe fluctuations and rather drastic decreases in the latter 1960's.

(f) St. Bernard Parish (Table 29)

No menhaden landings were reported in St. Bernard Parish. Most valuable species are shrimp and oysters which account for $11 million and $10 million revenue, respectively. However, their annual landings by value have not changed much since 1958 and in real sums they have decreased. In fact the total value of the catch has decreased in real or constant dollar sums by 25 percent from 1958 to 1971.

Table 28. Value and Quantity of Fishery Landings by Parish. Superport Parishes, 1958-1971. Plaquemines Parish.

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	1,019,097	919,845	1,431,139	25,352	194,117	3,589,550
	Quantity (lbs.)	2,848,200	2,354,900	95,409,300	633,800	9,009,500	110,235.700
1959	Value ($)	1,298,459	981,099	2,346,427	32,840	108,805	4,767,630
	Quantity (lbs.)	5,978,600	3,563,200	173,809,400	656,800	7,610,000	191,618,000
1960	Value ($)	1,346,242	853,776	2,247,659	34,090	204,247	4,686,014
	Quantity (lbs.)	5,210,600	3,055,500	206,207,300	681,800	1,319,500	216,474,700
1961	Value ($)	559,572	1,003,504	2,778,520	30,672	168,908	4,541,176
	Quantity (lbs.)	1,962,800	3,574,200	239,527,600	766,800	1,221,500	247,052,900
1962	Value ($)	1,585,754	1,143,443	3,204,302	24,784	167,737	6,126,020
	Quantity (lbs.)	5,055,000	3,577,600	276,232,900	619,600	1,218,100	286,703,200
1963	Value ($)	1,890,724	1,033,785	2,990,656	25,810	123,011	6,063,986
	Quantity (lbs.)	9,261,100	3,228,900	240,958,100	516,200	879,800	254,844,100
1964	Value ($)	2,081,333	588,700	3,115,237	21,027	764,268	6,570,565
	Quantity (lbs.)	7,139,000	2,513,800	206,307,100	290,200	1,505,500	217,755,600
1965	Value ($)	1,842,025	526,002	3,011,258	71,658	171,326	5,622,269
	Quantity (lbs.)	6,368,100	1,845,900	174,325,300	900,400	1,984,300	185,424,000
1966	Value ($)	3,264,983	265,768	1,410,631	50,924	209,366	5,201,672
	Quantity (lbs.)	9,850,400	502,800	82,013,400	761,200	1,507,800	94,635,600
1967	Value ($)	2,110,644	390,722	1,159,626	30,447	220,221	3,911,660
	Quantity (lbs.)	6,933,000	793,500	96,474,700	446,500	3,043,600	107,691,300
1968	Value ($)	2,260,408	764,535	1,050,523	43,568	241,917	4,360,951
	Quantity (lbs.)	6,720,700	1,756,800	84,470,900	522,400	6,527,000	99,997,800
1969	Value ($)	3,850,742	478,023	1,426,800	52,361	221,102	6,029,028
	Quantity (lbs.)	11,423,900	1,061,500	95,763,800	565,500	238,980	109,053,700
1970	Value ($)	3,773,959	553,133	2,721,094	52,650	218,246	7,319,082
	Quantity (lbs.)	11,465,300	1,269,400	137,986,500	622,100	1,335,600	152,678,900
1971	Value ($)	4,741,505	1,098,209	2,740,891	65,328	404,053	9,049,986
	Quantity (lbs.)	11,059,700	2,006,400	172,011,200	659,900	8,230,300	193,967,500
Total Value		31,625,447	10,600,544	31,634,763	561,511	3,417,324	77,839,589
Average Value		2,258,961	757,182	2,259,626	40,108	244,095	5,559,971
Total Weight		101,276,400	31,084,400	2,281,497,500	8,643,200	45,631,500	2,468,133,000
Average Weight		7,234,000	2,220,300	162,964,107	617,400	3,259,393	176,295,214
% Total Value *		14.11	26.50	28.04	6.05	19.51	17.85
% Total Weight *		14.31	21.20	28.52	6.50	25.50	26.48
% Average Value **		12.32	25.55	44.55	5.98	14.04	19.31
% Average Weight **		13.53	25.77	48.36	7.41	15.06	41.02

*Landings in Plaquemines Parish as Percent of Total Superport Area, 1971.

**Landings in Jefferson Parish as Percent of Average in Superport Area, 1958-1971.

Table 29. Value and Quantity of Fishery Landings by Parish of Superport Parishes, 1958-1971.

ST. BERNARD PARISH

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	1,080,940	718,920		140,264	549,284	2,059,559
	Quantity (lbs.)	3,185,000	2,572,500		1,862,100	2,045,700	8,451,500
1959	Value ($)	439,625	569,247		151,940	105,390	1,266,202
	Quantity (lbs.)	2,058,400	1,644,100		1,913,100	823,300	6,438,900
1960	Value ($)	424,332	487,051		168,720	79,765	1,159,868
	Quantity (lbs.)	2,019,600	1,408,400		1,988,400	445,700	5,973,100
1961	Value ($)	209,935	600,727		213,829	60,356	1,084,847
	Quantity (lbs.)	807,800	1,823,200		2,656,800	388,200	5,676,000
1962	Value ($)	493,118	653,452		172,800	53,873	1,373,243
	Quantity (lbs.)	1,412,000	1,825,200		2,376,000	376,100	5,989,300
1963	Value ($)	621,987	753,064		214,644	72,984	1,662,679
	Quantity (lbs.)	2,528,700	1,868,400		2,155,500	525,400	7,078,000
1964	Value ($)	629,434	427,683		208,777	38,185	1,304,079
	Quantity (lbs.)	2,027,600	1,506,700		2,139,200	358,200	6,031,700
1965	Value ($)	651,122	520,467		310,350	32,685	1,514,624
	Quantity (lbs.)	2,175,000	1,696,000		3,119,600	207,700	7,198,300
1966	Value ($)	679,012	702,309		234,347	55,097	1,670,765
	Quantity (lbs.)	2,053,500	1,450,900		2,976,000	490,600	6,971,000
1967	Value ($)	1,001,020	886,911		229,184	60,884	2,177,999
	Quantity (lbs.)	3,738,400	1,983,600		2,634,000	479,300	8,835,300
1968	Value ($)	1,030,355	1,523,647		372,082	92,781	3,018,865
	Quantity (lbs.)	3,767,100	3,615,000		3,330,500	655,000	11,367,600
1969	Value ($)	1,762,251	926,458		378,495	100,632	3,759,604
	Quantity (lbs.)	4,616,400	2,196,700		3,582,400	378,495	10,496,132
1970	Value ($)	1,235,739	831,826		367,854	103,478	2,538,897
	Quantity (lbs.)	3,943,200	1,972,900		3,901,900	736,600	10,554,600
1971	Value ($)	953,722	780,979		251,243	61,761	2,047,705
	Quantity (lbs.)	3,269,800	1,720,200		2,313,300	334,900	7,638,200
Total Value		11,212,592	10,382,741		3,414,529	2,058,923	26,638,936
Average Value		800,899	741,624		243,895	147,066	1,902,781
Total Weight		34,335,700	27,283,800		36,948,800	8,670,100	107,283,400
Average Weight		2,452,550	1,948,843		2,639,200	619,293	7,659,886
Landings in Jefferson Parish as Percent of Total Superport Area, 1971.							
Percent Total Value		2.84	18.84		23.30	2.98	4.04
Percent Total Weight		4.23	18.18		22.80	1.04	1.04
Landings in Jefferson Parish as Percent of Average Superport Area, 1958-1971.							
Percent Average Value		4.37	25.03		36.37	8.46	6.61
Percent Average Weight		4.59	22.62		31.68	12.86	.18

(g) St. Charles Parish (Table 30)

Fish landings in St. Charles Parish total to less than $3 million for the 1958-71 period. "Other species" account for almost this entire amount.

(h) St. Mary Parish (Table 31)

Value of landings for 1958-71 are $72 million or 18 percent of the superport area and $9 million or 16 percent for 1971. Most important species is shrimp with a total value of $45 million followed by menhaden with $19 million. Both shrimp and menhaden are increasing at the same rate as for the superport area. Also, St. Mary is one of the few parishes in which the quantity of crabs has increased significantly. Total value of the fish in landings is increasing faster in St. Mary's than in the superport area.

(i) Terrebonne Parish (Table 32)

Landings during 1958-71 were $92 million or 28 percent of total landings in the superport area. The shrimp landings were $63 million for the period and $9 million for 1971. Menhaden were $19 million or 27 percent of the superport area for 1958-71 and $3.9 million or 40 percent for 1971. Both shrimp and menhaden landings are increasing at a more rapid rate than in the superport area.

g. Sources of Fish Catches in Superport Area

(1) The Data

Section f presented data on the value, volume and prices of fish landings in seven of the eight superport parishes (St. James had none). These data are useful for determining the value, volume and prices of fish landed in each superport parish and the relative distribution and importance of fishing. However, they do not provide information on where

Table 30. Value and Quantity of Fishery Landings by Parish of Superport Parishes, 1958-1971.

ST. CHARLES PARISH

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)				18,000	77,290	95,290
	Quantity (lbs.)				450,000	379,100	829,100
1959	Value ($)				22,750	73,643	96,393
	Quantity (lbs.)				455,000	379,900	834,900
1960	Value ($)				16,625	144,790	161,415
	Quantity (lbs.)				332,500	635,000	967,500
1961	Value ($)				12,150	189,444	201,594
	Quantity (lbs.)				243,000	862,500	1,105,500
1962	Value ($)				9,268	175,066	184,334
	Quantity (lbs.)				185,400	833,700	1,019,100
1963	Value ($)				6,100	238,143	244,243
	Quantity (lbs.)				283,133	1,157,567	1,395,700
1964	Value ($)				2,352	87,650	290,002
	Quantity (lbs.)				29,400	1,339,100	1,368,500
1965	Value ($)				3,016	254,648	257,664
	Quantity (lbs.)				37,700	1,042,000	1,079,700
1966	Value ($)				3,765	194,286	713,379
	Quantity (lbs.)				55,400	723,200	778,600
1967	Value ($)				1,255	141,877	143,132
	Quantity (lbs.)				18,400	528,700	547,100
1968	Value ($)				17,213	174,306	191,519
	Quantity (lbs.)				206,400	634,000	840,400
1969	Value ($)				27,187	207,737	234,924
	Quantity (lbs.)				293,600	776,300	1,069,900
1970	Value ($)				13,896	197,667	211,563
	Quantity (lbs.)				152,700	749,000	901,700
1971	Value ($)				1,999	134,155	136,154
	Quantity (lbs.)				19,400	486,500	505,900
Total Value					155,576	2,490,702	2,646,278
Average Value					11,113	177,907	189,019
Total Weight					2,717,600	10,526,600	13,243,600
Average Weight					194,071	751,900	945,971
Landings in St. Charles Parish as Percent of Total Superport Area, 1971.							
Percent Total Value					.19	6.48	.27
Percent Total Weight					.19	1.51	.07
Landings in St. Charles Parish as Percent of Average Superport Area, 1958-1971.							
Percent Average Value					1.64	10.24	.65
Percent Average Weight					2.33	3.48	.22

Table 31. Value and Quantity of Fishery Landings by Parish of Superport Parishes, 1958-1971.

ST. MARY PARISH

	Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958 Value ($)	1,869,157			1,391	436,342	2,306,890
Quantity (lbs.)	4,274,900			27,800	2,476,200	6,778,900
1959 Value ($)	1,906,547		506,828	3,250	608,536	3,025,161
Quantity (lbs.)	5,712,900		37,542,800	65,000	9,731,020	53,989,500
1960 Value ($)	2,978,298		708,042	26,445	509,172	4,221,957
Quantity (lbs.)	8,298,800		64,958,000	528,900	2,976,100	76,761,800
1961 Value ($)	1,191,396		1,003,451	9,905	659,570	2,864,322
Quantity (lbs.)	3,043,600		86,504,400	215,100	3,473,900	93,237,000
1962 Value ($)	1,435,436		1,427,034	1,743	649,590	3,513,803
Quantity (lbs.)	2,508,800		123,020,200	24,900	3,456,400	129,010,300
1963 Value ($)	3,384,379		1,336,518	6,684	538,284	5,265,865
Quantity (lbs.)	8,348,100		107,738,000	111,400	2,831,400	119,028,900
1964 Value ($)	3,366,825		1,858,582	58,076	504,042	5,787,525
Quantity (lbs.)	7,280,800		123,085,000	831,500	2,564,600	133,761,900
1965 Value ($)	3,431,728		2,155,278	67,174	614,731	6,268,911
Quantity (lbs.)	6,947,800		124,738,600	1,119,800	2,741,000	135,547,200
1966 Value ($)	3,523,033	15,706	1,409,316	17,104	531,372	5,496,531
Quantity (lbs.)	5,794,700	23,700	81,937,000	255,300	2,271,700	90,282,400
1967 Value ($)	3,273,728		726,401	21,552	563,547	4,585,228
Quantity (lbs.)	6,280,000		60,432,700	317,000	2,491,200	69,520,900
1968 Value ($)	4,069,868		575,806	12,721	527,482	5,185,877
Quantity (lbs.)	6,371,700		46,299,700	152,700	2,331,700	55,155,800
1969 Value ($)	3,963,195		1,686,137	124,110	589,386	6,362,828
Quantity (lbs.)	5,727,400		113,190,500	1,340,300	2,761,200	123,019,400
1970 Value ($)	4,993,239		2,565,848	49,541	619,984	8,228,612
Quantity (lbs.)	7,511,100		130,114,000	554,400	2,584,100	140,763,600
1971 Value ($)	5,372,132		3,170,101	156,542	625,077	9,323,852
Quantity (lbs.)	6,045,900		193,388,800	1,341,800	272,080	203,497,300
Total Value	44,758,961	15,706	19,129,342	556,238	7,977,115	72,437,362
Average Value	3,197,069	1,122	1,366,382	39,731	569,794	5,174,097
Total Weight	84,146,500	23,700	1,292,949,700	6,885,600	42,962,500	1,426,968,000
Average Weight	6,010,464	1,693	92,353,550	491,829	3,068,750	101,926,286

Landings in St. Mary Parish as Percent of Total Superport Area, 1971.

Percent Total Value	15.98		32.43	14.52	30.19	18.40
Percent Total Weight	7.82		32.06	13.32	.84	27.79

Landings in St. Mary Parish as Percent of Average Superport Area, 1958-1971.

Percent Average Value	17.43	.04	26.94	5.98	14.18	17.97
Percent Average Weight	11.24	.02	27.41	3.33	14.18	23.72

Table 32. Value and Quantity of Fishery Landings by Parish. Superport Parishes, 1958-1971, Terrebonne Parish.

		Shrimp	Oysters	Menhaden	Crabs	Other Species	Total Value
1958	Value ($)	2,847,663	362,272		29,344	62,551	3,301,830
	Quantity (lbs.)	10,101,800	1,167,900		713,600	370,800	12,354,100
1959	Value ($)	2,436,396	332,107		26,300	70,288	2,865,091
	Quantity (lbs.)	13,053,900	1,214,600		657,500	725,700	15,651,700
1960	Value ($)	3,167,511	341,605		20,832	135,534	3,665,482
	Quantity (lbs.)	15,459,400	1,269,900		520,800	5,751,600	23,001,700
1961	Value ($)	2,183,004	408,413	88,756	32,307	33,182	2,745,662
	Quantity (lbs.)	8,998,300	1,416,400	7,651,400	1,043,100	232,700	19,341,900
1962	Value ($)	3,673,929	328,165	518,859	21,160	53,790	4,595,903
	Quantity (lbs.)	12,845,700	1,104,300	44,729,200	423,200	401,700	59,504,100
1963	Value ($)	3,746,627	433,392	677,693	21,960	58,169	4,937,841
	Quantity (lbs.)	22,329,800	1,776,700	54,609,700	439,200	377,000	79,532,400
1964	Value ($)	3,750,359	502,178	938,250	18,757	69,772	5,279,316
	Quantity (lbs.)	15,050,300	1,987,900	62,629,600	330,100	511,600	80,509,500
1965	Value ($)	3,560,578	344,076	2,322,702	83,675	89,933	6,400,964
	Quantity (lbs.)	15,428,000	1,349,900	134,426,100	1,673,500	532,200	153,409,700
1966	Value ($)	4,822,964	502,212	2,214,277	71,865	95,971	7,707,289
	Quantity (lbs.)	14,526,600	1,284,800	128,912,000	1,072,400	568,200	146,364,000
1967	Value ($)	5,333,094	1,040,244	1,109,925	43,682	105,666	7,632,611
	Quantity (lbs.)	20,872,100	2,141,600	92,340,100	640,500	2,815,800	118,810,100
1968	Value ($)	4,981,893	712,244	1,600,243	44,226	56,494	7,395,100
	Quantity (lbs.)	17,179,100	1,969,600	128,637,300	530.400	414,600	148,731,000
1969	Value ($)	7,161,949	935,159	2,340,936	89,315	88,451	10,615,810
	Quantity (lbs.)	22,170,700	2,287,500	157,051,400	963,800	553,400	183,028,200
1970	Value ($)	6,507,486	894,069	3,572,988	149,135	99,828	11,223,506
	Quantity (lbs.)	24,469,100	2,221,500	181,186,000	1,635,400	599,800	210,111,800
1971	Value ($)	9,009,667	900,677	3,862,742	206,007	134,811	14,113,904
	Quantity (lbs.)	27,444,400	2,443,300	237,812,500	2,166,000	1,876,000	271,742,200
Total Value		63,182,220	8,036,813	19,247,371	858,565	1,154,440	92,480,309
Average Value		4,513,016	574,058	1,374,812	61,326	82,460	6,605,736
Total Weight		239,929,200	23,635,900	1,229,985,300	12,809,500	15,733,100	1,522,093,000
Average Weight		17,137,800	1,688,279	87,856,093	914,964	1,123,793	108,720,929
% Total Value		26.81	21.73	39.52	19.10	6.51	27.85
% Total Weight		35.51	25.82	39.42	21.35	6.71	37.10
% Average Value		24.61	19.37	27.10	9.17	4.75	22.95
% Average Weight		32.05	19.59	26.07	10.9	5.19	25.30

the fish were caught. In order to complete the data on fishing and to provide a supplemental source of information this section will present value, volume and price data on piscatorial species caught in water bodies located in or near the superport area. The basic data were obtained from computer printouts obtained from the National Marine Fisheries Service (National Marine Fisheries Service, Room 412, 546 Carondelet St., New Orleans, La. 70130. Mr. Orville Allen and Mr. Ovide Plaisance of the New Orleans NMFS office were extremely helpful in both supplying and interpreting this data.). In order to save other researchers the trouble of reproducing this data, all of the raw data are presented so they may do their own manipulation of the data.

These data and those presented in section f should provide the reader with sufficient information on trends in prices, quantities, values, distribution of landings, catches, and the relative economic importance of the major fish species. Because of time and budget limitations this series starts with 1963 instead of 1958.

The reader is cautioned once again about the meaning of these values. Because of the common property problem they reflect the value of labor and capital expended in getting the fish from the sea to the dock and they do not represent or include the value of the fish in the sea.

The data cover both inside and outside water bodies along the Louisiana coast from 1963 to 1971. Inside water bodies include Barataria and Caminada Bays, Lake Borgne, Lake Pontchartrain, Breton Sound, Chandeleur Sound, Garden Island Bay, Timbalier Bay, Terrebonne Bay, Lake Pelto, Caillou Bay, Lake Barre, Vermilion and Coté Blanche Bays, Little Lake, Four League Bay, Lake Mechant, Adams Bay, Lost Lake and Lake DeCade.

Geographically, these water bodies range from the Mississippi Gulf Coast westward to Vermilion Parish.

The outside waters in this study are represented by offshore grid areas. These grid areas extend from the shoreline to 30 to 60 nautical miles off the coast into the Gulf of Mexico. For this study grids 11 to 15 were used. These cover the area from Mississippi to Vermilion Parish. (See Grid Map, Figure 15).

The data for both inside and outside waters are divided into the same general categories as the landings data by parish. The categories are shrimp, oysters, menhaden, crabs and "other species," and are given both in terms of volume and value of landings. The same measurement and valuation standards apply to these data that applied previously to the landings data.

The data contained in this section were obtained in three ways: through interview, through state records and by contacting fish wholesalers and fish product manufacturers. First, data are obtained for vessels over five net tons through interviews conducted by field personnel at the NFMS. These interviews are conducted to obtain information on the number of crewmen, the number and type of gear used on vessels, the area where the fish were caught, the depth where the fish were caught, and the fishing effort required (Department of Commerce, 1972).

Most of the data on volume and value is obtained from service tax records from the Louisiana Revenue Department and from the Louisiana Wild Life and Fisheries Commission. The National Marine Fisheries Service in Washington, D.C. notes that:

> Data on over 96% of the catch are available from summaries of monthly landings bulletins and other current records

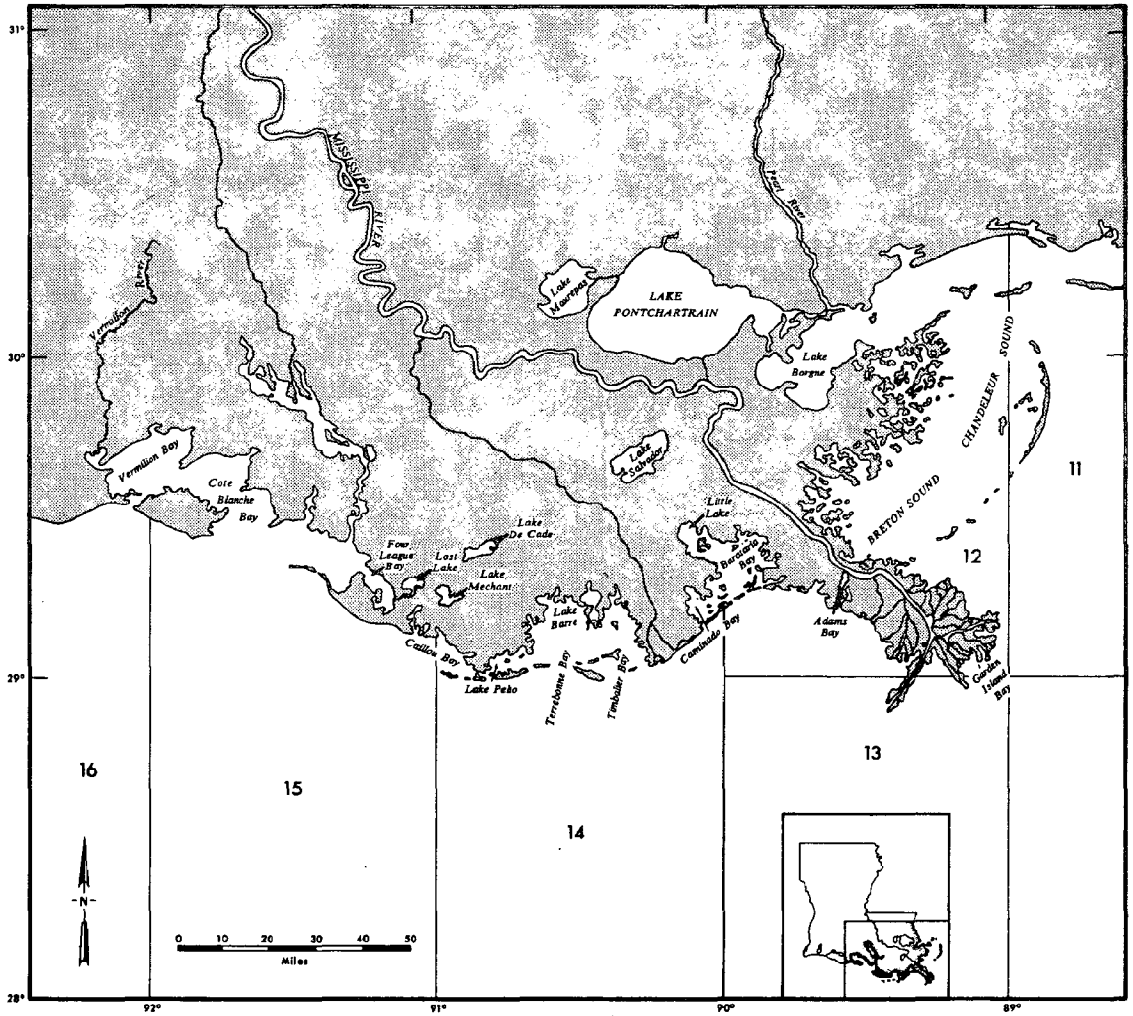

Figure 15. Geographic locations in coastal Louisiana of selected fishery data.

assembled by the Bureau or the various States. If complete catch data are not available from central sources, wholesale dealers and manufacturers of fishery products are visited, and data are obtained from them on purchases of fish or shellfish from fishermen (ibid.)

(2) What the Data Show

(a) Total Superport Area (Tables 33 and 34)

Table 33 provides data on the prices of the major species obtained by dividing quantity into value. The classification which shows the greatest relative price increase is "other species" followed by the price of shrimp. Shrimp prices increased steadily from $0.21 per pound in 1963 to $0.59 in 1971. In real sums (1967=100) the price of shrimp increased from $0.23 to $0.50 per pound. The real prices of oysters and menhaden actually decreased during this time period. Although the prices do differ from those presented in Table 34, they are of the same order of magnitude. Different sources were used for each table, so it was expected that differences would appear. Neither table shows the "correct" prices and either one or an average of the prices in both may be used.

In Table 34, (Note that the values cited in this series of tables are stated in thousands of dollars.) we can see that the total current dollar value of all species doubled from a value of $32 million in 1963 to $63 million in 1971. This represents a constant dollar increase of 48 percent from 1963 to 1971. Total value during the nine year period was $393 million. Shrimp were the most valuable catch and accounted for $248 million during the nine year period, or 63 percent of total catch. In 1971 shrimp value was $54 million or 86 percent of total catch. Shrimp were also increasing in value at the most rapid rate. Oysters and menhaden were increasing at a much slower rate. In the landings

Table 33. Fishery Catches in Waters Located in Superport Area. Real*and Current Price Per Pound, By Species, 1963-1971.

	Value Per Pound	Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Current Prices	.0492	.2102	.3165	.0124	.0776	.0310
	Real Prices	.0539	.2304	.3470	.0135	.0850	.0339
1964	Current Prices	.0486	.3111	.2559	.0146	.0869	.0290
	Real Prices	.0525	.3366	.2769	.0158	.0940	.0313
1965	Current Prices	.0502	.3037	.2848	.0166	.2588	.0819
	Real Prices	.0531	.3217	.3016	.0175	.2741	.0867
1966	Current Prices	.0606	.3989	.4405	.0173	.0767	.0314
	Real Prices	.0611	.4025	.4445	.0174	.0773	.0316
1967	Current Prices	.0661	.3238	.4170	.0121	.0821	.0334
	Real Prices	.0661	.3238	.4170	.0121	.0821	.0334
1968	Current Prices	.0559	.3862	.4033	.0126	.1026	.0371
	Real Prices	.0539	.3727	.3892	.0121	.0990	.0358
1969	Current Prices	.0744	.4134	.4254	.0148	.1045	.0807
	Real Prices	.0683	.3796	.3906	.0135	.0959	.0741
1970	Current Prices	.0784	.3822	.4204	.0196	.0962	.0870
	Real Prices	.0682	.3326	.3658	.0170	.0837	.0757
1971	Current Prices	.0714	.5874	.4021	.0156	.1103	.1140
	Real Prices	.0603	.4961	.3396	.0131	.0931	.0962

*Real price is obtained by dividing current price by the consumer price index for food; 1967 = 100.

Table 34.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches. Total Superport Area - Coastal Water Bodies and Gulf of Mexico Grids, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	31,998	19,780	3,664	5,824	488	2,242
	Pounds	650,173	94,079	11,573	465,935	6,287	72,299
1964	Value	33,737	19,512	3,481	7,583	436	2,725
	Pounds	692,782	62,711	13,600	517,655	5,017	93,799
1965	Value	35,933	16,069	2,716	10,101	4,741	2,307
	Pounds	714,547	52,903	9,534	605,623	18,319	28,168
1966	Value	39,746	25,675	2,318	8,636	521	2,595
	Pounds	655,247	64,354	5,262	496,405	6,792	82,434
1967	Value	36,087	24,432	3,458	4,340	518	3,338
	Pounds	545,734	75,450	8,291	356,044	6,302	99,648
1968	Value	44,147	27,479	5,620	6,506	781	3,761
	Pounds	788,419	71,134	13,934	512,622	7,609	101,261
1969	Value	53,420	36,320	4,031	8,423	959	3,686
	Pounds	717,623	87,838	9,475	565,480	9,173	45,658
1970	Value	54,858	35,637	3,789	10,660	850	3,923
	Pounds	699,414	93,226	9,011	543,263	8,831	45,084
1971	Value	63,249	54,621	4,973	10,660	1,199	5,106
	Pounds	885,836	92,984	12,366	682,703	10,869	44,768
Total							
	Value	393,176	247,927	34,051	72,733	10,493	27,973
	Pounds	6,275,978	680,809	93,046	4,745,729	79,196	677,098
Annual Average							
	Value	43,686	27,547	3,783	8,081	1,166	3,108
	Pounds	697,331	75,645	10,338	527,303	8,800	75,233

data of the previous section menhaden had a rapid rate of growth, but this occurred primarily in the latter 1950's and early 1960's.

(b) Open Gulf Grid Areas (Tables 35-40)

The grid areas in the Gulf and the coastal water bodies are shown on Figure 15. The reader should refer to this map to obtain the location of each grid area and coastal water body.

As one would expect, shrimp and menhaden are important in the open Gulf area, but oysters are not. Table 35 shows that between 1963 and 1971 70 percent of the shrimp and 79 percent of the menhaden were caught in the open Gulf. This area accounts for 66 percent of the value of fish caught in the superport area over the nine year period. The remaining 34 percent were caught in the coastal water bodies.

The most valuable grid area in sums of total value of fish produced is Grid 15 (most westward grid in superport area) in which 23 percent of total fish value was obtained. The primary factor in this ranking is the large number of menhaden taken from it. Although shrimp outrank menhaden in total value, nearly 68 percent of all menhaden caught in the superport area are caught in Grid 15.

The second most valuable grid area is 11 in which the total value of the catch is 18 percent of total superport area. Almost the entire catch in this grid is shrimp.

(c) Coastal Water Bodies (Tables 41-59)

The 18 coastal water bodies account for $134 million dollars of catch in the 1963-71 period and $21 million in 1971. Approximately 55 percent of total catch is shrimp, 25 percent oysters and 11 percent menhaden.

The most significant revenue producing water bodies

Table 35.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Total Open Gulf Grid Areas, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	20,857	13,859		5,005	3	1,990
	Pounds	533,049	59,264		403,306	66	70,413
1964	Value	21,275	13,488		5,513	24	2,249
	Pounds	497,262	38,092		367,554	459	91,156
1965	Value	25,137	10,482		8,547	4,145	1,962
	Pounds	558,709	28,257		494,724	11,581	24,146
1966	Value	27,742	18,681	17	6,802	13	2,228
	Pounds	515,540	39,982	25	395,436	201	79,895
1967	Value	23,185	17,290		2,975	11	2,908
	Pounds	388,282	43,925		247,181	161	97,015
1968	Value	27,544	19,742		4,436	14	3,353
	Pounds	574,971	38,734		356,060	171	98,258
1969	Value	34,584	25,198		6,693	29	2,663
	Pounds	538,388	48,123		448,232	306	41,727
1970	Value	36,719	24,931		8,410	29	3,348
	Pounds	518,898	51,614		425,452	324	41,509
1971	Value	42,147	42,148		8,924	32	4,355
	Pounds	682,994	49,086		550,062	377	41,322
Total							
	Value	259,190	174,221	17	57,306	4,301	23,346
	Pounds	734,196	383,209	25	3,688,007	13,646	649,309
Annual Average							
	Value	28,799	19,358	2	6,367	478	2,594
	Pounds	526,022	42,579	3	409,779	1,516	72,145
% of Total Superport Area, 1971							
	Value	66.63	77.16		83.71	2.63	85.28
	Pounds	77.10	52.79		80.57	3.46	92.30
% of Average for Total Superport Area, 1963-1971							
	Value	65.92	70.27	.04	78.78	40.99	83.45
	Pounds	75.43	56.28	.02	77.71	17.23	95.89

Table 36.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Open Gulf Grid Area - 11 , 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	4,045	3,182				863
	Pounds	60,772	10,360				50,412
1964	Value	4,408	3,427			5	976
	Pounds	61,197	9,905			104	51,188
1965	Value	5,624	4,962		40	2	619
	Pounds	44,157	13,684		2,318	29	28,125
1966	Value	6,418	5,613			3	802
	Pounds	46,005	12,862			52	33,091
1967	Value	6,858	6,001			3	857
	Pounds	50,559	14,320			39	36,234
1968	Value	9,190	8,210			1	979
	Pounds	51,250	16,820			9	34,421
1969	Value	10,681	10,010			4	667
	Pounds	23,754	17,778			40	5,936
1970	Value	9,447	8,344			2	1,101
	Pounds	24,179	16,695			23	7,461
1971	Value	13,073	11,955			1	1,098
	Pounds	28,099	18,854			265	8,979
Total							
	Value	69,745	61,703		40	39	7,962
	Pounds	389,973	131,278		2,318	527	255,849
Annual Average							
	Value	7,749	6,856		4	4	885
	Pounds	43,330	14,586		258	58	28,428
% of Total Superport Area, 1971							
	Value	20.66	21.88			1.75	21.49
	Pounds	3.17	20.27			2.44	20.05
% of Average for Total Superport Area, 1963-1971							
	Value	17.73	24.88		.05	.37	28.46
	Pounds	6.21	19.28		.04	.66	37.78

Table 37.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Open Gulf Grid Area - 12 , 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	516	516				
	Pounds	2,303	2,303				
1964	Value	307	306				1
	Pounds	1,037	1,020				17
1965	Value	1,261	149		1,112		0
	Pounds	64,815	449		64,364		2
1966	Value	896	162		734		1
	Pounds	43,044	363		42,672		8
1967	Value	68	65				3
	Pounds	196	171				26
1968	Value	127	127				0
	Pounds	243	238				4
1969	Value	528	526				2
	Pounds	1,086	1,061				25
1970	Value	264	258				6
	Pounds	649	598				51
1971	Value	66	47				19
	Pounds	229	95				134
Total							
	Value	4,035	2,156		1,846		32
	Pounds	113,602	6,297		107,036		269
Annual Average							
	Value	447	240		205		3
	Pounds	12,612	700		19,893		30
% of Total Superport Area, 1971							
	Value	.10	.08				.36
	Pounds	.02	.10				.29
% of Average for Total Superport Area, 1963-1971.							
	Value	1.02	.86		2.53		.11
	Pounds	1.80	.92		3.77		.03

Table 38.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Open Gulf Grid Area - 13 , 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	6,658	3,074		2,991		
	Pounds	276,157	10,404		240,958		24,795
1964	Value	6,183	2,706		2,717	2	758
	Pounds	219,637	7,769		181,840	28	30,000
1965	Value	4,120	2,426		1,134	4	557
	Pounds	87,853	6,324		65,628	77	15,823
1966	Value	5,236	4,100		306	1	828
	Pounds	56,398	8,772		17,583	31	30,012
1967	Value	5,222	3,799		383	0	1,040
	Pounds	75,547	9,560		31,511	7	34,468
1968	Value	5,536	3,627		511	1	1,398
	Pounds	84,015	7,127		40,863	10	36,015
1969	Value	6,162	4,771		574	1	816
	Pounds	53,705	10,269		38,516	11	4,908
1970	Value	6,299	4,801		470	1	1,027
	Pounds	38,835	10,476		23,812	12	4,535
1971	Value	7,734	5,973		615	0	1,145
	Pounds	64,802	9,826		38,876	2	16,100
Total							
	Value	53,152	35,278		9,700	11	8,164
	Pounds	956,948	80,527		679,587	178	196,656
Annual Average							
	Value	5,906	3,920		1,078	1	907
	Pounds	106,328	8,947		75,510	20	21,851
% of Total Superport Area, 1971							
	Value	12.22	10.93		5.76	.00	22.43
	Pounds	7.31	10.56		5.69	.00	35.96
% of Average for Total Superport Area, 1963-1971							
	Value	13.51	14.22		13.33	.10	29.18
	Pounds	15.24	11.82		14.31	.22	29.04

Table 39.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Open Gulf Grid Area - 14 , 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	2,389	1,911		678		250
	Pounds	68,704	6,243		54,610		7,851
1964	Value	3,282	1,987		929	6	360
	Pounds	76,044	5,184		61,542	100	9,218
1965	Value	5,242	2,895		1,728		619
	Pounds	134,883	6,810		100,045		28,028
1966	Value	4,746	3,584	17	712		433
	Pounds	64,801	7,298	25	41,417		16,061
1967	Value	4,879	3,683		371		825
	Pounds	66,229	9,789		30,856		25,584
1968	Value	4,862	3,328		746	5	782
	Pounds	93,822	6,835		59,714	86	27,207
1969	Value	5,571	3,533		1,152	12	875
	Pounds	114,200	6,732		77,300	124	30,044
1970	Value	6,958	4,853		1,165	21	918
	Pounds	96,979	10,000		59,103	228	27,649
1971	Value	4,820	3,437		1,101	2	280
	Pounds	86,069	5,926		68,975	18	11,149
Total							
	Value	43,199	29,211	17	8,583	46	5,342
	Pounds	801,732	64,818	25	553,563	536	182,791
Annual Average							
	Value	4,800	3,246	2	954	5	594
	Pounds	89,081	7,202	3	61,507	60	20,310
% of Total Superport Area, 1971							
	Value	7.62	6.29		10.32	.19	5.47
	Pounds	9.71	6.37		10.10	.16	24.90
% of Average for Total Superport Area, 1963-1971							
	Value	10.98	11.78	.04	11.80	.43	19.09
	Pounds	12.77	9.52	.02	11.66	.67	26.99

Table 40.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Open Gulf Grid Area - 15 , 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	6,797	5,176		1,337	3	282
	Pounds	125,112	16,095		107,738	66	1,213
1964	Value	7,095	5,061		1,868	11	154
	Pounds	139,347	14,215		124,172	227	733
1965	Value	8,890	51		4,533	4,139	167
	Pounds	277,001	990		262,369	11,475	2,168
1966	Value	10,445	5,222		5,050	8	165
	Pounds	305,291	10,688		293,763	118	721
1967	Value	6,157	3,742		2,221	10	184
	Pounds	195,751	10,085		184,814	150	702
1968	Value	7,829	4,450		3,179	7	192
	Pounds	263,893	7,714		255,482	86	610
1969	Value	11,642	6,358		4,968	12	304
	Pounds	345,642	12,282		332,416	130	813
1970	Value	13,751	6,675		6,775	6	296
	Pounds	358,255	13,845		342,537	60	1,813
1971	Value	16,454	9,137		7,208	8	1,813
	Pounds	461,648	14,385		442,211	93	4,959
Total							
	Value	89,060	45,872		37,137	4,205	1,846
	Pounds	2,471,940	100,299		2,345,502	12,405	13,733
Annual Average							
	Value	9,896	5,097		4,126	467	205
	Pounds	274,660	11,144		260,611	1,378	1,526
% of Total Superport Area, 1971							
	Value	26.01	16.72		67.61	.68	35.51
	Pounds	52.11	15.47		64.77	.85	11.07
% of Average for Total Superport Area, 1963-1971							
	Value	22.65	18.50		51.05	40.07	6.59
	Pounds	39.38	14.73		49.42	15.66	2.02

Table 41.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Total - Coastal Water Bodies, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	11,142	5,921	3,664	819	485	252
	Pounds	117,124	34,814	11,573	62,629	6,221	1,886
1964	Value	12,462	6,025	3,481	2,069	411	476
	Pounds	195,520	24,619	13,600	150,100	4,557	2,643
1965	Value	10,795	5,586	2,716	1,554	595	345
	Pounds	155,838	24,646	9,534	110,899	6,738	4,022
1966	Value	12,004	6,994	2,302	1,834	509	366
	Pounds	139,707	24,372	5,236	100,939	6,590	2,540
1967	Value	12,903	7,142	3,458	1,365	507	430
	Pounds	157,452	31,525	8,291	108,862	6,141	2,633
1968	Value	16,603	7,737	5,620	2,070	766	409
	Pounds	213,448	32,400	13,934	156,562	7,438	3,113
1969	Value	18,836	11,122	4,031	1,730	930	1,023
	Pounds	179,235	39,715	9,475	117,248	8,867	3,931
1970	Value	18,140	10,706	3,789	2,250	820	575
	Pounds	180,516	41,612	9,011	117,811	8,507	3,575
1971	Value	21,101	12,473	4,973	1,736	1,167	751
	Pounds	202,842	43,898	12,366	132,641	10,492	3,446
Total							
	Value	133,986	73,706	34,035	15,427	6,192	4,627
	Pounds	1,541,782	297,599	93,021	1,057,722	65,550	27,789
Annual Average							
	Value	14,887	8,190	3,782	1,714	688	514
	Pounds	171,309	33,067	10,336	117,525	7,283	3,088
% of Total Superport Area, 1971							
	Value	33.66	22.83	100.00	16.28	97.36	14.71
	Pounds	22.89	47.20	100.00	19.42	96.53	7.69
% of Average for Total Superport Area, 1963-1971							
	Value	34.07	29.72	99.95	21.21	59.00	16.54
	Pounds	24.56	43.71	99.97	22.28	82.76	4.10

Table 42.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Borgne - 122, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	524	248	176		83	17
	Pounds	2,819	1,038	515		1,151	117
1964	Value	475	246	145		75	9
	Pounds	2,385	841	373		1,101	70
1965	Value	260	23	91		138	8
	Pounds	1,928	83	173		1,618	53
1966	Value	234	109	16		99	10
	Pounds	1,754	332	39		1,312	71
1967	Value	565	154	283		144	14
	Pounds	2,716	651	674		1,300	91
1968	Value	1,103	115	781		186	21
	Pounds	4,149	461	1,824		1,723	141
1969	Value	1,095	407	470		196	23
	Pounds	4,244	1,145	1,076		1,875	147
1970	Value	745	143	416		166	20
	Pounds	3,258	491	950		1,693	124
1971	Value	473	126	262		79	7
	Pounds	1,528	374	562		551	42
Total							
	Value	5,475	1,570	2,640		1,136	129
	Pounds	24,781	5,416	6,185		12,324	856
Annual Average							
	Value	608	174	293		126	14
	Pounds	2,753	602	687		1,369	95
% of Total Superport Area, 1971							
	Value	.74	.22	5.26		6.58	.13
	Pounds	.17	.40	4.54		5.06	.09
% of Average for Total Superport Area, 1963-1971							
	Value	1.39	.63	7.75		10.82	.46
	Pounds	.39	.79	6.64		15.56	.12

Table 43.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Pontchartrain - 123, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	134				111	22
	Pounds	1,166				1,045	120
1964	Value	475	246			72	157
	Pounds	2,385	841			556	989
1965	Value	74	2			47	25
	Pounds	425	5			326	95
1966	Value	108	51			41	17
	Pounds	535	108			358	70
1967	Value	74				58	15
	Pounds	679				606	74
1968	Value	118	37			69	12
	Pounds	628	60			516	52
1969	Value	148	36			87	26
	Pounds	805	74			578	154
1970	Value	166	92			50	24
	Pounds	1,000	409			452	141
1971	Value	230	38			183	9
	Pounds	1,317	155			1,120	42
Total							
	Value	1,527	503			718	305
	Pounds	8,941	1,651			5,556	1,734
Annual Average							
	Value	170	56			80	34
	Pounds	993	183			617	193
% of Total Superport Area, 1971							
	Value	.36	.06			15.27	.17
	Pounds	.14	.16			10.30	.09
% of Average for Total Superport Area, 1963-1971							
	Value	.38	.20			6.84	1.09
	Pounds	.14	.24			7.01	.25

Table 44.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Breton Sound - 124, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	2,829	572	1,268	819	103	66
	Pounds	69,903	2,388	3,497	62,629	934	456
1964	Value	3,509	518	765	2,069	106	50
	Pounds	155,989	1,637	2,800	150,100	926	526
1965	Value	3,148	800	612	1,554	129	53
	Pounds	117,053	2,614	2,059	110,899	1,174	307
1966	Value	3,610	1,091	747	1,597	83	93
	Pounds	94,631	3,377	1,594	87,969	1,003	689
1967	Value	3,545	1,264	747	1,365	83	86
	Pounds	116,631	4,413	1,818	108,862	933	605
1968	Value	4,516	1,343	1,157	1,722	160	134
	Pounds	140,788	4,377	3,083	131,002	1,465	861
1969	Value	5,017	2,201	797	1,716	165	138
	Pounds	126,887	6,073	1,926	116,333	1,575	980
1970	Value	4,609	1,464	801	2,092	151	101
	Pounds	118,278	4,343	1,969	109,792	1,525	1,649
1971	Value	4,162	1,055	1,413	1,481	122	92
	Pounds	126,356	3,958	3,647	116,632	1,175	944
Total							
	Value	33,630	10,216	7,922	13,566	1,101	824
	Pounds	986,895	32,098	21,330	884,419	10,760	38,288
Annual Average							
	Value	3,737	1,135	880	1,507	122	92
	Pounds	109,655	3,566	2,370	89,017	1,196	4,254
% of Total Superport Area, 1971							
	Value	6.58	1.93	28.40	13.89	10.14	1.80
	Pounds	14.26	4.25	29.48	17.08	10.80	2.10
% of Average for Total Superport Area, 1963-1971							
	Value	8.55	4.12	23.26	18.65	10.49	2.94
	Pounds	15.72	4.71	22.92	16.88	13.58	5.65

Table 45.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Chandeleur Sound - 124, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	597	131	368		52	46
	Pounds	2,728	567	1,358		450	354
1964	Value	1,030	182	754		46	48
	Pounds	4,301	597	2,972		316	416
1965	Value	1,526	648	697		83	98
	Pounds	7,796	2,218	2,253		742	2,583
1966	Value	1,495	407	726	237	64	61
	Pounds	16,940	1,089	1,621	13,000	803	428
1967	Value	1,363	504	730		56	74
	Pounds	4,583	1,737	1,636		658	553
1968	Value	2,212	407	1,290	348	90	76
	Pounds	31,210	1,432	2,841	25,560	829	549
1969	Value	1,915	947	756	14	99	100
	Pounds	6,480	2,228	1,760	915	938	640
1970	Value	1,725	589	784	158	102	91
	Pounds	13,080	1,712	1,770	8,019	1,036	544
1971	Value	1,896	584	601	255	106	349
	Pounds	21,491	1,913	2,120	16,009	826	563
Total							
	Value	13,758	4,154	6,605	932	698	1,368
	Pounds	101,496	12,816	17,268	58,502	6,657	6,254
Annual Average							
	Value	1,331	462	734	104	78	152
	Pounds	11,277	1,424	1,919	6,500	740	695
% of Total Superport Area, 1971							
	Value	2.99	1.06	12.08	2.39	8.85	6.84
	Pounds	2.42	2.05	17.14	2.34	8.15	1.25
% of Average for Total Superport Area, 1963-1971							
	Value	3.04	1.67	19.39	1.28	6.64	4.89
	Pounds	1.61	1.88	18.55	1.23	8.40	.92

Table 46.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Garden Island Bay - 125, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value						
	Pounds						
1964	Value	174	174				
	Pounds	572	572				
1965	Value						
	Pounds						
1966	Value	339	339				
	Pounds	1,076	1,076				
1967	Value	4	4				
	Pounds	6	6				
1968	Value	159	159				
	Pounds	259	259				
1969	Value	4	4				
	Pounds	6	6				
1970	Value						
	Pounds						
1971	Value						
	Pounds						
Total							
	Value	680	680				
	Pounds	1,919	1,919				
Annual Average							
	Value	76	76				
	Pounds	2	2				
% of Total Superport Area, 1971							
	Value						
	Pounds						
% of Average for Total Superport Area, 1963-1971							
	Value	.17	.27				
	Pounds	.00	.00				

Table 47.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Barataria and Caminada Bays - 131, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	2,200	1,072	1,058		36	34
	Pounds	11,444	6,766	3,665		720	292
1964	Value	2,266	926	1,264		44	32
	Pounds	10,074	3,822	5,383		684	185
1965	Value	2,237	1,335	825		52	25
	Pounds	10,064	5,781	3,468		655	160
1966	Value	2,137	1,643	372		93	30
	Pounds	9,033	6,405	1,101		1,289	239
1967	Value	2,555	1,384	1,021		95	54
	Pounds	10,937	6,717	2,458		1,371	391
1968	Value	3,100	1,171	1,760		121	49
	Pounds	12,924	6,445	4,655		1,447	377
1969	Value	3,970	2,651	1,077		143	99
	Pounds	14,540	9,840	2,488		1,565	647
1970	Value	4,473	3,186	1,083		96	108
	Pounds	16,454	11,983	2,609		1,104	758
1971	Value	4,818	3,016	1,626		44	133
	Pounds	14,761	9,939	3,560		429	834
Total							
	Value	27,757	16,384	10,086		724	564
	Pounds	110,230	67,697	29,387		9,263	3,884
Annual Average							
	Value	3,084	1,820	1,121		80	63
	Pounds	12,248	7,522	3,265		1,029	432
% of Total Superport Area, 1971							
	Value	7.61	5.52	32.68		3.64	2.60
	Pounds	1.66	10.68	28.78		3.94	1.86
% of Average for Total Superport Area, 1963-1971							
	Value	7.05	6.60	29.61		6.90	2.01
	Pounds	1.75	9.94	31,58		11.69	.57

Table 48.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Little Lake - 133, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	135	77			57	
	Pounds	1,512	508			1,004	
1964	Value	146	112			18	16
	Pounds	656	357			220	79
1965	Value	160	122			22	16
	Pounds	767	473			214	81
1966	Value	103	54			14	36
	Pounds	509	119			105	285
1967	Value	181	142			20	19
	Pounds	913	709			87	117
1968	Value	250	197			32	21
	Pounds	1,211	913			161	138
1969	Value	208	142			35	31
	Pounds	799	455			162	181
1970	Value	361	296			35	30
	Pounds	1,339	878			274	187
1971	Value	329	163			145	20
	Pounds	2,246	580			1,549	117
Total							
	Value	1,873	1,306			378	188
	Pounds	10,016	4,992			3,774	1,248
Annual Average							
	Value	208	145			42	21
	Pounds	1,113	555			419	139
% of Total Superport Area, 1971							
	Value	.52	.29			12.12	.40
	Pounds	.25	.62			14.24	.26
% of Average for Total Superport Area, 1963-1971							
	Value	.47	.52			3.60	.67
	Pounds	.15	.73			4.76	.18

Table 49.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Adams Bay - 135, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	745	149	568		12	17
	Pounds	2,930	744	1,813		234	139
1964	Value	582	240	313		10	19
	Pounds	2,557	917	1,395		125	120
1965	Value	585	259	258		46	21
	Pounds	2,623	949	1,000		556	118
1966	Value	305	218	30		35	21
	Pounds	1,428	718	57		535	119
1967	Value	400	236	126		21	17
	Pounds	1,780	1,016	344		304	116
1968	Value	568	288	233		32	15
	Pounds	2,488	1,380	623		381	104
1969	Value	722	546	139		38	18
	Pounds	2,749	1,901	325		413	110
1970	Value	694	454	182		41	17
	Pounds	2,576	1,581	443		454	99
1971	Value	1,614	932	583		67	32
	Pounds	4,461	2,426	1,161		701	173
Total							
	Value	6,018	3,106	2,432		302	178
	Pounds	23,566	11,604	7,161		3,703	1,098
Annual Average							
	Value	669	345	270		34	20
	Pounds	2,618	1,292	796		411	122
% of Total Superport Area, 1971							
	Value	2.55	1.70	11.71		5.62	.62
	Pounds	.50	2.60	9.38		6.45	.38
% of Average for Total Superport Area, 1963-1971							
	Value	1.53	1.25	7.14		2.87	.63
	Pounds	.37	1.70	7.69		4.67	.16

Table 50.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Timbalier Bay - 141, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	1,478	1,369	66		10	33
	Pounds	8,268	7,605	193		201	270
1964	Value	960	903	38		3	16
	Pounds	4,559	4,250	124		58	127
1965	Value	962	904	29		4	25
	Pounds	5,111	4,780	97		61	174
1966	Value	999	932	35		7	25
	Pounds	4,224	3,902	52		106	165
1967	Value	1,493	1,461	5		10	17
	Pounds	7,036	6,775	8		140	113
1968	Value	1,192	1,092	66		8	26
	Pounds	5,763	5,344	110		98	211
1969	Value	1,659	1,416	200		4	39
	Pounds	6,716	5,965	453		41	256
1970	Value	2,025	1,950	31		6	37
	Pounds	9,232	8,820	78		68	266
1971	Value	3,044	2,949	44		27	23
	Pounds	11,162	10,629	93		325	115
Total							
	Value	13,811	12,977	513		80	241
	Pounds	55,235	51,232	1,208		1,097	1,698
Annual Average							
	Value	1,535	1,442	57		9	27
	Pounds	6,137	5,692	134		122	189
% of Total Superport Area, 1971							
	Value	4.81	5.39	.88		2.28	.45
	Pounds	1.26	11.43	.75		2.99	.25
% of Average for Total Superport Area, 1963-1971							
	Value	3.51	5.23	1.50		.76	.86
	Pounds	.88	7.52	1.29		1.38	.25

Table 51.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Terrebonne Bay - 142, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	337	291	41		5	
	Pounds	2,626	2,374	142		110	
1964	Value	943	903	38		2	
	Pounds	4,417	4,250	124		42	
1965	Value	258	216	28		10	4
	Pounds	1,434	1,139	75		200	20
1966	Value	295	209	70		11	5
	Pounds	1,163	824	152		161	27
1967	Value	610	494	92		15	8
	Pounds	2,762	2,284	179		223	76
1968	Value	1,912	1,841	56		9	5
	Pounds	7,955	7,664	134		112	47
1969	Value	808	726	64		11	8
	Pounds	3,042	2,725	146		114	57
1970	Value	634	600	13		11	11
	Pounds	2,909	2,695	31		116	67
1971	Value	713	671	20		9	14
	Pounds	3,022	2,784	50		101	87
Total							
	Value	6,511	5,950	423		82	55
	Pounds	39,330	26,738	1,033		1,178	380
Annual Average							
	Value	723	661	47		9	6
	Pounds	4,370	2,971	115		131	42
% of Total Superport Area, 1971							
	Value	1.12	1.22	.40		.71	.26
	Pounds	.34	2.99	.40		.92	.19
% of Average for Total Superport Area, 1963-1971							
	Value	1.65	2.40	1.24		.78	.19
	Pounds	.62	3.26	1.10		1.48	.05

Table 52.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Caillou Bay - 143, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	314	271	32		5	5
	Pounds	2,420	2,168	106		110	37
1964	Value	350	308	40		2	
	Pounds	1,535	1,399	105		32	
1965	Value	354	300	38		10	6
	Pounds	1,927	1,608	90		200	30
1966	Value	388	192	70		22	5
	Pounds	1,225	722	152		322	30
1967	Value	336	179	147		6	4
	Pounds	1,428	1,022	292		81	33
1968	Value	329	242	79		4	4
	Pounds	1,099	833	187		49	30
1969	Value	1,006	790	193		16	7
	Pounds	3,647	2,944	481		169	53
1970	Value	651	501	97		42	10
	Pounds	3,146	2,387	226		464	69
1971	Value	729	608	50		62	9
	Pounds	3,596	2,461	127		918	91
Total							
	Value	4,357	3,392	746		169	50
	Pounds	20,003	15,523	1,764		2,344	372
Annual Average							
	Value	484	377	83		19	6
	Pounds	2,223	1,725	196		260	41
% of Total Superport Area, 1971							
	Value	1.46	1.11	.99		5.21	.17
	Pounds	.40	2.64	1.02		8.44	.20
% of Average for Total Superport Area, 1963-1971							
	Value	1.10	1.36	2.19		1.60	.17
	Pounds	.31	2.28	1.89		2.95	.05

Table 53.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Barre - 144, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	283	251	22		5	5
	Pounds	2,057	1,840	71		110	37
1964	Value	322	276	40		3	3
	Pounds	1,432	1,245	105		57	26
1965	Value	315	270	28		10	7
	Pounds	1,780	1,473	72		200	35
1966	Value	362	275	70		11	6
	Pounds	1,343	1,030	152		161	38
1967	Value	495	351	131		10	3
	Pounds	2,212	1,777	271		143	21
1968	Value	451	388	53		7	3
	Pounds	1,937	1,693	135		86	24
1969	Value	660	584	59		10	7
	Pounds	2,504	2,192	146		113	52
1970	Value	580	519	36		10	6
	Pounds	2,550	2,314	91		105	40
1971	Value	811	725	37		16	16
	Pounds	3,542	3,171	111		140	120
Total							
	Value	4,254	3,639	477		82	56
	Pounds	19,393	16,734	1,153		1,115	392
Annual Average							
	Value	473	404	53		9	6
	Pounds	2,155	1,859	128		124	44
% of Total Superport Area, 1971							
	Value	1.28	1.32	.75		1.34	.32
	Pounds	.39	3.40	.89		1.28	.26
% of Average for Total Superport Area, 1963-1971							
	Value	1.08	1.46	1.40		.78	.20
	Pounds	.30	2.45	1.23		1.40	.05

Table 54.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Pelto - 145, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	547	571	65		5	5
	Pounds	4,330	3,970	214		110	37
1964	Value	428	382	40		3	3
	Pounds	1,779	1,598	105		50	26
1965	Value	477	402	57		10	7
	Pounds	2,572	2,209	125		200	38
1966	Value	617	502	70		22	14
	Pounds	2,400	1,851	152		322	76
1967	Value	598	458	124		7	9
	Pounds	2,693	2,286	244		102	62
1968	Value	250	176	61		5	8
	Pounds	866	609	143		61	54
1969	Value	857	683	148		13	13
	Pounds	3,303	2,706	374		139	85
1970	Value	804	617	146		31	11
	Pounds	3,713	2,876	373		335	129
1971	Value	1,030	919	55		34	22
	Pounds	4,074	3,479	147		309	139
Total							
	Value	5,698	4,712	767		129	91
	Pounds	25,732	21,583	1,876		1,630	644
Annual Average							
	Value	633	524	85		14	10
	Pounds	2,859	2,398	208		181	72
% of Total Superport Area, 1971							
	Value	1.62	1.68	1.11		2.80	.42
	Pounds	.45	3.74	1.18		2.84	.30
% of Average for Total Superport Area, 1963-1971							
	Value	1.44	1.90	2.25		1.22	.32
	Pounds	.41	3.17	2.01		2.05	.09

Table 55.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Decade - 146, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	91	91				
	Pounds	691	691				
1964	Value	31	31				
	Pounds	136	136				
1965	Value	13	13				
	Pounds	69	69				
1966	Value	49	49				
	Pounds	188	188				
1967	Value	19	19				
	Pounds	120	120				
1968	Value	4				4	0
	Pounds	50				49	1
1969	Value	6				6	0
	Pounds	63				62	1
1970	Value	7				7	0
	Pounds	80				78	2
1971	Value	19	13			3	3
	Pounds	119	72			37	10
Total							
	Value	241	218			20	3
	Pounds	1,516	1,276			226	14
Annual Average							
	Value	27	24			2	1
	Pounds	168	142			25	2
% of Total Superport Area, 1971							
	Value	.03	.02			.28	.05
	Pounds	.01	.07			.34	.02
% of Average for Total Superport Area, 1963-1971							
	Value	.06	.08			.19	.01
	Pounds	.02	.18			.28	.00

Table 56.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lake Mechant - 147, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	113	113				
	Pounds	838	838				
1964	Value	72	32	40			
	Pounds	247	142	105			
1965	Value	49	11	38			
	Pounds	146	56	90			
1966	Value	130	42	89			
	Pounds	308	156	152			
1967	Value	278	92	184			1
	Pounds	803	427	367			10
1968	Value	171	81	85		4	0
	Pounds	586	335	198		49	4
1969	Value	291	185	100		6	0
	Pounds	918	624	230		62	2
1970	Value	340	160	162		18	0
	Pounds	1,226	648	382		194	3
1971	Value	444	204	225		12	3
	Pounds	1,521	717	663		124	16
Total							
	Value	1,888	921	923		40	4
	Pounds	6,593	3,943	2,187		429	35
Annual Average							
	Value	210	102	103		4	1
	Pounds	733	438	243		48	4
% of Total Superport Area, 1971							
	Value	.70	.37	4.51		1.03	.05
	Pounds	.17	.77	5.36		1.14	.03
% of Average for Total Superport Area, 1963-1971							
	Value	.48	.37	2.71		.37	.01
	Pounds	.10	.57	2.35		.54	.00

Table 57.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Lost Lake - 151, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	59	59				
	Pounds	400	400				
1964	Value	18	18				
	Pounds	71	71				
1965	Value	9	9				
	Pounds	40	40				
1966	Value	55	55				
	Pounds	198	198				
1967	Value	37	36				1
	Pounds	223	223				15
1968	Value	1					1
	Pounds	6					6
1969	Value	3	3				0
	Pounds	18	16				2
1970	Value	27	27				0
	Pounds	99	97				2
1971	Value	31	18	13			0
	Pounds	142	105	37			0
Total							
	Value	239	224	13			2
	Pounds	1,197	1,135	37			25
Annual Average							
	Value	27	25	2			0
	Pounds	133	126	4			3
% of Total Superport Area, 1971							
	Value	.04	.03	.26			.00
	Pounds	.01	.11	.30			.00
% of Average for Total Superport Area, 1963-1971							
	Value	.06	.09	.03			.00
	Pounds	.01	.16	.03			.00

Table 58.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Four League Bay - 152, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	71	68			3	
	Pounds	529	485			44	
1964	Value	75	54			21	
	Pounds	486	185			301	
1965	Value	72	38			33	
	Pounds	721	168			553	
1966	Value	192	185			6	1
	Pounds	754	652			91	11
1967	Value	121	110			9	2
	Pounds	708	556			129	24
1968	Value	29	2			27	1
	Pounds	332	3			321	9
1969	Value	75	6	28		42	
	Pounds	530	11	71		449	
1970	Value	97	58	27		13	
	Pounds	423	213	70		140	
1971	Value	221	147	45		29	0
	Pounds	828	464	88		276	1
Total							
	Value	952	668	99		182	3
	Pounds	5,312	2,736	228		2,303	45
Annual Average							
	Value	106	74	11		20	0
	Pounds	590	304	25		256	5
% of Total Superport Area, 1971							
	Value	.34	.26	.90		2.45	.00
	Pounds	.09	.49	.70		2.53	.00
% of Average for Total Superport Area, 1963-1971							
	Value	.24	.26	.29		1.73	.01
	Pounds	.08	.40	.24		.90	.00

Table 59.
Value (Thousands of Dollars) and Weight (Thousands of Pounds) of Fish Catches.
Vermilion and Cote Blanche Bays - 153, 1963-1971.

