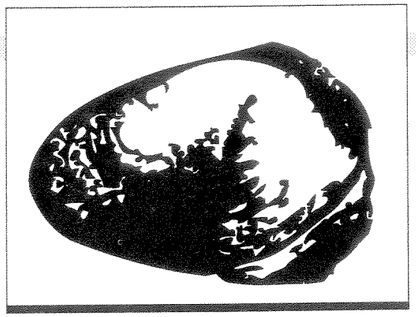
Galveston Bay Oysters

The Bay's Water Filtration System

The mixing of freshwater and saltwater that makes up an estuary produces an environment that is conducive to oyster production. Besides their importance as a commercial fishery resource, oysters play an important part in the Galveston Bay ecosystem.



American oysters (*Crassostrea virginica*) are bottom-dwelling invertebrates that create reef habitat utilized by other estuarine animals, such as mussels, other shellfish, finfish and birds. Unlike a coral reef ecosystem, which can lose several species of coral and still survive, the oyster reef ecosystem will collapse without a healthy population of oysters. Oysters also have a valuable ecological role as filter-feeders. An oyster can pump seven to ten gallons of water through its body in one hour—that's about 1,500 times the volume of its body! As it pumps water, it filters nutrients from the water in order to nourish itself. A large, healthy oyster population can filter large volumes of water and influence water clarity throughout the Bay.

Where Oysters Live

The Galveston Bay system is ideally suited for oyster production. Oysters survive best in habitats that provide a firm ***substrate*** (underlying layer or substance) for attachment, good water circulation and suitable water temperature and ***salinity*** (saltiness of the water), conditions that are all present in Galveston Bay. Water currents fast enough to exchange the water volume above a reef three times per hour provide the best source of food for oysters.

The ***hydrology*** (flow of water) of the system is driven by river inflow and saltwater exchange through three passes to the Gulf. The Trinity River provides the major portion of freshwater inflow (more than half), supplemented by inflows from the San Jacinto River and numerous smaller streams and bayous around the system. These freshwater inflows maintain the proper salinity balance necessary for a successful oyster crop.

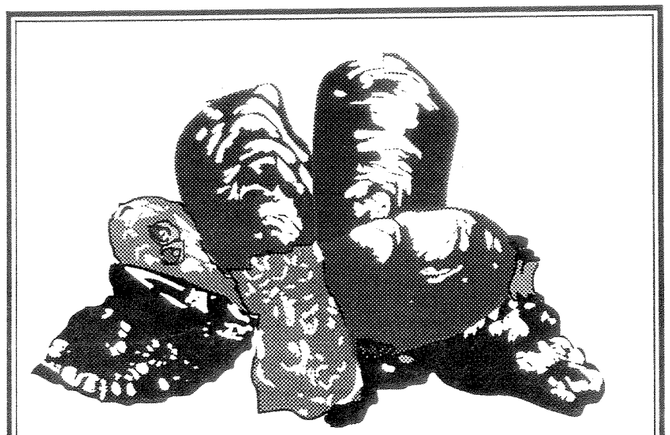
Bolivar Roads Pass (Galveston entrance to the Bay) is the major source of salt water exchange from Gulf to Bay, influencing Galveston and Trinity Bay, and parts of East and West Bays. San Luis Pass provides exchange for West, Chocolate, Bastrop, and Christmas Bays, while Rollover Pass influences upper East Bay. The Texas City Dike restricts freshwater inflow circulation to West Bay.

Oyster reefs are found in most areas of the system, with the largest complex of productive reefs in middle Galveston Bay. Reef configuration may vary with location. Most major reefs in Galveston Bay have been described as long and relatively narrow. They are usually orientated with the long axis perpendicular to prevailing water currents. A notable exception was Redfish Island, labeled as Redfish Bar on older maps, and appearing as a string of small islands from Eagle Point to Smith Point. Early scientific descriptions describe this reef as a barrier to water flow, dividing the Bay into an upper, fresh portion and a lower, saltier portion. After 1872, when work to breach navigational barriers was begun, sections of the bar disappeared or moved south. The reasons for this migration cannot be verified, but more modern charts show the remnants of the reef more or less parallel to the Houston Ship Channel.

