The Economic and Social Impacts of the 2019 Bonnet Carré Spillway Disaster: A Baseline Study

September 2024

MISSISSIPPI STATE UNIVERSITY™
NATIONAL STRATEGIC PLANNING
& ANALYSIS RESEARCH CENTER

MISSISSIPPI STATE UNIVERSITY™
COASTAL RESEARCH & EXTENSION CENTER

Acknowledgements

This report was prepared for the Mississippi Sound Coalition with support and contributions from the Harrison County Board of Supervisors, and numerous community members across Mississippi's Gulf Coast who generously shared their insights and experiences.

We extend our gratitude to a hard-working team of research staff whose commitment and dedication were essential to the development and completion of this project.

Financial support for this project was provided by the Harrison County Board of Supervisors through a Sub-Award Agreement from the Mississippi Department of Marine Resources. This funding, sourced from the Gulf of Mexico Energy Security Act (GOMESA) for Fiscal Year 2024, enabled comprehensive research and community engagement efforts integral to the success of this report.

The Economic and Social Impacts of the 2019 Bonnet Carré Spillway Disaster: A Baseline Study

Produced for the Mississippi Sound Coalition in September 2024.

Steven Michael Grice, Ph.D.
Michael Taquino, Ph.D.
Michael Spanbauer, Ph.D.
Tim Reling, Ph.D.
Ben Posadas, Ph.D.

About NSPARC

NSPARC, the National Strategic Planning & Analysis Research Center at Mississippi State University, is a trusted source for research addressing critical challenges faced by government, economic and workforce development professionals, educational institutions, nonprofits, and the private sector. Drawing on a team of social scientists, economists, data engineers, data analysts, and machine learning experts, NSPARC facilitates informed decision-making.

With over 20 years of experience, NSPARC excels at combining data from disparate sources to tackle complex issues. NSPARC scientists uncover trends and enable evidence-based research across areas ranging from workforce development, education, and economics to disaster resilience, and community development. NSPARC scientists' versatility allows them to easily translate knowledge from one domain to another and collaborate effectively with diverse partners, ensuring research findings have real-world impact. This allows NSPARC to draw meaningful insights from data to address challenges faced by policymakers, employers, economic developers, and state agencies.

About CREC

The Coastal Research and Extension Center is Mississippi State University's "southern exposure," linking residents of the coastal region to the university. The center's mission is to conduct research and education programs aimed at developing a better understanding and use of renewable and nonrenewable resources in south Mississippi. Its applied research and educational programs with biological, physical and social systems focus on enhancing the quality of life of residents of Mississippi and other Gulf states.

Contact

For more information about this report, contact NSPARC:
Phone: 662-325-9242 | Email: nsparc@nsparc.msstate.edu.

Table of Contents

Study 2: Sociocultural Impact of the 2019 BCS Openings

Conclusion

References and Appendices

Executive Summary

The 2019 Bonnet Carré Spillway openings had a significant and multifaceted impact on the Mississippi Gulf Coast, disrupting local economies, industries, and communities. This report, commissioned by the Mississippi Sound Coalition and the Harrison County Board of supervisors, analyzes the economic, social, and environmental impacts of the spillway openings, with a focus on key industries such as seafood, charter boats, tourism, and hospitality.

Economic Impacts

Our research reveals that the spillway openings led to substantial declines in seafood harvests, particularly in the eastern oyster and brown shrimp sectors, resulting in severe economic losses for fishermen and seafood processors. The tourism industry, including hotels and charter boat operators, also experienced a downturn as the spillway's environmental effects disrupted local attractions and deterred visitors.

The analysis found that the coastal seafood industry lost over $10.2 million in landings following the 2019 BCS openings. These direct effects rippled out across Mississippi's Blue Economy, ultimately leading to the estimated losses of 316 jobs and $5.3 million in wages, as well as $12.2 million in estimated lost sales by processors, markets, and other seafood-related businesses. The tourism industry also suffered, with $4 million in lost revenues primarily due to reduced tourism activity during the 2019 beach closures. Workers across tourism and related industries saw estimated wage losses exceeding $3 million, while state and local tax revenues decreased by an estimated $3.1 million.

Sociocultural Impacts

The project team conducted interviews and focus groups with business owners, fishermen, and community leaders, to understand the broader social and cultural impacts. Participants discussed their experiences facing challenges such as declining seafood landings and competing seafood imports driving down the value of the remaining landings. Participants explained how these difficulties were then exacerbated by rising diesel and insurance costs during the COVID-19 pandemic. In the tourism sector, reduced hotel occupancy and canceled charter boat operations forced businesses to cut costs and adapt their offerings. Restaurant owners turned to imported seafood or non-seafood alternatives due to supply chain challenges. Additionally, the spillway openings disrupted local cultural traditions, with community events canceled and ongoing concerns about future openings threatening the region's cultural and economic stability.

Future Projections

Forecasting models estimate that future spillway openings will have recurring impacts similar to those previously described. However, any future effects will depend heavily on the ability of coastal fisheries to recover ecologically from these events and whether the local workforce continues to engage in seafood-related businesses in an area where resources are frequently disrupted.

While some local experts believe recovery is possible if there are long periods without disruption, many in the community and workforce remain skeptical. Additional challenges compound these concerns: the local seafood industry faces intense competition from imported seafood, and many who have sustained the trade for generations are selling their boats and leaving the industry.

> **Research should continue to explore these complex and interconnected issues, including the economic and social ramifications of a broad structural shift in the Mississippi Gulf Coast economy towards other industries.**

1

Introduction

- Background and Context
- Project Scope
- Research Highlights

Background and Context

A disaster that severely impacted the Mississippi Sound was triggered in 2019 when the Army Corp of Engineers opened the Bonnet Carré Spillway (BCS) on February 27 for 43 consecutive days, and again on May 10 for another 79 consecutive days, releasing a total of 6 trillion gallons of fresh water into the Gulf of Mexico (Seubert, 2019). As a flood control mechanism, the spillway is designed to protect New Orleans from flooding by diverting excess water from the Mississippi River into Lake Pontchartrain and ultimately into the Gulf of Mexico (U.S. Army Corps of Engineers, n.d.). However, the volume of fresh water released was so significant and polluted with nutrients from agricultural runoff that it substantially reduced salinity levels and caused massive algal blooms in the Mississippi Sound (Armstrong et al., 2021; Snow et al., 2024). The immediate impact of the disaster included the decimation of the eastern oyster and brown shrimp populations, the loss of commercial fish populations native to the Mississippi Sound, and the closure of Mississippi beaches and water recreation at the height of the 2019 tourist season (Seubert, 2019; Mississippi Department of Environmental Quality, 2019).

The impacts of the 2019 BCS openings did not stop at the water's edge, but also resulted in economic impacts on industries and businesses reliant on the Mississippi Sound, including the seafood harvesting, seafood processing, charter boat, and tourism sectors along the Coast. The disaster also posed significant threats to Mississippi's $9.7 billion Blue Economy and the quality of life that is so integral to the Mississippi Gulf Coast.

To assess the extent of these economic and social impacts caused by the 2019 BCS openings, two major units of Mississippi State University – the National Strategic Planning & Analysis Research Center (NSPARC) and the Coastal Research and Extension Center (CREC) – were commissioned by the Mississippi Sound Coalition and the Harrison County Board of Supervisors to conduct this research. The research is designed to estimate the magnitude of economic losses incurred by the Mississippi Gulf Coast and its counties, municipalities, industries, and businesses, due to the 2019 BCS openings. The research also assesses the impacts of the openings on the well-being of businesses and residents and the perceptions of Mississippi seafood and the Gulf Coast as an ideal place to live, work, and visit. Finally, this research includes a forecast of the impacts that would likely be incurred if the BCS opened in a similar manner in the future.

Project Scope

The results of this research are presented as two distinct studies: a quantitative analysis focusing on the economic impacts and a qualitative assessment exploring the sociocultural effects. Together, these studies provide a comprehensive view of the 2019 BCS openings' short-term and long-term consequences on Mississippi's coastal economy and communities.

Quantitatively, the project team compiled data from a wide variety of public and proprietary sources, including the National Oceanic and Atmospheric Administration (NOAA), Bureau of Labor Statistics (BLS), Lightcast, Mississippi's Office of the State Auditor (OSA), Mississippi Department of Revenue (MDOR), Mississippi Department of Employment Security (MDES), Smith Travel

Accommodation Reports (STAR), and consumer expenditure surveys. These data were analyzed to quantify the extent of economic losses in the following areas:

Key Industrial Sectors – The economic losses experienced by the seafood harvesting (including eastern oysters, blue crab, brown shrimp, white shrimp, and spotted seatrout), seafood processing, charter boat, and tourism sectors in Hancock, Harrison and Jackson counties. These industries were chosen based on their economic importance and the priorities set by the Mississippi Sound Coalition and the Harrison County Board of Supervisors.

Tax Revenue – The impact of the 2019 BCS openings on local tax revenue critical to the economies of Mississippi's three coastal counties, the region's municipalities, and the state as whole. The measured revenues include state and municipal sales tax revenue within Hancock, Harrison, and Jackson Counties. Data on state and local gaming tax revenue in Hancock and Harrison Counties were examined along with associated school district revenue, state income tax revenue, special room and sales tax revenue for local governments in the three coastal counties, and ad valorem taxes for each of the coast's local governments and school districts.

Broader Blue Economy – The Mississippi Gulf Coast forms the backbone of the state's Blue Economy, and disruptions to this foundation could have far-reaching consequences. This section of the study provides estimates on how the 2019 BCS openings rippled through various industries across tied to the Blue Economy, highlighting broader impacts on workers and industries.

Future Impacts – Projections extend the analysis to estimate the potential economic impacts of future spillway openings over the next 14 years. This forward-looking component forecasts the likely effects on industries, tax revenues, and the Blue Economy.

Qualitatively, a series of semi-structured focus group surveys and interviews were conducted in Hancock, Harrison, and Jackson counties to assess how the 2019 BCS openings influenced consumer perceptions, business operations, livelihoods, and community well-being on the Mississippi Gulf Coast. Fifty local business leaders, elected officials, seafood industry workers, and community residents participated and provided their direct experiences on the 2019 BCS openings and their perspective on future impacts, should the spillway be opened again for a similar duration. The data gathered from these sessions provided insight into changes in consumer perceptions, operational challenges, and the broader cultural and community implications of the spillway openings.

Research Highlights

Study 1: Economic Impact of the 2019 BCS Openings

Seafood Industry – Seafood landings declined by 5.3 million pounds, with this result being primarily driven by the 100% reduction in eastern oyster landings, the 74% decrease in brown shrimp landings, and the 14% reduction in spotted seatrout landings. Collectively, these losses were valued at $10.2 million in dockside sales. These reduced landings led to broader economic losses, including 316 lost jobs between 2019 to 2022, $5.3 million in lost wages, and $12.2 million in lost sales across the coastal seafood industry and the state's broader Blue Economy.

Tourism Industry – Estimated direct losses in the tourism industry exceed $4 million, including $2.2 million in documented losses of hotel revenues, driven by a 3.8% decline in demand for hotel rooms during the beach closures of 2019. These losses induced ripple effects in the Blue Economy, including 101 lost jobs and a total of $3.2 million in lost wages on the coast and across the state.

Tax Revenues – The lost economic activity through the seafood industry, tourism industry, and the broader Blue Economy translated into an estimated $3.1 million reduction in state and local tax revenues. Of these, $2 million in losses were incurred by the state government, while the coastal county and municipal governments lost $401,000 and $732,000, respectively.

Study 2: Sociocultural Impact of the 2019 BCS Openings

Seafood Industry – Participants from the seafood industry reported significant declines in seafood landings due to the 2019 BCS openings, disrupting local supply chains. The ecological damage caused by the openings, combined with COVID-19 economic pressures on diesel and insurance prices, led to a shift toward imported seafood and led to a mass exodus of workers from the industry.

Tourism Industry – Participants from the tourism industry reported reduced occupancy rates among regional hotels following the spillway openings, prompting cost-cutting measures (e.g., staffing reductions) and operational changes to remain competitive. Charter boat operations were also affected, with cancellations and adjustments to fishing locations and species. Restaurant owners reported switching from local seafood to imported options or reducing seafood offerings in favor of poultry and beef due to supply chain disruptions.

Cultural and Economic Impacts – Participants emphasized the importance of the Mississippi Sound to the region's cultural identity. The 2019 BCS openings caused cancellations of community events and fostered ongoing concerns about future spillway openings causing disruptions to local industries and traditions.

Future Impacts

This report forecasts the potential impacts of future spillway openings by assuming that future spillway events will resemble those of 2019 in terms of frequency, intensity, and impact.

Projections indicate a consistent loss of approximately 410 jobs per event, alongside $10.1 million in lost wages, $11.3 million in lost sales, and $3.1 million in lost tax revenues (adjusted to 2024 dollars). However, these estimates may not fully capture the potential vulnerabilities of the Sound's ecosystem or the broader economic effects of its relationship with the region; for this reason, a detailed discussion of this topic is presented at the end of this report.

2

Economic Impact of the 2019 BCS Openings

- Overview
- Data and Sources
- Analytical Strategy
- Results

OVERVIEW

To comprehensively assess the multidimensional impact of the 2019 Bonnet Carré Spillway openings, this analysis incorporates a range of data from open-source, governmental, and commercially available sources. Each source was strategically selected to provide a unique perspective on the Mississippi Gulf Coast's economic landscape. This approach ensures that the analysis captures a broad range of economic changes, enabling the research team to extract specific insights that contribute to a broader understanding of the overall economic impact.

The data and analyses in this study are broadly grouped into three categories. First, this study examines data related to the coastal seafood industry, with a specific focus on the species that have been identified as priorities by the Mississippi Sound Coalition and the Harrison County Board of Supervisors: eastern oysters, blue crab, brown shrimp, white shrimp, and spotted seatrout. Second, this report examines data related to the coastal tourism industry, including the charter boat industry, the hotel and lodging industry, and the broader tourism industry as a whole.[1] Third, this study examines data related to the collection of tax revenues by coastal Mississippi counties and municipalities, including Hancock, Harrison, and Jackson counties.

These insights are then used to calibrate an econometric input/output model. Through this model, the research team captures the indirect impacts across Mississippi's broader Blue Economy and forecasts potential future economic effects from similar spillway openings.

DATA AND SOURCES

To assess the economic impacts of the 2019 Bonnet Carré Spillway openings on the Mississippi Gulf Coast, the project team collected and analyzed data which provide insight into the coastal seafood industry, coastal tourism industry, and municipal tax revenues.

While each dataset provides a unique perspective, each also has its limitations. By combining these data sources in this study's comprehensive analysis, it is possible to create a well-rounded and detailed assessment of its impacts on Mississippi's Gulf Coast's economy.

COASTAL SEAFOOD INDUSTRY DATA

Historic Fishery Landings Data – Annual data on fishery landings and ex-vessel prices (dockside value) for eastern oyster, blue crab, brown shrimp, white shrimp and spotted seatrout were obtained from the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries public data sets, which compile reports from commercial fishing operators. However, these data are do not provide information about individual employment or earnings of a harvesting operation, or how earnings are distributed to a crew.

Seafood Processing Data – Data on the number of seafood processing plants and data on employment in the seafood processing industry were collected by the NOAA Fisheries Seafood Processor Survey. These data also typically include information on the total pounds

[1] The tourism industry is not traditionally defined as an industry under the North American Industrial Classification System (NAICS). This report defined the tourism industry as an amalgamation of other existing industries; see Appendix A for a list of industries included in this definition.

and value of processed seafood by species (eastern oyster, blue crab, brown shrimp, white shrimp, and spotted seatrout), however, due to limitations of the survey, this processing data was largely unavailable in 2011-2022.

Coastal Tourism Industry Data

County-Level Employment Estimates – The project team compiled data on county-level employment estimates for the charter boat industry, hotel and lodging industry, and for the tourism industry overall. County-level estimates were obtained through Lightcast, which integrates data from government and private-sector sources to offer detailed economic profiles.

While Lightcast is the provider of the most complete, nuanced, and up-to-date labor market data available, these data come with two caveats (Lightcast, 2024). First, annual county-level estimates have the potential to mask granular changes occurring during a year and at smaller levels of geography. Second, the estimates treat part-time and full-time jobs equally, and do not provide information necessary to quantify reduced hours for hourly workers or diminished earnings for commission-based employees.

