the Governor's Oyster Council

RESTORATION & RESILIENCY

FINAL REPORT

JUNE 2015

Chapter 4

Oysters in the Environment Committee

Scope

The Oysters in the Environment Committee's scope is to improve, restore and enlarge Mississippi's Oyster Resources, enhance water quality in growing and harvesting areas, create habitat and develop a long-term resource management plan geared toward increasing the oyster population for environmental, social and economic benefits.

Goal

The Committee's goal is to increase the quantity and quality of Oyster Resources for habitat creation, for environmental benefits, and for production and consumption. The Committee identified environmental threats impacting oysters and then proposed solutions to address the identified threats. Solutions were then prioritized.

Challenges Facing the Oyster Industry

Environmental factors impacting oysters include acute and chronic impacts and consist of a complex set of natural and manmade challenges. The Committee organized and divided these challenges into the following four threat categories or Threats to Success:

- Insufficient fresh water quantity.
- Impaired water quality.
- Limited suitable substrate.
- Existence of negative non-environmental factors.

The Four Threats to Success

The Mississippi Gulf Coast environment encompasses an extensive, integrated array of ecosystems, habitats, and natural resources, which provide recreational and commercial opportunities for residents and visitors. Mississippi's coastal and marine environment extends from the intertidal to the oceanic zones including estuaries, coastal streams, bays, the Mississippi Sound, barrier islands, beaches, intertidal ecosystems, tidal and freshwater wetlands, and benthic environments. These habitats are rich sanctuaries of biodiversity and can influence the development and success of Oyster Resources.

These habitats exist as the cultural fabric connecting the Mississippi Gulf Coast - economically, environmentally, and socially. Simply put, the preservation and enhancement of the coastal environment is necessary to preserving the way of life in coastal Mississippi. Mississippi's abundant water resources, and the natural ecological systems connected by them, underpin virtually all facets of life on the Gulf Coast. For long term resiliency, this Committee believes stakeholders have a duty to encourage and promote thriving habitats, such as the barrier islands and coastal marshes. At the same time, a plan should be put forth to improve and re-establish under-performing habitats. Repaired, resilient coastal habitats contribute to a healthy environment, protect coastal communities, provide a line of defense against powerful storms, and preserve a high quality of life.

To achieve success, the Committee identified threats to oyster habitat and production and determined the root causes of the threats. From there, the Committee explored solutions to address each root cause. Finally, the Committee outlined goals and solutions and prioritized the solutions. Four matrices developed for the threats can be used as reference guides

for the Committee's chapter of the Report. (See Appendices III through VI.)

Threat to Success - Insufficient Fresh Water Quantity

Oysters require an aquatic environment of favorable tides, currents, and freshwater inflow. Oysters thrive in areas where they can be protected from full ocean salinity and fed by fresh water from rivers, streams, or bayous. Appropriate salinity levels are necessary for the oyster to survive predation and disease. Over the course of time, the flow of freshwater into and across the Mississippi Sound has been altered, contributing to lower production and survival in historical oyster reef areas.

Contributing factors to insufficient water quantity include the following:

- Alterations in the amount of and natural fluctuation in freshwater inflow.
- Lack of freshwater retention.
- Saltwater intrusion.
- Incomplete knowledge of controlling ecological factors.

Each of these contributing factors exists through a series of root causes, which can overlap at times. The altered amount of freshwater flow across and into the Mississippi Sound was likely caused by and is exacerbated by the creation of dams and other structures upland, water removal for human use (residential, commercial, and industrial), and channelization.

