THE TEXAS ARTIFICIAL REEF PROGRAM: OVER 50 YEARS OF MARINE HABITAT ENHANCEMENT IN THE GULF OF MEXICO

by

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ABSTRACT

Resource managers have been involved in artificial reef development off the Texas coast for over 50 years. The donation of 12 Liberty Ships in 1975-1976 formed the foundation of the current Texas Parks and Wildlife Department Artificial Reef Program (Program). These ships represent the first successful reef development activity within Texas using stable, durable, and complex material. In 1989, the Texas legislature directed the Texas Parks and Wildlife Department to develop the artificial reef potential off Texas, based on the 1984 National Fishing Enhancement Act. The Texas Artificial Reef Plan was adopted in 1990, formally creating the Program. The Program utilizes the federally approved Rigs-to-Reefs Program which provides the oil and gas industry a method to donate their obsolete petroleum structures as artificial reefs in lieu of the standard salvage removal option required by federal law.

The Program has reefed 64 obsolete petroleum jackets, one caisson, two decks and one net guard at 37 of the 46 currently permitted reef sites in the offshore waters of Texas. These donations have provided nearly $9 million dollars to the Texas Artificial Reef Fund. Other materials used in the construction of reefs placed at Texas reef sites include: 300 blocks made of coal combustion fly-ash by-products stacked in a pyramid shape; one pipe structure welded in the shape of a 4-pile jacket structure; 132 concrete fabricated "reef balls"; 46 square open-ended concrete (box) culverts; 22 concrete anchors; four stacks of concrete culvert pieces on slag; 50 1-2 ton natural quarry rocks; four sections of a 55-ton U.S. Navy surplus steel buoy; one 100-ft YR-U.S. Navy barge; one T-2 steel tanker; four 100-ft long barges; and one obsolete 44-ft steel tugboat. The Program continues to assess new materials and obsolete oil and gas structures on a case-by-case basis to determine their overall benefits to the program.

INTRODUCTION

Artificial reefs are structures placed by man in the aquatic environment, which alter the habitat to achieve ecosystem benefits. The benefits sought through the use of artificial reefs have been the enhancement of fishery resources in conjunction with increasing fishing and diving opportunities. The development of artificial reefs requires comprehensive planning strategies for reef placement, deployment, maintenance, and management of the reefs to maximize their assets, minimize their liabilities, and achieve desired purposes (Stephan et al. 1990).

Marine anglers have long recognized the utility of artificial structures in enhancing their fishing efforts. The first documented marine reef construction in the United States occurred in the mid 1800s (Stone 1986). The construction of reefs in the marine environment gained momentum in the 1930s, and by the 1960s a variety of materials such as automobiles and tires were commonly used. However, these materials were found to quickly deteriorate and became unstable as reef substrate.

By the mid 1970s, artificial reefs were recognized as important tools for the enhancement of marine habitat and fisheries management (Johnston 1974; Stone 1986). This was seen in Bohnsack and Sutherland's (1985) review of English scientific literature on artificial reefs through 1983. They identified 413 references, of which more than 75% were written after 1970. Most of these papers identified published areas with emphasis on: general program descriptions; structural designs of habitat; biology of reef organisms; and monitoring and assessment.

In 1984, Congress enacted the National Fishing Enhancement Act (P.L. 98-623, Title II) creating a National Artificial Reef Plan (Stone 1985). This plan provides guidance for individuals and agencies interested in artificial reef development and management. In the Gulf of Mexico, states operate autonomous artificial reef programs but have an open exchange of information and dialog on reef issues, facilitated by the Gulf States Marine Fisheries Commission (GSMFC) Artificial Reef Subcommittee (GSMFC 1993).

In 1999 the combined Artificial Reef Subcommittees of the Atlantic and Gulf States Marine Fisheries Commissions used their knowledge and experience of state artificial reef programs to update the National Artificial Reef Plan. The revised National Plan references the GSMFC Artificial Reef Subcommittee's *Guidelines for Marine Artificial Reef Materials* (GSMFC 1997). It was submitted to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service for their review and for processing through public notice. In addition, the GSMFC Technical Coordinating Committee presented this revised plan to the Gulf of Mexico Fisheries Management Council (Council) for their comments and endorsement in January 2001.

The Council recommended that charter boat captains and private reef building entrepreneurs also be given a chance to provide their own knowledge and experience into the revised materials guidelines before being incorporated as part of the revised National Plan. The GSMFC has responded by providing a forum for private charter boat operators and reef builders'

input to the Artificial Reef Subcommittee, which is currently revising the National Materials Guidelines document.

The Texas Artificial Reef Program (Program) in the Gulf of Mexico is managed by the Texas Parks and Wildlife Department (TPWD). The Program's strengths include: flexibility in creating reef sites; processes for evaluating reef materials and sites; and support from leaders and citizens of Texas.

REEF DEVELOPMENT AND MANAGEMENT IN TEXAS

History

Resource managers have been involved in artificial reef development off Texas for over 50 years. Crowe and McEachron (1986) documented 68 intentional artificial reef areas that were created in Texas marine waters from 1947-1984, consisting of oyster shell, tires, automobiles, construction rubble, and ships. In 1972, the United States Congress offered surplus U.S. Navy Liberty Ships in its Reserve Fleet to coastal states for use as artificial reefs. Twelve Liberty Ships were acquired by Texas during 1975-1976 and placed at five sites in the Gulf of Mexico. Other than these ships, most of these materials had little long-term success because they were easily broken up and moved by storms. By 1984, at least 2,191 *de facto* artificial reef areas had also been created, including open water spoil disposal areas, piers and docks, jetties, oil and gas well shell pads, and active offshore petroleum platforms (Crowe and McEachron 1986).

Natural hard bottom reef substrate is limited in the Gulf of Mexico (Parker et al. 1983). The Council estimated total natural reef habitat in the Gulf of Mexico to be 15,000 mi^2, with one-third offshore of Louisiana and Texas. This is also the area where 99% of the platforms in the Gulf of Mexico currently exist. Gallaway and Lewbel (1982) and Gallaway and Cole (1997) estimated that petroleum platforms provide 2,000 mi^2 of additional reef fish habitat, increasing the total amount of hard substrate habitat by an estimated 27%. These durable, complex steel structures are different from natural reef substrate, in that they extend throughout the water column, and allow space for sessile reef invertebrates to attach. This increased surface area has created an interactive food web supporting a diversity of valuable reef fish species.

With an escalation of rig removals in the early 1980s, artificial hard substrate and its associated reef dwelling organisms were in jeopardy. From 1938 - 1982, over 4,500 petroleum platforms had been placed in the Gulf of Mexico (Gallaway and Lewbel 1982). The need to preserve these diverse ecosystems created by offshore rigs became more evident to state and federal agencies. Wide spread support from the general public (primarily divers and anglers) for converting these structures into permanent artificial reefs inspired Congress to pass the National Fishing Enhancement Act in 1984. This legislation provided regulatory guidance to the states for

permitting and accepting liability for obsolete petroleum structures.

Pulsipher et al. (2000) documented that 5,561 platforms or structures have been installed on the Gulf of Mexico Outer Continental Shelf since 1942. They classified about 50% of these structures as "non-major" structures, having six or fewer wells. As of 1997, 1,645 of these structures had been removed leaving 3,916 operating platforms in federal waters. About 68% of the total number of removed structures was non-major, with 86% located in less than 400 ft of water. The investigators also reported that as the number of operating platforms installed in the 1960s and 1970s became uneconomical to operate and were removed, fewer replacement platforms were installed. Over time, installation of platforms has occurred farther from shore and in deeper water.

Pulsipher et al. (2000) used a forecasting model based on current oil prices and other economical issues to predict that between 1998 and 2023 approximately 142 platforms will be installed annually in the Gulf of Mexico's Outer Continental Shelf and approximately 186 platforms will be removed each year. In addition to these platforms in federal waters, there are approximately 800 platforms that have been placed in Texas state waters since the 1940s. Texas state jurisdiction extends from the Texas shoreline to nine nautical miles (nm) into the Gulf of Mexico. As platforms in state and federal waters end petroleum production, the need to convert them into artificial reefs will be of continuing importance.

In January 1983, the U.S. Department of the Interior Mineral Management Service (MMS), the federal agency responsible for regulating and monitoring platform removals in federal waters, stated its support of a concept termed "Rigs-to-Reefs," in which obsolete oil and gas structures could be converted to artificial reefs to preserve these valuable habitats (GSMFC 1993). The MMS divides the Gulf into management blocks (lease blocks) that are 3 x 3 statute miles (mi) in dimension. In 1989, largely in response to this loss of hard substrate habitat and national legislation to protect it, the Texas legislature directed TPWD to develop the artificial reef potential off Texas for enhancing fishery resources and fishing and diving opportunities.

From 1982 when the first petroleum jacket was donated to the Gulf of Mexico Rigs-to-Reefs program, through December 2002, 64 donations of petroleum structures have occurred in Texas. Twenty-nine petroleum structures were towed to established reef sites, 16 were toppled in place, and 19 were partially removed (Appendix A-2; Figure 1). Of these, 53 were from federal waters (two being from Louisiana) and the remaining 11 from state waters. A list of petroleum structures and other materials, with locations, coordinates, and donation amounts can be found in the Appendix A.

Texas Artificial Reef Plan

To guide future development and placement of reefs off the coast of Texas, the Program

drafted the Texas Artificial Reef Plan (Plan) in 1990. Legislation for the Texas Artificial Reef Act is provided under the Texas Parks and Wildlife Code, Chapter 89, (Section 89.001-89.0061).

The Plan follows an exclusion mapping approach. This technique applies geographic, hydrographic, geological, biological, ecological, social and economic considerations as site criteria (Stephan et al. 1990).

Design

The Plan promotes the use of diverse materials, and specifically requires that only highly durable, stable and complex structures in a "form as close to their current form" as possible be used. Petroleum platforms meet this criterion in addition to providing the maximum biological profile in the water column. The Plan also requires that these structures meet EPA clean water standards and be free of hydrocarbons before being accepted into the Program.

The Plan also gives guidance on reef location criteria to provide the optimum benefits to the reef fishery resource and recreational users, while minimizing impacts to other user groups in the Gulf of Mexico. Some of the criteria used in determining optimum reef location benefits include evaluating the biological, hydrographic, geographic, geological, ecological, social and economic factors surrounding each potential donation.

Bottom Characteristics

An important biological criterion for determining where artificial reefs are located is whether hard bottom habitat is available or limited in a specific area. The loss of an oil and gas platform structure means a loss of reef fish habitat. Preserving these structures for reef fish habitat in the Gulf of Mexico can aid in increasing reef fish stock size (Gallaway and Cole 1997).

Hydrographic considerations include evaluating the depth of water where the structure is located and the profile of that structure. Although biological activity occurs at all depths, biological productivity and diversity on platform reefs increase as the profile of the structure increases. Recent research has documented that the majority of biological activity surrounding a platform structure occurs above 300 ft (Dokken et al. 2000).