Mississippi Business Employment Records – The project team obtained business-level employment records from the Mississippi Department of Employment Security (MDES) which collects data directly from employers participating in Mississippi's covered employment system.

These records provide monthly information on employment, and therefore more detail about labor market fluctuations within a given year when compared to Lightcast estimates, but data are limited to employers that are headquartered in the coastal counties and that participate in the state's Covered Employment program. This excludes some businesses, including (but not limited to) self-employed charter boat captains, independent contractors, and proprietors of bed-and-breakfast establishments.

Tourism Industry Sales Revenue Data – Monthly sales data were gathered for Mississippi's coastal counties and the state as a whole, including gross sales, deductions, and net sales figures from 2013 to 2023. These data were collected from the Mississippi Department of Revenue annual tax reports. While these data offer a year-over-year measure of tourism industry growth, they cannot capture month-to-month or day-to-day fluctuations in the region's tourism activity.

Hotel Occupancy and Revenue Reports – Data on hotel performance came from the Smith Travel Accommodation Report (STAR), produced by STR (Smith Travel Research). These reports offer detailed metrics, focusing on occupancy rates and revenue, and provide insights into both annual and monthly trends in hotel performance. While these data deliver valuable information about the hotel sector, they represent only one component of the broader tourism industry.

Tourism Expenditure Data – Data on traveler spending came from the Consumer Expenditure Survey, an annual survey of households conducted by the U.S. Bureau of Labor Statistics (BLS) to study how U.S. consumers allocate their spending. These data break down expenditures into categories such as transportation, lodging, food, entertainment, and alcohol. Although they do not provide direct insight into Mississippi's coastal tourism industry, they can be combined with other datasets to estimate how changes in hotel occupancy impact overall tourism spending in the region.

State and Local Tax Revenue Data

Municipal Tax Revenue Data – General revenue data were collected for Hancock, Harrison, and Jackson counties and their respective municipalities and school districts, covering property taxes, sales taxes, gaming taxes, and other municipal revenue sources from 2016 to 2021. These data were extracted from 2016-2021 public audit statements produced by Mississippi's Office of the State Auditor. Data after 2021 were not uniformly available.

Additionally, data for Pass Christian were unavailable in 2016, and data for Moss Point were unavailable in 2021; however, the revenues of these municipalities account for less than 1% of the region's reported general revenues during the study period. In cases where intergovernmental transfers were included in the revenue figures, the team excluded them to ensure consistency across municipalities.

Analytical Strategy

This study analyzes historical data to assess long-term trends and establish a context for understanding to what extent the 2019 BCS openings disrupted established patterns in the local economy. In addition to trend analysis, this study employs a modified version of the Seafood Landing Assessment Model (SLAM), developed by Posadas et al. (2017), specifically adapted for this project to evaluate the economic impacts within each category.

The SLAM framework utilizes a mean-difference methodology to compare pre- and post-event data, enabling measurement of changes in economic activity such as seafood harvests and industry employment. This approach calculates the absolute difference between the arithmetic averages of different time periods or groups, and it is a widely accepted method for assessing the "scale and magnitude" of disaster impacts by comparing post-event data to pre-event baselines (Gallardo-Gomez et al., 2024; FEMA, 2020; NOAA, 2024). In this study, the pre-event baseline is 2014-2018, while the post-event data is presented from 2019 through 2022.

By applying both trend analysis and the SLAM framework, this study provides a comprehensive understanding of the spillway's economic impact across the region's seafood and tourism industry, as well as on the state and local government tax revenues.

Coastal Seafood Industry

Analysis of the coastal seafood industry data begins by examining 20-year trends in seafood landings, from 2003 to 2022. This longitudinal approach is ideal for estimating industry trends, especially since detailed employment data is not widely available. It establishes historical patterns in seafood landings and provides crucial context for understanding the effects of the 2019 BCS openings on the industry.

Next, the SLAM framework is used to compare seafood landings and dockside values during the pre-event baseline period (2014–2018) with the post-event period (2019–2022). This comparison provides both nominal values and the differences observed between the baseline and post-event periods.

The following key metrics were developed using this framework:

Seafood Landings – Measures the volume of eastern oyster, blue crab, brown shrimp, white shrimp, and spotted seatrout harvested (in pounds) before and after the spillway openings.

Lost Landings – Measures the difference in seafood harvest volumes during 2019, 2020, 2021, and 2022 relative to the average harvest volumes from 2014–2018.

Value of Landings – Measures the total annual dockside value (or ex-vessel price) of eastern oyster, blue crab, brown shrimp, white shrimp, and spotted seatrout landings (in dollars) before and after the spillway event.

Foregone Value of Landings – Measures the difference in the dockside value of seafood harvested in 2019, 2020, 2021, and 2022 relative to the average dockside value from 2014–2018.

Coastal Tourism Industry

This analysis begins by examining county-level tourism employment trends using data from Lightcast, which provides estimates of tourism jobs in Jackson, Hancock, and Harrison counties. While these estimates offer insights into historical tourism employment trends, their aggregation to the county-level may obscure specific impacts along the coastline, and their equal treatment of full-time and part-time jobs may overlook reduced hours for hourly workers or diminished earnings for commission-based employees.

Next, the SLAM framework is applied to compare tourism employment levels during the pre-event baseline period (2014–2018) with the post-event period (2019–2022).

To address the limitations of county-level estimates, this analysis next examines business-level employment records from Mississippi's coastal businesses. Sourced from the Mississippi Department of Employment Security, these data provide a more granular view of employment trends in the coastal tourism sector. However, as discussed above, these data only capture businesses participating in Mississippi's covered employment system which are headquartered in the counties of analysis.

Next, the analysis reviews annual gross sales revenue data from the Mississippi Department of Revenue to identify any measurable declines in sales within the coastal tourism industry. Although all tourism businesses report sales revenues, the annual nature of the data may mask short-term losses, such as those resulting from beach closures.

To specifically delve into short-term impacts resulting from beach closures, hotel performance data are assessed to determine whether hotel occupancy or revenue declined contemporaneously with the July 2019 beach closures. Year-over-year occupancy rates and revenue data were examined for July of 2019 in particular, and for study period in general. While these data offer insight into the volume and duration of overnight stays, they can only provide estimates of the broader impact on the tourism industry.

Within this framework, the following measurements were developed:

County-Level Employment – Estimates the level of employment in the coastal tourism industry, with specific breakdowns for the charter boat industry and the hotel and lodging industry.

Lost Employment – Measures the difference in estimated tourism employment during 2019, 2020, 2021, and 2022 relative to the estimated employment from the 2014–2018 baseline period.

Business Level Employment Trends – Measures the number of individuals employed each month by coastal tourism employers participating in Mississippi's covered employment system.

Annual Gross Sales in Coastal Tourism Industries – Measures the gross sales reported annually by tourism-related businesses in Jackson, Harrison, and Hancock counties to the Mississippi Department of Revenue.[2]

Estimated Change in Tourism Sales – Calculates the estimated change in tourism industry sales caused by a reduction in out-of-town visits, particularly in July 2019, when widespread beach closures deterred tourists. This is derived by combining year-over-year declines in hotel revenue with tourism expenditure data.

State and Local Tax Revenue

Financial audit data from Mississippi's Office of the State Auditor were analyzed to identify changes in state and local tax revenues over time, providing insight into how revenue streams—such as sales, property, and gaming taxes—were impacted by the spillway event.

Financial audit data statements for Hancock, Harrison, and Jackson counties, the municipalities within these counties, and the school districts within these counties were plotted over time to identify trends and patterns.

The following indicator was developed:

General Revenue – Measures the general revenue for each county and municipality. In cases where intergovernmental transfers were included in the reported revenue figures, these amounts were manually excluded to ensure consistency across municipalities.

IMPLAN Analysis

The IMPLAN (short for "impact planning") input/output model is a widely used economic analysis tool that evaluates the relationships between industries, quantifying how changes in one sector can affect others. The IMPLAN model incorporates data from multiple sources, such as the U.S. Bureau of Economic Analysis and the U.S. Bureau of Labor Statistics, to create a baseline model of a regional economy and then estimate the impact or ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its

[2] Because these data are not disaggregated by individual NAICS codes, this measurement was constructed using businesses in either the *Accommodation and Food Services* or the *Arts, Entertainment, and Recreation* industry.

Input-Output and Social Accounting Matrix model. Indirect impacts occur as affected businesses reduce purchases from their suppliers, leading to further job losses and income reductions in those sectors. Induced impacts arise when workers in the affected industries spend less due to decreased wages, further compounding the economic downturn in the community (Demski, 2020). IMPLAN has been used in numerous public and private studies to estimate economic impacts, and it is a well-regarded model for evaluating the complex relationships within an economy (IMPLAN Group LLC, 2024).

The IMPLAN model was calibrated with the seafood and tourism industry losses identified in this study, allowing for the measurement of broader economic impacts, including job losses and reductions in income. With these inputs, the model produced the following outputs:

Lost Employment – The estimated number of full-time equivalent jobs lost in Mississippi as a result of the 2019 BCS openings.

Lost Sales – The estimated annual sales lost by seafood harvesters in Mississippi attributable to the 2019 BCS openings.

Lost Income – The estimated annual sales lost by seafood harvesters, and the estimated annual income lost by workers in the related seafood industries (e.g., seafood processing and markets) and the tourism industry.

Foregone Tax Revenue – The estimated annual amount of tax revenue could have been collected by state and local governments, had the 2019 BCS impacts on the coastal seafood harvesting, seafood processing, seafood market, and tourism industries not occurred.

These impacts account for both the direct losses, and the indirect losses in Mississippi's Blue Economy.

Forecast of Future Impacts

Projections were developed to estimate the potential economic impacts of future BCS openings over a 14-year period (2025–2038). As specified by the Harrison County Board of Supervisors and the Mississippi Sound Coalition, these projections are based on historical patterns and assume the future events would occur with the same intensity as the 2019 BCS openings. Using these parameters, the project team assumed that major spillway events - of similar magnitude to 2019 - would occur approximately every eight years, including 2027 and 2035.

Using this information, it was assumed that future openings would produce similar economic effects to those observed in 2019. The IMPLAN model was used to forecast these impacts, including expected losses in jobs, income, and tax revenues on the Mississippi Gulf Coast and related industries throughout the state.

RESULTS

OVERVIEW

This section presents the findings of the study, organized by this study's three categories of analysis: coastal seafood, coastal tourism, and state and local tax revenue.

The coastal seafood industry results section first explores 20 years of seafood landings data from NOAA Fisheries (2003-2022), and then presents the SLAM framework's assessment of the 2019 BCS openings on seafood landings and dockside values, comparing the pre-event baseline (2014-2018) to the post-event period (2019-2022).

The coastal tourism industry results section begins with an analysis of employment trends using Lightcast estimates (2003-2022). Next, the SLAM framework assessment is presented to compare tourism employment estimates before and after the 2019 BCS spillway openings. Additional employment trends are presented using business-level employment records from the Mississippi Department of Employment Security (2018-2023). The section then presents findings gathered from Mississippi Department of Revenue sales data (2016-2023), followed by estimates of tourism spending created using hotel occupancy and revenue insights from STAR data (2018-2019).

The state and local tax revenue section focuses on revenue trends across Hancock, Harrison, and Jackson counties. Data from the Mississippi Office of the State Auditor (2016-2021) are plotted over time to provide insight into how tax revenues were affected by the spillway event.

Overall, this analysis identified a $10.2 million loss in seafood landings, resulting in 316 lost jobs, $5.3 million in lost wages, and $12.2 million in total economic losses across the seafood sector. Losses across the tourism industry included $4 million in lost revenues, driven mainly by the decreased tourism activity during the 2019 beach closures. Workers in tourism and tourism-related industries lost over $3 million in wages, and tax revenues for state and local governments fell by nearly $3.1 million.

RESULTS: COASTAL SEAFOOD INDUSTRY

Trends in Seafood Landings: Insights from NOAA Fisheries Data

Table 1 and Figure 1 present the annual landings, in pounds, of five seafood species that have been identified as priorities for the Mississippi Sound Coalition and the Harrison County Board of Supervisors - eastern oysters, blue crab, brown shrimp, white shrimp, and spotted seatrout - for a 20-year period (2003 through 2022).

Eastern oyster landings exhibited significant annual fluctuations, with peak landings occurring in 2003 (4.0 million pounds), followed by a sharp decline until 2006, when landings reached zero for the first time after Hurricane Katrina. Harvests recovered in 2008, reaching 2.6 million pounds, before declining again in 2011 (after the 2010 Deepwater Horizon oil spill). This declining harvest reached zero for the second time in 2019, after the BCS openings, and has remained at that level through 2022.

Blue crab landings appear to trend upwards as oyster landings trend downwards. Landings reached a peak in 2006 (1.1 million pounds) following Hurricane Katrina, and surged again in

2019 (928,000 pounds) after the 2019 BSC openings. Landings averaged 874,000 pounds per year from 2019 through 2022.

Brown shrimp landings were typically the largest in volume across the years. Landings peaked in 2004 (13.1 million pounds), but also experienced a substantial decline in 2014 when the shrimping grounds were temporarily closed mid-season (Coblentz, 2015). Brown shrimp harvests dropped from 6.2 million in 2018 to 1.5 million pounds in 2019, the lowest value in this period. Landings partially recovered in 2020-2022, averaging 2.5 million pounds per year.

White shrimp landings reached a peak in 2019 (5.8 million pounds), and the second-highest year of landings occurred in 2016 (5.6 million pounds). Harvests from 2019-2022 (after the BCS openings) averaged 4.1 million pounds per year.

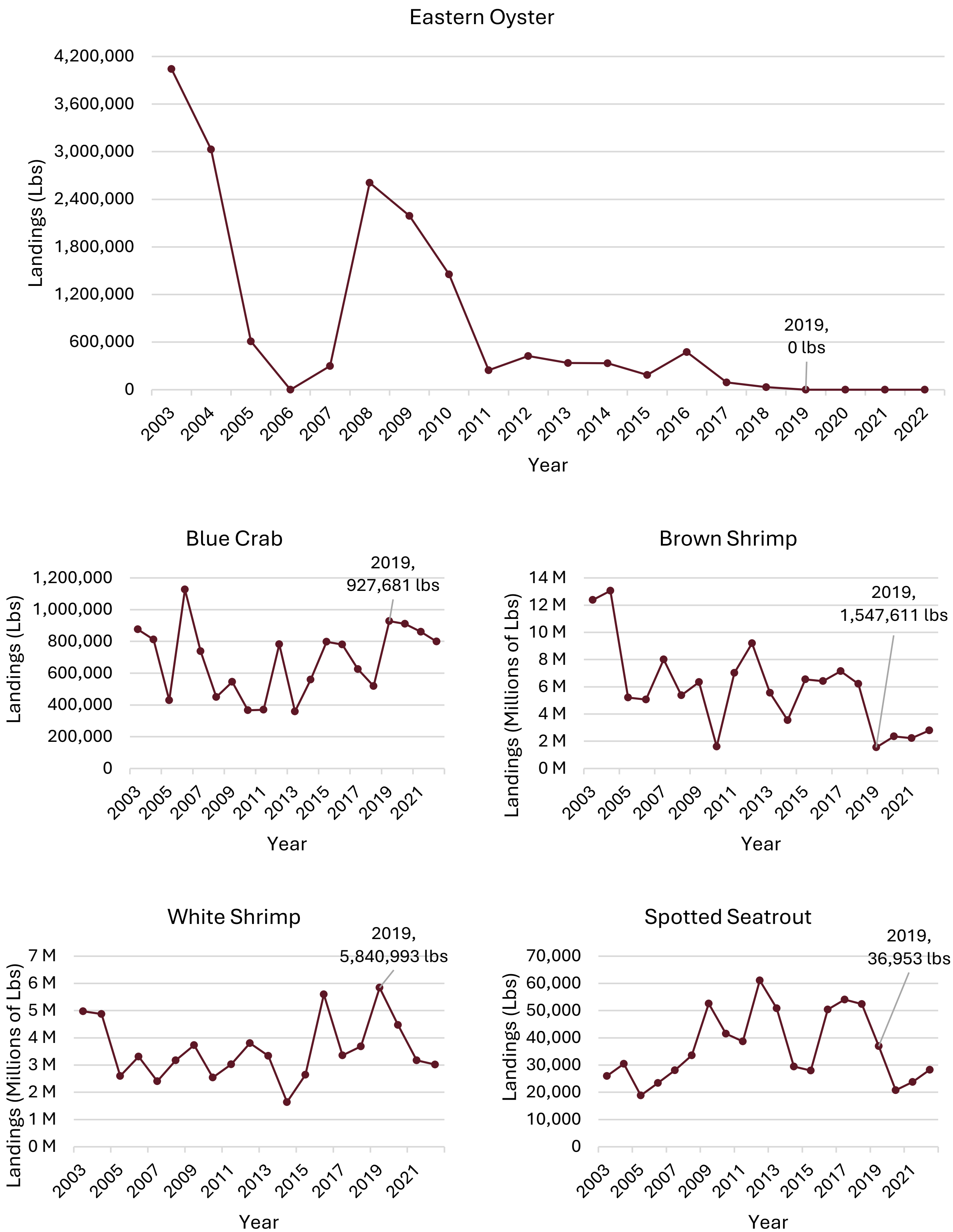
Spotted seatrout landings are relatively lower than other species throughout the period. Harvests fluctuated around 25 thousand pounds from 2003-2005 before increasing to 53 thousand in 2009. Landings then averaged around 44 thousand pounds per year from 2010 to 2019, before falling to an average of 27 thousand pounds per year from 2019-2022.