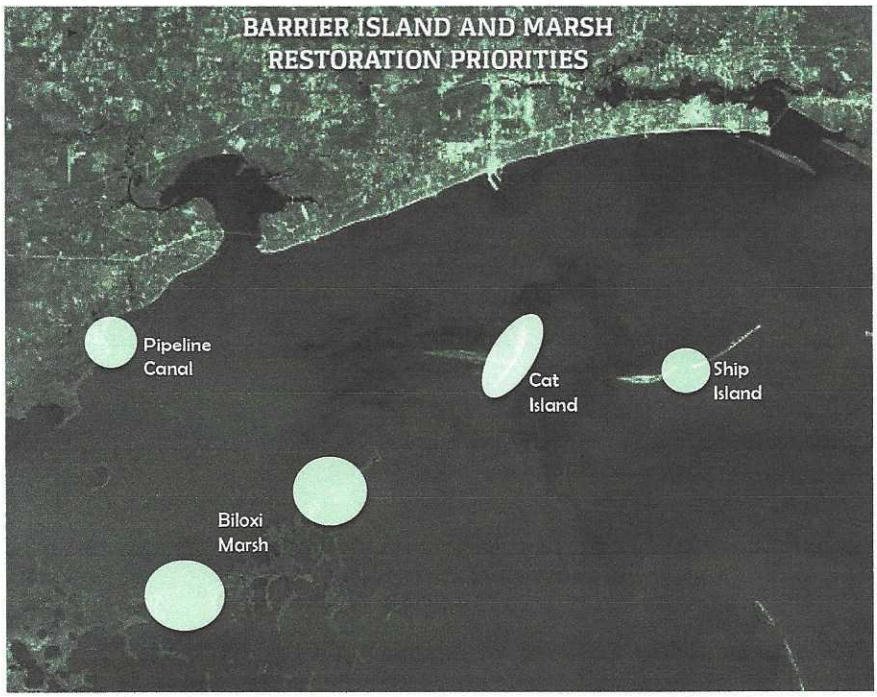
Lack of fresh water retention is the inability of the Mississippi Sound to maintain freshwater levels near shore or oyster habitats. Saltwater intrusion is the encroachment of high salinity water closer to shore and further into rivers and streams. The lack of freshwater retention and the increase in saltwater intrusion are factors caused by the reduction in the amount of wetlands and barrier island erosion. Barrier island erosion and the deepening of navigation channels contributes to increased salinity levels in the Mississippi Sound.

Another threat to water quantity is the lack of knowledge about how BMPs affect the ecological fabric of the coastal environment. Enhanced monitoring and assessment, as well as hydrological model development, are solutions to be considered.

Water Quantity Recommendations for Action or Research

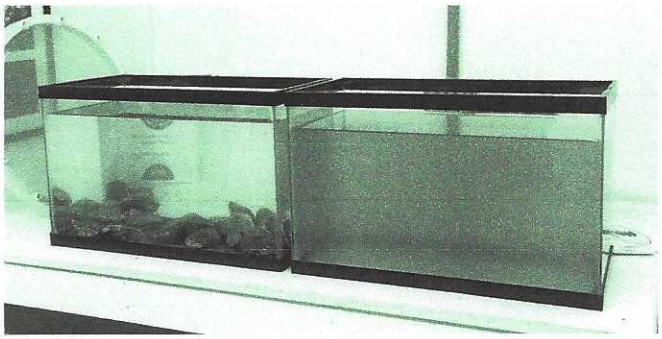
- Continue barrier island restoration.
  - » Ship Island, Chandeleur Island, Three Mile Pass, Nine Mile Pass.
  - » Utilize strategic placement of sediment from navigation channel dredging between islands.
- Create additional marsh and habitat.
  - » Build living shorelines and natural approaches to shoreline stabilization.
  - » Encourage restoration and green practices.
  - » Evaluate closure of specific canals to allow for marsh restoration.

- Focus land acquisition, conservation, and restoration efforts in historical oyster producing watersheds.
- Commission a regional, integrated watershed management plan.
  - » Implement BMPs.
- Enhance modeling of hydrological patterns and salinity.
- Improve streamside management.
- Discourage freshwater depleting projects and educate decision-makers on impacts of major freshwater-depleting projects.



Threat to Success - Impaired Water Quality

Water quality is key to healthy and vital ecosystems and habitats in the Gulf that support fish, shellfish, aquatic vegetation, wetlands, and birds. Water quality is fundamental for a healthy, resilient Gulf and is threatened by various impairments which vary greatly from one-time events such as major storms to the continuous effects from upstream land use. Though water quality impairment can have a negative impact on oyster production and harvest, the reverse also holds true.



Threats to water quality include:

- General impairment.
- Non-point source pollution.
- Point source pollution.
- Vessel discharges.
- Ocean acidification.

