The State of the Gulf Oyster Workshop

GULF STATES MARINE FISHERIES COMMISSION
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

August 8-9, 2023

The Lodge
Gulf Shores, AL

GSMFC Number 322

The State of the Gulf Oyster Workshop

Gulf States Marine Fisheries Commission • Florida Fish and Wildlife Conservation Commission

The Lodge • Gulf Shores, AL

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August 8 Agenda

- **Welcome and opening remarks** - *Steve VanderKooy* & *Stuart Cumberbatch*
- **Housekeeping** – *Steve VanderKooy*
- **The Current Status of the Gulf Oyster Populations and Fishery** – *All (short 10 minute overviews)*
- **Roundtable**
- **Detail on Individual State Management Practices: Past and Present-** *All*
    - *Topics to consider:*

      Overview of Issues

        1) *Physical production limitations*
        2) *Biologic impedances on production (water quality, new challenges in a changing environment and climate)?*
        3) *Physical destruction to reefs other from human related activities (other than harvest)*
        4) *Insufficient data to conduct a traditional stock assessment*
        5) *Managing for ecosystem services (Shoreline enhancement, Storm impacts, …)*
        6) *Restoration & maintenance of restored (natural areas & reefs)*
        7) *Seed supply priorities*
        8) *Regulation restrictions reducing seed availability*
        9) *Shell recycling programs*

      Working With Industry

        1) *Communication*
        2) *Stakeholder engagement and co-developing solutions*
        3) *Enforcement/Poaching*
        4) *Economic and markets*
        5) *Realistic expectations for the wild fishery?*
        6) *What it takes to have productive oyster populations and fisheries*
        7) *Funding*

- **Louisiana** – Presentation and Discussion
- **Texas** – Presentation and Discussion

August 9 Agenda

- **Alabama** – Presentation and Discussion
- **Mississippi -** Presentation and Discussion
- **Florida** – Presentation and Discussion
- **Roundtable**
- **Wrap up**

The State of the Gulf Oyster Workshop
The Lodge
Gulf Shores, Alabama
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Attendees

Bannon, Scott	ADCNR/Marine Resources Division
Bendick, Robert	The Nature Conservancy
Broussard, Erik	Mississippi Department of Marine Resources
Burgess, Erika	Florida Fish & Wildlife Conservation Commission
Caballero, Robert	Louisiana Department of Wildlife and Fisheries
Cumberbatch, Stuart	Florida Fish & Wildlife Conservation Commission
Davis, Matthew	Florida Fish & Wildlife Conservation Commission
Duke, Ronnie	Delta Coast Consultants, LLC
Ellinor, Dan	Florida Fish & Wildlife Conservation Commission
Gandy, Ryan	Florida Fish & Wildlife Conservation Commission
Grice, Rusty	MASCG - Auburn University
Herrmann, Jason	ADCNR/Marine Resources Division
Hopper, Joshua	Alabama Department of Public Health
Jensen, Christine	Texas Parks & Wildlife Department
Kenworthy, Matt	Florida Fish & Wildlife Conservation Commission
King, Kenneth	Delta Coast Consultants, LLC
McCawley, Jessica	Florida Fish and Wildlife Commission
Pettis, Evan	Texas Parks & Wildlife Department
Resko, Devin	Florida Fish & Wildlife Conservation Commission
Rider, Jason	Mississippi Department of Marine Resources
Sapp, Portia	Florida Department of Agriculture and Consumer Services
Steedley, Nan	Alabama Department of Public Health
Webb, Byron	Alabama Department of Public Health - Seafood Branch

Staff

Donaldson, David	Gulf States Marine Fisheries Commission
Ferrer, Joseph	Gulf States Marine Fisheries Commission
Robertson, Charlie	Gulf States Marine Fisheries Commission
VanderKooy, Steve	Gulf States Marine Fisheries Commission

Day 1 – August 8

Welcome and Opening Remarks

Donaldson and **Ellinor** began by welcoming everyone to the workshop and providing some context for its origin. They highlighted that while the Molluscan Shellfish Subcommittee (MSSC) regularly discusses the status of wild oyster fisheries in each state, they haven't delved into much detail on some of the issues. The Florida Fish and Wildlife Conservation Commission (FWC) is exploring new management options for the Apalachicola Bay on-bottom fishery, as previous approaches seem ineffective. This workshop aims to allow each state to share more comprehensive insights into their past and current tools and methods, as well as their vision for the future of their fisheries. **Ellinor** had proposed the idea of this workshop to be facilitated through the IJF program, similar to the 2022 Flounder Symposium. Each agency was invited to present in-depth information about their oyster

management programs, creating an opportunity for meaningful discussions that aren't feasible during regular MSSC meetings.

Cumberbatch and **VanderKooy** added instructions on microphone usage for Q&A and outlined the plan to produce a comprehensive document summarizing the presentations and discussions. The Commission staff would collaborate with Cumberbatch and the FWC to provide a synthesis of key ideas, common challenges, solutions, and the outlook for oysters in the region.

Participants and audience members introduced themselves, and the session began with each state providing a brief preview of their upcoming presentations. Attendees were encouraged to ask questions and engage with the presenters, with the flexibility to explore tangential ideas, as these can lead to innovative solutions, which is the primary goal of the meeting.

The Current Status of the Gulf Oyster Populations and Fishery

Gulfwide states are struggling to maintain wild oyster harvests. The traditional cultching approaches do not have the responses they had in the past, resulting in poor, inconsistent, or nonexistent wild harvest depending on the state. More costly cultch experiments of larger material size and higher relief are being tried that are supported by abundant disaster and settlement funds. If it weren't for these funds the cost of this is financially unsustainable with revenue from state bag taxes or state licensing funds. These projects are also more expensive than the revenue they generate from landings and their expenditure is no guarantee of success or a sustainable fishery. The approaches being taken by the two largest oyster producing states in the Gulf (Louisiana and Texas) are to actively reduce the number of harvesters of wild oysters through buybacks or attrition in hopes of matching effort to the available resource. However, there is concern that the resource will continue to decline. Out of an abundance of concern the practice of relaying of seed from wild reefs has been stopped in all states due to adverse impacts to source reefs.

Transitioning of the oyster fishery to private aquaculture production has begun in three states (LA, TX and MS) where legislation has been enacted to support the production from on and off bottom aquaculture, as an alternative to wild harvest. The states expressed that the advantages of private leases in lieu of public grounds are that lease programs have proved to increase production (96.7 % of Louisiana oyster harvest and 40% of Galveston Bay harvest); place production in the hands of harvesters who have more control over cultching and seeding to match market demand for timing and smaller size oysters (2" instead of the 3" legal size wild); encourage self-reliant private business; reduce illegal harvest in closed waters; and allow the movement of oyster from leases with good growing conditions but poor water quality to leases with good water quality to depurate prior to sale or save product from adverse water quality conditions; allows selection of highly productive growout areas; and has the ability to rapidly develop or recover from adverse events due to the ~18 month growth from seed to sale.