		Total	Shrimp	Oysters	Menhaden	Crabs	Other Species
1963	Value	588	587				2
	Pounds	2,461	2,433				28
1964	Value	492	470	4		6	12
	Pounds	2,018	1,758	10		91	159
1965	Value	297	233	13		2	49
	Pounds	1,383	982	33		38	330
1966	Value	660	641	7		2	47
	Pounds	2,353	2,018	15		25	295
1967	Value	327	269			4	53
	Pounds	1,206	809			65	332
1968	Value	238	198			8	33
	Pounds	893	595			92	207
1969	Value	472	296			62	114
	Pounds	1,988	811			675	502
1970	Value	211	49	10		42	110
	Pounds	1,153	168	19		469	497
1971	Value	554	307			228	19
	Pounds	2,675	672			1,852	152
Total							
	Value	3,875	3,050	34		354	438
	Pounds	13,629	10,246	77		3,307	2,501
Annual Average							
	Value	431	339	4		39	49
	Pounds	1,514	1,138	9		367	278
% of Total Superport Area, 1971							
	Value	.87	.56			18.99	.36
	Pounds	.30	.72			17.03	.33
% of Average for Total Superport Area, 1963-1971							
	Value	.98	1.23	.09		3.37	1.56
	Pounds	.21	1.50	.08		4.17	.36

are:

- Breton Sound (124) which produced 8.6 percent of the total fishery revenue in the superport area. Forty percent of the Breton Sound catch was menhaden, 30 percent shrimp and 24 percent oysters. Total value for 1963-71 was $33 million, in 1971 $4 million.

- Barataria and Caminada Bays (131) produced approximately 7 percent of the superport area revenue in 1963-71 and in 1971 nearly 60 percent of the bays' revenues were yielded by shrimp, 0.036 percent by oysters. No menhaden and few crabs were caught. Total value for 1963-71 was 27.8 million; for 1971, $4.8 million.

- Timbalier Bay (144) produced 3.5 percent of superport area revenue in 1963-71 and 4.8 percent in 1971. Almost the entire catch was shrimp. Total revenue for 1963-71 was $13.8 million, and for 1971 it was $3 million. The major oyster producting water bodies for the nine year period are Barataria and Caminada Bays ($10 million), Breton Sound ($7.9 million) and Chandeleur Sound ($6.6 million).

Information on these and the other water bodies can be most easily obtained directly from Tables 41-59.

(d) Catch Values Per Water Body Surface Acre

Table 60 shows the value of total fish catch per surface acre for each of the 18 water bodies by major species for 1963-71 and for 1971.

One relatively small water body, Adams Bay, is the most productive by far. For the average year during the nine year period, it produced $164 per surface acre and in 1971 it yielded $400 per surface acre. The second most valuable water body is Lost Lake but it has only 413 surface acres. The third highest revenue-producing water body is

Table 60. Values and Quantities Per Surface Water Area by Water Body and Type of Fish for 1971 and 1963-1971 Average.

Water Body and Type of Fish	Surface Water Area (Acres)	1971 Value (Per Surface Acre)	1971 Quantity (Per Surface Acre)	1963-1971 Average Value (Per Surface Acre)	1963-1971 Average Quantity (Per Surface Acre)
LAKE BORGNE	171,380				
Total		2.76	8.92	3.55	16.07
Shrimp		.73	2.18	1.02	3.51
Oysters		1.53	3.28	1.71	4.01
Menhaden		--	--	--	--
Crabs		.46	3.21	.74	7.99
Others		.04	.24	.08	.55
LAKE PONTCHARTRAIN	394,127				
Total		.58	3.34	.43	2.52
Shrimp		.10	.39	.14	.47
Oysters		--	--	--	--
Menhaden		--	--	--	--
Crabs		.46	2.84	.20	1.57
Others		.02	.11	.09	.49
BRETON SOUND	195,330				
Total		21.31	646.88	19.13	561.38
Shrimp		5.40	10.00	5.81	18.26
Oysters		7.23	18.67	4.51	12.13
Menhaden		7.58	597.10	7.72	455.72
Crabs		.62	6.01	.63	6.12
Others		.47	4.83	.47	21.78
CHANDELEUR SOUND	578,003				
Total		3.28	37.18	2.30	19.51
Shrimp		1.01	3.31	.80	2.46
Oysters		1.04	3.67	1.27	3.32
Menhaden		.44	27.70	.18	11.25
Crabs		.18	1.53	.13	1.28
Others		.60	.97	.26	1.20
GARDEN ISLAND BAY	13,504				
Total		--	--	5.59	.16
Shrimp		--	--	5.59	.16
Oysters		--	--	--	--
Menhaden		--	--	--	--
Crabs		--	--	--	--
Others		--	--	--	--

Table 60. (con't)

Water Body and Type of Fish	Surface Water Area (Acres)	1971 Value (Per Surface Acre)	1971 Quantity (Per Surface Acre)	1963-1971 Average Value (Per Surface Acre)	1963-1971 Average Quantity (Per Surface Acre)
BARATARIA AND CAMINADA BAYS	57,709				
Total		83.48	255.78	53.44	212.23
Shrimp		52.26	172.22	31.55	130.34
Oysters		28.17	61.69	19.42	56.58
Menhaden		--	--	--	--
Crabs		.76	7.43	1.39	17.84
Other		2.30	14.44	1.09	7.48
LITTLE LAKE	12,888				
Total		25.55	174.30	16.15	86.35
Shrimp		12.66	45.00	11.26	43.04
Oysters		.02	.04	.01	.01
Menhaden		--	--	--	--
Crabs		11.28	120.16	3.26	32.54
Others		1.59	9.10	1.62	10.76
ADAMS BAY	4,080				
Total		395.55	1,093.46	163.89	641.76
Shrimp		228.38	594.68	84.59	316.74
Oysters		142.81	284.49	66.24	195.00
Menhaden		--	--	--	--
Crabs		16.52	171.84	8.22	100.85
Others		7.85	42.45	4.84	29.90
TIMBALIER BAY	79,713				
Total		38.18	140.03	19.25	76.99
Shrimp		37.00	133.34	18.09	71.41
Oysters		.55	1.17	.72	1.68
Menhaden		--	--	--	--
Crabs		.34	4.08	.11	1.53
Others		.29	1.45	.34	2.37
TERREBONNE BAY	50,388				
Total		14.15	59.97	14.36	86.73
Shrimp		13.31	55.25	13.12	49.04
Oysters		.40	1.00	.93	2.28
Menhaden		--	--	--	--
Crabs		.17	2.00	.18	2.60
Others		.27	1.72	.12	.84

Table 60. (con't)

Water Body and Type of Fish	Surface Water Area (Acres)	1971 Value (Per Surface Acre)	1971 Quantity (Per Surface Acre)	1963-1971 Average Value (Per Surface Acre)	1963-1971 Average Quantity (Per Surface Acre)
CAILLOU BAY	27,085				
Total		26.91	132.77	17.87	82.06
Shrimp		22.44	90.84	13.92	63.68
Oysters		1.83	4.69	3.06	7.24
Menhaden		--	--	--	--
Crabs		2.31	33.89	.69	9.61
Others		.34	3.35	.21	1.53
LAKE BARRE	21,247				
Total		38.17	166.68	22.25	101.42
Shrimp		34.12	149.23	19.03	87.51
Oysters		1.76	5.23	2.49	6.03
Menhaden		--	--	--	--
Crabs		.76	6.59	.43	5.83
Others		.78	5.63	.29	2.05
LAKE PELTO	24,633				
Total		41.81	165.39	25.70	117.29
Shrimp		37.32	141.25	21.25	97.35
Oysters		2.24	5.97	3.46	8.46
Menhaden		--	--	--	--
Crabs		1.36	12.54	.58	7.34
Others		.88	5.63	.41	2.90
LAKE DECADE	4,014				
Total		4.67	28.84	6.46	40.69
Shrimp		3.23	17.46	5.84	34.25
Oysters		--	--	--	--
Menhaden		--	--	--	--
Crabs		.82	8.94	.55	6.07
Others		.62	2.44	.08	.38
LAKE MECHANT	8,395				
Total		52.87	181.16	24.99	87.26
Shrimp		24.28	85.40	12.19	52.18
Oysters		26.75	79.01	12.22	28.94
Menhaden		--	--	--	--
Crabs		1.48	14.81	.53	5.67
Others		.36	1.94	.06	.47

Table 60. (con't)

Water Body and Type of Fish	Surface Water Area (Acres)	1971 Value (Per Surface Acre)	1971 Quantity (Per Surface Acre)	1963-1971 Average Value (Per Surface Acre)	1963-1971 Average Quantity (Per Surface Acre)
LOST LAKE	413				
Total		75.60	343.83	64.31	322.06
Shrimp		43.38	253.51	60.22	305.23
Oysters		32.16	89.83	3.57	9.98
Menhaden		--	--	--	--
Crabs		--	--	--	--
Others		.05	.48	.52	6.81
FOUR LEAGUE BAY	20,402				
Total		10.83	40.60	5.19	28.93
Shrimp		7.18	22.73	3.64	14.90
Oysters		2.20	4.29	.54	1.24
Menhaden		--	--	--	--
Crabs		1.44	13.52	.99	12.54
Others		.01	.06	.02	.24
VERMILION AND COTE BLANCHE	293,820				
Total		1.88	9.11	1.47	5.15
Shrimp		1.05	2.29	1.15	3.87
Oysters		--	--	.01	.03
Menhaden		--	--	--	--
Crabs		.78	6.30	.13	1.25
Others		.06	.52	.17	.95
TOTAL COASTAL WATER BODIES	1,957,257				
Total		10.78	103.63	7.60	87.52
Shrimp		6.37	22.42	4.18	16.89
Oysters		2.54	6.31	1.93	5.28
Menhaden		.88	67.76	.87	60.04
Crabs		.59	5.36	.35	3.72
Others		.38	1.76	.26	1.57

Barataria and Caminada Bays which yielded $53 per surface acre per average year during the nine year period and $83 per surface acre in 1971. Next highest is Lake Pelto ($26 per surface acre in 1963-71 and $42 in 1971) followed by Lake Barre ($22, $38), Breton Sound ($19, $21) and Caillou Bay ($18, $27).

All coastal water bodies together yielded $7.60 of revenue per surface acre per year, 1963-71, and $10.78 per surface acre in 1971. Shrimp produced the most revenue per acre ($4.18, $6.37) followed by oysters ($1.93, $2.54) and menhaden ($0.87 and $0.88). There were wide variations among water bodies, however. Adams Bay, for example, produced shrimp revenue per surface area of $85 (1963-71) and $228 (1971), whereas Lake Borgne yielded only $1.02 and $0.73 in shrimp revenue.

h. Future Projections

(1) The Data

A publication of the National Marine Fisheries Service (NMFS), entitled "The Future of the World's Fishery Resources: Forecasts of Demand, Supply and Prices to the Year 2000" was used to estimate future prices and quantities of major fish species. The basic methodology employed was to input the superport area's share of fish catch in 1970 and to hold that share constant to 2000. It was then a simple matter of deriving this constant share from the projected fish species catch from the United States. The projected prices as well as quantities were those used in the NMFS publication except for menhaden, oysters and other species. The NMFS report did not contain data on menhaden and other species. Consequently, menhaden prices and quantity in 1970 were held constant to year 2000. This is an unsatisfactory procedure but no significant trend values could be determined from past data. Consequently, menhaden prices and quantities

will be conservative.

Oysters posed an unusual problem. Their values and quantities were projected in the NMFS report but for some unknown reason the price they used was 5.5 cents per pound of oyster meat. Since our data suggested a price of 42 cents per pound this was a serious discrepancy. After a few checks it appeared that our data were correct. The NMFS report argued that the supply elasticity of oysters could be assumed to be high because of aquaculture. Consequently, the price of oysters was held constant to year 2000. Although we employed a price per pound of 42 cents instead of 5.5 cents the assumptions made in the report were employed and the price of oysters was held constant.

Other species could not be projected with any accuracy within the time constraints. A three year average (1969-1971) was determined and held constant during the 1970-2000 period.

(2) What the Data Show

Table 61 presents the weight, real price, value and the discounted present value for 1970 to 2000. Detailed data are provided so that the reader may obtain the present value for any group of years. The present value of shrimp caught between 1970 and 2000 in 1970 prices is $990,260,000. Shrimp are by far the most economically significant of fish species - through the next three decades. Table 62 provides data on crabs. The price of crabs is projected to increase from 8 cents in 1970 to $1.14 in 2000 because of increase in demand and limitations on potential supply. The present value of oysters is $65 million as shown in Table 63 and the present value of menhaden is $123 million as depicted in Table 64. Other species, shown in Table 65, have a present value of $62 million. The total present value of all commercial fish catches between 1970 and 2000 is

Table 61. Projected Quantities, Prices, Value and Present Value of Shrimp Catches in the Superport Area, 1970 - 2000.

Year	Weight (Thousands of Pounds)	Real Price	Non-Discounted Real Value (Thousands of Dollars)	Present Value 1970 (Thousands of Dollars)
1970	93,226	0.370	$ 34,494	$ 34,494
1971	97,279	0.378	36,771	34,690
1972	101,332	0.386	39,114	34,812
1973	105,386	0.394	41,522	34,863
1974	109,439	0.402	43,994	34,848
1975	113,492	0.410	46,532	34,771
1976	117,546	0.420	49,369	34,803
1977	121,599	0.430	52,288	34,774
1978	125,652	0.440	55,287	34,688
1979	129,706	0.450	58,367	34,547
1980	133,759	0.460	61,529	34,357
1981	137,272	0.472	64,792	34,132
1982	140,785	0.484	68,140	33,863
1983	144,297	0.496	71,571	33,555
1984	147,810	0.508	75,088	33,211
1985	151,323	0.520	78,688	32,833
1986	153,755	0.536	82,413	32,441
1987	156,187	0.552	86,215	32,017
1988	158,619	0.568	90,096	31,564
1989	161,051	0.584	94,054	31,086
1990	163,483	0.600	98,090	30,585
1991	164,969	0.624	102,941	30,280
1992	166,455	0.648	107,863	29,932
1993	167,942	0.672	112,857	29,545
1994	169,428	0.696	117,922	29,124
1995	170,914	0.720	123,058	28,672
1996	172,400	0.744	128,266	28,194
1997	173,887	0.768	133,545	27,693
1998	175,373	0.792	138,895	27,172
1999	176,859	0.816	144,317	26,634
2000	178,345	0.840	149,810	26,083
Total Present Value				$990,260

Table 62. Projected Quantities, Prices, Value and Present Value of Crab Catches in the Superport Area, 1970 - 2000.

Year	Weight (Thousands of Pounds)	Real Price	Non-Discounted Real Value (Thousands of Dollars)	Present Value 1970 (Thousands of Dollars)
1970	8,831	0.079	$ 693	$ 698
1971	9,305	0.083	770	727
1972	9,779	0.087	847	754
1973	10,251	0.090	927	779
1974	10,726	0.094	1,010	800
1975	11,200	0.098	1,098	820
1976	11,631	0.106	1,230	867
1977	12,062	0.114	1,370	911
1978	12,493	0.121	1,517	951
1979	12,923	0.129	1,670	988
1980	13,354	0.137	1,829	1,022
1981	13,139	0.226	2,964	1,561
1982	12,923	0.314	4,060	2,018
1983	12,708	0.403	5,119	2,400
1984	12,493	0.491	6,139	2,715
1985	12,277	0.580	7,120	2,971
1986	11,933	0.624	7,446	2,931
1987	11,588	0.668	7,741	2,875
1988	11,243	0.712	8,005	2,805
1989	10,899	0.756	8,239	2,723
1990	10,554	0.800	8,443	2,633
1991	10,414	0.834	8,685	2,555
1992	10,274	0.868	8,918	2,475
1993	10,134	0.902	9,141	2,393
1994	9,994	0.936	9,354	2,310
1995	9,854	0.970	9,558	2,227
1996	9,714	1.004	9,752	2,144
1997	9,574	1.038	9,938	2,064
1998	9,434	1.072	10,113	1,978
1999	9,294	1.106	10,279	1,897
2000	9,154	1.140	10,436	1,817
Total Present Value				$ 56,806

Table 63. Projected Quantities, Prices, Value and Present Value of Oyster Catches in the Superport Area, 1970 - 2000.

Year	Weight (Thousands of Pounds)	Real Price	Non-Discounted Real Value (Thousands of Dollars)	Present Value 1970 (Thousands of Dollars)
1970	9,911	0.421	$ 3,793	$ 3,793
1971	9,128	0.421	3,843	3,625
1972	9,245	0.421	3,892	3,464
1973	9,362	0.421	3,941	3,309
1974	9,479	0.421	3,991	3,161
1975	9,596	0.421	4,040	3,019
1976	9,735	0.421	4,098	2,889
1977	9,873	0.421	4,156	2,764
1978	10,011	0.421	4,215	2,644
1979	10,149	0.421	4,273	2,529
1980	10,287	0.421	4,331	2,418
1981	10,597	0.421	4,461	2,350
1982	10,906	0.421	4,591	2,282
1983	11,215	0.421	4,722	2,214
1984	11,525	0.421	4,852	2,146
1985	11,834	0.421	4,982	2,079
1986	11,678	0.421	4,916	1,935
1987	11,522	0.421	4,851	1,801
1988	11,366	0.421	4,785	1,676
1989	11,209	0.421	4,719	1,560
1990	11,053	0.421	4,653	1,451
1991	11,372	0.421	4,787	1,408
1992	11,690	0.421	4,921	1,366
1993	12,008	0.421	5,055	1,323
1994	12,327	0.421	5,190	1,282
1995	12,645	0.421	5,324	1,240
1996	12,807	0.421	5,392	1,185
1997	12,970	0.421	5,460	1,132
1998	13,132	0.421	5,528	1,081
1999	13,294	0.421	5,597	1,033
2000	13,456	0.421	5,665	986
Total Present Value				$ 65,149

Table 64. Projected Quantities, Prices, Value and Present Value of Menhaden Catches in the Superport Area, 1970 - 2000.

Year	Weight (Thousands of Pounds)	Real Price	Non-Discounted Real Value (Thousands of Dollars)	Present Value 1970 (Thousands of Dollars)
1970	512,658	0.016	$ 8,356	$ 8,356
1971	512,658	0.016	8,356	7,883
1972	512,658	0.016	8,356	7,437
1973	512,658	0.016	8,356	7,016
1974	512,658	0.016	8,356	6,619
1975	512,658	0.016	8,356	6,244
1976	512,658	0.016	8,356	5,891
1977	512,658	0.016	8,356	5,557
1978	512,658	0.016	8,356	5,243
1979	512,658	0.016	8,356	4,946
1980	512,658	0.016	8,356	4,666
1981	512,658	0.016	8,356	4,402
1982	512,658	0.016	8,356	4,153
1983	512,658	0.016	8,356	3,918
1984	512,658	0.016	8,356	3,696
1985	512,658	0.016	8,356	3,487
1986	512,658	0.016	8,356	3,289
1987	512,658	0.016	8,356	3,103
1988	512,658	0.016	8,356	2,928
1989	512,658	0.016	8,356	2,762
1990	512,658	0.016	8,356	2,605
1991	512,658	0.016	8,356	2,458
1992	512,658	0.016	8,356	2,319
1993	512,658	0.016	8,356	2,188
1994	512,658	0.016	8,356	2,064
1995	512,658	0.016	8,356	1,947
1996	512,658	0.016	8,356	1,837
1997	512,658	0.016	8,356	1,733
1998	512,658	0.016	8,356	1,635
1999	512,658	0.016	8,356	1,542
2000	512,658	0.016	8,356	1,455
Total Present Value				$123,379

Table 65. Projected Quantities, Prices, Value and Present Value of Other Species Catches in the Superport Area, 1970 - 2000.

Year	Weight (Thousands of Pounds)	Real Price	Non-Discounted Real Value (Thousands of Dollars)	Present Value 1970 (Thousands of Dollars)
1970	45,170	0.094	$ 4,238	$ 4,238
1971	45,170	0.094	4,238	3,998
1972	45,170	0.094	4,238	3,772
1973	45,170	0.094	4,238	3,558
1974	45,170	0.094	4,238	3,357
1975	45,170	0.094	4,238	3,167
1976	45,170	0.094	4,238	2,988
1977	45,170	0.094	4,238	2,819
1978	45,170	0.094	4,238	2,659
1979	45,170	0.094	4,238	2,508
1980	45,170	0.094	4,238	2,366
1981	45,170	0.094	4,238	2,232
1982	45,170	0.094	4,238	2,106
1983	45,170	0.094	4,238	1,987
1984	45,170	0.094	4,238	1,875
1985	45,170	0.094	4,238	1,769
1986	45,170	0.094	4,238	1,669
1987	45,170	0.094	4,238	1,575
1988	45,170	0.094	4,238	1,486
1989	45,170	0.094	4,238	1,402
1990	45,170	0.094	4,238	1,323
1991	45,170	0.094	4,238	1,248
1992	45,170	0.094	4,238	1,177
1993	45,170	0.094	4,238	1,110
1994	45,170	0.094	4,238	1,047
1995	45,170	0.094	4,238	988
1996	45,170	0.094	4,238	932
1997	45,170	0.094	4,238	879
1998	45,170	0.094	4,238	829
1999	45,170	0.094	4,238	782
2000	45,170	0.094	4,238	738
Total Present Value				$ 62,584

$1,298 million.

These projections contain very rough approximations and are probably on the conservative side, especially for oysters, menhaden and other species.

5. Selected Aspects on Recreational Use and Unique Environs of Coastal Louisiana

By Robert M. Pope, Center for Wetland Resources, Louisiana State University

a. Recreation

Coastal Louisiana is endowed with some of the nation's finest recreational environment, including Gulf beaches, expansive marshlands, innumerable lakes and bayous, picturesque cypress swamps, active river systems, lush vegetation and an abundance and variety of animal life.

Whether the recreator is interested in hunting, fishing, camping, hiking, swimming, boating, picnicking, birdwatching, driving or bicycling, archeology, photography, or the study of nature in its diversity, the Louisiana coast has a lot to offer.

Alteration of the natural systems of the coastal area by design or by accident is costly to the state's population. The costs are hard to measure in dollar terms, some losses being of incommensurables (quantifiable but not easily valued in money), and other losses being of intangibles (not measurable).

More and more, in today's society of shrinking natural environment, natural resource economists and ecologists are pointing out the need for evaluation of all the costs to society that result from the alteration of natural systems. As reported in the 1971 Report, Joint Committee on Environmental Quality of the Louisiana Legislature (1971), "What is now becoming evident is that there is no way, in the long run, to avoid the costs of using the environment. The policy question is not whether payment shall be made; it is when payment shall be made, in what form, and how the costs are to be distributed." Perhaps an equally important statement should be made: careful evaluation of the existing

state of an area must be made prior to the implementation of any man-made changes in it; and the social costs of such changes must be evaluated and charged to the project. Where such changes alter recreational land, thousands of users may be affected: a debt is thus incurred to each of them. The summation of this debt over all users is thus a portion of the social cost of the project, separate and distinct from other social costs such as effects on fisheries or other commercial interests.

In that light the recreational uses of the Louisiana coast may be examined.

User day participation in selected recreational activities are presented in Table 66. Several categories of outdoor recreation for which data are available have not been included in this table, since these forms of recreation are not as environmentally-dependent as the categories selected. The omitted activities are: outdoor games; swimming in pool; playing golf; attending outdoor concerts; and attending outdoor sports. By and large these recreational activities would not be affected by any but major environmental changes.

Examination of Table 66 indicates that outdoor forms of recreation in coastal Louisiana which depend on good environmental conditions run to the astronomical figure of 106,174,341 user days (summation of user days of the 14 activities over the 24 parishes). Dividing this figure by the population of these parishes yields a figure of 56.03 user days of outdoor environmental-dependent recreation per person. If only the five parishes most likely to be affected by the Superport (Plaquemines, Terrebonne, Lafourche, Jefferson, and St. James) are considered, the user days total 24,697,645. For these parishes, the

Table 66. Selected Recreational Activities, User Days, Louisiana Coastal Parishes, 1970

Activity	Ascension (31,176)	Assumption (16,713)	Calcasieu (120,896)	Cameron (6,614)	E.B.R. (240,312)	Iberia (47,381)	Iberville (26,182)	Jefferson (285,579)
	PARISHES (Population)							
Swimming at Beach	90,410	48,468	350,598	19,181	696,905	137,405	72,928	828,179
Picnicking	75,134	40,278	291,359	15,940	579,152	114,188	63,099	688,245
Motor Boating	73,887	39,610	286,524	15,675	569,539	112,293	62,051	676,822
Sailing/Canoeing	10,912	4,850	42,314	2,315	84,109	16,583	9,164	99,953
Fishing/Crabbing/Crawfishing	221,661	118,829	859,571	47,026	1,708,618	336,879	186,154	2,030,466
Camping	57,052	30,585	221,240	12,104	439,771	86,707	47,913	522,609
Horseback Riding	41,776	22,395	162,001	8,863	230,700	63,491	35,084	382,676
Nature Walks/Hiking/Pleasure Walks	211,373	113,314	819,675	44,843	1,629,315	321,243	177,514	1,936,225
Bicycling	399,365	214,094	1,548,677	84,725	3,078,396	606,951	335,391	3,658,267
Driving for Pleasure	259,696	139,219	1,007,064	55,095	2,001,798	394,684	218,096	2,378,873
Sightseeing	124,080	66,518	481,166	26,324	956,442	188,576	104,204	1,136,604
Hunting	103,504	55,487	401,375	21,958	797,836	157,305	86,924	948,122
Water Skiing	20,576	11,031	79,791	4,365	158,606	31,271	17,280	188,482
Bird Watching	55,182	29,582	213,986	11,707	425,352	83,864	46,342	505,475

Table 66. (Con't.)

Activity	Lafayette (92,179)	Lafourche (56,789)	Livingston (30,780)	Orleans (518,894)	Plaquemines (20,763)	St. Bernard (43,297)	St. Charles (23,089)	St. James (16,489)
	PARISHES (Population)							
Swimming at Beach	267,319	164,688	89,262	1,504,792	60,213	125,561	66,958	47,818
Picnicking	222,151	138,861	74,180	1,250,534	50,039	104,346	55,644	39,738
Motor Boating	218,464	134,590	72,949	1,229,778	49,208	102,614	54,721	39,079
Sailing/Canoeing	32,263	19,876	10,773	181,613	7,267	15,154	8,081	5,771
Fishing/Crabbing/Crawfishing	655,393	403,770	218,846	3,689,336	147,625	307,842	164,163	117,237
Camping	168,687	103,924	56,327	949,576	37,996	79,233	272,253	30,175
Horseback Riding	123,520	76,097	41,245	695,318	27,822	58,018	30,939	22,095
Nature Walks/Hiking/Pleasure Walks	624,974	385,029	208,688	3,518,101	140,773	293,554	156,543	111,795
Bicycling	1,180,813	727,467	394,292	6,647,032	265,974	554,635	295,770	211,224
Driving for Pleasure	767,851	473,052	256,397	4,322,386	172,956	360,664	192,331	137,353
Sightseeing	366,872	226,020	122,504	2,065,197	82,637	172,322	91,894	65,626
Hunting	306,034	188,539	102,190	1,722,727	68,933	143,746	76,655	54,743
Water Skiing	60,838	37,481	20,315	342,470	13,704	28,576	15,239	10,883
Bird Watching	163,157	100,517	54,481	918,443	36,751	76,636	40,868	29,186

Table 66. (Con't.)

Activity	St. John (19,935)	St. Martin (27,120)	St. Mary (50,433)	St. Tammany (52,505)	Tangipahoa (56,059)	Terrebonne (61,689)	Vermilion (36,513)	W.B.R. (13,553)
	PARISHES (Population)							
Swimming at Beach	57,811	78,648	146,256	152,264	162,571	178,898	105,888	39,304
Picnicking	48,043	65,359	121,544	126,537	135,102	148,670	87,996	32,663
Motor Boating	47,246	64,274	119,526	124,437	132,860	146,203	86,536	32,121
Sailing/Canoeing	6,977	9,492	17,652	18,377	19,621	21,591	12,780	4,744
Fishing/Crabbing/Crawfishing	141,738	192,823	358,579	373,311	398,579	438,609	259,607	93,362
Camping	36,481	49,630	92,292	96,084	102,588	112,891	66,829	24,802
Horseback Riding	26,713	36,341	67,580	70,357	75,119	82,663	48,927	18,161
Nature Walks/Hiking/Pleasure Walks	135,159	183,874	341,936	355,984	380,080	418,251	247,558	91,889
Bicycling	255,367	347,407	646,047	672,589	718,116	790,236	467,732	173,614
Driving for Pleasure	166,059	225,910	420,107	437,367	466,971	513,869	304,153	112,896
Sightseeing	79,341	107,938	200,723	208,970	223,115	245,522	145,322	53,941
Hunting	67,184	90,038	167,438	174,317	186,116	204,807	121,223	44,996
Water Skiing	13,157	17,899	33,286	34,653	36,999	40,715	24,099	8,945
Bird Watching	35,285	48,002	89,266	92,934	99,224	109,190	64,628	23,989

Source: State of Louisiana Comprehensive Outdoor Recreation Plan, 1970-75.

per capita user day figure is 55.97.

Attaching a value to the outdoor recreation enjoyed by the population of the Louisiana coast is almost impossible (for a discussion of the techniques usually employed and their shortcomings, see Pope, 1972) but if a minimum cost of $10 per user day is employed, it may be seen that a deterioration in environmental quality which curtails such activities by only 1% will impose a social cost of $10,617,434 per year on the residents of the Louisiana coast. For the five parishes mentioned above as being the most likely to be affected by the Superport, a 1% reduction in outdoor recreation, if valued at only $10 per user day, would impose a social cost of $2,469,765 per year on the residents of these parishes.

If only those certain forms of outdoor recreation which are associated with water use (swimming at beach, motor boating, sailing/canoeing, fishing/crabbing/crawfishing, and water skiing) were impaired by 50% for the five Superport parishes, again at an imputed value of $10 per user day, the annual social cost to the residents of those parishes would be $590,912. (Some other activities which are often associated with water use are not included in this formulation, i.e., hunting, sightseeing, birdwatching, etc.)

In Table 67, data are presented which indicate the participation rate (statewide) in the ten most popular outdoor recreation forms, with a projection of user days in the coastal parishes during the quarter of highest participation (summer).

b. State parks

The State of Louisiana maintains three types of state parks. The larger parks, named specifically State Parks, are located throughout the state to accomodate the larger population centers. Four of the

Table 67. Ten Most Popular Outdoor Activities and User Day Participation Rates, High Quarter, State of Louisiana and Coastal Zone Parishes, 1970.

Rank	Activity	Participation Rate[a]	Coastal Zone Projected User Days[b], High Quarter
1	Swimming		
	Pool	5.00	9,474,700
	Beach	2.83	5,362,680
2	Bicycling	6.17	11,691,780
3	Driving for Pleasure	4.15	7,864,001
4	Outdoor Games	3.90	7,390,266
5	Fishing	3.13	5,931,162
6	Walking for Pleasure	2.79	5,286,883
7	Sightseeing	2.42	4,585,755
8	Attending Outdoor Sports	2.10	3,979,374
9	Picnicking	1.79	3,391,943
10	Motor Boating	1.72	3,259,297

[a] Number of user days per person aged 6 or over.
[b] Assumes 24 coastal zone parishes have same participation rates as state as a whole. Computed by multiplying coastal zone population by high quarter user day participation rates.

Source: State of Louisiana Comprehensive Outdoor Recreation Plan, 1970-75.

eight such parks in the state are located in the coastal parishes: Longfellow-Evangeline State Park (St. Martin Parish); Sam Houston State Park (Calcasieu Parish); Fountainbleau State Park (St. Tammany Parish); and Fairview Riverside State Park (St. Tammany Parish). Additionally, the state operates two Wayside Parks: Abita Springs Park and Bogue Falaya Park (both in St. Tammany Parish). These wayside parks are not to be confused with the Roadside Parks developed and maintained by the State Highway Department.

The third type of state parks are denoted as State Historic Monuments. Of eight of these, three are located in the Superport parishes: Fort Pike and Fort Macomb (Orleans Parish), and the Edward Douglas White State Monument (Lafourche Parish).

Data furnished by the Louisiana State Parks and Recreation Deparment are presented in Table 68. These data are based on questionnaires of park users and indicate some aspects of state park use that are not obvious from other sources.

c. Recreational water quality guides

Data are presented in Table 69 which indicate the marginal water quality standards for recreational use (contact and non-contact). Such standards can easily be applied to a recreational area before and after a project is constructed, to give a retrospective view of the damages done. More importantly, a compendium of scientists can frequently predict the approximate level of such changes, given sufficient data about changes to be made as a result of a project. Such predictions can be used to evaluate damages to recreational facilities, so that a cost can be computed.

Of particular interest in regard to water-based recreation

Table 68. Selected Aspects of State Park Use in Coastal Louisiana.

Aspect	Park: Fairview Riverside	Fontaine-bleu	Longfellow-Evangeline	Sam Houston
	Percent of Users			
Distance Traveled to Park:				
0-25 mi	4.4	0.8	5.0	8.7
26-100 mi	78.8	9.2	9.2	8.6
101-200 mi	3.6	2.7	10.5	8.0
201-500 mi	2.2	8.4	14.6	11.8
501-1000 mi	4.4	30.9	13.4	14.1
1000 mi or more	1.5	40.8	40.2	44.7
No response	5.1	6.7	7.1	3.9
Type of Equipment Used:				
Tent	38.0	28.6	32.6	21.2
Travel Trailer	29.9	26.3	24.3	36.3
Tent Trailer	6.6	15.5	24.3	21.2
Pickup Camper	18.2	23.1	9.6	12.8
Other	5.8	6.1	8.4	7.7
No Response	1.4	0.4	0.8	0.7
Place of Residence:				
Louisiana	84.7	12.2	27.2	25.8
Other	10.2	79.6	64.0	65.6
No Response	5.1	8.2	8.8	8.6
Activities				
First Choice:				
Swimming	27.0	56.1	41.0	36.0
Fishing	39.4	13.0	23.8	30.1
Hiking/Walking	2.2	7.4	8.4	8.6
Games	8.8	4.2	6.7	4.8
Second Choice:				
Swimming	21.2	12.8	13.4	12.6
Fishing	22.6	21.2	20.9	21.3
Hiking/Walking	2.2	14.5	15.9	16.9
Games	15.3	9.7	12.1	10.9
Third Choice:				
Swimming	13.9	6.1	5.9	5.5
Fishing	7.3	10.7	13.0	9.1
Hiking/Walking	5.1	14.5	11.7	13.5
Games	13.1	12.2	12.6	13.3

Source: Louisiana State Parks and Recreation Department, questionnaire data, 1968.

Table 69. Recreation Water Quality Guides

Quality Parameter	Water Contact		Boating and Aesthetics	
	Noticeable Threshold	Limiting Threshold	Noticeable Threshold	Limiting Threshold
Total Coliforms[a]	1000/100 ml	--	--	--
Visible Solids of Sewage Origin	none	none	none	none
Alkyl Benzene Sulfonate (ABS)[b]	1 mg/l	2 mg/l	1 mg/l	5 mg/l
Suspended Solids	20 mg/l	100 mg/l	20 mg/l	100 mg/l
Floating Oil and Grease	0 mg/l	5 mg/l	0 mg/l	10 mg/l
Emulsified Oil and Grease	10 mg/l	20 mg/l	20 mg/l	50 mg/l
Turbidity	10 JTU[c]	50 JTU[c]	20 JTU[c]	--
Color	15 units[d]	100 units[d]	15 units[d]	100 units[d]
Threshold Odor Number[e]	32	256	32	256
pH Range	6.5-9.0	6.0-10.0	6.5-9.0	6.0-10.0
Temperature (Maximum)	30°C	50°C	30°C	50°C
Secchi Disc Visibility[f]	--	--	20 ft	--

[a]Coliforms are bacteria found in the intestines of mammals. Their concentration in water generally indicates the level of fecal material in the water. "All organisms which produce a dark colony (generally purplish-green) with a metallic sheen within 24 hours of incubation are considered members of the coliform group." (Standard Methods)

[b]A non-biodegradable compound used in some detergents.

[c]Jackson Turbidity Unit - a standard measure of turbidity.

[d]Color Unit - a standard designed to measure color in water.

[e]Threshold Odor Number - The dilution ratio at which odor is just detectable. A threshold odor number of 32 would indicate that when a 25 ml sample of water is diluted to 800 ml, the odor is just detectable (800 ÷ 25 = 32).

[f]Secchi Disc Visibility refers to the depth of water through which a disc of a standard size and color can be seen.

Source: State Water Control Board of California, Water Quality Criteria (1963), cited in Burk and Associates, Inc., Lower Mississippi River Basin Water Quality Management Plan State of Louisiana, V. 2, June 1973. Definitions taken in part from Standard Methods for the Examination of Water & Wastewater, Amer. Public Health Assoc., Inc., 12th Ed., 1965.

on the Louisiana coast, as it may be affected by the construction and operation of a superport, are the categories: Suspended Solids; Floating Oil and Grease; and Emulsified Oil and Grease. The liklehood of chronic spills affecting some recreational areas adversely is worthy of scrutiny.

d. Unique Environs

Coastal Louisiana's most striking environs are its extensive marshland and the geologically unique Mississippi River deltaic plain. [See Gagliano, et al., (1972) and Louisiana Wild Life and Fisheries Commission (1971).] Louisiana's coast contains some 3,910,664 acres of marsh, approximately one-fourth of the nation's marsh resources. Abundant wildlife are found here, and this marsh serves valuable functions in support of mankind (see Gosselink, Odum, and Pope, 1973). Recreational opportunities in many facets are afforded by this expansive marsh area.

One of the nation's unique wilderness-type recreational areas is dependent on the marsh and the many waterways associated with the deltaic plain, especially in the Atchafalaya spillway, which ranges from about 4 to 20 miles in width for its length of approximately 80 miles.

Cypress and tupelo swamps, while not unique to the state, are very characteristic in the coastal area of Louisiana. Meandering bayous, large lakes, and innumerable lagoons and bays add to the uniqueness of the Louisiana coast.

Geologically, the Mississippi River is responsible for this unusual land configuration. More detailed information on the geological aspects of the area are to be found elsewhere in this report, so this section will only touch on the geological aspects as they contribute to the uniqueness of the area. A brief description of the Louisiana coastal

terrestrial habitat follows, quoted from McGinnis, et al., (1972).

> The entire coastline of Louisiana from Texas to Mississippi is characterized by a wetland area. Separating the higher land from the Gulf of Mexico, the wetlands average 20 to 40 miles in width. Bayous, ponds, and standing water characterize this area.
>
> Geologically, the Mississippi River is responsible for the existence of this land. The wanderings and meanderings of the river with its tremendous silt load have brought about the formation of this wide deltaic region. Silt deposition over many years led to land formation. Once a portion of this land is cut off from new silt by a change in the river course, natural compaction and concomitant subsidence follows, producing extensive areas of marsh with the development of meandering streams and bayous leading in a general north-south orientation to the seaward bays and finally the Gulf. The continuous flow of fresh water through these systems puts a positive pressure against the tidal pressures of open water thereby controlling the degree of saltwater intrusion.
>
> The extensive management of the Mississippi River flow by man for flood control has led to a lessening of this freshwater pressure, and thus may contribute to saltwater intrusion in many areas. Man's management of the course of the Mississippi has also stopped much of the natural sedimentation necessary for land formation in much of the area. Natural subsidence and erosion are now dominant over siltation resulting in loss of marshland.
>
> Land development in estuaries may proceed by organic accretion as well as by siltation.... The various plant communities within the marshes are not equally productive with respect to organic buildup, just as they are not equally productive for support of differing shellfish or waterfowl species.
>
> Along the seacoast or sea rim, the immediate action of the tides produces an area devoid of vegetation buildup or peat formation. Here, wave action piles up layers of sand and shale (marine sediments) on top of the river sediments. The sea rim is characterized by only pioneer species of plant life and an abundance of shore birds.
>
> Behind the protective sea rims are vast areas of salt marsh. Salt marsh may also extend directly into adjacent open sea water areas protected from wave action. This occurs particularly in the numerous bays and terminal ends of the major stream channels of Louisiana. Frequent inundation by saltwater as a result of natural storm tides is necessary to maintain usual salinities. Protection against the abrasive action of waves is afforded by the sea rims and bays to the south and the natural levees along the transecting waterways. Organic accretion in these areas is moderate. The high production levels characteristic of smooth cordgrass (Spartina alterniflora) would

provide for extensive accretion if it were not for the abrasive action of the tides. The vegetation produced in these areas is mechanically broken down, flushed by the tides, and enters the detrital food chains. Odum (1972) reports that 50 percent of the Spartina organic matter is flushed from the estuary in Louisiana, and that 80 percent of that amount finally gets offshore to the Gulf. This in part accounts for the enormous value of this marsh type in shellfish and fish fry production.

Further inland where the pressures of the fresh water flow compensate for tidal pressures, a mixing zone occurs. These brackish marshes are the site of one of the most productive areas in the world. Vegetative land accretion in terms of peat accumulation can be very dramatic in the brackish marshes. The high nutrient levels provided by the fresh water flow, coupled with the preserving qualities of the salt water allow the accumulation of many yards of peat in the more productive areas. The most productive areas of coastal marsh are intermediate zones where salinity is not too high to restrict growth, and yet available nutrients are in high enough concentrations to allow good growth. These moderately saline marshes are in the greatest danger of being destroyed by salt water intrusion and industrial activities.

In the areas normally protected from salt water a different marsh type develops. While plant species differ, a good nutrient supply makes productivity nearly equal to that of the brackish marshes. Peat formation is, however, somewhat less in these areas due to the lack of protection against decay that the higher salt content of the brackish and saline marshes provide. Temporarily increased salinity from storm tide action, if not sustained, will usually be flushed from the system before serious changes occur. With prolonged salinity increases, existing salt-intolerant species will die out, followed by the growth of more salt-tolerant species until a new salinity equilibrium is established. The lag time in reestablishment of an equilibrium depends on the source of the initial salinity change and its duration. Aside from the initial impacts of such losses of vegetation, large expanses of mudflats may result if salinities do not become restabilized.

Coupled with the varying potential of the marshes in organic detrital production, substantially different substrate stabilities occur. The stability of a particular site will greatly influence the impact of construction on that area. A continuum of substrate makeup exists from the pure silt soils to the pure organic soils. The marshes of Louisiana contain all gradations. Both of the endpoints of this continuum represent highly unstable soils. The uniformity of both the silt and muck soils provides for little consolidation and thus little stability. However, areas where vegetation products and silt have mixed, soils may have greater stability. Peat areas and others, where root and tuber production are extensive, are characteristically very stable....

Coastal Louisiana has a wide range of environmental characteristics important to many forms of terrestrial and marine life. High productivity of fur and waterfowl, oysters, fish, and shrimp indicate the magnitude of importance to man.

Sites of archeological and historical interest are found in the coastal portion of Louisiana also. These vary from small Indian mounds to more recent and well known historic landmarks, such as Forts de la Boulaye, Jackson, and St. Philip. For further information in this field, see Hansen (1941).

Finally, it is worth mentioning that the French-flavored culture of southern Louisiana lends a degree of uniqueness to the entire area. The way of life in this area is different from that of any other part of America. Unfortunately, there is no way of evaluating this uniqueness or assessing costs for its deterioration.

C. Environmental History of Selected Oil Seaports and/or Terminals

1. Louisiana Oil Spills. The Chevron and Shell Spills and Related Studies

Two major spills have occurred recently off the Louisiana coast. The first spill was at a platform owned by the Chevron Oil Company; it started February 10 and lasted until March 31, 1970. The location of this spill was east of the Mississippi River in the Main Pass Oil Field. The second spill was at a platform owned by Shell Oil Company and lasted from December 1, 1970, until April 16, 1971. The location of this spill was approximately 7 miles south of Timbalier Bay.

The Chevron spill was monitored by a variety of federal, state, and private agencies. At least two reports on this spill were published. One report was published by Murray et al. (1970). The other report was prepared by Alpine Geophysical Associates, Inc. (1971). The U. S. Geological Survey (personal communication from CEQ, 1972) estimates that the total volume of oil spilled at and about the Chevron platform was 30,500 barrels (about 4,200 metric tons).

The Shell spill was also monitored by a variety of federal, state, and private agencies. At least two reports were published on this spill. One was prepared by Resources Technology Corporation (RTC Report, 1972). The other report was prepared by Texas Instruments, Inc. (TI Report, 1971a and b). Estimates of the total volume of oil spilled at and about the Shell platform range from 25,000 barrels, made by Shell Oil Company, to a 53,000-barrel estimate by the U. S. Geological Survey, and finally to a 90,000- to 119,000-barrel estimate by the EPA. These volume estimates are equivalent to 3,500, 7,420, 12,600, and 16,660 metric tons, respectively.

a. The Chevron Oil Spill

The reports on the Chevron spill mainly document the oceanographic observations made on the oil slicks as a function of winds, surface currents, and tidal currents. In general, Murray et al. (1970) found that the stress of the wind on the water's surface was the most important factor in determining the behavior of the oil slicks, especially when the winds were 15 mph. Tidal currents caused the oil slick to assume an "L" shape when the winds were 15 mph and their diurnal rotation helped to keep the slick away from the shore. Freshwater input from the Mississippi River also served as a barrier between the shore and the oil slicks by the development of convergence lines between fresh and saline waters. The width/length ratios of the oil slicks were found to be independent of current speed. Murray (1972) developed a model for prediction of gross size and overall shape of the oil slick; it is based on Fickian diffusion equations. The geometry of the oil slick is defined as a function of current speed, horizontal eddy diffusion, the oil discharge rate, and a boundary concentration determined empirically.

Apparently no significant biological damage resulted from the Chevron spill. No fish, bird, or other animal kills were reported. No data are given on various marine populations surrounding the platform. It is especially noteworthy that chemical dispersants were used (i.e., 1,000 barrels of "Corexit" and 500 barrels of "Cold Cream"), despite the fact that studies on oil spills elsewhere document the fact that dispersants are invariably more toxic than the oil itself and probably should not be used (see the article by Mills and Culley, 1970, as one example of the toxicity problem of dispersants).

b. The Shell Oil Spill

The reports (RTC Report and TI Report) on the Shell spill are more detailed than those on the Chevron spill in terms of data on marine populations in and about the spill site. In general, slick orientation was best correlated with the near-surface current, the 10-foot depth, and wind vectors. When the winds were out of the east, southeast, and south the surface water and the oil slick showed a net movement and set toward the northeast and north. Under these conditions, oil reached the beach just northeast of Bay Champagne. When the winds changed to a set toward the west and southwest, the surface movement and slick orientation were approximately 230° to 240°, or toward the southwest.

Biological sampling, though not definitive, was somewhat more detailed and extensive for the Shell spill than the Chevron spill. Stations were occupied at approximately every mile, out to 7 miles, from the platform along three transects. These transects had sets of approximately south, north, and northwest. Within the limited sampling program, the overall conclusion was that benthic and fish populations about the platform had been stressed as a result of exposure to petroleum hydrocarbons, but some recovery was apparent. The report states that a weak negative correlation generally existed between the presence of high concentrations of hydrocarbons in the sediments and low abundances of epifauna and infaunal species. This correlation should mean that areas having high concentrations of hydrocarbons have low abundances of species and individuals. The north transects for simple diversity, mean diversity, crab data, and composite meiofaunal mean consistently showed a negative correlation with hydrocarbon contents at -0.63, -0.13, -0.46, and -0.36, respectively. The

south transects had all positive relationships and had generally the lowest hydrocarbon concentrations. The northwest transect had positive and negative relationships. Limiting sampling to north, south, and northwest transects may have been unfortunate because the orientation of the slick near the platform appeared to be, depending on the wind, either toward the northeast or the southwest. Inasmuch as wind data taken from the oceanographic report on the Shell spill show that January winds came mainly (65 percent of the time) from the north, northeast, south, and southeast, it may be logical to assume that transport would be predominant to the right of the wind direction and hence oil stress might predominate along an axis running northeast to southwest. Thus it is likely that the hydrocarbons would also take an overall distribution along a southwest-northeast axis. Thus, it is possible that the particular transects used for sampling may not have crossed or coincided as much as they could have with areas affected by oil.

In general, the Shell report concludes that the epifauna and infauna decreased in numbers as the platform was approached, particularly within the first 2 miles. The average number of benthic creatures was about 13,000/m^2 within a 1-mile radius, but beyond the 2-mile radium the density of organisms went as high as 32,000 and 48,000/m^2. Grab samples also indicated a decrease in the number of organisms on approach to the platform. A limited examination of the histology of fish gill filaments (only 6 species) showed that some epithelial cells were being sloughed off and that some gill filaments were swollen, presumably as a result of exposure to oil. The fish examined were collected along the north and

northwest transects. The invertebrate form, stomatopods, was suggested to be an indicator of environmental or oil stress because no adult stages were taken within 4 miles of the platform. (The adults are burrowing benthic creatures and the larvae are planktonic.) The absence of adult stomatopods was taken as an indication that the oil had settled into sediments and then probably was being transported back and forth, recurrently, between the water surface and the sediments.

The Shell spill was also monitored, to a limited extent, by state officials (Adkins, 1972). This report concluded that there were no differences in the plankton as a result of the spill; the baseline data for this conclusion extended back 4 years, but they were not included with the above report. No dead organisms were reported in the spill area, but some dead ducks were found in an oil slick on Isles Dernieres, which is located on the extreme southwest corner of Terrebonne Bay, a considerable distance (about 30 miles or 48 kilometers due west) from the spill area. These conclusions need to be verified with more and better data than those attached to the report.

The validity of the data given in the RTC Report has been challenged by various marine researchers (Public Hearing Regarding Proposed 1972 Outer Continental Shelf Oil and Gas General Lease Sale, 1972, New Orleans, Louisiana). One critic stated that the useful results were as follows (verbatim from Cronin, 1973):

- Oil traveled substantial distances from the spill and some of it moved into the water, sediment and biota.
- Sediment hydrocarbon was in high concentration at some sites near the platform, and was present in concentrations of hundreds of

parts per million at some sites to a distance of several miles from the platform.

- Benthic organisms, in terms of the mean count/grab sample, were at low enough levels at distance of 0-1 miles from the platform to suggest damaging effects from the spill.

From a negative viewpoint, the critic stated that the report was poorly written, illustrated and referenced. In addition, the report was statistically naive and made the assumption that a limited, quick survey could provide adequate comparative data.

Yeast populations were monitored by Meyers (1971) during the Shell spill. The succession of yeast species and their populations was followed in oil-free waters and in oil-stressed waters for 13 weeks after the spill. In oil-free waters, yeast populations are relatively sparse, at concentrations of 0-10 cells per 100 milliliters, and are made up predominantly of the species complex Rhodotorula/Rhodosporidium, as well as Debaryomyces hansenii and Candida parapsilosis. Shortly after oil was introduced (about 2 weeks) the former group underwent a bloom and their populations increased to concentrations of >200 cells/100 ml, but other species started to appear, e.g., Candida spp. and Trichosporon cutanum. After 13 weeks, the concentrations of yeast populations returned to the baseline level of >10 cells/100 ml, but species of the Rhodotorula/Rhodosporidium complex were absent. Meyers (ibid.) believes that the latter and other species known as oil-decomposing types disappeared despite oil-enrichment because nutrients (probably nitrogen and phosphate) became limiting. Oil decomposition presumably cannot occur at a rapid rate without an adequate N/P substrate.

c. Related Studies

Zobell and Prokop (1966) studied oil-oxidizing microbes in mud samples taken from Barataria Bay and found them in abundance possibly because this area is under chronic hydrocarbon stress as a result of extensive development of the petroleum industry. Mackin (cited in Zobell, 1962) studied the effect of crude oil on a variety of Louisiana marsh grasses. The grass species included salt grass (Distichlis spica), saltwort (Bastis sp.), glasswort (Salicornia begeloii), cordgrass (Spartina alterniflora), and young mangroves (Avicennia sp.). The oil was retained in 16 ft^2 (1.7 m^2) pens (4 x 4 feet or 1.3 x 1.3 meters) with wooden bulkheads. Though estimates of absolute concentrations are not given, it can be assumed that there would be at least 4 inches (10 centimeters) of standing water surrounding the base of the plants; this assumption implies that the total volume of water in each pen would be approximately 25 gallons (114 liters). Mackin's data (ibid) strongly support that long-time exposure to relatively high concentrations (about 1 percent) is lethal and that immediate and rapid cleanup in a spill area is therefore very critical and essential.

Studies by Crow (1972) on yeast populations under oil stress in the marshes of Barataria Bay show the same general species succession as observed by Meyers (1971) offshore during the Shell spill. A series of plots of Spartina alterniflora were given monthly doses of crude oil at approximately a 1 percent concentration. Yeast species from the genera Pichia and Kenyveromyces usually predominate in the untreated marsh plots. However, after treatment with crude oil, species with known capabilities for decomposing oils assume dominancy; these species were Pichia ohmeri,

Trichosporon sp., and species from the Rhodotorula/Rhodosporidium complex. It is significant that the concentrations of yeast cells in the oil-treated plots were considerably higher than those of the untreated plots. For example, during June and July oil populations were about eight times greater than in untreated plots. Thus yeasts of both water and sediments appear to respond similarly to oil treatment in that species and numbers of the Rhodotorula/Rhodosporidium complex increase. Trichosporon types did not develop in the treated water samples as well as they did in marshland sediments.

Extensive studies on Louisiana oysters in relation to the oil industry were made under Projects 9 and 23, starting in 1947 and continuing into the 1960's (Mackin and Hopkins, 1961). The general conclusion was that the oil operations were not responsible for widespread mortalities of oysters but the probable cause was a fungus called Dermoceptidium marinum. Lund (1957) studied the effect of crude oil on Louisiana oysters and found that there was no apparent effect on the oyster's ability to clear suspended material from the water it pumps through its system.

Toxicity studies were made by Mills and Culley (1970) on four species of marine shrimp, including both brown shrimp (Penaeus aztecus) and white shrimp (P. setiferus). Static bioassays were employed using four types of crude oils. Tests lasted over a 48-hour period, and mortalities were recorded as a function of time and concentration. It was found that the oil dispersants were more toxic than the crude oil. The oil type Q-4-D was the most toxic and had a gas-oil fraction of 40 percent, the highest value of all the four crudes used. Median lethal concentration at 48 hours (48 hr LC_{50}) for Penaeus shrimp ranged from 1 to 40 ppt

(0.1 percent to 4 percent). Concentrations from 7.5 to 75 ppt (0.75 percent to 7.5 percent) caused 100 percent mortalities. Mixtures of crude oil and emulsifiers were considerably more toxic than either the crude oil or the dispersant by itself. No correlation was apparent between shrimp mortality and the sulfur content of the crude oils.

Qualitative toxicity data using the common guppy (Lebistes reticulatus), crude oils, oils innoculated with yeast, and dispersants were collected by Ahearn et al. (1971). Louisiana crude was lethal at 4 percent concentration within 24 hours, whereas the high-asphalt Mississippi crude had no adverse effect at 4 percent V/V on guppies over a 30-day period. The dispersant (same type used in several oil spills on the coast) killed the guppies within 8 hours. The addition of fungal culture did not, apparently, affect the test fish.

It is pertinent to add that the oil industry has other environmental effects besides causing oil stress on various populations. A major stress is the disruption and changes in the natural drainage of the marshes resulting from channels and pipelines dug expressly for oil exploration and production. Gagliano and Day (1972) estimate that approximately 35 percent (5.8 mi^2/yr or about 1,500 hectares) of all land losses in coastal Louisiana result from dredging activities--much of which are due to the petroleum industry. They further estimate that at least 10 percent (800,000 acres or 324,000 hectares) of the total coastal land of Louisiana will eventually be modified by petroleum-related activities.

2. Milford Haven, Wales, United Kingdom

Milford Haven is the largest oil port in Great Britain. It accepts vessels of more than 200,000 tons and handles approximately 40 million tons

of oil a year, and yet the estuary lies within the boundaries of the Pembrokeshore National Park. Oil spills do occur and percentage estimates of spills per ton of oil handled are as follows:

1966	0.0002%
1967	0.0014%
1968	0.0002%
1969	0.0001%

These data imply an annual loss ranging between 50 to 560 tons (280 to 3920 barrels). In addition, refineries in the port discharge an estimated 240 ton/yr of oil in a dilute form of $\leq$25 ppm (volume basis).

Oil companies and the port authority have a joint contingency program to keep spills away from the shores. An average of 2500 gallons per month of emulsifier is used; the present emulsifier is 1000X less toxic than its previous equivalent.

Salt marshes are present in the Milford Haven estuary. When an oil spill covers the marsh grass, recovery usually takes place, depending on the circumstances but the time varies from 3 weeks to as long as 2 years. Tides wash little of the oil off the plants and generally the coated leaves yellow and die. It is of interest that soils having up to 20 percent hydrocarbon concentration will still support the growth of marsh grasses. The effect of oil on marsh plants is apparently worse during spring and early summer and less during winter and when the top of the plants are dead. The former effect is probably due to the fact that the grasses are not very high and hence the leaves become coated more readily. Oil apparently affects oxygen transfer within the leaves but some leaves, such as those with thick surfaces, are more resistant. Those oils having a higher

content of aromatics and fractions that boil at 149°C are generally more toxic. Low-level dosages to plants show recovery up to four successive monthly doses but at greater rates recovery is less.

Animals most affected in the grasses are apparently the snails (gastropods) and this effect is more severe during the winter but species differences are present.

Milford Haven workers recommend emulsifiers in treating plants but only if the toxicity is extremely low and only if used in solutions less than 10 percent of stock. Detergents should never be used on marsh grasses. At Milford Haven, they attempt to deal with free-floating slicks before they get to the shore. Long-term studies reveal no significant flora and faunistic changes except at the discharge point of one refinery where the dispersion or mixing is inadequate, and at a recreation beach which is repeatedly cleaned.

3. Implication for Environmental Protection Plan

The historical data given previously imply the following conclusions in regard to a Louisiana superport and the Environmental Protection Plan:

a. Oil spills and damage will occur to the Louisiana coastal environments.

b. Biological communities damaged by oil spills will recover but the rate depends on the species, the season, the type of oil, the amount of exposure, time, and the frequency of exposure. Continuous oil spills will, however, tend to preclude recovery.

c. Ancillary developments (such as refineries) will cause severe to permanent stress to biological communities. Plant locations and their urban requirements must be critically examined and controlled.

d. Offshore locations for oil terminals are less vulnerable than inshore or estuarine locations.

On the basis of the above conclusions, it is strongly recommended that the Environmental Protection Plan for Louisiana should include provisions for the following items:

- Oil spill controls

The coastal marshlands of Louisiana are most vulnerable areas to oil spills. Oil spill probabilities (Bryant, 1973) indicate that ship collisions are the prime source of polluting incidents and, therefore, it is logical to recommend that the ships carrying crude oil be kept as far as possible from the shoreline. This recommendation, necessarily, affects the choice of the site location for the offshore receiving terminal. In addition, all ships using the facility should be required to strictly adhere to established sea lanes and to rigorous navigational controls.

- Contingency planning

Contingency planning should identify those coastal areas that have the highest probability of being affected by an oil spill. These plans should also develop and implement various techniques for containing and cleaning up an oil spill, including the use of relatively nontoxic emulsifiers or dispersants and the non-use of detergents. Special emphasis should be given to increased surveillance and monitoring during the spring and early summer when most phases of biological growth and production are the most vulnerable.

- Background environmental data

Baseline data are vitally important for every part of the superport development. These data will provide an objective means for the

comparison of effects before and after any potential oil spill. In addition, they will provide a time basis for evaluating potential gradual deterioration of the environment. Within the project area, data should be gathered on the local meteorology, and hydrography. Population changes on the commercial and dominant plant and animal species are also necessary baseline. The potential toxicity of various crude oils on commercially important and dominant plant and animal species should also be included.

- Compensatory and rehabilitative programs

Compensatory programs are necessary to provide a monetary basis for reestablished all areas affected by superport activities. Compensation should be provided for both construction and operation damage. Rehabilitative programs should include reestablishment of plant and animal communities, techniques to reduce erosion and/or land loss.

- Ancillary development controls

Ancillary developments probably pose the greatest environmental stress as a result of superport development. This environmental stress cannot be adequately assessed in time to design rehabilitative programs mainly because of the difficulties of measuring the effects accurately. Lack of legal jurisdiction may limit the Authorities ability to control ancillary development. This problem however, must be considered. We recommend that the environmental stresses that will occur from ancillary developments at several levels of economic growth, such as low, medium and high be detailed. The basis of the economic data should be an economical feasibility study of the proposed project.

- Special operational procedures

Special operational procedures should be developed for certain seasons of the year. For example, spring and early summer are especially vulnerable times for biological stresses; other critical periods can also be identified. A general schematic of critical environmental times is presented in Table 70. These operational procedures might include increased supervision of personnel to reduce the chances of error, and/or special operating procedures.

- Applied research

Many to most environmental problems are due to a lack of data or information. They are not yet akin to the "typical" engineering problem where most to all the background data are available; the only need being to assess the data and formulate a solution. In order to avoid these same problems in the future it is essential that work at some financial level be started in order to provide the now missing data baseline.

D. Expected Environmental Stresses

Figures 16 through 26 are presented in order to present a visual schematic of various environmental aspects of a superport. Figure 16 identifies the major components of a port delivery system; it provides a diagrammatic model of a port. Figure 17 identifies the environmental aspects associated with dredging activities. Figure 18 identifies the environmental aspects of an offshore structure. Figure 19 identifies the environmental aspects of a material spill. Figures 20,21 and 22 identify the environmental aspects of a material transfer, ship operation and ship berthing. Figure 23 identifies the environmental aspects of storage facilities. Figures 24 and 25 identify the environmental aspects of a marine and an offshore

Table 70. The major components of the estuarine system of Louisiana especially Barataria Bay (Stone, 1972).

		SPRING (MAM)	SUMMER (JJAS)	FALL (ON)	WINTER (DJF)
PHYSICAL FACTORS	1. Insolation	Increase	Maximum	Decline	Lowest
	2. Air Temperatures	Increase	Maximum	Decline	Lowest
	3. Water Temperatures	Increase	Maximum	Decline	Lowest
	4. Rainfall	Moderate	Maximum	Lowest	Increase
	5. Mean Water Level	Increase	Decline then Increase	Maximum	Lowest
	6. River Input	Maximum	Decline	Lowest	Increase
	7. Wind	Decrease (SE)	Calmest then Increase (SE, (NE	Increase (NE)	Windiest (NE)
PRIMARY PRODUCTION	1. Marsh Grass	Maximum Production	High Production	Maximum Standing Crop	Annual Die Back
	Dead Grass	High	Low	Lowest	Highest Standing Crop
	Detritus	Peak Loss Rates	Moderate	Secondary Peak Loss Rate	Low
	2. Phytoplankton	Increasing	Maximum Production	Decline	Low
	3. Epiphytes	Maximum	Low	Low	Maximum
	4. Benthos	Decreasing	Lowest	High	Maximum
MAJOR CONSUMER SPECIES	1. Bacteria				
	Marsh	High	High	Highest	High
	Sediment	Highest	Minimum	Minimum	Secondary Peak
	Water	Highest	Minimum	Minimum	Secondary Peak
	2. Fungi	Increase	Secondary Peak	Maximum	Decline
	3. Meiofauna	Maximum	Low	Lowest	Low
	4. Zooplankton	Maximum	Low	Low	Low (secondary peak)
	5. Menhaden	Maximum	Decrease (adults out)	Lowest	Increase (post larvae in)
	6. Shrimp	Maximum {brown shrimp in	Maximum then Decrease	Low {brown shrimp out white shrimp in	Increase (white shrimp out)

pipeline. Figure 26 identifies environmental aspects of processing facilities. Specific environmental stresses are discussed below. For additional details the reader should consult Rounsefell, 1972, the Institute of Water Resources Report 72-8, Department of the Army, 1972, and St. Amant, 1972.