General Impairment of Water Quality

General impairments to water quality include acute stressors and chronic stressors. Acute stressors impacting water quality consist of events such as hurricanes, oil spills, and bio toxins. Chronic stressors include increased nutrients causing dead zones and eutrophication, increased pathogens, non-point pollution due to changes in land use upstream, and loss of a natural vegetated buffer at the water's edge.

The Committee identified the following goals to mitigate the acute and chronic stressors causing general impairment of water quality:

- Establish more resilient and sustainable policies to reduce the frequency of oil spills and to better prepare for and recover from weather-related events.
- Reduce nutrients loading.
- Remove or repair leaking septic systems.
- Reduce sedimentation.
- Increase vegetated buffers and green infrastructure.
- Encourage stakeholder engagement.

To achieve the above goals, the Committee proposed to explore the following overarching solutions:

- Promote resilient practices and policies including more resilient marinas, resilient ports, and resilient communities.

- Adopt hazard mitigation plans and pollution prevention plans to focus on protection of natural resources (oyster beds) in the event of storms.
  - » Focus on implementing sustainable practices and eliminating the source of potential pollution before any storm event.
  - » Suggested uses include shut-down pumps, portable bathroom facilities, securing industrial sites, and securing storm-resistant shelters for oils, chemicals, and products used at maintenance facilities, municipal barns, and other structures.
- Provide incentives to reduce nitrogen and phosphorus and other nutrients at both the industrial and municipal levels.
- Increase coordination for permitting and inspecting septic systems among Mississippi State Department of Health ("MDOH"), MDMR, and Mississippi Department of Environmental Quality ("MDEQ").
- Promote green infrastructure throughout the watershed.
- Encourage living shorelines and natural approaches to shoreline stabilization.
- Address socio-science connections.
- Increase public outreach with translators at meetings.

Point Source and Non-Point Source Pollution

The Committee identified contributing factors of point source and non-point source pollution. Point source pollution is water pollution that comes from a single point, such as the discharge pipe from a wastewater treatment facility. Non-point source pollution is water pollution discharged over a wide area – such as roadway runoff – not from one specific point. The root causes of point source pollution are industrial, municipal wastewater systems, and mouth-of-river discharges into the Mississippi Sound. Non-point source pollution originates from storm water runoff from parking lots, roads, and lawns, as well as land disturbance activities such as construction, failing onsite wastewater systems, and wildlife.

The Committee identified the following goals to mitigate the cause or impact of point source and non-point source pollution of water:

- Reduce nitrogen and phosphorus and other nutrients.
- Reduce oil and grease.
- Reduce sedimentation and turbidity.
- Reduce heavy metals.
- Reduce pathogens, viruses, and harmful bacteria.
- Reduce harmful algal blooms.

To achieve the above goals, the Committee proposes to explore the following overarching solutions:

Non-point Source Pollution

- Identify and evaluate through sanitary and shoreline surveys all actual or potential pollution sources that may impact the classification of shellfish growing areas (required in ISSC Model Ordinance and conducted by MDMR).
  - » Recommend routine surveys and share findings with MDEQ and other coordinating agencies.
  - » Prioritize according to the extent of their potential impact on the area classification or potential threat to product safety.
  - » Contact responsible person or governing (regulatory) authority for the actual or potential pollution source to rectify the problem.
  - » Strengthen the communication and the coordination between MDEQ, MDMR, MDOH, and the violator.
- Suggest regulatory and legislative changes to mitigate cause and impact.
- Explore in detail the contaminant of concern and the toxicity levels to humans and to oysters and then consider "treatment" options - relaying, purging, depuration, etc.
- Develop a specific plan to remove storm water drains from beach areas.
  - » Identify a capture or containment system to collect storm water runoff.
  - » Treat storm water and release the clean, fresh water into areas near oyster beds to provide the valuable freshwater resources needed.
  - » Result is two issues addressed:

◊ Reduced non-point source pollution through the elimination of some storm water on coast and provision of clean, fresh water.