Geographic considerations include locating reef sites at least 2 nm from designated safety fairways, and different distances from shore in accordance with user's preferences. Recent demographic surveys have shown anglers prefer shallower reefs closer to shore and divers prefer deeper reefs farther offshore (Ditton et al. 1995).

Staff have calculated the spatial impact of artificial reefs on the Gulf bottom and found that if all platforms were converted into artificial reefs they would take up less than 0.2% of the bottom, causing little impact on other user groups (TPWD 2002). However, Texas has determined, with input from the U.S. Army Corps of Engineers (COE), that to minimally impact other user groups, reef sites should be at least 3 mi apart. From an operational perspective, reef

sites should also be located offshore of major cities for accessibility and economic benefits.

Program Guidance

The Plan requires that all potential donations be reviewed by a citizen's advisory committee composed of interested user groups in the Gulf of Mexico. This advisory committee allows for a forum to minimize conflicts between user groups before the permitting process begins. The committee includes representatives from the following interest groups: recreational fishing; offshore oil and gas industry; commercial shrimp fishery; Texas diving clubs; environmental issues; university research; nautical archeology; state oil and gas leasing; maritime interests; land resources; and transportation (Appendix B). This diverse group has provided an excellent forum for discussing and reaching consensus on a variety of reef issues.

Rigs-to-Reefs Program

The state legislation, which created the Program also provided for future needs by establishing a dedicated Artificial Reef Fund. Through the Rigs-to-Reefs program, devised by MMS, petroleum companies are allowed to donate their structures to individual state artificial reef programs instead of having to remove them from the sea bottom once they are no longer producing. In the Texas Rigs-to-Reef Program, donors are also required to donate 50% of their realized savings to the Program. Realized savings are defined as the monetary difference between donating a petroleum structure to the Program relative to the costs for moving the structure to shore and returning the bottom to its former natural condition. Monies received through donations are legislatively dedicated to the Artificial Reef Fund. These donations provide funds for research, administration of permits, liability and construction of near shore artificial reefs. In addition, they cover the maintenance of buoys marking each new reef.

Individual Permit Sites

There are several alternative permit options that may be used when a petroleum structure is donated to the Program. The Galveston District COE has developed a policy which allows the permitting of individual 40-ac reef sites as long as site location and materials placed in it meet the guidelines of the Plan. Each 40-ac permitted reef site encompasses 1/16 of a square mile (1320 ft x 1320 ft) and has enough space to cluster at least nine jacket structures on the bottom.

The initial donor at a particular permitted reef site is allowed to topple the structure in place if clearance restrictions can be met. Other donors of nearby structures are encouraged to transport their structures to that site to increase its complexity and to avoid additional permitting. There are exceptions to this reef size policy, such as four 160-ac Liberty Ship reef sites along the Texas coast, and the 418-ac South Padre Island reef site. These larger permitted areas were created before the Plan was initiated and contain a variety of reef material.

General Permit Area

Although many of Texas artificial reef sites are individually permitted, reefs created in the High Island Outer Continental Shelf (OCS) leasing area are an exception (Figures 1, 2). Under the authority of a General Permit from the COE, artificial reefs created in the General Permit Area (70-110 miles offshore) are constructed without the requirement of a 30-day public comment period. The special conditions of this permit are listed in Appendix C. Basically, the permit requires the reef location to be at least 3 mi from another reef site, 2 nm from any safety fairway and 1,000 ft from any active pipeline while not disturbing any abandoned pipelines. In addition, the location must have at least 85 ft of water depth over the highest portion of the structure (a U.S. Coast Guard requirement) and be at least one-half nautical mile away from any natural hard bottom communities (such as the Flower Garden National Marine Sanctuary East and West Banks). Reefs that do not meet these criteria require an individual permit from the COE, issued after a 30 day public comment period.

In 1994, the Program was granted General Permit 19942 by the COE for 2,510 mi^2 of the High Island (HI) area located in the Northwestern Gulf of Mexico. The original permit area encompassed 260 leasing blocks totaling 5,758 ac. In 1999, the General Permit was modified to increase the planning area to 17,663 ac, which now encompasses 316 leasing blocks. This General Permit allows the Reef Program to create 40-ac artificial reef sites. Petroleum companies can now bypass the lengthy and uncertain public comment period when creating a new artificial reef site in this area if their donation meets the criteria outlined in the General Permit.

In 1994, a petroleum structure in HI-A-355 donated by OXY USA became the first artificial reef site developed under the General Permit. To date, 19 of the 24 artificial reefs created in this General Permit Area have followed the general guidelines; five required individual permits because they did not meet distance requirements.

Removal Options

Prior to the acceptance of a petroleum structure into the Program, all wells must be properly plugged and wellheads removed. With two exceptions, the Program has also required all decks to be removed from the jacket structure. Petroleum companies have three jacket removal options.

Explosive Removal: Explosive removal is the most common removal option in deep water reefing. It involves using explosives to sever the jacket legs 15 ft below the mud line, and pulling the structure over in a horizontal position onto the bottom (Figure 3a.) or towing the structure to another reef site. The first rigs donated to the Program were removed through the use of explosive procedures. This method is efficient but damages the sessile marine fauna on the platform legs. Incidental loss of reef and pelagic fish communities around the platform, including commercially and recreationally important fish species, can also occur.

Data from the National Marine Fisheries Service (NMFS) platform removal observer program in both federal and state waters showed that from 1989-1998 a total of 958 structures were salvaged using explosives, averaging 96 structures annually. The most severely impacted fish species at explosive removals in order of abundance were Atlantic spadefish (*Chaetodipterus faber*), blue runner (*Caranx crysos*), red snapper (*Lutjanus campechanus*), and sheepshead (*Archosargus probaocephalus*). These four species accounted for 86% of the estimated mortality (Gitschlag et al. 2001).

The Program has been monitoring a cluster of six jackets which were towed to the Freeport Liberty Ship Reef Complex (GA-A-22) after being removed by explosives by Cal Dive International and Blue Dolphin Energy. The jackets were placed in 100 ft of water with a vertical profile from the bottom of 60 ft. These six structures (known as Star Reef) were placed in the shape of a Texas star at the complex in 1994 and are attracting numerous commercially important reef fish such as red snapper and amberjack. Although many of the original encrusting organisms were lost during the removal process, sponges, tunicates, hydroids, and bryozoans quickly repopulated the structure (TPWD unpublished data).

Full Mechanical Removal: A second removal option involves full mechanical removal of the jacket. Jacket piles are cut 15 ft below the mud line with abrasive or mechanical cutters, and then the entire structure is placed in a horizontal position on the bottom (Figure 3b.).

The advantages of using this removal method in relatively shallow water (less than 100 ft) include the lack of risks associated with explosives to: commercial divers; sea turtles; marine mammals; commercially important reef fish; and sessile animals attached to the structure. In 1994 the Program accepted the donation of six jackets from Mobil Exploration and Producing Corporation, that were abrasively cut below the mud line and transported intact to two separate reef sites several miles away. Mobil Exploration and Producing Corporation was able to transport the living reefs attached to these structures to new locations and protect the numerous sea turtles and marine mammals that were observed in the vicinity during the lengthy removal process. Due to the expense of using this new technology, there was no fiscal savings realized from this donation.

Partial Mechanical Removal: The third method, termed "partial mechanical removal," is the Program's preferred removal method. This method leaves a structure in a state as close to its original form as possible. This is accomplished by mechanically cutting the jacket at a safe navigational depth (typically 85 ft) specified by the United States Coast Guard (USCG) and placing the top section of the jacket next to the base. The base is left attached to the seafloor virtually undisturbed, and the use of explosives is eliminated (Figure 3c.).

The Program first reached an agreement with MMS in 1995 to allow for a partial mechanical cutting technique in an effort to maximize the biological, social and economic benefits associated with petroleum structures. In October 1995, the Union Pacific Resources Company (UPRC) became the first company in the Gulf of Mexico to use this partial mechanical

removal method. UPRC donated a four-pile jacket structure in North Padre PN-A-58, located 62 mi southeast of Corpus Christi, Texas. Divers mechanically cut the structure at the 85-ft water depth, and placed the upper section next to the base of the jacket in 253-ft of water. This allowed for the creation of a higher profile reef (169-ft vertical profile) and saved the company $650,000 in removal costs.

In January 1996, a second rig (HI-A-355) owned by OXY USA Inc. underwent partial mechanical removal at 85 ft while a portion of the upper jacket was placed at another location in the Gulf of Mexico. This removal operation created a higher profile reef in 305 ft of water and saved the company at least $552,400.

Since these donations, a study by the National Research Council recommended that the MMS support partial mechanical removal as a more environmentally sound technique (National Research Council 1996). Currently, the Program has received 19 donations through partial mechanical removal in lieu of the standard explosive removal option (Appendix A-2).

Current Status: To date the Texas Artificial Reef Program has 64 obsolete petroleum jackets, 1 caisson, 1 net guard, and 2 decks located at 37 of 46 Texas permitted reef sites (Appendix A-1, A-2). In addition, the artificial reef fund has received nearly $9 million in donations from petroleum companies. The Program continues to assess each donation on a case-by-case basis for its value to the Program and to determine if it meets the guidelines of the Plan.

Liberty Ship Reefs

The Liberty Ship reef sites form the nucleus of the near shore reefs within the current Program and represent the first successful reef development activity along the Texas coast. In an ironic twist of fate, 11 of 12 Liberty Ships, which survived enemy sinking attempts during World War II, were intentionally sunk at four sites in the Gulf of Mexico during 1975-1976 to create artificial reefs (Figure 1, Appendix A-1). (A fifth reef site was created by the accidental sinking of the *George Vancouver* as it was being towed to the Freeport Liberty Ship Reef during a storm). Texas acquired the ships during the early 1970s. The ships were cleaned, their super structures removed, and all salvageable items sold. Large holes were then cut in their hulls to allow for water flow before being reefed.

While the Liberty Ships sunk off Texas had similar functions during the war, each has a unique and fascinating wartime history. These lightly armed ships carried millions of tons of cargo and thousands of troops to battle zones in Europe, Africa, and the South Pacific throughout World War II. Liberty Ships were originally built to bolster the United State's inadequate merchant marine fleet at the beginning of World War II. Each ship was 440 ft in length and able to carry 22.5 million lbs of cargo in their holds. Generally, the ships were equipped with 2 76-mm guns and 8 20-mm anti-aircraft machine guns. A U.S. merchant marine crew operated the ship while a U.S. Navy armed guard manned the guns (Arnold et al. 1998).

The Program is using the historical significance of these ships in promoting the use of Liberty Ship reef sites to the diving and angling public. Brochures describing each reef site have been produced and a book jointly written by the Program and Texas Historical Commission staff is nearing completion. These Liberty Ship reef complexes continue to attract sport anglers and divers, offering them a dual encounter with magnificent reefs and America's maritime heritage. Arnold et al. (1998) provides a detailed history of how these ships were acquired and reefed in Texas waters.