Oyster fisheries in Gulf Coast states face common challenges related to environmental factors, resource management, and restoration efforts. These challenges have led to innovative management strategies and collaborative approaches to sustain oyster populations and support the oyster harvesting industry. Below are the general trends and common themes observed across Alabama, Texas, Louisiana, Mississippi, and Florida, along with the corresponding management strategies. Each state offered a concise overview of their presentations in preparation for the full discussion by state. We suggest reviewing the presentations along with the associated section for each state to gain a comprehensive understanding of the meeting.

Roundtable

Prior to the workshop, the FWC had circulated a survey via email to gather initial responses to guide the discussions. **Cumberbatch** reviewed the survey results to facilitate the conversation. The top three issues identified by participants as affecting oyster fisheries were 1) environmental/water quality, 2) restoration challenges (recruitment/seed), and 3) reef degradation. **Ellinor** raised the question of whether people and funding might be long-term "resource limitations." The top priorities for restoration, according to participants, were 1) fishery sustainability/industry resilience/oyster density increases, 2) leasing/licensing (privatization), and 3) new management options in general. **Rider** highlighted the need for a common language to compare priorities, as different states use varying terminology for aspects like size classes and "natural" oyster beds.

The survey also inquired about Stakeholder Climate, gauging stakeholder attitudes toward current management and fisheries resources. The majority (50%) of respondents indicated that their stakeholders were unhappy, while 33% were indifferent, and only 17% felt they were supportive. It was noted that all states were involving stakeholders in their current management efforts, including through public meetings, task forces, collaboration in restoration, education, certification programs, and lease programs.

The discussion shifted to funding, exploring potential correlations between funding levels and success. **Ellinor** raised the issue of staff resources as a concern, while **Caballero** noted the numbers for Louisiana didn't reflect the real spending. Some states were reviewing the activities of historic oystermen in light of the fishery's contraction. Finally, a question arose about the potential for the fishery to recover. Four states expressed optimism, while one was less certain. **VanderKooy** clarified that the question pertained to the participants themselves, asking if historic oystermen would return if the resource recovered, or if a new generation of fishermen would be interested. The survey responses would be revisited at the end of the discussions to see if they still aligned with the group's conclusions.

Alabama (AMRD Presentation Link)

Herrmann from Alabama presented an overview of the oyster management situation in the state. Alabama currently has just over 3,000 acres of reefs in state waters, with two agencies responsible for oyster management: the AMRD for harvest and regulation, and the ADPH for reef openings and closures. The AMRD focuses on abundance, stock quality, and enforcement, while the ADPH manages aspects like time/temperature limits, dealer inspections, ISSC compliance, water quality, and location designations.

Commercial oyster landings in Alabama have seen a decline since 2008, with a slight improvement after 2011, but overall, production remained low until 2019 when a slight uptick was observed. Notably, Alabama no longer enforces a summer closure, but landings are still lower compared to pre-2008 levels. Various environmental factors, including hurricanes, droughts, and the Deepwater Horizon oil spill, have impacted the oyster population. For instance, significant rainfall in 2017 led to a drop in dissolved oxygen levels in Mobile Bay.

AMRD assesses oyster reefs through SCUBA quadrat dives to estimate density and potential harvest. Quadrat samples are taken in ten-square-yard increments, and these samples help measure two size classes (legal and sublegal) along with half shells, boxes, and drills. The AMRD also employs a hand dredge and is testing hydraulic patent tongs for spot checking specific areas. **Herrmann** shared results from quadrat samples dating from 2016 to the present, with the first area, Heron Bay, showing the highest production due to extensive planting efforts in 2015. Cedar Point West has experienced declines in all size categories, while Cedar Point East also faces challenges with limited spat or sublegal oysters.

Alabama's oyster management follows a Flexible Harvest Goal, which utilizes the dive quadrat results. Areas with less than one oyster per sample are excluded from the harvest estimate, providing a buffer to protect stock in specific reef sections. Quadrats with one oyster and more contribute to the calculation of the total number of

sacks (180/sack), with an assumption of 100% coverage in an area. This approach allows fishermen to harvest up to 33% of the reef.

Similar to Mississippi, Alabama operates the AMRD Oyster Management Station for monitoring harvest. Alabama has a six-sack limit per day that is based on economics and to keep a low but steady supply of ousters to dealers to prevent gluts and maintain a regular income for fishers. Fishermen check in at the station, depositing their card in a box and picking it up when they return. This system helps determine true effort and ensures the safety of fishermen. Cards left unclaimed trigger welfare checks or searches if necessary. Additionally, a consumer survey is mandatory and helps track oysters, ensuring their safety and quality. A $2.00 fee is charged per sack, with a requirement to return 50% of the shell to the reef. If shell availability diminishes, the fee can be used to purchase cultch. In 2021, Alabama introduced a recreational tag, with 1,177 sacks harvested in 2021 and 562 sacks in 2022. No fishing license is required; the tag serves as the license, and recreational harvesters are exempt from the reshelling fee.

Alabama has implemented a reef grid system to direct oyster harvesting locations, with specific areas closed when target percentages are reached. Biologists are on the water to observe cull boards for the amount of cultch compared to live oysters and when the ratio exceeds 1:1 this can trigger closure. They also monitor daily landings from the check in station via an electronic dashboard and can close the fishery once the target of 33% is reached or may allow fishing to continue if the ratio remains low or diver samples during the season show more oysters than preseason estimates. The grid system was developed in 2020, mapping the entire bay into grid boxes. A smartphone app guides fisherman to approved locations, and enforcement ensures compliance with real-time location tracking. This system aids in resource conservation and ensures accurate reporting.

Regarding oyster restoration, Alabama has regularly planted substantial quantities of cultch in the past, in the more traditional manner of small #4 limestone sprayed from barges at low densities. It was apparent that the cultch is not responding with abundant legal oysters in 1.5 years as it has in the past. The response is patchy and takes up to 7 years to be productive. The reasons given for the high variability response is due to the more frequent increases in predators (drills), freshettes, drought, and hurricanes that impact the reefs and prevent them from responding as they have in the past. Recent years have seen seed planting using less desirable aquaculture seed in protected areas. Seed plantings occurred post-hurricanes Ivan and Katrina and after the Deepwater Horizon spill. However, siltation in 2012 impacted many areas. Recruitment challenges persist due to environmental factors like dissolved oxygen and salinity fluctuations. Experimental techniques, such as remote set projects, are being explored. The AMRD is also investigating new planting areas and experimenting with reef height, hoping to raise the shell out of the hypoxic zone.

Alabama has aligned its restoration plan with NOAA's priorities to restore abundance, resilience, and diversity on reefs. They plan to identify data gaps and needs, focusing on intertidal populations, larval transport modeling, and seasonal flow and hydrology modeling. Finding the balance between population restoration and supporting the harvester population is a key challenge.