- Implement storm water treatment train approach at locations where storm water runoff is adjacent to historic oyster bed areas.
- Improve the communication and outreach to upstream partners.
- Explore existing relationships with United States Department of Agriculture ("USDA"), The Nature Conservancy ("TNC"), MSU Extension Center, etc. to coordinate the outreach message.
- Recommend "One Mississippi" – we are all connected, upstream land use affects downstream resources and downstream water quality impairment affects upstream quality of life issues.
- Demonstrate connectivity.... positive changes will be beneficial to all.

- Offer incentives to reduce non-point and point source pollution.
  - » Example – tax incentives to farmers who reduce nutrients, enact significant irrigation reuse practices, and reduce storm water runoff, etc.
- Development of storm water management plans at the local (city/county) levels.
  - » These plans will provide the following:
    - ◊ Focus on prevention versus treatment.
    - ◊ Public education.
    - ◊ Public involvement.
    - ◊ Encourage pollution prevention/good housekeeping at potential storm water sources.
    - ◊ Identify and eliminate illicit discharges.
    - ◊ Identify construction sites and provide enforcement at the local levels.
    - ◊ Address post-construction storm water runoff.
    - ◊ Implement specific and efficient BMPs depending on storm water source.
- Engage MDOH to monitor and enforce residential wastewater land application discharges and to locate and inspect potential failing systems.
- Either implement repairs of failing systems or connect these to wastewater collection systems.
  - » Develop monitoring plans to evaluate in-streams conditions and identify and prioritize areas of concern.
  - » Examples include the work being done in Rotten Bayou and Turkey Creek.

Point Source Pollution

- Identify and map industrial and municipal National Pollutant Discharge Elimination System point source locations (majors and minors) and receiving waters relative to oyster bed locations.
- Identify the oyster beds in proximity of outfalls and areas with contamination concerns.
  - » Explore the feasibility of re-locating those outfalls to locations of no potential impact.
  - » Propose special evaluation or monitoring of these outfalls where it does not currently exist, and assess level of potential contamination to oyster beds.
- Based on bacteria data and sanitary surveys, identify those beds that are classified:
  - » Approved.
  - » Conditionally approved.
  - » Restricted.
  - » Conditionally restricted.
  - » Prohibited.
- Establish water quality monitoring stations at the mouth of all river discharges into the Mississippi Sound to evaluate any and all potential pollutants entering the Mississippi Sound.
  - » Identify those inflows with gauging stations and continuous monitoring stations and use this information to assess water quality.
- For Municipal Separate Storm Sewer System ("MS4") permitted entities:
  - » Require inspections.
  - » Adopt Model Ordinance.
  - » Identify clear enforceable actions.
  - » Identify clear line of communication.

» Prepare handouts or develop stakeholder engagement campaign.

Other contributing factors identified by the Committee are vessel discharges of onboard wastewater, fuel, or cargo spills, and ocean acidification. The overarching solutions to address these threats follow:

Vessel Discharges

- Evaluate the current laws in place that address onboard wastewater discharges.
- Identify problem areas of onboard wastewater discharges, for example, fish camps.
- Engage United States Coast Guard ("USCG") to monitor and enforce laws.
- Explore Clean Water Act ("CWA") Section 312 that allows states to designate waters as "no-discharge zone" for vessel sewage discharges, especially in sensitive shellfish areas.
- Explore mandatory marine sanitation services on all vessels of a certain length or greater.
- Encourage the Resilient Marina Program – resilient and clean marinas can be certified, i.e., recognized for providing services such as free and convenient pump-out facilities.
- Develop a stakeholder engagement campaign.
- Educate and engage the public to report fuel/ cargo spills and environmental incidents to the National Response Center (1-800-424-8802).
  - » Rapid and efficient response is the best tool to combat spills.

Ocean Acidification and Hypoxia

- Develop and implement monitoring program.
- Review current literature and develop BMPs for handling future events.