Other Vessels

In addition to the Liberty Ships, the *V.A. Fogg* (previously known as the SS *Four Lakes,* a T-2 tanker) was inherited by the Texas Coastal and Marine Council after she sank on February 1, 1972. The *V.A. Fogg* had sailed from Freeport, Texas into the Gulf of Mexico after offloading a cargo of benzene, a highly volatile hydrocarbon. She was heading to a point 50 mi offshore to clean the tanks and was carrying a load of xylene. It is not known what caused a spark which ignited the benezene fumes and then the volatile cargo. The explosion ripped apart the ship's hull plating midway between the midships and aft superstructures, almost splitting the vessel in two. She quickly sank in 100 ft of water (Arnold et al. 1998). This unfortunate accident created the beginnings of the Freeport Liberty Ship Reef Site, in which the Program reefed two other Liberty Ships.

Additional vessels reefed by the Program include: one 100-ft YR-U.S. Navy barge; four 100-ft long hopper barges; and one obsolete 44-ft steel tugboat.

Future vessel acquisitions will include the T/S *Texas Clipper*, a 473-ft converted maritime training vessel. She was previously commissioned as the USS *Queens* (APA 103), a U.S. Naval attack transport / personnel carrier in 1944. The ship is currently berthed at the U.S. Maritime Administration Reserve Fleet in Beaumont, Texas. Plans call for the ship to be cleaned of hazardous materials and sunk in the southern portion of the coast as a premier dive and fishing reef. Additional ships may be added to this site in the future.

Other Reef Materials

Although Rigs-to-Reefs donations have been the foundation of the Program, many of these reefs are greater than 35 mi from shore and out of the reach of average recreational Gulf boaters. To provide additional opportunities for fishing and diving, the Program has used monies from the Artificial Reef Fund to create and enhance a number of near shore artificial reefs with other complex, durable, and stable materials.

Since 1988, the Houston Lighting and Power Company (HL&P) and Texas A&M University at Galveston (TAMUG) have extensively evaluated the potential for constructing reefs made of coal combustion by-products (CCB), known as fly ash. Fly ash is the powder-sized CCB which is transported in flue gases from the boiler and collected by devices such as

electrostatic precipitators and bag houses. Fly ash can be molded into blocks and pellets. HL&P did extensive testing of fly ash pellets with different mixes of concrete in the laboratory and developed a protocol which requires that ash mix in reef materials come from only one source of coal or specific sources of coal to reduce metal and organic toxicants. Baker et al. (1991) evaluated bioaccumulation of heavy metals and contaminants in sessile organisms (e.g. oysters) in a Galveston Bay fly ash pellet reef. The results of the study alleviated U.S. Environmental Protection Agency (EPA) concerns on using the material as artificial reef substrate.

In 1993, 300 two-ton (4 ft x 4 ft x 3 ft) coal combustion fly-ash blocks were placed in an 18-ft tall pyramid shaped mound at the Freeport Liberty Ship Reef. Fish monitoring research conducted between 1993 and 1994 by HL&P, TAMUG, and the Program through fish trapping and tagging indicated large numbers of reef fish present. Extensive growth of sessile organisms was also documented (TAMUG and TPWD, unpublished data). No significant bioaccumulation of heavy metals or other contaminants was found in sessile organisms (Baker et al. 1995). These tests, using EPA testing protocols, in both controlled and field conditions, convinced the GSMFC to reverse its prohibition on the use of coal combustion fly-ash as a suitable reef material in 1995 (R. Lukens, Gulf States Marine Fisheries Commission, personal communication; GSMFC 1997).

In 1993, Galveston County and Conoco jointly financed the creation of a 46-ft tall welded pipe structure made from 1,000 ft of surplus pipe to resemble a 4-pile jacket structure. The structure was placed near the *VA Fogg* and the coal combustion fly ash pyramid at the Freeport Liberty Ship Reef. The welded pipe structure's raised profile reportedly attracts numerous pelagic fish such as greater amberjack (*Seriola dumerili)* (TPWD unpublished data).

In addition, artificial reef funds were used to acquire and/or deploy miscellaneous reef materials including: 132 concrete fabricated "reef balls"; 46 square open-ended (box) concrete culverts; 23 concrete anchors; four stacks of concrete culvert pieces on slag; 50 1-2 ton natural quarry rocks; and four sections of a 55-ton U.S. Navy surplus steel buoy. The Program continues to assess new materials on a case-by-case basis to determine their overall benefits to the Program.

Many of these projects utilized volunteer time as well as donated equipment and services from numerous local citizens and companies. The reef ball project was funded by a grant from Reef Ball Development Group, Ltd. (Brandenton, Florida) and construction was accomplished through the efforts of Sea-Borne Cadets at TAMUG over the summer school session. This project allowed these students to learn construction methods, as well as how to build reef fish habitat.

RESEARCH

Social Surveys

From a sociological and economic aspect, artificial reefs have an important impact in Texas. The Program sponsored a series of surveys using mail questionnaire methodology to better ascertain these attitudes, opinions, and behavior patterns. Osburn et al. (1995) documented that in Texas waters, over 73% of all fishing and diving charter boat trips were to natural or artificial hard substrate habitats and that over 52,000 anglers and 6,000 divers on charter boats visit TPWD artificial reef sites each year. Ditton et al. (1995) found that 44% of the total number of trips taken offshore in Texas by charter boats (which encompassed charter, party, and diving boats) were to artificial reefs. Ditton and Baker (1999) also found that in a random sample of 1,059 Texas sport divers, 56% indicated they had taken one or more trips in the previous 12 months to artificial reefs in Texas offshore waters. Of those, 55% visited artificial reefs created by the Program.

With an estimated 900,000 saltwater anglers and 250,000 divers in Texas, demand remains high for fishing and diving opportunities at these reef sites. Maximizing social and economic benefits from artificial reefs requires continual knowledge about the preferences of the reef user groups and how they change over time. These surveys will continue to be funded to access social and economic impacts of artificial reefs to the state of Texas.

Fish Population Studies

Artificial reefs are important biologically and can function to: (1) redistribute biomass; (2) increase exploitable biomass by aggregating previously unexploited biomass; and (3) improve aspects of survival and growth, creating new production. Artificial habitats can potentially alter fishing effort, gear, size of fish at entry to the fishery, species targeted, and catch. The impact of change in fishing mortality on stocks is dependent on the relative level of exploitation and the rate of movement of the resource to the artificial habitat (Polovina 1991).

During 1996-1997, the Program investigated the use of collapsible traps to tag fish underwater as a potential long-term monitoring tool for assessing reef fish populations. The cost effectiveness and efficiency of this gear type was compared to hook and line capture techniques. During the initial effort, 223 red snapper (*Lutjanus campechanus)* were tagged underwater by divers after capture by three collapsible traps, and 291 red snapper were tagged on the surface by anglers after capture by hook and line techniques. The collapsible traps appeared to be more size selective for smaller sized red snapper than hook and line techniques. Fish tagged underwater had a higher recapture rate of 25.5% compared to the 11.9% recapture rate for fish caught and tagged on the surface. Although three recapture periods were used to evaluate tag return data, findings suggested that future efforts directed at monitoring artificial reef fish populations should

use multiple gear types with equal effort applied to account for size-selective capture patterns and logistical constraints (Culbertson and Peter 1998).

Currently, diver surveys (using photographic and video transects) are being used to facilitate the collection of data to document all species of fish present at reef sites and their relative abundance. In addition, the Program continues to build on its success through coordinated planning and research with other government agencies, universities, and private industries.

Exotic Tunicate Studies

The Program and TAMUG conducted an unusual monitoring project that investigated the dominance of an ascidian on an obsolete oil production platform. The ascidian dominated an 8-pile structure 12 nm west of Stetson Bank at High Island (HI) A-532, in 190 ft of water. The structure was converted into an artificial reef in 1997. The upper 89 ft of this structure was mechanically cut and placed on the sea floor next to the undisturbed lower section of the rig. Before the platform was cut, Program divers observed a thin white encrusting ascidian colonizing most of the structure below the water line. Program dives between 1998 and 2001 confirmed that the animal colonized the majority of both portions of the structure from 89 ft to below 138 ft (Culbertson and Harper 2000).

Samples of the ascidian at HI-A-532 were collected and compared to other species found in the Gulf of Mexico and the Pacific. It was identified as *Didemnum perlucidum*, in the Family Didemnidae (G. Lambert, University of Washington, Seattle, personal communication). This ascidian forms a thin tunic layer over the colony, less than 1 mm thick, and appears white due to the aster-like spicules in the tunic. Colonization occurs through sexual and asexual reproductive budding. It settles or grows over native encrusting organisms such as sponges, corals, bryozoans, hydroids, and mollusks until the colonized animal is hindered in growth and survival. Divers recently observed this same species colonizing other platforms within 12 nm of the HI-A-532 reef site (Culbertson and Harper 2000).

Monniot (1983) first described *D. perlucidum* from Guadaloupe in the Western Caribbean. This species appears to be a native of the Western Caribbean, where it occurs in small numbers, usually on the under surface of stones on reef flats, and on the undersides of coral (I. Goodbody, University of West Indies, Jamaica, personal communication). Although it is currently found growing on both artificial and natural coral reefs in Hawaii and Guam, it is not a dominant species in the Pacific (Kott 2001). The Program was the first to report this species colonizing oil and gas platforms, but it is unknown how this organism first became established in the Gulf of Mexico.

During 2000, five monitoring stations were established at HI-A-532. Monitoring during 2000-2001 determined that *D. perlucidum* quickly colonizes hard substrate. Evaluation of the data collected is currently in progress, but initial observations showed that complete re-

colonization of 100-cm^2 surfaces could occur within two to three months (Culbertson and Harper 2000). It is known that artificial substrates allow ascidians to colonize more quickly without competition, whereas natural coral reefs protect their space from fouling organisms with stinging nematocysts (Kott 2001).

DIVING PROGRAM

SCUBA diving is the primary method of conducting research within the Program. Diving projects are executed by a core team comprised of Program staff with the assistance of volunteer divers from universities and other agencies. Many of the underwater projects are large in scope and could not be completed without the support of dedicated volunteers. Diving conditions vary greatly; visibility ranges from zero to over 150 ft. Reef sites vary from 33 to over 300 ft in water depth with most being at least 98 ft deep.

Currently, the Program has the challenge of monitoring 44 reef sites (two other permitted sites do not contain material at this time). New reef sites are continually added. If possible, divers investigate potential platform donations prior to their acceptance into the Program. Divers accomplish a variety of tasks before and after the creation of a reef site, including: assessing the area within a reef site to determine the most advantageous locations for material; determining bottom stability; and collecting data on marine life before and after reefing. Fragile ecosystems are identified and left undisturbed. Once reef material is placed on the bottom, divers are used to verify that USCG clearance requirements have been met.

Dive teams use fish counts, video, still photographs and fish tagging to monitor reef health. Pelagic and reef associated fish, fouling communities, and the development of biodiversity are recorded and compared over time. Of special importance is the identification of marine mammals and turtles that frequent reef sites.

The Program utilizes specialized dive equipment to increase safety and perform research more efficiently. In some cases, Aqa Mark IV Divator (Interspiro Co.) full-face masks are used so divers can verbally communicate with each other and with team members on the support vessel. A communication device, worn on the masks, transmits an audible signal up to 300 ft. The masks are especially useful for communication between divers and the vessel in low visibility situations.

