

**A PROFILE OF
ARTIFICIAL REEF DEVELOPMENT
IN THE GULF OF MEXICO**



No. 11-WB

**GULF STATES MARINE FISHERIES COMMISSION
P.O. BOX 726
OCEAN SPRINGS, MS 39566-0726**

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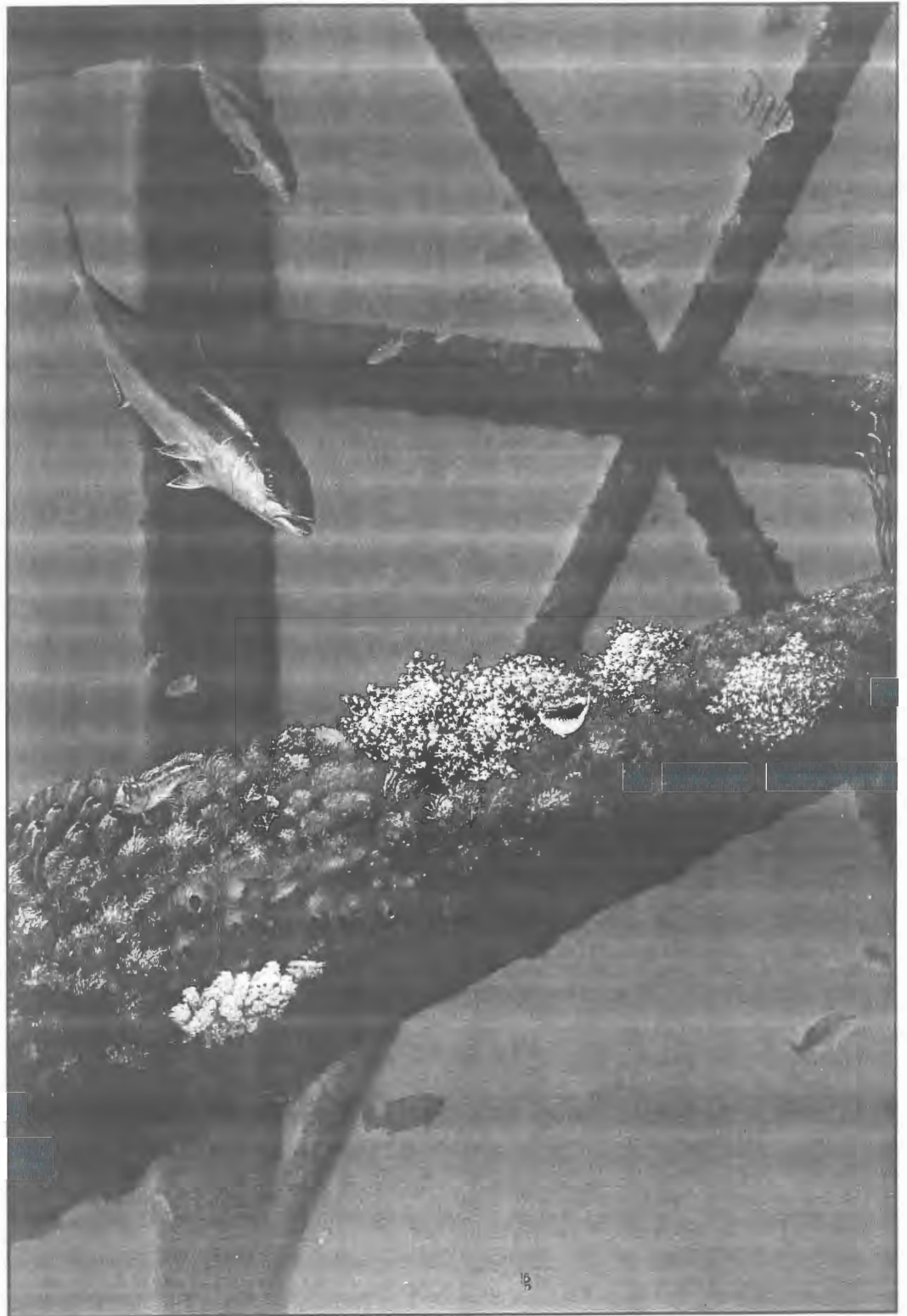
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**A PROFILE
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IN THE
GULF OF MEXICO**

Compiled by the

Recreational Fisheries Management Subcommittee
of the
Technical Coordinating Committee
Gulf States Marine Fisheries Commission

Ronald R. Lukens
Project Coordinator

December 1993

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ACKNOWLEDGEMENTS

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PREFACE

The data and information compiled in this document are accurate through the publication date. Recognizing that programs grow and evolve, and that additional artificial reef material is being deployed on a continuous basis, regular updates of this document are expected.

The maps in this document are included for the purpose of depicting the distribution and magnitude of artificial reef sites in the Gulf of Mexico. They are not intended to be used as navigational aids or to depict precise locations of artificial reefs.

GLOSSARY

Latitude/Longitude	As referenced in the tables, latitude and longitude are listed as degrees, minutes, and hundredths of minutes (dd.mm.mm).
Distance	As referenced in the tables, distance refers to the distance from the nearest point on shore to a particular artificial reef.
Depth	As referenced in the tables, depth is the actual depth or a depth range (in feet) for a specific artificial reef site.
Relief	As referenced in the tables, relief is the height (in feet) of a particular artificial reef material above the bottom.
Year	As referenced in the tables, year refers to the year when materials were deployed on an artificial reef site, not the permit year, except as noted in the "Comments" section of the tables.
Total Area	As referenced in the tables, total area refers to the total area of the permitted site, not the total area of deployed materials.

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INTRODUCTION

Artificial reefs have been used to enhance fishing success in the United States for over a century; however, it was not until the mid 1970s that serious attention was given to artificial reefs as tools to assist in habitat enhancement and fisheries management. The National Fishing Enhancement Act of 1984 (Act) called for the development of a national plan to provide guidance to those individuals and agencies interested in artificial reef development and management. The National Marine Fisheries Service (NMFS) was charged with developing the National Artificial Reef Plan (National Plan), which was a combined effort of fishermen, divers, conservation groups, scientists, and state and federal fishery agencies (Stone 1985). The National Plan states that "... properly designed, constructed, and located artificial reefs ... can enhance the habitat and diversity of fishery resources; enhance United States recreational and commercial fishing opportunities; increase the production of fishery products in the United States; increase the energy efficiency of recreational and commercial fisheries; and contribute to the United States and coastal economies."

ARTIFICIAL REEF PROGRAM COMPONENTS

While early artificial reef efforts focused exclusively on construction, the National Plan calls for a more integrated approach to artificial reefs which requires addressing several work areas. The following is a short discussion of the major components of an integrated artificial reef program.

Planning

The National Plan represents only the beginning of the planning process for artificial reef activities, calling for increasing refinement of planning activities from national to regional, regional to state, and state to local. While there is no codified regional artificial reef plan for the Gulf of Mexico, regional planning activities are conducted through the Recreational Fisheries Management Subcommittee of the Gulf States Marine Fisheries Commission's (GSMFC) Technical Coordinating Committee.

Since the passage of the Act, when no state artificial reef plans existed in the Gulf region, there are now two state plans adopted, one plan completed in draft form pending adoption, and one plan in the developmental stage. While state artificial reef plans differ to reflect the needs of the individual states, there are some strong consistencies regarding the issues that are addressed, including permitting, planning, materials, buoying, monitoring and evaluation, and research and management needs. All of these topics are discussed in the National Plan, and should be considered standard components of any artificial reef plan.

Concomitant with the development of state plans, local/site specific plans should be developed. The three major areas of activities that should be addressed in such plans include pre-deployment, deployment, and post-deployment activities. Examples of pre-deployment activities include permitting; siting criteria, such as proximity to land based access sites, characterization of bottom sediments, and avoidance of use conflicts such as proximity to boating and shipping lanes, and historic commercial fishing areas; and the development of a deployment plan which provides details on who will deploy materials as well as when and how the materials will be deployed. Deployment plans should include contingency and safety plans, provisions for spotter vessels to locate and verify the deployment site, provisions for a representative of the permit holder to oversee the deployment plan, and verification of final placement of materials. Post-deployment activities include physical, biological, economic, and sociological monitoring of reef sites, buoy

maintenance, development of reports to document program activities, and research projects.

Materials

Artificial reef construction activities in the United States have traditionally taken advantage of the surplus of solid waste materials that are known as "materials of opportunity." Examples of materials of opportunity that have been used in the Gulf of Mexico region include automobile and other vehicle bodies, garbage dumpsters, refrigerators and other appliances, bed frames, aircraft, boats, ships, barges, concrete rubble, and oil and gas structures. While this list is not inclusive, it is representative of the kinds of materials that have been used. Not all of these materials of opportunity are ideal for use as artificial reefs; however, some are. Specific criteria for materials will be covered later in this section.

More recently, there has been a nation-wide trend to examine the feasibility of using designed structures made from fiberglass, concrete, metal, and plastics, among others. The States of North and South Carolina, for instance, have conducted a number of projects to evaluate the use of manufactured materials including a number of steel and concrete designs. The State of Virginia has experimented with a concrete "igloo", while a number of other Atlantic coast states have experimented with designed units using automobile tires ballasted with concrete. In response to the increasing interest in designed and manufactured structures, a number of private companies have begun producing and marketing their own artificial reef units.

Important criteria to consider when choosing artificial reef materials, whether materials of opportunity or designed structures, include practicality, durability, stability, and biological/environmental effectiveness. The practicality of a material includes consideration of material costs, availability, ease of handling (both at sea and shoreside), and labor requirements. Durability relates to how long a material will last in the marine environment and includes implications regarding biological/environmental effectiveness and economic considerations. Stability relates to whether or not a material is likely to move as a result of wave and tidal action, storm surge, or other external forces. Certainly the biological/environmental effectiveness is affected by a lack of stability, but there are other implications including economic considerations and the potential for conflict. Biological/environmental effectiveness relates to a material's impact on the environment and how well a material contributes to the enhancement of fish habitats and fish populations, including plants and invertebrates. All of these criteria should be considered when determining which material to use; however, if artificial reefs are being used as fishery management tools, then the factor of primary importance should be the overall biological/environmental effectiveness of the materials to be used. Long-term benefits to the environment and the resources will be more likely, even if costs are higher and less material is used.

Monitoring

Monitoring is a vital part of any fully integrated artificial reef program. The National Plan discusses monitoring in two categories, compliance and performance monitoring. Compliance monitoring is designed to assure adherence to all provisions of applicable permits, including location, navigable clearance, acceptable materials free of toxic materials and pollutants, and buoying.

Just as important as compliance monitoring, but not required by most permit provisions, is performance monitoring. This activity addresses the physical, biological/environmental, economic, and social aspects of an artificial reef. Physical monitoring provides for assessments of how well materials withstand the

environment, how stable the materials are, and material longevity. Biological/environmental monitoring provides data on how the artificial reef is affecting the biological community of the surrounding area and its effectiveness in attracting and maintaining populations of fish and other organisms. Economic and social monitoring is related to the use of artificial reefs by recreational and commercial fishermen and divers and related conflicts. These activities are important in determining the impacts of artificial reefs on people and economies, and can be useful marketing tools, not only for the public but also for funding sources, and addressing conflict resolution.

A REGIONAL GULF OF MEXICO ARTIFICIAL REEF PROGRAM

While there are localized differences in needs and approaches regarding artificial reef use, many issues are common to all programs. The need for comprehensive regional planning and management, which includes the factors discussed above, has provided the impetus for the establishment within the GSMFC of a technical subcommittee to coordinate state and federal artificial reef activities, facilitate the exchange of information, and provide for the development of regional policies and priorities. In agreement with objectives of the Atlantic coast artificial reef programs as established through the Atlantic States Marine Fisheries Commission (McGurrin et al; 1988), the regional program of the GSMFC strives to address the following objectives:

- * To establish regional planning guidelines for state artificial reef programs
- * To provide for information exchange on all aspects of artificial reef development and management
- * To provide guidelines for evaluating costs and benefits of artificial reef programs
- * To define the role of artificial reefs in an overall program of habitat and fisheries management

This publication represents the initial step in developing a regional planning and management program by defining existing programs and documenting various parameters of existing permitted artificial reefs. Additional projects related to planning and management of state artificial reef programs are scheduled for action building upon this document.

FEDERAL INVOLVEMENT IN ARTIFICIAL REEF ACTIVITIES

National Marine Fisheries Service

Federal involvement in artificial reef research and development began in earnest around 1966 with the initiation of a formal research program at the U.S. Bureau of Sport Fisheries and Wildlife's Sandy Hook, New Jersey Laboratory. Original research objectives included evaluations of existing reefs to determine their efficacy, construction of a series of new reefs to evaluate building materials, development of engineering techniques, assessment of biomass impacts, and general evaluation of artificial reefs as fishery management tools. A series of ten reefs was built and studied along the Atlantic coast, but the most successful study sites were in South Carolina and Florida offshore waters. When the U.S. Department of the Interior's Bureau of Commercial Fisheries and Marine Game Fish Program was combined in 1970 to form the National Marine Fisheries Service (NMFS) within the U.S. Department of Commerce's National Oceanic and Atmospheric Administration, this research program was continued by the NMFS to its completion around 1973.