Alabama is involved in cooperative projects with groups like The Nature Conservancy to plant non-harvested shoreline oysters for stabilization and reproductive sources. Development has altered the historic source/sink reproductive dynamics in Mobile Bay, emphasizing the need for conservation efforts.

Texas (TPWD Presentation Link)

Jensen from Texas Parks and Wildlife Division (TPWD) gave an overview of the oyster fishery in Texas. Currently, oysters are found in the areas around Sabine, Galveston, Matagorda, San Antonio, and Aransas bays, from north to south. The Texas oyster fishery is second in production to Louisiana with a 30 sack/ day limit (sack = 110 lb) of 3” oysters. Catch is highly variable/inconsistent with many areas being closed for long periods. In the past, Texas

contributed a significant portion of Gulf-wide oyster landings, with Galveston accounting for about 71% of production in the state. However, over the last decade, San Antonio and Aransas bays have seen increased oyster production. TPWD initially started creating leases for oyster harvesting, but a lawsuit determined that only the General Land Office could issue "leases," so TPWD began calling them Certificates of Location instead. Currently, there are 43 of these certificates, each with 15-year terms. The lease cost is adjusted every three years and is presently $23 per acre.

As a result of these certificates, private oyster harvests (leases) contribute to 25% of the total oyster harvest in Texas. These leases remain open year-round, which was intended to reduce illegal harvesting in restricted waters. Leaseholders were initially allowed to legally move oysters from closed areas to their lease areas for depuration through transplanting. However, since 2015, no transplants have been permitted, as the oysters in the restricted reefs haven't been doing well. In some years, leaseholders sold less than they were transplanting, leading to the growth of reefs and cultch but not harvesting, which added to the problem.

In May 2023, the Texas Legislature passed Senate Bill 1032, redefining a "natural reef," eliminating the requirement for renewal to depurate, designating and building oyster conservation zones (as requested by eNGOs), and encouraging more private oyster harvesting in other areas, with a focus on expanding in Galveston and other bays.

TPWD conducts independent sampling using dredges for monitoring, but this is not sufficient for managing by harvest area. Sampling primarily targets more productive areas and neglects known degraded areas. Overall oyster abundance, sampling degraded and productive reefs statewide with 10-30 stratified random dredge samples per bay system per month. Fisheries specific sampling targets productive/fished reefs with ~180 stratified random dredge samples per bay system. This information helps inform fishermen about expected open harvest areas before the season begins and allows for quick closures if the production suggests overfishing. Citations by LE on fishers and fish houses triggers more sampling and can trigger closures. In 2017, TPWD increased penalties for undersized oysters with an allowance of no more than 5% of sublegals or cultch per bag, leading to fewer undersized oysters being harvested.

TPWD employs a version of the Traffic Light Model to assess market size oysters larger than 76mm (3 inches). Areas with low oyster abundance are marked in red, indicating concern. Even in Sabine, where no harvest is allowed, the oyster abundance has declined without any intervention, serving as a control population for comparison with the rest of the state. Galveston has consistently been marked as red, San Antonio Bay saw an increase but then went back to red due to harvesting, and Aransas Bay is doing well, although the reasons for this success are not clear. Aransas Bay serves as a genetic mixing zone between north and south oyster populations.

Texas is facing oyster declines due to fishing, reduced freshwater flow/drought, predators, disease (Dermo), silt from tropical systems, high market demand, habitat destruction (such as Houston Ship Channel dredging), and occasional significant flooding. While Texas was not believed to be limited by oyster larvae, it has plenty of cultch (substrate for oyster attachment). However, there appears to be an increase in black shell compared to brown shell (which is exposed for oyster spat attachment). Galveston used to have more substrate, while Matagorda's cultch has been increasing, although it's lower when considering only brown shell. San Antonio was increasing until recent harvesting reduced it, while Aransas is currently on the rise.

Texas employs a spatial cultch planting tool and extensive mapping and monitoring to manage statewide cultch planting, harvest, and track restoration projects. It was expressed that cultch planting is a large cost to the state and that alternative production methods (leases and Mariculture) are being encouraged. Historically, TPWD lacked funding for cultch planting and relied on donations and disaster funds. There was a $0.20 tag fee

intended for cultch planting, but it was insufficient. Dealers are now required to plant 30% of what they buy from fishermen back into the bays or pay a fee. The cost is based on $72 per yard for cultch, resulting in a new sack fee of $1.32. However, the cost of obtaining cultch has increased to over $200 per yard, while the tag fee has not changed. TPWD invoices the dealers monthly based on trip tickets. Instead of direct payment, dealers have their own contractors to plant the required cultch. However, there isn't a mechanism in place to ensure compliance if dealers fail to plant as required. Nonetheless, most dealers are cooperative. So far, 43,000 yards of cultch have been planted on 53 acres through this program.

TPWD began closing areas based on undersized oysters in 2014 to stop the relay and harvest of seed oysters because of damage to the wild reefs from cultch removal. Texas noted that where seed oysters were removed the reefs were unable to recover. In 2015, they introduced the Traffic Light approach, which included abundance estimates and undersized oyster percentages with harvest control rules. However, in 2020, they simplified the approach to focus solely on the abundance of market-sized oysters. Rules for reopening reefs are stricter than those for closure. Due to the numerous closures, boats tend to crowd the few open areas, even in environmentally sensitive areas. Traditional oystering is done with dredges, but Christmas Bay, which historically allowed hand harvesting, has closed shallow areas due to damage and now requires licenses for hand harvesting. TPWD also increased fines for undersized oysters per sack, resulting in better culling. Culled materials must be returned to where they were harvested. The fishery is understood by the state to be overcapitalized with ~500 licensed fishers and a goal of decreasing this to 250. They have implemented a commercial buyback program, but many are holding out for higher buyback amounts. The program to buy back licenses hasn't been successful, as fishermen demand high prices that the state won't pay. TPWD can retire a license if it's not renewed for a certain number of years, although the specific number isn't clear.

TPWD has established stakeholder groups that include various stakeholders beyond the industry. Texas has begun to develop diverse stakeholder groups represented by industry, government, NGO’s, academia, recreational fishers, and a variety of special interest groups to advise the state on oyster fishery management. The department plans to conduct more reef mapping for restoration. There are several additional steps needed for sustainable management, but resources are currently limited.

Pettis explained Texas's oyster conservation strategy rests on the creation of oyster conservation areas. These carefully designated zones, spanning seven minor bay complexes, are strictly off-limits to oyster harvesting activities. These areas feature distinct characteristics, such as shallow bays and intertidal or shallow reefs near sensitive ecosystems like seagrass beds. Historically, these zones have faced minimal harvesting pressure and will be maintained as vital spawning reserves. The establishment of these conservation areas was prompted by the escalating harvest pressure experienced by primary oyster fishing grounds, which led to their depletion. Recently, in response to public outcry over the harvest of shoreline oysters and destruction of habitat by industry, Texas closed harvest within 300 ft of shore statewide to protect oysters and the habitat they provide to fisheries.