1. Offshore Stresses

During the construction and operation of a deep water terminal the following types of environmental stresses will occur:

a. Habitat Loss and/or Disturbance

At the point of attachment of the sea bottom to the receiving terminal, benthic forms will be destroyed. Placement of the pipeline will destroy and disturb up to a 100 to 200 ft swathe of substrate. Substrate changes will induce changes in benthic populations. If deep holes result then oxygen depletion might occur and hydrogen sulfide (a toxin) can accumulate which would deplete the area of almost all living forms (Rounsefell, 1972; Figures 17, 18, 22, 23).

b. Waste Disposal Effects

All phases of construction and operation will utilize certain chemicals that if released inadvertently would have adverse effects on living forms. In addition, human sewage will accumulate or be discharged into the environment with adverse effects. Washings of materials and structures can also introduce toxins into the air and aquatic environment (Rounsefell, 1972; Figures 18, 19).

c. Ocean Current Changes

Structures, such as platforms, buoys, and pipelines, will create changes in the water circulation. As the pipeline crosses to the

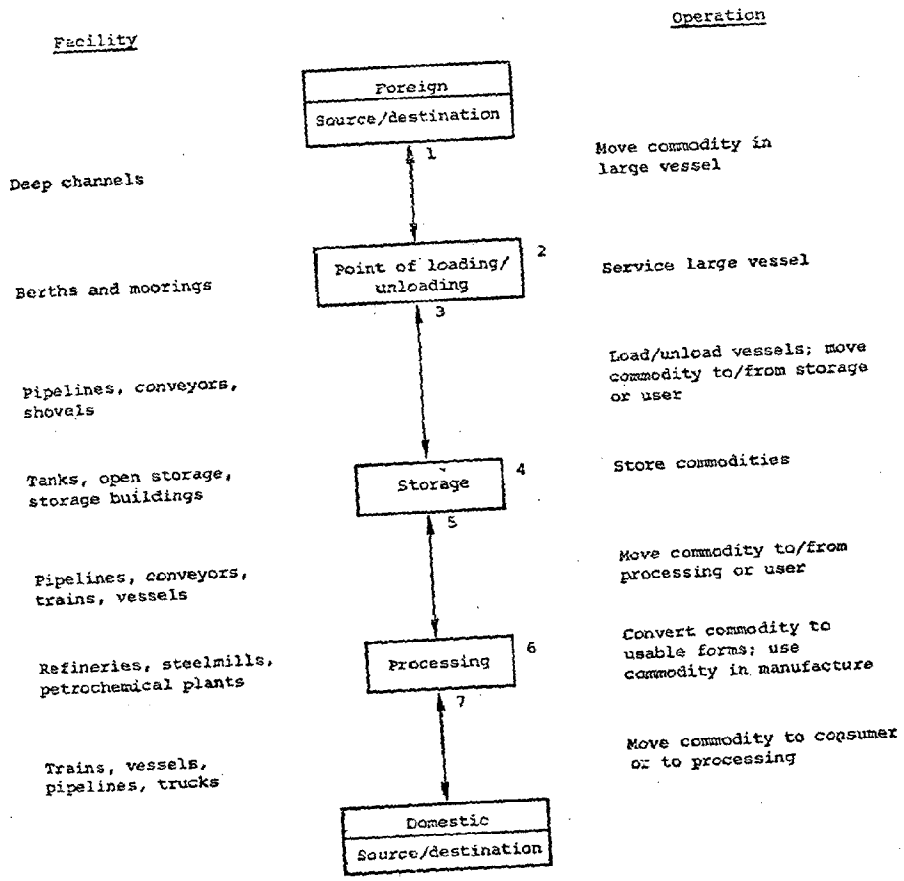

Figure 16. Components of a port delivery system (from IWR Report, Department of the Army, 1972).

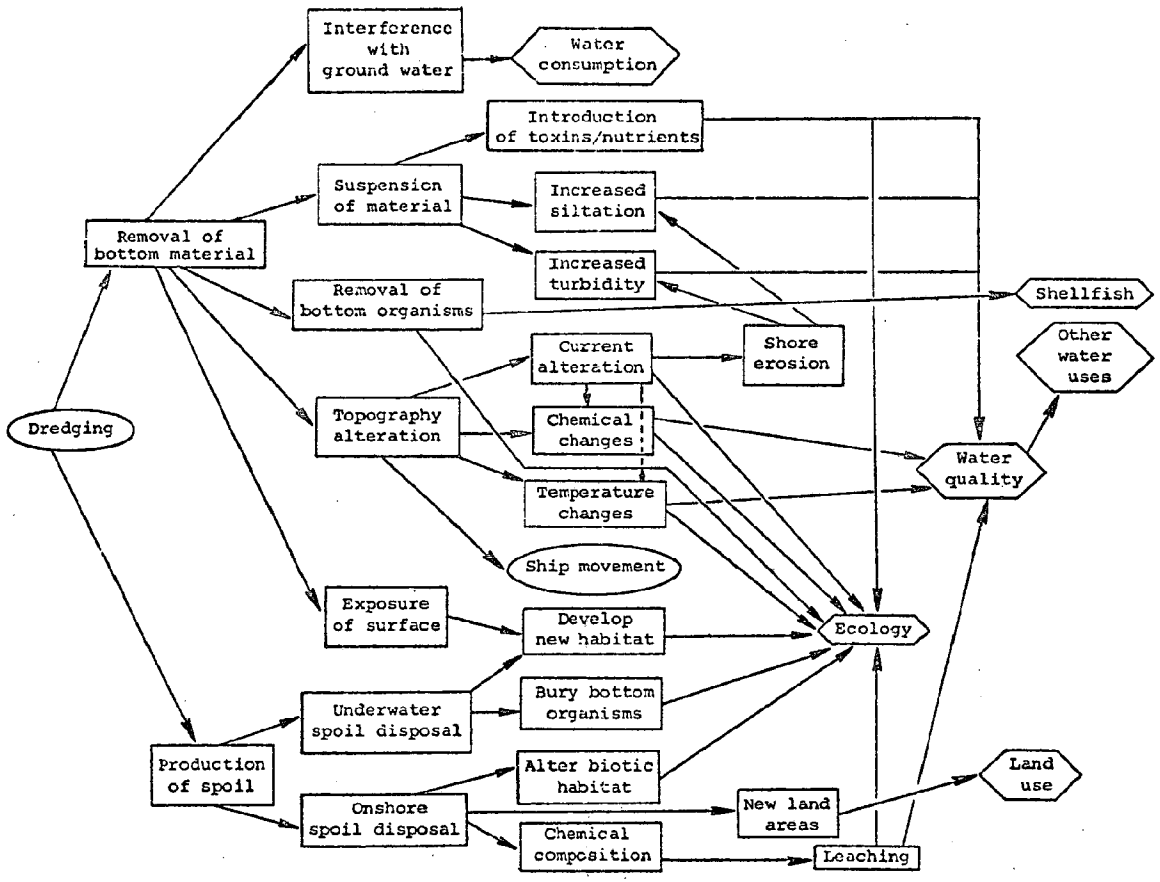

Figure 17. Environmental aspects of dredging (from IWR Report, Department of the Army, 1972).

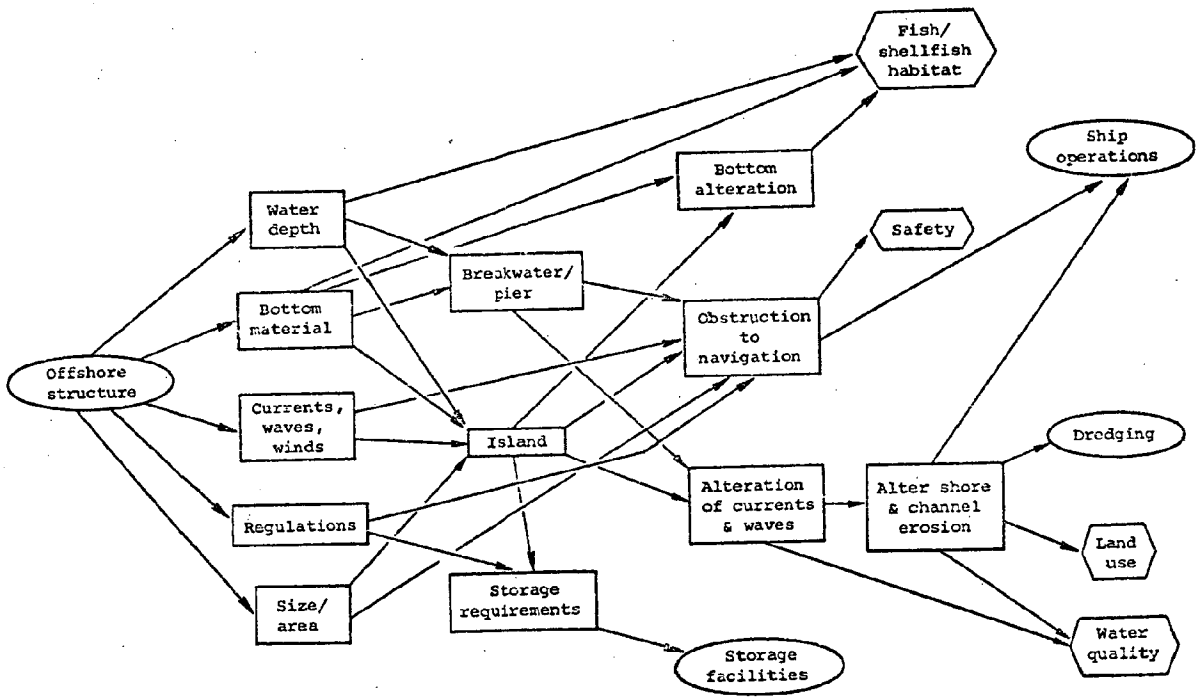

Figure 18. Environmental aspects of offshore structure (from IWR Report, Department of the Army, 1972).

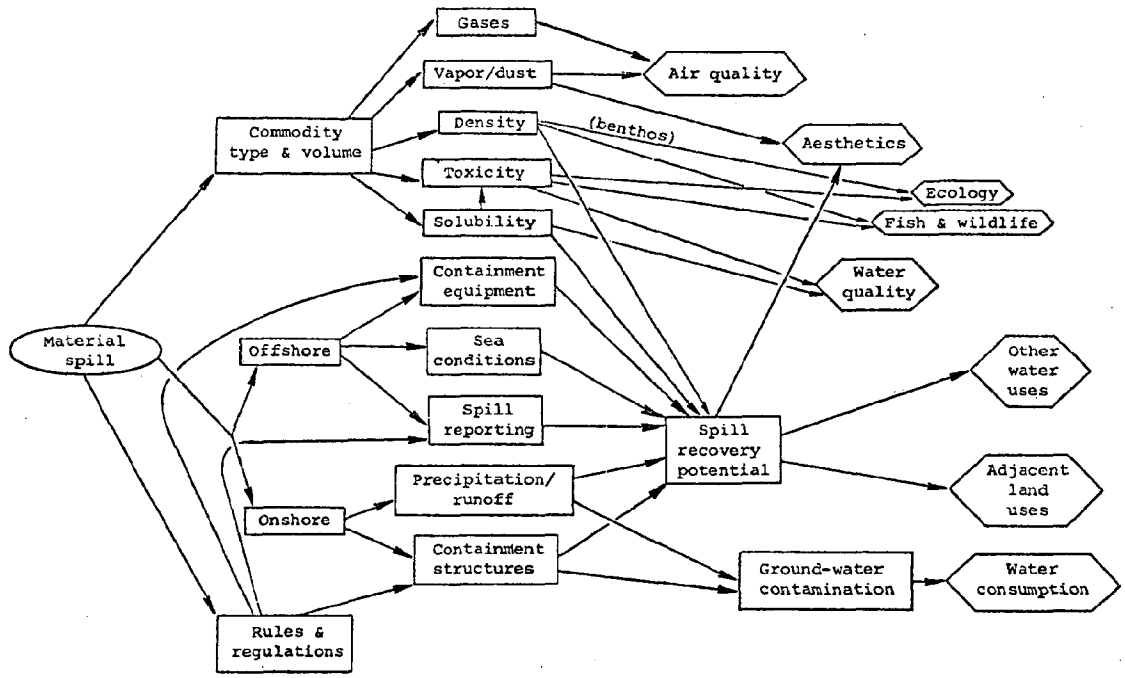

Figure 19. Environmental aspects of material spill (from IWR Report, Department of the Army, 1972).

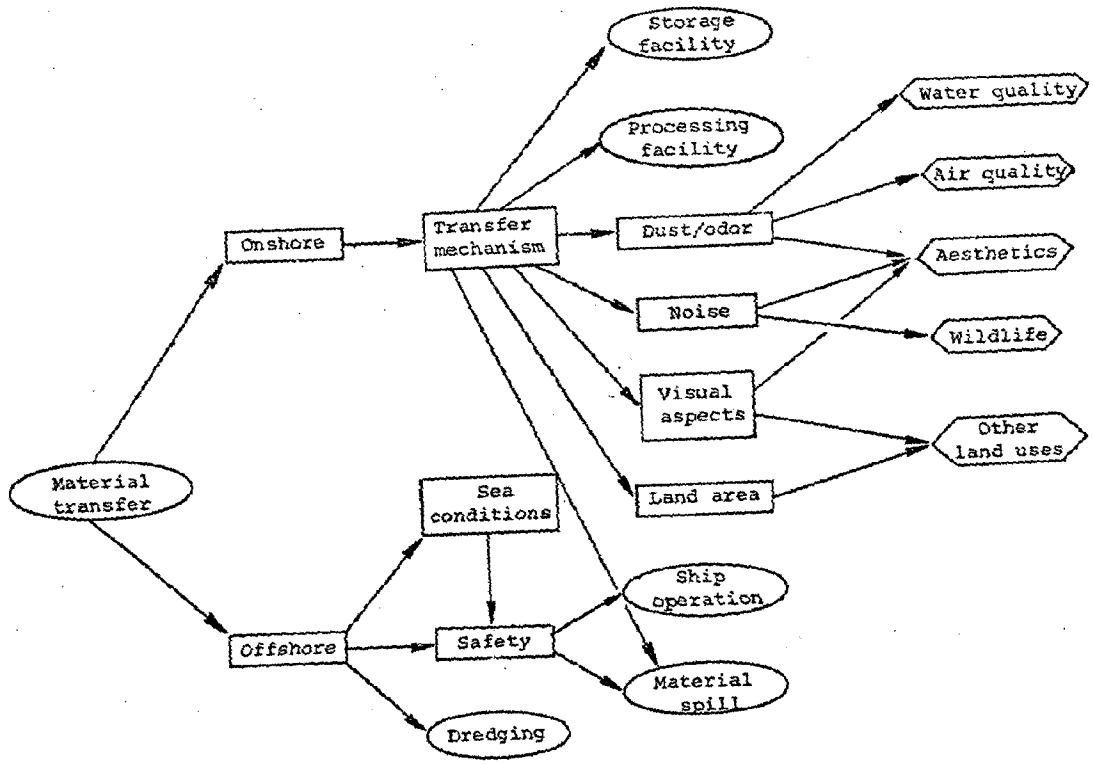

Figure 20. Environmental aspects of material transfer (from IWR Report, Department of the Army, 1972).

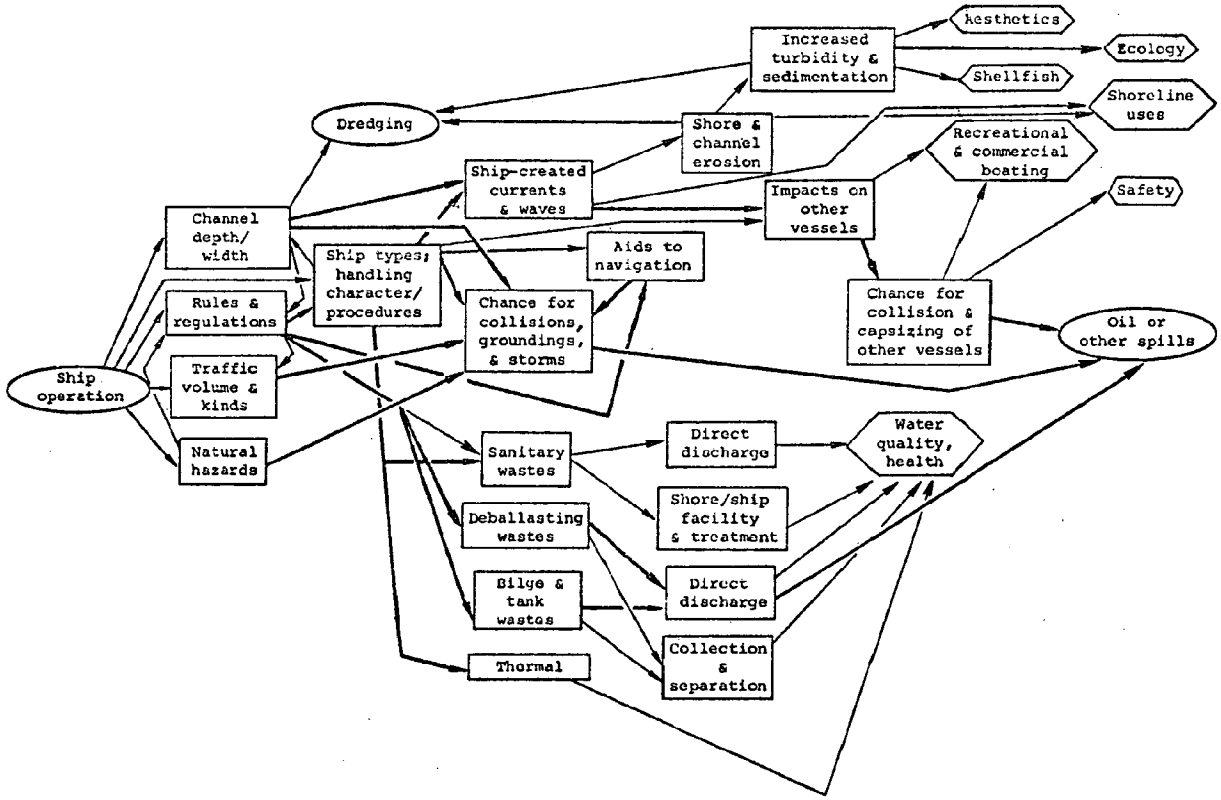

Figure 21. Environmental aspects of ship operation (from IWR Report, Department of the Army, 1972).

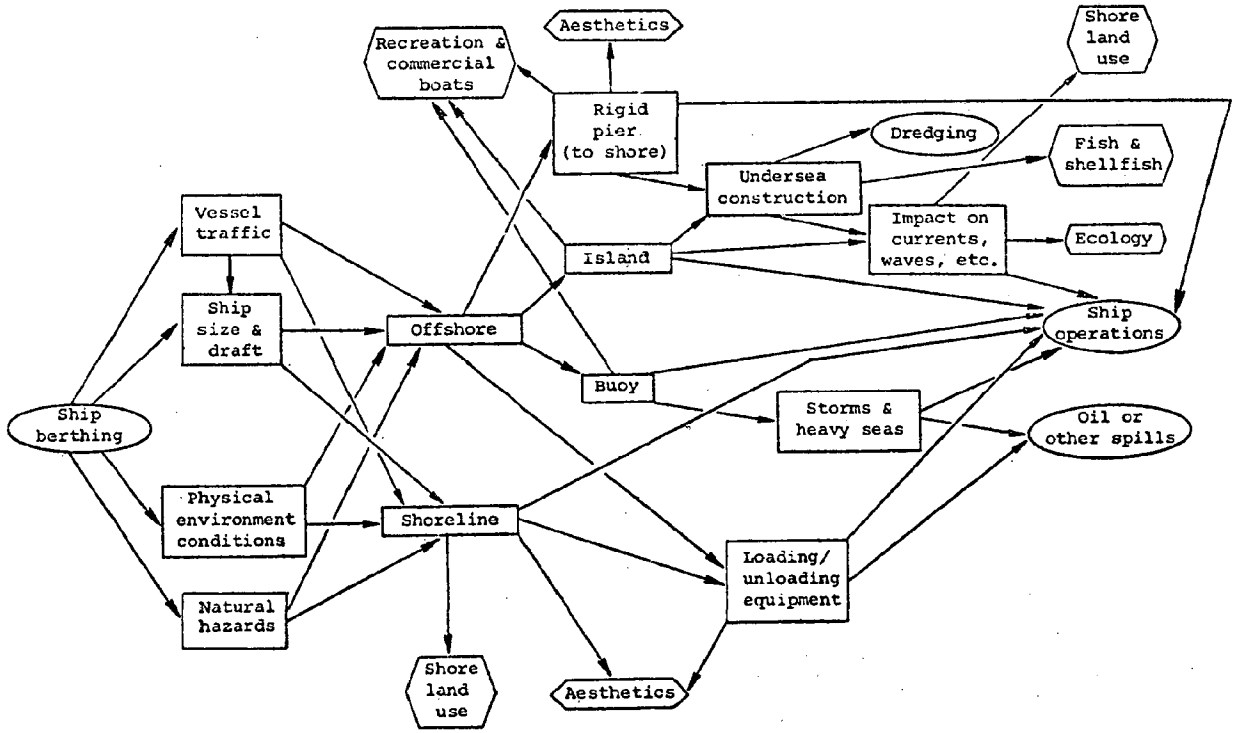

Figure 22. Environmental aspects of ship berthing (from IWR Report, Department of the Army, 1972).

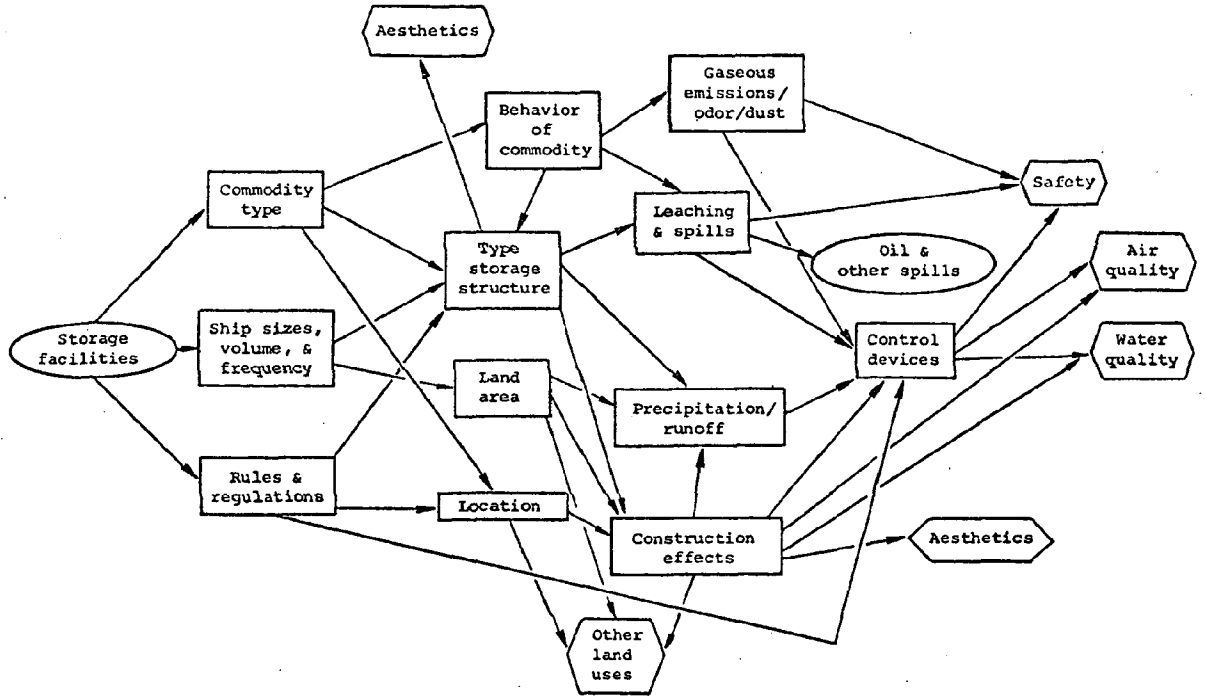

Figure 23. Environmental aspects of storage facilities (from IWR Report, Department of the Army, 1972).

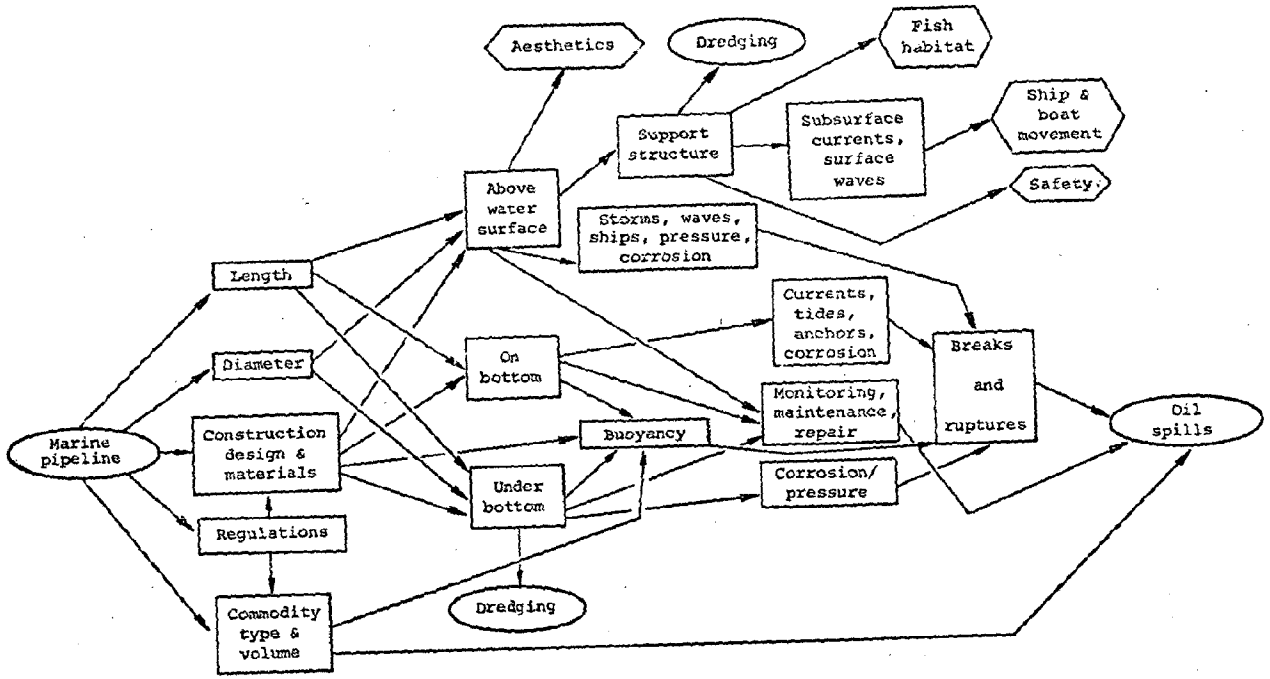

Figure 24. Environmental aspects of marine pipeline (from IWR Report, Department of the Army, 1972).

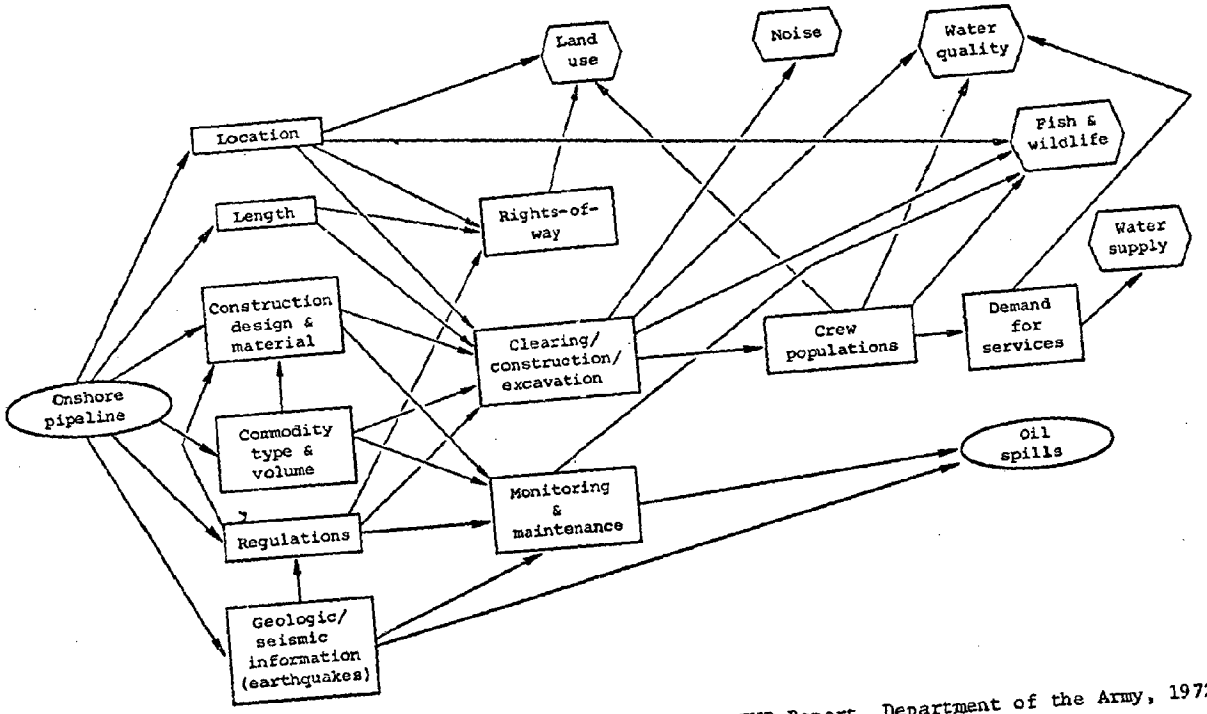

Figure 25. Environmental aspects of onshore pipeline (from IWR Report, Department of the Army, 1972).

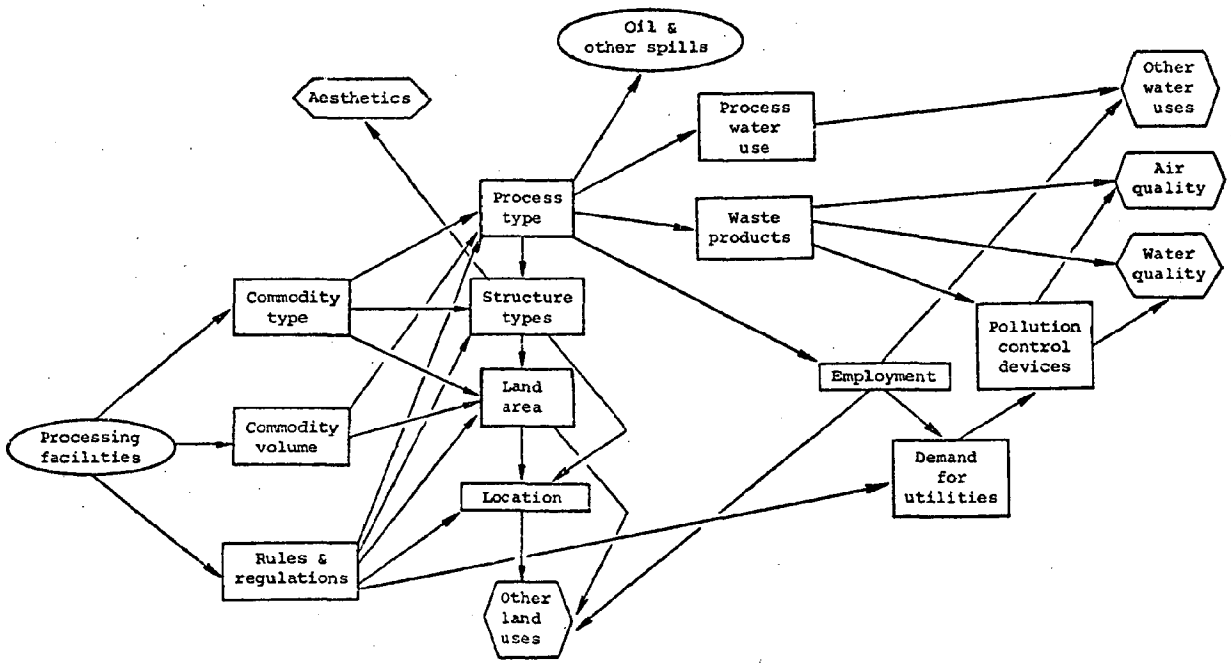

Figure 26. Environmental aspects of processing facilities (from IWR Report, Department of the Army, 1972).

shoreline it will transverse shoreline or littoral currents (Rounsefell, 1972; Figure 18).

d. Navigational Effects

Construction vessels, navigational fairlanes will tend to preempt use of the area by other activities such as commercial fishing and possibly recreation (Rounsefell, 1972; Figures 17, 18, 20, 21).

e. Interference with Detrital Food Web

Disturbed sediments, discharged or spilled materials (such as oil) will tend to adhere to detrital materials in the water column. The coated detritus will tend to sink and thus be removed, as a result, for a time from the food-web cycle (Rounsefell, 1972; Figures 17, 18, 19, 20, 21).

f. Interference with Sedimentation and Flocculation

Sedimentation and flocculation are a function of physical adsorption and absorption and the latter can be influenced by changes in salinity or discharge of various chemicals. This effect could cause substrate and hence biological population changes (ibid).

g. Destruction of Planktonic Forms in Areas of Activity

Phytoplankton, zooplankton, and larval forms of large invertebrates are especially susceptible to most changes in their immediate area. These forms are, for all purposes, immobile horizontally. Total populations of a large region would not be adversely affected if stress area is small (ibid).

h. Destruction of Spawning of Fishery Species

Attachment of structures to the bottom, discharging various materials over the side of vessels and/or platforms, dragging the bottom

with equipment, will destroy any egg spawned in the immediate area (ibid).

i. Introduction of Exotic Species

Vessels coming from other parts of the world can purposely and inadvertently introduce species common to other areas of the world. Species introduced to areas where they are not established can adversely affect the present relationships.

j. Spoil Removal and Disposal

Construction will require removal of substrate with the attendant loss of living forms in the disturbed sediments. In addition, the disposal material can adversely affect living forms in undisturbed areas if discharged in those areas. These effects include smothering--depletion of oxygen (Rounsefell, 1972; Figures 17, 22, 23, 24).

k. Chronic Oil Spills (major oil spills treated below)

Small amounts of oil discharged continually can be toxic to most life forms (Rounsefell, 1972; Figures 19, 20, 22, 23, 24, 25).

l. Effects of Explosives

If explosives were used then massive fish mortalities can result if detonated close to bottom (Rounsefell, 1972; St. Amant, 1972).

m. Changes in Air and Water Qualities

Ambient conditions in air and water will be affected by all activities contemplated in the port development (Figures 17, 18, 19, 20, 21, 22, 23, 24, 25).

2. Shoreline Stresses

Construction and operation of a deep water port will produce the following environmental stresses at or near the shoreline (Figures 22, 24, 25).

a. Interference with Sand Transport

Barrier islands along the Louisiana coast are produced by lateral or shoreline transport of sand from the discharge points of rivers and bayous. A pipeline inadequately buried and transversing these areas will interfere with this transport (Figures 23, 24).

b. Shoreline Current Changes

A pipeline will create a barrier and/or a change in the littoral currents that move along the shoreline. These currents are the principal avenues used by fishery species in their movements into and out of the estuaries (Figures 23, 24).

c. Shoreline Changes due to Devegetation

The vegetation along the shoreline will be removed and destroyed in those areas where the pipelines cross and where the terminal tank farms are located. Erosion will be increased with the loss of the vegetation (Figures 23, 24).

d. Bulkhead Effects

The construction of bulkheads will reduce the interface between the open water and marsh vegetation. This type of construction reduces fishery yield in the immediate area (Figure 24).

e. Spoil Removal and Disposal

Construction will require removal of substrate with the attendant loss of living forms in the disturbed sediments. In addition, the disposal material can adversely affect living forms in undisturbed areas if discharged in those areas. These effects include smothering -- depletion of oxygen (Rounsefell, 1972; Figures 17, 22, 23, 24).

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If explosives were used then massive fish mortalities can result if detonated close to bottom (Rounsefell, 1972; St. Amant, 1972).

h. Changes in Air and Water Quality

Ambient conditions in air and water will be affected by all activities contemplated in the port development (Figures 17, 18, 19, 20, 21, 22, 23, 24, 25).

3. Onshore Stresses

a. Changes in Drainage Patterns of Estuaries

Any disturbance of the sediments in an estuary will/can change the drainage pattern of that estuary (Figures 25 and 25).

b. Nutrient Cycle Changes

Sediment disturbances can result in oxygen depletion and the release of ionic phosphates into solution, thereby causing a leaching or loss of important nutrients (Figures 24 and 25).

c. Salinity Changes

Changes in the water circulation pattern in the estuaries and/or the digging of channels can introduce more saline water into the estuaries. This will have pronounced effects on the flora and fauna of the immediate and contiguous area (Figures 24, 25).

d. Changes in Turbidity

Construction activities that disturb the sediments will increase turbidity of the surrounding waters. This can adversely affect the benthic plant and animal population in the immediate area (Figures 24 and 25).

e. Changes in Dissolved Oxygen

Waste materials, spoils and toxins can use up the available oxygen in water. Anoxic conditions can adversely affect plant and animal populations (Figures 24, 25).

f. Interference with Grass Detritus Formation

If the microbes that initiate detritus formation are inhibited by toxins or materials, then the formation of detritus can be severly affected.

g. Interference with Sedimentation and Flocculation

Sedimentation and flocculation are a function of physical adsorption and absorption and the latter can be influenced by changes in salinity or discharge of various chemicals. This effect could cause substrate and hence biological population changes.

h. Spoil Removal and Disposal

Construction will require removal of substrate with the attendant loss of living forms in the disturbed sediments. In addition, the disposal material can adversely affect living forms in undisturbed areas if discharged in those areas. These effects include smothering -- depletion of oxygen (Rounsefell, 1972; Figures 17, 22, 23, 24).

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All phases of construction and operation will utilize certain chemicals that if released inadvertently would have adverse effects on living forms. In addition, human sewage will accumulate or be discharged into the environment with adverse effects. Washings of materials and structures can also introduce toxins into the air and aquatic environment (Rounsefell, 1972; Figures 18, 19).

j. Effects of Explosives

If explosives were used then massive fish mortalities can result if detonated close to bottom (Rounsefell, 1972; St. Amant, 1972).

E. Major Stresses

The major stresses associated with a deep water port are the accidental discharge or release of the cargoes (such as oil) and the establishment of various industries ancillary to the port. These stresses can result in the acute deterioration and/or gradual irreversible deterioration of the environment.

1. Casualty Oil Spills

A major or casualty oil spill would be most adverse if it occurred in the estuaries. Oil spilled there could kill the marsh grass and/or interfere with detritus formation and eventually fishery harvest. In addition, oil would tend to be entrapped in the back part of the marsh grasses by means of the branch-like water distributaries into the marsh. This is an area having the highest biomass of consumer species in the marsh and they would be subject to suffocation and toxic effects.

2. Ancillary Developments

Industrial development ancillary to a deep water port if established in prime marsh areas would have extremely adverse environmental effects. There would be loss of the immediate area of the industry, disruption of the circulation pattern by construction and by roads built into the area and by a gradual deterioration of the environment.

F. Environmental Monitoring

1. Present Data Base

Adequate environmental data are lacking for most to all offshore areas. No systematic or quantitative data are available on the distribution and abundances of the benthic populations such as molluscs, polychaets, echinoderms, nermetans, and fishes, etc. In addition, seasonal and monthly data are not available on planktonic and mobile forms. Sea birds and mammals are only cursorily known.

The shoreline and onshore areas are more adequately known except monthly and seasonal changes are not available in all of the various marsh plant zones. In addition, the variation of primary production in each of them is inadequately known.

2. Environmental Data Requirements

Minimum requirements for environmental data are given below:

a. Hydrography - inshore and offshore, seasonally

- Surface currents vectors
- Flushing time (resident times for each)
- Effects of hurricanes on them

b. Meteorology

- Surface winds vectors along entire coastline north to the Intracoastal Canal

c. Geology

- Erosion baseline data
- Amount of water-land interface present (annually)
- The changes in isohalines (annually) or saltwater intrusion

d. Biology

- Coastal vegetation inventory (annually)
- Marsh meiofauna and macrofauna (seasonally)
- Primary productivity along entire coast (freshwater, brackish, saline)
- Plankton, fish, and marine species
- Detritus production along entire coast
- Nutrient flow (annually)

CHAPTER 2

ENVIRONMENTAL GUIDELINES FOR SUPERPORT SITE SELECTION

A. Requirements and Intent of Chapter

1. Statute

2. Principal Feature of Chapter

3. Types of Superport Site and Auxillary Site Considered

B. Site Selection Guidelines

1. Coastal Region for Superport Activities

2. Navigational Sea Fairway and Anchorage Locations

3. Offshore Terminal Location

4. Offshore Pipelines and/or Connecting Links Locations

5. An Onshore Terminal Location

6. Onshore Pipelines and/or Right-Of-Way Locations

7. Support Facilities Locations

8. Processor Locations

Sections discussed under each locale are

a. Essential Environmental Features

b. Economic Considerations

c. Selected Economic-Ecologic Combinations

d. Critical Environmental Considerations

C. Environmental Cost Assessment Techniques and Economic-Ecologic Formulae

1. Environmental Cost Assessment Techniques

a. Technique (1)
By David B. Johnson, Department of Economics, Louisiana State University, Baton Rouge.

b. Technique (2)
By Robert M. Pope, Center for Wetland Resources, Louisiana State University, Baton Rouge

2. Economic-Ecologic Formulae

   a. Leontief Model

   b. Odum and Odum Model

CHAPTER 2

ENVIRONMENTAL GUIDELINES FOR SUPERPORT SITE SELECTION

A. Requirements and Intent of Chapter

1. Statute

Louisiana Revised Statute 34:3113(J)(2) is as follows:

> "Describe the essential features or existing environmental data upon which the selection of a site for a Deep Draft Harbor and Terminal may be based. Indicate how this (Sic) data has been analyzed and compared with the inventory of potential and actual stresses required in the above Paragraph so that the site selected will result in the least total stress on the environment. Indicate how economic considerations are compared with the assessed total stress on the environment to arrive at the best economic-ecologic formula for determination of a site for the Deep Draft Harbor and Terminal. State the location and availability of the environmental data upon which these determinations are based."

2. Principal Feature of Chapter

The most important feature required by chapter 2 of the Environmental Protection Plan is that the site selected for the Superport and its auxillary site be those that result in the best of the possible economic-ecologic combinations. First consideration should be given to those sites which would result in the least total stress on the environment.

3. Types of Superport Site and Auxillary Sites Considered

Regardless of the types of commodities handled by a superport, it is apparent that a variety of geographic sites will be required in order for the port to operate. These auxillary sites include:

1. A Coastal Region for Superport Activities

2. Navigational Sea Fairway and Anchorage Locations

3. Offshore Terminal Location

4. Offshore Pipelines and/or Connecting Links Locations

5. An Onshore Terminal Location

6. Onshore Pipelines and/or Right-Of-Way Locations

7. Support Facilities Locations

8. Processor Locations

The remainder of this chapter will discuss each of these sites in regard the following four subsections:

a. Essential Environmental Features

These features include the most important environmental aspects of each site and act first as a constraint and second as a stress. An environmental constraint is defined as "any process or condition which acts as a limiting factor or a hinderance to the particular project." An environmental stress is defined as "any effect which the particular project would have on physical and biological processes, above and beyond the natural rates. Physical stresses are indicated* by:

(1) Any changes in the hydrography of the project area

(2) Any increase of erosion and subsidence rates

(3) Any modification of geological forms, such as tidal passes, barrier islands, land-water interface, and/or unmodified wetlands

(4) Any modification of cyclic of nutrients and organic compounds

Biological stresses are indicated* by:

(1) A reduction of the number of species

---

*Indices should be statistically significant at $\leq$5% level.

(2) A reduction of individuals of any one species

(3) A reduction in any of several diversity indices, such as,

- MacArthur's Shannon-Wierner Index
- Heatvole and Levins Index

Each index should be computed separately using the number of species, the amount of biomass, and/or the extent of coverage or dominance.

(4) Any change in primary and secondary production and/or their turnover rates

b. Economic Considerations

These considerations include the most important economic feature of each site which would in some way limit or prevent the particular project or would limit other economic activities.

c. Selected Economic-Ecologic Combinations

This section will place in counterpoise the important economic features of each site with its equivalent ecologic features in order that a scheme for potential combination can be presented and weighed.

The statute requires that the best economic-ecologic formula be used for determination of superport sites. Although the above formulation of placing economic and ecologic factors in counterpoise is tentative, it is probably the only one now available. As a result, the Authority should give first research priority to this problem. It clearly represents one of the most serious uncertainties in the Environmental Protection Plan as indicated in La.R.S. 34:3113(I).

d. Critical Environmental Considerations

This section will summarize the most critical stresses that should be administered by legal regulations.

B. Site Selection Guidelines

1. Coastal Region for Superport Activities

a. Essential Environmental Features

The most important environmental constraint that a coastal region has in regard to superport activities is:

- the distance from the shoreline to water depths greater than or equal to approximately 100 feet.

If this distance is too great then the project cannot be considered as feasible for that area. The final judgment of what distance is considered to be too great is primarily the economic and engineering feasibility. Figure 27 shows the distance of the 100 foot depth contour along coastal Louisiana; it ranges in value from approximately 5 miles from the shoreline near the Mississippi River delta to about 70 miles off Calcasieu Pass. Almost all proposals for a Louisiana superport have expressed an interest in the coastal area south or southwest of Bayou Lafourche, or near Southwest Pass, or near South Pass, or off the North Pass of the Mississippi River delta. (Louisiana Superport Studies: Report 1, 1972; Louisiana Offshore Oil Port, 1972; Department of the Army, LMNPL-F, 1973). The area east of Bayou Lafourche, therefore, probably represents the present optimum balance for economic and engineering variables.

The most important potential and/or actual environmental stress that can be expected to occur in any of the coastal areas as a result of superport site activities is:

- the reduction and/or loss, of biological production (or a renewable resource) in the project area.

This reduction and/or loss can and probably will occur in a variety of ways including: direct construction damages, loss of coastal

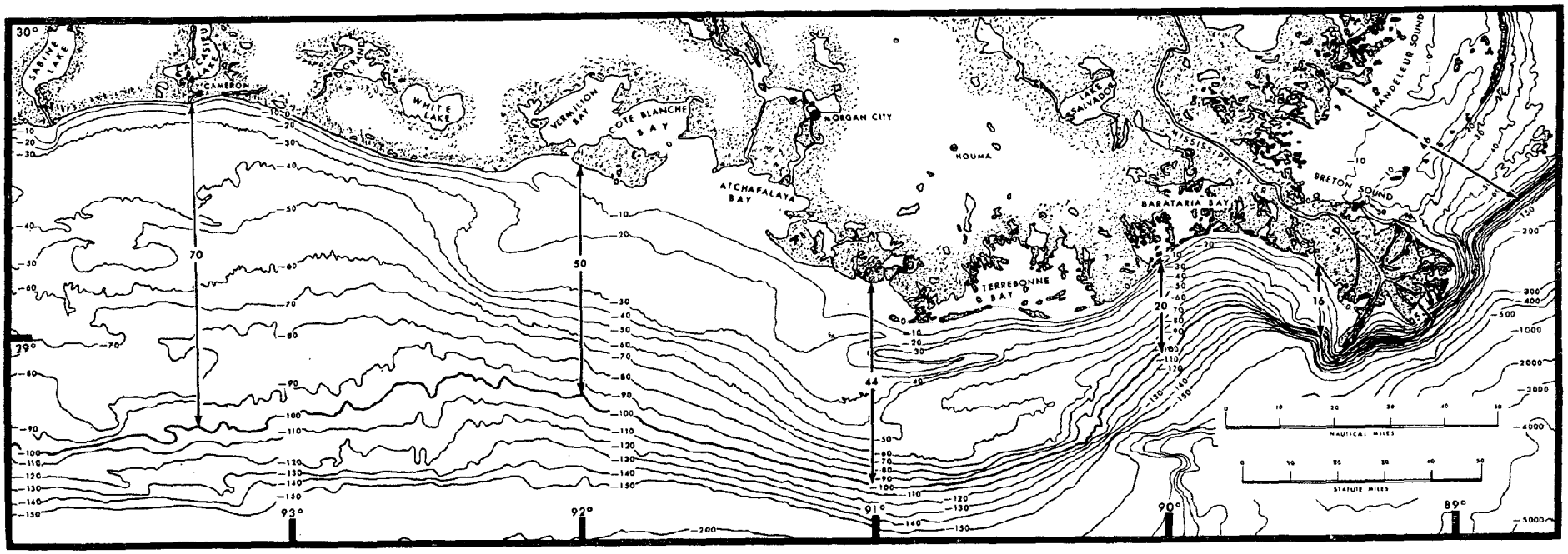

Figure 27. Location of the 100-foot depth contour along coastal Louisiana.

wetlands used for urban and industrial development associated with a superport, and oil spill damages. The coastal wetlands area of Louisiana is shown in Figure 28. There are approximately four million acres of marshlands in the coastal zone of Louisiana (Chabreck, 1972). This is the area in Louisiana of prime vulnerability to superport activities; it is approximately ten times more productive than the offshore waters and the upland terrestrial areas (Table 7). We do not have primary (plant) production data for each area along coastal Louisiana, however, we do have commercial fish harvest data (Table 71) for all coastal areas. Hydrologic Units IV, I combined with II, and V are the first, second and third best-ranked areas in terms of fishery yields per unit area. We assume that fishery harvest is a relatively good index to the productive capacity of the coastal land, since 90 percent of the harvest is made up of menhaden and shrimp species which are in turn dependent on plant food originating in the coastal marshes (i.e., detritus). Thus the coastal area from Terrebonne Bay east to Chandleur Sound constitutes the most productive area of Louisiana.

b. Economic Considerations

A Louisiana superport site poses at least two important economic questions:

- Are the commodity flows of the State amenable to superport transit?
- Can the engineering prerequisites be economically satisfied?

The answer to both questions is yes. Johnson (1972) found, for example, that the major outbound commodity of the central Gulf region (which is mainly Louisiana) is crude oil; it accounts for more than 20 percent of the total commodity flow. In addition, petroleum products

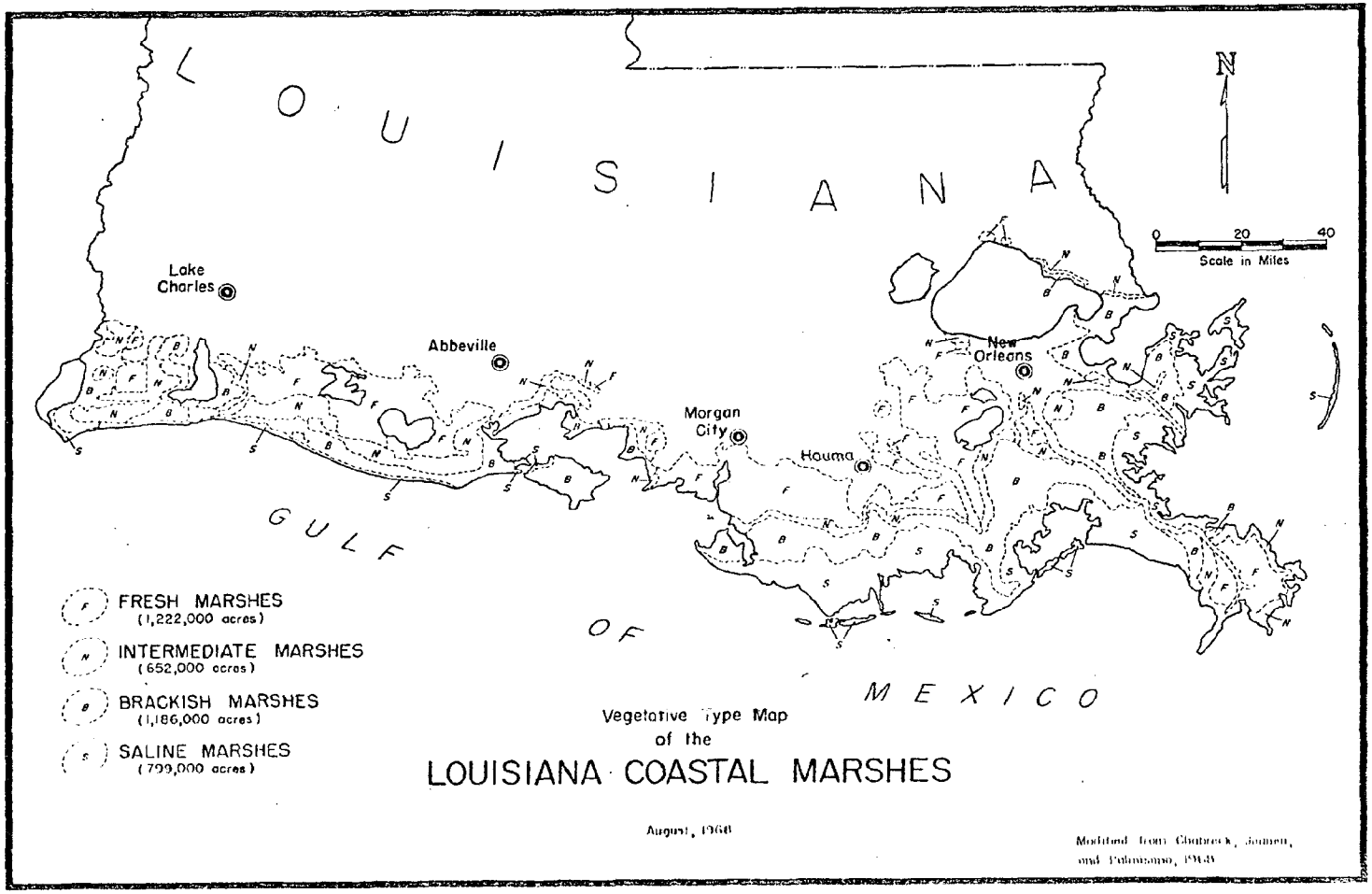

Figure 28. Coastal marshes of Louisiana (from Chabreck, et al., 1968).

Table 71. Production and value of major commercial estuarine-dependent fisheries by hydrologic unit. Data based on five-year (1963-67) average annual harvests and 1967 exvessel prices (Lindall, et al., 1972).

Species	Hydrologic Unit								
	I and II[1]	III	IV	V	VI	VII	VIII	IX	Total
Menhaden									
Production[2]	159.33	30.20	335.83	64.80	28.30	41.10	12.40	41.10	713.06
Value[3]	2.26	0.43	4.77	0.92	0.40	0.58	0.18	0.58	10.12
Shrimp									
Production	18.30	3.70	20.00	22.91	2.00	3.20	0.50	2.90	73.51
Value	6.64	1.34	7.25	8.31	0.73	1.17	0.19	1.05	26.68
Croaker									
Production	4.33	1.20	4.93	7.63	1.10	2.11	0.30	2.11	23.71
Value	0.07	0.02	0.08	0.14	0.02	0.04	0.01	0.04	0.42
Oyster									
Production	4.68	0.00	4.14	0.85	0.00	0.01	0.00	0.29	9.97
Value	2.06	0.00	1.82	0.37	0.00	0.005	0.00	0.13	4.39
Blue Crab									
Production	3.66	0.03	2.46	1.12	0.28	0.06	0.04	0.62	8.27
Value	0.32	0.003	0.22	0.10	0.03	0.005	0.004	0.05	0.73
Spot									
Production	0.57	0.23	0.85	1.58	0.22	0.53	0.11	0.53	4.62
Value	0.01	0.004	0.01	0.03	0.004	0.01	0.002	0.01	0.08
Catfish and Bullheads									
Production	0.16	0.00	1.94	0.41	1.79	0.07	0.22	0.003	4.59
Value	0.03	0.00	0.33	0.07	0.30	0.01	0.04	0.001	0.78
Seatrout									
Production	1.41	0.21	1.08	0.31	0.18	0.42	0.08	0.42	4.11
Value	0.07	0.01	0.05	0.01	0.01	0.02	0.003	0.02	0.19
Red Drum									
Production	0.23	0.02	0.12	0.13	0.005	0.00	0.00	0.02	0.53
Value	0.04	0.003	0.02	0.02	0.001	0.00	0.00	0.003	0.09
Total									
Production[2]	192.68	35.59	371.35	99.74	33.87	47.50	13.65	47.99	842.37
Value[3]	11.50	1.81	14.55	9.97	1.50	1.84	0.43	1.88	43.48
Estuarine water[4]	1,764	163	314	419	153	323	13	134	3,283
Production, pounds/acre	109.2	218.3	1,182.6	238.0	221.4	147.1	1,050.0	358.1	256.6
Value dollars/acre	6.5	11.1	46.3	23.8	9.8	5.7	33.1	14.0	13.2

1/ Hydrologic Units I and II were grouped because of overlap of Breton and Chandeleur Sounds and probable overlap of catch designations therein

2/ Millions of pounds

3/ Millions of dollars

4/ Thousands of acres

make up nearly 15 percent of the total volume. These data indicate that Louisiana can handle and process a large volume of crude oil and since it has approximately 13 percent of the nation's refinery capacity (Department of the Army, 1973) it also has a well-developed pipeline and water distribution network (Johnson, 1972; Coignet, 1971; LOOP, 1972) to Texas, the Midwest and the East coast of the United States. Approximately one third of the State's refinery capacity is located near Lake Charles while two thirds is located along the Mississippi River Corridor (Table 72).

In regard to engineering prerequisites, water depths greater than 100 feet are relatively close (5 to 20 miles) to the Mississippi River delta and Bayou Lafourche (Figure 27). In addition, considerable engineering experience exists in coastal Louisiana in regard to port operations and offshore platform construction and operations.

c. Selected Economic-Ecologic Combinations

Regardless of where the final sites selected for superport activities are located there will be some environmental stress, by either the reduction or the loss of biological production(or a renewable resource) in the site areas. If a superport is built in Louisiana, the important question is how to locate it in an area with the least total environmental stress, and/or if this is impractical how to provide extra environmental safeguards as a trade-off for locating sites in areas having higher environmental risks.

A likely site west of Bayou Lafourche is probable only near Calcasieu Pass since Lake Charles has 20% of the state's refinery capacity and other industrial development. However, the port of Lake Charles only accounts for about 4 percent of the total commodity flow in the central

Table 72. Coastal Refinery Complexes. Refinery Capacity (U.S. Department of Army, 1973). (Barrels per day)

Coastal Complex	Existing 1972	Cases I-V 1980	Case I 2000	Case II 2000	Case III 2000	Case IV 2000	Case V 2000
Panama City	---	---	---	84 000	424,000	---	---
Pensacola	---	---	---	84,000	424,000	---	---
Mobile	18,000	19,000	23,000	108,000	447,000	23,000	868,000
Pascagoula	270,000	519,000	802,000	802,000	1,030,000	707,000	1,557,000
Baton Rouge	585,000	1,334,000	2,047,000	2,016,000	1,847,000	2,097,000	1,847,000
New Orleans	540,000	872,000	1,470,000	1,440,000	1,270,000	2,115,000	1,270,000
Lake Charles	306,000	438,000	1,070,000	940,000	770,000	770,000	770,000
Beaumont-Port Arthur	1,291,000	1,915,000	3,633,000	3,502,000	3,333,000	3,333,000	3,333,000
Galveston-Houston Area	1,460,000	3,160,000	4,773,000	4,773,000	4,434,000	4,434,000	4,434,000
Corpus Christi	340,000	805,000	1,321,000	1,435,000	1,096,000	1,096,000	1,096,000
Total	4,810,000	9,062,000	15,175,000	15,175,000	15,175,000	15,175,000	15,175,000

Gulf, whereas the Port of New Orleans accounts for about 76 percent of the total. This area is the fourth (out of the 8 hydrologic areas) ranked fishery area along Coastal Louisiana. If an offshore terminal was located at the 100 foot depth contour -- about 70 miles away from the shoreline -- and no dredging was allowed to create a deep channel into Calcasieu Pass, then it could well be the area of least total environmental stress. The probability of Oil Spill damage near Calcasieu Pass would be minimal because the set of the surface currents is to the West and because of the great distance of the 100 foot depth contour from the shoreline. This combination assumes, however, that all industrial development will occur in or north of the area of the City of Lake Charles -- for all purposes out of the coastal wetlands. This also assumes that the pipeline networks to Texas and to the Atlantic seaboard can be expanded to handle the required throughput. Probably the major economic problem for an oil-receiving facility would be the extra cost (on the order of $3,000,000 per mile) of laying an additional 50 or more miles of pipeline.

It is unlikely that a superport would be located between Lake Charles and Terrebonne Bay, because there appears to be no important economic reasons for so doing.

It seems probable, therefore, that present economics favor a superport site east of Bayou Lafourche. This is the most productive area in terms of fisheries harvest and because of this it is also the most vulnerable. Within this area, however, we believe that the region east of the Mississippi River is more vulnerable to environmental stress because it is an established oyster producing area; there is a menhaden nursey

area within its confines; there are at least four major wildlife preserves and/or management areas within it (these are near or on the shoreline); and the surface currents set toward the northwest, north, and northeast, posing a substantial threat to the wetlands of this area as a result of an oil spill.

The area between Bayou Lafourche and the Mississippi River has several viable site possibilities; they are, south of Bayou Lafourche, near Southwest Pass, and near Garden Island Bay. A site south of Bayou Lafourche might be suitable if located where surface currents set predominately away from the coastline and if ancillary developments along Bayou Lafourche were rigidly controlled. This site has high environmental risks because the coastal wetlands near it are the most productive of Louisiana and probably of the world. Sites near southwest pass and near Garden Island Bay may have suitable currents (see Stone, 1973) which set, and may flush potential pollutants, away from the coastline. Certainly the tip of the Mississippi River delta is not greatly productive (sixth ranked fishery area, out of eight in the state). Heavy ship traffic and unsuitable soil foundation may however produce more environmental risks and engineering problems than the Bayou Lafourche area. These areas are also known to have cells of saltwater trapped near the mouths of the various passes of the Mississippi River. This aspect would be a positive environmental feature if the cell would also provide an interface between any oil spill and the coastal wetlands (Murray, et al., 1970); it would be a negative environmental feature if an oil spill were to become entrapped in the saltwall cell and remain there for some period of time, with the possible result being similar to the red tide phenomenon so common along the Gulf coast of Florida, i.e. extensive fish mortalities.

d. Critical Environmental Considerations

We strongly recommend that only one superport should be established and that it be confined to one coastal region. We believe that this limitation is necessary because the environmental impact of one superport will undoubtedly be of the same order of magnitude as that of the economic spinoff (GSRI - Kaiser Report, 1973). If more than one port is allowed, or if its economic impact is not contained and confined, environmental safeguards and monitoring will be more diffused and may be less effective.