From the mid-1970s forward, the NMFS took on more of a supporting role, assisting the states, counties, and private interests in their artificial reef activities. Many contributions were made in the form of technical and financial assistance regarding artificial reef planning, design, permitting, construction, monitoring, and evaluation. Specific examples include:

- * funding and sponsorship of numerous local, regional, and international artificial reef conferences,
- * securing and improving access to surplus federal properties for reef construction, such as Liberty ships and other vessels,
- * funding and technical support of artificial reef research involving:
 - translation, transfer, and application of Japanese artificial reef research findings
 - deployment and evaluation of Japanese and other prefabricated reef construction modules, including fish attractor devices
 - development of artificial reef planning protocols and siting plans
 - development and testing of research and monitoring methodologies
 - development of a National Artificial Reef Development Center and data base (housed by the Sport Fishing Institute)
 - development of strategies, tactics, and methods for overcoming artificial reef development constraints involving permitting, maintenance, liability concerns, transportation costs, and economic assessment methods
- * development and implementation of streamlined federal and state permitting procedures (joint applications and general permits).

Perhaps one of the more significant contributions of the NMFS has been the development and publication of the National Plan in 1985. This plan was produced pursuant to the National Fishing Enhancement Act of 1984 (P.L. 98-623, Title II) to promote and facilitate responsible and effective artificial reef use based on the best available scientific information. Notably, the National Plan describes the roles of government and private organizations in artificial reef development and provides guidelines regarding artificial reef siting, construction materials and methods, reef design, regulatory requirements, reef management, and liability. Most importantly, the National Plan encourages and promotes the development of more specific state and local reef siting and management plans.

Since 1985, the NMFS has continued to actively support regional, state, and local artificial reef development programs through technical consultations, research funding assistance, and participation as members of regional artificial reef management committees established and supported by interstate marine fisheries commissions.

U.S. Fish and Wildlife Service

The primary involvement of the U.S. Fish and Wildlife Service (Service) in artificial reef work is through the Federal Aid in Sport Fish Restoration (Federal Aid) Program which provides funding to the states for important recreational fisheries work. Each coastal state in Region 4 of the Service (NC, SC, GA, FL, AL,

MS, and LA), and Texas from Region 2 use Federal Aid funding to develop and maintain artificial reefs and provide access to them according to the relative configuration of its respective portion of the continental shelf. These artificial reefs have been historically used to attract, concentrate, and exploit desirable fisheries species. Under U.S. Army Corps of Engineers and/or U.S. Coast Guard permits, the states perform planning and development activities including assessment of appropriate development materials and locations, and transportation and deployment practices. Maintenance activities include monitoring reef effectiveness and stability as well as informing the public about artificial reef locations through buoy systems, reference charts, and information booklets. Some states have used Federal Aid funds to develop strategic plans and policies for using artificial reefs as fishery management tools. Through the establishment of standards and guidelines for use of Federal Aid funds for artificial reef work, the Service plays an important role in the quality and direction of current and future activities.

U.S. Army Corps of Engineers

The Corps of Engineers (COE) Permits and Evaluation Branch regulates all construction operations in U.S. waters, including artificial reef construction. The COE receives its regulatory authority from several congressional directives including the Rivers and Harbors Act of 1899, the Outer Continental Shelf Lands Act of 1953, the National Environmental Policy Act of 1969, the Clean Water Act of 1972, and the Marine Protection Research and Sanctuaries Act of 1972 (Ocean Dumping Act).

Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) empowers the COE to prohibit the alteration or obstruction of navigable waters of the United States without a permit from the COE. This authority was extended to include construction of artificial reefs and fixed structures located on the continental shelf (beyond territorial seas) by Section 4 of the Outer Continental Shelf Lands Act (43 U.S.C. 1333). Under the authority of these two Acts, the COE is required to evaluate any navigational issues which may impact the navigable water of the United States within the territorial seas and beyond the territorial seas on the outer continental shelf before issuing a permit. Under the provisions set forth by the National Environmental Policy Act, the COE is also required to assess the potential environmental impact of artificial reef projects before issuing a permit.

The COE is also empowered by Section 404 of the Clean Water Act (33 U.S. C. 1344) to prohibit the discharge of dredged or fill material into the waters of the United States without first obtaining a permit. In addition, Section 103 of the Marine Protection Research and Dumping Act prohibits the transportation of dredged materials for the purposes of oceanic dumping, unless authorized by a COE permit. However, construction of fishing reefs are specifically excluded from these regulations provided the nature of the materials used to construct the reef are regulated by an appropriate state or federal agency. An important function of the COE under the jurisdiction of these two Acts is to require an inspection of the materials prior to placement to certify them free of toxic materials and pollutants.

Minerals Management Service

In January 1983, the Minerals Management Service (MMS) of the U.S. Department of the Interior (USDOL) announced its support for the concept of the conversion of selected obsolete oil and gas structures to artificial reefs (Rigs-to-Reefs) to enhance recreational and fishing opportunities. Subsequently, actions were undertaken within the USDOL and MMS to promote the development of artificial reefs. The USDOL, for example, formed the Recreational and Environmental Enhancement for Fishing in the Seas Task Force composed of representatives from

the federal, state, and private sectors to promote an artificial reef program at the national level. This Task Force motivated agencies and organizations to begin planned and organized development of artificial reefs. Such actions were instrumental in the enactment of the National Fishing Enhancement Act of 1984 (P.L. 98-623, Title II) which established national standards for construction of artificial reefs. Formally adopted as federal policy by the MMS in 1985, Rigs-to-Reefs has become an important component and integral part of state artificial reef programs. Working in cooperation with the Gulf of Mexico Program of the U.S. Environmental Protection Agency, the COE, and the petroleum industry operating in the Gulf of Mexico, the MMS has and continues to support the conversion of offshore petroleum structures and other feasible and environmentally compatible materials into artificial reefs in state artificial reef planning areas.

U.S. Coast Guard

The U.S. Coast Guard (USCG) is responsible for ensuring aids to navigation are established and maintained for all navigable waters of the United States. Aids to navigation include any device external to a vessel or aircraft intended to assist a navigator in determining his/her position or safe course, or designed to warn him/her of dangers or obstructions to navigation. The USCG's authority is provided in Title 14 U.S.C. Section 81-87 and 43 U.C. C. Section 1333 for regulation of the proper marking of obstructions to protect maritime navigation, commerce and the armed forces (Burgess 1974, Christian 1984, Ditton and Burke 1985). By law, the permit holder, lease holder or owner of an obstruction is held liable for the cost of marking the obstruction with an appropriate aid to navigation (Stone 1985).

Environmental Protection Agency

The Environmental Protection Agency (EPA), as mandated under Section 1412 of the Marine Protection, Research, and Sanctuaries Act (MPRSA), is responsible for regulation of the dumping of materials in the waters of the United States. In addition, the EPA must ensure compliance with Sections 402 and 404 of the Clean Water Act (Stone 1985).

Although the regional ocean dumping coordinator for the EPA has the authority to require a permit for artificial reef construction, the general policy has been to act as a review agency for the U.S. Army Corps of Engineers artificial reef permits, provided the project is intended for fishery enhancement and the construction materials are not in violation of water quality standards. Since the COE permit applications are routinely reviewed by the EPA (Christian 1984), it is assumed that any negative comments generated by the EPA would be forwarded to the applicant.

Coastal Zone Management (CZM) Act Programs

Under the Coastal Zone Management (CZM) Act, states receive federal assistance grants to maintain federally-approved planning programs for enhancing, protecting and utilizing coastal resources. These are state programs, but the act requires that federal activities must be consistent with the respective states' CZM programs. Depending upon the individual state's program, the Act provides the opportunity for considerable input into artificial reef development within state jurisdictional waters.

Under the CZM program, states are encouraged to develop coastal zone management programs which establish unified policies, criteria, and standards for dealing with land and water use issues in their coastal zone, an area which includes the states' territorial sea. Approved CZM programs are thus capable of directing

activities away from areas possessing particularly sensitive resources. Thus, criteria for CZM programs can, in part, be used to establish requirements for permitting artificial reef activities.

NON-GOVERNMENTAL INVOLVEMENT IN ARTIFICIAL REEF ACTIVITIES

In concert with the evolution of the National Fishing Enhancement Act and the National Plan (Stone 1985), the NMFS fulfilled the need for an expanded national artificial reef focus by working with the Sport Fishing Institute to create the Artificial Reef Development Center (ARDC). Through the Saltonstall-Kennedy fishery development program and the support of the sport fishing and boating industries, the ARDC has continually worked to develop the tools and information needed to help define the role of marine artificial reefs in U.S. fishery development and management.

The ARDC provides information, research, and education services to a diverse constituency of businesses, fishery managers, researchers, fishing and boating organizations, outdoor writers, civic and community groups, and decision makers. The ARDC's Technical Report Series, Artificial Reef Bibliography, and National Artificial Reef Profiles and Data Base provide the core of its information services. Over the past eight years, the ARDC has undertaken research on some of the most problematic areas of artificial reef development, such as the permitting process, maintenance of artificial reef buoys, costs of transporting artificial reef materials for deployment, liability concerns, the economic valuation of artificial reefs, and siting considerations. Continually updated, the bibliography contains over 2,000 literature references on artificial reef development, research, and management in both technical and popular formats.

The National Artificial Reef Profiles and Data Base, first developed in 1986, currently contains the most up-to-date and detailed information available on coastal state artificial reef programs and permitted artificial reef sites located throughout the coastal waters of the U.S. Since 1990, the GSMFC, through the Recreational Fisheries Management Subcommittee of the Technical Coordinating Committee, has played an extremely active role in the continuing expansion and development of the data base. As a result of this involvement, the data base now contains detailed information on all five artificial reef programs and 278 permitted sites throughout the Gulf of Mexico and represents the first comprehensive information source on artificial reef development and management activities in that region. It is this data base that has provided the foundation upon which this report was developed.

STATE ARTIFICIAL REEF PROGRAM PROFILES

FOR THE

GULF OF MEXICO REGION

**ARTIFICIAL REEF DEVELOPMENT AND MANAGEMENT
IN ALABAMA**

**PREPARED BY
WALTER M. TATUM**

ALABAMA

History of Construction

The Marine Resources Division of the Alabama Department of Conservation and Natural Resources has been in the artificial reef construction business since 1953, and was the first state organization in the Nation to establish an artificial reef program. The first project was conducted at the request of the Orange Beach Charter Boat Association, resulting in the placement of 250 automobile bodies in water depths of 60 to 90 feet off Baldwin County. This is reported to represent the first intentionally constructed artificial reef in the Gulf of Mexico. Following this first successful effort, the Department, in 1957, constructed a series of artificial reefs throughout the waters off Baldwin and Mobile Counties using 1500 automobile bodies in small bundles. In 1959, the Department, in partnership with the Mobile County Wildlife and Conservation Association, sunk a 300 foot drydock off Mobile County. In 1962, approximately 300 tons of imperfect concrete roadway culvert were sunk off Perdido Pass in 75 feet of water. This site was replenished with additional concrete materials in 1970 and 1981. These early efforts proved successful in increasing fishing success for several years.

In 1964 the Department placed six buoyed artificial reefs three to five miles offshore of Fort Morgan in 30 to 50 feet of water. The purpose was to provide an artificial reef area for small-boat fishermen. Although some success was achieved with catches of white trout and cobia, it was determined that low salinity estuarine water influenced the associated fish species, and suspended solids from Mobile Bay covered up the artificial reef before any real success could be realized.

Perhaps Alabama's most impressive and lasting contribution to artificial reef activities is the initiative to secure Liberty ships from the U.S. Maritime Administration's Reserve Fleet in the Alabama River. Alabama Congressman Bill Dickinson, in cooperation with the Department, introduced H.R. 650 which led to an amendment to the 1972 Appropriations Bill for the Maritime Administration which provided for the transfer of "ghost fleeted" Liberty ships to coastal states for use as artificial reefs. Alabama received five ships and placed them in five locations in Alabama's offshore waters, providing excellent offshore fishing opportunities for recreational fishermen.

An artificial reef construction effort in 1979 created some controversy when concrete rubble from the Dauphin Island bridge was placed along a 4.3 mile transect in 65 feet of water off Dauphin Island. Due to unusually rough winter weather conditions, some materials were accidentally placed outside the permitted area, and shrimp fishermen began picking up the concrete in their nets. The areas were ultimately included in the permitted area, and in spite of the early controversy, have proved successful in increasing angler success. Since that time numerous additional artificial reef construction efforts have taken place, including a section of drydock sunk in 1982. More notably, Marathon Oil Company donated sections of a retired oil rig which was sunk by the Department in 1983 some 60 miles offshore in 240 feet of water. Even though the reef is located a great distance offshore, it is visited by fishermen on a regular basis and provides excellent fishing.