Advanced mapping techniques play a pivotal role in guiding Texas's oyster conservation and restoration endeavors. The state employs innovative technologies, including aerial imagery assessments and sonar surveys, to conduct comprehensive evaluations of oyster habitats. Aerial imagery assessments focus on shallow reefs, while sonar surveys encompass large-scale bay-wide assessments and targeted small-scale surveys aimed at assessing deep reef conditions. These mapping initiatives play a vital role in facilitating restoration planning, design, verification, and ongoing monitoring. By providing critical insights into the spatial distribution and health of oyster reefs, these technologies enable informed decision-making. Several examples of the products from various types of mapping were showed as examples.

To deepen our understanding of the intricate relationship between oyster populations and reef structure, Texas employs an integrated approach that combines acoustic data with dredge sample metrics. This approach seeks

to achieve several objectives, including assessing the correlation between existing sampling metrics and reef structure and identifying alternative oyster metrics that provide a better understanding of reef health. Preliminary findings suggest that the Market Oyster CPUE (Catch Per Unit Effort) metric is closely tied to reef structure. This discovery underscores the potential value of employing multiple metrics to holistically represent the diverse characteristics of oyster habitats.

Effective restoration planning is paramount to the success of oyster reef rehabilitation in Texas. The state employs a diverse array of tools and methods, including side-scan surveys, bathymetry surveys, and pre-restoration sampling, to pinpoint suitable areas for oyster restoration. Various restoration approaches are embraced, ranging from contracted cultch placement to experimental designs and dealer cultch placement, all geared towards enhancing oyster habitats and fostering their recovery.

Over time, the state has successfully restored 611 acres of oyster reef through contracted cultch placement, with a primary focus on the Galveston Bay system. An additional 1,104 acres have been enhanced through bagless dredging. It is worth noting, however, that the rising costs associated with cultch placement have presented new challenges for restoration practitioners. Prices between 2009 to 2022 have ranged from $38 per cubic yard to the most recent cost of $227 per cubic yard. This has prompted the exploration of innovative approaches to ensure the continued sustainability of restoration efforts.

Innovation and experimentation are fundamental to Texas's commitment to oyster restoration. The state is actively exploring novel strategies to restoration, such as alternative cultch depths, mound spacing, cultch material type, and mound height, at various experimental restoration locations to gauge their effectiveness in restoring oyster reefs.

Through partnerships, the state is evaluating the source-sink dynamics of sanctuary reefs in Trinity Bay. This endeavor is vital for making well-informed decisions about reef management and guiding future restoration endeavors.

Post-restoration monitoring is a critical element of Texas's oyster conservation efforts. Following the completion of restoration projects, Texas conducts biannual sampling over a period of 3-5 years. This monitoring encompasses various treatment areas, reference sites, and assessments conducted both before and after harvest closures. Sampling is conducted using tongs and dredges, with metrics including live/dead counts, recruitment (spat counts), growth (lengths), and infauna. This meticulous monitoring regimen ensures the success and sustainability of restored oyster populations and informs adaptive management strategies.

To support oyster habitat restoration, Texas has instituted oyster shell recovery programs. The "Sink Your Shucks" Oyster Recycling Program, founded by Texas A&M Corpus Christi Harte Research Institute, has collected over 2 million pounds of oyster shells since its inception in 2009. These shells undergo a 6-month quarantine period before being utilized for living shoreline projects and oyster reef restoration. Similarly, the Galveston Bay Foundation Oyster Shell Recycling Program, initiated in 2011, has recycled 1,140 tons of shells, relying on a dedicated network of volunteers. These initiatives make a significant contribution to the sustainable management of oyster habitats.

Active engagement with stakeholders is another integral component of Texas's oyster conservation strategy. The state convenes various workgroups, including the Oyster Regulation Workgroup and Oyster Restoration Workgroup, which serve as forums for industry representatives, non-governmental organizations, and academic institutions to collaborate on restoration projects. These workgroups provide a platform for brainstorming solutions, sharing lessons learned, and collectively addressing challenges. Furthermore, Texas hosts industry workshops aimed at involving industry members in site selection, project planning, and construction for a range of restoration efforts. These workshops foster collaboration and prioritize locations for future restoration

initiatives. They ensure that industry stakeholders are actively engaged in the restoration process, aligning economic interests with conservation objectives.

Texas has a slate of upcoming projects on the horizon. The CARES Act in 2023 centers on the Galveston Bay System, with previously permitted areas set to receive 3-5" layers of cultch. In 2024, the Mesquite Bay Complex in the Aransas Bay System will undergo maintenance with a 1-2" cultch layer. Pre-coordination with stakeholders will be instrumental in site selection, site visits/sampling, and cultch placement, ensuring the continued success of Texas's oyster conservation initiatives.

Day 2 – August 9

Louisiana (LDWF Presentation Link)

Caballero presented on Louisiana's oyster restoration efforts providing a comprehensive overview of the LDWF program and its historical context. One significant aspect of their restoration strategy involves collaborating with the US Corps of Engineers to optimize the timing and flow of diversions for the benefit of oyster reefs. A detailed flowchart outlines the various options available for aiding the restoration of Louisiana's oyster reefs.

Water quality issues, especially related to low salinities, pose significant challenges. To address these concerns, the LDWF has expanded its hydrologic monitoring efforts and developed HSI index models. These tools play a crucial role in managing water conditions, guiding cultch planting initiatives, and facilitating future forecasting.

Recruitment of oysters varies across different salinity levels. While some areas show promise, high salinity environments present settlement challenges. To address this, LDWF has initiated spat-on-shell deployment. They previously had a POLR (Private Oyster Lease Rehabilitation) program for private leaseholders, but its usage has been temporarily halted. Availability of seed remains a concern for leaseholders due to the scarcity of natural seed on reefs. The industry transitioned to purchasing seed from hatcheries following the BP Oil Disaster, alleviating the state's seed supply responsibilities.

A 2019 survey revealed a pessimistic outlook among oystermen and farmers regarding coastal conditions. Industry stakeholders expressed support for buyouts of state-owned leases but exhibited skepticism towards the Louisiana Coastal Plan. The Louisiana Oyster TTF, composed of various stakeholders, meets regularly to coordinate outreach efforts, forge partnerships for restoration, and collaborate with universities on research initiatives. Additionally, restaurants participating in shell recycling now receive tax incentives, making the program cost-neutral.

Caballero addressed the question of whether oystermen could return to the fishery once they leave, given the current situation. Louisiana currently has 7,932 leases covering 400,403 acres. However, a new lease moratorium is in place, preventing the issuance of new leases and public ground permits. Oystermen can explore options like subleasing, purchasing a lease from a delinquent owner, or acquiring a vessel with an existing permit to harvest on public grounds. Access to oyster harvesting has become considerably restricted, making re-entry less likely.