TABLE 1: POUNDS OF SEAFOOD LANDINGS, 2003-2022

Year	Eastern Oyster	Blue Crab	Brown Shrimp	White Shrimp	Spotted Seatrout
2003	4,042,136	876,521	12,385,549	4,979,436	25,940
2004	3,029,391	812,106	13,052,681	4,879,212	30,469
2005	610,384	429,231	5,213,743	2,600,677	18,850
2006	0	1,126,818	5,071,731	3,308,232	23,404
2007	299,088	737,668	8,009,397	2,409,470	28,098
2008	2,610,349	450,188	5,382,305	3,175,531	33,533
2009	2,191,724	545,626	6,334,530	3,731,209	52,615
2010	1,452,712	367,189	1,602,473	2,545,338	41,534
2011	247,384	370,195	7,017,605	3,027,277	38,675
2012	425,496	782,114	9,197,616	3,808,135	61,099
2013	336,192	359,254	5,565,645	3,336,862	50,820
2014	333,208	558,877	3,545,074	1,641,828	29,437
2015	185,688	798,305	6,544,996	2,640,028	27,995
2016	474,784	780,047	6,412,041	5,597,822	50,436
2017	92,392	625,683	7,143,070	3,357,426	54,062
2018	31,832	518,781	6,208,266	3,687,698	52,404
2019	0	927,681	1,547,611	5,840,993	36,953
2020	0	910,077	2,362,366	4,469,449	20,814
2021	0	860,675	2,225,194	3,175,431	23,795
2022	0	798,886	2,798,053	3,017,350	28,252

Source: NOAA Fisheries, 2024

FIGURE 1: MISSISSIPPI SEAFOOD LANDINGS, BY YEAR, 2003 - 2022



Source: NOAA Fisheries, 2024

SLAM Analysis: Comparison of Seafood Landings

Table 2 compares the average seafood landings for eastern oysters, blue crab, brown shrimp, white shrimp, and spotted seatrout during the five-year period before the 2019 BCS openings (2014–2018) against the landings recorded from 2019 through 2022.

In some instances, total seafood landings and the value of harvests rose following the 2019 BCS openings. For these instances, no adverse impact was attributed to the event.

In other instances, a nominal decrease in seafood harvests was observed, which also coincided with rising diesel fuel costs and decreasing dockside seafood prices. Previous research has shown that fishermen are less willing to incur the costs of operating a fishing vessel when diesel prices rise and the dockside value of a landing falls (Posadas, 2022); for this reason, no adverse impact was attributed to the BCS openings for these instances.

Eastern oyster landings saw a complete loss; zero landings following the 2019 BCS openings, in contrast to the 2014-2018 average of 224,000 pounds.

Blue crab landings increased after the 2019 BCS openings compared to the 2014-2018 average, peaking at nearly 928,000 pounds in 2019. Landings remained at higher-than-average levels through 2022.

Brown shrimp landings experienced a significant decrease from the 2014-2018 average of 6.0 million pounds, before the 2019 BCS openings, to 1.5 million pounds in 2019, with a slight recovery to approximately 2.5 million per year in the subsequent years.

White shrimp landings increased in 2019 to 5.8 million pounds, exceeding the 2014-2018 average of 3.4 million pounds, before returning to an average of approximately 3.6 million pounds per year in the remaining years.

Spotted seatrout landings decreased from an average of 43 thousand pounds in 2014-2018 to 37 thousand pounds in 2019. Landings remained lower than average in the remaining years, fluctuating between 21 and 28 thousand pounds per year.

TABLE 2: SEAFOOD LANDINGS BEFORE AND AFTER 2019 BONNET CARRÉ SPILLWAY OPENINGS

Average Landings Before 2019 BCS Openings, in Pounds (Mean Landings, 2014-2018)		Landings After 2019 BCS Openings in Pounds			
		2019	2020	2021	2022
Eastern Oyster	223,581	0	0	0	0
Blue Crab	656,339	927,681†	910,077†	860,675†	798,886†
Brown Shrimp	5,970,689	1,547,611	2,362,366*	2,225,194*	2,798,053*
White Shrimp	3,384,960	5,840,993†	4,469,449†	3,175,431*	3,017,350*
Spotted Seatrout	42,867	36,953	20,814*	23,795*	28,252*

**Note: These decreases in landings relative to the 2014-2018 average value coincide with increases in diesel fuel prices, decreases in shrimp prices, and increased volume of shrimp imports. Previous research has shown that some fishermen are less willing to incur the costs of operating a fishing vessel when diesel prices rise and the dockside value of a landing falls (Posadas, 2022). For this reason, no adverse impact was attributed to the BCS openings.*

†Note: These landings increased relative to the 2014-2018 average value. For this reason, no adverse impact was attributed to the BCS openings.

Source: NOAA Fisheries, 2024; Posadas, 2022

Table 3 presents the lost seafood harvests for each species (in pounds), calculated using the mean-difference methodology, or the annual difference between each harvest year, from 2019-2022, and the 2014-2018 baseline period.

Eastern oyster landings experienced a complete loss, with landings dropping by 223,581 pounds each year from 2019 to 2022, totaling a loss of 894,324 pounds over the four-year period.

Blue crab landings showed no identifiable loss, as landings increased throughout the post-opening period.

Brown shrimp landings experienced the largest reduction in 2019, with a loss of 4.4 million pounds, representing a 74% decrease from the pre-2019 average, but no further attributable losses were recorded in subsequent years due to corresponding increases in diesel fuel prices, decreases in shrimp prices, and increased volume of shrimp imports.

White shrimp landings showed no identifiable loss in 2019 and 2020, as landings increased throughout these years. Landings fell below the 2014-2018 average during 2021 and 2022, but these decreases corresponded with increases in diesel fuel prices, decreases in shrimp prices, and increased volume of shrimp imports.

Spotted seatrout landings experienced a small reduction of 5,914 pounds (14%) in 2019, with no further losses attributed to the spillway openings in later years due to increases in diesel fuel prices.

In total, the lost landings from 2019 to 2022 amounted to 5.3 million pounds, primarily driven by the substantial reductions in Oyster and Brown Shrimp harvests.

TABLE 3: LOST LANDINGS OF SEAFOOD HARVESTS, IN POUNDS, 2019-2022

Average Landings Before 2019 BCS Openings, in Pounds (Mean Landings, 2014-2018)		Lost Landings in Pounds				
		2019	2020	2021	2022	Total
Eastern Oyster	223,581	-223,581 (-100%)	-223,581 (-100%)	-223,581 (-100%)	-223,581 (-100%)	**-894,324**
Blue Crab	656,339	*No Identifiable Loss (Landings Increased)*	*No Identifiable Loss (Landings Increased)*	*No Identifiable Loss (Landings Increased)*	*No Identifiable Loss (Landings Increased)*	*No Identifiable Loss (Landings Increased)*
Brown Shrimp	5,970,689	-4,423,078 (-74%)	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	**-4,423,078**
White Shrimp	3,384,960	*No Identifiable Loss (Landings Increased)*	*No Identifiable Loss (Landings Increased)*	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*
Spotted Seatrout	42,867	-5,914 (-14%)	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	**-5,914**
Total	**10,278,436**	**-4,652,573**	**-223,581**	**-223,581**	**-223,581**	**-5,323,316**

Source: NOAA Fisheries, 2024; Posadas, 2022

SLAM Analysis: Comparison of Dockside Values

Table 4 compares the average dockside value of seafood landings from 2014-2018 against the value of landings from 2019 to 2022.

Eastern oyster landings experienced a complete loss in dockside value, given that there were no oyster landings. These landings were previously valued at an average of $1.1 million per year.

Blue crab landings increased in value, corresponding with the rise in landings. The average value of the harvest rose from a 2014-2018 average of $930,000 to a value of $1.3 million in 2019. Values continued to rise, reaching $1.6 million in 2021 and $1.5 million in 2022.

Brown shrimp landings experienced a sharp decline in 2019, with the value dropping to $2.3 million from a 2014-2018 average of $8.1 million.

White shrimp landings increased in value after the spillway openings, peaking at $12.9 million in 2019 before tapering off to pre-2019 levels.

Spotted seatrout landings declined in value after the spillway openings, with a low in 2020 of $72,000 and a high of $128,000 in 2019; these values were consistently below the 2014-2018 average of $146,000.

TABLE 4: VALUE OF SEAFOOD LANDINGS BEFORE AND AFTER 2019 BONNET CARRÉ SPILLWAY OPENINGS

Average Value of Landings Before 2019 BCS Openings (Mean Value, 2014-2018)		Value of Landings After 2019 BCS Openings			
		2019	2020	2021	2022
Eastern Oyster	$1,093,890	$0	$0	$0	$0
Blue Crab	$930,260	$1,274,797†	$1,340,474†	$1,635,213†	$1,494,771†
Brown Shrimp	$8,050,342	$2,292,786	$3,657,543*	$4,376,146*	$3,705,199*
White Shrimp	$6,808,795	$12,905,558†	$9,354,794†	$7,905,717†	$5,861,837*
Spotted Seatrout	$146,247	$128,191	$71,869*	$84,944*	$111,479*

**Note: These decreases in landings relative to the 2014-2018 average value coincide with increases in diesel fuel prices, decreases in shrimp prices, and increased volume of shrimp imports. Previous research has shown that some fishermen are less willing to incur the costs of operating a fishing vessel when diesel prices rise and the dockside value of a landing falls (Posadas, 2022). For this reason, no adverse impact was attributed to the BCS openings.*

†Note: These landings increased relative to the 2014-2018 average value. For this reason, no adverse impact was attributed to the BCS openings.

Source: NOAA Fisheries, 2024; Posadas, 2022

Table 5 presents the foregone value of seafood landings calculated using mean-difference methodology, or the annual difference between each harvest year and the 2014-2018 baseline period.

Eastern oyster landings experienced a loss of $1.1 million each year from 2019 to 2022, resulting in a cumulative loss of $4.4 million.

Blue crab landings showed no identifiable loss, as the value of landings increased throughout the post-opening period.

Brown shrimp landings experienced a sharp loss in 2019, with the value dropping by $5.8 million, or 72% below the 2014-2018 average.

White shrimp landings showed no identifiable loss, as the value of landings increased from 2019-2021. Although the value of landings decreased slightly in 2022, the decrease corresponded with increases in diesel fuel prices, decreases in shrimp prices, and increased volume of shrimp imports.

Spotted seatrout landings experienced a modest reduction in value in 2019, with a loss of $18,000 (12%). No further losses were attributable to the spillway openings in later years due to corresponding increases in diesel fuel prices.

Table 5: Foregone Value of Lost Seafood Landings, 2019-2022

Average Value of Landings Before 2019 BCS Openings (Mean Value, 2014-2018)		Foregone Value of Landings				
		2019	2020	2019	2022	Total
Eastern Oyster	$1,093,890	-$1,093,890 (-100%)	-$1,093,890 (-100%)	-$1,093,890 (-100%)	-$1,093,890 (-100%)	**-$4,375,560**
Blue Crab	$930,260	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*
Brown Shrimp	$8,050,342	-$5,757,556 (-72%)	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	**-$5,757,556**
White Shrimp	$6,808,795	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Attributable Loss*	*No Attributable Loss*
Spotted Seatrout	$146,247	-$18,056 (-12%)	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	**-$18,056**
Total	**$17,029,534**	**-$6,869,502**	**-$1,093,890**	**-$1,093,890**	**-$1,093,890**	**-$10,151,172**

Source: NOAA Fisheries, 2024; Posadas, 2022

Results: Coastal Tourism Industry

Trends in Tourism Employment: Insights using County-Level Estimates

Table 6 presents the annual employment estimates for the coastal tourism industry, broken down into three key sectors: the charter boat industry, the hotel and lodging industry, and an aggregated group of other tourism-related industries, including restaurants and entertainment establishments. These estimates are derived from county-level data provided by Lightcast. A full definition of all sectors included in the tourism industry can be found in Appendix A.

Overall, employment estimates indicate that employment in the coastal tourism sector declined sharply in 2006 due to Hurricane Katrina, before trending generally upward. A second sharp decline occurred in 2020 during the COVID-19 Pandemic, before rising again.

Charter Boat employment in the region fluctuated from 2003-2017 but remained under 100 employees during these years. In 2018, employment sharply rose to 300, before falling to 156 in 2019. In 2020-2022, employment remained around 200.

Hotel and Lodging employment reached nearly 16,000 in 2003 but fell to less than 9,000 in 2006. Employment recovered to about 12,000 in 2007 and 2008, before falling again in 2009 and 2010. Employment rose from 2011 through 2019, reaching almost 15,000 in 2019. Another decrease occurred during 2020, falling to about 11,000, before recovering to approximately 12,500 in 2021 and 2022.

Other tourism employment, including employment at restaurants, bars, and other entertainment establishments, fell from 2003 (19,000) through 2006 (15,000) before experiencing an upward trend. This upward trend was interrupted in 2020, when employment fell by roughly 1,500 before recovering to about 21,000 in 2022.

Table 6: Industry Employment, 2003-2022

Year	Charter Boats	Hotel and Lodging	Other Tourism	Total
2003	53	15,990	19,302	35,345
2004	54	15,614	19,426	35,094
2005	26	14,332	16,871	31,229
2006	32	8,685	15,087	23,804
2007	34	12,344	17,220	29,598
2008	37	12,182	17,460	29,679
2009	32	10,782	17,068	27,882
2010	69	10,541	17,264	27,874
2011	56	10,661	17,946	28,663
2012	58	10,696	18,809	29,563
2013	50	10,775	19,110	29,935
2014	49	11,060	19,156	30,265
2015	76	11,151	19,725	30,952
2016	73	12,133	20,734	32,940
2017	95	14,183	19,201	33,479
2018	300	14,349	19,504	34,153
2019	156	14,547	20,084	34,787
2020	206	11,311	18,598	30,115
2021	227	12,153	20,517	32,897
2022	213	12,755	21,397	34,365

Source: 2024; Lightcast, 2024

SLAM Analysis: Comparison of Tourism Employment

Table 7 compares the average coastal tourism employment in 2014-2018 against the employment in 2019 to 2022, using Lightcast employment estimates.

Overall, employment estimates from Lightcast indicate that employment in the coastal tourism sector was generally higher in 2019 when compared to the 2014-2018 period, before dipping in 2020 and recovering shortly thereafter. However, it is important to reiterate that these county-level employment estimates may obscure localized impacts along the coastline, and that the specific measurement of employment in these data may mask reduced hours for hourly workers or diminished earnings for commission-based employees.

Charter Boat employment from 2014-2018 averaged 119 jobs and rose to 156 in 2019. Employment peaked in 2021 and slightly decreased in 2022 but remained above the 2014-2018 average level.

Hotel and Lodging employment averaged roughly 12,500 jobs from 2014-2018 and rose to roughly 14,500 jobs in 2019. Employment dipped in 2020 to roughly 11,000, before recovering in 2021 and 2022.

Other tourism employment averaged nearly 20,000 jobs from 2014-2018 and remained at roughly the same level in 2019. Employment declined by roughly 2,500 in 2020 but recovered after 2021.