Establishment of General Permit Areas

On July 1, 1986, the Orange Beach Charter Boat Association requested that the Marine Resources Division meet with them to develop a program which would enable continued reef construction efforts offshore Baldwin County, Alabama. Members of the Association were aware that a federal permit was required for all

materials purposely dumped into navigable waters, but since enforcement of the law appeared to represent a low priority with federal agents, a general attitude existed among the fishermen that their unpermitted activities were fine.

At some point during the early spring of 1986, USCG vessels began intercepting boats loaded with reef material to determine if they were permitted. When permits were not shown, officials turned the boats around with a stern reminder that the unpermitted activity was in violation of federal law and carried an extremely stiff fine with possible imprisonment. After several captains had been intercepted, it became apparent to the Association that something had to be done. Before meeting with the Association in July, the Marine Resources Division contacted the COE, Mobile District, and an offshore shrimp fisherman to insure their presence at the meeting. A proposal was made that the Department obtain a general permit for a substantial area of the Gulf off Baldwin County, and that the Association issue approval documentation to those fishermen desiring to construct reefs in the area. The COE representative was to check the legality of the proposal and the shrimp fisherman was to check with other area fishermen to determine adverse impacts, if any. The COE reported that there were no legal barriers to permit issuance, and the shrimp fisherman reported that area fishermen favored the proposal because it would allow an area dedicated to artificial reef construction, thereby reducing the amount of illegal reef construction on shrimp fishing grounds.

The first general permit was requested by the Department in August of 1986, and it was issued by January of 1987. That first site encompassed 360 square miles in an area offshore of Baldwin County. Since that time, a second Baldwin County area was established south into 100 fathom-plus water depths, and those sites are known as the Don Kelly North and South General Permit Areas. Also in 1991, another general permit site was acquired off Mobile County and is known as the Hugh Swingle General Permit Area. The Alabama General Permit Areas represent an action that was forced into effect by enforcement of existing laws. It also required that competing resource interests work together for mutual benefit, and made the Association and other reef builders recognize the common property nature of artificial reefs when built in public waters.

For data and information regarding specific artificial reef sites for the State of Alabama, refer to Table 1. Figure 1 provides a distribution of artificial reefs offshore Alabama. Figure 6 provides a Gulf-wide distribution of artificial reefs.

STATE SUMMARY

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State Reef Program: Yes

State Reef Plans: None

Reef Program Staff: 4

Program Budget: None

Number of Permitted Reef Sites:

Site Assessment Practices:

Pre-permitting: Yes

Pre-deployment: Yes

Post-deployment: Yes (ad hoc)

Annual performance/status:

Research Projects: SEAMAP Reef Fish Assessment (pilot)

Publications:

State Advisory Group: No

Other Active Interested Parties: Orange Beach Fisherman's Association
Gulf Coast Conservation Association
Mobile County Wildlife Federation
Baldwin County Wildlife Federation
Dauphin Island SEALAB
Auburn University Marine Research Center

Table 1. Artificial reefs in the State of Alabama.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
105 FT. TUG	30°03.97	87°42.40	19.0	64				Vessel	
ALLEN	30°07.94	87°31.80	26.3	88		1974		Vessel	
ANDERSON	29°59.20	88°04.31	10.3	82		1974		Vessel	
BUFFALO BARGE II	30°04.87	87°50.47	12.3	66		1974		Vessel	
CSX (BOXCARS)	29°59.77	87°33.96				1989		Boxcars	
DAUPHIN ISLAND BRIDGE			12.0	65		1980		Concrete, rubble	
DRYDOCK	30°01.42	88°07.26	10.6	72		1959		Vessel	
DRYDOCK II	29°59.32	87°49.79				1982		Vessel	
EDWARDS	29°58.07	88°06.65	13.8	84		1959		Vessel	
GCCA REEF	30°03.17	87°32.25		90		1992		Vessel	
GUY HUNT REEF	29°56.32	87°41.85				1989		Boxcar	
KELLEY PIPES & LILLIAN BRIDGE I	30°08.72	87°34.10	25.5	60		1962		Concrete, rubble	
LILLIAN BRIDGE II	29°32.30	87°32.70		92		1981		Concrete, rubble	
LIPSCOMB TUG	30°05.02	87°48.11	13.9	65				Vessel	
MARATHON OIL PLATFORM	29°27.09	87°37.03							
MARATHON REEF	29°30.40	87°35.45	50.0	130		1983		Oil rigs	
McMILLIAN BARGE	29°58.90	88°02.74		90		1991		Barge	
MOBIL OIL PLATFORM	30°00.19	87°30.84	29.0	96				Oil rigs	
MORRISETTE REEF	30°03.18	87°33.01		90		1992		Firetrucks, airplanes, car bodies	
PERDIDO PASS BRIDGE:				6-12		1989			
SITE 1	30°02.09	87°33.50						Concrete, rubble	
SITE 2	30°08.52	87°34.19						Concrete, rubble	
SITE 3	30°08.56	87°34.00						Concrete, rubble	

Table 1. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SITE 4	30°02.49	87°33.26						Concrete, rubble	
SITE 5	30°02.93	87°33.11						Concrete, rubble	
SITE 6	30°03.32	87°32.88						Concrete, rubble	
SITE 7	30°03.80	87°32.71						Concrete, rubble	
SITE 8	30°08.57	87°34.31						Concrete, rubble	
PERMIT AREAS:									
HUGH SWINGLE AREA	30°03.00	88°07.50		60-100		1987			Year permitted
	30°03.00	87°59.00							
	29°54.50	87°55.25							
	29°54.00	88°07.00							
DON KELLY NORTH AREA	29°59.67	87°47.00		60-180		1987			Year permitted
	30°03.50	87°32.00							
	29°32.50	87°31.50							
	29°51.75	87°47.00							
DON KELLY SOUTH AREA	29°47.25	87°46.50		180-1200		1988			Year permitted
	29°28.50	87°32.00							
	29°15.75	87°31.75							
	29°26.00	87°45.50							
SCOTT BARGE	29°59.33	88°01.76		90	12	1993		Barge	Concrete/metal inside
SEA GRANT/SEA LAB STAR REEF	29°59.65	87°47.77				1988		Plastics	
SOUTHEAST BANKS	30°01.11	87°56.98	11.6	75				Rock	
SOUTHWEST ROCK	30°06.39	88°12.30	11.0	66				Rock	
SPARKMAN	29°59.91	87°43.00	20.3	93		1974		Vessel	
SURPLUS PROPERTY:				90		1992		Vessel	
SITE 1	30°03.18	87°33.72							
SITE 2	30°03.20	87°33.02							
SITE 3	30°03.10	87°33.76							

Table 1. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SITE 4	30°03.08	87°33.76							
SWINGLE REEF	29°24.36	87°35.62				1990		Oil rig	
TRYSLER GROUND	29°54.62	87°27.13	31.0	102				Oil rig	
TULSA WRECK	30°01.13	88°06.53	11.0	84		1940's		Rock	
WALLACE	30°05.29	87°34.60	25.3	90	15	1974		Vessel	



Figure 1. Location of artificial reefs in Alabama waters.

**ARTIFICIAL REEF DEVELOPMENT AND MANAGEMENT
IN FLORIDA**

**PREPARED BY
VIRGINIA A. VAIL**

FLORIDA

Florida leads the nation in both the total number and annual development/replenishment rate of marine artificial fishing reefs. According to available data, development of artificial fishing reefs in Florida has been occurring for at least 70 years. After a slow beginning, spanning several decades, the rate of artificial reef development has increased dramatically during recent years. In a 1966 report, Woodburn identified 35 artificial reef sites, all but seven of which were in the Gulf of Mexico. In 1983, Aska and Pybas, conducting a survey of artificial reefs for Florida Sea Grant, reported a total of 173 reef sites, 86 of which were in the Gulf. In a 1987 update of this survey, Pybas listed a total of 228 reef sites, of which 116 were in the Gulf. By 1991, in second update of the survey, Pybas reported 329 permitted reef sites, including 177 in the Gulf. Permitted reef sites vary in size from a quarter mile diameter to well over one square mile.

The prolific development of artificial reefs in Florida has been highly decentralized. Although federal and state regulatory agencies (i.e., COE, Florida Department of Environmental Regulation, Florida Department of Natural Resources Division of State Lands) must permit development of artificial reefs, reef development generally is the result of local government initiatives or support in the 35 coastal counties. Florida's artificial reefs are typically built through the coordinated efforts of a county or city governmental unit (as the permit holder and project manager) and private citizens. Volunteers (as individuals or representatives of reef organizations or fishing clubs) may serve on reef advisory boards, conduct site selection assessments and complete documentation necessary for permit or grant applications, obtain donations of suitable materials, conduct pre- and post-deployment assessments, and/or periodically monitor the reefs. Materials deployed are typically "materials of opportunity," especially concrete rubble (e.g., culverts, junction boxes, slabs, bridges), scrap steel, and vessels/barges.

In recent years, significant financial assistance for reef development has been provided through grants to local governments from the Florida Department of Natural Resources* Office of Fisheries Management and Assistance Services. Funds to support these projects are derived from recreational saltwater fishing license revenues and the Federal Aid in Sport Fish Restoration (Wallop-Breaux) Program. At this time the use of funds is limited to transportation of materials to a staging area and/or the reef site and certain pre- and post-deployment engineering activities. However, in the near future, the State Reef Program anticipates approval of revisions to its rule which will allow funds to be used for construction or purchase of modular units or vessels and assessments of reef performance. The average grant to a local government for reef construction is \$25,000. However, several special projects, each costing in excess of \$100,000, have been funded.

Although local government and state documentation of reef development and performance has been minimal and somewhat uncoordinated, there is an increasing interest in evaluating the effectiveness of past efforts to insure future ones are cost effective. Florida Sea Grant has implemented a training program for volunteer divers to provide direction and base line standards for reef monitoring and data management. Several local governments have implemented programs to take advantage of volunteer efforts. The State Reef Program drafted a State Reef Development Plan, which provides guidance and direction for reef planning and development activities and a State Reef Monitoring Plan, which provides basic guidance and primary references for the biological, physical, oceanographic and socio-economic evaluation of artificial reefs. The objective is to provide a frame of reference for development of independent local reef monitoring activities which will produce data that can be used in a statewide evaluation of reef success.

Communications among local program managers, volunteer groups, state program officials, state and federal regulatory agency staff are enhanced through periodic conferences and workshops hosted by Florida Sea Grant, volunteer groups, or the Florida Department of Natural Resources. Such gatherings, which address specific current reef issues or management needs, are eagerly anticipated and well attended.

For data and information on specific artificial reef sites for the State of Florida, refer to Table 2. Figure 2 provides a distribution of artificial reefs offshore Florida. Figure 6 provides a Gulf-wide distribution of artificial reefs.

* On July 1, 1993, the Florida Departments of Natural Resources and Environmental Regulation merged to become the Florida Department of Environmental Protection.

STATE SUMMARY

PRIMARY CONTACT: Jon Dodrill

Title: Environmental Administrator

Address: Office of Fisheries Management & Assistance
Services, MS240, Department of Environmental
Protection
3900 Commonwealth Boulevard
Tallahassee, Florida 32399

Telephone: (904) 922-4340

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State Reef Program: Yes

State Reef Plans: Draft reef development plan and draft monitoring
plan

Reef Program Staff: 2 1/2

Program Budget:
(approximate) FY 92/93 \$1 million for construction grants
\$85,000 salaries
\$10,000 operation/travel expense

Number of Permitted Reef
Sites: 176

Site Assessment Practices (State):

Pre-permitting: N/A

Pre-deployment: N/A

Post-deployment: Yes, 26 sites since June, 1992 (see attached list for
sites selected to be monitored for compliance with
contractual terms)

Annual performance/status: Yes

Research Projects:

1. Fundamental Design Parameters for Artificial
Reefs: Interaction of Patch Reef Spacing &
Size. *
2. Determining the Optimal Design,
Construction, Materials and Location of
Artificial Reefs in Florida Waters. *
3. Stability of Automobile Reefs in the
Northeastern Gulf of Mexico. *

4. The Use of Large Artificial Reefs to Enhance Fish Populations at Different Depths in the Florida Keys.
5. Artificial Reef Complexity and Primary Productivity.

* Funded by grants from the Florida Department of Environmental Protection

Publications:

Status Reports on projects 1-3

Kruer, C.R. and L.G. Causey. 1992. The Use of Large Artificial Reefs to Enhance Fish Populations at Different Depths in the Florida Keys. NMFS MARFIN Program #NA89AA-H-MF179. 207 pp.

State Advisory Group:

No

Other Active Interested Parties:

Yes, in addition to the 35 county government programs, there are nine volunteer reef research groups in the state working with the permitting, deployment, and monitoring of artificial reefs in the state.