Reef structure varies from thin crusts of oysters over a stiff mud bottom to reefs situated over thick shell deposits rising to three or more feet above bottom. Oysters are found in varying water depths, to thrive in this system. An increase in the amount of predators and disease could follow increased salinities. However, the salt wedge may be balanced by increased freshwater flows down the San Jacinto River. Any siltation associated with dredging could also be detrimental unless careful planning and coordination is implemented.

Domestic sewage pollution in Bay areas has remained consistent during recent years, resulting in permanent closures along most of the shoreline areas of the Bay. Continued attention to waste treatment facilities is needed to reduce this type of pollution.

Other threats to a healthy oyster population include increased contamination from pesticides, heavy metals and chemicals. Because oysters can **bioaccumulate** (concentrate in tissues) some pollutants, they are an important indicator species for determining the health of the Bay.



Oyster Community

Oyster Harvest

Since the late 1950's, Galveston Bay has produced about 80% of the oysters harvested in Texas bays. Harvests have fluctuated from 43,000 pounds of oyster meat valued at $66,788 in 1979 to almost 7 million pounds valued at $9.9 million in 1983. The average annual harvest during this period was 2.2 million pounds of oyster meat, with an average value of $3.3 million. The majority of this harvest has been taken from the Redfish complex in Galveston Bay.

Another source of oyster production comes from private leases in Galveston Bay. In 1995 there were 43 leases, with 2,322 acres of Bay bottom leased. All leases are located in Galveston and East Bays. Oyster leasing is based on the premise of moving oysters from reefs designated by the TDH as polluted to leases in approved waters. Unlike organic and inorganic chemicals (such as heavy metals and dioxins) that can bioaccumulate in tissue, bacterial contaminants do not bioaccumulate. Oysters affected by bacterial contamination can flush the pathogens out of their systems and be safe to eat in fourteen days, after which they can legally be harvested for consumption. The TPWD issues transplant permits between May and October and no transplanting is permitted during the open oyster season, November through April. Lease production has ranged from 38,300 pounds of oyster meat in 1979 to about 1.5 million pounds in 1986, with the average harvest being 0.66 million pounds since 1978.

There is some recreational harvest of oysters each year, ranging from collecting oysters by hand on reefs accessible by low tides to use of sport oyster dredges pulled by boats. No accurate records of the recreational fishery exists. Because many reefs close to shore are classified as polluted, or closed, citizens harvesting oysters for their own use should first obtain oyster closure maps and a license from their local TP&W office. Maps can also be requested from the Texas Department of Health Seafood Office in Austin by calling (512)719-0215.

Recreational sportfishing is often centered around oyster reefs, a rich assemblage of marine life which attracts larger predators. These species include spotted seatrout, red drum, black drum, croaker and flounder, which are sought by most boat fishermen, thereby placing another value on the oyster reefs in the Bay.

This fact sheet is one of a series produced through a cooperative agreement between the Galveston Bay Foundation and the U.S. Fish and Wildlife Service. The information in this series was developed by authors from the Galveston Bay Foundation, National Marine Fisheries Service, Sea Grant College Program, Texas Natural Resource Conservation Commission, Texas Parks and Wildlife Department, Texas Water Development Board and the U.S. Fish and Wildlife Service.

The Galveston Bay Foundation is a nonprofit organization whose mission is to preserve and enhance the Bay for its multiple uses through education, conservation, research and advocacy. The mission of the U.S. Fish and Wildlife Service is to conserve, protect and enhance the nation's fish and wildlife and their habitats for the continuing benefit of the American people.

For more information, contact the Galveston Bay Foundation at 17324-A Highway 3; Webster, Texas 77598, or call 713/332-3381.

including intertidal zones occasionally exposed by low tides and on slopes of navigation channels in excess of twenty-foot depths.

Galveston Bay had 7,526 acres of surveyed oyster reefs in 1976, the majority of which were located in Galveston and East Bays. A 1994 study indicated nearly twice that area, 14,210 acres (not including West Bay). This increase can be attributed to several factors. While some new reef may have been created in the past twenty years, it is likely that better technology allowing more extensive mapping has resulted in better documentation, rather than more reefs. Working oystermen indicate that very little loss of previously-mapped reef has occurred over the past 20 years.

Specific areas of increase include open Bay reaches of the Houston Ship Channel, the southern edge of Redfish Bar, the Bull Hill extension of the Hannah Reef tract, and in the Dickinson embayment.