TABLE 7: COASTAL INDUSTRY EMPLOYMENT BEFORE AND AFTER 2019 BONNET CARRÉ SPILLWAY OPENINGS

Average Estimated Employment Before 2019 BCS Openings (Mean Employment, 2014-2018)		Employment After 2019 BCS Openings, in Jobs			
		2019	2020	2021	2022
Charter Boats	119	156	206	227	213
Hotels and Lodging	12,575	14,547	11,311	12,153	12,755
Other Tourism (Excluding Hotels and Charter Boats)	19,664	20,084	18,598	20,517	21,397
Total	32,358	34,787	30,115	32,897	34,365

Source: 2024; Lightcast, 2024

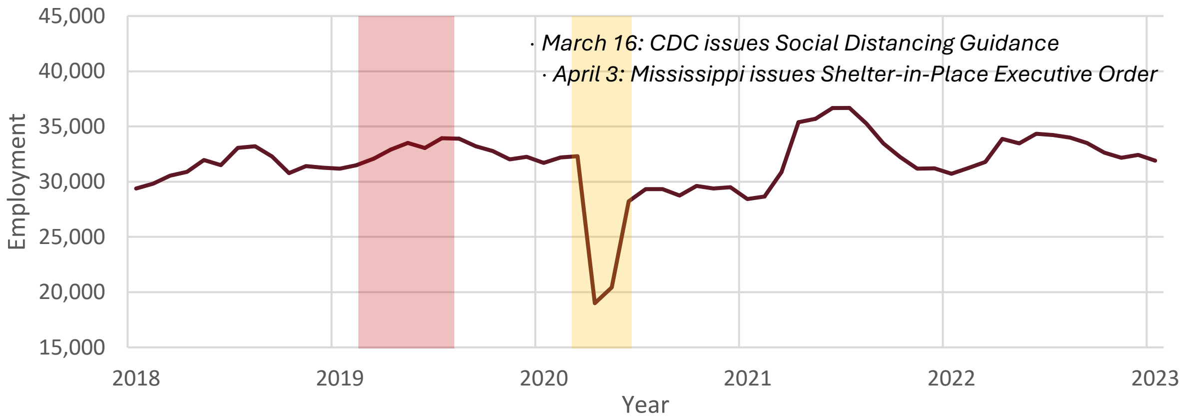
Trends in Tourism Employment: Insights using Business Employment Records

Figure 2 presents data from business-level employment records for the period between 2018 and 2023. The data indicate a seasonal hiring pattern. In January 2018, the coastal tourism industry employed 29,390 individuals, with employment increasing over the summer months to a peak of 32,278, before declining during the winter. In 2019, employment followed a similar upward trend, peaking in August at 33,896, before again dropping during the winter months.

In 2020, the COVID-19 pandemic led to a sharp decline in employment, coinciding with social distancing measures and shelter-in-place orders. Employment reached a low of 18,999 during this period. While there was some recovery towards the end of 2020, pre-pandemic employment levels were not fully restored until the spring of 2021. Employment in 2021 peaked in July at 36,681, and the seasonal pattern continued in 2022, with a peak of 34,337 in June.

Although these data do not show a dramatic loss of employment in 2019, it is important to note that these data only capture businesses participating in Mississippi's covered employment system; as a result, these data typically exclude the self-employed, independent contractors, small proprietorships, and most seafood harvesters.

FIGURE 2: MONTHLY EMPLOYMENT IN COASTAL TOURISM, 2018-2023



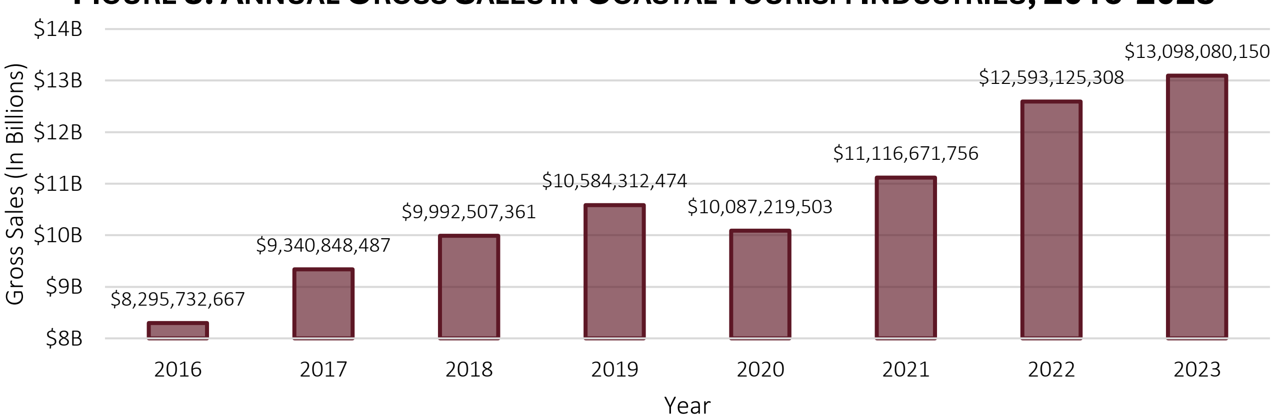
2019 Bonnet Carré Spillway Openings Highlighted in Red; Pandemic Closures Highlighted in Yellow
Source: Mississippi Department of Employment Security, 2024

Trends in Tourism Revenue: Insights using Annual Industry Sales Data

Figure 3 presents the annual gross sales revenue reported by businesses in the coastal tourism industry to the Mississippi Department of Revenue from 2016 to 2023. There is a distinct upward trend over this eight-year period, with tourism revenue at $8.3 billion in 2016 and consistently rising to $10.6 billion in 2019. The following year, 2020, shows a decline to $10.1 billion. This is followed by an increase in revenue from 2021 ($11.1 billion) through 2023 ($13.1 billion).

Although all tourism businesses report sales revenues, the annual nature of these data may mask short-term losses, such as those resulting from beach closures.

FIGURE 3: ANNUAL GROSS SALES IN COASTAL TOURISM INDUSTRIES, 2016-2023



Source: Mississippi Department of Revenue, 2024

Trends in Hotel Performance: Insights using Hotel Occupancy and Revenue Data

To specifically examine a critical period in July 2019, when beach closures likely influenced tourist behavior, an analysis of hotel performance was conducted using STAR data. Monthly hotel occupancy rates and revenues were compared between 2018 and 2019. Results indicate a 3.8% decline in demand for hotel rooms during July 2019 compared to the same month in 2018, representing a significant reduction in hotel stays. This decline translated into a reported $2.2 million loss in hotel revenue.

While these data provide valuable insights into the volume and duration of overnight stays, they do not offer estimates of the broader impact on the tourism industry. To estimate the broader economic impact of this decline in occupancy, we combined results from the STAR data with BLS estimates on average tourist spending, focusing on the typical distribution of expenditures across categories such as Transportation, Lodging, Food, Entertainment, and Alcohol. Table 8 summarizes the estimated losses in these categories due to the drop in hotel occupancy, highlighting both the direct decline in hotel revenues and the ripple effects across related tourism sectors. In addition to the $2.2 million loss in hotel revenue, the related coastal tourism industries are estimated to have lost another $2.2 million in sales, due to the decrease in overnight travelers. Appendix C provides detailed calculations for the estimates.

TABLE 8: DECLINE IN HOTEL REVENUES AND RELATED SALES

Industry	Sales Loss
Reported Decline in Hotel Revenues	**-$2,173,763.00**
Estimated Decline in Related Other Tourism Sales	**-$2,210,606.45**
Estimated Decline in Food Sales	*-$1,481,106.32*
Estimated Decline in Alcohol Sales	*-$243,166.71*
Estimated Decline in Entertainment Sales	*-$486,333.42*
Total Industry Losses	**-$4,384,369.45**

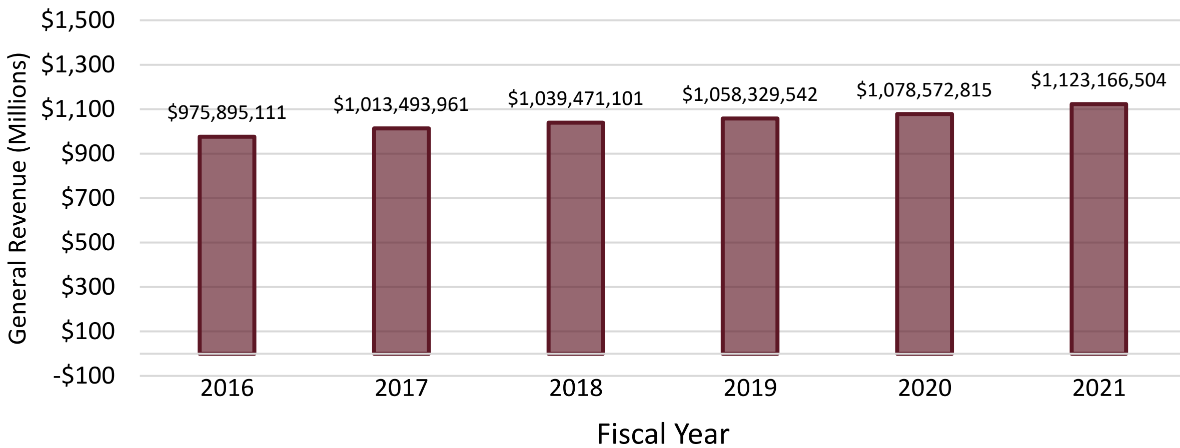
Note: Travel expenses are excluded from this analysis, as these are assumed to be spent outside of the coastal destination counties.
Source: Smith Travel Research, 2024; U.S. Bureau of Labor Statistics, 2024

Results: State and Local Tax Revenue

Trends in Tax Revenue: Insights using MS Office of the State Auditor Data

Figure 4 presents the general fund revenues for municipalities within Hancock, Harrison, and Jackson Counties from 2016 to 2021, including the county governments, city governments, and school districts. Over this six-year period, revenues exhibit a steady upward trend. In 2016, total general fund revenues amounted to $975.9 million, increasing to nearly $1.06 billion in 2019. After the 2019 BCS openings and the disruptions discussed in the previous sections, revenues continued to grow in 2020 and 2021, reaching over $1.12 billion in the last year of available data. Adjusting for inflation does not substantially alter these findings; inflation-adjusted figures are presented in Appendix C.

Figure 4: General Fund Revenues for Municipalities within Hancock, Harrison, and Jackson Counties (Combined), 2016-2021



Note: General Fund Revenue data obtained from financial audit statements published by Mississippi's Office of the State Auditor. Data for Pass Christian were unavailable in 2016, and data for Moss Point were unavailable in 2021. Intergovernmental transfers are excluded from this analysis. Source: Mississippi Office of the State Auditor, 2024

A further examination of data for individual municipalities demonstrated that general revenues typically increased throughout the years for which data were available. Two exceptions to this trend include the Waveland and Biloxi municipalities, which saw a 7% and a 4% decline in general revenues from 2018 to 2019, respectively. Detailed figures presenting the general revenues for the county governments of Hancock County, Harrison County, and Jackson County, as well as the school districts and cities within these counties are available in Appendix B, and inflation adjusted values are available in Appendix D.

IMPLAN Analysis

In this analysis, the direct impacts identified in the analyses of the coastal seafood and tourism industries are combined and input into the IMPLAN model. The IMPLAN model captures the broader economic ripple effects of the 2019 BCS openings, quantifying both indirect and induced impacts across Mississippi's Blue Economy.

The results are presented for the coastal seafood industry, the tourism industry, and the combined total impact. Four key metrics are highlighted: lost employment, lost sales, lost income, and lost tax revenue.

Broader Impacts of BCS Openings: Coastal Seafood Industry

Table 9 presents the estimated lost employment, sales and income, and tax revenue resulting from the 2019 BCS openings for the coastal seafood industry. Impacts were calculated by inputting the foregone value of seafood harvests and related industry losses into the IMPLAN model.

Lost employment is estimated to be 316 jobs from 2019 to 2022, with 253 jobs lost directly in coastal areas and 63 jobs lost in related industries statewide.

Lost income due to the spillway openings is estimated at approximately $5.3 million, with $3.7 million in direct coastal income losses and $1.6 million in income losses from related industries across the state.

Lost sales attributable to the spillway openings total approximately $12.2 million from 2019 to 2022, with $10.2 million in direct coastal losses and $2 million in losses from related industries statewide.

Lost state and local tax revenues are estimated to be $2.1 million over the four years. State taxes accounted for $1.4 million of this loss, county taxes totaled $271,000, and other municipal taxes amounted to $487,000.

Table 9: Economic Impact of the 2019 BCS Openings on Mississippi's Coastal Seafood Industry and Related Industries Statewide

	2019	2020	2021	2022	Total
Lost Employment	**-279**	**-15**	**-11**	**-11**	**-316**
Direct Coastal Losses	*-220*	*-13*	*-10*	*-10*	*-253*
Losses from Related Industries, Statewide	*-59*	*-2*	*-1*	*-1*	*-63*
Lost Income	**-$5,288,125**	No	No	No	**-$5,288,125**
Direct Coastal Losses	*-$3,671,350*	Attributable	Attributable	Attributable	*-$3,671,350*
Losses from Related Industries, Statewide	*-$1,616,775*	Loss	Loss	Loss	*-$1,616,775*
Lost Sales	**-$8,491,804**	**-$1,281,923**	**-$1,192,793**	**-$1,214,571**	**-$12,181,091**
Direct Coastal Losses	*-$6,869,502*	*-$1,093,890*	*-$1,093,890*	*-$1,093,890*	*-$10,151,172*
Losses from Related Industries, Statewide	*-$1,622,302*	*-$188,033*	*-$98,903*	*-$120,681*	*-$2,029,919*
Lost Tax Revenues (State and Local)	**-$1,978,371**	**-$45,795**	**-$19,403**	**-$99,217**	**-$2,142,786**
State Taxes	*-$1,262,210*	*-$33,960*	*-$17,655*	*-$70,382*	*-$1,384,207*
County Taxes	*-$255,744*	*-$4,338*	*-$646*	*-$10,565*	*-$271,293*
Other Municipality Taxes	*-$460,417*	*-$7,497*	*-$1,102*	*-$18,270*	*-$487,286*

Source: Mississippi State University, NSPARC Impact Analysis, 2024

Broader Impacts of BCS Openings: Coastal Tourism Industry

Table 10 presents the estimated lost employment, sales and income, and tax revenue for the coastal tourism industry in 2019 due to the BCS openings. Impacts were calculated by inputting the identified losses of tourism revenues into the IMPLAN model.

Lost employment is estimated to be 101 jobs, with 77 jobs lost directly from coastal tourism establishments and the remaining 24 lost from related industries statewide.

Lost income attributable to the BCS openings amount to approximately $3.2 million, with direct coastal losses accounting for $2.3 million and related industries statewide accounting for the remaining $904,000.

Lost state and local tax revenues are estimated to be $942,000. State taxes made up $567,000 of the lost revenue, county taxes accounted for $130,000, and other municipal taxes amounted to $245,000.

TABLE 10: ECONOMIC IMPACT OF THE 2019 BCS OPENINGS ON MISSISSIPPI'S COASTAL TOURISM INDUSTRY AND RELATED INDUSTRIES STATEWIDE

	2019	2020	2021	2022	Total
Lost Employment	**-101**	No	No	No	**-101**
Direct Coastal Losses	*-77*	*Attributable*	*Attributable*	*Attributable*	*-77*
Losses from Related Industries, Statewide	*-24*	*Loss*	*Loss*	*Loss*	*-24*
Lost Income	**-$3,200,074**	No	No	No	**-$3,200,074**
Direct Coastal Losses	*-$2,296,499*	*Attributable*	*Attributable*	*Attributable*	*-$2,296,499*
Losses from Related Industries, Statewide	*-$903,575*	*Loss*	*Loss*	*Loss*	*-$903,575*
Lost Tax Revenues (State and Local)	**-$941,643**	No	No	No	**-$941,643**
State Taxes	*-$566,746*	*Attributable*	*Attributable*	*Attributable*	*-$566,746*
County Taxes	*-$129,904*	*Loss*	*Loss*	*Loss*	*-$129,904*
Other Municipality Taxes	*-$244,993*				*-$244,993*

Source: Mississippi State University, NSPARC Impact Analysis, 2024

Broader Impacts of BCS Openings: Total

Table 11 presents the total economic impact of the 2019 BCS openings, calculated by inputting the foregone value of seafood sales and related seafood industry losses along with the identified losses in tourism revenues.