2. Navigational Sea Fairway and Anchorage Locations

a. Essential Environmental Features

The most important environmental constraints that a coastal area has in regard sea fairways and anchorage locations are:

- obstructions and/or structures that might cause ship collisions or interfere with ships navigation;
- suitable water depths (bathymetry);
- weather conditions and sea-state;
- the intrusion of other human activities such as fishing and recreation.

Along the continental shelf of Louisiana there are more than 2500 structures used for oil and gas production (U.S. Coast Guard, 1971). Table 73 gives the number of oil wells and submerged structures in various offshore areas along Coastal Louisiana. Thirty-five percent (>900) of these structures are found near and about the Mississippi River delta. The 100 foot depth contour is shown in Figure 27. Any superport fairway must be designed in such a way that any possible ship groundings will be avoided due to insufficient depths such as those <100 feet.

Table 73. Offshore Oil Structures and Submerged Wells (Treasury Department, U.S. Coast Guard, 1971).

Area	Oil Well Structures	Submerged Wells	Total	
			Number	Percent
1. Chandeleur Sound	0	0	0	.00
2. Breton Sound	8	0	8	.31
3. Main Pass	194	13	207	8.11
4. South Pass	419	9	428	16.77
5. West Delta	255	18	273	10.70
6. Grand Isle	85	8	93	3.64
7. Bay Marchand	77	1	78	3.05
8. South Timbalier	238	16	254	9.95
9. Ship Shoal	270	31	301	11.79
10. Eugene Island	336	44	380	14.89
11. South Marsh Island	66	20	86	3.37
12. Vermilion	141	18	159	6.23
13. East Cameron	96	15	111	4.35
14. West Cameron	168	5	173	6.78
GRAND TOTALS	2353	198	2551	

The coastal weather of Louisiana is influenced by two pressure centers; a high located over Bermuda and a low located over Texas. Pressure changes associated with these centers set up winds that come predominantly out of the east. During fall and winter a north to northeast component is dominant while spring and summer winds shift to the southeast. Waves follow the wind pattern, most being 3 to 5 feet in height and wave power is greatest near the east of the Mississippi River delta. Visibility of less than one-fourth mile occurs less than 1 percent of the time along the Louisiana coast.

A measure of human activities in terms of commercial and recreational fishing is provided in sections B3, B4 and B5 of Chapter 1. The most serious intrusion might result from commercial fishing activity.

The most important environmental stress to the coastal area as a result of establishing sea fairway and anchorage locations is:

- damages resulting from oil spills.

The most serious spill damage will occur in the estuaries or coastal wetlands if the oil reaches them. If fairway sites are located beyond or at the 100-foot depth contour, then estuarine damage would be likely to occur only at some sites east of Bayou Lafourche because the distance to shoreline is considerably less than west of Bayou Lafourche, and the set of the currents is sometimes toward the shoreline. Offshore spill damage will occur to planktonic forms within the water column wherever the oil spreads; most of the more mobile forms of life, such as fish, will probably move away from a spill. The most serious potential offshore damage will be to the benthic populations (those organisms living at or near the bottom of the coastal waters) and to the spawning ground of various marine species. Quantitative data are lacking for

offshore benthic populations so little can be stated as to the differences of one benthic area compared to another. However, locations of spawning ground of menhaden are shown in Figure 11. It is also possible the designation of a sea fairway and anchorage will reduce their availability for commercial fishing and recreational activities.

b. Economic Considerations

It is possible that the selection of certain fairway sites could result in ship movements being slightly delayed but, when viewed in relation to their total transit time, this effect will probably be negligible. For example, the fairway will probably be less than 100 miles long compared to a total route distance of probably over 10,000 miles (a time effect of probably less than 1 percent).

c. Selected Economic-Ecologic Combinations

Most shipping safety fairways and anchorage locations are probably established only by reference to navigation safety and economic constraints, and as a result, they are usually straight-line approaches from the open ocean into the port (see LOOP, 1973). This approach may be valid if it does not preempt unduly other economic activities, or if there are no other activities in the area.

Another possible combination is that of the fairways and anchorages transecting a major fishery area, dense benthic populations, or a spawning area of marine species. The anchorage location will probably show the most environmental stress since some ships will probably always be located in it and any leaks will produce chronic (low-level) pollution.

Another possibility is that of critically evaluating those

water areas with structures in them and determining if a safe and curved fairway lane can be established. Extra costs might be accrued as a result of some ship delay, or as a result of additional navigational controls.

d. Critical Environmental Considerations

We recommend that all navigational and anchorage locations be located along areas that, as much as possible, have benthic populations of low diversity (in terms of species numbers and biomass) and that are not located in prime spawning areas of marine species. Permanent or temporary damage to either the benthic populations or the spawning areas should be compensated for by means of reestablishment of the affected areas or in an equivalent unaffected area. Preproject inventory and monitoring during operations will be necessary to establish these conditions.

We further recommend that all ships using the facilities of the Louisiana superport be rigidly controlled and restricted to these fairway and anchorage locations.

3. Offshore Terminal Location

a. Essential Environmental Features

The most important environmental constraints of a coastal area to an offshore terminal location are:

- the distance from the shoreline to water depths greater than or equal to 100 feet;
- weather and sea-state conditions;
- soil or foundation stability at the sea bottom;
- navigational hazards.

All of these items are discussed under the previous two sections dealing with site locations.

The most important environmental stresses to a coastal area from an offshore terminal are:

- oil spill damages;
- toxin spill damages;
- construction damages.

Oil spill damages would accrue as indicated in the previous sections. However, an additional stress,unique to the terminal, will be chronic (low-level) oil leakage. This will probably cause a depletion or general reduction of all organisms in the area of the platform and will probably vary directly with the hydrography (water movements) near and around the platform. Toxin spills can result from the discharge at or near the terminal. The severity of such spills is proportional to the type of toxin and the amount spilled (see Chapter 4). Construction acitivities necessary to build the offshore terminal will probably adversely affect some planktonic forms but most likely the largest stress will be to the immediate bottom area where the terminal will be attached.

b. Economic Considerations

For an offshore terminal site we must consider the distance necessary for connecting links to operate or to be built, for example, the length of pipeline necessary to reach the shoreline or the onshore terminal. In addition, when selecting the offshore terminal site we must consider transfer costs which will result from the type of terminal structure and the weather or sea-state conditions.

It now appears that the preferred structure for an oil-receiving terminal off Louisiana is the single-point mooring buoy (LOOP, 1973; James,et al., 1972). The claim is that these structures have proven to be operationally

reliable and environmentally safe in other parts of the world (L.S.U. Superport Report No. 1).

Average weather and sea-state conditions have already been discussed above.

c. Selected Economic-Ecologic Combinations

The first possible combination is to place the offshore terminal in the optimum economic location and, as this is likely to be east of Bayou Lafourche, it will be located off the most productive coastal area of Louisiana. This approach assumes that environmental damage can be controlled and minimized.

A second combination is to place the offshore terminal in a location where the surface currents would transport all potential oil spills or other pollutants away from the coastal wetlands. This approach assumes that such an area categorically exists; it probably does not.

The other combination is to survey the ocean currents of each offshore terminal site and establish what the surface currents do on a seasonal basis. The selected site should represent a balance of being offshore as far as possible, where prevailing currents set away from the coast and where operational procedures will allow for appropriate modification and/or cessation of all port activities.

d. Critical Environmental Considerations

We recommend that the location of an offshore terminal should be as far as possible from the shoreline so as to prevent any possibility of an oil spill intruding into the coastal wetlands. Preferably this should be at a site where the surface currents always or predominantly move away from the coastline. If the former is impossible, as indicated

by field data, then strict operational controls should be applied. Severe limitations should be placed on operations when surface currents set toward the shoreline, unless it can be demonstrated that an oil spill will not intrude into the coastal wetlands. Damage to benthic populations or spawning grounds of marine species, temporary or permanent, should be compensated for by means of reestablishment either in the affected area or in an equivalently unaffected area.

4. Offshore Pipelines and/or Connecting Link Locations

a. Essential Environmental Features

The most important environmental constraints of a coastal area in regard to pipelines or connecting links are:

- sea-bottom or foundation conditions as indicated by erosion and subsidence;
- mud lump activity;
- storm surge.

River deltas, and especially the Mississippi River delta, generally have unstable sea-bottom conditions because of the accumulation of relatively coarse sediments over a thick section of fine-grained materials at the discharge point (Coleman, 1972). This results in the formation of mudlumps (Morgan, et al., 1968), general subsidence (Morgan, 1972), and an increase of erosion rates; values for the latter rates are almost 2 inches a year off South Pass, Louisiana (Swanson & Thurlow, 1973).

Storm surges, usually associated with strong winds, can cause pipelines to shift, to scour, to buckle and sometimes to break.

The most important environmental stresses on a coastal area as a result of pipeline (or connecting link) locations are:

- pipeline construction damages to the populations of the water column and of the sea bottom;
- the obstruction of bottom and littoral (shoreline) ocean currents;
- possible heavy metal contamination from external cathode protection devices;
- oil spill damages.

Pipeline-laying techniques probably destroy almost all living organisms in the ditch area of the pipe (approximately 5 feet deep by 10 feet wide). The effect is evident on either side of the pipeline for at least 200 feet. Generally the displaced sediments are not replaced but are left to be dispersed by the bottom currents. Suspended and coarse bottom materials generally increase in concentration in the water column but their general effect is unknown. It is highly probable that most of the softer planktonic forms in the water column near the project area would be killed. It is conceivable that localized aerobic (no oxygen) conditions could be produced and conditions thereby established which permit nutrient loss from the bottom sediments and killing of fish and other marine organisms due to oxygen-depletion.

b. Economic Considerations

The length of the pipeline connecting link and its construction costs are the primary economic consideration in regard to pipeline routes. Suitable sea bottoms are necessary for proper pipe laying and to prevent pipe breaking and/or buckling.

c. Selected Economic-Ecologic Combination

The first combination is to lay the pipeline according to optimum economic requirements and by existing techniques. As a result, considerable damage is done to the sea bottom, some damage is done to

the planktonic forms of the water column; and the bottom is left to re-establish itself. It is generally assumed that the benthic populations re-establish themselves but no data are available to support this assumption.

Another approach would be to inventory several possible routes and determine the one having the least biological value and use it for the pipe route. In addition, new pipelaying techniques should be devised, all ditches should be refilled; and all affected areas should have their populations re-established.

d. Critical Environmental Considerations

We recommend that new pipelaying techniques be studied, that all ditches be filled to the extent practicable, and that all affected biological populations be re-established. Monitoring along the pipeline is essential to assure that no low-level leaks are present and thereby possibly causing stress to the biological communities at some spots along the pipeline. Special care should be directed toward detecting whether or not the proposed pipeline route avoids, if possible, transecting any spawning areas.

5. An Onshore Terminal Location

a. Essential Environmental Features

The most important environmental constraints of a coastal region in regard to an offshore terminal location are:

- soil foundation characteristics as indicated by erosion and subsidence rates;
- storm and wave surge characteristics of the area.

The Louisiana coast is a low-energy coastline in terms of offshore waves. As a result of this and the gentle offshore slope the coast is dominated by the discharges of the various rivers which transect the coastal area to the Gulf. Where river water is actively being discharged the coastline is advancing; for example, it is advancing at

Calcasieu Pass, at the Atchafalaya outlet, and at the mouth of the Mississippi River. In between these rivers the coastline is generally retreating and, in some places, such as off Barataria Bay, the rate of land retreat is more than 50 ft./yr. (Becker, 1971; Gagliano, et al., 1970).

Storm and wave surge are discussed above.

The most important environmental stresses to an onshore area as a result of a terminal are:

- using a barrier island;
- transversing across the beach front;
- filling in and destroying marsh lands;
- blocking or creating tidal passes.

Barrier islands are common along the eastern half of the Louisiana coast. They serve as a regulator for salt and freshwater balance in the estuaries. They serve as a sand source for beach fronts, they help to abate storm surges, and finally they provide a physical setting for Gulf recreation (Gagliano, et al., 1973). Occupance of a barrier island usually means erosion control techniques will be employed to preserve any development that occurs on it. Attempts to maintain ocean beaches are often futile and sometimes result in more extensive land loss and a more rapid rate of erosion (e.g., North Carolina, see Dolan, et al., 1973).

Cutting across a beach front for a pipeline transect creates several possible stresses. If unfilled, a new tidal pass can be created. If partially filled, differential depositation and/or erosion can occur (Dolan, et al., 1973).

The onshore terminal is required as close to the shoreline as possible, to minimize pumping and pipeline requirements. This requires an area having good foundation characteristics, usually on high sand

content, so that additional filling of the land can be done to provide pads for storage areas and a protection levee around the entire property. The end result is that a considerable (several thousands of acres and possibly more) acreage is taken irreversible out of natural production and a levee system is established which can change the local circulation pattern in the adjacent estuaries. In addition, sand filling of any water areas can result in damage to benthic populations and to bottom-spawning organisms.

Tidal passes are critical along the Louisiana Coast because they control the water regime for the estuaries (and coastal wetlands), and they provide a route by which migratory estuarine species enter and leave the estuaries. If they are blocked or new passes are created the existing hydrologic conditions will be changed.

b. Economic Considerations

The major economic prerequisites for an onshore terminal are that it be as close to the shoreline as possible so as to insure the use of the least number of booster pumps on the pipeline; that the soil-bearing characteristics be adequate for storage facilities, such as tanks; that the area be accessible to a transportation system and an energy source; and that enough space be available to allow segregation of oil and/or cargoes.

c. Selected Economic-Ecologic Combinations

The first alternative is to locate the onshore terminal solely on the basis of economics. If, for example, this is done in an area east of Bayou Lafourche then potentially prime estuarine land will be used. This assumes that sand-filling and leveeing will not unduly affect the biological production of the area.

The second alternative is to locate the onshore terminal as

far as possible inland and, if it is still in the coastal zone, then it should be located on a corridor, such as natural levee system. This alternate assumes that engineering requirements are feasible. It also assumes that the segregation of cargoes can be done just as well at an inland location. It may result in additional pipeline and pumping requirements between the offshore and onshore terminal.

The third alternative is to locate the site in an area adjacent to already developed land, preferably not in an existing natural marsh. Such a location could still be quite close to, or on, the shoreline but urban and industrial development related to the terminal should also be so rigorously restricted.

d. Critical Environmental Considerations

We recommend that no barrier islands be used for the onshore terminal or for any of its related development needs. The terminal should be located on an existing levee system or development corridor, and in areas already drained and/or adjacent to existing development corridors. No unmodified coastal wetlands should be sacrificed for the terminal site. No new tidal passes should be created as a result of an onshore terminal and its connecting pipelines. Existing tidal passes should not be deepened, widened, or permanently blocked. If temporary blocking is necessary, there should be strict regard for the critical time periods of the migrating fishery and other marine species.

6. Onshore Pipelines and/or Right-Of-Way Locations

a. Essential Environmental Features

The most important environmental constraints on pipeline or right-of-way locations are:

- subsidence and erosion problems;
- storm surges.

Subsidence and erosion and storm surges are treated above.

The most important stresses of an onshore pipeline or right-of-way locations are:

- damage and loss of coastal wetlands;
- change in inshore estuarine circulation;
- change in salt-freshwater balance;
- increase of erosion.

Pipeline or other connecting links which require a right-of-way are usually buried in a ditch. This involves digging with heavy machinery and providing appropriate support facilities and equipment. As a result, all plant life on the land where the ditch is to go, and as much as several hundred feet on either side, is destroyed. Most of the time these ditches are not backfilled and spoil banks characterize the area. In addition, no concerted effort is made to reestablish the marsh plant and animal community.

A ditch and its spoil bank can create a change in the inshore estuarine circulation pattern. The flow of water, in the form of a "sheet flow", over the marsh grasses is absolutely necessary for the formation of fishery food (i.e., detritus). If this pattern is changed or blocked, the area will probably not contribute to inshore and offshore fishery production. In a similar manner, the saltwater-freshwater balance can be affected.

Any digging of marshlands increases the amount of interface between the land and the water and, as a result, erosion rates can increase.

b. Economic Considerations

The principal economic consideration of a pipeline is its cost which depends on what land it goes through and how far it goes. Therefore, "straight-lining" a pipe route is the usual practice. If any "bends" are

in the pipeline, it is usually caused by engineering an economic reasons or by restrictions placed by the state and private land owners.

c. Selected Economic-Ecologic Combinations

At least two alternatives are open for right-of-way locations. The first is to "straight-line" the pipeline for an optimum economic outlay. Pipeline would be laid in unmodified coastal wetlands and the ditch not filled except at the required intersections of canals, between separate water bodies, etc. This position assumes no change in water circulation and that the area "adjusts" to its previous condition. It assumes that an open ditch has no significant environmental impact and it assumes that plugs, weirs, and such devices are effective and remain effective.

The second alternative is to confine the pipeline to existing canals or pipeline routes and to development corridors whose land has already been drained and leveed. These areas are modified wetlands. This approach would probably have the least total impact.

d. Critical Environmental Considerations

We recommend that any pipeline or right-of-way granted for superport operations be confined to an existing development corridor, and/or to existing pipeline right-of-ways or canals. No unmodified estuarine-marsh areas should be used for the right-of-way. All discharge points, all lateral feedoff positions, all connections to existing and future pipeline should be identified. Any changes in their positions or additions should require prior approval by the Authority. Lateral feedoffs in unmodified wetlands should either be prohibited or critically examined so that industrialization and/or urbanization will be strictly controlled.

7. Support Facilities Location

a. Essential Environmental Features

The most important environmental constraint or location of support facilities for superport activities is:

- accessibility to Superport in terms of geographic distance and time.

All support facilities need to be close to the component they service, for example, boats, crews, labor, equipment.

The most important environmental stresses, as a result of support facilities associated with a superport are:

- An increase of urban development;
- An increase of small, support industries.

Urban development for support categories of an industry is usually random and uncontrolled. Urban spread usually carries a demand for more government services and in some coastal marsh areas this can cost more than if suitable lands were established and identified before a project.

b. Economic Considerations

The principal economic considerations for support facilities location are the time required (a function of distance) for the necessary support to arrive at the particular job, and to complete the job, and finally the costs incurred for these services.

c. Selected Economic-Ecologic Combinations

Support facilities should be located in areas that are on a development corridor or as contiguous to developed areas as possible. No major industries (say greater than 100 employees) should be considered in unmodified wetland areas.

d. Ciritical Environmental Considerations

Support facilities needed for all superport operations, for

each year of the project life, should be estimated in quantitative terms. For example: how many crew-boats will be needed? what kind of labor and/or support types will be needed? The preferred locations with several alternatives should be identified. Support facilities located, as a result of the superport, in unmodified wetlands should not be contracted for support work.

8. Processor Locations

a. Essential Environmental Features

The most important environmental constraints for processor locations are:

- a suitable commodity flow picture and/or economic feasibility;
- available land and labor.

Commodity flows are treated above. The economic feasibility study on a Louisiana superport (Kaiser-GSRI, 1973) showed a benefit:cost ratio of 5:1. In addition, these workers state that over a 20-year period 100,000+ new and induced jobs will be created as a result of a superport and that the project would increase the annual salary of each Louisiana worker by $186. Government costs were expected to rise $1.00 for every $1.09 of tax revenues.

Suitable industrial land exists north of the coastal wetlands and along the Mississippi River corridor.

The most important environmental stresses, as a result of processors being located in an area, are:

- an increase of air and water degradation;
- an increase of urbanization;
- changed land use;

- a gradual deterioration of the environment and especially of renewable resources.

Air and water quality will undoubtedly degrade from their present condition since the refining capacity of Louisiana is expected to increase by a factor of 3.5 times. The Department of the Army (1973) has suggested, as a result of superport activity, that air particulates might increase up to 1.5 million pounds per day, and the biological oxygen demand in local waters would increase by 74,000 pounds per day and 1.6 million additional gallons of water would be used (we understand, however, that these figures do not reflect the latest EPA standards).

Urbanization and industrialization will increase along the Mississippi River corridor, as stated in the Corps Report (Department of the Army, 1973).

Unless urbanization and industrialization are controlled, it is likely that some coastal wetlands will be destroyed and/or permanently lost as a result of the pressures of economic growth.

The most harmful stress, however, will be the gradual deterioration of the environment and especially of the renewable resources.

b. Economic Considerations

Future industrial growth within the State of Louisiana related to the superport will depend on transportation costs, availability of suitable labor and the general political atmosphere (see Kaiser-GSRI, 1973).

c. Selected Economic-Ecologic Combinations

Locations of processors dependent on the superport should be confined to the Mississippi River corridor and to a lesser degree along Bayou Lafourche*. No industry should be allowed south of the Intracoastal

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*(or to areas north of U. S. Highway 190)

Canal along both corridors. Economic flow data and land use along each corridor should be developed and critically considered for the planning of future development.

d. Critical Environmental Considerations

The Authority should identify all primary and secondary industry that develops or expands as a result of the superport. Quantitative estimates should be made for the expected amount of environmental residuals for each year of the project. These estimates should be updated each year and compared with baseline data before the start of the project. The modified Leontief model (Hite and Laurent, 1971) lends itself to this type of analysis. The Authority should use this model for the annual analysis of such environmental data. Quality control lines at several levels should be established for each environmental parameter. Continued violation of these quality control lines should result in a cessation of the delivery of port commodities to the industrial violator. Quality control could also be established by use of the Odum and Odum model (1972) and by appropriate scientific advice.

C. Environmental Cost Assessment Techniques and Economic-Ecologic Formulae

1. Environmental Cost Assessment Techniques

a. Technique (1)
By David B. Johnson, Department of Economics, Louisiana State University, Baton Rouge.

General

If an oil spill or other environmental alteration is caused by the superport or superships, it will have a negative effect on the value and/or quantity of resources. One often hears environmentalists or even economists stating that such possibilities raise a question of economic versus environmental values. This is a totally incorrect view.

It is never the environment versus the economy; rather it is a problem that the production of some economic variables may result in damage to other economic variables.

A few years ago, most economists agreed that if one economic activity, say the production of X, created an additional or external cost for the producers of Y, the producers of X should be required to compensate the producers of Y for the damages. However, this view is now rejected by the majority of economists because in every external relationship there is a two way relationship. For example, fishermen and consumers of fish would not be hurt if the superport were not built because the quantity of fish catch would not be decreased. Similarly, the oil importers and consumers of oil would not be hurt (by damage payments) if the fish were not there. Hence, the relevant question is: should the fisherman and the fish consumer suffer the loss through higher prices and decreased production, or should oil producers and oil consumers suffer the loss through higher prices, decreased quantity of imports, or less efficient methods of transportation? The economic solution is to determine the relative value of fish and oil at the margin. However, without studying the facts relative to the circumstances, the Louisiana Deep Draft Harbor Authority has taken the view that the oil producers should be assessed the cost for environmental damages. Given the same constraints, this <u>may be</u> a reasonable assumption, but one should be aware of its potential distortions.

The following is a very crude analysis which should be made more sophisticated before policy decisions are made.

Cost Assessment Technique

Although there may be additional classifications of environmental damage, three obvious ones are:

- damage to the fisheries, including food sources;
- reduction in waste assimilation;
- decrease in recreational value.

These damages could occur during construction which would be of limited duration, say one year; or they could occur during operation at periodic intervals with various rates of recovery.

Estimating the Present Value of Future Costs

Construction. Assume that we want to determine today the present value of future environmental costs resulting from the construction of the superport and its associated facilities. Assuming construction will take place during 1976, that full recovery will occur the following year, and that fisheries only are damaged, the formula would be:

$$PVC_e^{1973} = \frac{P^i_{1976} \cdot QA^i_{1976} \cdot AC}{(1 + r)^3}$$

where PVC_e^{1973} = is the estimated present value of damages to the fisheries in 1976

P^i_{1976} = is the estimated price of the ith species

QA^i_{1976} = is the estimated quantity yield per acre in the appropriate water body for the ith species

i = major species: crabs, oysters, shrimp and menhaden

r = discount rate, probably 6 percent or 7 percent

This permits us to convert 1976 values to 1973 values.

AC = acres used by superport and facilities

How available and reliable are the data that will be plugged into this equation? Let's examine each on a data reliability scale of 1 to 10.

P^i_{1975} = P^i_{1971} exists for all major species. The prices of shrimp and menhaden, the most economically important species, have not changed rapidly so we could use 1971 prices, or we could make future estimates. Data reliability is about 7.

QA^i_{1976} = Q_{1971} exists for major species in the open grid and QA_{1971} for major water bodies. Total acreage in Grids 11 - 15 are needed so it is possible to calculate QA_{1971}. It is also possible to use QA_{1971} of value estimates for 1976. Data reliability is about 7.

AC = Total number of acres used by the terminal and pipeline are needed.

Although the data are fairly reliable and meaningful, the problem with the calculation is the assumption that fish value can be allocated equally among all acres. Obviously, fish will not remain in the construction area to be destroyed by the construction activity. However, the assumption may be partially rescued by considering that the construction will, at least temporarily, reduce the water bottom food used in the life cycle of fish, and thus reduce the natural equilibrium quantity of fish.

The offshore facilities will probably not cross a coastal water body. If environmentalists believe that, say, Caminada Bay would be affected by the construction activity, then it is possible to calculate the loss more precisely.

This same technique could be used with recreation and waste assimilation. If recreation and waste recycling are included the following assumptions might be used as the limiting conditions:

(1) Include only Lafourche and Terrebonne Parishes.

(2) Include only fishing and motor boating.

(3) Multiply user days by \$10-\$20 per day.

(4) Allocate among total acreage in adjoining water bodies and grid acres.

(5) Take the per acre value determined in (4) and multiply by number of acres used by superport.

Operation

This procedure is essentially the same as above but is more complicated because of recovery periods and the need for more input by the environmentalists. Data needed are as follows:

(1) Amount of oil spills (on probability basis) each year.

(2) Number of shrimp, oysters, crabs, menhaden and other species it will kill.

(3) The recovery rate for each species, the number of fish not reproduced in subsequent years because potential parents were killed this year. Numbers or percentage would be satisfactory.

If we know that an oil spill in 1979 will recover by 1/2 in 1980, the cost estimate for 1980 would be:

$$PV^{1973} = \frac{P^i_{1980} \cdot Q^i_{1980}}{(1 + r)^7} + 1/2 \frac{P^i_{1980} \cdot Q^i_{1979}}{(1 + r)^7}$$

The value of fish lost in 1980 is equal to the loss resulting from the 1980 spill plus the value of the fish that would have reached maturity

in 1980, but did not because their "parents" were eliminated in 1979.

The methodology for major spills is the same as that for minor spills except that the losses will be stretched more into the future.

Methodology if Losses are Known

If the port is in operation and the Harbor Authority wishes to determine damages to assess those responsible, the formula is:

$$D_o = P_o^i \cdot Q_o^i + P_o^j Q_o^j + P_o^k Q_o^k + \alpha \frac{P_1^i Q_1^i + P_1^j Q_1 + P_1^k Q_1^k}{1 + r}$$

$$- - - - \alpha \frac{P_n^i Q_n^i + P_n^j Q_n^j + P_n^k Q_n^k}{(1 + r)^n}$$

where i = species of fish

j = recreation units

k = waste assimilation units

α = non-recovery rate

This equation merely states that the cost of any oil spill is current period (0) damage to the fisheries,recreation and waste assimilation plus the future period damages resulting from the non-total recovery discounted by the interest rate.

b. Technique (2)
By Robert M. Pope, Center for Wetland Resources
Louisiana State University, Baton Rouge

Certain environmental costs are sure to result from the construction and operation of an offshore oil terminal on the Louisiana coast. Despite these costs, the terminal may be a very feasible project. This preliminary discussion does not attempt to determine who should pay such costs, but is designed to help solve the problems of deciding what the costs are and how a basis for assessing costs may be determined. The question of equitably distributing these costs (and reimbursements) shall

remain unanswered for the time, but must be considered in tandem with the means of cost-assessing outlined herein.

Types of Costs

Environmental damages may be assessed in three rather broad categories: those costs associated with the actual construction of an offshore terminal and its onshore holding area; those costs associated with the operation of such facilities; and those costs associated with secondary economic growth, i.e., supportive industry developing due to the existence of the offshore terminal.

In order to compare and combine costs occurring over a substantial time span, a discounting procedure should be used, so that all costs can be examined on a present-value basis. This procedure is absolutely necessary if an attempt is to be made to compare costs and benefits resulting from the project. The process of discounting is in itself a simple mathematical manupulation and should generate no disagreement between groups of people who may not agree on the actual size of the costs.

Assessment

Assessment of costs of environmental damage must be done on the basis of combining biological, ecological, and economic data -- which is not always an easy marriage. Fundamental costs will be of the following types:

(1) Damages to marshland, i.e., impairment or destruction of biological productivity. This figure must be estimated on the basis of the best available knowledge, and due to the lack of unanimity on such values, probably will have to be indicated as a range (high-medium-low) of estimates.

(2) Damages to nursery areas for commercial fisheries.
a) permanent
b) temporary (recovery time must be estimated)

(3) Additional waste load to be assimilated (or impairment of existing assimilative capacity).

(4) Impairment or destruction of recreational opportunities, primarily water or marsh-based.

(5) Loss of habitat for wildlife, i.e., migratory waterfowl.

Since some of these costs will be permanent and some will be temporary, the cost-assessing machinery must effectively be a time-stream evaluation. For any permanent or long-term damage, the assessed cost may be summarized thus:

$$PC = D[1 + 1/(1 + r) + 1/(1 + r)^2 + 1/(1 + r)^3 + \ldots + 1/(1 + r)^n]$$

$$= D + D\ [1 - (1 + r)^{-n}/r]$$

where PC = Present cost of D damages per year for n years

D = Damages (in dollars) per year

r = The rate of interest used for discounting purposes

n = The number of years of evaluation.

Example of application: suppose an action results in a damage of $100 per year for four years, at an assumed interest rate of 5 percent. The technique for determining the present value of the damages is demonstrated in Table 74. It may be seen that the technique for summing future damages is relatively simple, once the data are provided. The technique for estimating the level of damages is a bit more complicated. An advantage of this system of accounting for damages on a time-stream basis is that the figures can be adjusted with the passage of time to reflect actual experience and costs. Therefore, the system is retrospectively self-adjusting. Past years can be adjusted by actual data, and future estimates can be reformulated by new information, and the entire formulation tends towards greater accuracy.

The basic framework for computing environmental costs resulting from superport activity is presented in Table 75. A value for each

Table 74. Demonstration of use of discount to express damages over time as present cost.

Time stream	Present Year	2nd Year	3rd Year	4th Year	5th Year
Damages	\$100	\$100	\$100	\$100	0
Discount factor	1	$1 + r$	$(1 + r)^2$	$(1 + r)^3$	-
Present value	\$100	\$95.24	\$90.70	\$86.38	-
Summation	\$372.32				

Derivation by formula $D + D[1 - (1+r)^{-n}/r]$

$= \$100 + \$100[1 - (1.05)^{-3}/.05]$

$= \$372.32$

Table 75. Matrix of costs to be evaluated in order to assess cost of constructing and operating a Superport.

Activity	Year 1	Year 2	Year 3	Year 4	.....	Year N
Superport Construction						
Offshore						
Land productivity	x	x	x	x	.....	x
Fishery costs	x	x	x	x	.....	x
Waste Assimilation	x	x	x	x	.....	x
Recr. val. foregone	x	x	x	x	.....	x
Pipeline to Shore						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x
Onshore						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x
Pipeline to Capline						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x
Superport Operation						
Major Spills*						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x,	x	x	x	.....	x
Minor Spills*						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x
Chronic Spills*						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x
Ancillary Development						
Land	x	x	x	x	.....	x
Fish	x	x	x	x	.....	x
Waste	x	x	x	x	.....	x
Recr.	x	x	x	x	.....	x

Summation (by years)	Σ Year 1		Σ Year 2		Σ Year 3		Σ Year 4		.....		Σ Year N		
Discounted by factor	1		$(1+r)$		$(1+r)^2$		$(1+r)^3$		.....		$(1+r)^{N-1}$		
Summation (across years)	D_1	+	D_2	+	D_3	+	D_4	+	.....	+	D_N	=	Total Damages

*Yearly cost of spills which are not necessarily an annual occurance may be computed on probability basis. If the expected cost is $1,000,000 once every 10 years, $100,000 per year may be charged off in estimating costs. Retrospectively, actual costs and frequencies can be "plugged in".

cell should be computed (even if that value is zero), and the two summations will then give the overall cost assessment. Where a range of values is employed, different costs will be indicated in the total. For this reason, it will doubless be advisable to express all range-type values in comparison with the same level for other range-type values. E.g., one cost assessment can be expressed with all range-type values at their "low" estimate, another at "medium" and another at "high". If all combinations of low-medium-high ranges were used, and there were only 10 such variables, it would require $n!/r!(n-r)! = 10!/3!7! = 120$ different figures to represent the possible combinations. By using a summation of only low, medium, or high values, only 3 calculations will be necessary. To adjust Table 75 to this approach, each line would have to follow this model: Superport Construction/Offshore/Land Productivity; Year 1 - h m l; Year 2 - h m l; Year 3 - h m l; Year 4 - h m l; ... Year n - h m l. Summation by years would thus be ΣYear 1 high, ΣYear 1 medium, ΣYear 1 low, etc.

Estimation of Costs

Estimation of costs of environmental damages must be carried out on the basis of the best-known existing techniques, or on the basis of origianl techniques developed by the project team. Given possible disagreements over the actual level of costs for any specific damages, the formulation as presented will suffice to handle the cost data at whatever level may be agreed upon as "reasonable".

2. Economic-Ecologic Formulae

a. Leontief Model

Hite and Laurent (1973) have modified the Leontief model so that economic inputs can be translated into environmental effects. It is based on the Leontief inverse of an output matrix of a local economy and

a matrix of the inflow from the environment. The final data are residual outflows or income multipliers to the environment associated with each dollar of gross output of each economic sector of the input-output matrix. The modified Leontief model views materials as moving from the natural environment into the processing and consuming sectors of the economy, and then back into the environment as waste residuals. This flow of materials is considered a variation of import-export activity or an interaction of trading between the economy and the ecosystem. Table 76 presents data from Hite and Laurent (1973) for six selected industrial sectors of Charleston, South Carolina. Given the projected income increases in each of these economy sectors the modified Leontief model estimates the environmental repercussions. Further calculations can produce a matrix of income multipliers (Table 77) which can be interpreted as the environmental repercussions resulting from each dollar increase or decrease of local income for each economic sector. These multipliers are considered approximations of the possible trade-offs between economic growth and environmental quality. They also identify those industries which generate the most income with the least environmental residuals.

The previous data on nine selected economic sectors for Charleston, South Carolina illustrate that there are no clean industries. All economic activity, directly or indirectly, produces residuals that are potential pollutants of the natural environment. The authors claim that an analysis of direct linkages will underestimate environmental effects and will not provide any measure of interactions between various economic sectors.

The model is limited in that it does not provide an estimate of the optimum balance between development and no development. It also

Table 76. Selected Direct and Indirect Environmental Impacts of a One-Dollar Increase in External Deliveries by Sector, Charleston Study Area, 1968 (9). A minus sign means movement from region into the environment and a positive sign means movement from the environment into the region. Environmental impacts are proportioned for each dollar of sales external to the area. Thus for each one-dollar increase in sales outside the region (Charleston SMSA), environmental impacts are indicated. For example; each one-dollar sales outside the region by sector 1 (Agriculture, Forestry, Fisheries), .0512 lbs of particulates and .0325 lbs hydrocarbons are added to the environment and 10.2799 gallons of domestic water are used from the environment.

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6
Particulates, lb	- 0.0512	- 0.0268	-0.0837	- 0.0193	-1.3208	-0.6742
Hydrocarbons, lb	- 0.0325	- 0.0277	-0.0155	- 0.0210	-0.0125	-0.0445
Sulfur dioxide, lb	- 0.0103	- 0.0159	-0.0215	- 0.0111	-0.0215	-0.0429
Gaseous fluorides, lb	- 0.0006	- 0.0012	-0.0028	- 0.0008	-0.0031	-0.0019
Hydrogen sulfide, lb	- 0.0003	- 0.0003	-0.0023	- 0.0003	-0.0431	-0.0218
CO_2, lb	- 0.0265	- 0.0016	-0.0109	- 0.0147	-0.0071	-0.0116
Aldehydes, lb	- 0.0005	- 0.0003	-0.0002	- 0.0003	-0.0002	-0.0003
NO_2, lb	- 0.0025	- 0.0030	-0.0018	- 0.0023	-0.0015	-0.0107
Domestic water, gal.	10.2799	10.1591	9.4256	12.7709	5.0273	9.7076
Cooling water, gal.	0.0000	0.0000	0.0003	0.0004	0.0051	0.0026
Process water, gal.	0.0001	0.0018	0.0009	0.0032	0.0151	0.0076
Total water intake, gal.	-10.2768	10.1609	9.4267	12.7742	5.0475	9.7178
Total water discharge, gal.	-10.2768	-10.1609	-9.4263	-12.7736	-5.0424	-9.7152
5-day BOD, lbs	- 0.1853	- 0.5519	-9.2367	- 0.6150	-1.4714	-0.8640
Suspended solids, lbs	- 0.0094	- 0.0114	-0.0648	- 0.3601	-1.0303	-0.5218
Solid waste, yd^3	0.0072	- 0.0073	-0.0158	- 0.0098	-0.1333	-0.0720

Table 77. Selected Environmental-Income Multipliers, or Direct and Indirect Environmental Linkages per Dollar of Local Pecuniary Income Generated, Charleston Study Area, 1968 (9). A minus sign means movement from region into the environment and a positive sign means movement from environment into the region. Environmental effect is proportioned for each dollar at local income. This implies that each dollar of Table 76 is spent more than once so the impact is proportioned among them. For example; each one-dollar local income generated by sector 1 will add .0254 lbs particulates to the environemnt, and take away 5.0999 gals domestic water, etc.

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6
Particulates, lb	-0.0245	-0.0163	-0.0387	-0.0097	-0.1309	-0.3883
Hydrocarbons, lb	-0.0161	-0.0168	-0.0072	-0.0106	-0.0124	-0.0256
Sulfur dioxide, lb	-0.0051	-0.0097	-0.0099	-0.0056	-0.0213	-0.0247
Gaseous fluorides, lb	-0.0003	-0.0007	-0.0013	-0.0004	-0.0031	-0.0011
Hydrogen sulfide, lb	-0.0001	-0.0002	-0.0011	-0.0002	-0.0427	-0.0126
CO_2, lb	-0.0131	-0.0010	-0.0050	-0.0074	-0.0070	-0.0067
Aldehydes, lb	-0.0002	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002
NO_2, lb	-0.0012	-0.0018	-0.0008	-0.0012	-0.0015	-0.0062
Domestic water, gal.	5.0999	6.1885	4.3566	6.4320	4.9820	5.5916
Cooling water, gal.	0.0000	0.0000	0.0001	0.0002	0.0057	0.0015
Process water, gal.	0.0000	0.0011	0.0004	0.0016	0.0150	0.0044
Total water intake, gal.	5.0983	6.4626	4.3572	6.4337	5.0021	5.5974
Total water discharge, gal.	-5.0983	-6.4626	-4.3571	-6.4334	-4.9971	-5.5960
5-day BOD, lbs	-0.0919	-0.3369	-0.1094	-0.3097	-1.4581	-0.4977
Suspended solids, lbs	-0.0047	-0.0069	-0.0300	-0.1814	-1.0210	-0.3006
Solid waste, yd^3	-0.0036	-0.0044	-0.0073	-0.0049	-0.1321	-0.0415

assumes a static technology, i.e., industry will not use the latest technology to clean up its residuals or new clean up technology will not be devised. It is, however, probable that actual conditions will dictate use of somewhat less than the latest technology. The model lumps the effects of several so-called related industries into one sector so that weighted averages of coefficients are used. This may be a severe limitation. Finally, the model uses linear analysis and does not lend itself to analysis of the growth of highly specialized firms within one economic sector.

The value of the modified Leontief model is that it provides estimates for a particular region on both economic growth and environmental quality. In other words, it maps pathways of minimum environmental stress since it identifies those income multipliers for each economic sector that will generate the most local income with the least environmental residuals.

b. Odum and Odum Model

The thesis of the Odum and Odum model is that for any geographic region there exists an optimum proportion of natural and developed enviroments. The model is based on "energy language". They define natural environment as ecological systems that produce useful products and recycle wastes on a continuous basis but without any significant economic costs to man. These self-maintaining environs include moderately used forests, grasslands, rivers, estuaries, oceans, etc. Developed systems include ecosystems that are highly structured and maintained by outside energy from fossil or other fuels. A city, suburban developments, agricultural fields, channelized rivers are included under this category.

The claim is that the developed ecosystems have an inherent

tendency to grow beyond optimum size and usually at the expense of natural systems. The model is based on the following three-linked equations:

$$\dot{N} = k_1 S(1-D) - K_2 N - k_3 CN$$

$$\dot{C} = k_4 \ DFN - k_5 \ CN$$

$$\dot{I} = k_5 \ CN - k_7 I$$

where S = natural energies
F = fossil fuels
C = developed ecosystems
I = interactions of diversity between man and nature
k = coefficients from data

Value rates (V) are the sum of the energies of replacement and maintainance and are the sum of the three rates of energy flow given by the above equations. A steady state sum of value rates obtained for a south Florida environment suggests an optimum ratio of 50 percent development to natural environment. The resulting performance curve shows a steep downward slope if this optimum ratio is exceeded. This presumably means that the performance of a Florida ecosystem with greater than 50 percent development quickly drops off. This drop-off also suggests a reason for rapid environmental deterioration that is difficult to detect by monitoring or to predict when quality control guidelines have been violated.

The model illustrates that both natural and developed ecosystems have storage capacities that are important during reduced energy inflow. It identifies points of energy loss and shows that developed systems feed on energy of natural systems and require abundant life support capacities, as furnished by the natural ecosystems. The model can be

further used to calculate monetary value for the work performed by the natural environment.

The Odum and Odum model is limited by its oversimplification. It needs to define additional modules for various types of developed and natural ecosystems. In addition, the baseline data requirements are usually not available. Actual economic budgets, power flows and land use patterns are needed for any region that is to be analyzed by this model.

CHAPTER 3

ENVIRONMENTAL GUIDELINES FOR DESIGN OF SUPERPORT AND RELATED ACTIVITIES

A. Requirements and Intent of Chapter

1. Statute
2. Principal Feature of Chapter
3. Types of Design Features Considered

B. Superport Design Guidelines

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   a. Authority Projects Reviewed by Environmental Protection Plan
   b. Steps for Implementing Environmental Protection Plan
   c. Steps for Evaluating a Project Proposal
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3. Design Features which Control Long-term Development
   a. Expected Life of Each Project
   b. Urban and Industrial Development
   c. Culture and Aesthetics

CHAPTER 3

ENVIRONMENTAL GUIDELINES FOR DESIGN OF SUPERPORT AND RELATED ACTIVITIES

A. Requirements and Intent of Chapter

1. Statute

Louisiana Revised Statute 34:3113(J)(3) is as follows:

> "State how the Deep Draft Harbor and Terminal facility design minimizes potential environmental damage, considers environmental factors as a positive part of the design, and controls long-term development so that growth and additions to the Deep Draft Harbor and Terminal do not result in random growth or in gradual environmental deterioration."

2. Principal Feature of Chapter

The most important feature required by Chapter 3 of the Environmental Protection Plan is that the design of Superport Development controls long-term growth and development and prevents gradual deterioration of the environment as a result of port and related activities.

3. Types of Design Features Considered

At least three design features for the Superport Development will be considered as described in section B as follows:

Subsection 1. Design features which minimize environmental damage

a. Authority Projects Reviewed in accordance with the Protection Plan

b. Steps for Implementing Environmental Protection Plan

c. Steps for Evaluating a Project Proposal

Subsection 2. Design Features with Positive Environmental Effect

a. Alternative Uses of Project Facility and Sites

b. Environmental Research Programs

c. Monobuoy and/or Structure systems

Subsection 3. Design Features which Control Long-term Development

a. Expected Project Life

b. Urban and Industrial Growth and Development

c. Culture and Aesthetics

The remainder of this chapter will discuss each of the above design features and their parts.

B. Superport Design Guidelines

1. Design Features which Minimize Environmental Damage

a. Authority Projects Reviewed in accordance with the Environmental Protection Plan

All projects considered under the Authority Development Program having environmental impact should be reviewed in accordance with the Environmental Protection Plan. This procedure will minimize potential environmental damage indirectly since it would allow no exceptions. In this way all potential environmental problems can be identified, the amount of their effect estimated, plans made for re-establishing the affected areas, and equitable compensation set forth.

b. Steps for Implementing Environmental Protection Plan

The Environmental Protection Plan will be effective only if it is vigorously implemented and enforced. The regulations promulgated in regard to the plan will by themselves provide a checklist by which the Authority can determine if the plan is being adhered to. In addition, the following steps are suggested as additional design guidelines for evaluating any project under the environmental protection plan:

Step I. Submission of Summary Proposal of Project

All essential economic and environmental factors should be outlined in the summary.

Step II. Presentation of Detailed Plan

If the summary proposal is satisfactory then the Authority should request a detailed statement of project plans. These data should include the economic background for each site location of the project and quantitative data on the expected environmental stresses at each site.

Step III. Completion of Detailed Environmental Inventory

It is probable that this will be required if the project falls under the jurisdiction of the National Environmental Policy Act (NEPA). However, if the project does not, then the Authority should require this step. Inventory data will verify and make more certain the various economic-ecologic combinations considered for each site location. It will also provide baseline data to establish the extent of potential damage and provide an equitable compensation base.

Step IV. Determination of Potential Environmental Impact on Each Project Action

The Authority should require of each project a listing of each potential environmental impact for each project action. Each project action should address itself to the promulgated regulations of the Environmental Protection Plan and, in particular, special attention should be directed at those critical environmental features of coastal Louisiana as

listed in Chapter 1. For example, for each critical feature the project should state:

--will it affect that environmental feature?

--if there is an effect, how much is it, how long will it last and over what time period will it occur?

--will the damage be temporary or irreversible?

Step V. Submission of Detailed Plans on Treating Each Impact

Estimates should be provided for recovery time for each impacted area with detailed plans of how reestablishment will be done.

Step VI. Compensation Costs for Temporary and Irreversible Damages

The Authority should establish the level of compensation costs for all temporary and irreversible damages as indicated in Step IV and modified accordingly by Step V. The factors to be considered are given in the environmental cost assessing technique as developed by Pope, Johnson and Stone (1973).

Step VII. Review of Plans and Data by Other Agencies with Legal Mandate

All other agencies with a legal mandate should be advised of the project's plans and data. This will insure cooperation and coordination, avoid duplication, and determine any possible incompatibilities.

Step VIII. Annual Environmental Review of Project

The purpose of an annual review is to verify the effectiveness of the Environmental Protection Plan and to determine if new and additional environmental stresses are apparent.

c. Steps for Evaluating a Project Proposal

The Authority should require that all projects proposed to them be required to detail, first, the economic costs and feasibility of the project. These costs should include specifics on the costs for the preferred site locations, the preferred construction techniques, the preferred structure types, the operation costs and various levels of economic spinoff (Kaiser - GSRI, 1973).

The second step after the above economic and technical feasibility should provide estimates on the costs for the predicted environmental stresses as outlined in Johnson, Pope and Stone (1973). These stresses should include, at least, fishery costs, waste recycling costs, and recreation costs for each of the following locations:

(1) Coastal Region of Superport Activities

(a) Estimate amount of development in region in absolute terms of acreage.

(b) Estimate amount of acreage of unmodified land in region.

(c) Express (a) and (b) as percent of total area in region and as percent of total area suitable for development (i.e. development corridors).

(d) Use a model for land management (See Odum and Odum, 1972) to estimate with various coefficients for various ratios of natural: developed lands use.

(e) In lieu of above data, use a 50 percent ratio as a limit until more accurate values can be estimated.

(2) Fairways and Anchorage Sites

(a) Estimate probability of oil spill/year.

(b) Estimate extent of spill.

horizontal) total volume of
vertical) water affected

(c) Estimate bottom area affected.

(d) Estimate anchorage area affected by low-level spills.

(3) Offshore Terminal

(a) Estimate total acreage of sea-bottom affected by structures.

(b) Estimate probability of oil spill/year.

(c) Estimate extent of oil spill. (Total volume)

(d) Estimate area affected by low-level spills.

(4) Offshore Pipelines and/or Connecting Links

(a) Estimate oil spill probability.

(b) Estimate volume of water and amount of land affected.

(c) Estimate ditch length and volume affected.

(d) Estimate recovery time of above damages.

(e) Estimate changes in curculation patterns and erosion rates.

(5) Onshore Terminal

(a) Estimate area affected.

(b) Estimate probability of oil spill.

(c) Estimate increase of subsidence estimate.

(d) Estimate increase of erosion estimate.

(6) Right-of ways

(a) Estimate total area affected

(b) Estimate recovery time.

(c) Estimate probability of oil spill.

2. Design Features with Positive Environmental Effects

a. Alternative Uses of Project Facilities and Sites

The Authority should make every effort to see that each project develops alternative uses for its facilities and sites. The best example of this proposal is the recreational fishing now associated with the Louisiana offshore oil and gas platform structures. Various proposals for alternatives have been proposed (Gagliano, et al., 1972). These include some of the following:

- Establish recreation sites and/or camps;
- Promote water-related recreation;
- Establish environmental monitoring stations for weather, air and water chemistries, flora and fauna counts;
- Create new habitats in spoil-affected or canal areas;
- encourage development of renewable resources of areas such as lumbering, paper production, fur production, erosion-control.

b. Environmental Research Programs

The Authority should develop and support studies that relate specifically to environmental problems and uncertainties that occur as a result of any of the projects accepted under its development program. This is a positive environmental feature as it provides financial support not available for environmental work. These applied studies would benefit both public and private bodies, because the data will apply to future and other project actions. Some suggested research projects are discussed below; they are:

(1) Species bank program [laboratory phase / field preserves

(2) Economic benefits: environmental costs ratios

(3) Erosion control studies

(4) Environmental stress capacity techniques

(5) Pipeline effects on biological production

(6) Chronic oil pollution effects on benthic populations

(7) Water management and/or estuarine circulation studies

(8) Oil control studies (tidal pass blockage, etc.)

For each program the following information is given:

- Objective and/or purpose
- General materials and methods
- Estimated costs and/or manpower

(1) Species bank program: Laboratory phase

- Objective and/or purpose

Because a major oil spill is probable during the lifetime of an oil-receiving superport terminal, it is logical to assume that mortalities will occur to various plants and animal species. In order to anticipate means to reestablish these losses, it is proposed that certain plant and animal species be developed into "bank" species. By this we mean that a suitable group of seedlings or reproductives be maintained at all times in a laboratory and be ready for use in reestablishing these species in an area that has been destroyed by an oil spill. Commercial fishery species and dominant marsh-plant species should probably be developed first. Scientific precedent already exists in this regard for oysters. Some suggested species are:

Plants	Animals
Marsh Bacteria	Various Marsh Snails

Spartina spp.	Oysters
Scirpus spp.	Gravid Shrimp
	Gravid Menhaden

- General materials and methods

This effort will require the collection of field specimens on a regular basis to insure maintainence of a fresh and viable stock. For plants *Spartina* spp. collection of specimens with ripening seeds will be necessary. These can be collected and the seeds allowed to dry; then shake the seeds off and place them in storage. Conditions necessary for germination (such as photoperiod, temperature, humidity, and dormancy) may have to be determined for each species. Some *Scirpus* spp., for example, do not require anything other than exposure on a moist filter paper in a petri dish exposed to continuous light. The seedling can be immediately planted. For animals, more care is probably necessary; oysters for example, spawn in relation to a temperature increase and/or in relation to the gametes of male oysters. In Connecticut, a stock of viable oysters are kept under refrigerated conditions and when gametes for fertilization are needed the oysters are taken out and exposed to a temperature rise in a finger-bowl of water. Fertilization and husbandry are then done according to standard techniques. For other fishery species this approach needs to be researched and an interim method might be to maintain gravid individuals and/or fingerlings or young fry.

- Estimated costs and/or manpower

At least one senior biologist would be needed full-time for this effort. Supporting personnel could range from one to many depending on available dollars but probably two at master's-level and four laborers would suffice. A building-laboratory with some control

would be necessary; perhaps starting with a floor space of about 50 feet by 50 feet. A modest operating budget would probably range between $75 thousand to $100 thousand a year.

(1) Species bank program: Field phase or marshland preserves

- Objective and/or purpose

Because a major oil spill may occur during the lifetime of an oil-receiving superport terminal, it is logical to assume damage and mortalities will occur to various plant and animal species. In order to anticipate means to reestablish these losses, it is proposed that tracts of marshlands being set aside in proportion to the land taken out of production by the various parts of the superport, such as, offshore terminal, offshore pipelines, onshore terminal, and onshore pipelines. Such tracts of land should probably be widely dispersed and large enough so that a sufficient stock of dominant plants and animals exist in them for possible use as "transplants" in areas damaged by oil spills and/or other related activities of the superport.

- General materials and methods

The effort will require no special materials or methods only the location and purchasing of suitable coastal wetlands.

- Estimated costs and/or manpower

Tracts of suitable lands could be purchased by means of environmental tax for lands used by various parts of the superport facility. Some professional advice, say of the order of 1 to 2 man-months of a senior environmentalist would be necessary in order to select the marshland preserves.

(2) Economic benefits: Environmental costs ratios

- Objective and/or purpose

Additional work is necessary to refine both the compensatory procedures and means for evaluating environmental costs. The objective being to develop a more equitable benefit:cost ratio and cost-assessing methods.

- General materials and methods

This effort will require general office space, access to environmental data, access to recent analytical techniques, and access to a computer. Environmental data of all sorts would be developed for as small as possible land units, and alternate cost assessing methods evaluated. One recent approach has been developed by Gosselink, et al., (1973).

- Estimated costs and/or manpower

One senior economist, with environmental experience, with one to two assistants would form the minimum program. Estimated costs per year would probably range between $30 thousand and $50 thousand for the first phase of work. Definitive work would require at least three years of effort.

(3) Erosion control studies

- Objective and/or purpose

The objective of this research is to devise ways by which erosion in the coastal wetlands can be significantly slowed down.

- General materials and methods

This research would require some building materials (lumber, etc.) and plant specimens common to the various coastal wetlands.

- Estimated costs and/or manpower

One landscape architect, one marine scientist, and one botanist, with one to two laborers or assistants would form the minimum

program. Estimated costs would probably range between $20 thousand and $40 thousand for 1 year's work. Definitive work would require at least one or two years of effort.

(4) Environmental stress capacity

- Objective and/or purpose

The purpose of this research is to establish the stress capacity of the coastal region of the superport and its related activities.

The expected economic growth in Louisiana as a result of a superport is of the order of $2 billion over a 25-year period (Kaiser-GSRI, 1973). This means over 36,000 new jobs in petrochemicals alone will be created which implies new or expanded refineries. The point being that for every dollar brought into the economy a corresponding effect will most probably occur to air and water quality. For example, there will be increases in air particulates, in SO_2, in the B.O.D. of discharge water, etc. -- unless substantial effort is expended to comply with present and future air and water criteria.

- Materials and methods

This effort will require general office space, access to environmental data, access to recent analytical techniques, and access to a computer. Environmental data will be collected on: air particulates, hydrocarbons, sulfur dioxide, hydrogen sulfide, carbon dioxide, aldehydes, nitrogen oxide, domestic water, cooling water, process water, total water intake, total water discharges, 5-day B.O.D., suspended solutes, C.O.D., and solid waste, etc. One technique for evaluating these data has been proposed by Hite and Laurent (1971). This method links the economic inputs with corresponding environmental outputs via

a modification of the Leontief model; it also identifies interactions among various types of industries.

- Estimated costs and/or manpower

This effort will require at least one senior environmental economist with one assistant. Estimate costs for a minimal program are about $30 thousand per year.

(5) Pipeline effects on biological projection

- Objective and/or purpose

The objectives of this project are (1) to determine if dredging has any significant effect on the standing crop of detritus, on nutrient levels in the sediments of water and on the populations of the meiofauna and shrimp, (2) to quantify these effects, (3) to determine if there are any ciritical seasonal components, and (4) to determine and quantify any erosion effect.

This work will provide objective guidelines for development activities in the marsh ecosystem, particularly those requiring dredging and/or land removal. It will also provide data in regard to the effect that dredging and/or land removal has on nutrient trapping and cycling in the marsh ecosystem.

- Materials and methods

Detritus standing crops, in terms of its organic components, should be sampled biweekly along with nutrient levels in sediments and the water column, and with population estimates of meiofauna and shrimp. This will be done at stations in a series of small tidal ponds before and after dredging and/or a drainage change has been established.

The major project phases are as follows:

(a) Identify series of small tidal ponds.

(b) Establish experimental procedure for measuring detritus standing crop.

(c) Establish and make sampling stations in experimental stress (dredging, etc.) and for baseline data in Barataria Bay and Caminada Pass.

(d) Perform dredging and needed experimentation.

(e) Establish and make sampling stations after environmental stress (dredging, see above)

(f) Interpretation and analyses of data.

Several tidal ponds, probably at least four, each having an area of about 1 to 5 acres, will be identified and stations established in their main drainage channel. Detritus will be monitored at least every two weeks at mid-ebb and mid-flood stages before dredging takes place.

Dredging and/or barriers will be established as soon as possible after initial start of project. At least one pond will be a control, and the others as experimental.

Samples will also be taken to determine the nutrient levels in the sediments and water columns (Bormann and Likens, 1967), and of the populations of the meiofauna and shrimp.

Baseline data on detritus will also be gathered at stations in Barataria Bay in order to determine its time and spatial variations with the above populations and at stations at Caminada Pass in order to determine the net export of detritus to the Gulf of Mexico.

Detritus will be collected by means of large water samples and then appropriately separated from the water and divided into various size-classes. Considerable work will be necessary to develop a

technique which gives consistent and unbiased data. Organic carbon, inorganic materials and total amino acids will be analyzed thus: if a GLC (Gas Liquid Chromatography) is available then select samples will be analyzed for as many amino acids as possible; if a total carbon analyzer is available, then for each sample obtained during a tidal cycle and during the general sampling throughout the bay, a portion of each will be filtered through a 0.45u millipore filter (or another pore size perhaps), and the other portion will be taken, as is, for analysis. Each of these will probably be about 10-20 ml. These analyses would give total and dissolved organics and, by difference, the particulate fraction.

Nutrients will be analyzed in water samples for soluble chemical parameter such as inorganic nitrogen compounds (NH_4^+, NO_3^-, NO_2^-), $PO_4^{\equiv}$-P, organic -N, total -P; dissolved silica, and possible, salinity and pH. In the sediments, the clay content will be determined by X-ray diffraction; the organic carbon and nitrogen will be determined by oxidization and spectrophotometry; d-amino acids will be determined in the organic component by acid hydrolysis, and also possibly, for the sulfides. Interstitial water will be analyzed for inorganic chemical species (as above) and soluble organic (such as amino acids).

Meiofauna samples will be taken at points selected at random from a grid in the ponds (perhaps a stratified, random method to insure that both nearshore areas, which are richer in organic materials, and more centrally located areas are adequately sampled). The samples would consist of cores about one inch in diameter so that there would be minimum disturbance of the bottom. A first proposal would be to take

about 5-10 samples per month, or every other month per pond. It is necessary to measure the numbers of organisms, the species composition and biomass of each species if possible. A suggestion for accomplishing the meiofaounal studies is that about $4,000 to $5,000 be set aside for an expert who could be employed as a consultant to teach the necessary taxonomy and details. This approach might include the following setup: an expert would spend several weeks in Louisiana, particularly in the marshes during the summer and again during the winter. In addition, samples would be sent to him for identification. One advantage would be that Louisiana could develop it's own expertise on these matters.

Shrimp samples will be taken in each pond and marsh area by means of a pull-up trap (Hilger and Kolipinski, 1962) set the night or day before sampling. This will probably be done once a month. Fish species might also be captured in this way. Some "walk-ways" may have to be used to insure a minimum of disturbance to the marsh area.

- Cost estimates and/or manpower

This effort will require approximately 20 percent of four senior investigators (three ecologists, one chemist), plus two full-time technicians over a one-year period. Estimated costs would range between $30 thousand and $50 thousand.

(6) Chronic oil pollution effects on benthic populations

- Objectives and/or purpose

The purposes of this study are two-fold:

(a) To conduct a study of changes in marine benthic populations with the introduction of low-level oil seepage;

(b) To prepare a guide for the identification of benthic organisms in coastal Louisiana.

- Materials and methods

Samples will be collected at two-month intervals for a period of one year to ascertain changes with the introduction of low-level oil seepage.

The number and location of sampling stations in the sampling area will be determined after initial survey trips to the field. In addition to analyzing samples from the sampling area, samples will be analyzed that are taken in other areas of coastal Louisiana in order to determine what variations occur. These samples can be collected during times when there is no sampling in the study area. Two types of samples will be collected: (1) Cores will be taken for meiofauna and (2) a modified oyster dredge will be used for macrofauna collections.

In addition to sample collection, certain physical and chemical parameters will be measured. These include profiles of the redox potential of the sediment, organic carbon levels of the sediments, and salinity and temperature of overlying and interstitial water.

The preparation of the guide will take place mainly during the laboratory analysis of the samples. In the preparation of the guide, we will make use of all available information concerning benthic populations. This will include data collected during this study, data available from earlier marine studies, and all pertinent literature studies. The guide will consist of several parts:

(a) Discussion of sampling--where to sample, how many samples necessary, frequency, methods of sampling including taking and field preparation of sample. This part will include a discussion of types of gear which can be used (nets, dredges, etc.), depth of sampling for different types of benthic organisms, washing and preser-

vation of samples in field, allowable time lag between taking, preparation, and analysis of samples.

(b) Analysis of samples--types of equipment necessary for different animals (from macrobenthic organisms such as oysters to meiobenthos such as nemotodes). Necessary amount of counting to establish significant results.

(c) Statistical analysis of data.

(d) An extended key:

- It will include a thorough review of literature concerning sampling and identification of benthic animals, especially existing keys.
- A collection of specimens (preserved in jars or on slides) for reference.
- Drawings and/or pictures of common benthic organisms of Louisiana, including figures showing relative sizes of different meiobenthic organisms.
- Identification of organisms. For larger organisms (oysters, and larger meiobenthos such as amphipods), identification can probably be to species level; but for small organisms such as nematodes class or order will be the best that can be done.
- A discussion of the spatial and time variations which we believe will occur in the benthic populations. Also, the relative abundance of organisms in the benthic populations.

