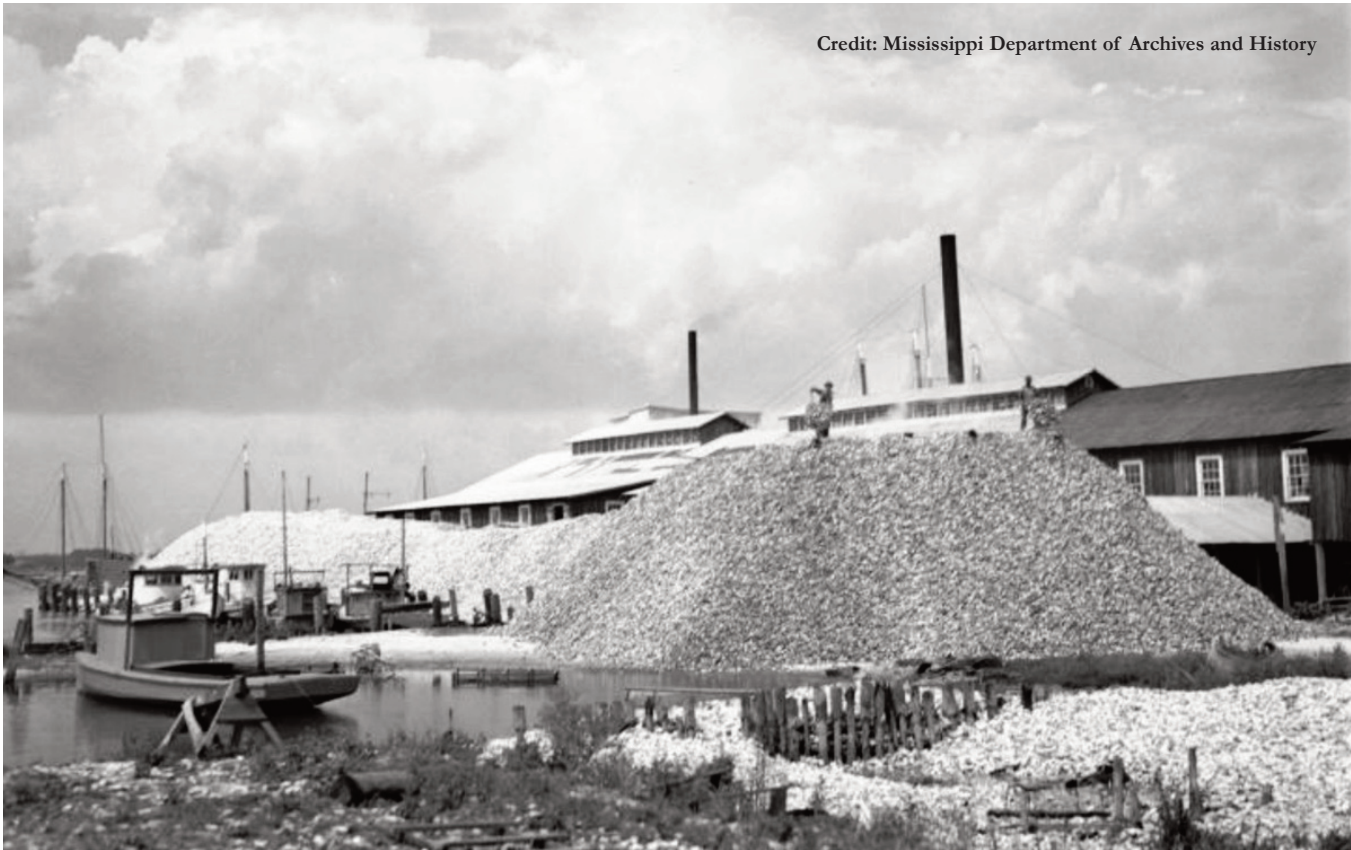


Mississippi's Oyster Journey from “Seafood Capital of the World” to 21st Century Collapse

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Credit: Mississippi Department of Archives and History

Oyster shell pile in 1900's.

In September 2019, the Mississippi Commission on Marine Resources voted to close the state's public oyster reefs for the 2019-2020 season. Earlier that year, heavy rainfall within the Mississippi River basin resulted in the U.S. Army Corps of Engineers opening the Bonnet Carré Spillway twice to relieve the threat of flooding to New Orleans. This was the first time since its completion in 1931 that the spillway had been open twice in one year.

Due to the increase of freshwater in the Mississippi Sound during these openings, salinity levels dropped significantly and were often near zero between the months of March and July. Researchers from the Mississippi Based RESTORE Act Center of Excellence¹ (MBRACE) documented 100% oyster mortality by September 2019 on all reefs surveyed in the western Mississippi

Sound. Almost no spat (baby oysters) settled between July and October. Oyster populations have yet to show signs of recovery.