Table 2. Artificial reefs in the State of Florida.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
ESCAMBI A COUNTY									
SITE 7	30°08.15	87°13.15	8.5-15.0	78-95	20	1988		180 ft. ship 'PETE TIDE', vessel, steel, concrete, plastic modules	17 placements (8-88, 3-89, 3-90,91, 2-93)
SITE 15	30°11.12	87°14.08	6.5-8.3	65-82	22	1988		Vessel, steel modules, concrete cars	15 p lacements (4-88, 5-89, 3-90, 91, 2-93)
SITE 20	29°57.11	87°12.24	19.3-22.5	124	12	1990		Vessel, steel, concrete, plastic	4 placements (3-90, 93)
SITE 21	30°03.90	87°01.81	18.7	150	60	1993		Oil rig	2 sections (93)
BARGE (1982)	30°13.98	87°09.43		75		1982		Barge	
CASINO FISHING REEF	30°17.33	87°08.00	3.5	60		1978		Concrete rubble	
BRIDGE RUBBLE	30°13.80	87°10.75		80				Concrete rubble	
LIBERTY SHIP REEF	30°16.30	87°09.70	3.0	82	15	1976		Liberty ship 'JOSEPH L. MEEK'	
THREE BARGES SITE	30°16.95	87°12.83	6.9	54	10	1976		Vessels, concrete rock	
SAN PABLO	30°11.33	87°10.63	9.0	84	27	1943		Vessel, concrete	
SANTA ROSA COUNTY									
LIBERTY SHIP REEF	30°12.78	86°48.35	10.8	85		1980		Liberty ship 'JOSEPH E. BROWN'	
TENNECO REEF SITE	30°00.00	87°04.00	22.0	156	71	1982		Oil rigs	3 placements (82, 2-87)

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
OKALOOSA COUNTY									
SITE 1 (POLE SPOT)	30°22.00	86°35.00	1.5	75	75	1976		Concrete, pier rubble, barge, fuel tanks	3 placements (76, 92)
SITE 1A (FT. WALTON BARGE)	30°21.00	86°35.00	3.0	80	11	1977		100 ft. barge	
SITE 2 (BRIDGE RUBBLE)	30°22.00	86°30.00	1.9	73		1977		Bridge rubble, rock	
SITE 2	30°21.00	86°30.00	1.5	72		1977		Concrete, rock barge	2 placements (77)
SITE 3	30°22.00	86°25.00	1.2-1.5	65		1977		Concrete, fuel tanks	2 placements (77,90)
SITE 4	30°19.60	86°36.10	13.0	87		1977		Liberty ship 'THOMAS HAYWARD'	
SITE 5	30°03.60	86°45.70	18.0	130	20	1983		Tires, concrete, metal, rock, plastic	
SITE 8 (TEENS REEF)	30°10.00	86°45.00	14.2	118		1979		Vessel, barge	
SITE 10	30°02.12	86°53.00	27.5	354				Oil rig structure	
CHOCTAWHATCHEE BAY REEF	30°25.65	86°29.35	0.5	26	12	1987		Polyolefin, prefab. material	
LANDING CRAFT	30°09.07	86°18.00	12.4	102				Landing craft	
OZARK TARGET SHIP	29°55.00	86°34.08	27.8	180		1982		Vessel	
BAY COUNTY									
CHIPPEWA SITE	30°00.00	85°48.00	9.0	105	36	1988		210 ft. tugboat, bridge rubble	8 placements (79, 87, 5-88, 90)
FOUNTAINBLEAU SITE	30°09.00	85°53.00	9.0	68-75	36	1979		Vessel, concrete	5 placements (79, 4-88)

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
GREY GHOST SITE	30°02.82	86°05.53	19.0-21.0	105		1978		Tires, vessels, metals	3 placements (78, 2-88)
MIDWAY SITE	30°02.38	85°43.30	5.0	71		1979		Tires, vessels, concrete, metal	6 placements (79, 5-88)
LIBERTY SHIP	30°00.00	85°40.50	8.0	72	15	1977		Vessel 'BENJAMIN H. GRIERSON'	
LOSS PONTOON SITE	30°05.08	85°44.12	2.0	65	10	1978		Steel structure, bridge spans	3 placements (78, 88,90)
PCMI BARGE SITE	30°07.08	85°49.48	4.5	75		1980		Vessel, metal	
STAGE I SITE	29°58.12	85°48.82	9.0	15	36	1979		Tires, vessels, concrete, metal	5 placements (4-88, unk)
T-SQUARE REEF	28°37.08	85°55.08	23.0	132		1987		Tire modules	
WARSAW SITE	30°04.00	85°48.12	4.5	75-80	36	1978		Concrete, bridge, 180 ft. ship 'BLACK BART'	5 placements (78, 2-88, 2-95)
GULF COUNTY									
BARRIER DUNE BARGE	29°45.03	85°25.63	1.0	35	8	1989		200 ft. barge	
GATEWAY BARGE REEF	29°50.23	85°34.86	12.0	80	8	1988		70 ft. barge, steel tanks	
J.C. REEF (VIRGINIA)	29°50.33	85°29.50	1.6	45	10	1987		Concrete, steel, cars, vessels, bridge	3 placements (87, 91, 93)
KAISER SITE	29°53.83	85°31.00	3.0	42	10	1932		Wooden tug	
LUMBER SHIP	29°53.73	85°27.87	1.5	25	14	1942		Metal ship	
MEXICO BEACH SITE	29°54.02	85°32.00	3.0	55	10	1988		Bridge spans, boxcars	4 placements (88)
PORT ST. JOE CHAMBER OF COMM.	29°50.40	85°29.30	4.4	40		1964		Concrete	

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
FRANKLIN COUNTY									
APALACHICOLA SITE (CITY)	29°30.50	84°50.50	10.0	75	75	1988		Concrete, metal, rock	
C TOWER	29°24.23	84°51.47		85		1973		Vessel, concrete	
CITY OF CARRABELLE SITE	29°31.08	84°39.42	13.0	70		1982		Vessel, concrete, metal, rock	3 placements (2-82, unk)
CARRABELLE 3 MILE SITE	29°45.07	84°34.37	5.0	35	8	1992		Concrete, culverts	2 placements (92, 93)
CARRABELLE 14 MILE SITE	29°34.34	84°32.22	12.0	75		1993		200 ft. barge	
EMPIRE MICA SITE	29°18.75	85°21.22	28.0	110	60	1942		Steel hull vessel	
FRANKLIN CO. REEF SITE	29°32.52	84°45.77	10.0	75		1988		Concrete, rock	
K TOWER	29°30.47	84°22.05	13.0	60		1981		Vessel, concrete	
L BOUY SITE	29°31.12	85°07.36	6.5	45		1965		Concrete, rock	
ONE MORE TIME SITE	29°42.34	84°37.34	4.9	40	23	1992		70 ft. steel hull vessel	
O TOWER	29°32.12	84°37.05	13.0	70		1981		Tires, concrete, rubble	
S TOWER REEF	29°17.05	84°36.47	35.0	105		1980		Metals, car bodies	
S TOWER REEF (DNR EXXON SITE)	29°17.92	84°36.80	35.0	105		1979		Oil rigs	
V TOWER	29°24.53	84°21.53	15.0	70				Vessel, concrete	
WAKULLA COUNTY									
BARGE WRECK	29°50.08	84°09.27	13.0	35	18	1986		Vessel	
OCHLOCKONEE SITE	29°54.70	84°13.12	9.0	21-30		1988		Concrete, tires	6 placements (5-88, 90)
OAR/WAKULLA REEF	29°43.75	84°17.55	11.0-12.0	50-55	10	1989		Concrete, culvert	3 placements (89, 90, 92)
ST. MARKS REEF SITE	30°00.00	84°09.25	5.0	20		1964		Concrete, culvert	4 placements (64, 82, 2-88)

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
TAYLOR COUNTY									
BIRDRAK REEF-BIG GRASSY	29°40.78	83°34.25	83°34.25	16	16	1992		Concrete rubble	Concrete rubble
BIRDRAK REEF-DEKLE BEACH	29°49.80	83°38.50		4		1992		Concrete rubble	
BIRDRAK REEF-FISH CREEK	29°47.17	83°37.25		5		1992		Concrete rubble	
STEINHATCHEE SITE	29°39.80	83°37.90	11.0	20		1965		Vessels, concrete, metal	2 placements (65, 90)
DIXIE COUNTY									
FISH HAVEN/N.W. RED BANKS REEF	29°19.47	83°15.70	5.0	13	13	1964		Autos, white goods, metal	
SUWANNEE REGIONAL REEF # 9	29°06.92	83°28.36	17.5	35		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 10	29°06.92	83°29.08	18.1			1992		Concrete modules	
SUWANNEE REGIONAL REEF # 11	29°08.76	83°29.79	17.8	34		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 13	29°10.75	83°30.79	17.7	35		1992		Concrete modules	
SUWANNEE REGIONAL REEF # 14	29°11.83	83°31.07	17.0			1991		Concrete modules	
SUWANNEE REGIONAL REEF # 15	29°12.90	83°31.36	16.3	34		1992		Concrete modules	
SUWANNEE REGIONAL REEF # 16	29°13.98	83°31.65	15.6			1991		Concrete modules	
SUWANNEE REGIONAL REEF # 17	29°14.05	83°31.93	15.1	34		1992		Concrete modules	
SUWANNEE REGIONAL REEF # 19	29°16.20	83°32.50	14.5	35		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 20	29°17.28	83°32.79	14.2			1992		Concrete modules	
SUWANNEE REGIONAL REEF # 21	29°18.35	83°33.08	13.6	33		1991		Concrete modules	
SUWANNEE REGIONAL REEF #22	29°19.43	83°33.36	12.7			1992		Concrete modules	
SUWANNEE REGIONAL REEF #23	29°20.50	83°33.65	12.7			1992		Concrete modules	

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
LEVY COUNTY									
BETTY CASTOR SITE	29°16.50	83°23.00	3.0	22	4	1989		Vessel, concrete, metal, rock	
COAL ASH REEF (CEDAR KEY SITE 1)	29°07.27	83°12.30	9.3	25		1985		Flyash, concrete, prefab.	
CEDAR KEY SITE 1	29°07.00	83°12.50	9.0	23		1985		Concrete, culvert	
CEDAR KEY SITE 2	28°58.95	83°11.88	11.0	26		1988		Concrete, culvert, boulders	
CEDAR KEY SITE 3	29°06.83	83°25.62	13.0	36		1989		Concrete, culvert	
CEDAR KEY SITE 4	29°08.97	83°22.08	6.9	26		PROPOSED		PROPOSED	
SUWANNEE REGIONAL REEF # 0	28°57.65	83°21.95				1992		Concrete modules	
SUWANNEE REGIONAL REEF # 1	28°58.57	83°22.66	16.8	39		1990		Concrete modules	
SUWANNEE REGIONAL REEF # 2	28°59.49	83°23.38	17.3	36		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 3	29°00.41	83°24.09	17.5	35		1990		Concrete modules	
SUWANNEE REGIONAL REEF # 4	29°01.33	83°24.80	17.3	36		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 5	29°02.25	83°25.51	18.4	38		1990		Concrete modules	
SUWANNEE REGIONAL REEF # 6	29°03.17	83°26.23	18.2	35		1991		Concrete modules	
SUWANNEE REGIONAL REEF # 7	29°04.08	83°26.94	18.0	34		1990		Concrete modules	
SUWANNEE REGIONAL REEF # 8	29°05.00	83°27.65	17.8	35		1991		Concrete modules	
CITRUS COUNTY									
CITRUS COUNTY REEF SITE 1	28°47.30	83°03.50	19.2	30	10	1983		Vessel, concrete, metal, rock	3 placements (90, 91, 92)
WITHEROW REEF SITE	28°52.05	82°45.10	4.5	9				Metal	
HERNANDO COUNTY									
SITE 1 (A.H. RICHARDSON REEF)	28°30.00	82°55.00	18.0	22	22	1977		Tire, concrete	Tire, concrete