- Estimated costs and/or manpower

This effort will require at least one senior worker, one full-time technician and one laborer for a one-year period. Estimated costs would range between $30 thousand and $50 thousand.

(7) Water management and/or estuaries circulation studies

- Objective and/or purpose

The purpose of this research is to define the circulation patterns on at least a seasonal, or perhaps monthly basis, for those estuaries that are in the coastal region of the superport. Average resident time of water in each estuarine basin area should also be estimated.

- Materials and methods

Several boats, motors and field equipment such as current meters, dye drogues, temperature and salinity monitors, etc. are necessary. Special circumstances might dictate use of dye dropping from an airplane for a "more or less" instantaneous view of water circulation.

- Estimated costs and/or manpower

This effort will require a senior physical oceanographer, at least two assistants, a computer programmer and one to two laborers. Estimated costs will range from $50 thousand to $100 thousand a year and two to three years will be necessary to complete the objectives.

(8) Oil control studies

- Objectives and/or purpose

The purpose of this research is to provide effective technical means for blocking tidal passing during an oil spill so as to prevent any oil from intruding into the marsh-estuarine system.

- Materials and methods

Various barriers, floating or pneumatic, will be tested as to their effectiveness in keeping an oil spill out of the estuarine

bay. A prototype testing program would be the most economical approach for the first phase of work. It is evident that a floating mechanical barrier could be more readily installed at most tidal inlets while a pneumatic barrier could be permanently installed and would permit uninterrupted ship movement (James, et al., 1972).

- Estimated costs and manpower

This effort will require at least one senior engineer, one full-time technician and two laborers. Estimated costs rrange between $100 thousand to $150 thousand for the first phase of the study.

c. Facility Structure Types

(1) Offshore Terminal

There are at least four types of structures possible for the offshore terminal; they are:

(a) Single-point mooring

(b) Floating platform

(c) Rigid platform

(d) Man-made island

The single-point mooring terminals are less costly than the others and can operate in more severe sea states than others. Because ship berthing is easier there is less danger of ship collisions and oil spills. In addition, this terminal would probably occupy a minimum of bottom area (Whitehurst, et al., 1972).

(2) Offshore and onshore pipelines

The only significant difference between the proposed superports and other pipelines is of size. Design features should include complete burial of all pipelines with an annual check to verify burial

and to verify reestablishment of animal and plant populations

(3) Onshore terminal

The onshore terminal will require land probably close to the shoreline that is suitably protected by levees and filled in to provide a substantial foundation.

Design features should include provisions for use of developed land or land contiguous to developed land such as near a natural levee corridor. They also should include adequate levees to protect outside marshlands during a possible oil spill.

3. Design Features which Control Long-Term Development

a. Expected Life of Each Project

The Authority should require that all projects considered under its development program having environmental impact critically estimate the expected life-span of their activity. This feature will control development by establishing the time limits of the proposed economic activities because it would provide a more accurate assessment of the potential benefit:cost ratios (it would tend to decrease the ratio) and more accurate data for compensation of temporary and irreversible damages to the environment.

b. Urban and Industrial Development

The Authority should require that any industries related to the superport be required to establish the economic need and their potential environmental impact. Because we believe that this type of development will inevitably lead to the gradual deterioration of the coastal environment, it should therefore receive priority treatment by the Authority. Strong procedures are necessary to insure protection against this stress. Such procedures should consider the cessation of

of port operation or delivery to a processor if any of the private companies involved do not comply. Items to be considered:

- How will each of the future industrial plants comply with present air and water quality criteria?
- A written statement of intent should be provided and established review procedures, on an annual basis, to verify this intent.
- There should be a statement of intent to subscribe to general land-use policy where all development will be circumscribed to:
  - use of levee-development corridors only;
  - no development in unmodified coastal wetlands;
  - no development on barrier islands;
  - no heavy industry south of the Intracoastal Canal along Bayou Lafourche;
  - all pipeline excavations restored to the extent practicable and the water circulation pattern restored.

c. Culture and Aesthetics

The Authority should make every effort to preserve and protect regional culture and aesthetics. Changes in culture and aesthetics can result from the impact of any new industrial project to a region. These changes are reflected in different life styles, changes in land appearances, unsightly construction and industrial sites.

One approach to measure cultural effects and desires would be for the Authority to scientifically sample the opinions concerning each project of people at all economic levels in those parishes most likely to be affected.

Aesthetical problems should be addressed by a team of environmentalists with landscape arachitects assuming leadership.

CHAPTER 4

ENVIRONMENTAL GUIDELINES FOR SUPERPORT CONSTRUCTION AND OPERATIONS

A. Requirements and Intent of Chapter

1. Statute

2. Principal Features of Chapter

3. Types of Construction and Operations Considered

B. Environmental Guidelines for Construction and Operations

1. Mobilization

2. Construction

3. Testing

4. Operations

a. Ship Movements

b. Operators Training

c. Transfer Operations

d. Terminal Operations

e. Demobilization

Under each the following topics will be discussed:

- Environmental stresses and/or problems
- Environmental guidelines

C. Monitoring, Enforcement and Bonding

1. Monitoring Recommendations

a. General Monitoring Provisions

b. Suggested Monitoring Program

2. Enforcement Recommendations

a. General Provisions

b. Office of Environmental Protection

c. Environmental Protection Certificate

d. Oil and Hazardous Substance Contingency Planning

e. Cessation of Port Activities

f. Other Suggested Enforcement Regulations

3. Bonding of Vessels and Facilities

CHAPTER 4

ENVIRONMENTAL GUIDELINES FOR SUPERPORT CONSTRUCTION AND OPERATIONS

A. Requirements and Intent of Chapter

1. Statute

Louisiana Revised Statute 34:3113.J.(4) is as follows:

> "Present details of how the operational aspects of the Authority Development Program will be conducted so as to minimize environmental problems, including but not limited to a monitoring program by the Louisiana Wild Life and Fisheries Commission; establishment of constructional and operational guidelines for environmental protection; strong enforcement provisions, and mechanisms to insure cleanup of accidental spills by technical means, with a surety bond to insure performance. The plan shall consider the circumstances which may justify the temporary cessation of the port activities."

2. Principal Features of Chapter

The most important features required of Chapter 4 by the Environmental Protection Plan are guidelines for superport construction and operations which will minimize environmental problems.

3. Types of Construction and Operations Considered

Constructional and operational activities for any superport will involve the following general stages as described in:

Subsection 1. Mobilization

Subsection 2. Construction

Subsection 3. Testing

Subsection 4. Operations (Commissioning)

Subsection 5. Demobilization

Operational Activities (Subsection 4) for any superport will include the following activities as described under:

a. Ship Movements

b. Operators Training

c. Transfer Operations

d. Terminal Operations

e. Demobilization

Most of this chapter will discuss the constructional and operational activities in regard to the following subsections:

- Environmental stresses and/or problems

This section will identify the most probable environmental stresses and/or problems with each of the above constructional and operational activities.

- Environmental guidelines

This section will suggest various features that will either protect the coastal environment or minimize potential stresses.

B. Environmental Guidelines for Construction and Operations

1. Mobilization

- Environmental stresses and/or problems

Mobilization means the initial organization of people, equipment and sites for the construction of the project facilities. The primary environmental problems will be:

- limited land preparation for storage of equipment and initial operation
- initial survey work for construction

Land preparation will probably involve localized filling, excavation, leveeing, bulkheading etc. If this is done in the coastal wetlands (unmodified) the potential stresses will include: loss of

fishery production (from 2.5 times to 14 times less) due to bulkheading (Mock, 1966); habitat loss due to excavation since excavation causes a change in benthic populations (Williams, 1958). Leveeing which creates new water circulation patterns and can significantly affect detritus production (Odum and de la Cruz, 1967) which in turn affects fishery production (Day et al., 1973).

Initial survey work will involve the intrusion of various crews into the coastal wetlands and offshore areas. The most severe impact would undoubtedly be to the coastal wetlands. This impact can be as a result of vehicular travel into the marsh areas, by the discharge of solid and liquid wastes by the crews, and by possible blasting of explosive materials. Vehicular travel in the coastal marshes creates a path by crushing the plants; some localized animal mortality will occur as a result, but more serious would be the changing of the water flow patterns as a result of the vehicle ruts. Solid and liquid discharges can create toxicity stresses and/or oxygen depletion and often, as a result, associated kills of fish and other species. Explosives can kill and disturb aquatic life (St. Amant, 1972).

- Environmental guidelines

No new or unmodified coastal wetlands should be used for the mobilization phase of construction and operations. Land which is already prepared and adjacent to other developments should be used -- preferably those lands next to existing development corridors such as land which is part of the natural levee systems.

2. Construction

- Environmental stresses and/or problems

Full-scale construction will create the same environmental

problems of mobilization but on a larger scale. For an oil-receiving facility the most detrimental construction effects will occur at the offshore site, along the offshore pipeline, at the onshore terminal, and along the pipeline right-of-way. The area immediately below the offshore terminal and in contact with structual features of the terminal will be irreversibly lost to biological production for the tenure of the project. The offshore pipeline area will probably re-establish itself within one to three years. The onshore terminal will probably be lost forever to biological production as it will be drained, filled and leveed.

- Environmental guidelines

Constructional activities should intrude as little as possible into the coastal wetlands. Canals, ditches and all other excavations should be restored to the extent practicable and the plant life re-established. Dredging and channeling should be done in a manner to minimize any temporary adverse effects in areas other than the immediate dredging or spoil areas. No permanent changes to the tidal flow or water circulation patterns should be allowed. Temporary stresses can be minimized by avoidance of critical areas or conditions whenever possible and by restricting work in sensitive areas to those seasons and to those times in the tidal cycle which would least effect the marine life.

Construction activities causing:	Guidelines:
Hydrology changes or sedimentation	(1) Minimize dredging in areas or directions that might effect the change of tidal flow. (2) Minimize blocking of tidal currents especially in passes during periods of recruitment or emigration. (3) Minimize dredging near oyster reefs. (4) Minimize dredging in direction perpendicular to prevailing currents. (5) Minimize dredging during rising tide if susceptible area above dredge site or falling tide if susceptible area below dredge site.
Chemical changes	(1) Require that no toxic waste

	products of any kind be discharged into the environment. (2) Require a license for all other types of discharges.
Biological changes	(1) Shallow water work should be emphasized during the winter period and deemphasized during spring and late fall.
Physical changes	(1) No cut banks either above or below water should be allowed to remain open. (2) Nothing should be attached to the bottom unless it is adequately marked with buoy or light. (3) No junk should be allowed to be thrown overboard by oil companies, contractors, subcontractors, or any related industries.

3. Testing

a. Environmental stresses and/or problems

Testing is the small-scale operation of all facility units separately, as unit systems and finally as a total system. The environmental impact of testing is probably considerably less than operations since it is usually done for over a very small time scale and with less frequency and total volume. The environmental impacts would be of the same variety as during operations; the only exception might be that a new and untested system may pose initially a greater environmental threat due to the operator unfamiliarity and due to ill-advised economics and engineering.

- Environmental guidelines

The Authority should require that the most hazardous testing steps be identified and that a time schedule be announced as to when, how long, and how much will be tested for each unit, or system or all the systems together.

4. Operations

a. Ship Movements

- Environmental stresses

Environmental stresses associated with ships movements are outlined in Figures 21 and 22. Potential stresses involved with ship berthing includes oil or other spills, impact on currents, waves, etc, effect on recreation and commercial boats and fishing. Stresses involved in general ship operation include the previous stresses plus impact on water quality health, thermal discharges, increased turbidity and sedimentation, shore and channel erosion, collisions and etc. Ship movements will create possibilities for collisions and hence spills of oil or other toxins. The presence and use of deep draft vessels may also set up a economic precedent for dredging to allow these vessels to enter closer to the shoreline. The impact of dredging is loss and removal of bottom habitats, increased water turbidity, increased Biological Oxygen Demand (B.O.D.) and Chemical Oxygen Demand (C.O.D.), and possible nutrient losses.

Most oil spills of the past occurred as a result of tanker collisions (Hellman, 1973); data indicate that the busiest ports have the most collisions. The Mississippi River delta is ranked with other ports as belonging to the category just below the busiest.

- Environmental guidelines

We recommend that the Authority establish strict navigational controls over all ships using the facility. Additional requirements for consideration include:

- all ships should be required to stay in fairway and/or anchorage sites;
- use of tugs, pilots and vessel traffic control systems;

- all ships should leave the coastal area during hurricane conditions or other times of severe environmental dangers, such as flooding, high winds, etc.

More specifics are incorporated into the Burk and Associates (1973) report.

b. Operators Training and Performance

- Environmental stresses

Oil spills are in large part caused by either equipment failure or human error (Wilson and Shipley, 1973). If human error causes an accident or a spill then the environmental stresses are those that have already been discussed, i.e., oil damages to coastal wetlands, such as mortality and/or damage to marsh grasses and its fauna, to planktonic forms in the offshore water column, to the offshore fishery and marine species and benthic populations.

- Environmental guidelines

We recommend that the Authority develop legal requirements for pilotage and vessel safety as follows:

(1) Pilot rest periods

(2) Pilot training

This should include a physical examination each year and successful completion of training courses or equivalent experience.

(3) Pilots required to refuse navigation to an unsafe ship. An unsafe ship being rigorously defined.

Further consideration might be given to incorporation of pertinent environmental guidelines as established in the state of Washington (Oceanographic Commission of Washington, 1972). In addition the Burk and Associates (1973) report should be consulted.

c. Transfer Operations

- Environmental stresses

Potential stresses involved with transfer operations are outlined in Figure 20. These include the impact of the transfer equipment in terms of "sitting pollution"(aesthetics), dust and odor, noise, and impact on air and water quality.

- Environmental guidelines

The Authority should establish specific and rigorous checklists for transfer operations. The operator of the terminal should place a qualified officer on each vessel to supervise the transfer operations and to be responsible for executing all items on the checklist. Critical transfer equipment should be inspected before each transfer operation.

d. Terminal Operations

- Environmental stresses

The potential stresses associated with terminal operations are outlined in Figure 23. These include oil and other spills, construction effects, land use, effect on local hydrography, "sitting pollution" (aesthetics), air and water quality and the demand for support facilities and urban dwelling in nearby area.

- Environmental guidelines

We recommend that the Authority develop and implement strong requirements on the operation of the terminal. This includes: up-to-date navigational devices and procedures; standby emergency equipment; oil spill contingency plans; no support facilities in unmodified wetlands; no urban or secondary development in unmodified wetlands.

5. Demobilization

- Environmental stresses assoicated with demobilization is the

nonremoval of all equipment and facilities in the project area, and the lack of any rehabilatative program to reestablish the natural environment after the project is completed.

- Environmental guidelines

We recommend that all projects be required to develop phase-out plans including the removal of all equipment and facilities from the project area and the reestablishment of the environment to the condition prior to the project whenever practicable. Alternative uses of areas in accordance with the coastal zone management objectives of the state may also be considered.

C. Monitoring, Enforcement and Bonding

In La. R.S. 34:3113(J)(4), the Authority is instructed to present details of "...a monitoring program by the Louisiana Wild Life and Fisheries Commission;...strong enforcement provisions, and mechanisms to insure clean-up of accidental spills by technical means, with a surety bond to insure performance." As it is believed that any provisions concerning the foregoing programs would likely overlap in many instances, all recommendations concerning such programs are included in this section of Chapter 4.

It is further expressed in the statute that the Authority is "...not limited to..." the monitoring, enforcement, bonding or other programs named in the statute. Therefore, additional suggestions are offered in this section directed at coordinating and accomplishing all environmental protection programs. This coordination would occur not only within the Authority organization, but among all other Federal and State agencies, as well as local authorities, generally.

1. Monitoring Recommendations

a. General monitoring provisions

Monitoring, in this report, means the casual, systematic and routine scientific and technical investigation, sampling and analysis of the condition or state of the environment within which any aspect of the Authority Development Program, or development associated therewith, may expand or otherwise affect and influence.

The statute indicates that the Louisiana Wild Life and Fisheries Commission is to conduct monitoring activities. It is further suggested that the Louisiana Deep Draft Harbor and Terminal Authority establish, in association with the Wild Life and Fisheries Commission, a coastal environmental monitoring program. The primary objective of this monitoring program would probably be the timely location of potential and actual environmental stresses. This would include polluting incidents occurring at port facilities, but should also be extended to include all other environmentallly harmful events.

In order to assure adequate performance of this monitoring program, and all other environment programs, it is suggested that the Louisiana Deep Draft Harbor and Terminal Authority establish and make part of its existing organization an environmental office. This office could be authorized, obligated and empowered to conduct all environmental activities and responsibilities of the Authority, including performance of all duties and programs as may be established by Environmental Protection Plan regulations. Any additional duties could be subsequently established by the Authority. More details concerning the function of a special environmental affairs office are contained in the following subsection entititled "Enforcement Recommendations."

The monitoring program should probably encompass the same geographical limits as all aspects of the Authority Development Program and

other development associated with superport facilities.

All funding for a monitoring program should probably be provided by the Louisiana Deep Draft Harbor and Terminal Authority and should be in an amount sufficient to allow thorough and adequate performance of the monitoring projects. If an office is created to manage and conduct all environmental affairs of the Authority, including monitoring, then the funding should be extended to assure adequate and thorough performance of the duties, obligations, and responsibilities of such office.

b. Suggested monitoring program

Monitoring could be coordinated with the existing program of aerial surveillance being conducted by the U.S. Coast Guard. This surveillance is in accordance with Coast Guard responsibilities as assigned under the Sixth Regional Oil and Hazardous Substances Contingency Plan (CCGD8 INST 5922.4).

The monitoring program should require regular sampling of air, water and sediment from at least two locations proximate to any aspect of the Authority Development Program. Sampling should probably occur on a monthly schedule, but should depend on the type of development, readily observable or irregular changes, and other factors, such as the object and nature of the sampling and the history of the area.

Air, water and sediment samples should be obtained from every coastal area in which expansion of any aspect of the Authority Development Program or other development is anticipated prior to that development. All samples should be tested using only the most modern and accurate equipment (i.e., gas chromatogram) and the most reliable and efficient analytic technique for determination of the presence and volume of important chemical concentrations. These chemical concentrations and any other applicable

characteristics should be included in a listing for future reference and data comparison. The initial sampling results could form the baseline for comparison of subsequent air, water, and sediment samples. Any build-up or depletion of one or more chemical concentrations, or the development of other unusual conditions, could then be ascertained at an early stage. These changes could then be thoroughly investigated, with published conclusions as to a possible connection with any aspect of the Authority Development Program or associated development in the coastal environment.

The monitoring program should include measurement of hydrocarbon levels. Hydrocarbon concentration per unit volume should probably be monitored on at least a monthly frequency. It would be advisable to obtain baseline data along all prospective areas of superport development at least one year prior to beginning port operations. These measurements should be taken at regular points from offshore locations through onshore rights-of-way. Sampling stations could be established in all particular habitats through which such facilities traverse, as suggested by, but not limited to, the following habitats:

(a) offshore water column,

(b) offshore benthos near and about the terminal and along the pipeline route,

(c) shoreline vegetation and fauna,

(d) estuarine-marsh vegetation and fauna,

(e) fresh water swamp vegetation and fauna, and

(f) any other habitats as subsequently may be established by the office or agency charged with conduct of environmental activities of the Authority.

One station should be occupied in at least each of the benthic habitats as determined by species presence, by sediment characteristics, by water depth, and by water currents. Reliable and accurate analytical technique should

be used, such as ALC laboratory analyses, and suitable field sampling techniques so results can be expressed in a sound statistical manner.

The monitoring program should establish benthos populations by dominant species comprising 75 percent or more of total population abundance. Plant and animal species should be monitored at least on a seasonal basis. Sampling done each season should be based on a statistically valid number of samples per habitat unit, for example:

(a) A standard error of between 10 percent and 25 percent of the mean, or a variation of

(b) number of samples (N) given by $N = \frac{ts}{D\bar{x}}$

where s = standard error, D = the level of accuracy as a decimal, say 0.10, and t = a quantity from sampling tables, $\bar{x}$ = mean per sample; and

(c) Stratified random sampling.

Where possible all effort should be made to monitor both structural and functional aspects of benthic populations. For example, structure can be expressed in terms of species and their numbers per unit time per area, their biomass, species groupings, population composition, or intra and inter species relationships, to illustrate a few meaningful expressions.

Species function can be expressed in terms of their productivity per unit time per unit area, their respiration, their trophic or niche characteristics (i.e., what or how they capture energy), and other acceptable scientific expressions.

The monitoring program should establish and determine the dominant species of the nekton in areas proximate to potential or actual superport facilities and other development. This monitoring should probably be conducted thereafter on a regular basis. A monthly or oftener schedule, depending on circumstances (i.e., polluting incident), would

probably be sufficient. Dominant species comprising 75 percent or more of total population abundance of the nekton should be established. Standard sampling procedures should be used (nets) but relativized to a unit of time and area.

The monitoring program should include inventory of estuarine areas to be traversed by, and in proximity to, deep draft harbor and terminal facilities and associated development. This estuarine inventory should comprehend the following baseline data within critical areas as determined by probability and field study:

(a) primary productivity;

(b) plant biomass production;

(c) marsh fauna; and

(d) other populations.

Erosion and land loss rates along all aspects of the Authority Development Program and associated development should be monitored on a seasonal basis by aerial photographs. These photographs should be taken from a uniform altitude following established flight paths on the month, day and hour of highest and lowest seasonal tidal flow along the Louisiana coast. If cloud cover or other weather conditions indicate great difficulty or impossibility of conducting accurately and validly such aerial photography, the photographs should be taken on a day and hour most nearly identical in tidal characteristics as the day and hour of highest and lowest seasonal tidal flow. Meteorological conditions should be observed and data recorded for each flight.

Data should be extracted from these films using the most accurate and valid techniques. Baseline data prior to construction and operation of deep draft harbor and terminal facilities and associated development should be established to provide the measuring and comparison base.

If erosion and land loss is indicated, thorough testing and analysis should be conducted by the Authority to determine precisely the cause of the loss and the best corrective and preventive measures which should be taken to abate further erosion or land loss. If any aspect of the Authority Development Program or associated development is directly, indirectly or casually responsible for such erosion or land loss, the parties responsible should be required to compensate the environment for such losses. (See Chapter 5 for compensation discussion). If such loss continues to occur the authority should initiate whatever corrective action or program as necessary to stop such land loss.

The monitoring program should establish an inventory and breakdown of terrestrial populations. This inventory should be performed according to accepted technique. There should be a regular monitoring of these populations to assure continued and steady growth and that no destructive imbalance of one or more populations occurs or threatens to occur in the environment. All results and conclusions should be published at least annually.

The monitoring program should strive to develop an understanding and accurate assessment of the total environmental stress-assimilative capacity (i.e., the total stress the environment can endure and continue functioning without sustaining significant loss or degradation of existing environmental quality) of the region into which a superport and other development may eventually expand. Naturally, the Authority would not be expected to facilitate, encourage or assist any development which would tend to exceed the assessed assimilative capacity or otherwise endanger the coastal region.

As a final suggestion, the Authority might consider requiring a number of log books and other instruments of recordation for various operational and maintenance activities. For instance, they might require a log book for recording name of responsible party, date and amount of oil and hazardous substance spillage during normal offloading operations. They could require an advance publishing of a schedule of import-export products being transferred through port facilities. Metering books and instrumentation could be required at selected points as determined by the Authority. These are just a few of the types of records which might be useful in determining activities which are actually and potentially dangerous to the environment, or activities and equipment requiring greater care, training and technilogical improvement.

2. Enforcement Recommendations

a. General provisions

Enforcement, for purposes of this report, includes inspection, monitoring and policing to assure compliance with rules and regulations established by the Environmental Protection Plan, coordination of activities with other State and Federal agencies, clean-up activities, and such additional activities as the Authority may provide.

As enforcement and other provisions of the Plan will probably be extensive, it is suggested that the Authority create a new office of environmental protection. Such an office could then be authorized, obligated and empowered to conduct all environmental activities and responsibilities of the Authority, including performance of all duties and programs as are established by Environmental Protection Plan regulations. Suggestions concerning this office are developed more thoroughly in subsection b below.

Other enforcement recommendations concern the possibility of

requiring certification of environmental protection competency, contingency planning, and cessation of port activities.

b. Office of environmental protection

The purpose of an office of environmental protection should probably be to provide protection of the coastal and marine environment of Louisiana and to assure compliance with the Environmental Protection Plan and the Environmental legislation and other regulations of the Federal, State and local governments.

Enforcement of all Environmental Protection Plan regulations could be performed by personnel employed in this office. The Authority could establish an environmental director to administer and otherwise oversee activities being conducted within their jurisdiction. This position of director should probably be established on a contractual basis in order to attract the most qualified and able applicants. Several qualifications which might be desirable for a director to possess are listed below. First, a candidate for director should possess past experience in a position of administration and public trust and have been successful at such position. This should probably include experience in, or at least a basic working knowledge of, sciences in operation along the Louisiana coast (i.e., geology, meteorology, and biology). It would be desirable to have a person with a knowledge and understanding of the current Federal environmental regulations and enforcement agencies. Further, the director should be totally independent of shipping interests, including any interest of a financial or other nature in any aspect of the import-export industry, particularly involving petroleum products. The Authority might want to limit the amount of outstanding financial indebtedness. The Authority also might want to investigate the amount of outstanding financial indebtedness of such a director, and establish a maximum limit

for candidates applying for the position. This would aid in assuring selection of an independent director.

It is further suggested that any director be a non-political figure, uncontrolled by any group with interests adverse to environmental protection. Development of the foregoing qualifications in an environmental director would probably be essential to the efficient and effective operation of an environmental protection office. Additional criteria could be included according to the guidance of the three directors.

This office should be charged with all contingency planning. (Suggestions concerning such planning are contained in subsection d.) The director should probably be authorized to determine all equipment needs and other supplies which might be required to adequately enforce Environmental Protection Plan provisions.

If additional personnel are essential to adequate enforcement of the Environmental Protection Plan under the environmental protection office, the director should make such employee determinations. It might be advantageous to offer such employment on a competitive, nonclassified basis in order to obtain highly qualified and effective applicants.

In order to simplify discussion of desired personnel qualifications and duties, the office is subdivided into three relevant employee positions, as follows: Enforcement personnel, science personnel, and administrative personnel.

First, the purpose of enforcement personnel would be to provide versatile and effective enforcement and clean-up. They should be trained in normal enforcement procedures such as used by agents of the Louisiana Wild Life and Fisheries Commission. They should have a thorough working knowledge of the Environmental Protection Plan as well as Federal, State

and local environmental legislation, regulations and agencies. All personnel should be trained in all aspects of terminal operations, including offloading techniques, reading and interpretation of log books, records and instruments, and safety and maintenance requirements. Enforcement personnel should be trained and qualified to take air, water and sediment samples and to use other environmental testing technique. Finally, all personnel should be trained and capable in the deployment and operation of any and all pollution control and clean-up equipment of the Authority.

Powers and duties of enforcement personnel would probably be similar in scope to other regulatory agents, except these would be applicable only to superport operations under the jurisdiction of the Authority. They should have the right of entry without warrant for purposes of inspection and enforcement onto any premises under the jurisdiction of the Authority. This right of entry should exist at any time of the day or night upon a showing of proper identification. They should have the right to issue citations for violations of the Environmental Protection Plan, and other Federal, State and local laws and regulations. Enforcement duties should probably include inspection of records, offloading operations and techniques, vessels, hoses and other equipment and instrumentalities of superport facilities and the steps and processes being used in construction, operation or maintenance of any other aspect of the Authority Development Program. Inspection should occur regularly on both a scheduled and unscheduled basis. Monitoring activities should probably be conducted by enforcement personnel in association with agents of the Louisiana Wild Life and Fisheries Commission. The final duty to be included as illustration is the duty of cleanup. This should include assisting cleanup efforts by the U.S. Coast

Guard, regional cleanup groups, or private cleanup organizations.

Second, science personnel might be employed to provide rapid and accurate assimilation of data to enable maximum protection of the Louisiana coastal and marine environment. Further, these personnel might be involved in developing new and efficient technology for preventing and abating pollution which might result from the construction, operation or maintenance of any aspect of the Authority Development Program. They should be capable of researching problems arising in all facets of coastal and marine sciences, including biology, chemistry, geology, geography and hydrography. Several qualifications would be desirable. They should have training and knowledge of the most advanced and accurate research technology applicable to proper scientific analysis, including usage and operation of research instrumentation, such as the gas chromatogram and techniques of proper air, water, sediment and biological sampling.

The function of science personnel would be basically that of research. They should probably be careful to coordinate their research efforts with the efforts of other agencies, such as the Louisiana Wild Life and Fisheries Commission, the Air Control Commission and Department of Health, and the Stream Control Commission. They should coordinate, conduct and participate in any research and development or other projects established as compensatory projects in accordance with La. R.S. 34:3113 (j)(5). They should probably engage in independent research and analysis of pollution situations in proximity of any aspect of the Authority Development Program. They should probably engage in a scheduled sampling program in all areas of the coastal and marine environment which, in the opinion of such personnel, might be affected by the construction, operation or maintenance of any aspect of superport development.

The third section of suggested qualifications, powers and duties concern administrative personnel. The purpose of this section might be to effect coordination of efforts of the Authority with other Federal, State and local agencies and private organizations and the environmental programs of those agencies and organizations. Additionally, this section could be responsible for reviewing applications for construction, operation or maintenance activities throughout all aspects of the Authority Development Program. Approval might take the form of a certificate and is discussed in subsection c.

Desired qualifications should probably include knowledge of other Federal, State and local governmental agencies and the environmental programs of those agencies. Also, they should probably develop a thorough knowledge of Federal, State and local environmental rules and regulations, as well as all provisions of the Environmental Protection Plan. They should be familiar with all aspects of the Authority Development Program from construction and operation through maintenance and repair procedures.

Powers and duties might consist of affirmative activities. For instance, they should probably correspond regularly with other Federal, State and local agencies and private organizations which may have some bearing on superport activities and the Louisiana coastal and marine environment. This would aid in dispersal and accumulation of information for greater coordination of effort. Also, files should probably be maintained on current rules and regulations promulgated by Federal, State and local agencies concerning environmental and superport matters. These files should probably include all environmental programs of other Federal, State and local agencies and private organizations which may affect the Authority and Louisiana's coastal and marine environment. Administrative personnel might seek to assure that activities of the deep draft harbor and terminal

are conducted in such manner that no environmental laws or regulations are violated and that the environment and living resources of the coastal region are not damaged or otherwise endangered. They should also seek to establish such positive programs as exchange of meteorological data with the National Weather Service and the National Aeronautics and Space Administration, as well as the development of a modern weather station to serve the superport. If any superport activities required any type of certification from the environmental protection office, the administrative personnel could review and comment on issuance of such certificate.

The foregoing three sections were proposed solely to reflect possible powers and duties of an environmental protection office and to suggest possible qualifications expected of personnel selected for such an office. Obviously, many duties could be performed by one or two employees, depending on the extent an environmental protection office were to be developed. Also, the Act refers to several activities which are to be conducted by the Louisiana Wild Life and Fisheries Commission. In this connection, it is possible that the Authority and the Commission could join in the enforcement activities, or the Wild Life and Fisheries Commission could undertake all enforcement, including monitoring and inspection. However, if this were done, the Authority would probably be responsible for reimbursing the Commission for all expenses occasioned by such activities. Reimbursement could be accomplished by arranging a schedule of payment between the Authority and the Louisiana Wild Life and Fisheries Commission. These payments, as other expenses incurred for purposes of La. R.S. 34:3113(J)(4), should probably be considered expenses of administration to be paid from the general operating budget of the Authority.

c. Environmental Protection Certificate

An environmental protection certificate from the Environmental Director might be required prior to beginning physically any construction under the jurisdiction of, or related to, the Authority. Operating procedures and maintenance procedures could also be required to receive a similar certification. This certification could be issued directly by the office of environmental protection and could be signed by the environmental director.

A certification from the director might also be required to show that a registrant can provide all necessary equipment to prevent and remove discharges of oil and other pollutants.

The terms of the certificate should probably be evidenced in writing and made a part thereof. All provisions and prohibitions of the Environmental Protection Plan could be included by reference as inviolable conditions of the certificate. Special terms regarding a proposed activity could also be included in each certificate. These special terms could be formulated by the office of environmental protection with the advice of the Attorney General's Office, and such legal counsel as may be employed by the Deep Draft Harbor and Terminal Authority.

Violation of any one of the general or special terms or conditions of a certificate would be grounds for revocation of the certificate and hence the right to conduct the activity.

The notice and revocation procedure, assuming that an environmental protection certificate were established by the Authority, should probably be determined by the environmental director. An adequate procedure for appealing from a ruling of the director should be clearly provided.

d. Oil and Hazardous Substance Contingency Planning

Contingency plans can be made up in a variety of ways. The important features should be that they can work quickly and effectively. All such plans should be tested by simulation of an emergency and graded and changed (if needed) accordingly. At least five phases are necessary. They are (after Hellman, 1973):

Phase I	Discovery and Notification
Phase II	Containment and Countermeasures
Phase III	Cleanup and Disposal
Phase IV	Restoration
Phase V	Recovery of Damages and Enforcement

The plans should incorporate the strongest support capabilities in those areas having the highest probability of oil spills or ship collisions or other material spills. In addition, areas of jurisdiction should be established with a communication system, ready to work, and names and addresses of all pertinent people needed and where resources and equipment are located. Critical water areas should be identified by a cleanup priority number system. For more details see Hellman (1973) and Burk and Associates (1973), and the Clean Gulf Associates consortium.

The Federal Water Pollution Control Act of 1972 (replacing the Water Quality Improvement Act), 33 U.S.C. 1151 et seq., authorized the development of a National Contingency Plan to provide for a response to polluting spills. Accordingly, the Council on Environmental Quality created this plan, entitled the National Oil and Hazardous Substances Pollution Contingency Plan, and required the formulation of regional contingency plans by the U.S. Coast Guard district included within the region. The contingency plan for the Sixth Coastal Region, in which the State government of Louisiana is a participant, has been developed

by the Eighth Coast Guard District. The Region Sixth Coastal Region extends seaward off the coasts of Texas and Louisiana, extending into the Gulf of Mexico to encompass any area where a spill can pose a threat to U.S. Waters and inland as far as areas where the tide ebbs and flows, areas supporting deep draft vessels including the Mississippi River to Baton Rouge, Louisiana and the intercoastal waterways. The plan developed in this region is entitled the Sixth Regional Oil and Hazardous Substances Pollution Contingency Plan and would have application to polluting spills which might occur in and about superport facilities in Louisiana.

The objectives of this plan are to provide for efficient, coordinated and effective action to minimize damage from oil and hazardous substance discharges, including containment, dispersal, and removal. This Plan provides for assignment of duties and responsibilities; establishment and identification of local strike forces; a system of notification, surveillance and reporting; establishment of a Regional Center to direct operations in carrying out of this Plan; a schedule for the use of dispersants and other chemicals to treat oil spills; enforcement and investigative procedures to be followed; directions on public information releases; and instructions covering on-scene coordinators.

For spill response activities, Federal on-scene coordination is accomplished through a single, predesignated agent, the On-Scene Coordinator. The On-Scene Coordinator for Louisiana is:

Captain of the Port
U.S. Coast Guard
4640 Urquhart Street
New Orleans, La. 70117

Telephone Number: (504) 527-7101

A subregional contingency plan has been developed for Louisiana and is intended to provide detailed guidance for the On-Scene Coordinator. This subregional plan is relatively general at the present time, and

probably should be developed more thoroughly in any area affected by superport development. The plan is to include control techniques and applications peculiar to the subregions; critical water use areas including the priority of uses within those areas; potential pollution sources including the determination of the maximum credible spill, inventories and commitments of men, material and equipment including details of procuring same; and such other material as may be required.

The environmental director, or other person directed by the Authority, should become thoroughly familiar with all existing contingency plans and available cleanup resources. There should then be a determination of what equipment, personnel, and other materials are needed in order to effectively combat and remove a spill. These items should then be purchased and employed by the Authority during construction and operation of superport facilities.

The environmental director, or such other person, should be designated as the person to notify in any case of an unauthorized discharge or spill of pollutants during the construction, operation or maintenance of, or otherwise resulting from, any aspect of superport development, including discharges from vessels.

He should coordinate cleanup efforts of the Authority with efforts of the U.S. Coast Guard and other participating agencies and parties. He should contact the On-Scene Coordinator in situations requiring cleanup assistance and as required by the Contingency Plans.

The Authority probably should require every operator, vessel owner or other user of deep draft harbor and terminal facilities to report any actual or potential oil or polluting substance spill to the office authorized, obligated and empowered to conduct environmental activities and responsibilities of the Louisiana Deep Draft Harbor and

Terminal Authority. The initial spill report should be communicated to the office using the speediest available mode of communication (telephone, telegraph, radio) and should be confirmed by certified mail within seven (7) days subsequent to the spill.

This mail could consist of an acknowledgement of the spill in a written report containing information as may be requested by the office conducting environmental affairs of the Authority.

Standard compensatory payments could be made to the Louisiana Deep Draft Harbor and Terminal Authority for application to expenses incurred and possibly for inclusion into the environmental protection fund.

e. Cessation of Port Activities

The environmental director, or such other person as indicated by the Authority, should determine and make the final decision in situations requiring temporary cessation of port activities. For periods of short duration, this decision should probably be uncontrovertable and nonreviewable, barring gross abuse of discretion by the director or other person.

The following situations are suggested as possibly requiring temporary cessation of port activities:

- Whenever a hurricane or severe tropical storm is reported within x miles of the offshore terminal and is moving so as to pose a potential threat to the terminal;
- Whenever a spill of major proportion occurs, offloading should be discontinued if such operations would interfere with clean-up activities or create an additional hazard;
- Whenever waves reach a height in excess of X feet, there could be required the automatic cessation of offloading activities;

- Whenever any other situation may exist which, in the opinion of the office of environmental protection, requires temporary cessation of port activities, the decision could be made by the environmental director.

Whenever indications become evident that the marsh-estuarine or marine environments are stressed or otherwise responding unfavorably to construction, operation and maintenance or other activity of, or associated with, a superport within, or contiguous to, the Louisiana coastal region, there should be required cessation of port activities until necessary corrective action has been taken. This determination should probably be made by the office of environmental protection based on research conducted by that office. (Note that this research might be considered a type of compensation project as suggested in La. R.S. 34: 3113(J)(5).)

Any decision of the environmental director which requires temporary cessation of port activities for a duration in excess of twenty-four hours should probably be subject to review by the Deep Draft Harbor and Terminal Authority or by the three directors.

Permanent cessation of port activities should probably be made by a majority vote of the Deep Draft Harbor and Terminal Authority at a public meeting conducted in accordance with the provisions of the Louisiana Administrative Procedure Act (La. R.S. 49:951-966).

f. Other Suggested Enforcement Regulations

A possible preventive regulation might be to permit no vessel to be offloaded of oil or any other polluting substance, or otherwise granted access to deep draft harbor and terminal facilities, which does not possess and use all safety and spill prevention equipment as authorized by latest U.S. Coast Guard regulations, and such additional regulations as

may be promulgated by the Louisiana Deep Draft Harbor and Terminal Authority.

If the operator of any superport facility permitted a vessel to offload which vessel was not in full compliance with U.S. Coast Guard regulations, as supplemented by regulations of the Authority, the permission to operate which may have been granted to such operator by the Louisiana Deep Draft Harbor and Terminal Authority could be revoked immediately and permanently. Such operator could be barred from performing similar duties in the State of Louisiana for life or a designated term. The owner and operator of the offending vessel could be barred from offloading such offending vessel in Louisiana coastal waters for the purpose of commerce, forever, or for a designated term, but only after demonstrating compliance with all regulations

3. Bonding of Vessels and Facilities

Each owner or operator of a terminal facility or vessel, including any barge using any deep draft harbor and terminal within the jursidiction of the Deep Draft Harbor and Terminal Authority probably should be required to establish and maintain evidence of financial responsibility based on the capacity of the terminal facility or tonnage of the ship, the type of cargo carried, and similar factors. Financial responsibility could be established and maintained by any one, or a combination of the following:

- Evidence of insurance;
- Surety bonds payable to the coastal protection fund and conditioned to pay all costs and expenses of the cleanup of any discharge, as well as damages caused to the State;
- Qualification as a self-insurer; or
- Cash depositied in a bank of the State in amount sufficient to satisfy the bond.

A bond filed with the Deep Draft Harbor and Terminal Authority should be issued by a bonding company authorized to do business in the State.

Provisions of the bond should probably include at least the following:

- Any claim for costs incurred by a terminal facility or vessel may be brought directly against the insurer or any other person providing evidence of financial responsibility;
- Any claim for costs of cleanup, civil penalties, or damages by the Authority and Louisiana may be brought directly against the bond, the insurer, or any other person providing evidence of financial responsibility;
- Any other terms and conditions as may be deemed necessary and desirable by the Deep Draft Harbor and Terminal Authority, such as waiver of defenses and acknowledgement of strict liability.

Any operator of a superport facility and his agents or servants, including vessels destined for or leaving a superport facility, who permits or suffers a prohibited discharge or other polluting condition to occur within State boundaries, or who permits or suffers a prohibited discharge or other polluting condition to take place, which is transported by any means into the coastal and marine environment, and which condition thereafter affects or potentially could affect the quality and condition of any environment of the State or the economy and property of any of the citizens of the State, should be liable to the State for all costs of cleanup or other damage incurred by the State. This could be included among the terms and conditions of the bond.

Further, in any petition to the Authority to enforce claims of the State, it should not be necessary for the State to plead or prove

negligence in any form or manner on the part of the terminal operator or any vessel. If the State is damaged by a discharge prohibited by the Environmental Protection Plan, they should need only plead and prove the fact of the prohibited discharge or other polluting condition and that damage occurred. All recoveries to the State, except for cleanup expenses should probably go into the environmental protection fund.

A monetary penalty might be established to be paid from bond moneys to the Authority for the following quantities of prohibited discharges of pollutants into, or such discharges occurring outside the territorial boundaries of the State and conveyed by any means into, the coastal environment of the State, or otherwise affecting the environment of Louisiana, and in the monetary amounts set forth herein:

(1) Chronic daily spillage

1-x bbls. - _____ dollars ($ _____.00)

x-y bbls. - _____ dollars ($ _____.00)

y-z bbls. - _____ dollars ($ _____.00)

(2) Massive spill

over z bbls. _____ dollars ($ _____.00)

(3) Other pollutant discharges (See note)

The Deep Draft Harbor and Terminal Authority probably should authorize the payment of such monetary penalty into the environmental protection fund.

Note: This category could be made dependent on the toxicity of the pollutant and the quantity of such pollutant that is discharged. Coordination with State standards as promulgated in the emplementation plans, and Federal minimum standards as contained in Environmental Protection Agency regulations could form the basis for compensation determination. Additional standards not included in those regulations could be established by the Deep Draft Harbor and Terminal Authority.

CHAPTER 5

AUTHORITY FUNDING AND COMPENSATORY PROJECTS

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3. Creating an Advisory Group

4. Projects

   a. Losses

   b. Land and water projects

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E. "... Louisiana Wildlife and Fisheries Commission or any agency..."

1. Statute

2. The Authority

3. "... Louisiana Wildlife and Fisheries Commission..."

4. "...any agency..."

Chapter 5

AUTHORITY FUNDING AND COMPENSATORY PROJECTS

A. Introduction

The purpose of Chapter 5 of the L.S.U. Environmental Protection Plan report is to offer an analysis of La. R.S. 34:3113(J)(5) and suggest a series of options available to the Authority regarding compensatory projects. First, the need for such projects is established in accordance with statutory, biological and economic considerations. Next, procedures for funding projects are discussed, with a short summary of compensatory-type programs that have been proposed or adopted in other jurisdictions. In the third section, there is presented discussion of materials and suggestions believed relevant to compensatory projects. And finally, a fourth section offers several alternatives concerning the agency, or agencies, to be responsible for conducting all, or portions, of compensatory projects.

B. Need for Compensatory Programs

Projects compensatory of harm which may be sustained to the Louisiana coastal environment as a result of superport development are strongly supported by statutory, biological and economic needs.

1. Statute

First, compensatory projects are required by statute. In July

of 1972, the Louisiana legislature, by enacting the Deep Draft Harbor and Terminal Act, established, among other things, compensatory provisions to be included among Environmental Protection Plan regulations. Statutory language specifically applicable to environmental compensation is found at La. R.S. 34:3113(J)(5) and is cited as follows:

> (5) Provide procedures for the funding of projects to be paid for by the Authority to the Louisiana Wildlife (sic) and Fisheries Commission or any agency designated by the Governor, which shall compensate the coastal environment for the loss which may be sustained through the stresses on the environment created by the Authority Development Program.

Portions of this statutory provision will be cited appropriately throughout the remaining sections of Chapter 5.

2. Biological

The statutory requirement is further supported by the critical need to protect the biological processes, and hence the renewability characteristic of the Louisiana coastal environment. One outstanding feature of a Louisiana marsh-estuarine system is the fact that it can serve the residents of the State continuously and indefinitely free of capital investment or expenditure. All that must be done is to conserve and protect the system from physical encroachment by urban or industrial expansion or degradation of environmental quality occasioned by polluting acts of man.

As indicated and discussed in previous chapters (see Chapters 1, 2, 3 and 4), the biotope of Louisiana's coastal environment consists of innumerable plant and animal species. These species constantly experience a critical interdependence, as illustrated in a multitude of biological cycles and food chains. Often single plant or animal species,

or groups of closely related species, provide a vital function or link in the survival of two or more distinct biological cycles and food chains. To stress the importance of maintaining the continuity of these links and functions to the continued life processes within a coastal environment, the following examples are offered:

a. The most important single species in the estuarine system is the marsh grass, Spartina alterniflora. This grass is the most important plant in the system and elimination of this single species would probably mean virtual collapse of the entire system. As stated in previous chapters, most Spartina is used only after it has died and become partially degraded material called organic detritus. Detritus forms the basic source of nutrients for many fisheries species during larvae stages and for zooplankton in general.

b. A group of bacteria and small animals called meiofauna are responsible for much of the detritus production. This group of organisms is also responsible for cycling of nutrient materials which are so important to plant growth and detritus production. Most of this bacterial meiofauna community occurs in the marsh soils and on the bottom portions of the grass. A disturbance of the bacterial meiofauna organism group would seriously affect food production in the estuaries. As many commercial fishery species, such as shrimp, oysters, and menhaden, feed at least partially on detritus, it is obvious that interference with any aspect of detritus production would adversely affect commercial fisheries.

c. Wading birds, such as egrets and herons, feed largely on populations of marsh snails and minnows. Elimination of either of

these populations would mean a great reduction in the bird populations. On the other hand, if the birds were removed, then snail and minnow populations might grow unrestrained, consuming more food than they now do and perhaps leaving less for commercially important fishery species.

d. A situation similar to c above now exists for the nutria. The nutria was introduced by man into Louisiana marshes where it had no natural predators. Now, unless nutria are controlled by trapping, they can "eat out" large sections of marsh, virtually destroying the subsequent contribution of such an area to fisheries productivity.

e. A final example illustrating interdependency of species are the zooplankton. Zooplankton are microscopic animals which float freely in the water. These small life forms feed on single-celled plants (phytoplankton), one another, and detritus, and in turn serve as food for many other organisms, particularly larval shrimp and menhaden. These latter two species have been shown to consume zooplankton in addition to detritus.

In the Louisiana coastal situation, if a species performs vital functions in several cycles or food chains, i.e., Spartina, the demise of that single species would totally disrupt and could ultimately destroy the entire biological process, and hence the productivity, of a marsh-estuarine system. The result would be conversion of a once-living and important estuary into a biologically dead and non-productive area.

The importance of conserving and continuing to stimulate growth of all species, commercially and recreationally valuable or

otherwise, should be manifested throughout all stages in the development of a deep draft harbor and terminal. Compensatory projects which would aid in conserving and protecting the coastal environment of Louisiana are discussed in section D of this chapter.

3. Economy

A third factor supporting establishment of compensatory programs is the overall economy of the coastal region. This economy is based largely on commercial fisheries and on employment in the offshore oil industry.

If a superport were not to influence the location of petroleum refining activities in the coastal region, then two results would probably be evidenced. In the first place, long-term employment prospects would be augmented only minimally by superport development. And secondly, those occupations dependent on the existence of a productive fisheries industry would have to be strongly protected in order to assure a viable coastal economy in the future. This dominate need to protect the existing economy certainly offers additional support to the need for establishing compensatory projects.

Another economic consideration supporting compensatory projects is the fact that employment in the offshore oil industry of Louisiana has reached its highest projected level, having remained stable over the past five years (D. Johnson, 1972). This type of employment probably will begin to decline, concurrently with the decline in offshore production, within the next ten years. This is based on the fact that fewer new oil deposits are being discovered in outer continental shelf lands, with existing reserves in waters

offshore of Louisiana being depleted more rapidly than new reserves are being discovered. Already employment offshore has stabilized to the extent that no new jobs are becoming available (ibid.). Therefore, residents of coastal parishes who depend on these offshore jobs soon will be forced either to leave the parish or engage in a livelihood dependent on a different coastal industry. If biological productivity of the estuaries is protected, if geology and physical features of the coastal environment are not destroyed, if existing natural processes continue to occur, and the coastal environment remains naturally dynamic and productive, that income-generating livelihood will be available to the coastal populace in the form of a lucrative fishing industry.

On the other hand, if a deep draft harbor and terminal were to have the effect of causing an influx of petroleum refining industry into the coastal region, then experts have predicted there would be an accompanying increase in other industrial and commercial development, including augmentation of coastal populations. With these possibilities follows the accompanying probability of increased pollution in every form. There would be produced a proportionate increase in volume of sewage, both industrial and human, with the critical need to dispose of that sewage. If the constraints established under national legislation (Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq., and the Clean Air Act, 42 U.S.C. 1157a et seq.) are strictly enforced and properly followed by all new industries and point sources of pollution, there would be no danger of polluting the coastal environment. However, if the "no-pollution" goal of the 1980's

and the existing minimum discharge and effluent standards are unsuccessful or are otherwise obviated, the establishment of a deep draft harbor and terminal would be responsible for endangering the quality of our estuarine waters and, consequently, the consumability of the fish, shellfish and crabs produced therein and the recreational potential obtainable therefrom. The mussel harvesters of Italy, the swordfishermen of America, and the oyster industry of Louisiana offer bleak illustration of how pollution by man can destroy the usefulness of invaluable renewable natural resources. Existing air quality might be threatened by the encroaching industrial development, as might the quality of surface water supplies. Further, the threat would exist of possible subsurface and groundwater supply depletion through urban and industrial use. Development might attempt to reclaim large or significant portions of the existing marsh-estuarine environment, either through fill to create construction sites, or canals built in an effort to attract industry. The effects of this potential development should be carefully weighed and balanced in order to permit the continued side-by-side existence of the estuarine fisheries industry and the petroleum and other manufacturing industries.

But, with or without a superport, an economically diversified economy in the coastal zone is essential for long-term economic strength. Compensatory programs associated with a superport development could assist in this by insuring and stimulating renewable resource productivity, greater recreational and commercial benefits, and a better and more enjoyable environment for those living in the coastal zone.

4. Louisiana Advisory Commission on Coastal and Marine Resources

A final item might be cited in support of the need for compensatory programs. This is the final report (September, 1973) of the Louisiana Advisory Commission on Coastal and Marine Resources (Advisory Commission hereafter). This report, entitled Louisiana Wetlands Prospectus, contains conclusions, recommendations and proposals of the Advisory Commission and represents the culmination of an intensive two-year study effort concerning use and management of Louisiana's coastal and marine resources.

These resources are experiencing a gradual decline, both in availability and consumability. It was indicated by the Advisory Commission that this decline is due largely to man's activities both within and without the bounds of the coastal zone. Further, unless adequate and responsible programs directed at managing and controlling uses affecting the natural coastal environment are instituted, it was the Advisory Commission's opinion that this slow degradation would continue to occur. As development in and affecting the coastal zone spreads in Louisiana, unless programs are started to assure maintenance and enhancement of existing environmental quality by appropriate and specially authorized State agencies and other parties, this degradation will be accelerated at an ever-increasing rate.

The study also includes an inventory of uses and activites in the coastal zone and makes many specific recommendations. These recommendations not only identify areas requiring additional research and techniques of resource planning and management, but outline many "positive" programs specifically needed in Louisiana. Those programs

which might have application as compensatory projects under the Environmental Protection Plan are described briefly in section D of this chapter.

Included within the coastal zone, as studied and defined by the Advisory Commission, are all areas and sites presently under consideration for deep draft harbor and terminal development in Louisiana.

C. Procedures for Funding

1. Statute

The Deep Draft Harbor and Terminal Act directs the Authority to "[p]rovide procedures for the funding of projects..." (La. R.S. 34:3113 (J)(5)). This section of Chapter 5 suggests alternatives and options which might be adopted by the Louisiana Deep Draft Harbor and Terminal Authority to comply with this portion of their statutory responsibility.

Basically, the Authority must fulfill two responsibilities to provide proper funding procedures: first, they must determine the method, or methods, of generating revenues; and second, they must determine an efficient method of accounting and budgeting the revenues which may be generated.

2. Funding Alternatives

Many alternatives or options are available to the Authority as methods of generating revenues for funding compensatory projects. The Authority, as a subdivision of the State, could seek a direct appropriation from the legislature each year. Of course, if this method of obtaining revenues were selected, then budgeting of compensatory projects would

require State legislative approval every fiscal session.

Another method might be to require bonding of every activity deemed potentially disruptive to the environment. Under this method, the Authority would determine what activities require a bond, and also would specify the amount and type of bond required. Unfortunately, this method, if adopted as the sole method of funding projects, has a primary defect of barring the starting dates of compensatory projects to, at the earliest, the date bond money is finally recovered from the surety. Further, if monitoring and surveillance were considered compensatory projects, then, technically, these projects could not be started until after environmental damage occurred and funds became available. And without monitoring or surveillance, it would be difficult, if not impossible, to readily detect environmental damage or the cause of that damage. [Note, however, that the Authority could charge a set monitoring and surveillance fee to any party whose activities require such attention. Several other States have incorporated such a mechanism into their coastal protection legislation.]

One funding method could be to require a user fee paid according to product use of superport facilities. This fee could be based on volume of commodity flow, with a specified fee charged per barrel throughput for liquid or slurried products, and tonnage or some other standard measurement for other cargo. Or the fee could be charged on the basis of frequency and length of use, vessel tonnage, toxicity or other product characteristics, or any other basis totally unrelated to petroleum throughput volume or other cargo transferred through the superport facilities.

This use fee could be limited to a maximum total amount

contributed yearly into an environmental protection fund. For instance, when the total amount of use fees paid in any one year reached $X millions, then the use fee could be discontinued for the remainder of that year. Naturally, any fee could be limited to a reasonable amount, dependent on the environmental cost which is to be determined in accordance with La. R.S. 34:3113(J)(2). (See Chapter 2, C.) [Note that the Authority cannot engage in the handling of break-bulk or general cargo without the prior written agreement of the three deep water ports (the Board of Commissioners of the Port of New Orleans, the Greater Baton Rouge Port Commission and the Lake Charles Harbor and Terminal District) (La. R.S. 34:3110(D)).]

Another option open to the Authority could be to establish a licensing requirement over all facilities owned, operated, maintained, leased or otherwise within or under Authority jurisdiction. An annual license fee could then be collected from each applicant seeking the right to construct, operate, maintain, lease or otherwise undertake activities related to a deep draft harbor and terminal within the State. A set percentage or monetary amount of the revenues generated in accordance with this licensing power could then be dedicated for the funding of compensatory programs.

Additionally, revenues could be obtained by establishing an environmental use charge to be paid for any and all activities requiring construction or other types of disruption of the natural environment. These activities could range in scope from offshore platform and pipeline construction through all aspects of onshore development including pipelines and other transporting facilities affecting the environment. Such an

environmental use charge could probably be assessed, at least partially, prior to commencement of any construction or other activity potentially or actually harmful to the environment. An initial charge for the activity might be provided, with such additional charges as may become necessary to offset permanent environmental damages. Any such environmental use charge should be used for the purpose of funding compensatory projects. Naturally, if any activity indicated substantial and irreversible effects to the environment, the environmental use charge should probably be immediate discontinuance of the activity and repair of damages.

3. Accounting and Budgeting Funds for Compensatory Projects

The second basic responsibility of the Authority in seeking to provide funding procedures for compensatory projects is to determine the best method of accounting and budgeting such funds. If the Authority were to fund compensatory programs solely on the basis of a yearly appropriation from the legislature, this money could be budgeted into a yearly account and dispensed in accordance with the terms of the appropriation.

However, all other revenues derived by the Authority either through one or more license fees, environmental use charges or other charges could most efficiently be managed within a special budget established by the Authority. The most efficient method would seem to be the establishment of a special fund. (For purposes of this report, this fund will be referred to as the environmental protection fund.) Moneys in the environmental protection fund could be dispersed for any of the following purposes:

a. Administrative expenses, personnel expenses, and equipment

cost of the Deep Draft Harbor and Terminal Authority and the Louisiana Wild Life and Fisheries Commission related to the enforcement of, and compliance with, this Environmental Protection Plan, including reimbursement to other State and local agencies for such services and personnel as may be provided for the enforcement of and compliance with the Environmental Protection Plan;

b. All costs involved in the abatement of pollution related to the discharge of oil or petroleum products or their by-products and other pollutants covered by the Environmental Protection Plan and the abatement of other potential pollution hazards as may be authorized therein (This expenditure could be reimbursed by the party responsible for the polluting incident. The bond required by La. R.S. 34:3113(J)(4) might adequately furnish such reimbursements.);

c. All costs and expenses for cleanup and rehabilitation of water fowl, wildlife and fisheries, and other plant and animal species, whether performed by, or under the direction of, the Deep Draft Harbor and Terminal Authority or other State or local agency;

d. Sums allocated to projects of research and development designed to enhance and maintain the coastal environment as determined by the Louisiana Wild Life and Fisheries Commission, or other agency approved by the governor;

e. Establishment and maintenance of the projects suggested and developed in part D of this chapter and the preceding chapters 1, 2, 3 and 4 ; and

f. Any other purpose as may be later determined by the Authority.

Moneys in the fund could be subject to a maximum balance of a specified amount, or the amount could be unlimited. If the fund is limited to a maximum amount at the end of any fiscal year, the Authority would be presented with two alternatives: either charges which provide revenues for the fund could be discontinued; or, moneys remaining in the fund after the expiration of each fiscal year, in excess of the maximum limit, could be deposited in the general fund of the State. This latter alternative is provided for in La. R.S. 34:3106(B), if excess funds were to be treated as surplus revenue. However, if these surpluses were deposited in the General Fund of the State, the Authority should establish the following condition: that payments for cleanup expenditures and for damages to public property and other rights occasioned by an oil spill or other polluting incident be apportioned between the environmental protection fund and the General Fund of the State to assure full reimbursement of such damages, with the State guaranteeing such full reimbursement whenever such payments would exceed available moneys in the environmental protection fund.

If the fund were determined available for expenses incurred by the State or other parties for cleaning up discharges of oil or other polluting substances, then the Authority should be permitted to recover, to the use of the fund from the party or parties causing the discharge, jointly and severally, all sums expended therefrom. Recoveries resulting from cleanup expenses and damages due to an oil or polluting substance discharge should be apportioned between the Louisiana environmental protection fund and the State general fund so as to assure repayment in full of costs resulting from such discharges.

Requests for reimbursements to the environmental protection fund of the Authority and the State General Fund for the above expenditures, if not paid within thirty (30) days of demand, should be turned over to the Authority legal counsel, who, in cooperation with the Department of Justice, should undertake collection.

Upon petition of the person determined to be liable for reimbursement to the fund for abatement costs, the Deep Draft Harbor and Terminal Authority, in cooperation with the Attorney General's Office representing State interests, could, after hearing, waive the right of total reimbursement to the respective funds from such person, or persons, if it is determined that the occurrence was the result of either of the following:

- An act of war; or
- An act of government, either Federal, State or municipal.

4. Other Compensatory Provisions

a. Introduction

Regardless of procedures ultimately adopted to fund compensatory projects, or the accounting and budgeting methodology instituted to manage such funds, the Authority should review compensatory provisions that are developing in other jurisdictions. Recent developments in the national and international legal systems have extended legal coverage to many areas of the environment, requiring protection and the identification of acts of man causing adverse environmental impacts for which there must be compensation and adjustment. Many coastal States of the United States have begun to seek precautionary and preventive measures against the onslaught of environmental degradation, particularly where an activity is conducted which presents an immediate and substantial threat to the

quality of an environment as vital to mankind as a coastal region.

However, despite the feasibility of compensating the environment as demonstrated in other jurisdictions, the final responsibility rests with the local citizenry and public officials of the State, acting for and in the interest of all the public, to assure adequate and permanent protection of all renewable natural resources of Louisiana.

The following presents a short review of compensatory provisions which have been enacted or offered for enactment in other jurisdictions.

b. International

The International Convention on Financial Responsibility for Oil Pollution Damage, not yet signed by the United States, is the principal international agreement creating compensatory provisions.

This treaty establishes liability on private vessel owners for pollution damage caused by oil discharged from their vessels onto a nation's territory or territorial sea. Strict liability attaches unless a vessel owner can prove the discharge resulted from one of the following: an act of war or an inevitable natural phenomenon; negligence of a third party; negligence of a government responsible for maintaining lights or other navigational aids.

Liability is limited to $456.00 per ton of a vessel's oil carrying capacity, or $47,880,000, whichever is less. A vessel owner must deposit a sum of money equal to his total vessel tonnage, or a bank or insurance certificate for the same sum, with the court of a signatory nation. Signatory nations are required to maintain insurance

or security on all ships under their registry. Also, signatory nations must pass national legislation requiring all ships entering their ports, or calling at their offshore terminals, to have insurance or other security to the extent specified in the treaty.

Once a fund is established or a security deposited with a nation's court, no nation may claim any other assets of a vessel owner, nor may any vessel of an owner be arrested or seized. However, no owner is allowed to limit his liability for oil pollution damage occuring to a nation's territory if the oil discharge occurred through his willful negligence or with his knowledge.

Claims against a fund are to be distributed among claimants in proportion to their damage. The owner of a ship may rank equally with other claimants if he expended money to minimize damage after the polluting incident.

c. National

Nationally, this trend in law requiring compensation for disrupting or disturbing the environment has developed into several strong congressional enactments. The most thorough of these is found in the Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq. This act establishes a financial responsibility on vessels and vessel owners in the sum of up to $14,000,000, and on terminal operators in the sum of up to $8,000,000 for cleanup expenses which might result from spills of oil and other hazardous substances. This financial responsibility ordinarily is satisfied by providing a bond in the amount of the responsibility. The principal drawback of this law is that damages to public or private properties, including fisheries, are not considered an

expense of cleanup, and therefore are not recoverable under the financial responsibility provisions of the Act. Also, independent cleanup expenses incurred by private property owners would go uncompensated. Another drawback is evident if expenses covered exceeded the amount of the bond provided by the vessel or terminal operator. Then, a claimant would be required to seek recovery of additional expenses and damages through the time-consuming procedure of petition in an appropriate trial court.

d. Coastal States

Several coastal States, principally those located along the Eastern seaboard, have enacted some form of coastal protection legislation.