Diver safety is paramount in the Program. Each dive team member is required to undergo annual training sessions that test one's physical abilities and skills using various pieces of technical dive equipment. Shively et al. (1998) developed the *Artificial Reef Program Scientific Diving Standards and Safety Manual* under which the dive program operates. This publication serves as a guide for dive planning and safety and is based on American Academy of Underwater

Sciences (AAUS) standards. The dive program averages 168 dives per year (Table 1.).

FUTURE RESEARCH NEEDS AND DONATIONS

Conducting research on present and future artificial reefs is inherently difficult and expensive given the open ocean environment in which the research must take place. Nevertheless, in order to better establish the biological, sociological, and economic value of these reefs, research must continue and expand.

Some areas of research that should continue in the Program include: 1) in-depth angler and diver surveys to determine preferences of reef locations, material types, use rates, etc.; 2) evaluation of material types, deployment methods and reef configurations for the best biological impacts; 3) evaluation of biological and ecological survey methods to better ascertain biological impacts; and 4) investigation of alternative in-situ observation and data collection methods utilizing new or improved technologies.

The Program will continue to obtain additional reef donations and research new types of materials that will meet the established materials guidelines. Obsolete petroleum platforms are continually added to the Program as they become available and a stock-pile of other materials such as granite blocks, and obsolete concrete utility poles and bridge spans will aid in enhancing current reef sites. A strategic plan is being drafted with the Texas Department of Transportation to enable the Program to acquire obsolete bridge and other road building materials for use in creating reefs.

With the majority of the Program's reef sites being greater than 30 mi offshore, strategic plans are being developed for the creation of near shore reef sites along the Gulf of Mexico coast. Plans call for the development of shallow water reefs near major entrances into the Gulf to provide reef access for small boats and others that do not want to travel far offshore. To aid in this effort, the Program is negotiating leases of property with several coastal communities for the storage of reef material until reef development can begin.

CONCLUSION

Moving forward from 50 years of marine habitat enhancement, the Texas Artificial Reef Program continues to pursue future reef donations to continue its efforts in providing hard substrate for marine communities in the Gulf of Mexico. The potential supply of donated petroleum platforms to the Program remains high in the foreseeable future. Materials of opportunity continue to be

readily available. In addition to increasing habitat, reef construction enhances fishing and diving opportunities for the public. Based on current research results, diversity in reef site selection and materials appears to be the best way to maximize benefits to reef users, given the wide range in primary activities and geographic location of these user groups along the Texas coast. Unfortunately, the logistics and expense of utilizing available reef building materials remains onerous to the Program, and frustrating to anglers and divers anxious to see these materials incorporated into reefs.

It has been the expectation of these citizens that government, private industry and vested interest groups should work together to achieve the public's greatest good. The Texas Artificial Reef Program is a successful example of this cooperative effort. Habitat enhancement, in conjunction with increased fishing and diving opportunities, are the continued goals of the Texas Artificial Reef Program.

LITERATURE CITED

Arnold, J. B., III, J. L. Goloboy, A.W. Hall, R.A. Hall, and J.D. Shively. 1998. Texas' Liberty Ships. From World War I I working-class heroes to artificial reefs. Bulletin No. 99-1. Texas Parks and Wildlife Department, Coastal Fisheries Division. Austin.

Baker, W. B., Jr., S. M. Ray, Jr., and A. M. Landry, Jr. 1991. Investigation of coal combustion by-product utilization for oyster reef development in Texas Bay waters. Proceedings: Ninth International Ash Use Symposium, Orlando, Florida. EPRI GS-7162, Vol. 2 (48):1-14.

Baker, W. B., Jr., S. M. Ray, Jr., and A. M. Landry, Jr. 1995. Utilization of coal combustion byproduct oyster reef substrate in Texas coastal waters. Proceedings of Oyster Reef Habitat Restoration Symposium: A Synopsis and Synthesis of Approaches, Williamsburg, VA. Virginia Institute of Marine Science, Glouster.

Bohnsack, J. A. and D. L. Sutherland. 1985. Artificial reef research: A review with recommendations for future priorities. Bulletin of Marine Science 37:11-39.

Crowe, A. and L. W. McEachron. 1986. A summary of artificial reef construction on the Texas coast. Management Data Series Number 98. Texas Parks and Wildlife Department, Coastal Fisheries Branch. Austin.

Culbertson, J. C. and D. D. Peter. 1998. Development of tagging techniques for monitoring fish populations at Texas artificial reefs. Gulf of Mexico Science 16(1):46-53.

Culbertson, J. C. and D. Harper. (in press). Settlement of a colonial ascidian on an artificial reef in the Gulf of Mexico. Proceedings: Gulf of Mexico fish and fisheries bringing together new and recent research. U.S. Department of the Interior Minerals Management conference, October 24-26, 2000. New Orleans, LA.

Ditton, R. B. and T.L. Baker. 1999. Demographics, attitudes, management preferences, and economic impacts of sport divers using artificial reefs in offshore Texas waters. Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas.

Ditton, R. B., L. D. Finkelstein, and J. Wilemon. 1995. Use of offshore artificial reefs by Texas charter fishing and diving boats. Technical Report HD-604, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas.

Dokken, Q. R., K. Withers, S. Childs, and T. Rigg. 2000. Characterization and comparison of platform reef communities off the Texas coast. Center for Coastal Studies, Texas A&M University. TAMU-CC-000 CCS. Corpus Christi, Texas.

Gallaway, B. J. and G. S. Lewbel. 1982. The ecology of petroleum platforms in the northwestern Gulf of Mexico: a community profile. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. FWS/OBS-82/27: Bureau of Land Management, Gulf of Mexico OCS Regional Office, Open File Report 82-03.

Gallaway, B. J. and J. G. Cole. 1997. Cumulative ecological significance of oil and gas structures in the Gulf of Mexico: Information search, synthesis, and ecological modeling - phase I model description. National Biological Service Information and Technology Report USGS/BRD/CR-1997-0006.

Gitschlag, Gregg R., M. J. Schirripa, and J. E. Powers. 2001. Estimation of fisheries impacts due to underwater explosives used to sever and salvage oil and gas platforms in the U.S. Gulf of Mexico. MMS 2000-087. Prepared by the National Marine Fisheries Service U.S. Dept. of the Interior for MMS-GOMR, New Orleans, LA.

Gulf States Marine Fisheries Commission (GSMFC). 1993. A profile of artificial reef development in the Gulf of Mexico. Technical Publication No. 11-WB. Ocean Springs, Mississippi.

_____. 1997. Guidelines for marine artificial reef materials. Technical Publication No. 38. Ocean Springs, Mississippi.

Johnston, L. (Ed.). 1974. Artificial reefs for Texas. Texas Coastal and Marine Council and Texas A&M University. Sea Grant Program Publication: TAMU-SG-73-214.

Kott, P. 2001. The Australian Ascidiacea. Part 4, Aplousobranchia (3). Didemnidae. Memorandum of the Queensland Museum, 47: 1-407.

Lukens, R. Personal communication. Memorandum dated May 17, 1995 to GSMFC Technical Coordinating Committee regarding the use of combustion/incineration ash for artificial reef construction. Gulf States Marine Fisheries Commission. Ocean Springs, Mississippi.

Monniot, F. 1983. Ascidies littorales de Guadeloupe. I. Didemnidae. Bulletin of the Museum of Natural History, 4 (5): 5-49). Paris, France.

National Research Council. 1996. An assessment of techniques for removing offshore structures. National Academic Press. Washington, D.C.

Osburn, H. R., L. D. Finkelstein, and R. B. Ditton. 1995. Artificial reefs off Texas: an evaluation by charter fishing and diving boat captains. Pages 790-795 *in* Ecoset '95 Proceedings Volume II. International Conference on Ecological System Enhancement Technology for Aquatic Environments. Sixth International Conference on Aquatic Habitat Enhancement. Tokyo, Japan.

Parker Jr., R. O., David R. Colby. and T. D. Willis. 1983. Estimated amount of reef habitat on a portion of the U.S. South Atlantic and Gulf of Mexico Continental Shelf. Bulletin of Marine Science, 33(4). pp. 935-940.

Polovina, J. J. 1991. Fisheries applications and biological impacts of artificial habitats. Pages 153-176 *in* W. Seaman, Jr. and L. M. Sprague (editors), Artificial Habitats for Marine and Freshwater Fisheries. Academic Press, Inc., San Diego, CA.

Pulsipher, A. J., O. O. Iledare, D. V. Mesyanzhinov, A. Dupont, and Q.L. Zhu. (in press). Forecasting the number of offshore platforms on the Gulf of Mexico OCS to the Year 2023. Proceedings: Gulf of Mexico fish and fisheries bringing together new and recent research. U.S. Department of the Interior Minerals Management conference, October 24-26, 2000. New Orleans, LA.

Shively, J. D., J. C. Culbertson, and D. D. Peter. 1998. Artificial reef program: scientific diving standards and safety manual. PWD BK V3400-465 (04/98). Texas Parks and Wildlife Coastal Fisheries Division, Austin.

Stephan, C. D., B. G. Dansby, H. R. Osburn, G. C. Matlock, R. K. Riechers, and R. Rayburn. 1990. Texas artificial reef plan. Fishery Management Plan Series Number 3. Texas Parks and Wildlife Department, Coastal Fisheries Branch. Austin.

Stone, R. B. 1985. National artificial reef plan. NOAA Technical Memorandum NMFS OF-6. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Washington, D.C.

Stone, R. B. 1986. History of artificial reef use in the United States. Pages 3-11 *in* F. M. D'itri (editor), Artificial reefs: marine and freshwater applications. Lewis Publishers, Inc., Chelsea, Michigan.

Texas Parks and Wildlife Department (TPWD). 2002. The Texas shrimp fishery. A report to the Governor and the 77th Legislature of Texas. Appendix A. Overview of coastal and marine habitat in Texas. Austin.

Table 1. Total dives per annual year (January - December) of all Program divers combined. (Program divers include staff and scientific divers from other groups that participated in TPWD dives).