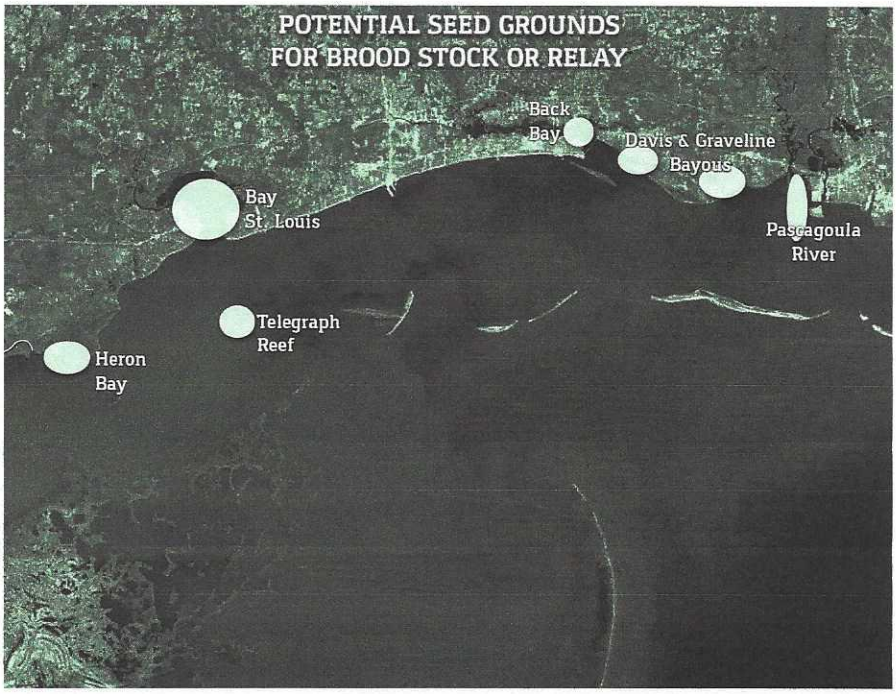
Water Quality Recommendations for Action or Research

Once the overarching solutions to address each specific threat to water quality were established, the Committee prioritized the solutions as follows:

- Play detective for each water body -- use "fingerprinting" to identify contaminants.
  - » Research if impairment exists.
  - » Link to cause.
  - » Research trends.
  - » Identify solutions.
- Target at-risk areas and areas for potential for harvesting and employ location-specific remedies to address identified water quality concerns.
  - » Classify areas.
  - » Use hydrographic studies including bacterial source tracking.
  - » Continue research and water quality monitoring, improvement of technology, and fingerprinting of pathogens.
  - » Continue to gather data at weather stations.
- Storm water management.
  - » Give enforcement grants for storm water management plans at local level.
  - » Eliminate untreated storm water drains on Coast.
    - ◊ Collect.
    - ◊ Treat.
    - ◊ Release.
  - » Manage upstream storm water.
  - » Reduce point and non-point source pollution.
  - » Promote living shorelines and green infrastructure practices.
  - » Establish oyster farming projects using students and baskets.
  - » Utilize storm water BMPs or "treatment train" approach adjacent to oyster habitat.
  - » Consolidate and treat storm water prior to discharge.
  - » Conduct storm drain and septic system inspections.
- Education and Outreach.
  - » Create points of interests for tourists numbered with Oyster Information/Oyster Stewardship Program/Oyster farming projects/Prohibit Live-Aboards/ Use Pump-Out Stations, and No Dumping, etc.

- Require resilient practices at marinas, ports, industrial facilities, and communities.
- Continue coordination of MDOH, MDMR, and MDEQ efforts.
- Develop Regional Oyster Restoration, Enhancement, and Expansion for Sustainability ("REEFS") Plan with a systems approach focused on sustainability. The REEFS Plan recommendations are as follows:
  - » Link historic oyster bed areas to specific threats. The Committee recommends beginning with the identification and investigation of threats for individual historic areas such as Biloxi Bay, Graveline Bayou, Mouth of Pascagoula River, Pass Christian.
  - » Conduct stepwise and routine habitat and bottom mapping.
  - » Link waterbody impairment to specific cause(s).
    - ◊ "Fingerprint" fecal coliform.
    - ◊ Investigate emergency contaminants of concern such as pharmaceuticals.
    - ◊ Investigate non-point and point sources of pollutions.
  - » Investigate salinity and flow changes over time through modeling hydrological and salinity patterns.
  - » Expand Coastal Stream Assessment Project to all coastal streams within five years.
  - » Enhance monitoring and assessment.
  - » Develop Integrated Watershed Management Plans.
  - » Continue to focus on barrier island restoration and coastal marsh restoration.
  - » Encourage aggressive storm water management and treatment – treatment "train" approach.
  - » Promote living shorelines and green infrastructure.
  - » Increase stakeholder engagement and outreach.