This legislation consists of two general classes. The first class is penalty legislation, which provides for a fine after the prohibited activity has been committed. A major draw-back of this type of legislation is that it does not protect against the occurrence of the act nor adequately compensate for environmental damages. The other general class of legislation normally provides for a bond or other funding device to protect against environmental degradation and covers immediate expenses of cleanup.

New Jersey offers a good example of penalty legislation. (See N.J.S.A. 58:10-23.1-10-23.10.) In that State, there is a penalty of up to $3000 for not reporting a prohibited discharge. The limit of liability for cleanup expenses is set at $14,000,000 -- the same level as that established under the Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq. However, no bond, fund or other funding mechanism is established to compensate for environmental damages. For this reason, New

Jersey is included for illustrative purposes only and is the only State example cited in this report of purely penalty legislation. It is believed that the Louisiana Act anticipates a more thorough plan of environmental compensation and coastal protection.

Maine and Florida enacted the most comprehensive legislation establishing coastal protection funds, and are the two most representative of the current trend in State legislation regarding liability for oil spills. However, many other States have compensatory legislation or pending legislation and are included in this review.

(1) Maine

Maine enacted the Oil Discharge Prevention and Pollution Control Act (38 M.R.S.A. §541-557) establishing an Environmental Improvement Commission and a coastal protection fund. The Maine Commission is charged to oversee oil terminal facilities, with the coastal protection fund providing the requisite financing of Commission expenses and costs of cleanup, including damages to State and private property owners. An annual license fee of 1/2 cent is charged for every barrel of petrochemical product transferred through terminal facilities. The Maine coastal protection fund is limited to $4,000,000, plus expenses of the Environmental Improvement Commission. Strict liability for oil spills is imposed on terminal operators, with violators being required to reimburse the State for cleanup. A Board of Arbitration is empowered to decide disputes raised by third parties.

In Portland Pipe Line v. Environmental Improvement Commission, 5 E.R.C. 1513, the Maine Supreme Judicial Court upheld the sections of the Act creating the Coastal Protection Fund and providing

for expenditures from it and reimbursements to it (38 M.R.S.A. 551 and 552) as being non-violative of the United States or Maine constitutions. The Court maintained that the Act did not violate due process, equal protection, the import-export clause, the commerce clause nor the admiralty clause of either constitution. (See also State of Maine v. Tamano, 5 E.R.C. 1379).

(2) Florida

The Oil Spill Prevention and Pollution Control Act of Florida (F.S.A. §376.01-376.21) establishes in the Department of Natural Resources a licensing and administrative authority concerning pollutant transferrals generally. A coastal protection fund was erected to ensure administrative and other expenses of the department and all cleanup costs and expenses incurred by the State for unauthorized pollutant discharges. Florida imposes strict liability on a terminal licensee, including vessels destined for or leaving a licensed terminal facility. The party determined by the department to be responsible for an unauthorized discharge is liable to reimburse the coastal protection fund for all costs incurred as a result of such discharge. No license fee based on volume of pollutant off-loaded or transferred through a terminal is charged. The fund is limited to five million dollars ($5,000,000), and includes all license fees (no annual license fee may exceed $500), penalties, and other fees and charges, including administrative expenses, and cost of removal of discharges of pollution.

The constitutionality of the Florida statute recently was upheld by the U.S. Supreme Court in Askew v. American Waterways Operators, Inc. __ U.S.__, __S.Ct.__, __L. Ed.__[5 E.R.C. 1209] (1973).

Mississipppi will be considering a new proposal during their 1974 legislative session concerning offshore terminals in that State. This proposal, prefiled SB 1593, embodies practically every environmental protection provision of the Maine and Florida statutes, including the power of certification, a license fee based on volume, and a coastal protection fund.

(3) Maryland

In 1971, the Maryland Legislature created the Environmental Trust Fund (Ann. C. Md., Art. 66C, §766-771). Revenues for the fund come from a surcharge tax on electrical energy generated within the State. The initial assessment is 0.1 mill per kilowatt hour.

The fund is to be administered by the Secretary of the Department of Natural Resources. The fund must be used to develop and implement a continuing research program for electrical power plant site evaluations and related environmental and land use considerations in and about Chesapeake Bay.

The Department is also authorized to use the fund to implement a long-range environmental evaluation of power plant sitings. Upon receipt of possible and proposed sites for power plant construction over a ten-year period, the Department must prepare a preliminary environmental statement on each of the possible and proposed sites.

Further, the Department is required to publish a biennial report of the culmulative environmental impact of all electric power plants in the State. The report is financed by the Environmental Fund.

The Secretary of the Department of Natural Resources may acquire in the name of the State a sufficient number of approved sites to satisfy the projected electrical requirements of the State. Payment for the property is to come from the environmental fund. Electric companies may then lease or purchase the approved sites at a fair market value. An electric company buying or leasing any site acquired through the Department is exempted from all county or local zoning regulations regarding the site.

The Maryland legislature indicated grave concern over proper development of research projects and the protection of Chesapeake Bay and bay coastal regions by including a list of specified projects in their statute. To fully appreciate this legislative concern, and by way of example, this list is reproduced as follows:

(a) General biological and ecological baseline studies, including but not limited to appropriate environmental studies of the biology, physics, and chemistry of the Chesapeake Bay and tributaries; sediment; biological surveys to determine and identify essential marine organism nursery areas of the State's waters, including the Chesapeake Bay and tributaries; epibenthos; bottom species; crab; fin fish and human use studies,

(b) Research to assist prediction, including but not limited to experimental research, field and laboratory, and the development and provision for physical, mathematical, and biological modeling tools to assist in and to evaluate the effects of variation of natural waters resulting from electric generating plant operations including changes in temperature, oxygen levels, salinity, biocides, radionuclides

and "heavy" metals and to also include the collection and organization of relevant information and data necessary to the operation of physical, mathematical, and biological modeling tools,

(c) Provisions for monitoring the operations of existing and hereafter established electric power facilities located in the State and which shall include, but not be limited to determination of the actual distribution and effect of temperature, salinity oxygen, radionuclides and heavy metals, biological effects; radiological, heavy metal and biocide effects; recreational and commercial fishing gains and human health and welfare effects,

(d) Research and investigations relating to the effects on air resources of electric power plants and the effects of air pollutants from power plants on public health and welfare, vegetation, animals, materials and esthetic values, including baseline studies, predictive modeling, and monitoring of the air mass at proposed sites and sites of operating electric generating station, evaluation of new or improved methods for minimizing air pollution from power plants and other matters pertaining to the effect of power plants on the air environment,

(e) An environmental evaluation of electric power plant sites proposed for future development and expansion and their relationship to the waters and air of the State,

(f) Evaluation of the environmental effects of new electric power generation technologies and extraordinary systems related to power plants designed to minimize environmental effects,

(g) The determination of the potential for construction use(s) of the waste energy to be released at proposed electric power plant sites,

(h) Analysis of the socio-economic impact of electric power generation facilities on the land uses of the State.

Many, if not all, of the foregoing projects are as applicable to the Louisiana marsh-estuarine situation and development of a superport in our coastal region as to power plant development in Maryland.

Other states which have followed the Maryland example and enacted power plant siting legislation include New York, Washington, Arizona, Oregon, Connecticut and Vermont. The essential quality of these laws is that many states are responding to the need to insure optimum industrial growth with minimum environmental damage.

The importance of such new laws to Louisiana is to tell us, by analogy, that all forms of industrial growth must be regulated and planned if a harmonious pattern of living is to be ensured in the State. These siting and funding programs should serve as a model for controlling both the direct and ancilliary superport development likely to occur in Louisiana.

(4) Massachusetts

The Division of Water Pollution Control of the Commonwealth of Massachusetts is empowered to license all terminals that operate for the purpose of receiving, loading, or discharging petroleum products, and to issue rules and regulations for the safe operation of these facilities. (Ann. C. Mass. Ch. 21:50-50B). The Division may inspect hoses, gaskets, tanks and pipelines and may require safety equipment for all terminals in the State. A reasonable fee may be charged to terminal owners for inspections by the Division. The fine for operating a terminal without a license is $100 a day.

Massachusetts law requires every oil terminal owner or operator to employ a trained crew and have a plastic or wooden boom capable of encircling any ship or vessel depositing oil into the terminal tanks to be used for containment purposes whenever oil is spilled. For repeated spillage, the Director of the Division may order the operator to encircle every ship unloading oil with a boom for safety purposes. The owner or operator of a terminal must remove all oil within a boom before the ship leaves the wharf. Violators of any provision of this law shall be fined up to $1000 and may suffer revocation of the license.

Vessels entering State waters for the purpose of discharging or receiving oil must post a bond of $25,000 payable to the State. If the Division determines oil has been discharged, the bond shall be forfeited to cover the costs incurred by the Division to remove the oil.

(5) Washington

Washington's pending legislation suggests a tax on first delivery oil stored at any oil terminal in the State for longer than 48 hours. The initial tax would be 2¢ per barrel of oil, with the tax being subsequently reduced to 1¢ per barrel after a statutorily specified date (December 31, 1975, is the suggested date). One cent of the tax would be dedicated to the Washington Department of Ecology to support oil monitoring, coordination and other duties related to the oil pollution control program, including oil research programs. A tax of 1¢ would to into a coastal protection fund for cleanup of oil spills. This latter 1¢ portion would be discontinued on the same date specified above.

D. Projects to Compensate the Environment.

1. Statute

La. R.S. 34:3113(J)(5) states that there shall be a funding of "projects ... which shall compensate the coastal environment for loss that may be sustained through stresses on the environment created by the Authority Development Program." As projects to compensate the environment are not further enumerated in the statute, the formulation of such projects should be regarded as the responsibility of the Authority and should be provided for and adequately described in the Environmental Protection Plan.

2. Alternatives

In formulating the projects, several alternatives are open to the Authority. First, the Authority could be the sole determiner of all compensatory projects. Second, the Louisiana Wild Life and Fisheries Commission, as primary enforcer of regulations and protector of renewable resources in the coastal zone, could be allowed to determine compensatory projects. A third alternative would be to create an advisory group representing diverse interests to determine the projects and the priority placed on those projects.

3. Creating an Advisory Group

The creation of an advisory group is considered the more advantageous alternative and is developed in the following recommendations. The most desirable advantage is balanced decision-making. By permitting introduction and consideration of diverse viewpoints and the representation of varied ideas for coastal environmental protection, a well-rounded schedule of compensatory projects should evolve. Further, an advisory group would be better able to coordinate joint and single

project efforts of the Authority and any other agency, or group of agencies, directly involved in accomplishing the directives of the project.

The advisory group might be constituted in the following manner: The three directors could form a nucleus for the group. Other State agencies that might be included are the Department of Public Works, the State Planning Office, the State Parks and Recreation Commission, the State Land Office, and the Governor's Council on Environmental Quality. Naturally, any other State agency expressing an interest should be permitted a voice in the recommendations of the advisory group. Local government (parish or municipal) also could be represented on the group whenever a project or other activity is considered which might affect the planning or other jurisdiction of such local governing body. Private land owners and other interested members of the public could also be allowed a voice in the advisory group.

In order to develop compensatory projects more efficiently, there are a number of duties which should probably be performed at the outset by the group charged with compensatory project determination.

An initial duty might be to develop objectives for the projects. These objectives might concern creating greater recreational uses of, and development of recreational facilities in, the Louisiana coastal region. Another objective might be to reduce erosion and land loss, or to develop a concentrated science study program designed to enhance man's knowledge of coastal processes. One objective might be to increase appreciation and understanding of the coastal region by creating a comprehensive program of education and information dissemination.

Another duty of the body charged with the task of determining

compensatory projects could be to define statutory terms, such as "compensate" or "projects."

A third duty could be to develop a list of potential or possible compensatory projects, with an assigned order of priority and a cost estimate for conducting the project. This duty could be preformed in light of the discussions contained in Chapters 1, 2, 3 and 4 of this Environmental Protection Plan report. The list of projects could be developed in the course of public hearings similar to the procedure presently being used by the Authority for adoption of rules and regulations. (See Louisiana Administrative Procedure Act, La. R.S. 49:951-966.)

This list of projects, with order of priority and cost estimates, could be circulated to all State agencies, whether or not represented in an advisory capacity, to appropriate Federal agencies, and to interested members of the public, including institutions of higher learning. The list could be augmented and the order of priority could be adjusted in view of comments received from the foregoing parties.

Another function of such advisory body might be to initiate procedures with other agencies having a special interest in the coastal zone for coordinating joint or individual efforts in accomplishing the compensatory projects.

The final function or duty to be considered is that of project timing. The entire compensatory program should be scheduled to begin no later than the same day as beginning the first physical activity which may produce an environmental stress. Projects of first priority should begin immediately. Projects of lesser priority should be initiated

as revenues become available. As project budgeting could be considered a duty of the advisory group, they also could be responsible for scheduling a starting and ending date for all projects. It should be noted, however, that some types of projects will not be susceptible to such precise timing. Some projects may depend on damage being sustained to the environment, while another project may be designed to run continuously.

4. Projects

a. Losses

In developing compensatory projects, there first should be inquiry into losses which "... may be sustained..." to the environment (La. R.S. 34:3113(J)(5)). Losses probably should include both potential losses, which could result from any activity conducted under the Authority Development Program, and losses actually sustained to the environment as a result of such activities.

Potential losses could be coordinated into projects to study and establish techniques for preventing or minimizing possible damage occasioned by a specified activity, or set of activities. (See Chapters 1, 2, 3 and 4 for activities and project ideas which might be adopted to compensate the environment for potential losses.)

Potential and actual losses could be mitigated by establishing projects of environmental maintenance designed to provide replenishment to coastal and marine areas adversely affected by any activity under the Authority Development Program. A species bank is an example of such a replenishment project. Other projects could be established to study short-term and long-term effects of any activity resulting directly or

indirectly from the Authority Development Program. (See Chapters 1-4 for activities and effects which should be studied.)

"Stress" could be interpreted as including every possible stress which is or may be created by the Authority Development Program. This would apply to stresses that are directly and indirectly associated with construction, operation and maintenance of deep draft harbor and terminal facilities.

b. Land and water projects

As a minimum, a quid pro quo concept could be used. For example, if 500 acres were destroyed by the Authority Development Program, then 500 acres of similar consistency and productivity could be purchased and set aside as a nursery-sanctuary area. Or this type of compensatory project could be extended to provide a more comprehensive coverage of land and water areas. In a compensatory lands project, lands providing any linkage in the life-cycle or food web of recreationally or commercially important wildlife or fisheries and which are destroyed or altered as a result, direct or indirect, of any aspect of the Authority Development Program, would be compensated. This compensation could occur in the following situations and methods:

- In cases of permanently destroyed lands, there should probably be maintained and established a species bank of similar acreage, species and environment as that of the land which was permanently destroyed. Monetary damages could be repaid in like sum.

- There could be a project of rehabilitation and rejuvenation of lands which are only temporarily non-productive or dormant by enhancing and refurbishing the area. Species being maintained in a species bank could be used to assist in this project.

Compensatory projects applicable to lands could be similarly applied to waters. Coastal waters providing any linkage in the life cycle or food web of recreationally or commercially valuable wildlife or fisheries, the quality and value of which is destroyed or altered as a result, direct or indirect, of any aspects of the Authority Development Program, should probably be compensated. This compensation could occur in the following situations and methods:

- For permanently destroyed or altered water areas, compensation could be in the form of a monetary payment based on the impaired value of commercial and recreational fisheries and wildlife as determined by the Authority. This monetary compensation could be paid on a yearly basis until the permanently destroyed or altered condition is no longer extant.

- Compensation for temporarily destroyed or altered waters could take the form of a monetary payment based on damages established by the expertise employed by the Authority. Monetary payments could be decreased in proportion to the improvement in such temporary condition as determined by the Authority.

In determining the amount of loss, secondary losses such as lost recreation and commercial fisheries should probably be considered. However, a question requiring decision is whether secondary economic

development resulting from the establishment of a superport and the stress of such development on the environment should be considered. This could require an immediate determination as to the scope of meaning to be given the term "Authority Development Program."

c. Positive Projects

The Louisiana Advisory Commission on Coastal and Marine Resources, in its final report entitled Louisiana Wetlands Prospectus (1973), proffered many recommendations concerning positive programs which should be established in the coastal zone. These recommendations believed useful in developing projects to compensate for loss caused by deep draft harbor and terminal construction, operation and maintenance are reviewed hereafter.

First, it was recommended that coastal resources programs give priority to the orderly use, protection and enhancement of the coastal zone in order to maintain their productivity and essential role in sustaining the State's fisheries and wildlife resources and recreational uses.

Certain trends in the coastal zone were then noted by the Commission which might deserve periodic monitoring or possibly the development of a study program. These trends were identified as: pollution and decline of the oyster industry, decrease in shrimp catch per boat, saltwater intrusion, and the general subsidence of wetlands.

It was suggested that many compensatory projects could be

incorporated into programs of study and research into characteristics of the coastal region about which insufficient information currently is available. There data could be organized and disseminated through an educational program designed to inform the public, and to encourage assistance and cooperation in maintaining and enhancing the integrity of the coastal environment. Suggested studies and programs include: water flow, circulation, quantity and quality; impact of combined uses on the total marsh-estuarine ecosystem; site suitability for proposed land uses; encourage urban and industrial growth in development corridors; multiple and economically diversified uses.

The Advisory Commission encouraged full and open participation of the public in reviewing coastal problems and proposals. This could be accomplished by holding public hearings and developing a program of public education.

The following recommendations were offered by the Advisory Commission with respect to projects concerned with the planning and management of growth and the conservation of the coastal zone:

- Building in the coastal zone should not occur in undeveloped areas; feasible development corridors should be designated in already disturbed stable areas;
- Discourage flood control in undeveloped wetlands; development of water projects which would maintain the quality of the wetlands;
- Regulate draw-down of ground water and study feasibility of refurbishing freshwater aquifers;

- Maximum surveillance and enforcement of water quality standards;
- Pipelines should be laid along already disturbed routes; pipelines should be monitored routinely; multiple use of existing pipelines and rights-of-way;
- Critical study of necessity of new navigation canals with view to minimizing environmental impact;
- Study and use of surface-effect vehicles (air-cushion vehicles and hovercraft) along with helicopters to transport equipment and personnel through the wetlands;
- Soil studies;
- Establish the maximum permissable expansion of superport facilities before the cumulative or aggregate effect would begin to adversely affect the coastal ecosystem;
- Study and encourage land-use planning for area to affect superport;
- Initiate and design an aggressive open space program, with identification of areas in proximity of onshore development which could be designated open space areas;
- Establish basic programs of long-term research;
- Evaluation of wetlands; and
- Assist in studying and developing mariculture programs and water resource management programs.

The Authority, as a representative agency of the public, should seek to stimulate public interest in, and knowledge of, the

environment into which may develop deep draft harbor and terminal facilities. This could be accomplished by fully supporting and actively participating in a comprehensive program of public education. The Authority could include among compensatory projects several programs of public educational benefit.

For instance, there could be a dissemination of data obtained from study and research projects to elementary, secondary and vocational schools and to institutions of higher learning.

The Authority could create, or assist in the creation of, coastal and marine science instruction and research facilities at onshore and offshore sites, to be available to State colleges, universities and high schools.

In the interests of Louisiana history, the Authority could adopt a project to establish, or assist in the establishment of, a coastal wetlands amenities museum depicting Louisiana coastal culture.

Many special programs were recommended by the Advisory Commission which might be developed by the Authority into compensation projects. As an example, the Authority could develop and encourage the development of, a comprehensive recreation program by working in close cooperation with the State Parks and Recreation Commission, and regional and local planning commissions or other governing bodies.

Also, through the establishment of compensation projects, the Authority could assist with the following studies: use of marsh for waste treatment; controlled deposition of sediment; alternate uses of offshore platforms; and major water resource projects.

However, whatever compensatory projects may be undertaken by the Authority, every effort should be coordinated with proper coastal zone management planning for Louisiana. The Authority should follow precisely the guidelines and other assistance available from Federal agencies, such as the Office of Coastal Environment in the National Oceanic and Atmospheric Administration (NOAA).

E. "... Louisiana Wildlife and Fisheries Commission or any agency..."

1. Statute

This final section of Chapter 5 concerns the language in La. R.S. 34:3113(J)(5) which states that "the funding of projects [is] to be paid for by the Authority to the Louisiana Wildlife (sic) and Fisheries Commission or any agency designated by the Governor..."

2. The Authority

The first obvious intent to be derived from this portion of the statute is that the Authority is directly responsible for funding the compensatory projects. Further, this funding must be paid to whatever agency conducts the project. It apparently is not necessary for the Authority to conduct all projects; however, the Governor conceivably could designate the Authority as being responsible for one or more, if not all, projects.

3. "... Louisiana Wildlife and Fisheries Commission..."

Naming the Louisiana Wild Life and Fisheries Commission in the statute is easily justified. For many years the Louisiana Wild Life and Fisheries Commission has been the traditional guardian of the coastal environment, often furnishing the only personnel available for law

enforcement in uninhabited coastal areas. The Commission is the manager of Louisiana's refuges and game management areas and is the best agency for analysis of the impact of activities on fish and wildlife resources.

However, the Authority should not look to the Louisiana Wild Life and Fisheries Commission as the only agency interested in compensatory projects. The organizational structure, duties, personnel and resources of the Commission often would preclude them from performing many of the projects suggested in section D of this report. Therefore, it would seem advisable for the Authority to look to other agencies which might have a special interest in a particular project, or series of projects, in addition to the Louisiana Wild Life and Fisheries Commission. One agency need not be responsible for the performance of all projects.

4. "...any agency..."

Although the statute authorizes any properly designated agency as being qualified to perform a project, this qualification often depends on consent of the agency, or just the ability of the agency to perform a project within the limits of its stated policies, facilities, personnel and established rules and regulations.

The Governor, should seek the advice and counsel of the Authority, when assigning performance of a compensatory project to an agency other than Louisiana Wildlife and Fisheries. Further, in many instances, one project might require the efforts of two or more agencies.

An agency which might be considered specifically for water resource development projects is the Department of Public Works (with the possible assistance of the U.S. Army Corps of Engineers). For projects in which the principal objective involves only study and analysis, any

agency possessing the requisite research capabilities might be designated to conduct the project. This could include university-based research organizations, and agencies such as the Stream Control Commission or the Department of Health.

The Parks and Recreation Commission would be the one ideally suited to oversee the design and implementation of all recreational development projects.

Further, if a project were to involve lands under private ownership, the owner could be granted some voice in the performance of the project. For instance, private land owners would be directly involved in any project concerning the establishment of open-space in the coastal zone.

Finally, the Louisiana Deep Draft Harbor and Terminal Authority might be expected to assume administration and control of the overall Authority Development Program if it found improper, incomplete or ineffective compliance with Environmental Protection Plan provisions by any party concerned with any aspect of the Program. Presumably, the administration and control could extend to all aspects of the Authority Development Program from siting and construction through operation and maintenance of deep draft harbor and terminal facilities, including development influenced by the existence of such facilities. Such action by the Authority might be essential to assuring accomplishment of the objectives evidenced by the promulgation of regulations contained in the Environmental Protection Plan and designed specifically to protect the Louisiana coastal and marine environment.

CHAPTER 6

LEGAL REQUIREMENTS OF GOVERNMENTAL AGENCIES

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3. Department of Conservation
4. Department of Health
5. Department of Public Works
6. Department of Wild Life and Fisheries
7. Environmental Protection Section (Office of the Attorney General)
8. Governor's Council on Environmental Quality and Citizens Advisory Board
9. Louisiana Advisory Commission on Coastal and Marine Resources
10. Louisiana Coastal Commission
11. Louisiana Deep Draft Harbor and Terminal Authority
12. Louisiana Stream Control Commission
13. Public Service Commission
14. State Land Office
15. State Mineral Board
16. State Parks and Recreation Commission
17. State Planning Office

E. Local Government

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CHAPTER 6

LEGAL REQUIREMENTS OF GOVERNMENTAL AGENCIES

A. Introduction

Chapter 6 of the L.S.U. Environmental Protection Plan report for the Authority Development Program of the Louisiana Deep Draft Harbor and Terminal Authority is compiled in accordance with the statutory directives of La. R.S. 34:3113(J)(6). Those directives are set forth as follows:

> "Analyze ongoing programs of the Federal, State and local governments designed to protect the coastal environment and to insure that there is no unnecessary duplication of effort and to insure that cooperation and coordination of environmental protection measures are achieved. The opinion of all agencies with a responsibility for monitoring the coastal environment shall be sought with regard to this Coastal (sic) Protection Plan prior to its promulgation, to determine if there are incompatibilities between specific provisions of this measure and the requirements of other rules and regulations." [La. R.S. 34:3113(J)(6)]

This chapter is organized into five parts to facilitate locating pertinent ongoing programs at all governmental levels. Part A is intended as a summary of the data organization of the more substantive Parts B, C, D and E. International organizations which conduct programs that could influence development of a deep draft harbor and terminal, and in which the United States is a participating member, comprise the contents of Part B. Part C concerns agencies of the Federal government and is entitled "Federal Government." Parts D and E provide similar coverage of State and local governmental authorities and programs.

Each agency forms a separate section under the appropriate Federal, State or local part. Of these agency sections most are divided into distinct subsections to provide a basic breakdown of the agency, including an analysis of ongoing programs of that agency. These subsections are entitled: Function, Authority, Procedure and References. The following is a summary of the contents of each subsection:

Function. A brief description of the scope of activities over which the agency performs some function is included.

Authority. Each point in the development of a deep draft harbor and terminal at which the agency could be expected to participate is discussed.

Procedure. Each step, including requisites, for obtaining certification, license, permit or other documental agency approval is provided.

References. All official publications, forms and statutes believed applicable to the operation of a deep draft harbor and terminal are listed.

The Act requires that the "... opinion of all agencies ... be sought ..." with regard to the Environmental Protection Plan prior to its promulgation [La. R.S. 34:3113(J)(6)]. In accordance with this requirement, it is probably the duty of the Louisiana Deep Draft Harbor and Terminal Authority to deliver to all named governmental agencies a copy of Environmental Protection Plan proposals in advance of public hearings. Opinions could be requested at that time, and might provide useful assistance in coordinating future port activities.

As stated previously, Part B gives basic coverage to international organizations in which the United States is a participant. Only two organizations are listed, both being composed of United Nations members and providing only consultative services.

Part C analyzes Federal agencies and programs having apparent influence on coastal environmental matters believed closely associated with the Authority Development Program. However, it should be noted that when this report was written no Federal legislation or international convention provided specific authorization for construction of a deep draft harbor and terminal beyond the territorial waters of a coastal sovereign. For this reason, each analysis contains only responsibilities and duties of Federal agencies as such exist under the pre-superport legal structure.

Among Federal agencies, pollution inspection beyond three miles from the baseline is conducted almost exclusively by the U.S. Geological Survey. However, the Bureau of Land Management maintains a small environmental protection division which monitors substantial oil spills. Also, the Environmental Protection Agency is expanding its programs and soon may participate substantially in environmental affairs beyond territorial sea limits.

The Department of the Interior administers all public lands of the United States. Included among public lands are those lands comprising the seabed and subsoil of the outer continental shelf beyond the limits of the U.S. territorial sea. Administration of outer continental shelf lands is divided between two agencies within that department. The Bureau of Land Management conducts mineral lease sales for mineral exploration and exploitation, while the U.S. Geological Survey regulates certain aspects of engineering and site location for mineral lease operations.

Activity affecting navigation or the navigability of the U.S. waters must have approval of the U.S. Army Corps of Engineers, whether within or without the territorial jurisdiction of Louisiana or the United States. Structures on the outer continental shelf also require prior approval from the Corps of Engineers, as well as the U.S. Coast Guard.

Regulations regarding safety, oil and hazardous substance pollution, and navigation of vessels to and from ports of entry of the United States are promulgated by the U.S. Coast Guard. The Coast Guard also maintains a "Strike Force Team" for oil and hazardous substance cleanup in compliance with national and regional contingency planning. Currently, the Coast Guard is under the administration of the Department of Transportation.

The Environmental Protection Agency administers many recent Federal environmental protection laws, including the Federal Water Pollution Control Act (33 U.S.C. 1151) and the Clean Air Act (42 U.S.C. 1157). All minimum Federal air and water pollution standards are issued by the EPA. State air and water implementation plans must have approval of the Administrator of the Environmental Protection Agency before the State can exercise jurisdiction over discharges and effluents within its boundaries.

Pipelines are regulated by several agencies. Outer continental shelf rights-of-way applications must be approved by the U.S. Geological Survey for private pipelines and by the Bureau of Land Management for common carrier pipelines. Oil pipeline charges and services are regulated by the Interstate Commerce Commission, while charges and services for gas

pipelines are regulated by the Federal Power Commission.

Vessels require certification from the U.S. Coast Guard, the Federal Maritime Commission and the Maritime Administration. These certificates concern safety and sanitary apparatus and financial responsibility as provided in the Federal Water Pollution Control Act. Roadsteads, moorages, and fairways require Coast Guard consent as to location. Compliance with Coast Guard promulgated Rules of the Road is required for vessel operation. All harbor and navigational areas and problems associated therewith are coordinated through the Coast Guard and the Corps of Engineers.

Part D is concerned with existing agencies of State government, many of which could have an interest in some aspect of the Authority Devleopment Program.

The principal State enforcement-inspection agency available to coastal areas of Louisiana is the Louisiana Wild Life and Fisheries Commission. This agency is closely associated with the Deep Draft Harbor and Terminal Authority in many respects. For instance, funds must be paid by the Authority to the Commission to finance projects approved by the Commission in accordance with La. R.S. 34:3113(J)(5). (See Chapter 5 of this report for discussion of compensatory projects.) Among other projects to be developed is the enforcement of environmental requirements throughout all stages of the Authority Development Program from design and site selection criteria through ultimate operating procedure and facility expansion.

Primary approval of pipeline rights-of-way applications is vested in the Department of Public Works. This department has been authorized, by agreement of the governor and other State agencies, to register State

approval of rights-of-way as required by the U.S. Army Corps of Engineers prior to issuance of a permit to cross any navigable water body within the State.

Oil transported into and through the State by pipeline must be reported to the Louisiana Department of Conservation. This report must include quantity, origin and destination of such oil.

Lease sales and rights-of-way across public lands of the State are controlled by the State Land Office. This office must work closely with the Louisiana Wild Life and Fisheries Commission and the Deep Draft Harbor and Terminal Authority, when leasing public lands for superport development (La. R.S. 34:3108).

State air and water implementation plans are under the direct jurisdiction and enforcement of the Air Control Commission and the Stream Control Commission.

All State agencies have expressed an interest in developing new sources of petroleum to supply the Louisiana petrochemical industry. Many agencies believe such additional sources will encourage the expansion of refining capacity of such industry in south Louisiana.

Local agencies at the parish and municipal level are contained in Part E. Organization of agencies in Part E is identical to that in Parts C and D.

Of primary jurisdictional interest during initial stages of deep draft harbor and terminal development is the parish port authority. Existing facilities erected by a parish port authority normally would remain under its jurisdiction. However, such parish authority could elect voluntarily to allow acquisition of these pre-existing facilities by the Louisiana

Deep Draft Harbor and Terminal Authority. Further, jurisdiction of the parish and State harbor and terminal authorities could conceivably be concurrent within the boundaries of the parish. However, if jurisdictional questions are not sufficiently clarified by new legislative enactment, resolution of these issues may ultimately require litigation.

In concluding this introductory part, it is suggested that an appendix or technical reference binder be maintained on all agencies which could influence some aspect of the Authority Development Program. It was not deemed advisable to compile such an appendix in this instance due to the nature of the L.S.U. publication and the status of the law concerning deep draft harbors and terminals. Further, due to the propensity to change noted in statutes, rules and regulations and in agency procedures, it is suggested that these types of materials be periodically updated and revised in accordance with provision changes. Such action would assure current and timely compliance with applicable changes in the law and more efficient coordination and cooperation between the Authority and other agencies.

B. International Organizations

1. Intergovernmental Maritime Consultative Organization

a. Function

The Intergovernmental Maritime Consultative Organization (IMCO) functions in a consultative and advisory capacity concerning international shipping. It also exercises the depositary functions of the International Convention for the Prevention of Pollution of the Sea by Oil.

b. Authority

IMCO is to encourage, among other things, the general adoption of the highest practicable standards in matters concerning maritime safety and efficiency of navigation.

This international organization, established by the Convention on the Intergovernmental Maritime Consultative Organization, provides the machinery for establishment of international agreements, regulations and other instruments, including recommendations and information exchange among signatory nations of the Convention.

Intergovernmental Maritime Consultative Organization consists of an Assembly of all member nations, a council, a Maritime Safety Committee and subsidiary organs, and a Secretariat. Of principal concern to deep draft harbor and terminal environmental operations is the Maritime Safety Committee. This Committee is composed of fourteen member nations, not less than eight of which are the largest ship-owning nations. The United States numbers among the members of this Committee.

Duties of the Maritime Safety Committee include consideration of the following matters:

(1) Aids to navigation;

(2) Construction and equipment of vessels;

(3) Crew safety;

(4) Rules for the prevention of collisions;

(5) Handling of dangerous cargoes;

(6) Identification of noxious and hazardous cargoes;

(7) Maritime safety procedures and requirements;

(8) Hydrographic information;

(9) Log-books and navigational records;

(10) Marine casualty investigation;

(11) Salvage and rescue; and

(12) Any other matters directly affecting maritime safety.

Due to the long elapse of time between meetings, of not only the IMCO Assembly and Maritime Safety Committee, but of international organizations generally, and the subsequent delay of acceptance by nations in the world community, development of comprehensive and substantive international conventions is often a slow and tedious process. However, several multilateral treaties have resulted from IMCO efforts and are listed in the reference subsection below.

IMCO is expressly authorized to consult and co-operate with the following organizations:

(1) United Nations;

(2) Specialized agencies of the United Nations in matters of common concern;

(3) Inter-governmental agencies which are not specialized agencies of the United Nations but whose interest and activities are related to IMCO purposes; and

(4) Non-governmental international organizations.

Comment is reserved as to whether the Deep Draft Harbor and Terminal Authority, as a subdivision of the State of Louisiana, qualifies as an intergovernmental agency or a non-governmental international organization. The term "State" in international law refers to the

national sovereign and not a regional (i.e., Louisiana) governing authority.

c. Procedure

The procedure for adopting international provisions governing matters of maritime safety is as follows:

(1) Representative of member nation submits comments, recommendations or proposals to the Maritime Safety Committee;

(2) Committee reviews and circulates proposals for comment among member nations;

(3) Committee drafts recommendations and submits to Council;

(4) Council transmits recommendations to Assembly;

(5) Assembly receives recommendations and votes acceptance or otherwise;

(6) Recommendations are then subject to acceptance by governments of member nations.

Comments and suggestions which might be proposed on behalf of the Louisiana Deep Draft Harbor and Terminal Authority should be submitted to the U.S. representative in IMCO.

d. References

Convention on the Intergovernmental Maritime Consultative Organization, 9 U.S.T. 621, T.I.A.S. 4044, 289 U.N.T.S. 48.

Convention on Facilitation of International Maritime Traffic, 18 U.S.T. 410, T.I.A.S. 6251, 591 U.N.T.S. 265.

Convention on the Prevention of Pollution of the Sea by Oil, 12 U.S.T. 2989, T.I.A.S. 4900, 327 U.N.T.S. 3.

International Convention for the Safety of Life at Sea, 16 U.S.T. 185, T.I.A.S. 5780, 536 U.N.T.S. 27.

2. Governing Council for Environmental Programmes

a. Function

The Governing Council for Environmental Programmes (Governing Council) functions in an advisory capacity to the United Nations and to intergovernmental bodies on environmental activities and the world-wide environmental situation.

b. Authority

Programs of the Governing Council for Environmental Programmes are directed primarily toward assisting developing nations in controlling new and existing sources of pollution. However, there is established, under the administration and control of the Governing Council, a financing project entitled the Environment Fund. The Environment Fund may be used for financing the following regional and global programs:

(1) monitoring, assessment and data-collecting system;

(2) improvement of environmental quality management;

(3) environmental research;

(4) information exchange and dissemination;

(5) public education and training;

(6) assistance for national, regional and global environmental institutions;

(7) promotion of environmental research and studies for the development of industrial and other technologies best suited to a policy of economic growth compatible with adequate environmental safeguards;

(8) such other programs as the Governing Council may decide upon.

An Environmental Coordinating Board, within the organizational framework of the Governing Council, is charged with ensuring cooperation

and coordination among all bodies - United Nations, regional commissions, and other intergovernmental and non-governmental organizations - concerning implementation of environmental programs and the adoption of measures regarding international environmental problems.

c. Procedure

The procedure for interacting with the Governing Council for Environmental Programs is basically similar to the steps provided for in the Intergovernmental Maritime Consultative Organization section (subsection 1, c.).

d. References

Convention on the Governing Council for Environmental Programmes, _U.S.T.__, T.I.A.S.__, __U.N.T.S.__.

C. Federal Agencies

1. Atomic Energy Commission

a. Function

The Atomic Energy Commission (AEC) regulates activities involving the atomic energy fuel cycle from uranium mills through ultimate disposal of radioactive waste.

b. Authority

The AEC is vested with a licensing power for possession and use of radioisotopes in commerce and industry.

The Environmental Impact Statement required of each license applicant is reviewed and commented on by the AEC as such statement relates to radioactive releases into the environment.

Policy, procedure, standards and regulations for safeguarding materials and issuance of safeguard license conditions regarding radio-

isotopes are developed by the AEC. Radioactive and heat emission standards as promulgated by the Environmental Protection Agency in accordance with statutory directives are formulated with the advice and consent of the AEC.

The AEC regularly inspects licensed facilities to ascertain compliance with existing safeguards.

c. References

Atomic Energy Act, 42 U.S.C. 2011 et seq.

Atomic Energy Community Act, 42 U.S.C. 2301 et seq.

2. Bureau of Land Management (Department of the Interior)

a. Function

The Bureau of Land Management (BLM) is authorized to administer and lease public lands of the Federal government. On outer continental shelf lands, this leasing function is limited to those leases whose purpose is exploring or exploiting minerals in the seabed or subsoil. (Outer Continental Shelf Lands Act, 43 U.S.C. 1331 et seq.) Although BLM leasing power presently is limited to mineral leases, it is anticipated that this could be the proper agency through which a lease application should be made for development of a deep draft harbor and terminal beyond the territorial waters of the State. For this reason, BLM is included among the digest of agencies in this Chapter.

b. Authority

BLM has been delegated the leasing authority of public lands on the outer continental shelf for purposes of mineral exploration and exploitation. This regulation extends to common carrier pipelines.

Rules and regulations regarding mineral leases and common carrier pipeline rights-of-way have been promulgated by this agency.

General regulations concerning pipeline construction include:

(1) Pipelines should be buried three feet;

(2) Line size 10 inches and above should be concrete encased to prevent buoyancy;

(3) Pipelines in water depths greater than 200 feet need not be buried;

(4) Forces due to hurricane currents should be considered in depths less than 70 feet;

(5) Some pipelines may require anchoring or other special treatment as conditions warrant.

Environmental impact statements are required by BLM prior to lease sales and for all activities and rights-of-way requests on outer continental shelf lands. These statements are reviewed and commented on by the BLM and must consider the following environmental factors:

(1) Physical Oceanography

(2) General Geology

(3) Bottom Sediments

(4) Natural Hazards

(5) Recreation, Archaeologic, Historic Resources

(6) Sportfishing

(7) Commercial Finfish

(8) Shellfish

(9) Commercial Shrimp

(10) Rare and/or Endangered Species

(11) Wildlife - Big Game

(12) Wildlife - Small Game

(13) Waterfowl Concentrations

(14) Vegetation

(15) Livestock and Grazing

(16) Lands and Waters "Unsuitable" for Development

(17) Lands "Suitable" for Development

(18) Transportation

(19) Socio-Economics

(20) Projected Acreage of Industrial Development

These factors must be considered in accordance with the approved BLM format. A copy of that format is available on request from the BLM regional office located in New Orleans, Louisiana.

The jurisdiction of the BLM extends from the outer limits of the Louisiana territorial sea to the 200 meter isobath seaward.

c. Procedure

If the Outer Continental Shelf Lands Act becomes the ultimate legal basis for acquiring a lease of public lands for erection of deep draft harbor and terminal facilities on outer continental shelf lands, and BLM is vested with administration of such leasing, the following is included as representative of existing leasing procedure.

Procedure for acquisition of a lease of public lands for exploration and exploitation of minerals in the seabed and subsoil of the outer continental shelf of the U.S. is as follows:

(1) Leasing map is prepared showing outer continental shelf lands which will be offered for sale.

(2) An evaluation of resources in the area if required by other agencies.

(3) Nomination by either BLM or any interested party is made of lands for lease. This is referred to as final tract selection and must include fair market value, orderly development schedule, and environmental protection provisions.

(4) A draft environmental impact statement must be prepared following the prescribed BLM format and reflecting coordination with other State and Federal agencies. There should be public distribution of the statement.

(5) A public hearing is held where oral and written testimony is received identifying areas of conflict. All recommendations from interested parties are accepted.

(6) The final environmental impact statement is prepared.

(7) The decision to proceed, amend or cancel the lease sale is then made. If the decision is not to sell, then the proceeding is ended. If the decision is to sell, then the remaining procedure must be fulfilled.

(8) Development must begin within three years after the sale.

Although no special form is required, rights-of-way applications for common carrier pieplines on the outer continental shelf must be filed in duplicate and must contain the following standards:

(1) Applicant must specify that it is made pursuant to the Outer Continental Shelf Lands Act and 43 C.F.R. 2833;

(2) Applicant must agree to the terms and conditions of BLM regulations;

(3) Applicant must state the primary purpose for which the right-of-way is to be used;

(4) A $10.00 filing fee, plus required rental;

(5) A map showing the center line of the right-of-way, properly identified, must accompany each copy of the application; and

(6) The application must show the extent to which such right-of-way invades or crosses mineral leases or rights-of-way other than his own and must submit written consent of each established lessee or right-of-way holder with his application. Notice by registered mail to each affected lessee or right-of-way holder is required in lieu of their formal written consent.

Final approval of the right-of-way is made by BLM, but proof of construction must be submitted within five years from date of the grant or the grant will be deemed abandoned. Assignment may be made of a right-of-way as to the whole or as to any lineal segment thereof after construction, subject to the approval of BLM.

Right-of-way includes the site on which the pipeline and assorted structures are situated, which must not exceed 200 feet in width for pipelines and is limited to the area reasonably necessary for pumping stations or other accessory structures. It does not include gathering lines and assorted structures for the purpose of conveying production for gathering, storage, or treating of the production from a lease or leases. The construction of gathering lines must be approved by the Oil and Gas Supervisor, U.S. Geological Survey, in accordance with the provisions of 30 CFR 250.18 and 250.68.

d. References

5 App. Reorg. Plan of 1946, No. 3, pt. IV, 5 U.S.C. 133y-16.

43 C.F.R. 2883 - For Pipelines on the Outer Continental Shelf.

43 C.F.R. 3300 - Outer Continental Shelf Leasing.

Outer Continental Shelf Lands Act, 67 Stat. 462, 43 U.S.C. 1331 _et seq_.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 1331 _et seq_.

Federal Water Pollution Control Act, 86 Stat. 816, 33 U.S.C. 1151 et seq.

Convention on the Continental Shelf, 15 U.S.T. 471, T.I.A.S. 5578, 499 U.N.T.S. 311.

Executive Order 11514.

Notice to Lessees and Operators of Federal Oil, Gas, and Sulphur Leases in the Outer Continental Shelf Gulf of Mexico Area, OCS Order Nos. 1 through 12 - Gulf of Mexico. U.S. Dept. of the Interior, Geological Survey.

Regulations Pertaining to Mineral Leasing, Operations and Pipelines on the Outer Continental Shelf, U.S. Dept. of the Interior, Geological Survey.

Form 3300-1: Oil and Gas Lease of Submerged Lands under the Outer Continental Shelf Lands Act.

3. Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service (Department of the Interior)

a. Function

The primary function of the Bureau of Sport Fisheries and Wildlife (BSFW) is the preservation, procreation, and expansion of the fish and wildlife resources of the nation. Although this bureau is vested with no Federal permit authority, several of its programs could foreseeably affect the development of a deep draft harbor and terminal in coastal and off-shore waters of Louisiana. Enforcement of Federal game laws, and programs designed to effect the spirit of those laws, constitute the primary function of the Bureau of Sport Fisheries and Wildlife.

b. Authority

A number of programs directed at management and investigation of sport fish and wildlife resources are conducted by the Bureau of Sport Fisheries and Wildlife. Programs which could have a direct impact on

the development of a deep draft harbor and terminal for the State have been analyzed.

One principal BSFW program is that of management and enforcement. The primary goal of this program is to protect international fish and wildlife resources. Further, the Bureau seeks to control human activities so as to ensure the perpetuation of these resources while providing optimum human benefits and pleasures. Under this program, the Bureau conducts surveillance and makes case studies of environmental degradation involving water pollution. Appropriate officials are alerted in critical cases. In certain instances, the Bureau may lend direct investigative and enforcement assistance to State and local authorities.

Wildlife Services form another program of BSFW. The basic objective of this program is better management of wildlife, protection and improvement of necessary habitats, and increased opportunity for public use and enjoyment of these renewable resources. One service under this program is to provide an analysis of the adequacy of environmental impact statements.

Another pollution-oriented program being conducted by BSFW is a series of river basin studies. The program objective is to insure that fish and wildlife and environmental concerns are fully considered in water resource developments. Under this program, the Bureau discharges many statutory responsibilities, studying water use projects of Federal agencies and studying projects constructed under Federal license or permit throughout the United States.

Water resource development projects studied by the Bureau include among others, the following:

(1) Projects proposed for construction by the Bureau of reclamation and the Corps of Engineers;

(2) Hydroelectric projects subject to the Federal Power Commission license or permit;

(3) Small reclamation projects;

(4) Water use projects requiring land use permits from the Forest Service and the Bureau of Land Management;

(5) Private dredging and filling projects requiring a Corps of Engineers permit;

(6) Nuclear power projects requiring permits from the Atomic Energy Commission;

(7) Highway and airport location and construction projects; and

(8) Land development proposals.

The Bureau's Office of Environmental Quality assists in the preparation of environmental statements.

In order to assure systematic and thorough review of permit applications for activities affecting navigable waters of the United States, the Bureau of Sport Fisheries and Wildlife has developed general and specific guidelines for in-house use. A revised copy of those guidelines would provide useful assistance when preparing any environmental impact statement for review by the Bureau.

c. References

Fish and Wildlife Act of 1956, 70 Stat. 1119, 16 U.S.C. 742 et seq.

Fish and Wildlife Coordination Act of 1958, 16 U.S.C. 742a et seq.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Fish and Wildlife Coordination Act. 16 U.S.C. 661, *et seq*.

River and Harbors Act of 1899

Watershed Protection and Flood Prevention Act, 16 U.S.C. 1008, *et seq*.

Estuary Protection Act,

Federal Water Pollution Control Act, 86 Stat. 816, 33 U.S.C. 1151 *et seq*.

Solid Waste Disposal Act, Pub. L 89-272.

Executive Order 11514.

Circular 39, *Wetlands of the United States* (1956).

4. Council on Environmental Quality (Executive Office of the President)

a. Function

The Council on Environment Quality (CEQ) is an executive office-based council which reports directly to the President, and advises the President concerning environmental affairs. This council was created in 1969 by the National Environmental Policy Act (NEPA). NEPA vested in the Council on Environmental Quality the right of review of environmental impact statements submitted by Federal agencies. CEQ was required to make recommendations as to how the Federal program or activity might affect the policies declared in NEPA and to comment on the sufficiency of environmental impact statements. Environmental impact statements must be filed with the Council on Environmental Quality for all activities affecting the environment and requiring a Federal license or permit.

b. Authority

The Council on Environmental Quality set forth guidelines to be followed when preparing statements on the impact of proposed Federal actions affecting the environment. Actions for which these environmental

impact statements must be prepared include, but are not limited to, projects and continuing activities directly undertaken by Federal agencies; supported in whole or in part through Federal contracts, grants subsidies, loans, or other forms of funding assistance; or involving a Federal lease, permit, license, certificate or other entitlement for use.

General guidelines concerning content of environmental impact statements have been promulgated by CEQ and many be found at 36 F.R. 106 (23 April 1971).

According to CEQ quideline requirements, the overall cumulative impact of the total development of a deep draft harbor and terminal, including anticipated effects on the Louisiana coastal environment, should be covered by an environmental impact statement submitted to the Council.

The following duties and responsibilities are required of the Council on Environmental Quality:

(1) Prepare an annual environmental quality report;

(2) Prepare recommendations to the President on policies for improving environmental quality;

(3) Analyze conditions and trends in the quality of the environment;

(4) Conduct investigations relating to the environment;

(5) Appraise the effect of Federal programs and activities on environmental quality;

(6) Evaluate the effect of technology;

(7) Recommend to the President and the Federal agencies priorities and environmental programs;

(8) Promote the development and use of indices and monitoring system;

(9) Advise and assist the President and agencies in achieving international and environmental cooperation, with the foreign policy guidance of the Department of State; and

(10) Review the implementation of Executive Order 11507 and report to the President thereon.

CEQ was responsible for development of the National Oil and Hazardous Materials Pollution Contigency Plan.

c. Procedure

After preparing an Environmental Impact Statement in compliance with the published guidelines, it is submitted to the Council on Environmental Quality for comment as to the sufficiency of content.

d. References

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Clean Air Act, 42 U.S.C. 1857a et seq.

Executive Order 11507.

Executive Order 11514.

Federal Register, Volume 36, No. 79 (April 23, 1971), "Guidelines."

Federal Register, Volume 34, No. 106 (June 2, 1969), "National Oil and Hazardous Materials Pollution Contingency Plan."

5. Environmental Protection Agency

a. Function

Functions previously conducted by several departments of the Federal government were consolidated under the single control of the recently established Environmental Protection Agency (EPA). Most Federal legislation concerning pollution of the various U.S. environments is now administered by the EPA. The Environmental Protection Agency has a

broad mandate to prevent and abate degradation of the environment and to promote environmental enhancement. Currently, programs of EPA primarily are concerned with alleviating and eliminating the environmental degradation caused by air and water pollution.

b. Authority

Present authority of the Environmental Protection Agency is divided into six programs. These include Federal grants, the two more advanced air and water programs, a program of pesticide usage, and the newer radiation and noise abatement programs.

Only two programs - air and water - are believed applicable to any facet in the present development of a deep draft harbor and terminal for Louisiana.

However, depending on future developments of the deep draft harbor and terminal, even the grant and pesticide programs, as well as the radiation and noise abatement programs, may become applicable to the Authority Development Program.

A power of permit is vested in EPA regarding air pollutant discharges and enforcement of minimum ambient air quality standards in States having no State or regional control agency. Louisiana has established a State air control agency to regulate emissions, although its implementation plan has not been totally accepted by EPA.

Promulgation of minimum primary and secondary ambient air quality standards and identification of pollutants is a major concern of the Environmental Protection Agency. And, although States have been authorized to issue air standards more stringent than those of EPA, until Louisiana's

Air Implementation Plan is approved, the Federal standards will prevail.

Approval of State implementation plans is another major responsibility of the EPA. State plans must provide compliance schedules, air quality surveillance, and rules and regulations.

Federal enforcement will occur if the State fails to enforce its implementation plan effectively. This enforcement consists of an order to comply with standards and/or appropriate civil actions in the form of temporary and permanent injunctions. EPA will control if the Louisiana Air Implementation Plan is not approved.

The EPA has the right of inspection, monitoring, and entry for the purpose of developing or assisting in the development of an implementation plan. Louisiana has been regimented into three Federal air quality control regions. The Southern Louisiana - Southeast Texas interstate air quality control region encompasses the entire coastal zone of Louisiana. Specifically included in this control region are Jefferson Parish, Lafourche Parish, Terrebonne Parish, St. James Parish, and Plaquemines Parish.

Listed by the EPA as major air pollutant sources are petroleum refining and petrochemical operations, and petroleum storage tanks and bulk terminals.

Preparation, publication, and promulgation of water quality standards are also primary responsibilities of EPA. EPA issues regulations governing the discharge of oil and hazardous substances from vessels, on-shore facilities and off-shore facilities out to the bounds of the contiguous zone. In accordance with these regulations, any violator must report such discharge to EPA when he has knowledge. EPA has authority to

set standards of operation over sources of thermal pollution and the location, design, construction, and capacity of cooling water intake stations.

EPA maintains a permit program covering facilities which discharge waste into navigable waters of the United States. A certification of compliance with applicable water quality standards must be obtained from EPA (if no state agency has authority) before any of the required permits or licenses will be issued for such activity.

The Louisiana Stream Control Commission, with its approved implementaion plan, presently has the exclusive permitting authority throughout the State for industrial effluent discharges.

Inspection, monitoring and entry are authorized for both Federal and State water pollution agencies to assure compliance with effluent standards by point sources of pollutant discharges.

The filing of a report with the administrator by persons whose alleged activities result in discharges causing or contributing to water pollution may be required in certain instances, depending on the volume and circumstances of the discharge.

There will be Federal enforcement of effluent standards if the State fails to enforce permit conditions (see section D, 12, c for State permit conditions). This enforcement consists of either a compliance order or civil action in a Federal District Court.

General EPA policy considerations affecting issuance of certification are as follows:

(1) Effluent discharges should be in accord with standards or technology that is economically feasible;

(2) Effluent limitation may be more strenuous in specific situations where normal limitations would interfere with the attainment or maintenance of other qualities in that particular portion of navigable waters and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water;

(3) New sources can not operate in contravention of Federal minimum effluent standards, nor in contravention of more stringent State standards; and

(4) In the case of the discharge of oil into or in the waters of the contiguous zone, only those discharges which threaten the fisheries resources of the contiguous zone, or threaten to pollute or contribute to the pollution of the territory or to shorelines of the territorial sea may be harmful.

c. Procedure

Any applicant for Federal licenses or permits to conduct any activity which may result in the discharge into navigable waters, shall obtain a certificate from the State, in which the discharge originates, that such discharge is in compliance with sections 301, 302, 306, and 307 of the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq.) EPA shall certify in cases where the State has no authority. (Note: Louisiana has an acceptable water pollution program enforced primarily by the Stream Control Commission, but this agency does not have jurisdiction beyond the territorial waters of Louisiana.)

Apparently, State certification must be granted before a Federal permit or license is obtainable authorizing a construction or operation activity affecting environmental quality. This certificate should set forth effluent limitations and other limitations, including monitoring requirements necessary to assure compliance with Federal and State effluent limitations and standards of performance or prohibitions as required by the State. All provisions of the State certificate will then

become incorporated by reference into the terms of any Federal license or permit.

Conditions of a permit to discharge into navigable waters are basically identical for both State and Federal programs. Minimum permit limitations are as follows:

(1) Fixed term not to exceed five years;

(2) Application of the best practicable technological control available;

(3) Can be terminated or modified for cause;

(4) Control the disposal of pollutants into wells; and

(5) Apply and insure compliance by any applicant, with sections 301, 302, 306, 307, and 403 of the Federal Water Pollution Control Act as amended, 86 Stat. 816, 33 U.S.C. 1151 et seq.

Conditions which must be met before an activity will be approved by certification are as follows:

(1) The point source shall use the best practicable technological control currently available (section 301).

(2) Effluent limitations for a point source or sources must be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality (section 302). Such effluent limitations must assure the attainment or maintenance of that water quality of the specific portion of the navigable water which shall assure protection of public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water (section 302). (Note: Prior to establishing effluent limitation there must be notice of intent to interested parties followed by a public hearing to consider economical and social cost (section 302).

(3) Point source must meet the standards of performance established for that industry (section 306). The point

source can not be operated in violation of effluent standards or prohibition of pretreatment standards (section 307). Discharge into the waters of the territorial seas, the contiguous zone and the oceans shall be detailed by the ocean discharge criteria issued by EPA. These criteria are as follows:

(a) Effect of disposal of pollutants on human health or welfare, including but not limited to plankton, fish, shellfish, wildlife, shorelines, and beaches;

(b) Effect of disposal of pollutants on marine life including the transfer, concentration, and dispersal of pollutants or their byproducts through biological, physical, and chemical processes; changes in marine ecosystem diversity, productivity, and stability; and species and community population changes;

(c) Effect of disposal of pollutants on esthetic, recreation, and economic values;

(d) Persistence and permanence of the effects of disposal of pollutants;

(e) Effect of the disposal at varying rates, of particular volumes and concentrations of pollutants;

(f) Other possible locations and methods of disposal or recycling of pollutants including land-based alternatives; and

(g) Effect on alternate uses of the oceans, such as mineral exploitation and scientific study.

[Note: Discharges from vessels are subject to regulations issued and enforced by the U.S. Coast Guard. The U.S. Army Corps of Engineers is the permitting authority for disposal of dredged material in ocean waters. Further, the Corps is authorized to issue permits for use of spoil disposal areas under its jurisdiction (sections 401, 404)].

d. References

40 C.F.R. 50 - National primary and secondary ambient air quality standards.

40 C.F.R. 51 - Requirements for preparation, adoption, and submission of State Implementation Plans.

40 C.F.R. 52.970 - 52.981 - These provisions apply to the Louisiana Air Control Commission Implementation Plan.

40 C.F.R. 60 - Standards of performance of new stationary sources.

40 C.F.R. 81 - Federal air quality control regions, criterion and control techniques.

40 C.F.R. 104 - Standards in setting conference hearings and notifications of alleged violators of water quality standards.

40 C.F.R. 106 - Public hearings under the Federal Water Pollution Control Act.

40 C.F.R. 107 - Filing of reports by persons whose alleged activities result in discharges causing or contributing to water pollution.

40 C.F.R. 109 - Criteria for State, local or regional oil removal contingency plans.

40 C.F.R. 110 - Discharge of oil.

40 C.F.R. 113 - Liability limits for small on-shore storage facilities up to 1000 bbl. capacity.

40 C.F.R. 115 - State certification of activities requiring a Federal license or permit.

40 C.F.R. 120 - Water quality standards.

40 C.F.R. 122 - Revision of water quality standards.

The Refuse Act (Rivers and Harbors Act of 1899), 33 U.S.C. 419 et seq.

Clean Air Act, 42 U.S.C. 1857a et seq.

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.

International Convention for the Prevention of the Pollution of the Sea by Oil, 12 U.S.T. 2989, T.I.A.S. 4900, 327 U.N.T.S. 3.

International Convention on the Territorial Sea and the Contiguous Zone (Article 24) 15 U.S.T. 1606, T.I.A.S. 5639, 516 U.N.T.S. 205.

International Convention on the High Seas (Article 24 and 25). 13 U.S.T. 2312, T.I.A.S. 5200, 450

5 App. Reorg. Plan of 1970, No. 3.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Ocean Dumping Act, 86 Stat. 1052-1063.

Solid Waste Disposal Act.

Executive Order 11288.

Executive Order 11514.

Executive Order 11507.

Executive Order 11548.

Executive Order 11574.

Executive Order 11602.

6. Federal Maritime Commission

a. Function

The primary function of the Federal Maritime Commission involving environmental matters and superport development is administration of the vessel financial responsibility provisions of the Federal Water Pollution Control Act (33 U.S.C. 1151 et seq).

b. Authority

The Federal Maritime Commission is vested with the power of certification of vessels in accordance with the Oil and Hazardous Substance Liability section of the Federal Water Pollution Control Act. Specifically, the Federal Maritime Commission enforces §311 (p) of that Act.

All vessels over 300 gross tons are required to have this certificate before entering any U.S. port, navigable waters of the

United States, or waters of the territorial sea or contiguous zone of the United States. Evidence must be given to the Federal Maritime Commission of financial responsibility in an amount equal to $100 per gross ton or $14,000,000, whichever is smaller. A person responsible for more than one vessel need only establish financial responsibility in an amount sufficient to meet the maximum liability to which the largest vessel of such vessels could be subjected. This financial responsibility is required to meet liability to the United States for the discharge of oil or hazardous substances into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone.

The Federal Maritime Commission has the right to deny, revoke, suspend, or modify the terms of any certificate.

Uncertified vessels subject to the foregoing provision may be denied entry into any part or place in the United States, or detained in such port or place by the U.S. Coast Guard.

c. Procedure

The certificate of financial responsibility for vessels may be obtained in accordance with the procedure indicated by the Federal Maritime Commission. As the Authority probably will not be operating tanker vessel or vessels in excess of 300 gross tons, the procedure for obtaining FMC certification has been omitted.

It will be the duty of the Authority to be certain that all vessels using superport facilities are in possession of a valid FMC Certificate of Financial Responsibility. Further, there is no legal preemption which prevents the Authority from requiring a similar financial

responsibility of superport users if such requirements are not duplicious with existing Federal provisions (See Askew v. American Waterway Operators, Inc., 5 E.R.C. 1209).

d. References

46 C.F.R. 542 - Financial Responisbility for Oil Pollution Cleanup.

Form FMC-224 - Application and Certificate of Financial Responsibility.

Form FMC-225 - Certificate of Insurance.

Form FMC-226 - Oil Discharge Surety Bond.

Form FMC-227 - Guaranty in Respect of Liability of Discharge of Oil.

5 App. Reorg. Plan of 1961, No. 7, Part I.

National Environmental Policy Act, 42 U.S.C. 4321, et seq.

Federal Water Pollution Control Act, 86 Stat. 862, 33 U.S.C. 1151 et seq.

7. Federal Power Commission

a. Function

The Federal Power Commission (FPC) functions as the primary agency overseeing water power projects and the interstate transportation and importation of natural gas or liquified natural gas. Interstate transport of natural gas or liquified natural gas by trucks or barges has been defined by the FPC as non-jurisdictional (Federal Power Commission Order Dated May 4, 1973).

b. Authority

Unless the Authority engages in an activity which might qualify for coverage under the Federal Power Act (49 Stat. 863, 16 U.S.C. 791a - 828c), it is not foreseeable that a Federal Power Commission license or permit would be needed. Activities which require a Federal Power Commission license are described in the Federal Power Act as follows:

> "...constructing, operating, and maintaining dams, conduits, reservoirs, power houses, transmission lines or other project works necessary or convenient to the development or improvement of navigation and for the development, transmission and utilization of power across, along, from or in the streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several states."

Prior approval of such plans must be given by the Chief of Engineers and the Secretary of the Army.

Congress placed the jurisdiction over natural gas under the authority of the Federal Power Commission. Before a person can engage in the interstate transportation of natural gas via pipeline, such person must have a certificate of public convenience and necessity issued by the Commission authorizing such acts or operations. Gas pipelines on outer continental shelf lands are under FPC jurisdiction. The FPC also is authorized to issue any and all rules and regulations pertaining to the transportation and importation of natural gas or liquified natural gas through pipelines as it is involved in interstate commerce.

c. Procedure

If a natural gas piepline were tapped to provide a source of power for an outer continental shelf structure, the FPC would have to be contacted and would govern the procedure.