Despite this increase, losses have occurred in three concentrated areas: along the southern shore of Trinity Bay, in the Mattie B./Tom Tom Reef area located at the northern end of the Hanna Reef complex, and in the inner portion of the Clear Lake embayment.

Salinity and Oysters

One vital component of oyster habitat is the salinity of the water in which the reef is located. Oyster reefs form in areas of favorable salinity regimes. Fresh water ranges from 0 to one or two parts per thousand (ppt). Seawater is generally about 35 ppt. Salinities in Galveston Bay typically range from 0 ppt near freshwater inlets to 25 or 30 ppt near Bolivar Roads and San Luis Pass. Oysters do well in salinities of 10-20 ppt, which explains why they thrive in certain areas of the Bay.

Oysters start life as free-swimming larvae that must locate hard substrate (usually existing oyster shell) on which to attach. Once attached, the young oysters are called ***spat***. Salinities ranging from 17-24 ppt are favorable for **spat setting** (attaching to a reef and establishing shell growth). Waters below 8 ppt have poor spat survival.

Mature oysters often die when salinities fall below 5 ppt for extended periods. Prolonged flooding occasionally causes oyster mortality in Galveston, Trinity and East Bays. Temperature is a factor during periods of low salinities as oysters have higher survival rates during lower temperatures than during high temperatures.

Before reservoirs and dams were constructed on Texas rivers, large floods passed through the Bay rather quickly, minimizing the period of time oysters were exposed to lower salinity (called a ***freshet***). Oyster populations could bounce back rapidly after a freshet. Reservoirs extend the length of time the salinity is reduced. Longer floods are more destructive than quickly passing freshets.

Not only is salinity important in maintaining good populations of oysters, it is also an important factor for oyster diseases and predators. The primary oyster disease in Galveston Bay is a protozoan parasite commonly referred to as **Dermo** (*Perkinsus marinus*). It tends to flourish during periods of high salinities (21-25 ppt) and affects larger oysters more than smaller ones. It can kill up to 50% of the oysters in the Bay, annually. **The southern oyster drill** (*Thais haemastoma*) is a predatory snail that drills into shells to eat soft oyster tissue. The oyster drill is probably the most serious predator of oysters, and like Dermo, prefers a higher saline environment, exceeding 15 ppt. It is more prevalent on Half Moon Reef and other high-salinity reefs along the ship channel. One desirable effect of periodic freshwater flushing is to create conditions inhospitable to these organisms.

Oyster Management

Oyster fishery management is conducted by the Texas Parks & Wildlife Department (TPWD). Systematic sampling is carried out on reef areas each month to provide status and trend information. This data has been collected since the mid-1970's and is used to evaluate oyster populations. Landing data from the commercial fishery is collected by monthly reporting, and it is also used to evaluate the size of the oyster fishery in order to make management decisions.