- The following areas are recommended as project priority areas:
  - » Biloxi Bay.
  - » Bay of St. Louis.
  - » Graveline Bayou.
  - » Off Mouth of Pascagoula River.
  - » Henderson Point.
  - » Grand Bay NERR.



Threats to Success - Limited Suitable Substrate

Oyster reefs require hard bottom habitat and exist through an accumulation of live oysters, shell and other suitable substrate on which oysters can affix. Reefs grow by having generations of oysters reproduce and grow in one place over time. Natural oyster reefs consist of shell on hard bottom, and reefs can be created by cultch planting (shell, concrete or limestone) on hard bottom. Areas within the Mississippi Sound offer ideal aquatic conditions to encourage oyster production and survival; however,

many of these areas do not have the water bottom characteristics necessary to support an oyster reef. As such, the Committee recognized limited suitable substrate is a threat to success of greater oyster production in Mississippi.

The Committee divided the threats and associated root causes to limited suitable substrate as follows:

- Lack of data regarding resource quantity, location and delineation.
  - » Insufficient planning for future reef expansions by sediment type.
  - » Lack of sufficient benthic habitat mapping.
- Change in substrate over time, affecting suitability for oyster production.
  - » Caused by sediment contamination, accretion, and scouring.
- Substrate removal or disturbance.
  - » Harvesting or over-harvesting.
  - » Dredging.
  - » Shrimping.
- Improper or inefficient reef restoration methods.
  - » Use of ineffective substrate material.
  - » Lack of availability of effective materials (shell).
  - » Inadequate cost-benefit analysis.
- Ocean acidification and hypoxia in areas with otherwise suitable substrate.

Suitable Substrate Recommendations for Action or Research

Lack of Data Regarding Resource Quantity, Location and Delineation

- Develop, fund, and implement a comprehensive habitat mapping plan, which includes routine mapping, sediment sampling, and analysis of rates of deposition and erosion.
- Take stepwise approach for localized to coast-wide habitat mapping.
  - » Start mapping program of historical reef areas and expand outward to delineate bottom characteristics.
- Create substrate suitability maps using Habitat Suitability Indices ("HIS") informed by surveys.
  - » Determine substrate type/mixture via penetrometer.
  - » Analyze sediment core, including temperature, salinity, dissolved oxygen, and particulate organic carbon.
- Include depositional rates (and characteristics of deposited sediments - linked to sediment contamination, accretion, and scouring below) for sediment source identification and threat to suitability.

Change in Substrate over Time, Affecting Suitability for Oyster Production

- Conduct routine or event-specific habitat mapping and accompanying sediment sampling to characterize geochemical properties.
- Deploy scouring plates on legacy reefs (and new cultch) to assess intensity of sloughing/scouring.
  - » Relate to experimentation of spat settlement in flume tanks.
- Analyze suspended sediment/detritus versus spat settlement rates in legacy reef and cultch areas.
  - » Include periodic toxicity assessments.

Substrate Removal or Disturbance

- Consider adoption of a Shell Budget Model or other no-net change model to manage the annual harvest more sustainably.
- Develop a Shell Recycling Program.
- Assess fishing impacts on reefs to include substrate removal and burial.
- Develop/update coastal substrate management plan to maximize retention of shell resources and substrates beneficial for propagation of oyster reefs.
- Assess the direct and indirect effects of sediment contamination, accretion, and scouring on water quality.
- Manage dredging and shrimping practices which affect sediment disturbances.
- Incentivize oyster processors to preserve shell for cultch material.
- Incentivize oyster processors to return live sub-market sized oysters to the reef.