Total lost employment is estimated to be 417 jobs over the four-year period. 330 of these lost jobs were incurred directly by the coastal industries, while the remaining 87 were lost from related industries statewide.

Total lost income due to the BCS openings is estimated to be approximately $8.5 million, with $6 million lost directly in coastal areas and $2.5 million lost in related industries statewide.

Total lost sales attributable to the BCS openings are estimated at approximately $12.2 million. Direct coastal losses account for $10.2 million of the total, with related industries statewide contributing $2 million in losses.

Total lost state and local tax revenues are estimated to be $3.1 million, with $2 million of the losses incurred by the state government, $401,000 by county governments, and $732,000 by local municipalities.

Table 11: Total Impacts of the 2019 BCS Openings in Mississippi

	2019	2020	2021	2022	Total
Total Lost Employment	**-380**	**-15**	**-11**	**-11**	**-417**
Direct Coastal Losses	*-297*	*-13*	*-10*	*-10*	*-330*
Losses from Related Industries, Statewide	*-83*	*-2*	*-1*	*-1*	*-87*
Total Lost Income	**-$8,488,199**	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	**-$8,488,199**
Direct Coastal Losses	*-$5,967,849*				*-$5,967,849*
Losses from Related Industries, Statewide	*-$2,520,350*				*-$2,520,350*
Total Lost Sales	**-$8,491,804**	**-$1,281,923**	**-$1,192,793**	**-$1,214,571**	**-$12,181,091**
Direct Coastal Losses	*-$6,869,502*	*-$1,093,890*	*-$1,093,890*	*-$1,093,890*	*-$10,151,172*
Losses from Related Industries, Statewide	*-$1,622,302*	*-$188,033*	*-$98,903*	*-$120,681*	*-$2,029,919*
Total Lost Tax Revenues (State and Local)	**-$2,920,014**	**-$45,795**	**-$19,403**	**-$99,217**	**-$3,084,429**
State Taxes	*-$1,828,956*	*-$33,960*	*-$17,655*	*-$70,382*	*-$1,950,953*
County Taxes	*-$385,648*	*-$4,338*	*-$646*	*-$10,565*	*-$401,197*
Other Municipality Taxes	*-$705,410*	*-$7,497*	*-$1,102*	*-$18,270*	*-$732,279*

Source: Mississippi State University, NSPARC Impact Analysis, 2024

Projection of Future Impacts

This section provides estimates of the potential future economic impacts of BCS openings over the next 14 years (2025–2038). As outlined by the Harrison County Board of Supervisors and the Mississippi Sound Coalition, these projections assume that future opening events will occur at a similar frequency and intensity as in the past 14 years. Based on historical patterns, these forecasts assume major spillway events will occur approximately every eight years, with openings expected in 2027 and 2035.

A key assumption underlying these projections is that the Mississippi Sound's fisheries will recover to pre-2019 levels prior to each future opening event, and that the local workforce will continue to participate in the fishing industry at pre-2019 levels. However, interviews with local fishermen, residents, and marine biologists suggest a more complex reality, as many oystermen and fishermen are selling their boats and exiting the industry.[3] Our interviews, discussed in the next section, reflect a reality where declining harvests, decreased workforce participation in the seafood industry, and competition from imported seafood are already leading to a transformation of the industry and the culture surrounding Mississippi's seafood sector. Therefore, while these projections assume a recovery of fisheries, future impacts of BCS openings may be affected by both ecological challenges for the fishery and structural workforce challenges for the industry.

A deeper discussion of these forecasts, the assumptions they rely on, and the necessity for future research is presented at the end of this section.

[3] This is discussed in greater detail in the second study of this report, as well as in the conclusion.

Projected Impact of Future BCS Openings

Table 12 presents the projected lost employment, sales and income, and tax revenue that could be attributable to future BCS openings, based on a full recovery and commercial use of the Mississippi Sound to pre-2019 levels. All values are presented in 2024 dollars.

Projected lost employment is estimated to total 410 jobs. Roughly 80% of these losses are incurred directly by coastal industries, while the remaining 20% of losses are incurred by related industries in the statewide Blue Economy.

Projected lost income is estimated at $10.1 million. Approximately 70% of the income losses are projected to occur directly within coastal industries, with the remaining 30% attributed to related industries statewide.

Projected lost sales total approximately $11.3 million, with $10.1 million (90%) incurred by coastal industries and $1.2 million (10%) by related industries in the statewide Blue Economy.

Projected lost state and local tax revenues are estimated to reach $3.1 million for each forecasted opening, with 63% of these losses incurred by state government, 13% by county governments, and 24% by local municipalities.

TABLE 12: AVERAGE PROJECTED LOSSES FOR POTENTIAL FUTURE SPILLWAY OPENINGS; AVERAGE (MEAN) 2027 AND 2035

	Average Projected Losses for Future Openings
Projected Lost Employment	**-410**
Direct Coastal Losses	*-327*
Losses from Related Industries, Statewide	*-82*
Projected Lost Income	**-10,085,947**
Direct Coastal Losses	*-7,043,278*
Losses from Related Industries, Statewide	*-3,042,669*
Projected Lost Sales	**-11,336,591**
Direct Coastal Losses	*-10,149,862*
Losses from Related Industries, Statewide	*-1,186,729*
Projected Lost State and Local Tax Revenues	**-3,135,054**
State Taxes	*-1,979,638*
County Taxes	*-410,561*
Other Municipality Taxes	*-744,855*

Source: Mississippi State University, NSPARC Impact Analysis, 2024

Discussion of Forecast Assumptions and Implications

The forecasting conducted with the IMPLAN model provides a recognized and structured framework for estimating future economic impacts of anticipated economic disruptions. However, these forecasts rely on a critical assumption: that the fisheries in the Mississippi Sound will eventually recover from disruptions caused by the 2019 BCS openings as well as future openings. It is questionable that this assumption can fully reflect the interdependence of the local economy with the Sound's ecosystem, or the ecosystem's current fragility; literature shows that current oyster populations are substantially diminished and that juvenile oyster recruitment, a process necessary for repopulation, is more limited compared to previous post-disaster periods (Pruett, et al., 2024). Furthermore, an interview with a local marine biologist suggests that eastern oysters require approximately 10 years without significant mortality events to recover to sustainable levels. However, historical patterns of spillway openings indicate an average interval of roughly 8 years between major events, such as the 2019 opening, which may not provide sufficient recovery time for the oyster populations.

As a result, these forecasts do not illustrate a potentially more severe outcome – rather than a cycle of impact followed by recovery, there is instead a collapse of Mississippi's marine fisheries and/or its commercial use. Such a collapse could potentially lead to a broader destabilization of the region's economy, in which case future BCS openings would need to be modeled in the context of broader structural changes rather than an isolated, temporary economic disruption (Dalyander, et al., 2022). Although modeling this complex structural change was beyond the scope of this research, the research team documented residents' experiences with these issues through interviews and focus groups conducted in Hancock, Harrison, and Jackson counties.

> **While the forecasts presented in this report provide useful and actionable insight into the immediate economic consequences of these disruptions, further research is necessary to identify and simulate the full range of possible long-term consequences. A more detailed discussion of this topic that fully incorporates the results of the qualitative analysis is presented in the conclusion of this report – see pages 52 and 53.**

3

Sociocultural Impacts of the 2019 BCS Openings

Overview

This second study provides a qualitative analysis of the sociocultural impacts of the 2019 BCS openings on Mississippi Gulf Coast industries, communities, and residents. It focuses on examining the reported lived experiences, perceptions, and concerns of individuals who own or operate businesses within the Mississippi Gulf Coast seafood industry (e.g., seafood harvesters, processors, and distributors) or the Mississippi Gulf Coast tourism industry (e.g., charter boats, hotels and lodging, restaurants), as well as those of elected officials and community members. These industries were identified as priorities for examination by the Mississippi Sound Coalition and the Harrison County Board of Supervisors. Specifically, this study assesses the 2019 BCS openings' effect on business operations and consumer concerns regarding the products and services offered by these industries, as well as the 2019 BCS openings' effect on local culture and individual well-being.

Focus Group and Interview Survey Methodology

To assess the sociocultural impacts of the 2019 BCS openings on coastal businesses, communities, and residents, the project team undertook an exhaustive qualitative research effort using focus groups and individual interview surveys to triangulate responses until reaching a point of code-based saturation (i.e., the point in which all respondents consistently provided the similar thematic components through their responses without the respondent introducing new thematic components). Though quantitative research methodologies (e.g., traditional mail, telephone, or computer-assisted surveys) are well-suited for assessing the broad economic impacts of the 2019 BCS openings on Mississippi Gulf Coast industries, such methodologies are ill-equipped to provide detailed assessments of the subjective lived experiences and perceptions of Mississippi Gulf Coast business owners, community leaders, and residents due to the inability to collect in-depth responses and allow for follow-up lines of inquiry (Babbie, 2020; Hesse-Biber, 2016).

Furthermore, quantitative methodologies are often ill-suited to conduct with difficult to reach or insular sub-populations due to a lack of access and established rapport (Babbie, 2020; Hesse-Biber, 2016). As this research was tasked with assessing how the 2019 BCS openings impacted local businesses and consumer perceptions of Mississippi Gulf Coast products and services, as well as the well-being of fishermen, oystermen, and shrimpers, semi-structured focus group and interview surveys were employed to allow for collection of in-depth accounts regarding localized, micro-level impacts of the 2019 BCS openings which would potentially be masked by quantitative research methodologies.

Data Collection

The research team conducted a series of semi-structured focus groups and interviews from August 1, 2024, through September 14, 2024, to assess the sociocultural impacts of the 2019 BCS openings on Mississippi Gulf Coast industries, communities, and residents. Through these efforts, the project team solicited perspectives related to the impact of the 2019 BCS openings on local business operations and consumer perceptions, as well as individual and community well-being. These qualitative approaches were chosen to allow participants the opportunity to express their own subjective attitudes, perceptions, and lived experiences related to the aftermath of the 2019 BCS openings, as well as solicit concerns related to future BCS openings. Whereas the interviews provided the opportunity for an in-depth examination of individual life experiences, the focus groups provided the opportunity to triangulate responses through multivocal expression, allowing for the assessment of similarities and dissimilarities among participant experiences in the aftermath of the 2019 BCS openings (Barbour, 2007; Charmaz, 2014; Hesse-Biber, 2016).

Participants

Since a comprehensive list of coastal industry business leaders, employees, and residents was not available, a convenience sampling strategy was used to recruit participants from various coastal industries and communities in Hancock County, Harrison County, and Jackson County. A snowball sample was constructed in which each wave of participants identified key informants and stakeholders who should be solicited to participate in subsequent focus groups and interviews.

The sample consisted of 50 participants who collectively reflected the hospitality and tourism, seafood harvesting, and seafood processing industries of coastal Mississippi, as well as representatives of Mississippi Gulf Coast communities. Participants included, but were not limited to elected officials, hospitality portfolio managers, restaurant owners, charter boat captains, seafood processors, seafood distributors, fishermen, oystermen, marine biologists, and community residents.

Procedures

Focus groups and interviews were conducted until reaching the point of code-based saturation (i.e., the point in which all respondents consistently provided the similar thematic components through their responses without the respondent introducing new thematic components). Prior research suggests code-based saturation is typically achieved within a narrow range of four-to-eight focus groups or nine-to-seventeen interviews (Hennink & Kaiser, 2022; Hennink, Kaiser, & Weber, 2019). To ensure code-based saturation was achieved, the current study conducted five focus group surveys and thirty-two interview surveys for Hancock County, Harrison County, and Jackson County from August 1, 2024, through September 14, 2024. Whereas each interview consisted of a single participant, each focus group consisted of three to six participants. Collectively, 50 individuals participated in this study.

Each focus group and interview was recorded with the consent of the participants. Each interview lasted approximately 30-to-60 minutes and each focus group lasted approximately 60-to-120 minutes. Collectively, the focus groups and interviews yielded approximately 40 hours of contact with participants. A semi-structured guide (see Appendix E) was used to facilitate progressive conversation with participants regarding the economic and sociocultural impacts of the 2019 BCS openings on local businesses, consumer perceptions, and individual and community well-being, as well as the impact of future BCS openings.

As the 2019 BCS openings occurred five years prior to this study, focus group and interview survey participants were presented with a neutral-phrased introduction outlining the purpose of this study and an overview of the objective facts (e.g., opening timeframe, opening duration, state agency response, impact to local marine life) to facilitate recollection of lived experiences and personal perceptions related to the aftermath of the 2019 BCS openings. After presenting participants with the introduction, participants were asked to describe the impact of the 2019 BCS openings on industry-specific business operations, employee outcomes, and recovery strategies.

Next, participants were asked to describe how the 2019 BCS openings influenced consumer perceptions of Mississippi Gulf Coast industry products and services throughout 2019, as well as whether such perceptions returned to normal in subsequent years. Participants were then asked to describe the importance of the Mississippi Sound to their communities' traditions and culture, as well as discuss the adverse impacts the 2019 BCS openings had on cultural identity, community events, and their own personal lives.

Finally, participants were asked to describe their level of concern regarding potential economic and sociocultural impacts of future BCS openings.

Each focus group and interview was audiotaped, independently reviewed, and transcribed for subsequent analysis. During the initial phase of transcription, each audio file was transcribed verbatim to ensure the accuracy of each statement, after which each transcript was revised to remove linguistic placeholders (e.g., "um," "uh," "you know") and repetitious phrases that occurred when participants stuttered to enhance readability and ease of interpretation during the subsequent analysis.

Analytical Strategy

Analyses of focus groups and interviews were conducted based on a grounded theory approach (Charmaz, 2014; Corbin & Strauss, 2015; Creswell & Poth, 2018). Initial analyses were conducted through three stages: open coding, focused coding, and conceptual network mapping. Using ATLAS.ti 24 (ATLAS.ti Scientific Software Development GmbH, 2024), a qualitative data analysis software, open sentence-by-sentence coding was performed to group participant responses into broad categories. Open coding categories included but were not limited to: "*Impact to Hospitality,*" "*Impact to Seafood Harvesting,*" and "*Importance of the Mississippi Sound.*" Next, focused coding was conducted within each category to identify more nuanced sub-codes. For example, within the topic of "*Importance of the Mississippi Sound*," sub-codes such as "*Natural Resources: Seafood,*" "*Community Events: Seafood Festivals,*" and "*Cultural Preservation: Social Solidarity*" emerged.

Results

Influence on Mississippi Gulf Coast Culture

Throughout each focus group and interview, participants emphasized the importance of the Mississippi Sound to Mississippi Gulf Coast culture, noting the body of water is not only intrinsically tied to their core industries and recreational pastimes, but also their sense of identity. From elected officials to business owners to community residents, participants frequently noted the Mississippi Gulf Coast is known for its abundant resources, quality seafood, and natural splendor. For instance, when prompted to discuss how the Mississippi Sound relates to the traditions and culture of the Mississippi Gulf Coast, local hotel portfolio manager Trevor Allen stated:

> From the natural resources to the islands to the fishing to the boating and other activities…that sets a picture that we're trying to make sure the next generation sees as they come through…that's one of our strengths.

In making this statement, Trevor succinctly illustrates how the Mississippi Sound serves as a core component of the cultural identity of Mississippi Gulf Coast communities, emphasizing the variety of water-based resources and activities available to residents and tourists alike. Such sentiments were routinely expressed throughout each focus group and interview, as participants often noted not only how the seafood and tourism and hospitality industries tied into their local economies, but also how the association of the Mississippi Sound with these industries directly influences their cultural identities. For example, when asked to describe the how the Mississippi Sound and local industries affect the identity of Mississippi Gulf Coast communities, local seafood harvester and distributor Matthew Collins contended:

> We bring in folks from all over the country who will travel just to load up with some fresh Gulf seafood. They'll load up their truck and go home…but when they come, they stay at our hotels, go to our casinos, go on the charter to fish trout, eat out at our restaurants that are serving what these processors are selling, take a load of that stuff back home with them and show their friends and family…and the next thing you know, they're calling "Hey, we want to come down there and get some of what our cousin got."