Year	Number of Dives
1994	28
1995	172
1996	160
1997	96
1998	147
1999	151
2000	250
2001	300
2002	208
Average	**168**

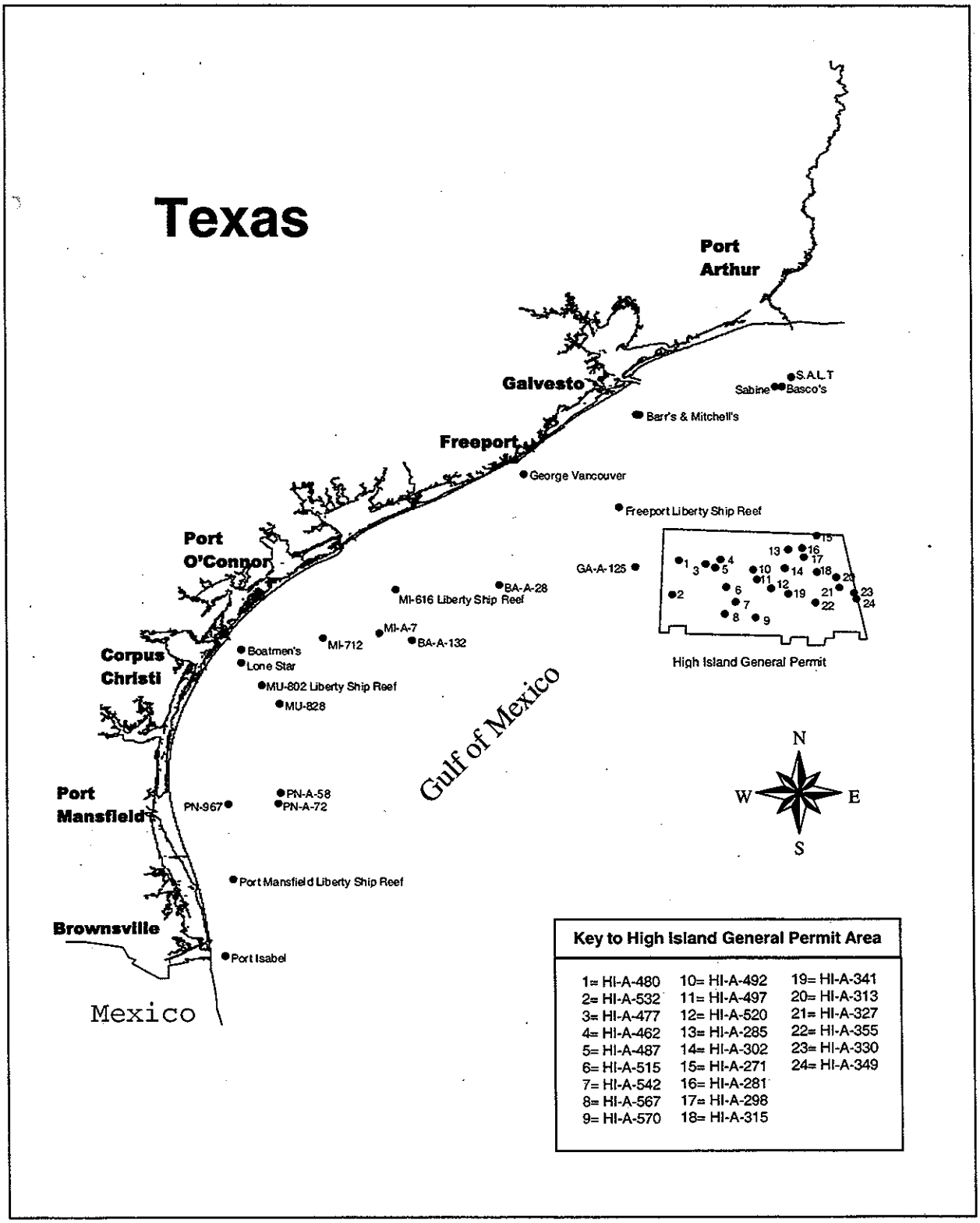

Figure 1. Artificial reef locations along the Texas coast in the Gulf of Mexico.

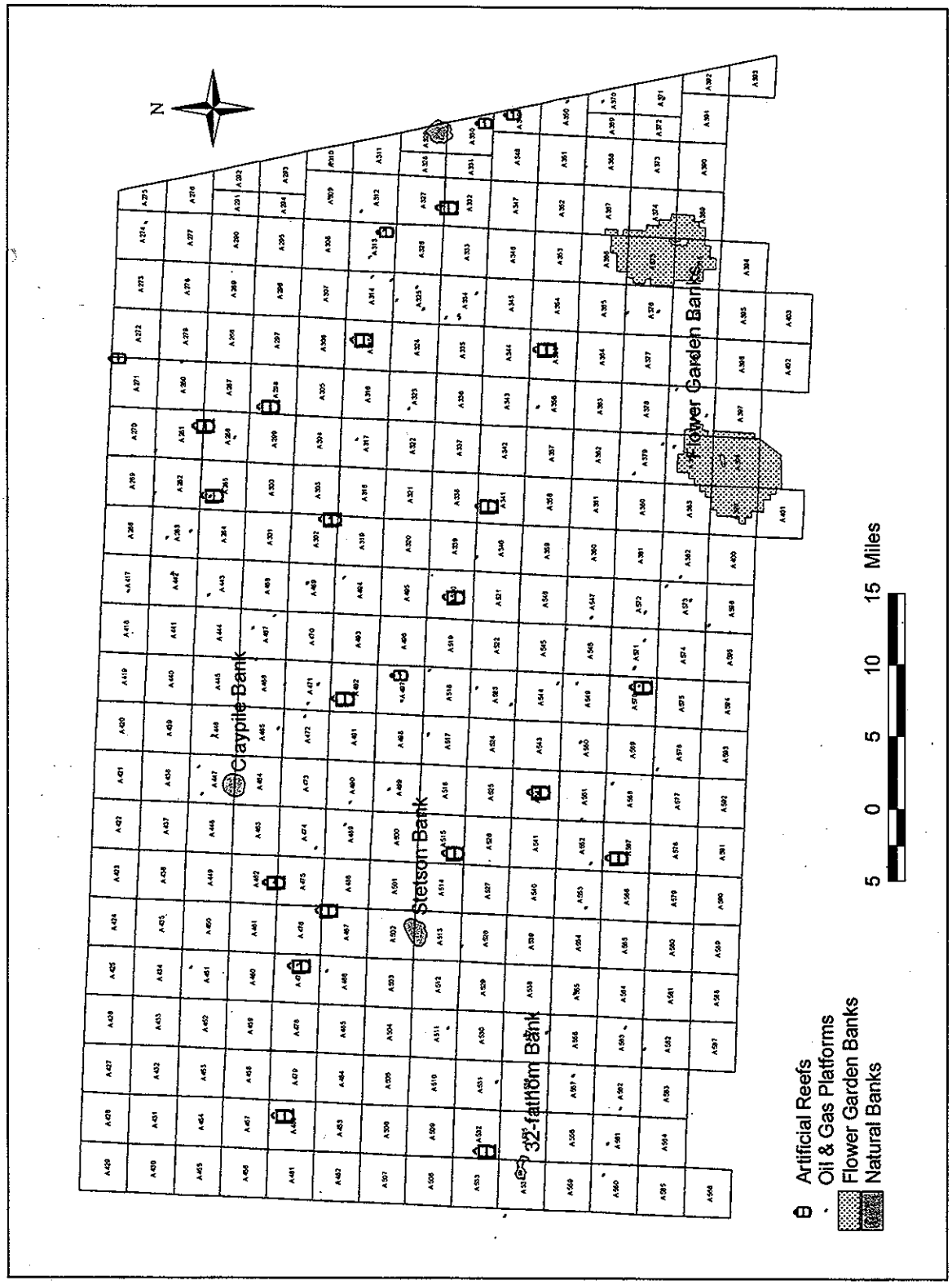

Figure 2. Detail map of General Permit Area in the High Island Area of the Gulf of Mexico.

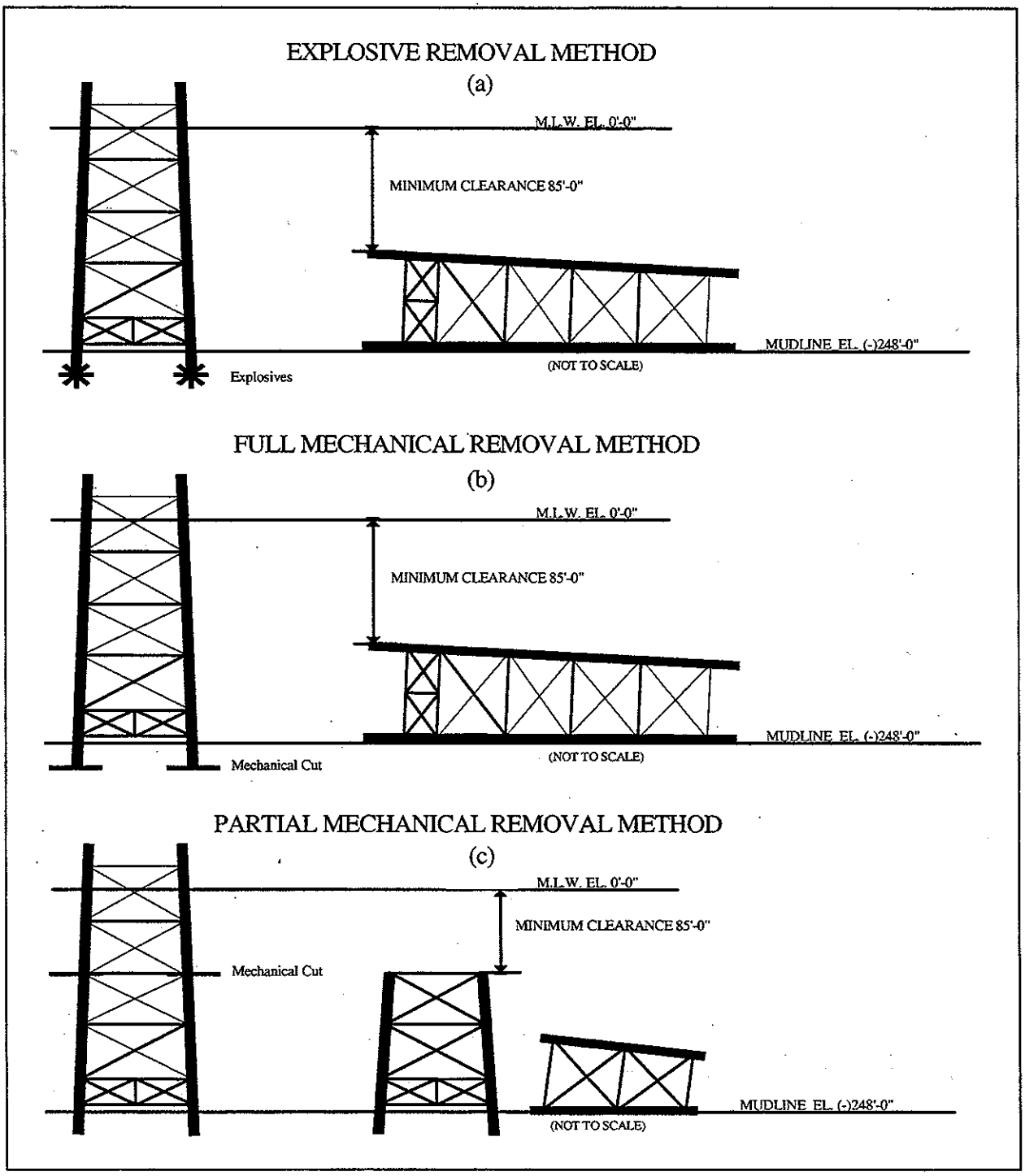

Figure 3. Oil platform removal methods used in the Texas Artificial Reef Program. (M.L.W.EL. = mean low seawater elevation).