A notable development in Louisiana is the creation of the Shellcatcher App for reporting commercial harvest activities. This app streamlines the reporting process by allowing fishermen to input their harvest locations, targeted quantities, and additional data. The LDWF is considering adding temperature data for tracking health regulations. The plan is to expand this app to cover all public leases, potentially facilitating seed movement tracking. However, the app is still in development, and Caballero has limited information about its construction.

Unlike current reporting methods that define an "area fished" within a small polygon around the reef, the app will provide much higher resolution data.

Louisiana boasts 1.7 million acres of public seed grounds and 400,000 private leases. The Oyster Strategic Plan, initiated in 2021 in response to the 2019 Bonnet Carré releases, has an estimated cost of approximately $132.3 million but remains unfunded.

The restoration efforts encompass 12 initiatives, with cultch planting being the primary focus. Cultch, primarily originating from Kentucky, has been used to enhance oyster beds. While some shell is acquired, rock is more common, with ton-based purchases being the most cost-effective approach. Other productive areas for cultch planting include Drum Bay near Chandeleur Sound. Private lease owners are typically responsible for providing their own cultch. A program previously assisted with offsetting costs or accepting donations, such as bridges crushed by the state and provided to leaseholders through the Oyster TTF. Each shell planting endeavor requires a "coastal use permit" from the state land grant office, outlining the terms of placement, location, and relief. Even the LDWF must obtain these permits for activities in state waters.

In addition to cultch planting, LDWF has conducted bottom scanning in Calcasieu Lake to identify suitable areas for planting near shell and hard bottoms. There is also an AOC park in the port area of Calcasieu. Funding from the Restore Act is directed towards the Morgan Harbor area for planting, shoreline restoration, and establishing brood reefs near the southeast edge of Biloxi Marsh around Pass-a-Loutre.

The 12 initiatives include Spat-on-Shell (SOS) or remote setting (Initiative 2), Spawning Stock Sanctuary Network (Initiative 3), support for nursery and growout farms (Initiative 4), and hydrologic monitoring (Initiative 6), among others. Evaluating unproductive leases (Initiative 7) and reinstating cultivation and production requirements (Initiative 8) are part of the strategy. Expansion of public oyster grounds in Barataria Bay (Initiative 9), improving conditions in Lake Borgne (Initiative 10), and restoring the Bohemia Spillway (Initiative 11) are also integral to the restoration efforts. Furthermore, the LO-SPAT project (Initiative 12) focuses on developing genetic lines of oysters with varying salinity tolerances.

As of the present, Louisiana is three years into its five-year plan and has successfully funded seven of the 12 initiatives. Additional funding is anticipated, which will be allocated to the remaining initiatives as needed.

Caballero shared insights into reconnaissance efforts conducted in Hackberry Bay to identify potential cultch planting sites and brood reefs. The CPRA's Oyster Resource Suitability tool was employed to assess how the Habitat Suitability Index (HSI) aligned with field observations. This model considers various variables, including oyster cultch percentage, mean spawning salinity, minimum monthly salinities, annual salinity, and water proportion, among others. It integrates a substantial reference database spanning studies dating back to 1983.

Historical commercial oyster landings in Louisiana exhibit significant fluctuations, as evidenced by data from NOAA and trip ticket records dating to 1961. In 2020, a record-low harvest of 3.8 million pounds of oyster meat occurred due to multiple factors, including the 2019 Bonnet Carre floods, the 2020 pandemic, and natural disasters. However, 2021 witnessed a partial recovery, with landings totaling 6.6 million pounds, despite the additional impact of Hurricane Ida. Though still 83% below the long-term average (LTA), the upward trend continued into 2022, with landings reaching 7.22 million pounds.

When examining commercial oyster landings in terms of private leases and public seed grounds, a significant shift is evident. In 2021, private leases accounted for an overwhelming 99.6% of total landings, with only 0.4% originating from public seed grounds. In the subsequent year, public grounds' contribution increased to 3.3% of total landings and wild harvest permits decreasing from ~700 in 2012 to ~400 currently.

Stock assessment is a critical aspect of oyster management. Data from 2022 indicated a modest improvement compared to 2021, though still 83% below the LTA. The assessment estimated 539,058 sacks of market oysters and 40,846 sacks of seed oysters available for harvest in designated areas. Notably, 30% of the market stock was harvested from the Biloxi Marsh/Lake Bourne area, while Hackberry Bay saw minimal harvest. Sister Lake had a special 5-day season with an estimated 5,976 sacks harvested. Bay Junop and Lake Mechant reported less than 1% harvest, while the Vermilion/Atchafalaya Bay areas had no harvest. Calcasieu Lake recorded just over 10% harvest on the east side and around 3% on the West Cove.

The total market oyster harvest accounted for 5.4% of the oyster stock from the state's public grounds, underscoring the importance of sustainable management. To enhance reporting, a phone-based harvest reporting system achieved a 68% compliance rate. In the upcoming season, an e-reporting app will be introduced to further streamline data collection. The outlook for the upcoming season is cautiously optimistic, with preliminary dive sampling indicating an increase in seed and sack oysters, possibly attributed to a boost in spat from fall recruitment and favorable salinity conditions. This ongoing effort seeks to strike a balance between oyster harvest and preservation, ensuring the long-term sustainability of Louisiana's oyster industry.

Mississippi (MDMR Presentation Link)

Rider provided a summary of the state of the oyster resources in Mississippi. Aiming to rebuild and enhance oyster reef production while maintaining size class dynamics to ensure sustainable public harvesting, the state of Mississippi has outlined a multifaceted approach to oyster management. This strategy not only seeks to rejuvenate oyster populations but also recognizes the importance of ecosystem services and water quality improvement.

The Mississippi Department of Marine Resources (MDMR) executes oyster management through three primary mechanisms, with a key focus on compliance. Monthly sampling of sea water for fecal coliform bacteria is conducted, and 89 samples were collected in the last year. This regular sampling helps mitigate seafood-related health risks and identifies pollution sources. The selection of sampling sites is strategic, located between oyster resources and potential pollution sources. An extensive database spanning two decades aids in understanding historical trends.

Another vital compliance aspect is the classification of growing areas. There are eight growing areas categorized as Approved, Conditionally Approved, Restricted, Prohibited, and Unclassified. Annual shoreline and sanitary surveys evaluate pollution sources and their proximity to growing areas. Factors such as the distance between pollution sources and the impact of each source in the growing area are assessed, along with evaluations of wastewater treatment plants and marinas. Phytoplankton sampling is performed quarterly across 15 stations, with monthly monitoring in open harvest areas to detect marine biotoxin-producing organisms that may pose public health risks.

A crucial part of Mississippi's oyster restoration strategy involves benthic mapping conducted by the Mississippi Department of Environmental Quality (MDEQ). This initiative is part of an $11.7 million project, conducted in partnership with MDMR. Its goal is to better understand why oyster populations have not shown more resilience and how productivity can be improved. The project seeks to enhance oyster sustainability along the Mississippi coast.