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SITE 2 (JIM CHAMPION REEF)	28°36.75	82°57.78	16.5	20		1990		Concrete	2 placements (91, 92)
PASCO COUNTY									
PASCO CO. REEF: SITE 1	28°15.06	82°57.47	11.0	25	25	1981		Vessel	Vessel
PASCO CO. REEF: SITE 2	28°17.45	83°01.23	13.2	40	20	1982		Vessel	2 placements (82, 87)
HILLSBOROUGH COUNTY									
BAHIA BEACH SITE	27°44.85	82°31.00	1.8	24	14	1987		Concrete	Concrete
BALLAST POINT PIER SITE	27°53.37	82°28.80		8	8	1987		Concrete	
COURTNEY CAMPBELL SITE	27°57.75	82°36.86	0.4	16		1991		Concrete pilings	
EGMONT KEY SITE	27°35.00	82°44.60	0.8	23		PROPOSED		PROPOSED	
HOWARD FRANKLAND SITE	27°54.63	82°33.23	1.0	16		1991		Concrete pilings	
PICNIC ISLAND PIER SITE	27°51.42	82°33.27	0.1	18	8	1991		Prefab. concrete modules	
PORT MANATEE SITE	27°39.68	82°34.87	0.7	21	13	1990		Concrete, bridge, rubble	
PORT OF TAMPA SITE	27°51.65	82°33.84	0.6	24	10-12	1987		Vessel, rubble, concrete	
TAMPA: PICNIC ISLAND SITE	27°51.39	82°33.20	1.0	26		1987		Concrete, clay, pipe	
PINELLAS COUNTY									
CITY OF CLEARWATER: PIER 60 SITE	27°58.63	82°49.83	0.0	5-12	5-12	1986		Concrete pipe	Concrete pipe
CLEARWATER SITE	28°00.95	82°53.70	3.3	27-29		1974		Vessel, concrete	
DUNEDIN SITE	28°03.20	82°54.55	4.4	25-30		1975		Boat molds, culverts	
INDIAN SHORES SITE	27°51.40	83°01.80	9.3	46		1975		Vessel, concrete	
MADEIRA BEACH SITE	27°46.20	82°54.90	5.7	33		1975		Concrete rubble	
PINELLAS TWO SITE	27°52.50	83°11.40	12.8	80		1975		Tires, vessel	2 placements (75, 82)

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
RUBE ALLYN (PINELLAS 1) SITE	27°55.36	83°01.40	9.2	50		1975		Vessel, FAD	
ST. PETE BEACH SITE	27°40.60	82°51.75	6.3	34-36		1975		Bridge rubble	
ST. PETERSBURG (BAY) SITE	27°47.10	82°35.37	1.0	34-36		1975		Bridge rubble	
TARPON SPRINGS SITE	28°08.25	82°55.85	7.2	26-28		1975		Concrete pipes	
TREASURE ISLAND SITE	27°44.50	82°52.85	5.8	29-33		1975		Concrete pipes	
MANATEE COUNTY									
SITE 'A' 7 MILE	27°32.25	82°52.70	7.0	40	40	1976		Tires, concrete	Tires, concrete
SITE 'B' 3 MILE	27°29.95	82°47.00	3.5	30		1976		Tires, concrete, rubble	
SITE 'C' 7 MILE	27°26.55	82°49.20	7.0	40		1976		Tires, concrete, rubble	
SITE 'D' 3 MILE	27°26.55	82°44.80	3.0	30		1976		Tires, concrete, rubble	
BAYSHORE GARDENS	27°24.50	82°36.08	0.5	10	2	1976		Tires, concrete, rubble	
FUNERARIUS SITE (FRANK ZAFFINA)	27°23.97	82°43.50	3.2	35		1987		Prefab. concrete cubes	
ONE MILE SITE	27°29.50	82°44.08	1.0	20		1976		Vessel, tires, pipe	3 placements (76, 92, 93)
PT. PLEASANT SITE	27°30.22	82°35.00	0.4	12		1976		Tires, concrete, rubble	
SNEADS POINT	27°31.50	82°39.45	0.1	15		1975		Tires, concrete	
SARASOTA COUNTY									
D3 SITE	27°15.83	83°07.28	28.8	105	20	1988		Steel scrap, boxcars	Steel scrap, boxcars
D4 SITE	27°15.83	83°07.28	29.0	103	25	1988		Steel scrap, boxcars	
D6 SITE	27°06.32	83°03.30	28.0	109	25	1990		Boat molds	

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
D9 SITE	26°54.58	82°55.98	28.0	100	20	1988		Vessel	
I1 SITE	27°16.95	82°35.90	2.0	30	12	1980		Concrete, rubble	
I2 SITE	27°17.92	82°37.10	2.0	30	10	1982		Concrete, rubble, pilings	
I3 SITE	27°18.10	82°35.60	0.7	22	10	1982		Concrete, rubble, pilings	
I4 SITE	27°06.13	82°29.13	1.3	25	10	1980		Concrete, rubble	
M1 SITE	27°19.10	82°43.33	7.1	42	15	1987		Concrete, rubble	2 placements (87, 93)
M2 SITE	27°18.61	82°43.05	7.0	42	12	1990		Vessel	
M3 SITE	27°18.63	82°43.28	7.0	42	15	1990		Concrete	
M4 SITE	27°14.90	82°43.50	7.5	42		1990		Concrete, rubble	
M6 SITE	27°11.13	82°43.66	11.0	55	20	1988		Vessel, concrete, scrap steel	
M7 SITE	27°16.00	82°48.30	11.6	50	20	1988		Boxcars, steel	
M8 SITE	27°12.47	82°48.30	12.2	65	20	1985		Vessel, boxcars, steel	
M9 SITE	27°04.35	82°42.15	11.5	61		1990		Concrete, rubble	
M10 SITE	27°02.00	82°42.55	15.5	65	20	1987		Vessel	
M14 SITE	26°52.12	82°26.93	7.0	43		1990		Concrete, rubble	
M15 SITE	27°04.90	82°32.62		38		1990		Concrete, rubble	
MD1 SITE	27°09.67	82°53.35	16.0	80		1990		Concrete, rubble, vessel	
<u>SARASOTA (CITY)</u>									
SITE 2	27°22.03	82°34.57	0.5	10	4	1989		Vessel, metal	
SITE 3	27°20.12	82°34.67		9-21	4	1989		Concrete, rubble, insulators	

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SITE 4	27°19.82	82°34.78		7		1989		Concrete, rubble, insulators	
SITE 5	27°20.25	82°34.95		8		1989		Concrete, rubble, insulators	
SITE 6	27°19.67	82°33.53		10	4	1989		Concrete, rubble, insulators	
SITE 7	27°18.78	82°34.35		12	4	1989		Concrete, rubble, insulators	
SITE 8	27°18.62	82°32.72	0.5	7		1989		Concrete, rubble, insulators	
CHAROLETTE COUNTY									
CHAROLETTE HARBOR SITE	26°50.50	82°05.32	1.5	8-11	8-11	1987		Metal, concrete, rock	3 placements (83, 87, 89)
DESMOND SITE	26°53.70	82°29.50	8.0	50		1987		Fiberglass, concrete, rubble	
ENGLEWOOD FISHING CLUB REEF	26°54.70	82°21.80	0.4	22		1960		Concrete, rubble	
HOG ISLAND FISH HAVEN SITE	26°54.80	82°07.62	1.3	6-8		1970		Tire	
STUMP PASS SITE	26°52.21	82°26.51	5.5	42		1992		Concrete pipes	
LEE COUNTY									
SITE 1 (HELENS)	26°38.10	82°17.30	3.4	32	32	1989		Concrete	Concrete
SITE 2 (POWER POLE)	26°41.00	82°22.20	6.4	46		1989		Concrete, vessel	
SITE 3 (MARYS)	26°46.10	82°18.20	2.9	32		1989		Concrete	
SITE A-B (MAY REEF)	26°22.80	81°55.77	2.5	20		1983		Vessel, concrete	2 placements (77, 83)
SITE C-D (SANIBEL)	26°24.58	82°02.83	2.9	20	10	1978		Concrete	2 placements (79, 89)
SITE E-F (JAYCEES)	26°24.12	82°05.08	8.5	33		1988		Tires, vessels, concrete	3 placements (88, 91, 92)

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SITE G-H (D.J.H. REEF)	26°20.63	81°57.17	4.5	30		1983		Tires, vessels, concrete, metal	2 placements (83, 84)
SITE I-J (CSX BOXCAR)	26°42.00	82°36.00	18.0	70	10	1987		Vessel, concrete, boxcars	
EDISON BRIDGE REEF	26°18.45	82°13.26	9.5	40		1992		Bridge rubble	
COLLIER COUNTY									
CAXAMBAS PASS 14 MI. SITE	25°47.60	81°56.60	14.0	48	8	1991	1991	Concrete, culvert	
DOCTORS PASS 5 MI. SITE	26°10.22	81°54.30	5.0	28		1987		Concrete, culvert	
GORDON PASS 5 MI. SITE	26°05.22	81°53.43	4.5	28		1987		Scrap metal, aircraft	
GORDON PASS 9 MI. SITE	26°04.71	81°58.50	9.5	38	5	1990		Concrete module	
GORDON PASS 14 MI. SITE	26°03.85	82°03.00	13.5			1990		PROPOSED	
MARCO ISLAND 5 MI. SITE	25°52.70	81°47.80	5.0	35		1972		Concrete, rubble, dredge pipe	9 placements (72, 8-86)
MARCO ISLAND 2 MILE SITE	25°55.23	81°46.15	2.0	23		1972		Concrete, rubble, tires	
NAFTAL: SITE #1 (CAPE ROMANO)	25°55.22	81°38.93		45		1987		Concrete, pilings	
NAFTAL: SITE #2	25°47.00	81°41.13	4.0	14		1988		Concrete, culvert, rubble	
NAPLES PIER (CRUISE CLUB) REEF	26°07.75	81°50.75	2.0	25		1973		Concrete, pilings	
PAVILION KEY SITE	25°41.18	81°28.00	6.0	16		1989		Concrete	
STEINAUER#1 (MARCO REEF BUILDERS)	25°49.00	81°57.00	12.0	40		1988		PROPOSED	
STEINAUER#2 (MARCO REEF BUILDERS)	25°45.50	81°57.20	12.5	45		1989		Concrete, white goods	
WIGGINS PASS 4.6 MI. SITE	26°17.30	81°54.85	4.8	30		1987		Vessel, steel scrap	
WIGGINS PASS 5 MI. SITE	26°17.15	81°55.48	5.0	30		1987		Buses, trucks	2 placements (87, 90)
WIGGINS PASS 14 MI. SITE	26°14.87	82°05.83	14.5	48	8	1991		Concrete, culvert	

Table 2. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
MONROE COUNTY (GULF)									
FKARA REEF: GUNBOR SITE	24°57.00	81°46.00	19.6	52	26	1985	1985	Vessel	Vessel
FKARA REEF: KEY WEST GULFSIDE SITE	24°41.13	81°52.73	9.8	32	10	1987		Vessel, concrete, metal, rock	5 placements (3-83, 86, 87)



Figure 2. Location of artificial reefs in Florida waters.

**ARTIFICIAL REEF DEVELOPMENT AND MANAGEMENT
IN LOUISIANA**

**PREPARED BY
RICK KASPRZAK**

LOUISIANA

The development of the oil and gas industry in the Gulf of Mexico resulted in the creation of this country's most extensive artificial reef system. Over 90% of the 3,800 mineral mining structures in the United States coastal waters are located off Louisiana's coastline. Since the first platform went into place in 1947, fishermen of Louisiana and bordering states have recognized the fishing value associated with this industry. Currently, over 75% of all recreational fishing trips originating in Louisiana are destined for one or more of these structures. For over 40 years, Louisiana fishermen have benefitted from the increased biological activity associated with this unintentional artificial reef habitat.

Since these platforms are so commonplace off the Louisiana coast, many citizens and management groups believe that they are permanent and will always be available for fishing. This is, however, not the case. Already, 470 structures are estimated to have been removed from coastal Louisiana, and by the year 2000, over 40% of the remaining oil and gas structures in the Gulf of Mexico could be removed. This would represent a major loss to Louisiana fishermen.

It was, therefore, imperative that Louisiana recognize this potential loss of habitat and plan to offset it by either creating new artificial reefs or preserving existing structures. The National Fishing Enhancement Act of 1984 (P.L. 98-623) established national standards for the creation of the National Plan, which established guidelines for creating artificial reefs in state and federal waters. In response to this federal act, the Louisiana Artificial Reef Initiative (LARI) combined the talents of university, state, federal, and industry representatives to develop an artificial reef program for the State of Louisiana. As a result of their efforts, the Louisiana Fishing Enhancement Act (Act 100) became law during the 1986 regular legislative session. The Louisiana Artificial Reef Plan contains the rationale and guidelines for implementation and maintenance of a state artificial reef program. Intended to serve as a flexible working document, it will be periodically updated through the Louisiana Artificial Reef Council (LARC) on the basis of the results of operational activities. The LARC consists of the Secretary of Wildlife and Fisheries, who is responsible for administration of the program, along with the Dean of the Center for Wetlands Resources, and the Director of the Louisiana Geological Survey at Louisiana State University, which provides technical support.

The state plan has been approved by the Louisiana Senate and House Natural Resources Committees and is implemented under the leadership of the Louisiana Department of Wildlife and Fisheries. Materials for use as artificial reefs will be accepted and their placement within the reef planning areas determined on a case-by-case basis by the consensus of the LARC. Artificial reef complexes will be established within each reef planning area on the basis of the best available information regarding bottom type, currents, bathymetry, and other factors affecting performance and productivity of the reefs. Precise design and location of the reef complex will also depend upon the physical dimensions of the donated materials. With input from various user groups, such as recreational and commercial fishermen (including shrimpers and oystermen), and members of state and federal agencies, the LARC approved nine artificial reef planning areas off the Louisiana coast. These areas are where artificial reefs can be sited and will be used in Phase I of the Louisiana Artificial Reef Program.