Through his response, Matthew contends the Mississippi Sound not only sustains a renowned seafood industry which serves as the core of Mississippi Gulf Coast communities' identities, but also fosters their identities as a desirable tourist destination. For each participant, the high quality of Mississippi Gulf Coast seafood served as the basis of how they perceived others to view their communities' reputations, taking great pride in the seafood derived from the Mississippi Sound.

Like Matthew, other participants often noted how the natural resources of the Mississippi Sound coalesce to provide complimentary support for coastal seafood and tourism. In noting the importance of the Mississippi Sound to Mississippi Gulf Coast culture and industries, participants universally expressed frustration regarding the impact of the 2019 BCS openings on the Mississippi

Sound. For instance, in discussing the importance of the Mississippi Sound to his community's traditions and culture, charter boat captain Derek Winslow stated:

> I mean, the Mississippi Sound is everything. From the kids playing on the beach and doing all the stuff we did growing up…to the shrimpers, to the oystermen, to the crabbers, and now charter boat operators…it's our selling point, you know? That beautiful water and our barrier islands and the piers and the yacht clubs. It's kind of the cornerstone of everything we have here and when it's covered up with fresh polluted river water that wipes out the fishing and the crabs and the oysters…it's just like somebody coming over and kicking all their garbage cans over in your front yard. You're just trying to live a normal life and it's the neighbors down the street kicking it over again and again. And it's like, "Man, it's just not working. We have got to find a new solution."

Through his response, Derek argues that the Mississippi Gulf Coast serves as a proverbial sacrificial lamb for the sake of protecting non-Mississippi communities, expressing frustration towards the repeated ecological and economic ramifications freshwater intrusion from BCS openings have upon the marine life and water quality of the Mississippi Sound. Such sentiments were near universal among participants, as the overwhelming majority expressed similar frustrations.

Though most participants simply referenced the role freshwater intrusion from the 2019 BCS openings had on decreased salinity levels throughout the Mississippi Sound which negatively impacted local marine life and industries, some participants such as Derek elaborated on their response by directly referencing the agricultural runoff and pollution introduced throughout the United States to the Mississippi River and its tributaries prior to being released into the Mississippi Sound. When asked to describe how the 2019 BCS openings influenced his community, local entrepreneur and restaurant owner Eli Thomas stated:

> Prior to the openings, it was not unusual in a full moon to see the beach full of little lights sparkling off of the waves while seeing young people with gigs getting flounder and picking up softshell crab. Not anymore…it's not there. That is cultural. That to me is as important as watching the Aurora Borealis in the Arctic, you know what I mean? In other words, there are some cultural aspects that are now diminished because of an adverse effect on its character…I don't know if I could put it into words better than that. When you realize the experience of the Gulf Coast is not the same…now you go to the casino because there's nothing biting…you walk along the beach now, it's not the same…there's not going to be any scales. You don't see anything there that catches your eye…there's dead fish, crab, or whatever… that causes you to say, "Man, nowhere else in America, right?" So, the actual experience of living here has, I don't doubt, antagonized many of those who've been here long before me…it's like there is the idea of some guy driving up and saying, "Look, I just caught a big old redfish, or I got a basket of crab," ... those days are gone.

Through his explanation, Eli argues the culture of Mississippi Gulf Coast communities has been damaged by the ecological and economic ramifications the 2019 BCS openings had upon local marine life and industries, which subsequently diminished the appeal of the Mississippi Gulf Coast as a tourist destination. In addition to decimating certain marine life species (e.g., oysters), other types of marine life were noted to have been displaced due to decreased salinity levels from the 2019 BCS openings which resulted in dead zones, decreasing such natural resources available to commercial and recreational fisherman. Though not explicitly stated in this excerpt of his response, Eli alludes to the seafood-based supply chain disruptions which resulted from the 2019 BCS openings, as well as the negative perceptions which arose regarding if Mississippi Gulf Coast seafood is safe to consume and if it is safe for people to enter the water.

In July 2019, the Mississippi Department of Environmental Quality (MDEQ) issued a series of beach closures and water contact advisories due to harmful algae blooms resulting from the freshwater intrusion of the 2019 BCS openings. Many participants expressed media coverage of the algae blooms, beach closures, and water contact advisories contributed to longstanding perceptions that the water along the Mississippi Gulf Coast was unsafe, subsequently leading to the cancellation of longstanding community events and festivals. For instance, when asked to describe how the 2019 BCS openings affected local community events, local charter boat captain Jason Miller explained:

> The annual fishing tournaments were canceled and were not able to take place. I think there were a lot supposed to happen that year. I also don't remember seeing many catamarans from Ocean Springs Marina or Ocean Springs Yacht Club…they have tournaments out there for racing. I think because of the four contact advisories, they didn't have any of those. I know that there's a parasailing boat that comes out of Biloxi. I know they didn't run…it totally shut them down. Anything that had anything to do with water contact or getting in the water was definitely not happening.

In describing the cancellation of these local fishing tournaments and boat races, Jason alludes to the concerns that residents and tourists felt regarding their personal health and safety interacting with the Mississippi Sound due to the algae blooms caused by the 2019 BCS openings. The overwhelming majority of participants noted these concerns affected their local community events, as well as commercial activities which occur in the Mississippi Sound, asserting these concerns for personal health and safety remained even after the 2019 BCS openings. In addition to the cancellation of fishing tournaments and boat races, participants noted the beach closures and water contact advisories issued by MDEQ due to the 2019 BCS openings led to the cancellation of annual 4th of July celebrations which occur on beaches along the U.S. Highway 90 corridor.

Furthermore, participants frequently explained the ecological impacts of the 2019 BCS openings which destroyed or displaced local marine life led to the cancellation of most local seafood festivals due to local seafood supply chain disruptions and concerns about the safety of consuming Mississippi Gulf Coast seafood. Those which were not cancelled, such as the Our Lady of the Gulf Crab Festival in Bay St. Louis, Mississippi sourced their seafood from out of state.

Despite these challenges to their traditions and ways of life, participants expressed optimism when discussing the work being undertaken to preserve their cultural identities. For instance, throughout his discussion of the impacts the 2019 BCS openings had on his community, local hotel portfolio manager Trevor Allen stated:

We're going to rebuild upon our identity…it's going to become what the Gulf Coast has always been. It's going to be beautiful beaches. It's going to be wonderful seafood. It's going to be our hospitality…and then it's going to be the gaming and all the different affordable family attractions that are here to enjoy on the Mississippi Gulf Coast. That will be our sense of place. That will be our sense of success as we get beyond Bonnet Carré.

Influence on Mississippi Gulf Coast Seafood Harvesting and Processing

Many of the discussions regarding how the 2019 BCS openings impacted the Mississippi Gulf Coast seafood industry noted the freshwater intrusion resulted in decreased salinity levels which created dead zones throughout the Mississippi Sound that adversely affected local seafood landings and disrupted local seafood supply chains. The decimation of certain species of marine life and displacement of other species were reported to bear a direct impact on the operations of local seafood harvesters, distributers, and processors, as well as propagate negative consumer perceptions regarding the quality of Mississippi Gulf Coast seafood and its safety for consumption. For instance, when asked to describe how the 2019 BCS openings impacted his business operations, seafood harvester and distributor Matthew Collins stated:

Our direct impact during that time was eventually all that freshwater made its way offshore…it pushed our fish further out…essentially, it made dead zones in places we had been. So, during that immediate time frame, either we didn't fish, we'd fish less, or we had to fish further out…that was the direct impact. The consumer impact is just unmeasurable…it certainly played a role in that…even though we were selling fish that perception was nuts…and coming from that region, we've certainly seen a downtick in demand for our products. You know, I was fortunate. Like I said, I fished further offshore where we could get away from the degradation to some extent, but those inshore folks…our shrimpers, crabbers, oystermen…they certainly felt it. Like you said, all these other disasters that we've had…the BP oil spill…we had the Bonnet Carré back in 2011…this was getting to a point where guys have been suffering for a long time. Then come 2019, we're almost to a point of recovery…our oysters are coming back, things are starting to stabilize, and to get completely wiped out…I mean, it's completely wiped out…there was no fishing going on all the way to Ocean Springs in our inshore water. Even our oyster farmers…that was the first year oyster farms were on Deer Island…I knew a lot of guys doing that for the first time…the freshwater got all the way down there long enough to kill the oysters from the oyster farm. So those guys lost…they have a total loss because it was so fresh and so new for the industry, there was no insurance in place. There were no fallbacks for them.

Through his discussion, Matthew argues the 2019 BCS openings most adversely affected inshore oystermen, fishermen, shrimpers, and crabbers due to the freshwater intrusion and resulting decreased salinity throughout the Mississippi Sound eliminating their harvests or displacing the targeted marine life to an area beyond the reach of inshore vessels. Participants frequently expressed local oystermen experienced an immediate total loss of their harvest resulting from the 2019 BCS openings, while local fishermen, shrimpers, and crabbers experienced a partial loss due to the increased mortality rates among their targeted species resulting from decreased salinity levels. Though owners of larger vessels, such as Matthew, were able to fish, shrimp, or crab further away from the Mississippi Gulf Coast shoreline, these seafood harvesters reported decreased seafood landing yields.

Participants often noted there was no financial or state assistance in the immediate aftermath of the 2019 BCS openings, though the Mississippi Department of Marine Resources (MDMR) eventually offered financial assistance to commercial fisheries, seafood dealers, and charter operators in late 2023.

Participants in the seafood industry universally expressed that the ecological impacts of the 2019 BCS openings on local marine life, as well as the subsequent harmful algae blooms and beach closures, fostered long-lasting negative consumer perceptions that Mississippi Gulf Coast seafood was tainted. When prompted to elaborate on his response regarding the longevity of these negative consumer perceptions, Matthew stated:

> I would say that consumer impact is still going on today. I mean, even this much time later, we still have so many people asking, “Is the seafood safe?”, “Is the water safe?”, and “Is the beach safe to go to?”. There are so many lingering questions that we've dealt with from negative publicity and the way that the state agencies put out information.

Each participant regardless of their industry background attributed immediate disruptions of local seafood supply chains to the 2019 BCS openings. Though each participant in the seafood industry directly attributed the long-term decimation of oyster landings to the 2019 BCS openings, participants who were seafood harvesters or restaurant owners attributed the long-term decline in other seafood landings, as well as decreased commercial fishing activity, to the penetration of imported seafood into local markets and the economic decline which occurred throughout the COVID-19 pandemic. For instance, when prompted to describe the long-term impacts of the 2019 BCS openings on the Mississippi Gulf Coast seafood industry, local restaurant owner Oliver Grant explained:

> When stuff like the Bonnet Carré Spillway happens and you have a lack of product coming into your own harbor, you are opening the door for imports. Because people are going to find something to put on the menu and try to find the closest thing that they can…and then once they get that on the menu and they realize, “Well, I spend a lot less money for this and customers are still buying it, why would I want to get the more expensive item?”

Similar to Oliver, participants who were seafood harvesters candidly explained disruptions to local seafood supply chains resulting from the 2019 BCS openings increased competition with imported seafood products, making it difficult to earn a living in subsequent years due to decreased seafood landing yields, lower dockside purchase prices, increased fuel prices, and increased insurance prices. The economic pressure caused by these coalescing factors were reported to result in a mass exodus of local seafood harvesters from the industry. For instance, when asked to describe the circumstances which led to seafood harvesters exiting the industry, retired charter boat captain and seafood harvester Henry Wells stated:

It's almost impossible for a shrimper to make a living in today's market because of imports, fuel prices, and insurance…almost 90% of your suppliers are Vietnamese now…but right now, there's a bunch of them tied up because of pricing. But in that period, fuel prices were up and the combination of that situation compounded…a lot of them decided to get out of the business which they had been in and sold their boats at brokerage prices and wholesale prices to get out from under the boat.

Similar to Henry, most participants who work in the seafood industry acknowledged the shift in local seafood supply chains from local seafood harvesters to imported seafood distributors following the 2019 BCS openings, as well as reported the subsequent exit of these local seafood harvesters and even imported seafood vendors from the industry as the U.S. economy declined throughout the COVID-19 pandemic. In discussing seafood harvesters exiting the industry from 2019 to 2024, local seafood harvester and distributor Matthew Collins explained:

The Caucasian fishermen and shrimpers have been the first ones to go. They said "To hell with it. It's going to take too much." The Vietnamese ones have survived a little bit longer…we've actually almost seen the Vietnamese have become a majority at one point, but now we're seeing even them getting out as well. The way Vietnamese culture and family life is, a lot of them live multigenerational in one home, some of them live on their boats. So, they can weather the hard times a little better…but even we're seeing them getting out of it.

Through his comment, Matthew notes multigenerational seafood harvesters are slightly more resilient to economic downturns; however, even in these scenarios, the constellation of economic pressures arising from decreased seafood landings, decreased dockside seafood landing value, increased fuel prices, and increased insurance contributed to the exit of these seafood harvesters from the industry. Prior research has indicated fishermen, shrimpers, and crabbers are less willing to incur the costs of operating a fishing vessel when diesel prices rise and the dockside value of a landing falls (Posadas, 2022). In further describing the exit of seafood harvesters from the industry, state agency representative Adam Fisher explained:

COVID didn't help any…it didn't help a bit because what happened with that was it turned around and nobody was buying anything. So why go shrimp if you can't sell it? In the industries, the processors were getting stockpiled with it so that drove the price down to nothing…I mean, right now, if you walk into a processor and you got 20,000 pounds of shrimp, you're going to get 75¢ per pound. You can't afford that…you can't run a boat and do the things you need to do at $5 per gallon for diesel and everything else to be able to stay in business.

As previously stated, due to the decreased seafood landings that arose from the 2019 BCS openings, local dockside seafood distributors and processors shifted their supply chains from relying on local seafood harvesters to imported seafood vendors. Despite this shift, participants who were local dockside seafood distributors, as well as local seafood processors who relied on specific targeted marine life species, often reported that the mass exodus of local seafood harvesters that resulted from the 2019 BCS openings and compounding economic pressures negatively impacted their business operations. When asked to describe how the 2019 BCS openings affected his business operations, local dockside seafood distributor Patrick Vaughn explained:

> I'm trying to sell my business because of all the stuff that's been happening…I mean, if I could make good money, I'd stay here. It's a joke now. You could make more money by accident in one hour back when there was local seafood…then you'd have it all day, all week…sometimes you don't even sell nothing in a day now…you don't sell nothing, or you can't hardly get nothing. You can get plenty of shrimp, but you know, we get freezer boat shrimp now.

Through his explanation, Patrick notes that despite shifts in the supply chain from local seafood harvesters to imported seafood vendors, even local dockside seafood distributors and processors were subject to the financial impacts resulting from the 2019 BCS openings and subsequent compounding economic pressures that caused a mass exodus of local seafood harvesters from the industry. Many participants who were local dockside seafood distributors and processors noted consumer preference for Mississippi Gulf Coast seafood was marred by concerns regarding their products' safety for consumption resulting from media coverage pertaining to the adverse effects the 2019 BCS openings had on local marine life. For instance, when asked to describe how the 2019 BCS openings impacted consumer perceptions of her business, local seafood distributor Rachel Olson stated:

> "Is it safe to eat it?" That's what I got a lot. They hear all these things going on with the Bonnet Carré Spillway openings killing the animals, and they were like, "Is it safe?" I mean, I've had that thought…I'm like, "I wouldn't be selling it if it wouldn't be safe. I get regulated by safety people."

Despite efforts by the local seafood industry to combat these consumer concerns, participants often expressed those notions that Mississippi Gulf Coast seafood was unsafe for consumption became ingrained among residents and tourists, persisting throughout subsequent years. Though such impressions were reportedly longstanding, participants noted consumer perceptions slowly recovered over time. For some, however, the damage was already done; the economic hardships resulting from the impact of the 2019 BCS openings on the local seafood supply chain and product safety perceptions, combined with the national economic downturn following the COVID-19 pandemic, have led to their decisions to exit the Mississippi Gulf Coast seafood industry.