Reef cultivation is another significant aspect of restoration efforts. Cultivation takes place during April and May and employs innovative technology such as ArcGIS and QuickCapture to monitor and verify cultivation tracks. Approximately 148 total acres in the Western Sound are targeted for cultivation, amounting to about 100 miles of cultivation tracks. Key cultivation sites include Henderson Point, Pass Marianne, Pass Christian Dredging, and St. Joe, primarily utilizing limestone as cultch material.

The Mississippi Sound is continually monitored for eastern oyster (Crassostrea virginica) settlement, with regular spat sets typically observed from early summer through the fall. However, there is limited monitoring during the rest of the year, leaving a gap in understanding possible spawning. A project was initiated to continuously monitor the Mississippi Sound for spawning outside the known season across multiple years and better identify recruitment hotspots for future restoration efforts.

Cultch material deployment is an essential part of restoration. MDMR deploys cultch material using the RV Conservationist, focusing on both targeted areas and remote-setting deployments, aiming to restore specific areas and encourage oyster growth.

In addition to direct deployments, MDMR collaborates with local businesses to deploy substantial amounts of cultch in the Mississippi Sound. This includes relays and spat on shell deployments, significantly contributing to oyster restoration.

Rider described the Phase 1 remote oyster setting facility is part of a Restore Council-funded project aiming to determine the feasibility of a facility to expedite oyster reef restoration. Phase 1 included a comprehensive feasibility study, which reported the deployment of nearly 24 million spat-on-shell oysters with an average setting efficiency of 15-20%. This amounts to a cost of $0.005 cents per oyster, or half a cent. The project test site covers a substantial reef footprint of 227 acres, with population and size classes consistently increasing since 2019 for areas with remote set oysters versus areas without remote set oysters.

The MDMR conducts comprehensive assessments of oyster reefs to inform harvest strategies. They employ square meter dives and dredge tows to assess the status of oyster reefs. The recent assessments involved 75 one-minute dredge tows and the completion of 210 square meter samples, totaling 420 samples.

Specific reefs, such as the Pascagoula Causeway and St. Joe Reef, were shown as examples. The Pascagoula Causeway reef, covering 220 acres, is known as one of the most productive in the eastern region. However, it faces challenges related to limited seed class oysters and was potentially affected by low salinity in 2021. It has also been relayed from multiple times in the last decade. Similarly, the St. Joe Reef, spanning 473 acres, exhibits low predator activity, with most oysters found within the cultch plants. Salinity significantly influences oyster growth and spawning on this reef, necessitating ongoing monitoring.

While there is positive growth in the oyster resource, a lack of size class variation remains a challenge. The resource is still recovering from limited recruitment. To address this, MDMR plans to continue cultch plant and spat on shell deployments to diversify size classes. Mississippi hopes to improve the assessment of healthy reefs so they can compare across the regions and answer questions about sustainable harvest in today's environment. They'd like to consider reef specific issues, such as predators, cultch densities, and harvest amounts.

Mississippi aims to stimulate the prosperity of coastal communities and foster a thriving shellfish industry through updated regulations for on-bottom molluscan shellfish leases. A recent state Senate bill 2544 started a lease program for oysters with 15-year leases available and a maximum of 2,500 acres per person or entity. The objectives include encouraging private individuals or businesses to lease and develop previously inaccessible water bottoms, ensuring compliance with environmental and conservation requirements, and fostering a sustainable framework for shellfish production. These leases span fifteen years, with specific acreage limitations per individual or business (max. 2,500 acres at $3 per acre per year). Leaseholders are required to propagate a minimum twenty percent of the total bottom area within two years, ensuring responsible and sustainable shellfish cultivation. They must also maintain a minimum cultch planting density of 60 cubic yards per acre or no less than five cubic yards with a minimum of 75,000 oyster spat per cubic yard. Failure to meet requirements may be deemed an "event of default" on their lease agreement.

Overall, Mississippi needs to diversify their oyster harvest and restoration strategies in an effort to restore and support a more sustainable oyster resource in the state.

Florida (FWC Presentation Link)

In Florida's ongoing efforts to restore and manage its oyster fisheries, **Gandy** presented several key points during the recent presentation. The primary focus has been on environmental management and water quality monitoring, with limited emphasis on fishery-related data because Florida does not have a statewide oyster Fisheries Independent Monitoring program and relies on grant funded projects and partner projects to inform status. In 2015, Florida received state funding for a fishery disaster in Apalachicola, and a Fishery-Independent Data (FID) monitoring program was initiated for Apalachicola. However, the state as a whole faces data scarcity, prompting efforts to build communities of practice for data compilation and meta-analysis.

The Oyster Integrated Mapping and Monitoring Program (OIMP) plays a vital role in Florida's coordination of data collection and a repository for information. This effort is a resource for standardized monitoring metrics and survey designs. It maintains a living white paper that addresses data, divided by region, and provides Standard Operating Procedures (SOPs) for various management aspects, focusing on oyster habitats throughout the state. OIMP annually updates mapping and landings, including GIS resources, while ground truthing the maps. It also incorporates historical harvest data dating back to the 1950s. The SOPs for monitoring are clearly outlined.

Florida’s diverse habitats change significantly across its latitudinal span. The panhandle is characterized by subtidal bars, although severely depleted were once ideal for oyster fisheries. Moving south towards Big Bend and springs areas, intertidal bars dominate with marginal production of legal oysters. This region faces extreme salinity and temperature conditions, resulting in fewer legal oysters. These conditions sometimes lead to illegal harvesting opportunities due to the remoteness of the locations, lack of supply and high prices. Further south, tropicalization is causing mangroves to encroach on intertidal oyster bars, changing the composition of intertidal oyster bars.

Apalachicola remains the primary habitat for oysters in Florida. Historically, this region may have covered up to 10,000 acres of oysters. However, in 2022, the University of New Hampshire (UNH) mapped around 2,000 acres and only found 500 acres with a presence of live oysters, although these samples include oysters without necessarily indicating production quantities. Much recovery work is still required, especially in the western portion of the Bay, which is currently experiencing a dearth of oysters. Central and the east side of the Bay is relatively more productive, with a substrate composed of mud and some shell hash over remnant reefs. Oyster numbers in the bay showed abundance until about 2010, after which legal and sublegal numbers have been consistently low, signaling severe depletion and justification for the closure if the fishery in 2020. Various restoration efforts have faced challenges and failures throughout the region.

Suwannee Sound is data poor. In 2021, funding from the National Fish and Wildlife Foundation (NFWF) and a data gaps project by the Florida Trustee Implementation Group (FLTIG) enabled mapping and ground truthing in four regions of the state, including Suwannee Sound. The intent of this project is to provide baseline information for restoration. These projects will continue until 2026. State funding for long-term monitoring is being sought but has not been secured. Published studies on Suwannee Sound are scarce, but a 2011 study by Seavey et al. indicated an overall 66% loss of oyster reefs with losses concentrated on offshore (88%), followed by nearshore (61%), and inshore reefs (50%). Moore et al. 2020 confirmed those losses and additionally increased the loss estimates for the region due to sea level rise and loss of estuarine habitat in an open Gulf facing estuary. Offshore reefs faced severe impacts, leading to the movement of oysters inland as saltwater

inundation increases. However, the inshore colonization does not mirror offshore losses and does not produce significant quantities of legal oysters. While sea-level rise is not extensive, it is encroaching into marshes, posing a high-risk challenge for restoration efforts. Harvesting in the Suwannee area has nearly ceased.