Currently, Louisiana is embarking on its inshore program, or Phase II, of Louisiana's Artificial Reef Plan. Over 6,000 structures in Louisiana's inshore coastal waters have been identified as artificial reefs. Louisiana intends to map these obstructions and have the maps published and distributed to fishermen. To date, two shell pad reefs have been constructed in Vermilion Bay.

For data and information for specific artificial reef sites for the State of Louisiana, refer to Table 4. Figure 4 provides a distribution of artificial reefs offshore Louisiana. Figure 6 provides a Gulf-wide distribution of artificial reefs.

STATE SUMMARY

PRIMARY CONTACT: Rick Kasprzak

Title: Artificial Reef Coordinator

Address: Louisiana Department of Wildlife and Fisheries
P.O. Box 98000
Baton Rouge, Louisiana 70898

Telephone: (504) 765-2375

Fax: (505) 765-2189

State Reef Program: Yes

State Reef Plan: Yes

Reef Program Staff: 1

Program Budget: FY 1992-1993 - \$165,000.00

Number of Permitted Reef Sites: 13

Number of Developed Reef Sites: 13

Site Assessment Practices:

Pre-permitting: Yes

Pre-deployment: Yes

Post-deployment: Yes

Annual performance/state: Yes

Research Projects: Hydroacoustic monitoring, side scan sonar surveys, and dive surveys

Publications: None

State Advisory Group: Yes

Table 3. Artificial reefs in the State of Louisiana.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
ANGEL REEF (WC 616-617)			120.0	310			576		
CNG (WC-624)	28°02.92	93°18.87			135	1990		Oil Rig	
EXXON (HI-342B)	28°03.02	93°19.00			134	1988		Oil Rig	
EXXON (HI-343A)	28°02.82	93°19.00			134	1988		Oil Rig	
MOBIL (MUIA90A)	28°02.97	93°18.35			130	1988		Oil Rig	
EXXON (VE-372)	28°03.47	93°18.70			120	1991		Oil Rig	
MOBIL (WC-617)	28°03.22	93°18.33			140	1992		Oil Rig	
BUCCANEER REEF (EI-366)			75.5	345			576		
FOREST (SS-296)	28°07.25	91°24.83			124	1992		Oil Rig	
DELMAR (EI-260)	28°07.47	91°25.12			78	1992		Oil Rig	
HARBOR REEF (ST-86)			21.0	91			18		
ODECO (ST-86)	28°46.73	90°14.33			41	1991		Oil Rig	
HURRICANE REEF (WD-134)			39.0	280			260		
KIRBY (WD-134)	28°44.07	89°44.08			113	1992		Oil Rig	
SHELL (WD-122)	28°44.33	89°44.17			116	1992		Oil Rig	
PELICAN REEF (WC-595)			112.0	240			34.1		
UNOCAL (WC-595)	28°08.90	93°17.50			106	1991		Oil Rig	
KERR-McGEE (WC-543A)	28°09.07	93°17.53			95	1991		Oil Rig	
KERR-McGEE (WC-543B)	28°09.02	93°17.52			60	1991		Oil Rig	
SHELTER REEF (SMI-146)			80.0	238			576		
OXY (SMI-146)	28°13.13	91°58.77			113	1987		Oil Rig	
CNG (EI-392)	28°13.12	91°58.60			135	1990		Oil Rig	

Table 3. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
SNAPPER REEF (ST-128)			25.0	103			21		
CHERVON (ST-128)	28°40.23	90°15.80			47	1988		Oil Rig	
CHEVRON (ST-134)	28°40.22	90°15.80			47	1990		Oil Rig	
VOLCANO REEF (SS-320)			70.0	335			576		
CNG (SS-320)	28°08.62	91°19.50			112	1990		Oil Rig	
MESA (VE-381)	28°08.22	91°19.22			136	1991		Oil Rig	
DESPARATION REEF (SS-230)			65.0	120			220		
KERR-McGEE (SS-230)	28°28.45	91°02.23			47	1992		Oil Rig	
NAUTICAL REEF (WC-608)			112.0	260			576		
CHEVRON (WC-541)	28°06.50	93°18.52			70	1992		Oil Rig	
ISLAND REEF			65.0	180			576		
CHEVRON (VE-260)	28°25.05	92°37.95			82	1992		Oil Rig	
CYPRE MONT POINT	29°44.10	91°52.15	>1	8	1	1991	1	Shell	
REDFISH POINT	29°40.72	92°07.47	>1	8	1	1991	1	Shell	



Figure 3. Location of artificial reefs in Louisiana waters.

ARTIFICIAL REEF DEVELOPMENT AND MANAGEMENT

IN MISSISSIPPI

PREPARED BY

MICHAEL BUCHANAN

MISSISSIPPI

Mississippi began its involvement with artificial reefs in the 1960s with the deployment of car bodies offshore. That reef soon deteriorated, and it was not until 1972, when the federal government made Liberty ships available, that Mississippi again became seriously involved with artificial reefs. In 1972, through the Mississippi Marine Conservation Commission, Mississippi received title to five retired Liberty ships from the federal government for the purpose of building artificial reefs. Those ships were scrapped and sunk by 1978, creating two artificial reef sites.

The money derived from the scrapping of the five Liberty ships was transferred to the Mississippi Gulf Fishing Banks, Inc. (MGFB), a private, non-profit organization. The MGFB used the surplus salvage funds to create several other offshore artificial reefs and currently holds permits on seven offshore sites. In 1987 and 1989, the Department of Wildlife, Fisheries, and Parks/Bureau of Marine Resources (MDWFP/BMR) assisted in artificial reef building efforts with Federal Aid in Sport Fish Restoration funds, administered by the U.S. Fish and Wildlife Service, with the deployment of concrete modules and various vessels. In addition, four inshore artificial reefs have been permitted by the MGFB approximately one mile north of the barrier islands inside Mississippi Sound. Three of these inshore sites have been planted with oyster or clam shell. The fourth is currently undeveloped.

Approximately 21 sites in and around bays and piers in the coastal zone of Mississippi have received various quantities of oyster or clam shell for low profile artificial reef development. Most of the sites were not permitted and were developed by the MDWFP/BMR and the MGFB.

Beginning in 1975, a project of biological monitoring was begun through the efforts of the Mississippi-Alabama Sea Grant Consortium, the Dauphin Island Sea Lab, and the Gulf Coast Research Laboratory. Observations ended in 1978, and, from then until May of 1984, no monitoring of Mississippi's offshore artificial reefs was undertaken. Due to increased interest and attention being given to artificial reefs by the federal government, the MGFB determined that there was a need to upgrade their efforts at monitoring and management of their offshore artificial reef sites in order to bring the program up to current standards.

In May, 1984, an agreement was made between the MGFB and the Mississippi Sea Grant Advisory Service/Mississippi Cooperative Extension Service to conduct a one year project to develop management and monitoring guidelines for the state. Two publications, "Monitoring of Mississippi's artificial reefs and evaluation of midwater fish attraction devices" and "Management of the Mississippi artificial reef program" are the two best sources of information available on Mississippi's artificial reefs.

For data and information regarding specific artificial reef sites for the State of Mississippi, refer to Table 3. Figure 3 provides a distribution of artificial reefs offshore Mississippi. Figure 6 provides a Gulf-wide distribution of artificial reefs.

STATE SUMMARY

PRIMARY CONTACT: Michael Buchanan

Title: Fisheries Biologist

Address: 2620 Beach Boulevard
Biloxi, MS 39531

Telephone: 385-5860

Fax: 385-5864

State Reef Program: Yes

State Reef Plan: None

Reef Program Staff: 1

Program Budget: No regular allocation of funds

Number of Permitted Reef Sites: 18

Number of Developed Reef Sites: 17

Site Assessment Practices:

Pre-permitting: Yes

Pre-deployment: Yes

Post-deployment: Yes, for offshore reefs

Annual performance/status: No

Research Projects: Research projects include monitoring the suitability of reef materials for artificial reef developing with on site dive inspections and side scan sonars. Ichthyofaunal succession on newly created reefs was investigated and midwater fish attraction devices were evaluated.

Publications: Lukens, Ronald Ray. 1980. The Succession of Ichthyofaunal on a New Artificial Reef in the Northern Gulf of Mexico. University of Southern Mississippi. M.S. Thesis.

Lukens, Ronald Ray. 1986. Monitoring of Mississippi's Artificial Reefs and Evaluation of Midwater Fish Attraction Services. A Completion Report Submitted to the Mississippi Gulf Fishing Banks, Inc.

Lukens, Ronald Ray, John D. Cirino, A.A. Ballard, and Glen Geddes. 1989. Two Methods of Monitoring and Assessment of Artificial Reef Materials. Gulf State Marine Fisheries Commissions Special Report No. 2-WB.

Mississippi Cooperative Extension Service. 1985. Management of the Mississippi Artificial Reef Program. A Completion report submitted to the Mississippi Gulf Fishing Banks, Inc.

State Advisory Group: Mississippi's advisory committee consists of an eight-member board chosen by the Mississippi Commission on Wildlife, Fisheries and Parks. Board members consist of both recreational and commercial fishermen. The most current members are listed below, however, the committee has not met in several months and its status is uncertain.

Tommy Schultz
273 Bleuer Dr.
Biloxi, MS 39530

Ely Ross
176 Rosetti
Biloxi, MS

Steve West
1707 State Street
Biloxi, MS

Ramon Guitierrez
P. O. Box 730
Biloxi, MS

Mike Cure
106 Yarborough
Waveland, MS 39567

Kenny Borries
3300 Oak Street
Gautier, MS 39553

John Lambeth
P. O. Box 4567
Biloxi, MS 39531

Doug Gautier
2417 Orrell Street
Gautier, Ms 39553

Other Active Interested parties: The Mississippi Gulf Fishing Banks, Inc. is a private organization which has permitted fishing reef sites both offshore and inshore. The membership is open to the general public and is made up of mostly charter boat and recreational fishermen.

Table 4. Artificial reefs in the State of Mississippi.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
FH-1	30°03.12	88°37.36	17.0	65	13	1984	330	Tires, vessel, concrete	
FH-2	30°05.03	88°33.45	15.5	55-60	10	1987	900	Vessel, concrete	
FH-3	30°09.49	88°45.00	15.0	40-45	10	1978	6	Vessel	
FH-4	30°10.00	88°54.00	13.5	30	12	1986	200	Vessel	
FH-5	30°10.16	88°50.37	13.5	36	12	1986	200	Vessel	
FH-6	30°01.51	88°41.42	24.5	60	19	1978	200	Vessel	
FH-7	29°37.28	88°24.30	50.0	130	24	1987	650	Vessel	
FH-8	30°15.44	88°54.48	8.0	15	2	1989	3	Shell	
FH-9	30°15.45	88°53.57	8.0	17	2	1989	3	Shell	
FH-10	30°15.54	88°38.54	6.5	12	2	1989	3	Shell	
GULF MARINE PARK PIER	30°23.00	88°51.30	0.5	6	1	1987	25	Shell	
GULF PARK ESTATES PIER	30°21.60	88°45.90	0.5	5		1990	0.25	Shell	
KUHN ST. PIER	30°22.36	88°52.24	0.5	8	1	1987	0.5	Shell	
ULMAN PIER (ST. LOUIS BAY)	30°18.20	89°19.35	0.5	8	1	1987	1	Shell	
US 90 BR (ST. LOUIS BAY)	30°18.50	89°17.70	0.5	8	1	1987	20	Shell	
US 90 BRIDGE (BILOXI BAY)	30°24.30	88°50.42	0.5	10	1	1987	15	Shell	
WEEKS BAYOU	30°23.00	88°49.18	0.5	6	1	1987	20	Shell	

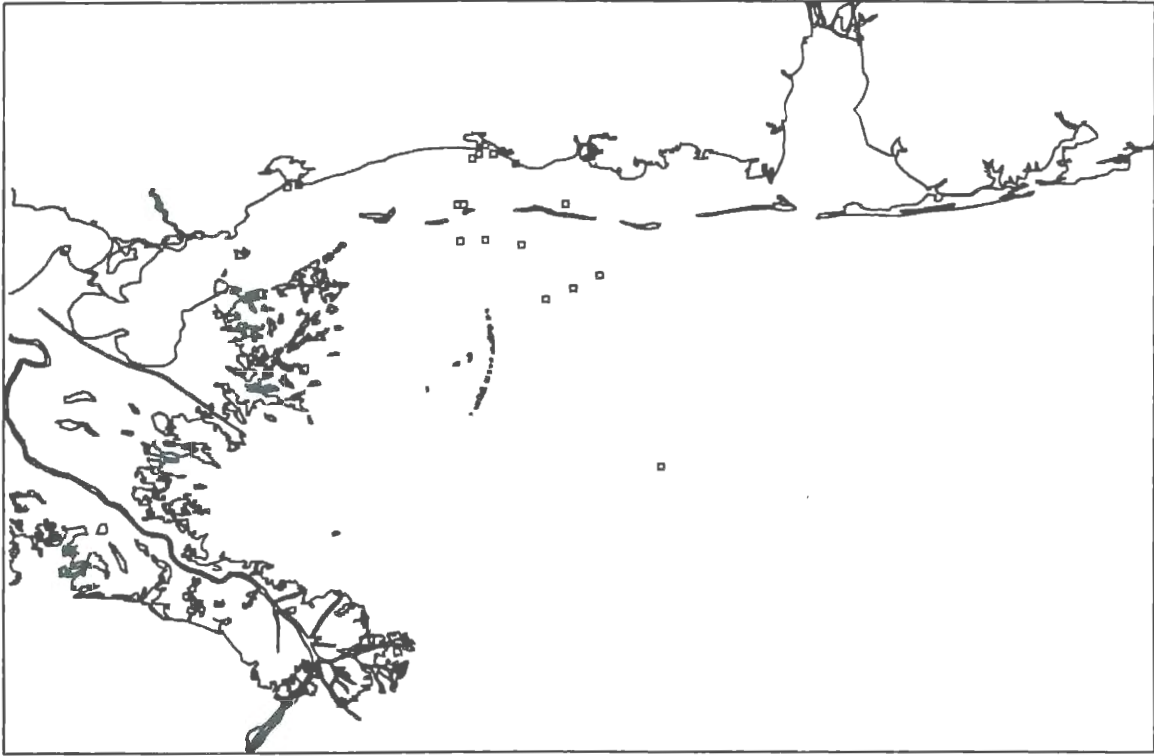


Figure 4. Location of artificial reefs in Mississippi waters.