Appendix A. Location and description of artificial reef sites.

Appendix A-1. Texas Artificial Reef Program material summary.

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
Barr's Reef (GA-189)	Texas Game and Fish Commission	Concrete Culverts	29° 08.414' 94° 42.112'	12 nm Galveston	57-ft
	Texas Parks & Wildlife	100 Reef Balls	29° 08.339' 94° 42.048'		
Basco's Reef (HI-117)	Reed Tool Company & Offshore Marine Services, Inc.	50 Quarry Rocks	29° 18.014' 93° 53.310'	23 nm Sabine Pass	50-ft
	Texas Parks & Wildlife	Marad Buoy piece #1 Diameter 14 feet	29° 18.029' 93° 53.262'		
		Marad Buoy piece #2 Diameter 14 feet	29° 18.032' 93° 53.267'		
		Marad Buoy piece #3 Diameter 16 feet	29° 18.026' 93° 53.259'		
		Marad Buoy piece #4 Diameter 16 feet	29° 18.025' 93° 53.267'		
	U.S Coast Guard	10 Concrete Anchors	29° 18.016' 93° 53.350'		
		3 Concrete Anchors	29° 17.991' 93° 53.327'		
		3 Concrete Anchors	29° 17.991' 93° 53.306'		
		6 Concrete Anchors	29° 18.031' 93° 53.303'		
Boatmen's Reef (MU-746L)	Boatmen's Association	Sunken Barge	27° 46.369' 96° 58.287'	6 nm Port Aransas	60-ft
	Gifford Hill	46 Concrete Culverts	27° 46.411' 96° 58.275'		
Brazos-A-132 Reef	Arco Oil & Gas Company	BA-A-132 (8-pile jacket)	27° 49.363' 95° 59.401'	40 nm Port O'Connor	200-ft
Brazos-A-28 Reef	Mobil Producing Texas & New Mexico, Inc.	BA-386S (4-pile jacket)	28° 08.965' 95° 29.707'	47 nm Port O'Connor	150-ft
	ReefScape, L.L.C.	BA-578 (4-pile jacket)	28° 08.935' 95° 29.751'		
	Samedan Oil Corporation	BA-A-28 (4-pile jacket)	28° 08.998' 95° 29.728'		
Freeport Liberty Ship Reef Site (GA-A-22)		V.A. Fogg Middle section	28° 35.647' 94° 48.786'	32 nm Freeport	102-ft
		V.A. Fogg North section	28° 35.691' 94° 48.782'		
		V.A. Fogg South section	28° 35.610' 94° 48.749'		
	Cal-Dive International & Blue Dolphin Energy	GA-288 No. 10 (4-pile jacket)	28° 35.759' 94° 48.693'		
		GA-288 No. 4 (4-pile jacket)	28° 35.779' 94° 48.674'		
		GA-288 No. 5 (4-pile jacket)	28° 35.768' 94° 48.678'		
		GA-288 No. 8 (4-pile jacket)	28° 35.795' 94° 48.689'		
		GA-296 No. 1 (4-pile jacket)	28° 35.795' 94° 48.709'		
		GA-296 No. 6 (4-pile jacket)	28° 35.768' 94° 48.712'		
	Galveston County/Conoco	Conoco Structure	28° 35.593' 94° 48.723'		

Appendix A-1. (continued).

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
	HL&P (Reliant Energy)	300 2-ton Coal-ash Blocks	28° 35.601' 94° 48.764'		
	Texas Coastal & Marine Council	Liberty Ship-B. F. Shaw	28° 35.877' 94° 48.696'		
		Liberty Ship-William F. Allen	28° 35.649' 94° 48.738'		
Galveston-A-125 Reef	Levinson Partners, Inc.	GA-A-125 (3-pile jacket base) GA-A-125 (3-pile jacket top)	28° 15.044' 94° 43.302' 28° 15.069' 94° 43.306'	51 nm Freeport	166-ft
George Vancouver Liberty Ship Reef (BA-336)	Texas Coastal & Marine Council	Liberty Ship-George Vancouver	28° 47.580' 95° 20.868'	9 nm Freeport	60-ft
High Island-A-271 Reef	El Paso Production Oil & Gas Company	HI-A-271 (4-pile jacket)	28° 26.431' 93° 43.090'	86 nm Galveston	160-ft
High Island-A-281 Reef	Chevron USA, Inc.	HI-A-281 "A" (4-pile jacket)	28° 21.820' 93° 47.104'	74 nm Galveston	185-ft
		HI-A-281 "A" Aux. (4-pile jacket)	28° 21.860' 93° 47.074'		
	Seagull Energy Corporation	HI-A-414 (4-pile jacket)	28° 21.914' 93° 47.077'		
High Island-A-285 Reef	Global Industries Offshore, L.L.C.	HI-A-285 (8-pile jacket base)	28° 21.318' 93° 51.374'	75 nm Galveston	185-ft
		HI-A-285 (8-pile jacket top)	28° 21.323' 93° 51.329'		
High Island-A-298 Reef	Freeport-McMoran, Inc.	HI-A-289 (8-pile jacket)	28° 18.246' 93° 46.019'	80 nm Galveston	192-ft
	Phillips Petroleum Company	HI-A-298 (4-pile jacket)	28° 18.192' 93° 46.013'		
		WC-480 (8-pile jacket)	28° 18.233' 93° 45.954'		
High Island-A-302 Reef	Unocal	HI-A-302 (8-pile jacket base)	28° 14.471' 93° 52.653'	78 nm Galveston	212-ft
		HI-A-302 (8-pile jacket top)	28° 14.468' 93° 52.684'		
High Island-A-313 Reef	El Paso Production Oil & Gas Company	HI-A-313 A (8-pile jacket base) HI-A-313 A (8-pile jacket top)	28° 11.450' 93° 35.354' 28° 11.445' 93° 35.302'	90 nm Galveston	214-ft
		HI-A-313 B (3-pile jacket)	28° 11.390' 93° 35.325'		
		HI-A-314 A (3-pile jacket)	28° 11.382' 93° 35.340'		
		HI-A-314 B (3-pile jacket)	28° 11.391' 93° 35.355'		
High Island-A-315 Reef	Mesa Petroleum Company	HI-A-315 (8-pile jacket)	28° 12.863' 93° 41.923'	86 nm Galveston	214-ft
	Union Pacific Resources Company	WC-604 (3-pile jacket)	28° 12.802' 93° 41.899'		

Appendix A-1. (continued).

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
High Island-A-327 Reef	Kerr-McGee Corporation	HI-A-327 (8-pile jacket base)	28° 08.176' 93° 33.883'	95 nm Galveston	227-ft
		HI-A-327 (8-pile jacket top)	28° 08.159' 93° 33.907'		
		Net Guard- 10 pieces clustered	28° 08.144' 93° 33.914'		
High Island-A-330 Reef	El Paso Production Oil & Gas Company	HI-A-330 (8-pile jacket base)	28° 05.788' 93° 28.714'	110 nm Galveston	265-ft
		HI-A-330 (8-pile jacket top north section)	28° 05.814' 93° 28.703'		
		HI-A-330 (8-pile jacket top south section)	28° 05.799' 93° 28.682'		
High Island-A-341 Reef	Unocal	HI-A-341 (4-pile drilling jacket)	28° 05.661' 93° 51.991'	95 nm Galveston	254-ft
		HI-A-341 (4-pile production jacket)	28° 05.639' 93° 52.013'		
High Island-A-349 Reef	El Paso Production Oil & Gas Company	HI-A-349 (8-pile jacket base)	28° 04.198' 93° 28.168'	100 nm Galveston	278-ft
		HI-A-349 (8-pile jacket top north section)	28° 04.252' 93° 28.161'		
		HI-A-349 (8-pile jacket top south section)	28° 04.218' 93° 28.159'		
High Island-A-355 Reef	Oxy USA, Inc.	HI-A-355 (8-pile jacket base)	28° 02.507' 93° 42.561'	103 nm Galveston	305-ft
		HI-A-355 (8-pile jacket top)	28° 02.482' 93° 42.518'		
High Island-A-462 Reef	CNG Producing Company	HI-A-462 (4-pile jacket base)	28° 17.650' 94° 14.624'	81 nm Galveston	178-ft
		HI-A-462 (4-pile jacket top)	28° 17.665' 94° 14.600'		
High Island-A-477 Reef	CNG Producing Company	HI-A-477 (6-pile jacket base)	28° 16.342' 94° 19.603'	86 nm Galveston	164-ft
		HI-A-477 (6-pile jacket top)	28° 16.368' 94° 19.596'		
	Pogo Producing Company	HI-A-451 (3-pile jacket)	28° 16.364' 94° 19.656'		
High Island-A-480 Reef	Samedan Oil Corporation	HI-A-480 (4-pile jacket east half)	28° 17.247' 94° 28.673'	65 nm Galveston	155-ft
		HI-A-480 (4-pile jacket west half)	28° 17.259' 94° 28.732'		
High Island-A-487 Reef	Amerada Hess Corporation	HI-A-487 (4-pile jacket)	28° 14.929' 94° 16.314'	72 nm Galveston	170-ft
High Island-A-492 Reef	Transco Exploration Company	HI-A-492 (8-pile jacket)	28° 13.596' 94° 03.500'	75 nm Galveston	195-ft
High Island-A-497 Reef	El Paso Production Oil & Gas Company	HI-A-497 (4-pile jacket base)	28° 10.605' 94° 01.967'	88 nm Galveston	220-ft
		HI-A-497 (4-pile jacket top)	28° 10.630' 94° 01.985'		

Appendix A-1. (continued).

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
High Island-A-515 Reef	Samedan Oil Corporation	HI-A-515 (4-pile jacket)	28° 07.714' 94° 12.805'	78 nm Galveston	202-ft
High Island-A-520 Reef	Oxy USA, Inc.	HI-A-520 (8-pile jacket)	28° 07.466' 93° 57.418'	82 nm Galveston	238-ft
High Island-A-532 Reef	Kerr-McGee Corporation	HI-A-532 (8-pile jacket base) HI-A-532 (8-pile jacket top)	28° 05.937' 94° 30.723' 28° 05.938' 94° 30.752'	75 nm Galveston	192-ft
High Island-A-542 Reef	Hall-Houston Oil Company	HI-A-542 (4-pile jacket)	28° 02.863' 94° 09.142'	84 nm Galveston	230-ft
High Island-A-567 Reef	Challenger Minerals, Inc. Ocean Energy, Inc.	HI-A-567 (8-pile jacket) HI-A-562 (4-pile jacket)	27° 58.509' 94° 13.117' 27° 58.573' 94° 13.098'	87 nm Galveston	288-ft
High Island-A-570 Reef	CNG Producing Company	HI-A-570 (8-pile jacket base) HI-A-570 (8-pile jacket top)	27° 57.092' 94° 02.713' 27° 57.055' 94° 02.727'	116 nm Galveston	270-ft
Lonestar Reef (MU-770L)		3 Barges	27° 41.519' 96° 58.514'	10 nm Port Aransas	72-ft
Matagorda Island Liberty Ship Reef (MI-616)	Texas Coastal & Marine Council	Liberty Ship-Dwight L. Moody Liberty Ship-George Dewey Liberty Ship-Jim Bridger	28° 06.996' 96° 05.201' 28° 07.003' 96° 05.296' 28° 06.924' 96° 05.155'	21 nm Port O'Connor	107-ft
Matagorda Island-712 Reef	Chevron USA, Inc.	MI-712 (deck structure)	27° 49.972' 96° 30.387'	29 nm Port Aransas	130-ft
Matagorda Island-A-7 Reef	Taylor Energy Company	MI-A-7 (4-pile jacket base) MI-A-7 (4-pile jacket top)	27° 51.387' 96° 11.379' 27° 51.393' 96° 11.423'	37 nm Port O'Connor	198-ft
Mitchell's Reef (GA-189)	Mitchell Energy Corporation	"B" (4-pile jacket base) "C" (4-pile jacket base)	29° 08.637' 94° 40.796' 29° 08.653' 94° 40.812'	11 nm Galveston	60-ft
Mustang Island Liberty Ship Reef (MU-802)	Texas Coastal & Marine Council	Liberty Ship-Charles A. Dana:bow Liberty Ship-Charles A. Dana:stern Liberty Ship-Conrad Weiser Liberty Ship-Rachael Jackson	27° 34.074' 96° 51.602' 27° 34.076' 96° 51.643' 27° 34.109' 96° 51.555' 27° 34.025' 96° 51.575'	18 nm Port Aransas	110-ft

Appendix A-1. (continued).