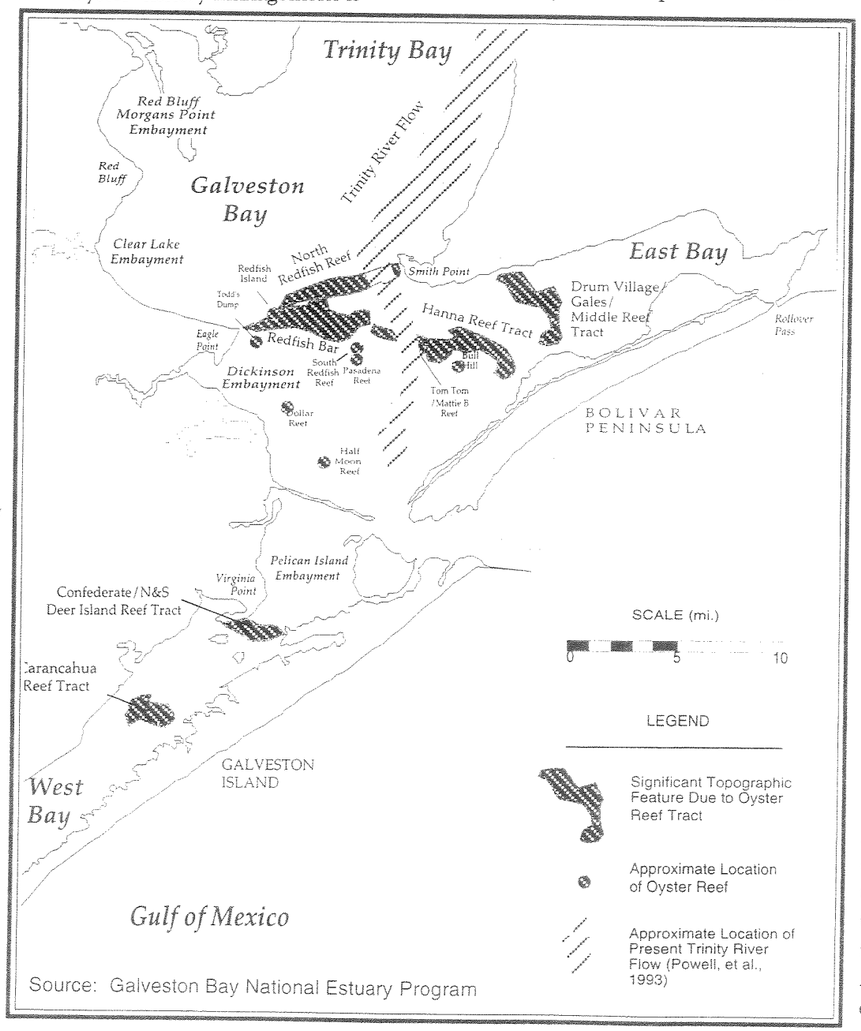
The Texas Department of Health (TDH) conducts regular sanitary surveys of those portions of the watershed which affect shellfish growing areas in the Bay. Pollution sources are tracked according to Texas Natural Resource Conservation Commission (TNRCC) discharge permits, shoreline surveys, and water sampling. This ***detailed pollution source survey*** determines the type, quantities and known discharge points of all pollution.

There are three classifications used by the TDH for oyster beds. An ***approved*** oyster bed meets or exceeds minimum standards on a consistent basis over an extended period of time under all but very unusual conditions. A ***conditionally approved*** area is one where pollution sources and the conditions that cause pollution (such as flood runoff) are known. A management plan is drawn up for the area, and a set of conditions that is easily predictable or easily monitored (like a certain amount of rainfall) is determined. When those conditions occur, the area is automatically closed. A ***restricted*** designation means that the area does not meet the standards for shellfish consumption by humans. Currently, 73% of the surveyed reefs in Galveston Bay (5913.8 acres) are in waters classified by TDH as approved or conditionally approved, with 27% (1612.9 acres) in closed or restricted areas.

Another aspect of management included construction of oyster reefs during the mudshell dredging of the 1950/60's. As early as 1916, oyster shell was in demand for manufacture of such products as cement, poultry feed supplements, plaster, mortar, and for road-building. By World War II, reef shell had become a basic raw material for a major component of the growing chemical industry in the Galveston Bay area, and was used for dry ice production, paper manufacturing and magnesium refining. As concern mounted about the environmental impacts of ever-increasing dredging, regulations were imposed to limit dredging near living reefs. A small portion of the shell removed was dedicated to new reef construction. Most of the reefs built during this period are viable and producing oysters today.

During two periods, 1980 and 1991, oyster shell was purchased for rehabilitating depleted reefs. The shell was spread on the reef in a thin layer immediately prior to the expected spawning season. The clean shell served to enhance spat setting and recovery of the reef areas.

An experimental program to create oyster reefs from coal combustion by-products was begun in 1988 by Houston Lighting & Power Co. (HL&P). Fly ash from the smokestacks of power plants was collected and pressed into ping-pong ball-sized pellets, and spread on the Bay bottom. Initially, five small reefs were constructed in areas of varying salinity, from upper Trinity Bay to lower West Bay. Except for the Trinity Bay reef, which was in virtually fresh water, all are still producing oysters. Two larger-scale reefs have since been constructed. In 1992, a 1.25-acre reef was constructed at the northern end of April Fool Reef off San Leon, and in 1993 a five-acre reef was constructed at the north end of Redfish Bar.



Source: Galveston Bay National Estuary Program

Threats to Oysters

There are other concerns as to serious threats to oyster populations in Galveston Bay. Of long concern has been the proposed deepening and widening of the Houston Ship Channel. Increased salinities caused by the deeper saltwater wedge moving upstream from the Gulf would alter historical salinity patterns that have allowed oysters