ARTIFICIAL REEF DEVELOPMENT

IN TEXAS

PREPARED BY

HAL OSBURN

and

JAN CULBERTSON

TEXAS

The Texas Parks and Wildlife Department has been sporadically involved in artificial reef development since the 1940s. Major programs have included the development of oyster reefs and transplanting of oyster spat in Texas bays from 1947-1982; the development of tire reefs in Texas bays from 1966-1977; and the use of cars, concrete, vessels, Liberty ships, drilling rigs and other materials to develop offshore reefs from 1950s-1990s.

The Texas legislature passed the Artificial Reef Act of 1989, which directed the Texas Parks and Wildlife Department to promote, develop, maintain, monitor, and enhance the artificial reef potential in state waters and federal waters adjacent to Texas. To fulfill these purposes the Department was directed to develop a State Artificial Reef Plan with the goals of enhancing fishery resources and increasing fishing and diving opportunities in such a manner as to minimize conflicts among competing user groups and also reduce environmental risks.

The Department adopted the "Texas Artificial Reef Plan" (Texas Plan) in 1990, which was modeled after the guidelines established in the National Plan. The Department also created a program within the Coastal Fisheries Branch to administer the goals of the Texas Plan. The primary emphasis of the program is on constructing complex benthic reefs, which maximize the effectiveness, durability and stability of the reef site. The program also reviews all proposed potential reef sites for geographic, hydrographic, geological, biological, ecological, social, economic, and liability issues prior to accepting new reef sites into the program.

The Texas Parks and Wildlife Commission also appointed a 10 member committee to advise and make recommendations to the Department on details and specifications of the Texas Plan. The Artificial Reef Advisory Committee is composed of at least one representative of the following interested user groups in the Gulf: (1) salt water sports fishing organization, (2) offshore oil and gas company, (3) Texas tourist industry, (4) General Land Office, (5) shrimping organization, (6) Texas diving club, (7) Attorney General's Office, (8) Texas university, (9) environmental group, and (10) the Texas Antiquities Committee. This Committee maintains a high level forum for discussing and resolving conflicts. The Artificial Reef Program, with the guidance of the Committee, has developed several "rigs to reef" sites in addition to enhancement of several near shore reef sites.

As part of the administrative duties under the Texas Plan, the Artificial Reef Program (Program) is responsible for obtaining the appropriate permits for placement of materials and structures at both new and existing reef sites. The Program is also responsible for maintaining the buoys marking each reef site, in accordance with Coast Guard private aids to navigation regulations. Several yellow, temporary spar buoys mark the offshore "rigs to reef" sites and must be maintained until the reef has been marked on published NOS navigation charts.

To fulfill the monitoring responsibilities of the Texas Plan, the Program has sponsored a long term biological monitoring study to document the benefits from artificial reefs to the fishery resources. The Program has also provided funds to study the social-economic benefits from artificial reefs to the people who use them.

In order to provide funding for the Program and address potential liability issues associated with constructing artificial reefs in navigable waters, the Legislature created an independent Artificial Reef Fund in the State Treasury. The Texas Plan requires that the donor contribute at least 50% of their realized savings for costs associated with not salvaging and transporting a jacket to shore to this established fund. The monies in this fund, received from oil and gas donations, has exceeded 2 million dollars by the summer of 1993.

For data and information for specific artificial reef sites for the State of Texas, refer to Table 5. Figure 5 provides a distribution of artificial reefs offshore Texas. Figure 6 provides a Gulf-wide distribution of artificial reefs.

STATE SUMMARY

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State Reef Program: Yes
State Reef Plans: Yes
State Reef Staff: 2
Reef Program Budget: FY 1992-1993 - \$ 290,600.00
Number of Permitted Reef Sites: 72
State Permits: 12 Rigs to Reef Sites
5 Liberty Ship Reef Sites
5 Other Offshore Material Reef Sites
8 Bay Material Reef Sites
37 Shell Rehabilitation Reef Sites
Non-State
Owned Permits: 3 Rigs to Reef Sites
2 Bay Material Reef Sites
Number of Developed Reef Sites: 35
(excludes shell reefs)
Offshore Reefs: 33
Bay Reefs: 10

Site Assessment Practices:

Pre-permitting: Yes

Pre-deployment: Yes

Post-deployment: Yes

Annual performance/state: Yes, Donation Status
Summary Sheets (updated monthly)

Research Projects Benthic and larval fish monitoring, side scan surveys, dive surveys, and social-economic surveys of charter boat anglers.

Publications:

Stephan, D.C., et al. 1990. Texas Artificial Reef Fishery Management Plan. Fishery Management Series No. 3. Texas Parks and Wildlife Department.

Stephan, D.C., et al. 1990. Texas Artificial Reef Fishery Management Plan. Source Document. Texas Parks and Wildlife Department.

"Texas Parks and Wildlife Artificial Reef Donation Status as of June 21, 1993." (Updated Monthly).

State Advisory Group: 10 Representatives for Gulf User Groups

- (1) salt water sports fishing organization,
- (2) offshore oil and gas company,
- (3) Texas tourist industry,
- (4) General Land Office,
- (5) shrimping organization (Texas Shrimp Association),
- (6) Texas diving club,
- (7) Attorney General's Office,
- (8) Texas university,
- (9) environmental group, and
- (10) Texas Antiquities Committee.

Table 5. Artificial reefs in the State of Texas.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
RIGS TO REEF SITES									
BRAZOS A-28	28°08.98	95°29.68	48.0	150	60	1991	40	2 Oil rigs	TPWD
BRAZOS A-132	27°49.37	95°59.37	43.0	204	115	1992	40	1 Oil rig	TPWD
HIGH ISLAND REEFS:									
A-281	28°21.83	93°47.12	89.0	185	100	1992	40	3 Oil rigs	TPWD
A-298	28°18.18	93°45.98	91.0	192	91	1991	40	2 Oil rigs	TPWD
A-315	28°12.83	93°41.87	99.0	214	102	1992	40	1 Oil rig	TPWD
A-471 TOPPER III REEF (AR 203)	28°14.80	94°02.63	89.0	196	112	1977		1 Oil rig w/deck	Mobil owned; blow-out
A-487	28°14.92	94°16.32	77.0	170	85	1992	40	1 Oil rig	TPWD
A-492 TRANSCO REEF (AR 204)	28°13.45	94°03.35	90.0	195	102	1990	155	1 Oil rig	TPWD
A-520	28°07.45	93°57.40	95.0	238	103	1991	40	1 Oil rig	TPWD
A-542	28°02.83	94°09.15	94.0	230	112	1993	40	1 Oil rig w/deck	TPWD
A-567	27°58.50	94°13.05	110.0	288	124	1993	40	1 Oil rig	TPWD
MATAGORDA ISLAND 712	27°49.95	96°30.37	25.0	130	36	1992	40	1 Oil platform deck	TPWD
MATAGORDA ISLAND 657 (PENROD REEF)	28°01.52	96°36.57	27.0	68-135.4	67	1983	40	1 Oil rig w/deck	Penrod owned; blow-out (rig below sea floor)
N. PADRE ISLAND 980 (ARCO REEF, AR 601)	26°47.33	97°09.37	15.0	97	36	1981		1 Oil rig w/deck	ARCO owned; blow-out
PORT ISABEL/SO. PADRE ISLAND REEF (AR 702) SO. PADRE ISLAND 1169-L	26°58.17	97°04.00	7.0	65	5	1975	242	1 Vessel	Transferred to TPWD in April 1993, 2 tripod rigs planned for 6/94
TPWD LIBERTY SHIP REEFS									
FREEPORT LIBERTY SHIP (AR 403) GALVESTON A-22	28°35.83	94°48.67	30.0	105	20-45	1976/1993	160	3 Vessels; 1 Pipe structure, 300 CCBP (fly-ash) blocks	Conoco/Galveston Co. donated pipe structure, HL&P donated blocks
GEORGE VANCOVER LIBERTY SHIP (AR 401) BRAZOS 336	28°47.65	95°20.87	9.0	45	20	1976	160	1 Vessel	Yellow-lighted buoy marks wreck

Table 5. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
MATAGORDA ISLAND LIBERTY SHIP (AR 301) MATAGORDA ISL. 616	28°06.58	96°05.00	35.0	108	20	1976	160	3 Vessels	
MUSTANG ISLAND LIBERTY SHIP (AR 503) MUSTANG ISLAND 803	27°34.17	96°51.50	18.0	110	20	1976	160	3 Vessels	
PORT MANSFIELD LIBERTY SHIP REEF (AR 602) SO. PADRE ISL. 1070	26°25.50	97°01.50	15.0	101	20-40	1976/1993	160	3 Vessels 2 Oil rigs	2 rigs cut in half (4 units) placed between ships, 4 additional rigs planned for 6/94
OTHER TPWD OFFSHORE REEFS									
BOATMENS REEF (AR 501) MUSTANG ISLAND 746-L	27°46.42	96°58.25	6.0	60	2-4	1958/1963 1983/1993	40	Car bodies; Concrete rubble	Port Aransas Boatmen's Assoc. transfered site back to TPWD in 5/93
EAGELSCLIFF REEF (AR 201) GALVESTON 101-L	29°21.92	94°41.85	8.0	32		1983		Vessel	Owner Unknown
FREEPORT CAR REEF (AR 402) BRAZOS 305-L	28°50.10	95°08.08	13.0	62		1959	40	Car bodies	No materials remain at reef site
GALVESTON PIPE REEF (AR 202) GALVESTON 189-L	29°08.67	94°42.17	11.5	57	4	1962	40	Concrete/Clay Pipe	Coast Guard anchors to be placed in 1994.
LONESTAR REEF (AR 502) MUSTANG ISLAND 770-L	27°41.50	96°58.50	10.0	79	10	1969	23	Vessel	Port Aransas Boatmen's Assoc. transfered site back to TPWD in 5/93
PORT ISABEL CAR REEF (AR 701) STATE TRACT 1216-L	26°05.35	97°06.63	6.0	54		1959	40	Car bodies	No materials remain at reef site
ARTIFICIAL REEFS CONSTRUCTED IN BAYS									
COLE PARK PIER REEF (AR 61)	27°46.80	97°23.20		7	1	1977	0.46	Tires	TPWD; Corpus Christi Bay
COON ISLAND REEF (AR 32)	28°39.58	96°13.83		6	1	1977	0.25	Tires	TPWD; Tres Palacious Bay
DRY HOLE TIRE REEF (AR 21)	29°36.00	94°51.75		9	2	1966	0.05	Tires	TPWD; Trinity Bay
GALVESTON BAY NATIONAL ESTUARY PROGRAM REEF	29°32.53	94°53.03		9-12	1	1993	4.8	Coal Fly-Ash Pellets (CCBP)	Port of Houston owned; Galveston Bay