The south Florida region also merits attention, particularly at the outfalls for the Lake Okeechobee drainage. Frequent water releases (freshets) disrupt intertidal oysters, which subsequently rebound with various age groups. However, none of these areas are open for harvest.

Burgess provided insights into the northwest region's oyster fishery, characterized primarily by wild harvests from public reefs using hand tools or tongs. Although some aquaculture areas exist, on-bottom harvesting remains dominant. The majority of fishermen are older, with significant populations residing in Apalachicola and Suwannee. Historical meat harvests ranged from 2 to 3 million pounds but experienced a significant crash in 2012. Apalachicola Bay remains crashed and was close to harvest in 2020. This displaced fishers who moved to Suwannee Sound region and landings there have subsequently plummeted. Some landings are also associated with the Panama City and St. Augustine areas, albeit in smaller quantities.

The Florida Fish and Wildlife Conservation Commission (FWC) plays a crucial role in managing oyster harvests, while the Florida Department of Agriculture and Consumer Services (FDACS) oversees closures and determines water quality. The supply of cultch material is diminishing, partly due to the rise of the half-shell market and reduced shucking. Without shucking, shell production declines, and singles are shipped elsewhere.

Historically, FWC used fossilized shell for restoration, but recently it has had limited success due to environmental conditions and rapidly degradation of the shell cultch. Projects that utilized harder materials like Kentucky limestone have shown promise since they do not degrade rapidly thus making them available when environmental conditions are adequate for good spat settlement. Challenges exist in restoration of ecosystems that have reset to a lower baseline which requires considerable time, energy, and effort to return it to prior production levels. Florida has initiated the use of larger materials for cultching, such as dolostone, which helps maintain vertical relief and allows reef building on top of it, making it suitable for tonging. Relief heights of 12" and 24" are part of a NFWF funded pilot program to test reef heights as a factor for success. FWC is also creating reefs near more productive areas to enhance connectivity.

Florida is currently in possession of $20 million in NFWF funds for restoration in both Apalachicola and Suwannee. An additional $10 million from the state was dedicated for Apalachicola. Success in these restoration endeavors requires effective stakeholder engagement in Apalachicola, where meetings are ongoing. Stakeholders hold mixed opinions, with the public yearning for a return to the past, which may be unattainable because of the lower and inconsistent productivity of the coastal ecosystems. A balanced approach combining stakeholder knowledge with scientific insights is being pursued. Additionally, FWC is using larger cultch materials in dolostone to maintain vertical relief and stimulate reef growth. Monitoring efforts continue to track progress, with an emphasis on achieving sustainable oyster populations in Florida's diverse habitats.

The Nature Conservancy

Robert Bendick mentioned that TNC is producing a number of recommendations related to oysters Gulf-wide in the next several weeks. When that report is out, he will provide it to the group for their information. There are recommendations on monitoring included. Most of what is in the document has already been discussed during this session.

Roundtable Follow-up

During the roundtable discussion, **Cumberbatch** raised a series of critical questions concerning state-level oyster restoration and management:

1. Balancing Funding for Ecosystem and Fishery Restoration:

- *Louisiana* employs a strategy of placing bags in the water for oyster sets, which later transition to support shoreline restoration. However, the challenge arises when these bags take time to break down and are often located in shoreline areas that are closed for other reasons.
- *Alabama* focuses on bank stabilization through limited subtidal planting but grapples with how to integrate ecosystem services into their spending.
- *Texas* undertakes habitat restoration, with some projects involving intertidal areas. Funding sources vary, including NRDA and NFWF, which use non-traditional materials. Additionally, they collaborate with The Nature Conservancy (TNC) to establish reef areas, preparing for potential sea-level rise.
- *Mississippi* manages to plant for both ecological and fishery purposes.

2. Incorporating Stakeholder Perspectives in Stricter Management:

- *Texas* has encountered protests linked to limited entry, as some fishermen oppose the "traffic light" approach. They believe that constant reef management is essential for production. Other stakeholders, like recreational anglers, also have opinions since they rely on these reefs as habitats for finfish. The Coastal Conservation Association (CCA) supports reef closures for harvest protection, and cooperative restoration efforts with stakeholders have been positive.
- *Alabama* faces similar challenges, with plans to study the impact of "working" versus not working the reef. They aim to assess fishing mortality from tonging, potential cryptic mortality from reef disruption, and the effects of culling.
- *Florida* recognizes the dilemma of involving individuals in areas once known for oysters but no longer productive. In Apalachicola, stakeholders suggestions like hiring oystermen and their boats for restoration involvement.
- *Louisiana* encounters resistance when attempting regulatory changes. Convincing the legislature often necessitates data, but trust can be an issue. Data plays a crucial role in presenting industry preferences to the commission.

3. Linking Habitat Quality to Water Quality:

- *Alabama* emphasizes the importance of conveying the ecosystem value of oysters, particularly their role in improving water quality.

4. Metrics for Measuring Restoration Success:

- *Florida* questions whether achieving material coverage over a large area with only a few oysters per meter is a true success or if a smaller area with harvestable oysters is more valuable.
- *Texas* suggests that success metrics may vary by reef, emphasizing the need to define what constitutes success.
- *Mississippi* is working on a project that explores success by assessing the rate of exploitation, grading and harvesting reef areas at different removal percentages.
- *Louisiana* uses a target of 25 oysters per square meter as an indicator of good production and a healthy reef. They also employ PVC poles to assess shoreline depletion over time and the presence of oysters for gauging success on brood reefs.

5. Setting Targets and Limits for Opening:

- *Florida* seeks to employ thresholds for oyster management decisions.
- *Texas* relies on a measure of general abundance, specifically how long it takes to fill a sack, to gauge reef health and determine reopening times.
- *Alabama* closes based on fishing times and the presence of cultch material on culling boards, with reopening tied to achieving a specific reef goal.
- *Mississippi* sets an annual target for abundance, aiming for approximately 33% of the available estimated stock.
- *Louisiana* previously used a Vessel Monitoring System (VMS) for oyster boats but discontinued it due to political factors. The VMS provided valuable data on boat locations and work activity, often cross-referenced with trip tickets for estimating sack quantities. Currently, they employ a check-in/out system to report total sacks harvested per area.