Improper or Inefficient Reef Restoration Methods

- Evaluate literature and review, and conduct field-based experiments to determine optimum cultch material for various bay systems.
  - » Material may be effective, but not ideally located; use HIS maps to inform placement.
- Fund comprehensive cost-benefit analysis.
  - » Perform cost-benefit analysis for available cultch types.
- Create shell retention and shell return requirements.
- Assess experimental reef material.
  - » Explore alternate reef-building materials.

Ocean Acidification and Hypoxia

See Water Quality Subsection regarding Ocean Acidification and Hypoxia.

Threat to Success - Existence of Negative Non-Environmental Factors

Oysters can be impacted by a number of environmental factors as identified by the Committee—insufficient fresh water quantity, impaired water quality, and limited suitable substrate. In addition to the environmental threats, Oyster Resources face numerous non-environmental threats jeopardizing their survival or limiting their ability to thrive.

The contributing factors the Committee determined to be primary and their root causes include:

- User conflicts including homeowners, recreational boaters, commercial fishermen, pipelines, navigation channels, and Federal, state and local entities and uses.
  - » Negative perception by homeowners that Oyster Resource or activities diminish aesthetic values, tourism, or other economic opportunities.
  - » Commerce demands (navigation and pipelines).
  - » Economic development.
  - » Increased populations in coastal zones.
  - » Limited resources or geographic constraints on aquatic habitat, i.e., shrimping grounds and recreational fishing areas versus reef development.
  - » Unintended conflicts such as municipal needs over resource needs.
- Use of improper equipment and harvesting gear due to insufficient instruction, knowledge, or old habits.

  - » Improper use of gear [dredge flipping (basket versus bag), weight, line scope, etc.].
  - » Lack of research on improved methods or impact to the resource.
  - » Gear preferences.
- Conflict of local, regional, or political interests stemming from limited resources and regional perceptions and attitudes.
  - » Limited resources (partitioning resources, geographic resources).
  - » Perception or attitudes.
  - » Lack of cohesive planning for the entire Gulf Coast. Continued turf and political boundaries remain challenging.
  - » Regionalism (Pine Belt, Delta, versus Coastal needs and desires).
  - » Priorities other than for natural resources.
- Regulatory challenges due to often disputed, multi-level regulations.
- Poor management decisions because of industry pressure, resource closures, and conflicting regional interests.
- Lack of environmental regulatory enforcement.
  - » State agencies' lack of enforcement.
  - » Regulations may not have consequences to force compliance.
  - » Perception of accountability (see oil slick, don't see dead oysters).
- Lack of public awareness because of loss of connectivity to the resource.
- Lack of funding.

Non-Environmental Threat Recommendations for Action or Research

User Conflicts

- Education and Outreach.
- Community planning and stakeholder inclusion.
- Zoning regulations to deal with runoff, storm water (retention and detention ponds), and materials.
- Citizen scientist/build a reef as an outreach project (schools, civic groups, etc.)(non-production reef projects/living shoreline).
- Simplify permitting process for neighborhood reefs and fishing structures (oyster reefs).
- Suitability mapping to insure the resources are being utilized in a fair, equitable, and sustainable manner.

Use of Improper Equipment and Harvesting Gear

- Education and outreach for oyster fishermen.
- Research on gear impacts and research to improve gear technology/efficiency.

Conflict of Local, Regional, or Political Interests

- Education and outreach for bigger ecosystem value.
- Community projects (i.e. Adopt a Reef, shell recovery, citizen contributions) (Coast-wide community projects).
- Developing political will and advocacy.

Regulatory Challenges

- Streamlining of regulatory process and procedures.

Poor Management Decisions

- Education about value beyond fishery.
- Move to stock assessment process for the resource.
- Education about larger picture for region as a whole.

Lack of Environmental Regulatory Enforcement

- Education followed by consequence (increasing consequence).
- Enforcement of zoning regulations for point and non-point source pollution.

Lack of Public Awareness

- Stewardship projects (living shoreline, shell recovery projects, etc.).
- Education and outreach (public service announcements, schools, scouts, coastal history, etc.).
- Promotion of green infrastructure, tying benefits to the resource.

Lack of Funding

- Integration of resource stewardship into existing/ future municipal projects (roads, storm water, etc.).
- Consideration of mitigation options.