Table 5. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft.)	RELIEF (ft.)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
ROCKPORT CONCRETE REEF	28°00.00	97°05.00		8	2-4	1967	2.8	Concrete	TPWD; Aransas Bay
ROCKPORT JETTY TIRE REEF (AR 51)	28°01.50	97°02.07		5	2	1966	0.25	Tires; Concrete Rubble	TPWD; Aransas Bay
SOUTH SABINE LAKE REEF (AR II)	29°47.13	93°55.62		6	2	1977	0.5	Tires	TPWD; Sabine Lake
SYLVAN BEACH FISHING PIER REEF	29°38.80	94°00.80		6	1	1977	0.5	Tires	TPWD; Galveston Bay
BAPTIST ENCAMPMENT REEF (AR 31) ALSO KNOWN AS WADEFISH REEF	28°41.80	96°12.65		4	1	1977	0.06	Tires	TPWD; Matagorda Bay
WEST GALVESTON BAY REEF (AR 22)	29°09.00	95°07.00		6	1	1971	7.9	Tires	Sportsman's Club owned; West Bay
TPWD SHELL REEFS CONSTRUCTED IN BAYS									
1.8 KM E MARKER 63 REEF	27°25.60	97°20.30		5	.5	1962	1	Shell	Upper Laguna Madre
5.6 KM W MARKER 51 REEF	27°32.20	97°19.60		5	.5	1962	1	Shell	Upper Laguna Madre
ADJACENT TO REEF 51 (ST 136)	28°19.67	96°46.50		6	1	1973/1982	19.8	Shell	San Antonio
BAYVIEW REEF	29°31.00	94°59.00		7	1	1952	31.1	Shell	Galveston Bay
BETWEEN 167-168 REEFS	28°22.00	96°46.50		6	1	1973/1982	0.5	Shell	San Antonio Bay
BREAKWATER REEF	27°48.78	97°23.28		10	1	1962	0.5	Shell	Corpus Christi Bay
CHICKENFOOT REEF	28°13.50	96°47.83		6	1	1982	9.4	Shell	San Antonio Bay
CLAMSHELL REEF	29°35.25	94°45.75		7	1	1963	10.1	Shell	Trinity Bay
COLLEGE REEF	27°42.98	97°18.87		10	1	1962	0.5	Shell	Corpus Christi Bay
COURTHOUSE REEF	29°33.50	95°00.25		7	1	1961	8.1	Shell	Galveston Bay
DRY HOLE SHELL REEF	29°36.00	94°51.75		9	1	1962	16	Shell	Trinity Bay
EAGLE POINT REEF	29°30.50	94°55.00		8	1	1959	42	Shell	Galveston Bay
EXPERIMENTAL REEF	29°29.50	94°53.50		7	1	1958	6.9	Shell	Galveston Bay
FOUR BIT REEF	29°27.75	94°50.00		9	1	1961	23.9	Shell	Galveston Bay
GADWALL REEF	28°38.08	96°19.58		6	1	1961/1982	31	Shell	Matagorda Bay

Table 5. Continued.

REEF NAME	LATITUDE (dd.mm.mm)	LONGITUDE (dd.mm.mm)	DISTANCE (miles)	DEPTH (ft)	RELIEF (ft)	YEAR	TOTAL AREA (acres)	MATERIALS	COMMENTS
GASPIPE REEF	29°31.00	94°47.50		7	1	1960	34.8	Shell	Galveston Bay
HALFWAY REEF	29°30.50	94°55.00		7	1	1960	6.9	Shell	Galveston Bay
HOTEL POINT REEF	28°36.50	96°13.83		6	1	1982	23	Shell	Matagorda Bay
LITTLE BIRD ISLAND (ST-106)	29°33.75	94°46.00		4	1	1962	4	Shell	Trinity Bay
LONESOME REEF	29°35.50	94°49.00		7	1	1962	18	Shell	Trinity Bay
MARKER 58 REEF (RANGE LIGHT REEF)	29°31.00	94°53.00		7	1	1959	17	Shell	Galveston Bay
MATAGORDA BAY REEF	28°35.00	96°10.00		6	1	1974	159	Shell	Matagorda Bay
MIDDLEGROUND REEF	28°17.00	96°41.00		6	1	1976	13.1	Shell	San Antonio Bay
MISSING REEF	29°30.25	94°51.00		9	1	1959	23	Shell	Galveston Bay
NORTH SIDE OF REEF 73 REEF (DAGGER POINT)	28°18.17	96°46.67		6	1	1982	1.2	Shell	San Antonio Bay
NW END OF REEF 78 (TURTLE REEF)	28°19.33	96°46.00		6	1	1973	14	Shell	San Antonio Bay
OSO REEF	27°43.20	97°19.75		10	1	1962	0.5	Shell	Corpus Christi Bay
PINTAIL REEF (ST 183)	27°59.40	96°59.20		6	1	1960	3.5	Shell	Aransas Bay
REDFISH BAR REEF COMPLEX (ENHANCED NATURAL REEF)	29°30.00	94°50.00		9	<1	1980	854.3	Shell	Galveston Bay
SOUTH OF HALFMOON REEF	28°20.00	96°46.50		6	1	1969	12	Shell	San Antonio Bay
SPOONBILL REEF	29°33.00	94°47.50		7	1	1958	3.2	Shell	Trinity Bay
SUN FLARE REEF	29°38.75	94°50.75		7	1	1962	16	Shell	Trinity Bay
SWITCHOVER REEF	29°30.50	94°53.50		7	1	1957	64	Shell	Galveston Bay
TERN REEF	29°36.00	94°50.75		7	1	1964	34	Shell	Trinity Bay
TRIANGLE REEF	29°30.50	94°50.50		9	1	1961	8.9	Shell	Galveston Bay
TRINITY REEF	29°41.00	94°51.00		6	1	1961	18	Shell	Trinity Bay
UMBRELLA POINT REEF	29°39.50	94°53.50		7	1	1954	0.9	Shell	Trinity Bay

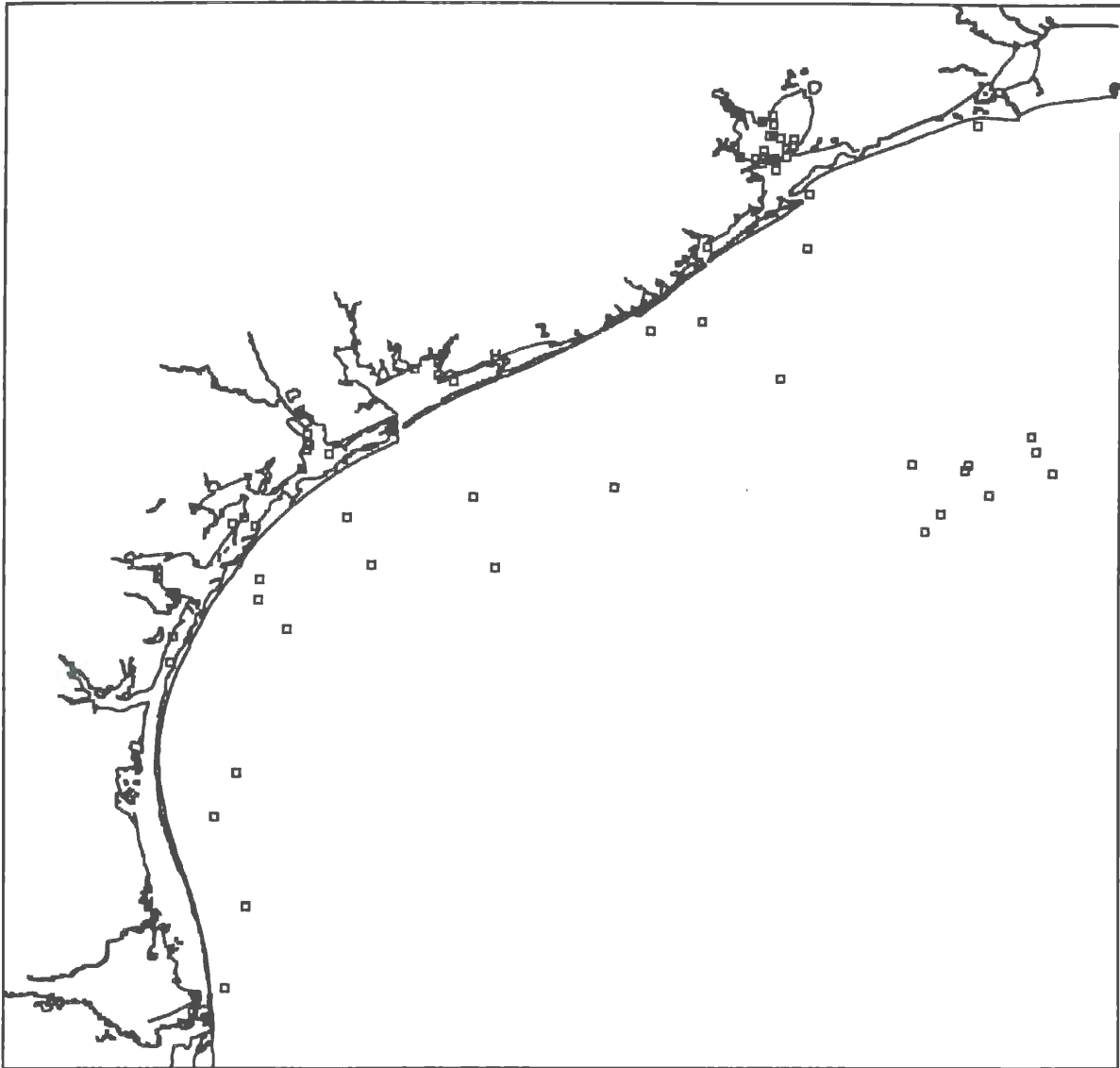


Figure 5. Location of artificial reefs in Texas waters.

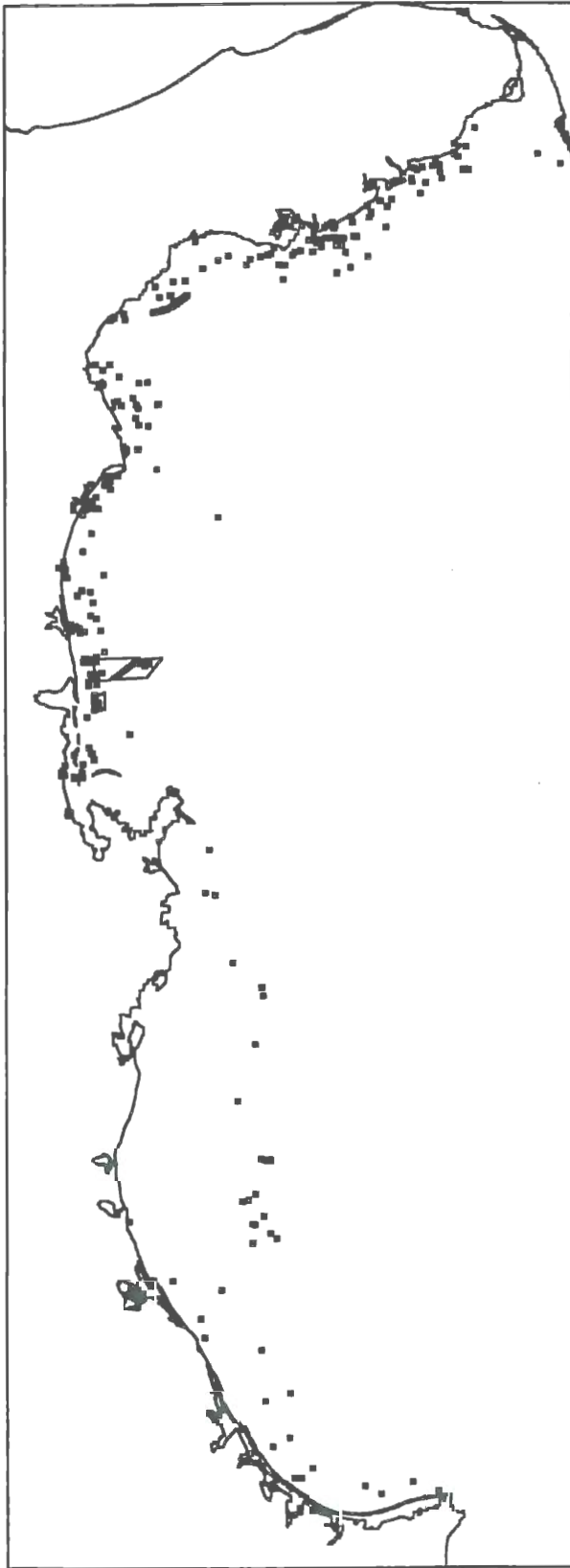


Figure 6. Location of artificial reefs in the Gulf of Mexico.

LITERATURE CITED

- Burgess, F. F. Jr. 1974. Role of the Coast Guard in artificial reefs. Proceedings of an International Conference on Artificial Reefs. Texas A&M University Sea Grant Publication TAMU-SG-74-103. College Station, Texas.
- Christian, R. T. 1984. Permitting procedure for artificial reefs. Sport Fishing Institute, Artificial Reef Development Center, Technical Report Number 1. Washington, DC.
- Ditton, R. B. and L. B. Burke. 1985. Artificial reef development for recreational fishing: A planning guide. Sport Fishing Institute, Artificial Reef Development Center. Washington, DC.
- McGurrin, J. M. and the Atlantic States Marine Fisheries Commission (ASMFC) Artificial Reef Committee. 1988. A profile of Atlantic artificial reef development. Special Report Number 14, ASMFC. Washington, DC.
- Stone, R. B. 1985. The National Artificial Reef Plan. NOAA Technical Memorandum NMFS OF-06. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Washington, DC.