Influence on Mississippi Gulf Coast Hospitality and Tourism

Hotels and Lodging

Many of the discussions regarding how the 2019 BCS openings impacted Mississippi Gulf Coast hotels and lodging reported the degree to which negative consumer perceptions resulting from MDEQ-issued beach closures and advisories, as well as media coverage of dead or injured dolphins and sea turtles washing up on beaches, decreased the occupancy of select beachfront hotel portfolios along the U.S. Highway 90 corridor, increased local competition, and increased competition with out-of-state markets. When prompted to discuss how the 2019 BCS openings affected hotels under his purview, local hotel portfolio manager Trevor Allen explained:

> As the freshwater intrusion came into the Gulf, it affected the Gulf in many ways which prompted beach advisories and closures which immediately impacted travelers who pay attention to those reports, whether it's on social media or other sources, and occupancies quickly declined….we went from occupancy in the 90th percentile, which is where they historically have been, dropping down into the 40th percentile…and even more devastating is that when you have occupancies decline, hotels have a tendency to drop their rates.

Through his explanation, Trevor reports the MDEQ-issued beach closures and advisories responding to the harmful algae blooms caused by the freshwater intrusion of the 2019 BCS openings substantially impacted the occupancy of the beachfront hotel properties under his purview, resulting in a reduction in nightly rates to increase the appeal of his properties to potential customers. In doing so, Trevor also alludes to how the ecological impacts of the 2019 BCS openings on local marine life and water quality fostered consumer concerns pertaining to personal health and safety which increased competition within local and out-of-state markets.

Though participants often expressed such consumer concerns were long-lasting, many reported that such effects were potentially geographically isolated to beachfront boutique properties along the U.S. Highway 90 corridor. When prompted to discuss the regional impact such perceptions had on non-beachfront properties across the Mississippi Gulf Coast, tourism executive Margaret Lewis stated:

> At one point during the summer of 2019, we were 47% down over the previous year. Now, not all the hotels were…Marcus happens to have hotels up on the interstate and not on the beach, so his were not as impacted…in fact, he may have gotten people that were passing through on their way to the beaches that weren't closed…but the beach properties especially were heavily impacted and by the time MDEQ changed the message, it was too late and the images were out…I mean, people were seeing it…nobody wants to swim in something that is killing sea life. If you've got little children, no way you're going to let them go in that.

Through her statement, Margaret highlights the natural resiliency certain hotel properties away from the coastline possess due to their distance from the beach and proximity to major travel corridors, while simultaneously reporting localized economic impacts to boutique beachfront properties. Like many participants, Margaret emphasizes the appeal of such properties as being intrinsically tied to their proximity to the Mississippi Sound for scenic views and recreational activities, noting such properties were adversely affected by consumer concerns pertaining to personal health and safety fostered by media coverage depicting dead marine life and government-issued beach closures. Participants often stated such concerns dissuaded potential tourists from visiting, pushing these visitors to opt instead for out-of-state markets. For example, when asked to describe how the 2019 BCS openings impacted the local hospitality and tourism industry in his district, local elected official Nicholas Palmer explained:

> Our hotel and motel occupancy went from about 80% to about 40%, so when you're looking at an area like ours, which is tourism, that's a major blow to our economy…and I think a lot of it had to do with the media saying, “Hey, don't come down here. You can't get in our beaches. If you get on our beaches and get in the water, you're subject to lose a limb or the algae and the bacteria will eat you up.” So that also played a big part in people canceling their trips and people not visiting our beaches…and if they're not going to visit our beaches, then they're not going to fill our hotel rooms up.

Like Nicholas, participants often noted the identities of certain hotel portfolios are intrinsically tied to their proximity to the beachfront and access to recreational activities which occur in the Mississippi Sound, citing prolonged media coverage of the aftermath of the 2019 BCS openings as diminishing the general appeal of visiting the Mississippi Gulf Coast. In his explanation, Nicholas highlights potential visitors cancelled planned visits for beachfront and marine recreational activities due to concerns for personal health and safety, which translated to lower occupancy for certain hotel properties along the U.S. Highway 90 corridor.

Participants within the tourism and hospitality industry often attributed the loss of first-time and repeat visitation to media coverage pertaining to the ecological impacts the 2019 BCS openings had upon local marine life and water quality, noting such perceptions, once ingrained, are longstanding and difficult to overcome. For instance, later during his discussion regarding how the 2019 BCS openings affected occupancy for his hotel portfolio, Trevor explained:

> Psychologically, the travelers in the Mississippi Gulf Coast…whether they were existing, whether this was going to be their first time, or whether it was going to be a future traveler…because of what transpired with the Bonnet Carré Spillway openings and the beach closures and the sea life dying and the perception that “If I go in the water, I'm going to have lesions and sores and I might die”…the psychological impact was far reaching…we can’t put a number on that because they're gone and a lot of them didn't come back or wouldn't come back.

To overcome the reported occupancy declines in the aftermath of the 2019 BCS openings, participants who managed select beachfront hotel portfolios explained traditional and innovative cost-saving measures were implemented to mitigate decreasing profit margins, resulting in an impact to the overall customer experience and types of services rendered at specific properties. For example, when asked to discuss how the 2019 BCS impacted local tourism and hospitality business operations, tourism executive Brenda Howard explained:

> Your hard costs are so high that if you lose 30% of your occupancy for an entire year, you go down to skeleton staff…GMs and other people are cleaning rooms and checking people in…you're cleaning the pools yourself. That's what happens and you end up having to lay off or shorten or cut those critical hospitality jobs, which are the people who actually make it happen like housekeeping, engineers, HVAC, pool personnel, the lady who cooks the muffins and the cookies and all of that…so you've just taken your biggest ambassadors and they've gotten laid off.

The participants who described reducing staff hours or laying off personnel to mitigate decreasing profit margins often expressed these solutions ultimately impacted guest experiences, resulting in delayed check-ins or longer caller hold times, as well as requiring middle- and upper-management to fill in for duties normally outside their range of responsibilities, such as guest check-in or housekeeping.

Certain participants whose beachfront hotel portfolio consisted of properties within close proximity of each other engaged in more innovative cost-saving measures, such as sharing staff across properties during their shifts. For instance, when prompted to describe operational adjustments undertaken for his beachfront hotel portfolio in response to the 2019 BBCS openings, Trevor stated:

> For the most part, I would say 97% of our employees work at one particular location; however, during this time frame, for some of the properties that are in close proximity to each other, we did try to share some properties with particularly the housekeepers to be able to have…usually the standard is about 30-35 minutes per room…so we put boards together each day so we take 30 minutes per room and try to assign seven hours per housekeeping attendant…and we were creative in doing that with a couple of our properties that were in close proximity to each other.

Despite these cost-saving measures, participants who managed select beachfront hotel portfolios reported other initiatives undertaken to become more competitive with local and out-of-state markets that increased the overall operational cost of their properties. Efforts such as removing the number of minimum nights required for each stay, increased overall labor costs among a reduced staff. For example, during his discussion of the operational adjustments undertaken for his beachfront hotel portfolio in response to the 2019 BCS openings, Trevor explained:

> Normally during peak months we're able to put into effect two-night minimums or even three-night minimums…and what does that do because of the length of stay? The housekeeping expense is lowered because they're cleaning the room as a stayover and not as a check-out, preparing it, they're not pulling everything and rechanging everything for the new guest coming in until two or three days later...now that we have got to remove those minimums, more people may be staying one night instead of two or three nights, and it increases our housekeeping cost. So that bit into some of the cost, which is one of our major expenses, the labor housekeeping.

Furthermore, the subset of participants who described initially laying off personnel as a cost-saving measure reported difficulty hiring qualified employees in the aftermath of the 2019 BCS openings. For instance, when prompted to describe how the 2019 BCS openings affected his ability to hire qualified employees for his hotel portfolio, Trevor stated:

I think what happened with the existing hospitality pool, they had to make decisions to go in a different direction so that pool of available employees shrunk because they had a bad taste in their mouth as far as "Hey, I just got burned in this industry thinking I could make it pursuing this career". So they looked elsewhere…whether they were able to take classes or get certified in another area or just simply be attracted to another area. It made it harder on the hospitality industry with a shrinking pool with all of us trying to as we saw occupancies eventually inch back up to compete for that employee. So, then what do you do when you have a shrinking pool? You try to increase your wages to try to attract those employees to be able to fill vacancies and that certainly affects and is a challenge to our bottom line.

Through his response, Trevor highlights the drawback of traditional cost-saving measures undertaken to mitigate financial impacts of the 2019 BCS openings, noting increased competition within a shrinking pool of potential employees required increasing hourly wages to entice individuals to work for their businesses, ultimately increasing operational costs.

Charter Boats

As with many participants in the tourism and hospitality industry, participants employed as charter boat captains universally expressed their businesses were adversely affected by the ecological impacts the 2019 BCS openings had on local marine life, as well as customer concerns for personal health and safety fostered by MDEQ-issued beach closures/water contact advisories and subsequent media coverage depicting dead or injured dolphins and sea turtles washing up on beaches. When prompted to describe the specific aspects of the 2019 BCS openings that impacted his business, charter boat captain Troy Sanders explained:

The negative publicity resulting from the 2019 BCS openings was really something that we felt right away. Our business dropped down to about…well, we'll put it this way. We normally carry around 50,000 people a year. I think we wound up with about a 30% drop in business that summer.

These participants noted the reduced customer volume adversely impacted their overall profit margins in 2019. For certain participants who were expanding their operations by adding vessels just prior to the 2019 BCS openings, the reduced customer volume translated into a higher volume of lost revenue. For instance, when asked to discuss how the 2019 BCS impacted his business, charter boat captain Jason Miller stated:

I think we probably lost…the expectation of what we were projected to do with a second vessel and the current vessel…I think we lost about 200 trips. These are an average of about $600 to $700 a trip. That adds up quickly.

Based on his estimations, Jason reported losing approximately $120,000 to $140,000 in revenue due to the reduced customer volume resulting from the 2019 BCS openings. Though not all participants employed as charter boat captains reported experiencing a disruption to operational expansions, each participant reported changing their business operations for a time to compensate for the ecological effects the 2019 BCS openings had upon local marine life. For instance, when asked to describe changes to his business operations resulting from the 2019 BCS openings, charter boat captain Derek Winslow explained:

> I mean, it was kind of a disaster just because where our company is based is in the very southwest corner of Mississippi. We're almost on the state line down there by Lake Bourne, so we get an absolute haymaker to the face when they open that spillway. From our Bayou Caddy dock, we're almost on the East Pearl River…there is nowhere to hide from it. We've got to keep going further and further east or south and that year you really couldn't do much of either.

Through his response, Derek highlights that the location of his ship launches directly correlated with the degree to which he needed to adjust his business operations. As his business is in close proximity to the estuaries that feed into the Mississippi Sound from Lake Bourne, Derek describes his necessity to either run fishing charters further south offshore in the Gulf of Mexico or further east along the Mississippi Gulf Coast where decreased salinity levels had not yet impacted local marine life. Such sentiments were commonly expressed by charter boat captains who offered commercial fishing charters. For example, when asked to describe changes to his business operations resulting from the 2019 BCS openings, Jason explained:

> We needed to go further out to fish because in a lot of areas, the Mississippi Sound is a dead zone because of that freshwater. I mean, you've got to know that if it kills the plankton, if it kills out the barnacles, it kills out all this stuff… there's nothing there to breed there. There's no reason for anything to breed there so they become dead zones…and it's going to take millions to create structure and things in those places to regrow life there. But we still have that issue of fishing in close. We just can't…it's just dead zones. You got to go where the fish are and now because there's so many dead zones in the Mississippi Sound, everybody is fishing in certain locations where the fish are now…you got 10-to-20 times the amount of pressure on these fish.

Through his explanation, Jason illustrates the necessity to operate commercial fishing charters further away from the Mississippi Gulf Coast shoreline directly resulted from the adverse ecological effects the 2019 BCS openings had on local targeted marine life populations, noting the freshwater intrusion resulted in decreased salinity levels which created dead zones throughout the Mississippi Sound. Participants often noted that not only did this prevent natural breeding of local targeted marine life, but non-sedentary species were pushed further offshore to areas possessing the requisite salinity levels necessary for survival. Furthermore, participants explained the impact revised fishing practices had upon local targeted marine life, as their own charter fishing operations and commercial seafood harvesters now operated in the same vicinity, exponentially decreasing those populations.

In addition to their businesses being impacted by the direct ecological effects the 2019 BCS openings had upon local targeted marine life, participants whose businesses offered commercial fishing charters reported experiencing cancellations due to either a lack of interest in pursuing alternative species or consumer concerns pertaining to personal health and safety. For example, when asked how the reduction of typical targeted marine life species affected his business operations, Derek explained:

> Part of our business model is brutal honesty…I mean, if it's rough, if it's cold, if we think it's going to rain, if a certain species that we're targeting hasn't been good the last week or two, we will tell the people exactly what we're seeing and what's going on…and they love us for it. And when they asked, "How's the trout?" because, you know…April May, June…that's the best… that's the Super Bowl, the Kentucky Derby, the Daytona 500 of trout fishing… and there were none to catch. So, unless they wanted to go pick around looking for a handful of red fish, if they were lucky, they just said call back when things get right. So, it completely obliterated our spring and early summer.

Though customer lack of interest in pursuing certain species was expressed by a few participants, all participants employed as charter boat captains reported experiencing cancellations due to customer concerns pertaining to personal health and safety resulting from MDEQ-issued water contact advisories and subsequent media coverage related to harmful algae blooms caused by the 2019 BCS openings. For instance, when asked how the 2019 BCS openings impacted his business operations, Jason stated:

> People would call and cancel. I tried to explain the reality of the situation and some of them chose the option to cancel anyway…others that came down were like, "We are not going to be in the water, right?" I'm like, "No." They were like, "But what if we get water splashed on us from the boat?" And I'm like, "Well, it's going to be ok." It was just a bad misperception about what happened as far as the reality of the situation goes. The effects and the impacts that we actually felt were not in the media; it was not widely known that most of this was in shallow water and along the shoreline. Most of it that you couldn't fish in was stagnated water, areas that didn't have much tide, but that was not conveyed to the people and so it was a misperception.

Regarding additional operational adjustments deemed necessary to mitigate financial losses from reduced customer volumes and increasing operational expenses for their commercial fishing charters resulting from the necessity to travel further to reach targeted marine life species, participants often described implementing cost-saving measures wherever possible, primarily by reducing the amount of bait purchased for each trip and making their own ice to keep trophy fish in cold storage. However, certain participants employed as charter boat captains reported shifting their marketing strategies to mitigate the influence of media coverage that contributed to sustained consumer concerns for personal health and safety. For instance, when prompted to describe operational changes to his marketing strategy, Jason explained:

I focused more on places that didn't seem to be aware of what was going on, like places in the Midwest and places in the Northeast. With what we have here on the coast with the casinos, we can draw people from not just the casinos…but I marketed in a lot of different states. I still do and we draw people from all over. We don't do a local clientele often…that just doesn't happen. It's a small percentage…But yes, I had to change marketing place. I couldn't market in Alabama, northern Alabama, Louisiana, Texas. I had to market in places like Minnesota, Wisconsin, Virginia, Kentucky, Oklahoma…and when you're marketing out in those areas, it takes a certain clientele to spend that money to come down to the coast, so you can imagine that it just wasn't that plentiful.

Through his explanation, Jason notes adjusting his marketing strategy to reach out-of-state markets not located in the southeastern U.S. allowed his business to become partially insulated from effects localized media coverage had on consumer concerns pertaining to personal health and safety. Though Jason opted to focus on penetrating out-of-state markets, participants such as Derek opted to leverage social media as a means of reinforcing his customer base throughout the southeastern U.S., noting a daily effort to create and maintain positive images of his business and their successful offshore fishing charters. Despite these efforts, participant opinions on recovery in the aftermath of the 2019 BCS openings were mixed. For instance, when asked about his thoughts on how his business has recovered, Derek stated:

I remember things started getting better to the east. I remember it because I went to a meeting where they were trying to get everybody rallied up to file for money trying to get a handout and I was the only person that spoke at that damn thing and said, “Hey, look…this is great, but this check isn't going to…nobody's going to retire off this. We've got to get back to work.” And the next day…I remember that the next day, it would have been about the third week in June, the fishing started getting good…because I went on a three-day trip to Cat Island. By July and August, we were okay further to the east. I think we just stayed on our eastern fringe of where we fish. I don't even remember coming back to fish in the west until later in the summer…probably August or September.