The Deep Draft Harbor and Terminal Authority has not indicated an intent to engage either directly or indirectly in the construction of a power project or the importation of natural gas. Therefore, no further description of the Federal Power Commission procedure seems essential at this point in the Authority Development Program.

d. References

Federal Power Act, 49 Stat. 863, 16 U.S.C. 791a - 828c.

Natural Gas Pipeline and Safety Act, 49 U.S.C. 1671 et seq.

The Natural Gas Act, 16 U.S.C. 717-717w.

Submerged Lands Act, 43 U.S.C. 1301 et seq.

Executive Order No. 11514.

8. Foreign Trade Zones Board

a. Function

This Board, composed of the Secretary of Commerce, Secretary of the Treasury, and Secretary of the Army, is responsible for overseeing foreign trade zones within the United States.

b. Authority

This Board can create or authorize foreign trade zones or "free" zones within a U.S. port or harbor district. One foreign trade zone per port or harbor will be granted customarily, although two or more zones may be established for a single port or harbor depending on circumstances.

c. Procedure

Although all governmental agencies received the mandate from the President to inquire of environmental matters prior to undertaking certain projects, it is apparent that duties of the Foreign Trade Zones Board rarely would require inquiry into environmental impacts. For this reason, the procedure for designating an area a foreign trade zone is omitted from this report.

d. References

Foreign-Trade Zones Act, 48 Stat. 998, 19 U.S.C. 81a - 81u

9. Interstate Commerce Commission

a. Function

The Interstate Commerce Commission (ICC) functions solely in a regulatory capacity.

b. Authority

The ICC is authorized to issue regulations, rates and tariff charges for oil pipelines in interstate commerce. It is after construction of a pipeline that the ICC steps in to control the permissable rates charged for use of that pipeline. If any portion of the product enters interstate commerce, the ICC is authorized to exercise its regulatory powers.

A certificate from the ICC is necessary to transport oil from one point to another point. An application for a certificate and/or tariff must contain a statement as to whether the human environment will be affected by such application. If the application will not affect the environment, no further explanation is necessary. The suggested statement to that effect is:

> "The provision published herein will, if effective, not result in an effect on the quality of the human environment.

If the answer is affirmative, then the applicant must explain how and why according to the National Environmental Policy Act (42 U.S.C. 4321 et seq.).

c. Procedure

As the regulatory jurisdiction of the ICC attaches only after the activity is completed, and as an increase in rates rarely would have

adverse environmental implications, any procedure for obtaining an ICC oil transportation certificate or rate change authorization is omitted from this portion of the report.

d. References

42 C.F.R.1 - Interstate Commerce Commission.

Interstate Commerce Act, 49 U.S.C. 901 et seq.

National Environmental Policy Act, 42 U.S.C. 4321 et seq.

Executive Order No. 11514.

Outer Continental Shelf Lands Act, 43 U.S.C. 1331 et seq.

10. Maritime Administration (Department of Commerce)

a. Function

The Maritime Administration (MarAd) is established for the purpose of enhancing the competitive position of American flag lines. MarAd strives to stimulate all segments of the maritime industry, particularly American shipbuilding and the American Merchant Marine. This enhancement and stimulation is accomplished through incentives such as subsidy financing, insurance and ship construction design and research.

b. Authority

As authority of the MarAd is limited to American flag vessels, it has no power of permit, license, or certification authority over any foreseeable aspects of the Authority Development Program or any other activities of the Deep Draft Harbor and Terminal Authority.

A pollution abatement program is conducted by MarAd concerning specifications governing control of ship-generated pollutants, including oil, sewage, garbage and smoke. If such specifications are adopted by the Deep Draft Harbor and Terminal Authority for all vessels using the port

facilities, many existing tankers might be prohibited from access to such a deep water terminal. However, even with such a prohibitive result, all specifications concerning pollution abatement equipment should probably be required of all vessels for entry into a port located in Louisiana offshore waters.

Additionally, research programs are being pursued on the effects of oil spills on marine organisms and the development of onshore site facilities for collecting and treating ship-generated waste. The result of this research and development program could be applied positively to vessel facilities of a deep draft harbor and terminal in Louisiana.

MarAd works closely with several agencies. In its ship construction program, advice is sought from the Council on Environmental Quality. The U.S. Coast Guard and the Environmental Protection Agency, in association with MarAd, are continuing with the development of specifications governing pollutant control of vessels. In the international tanker study being conducted by MarAd, input is obtained from the U.S. Coast Guard, the Environmental Protection Agency, industry and the Intergovernmental Maritime Consultative Organization.

c. References

Maritime Administration, 40 C.F.R. 200-390.

5 App. Reorg. Plan of 1961, No. 7, Part II.

Federal Water Pollution Control Act (Title 11 Insurance), 86 Stat. 862, 33 U.S.C. 1151 et seq.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

11. National Bureau of Standards (Department of Commerce)

a. Function

The function of the National Bureau of Standards (NBS) is derived from the Bureau's basic statutory responsibility for accuracy and compatability of measurements. Environmentally, this responsibility means devising accurate instrumentalities for assessing and measuring emission and effluent discharges and resulting pollution. Therefore, NBS's function is basically one of research with subsequent dissemination of resulting information.

b. Authority

The National Bureau of Standards has established programs of air, water and noise pollution abatement technology.

Research on air quality measurements by NBS is intended to overcome the inadequate techniques for assuring progress toward, and ultimate enforcement of, air quality standards.

Water pollution research is oriented toward the development of techniques for measuring low level pollutants that have toxic or unpleasant effect on organisms with long term exposure.

Noise pollution research emphasizes the development of standard methods for measuring noise levels and research on human responses to noise.

c. Procedure

As the National Bureau of Standards has no licensing, certificating or other authority over activities affecting the environmental, no procedure exists to set forth in this section of the report.

d. References

Organic Act, 31 Stat. 1449, 15 U.S.C. 271 et seq.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Executive Order 11514.

12. National Oceanic and Atmospheric Administration (Department of Commerce)

a. Function

The National Oceanic and Atmospheric Administration (NOAA) was created in 1970 in an effort to consolidate all Federal agencies performing primarily marine and atmospheric research activities for the United States. It functions primarily as a scientific information advisor and dispenser for the Nation with regard to the marine and atmospheric research. In 1972, the administration of the Coastal Zone Management Act (CZMA) was placed under NOAA's Office of Coastal Enviornment. NOAA is comprised of several newly reorganized divisions: National Ocean Survey, National Marine Fisheries Service, National Weather Service, the Sea Grant College Program, and the Office of Coastal Environment.

b. Authority

As the function of NOAA is basically of a scientific nature, there presently exists no licensing, permitting or certificating power which would affect superport development in Louisiana. However, it is conceivable that the Authority might qualify for grant moneys available under Coastal Zone Management Act appropriations, if the Environmental Protection Plan were to be deemed an acceptable coastal management plan by the Office of Coastal Environment. (Also note a recent U.S. Senate proposal would place the licensing power for deep draft harbor and terminals under NOAA jurisdiction.)

The methodology used to analyze NOAA is to discuss each division separately. Therefor, this section develops the five major divisions according to programs conducted exclusively by it.

The most important division to the Authority for funding purposes is the Office of Coastal Environment. This office is charged with administering the Coastal Zone Management Act, and is responsible for granting development funds to applying states with acceptable coastal management plans. To be acceptable, a plan must conform to the policies and requirements of the CZMA.

The Office of Coastal Environment serves as a clearing house for specialized coastal zone technical information, identifying coastal research problems and solution possibilities.

The National Ocean Survey (formerly U.S. Coast and Geodetic Survey) provides charts and related information for the safe navigation of marine and air commerce, basic data for engineering and scientific purposes, and commercial and industrial needs. The agency is authorized to conduct hydrographic and topographic surveys, tide and current observations, geodetic control surveys, field surveys for aeronautical charts, and geomagnetic, seismological, gravity and related geophysical measurement. This information may be processed, published, and distributed for the benefit of the public.

The National Marine Fisheries Service (formerly Bureau of Commercial Fisheries, Fish and Wildlife Services) performs programs of biological research and other services regarding commercially important marine fisheries species, including conservation and enhancement of

inland fisheries. They enforce international agreements regulating commercial fisheries and marine life and suggest needed changes to the Federal government.

The National Weather Service (formerly U.S. Weather Bureau) is charged with the forecasting or weather, the issuance of storm warnings, the display of weather and flood signals, the gauging and reporting of rivers, and the maintenance of telegraphic lines along the coastline, and the taking of meteorological observations to establish and record the climatic conditions of the United States. This information is distributed daily to all interested parties and could prove immensely valuable to superport operations.

The Sea Grant Program (formerly under the National Science Foundation) is established to develop sea grant programs on the marine environment. The program includes the funding of educational and related research activities for the development of the marine resources through programs at colleges and universities.

c. Procedure

As no licensing, certificating or permitting power is vested in NOAA at present which would affect superport operations, no such procedure is set forth herein.

However, the Authority as a State agency might qualify to receive a portion of any CZMA funding received by the State. In qualifying, the Authority would have to perform a part of a comprehensive State coastal management program.

To acquire such funding, application for a development grant must first be made by the Governor, with a single State agency being

designated to receive the funds. The application must cover all programs and should set forth the manner in which the State intends to allocate any portion of its grant to substate or multistate units. The substate unit (i.e., Louisiana Deep Draft Harbor and Terminal Authority) must show clearly that it is developing sufficient capabilities, that its work is integrated into the State's program, and that it will contribute to effective coastal zone policy.

Also, as a State plan may develop and evolve in segments, it is possible that a thorough and workable Environmental Protection Plan would qualify as such a segment. Of course, even as a segment of the overall state coastal management plan, the Environmental Protection Plan would still have to meet all requirements fo the CZMA.

Federal grants are not to exceed 2/3 of the annual program budget of the State plan.

Before applying for a grant, the State should seek to obtain extensive public participation in each phase in the development of its coastal management program. Public hearings, with advance notice, should be conducted in geographic areas to be affected by coastal development planning. Data information exchanges and forums for discussing related topics should also be established.

Requests for information on grant applications and application forms should be directed to:

Office of Coastal Environment
NOAA
Department of Commerce
Rockville, Maryland 20852

d. References

National Marine Fisheries Service, 50 C.F.R. 201-295.

National Weather Service, 15 U.S.C. 311 et seq.

National Weather Service, 15 C.F.R. 945.1-945.6.

Reorg. Pl. 4 of 1970, 15 U.S.C. 1511 et seq.

Coastal Zone Management Act,

National Ocean Survey, 33 U.S.C. 851 et seq.

Sea Grant Colleges, 33 U.S.C. 1101-1124.

13. Office of Environmental Affairs (Department of State)

a. Function

This office is charged to provide leadership and to serve as a focal point in the Department of State in the development and coordination of policies concerning international environmental affairs.

b. Authority

The Office of Environmental Affairs works in concert with other bureaus to assure coordination with United States foreign policy objectives of the international programs and activities of the technical agencies of other governments, and provide representation for the Department on inter-agency groups or committees concerned with environmental quality problems.

This office has the responsibility for meeting the Department's obligation as requried by the National Environmental Policy Act, including reviewing departmental actions subject to the Act and preparing environmental impact statements when necessary. Additionally, this Office is responsible for establishing procedures for developing impact statements on international agreements and conventions.

c. Procedure

As the Office of Environmental Affairs has no licensing, certificating or other jurisdiction over port activities affecting the environment, no procedure exists to set forth in this section of the report.

d. References

Foreign Affairs Circular Manual No. 545 (January 9, 1970).

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Executive Order 11514.

14. Office of Pipeline Safety (Department of Transportation)

a. Function

The Office of Pipeline Safety establishes minimum Federal safety standards for interstate pipeline facilities.

b. Authority

Common carrier pipeline facilities under the authority of this office include both natural gas and liquified petroleum products. Jurisdiction for issuing minimum safety standards extends to pipelines within the bounds of the United States and seaward to the limits of the Outer Continental Shelf. The Office of Pipeline Safety is responsible for establishing minimum safety standards and for creating a system for reporting of leaks and spillages.

For natural gas pipelines, the minimum federal standards presently in effect include regulations relating to materials, pipe design, component parts design, welding, construction requirement, corrosion control, testing requirements, and maintenance.

For liquid petroleum pipelines, minimum guidelines have been promulgated for design requirements, construction specifications, hydrostatic testing, and operation and maintenance.

There is no licensing, certificating or permitting power vested in this agency which is applicable to superport development in Louisiana.

c. Procedure

As no applicable licensing, certificating or permitting power is vested in the Office of Pipeline Safety, leaks must be reported by telephone to the Office.

d. References

Enabling legislation, 49 U.S.C. 190 - 195.430.

Natural Pipeline Safety Act, 49 U.S.C. 1671 et seq.

Hazardous Materials Transportation Control Act, 49 U.S.C. 1761 et seq.

15. U.S. Army Corps of Engineers (Department of Defense)

a. Function

The Secretary of the Army, with the consent of Congress, and acting through the Corps of Engineers, administers construction, obstruction, excavation and fill activities conducted in, on and under the navigable waters of the United States. In 1953, this administration was extended to include drilling platforms and artificial islands located on the outer continental shelf.

b. Authority

Authority is delegated by the Secretary of the Army and by the Chief of Engineers to subordinates to act in certain specified cases.

District Engineers are authorized to issue permits and approvals in routine cases involving no difference of opinion on the part of engineer authorities, nor doubt as to the law, facts, or regulations, nor any opposition or other considerations which should be decided by higher authority. Approval of plans is authorized in such routine instances when application for approval is submitted after the commencement or completion of the structures or work, subject to the same conditions which pertain to permits. A specific form is provided for such approvals.

The Corps of Engineers has permit authority over the location and plans of dams and dikes across navigable waters, and over plans for wharves, piers, dolphins, booms, weirs, breakwaters, bulkheads, jetties and other structures, and excavation or fill in navigable waters. This includes obstruction to navigation caused by artificial islands and structures on the outer continental shelf.

The Corps of Engineers is authorized to establish harbor lines to fix the limit to which piers, wharves, bulkheads, or other work may be extended in navigable waters.

Further, any person or persons, corporations, municipal or private, desiring to improve any navigable river, or any part, at their or its own expense and risk may do so upon approval of the plans of the proposed improvement by the Secretary of the Army and the Chief of Engineers.

Pipe, wire or cable crossings, under or above, navigable waters of the United States require prior permit approval from the Corps of Engineers.

There are several general policy considerations which may affect issuance of a Corps permit. For instance, the Corps of Engineers often considers the effect of the proposed work on navigation, fish and wildlife, conservation, pollution, aesthetics, ecology and the general public interest. Fixed structures or artificial islands on outer continental shelf lands are limited only to considerations of the effects such structures or islands might have on navigation and national security.

Often, State or local authority declination to consent to work proposed will form the sole basis for refusing a permit application.

Another consideration is the possible affect on the nation's baseline of works in the coastal waters.

With regard to small boat structures, policy considerations are generally limited to structural durability and obstruction to navigation. A Letter of Approval is all that is required for minor structures and work in unimproved waterways or in improved waterways where such structures and work are well removed from fairways used by navigation.

Pollution control for dredging under navigation permits is accomplished simply by adding the controls as a condition of the permit. This is a two-fold condition and provides that enforcement of water quality standards are the responsibility of the Secretary of the Interior or authorized State agency. Further, the permittee is instructed to comply with any regulations, conditions, or instructions affecting the work authorized as may be issued by the Federal or State authority having jurisdiction.

c. Procedure

This section sets forth generally the requirements for

obtaining a Corps of Engineers permit to conduct specified activities.

First, a letter of application must be sent to the District office (in Louisiana, this office is located at the foot of Prytania Street, New Orleans, Louisiana) embodying the request and showing the name and address of the applicant. This is the initial step in seeking a request for all activities.

Next, maps and plans are essential and should accompany the letter of application. Due to the expense involved in the preparation of this portion of the application, the applicant would be wise to confer with the District Engineer for requirements and feasibility of the project.

Applicants for permits for dredging and filling operations and similar work which may affect the navigable capacity of a waterway or have a pollution impact on a waterway are required to furnish certain additional information with their application. This information is given as follows:

(1) type and quantity of solids to be removed or deposited;

(2) proposed method of measurement;

(3) alternate methods of disposal and impact of alternate methods of disposal on the economy of the industry; and

(4) the environmetnal effects on the waterway.

The final requirement which also must accompany the application concerns State or municipal agencies. If State law requires a license or approval of work from a constituted State agency, or agencies, a copy of such license or approval is required.

If the foregoing is fulfilled and the application is sufficient to satisfy Corps requirements, then the Corps will send notices

to all interested parties that the permit is being applied for and the location. A public hearing will be held whenever there appears sufficient public interest to justify such action, and will always be held in cases of doubt.

Following the public hearing, if a hearing is required, the Corps of Engineers either will issue or deny the permit.

d. References

33 C.F.R. 201 - General Regulations

33 C.F.R. 204 - Danger Zone Regulations

33 C.F.R. 205 - Dumping Ground Regulations

33 C.F.R. 209 - Administrative Procedure (Recent changes proposed May 10, 1973, 38 F.R. 12217)

E.R. 1145 - 2-203, "Civil Regulatory Functions in Permits: Policy, Practice and Procedure."

"Permits for Work in Navigable Waters." (Corps of Engineers, 1968.)

ENG Form 4345 - This form is used for all Corps of Engineers permit applications.

Part III - "How to use the application form." (Corps of Engineers publication)

Rivers and Harbors Act of 1899, 33 U.S.C. 401, et seq.

The Outer Continental Shelf Lands Act, 43 U.S.C. 1331, et seq.

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.

Ocean Dumping Act, 86 Stat. 1052-1063.

The Fish and Wildlife Coordination Act, 16 U.S.C. 661-668d.

National Environmental Policy Act, 42 U.S.C. 4321 et seq.

Submerged Lands Act, 67 Stat. 29

Enabling legislation is found at 10 U.S.C. 3063

Executive Order 11288

Executive Order 11514

Memorandum of understanding between the Department of the Army and the Department of the Interior

16. U.S. Coast Guard (Department of Transportation)

a. Function

The U.S. Coast Guard presently is operating under the administration of the Department of Transporation. Therefore, most rules and regulations are promulgated by the Secretary of the Department of Transportation, but are applied and enforced by the Coast Guard.

On the high seas and water subject to the jurisdiction of the United States, the Coast Guard is responsible for administration and enforcement of applicable Federal laws. This responsibility has been extended to include the promulgation and enforcement of regulations for promoting safety of life and property, covering all matters not specifically delegated by law to some other executive department other than reserved to the states. Finally, the Coast Guard is responsible for developing, establishing, maintaining and operating aids to navigation and rescue factors for promoting safety.

b. Authority

The Coast Guard has authority to issue certification in certain instances. These certifications normally are issued only with respect to safety, marine sanitation devices, and vessel regulations.

Rules and regulations and inspection with subsequent certification are made by the U.S. Coast Guard in the following prescribed instances:

(1) Authorization and approval of safety equipment on artificial islands and fixed structures on the outer continental shelf;

(2) Authorization and certification of oil pollution prevention devices for vessels, on-shore facilities, and off-shore facilities;

(3) Regulation and certification of vessels concerning safe transportation, handling, carriage, storage, and stowage of pollutants;

(4) Licensing and certificating of merchant marine personnel.

In accordance with its responsibility for maintaining safety of life and property on the high seas and in water subject to the jurisdiction of the United States, the Coast Guard has issued rules and regulations governing oil pollution, outer continental shelf structures, navigation and vessel construction and operation. These rules and regulations are listed in the reference subsection of this analysis.

Under the Ports and Waterways Safety Act, the Secretary of the department in which the Coast Guard is operating is authorized to establish permissive controls concerning navigable waters and shore areas of the United States. These permissive controls include, but are not limited to, the following:

(1) Establish, operate, and maintain vessel traffic services and systems for ports, harbors, and other water subject to vessel traffic;

(2) Require vessels to comply with that service or system, including the carrying of electronic or other devices, that may be necessary;

(3) Control vessel traffic in especially hazardous areas, or under certain conditions (adverse weather conditions, vessel congestion, or other hazardous circumstance);

(4) Direct anchoring, mooring or moving of a vessel when necessary;

(5) Require pilots on self-propelled vessels under certain circumstances;

(6) Establish procedures, measures, and standards of handling, loading, discharge, storage, stowage, and movement of explosives or other dangerous articles or substances.

(7) Prescribe minimum safety required conditions and standards.

(8) Establish waterfront safety zones.

(9) Establish procedures for examination to assure compliance with the minimum safety equipment requirements and standards.

The Secretary is given investigatory powers regarding incidents, accidents, or acts which affect or may affect the safety or environmental quality of the ports, harbors, or navigable waters of the United States.

Inspection, monitoring, and entry onto premises are rights vested in the U.S. Coast Guard as essential to enforcement of oil and hazardous substances pollutant discharge laws of the United States.

c. References

33 C.F.R. 67.

33 C.F.R. 140-146. Artificial islands and structures on the Outer Continental Shelf.

46 C.F.R. 1-6. Procedures applicable to the public.

46 C.F.R. 10-16. Merchant marine officers and seamen.

46 C.F.R. 20-26. Uninspected vessels.

46 C.F.C. 30-40. Tank vessels.

46 C.F.R. 42-46. Load lines.

46 C.F.R. 50-63. Marine engineering.

46 C.F.R. 66-69. Documentation and measurement of vessels.

46 C.F.R. 70-80. Passenger vessels.

46 C.F.R. 90-105. Miscellaneous vessels.

46 C.F.R. 110-113. Electrical engineering.

46 C.F.R. 136-137. Marine investigation and suspension and revocation procedure.

46 C.F.R. 145-199. Other regulations.

CG-193. "Coast Guard aids to navigation."

CG-174. "A manual for safe handling of inflammable and combustible liquids."

CG-191. "Rules and regulations for licensing and certification of merchant marine personnel."

"Oil pollution control for tankermen. (Feb. 1973)"

CG-320. "Rules and regulations for artificial islands and affixed structures on the Outer Continental Shelf."

CG-169. "Rules of the road: International-inland."

CG-421. "Merchant ship position reporting systems."

CG-239. "Security of vessels and waterfront facilities."

CG-323. "Rules and regulations of small passenger vessels."

CG-257. "Rules and regulations for cargo and miscellaneous vessels."

CG-256. "Rules and regulations for passenger vessels."

Federal Boat Safety Act, 85 Stat. 213.

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.

Ports and Waterways Safety Act, 86 Stat. 425.

Oil Pollution Act, as amended, 33 U.S.C. 1001 et seq.

International Convention for the Prevention of Pollution of the Sea by Oil, 12 U.S.T. 2989, T.I.A.S. 4900, 327 U.N.T.S. 3.

Convention on the Territorial Sea and Contiguous Zone, 15 U.S.T. 1606, T.I.A.S. 5639, 516 U.N.T.S. 205.

Convention on the High Seas, 13 U.S.T. 2312, T.I.A.S. 5200, 450 U.N.T.S. 82.

Convention on the Continental Shelf, 15 U.S.T. 471, T.I.A.S. 5578, 499 U.N.T.S. 311.

Convention on Fisheries and Conservation of Living Resources of the High Seas, 17 U.S.T. 138, T.I.A.S. 5969, 559 U.N.T.S. 285.

International Convention for the Safety of Life at Sea, 16 U.S.T. 185, T.I.A.S. 5780, 536 U.N.T.S. 27.

International Regulations for Preventing Collisions at Sea, 16 U.S.T. 794, T.I.A.S. 5813.

Executive Order 11239.

Executive Order 11514.

Executive Order 11548.

National Environmental Policy Act, 83 Stat. 852, 42 U.S.C. 4321 et seq.

Ocean Dumping Act, 33 U.S.C. 1401 et seq.

Outer Continental Shelf Lands Act, 43 U.S.C. 1331 et seq.

Submerged Lands Act, 67 Stat. 29.

Uninspected Towing Vessels License Act.

Bridge-to-Bridge Communications Act, 33 U.S.C. 1201 et seq.

Sixth Coastal Region Oil and Hazardous Substances Pollution Contingency Plan (March 1972).

Enabling legislation is found at 14 U.S.C. 1, et seq.

17. United States Geological Survey (Department of the Interior)

a. Function

Supervision of the operation of leases which have been awarded pursuant to the Outer Continental Shelf Lands Act (43 U.S.C. 1131 et seq.)

is the function of the United States GEological Survey (USGS).

b. Authority

The USGS has jurisdiction over fixed structures, including private pipelines, and floating drilling structures on the outer continental shelf.

In accordance with this jurisdiction, the Supervisor of the Geological Survey is authorized to grant rights of use and easement to such structures in several situations which could be applicable to Louisiana superport facilities.

In the case of offshore construction, the USGS could grant the Authority the right to construct and maintain platforms, fixed structures, and artificial islands, and to use the same for carrying on operations, beyond the bounds of their lease and on the lease of another if no objection were received thereto.

Where private pipelines are concerned the USGS may grant the right of use or easement for construction and maintenance of private pipelines for moving production to a central point for gathering, treating, storing, measuring, selling or delivery to a common-carrier operation.

However, the right of use or easement may be granted only after other lessees have been notified by the applicant and afforded reasonable opportunity to object. Any such rights must be exercised so as not to interfere unreasonably with operations of the lessee in any such lease.

The supervisor must approve location, size and design before an offshore platform can be constructed.

Generally, the USGS is authorized to regulate all operations conducted on a lease by or on behalf of the lessee. Other regulations could have application for offshore development of a deep draft harbor and terminal.

For instance, the USGS controls spacing of wells. This agency could prevent placement of platforms or other operations in areas near a deep draft harbor and terminal which could be hazardous to shipping.

Handling and gauging of oil and the measurement of gas and other products is regulated by the Supervisor.

Two other points which could affect superport operations beyond territorial sea limits concern supervision of operations and pollution control. The Supervisor is authorized to suspend any operation which in his judgment threatens immediate, serious, or irreplaceable harm or damage to life, including aquatic life, or to the environment. Also, pollution and waste disposal regulations may be controlled to a certain extent by the Supervisor of the USGS. The agency has declared primary, and virtually exclusive, jurisdiction over the outer continental shelf for purposes of preventing pollution of the waters thereof resulting from mineral operations. (But see U.S. Coast Guard, EPA and Executive Order 11514). This includes the determination of what constitutes a substantial spill or leak and approval of waste disposal methods. Spills and leaks must be reported to the Supervisor.

Additional programs of the Geological Survey include many oceanographic aspects which may provide affirmative oceanographic data affecting the development of a deep draft harbor and terminal off the

Louisiana coast. These programs are included in the offshore geological surveys and are listed below:

(1) Studies of geological processes, including sediment movement, faulting and earthquakes, submarine slope and foundation stability.

(2) Detailed investigation and evaluation of proposed near-shore and off-shore construction sites to determine geological conditions and hazards of public and Federal concern.

(3) Studies of distribution and movement of trace elements in major estuaries to determine which of these elements are toxic, as they enter the marine environment. These studies contribute geochemical data relating to the operation of geologic processes in the area.

(4) The Gulf of Mexico programs include analyses of sediment movement and deposition on the northern and western continental shelf and geophysical studies of the basin.

(5) There must be geological and geochemical analyses and review prior to approval of industry application to conduct operations, to change approved operation plans, or to diverge from conditions of the lease as originally issued. Such changes include platform erection plans or alternative mechanical conditions.

(6) The right of inspection of ill activity to assure compliance with regulations, orders and approved plans is vested in the USGS. Pollution control overflight inspections are made twice each week

The Authority could coordinate certain compensatory projects (La. R.S. 34:3113 (J)(5)) to assist and correlate data acquisition with programs being conducted by the USGS. An effective exchange of information between the two agencies could prove a valuable expediant of time and an expedition of accomplishment.

c. References

30 C.F.R. 200 - Forms and Reports.

30 C.F.R. 221 - Oil and Gas Operations.

30 C.F.R. 250 - Oil and Gas Operations in the Outer Continental Shelf Lands.

Outer Continental Shelf Lands Act, 43 U.S.C. 1331 et seq.

National Environmental Policy Act, 83 Stat. 852, U.S.C. 4321 et seq.

International Convention for the Prevention of Pollution of the Sea by Oil, 12 U.S.T. 2989, T.I.A.S. 4900, 327 U.N.T.S. 3.

Convention on the Territorial Sea and Contiguous Zone, 15 U.S.T. 1606 T.I.A.S. 5639, 516 U.N.T.S. 205.

Convention on the High Seas, 13 U.S.T. 2312, T.I.A.S. 5200, 450 U.N.T.S. 82.

Federal Water Pollution Control Act, 33 U.S.C. 1151.

Executive Order 11288.

Executive Order 11514.

Ocean Dumping Act, 86 Stat. 1052.

Submerged Lands Act, 67 Stat. 29.

D. State Agencies

1. Air Control Commission

a. Function

The Air Control Commission is the official State air control agency. In conducting air emission analyses and investigations, the Commission is required to act through the Engineering Division of the State Department of Health.

The objective of the Air Control Commission is to maintain purity of the air resources of the State consistent with the protection of the health and physical property of the people, maximum employment and full industrial development.

b. Authority

The Clean Air Act of 1970 (42 U.S.C. 1857a, et seq.) authorizes State control of air pollutant emissions through development of an implementation plan. This implementation plan must be approved by the Administrator of the Environmental Protection Agency before State enforcement can become effective. Louisiana's plan was approved in its entirety on 2 July, 1973.

The air implementation plan is to effect monitoring and enforcement of air quality standards. These standards must be equivalent to, or more stringent than, the national minimum primary and secondary ambient air quality standards.

The Air Control Commission has the statutory authority to develop and prepare the general implementation plan for the proper control of air resources of the State and to promulgate rules and regulations consistent with this plan and other statutory obligations. It is authorized to conduct investigations, to hold hearings on complaints and petitions for variances, and to enter such orders and determinations and recommendations as necessary to control air pollution that is beyond desirable levels.

This Commission may institute legal proceedings to compel compliance with orders and issue cease and desist orders where immediate action is required.

Finally, the Commission may request and be entitled to receive the assistance of any State education institution, experiment station, board, department or other State agency.

c. References

Clean Air Act, 42 U.S.C. 1857a, et seq.

La. R.S. 40:2201 - 2216

La. R.S. 32:1304 (A)

Air Control Regulations (effective July 17, 1972)

2. Department of Commerce and Industry

a. Function

The Department of Commerce and Industry is an industrial development agency possessing little regulatory power. Encouragement of industrial development in the State is the primary function of this Department.

The Department has an interest in the superport as a means of assuring petroleum feedstocks for Louisiana-based industry.

b. Authority

The Department of Commerce and Industry has no authority to issue any certificate, license, or permit.

The Department has no authority to issue rules and regulations concerning industry and commerce.

The Department has no right to comment on contracts between the Deep Draft Harbor and Terminal Authority and private concerns, unless an industrial bond is involved. When industrial bond contracts are involved, approval by the Department of Commerce and Industry is required.

The Department of Commerce and Industry is not authorized to comment on environmental matters. As the effectiveness of the Department of Commerce and Industry is measured in terms of dollars of industrial

growth added to the State, environmental matters are not foremost considerations of this Department.

c. Procedure

No rules and regulations, inter-office memoranda or guidelines, or other official documents or publications have been prepared by the Department of Commerce and Industry concerning procedural steps to follow when conducting business with such Department.

d. References

La. Const. Art. 10, § 4 (10).

La. Const. Art. 14, § 14 (b)(2).

La. R.S. 51:921-938.

3. Department of Conservation

a. Function

Conserving oil, gas and other mineral resources of the State is the constitutional and statutory mandate of the Department of Conservation.

b. Authority

The department is authorized to promulgate and enforce rules and regulations and to issue orders for the proper conservation of Louisiana's mineral resources.

Regulations have been issued by this department which prohibit disposal of oily waste into any body of water or any drainage leading thereto, requiring that all such waste be disposed of in a manner which prevents contamination of fresh water. Other regulations stipulate that operators must place dikes or retaining walls around certain installations on land to contain accidental spills.

A permitting authority exists in the Department of Conservation over the building and operating of plants to burn natural gas and carbon black and over the disposal of produced brine by injection into subsurface areas. It seems doubtful that either of these activities are anticipated in any aspect of the Authority Development Program.

All oil and condensate transported into or through, or stored in, Louisiana must be reported to the Department of Conservation. Information desired by the Department consists primarily of quantity, source and destination. Questions requesting such information are set forth in Report Form R-2 and must be completed and filed with the proper district (s) official in duplicate on or before the fifteenth day of each calendar month. Form R-2 must be completed as to the data covering the calendar month next preceding the date of filing.

Department rules and regulations are enforced by the Inspection and Enforcement section under the supervision of the district coordinator. Overlapping enforcement responsibilities of other Federal and State agencies create uncertainties as to precise pollution control enforcement duties. For instance, State agencies with shared jurisdiction include the Wild Life and Fisheries Commission, the Stream Control Commission, the Air Control Commission and the Department of Health. Federal agencies having similar pollution control responsibilities are the U.S. Coast Guard and the Environmental Protection Agency.

In case of a violation of rules and regulations or orders concerning pipelines, the Department can notify an industry that the material in the pipelines is not to be sold. This power is one method of assuring cleanup and compliance with other Department rules and

regulations.

c. Procedure

The procedure for granting permits either for building and operating a plant to burn natural gas and carbon black or for disposing of produced brine by injection, is believed inapplicable to any aspect in the development of a deep draft harbor and terminal.

All spills of oil or hazardous material in Louisiana must be reported to the Department of Conservation. A procedure and form for reporting spills has been approved by the Department of Conservation, Louisiana Wild Life and Fisheries Commission, United States Coast Guard, and the Mid-Continent Oil and Gas Association. The recommended procedure for reporting spills of oil or hazardous materials in Louisiana is given below, but should be revised and updated periodically by the Authority to assure efficient coordination of cleanup activities among all agencies and private parties.

Procedure for Reporting Spills of Oil or Hazardous Substances in Louisiana:

(1) The following information should be provided when reporting spills of oil or hazardous materials by telephone:

(a) Name of company reporting spill or sighting slick;

(b) Name of person reporting spill and telephone number;

(c) Location of spill;

(d) Approximate amount and type of material spilled;

(e) Source of spill and action taken to control spill.

(2) Procedure for reporting spills into waters during regular working hours:

(a) All spills occurring south of the Intracoastal Canal and on rivers as far upstream as they are navigable by ships should be reported to the appropriate U.S. Coast Guard District Office, Officer of the Day (New Orleans, 504-527-7171 or 504-7101 or Sabine, Texas 713-971-2361) by telephone or comparable means;

(b) Appropriate Federal agencies will be notified by the U.S. Coast Guard;

(c) Persons or company representatives should, in all cases involving five or more barrels of oil or hazardous materials, and of lesser quantities if the nature of the material or location of the spill indicate the possibility of significant impact on the environment, call the Louisiana Wild Life and Fisheries Commission, 504-527-8126, New Orleans; Louisiana Stream Control Commission, 504-389-5300, Baton Rouge; and the Louisiana Department of Conservation, 504-389-5161, Baton Rouge.

(3) Procedure for reporting spills into waters at night and on holidays:

(a) All spills occurring south of the Intracoastal Canal on rivers as far upstream as they are navigable by ships will be reported to the appropriate U.S. Coast Guard District Office, Officer of the Day (New Orleans or Sabine, Texas) by telephone or comparable means;

(b) The Coast Guard will notify appropriate Federal Agencies;

(c) The Coast Guard will, in cases of spills occurring in the areas outlined above, and of a magnitude of five (5) barrels or more, notify the Louisiana Wild Life and Fisheries Commission Wharf, New Orleans; and

(d) The Louisiana Wild Life and Fisheries Commission Wharf will notify one or more of the following:

A.J. Prehac	New Orleans	887-5974
R.A. Lafleur	Baton Rouge	926-1560
L.S. St. Amant	Hammond	345-4383
J.D. Givens	Baton Rouge	926-8297
Tom Bradley	New Orleans	721-2831

Joseph DeVall	Baton Rouge	344-8072
John Aldridge	Gonzales	644-3493
Felix Boudreaux	Baton Rouge	355-1941

(e) All spills, occurring north of the Intracoastal Canal and on rivers not navigable by ships, of a magnitude of five (5) barrels or more, and of lesser quantities if the nature of the material or location of the spill indicate the possibility of significant impact on the environment, will be reported to the Louisiana Wild Life and Fisheries Commission, 504-527-8126, New Orleans; Louisiana Stream Control Commission, 504-389-5300, Baton Rouge; and the Louisinaa Department of Conservation, 504-389-5161, Baton Rouge, on the following business day.

(4) Procedure for reporting spills on land:

(a) During regular working hours, the person or company representative should in all cases involving five (5) or more barrels of oil or hazardous materials, or lesser quantities if the nature of the material or location of the spill indicate the possibility of significant impact on the environment, call the Louisiana Department of Conservation, 504-389-5161, Baton Rouge.

(b) At night and on weekends and holidays, for spills of the same magnitude or consequence as indicated above, call the Louisiana Department of Conservation, 504-389-5161, Baton Rouge, on the following business day.

(c) Any spill which occurs on land but reaches a body of water should be handled in the same manner as the procedure for reporting spills into waters.

(5) Written reports must be filed with the Louisiana Department of Conservation for all spills of one (1) barrel or more which occur on land or water on forms prescribed by the Department. This is necessary even though the initial oral report is made to this agency or to the U.S. Coast Guard.

The form for reporting spills should probably be included among reference material maintained by the Authority.

d. References

La. Const. V, §§ 1 and 18.

La. Const. VI, § 1 (c).

La. R.S. 30:1-22; 201-221.

"Procedure for reporting spills of oil or hazardous materials in Louisiana." (Available on request from the Department of Conservation)

Form: "Report for spills of oil or hazardous materials" (Available on request from the Department of Conservation)

"Reporting of Oil and Condensate Transportation to the State of Louisiana, Department of Conservation, incident to United States Department of the Interior OCS Order No. 11, December 20, 1971 by the United States Supreme Court." (Available on request from the Department of Conservation)

Sixth Coastal Region Oil and Hazardous Substance Pollution Contingency Plan, CCGD8 INST 5922.4. (Available on request from the Commander, Eighth Coast Guard District, Custom House, New Orleans, Louisiana 70130)

National Oil and Hazardous Substances Contingency Plan (August, 1971)

4. Department of Health

a. Function

The Department of Health has jurisdiction over waste disposal and has been named the official agency to administer the State waste management program. Administrative authority of the Department is vested in the State Board of Health.

However, the total waste management program of Louisiana is not exercised exclusively by the Board as the State legislature has seen fit to regulate different facets of pollution through the creation of other agencies with greater regulatory responsibility. [See Sections D(1) and D(12)].

Much work of the Department is done in conjunction with local boards of health, which are required by statute to act under supervision of the State Board of Health.

b. Authority

Many activities of the Department directly or indirectly bear on water quality in the State. These activities may be separated into six programs.

The water supply program involves surveillance of public, semi-public and private water supplies to assure safety from disease transmission and to determine quality. Consultation services are offered by the Department regarding the best approaches encountered in the treatment, design, and operation of water supply systems.

A sewage and sewage treatment program has been developed by the Department in accordance with its responsibility for controlling disposal of sanitary sewage. In addition to regular consultation and advisory services, the Department conducts facility inspections and sampling of discharges.

Inspection and evaluation of solid waste disposal activities and consultation on proper management constitute the activities of the Department under its solid waste disposal program.

In accordance with its general sanitary engineering program, the Department of Health inspects recreational areas and surveys, samples and evaluates oyster-growing waters for determination of the safety of harvested oysters for consumption.

An air control program provides support for many activities of the Louisiana Air Control Commission. Specific activities include

enforcement of emission standards, surveillance and sampling, and inspection of industrial plants to assure compliance with regulations and standards.

A radiological health program involves surveillance of environmental factors for possible radioactive contamination.

The Department of Health, in carrying out its various environmental responsibilities, cooperates with a number of State agencies, including the following:

(1) Wild Life and Fisheries Commission for shellfish sanitation;

(2) Department of Conservation for subsurface injection of wastes (Department of Health approval is required for injections);

(3) Stream Control Commission for industrial waste as it affects health considerations (the Director of the Bureau of Environmental Health, Department of Health, is a member of the Stream Control Commission);

(4) State Parks and Recreation Commission concerning sanitation facilities in state parks; and

(5) Department of Public Works for various water resources activities.

c. References

La. Const. Art. 6, §11.

La. R.S. 40:1 et seq.

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.

Clean Air Act, 42 USC 1857a et seq.

Solid Waste Disposal Act, Pub. L. 89-272.

5. Department of Public Works

a. Function

The Department of Public Works (DPW) has complete responsibility for water resources projects, acting as the Governor's arm with respect to all water resources problems. DPW also works closely with the U.S. Army Corps of Engineers, and must give prior approval on behalf of the State to any action undertaken by the Corps of Engineers in navigable or territorial waters of Louisiana.

b. Authority

The Department of Public Works performs all administrative functions of the state in relation to the planning, design, construction, and operation of levees, canals, dams, locks, spillways, reservoirs, drainage systems, irrigation systems, aeronautical facilities, housing development, inland navigation projects, flood control, and other public works projects.

Planning assistance engineering advisory services are rendered by DPW to local governmental subdivisions and special districts, including port and terminal districts and levee districts.

Maintenance, improvement, and extension of the intracoastal canal system and its feeders is fostered by DPW. Further, they are authorized to initiate, sponsor, and implement all waterway projects within Louisiana.

Flood control and other reclamation projects requiring the drainage of marshlands and overflow lands within the State are conducted by the Department of Public Works.

DPW is authorized to confer with the Louisiana Wild Life and Fisheries Commission on projects affecting wetlands and other wildlife habitats.

Rules for navigational purposes have been promulgated by the Department concerning the location of pipelines crossing State waterways.

The Department of Public Works is responsible for making surveys, reports, and investigations, and preparing maps concerning the boundaries, titles, location, and other matters relating to State lands and water bottoms.

Department officials do not believe that environmental impact analyses form any part of their responsibility.

c. References

La. R.S. 38:1-18

Rivers and Harbors Act of 1899, 33 U.S.C. 401 et seq.

6. Department of Wild Life and Fisheries

a. Function

The Department of Wild Life and Fisheries functions to protect, conserve, and replenish the renewable natural resources of the State, including wild game and non-game quadrupeds and fowl, fish, shellfish, and other terregenous and aquatic life. The Louisiana Wild Life and Fisheries Commission (LWLFC) is the administrative control for the Department of Wild Life and Fisheries. This Commission is the State agency exercising complete jurisdiction over the management of living resources within the territorial bounds of Louisiana.

b. Authority

Programs of the Wild Life and Fisheries Commission have been divided among six major divisions. Each division with its respective activities is discussed independently below.

The Seafood, Oyster and Waterbottoms Division deals primarily with the management of the seafood industry, which includes all commercial fish species.

This division is responsible for the granting of "letters of no objection" for dredging and pipeline activities that operate through wetlands and marshes or state-owned waterbottoms. There is no direct statutory authority for issuing "letters of no objection," but the following customary practices* have evolved:

(1) conditions to minimize effects on fishing and environmental interest may be imposed in the "letters of no objection";

(2) proposed route for dredging will be examined for ecological and oyster lease disturbances;

(3) spoil may not increase the bottom more than 6 inches;

(4) the Commission may recommend a route where there are the least number of oysters or the area of least ecological damage;

(5) consent of the oyster lessee will be required; or

(6) when a canal passes through a bayou or pass, the Commission can require the operator to dam up the canal to maintain the integrity of the drainage pattern.

* This list of practices is intended as illustrative only and in no way limits the authority of the Louisiana Wild Life and Fisheries Commission, Department of Wild Life and Fisheries.

Other activities of the division include the granting, surveying and mapping of oyster leases, research into sciences affecting commercial fisheries, and regulation of seismic study activities. Further, all leases and permits for shell, sand, and gravel dredging, and fill work are handled through this division.

The Refuge Division has the responsibility for establishing, maintaining, and operating game refuges, reserves, state-managed hunting grounds, wildlife sanctuaries, and breeding, feeding and propagating grounds. This Division has issued regulations concerning the following aspects of the use of lands under its jurisdiction:

(1) Individual application must be made to the Commission for any surface construction or surface development work;

(2) All operations shall be conducted so as to avoid pollution and the escape of oil on the property;

(3) Drainage of property is prohibited;

(4) Burning of marshes is prohibited in most instances; and

(5) Utility rights-of-way over Louisiana Wild Life and Fisheries-owned forest and marsh lands are governed in part by Commission regulations.

Research by the Refuge Division is concerned with investigating and evaluating present and proposed marsh management for both fish and wildlife purposes. Much of this work is done in cooperation with the Louisiana Fisheries Unit of Louisiana State University.

The Fur Division is charged only with managing and promoting fur-bearing animals and alligators, while the Fish Division is responsible for fresh water fisheries in the State.

Enforcement of all game and fish laws in the State of Louisiana is the responsibility of the Enforcement Division.

The division of Water Pollution Control is concerned with water pollution control and works in conjunction with the Coastal Wastes Control Section of the Seafood, Oyster, and Waterbottoms Division. The Water Pollution Control and the Enforcement divisions cover the entire State, while the Coastal Wastes Control Section covers only the eastern part of the coast (Morgan City eastward). The Coastal Waste Control Section could have a bearing on the foreseeable expansion of the Authority Development Program.

The Water Pollution Control Division is the principal technical and enforcement arm of the Louisiana Stream Control Commission (see section D (12)). Research laboratories are maintained by this Division and support the Stream Control Commission and the State's water pollution control program.

The Louisiana Wild Life and Fisheries Commission is the leading environmental agency of the State. Comments regarding the environmental impact of a proposed project, whether a State project or a joint State-Federal project is made by the Commission.

The Commission comments on projects undertaken by the Highway Department and by the Department of Public Works. With respect to joint Federal-State projects, the Commission reviews for environmental impact projects undertaken by the U.S. Army Corps of Engineers and the U.S. Soil Conservation Service.

One long-range program of LWLFC is designed to acquire either ownership or long-term leases on lands for management for the public use of hunting and fishing. Outright purchases of land, wherever

possible is part of the Commission's efforts to assure sportsmen permanent recreational areas.

c. References

Cooperative Gulf of Mexico Estuary and Inventory Study, 2 vols., Louisiana Wild Life and Fisheries Commission (1972)

Compilation of Louisiana Laws Pertaining to Wild Life and Fisheries, Louisiana Wild Life and Fisheries Commission (1971)

La. Const. Art. 6 § 1.

La. R.S. 56: Title 56.

Fish and Wildlife Coordination Act, 16 U.S.C. 1661 et seq.

Federal Water Pollution Act, 33 U.S.C. 1251-1376.

La. R.S. 34:851.1 - 851.16. Motor Boats and Vessels.

La. R.S. 38:216. Drainage of Oil, Saltwater, Etc., into Natural Drain Prohibited.

La. R.S. 41:19, 1217, 1262-1268, 1501-1505. Leasing of State Lands.

La. R.S. 49:661-663. Federal-State Programs.

7. Environmental Protection Section (Office of the Attorney General)

a. Function

The Environmental Protection Section of the Office of the Attorney General has been charged with the responsibility of attending to all legal matters relating to environmental protection in which the State has an interest.

b. Authority

Attorneys in this section are required by statute to represent the Stream Control Commission, Air Control Commission and the State Land

Office. This section acts in an advisory capacity for the various State agencies which retain in-house counsel but whose functions directly affect the environment.

The Environmental Protection Section must prosecute enforcement actions for violations of rules, regulations and standards of the Stream Control Commission.

This section often prepares comments on environmental impact statements concerning public works projects.

Two full-time attorneys staff the Environmental Section.

There is no permit, license or certification authority vested in the Office of the Attorney General.

c. Procedure.

As no permit, license or certification authority is vested in the Office of the Attorney General, there exist no relevant procedural steps to set forth herein.

Comments or questions concerning environmental legal matters affecting State interests should be directed to either:

Mr. Dick Troy
Assistant Attorney General
Assistant in charge of Environmental Affairs
234 Loyola Ave.
New Orleans, Louisiana 70112

or,

Mr. Michael Duplantier
Special Counsel
104 Supreme Court Building
301 Loyola Ave.
New Orleans, Louisiana 70112.

d. References

La. Const. Art. VII, §56.

La. R.S. 13:5036

La. R.S. 40:2214.

La. R.S. 51:1061.

La. R.S. 56:1444.

Clean Air Act, 42 U.S.C. 1857a, et seq.

Federal Water Pollution Control Act, 86 Stat. 816, 33 U.S.C. 1151 et seq.

National Environmental Policy Act, 85 Stat. 852, 42 U.S.C. 4321, et seq.

8. Governor's Council on Environmental Quality and Citizens Advisory Board

a. Function

The Council on Environmental Quality was created to advise the Governor on pollution control, natural resources management and land use activities.

The Citizens Advisory Board functions in a purely advisory capacity to the Governor's Council on Environmental Quality.

b. Authority

The council is authorized to serve as a coordinating body for various State agencies, and as a clearing house for environmental impact statements prepared or reviewed by State agencies in accordance with the National Environmental Policy Act (42 U.S.C. 4321, et seq).

The Governor's Council has been assigned the duty of developing interrelated environmental quality criteria and long-range environmental quality goals.

The Board is authorized to review laws, standards, regulations and activities of State environmental agencies and to make recommendations in the form of an annual report to the Governor and legislators.

There is no permit, license or certification authority vested in the Governor's Council on Environmental Quality or the Citizens Advisory Board.

c. Procedure

As no permit, license or certification authority is vested in the Governor's Council on Environmental Quality or the Citizens Advisory Board, there exist no relevant procedural steps to set forth herein.

d. References

La. R.S. 40:2351 - 2355.

Executive Order 22.

Clean Air Act, 42 U.S.C. 1857, et seq.

National Environmental Policy Act, 85 Stat. 852, 42 U.S.C. 4321, et seq.

Federal Water Pollution Control Act, 86 Stat. 816, 33 U.S.C. 1151, et seq.

9. Louisiana Advisory Commission on Coastal and Marine Resources

a. Function

In 1971 the Louisiana Advisory Commission on Coastal and Marine Resources (Advisory Commission) was established for the purpose of developing a comprehensive coastal zone management plan for Louisiana. This plan was completed on 15 September 1973, the termination date of the Advisory Commission.

b. Authority

There was no permit, license or certification authority vested in this commission.

As the State Planning Office has coordinated coastal zone management planning in the past, the Louisiana Advisory Commission on Coastal and Marine Resources has worked in close cooperation with the Planning Office.

Primarily, the role of the Advisory Commission was to study existing and future programs, policies and projects concerning conservation and development of the Louisiana coastal zone and resources. Annual reports and a Coastal Zone Management Plan encompassing policy objectives and problem considerations have been prepared by the Advisory Commission and should reflect the results of the foregoing study efforts.

La. R.S. 34:3114(B) instructs the Deep Draft Harbor and Terminal Authority to take affirmative steps fully coordinating all aspects of the Authority Development Program with the coastal zone management planning of the Louisiana Advisory Commission on Coastal and Marine Resources or its successor group. This coordination should begin following the publication by the Advisory Commission of its Coastal Zone Management Plan study results.

c. Procedure

As the Louisiana Advisory Commission on Coastal and Marine Resources terminated in September, 1973, there exist no relevant procedural steps to set forth herein.

Further, no procedural steps have been formulated for coordination of effort between the Louisiana agency which may be charged with coastal zone management planning and the Deep Draft Harbor and

Terminal Authority.

d. References

Act #35, 1971 Legislative Acts

La. R.S. 34:3101-3114

Coastal Zone Management Act, 16 U.S.C. 1451 et seq.

National Environmental Policy Act, 85 Stat. 852, 42 U.S.C. 4321 et seq.

10. Louisiana Coastal Commission

a. Function

The Louisiana Coastal Commission was created primarily for the purpose of replacing and continuing with objectives of the Louisiana Intracoastal Seaway Commission. Ultimate plans of the Commission are to construct ocean-going ship channels to follow the intracoastal waterway across southwest Louisiana.

b. Authority

Present jurisdiction of the Coastal Commission is in an area consisting of the following parishes: Acadia, Calcasieu, Cameron, Iberia, Jefferson Davis, Lafayette, Lafourche, St. Landry, St. Martin, St. Mary, Terrebonne, and Vermilion.

The Coastal Commission has no power of license, permit or certification.

There is no legislative provision authorizing environmental studies by the Commission. An Advisory Board consisting of nine educators has been established to offer advice and make recommendations regarding scientific matters. No vote in determining commission policy has been accorded this Board.

The Commission is empowered to plan, establish, construct, own, operate and maintain:

(1) A system of navigation channels and equipment for oceangoing vessels;

(2) Structures to form a freshwater supply system for agricultural, industrial and domestic use, and improvement of wildlife ecology;

(3) Structures to control domestic and industrial water so as to prevent pollution of the fresh water system and pollution of wildlife habitat;

(4) Structures for protection against high tides and salt water intrusion; and

(5) Drainage improvement projects.

The Commission is authorized to disseminate information concerning its activities, program and needs to Federal, State and local political subdivisions and to the general public.

The Coastal Commission proclaims to conduct a water-land management program. This program consists of assisting in the identification of areas needing research.

No rules and regulations, inter-office memoranda or guidelines, or other official documents or publications have been prepared by the Louisiana Coastal Commission.

Port or navigation districts or authorities within the area affected by the Coastal Commission are not divested of any rights, authorities or functions.

c. Procedure

An executive director is the only full-time employee of the Coastal Commission and serves primarily as a lobbyist seeking approval of the Louisiana Intracoastal Seaway project. The director operates

with the close support of a private organization known as the Louisiana Intracoastal Seaway Association.

Two public agencies with which the Coastal Commission works most closely are the Louisiana Department of Public Works and the U.S.Army Corps of Engineers. Other state agencies are the Louisiana Department of Wild Life and Fisheries, State Land Office, Deep Draft Harbor and Terminal Authority, Advisory Commission on Coastal and Marine Resources and the State Planning Office. Additional Federal agencies include the Fish and Wildlife Service, Soil Conservation Service and the U.S. Coast Guard.

As no permit, license or certification authority is vested in the Coastal Commission, there exist no relevant procedural steps to set forth herein.

d. References

La. R.S. 34:2251 - 2255

La. R.S. 34:3114(B)

National Environmental Policy Act, 85 Stat. 852, 42 U.S.C. 4321 et seq.

Coastal Zone Management Act, 16 U.S.C. 1451 et seq.

11. Louisiana Deep Draft Harbor and Terminal Authority

a. Function

The Deep Draft Harbor and Terminal Authority is created with the primary function of promoting, planning, financing and constructing a deep draft harbor and terminal for Louisiana.

b. Authority

The Deep Draft Harbor and Terminal Authority may acquire waterbottoms by lease or purchase; it may grant contracts, borrow money,

issue bonds and is generally vested with exclusive and plenary authority to do any and all things necessary or proper to promote, plan, finance, develop, contract, control, operate, maintain and modify development of a deep draft harbor and terminal.

The Deep Draft Harbor and Terminal Authority presently is developing rules and regulations covering all aspects of its development program including an environmental protection plan for protection and enhancement of the coastal and marine environment which may be affected by such development. Such rules and regulations are to be promulgated by the Deep Draft Harbor and Terminal Authority no later than 25 January 1974.

No permit, license or certification authority has yet been established concerning development of a deep draft harbor and terminal in or affecting Louisiana.

c. Procedure

As no permit, license or certification authority has yet been established or formulated under the direction of the Deep Draft Harbor and Terminal Authority, no procedural steps are available to set forth herein.

d. References

La. R.S. 34:3101-3114.

Report, Louisiana Superport Task Force, A Superport for Louisiana. June, 1972.

Louisiana Superport Studies Report No. 1: Preliminary Recommendation and Data Analysis, Center for Wetland Resources, Louisiana State University, Baton Rouge, Louisiana (August, 1972) (pub. no. LSU SG 72 03).

Executive Order No. 86.

Clean Air Act, 42 U.S.C. 1857a et seq.

Federal Water Pollution Control Act, 86 Stat. 816, 33 U.S.C. 1151 et seq.

National Environmental Policy Act, 85 Stat. 852, 42 U.S.C. 4321 et seq.

12. Louisiana Stream Control Commission

a. Function

The Stream Control Commission has control of waste disposal, both public and private, by any person, into any of the waters of the State or any tributaries of any drains flowing into any such waters, for the prevention of pollution thereof tending to destroy fish life or to be injurious to the public health, the public welfare, or to other aquatic life or wild or domestic animals or fowl.

b. Authority

The Stream Control Commission is authorized to grant permits for industrial waste discharges into waters of the State. "Waters of the State" include rivers, streams, lakes and all bordering waters including the Gulf of Mexico.

Rules and regulations governing discharges of industrial waste into the waters of the State are issued and promulgated by the Stream Control Commission. The Water Implementation Plan, as provided in §402 of the Federal Water Pollution Control Act 33 U.S.C. 1151 et seq., has been approved by the EPA Administrator as required by law, and became effective in 1968. Permits issued under this section may still be subject to the approval of the Administrator of the Environmental Protection Agency. Water implementation plans constitute part of the

overall National Pollutant Discharge Elimination System.

Enforcement of regulations governing effluent discharges of industrial wastes into State waters is conducted through the Division of Water Pollution Control, Louisiana Wild Life and Fisheries Commission. This division is actively assisted in its efforts to control pollution by the State Board of Health, the Departments of Conservation, Agricultural and Immigration, Public Works, and Commerce and Industry, and the Office of the Attorney General. These agencies are also represented on the Stream Control Commission.

A state-wide water monitoring program of thirty streams has been conducted by the technical staff of the Commission. Bayou Lafourche, the Mississippi River, and the coastal waters of Louisiana were included in the monitoring program.

Chemical and biological stream surveys are conducted on various water courses as need, time, manpower, and other facilities permit. Field personnel investigate all reports and compliants of water pollution. Aerial surveillance is conducted at frequent intervals to detect pollution conditions that might not be otherwise discerned. Obvious pollution situations are investigated by staff personnel travelling by automobile or boat.

c. Procedure

A certificate of approval from the Stream Control Commission must be obtained by any person intending to discharge industrial waste at any location in the State where such person is not now discharging industrial waste. Also, any person intending to increase the quantity

of industrial waste which he is discharging into State waters, and any person intending to construct a new outlet, or build, add to, or alter any treatment works for the handling of industrial waste, should, before increasing such discharge or starting such work, obtain a Commission certificate of approval. A standard procedure is recommended for obtaining such certificates of approval.

First, written notice of intent should be sent to the Louisiana Stream Control Commission, Baton Rouge, Louisiana.

Then, a general report describing the proposed sewage system and protection steps to be taken must be supplied to the Commission. This report should include a brief statement describing the proposed action, a map or description of location showing such discharge, and the probable volume and concentration of the industrial waste. A description of treatment works which are to be installed and an estimate of the extent to which the quality of the industrial waste is to be improved should form part of the report. The report should include an estimate of the rate of low flow of the receiving stream and the extent to which the quality of receiving waters will be altered or affected. Finally, the Commission may require the inclusion of any other data believed necessary before issuing the certificate of approval of the discharge.

It is the policy of the Louisiana Stream Control Commission that all interstate waters or portions thereof, and coastal waters whose existing quality exceeds the approved water quality standards will be maintained at their existing high quality, unless or until it has been affirmatively demonstrated to the Louisiana Stream Control Commission that such changes will not interfere with or become injurious to the users of

the waters as described in the water quality standards.

Any industrial, public or private project or development that would constitute a new source of pollution or an increased source of pollution to any of the waters in Louisiana will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology consistent with the best practice in the area affected under the condition applicable to the project or development.

d. References

A regulation requiring the submission of reports for the discharge of industrial waste and for the construction or alteration of treatment works, Stream Control Commission, State of Louisiana, (August 1, 1951).

Water Quality Criteria and Plan for Implementation, Louisiana Stream Control Commission (-968)

Federal Water Pollution Control Act, 33 U.S.C. 1151 et seq.

La. R.S. 56:1431-1446.

La. R.S. 56:1451-1453.

La. R.S. 46:1461-1464.4.

13. Public Service Commission

a. Function

The Public Service Commission is empowered to regulate, control and supervise all common carriers and public utilities in the State of Louisiana, excluding natural gas pipelines.

b. Authority

The Commission may set and establish rates, fares or charges for services rendered by common carriers or public utilities in the State.

Orders of the Commission fixing rates go into effect at the time stated by the Commission. A plaintiff alleging irreparable damage may petition the district court for a temporary restraining order to remain in force only until the determination on the merits for an interlocutory injunction against the Public Service Commission is decided. Suits against Commission orders and decrees must be commenced within 90 days of the decree at the Commission's domicile. All cases are to be tried summarily, with appeal directly to the Supreme Court.

Penalty for violation of a Commission's order, decree or rate shall be a money fine between $100 and $5,000.

Municipal or parish authorities still retain regulation and control over any local public utility, unless the town, city or parish surrenders its powers to the Public Service Commission.

c. References

La. Const. Art. 6 §§4 - 10.

La. R.S. 33:4491 et seq.

14. State Land Office

a. Function

Principle functions of the State Land Office (SLO) relating to the development of a deep draft harbor and terminal in the State of Louisiana are management of state lands and collection of revenues due from such lands.

Special Louisiana legislation (La. R.S. 34:3108) directs the Register of State Lands to perform certain duties relating to the Louisiana Deep Draft Harbor and Terminal Authority. A special lease is to

be granted at a specified rate for a specified time whenever the Register is so requested by proper officials of the Deep Draft Harbor and Terminal Authority.

b. Authority

Authority to grant rights-of-way across all public lands of the State of Louisiana is vested in the State Land Office. Public lands include navigable waterbottoms and lands beneath the waters of the oceans seaward to the limits of the territorial sea.

Certain patents issued during the early history of the State vested ownership of specified navigable waterbottoms in private individuals. After a determination is made by the Authority as to which lands will be affected by the Authority Development Program, a search of the public records may be necessary to ascertain which, if any, navigable waterbottoms are vested in such private ownership.

In accordance with land management responsibilities, the State Land Office must locate and appraise State lands. Additionally, State Land Office directs a Land Management Program. This program is concerned with the best usage of public lands and has a primary goal of seeking the fullest utilization of such lands for public recreation. A secondary goal is the generation of revenues for the State. Protection of the natural environment is under constant consideration in pursuing all goals of the Land Management Program. However, no written guidelines have been established for this program.

No comprehensive enforcement or inspection program for rights-of-way across public lands is conducted by the State Land Office. This is due to 99 per cent of rights-of-way being under water.

Two field men are employed as inspectors whenever timber lands are in the path of a right-of-way. This inspection consists of an evaluation of timber which will be cut to enable construction in the right-of-way.