The oyster industry has a long and important history in the state of Mississippi, but the story of the fishery is a familiar one in natural resource management. Overharvesting and lax management lead to population crashes that result in stricter regulations and significant financial investments to try and rebuild populations. However, Mississippi oyster industry's journey from “Seafood Capital of the World” to complete fishery collapse in just over 100 years has an additional layer – repeated natural and human-induced disasters. Important lessons can be learned from the past to gain a better understanding of the health of oyster populations in Mississippi and inform future management decisions.

History of Mississippi Oyster Fishery

Oyster consumption in Mississippi pre-dates European settlement.² Oyster shells up to 8 inches long found in coastal Native American middens date back 2,500 years. After French arrival in 1699, oysters continued to be harvested from nearshore reefs by hand or using tongs. Signs of problems on the Mississippi reefs occurred even before official oyster landing records began in 1880. The state legislature enacted the first Mississippi oyster-related law in 1860 to prohibit dredging, but this was later repealed in 1865 due to stakeholder pushback.

Prior to state management, Mississippi coastal counties controlled local oyster reefs starting in 1896. Then, in 1902, the Board of Oyster Commissioners was appointed by the governor to help maintain and replenish the state's reefs. The Mississippi Oyster Commission, later renamed the Mississippi Seafood Commission, conducted regular shell and seed plantings on public oyster reefs using state funds and taxes. Oyster harvesting not only removes the animal, but also its habitat, and oyster fishery managers have long recognized the importance of needing to maintain oyster habitat by replacing shell or hard material lost due to harvesting or other natural events.

However, in the years leading up to World War II, Mississippi's reefs were unregulated, overfished, and shell material was not returned to the reefs. Then, in 1945, the Bonnet Carré Spillway was opened for the second time ever, resulting in up to 100% oyster mortality on western Mississippi Sound reefs. As a result, Congress authorized the U.S. Fish and Wildlife Service to appropriate \$3 million to Louisiana and Mississippi as reimbursement for damages to the oyster industry caused by the Spillway.³ Unfortunately, these restoration efforts were curtailed by the Hurricane of 1947 and several years of above average rainfall. The heavy rainfall, coupled with high freshwater river discharges, resulted in salinity conditions unfavorably low for oyster recovery.

The opposite, but no less damaging, situation occurred in the 1950s. Prolonged drought conditions resulted in high salinities on oyster reefs. High salinity favors the survival of voracious oyster predators, such as oyster drills. Overall, the fishery struggled between 1945-1959 due to these major environmental challenges and limited regulatory authority of the Mississippi Seafood Commission.

A new agency, the Mississippi Marine Conservation Commission,⁴ was created in 1960, with new powers, management authorities, and legal requirements that allowed Mississippi oyster landings to flourish throughout the decade.

Led by a marine biologist, the Marine Conservation Commission routinely planted shell and seed on the public oyster reefs. They also cultivated reefs after heavy spring rains by using dredges to re-expose clean shell surface in time for summer spat settlement.

Hurricane Camille struck the Mississippi coast in 1969, physically damaging nearshore oyster reefs, and destroying fishing boats and many oyster processing factories. The state thus began, once again, the slow process of rebuilding the reefs through significant shell planting operations. Larval oysters from less damaged populations in the Mississippi Sound settled on these rebuilt reefs, but oysters suffered high mortality during the Bonnet Carré Spillway openings of 1973, 1979, and 1983. Oyster management also shifted during this period when the Mississippi Department of Wildlife Conservation was created in 1978, and the Bureau of Marine Resources was given authority to manage the state's fisheries resources.⁵

During the 1960s, Mississippi coastal development rapidly expanded and reef closures due to sewage pollution became a major problem for the oyster industry. Pascagoula Bay reefs were entirely closed to harvesting in 1961 after hepatitis outbreaks. Biloxi Bay closures first began with Back Bay in 1945 and moved southward until the entire bay was closed by 1967. Oyster landings reached an all-time low between 1987 to 1991 as a result of decreased fishing efforts caused by the increase in restricted zones and reduced public demand for oysters from the Gulf of Mexico.

In 1994, oyster management shifted again with the creation of the Mississippi Commission on Marine Resources and the Mississippi Department of Marine Resources.⁶ Under the jurisdiction of the Commission on Marine Resources, the Department of Marine Resources was given the power and resources to manage, protect, and maintain the state's public oyster reefs. Between 1996 and 2004, annual oyster landings were averaging as high as during the 1960s. That continued until, as in 1969, a devastating hurricane hit Mississippi.

21st Century Declines on Mississippi Oyster Reefs

Hurricane Katrina, which made landfall in Mississippi in August 2005, damaged 90% of Mississippi's oyster reefs. The reefs were closed to harvest for the following two years to allow oyster populations to rebuild. Extensive cultch planting and oyster relaying, paid for with federal funding from the Emergency Disaster Recovery Program, led to a recovery of the oyster population by 2008.