The discussion underscored the complexity of oyster resource management and the importance of striking a balance between ecological and fishery-oriented restoration, considering stakeholder input, and defining clear success metrics

Wrap up

1. Opportunities
    i. Align definitions so all states can speak the same language
        1. Size classes
        2. Natural Oyster Bed
    ii. Overlay all Historic Harvest data for each state
        1. Correlation: Oysters, Other Species
    iii. Sampling Methodology
2. Define what success looks like
    a. Restoration Goals
    b. Density = 25/oysters per Meter
3. Stakeholder
    a. Engagement
    b. Education
4. Electronic data capture
    a. Louisiana trip tickets
5. Oyster shell bottom model (Cultch Model) (Louisiana)

Reflection on Effective Strategies and Potential Action Items:

Alabama advises against resistance to new approaches. They initially faced industry skepticism but found that embracing new methods, such as the grid system, yielded positive results. Emphasizing the adoption of innovative practices is essential, as they can eventually become industry norms. Moreover, diversifying resource allocation across multiple areas can safeguard against the impact of localized issues on the oyster resource.

Mississippi echoes the sentiment of embracing change while respecting historical knowledge. It's crucial to continually assess new data and remain attuned to environmental shifts to adapt effectively.

Florida recognizes the need for fresh approaches, as past methods have proven ineffective in addressing oyster resource challenges. Building trust and collaboration with the industry is seen as a pivotal step in implementing effective management changes.

Louisiana highlights the ability to explore alternative areas with lower risk, indicating the industry's willingness to adapt and relocate based on resource availability.

Texas underscores the value of workgroups in fostering industry participation and engagement. They have successfully created new opportunities through mariculture, involving a different group of stakeholders compared to traditional on-bottom harvesters.

Collective Perspective: The participants raise the question of whether the measure of recovery time has fundamentally shifted in the current environment, suggesting the possibility of a new steady state.

Potential Action Items:

These action items aim to foster data-driven decision-making and facilitate dialogue among stakeholders to drive positive changes in oyster resource management.

1. ***Evaluate Historical Harvest Data***: Conduct a comprehensive evaluation of historical harvest data to identify trends, peaks, and valleys. Explore whether specific practices or conditions during the "good years" contributed to successful oyster harvests.

2. ***Correlation Analysis***: Investigate potential correlations between the decline of oysters and other species, such as fish and crustaceans. Analyze how changes in oyster populations may impact or correlate to broader ecosystems and fisheries.

3. ***Discuss Findings***: Propose these findings as a discussion topic at the upcoming fall Commission meeting with the Mississippi Shellfish Sanitation Committee (MSSC). This will provide a platform for stakeholders to exchange insights and ideas on how to move forward effectively.

4. ***Momentum Maintenance***: Begin discussions on strategies to sustain the momentum generated by these actions and continue working collaboratively to address oyster resource challenges.

Common Challenges:

1. <u>Environmental Challenges:</u> All Gulf Coast states face environmental challenges, including hurricanes, droughts, oil spills, and excessive freshwater inflows. These factors disrupt oyster populations, hinder recruitment, and impact oyster habitats.

2. <u>Resource Management Challenges:</u> Balancing oyster population restoration with supporting the oyster harvesting industry is a recurring challenge. Effective enforcement, monitoring, and the management of areas with poor recruitment are common concerns.

3. <u>Restoration Challenges:</u> Uncertainty about the effectiveness of certain restoration techniques, changing patterns of source/sink reproduction, and identifying data gaps are shared challenges in oyster restoration efforts.

Management Strategies:

<u>Alabama:</u>

- Implements a Flexible Harvest Goal and reef grid system for effective harvest management.
- Focuses on seed planting, remote set projects, and experimenting with reef height and furrows to enhance oyster populations.

Texas:

- Establishes oyster conservation areas to safeguard spawning reserves.
- Utilizes advanced mapping technologies and biannual monitoring to assess oyster habitats.
- Explores innovative restoration strategies, including alternative cultch depths and materials, in collaboration with stakeholders.

Louisiana:

- Has a comprehensive plan with 12 initiatives for oyster restoration and management.
- Introduces phone-based harvest reporting and e-reporting app to improve data collection and compliance.
- Explores innovative methods like raising shell mounds and researching furrow impact to enhance oyster habitat.

Mississippi:

- Implements diversified restoration strategies, including cultch planting, spat-on-shell deployments, and remote oyster setting facilities.
- Fosters sustainability through updated regulations for on-bottom shellfish leases.
- Emphasizes ongoing monitoring and assessment to inform adaptive management practices.

Florida:

- Addresses the severe collapse of the Apalachicola Bay oyster fishery through increased funding of FIM monitoring programs and stakeholder engagement.
- Explores innovative restoration techniques and balances stakeholder knowledge with scientific insights.
- Focuses on achieving restoration goals and emphasizes research, adaptive management, and effective enforcement.

Common Themes:

1. Innovative Oyster Management: States like Alabama are employing innovative approaches, such as flexible harvest goals and reef grid systems, to manage oyster harvest effectively. Texas and Louisiana established oyster conservation areas and brood reefs to safeguard populations and promote spawning.

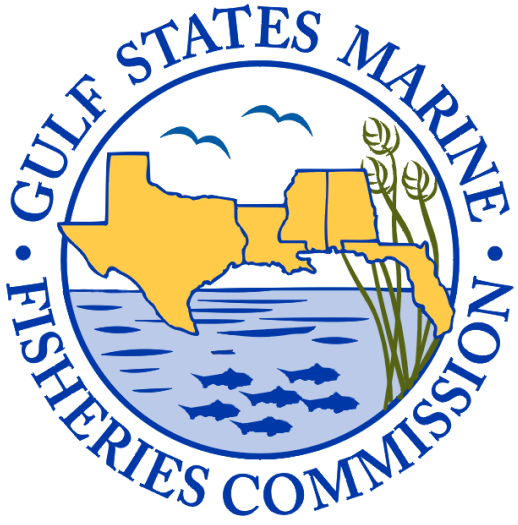
2. Advanced Mapping and Monitoring: Several states are utilizing advanced mapping technologies like aerial imagery and sonar surveys for oyster habitat assessments. Regular monitoring and post-restoration assessments are essential to establish metrics for sustainability.

3. Stakeholder Engagement: Engaging stakeholders, including the public, industry representatives, and conservation organizations, is a common theme in oyster fishery management. Collaboration and workshops contribute to a holistic approach.

4. Data Improvement: Efforts to enhance data collection and reporting are evident, such as the introduction of phone-based harvest reporting systems and e-reporting apps. This improves compliance, monitoring, and management.

5. Innovative Restoration Techniques: Gulf states are implementing diversified restoration strategies, including cultch planting, spat-on-shell deployments, and remote oyster setting facilities, to address challenges and support oyster resource recovery. Experimenting with techniques for oyster habitat restoration, including alternative cultch materials, reef designs, and other methods to enhance oyster populations may lead to some answers.

Gulf Coast states continue to face challenges in oyster fishery management. Restoration efforts, adaptive management, and stakeholder engagement are expected to contribute to the sustainability and recovery of oyster populations. Increased funding and ongoing research will be crucial to address the complex issues surrounding oyster fisheries in the Gulf Coast region.



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