The State Land Office depends on the State Department of Public Works for all engineering or enforcement phases during and after such right-of-way construction. This refers to specifications and techniques for controlling pipelines, which have been promulgated by the State Land Office or Department of Public Works. Maintenance and construction rules of the Federal Power Commission have been adopted by the State Land Office.

Rules and regulations concerning the granting of rights-of-way are issued by the State Land Office.

The State Lands Office has no authority over private lands.

c. Procedure

The Register of State Lands must issue a certificate of title evidencing a lease of State-owned waterbottoms in the Gulf of Mexico as described in any request from the governing body of the Deep Draft Harbor and Terminal Authority [La. R.S. 34:3108(A)]. Such lease or leases will be subject to the following conditions:

(1) $5.00 per acre per annum, with legislative re-evaluation of rental payments upward or downward to reflect changing economic conditions [La. R.S. 34:3108(B)];

(2) Such leases must be for a term of 40 years [La. R.S. 34:3108(C)];

(3) Proceeds are to be brought into the State treasury and shall become part of the general fund of the State [La. R.S. 34:3108(D)];

(4) The Authority is not authorized to seek a lease for properties not enumerated in the provisions of the Statute [La. R.S. 34:3108(E)];

(5) Lands so leased may not be leased by the State Mineral Board of the Louisiana Wild Life and Fisheries Commission without the express consent of the Authority, unless clear and convincing evidence is presented that such lease or leases will not adversely affect present or future operations [La. R.S. 34:3108 (E)].

To obtain a right-of-way across public lands, application is made to the State Land Office using the approved right-of-way form. The form, to be submitted in triplicate, must be signed and notarized before submission. A plat must be attached to each copy, with an indication of pipe size and the width and length of the proposed right-of-way. Maximum width allowable is 200 feet.

If other state leases are to be traversed, a copy of a letter of notification to such lessee, with signed certified receipt attached, must be included in the application. Where navigable waters are to be crossed, permission or clearance must be obtained from the U.S. Army Corps of Engineers and the Louisiana Department of Public Works. Copies of such permission or clearance should accompany the application.

Clearance must be obtained from the Wild Life and Fisheries Commission when oyster leases are trespassed, and when the proposed right-of-way crosses a Federal or State reserve.

Finally, a copy of the completed document must be filed with

the Clerk of Court for the parish, or parishes, affected.

For a single pipeline having multiple crossings of public lands or public waterbottoms a single right-of-way application for all crossings may be made. However, an individual application by parish may be preferred as the original of such lease contract must be filed in the public records of the parish wherein such State properties are located. Multiple lines are acceptable in a single application.

Pipe with an outside diameter of 40 inches or more is accorded a Class 6 status. The fee for permits for Class 6 pipelines is $10 per rod. This Class 6 permit is conditioned on a maximum right-of-way of 200 feet during construction, reverting to 60 feet after construction is completed, with the additional right of ingress and egress for the purpose of maintenance, repairs, removal or modification. No maintenance, repairs, removal or modification is required by the State Land Office other than such requirements as may be contained in Federal Power Commission rules. Other pipe classifications with permit fee requirements are as follows:

(1) Class 1 - Pipe with outside diameter of 2 to 5 inches; $3.00 per rod.

(2) Class 2 - Pipe with outside diameter of 6 to 10 inches; $4.00 per rod.

(3) Class 3 - Pipe with outside diameter of 11 to 19 inches; $6.00 per rod.

(4) Class 4 - Pipe with outside diameter of 20 to 29 inches; $7.00 per rod.

(5) Class 5 - Pipe with outside diameter of 30-39 inches; $8.00 per rod.

Two conditions exist which authorize termination of a right-of-way lease. First, the continuous nonuse of a right-of-way for five

years operates as a forfeiture. Second, if construction is not commenced within two years after the lease is granted, the lease is terminated.

Assignment of a lease requires the written consent of the State Land Office.

All pipelines constructed under permits granted by the State of Louisiana must be in accordance with the then current provisions of the American Standards Code for pressure piping.

d. References

Granting of Rights-of-Way to Corporations or Individuals, State Land Office, (May 14, 1969).

SLO 401 - Right-of-Way Grant (available on request from the State Land Office).

La. Const. Art. V., §1.

La. R.S. 34:3101-3114.

La. R.S. 41:1173 et seq.

La. R.S. 41:1-19.

La. R.S. 41:1261-1269.

La. R.S. 41:1211-1221.

15. State Mineral Board

a. Function

The primary function of the State Mineral Board is to lease State-owned lands for the development and production of minerals, oil and gas.

b. Authority

The Mineral Board is empowered to lease for mineral development roadbeds, State-owned waterbottoms, lands adjudicated to the

State at tax sales, together with public roads, canals and similar property, the title to which is in the State or parishes.

The State Mineral Board has full supervision of mineral leases created by the State. This supervisory power over leases involves:

(1) The power to determine whether the lessee has complied with the terms of the lease;

(2) Authority to take any legal action available to a private lessor;

(3) Power to annul the lease for cause;

(4) Power to amend leases under special restrictions.

State agencies have the discretionary power to request the Mineral Board to execute mineral leases on their lands.

No jurisdiction over pipelines or rights-of-way is exercised by the Mineral Board.

c. Procedure

The leasing procedure followed by the State Mineral Board relates only to mineral leases and is believed inapplicable to leases which may be desired by the Deep Draft Harbor and Terminal Authority.

This is particularly true in view of La. R.S. 34:3108 pertaining to acquisition of sites for a deep draft harbor and terminal on State-owned waterbottoms. The Register, State Land Office, is named as the leasing agency with the mandatory duty to lease public waterbottoms upon request of the governing body of the Deep Draft Harbor and Terminal Authority.

Mineral rights in such lands are to be reserved to the State, and may not be leased subsequently by the Mineral Board without the

express consent of the Deep Draft Harbor and Terminal Authority. The Mineral Board must show, by clear and convincing evidence, that such lease of minerals would not adversely effect present or future Authority operations before mineral rights beneath such lands could be leased.

d. References

La. R.S. 30:121-141.

La. R.S. 34:3101-3114.

16. State Parks and Recreation Commission

a. Function

State Parks and Recreation Commission was created in 1938 to promote an adequate parks and recreation system for the State.

b. Authority

The State Parks and Recreation Commission is empowered to acquire lands for the State park system by lease, purchase or other agreement, including eminent domain, and may construct and operate suitable public conveniences thereon.

The Commission is also authorized to enter into agreements with subdivisions of the State, other States and the Federal government to acquire, plan, develop, improve and maintain any park or recreational area. This authorization could prove of value to the Authority in the development of compensatory projects and coordinating other activities associated with superport development.

The State Parks and Recreation Commission is authorized by the legislature to cooperate and participate in projects of the U.S. Army Corps of Engineers to develop outdoor recreation and fish and wildlife enhancement as provided in the Federal Water Project Recreation Act.

The director of the Commission is designated as the authorized representative for the State in regard to the Federal Land and Water Conservation Fund Act.

c. Procedure

The State Parks and Recreation Commission will act upon request from another agency or by statutory mandate to assist or take over the administration and control of any park or recreational area which meets Commission criteria. This criteria is concerned with available facilities, acreage, contribution of the area to environmental conservation and other criteria as may be determined by the Commission.

d. References

La. R.S. 56:1681.

La. R.S. 56:1683.

La. R.S. 56:1741.

La. R.S. 56:1802.

Federal Land and Water Conservation Fund Act, 16 U.S.C. 4601 (4-11).

Federal Water Project Recreation Act, 16 U.S.C. 4601 (12) et seq.

17. State Planning Office

a. Function

The State Planning Office (SPO) serves as the principal staff agency of the Governor for State-wide planning.

b. Authority

The State Planning Office is authorized primarily to provide consultation, research and coordination relating to projects with a State-wide impact. Contract work with private consulting firms is let on a

regular basis by SPO and constitutes a considerable portion of its fiscal budget. The following are general activities performed by the State Planning Office:

(1) Conduct basic planning studies;

(2) Review planning efforts of all state agencies as well as municipal and regional planning commissions;

(3) Administer all Federal programs for planning purposes;

(4) Assist state fiscal agencies in the joint implementation of a program evaluation and comprehensive budgeting system;

(5) Collect, analyze, and report physical, social, and economic information relevant to State governmental operations;

(6) Recommend fund allocations to programs to achieve established state objectives; and

(7) Provide assistance on planning problems to parishes, municipalities, political subdivisions, and other State agencies.

In simple terms the role of the State Planning Office is to act as an interested and well-informed third person to coordinate interaction among State agencies.

As both the State Planning Office and the Department of Public Works have planning responsibilities, a memorandum of understanding was executed to delineate planning responsibilities of the two agencies. This memorandum states in effect that State-wide planning is the responsibility of the State Planning Office while local planning is the responsibility of the Department of Public Works.

Review and comment of environmental impact statements, particularly those concerning projects affecting scenic rivers and vital ecosystems, is done by the State Planning Office.

There is no permit, license or certification authority vested in the State Planning Office.

c. Procedure

As no permit, license or certification authority is vested in the State Planning Office, there exist no relevant procedural steps to set forth herein.

d. References

No rules and regulations, inter-office memoranda or guidelines, or other official documents or publications have been prepared by the State Planning Office.

La. R.S. 49:1051-1057.

National Environmental Policy Act, Pub. L. 91-190, 85 Stat. 852, 42 U.S.C. 4321 et seq.

E. Local Agencies

1. Greater Lafourche Port Commission

a. Function

The function of the Greater Lafourche Port Commission is to administer and regulate commerce and traffic within the area of a port developed and funded by the port commission and within the jurisdiction of said commission.

b. Authority

Jurisdiction of the Greater Lafourche Port Commission is limited to the boundaries and limits of the tenth ward of Lafourche Parish as such boundaries existed in 1960.

The commission has the right to issue bonds, with a bonded indebtedness limited to not in excess of twenty-five million dollars

($25,000,000). An ad valorem tax and revenues derived from port operations support these bonds. Additional bonds for construction and improvement of port facilities, payable from a tax on property within commission jurisdiction, may issue only after special election by affected property owners.

The Greater Lafourche Port Commission may acquire by expropriation any properties necessary for construction of port facilities and a deep sea channel. This expropriation must be in accordance with Louisiana law.

All powers necessary to construct, operate, maintain, service and acquire port facilities, including such additional powers as the legislature may confer, are vested in the Greater Lafourche Port Commission.

There is no stated permit, license or certification power expressly vested in this port commission. No rules and regulations concerning port activities or operations have been promulgated.

c. Procedure

As no express permit, license or certification authority has yet been established, nor any port facilities yet developed by the Greater Lafourche Port Commission, no procedure exists concerning this agency.

However, if any port facilities are constructed within the tenth ward of Lafourche Parish by the Louisiana Deep Draft Harbor and Terminal Authority, a question exists concerning concurrent as opposed to exclusive jurisdiction of the two agencies.

d. References

La. R.S. 34:1651-1661.

La. R.S. 34:3101-3114.

2. Greater Jefferson Port Commission

a. Function

The function of the Greater Jefferson Port Commission is to exercise full corporate powers over port facilities developed by it within the port area under its jurisdiction.

b. Authority

The jurisdiction of the Greater Jefferson Port Commission consists of wards 1, 2, 3, 4, 5, 6 and 11 of the Parish of Jefferson as the boundaries and limits of said wards existed in 1963. The Greater Jefferson Port Commission has the right to issue bonds, with a bonded indebtedness limited to not in excess of twenty million dollars ($20,000,000). These bonds may be supported by mortgages on port facilities or by pledged revenues to be derived from operation of the port facilities. Further, the commission is authorized, with approval of a majority in a special election, to assess an ad valorem tax of five mills upon all taxable property in its jurisdiction for the needs and purposes of the commission.

The Greater Jefferson Port Commission may acquire by its expropriation any properties necessary for construction of port facilities and a deep sea channel. This expropriation must be in accordance with Louisiana law and shall not apply or extend to any existing port facility.

All powers necessary to construct, operate, maintain, service and acquire port facilities, including such additional powers as the legislature may confer, are vested in the Greater Jefferson Port Commission.

There is no stated permit, license, or certification power expressly vested in this port commission. No rules and regulations concerning port activities or operations have yet been promulgated.

c. Procedure

As no express permit, license or certification authority has yet been established, nor any port facilities yet developed by the Greater Jefferson Port Commission, no procedure exists concerning this agency.

d. References

La. R.S. 34:2021-2025.

3. Terrebonne Port Commission

a. Function

The function of the Terrebonne Port Commission is to administer and regulate commerce and traffic within the area of a port developed and funded by the port commission and within the jurisdiction of said commission.

b. Authority

Jurisdiction of the Terrebonne Port Commission is limited to the boundaries and limits of Terrebonne Parish, and extends seaward coterminously with the Louisiana territorial sea. The Louisiana territorial sea extends three miles seaward from the base line as such base line may be established in accordance with the terms of the Geneva Convention on

the Territorial Sea and the Contiguous Zone.

The Terrebonne Port Commission is authorized to incur debt and issue bonds, with a bonded indebtedness limited to not in excess of 10 per cent of the assessed evaluation of the taxable property within the port area. A five mill ad valorem tax and fees and revenues derived from port operations support these bonds and other indebtedness.

The Terrebonne Port Commission may acquire by expropriation any property necessary for construction of port facilities and a deep sea channel. This expropriation must be in accordance with Louisiana law. All powers necessary to construct, operate, maintain, service, acquire and regulate port facilities, including such additional powers as the legislature may confer, are vested in this port commission.

There is no stated permit, license or certification power expressly vested in the Terrebonne Port Commission. No rules and regulations concerning port activities or operations have yet been promulgated.

c. Procedure

As no express permit, license or certification authority has yet been established, nor any port facilities yet developed by the Greater Terrebonne Port Commission, no procedure exists concerning this agency.

d. References

La. R.S. 34:2201-2205.

4. Greater Baton Rouge Port Commission

a. Function

The function of the Greater Baton Rouge Port Commission is to administer and regulate commerce and traffic within the area of a port

developed and funded by the port commission and within the jurisdiction of said commission.

b. Authority

Jurisdiction of the Greater Baton Rouge Port Commission consists of the parishes of East Baton Rouge, West Baton Rouge and Iberville as the boundaries and limits of such parishes existed in 1952. Excepted from this jurisdiction are industrial areas created in the parish of East Baton Rouge by provisions of section 1.08 (b) of the Plan of Government for the parish of East Baton Rouge and the City of Baton Rouge. The commission is authorized to incur debt and issue negotiable bonds or notes, provided that the amount of such bonds and notes outstanding at any one time shall not exceed fifteen million dollars ($15,000,000). The Greater Baton Rouge Port Commission is not authorized to levy any ad valorem tax on property in the port area.

All powers necessary to construct, operate, maintain, service, acquire and regulate port facilities are vested in the Greater Baton Rouge Port Commission. The commission may acquire by expropriation properties necessary for the benefit and advantage of said commission.

In accordance with the powers conferred on the Greater Baton Rouge Port Commission by the legislature of the State of Louisiana, the commission has issued Tariff Number 1 containing rates, charges, rules and regulations governing the Port of Baton Rouge. Among provisions of tariff number 1 reflecting environmental concerns, are contained rules and regulations governing dumping of wastes into port waters, storage of gasoline and other liquid petroleum projects in port areas, smoking and

hazardous products.

The Port of Baton Rouge maintains no oil or other petrochemical off-loading facilities, although petrochemical products contained in barrels or drums are among products passing through the Port of Baton Rouge.

No provisions are evident in Tariff Number 1 concerning environmental matters which require a permit, license or certification from the Greater Baton Rouge Port Authority.

c. Procedure

As no express permit, license or certification authority was evident in provisions governing use and access of the Port of Baton Rouge, no procedure exists concerning environmental matters of this agency.

d. References

La. R.S. 34:1221-1226.

FMC-T NO. 1. Tariff No. 1, Rates, Charges, Rules and Regulations Governing the Port of Baton Rouge (Greater Baton Rouge Port District), as issued by the Greater Baton Rouge Port Commission.

5. Lake Charles Harbor and Terminal District

a. Function

The function of the Lake Charles Harbor and Terminal District is to administer and regulate commerce and traffic within the area of a port developed and funded by the port commission and within the jurisdiction of said commission.

b. Authority

Jurisdiction of the Lake Charles Harbor and Terminal District is set forth in La. R.S. 34:201 and is limited primarily to areas in

Calcasieu Parish and Southwest Louisiana.

This harbor and terminal district is authorized to incur debts and issue bonds with no limitation on amount of bonded indebtedness. An ad valorem tax of two and one-half mills is authorized. The Lake Charles Harbor and Terminal District may acquire by expropriation any properties necessary for construction of port facilities in a deep sea channel.

All powers necessary to construct, operate, maintain, service, acquire and regulate port facilities, including such additional powers as the legislature may confer, are vested in the Lake Charles Harbor and Terminal District.

The Lake Charles Harbor and Terminal District has promulgated no rules and regulations concerning environmental matters applicable to vessels and other users of port facilities.

c. Procedure

As no rules and regulations or other requirements have been promulgated by the Lake Charles Harbor and Terminal District, there is no existing procedure applicable to set forth hereafter.

d. References

La. Const. Art. 14 §30.2.

La. Const. Art. 14, §31.

La. R.S. 34:201-213.

6. Board of Commissioners of the Port of New Orleans

a. Function

The function of the Board of Commissioners of the Port of New Orleans is to administer and regulate commerce and traffic within the

area of a port developed and funded by the port commission within the jurisdiction of said commission.

b. Authority

The jurisdiction of the New Orleans Port Commission includes the parishes of Orleans, St. Bernard and Jefferson. This jurisdiction could conceivably conflict with the jurisdiction vested by the Louisiana legislature in the Greater Jefferson Port Commission and the St. Bernard Port Commission. However, only the New Orleans Port has developed facilities capable of handling seagoing vessels and cargo.

The Commission has the right to issue bonds, with a bonded indebtedness limited to not in excess of ninety-five million dollars ($95,000,000). There is no ad valorem taxing power vested in the Port of New Orleans Commissioners. All powers necessary to construct, including such additional powers as the legislature may confer are vested in the Board of Commissioners of the Port of New Orleans.

c. Procedure

As no rules and regulations or other requirements have been promulgated by the Board of Commissioners of the Port of New Orleans, there is no existing procedure applicable to set forth hereafter.

d. References

La. Const. Art. 6, §16.1.

La. Const. Art. 6, §16.2.

La. Const. Art. 6, §17.

La. Const. Art. 6-A, §1,5.

La. Const. Art. 14, §30.

La. R.S. 34:1-44.

7. South Louisiana Port Commission

a. Function

The function of the South Louisiana Port Commission is to administer and regulate commerce and traffic within the area of a port developed and funded by the port commission and within the jurisdiction of said commission.

b. Authority

Jurisdiction of the South Louisiana Port Commission includes the entirety of St. Charles, St. John the Baptist and St. James Parishes.

The Commission has the right to issue bonds with a bonded indebtedness limited to not in excess of twenty-five million dollars ($25,000,000). Taxation is expressly prohibited.

All powers necessary to construct, operate, maintain, service, acquire and regulate port facilities including such additional powers as the legislature may confer are vested in the South Louisiana Port Commission. It is further authorized to acquire, purchase, construct or improve industrial plant buildings and necessary property, equipment and appurtenances thereto.

There is no stated permit, license or certification power expressly vested in this port commission. No rules and regulations concerning environmental matters regarding port activities or operations have yet been promulgated.

c. Procedure

As no regulations concerning environmental matters have yet been established nor any port facilities yet developed by the South Louisiana Port Commission, no procedure exists concerning this agency.

d. References

La. Const. Art. 6, §33.1.

La. R.S. 34:2471.

8. Levee Boards

a. Function

Levee districts are governed by levee boards, under the supervision of the Department of Public Works. Generally areas of flooding have been divided by the State legislature into organized levee districts. Where formal levee districts do not exist, parish and municipal governments are authorized to perform the function of the levee board by expropriating land to build levees for flood protection.

b. Authority

Jurisdiction of each levee board is conterminous with the boundaries of its levee district as created by legislative enactment.

Each levee board is empowered to construct and maintain levees in its district. Private owners must be compensated by the board for all lands and improvements used or destroyed for levee purposes. Compensation will not exceed the assessed value of the property for the preceeding year. All levee boards may tax at the rate of five mills on the dollar all taxable property situatuated within the alluvial portion subject to overflow. Additional taxes for levee construction may be added but only after approval of a majority of property holders at a public election.

Levee boards are charged with the duty of notifying the owners of oil, gas and water lines thirty days prior to construction of new levees or removal of old levees, to enable the owners to move their pipelines.

Levee boards which might be of particular interest to superport activities and ancillary developments are the Lafourche Basin Levee District, the Chalmette Back Levee District, the South Louisiana Tidal Water Control Levee District, the Orleans Levee District and the Pontchartrain Levee District.

d. References

La. Const. Art. 16 §1.

La. Const. Art. 16 §2.

La. Const. Art. 16 §6.

La. R.S. 38:2.

La. R.S. 38:6.

La. R.S. 38:111.

La. R.S. 38:141.

La. R.S. 38:143.

La. R.S. 38:181.

La. R.S. 38:281.

La. R.S. 38:287.

La. R.S. 38:901.

La. R.S. 38:1031.

La. R.S. 38:1051.

La. R.S. 38:1231.

La. R.S. 38:1311.

9. Municipalities

a. Function

Municipalities are divided into three classifications: cities, towns and villages. Cities have a population exceeding 5,000, towns have

between 1,000 and 5,000 people, and villages have less than 1,000 but more than 150 inhabitants.

b. Authority

Every municipality incorporated after July 29, 1898 is governed by the mayor - board of aldermen form of government.

The powers of the mayor and board include, among other things:

(1) Care, management and control of the municipality;

(2) Granting franchises for use of the streets, alleys and public grounds for the purpose of laying gas, water, sewer and steam pipes, and conduits for electricity, not to exceed 60 years and not an exclusive franchise;

(3) Regulating the storage of combustible and inflammable materials;

(4) Regulation of wharves and docks; and

(5) Regulating fire hazards and enforcing fire standards.

Mayor and board meet at least once a month at a regular time and place. These meetings are not necessarily public. All ordinances passed are published once in the official journal of the municipality within 20 days of enactment. Ordinances are not to be enforced until 10 days after publication.

c. Procedure

The procedure for obtaining municipal clearance for any activity which may be conducted by the Louisiana Deep Draft Harbor and Terminal Authority could be easily ascertained by contacting the mayor and board of aldermen of the municipality to be affected before continuing the activity.

d. References

La. R.S. 33:321.

La. R.S. 33:341.

La. R.S. 33:361.

La. R.S. 33:401-406.

10. Pipeline Companies

a. Function

All pipeline companies in Louisiana are independently owned entities funcitoning as private carriers or common carriers of liquid and gas products. They are included as local agencies for two reasons. First, various product transport activities fall under the control and regulation of either the Interstate Commerce Commission and Federal Power Commission of the Federal government or Louisiana's Public Service Commission or Department of Conservation, depending on the interstate nature of the transportation and the product being transported. Second, a number of Louisiana statutory provisions are applicable directly to pipeline company activities and may be affected by Environmental Protection Plan regulations.

b. Authority

Pipeline companies have been granted the right to expropriate lands for constructing, maintaining and operating their lines. This right has been extended to include both public and private property expropriations. In the case of public streets, navigable streams, or other public places, the right of expropriation is subject to the condition that traffic is not interfered with, that the public property be restored to its former usefulness, and that the restoration be subject to the approval

of the proper local authority.

However, the right of expropriation by a pipeline company does not extend to public streets and alleys of a municipality without the express permission of the governing body of the municipality.

c. Procedure

As pipeline companies are not vested with any permit, licensing or other authority, regarding development of superport facilities, there exists no procedural steps to set forth herein.

d. References

La. R.S. 45:251 - 254.

11. Planning Commission

a. Function

Every parish and municipality may create a planning commission. Planning commissions function as the makers of the official master plans for the parish or municipality. Municipal commissioners are appointed and funded by the executive branch of the municipality; parish planning commissioners are appointed by the police jury for the parish.

b. Authority

A Parish Planning Commission is authorized to make and adopt a master plan for the physical development of the unincorporated territory of the parish. A Municipal Commission is authorized to adopt a master plan for the municipality. Master plans should include the location, extent and character of transportation routes, public utilities, buildings, and property. The general extent and location of public and private utilities and terminals should also be included as part of any master plan.

The purpose of the master plan is the guided, coordinated, harmonious development of a parish or municipality to promote health, safety, morals and general welfare of the community.

No public buildings or public or private utilities are to be constructed unless the character, extent and location has been submitted to and approved by the proper planning commission. If a commission disapproves of a proposed building or utility, the legislative body of the parish or municipality may overrule the objection, but only by two-thirds recorded vote to so do. The failure of a planning commission to act on approval within 60 days should be considered an approval.

Any municipality located in a parish with a parish planning commission may designate that commission as the official planner for the municipality. In the case where there exist both municipal and parish commissions within one parish, the municipal commissions coordinate and consult with the planning commission for the parish. Where a municipal planning commission is established, it also serves as the municipal zoning commission, and holds separate meetings with separate records and minutes.

c. Procedure

Adoption of the plan by resolution must follow certain procedures. Before adoption, a commission must hold at least one public meeting. Notice of the meeting must be published in the official journal ten days prior to the meeting. The plan may be approved in stages or by geographical division of the city. Amendments to the plan must be conducted under the required procedure for adopting a plan as stated above.

d. References

La. R.S. 33:101.

La. R.S. 33:103-104.

La. R.S. 33:106-109.

La. R.S. 33:113.

La. R.S. 33:118-119.

12. Police Juries

a. Function

Police juries are the governing body of the parishes.

b. Authority

Jurisdiction includes all parish territory beyond municipal boundaries. Being subdivisions of the State, police juries possess only such powers as are conferred upon them by the constitution and laws of the State.

Among powers granted to police juries, those relevant for superport-related developments include:

(1) Making and repairing of roads, bridges, causeways, dikes, etc.

(2) Construction of drainage systems and the opening of natural drains.

(3) The leasing out of public lands of the parish.

(4) Regulations of public buildings, roads, bridges, playgrounds, and the systemmatic development of the parish.

(5) Creation of recreation districts and special recreation districts.

Parish police juries may create industrial areas composed of territory solely within the parish subject to the approval of 51 per cent by interest of the landowners in the proposed area. Such designation may

occur only after the feasibility therefor has been established by land-use studies conducted by the parish planning commission, development board or other recognized authority.

Before any designation is made, the parish governing authority must hold at least one public hearing. Notice of the hearing must be published in the official parish journal at least ten days in advance. The designation is by resolution of the parish governing authority. An area designated as an industrial area precludes the location of any facility that is not industrial in character. Industries located in such industrial area must furnish to themselves all local governmental-type services such as sewage, street cleaning and lighting, and fire protection. If the area fails to furnish itself with these services at its own expense, the police jury may abolish its status as an industrial area.

In addition, policy juries have the power to grant a franchise for the construction, laying and maintaining of pipelines and other utilities across public lands and developments such as roads and canals.

Police juries may set up regular times for meetings. These meetings are not required to be public, nor are public hearings mandatory before passage of police jury ordinances. However, in the case of the closing or damming of a stream, the police jury must give public notice of such action thirty days prior to meeting on the action in the official journal of the parish.

Police juries may create by ordinance a planning commission to regulate development of the parish.

c. Procedure

Procedure in making requests for various forms of permission may vary from parish to parish and are not required to be published or made part of the public record. However, most meetings of police juries are relatively informal, as are their rules of procedure, except where provided for statutorily.

d. References

La. R.S. 33:1224.

La. R.S. 33:1233.

La. R.S. 33:1236 - 1238.

La. R.S. 33:1240.

La. R.S. 33:1242.

La. R.S. 33:4361.

La. R.S. 33:4562.

La. R.S. 33:4762.

La. R.S. 33:130.11 - 18.

13. Regional Planning Commissions

a. Function

When one or more municipalities or parishes or both combine to form a continuous urbanized or suburbanized area, the local legislative bodies of the included municipalities and parishes may create a regional planning commission. The cooperating local legislative bodies must share in the appropriation of funding for the regional commission.

The regional planning commission must prepare a regional development plan, the purpose of which is to promote the general welfare and prosperity of the area.

b. Authority

The regional development plan must embody the policy recommendations of the regional planning commission and must include recommendations for the most desirable pattern of land use, including areas best sutiable for farming, for industrial, and residential areas.

This regional planning should also detail recommendations for circulation patterns, including routes and terminals for transportation facilities, and all recommendations concerning public and private facilities believed essential to balanced development.

The regional planning commission is required to cooperate and coordinate activities with State, municipal, and parish planning offices within the area. All regional planning commissions are authorized to hold public meetings and sponsor public forums whenever necessary.

A regional planning commission can not exercise any function of the municipal or parish planning authority, unless so designated by the parish or municipal legislative body.

c. References

La. R.S. 33:131 - 137.

14. Zoning Commission

a. Function

A zoning commission may be created by the legislative body of a municipality when no municipal planning commission exists. The function of the zoning commission is to recommend boundaries of districts and the regulations applicable therein.

b. Authority

All recommendations of the zoning commission must be made to

the municipal legislative body, but only after the commission has conducted a public hearing, notice of which was published in the official journal of the city at least ten days prior to the meeting. Zoning commission recommendations are not considered binding on the municipal government.

The various duties of a zoning commission are similar in scope to those of a municipal planning commission.

c. Procedure

Procedure before zoning commissions vary according to municipality, with most requiring only simple application and proceeding in an informal manner. However, due to the variances among commissions, the Authority would best be served by making inquiry of a zoning commission member as to the proper procedure for seeking zoning changes or other authorizations.

d. References

La. R.S. 33:4726 - 4727.

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GLOSSARY

A

Abandonment phase - The more stable period of the delta cycle when biologic activity is most significant.

Act of God - An act occasioned by an unanticipated grave natural disaster.

Actual stress - An identifiable stress which is relatively certain to occur as a natural and direct consequence of the construction and normal operation of a deepwater port, onshore facilities, and other development directly or indirectly associated with such deepwater port.

Acute - Having a sudden onset, sharp rise, and short course.

Aerobic - A microbe living on free oxygen; condition in which oxygen is present.

Aesthetics - Of or relating to the beauty in nature; beauty in nature.

Air - The mixture of gases comprising the Earth's atmosphere.

Air contaminants or air particles - Particulate matter, dust, fumes, gas mist, smoke or vapor, or any combination thereof produced by processes other than natural.

Air Pollution - The addition of air contaminants to the atmosphere.

Anaerobic - Condition in which oxygen is excluded, with the result that organisms which depend on the presence of oxygen can not survive. Anaerobic bacteria can, however, live under these conditions.

Anchorage - A partially or totally protected area in which vessels can enter and anchor for protection against adverse weather and sea conditions; a haven.

Ancillary development - Development which probably will occur in the same area as land-based facilities of a deep draft harbor and terminal. This type of development tends to support, directly or indirectly, the overall superport process and is largely dependent on the existance of such facilities.

Aromatic compounds - That class of reactive hydrocarbon molecules identified by their characteristic benzene ring. Aromatic compounds typically have high solvent power in contact with other substances.

Attached algae -- Nonvascular aquatic plants that attach to substrate by a holdfast or other means.

Authority -- The Deep Draft Harbor and Terminal Authority as established by Act 444 of 1972, as amended (La. R.S. 34:3101 et seq.).

Authority Development Program - All the phases of growth and development through which the concept of a deepwater port and onshore facilities may go, including but not limited to promoting the concept, raising funds to support the program, planning the uses of the facility, selecting a site for the deepwater port and onshore facilities, designing the structures, constructing the facility and the support facilities, operating and maintaining the facility, expanding or renovating the facility, modification and retirement of the facility and any other phases through which Authority development may proceed.

B

Bank - The sloping margin of a river or stream; the ground bordering upon a river. A raised edge of a pond, lake, river, etc.
Marine: An evaluation of the sea floor of a large area; a submerged plateau or shelf, a shoal, or shallow.

Barrel - Forty-two (42) United States gallons at 60 degrees Fahrenheit.

Barrier island - In Louisiana, this refers to a shoreline island, separating an estuary from the ocean, which acts as a natural barrier against storms and marine forces.

Bar - (1) An offshore ridge or mound of sand, gravel, or other unconsolidated material submerged at least at high tide, especially at the mouth of a river or estuary, or lying a short distance from, and usually parallel to, the beach. (2) The floodplain along the stream channel are likely to be found numerous deposits of sand and gravel designated by such names as channel bars, meander bars, and delta bars. Channel bars are located in the stream course; meander bars form on the inside of meanders and extend into meander curves; delta bars are formed by tributary streams building deltas into the main stream channel.

Baseline data - Data which is used as a base or norm from which to measure changes.

Basin - A large or small depression in the surface of the land, the lowest part of which may be occupied by a lake or pond; also, a similar depression in the ocean floor (2) The entire tract of country drained by a river and its tributaries; called specifically "river basin."

Bayou - In general, a creek, secondary watercourse, or minor river, tributary to another river or other body of water--the regular term in the lower Mississippi basin and in the Gulf-coast region of the United States. Along with the general sense many specific senses are found, but the most applicable to Louisiana is: A large stream or creek, or a small river, characterized by a slow or imperceptible current; a sluggish stream, esp. along a tortuous course, through alluvial lowlands, swamps, plantations, etc.--the typical watercourse of the Pleistocene or Quaternary area of the Mississippi Embayment, where "bayou" is the term in almost exclusive use.

Beach - The part of the shore lying between the high and low water marks.

Benthic - A primary division of the sea which includes all of the ocean floor. The Benthic Division is subdivided into the LITTORAL SYSTEM (the ocean floor lying in water depths ranging from the high water mark to 200 meters or the edge of the continental shelf), and the DEEP SEA SYSTEM (ocean floor lying in water deeper than 200 meters). The systems are further subdivided into the eulittoral zone (0-50 meters), sublittoral zone (50-200 meters), archibenthic zone (200-1000 meters), and the abyssal-benthic zone (1000 meters and greater).

Benthos - Organisms that live on or in the bottoms of bodies of water.

Bioassay - The determination of the properties and effects of a drug by testing it under controlled conditions in the bodies of laboratory animals.

Biological oxidation - The natural process of decay or destruction of organic materials by the action of microbes.

Biological oxygen demand (B.O.D. or BOD) - The oxygen requirements of organisms in a given body of water.

Biological monitoring - The determination of the effects on aquatic life, including accumulation of pollutants in tissue, and receiving waters due to the discharge of pollutants (A) by techniques and procedures, including sampling organisms representative of appropriate levels of food chain appropriate to the volume of physical, chemical, biological characteristics of the effluent, and (B) at appropriate frequencies and locations.

Biological Productivity - Rate at which energy is bound or organic material is created by all living processes (photosynthesis, animals, transformers.

Biological Sampling - A subgroup of a population of organisms.

Biomass - The total plant and animal life to be found in a given segment of an environment.

Biota - The plant and animal life of a region; flora and fauna considered collectively.

Bird - A warm-blooded, feathered, egg-laying vertebrate (class Aves), having the forelimbs modified as wings.

Booster pumps or station - A station whose function is to receive oil through a main pipeline and to transmit it to the next station. It receives no oil from any other source nor does it have a tank farm.

Buoy - A floating object, other than a lightship, moored or anchored to the bottom as an aid to navigation. Buoys may be classified according to shape, color or other characteristics.

C

Canal - An artificial watercourse cut through a land area for use in navigation, irrigation, etc.

Catchment basin - A term applied to all that part of a river-basin from which rain is collected, and from which therefore the river is fed. Also called the watershed or drainage basin of a river or stream.

Causeway - A raised road across wet or marshy ground or across water.

Channel - (1) That part of a body of water deep enough for navigation through an area otherwise not suitable. It is usually marked by a single or double line of buoys and sometimes by ranges. (2) The deepest part of a stream, bay, or strait, through which the main current flows. (3) A large strait, as the English Channel. (4) A hollow bed through which water does or may run.

Chronic - Marked by long duration or frequent occurance.

Circulation - The movement of water around and through the coastal areas of the State; also, the movement of water in the Gulf of Mexico.

Climatic regime or Climate - The combination of temperature, precipitation, winds, etc., characteristic of a locality or region over an extended period of time.

Coast - A strip of land of indefinite width (it may extend for miles) that extends from the seashore inland (usually to the first major change in terrain features).

Coast line - (1) Legally, the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters. (2) Technically, the line that forms the boundary between the coast and the shore. (3) Commonly, the line that forms the boundary between the water and the land.

Coastal waters - Those waters, adjacent to the shoreline, which contain a measurable quantity or percentage of sea water, including, but not limited to, sounds, bays, lagoons, bayous, ponds, and estuaries.

Coastal Waters of Louisiana - Those waters extending three nautical miles from the coastline, or beyond to the extent of the jurisdiction of the state of Louisiana.

Coastal zone - This term means the lands, waters, tide and submerged lands, bays, estuaries, marshes, coastal and intertidal areas, harbors, lagoons, inshore waters, and channels landward of the outer limit of the territorial sea of the United States, of the State of Louisiana, or of other waters subject to the jurisdiction of Louisiana where greater than the territorial sea of the United States, and extending inland to the landward extent of marine influences.

Commodity flow - The flow of a product in a given market, in this case through a port, which is usually expressed on a map or flow diagram. This usually reflects the source from which the product comes to where it is subsequently shipped.

Common carrier - All persons engaged in the transportation of petroleum as public utilities and common carriers for hire; or which on proper showing may be legally held a common carrier from the nature of the business conducted, or from the manner in which such business is carried on. (La. R.S. 45:251 (1)).

Compensation - This term includes, but is not limited to, rehabilitation, restoration and reparation.

Construction - Any one or more of the following: preliminary planning to determine the feasibility of a deep draft harbor and terminal, engineering, architectural, legal, fiscal, or economic investigations or studies, surveys, designs, plans, working drawings, specifications, procedures, or other necessary actions, erection, building, acquisition, alteration, remodeling, improvement, or expansion of a deep draft harbor and terminal, or the inspection or supervision of any of the foregoing items.

Contiguous zone - The entire zone established or to be established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone.

Continental shelf - The relatively shallow belt of sea-bottom bordering a continental mass, the outer edge of which sinks rapidly to the deep ocean floor.

Contingency plan - The National Contingency Plan for removal of oil and hazardous substances, prepared pursuant to section 11(c)(2) of the Federal Water Pollution Control Act, and published in the Federal Register of June 2, 1970 (35 F.R. 8508), and any amendments thereto.

Corridor - An area that is already heavily developed or where development might be projected. In most cases, corridors would be confined to land surfaces suitable for development. However, natural corridors might also include areas bounded by prominent man-made features such as major navigation canals or flood protection levees.

Current - A horizontal movement of water. Defined movement of water in the ocean in a definite direction with a perceptible velocity.

Cyclone - (1) Meteorologically, a system of winds circulating about a center of relatively low barometric pressure, and advancing at the earth's surface with clockwise rotation in the Southern Hemisphere, counterclockwise in the Northern Hemisphere. (2) Loosely, any violent and destructive whirling windstorm.

Cypress swamp - A swamp forest dominated by cypress trees, with the level of water normally above the surface of the ground.

D

Delta - The more or less triangular tract of alluvial land formed at the mouth of a river. Also stated as a more or less triangular terminal flood-plain of a river extended beyond the general trend of the coast, across which the river usually but not always reaches the sea by two or more distributaries.

Delta building or Deltaic sedimentation - The process whereby the river deposits sediment being carried in its load so as to form a delta.

Demersal fish - Fish living on or near the bottom of a lake or sea or ocean.

Deposition - The geological process whereby any mass of material is deposited, laid down, or placed in a more or less permanent or final position. This may be accomplished by an aqueous or aeolian agency.

Depth contour - The line on a navigation chart which joins areas of equal depth along the coast of a state.

Deep water port facility or deepwater port facility - A structure, or series of structures, or facility of any type designed to accomodate the cargo or passengers of deep draft vessels.

Detritus - Loose particles, formed by the disintegration of organic matter, which serve as a food source for aquatic species.

Development corridor - Existing land corridors which are already developed for human habitation, commercial and industrial activity, and transportation. (See also CORRIDOR).

Discharge - This term includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping. Discharge when used without the qualification includes a discharge of a pollutant, and a discharge of pollutants.

Dispersant - An active surface agent which causes an oil film to break up because of the formation of fine oil droplets, which are more susceptible to natural degradation.

Distributary - A river branch which flows away from the main stream without returning to it, as in a delta.

Distructional phase - That part of the delta cycle when subsidence is dominant.

Docks, wharves - A basin or enclosure for reception of vessels, and provided with means for controlling the water level; a structure serving as a berthing place for vessels.

Dredge or dredging - This is the term given the process of removing or displacing sand, earth and other materials from a land or water area.

Dredged material - Any material excavated or dredged from waters under the jurisdiction of Louisiana, or other property under the jurisdiction of Louisiana, or from beyond the territory of Louisiana but affecting or possibly affecting the coastal environment of Louisiana.

Dumping - A disposition of material.

E

Ecology - The relation of an organism to its environment.

Elevators - Silos used to store grain for transport through a port.

Emulsifier - An active surface agent which promotes the formation and stabilization of an emulsion.

Emulsion - A system consisting of a liquid dispersed in an immiscible liquid.

Environment - That which environs; the objects of the region surrounding anything. Especially the conditions under which any person or thing lives or is devleoped; the sum total of influences which modify and determine the development of life and character.

Environmental Protection Plan - A written document prepared in conformity with La. R.S. 34:3101 *et seq.*, as amended, which shall be a regulation of the Deep Draft Harbor and Terminal Authority, establishing those steps to be followed to insure the protection of the environment throughout all phases of the Authority Development Program.

Environmental stress - Any change or reduction in biomass; any affect which a particular project would have on the environment including the following:

1. Reduction in number of species;
2. Reduction in number of individuals in any one species; or
3. Decrease in a diversity index in terms of the following:
   a. Number of species
   b. Amount of biomass
   c. Coverage (plant)

Epifauna - Animals which live at the water-substrate interface, either attached to the bottom or moving freely over it.

Epiphytes - Plants which grow attached to other plants.

Erosion - All processes of wearing down of land, including weathering.

Estuarine - Of or pertaining to an estuary.

Estuarine zone - An environmental system consisting of an estuary and those transitional areas which are consistently influenced or affected by water from an estuary such as, but not limited to, salt marshes, coastal and intertidal areas, bays, harbors, lagoons, inshore waters, and channels, and the term "estuary" means all or part of the mouth of a river or stream or other body of water having unimpaired natural connection with open sea and within which the sea water is measurably diluted with fresh water derived from land drainage.

Estuary - (1) That portion of a stream influenced by the tide of the body of water into which it flows; (2) A bay, as the mouth of a river, where the tide meets the river current. (See definition of ESTUARINE ZONE.)

F

Facility - Any structure or improvement actively used on a regular basis in waterborne commerce. [La. R.S. 34:3102(5)]

Fairway - The main traveled part of a waterway; a marine thoroughfare.

Fauna - Animal life.

Feeder pipeline - An ancillary oil-transportation pipeline which is connected with, or tapped into, a main pipeline.

Fetch - (1) In wave forecasting, the continuous area of water over which the wind blows in essentially a constant direction. (2) In wind set-up phenomena, for enclosed bodies of water, the distance between the points of maximum water surface elevations. This would usually coincide with the longest axis in the general wind direction.

Fitter feeders - Aquatic animals that filter their food from the water by means of some anatomical structure or device (example an oyster).

Flora - The plant life, collectively, of a given age or region.

Flotant - Floating material, either organic or inorganic.

Food web - This is the interrelated food relationships in an ecosystem, including its production, consumption, and decomposition, and the energy relationships among the organisms involved in the cycle. Also, all the interconnecting food chains. A food chain is a dependence of a series of organisms, one upon the other, for food. The chain begins with plants and ends with the largest carnivores, e.g., phytoplankton--zooplankton--forage fish--game fish.

Fur bearers - Mammals with a soft, fine, pelt that are trapped for profit.

G

Garbage - Waste edible material generated by the preparation of food for human consumption or the disposal of uneaten food.

Grab sample - Material secured by an instrument possessing jaws that seize a portion of the bottom for retrieval and study.

Ground water - Subsurface water occupying the zone of saturation. In a strict sense the term is applied only to water below the water table.

Gulf of Mexico - Gulf on Southeast coast of North America; bounded on the North by the United States; on the East by the United States, Cuba and Mexico; on the South by Mexico; and on the West by the United States and Mexico; connects with the Atlantic Ocean through the Straits of Florida, and with the Caribbean Sea through the Strait of Yucatan; extends 1000 miles East to West and 800 miles North to South; greatest depth is 12,425 feet (Sigsbee Deep) in Southwestern central area.

H

Habitat - The locality in which a plant or animal naturally grows or lives; habitation. Frequently used as a synonym for environment.

Hazardous substance - Such elements and compounds which when discharged in any quantity into or upon the navigable waters of Louisiana or adjoining shorelines or lands of Louisiana, both public and private, which present an eminent and substantial danger due to the public health or wealth or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, beaches, and marsh estuarine environments.

Heavy industry - (1) Loosely used for those secondary industries in which large weights of materials are handled. More precise tests have been suggested based on: weight of material per operative; value of a given weight of product; cost of materials as a proportion of gross value of output; proportion of men to total workers employed; horse-power capacity in use per operative. (2) Industry that is largely fixed by heavy and bulky character of raw materials and finished products and much concerned with transport costs.

Herptiles - This refers to the overall group of reptiles and amphibians.

Humidity - The ratio of the quantity of vapor actually present to the greatest amount possible at the given temperature.

Hurricane - A cyclonic storm, usually of tropical origin, covering an extensive area, and containing winds of 75 miles an hour or higher.

Hydrocarbon - Any of a large and important group of organic compounds that contain hydrogen and carbon only.

Hydrography - The science which deals with the measurement of the physical features of the oceans, seas, lakes, rivers, and other waters, and their marginal land areas, with special reference to the elements that affect safe navigation, and the publication of such information in a suitable form for use of navigators.

Hydrology - The scientific study of the waters of the earth, especially with relation to the effects of precipitation and evaporation upon the occurance and character of water in streams, lakes and on or below the land surface. In terms of the hydrologic cycle, the scope of hydrology may be defined as that portion of the cycle from precipitation to re-evaporation or return of the water to the seas.

Applied hydrology utilizes scientific findings to predict rates and amounts of runoff (river forecasting), estimate required spillway and reservoir capacities, study soil-water-plant relationships in agriculture, estimate available water supply, and for other applications necessary to the management of water resources.

Hydrologic unit - Designated segment of water area.

I

Infauna - Animals that live buried in soft sub-strate.

Inorganic sediment - Of, or pertaining to, or designating those sediments lacking carbon; sediment derived from an inorganic source, or a source that is neither plant nor animal.

Interdistributary basin - The area or basin between two rivers, bayous, streams etc. as they flow to the ocean (example the Barataria-Salvador Basin).

Intermediate brackish - Estuarine waters ranging in salinity between 1 to 5 parts per thousand with a characteristic plant community.

Intertidal marshes - Coastal marsh regularly subject to the effects of tidal exchange of waters from the open ocean (example below St. Mary's Point in Barataria Bay).

Inventory - A listing or grouping of various variables.

L

Lake - A large body of water entirely surrounded by land; properly one sufficiently large to form a geographical feature. The word lake is the broad general term and is qualified in various ways. A very small natural lake is termed in ordinary speech a pond or pool; a lake may or may not have inflowing and outflowing rivers, a lake may not necessarily be a permanent body of water.

Land erosion - See EROSION.

Larval form - The immature form of an animal which is unlike its parents. Larva are usually self-feeding but must pass through some sort of metamorphosis before assuming the characteristics of the adult.

Leontiff model - A technique used in economics which allows the establishment of an output matrix of a local economy.

Licensee - A person to whom a license is issued pursuant to this Environmental Protection Plan to construct or operate a deepwater port facility.

Lithology - (1) Study of the characteristics of rocks. (2) Study of the composition of rocks.

Littoral current - A wave-induced ocean current adjacent and parallel to the shoreline.

Littoral drift - The movement of sand or sediment along the coastal shoreline which is usually caused by wave action.

M

Macrofauna - Animal organisms visible to the unaided eye and which are retained on a U.S. standard sieve no. 30 (openings of 0.589 mm.).

Macroorganism - Those organisms visible to the unaided eye and which are retained on a U.S. standard sieve no. 30 (openings of 0.589 mm.).

Major spill - This means a spill of oil or other substance involving more than 2500 barrels.

Marine environment - Includes, but it is not limited to, coastal navigable waters, the fish and wildlife resource of the coastal areas and coastal zone, and the recreational and scenic values of such waters and resources.

Marine sanitation device - Includes any equipment for installation on board a vessel which is designed to receive, retain, treat, or discharge sewage, and any process to treat such sewage. [Federal Water Pollution Control Act Amendments of 1972, 86 Stat. 871.]

Marsh - A tract of low-lying land usually more or less watery throughout the year, and partly covered with aqueous vegetation.

Meiofauna - Animals in the size range 100 to 500 microns.

Migration - A movement of animals, usually seasonal in or out of an area (example shrimp, crayfish, waterfowl, etc.).

Minor spill - An oil spill involving less than 250 barrels of oil.

Mineral lease - Any form of authorization for the exploration for, or development or removal of deposits of, oil, gas, or other minerals. (Outer Continental Shelf Lands Act, 67 Stat. 462).

Modified Leontiff Model - The original Leontiff model was modified by Hite and Laurent (1973) so that economic inputs could be translated into environmental effects.

Monitor - The program of regular air, water and sediment sampling to be conducted prior to and simultaneously with the Authority Development Program.

Montmorillonite - Type of clay sediment.

Mooring buoy - A buoy secured to the bottom by permanent moorings and provided with means for mooring a vessel by use of its anchor chain or mooring lines. In its usual form a mooring buoy is equipped with a ring. If it has an opening through which a mooring pendant is passed, it is called a trunk buoy.

Mud lump - Expressions on the surface of a seabed of massive subsurface diapiric folds and thrust faults resulting from deposition of thick localized masses of heavier bar sediments directly upon lighter, plastic clays.

N

National Environmental Policy Act - P.L. 91-190, 83 Stat. 852, 42 U.S.C. 4321.

National Contingency Plan - The national plan for removal of oil and hazardous substances, prepared pursuant to section 11(c)(2) of the Federal Water Pollution Control Act, and published in the Federal Register of June 2, 1970 (35 F.R. 8508), and any amendments thereto.

Navigational fairway - A navigational open path or approach corridor for vessels using a deepwater port facility.

Natural levees - The natural aggraded banks of a stream in a flood-plain.

Natural resources - Includes, without limiting the generality thereof, oil, gas, and all other material, and fish, shrimp, oysters, clams, crabs, and other marine animal and plant life. (ref. Submerged Lands Act, 43 U.S.C. §1302 (e)).

Nekton - A division made up of all the swimming animals found in the pelagic division.

Nutrient - In the ocean, any one of a number of inorganic or organic compounds or ions used primarily in the nutrition of primary producers. Nitrogen and phosphorous compounds are examples of essential nutrients.

O

Odum and Odum model - A formula which supports the thesis that for any geographic region there exists an optimum proportion of natural and developed environments. The natural environment is defined as ecological systems that produce useful products and recycle wastes on a continuous basis but without any significant economic costs to man. These self-maintaining environs include moderately used forects, grasslands, rivers, estuaries, ocenas, etc. Developed systems include ecosystems that are highly structured and maintained by outside energy from fossil or other fuels. A city, surburban developments, agricultural fields, channelized rivers are included under this category.

Offshore - (1) In beach terminology, the comparatively flat zone of variable width, extending from the breaker zone to the seaward edge of the continental shelf. (2) A direction seaward from the shore.

Offshore facility - Any facility of any kind located in, on, or under, any of the navigable waters of the United States other than a vessel or public vessel.

Oil - Oil of any kind in any form, including but not limited to, petroleum, fuel oil, petroleum products, sludge, oil refuse, and oil mixed with wastes other than dredged spoil.

Oil spill - The discharge or loss of oil.

Oil spill clean-up agent - Any substance applied to oil on water or associated shoreline, the function of which is to disperse, remove or otherwise control the oil

One-hundred year storm - The maximum storm which can be expected to occur at a frequency of once per one hundred years, based on past observations and their frequency of occurance. The winds and tides generated by such a storm will vary from location to location.

Onshore facility - any facility (including, but not limited to, motor vehicles and rolling stock) of any kind located in, on, or under, any lands within the United States other than submerged lands.

Organic sediment - Sediment composed largely of plant and animal matter.

Outer continental shelf - all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in section two of the Submerged Lands Act (Public Law 31, Eighty-third Congress, first session), and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control. (Outer Continental Shelf Lands Act, 67 Stat. 462).

Outfall - A structure extending into a body of water for the purpose of discharging sewage, storm runoff, or cooling water.

Owner or operator - (A) in the case of a vessel, any person owning, operating or chartering by demise, such vessel, and (B) in the case of an onshore facility, and an offshore facility, any person owning or operating such onshore facility or offshore facility, and (C) in the case of any abondoned offshore facility, the person who owned or operated such facility immediately prior to such abondonment.

P

Peat - A deposit of more or less altered vegetable matter which has accumulated through decay of plants under water.

Pelagic - Pertaining to the open sea, when used in connection with sediment type; it also refers to fish which do not spend their whole life on the bottom, although they may remain fairly near the shore, such as menhaden.

Person - An individual, firm, corporation, association, or a partnership.

Petrochemical - An all-inclusive term which has reference to petroleum and all petroleum derivatives, including but not limited to, the natural and synthetic hydrocarbons.

Petroleum - Crude petroleum, crude petroleum products, distillate, condensate, liquefied petroleum gas, any hydrocarbon in a liquid state which is derived in whole or in part from any hydrocarbon, and any mixture or mixtures thereof. (La. R.S. 45:251 (2))".

Pipe line or pipeline - Includes the real estate, rights of way, pipe in line, telephone and telegraph lines or other communication systems, tank facilities as herein designated, and necessary for the proper conduct of its business as a common carrier, all fixtures, equipment and personal property of every kind owned, controlled, operated, used or managed, in connection with, or to facilitate the transportation, distribution and delivery of petroleum through lines constructed of pipe. (La. R.S. 45:251 (3))".

Photosynthesis - The formation of carbohydrates and oxygen in the chlorophyll-containing tissues of plants exposed to light.

Physical processes - Processes that are caused by physical events like winds, solar energy, tides, currents, rainfall.

Phytoplankton - Planktonic plants. Unattached microscopic plants subject to movement by wave or current action.

Plankton - All the floating or drifting life found in the pelagic division of the sea. Plankton are further divided into phytoplankton which includes all the floating and drifting plants, and zooplankton which includes myriads of animals that live permanently in a floating or drifting state and countless numbers of helpless larva and eggs of the animal benthos and nekton.

Plug - The clay deposited in an abandoned stream channel.

Pollutant - This includes all substances that are alien to the environment, or environments, of an area and which could or might affect such area. Pollutant includes dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biographical materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, seller dirt and industrial, municipal and agricultural waste discharged in the water.

Pollution - The discharge or deposit into the air, water or soil of any liquid, gaseous or solid substance or substances which may create a nuisance therein or render such unclean or noxious to be determental to the propagation, cultivation or conservation of animals, fish or aquatic life, or unsuitable with reasonable treatment, for use as present or possible future source of public water supply or unsuitable for commercial, industrial, agricultural, recreational or other reasonable uses.

Port - A place provided with terminal and transfer facilities for loading and discharging cargo or passengers.

Potential stress - An identifiable stress which could occur as a natural consequence of the construction and operation of a deepwater port and onshore faciltiies, although all reasonable precautions against such an eventuality have been taken (for example, fires, explosions or casualty oil spills).

Precipitation - Condensation and deposition of moisture from the state of vapor, as by cooling; especially in the formation of dew, rain, snow, etc. That which is so deposited.

Pressure Ridge - An atmospheric area having the same or common pressure characteristics.

Primary industry - Activities concerned with collecting or making available materials provided by nature, e.g., agriculture, fishing, forestry, hunting, trapping, etc.

Primary productivity - The total quantity of protoplasm produced by autotrophic organisms per unit of time in a specified habitat.

Propagation - Reproduction.

Psammon organisms - Collectively the organisms inhabiting the interstices of a shoreline (usually sand) habitat.

R

Receiving terminal - An oil tank farm with storage facilities and associated pumps and piping.

Regional contingengy plan - This is the regional plan for the Sixth Coastal Region published pursuant to the National Contingency Plan.

Remove or removal - This refers to removal of the oil or hazardous substances from the water and shorelines taking such other actions as may be necessary to minimize or midigate damage to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, beaches.

Residence time - The time required to replace completely the amount of a given substance in the ocean or other body of water.

Ridge - A long and narrow strip of elevated ground.

Right-of-way - (1) The right of a person to pass over the land of another; also, the path or piece of land over which passage is made. (2) The strip of land over which a pipeline would be laid, on which a public highway is built, or above which a high-tension power line is built. Land in this situation includes the bottoms of streams and all navigable water bodies.

Riparian - Pertaining to the banks of a body of water.

River - A stream of water flowing in a channel towards the sea, a lake or another stream.

Roadstead - An area near the shore, where vessels can anchor in safety; usually a shallow indentation in the coast. One with relatively little protection may be called open roadstead. Also called road. Unclear in international law.

S

Salt marsh - Low area adjacent to the sea that is covered with salt tolerant vegetation and regularly flooded by high tide.

Saltwater intrusion - The intrusion of water with a measurable salinity difference into bodies of fresh water.

Sanitary waste - Human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes.

Secondary industry - Development of industry associated with commodities flowing through the port, processing facilities, and associated urbanization.

Secondary production - Total quantity of animal (and other heterotrophic) protoplasm produced per unit of time in a specified habitat.

Sediment - (1) Any material carried in suspension by water, which will ultimately settle to the bottom. (2) Fine water-borne matter deposited or accumulated in river beds. (May also be aeolian)

Sessile - Permanently fixed, sedentary, not freemoving.

Sheet flow (also, Laminar flow) - A flow in which the fluid moves smoothly in streamlines in parallel layers or sheets; a nonturbulent flow.

Ship - A vessel of varying sizes capable of use in commerce.

Shipways - See FAIRWAY.

Shore - That strip of ground bordering any body of water which is alternately exposed, or covered by tides and waves. A shore of unconsolidated material is usually called a beach.

Shoreline - The intersection of a specified plane of water with the shore. The line delineating the shoreline on U.S. Coast and Geodetic Survey (now National Ocean Survey) nautical charts and surveys approximates the mean highwater line.

Single-point mooring (SPM) - An offshore buoy to which a tanker vessel attaches a bow line. This permits the vessel to swing freely around the buoy in accordance to wind and currents.

Slip - (1) A berthing space between two piers. Also called dock. (2) The difference between the distance a propeller would travel longitudinally in one revolution if operating in a solid and the distance it travels through a fluid.

Spawning - In aquatic animals, the act of producing or depositing eggs or sperm. Also, the production of eggs or young.

Spill - The discharge or loss of oil or other hazardous substance.

S

Spring tide - An exceptionally high tide which occurs twice per lunar month when there is a new or full moon, and the earth, sun, and moon are in a straight line.

Storm surge - A rise or piling-up of water against the shore or coastal area, produced by wind-stress and atmospheric pressure differences in a storm.

Stress - A force or influence imposed upon the natural and human environment as a result of the Authority Development Program. Stress also includes any state resulting from the imposition of a force or influence in which natural or human processes or conditions have been changed. Stress might be referred to as an impact or effect.

Subsidence - The sinking or settling of land, or the gradual lowering of land with respect to sea level.

Substrate - A substance, base or nutrient on which an organism grows.

Submarine slumping - Sea floor slides caused by the instability of poorly consolidated deltaic sediments.

Superport - This term is synonymous with deep draft harbor and terminal. Both mean a structure, or series of structures, or facility or any type emplaced in coastal waters and designed to accommodate the cargo or passengers of deep draft vessels whose draft is greater than the depths of typical inland harbors and waterways commonly used by ocean-going traffic during the first half of the twentieth century, including all those structures and facilities functionally related thereto and necessary or useful to the operation thereof whether landward or seaward of the main structure or facility itself.

Supertanker - See VLCC.

T

Terrigenous - Of the land. When applied to ocean bottom deposits, it denotes those that are composed predominantly of material brought from the land. The continental shelves are covered almost entirely by terrigenous deposits.

Territorial sea - This term has the same meaning as that expressed the Convention on the Territorial Sea and the Contiguous Zone (U.N. Doc. A/Conf. 13/L.52). It refers to the belt of seas measured from the line of ordinary low water along that portion of the coast which is in direct contact of the open sea and the line marking the seaward limit of inland waters and extending seaward a distance of three miles.

Tidal exchange - The mixing of inland waters with tidal waters occurring near tidal passes and in estuaries.

Tidal flow or tidal current - The alternating horizontal movement of water associated with the rise and fall of the tide caused by the astronomical tide-producing forces.

Tidal pass - A natural channel which permits interchange of water between an estuary and the open sea, and provides a migration route for aquatic species.

Tide - The periodic rising and falling of the water that results from the gravitational attraction of the moon and sun acting upon the rotating earth. Although the accompanying horizontal movement of the water resulting from the same cause is also sometimes called the tide, it is preferable to designate the latter as tidal current, reserving the name tide for the vertical movement.

Three directors - The executive Director of the Authority as provided in the Act, the Director of the Louisiana Wild Life and Fisheries Commission, and the Director of the Louisiana State University Center for Wetland Resources.

Toxicity - Quality, state or degree of the harmful effect resulting from alteration of an environmental factor.

Toxic pollutant - Those pollutants, or a combination of pollutants, including disease-causing agents, which after discharge and upon exposure, injestion, inhilation or assimilation into any organism, either directly from the environment or indirectly by injestion through food chains, will, on the basis of information to the administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformation, in such organisms or their offspring.

Transfer - Both onloading and offloading between deepwater port facilities and vessel, deepwater port facilities and onshore facilities, and vessel to vessel.

Turbidity - A condition of darkened or reduced clarity of water caused by the presence of suspended material.

U

United States - The several States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, the territories and possessions of the United States, and the Trust Territory of the Pacific Islands.

Unmodified estuarine marsh area - Estuarine marsh area relatively unaffected by man (see Woody's Report).

V

Vessel - Includes any description of watercraft or other contrivance used, or capable of being used, as a means of transportation on water, whether self-propelled or otherwise, and includes barges and tugs.

VLCC - Very Large Crude Carrier, usually with a capacity in excess of 200,000 dead weight tons. Also called supertanker.

Volatile vapors - Those petroleum fractions which tend to vaporize at ambient temperatures and pressures.

W

Weir - A small dam or earthen structure placed across a river or canal to impound and raise the water level for the purpose of taking fish, of conveying a head to a mill, or of maintaining the water at the level required for navigation or for purposes of irrigation.

Wetlands - Lowland areas, such as marshes and swamps characterized by a high degree of soil moisture, which are periodically or permanently covered with water.

Z

Zooplankton - The animals of the plankton. Unattached microscopic animals having minimal capability for locomotion.

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