Credit: Kevin Bain/Ole Miss Digital Imaging Services

University of Mississippi researchers surveying oyster mortality during 2019 Bonnet Carré Spillway opening.

Then on April 20, 2010, an unprecedented disaster impacted the northern Gulf of Mexico. The Deepwater Horizon explosion released hundreds of millions of liters of crude oil into the Gulf, which ultimately affected over 2,000 km of coastline. Oyster deaths from direct oil exposure were reported on Louisiana and Mississippi oyster reefs and, until 2014, limited oyster recruitment was observed in these areas. A year after Deepwater Horizon, the 2011 Bonnet Carré Spillway opening inflicted additional stress on western Mississippi Sound oyster reefs already heavily impacted by the oil spill.

Following the Deepwater Horizon settlement, millions of dollars have been made available for oyster reef restoration across the Gulf of Mexico.⁷ The Mississippi Oyster Cultch Restoration Project during Phase I of the Natural Resource Damage Assessment (NRDA) Early Restoration was the largest cultch deployment in Mississippi history. Between 2013-2014, over 188,000 cubic yards of hard material were deployed to enhance more than 1,400 acres of reef area in the western Mississippi Sound. This \$11 million project showed promising signs of oyster recruitment in the first two years post-cultch deployment.

Unfortunately, a major hypoxic event in 2016 and the multiple 2019 Bonnet Carré Spillway openings caused major mortality on the restored reefs. No harvest has been allowed from public reefs since 2019. A record breaking 2020

Atlantic hurricane season and record regional rainfall in coastal Mississippi during 2021 further compounded the environmental problems. Mississippi's oyster populations are lower now than they were immediately following the Deepwater Horizon oil spill, despite extensive restoration efforts and a 2017 ban on basket dredging.⁸

Future of Mississippi Oyster Reef Recovery


The continued closure of the public oyster fishery in Mississippi demonstrates the state's commitment to long-term restoration of oyster reef ecosystems, despite the loss in economic benefits from harvesting. Off-bottom aquaculture, introduced in 2016,⁹ provides an alternative means of oyster production which can offset some of the economic losses from the closure of the wild fishery and relieve wild harvesting pressures in the future. While aquaculture operations can provide some of the same environmental benefits as natural reefs, such as water filtration and habitat creation, they are not a substitute for all of the beneficial ecosystem services that oyster reefs provide, like shoreline protection. Further, not all commercial oyster harvesters are able to or want to transition into aquaculture, and there can be conflicts with coastal property owners. Sustainable oyster reef restoration is therefore critical to the future environmental and economic health of the Gulf of Mexico and its coastal communities.

Current oyster restoration activities in the state need to maintain focus on rebuilding adult populations by adding live oysters to restored sites and existing reefs.¹⁰ Projects like the Department of Marine Resources Remote Oyster Setting Facility enhance oyster populations by settling hatchery-reared larvae on oyster shells in onshore tanks, and then moving this spat-on-shell to restored reefs in the Mississippi Sound. Allowing oysters to grow to a larger size in controlled or maintained environments before placing them on reefs can improve their chances of survival. The Mississippi Oyster Gardening Program recruits volunteers with access to docks to grow and cultivate young oysters prior to planting them on local restored oyster reefs. As populations begin to rebound, the creation of no-harvest sanctuary reefs will be critical to ensure spawning populations that produce sufficient larval supply to populate public oyster reefs.

Restoration planning and decision-making also need to consider the environmental challenges of freshwater flooding and major storms that have historically plagued Mississippi oyster reefs and will continue to escalate in frequency and intensity with climate change. Moreover, if Mississippi restoration efforts are to succeed, changes must be made in Bonnet Carré Spillway operations. After a recent federal court ruling,¹¹ the Army Corps of Engineers must consult with the National Marine Fisheries Service on ways to avoid harm to Louisiana and Mississippi coastal resources in the future. Historically, the most detrimental openings are the ones with the largest volume of freshwater discharge, and those occurring in late spring (April – June) when temperatures are higher and oysters are less able to cope with salinity stress. Future impacts of Spillway openings on salinity levels in the Mississippi Sound may be predicted using computer models developed by the University of Southern Mississippi and validated with MBRACE field measurements during the 2019 openings.

Conclusion

Since state management began in 1902, oyster landings in Mississippi have fluctuated dramatically due to complex interactions between natural and man-made disasters, variability in salinity regimes, and alterations in management authority. Previous efforts to rebuild Mississippi oyster populations have focused on adding materials to reefs to provide suitable substrate for oysters to settle and survive on, with the primary focus of restoring commercial landings.

Yet, recovering and sustaining the full array of environmental and non-harvest economic benefits of healthy oyster reefs will require an ecosystem-based management approach that encompasses goals beyond increases in oyster landings. Comprehensive science- and technology-based research, such as that funded by MBRACE, is essential to implementing such an approach and achieving sustainable use of oyster resources in Mississippi. 

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Endnotes

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