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
Mustang Island-828 Reef	Apache Corporation	MU-881 "A" (4-pile jacket)	27° 26.988' 96° 45.705'	27 nm Port Aransas	165-ft
		MU-881 "B" (4-pile jacket)	27° 26.990' 96° 45.726'		
	Ocean Energy, Inc.	MU-828 "A" (4-pile jacket)	27° 26.854' 96° 45.710'		
		MU-831 (4-pile jacket)	27° 26.838' 96° 45.725'		
North Padre Island-967 Reef	Samedan Oil Corporation	PN-967 (4-pile jacket east half)	26° 52.040' 97° 02.979'	22 nm Port Mansfield	125-ft
		PN-967 (4-pile jacket west half)	26° 52.056' 97° 03.008'		
North Padre Island-A-58 Reef	Union Pacific Resources Company	PN-A-58 (4-pile jacket base)	26° 56.129' 96° 45.164'	35 nm Port Mansfield	254-ft
		PN-A-58 (4-pile jacket top)	26° 56.130' 96° 45.148'		
North Padre Island-A-72 Reef	Seagull Energy Corporation	PN-A-72 (3-pile jacket base)	26° 52.369' 96° 46.336'	33 nm Port Mansfield	254-ft
		PN-A-72 (3-pile jacket top)	26° 52.342' 96° 46.361'		
Port Isabel Reef (PS-1169L)	Marine Salvage & Services	60' Tugboat-Courtney Lee	25° 58.089' 97° 03.920'	7 nm Santiago Pass	75-ft
	Mobil Producing Texas & New Mexico, Inc.	PS-1065 "E" (3-pile jacket)	25° 58.173' 97° 03.979'		
		PS-1066 "F" (3-pile jacket)	25° 58.095' 97° 03.917'		
	Texas Parks & Wildlife	32 Reef Balls	25° 58.152' 97° 03.983'		
		U.S. YR Navy Barge	25° 58.180' 97° 03.790'		
Port Mansfield Liberty Ship Reef (PS-1070)	Mobil Producing Texas & New Mexico, Inc.	PS-1047 "D" (4-pile jacket)	26° 25.499' 97° 01.257'	15 nm Port Mansfield	102-ft
		PS-1048 "B" (4-pile jacket)	26° 25.784' 97° 01.448'		
		PS-1065 "C" (4-pile jacket)	26° 25.619' 97° 01.228'		
		PS-1066 "A-1" (1/2 4-pile jacket)	26° 25.669' 97° 01.595'		
		PS-1066 "A-2" (1/2 4-pile jacket)	26° 25.757' 97° 01.610'		
	Smit Americas, Inc.	PS-1064 "A" (4-pile jacket base)	26° 25.518' 97° 01.361'		
		PS-1064 "A" (4-pile jacket top)	26° 25.505' 97° 01.378'		
		PS-1064 "B" (4-pile jacket base)	26° 25.494' 97° 01.395'		
		PS-1064 "B" (4-pile jacket top)	26° 25.500' 97° 01.339'		
	Texas Coastal & Marine Council	Liberty Ship-Edward W. Scripps	26° 25.528' 97° 01.505'		
		Liberty Ship-George L. Farley	26° 25.593' 97° 01.287'		
		Liberty Ship-Joshua Thomas	26° 25.508' 97° 01.642'		

Appendix A-1. (concluded).

Reef Site Name	Donor	Structure	Latitude and Longitude in NAD83	Distance from Land	Water Depth
S.A.L.T. Reef (HI-85)		Center of Reef (no material to date)	29° 21.514' 93° 50.060'	18 nm Sabine Pass	43-ft
Sabine Reef (HI-117)		Center of Reef (no material to date)	29° 18.214' 93° 55.310'	22 nm Sabine Pass	36-ft

Appendix A-2. Summary of donations to the Texas Artificial Reef Program by calendar year from1961-2002.

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
1961						
	06/01/61	Barr's Reef (GA-189)	4 piles of concrete culverts on slag or shell	Pushed from Barge	$0.00	$0.00
Total Donation Amount					**$0.00**	**$0.00**
1972						
	02/01/72	Freeport Liberty Ship Reef Site (GA-A-22)	T-2 Tanker-V.A. Fogg	Accidental Sinking	$0.00	$0.00
Total Donation Amount					**$0.00**	**$0.00**
1975						
	08/22/75	Port Mansfield Liberty Ship Reef (PS-1070)	Liberty Ship-Edward W. Scripps	Towed/Explosives	$0.00	$0.00
	11/04/75	Port Mansfield Liberty Ship Reef (PS-1070)	Liberty Ship-Joshua Thomas	Towed/Explosives	$0.00	$0.00
	11/08/75	Port Mansfield Liberty Ship Reef (PS-1070)	Liberty Ship-George L. Farley	Towed/Explosives	$0.00	$0.00
Total Donation Amount					**$0.00**	**$0.00**
1976						
	01/28/76	Mustang Island Liberty Ship Reef (MU-802)	Liberty Ship-Conrad Weiser	Towed/Explosives	$0.00	$0.00
	03/08/76	Mustang Island Liberty Ship Reef (MU-802)	Liberty Ship-Rachael Jackson	Towed/Explosives	$0.00	$0.00
	03/23/76	Mustang Island Liberty Ship Reef (MU-802)	Liberty Ship-Charles A. Dana	Towed/Explosives	$0.00	$0.00
	04/06/76	Matagorda Island Liberty Ship Reef (MI-616)	Liberty Ship-Dwight L. Moody	Towed/Explosives	$0.00	$0.00
	04/25/76	Matagorda Island Liberty Ship Reef (MI-616)	Liberty Ship-George Dewey	Towed/Explosives	$0.00	$0.00
	06/15/76	Matagorda Island Liberty Ship Reef (MI-616)	Liberty Ship-Jim Bridger	Towed/Explosives	$0.00	$0.00
	06/19/76	Freeport Liberty Ship Reef Site (GA-A-22)	Liberty Ship-B.F. Shaw	Towed/Explosives	$0.00	$0.00
	09/23/76	Freeport Liberty Ship Reef Site (GA-A-22)	Liberty Ship-William F. Allen	Towed/Explosives	$0.00	$0.00

Appendix A-2. (continued).

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
1976 (cont.)	10/29/76	George Vancouver Liberty Ship Reef (BA-336)	Liberty Ship-George Vancouver	Accidental Sinking	$0.00	$0.00
Total Donation Amount					**$0.00**	**$0.00**
1987						
	UNKNOWN	Boatmen's Reef (MU-746L)	Barge	Sunk by Flooding	$0.00	$0.00
	UNKNOWN	Lonestar Reef (MU-770L)	3 Barges	Sunk by Flooding	$0.00	$0.00
Total Donation Amount					**$0.00**	**$0.00**
1990						
	01/25/90	High Island-A-492 Reef	8-pile jacket	Explosives/Topple in place	$35,000.00	$0.00
Total Donation Amount					**$35,000.00**	**$0.00**
1991						
	06/19/91	High Island-A-298 Reef	4-pile jacket	Explosives/Topple in place	$144,000.00	$12,000.00
	07/17/91	Matagorda Island-712 Reef	MI-712 Deck	Mechanical Cut/Towed to reef	$111,500.00	$12,000.00
	09/10/91	High Island-A-520 Reef	8-pile jacket	Explosives/Topple in place	$244,000.00	$12,000.00
	09/18/91	High Island-A-298 Reef	8-pile jacket	Explosives/Towed to reef	$142,738.00	$0.00
	11/24/91	Brazos-A-28 Reef	4-pile jacket	Explosives/Towed to reef	$0.00	$0.00
	12/04/91	High Island-A-298 Reef	8-pile jacket	Explosives/Towed to reef	$169,852.00	$0.00
Total Donation Amount					**$812,090.00**	**$36,000.00**
1992						
	01/28/92	High Island-A-315 Reef	8-pile jacket	Explosives/Topple in place	$222,000.00	$12,000.00
	06/22/92	High Island-A-281 Reef	Two 4-pile jackets	Explosives/Topple in place	$270,000.00	$12,000.00
	07/11/92	Brazos-A-28 Reef	4-pile jacket	Explosives/Topple in place	$122,000.00	$12,000.00

Appendix A-2. (continued).

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
1992 (cont.)	10/10/92	High Island-A-281 Reef	4-pile jacket	Explosives/Towed to reef	$43,230.00	$0.00
	10/23/92	High Island-A-487 Reef	4-pile jacket	Explosives/Topple in place	$196,000.00	$0.00
	11/15/92	Brazos-A-132 Reef	8-pile jacket	Explosives/Topple in place	$251,100.00	$12,000.00
Total Donation Amount					**$1,104,330.00**	**$48,000.00**
1993						
	04/23/93	High Island-A-542 Reef	4-pile jacket	Explosives/Topple in place	$136,352.00	$12,000.00
	04/27/93	Freeport Liberty Ship Reef Site (GA-A-22)	Welded Pipe Structure	Lowered by Crane	$0.00	$0.00
	05/30/93	Port Mansfield Liberty Ship Reef (PS-1070)	Two 4-pile jackets	Explosives/Towed to reef	$0.00	$0.00
	07/19/93	Freeport Liberty Ship Reef Site (GA-A-22)	300 (2ton) Fly-ash Blocks	Dropped down in Basket 3 at a time	$0.00	$0.00
	08/31/93	High Island-A-567 Reef	8-pile jacket	Explosives/Topple in place	$385,000.00	$12,000.00
Total Donation Amount					**$521,352.00**	**$24,000.00**
1994						
	05/22/94	Freeport Liberty Ship Reef Site (GA-A-22)	Six 4-pile jackets	Explosives/Towed to reef	$0.00	$0.00
	08/10/94	Port Isabel Reef (PS-1169L)	Two 3-pile jackets	Mechanical Cut/Towed to reef	$0.00	$0.00
	08/14/94	Port Mansfield Liberty Ship Reef (PS-1070)	Four 4-pile jackets	Mechanical Cut/Towed to reef	$0.00	$0.00
	08/16/94	Basco's Reef (HI-117)	3 Concrete Anchors	Dropped off Boat	$0.00	$0.00
	08/22/94	High Island-A-480 Reef	4-pile jacket	Mechanically cut in half	$122,333.00	$20,000.00
	08/26/94	Boatmen's Reef (MU-746L)	46 Square Culverts	A-frame / divers placed	$0.00	$0.00
Total Donation Amount					**$122,333.00**	**$20,000.00**

Appendix A-2. (continued).

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
1995						
	08/03/95	Port Isabel Reef (PS-1169L)	Tugboat	Flooded for Sinking	$0.00	$0.00
	09/12/95	North Padre Island-A-58 Reef	4-pile jacket	Mechanical Cut/ Partial Removal	$317,500.00	$20,000.00
	10/22/95	High Island-A-341 Reef	Two 4-pile jackets	Explosives/Topple in place	$295,450.00	$20,000.00
Total Donation Amount					**$612,950.00**	**$40,000.00**
1996						
	01/09/96	High Island-A-355 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$256,400.00	$20,000.00
	05/28/96	Basco's Reef (HI-117)	10 Concrete Anchors	Dropped off Boat	$0.00	$0.00
Total Donation Amount					**$256,400.00**	**$20,000.00**
1997						
	03/29/97	High Island-A-315 Reef	3-pile jacket	Explosives/Towed to reef	$119,239.00	$0.00
	06/06/97	High Island-A-532 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$248,000.00	$20,000.00
	06/11/97	North Padre Island-967 Reef	4-pile jacket	Mechanically cut in half	$25,000.00	$20,000.00
	07/30/97	Barr's Reef (GA-189)	100 Reef Balls	Crane / deployed individually	$0.00	$0.00
	09/12/97	Basco's Reef (HI-117)	50 Quarry Rocks	Pushed off back of Boat	$0.00	$0.00
Total Donation Amount					**$392,239.00**	**$40,000.00**
1998						
	05/29/98	High Island-A-515 Reef	4-pile jacket	Explosives/Topple in place	$131,745.00	$20,000.00
	07/27/98	North Padre Island-A-72 Reef	3-pile jacket	Mechanical Cut/ Partial Removal	$209,700.00	$40,300.00
	08/14/98	Basco's Reef (HI-117)	6 Concrete Anchors	Dropped off Boat	$0.00	$0.00

Appendix A-2. (continued).

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
1998 (cont.)	08/25/98	Port Isabel Reef (PS-1169L)	32 Reef Balls	Pushed off back of Boat	$0.00	$0.00
	08/28/98	Port Isabel Reef (PS-1169L)	U.S. YR-Navy Barge	Flooded for Sinking	$0.00	$0.00
	09/17/98	Basco's Reef (HI-117)	3 Concrete Anchors	Dropped off Boat	$0.00	$0.00
	12/02/98	Galveston-A-125 Reef	3-pile jacket	Mechanical Cut/ Partial Removal	$141,500.00	$20,000.00
Total Donation Amount					**$482,945.00**	**$80,300.00**
1999						
	06/23/99	Mitchell's Reef (GA-189)	Two 4-pile jackets & Caisson	Mechanical Cut/ Partial Removal	$225,000.00	$75,000.00
	08/17/99	High Island-A-567 Reef	4-pile jacket	Explosives/Towed to reef	$170,000.00	$0.00
Total Donation Amount					**$395,000.00**	**$75,000.00**
2000						
	06/04/00	High Island-A-570 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$360,000.00	$20,000.00
	06/07/00	High Island-A-477 Reef	6-pile jacket	Mechanical Cut/ Partial Removal	$155,000.00	$20,000.00
	06/13/00	High Island-A-462 Reef	4-pile jacket	Mechanical Cut/ Partial Removal	$130,000.00	$20,000.00
Total Donation Amount					**$645,000.00**	**$60,000.00**
2001						
	08/25/01	Basco's Reef (HI-117)	MARAD Buoy	A-frame crane/Divers	$0.00	$0.00
	08/29/01	Mustang Island-828 Reef	Two 4-pile jackets	Explosives/Towed to reef	$36,354.00	$0.00
	09/07/01	Mustang Island-828 Reef	4-pile jacket	Explosives/Towed to reef	$100,000.00	$20,000.00
	10/15/01	High Island-A-302 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$370,000.00	$20,000.00
	10/23/01	High Island-A-285 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$248,500.00	$20,000.00

Appendix A-2. (concluded).

Calendar Year	Reefing Date	Reef Site	Type of Material	Reefing Method	Donation Amount	Buoy Fee
2001 (cont.)	10/24/01	High Island-A-327 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$301,065.00	$20,000.00
	11/12/01	High Island-A-327 Reef	10 Net Guard pieces	Mechanical Cut/ Towed	$27,000.00	$0.00
Total Donation Amount					**$1,082,919.00**	**$80,000.00**
2002						
	06/19/02	Brazos-A-28 Reef	4-pile jacket	Explosives/Towed to reef	$10.00	$0.00
	07/19/02	Mustang Island-828 Reef	4-pile jacket	Mechanical Cut/ Topple in place	$75,963.00	$0.00
	07/20/02	High Island-A-477 Reef	3-pile jacket	Explosives/Towed to reef	$35,291.00	$0.00
	07/04/02	High Island-A-313 Reef	3-pile jacket	Explosives/Towed to reef	$106,565.00	$0.00
	07/11/02	High Island-A-313 Reef	3-pile jacket	Explosives/Towed to reef	$110,573.50	$0.00
	07/25/02	High Island-A-313 Reef	3-pile jacket	Explosives/Towed to reef	$80,237.50	$0.00
	08/11/02	High Island-A-497 Reef	4-pile jacket	Mechanical Cut/ Partial Removal	$260,840.00	$20,000.00
	08/16/02	High Island-A-271 Reef	4-pile jacket	Mechanical Cut/ Topple in place	$178,634.00	$20,000.00
	08/24/02	High Island-A-313 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$259,240.00	$20,000.00
	09/20/02	High Island-A-349 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$326,176.00	$20,000.00
	10/13/02	High Island-A-330 Reef	8-pile jacket	Mechanical Cut/ Partial Removal	$342,188.00	$20,000.00
	11/25/02	Matagorda Island-A-7 Reef	4-pile jacket	Mechanical Cut/ Partial Removal	$312,750.00	$20,000.00
Total Donation Amount					**$2,088,468.00**	**$120,000.00**
Grand Total					**$8,551,026.00**	**$643,300.00**

Appendix B. Texas Artificial Reef Program Advisory Committee members.

Artificial Reef Advisory Committee
2003

Objective: This Committee was created for the purpose of advising the Department on implementation of the Texas Artificial Reef Plan.

Authority: Advisory authority only, originally authorized by Chapter 89, Parks and Wildlife Code. Subsequent to the adoption of the Artificial Reef Plan, the Parks and Wildlife Commission reauthorized the formation of the Committee.

Committee Members: The 9-member Committee is composed of persons interested in the development of the artificial reef potential off Texas. All members are appointed by and serve at the will of the Parks and Wildlife Commission Chairman.

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Appendix C. Special conditions for the General Permit Zone of the High Islands Area in the Gulf of Mexico. Agreement between TPWD and the US Army Corp of Engineers. (Sheets 1-2 shown; sheets 3-5 are maps of the particular reef site within the General Permit Area).

SPECIAL CONDITIONS FOR GENERAL PERMIT 19942 FOR ARTIFICIAL REEFS PLACED IN HIGH ISLAND. SPONSOR, TEXAS PARKS AND WILDLIFE
March 19, 1999 (revised April 15, 1999)

1. No sites will be placed within 3 statute miles of pre-existing artificial reef sites. One exception to this condition may be artificial reefs that are privately owned due to "blow-outs", which may not allow these structures to be accepted into the Artificial Reef Program (i.e. Topper III, owned by Mobil, COE permit #11860 in High Island A-471).

2. No sites shall be placed within one half nautical mile from any designated natural reef sites including Claypile, Stetson, and East and West Flower Garden Banks.

3. No sites shall be placed within 2 nautical miles of the Safety Fairways.

4. No sites shall be placed within 1000-ft of active or out of service pipelines. No reef materials or anchors associated with reef construction activities shall be placed on top of active, out of service, or abandoned lines.

5. All material(s) to be placed on the reef(s) is(are) to be selected to avoid/minimize movement of reef materials caused by sea conditions or currents and is(are) to be clean and free of asphalt, creosote, petroleum, other hydrocarbons, toxic residues, loose, free floating material, or other deleterious substances. Such materials may be inspected by the Corps or their designee prior to placement.

6. The permittee shall maintain a minimum vertical clearance above the reef that is no less than that shown in the drawings attached to, and made a part of the authorization granted. No material shall be placed outside the bounds of the designated reef areas.

7. No artificial reefs shall be authorized by this permit which would, in the opinion of the Corps of Engineers, constitute a hazard to/from shipping interests, general navigation, and/or military restricted zones.

8. No authorization shall be given until all necessary local, state, or Federal agency authorizations are granted.

9. Marking of the reef when applicable, shall be in accordance with the U.S. Coast Guard requirements.

10. No authorization is granted by this permit for the construction of artificial reefs on significant submerged beds of sea grasses, macro-algae, coral reefs, live bottom (areas supporting dense growth of sponges, sea fans, soft corals, and other sessile micro-invertebrates generally associated with rock outcrops), or live oyster reefs.

11. No work shall be performed until notification is given to the owner (lease holder) or operator of any marked utilities or structures in the block or adjacent blocks where the reef is

to be located.

12. If the issuance of authorization under this permit is found or suspected of affecting the continued existence of an endangered species, the activity will not be authorized by this general permit, and an individual permit will be required.

13. No fish attractors shall be authorized by this permit to be placed at artificial reef sites, which are authorized under the General Permit to the TPWD, in accordance to the guidelines stated in the 1990 Texas Artificial Reef Plan.

Requests for Authorization Under the General Permit: In order to be authorized by this General Permit, the Texas Parks and Wildlife Department (TPWD) is required to submit to the District Engineer, in writing, the following information:

a. State the number of the general permit under which the work is to be conducted.

b. Statement that the work will be conducted in compliance with terms and conditions of this General Permit.

c. Location map showing the proposed reef site.

d. Location coordinates using the Texas State Plane Coordinate System for horizontal control and the mean low tide for vertical control shall be depicted in the plans.

e. Name, address, and Telephone number of persons applying for authorization.

Upon receipt of this information, the District Engineer will advise TPWD in writing that the work is authorized under the General Permit, or will request additional information, if needed, or will advise that the proposed activity will require a separate permit.