Through his response, Derek highlights that part of the reason for his recovery is due to the diverse range of locations available for him to operate his commercial fishing charters. Though Derek notes the eastern perimeter of his operations had recovered by mid-summer of 2019, he describes his operations along the western Mississippi Gulf Coast as taking longer to recover. Conversely, when asked about thoughts on how his business recovered, Jason explained:

I don't think we've ever recovered as far as business goes…I think that's rebounded some, but I do not think that it's back to where it was. A lot of things could affect it…the current economy…a lot of things can affect that, but as far as fish and the abundance of seafood, bait, and fish we target, they were not there. The fish are not there.

Through his explanation, Jason reiterates that the adverse ecological impacts caused by the 2019 BCS openings, as well as the consumer concerns caused by subsequent media coverage and compounding economic pressures resulting from the COVID-19 pandemic, have paved a slow road to recovery. Like many other participants in the Mississippi Gulf Coast tourism and hospitality industry, Jason notes that even though his business has partially recovered, it has not reached levels of success seen prior to the 2019 BCS openings. As with those in the Mississippi Gulf Coast seafood industry, Jason alludes to the long-term ecological ramifications of the 2019 BCS openings, noting the local targeted marine life populations that sustain his business operations are no longer present in certain portions of the Mississippi Sound.

Other Tourism

Many of the discussions regarding how the 2019 BCS openings impacted the Mississippi Gulf Coast tourism and hospitality industry more broadly emphasized how local seafood restaurants were adversely affected by the subsequent lack of local seafood landing volumes and consumer concerns regarding Mississippi Gulf Coast seafood safety for consumption. Regardless of their industry, participants universally reported that residents and tourists alike were hesitant to consume Mississippi Gulf Coast seafood due to the ecological impacts the 2019 BCS openings had on local seafood landings, as well as subsequent media coverage emphasizing MDEQ-issued water contact advisories. For instance, when asked how the 2019 BCS openings impacted his business, local seafood restaurant owner Gavin Trent explained:

> There may have been still seafood…there may not have been oysters, but there still might have been shrimp, there still might have been fish…different things like that. But was it perceived as safe by the public? I think that that was a component that kept people maybe from going to restaurants, particularly those that offer the seafood variety that people would go and felt comfortable that they were getting some safe to eat.

Through his response, Gavin notes public perceptions regarding the safety of Mississippi Gulf Coast seafood for consumption had a considerable impact on decreasing customer volumes at local restaurants, particularly those whose identity centered upon seafood offerings. Like Gavin, participants often attributed these customer concerns to media coverage of the ecological impacts of the 2019 BCS openings, noting consistent coverage regarding water quality and depictions of dead or injured marine life fostered perceptions that Mississippi Gulf Coast seafood was tainted and unsafe to consume. For example, when asked to elaborate on how the 2019 BCS openings impacted local restaurants in his constituency, local elected official Peter Nolan explained:

> I think it was more to do with the perception that our seafood wasn't good because of the BCS as opposed to lack of people being here because we had people here. I mean, I can remember talking to our seafood restaurants…that it put a strain on it. I mean, when you've got people saying that the fish is not good, that dolphins and turtles are dying and washing up on the beach, and pretty much anything that couldn't run from it was killed…so, I think the biggest impact that it had on us was the thought that our seafood wasn't any good or that it was tainted in some kind of way.

In response to decreased customer volumes resulting from such concerns, as well as disruptions to existing seafood supply chains resulting from the 2019 BCS openings, participants who owned or operated local restaurants along the Mississippi Gulf Coast described shifting their seafood supply chains from local seafood harvesters to imported seafood vendors or adjusting their menu options to focus on non-seafood dishes. For example, when asked if any of the restaurants operated by his hotel portfolio had shifted their supply chain or menu offerings, local hotel portfolio manager Trevor Allen stated:

> We did. We recognize that was going to be an ongoing issue so we would put our focus more on poultry or beef or some of the other products. And then we would just make sure that the local seafood…it was difficult for us to promote that…of course, your Cisco's or US foods or other venues would provide seafood probably from an imported source…and we would just use that as an alternative.

Through his response, Trevor notes restaurants under the purview of his hotel portfolio not only shifted their menu offerings to poultry or beef dishes, but also alluded to the difficulty of promoting local seafood in the aftermath of the 2019 BCS openings when it was available due to perceptions of Mississippi Gulf Coast seafood being tainted and described shifting his seafood supply chain from local seafood harvesters to imported seafood vendors. Participants who owned or operated local restaurants often described shifting their menu options regardless of whether their establishment was primarily identified as a seafood restaurant. For certain participants, however, shifting their supply chains from local seafood harvesters to imported seafood vendors was cost prohibitive due to requirements by such vendors to purchase their products in bulk. For instance, when prompted to discuss how his restaurant adjusted its menu offerings, local entrepreneur Eli Thomas explained:

> We had to move more toward the poultry and beef direction. Of course, we picked up, trying to make up for it by going to raise Mississippi catfish, which is really a big hit. We did in fact experience some serious losses when it comes to people who normally will come in here from out of town. I mean, it's a real tourism destination…it's hard to tell people that you don't have shrimp or it's hard for them to get excited about little, tiny popcorn shrimp, right? I mean we're not Popeye's, you know? And it was a challenge that we just had to overcome, and we did. We could not buy in bulk…probably if we could, maybe we would have considered buying Vietnamese shrimp, but we couldn't buy in bulk…I mean you want to still try to stay in business. But at least let the customer know, "Well, these are not Gulf Shrimp."

Through his explanation, Eli notes his restaurant expanded its poultry and beef offerings, as well as shifted to other Mississippi-based seafood products which did not originate from the Mississippi Gulf Coast, to compensate for the disruptions the 2019 BCS openings caused to local seafood supply chains. Despite these shifts, Eli explained his restaurant was unable to shift its seafood supply chain to imported seafood vendors due to requirements for bulk product purchases. On a deeper level, Eli's response highlights the pride with which many local restaurants took in offering Mississippi Gulf Coast seafood due to its status as a core component of a shared cultural identity, as well as the disappointment that came from having to abandon part of that identity. Though discussed with varying degrees of passion, such sentiments were broadly reflected by participants regardless of their industry.

Concerns about Future Openings

Throughout each discussion, participants frequently expressed concerns regarding the impact future BCS openings would have upon their industries, communities, and culture, often expressing frustration regarding the lack of progress that has been made seeking alternatives in high water river management and diversion operations. For many participants, such concerns were directly attributed to the negative ramifications future openings would have on the economy, their livelihoods, their recreational activities, and their cultural identity. For instance, when prompted to describe his concerns towards future BCS openings, local charter boat captain Derek Winslow explained:

> It's just bad for everything…it's bad for our ecosystem, it's bad for our economy, it's bad for the kids, it's bad for the adults…the Mississippi Sound was never intended to handle that. I don't know how many more times you can do it…you know, they wiped out so many damn oyster beds doing it and every damn crab in its path…either they kill it or push it way the hell down the coast and the fish…it's just a lesion or just a nasty sore right in our front yard here on the Mississippi Gulf Coast. I mean, we hate them…we dread those damn openings. It is just like a plague…like a damn water-carried plague that we've got to fight through because I'm not going anywhere…I mean, I freaking love it here. I have no intentions of leaving. I have no dream place where I'm moving if I win the lottery. I love it here…I've always loved it here.

Through his explanation, Derek alludes to the negative ramifications BCS openings have historically had upon local marine ecosystems, supply chains, and the broader economy, while simultaneously expressing his frustration at the repeated long-term impacts the Mississippi Gulf Coast endures from such events. Like Derek, many participants were lifelong residents residing along the Mississippi Gulf Coast who expressed social solidarity and kinship with coastal residents, communities, and industries. Such participants often noted their frustration at the intangible damage BCS openings cause to their community reputations and cultural identities; however, those whose livelihoods are tied directly to the Mississippi Sound, whether in the seafood or hospitality and tourism industry, often expressed concerns regarding the sustainability of their businesses and industries more broadly. For example, when asked how concerned he would be regarding even a short-term BCS opening, local charter boat captain Jason Miller stated:

> I just don't want to see that thing open again any more…when you start hearing rumors about it open, you cringe, thinking "What's going to happen and where is my livelihood going to be? How am I going to pay my mortgage?" So that stuff runs through your mind when the Army Corps of Engineers start talking about opening that thing because the effects and devastation are coming.

Through his statement, Jason illustrates the ever-present sense of stress and anxiety Mississippi Gulf Coast business owners have regarding individual financial hardships they expect to face in the event of future BCS openings. Such sentiments were most prevalent among participants who were local charter boat captains, seafood processors, seafood distributors, and seafood harvesters, particularly if their business consisted of a smaller operation. However, many participants regardless of industry expressed concerns regarding the sustainability of the Mississippi Gulf Coast seafood industry in the wake of future BCS openings. For instance, when prompted to discuss his concerns regarding future BCS openings, local restaurant owner Oliver Grant stated:

> Now with the frequency of Bonnet Carré Spillway openings, who's going to want to make an investment into the seafood industry? Who's going to want to go buy a boat and invest that kind of money when next year their season is wiped out because of a rain event in the northern part of the country that's getting dumped into the Mississippi Sound? We're going to end up seeing an industry that just about goes completely away…at least one of those local seafood stands closed because no one's going to gamble the cost of investing into that kind of business…because these people that oyster, they don't just oyster…they try to maximize what they can do through the different seasons and if they're running the gamut, if they lose half of the shrimp season, they might as well shut down because they're in the red and they're not coming out of it.

Through his discussion, Oliver highlights a broader concern that future BCS openings will cause irreparable harm to the Mississippi Gulf Coast seafood industry by driving away potential investments and dissuading future generations of fishermen, oystermen, and shrimpers from entering the industry. Participants frequently expressed such concerns, noting the ecological impacts of the 2019 BCS openings and subsequent economic pressures in the aftermath of the COVID-19 pandemic have already reduced the Mississippi Gulf Coast seafood industry to a fraction of its former self. However, concerns regarding the impacts of future BCS openings were not simply limited to the Mississippi Gulf Coast seafood industry. For example, when asked to describe his concerns regarding future BCS openings, local restaurant owner and entrepreneur Eli Thomas stated:

> All you got to do is look at the number of mom-and-pop privately-owned restaurants that are not here anymore, even just between 2019 and now. I mean, you will find the franchises that come here and who knows where they get their seafood from? Doubtful that it is coming from the boat out front… very doubtful. So, I could see a time when local won't be local, you know? And that's very, very sad…there are some states, municipalities, and counties that understand how critical that is.

In looking to the past to speculate about the impact of future BCS openings, Eli points to the long-term impacts Mississippi Gulf Coast industries have already sustained due to the 2019 BCS openings, suggesting not only will local privately-owned restaurants be driven out of business, but also that seafood supply chain disruptions would become permanent. Like Eli, participants frequently expressed concerns that future BCS openings would erode core components of their cultural identities, fearing such events have the potential to permanently eliminate the natural resources of the Mississippi Sound and completely shutter local industries. For instance, when prompted to discuss his concerns about future BCS openings, local elected official and lifelong resident Edward Spector explained:

> What I'm concerned with is long-term if we don't start taking affirmative steps to protect the resource and to give it the things that it needs to bounce back… that one day, we'll knock it out completely.

4

Conclusion

- Overview
- Summary of Key Findings
- Discussion

DISCUSSION

The previous section alludes to the critical assumptions underpinning the economic forecasting model use to project future impacts: the assumptions that fisheries in the Mississippi Sound will recover after each spillway opening event, and the assumption that the people who have sustained these industries will continue to operate their seafood businesses.

Although many of the key informants we interviewed suggested that the Sound's fisheries have the potential to recover to historical levels of productivity, the quantitative trends in landing data cast uncertainty on this perspective – that fisheries will recover to pre-2019 levels after future ecological events impacting the Mississippi Sound. As shown in previous sections, the oyster fisheries have historically struggled to recover from major ecological events. For example, over 4 million pounds of oysters were landed in 2003, but harvests never returned to this peak after Hurricane Katrina. After Katrina, landings peaked at 2.6 million pounds, but never returned to this peak after the Deepwater Horizon oil spill. After the Deepwater incident, landings peaked at about 500,000 pounds, but then fell to zero from the 2019 BCS openings through 2022. This observable trend is reinforced with the statement from local marine biologists, who stated the oyster population requires "about 10 years" with "no large mortality events" in order to grow into a biomass that can be harvested sustainably.

To help restore the oyster population, Mississippi has introduced incentives for private businesses to seed oyster beds, offering 15-year leases at rates as low as $3 per acre (Lee, 2023a; Lee, 2023b). These leases require that at least 50% of the leased area be planted within five years using approved broodstock (Mississippi Department of Marine Resources, 2024). However, the potential for future spillway openings to wipe out these investments may undermine the positive impact of these initiatives, discouraging participation despite the favorable terms. Addressing this issue would likely require some form of protection or guarantee to safeguard business investments against potential future spillway events.

The Mississippi coastal seafood industry, already under pressure from the impacts of the BCS, is facing additional challenges from the competition posed by imported seafood (Sanchez, 2024). This pressure has gained national attention, with U.S. Senators urging the Federal Trade Commission to address "misleading marketing practices" associated with imported pond-raised shrimp, in an effort to protect the local shrimping industry (Southern Shrimp Alliance, 2024).

The combined force of these external pressures is contributing to the industry's struggle to retain its workforce. Interviews with local oystermen, shrimpers, and fishermen reveal that many are exiting the industry, selling their boats, and leaving behind livelihoods that have supported generations. This finding casts additional uncertainty on these projections' assumptions and highlights an additional challenge to the industry's recovery: its future hinges in part on whether the region's workforce remains committed to the continuation of the industry.

Conversely, our future forecasts assume that the tourism industry will experience only modest growth in the coming years, keeping pace with national trends. However, if the ongoing disruptions to the seafood industry cause the coastal economy to develop a heavier reliance on tourism, then the consequences of a future BCS opening event for an expanded tourism sector could be significantly more pronounced.

As a result, the impacts and projections provided in this report should be viewed as optimistic in the sense that they assume both the ecological recovery of the fisheries and that the seafood industry's workforce will remain in the industry despite growing challenges. If, instead, the industry continues to contract, it could lead to a collapse of Mississippi's coastal seafood industry and, potentially, to a broader destabilization of the region's economy. In this scenario, a future BCS opening event would no longer be modeled as a temporary economic disruption, but instead would be modeled as an ongoing structural change occurring within the region's economy; modeling this type of structural change was beyond the scope of this research project.

While this report provides useful and actionable insight to the immediate economic consequences of these disruptions, further research is necessary to identify and simulate the full range of possible long-term consequences; including comprehensive modeling of alternative scenarios where recovery cannot occur. The research team recommends that future research be undertaken in the following areas:

Examination of existing and ongoing structural changes in the fishing industry including the permanent disruptions in supply chains, rising operational costs, and declining participation in the seafood harvesting industry.

Research into the ability of fisheries to recover from repeated disruptions and the long-term viability of the fishing industries operating in the Mississippi Sound.

Development of specialized modeling to account for non-linear effects and identify potential tipping points in the coastal ecosystem or economy.

Forecasting cascading impacts on both the coastal economy and the broader Blue Economy if a collapse of the fisheries were to occur.

Identification of mitigation strategies, policy interventions, or adaptive measures that could help safeguard the region's economy against broader environmental shifts.

> **Advancement of this research can assist policymakers, industry leaders, and community planners in their efforts to ensure the long-term resilience of Mississippi's coastal economy.**

5

REFERENCES AND APPENDICES

REFERENCES

1. ATLAS.ti Scientific Software Development GmbH. (2024). ATLAS.ti Windows (version 24.1.1.30813) [Qualitative data analysis software]. https://atlasti.com
2. Armstrong, B. N., Cambazoglu, M. K., & Wiggert, J. D. (2021, September). *Modeling the impact of the 2019 Bonnet Carré Spillway opening and local river flooding on the Mississippi Sound*. In OCEANS 2021: San Diego–Porto (pp. 1-7). IEEE.
3. Babbie, E. R. (2020). *The practice of social research*. South Melbourne, Australia: Cengage.
4. Barbour, R. (2007). *Underpinnings of focus group research: Doing focus groups*. London, England: SAGE Publications.
5. Charmaz, K. (2014). *Constructing grounded theory: A practical guide through qualitative analysis*. London, England: SAGE Publications.
6. Coblentz, B. (2015). *Shrimp season interruption, low prices make tough year*. Mississippi State University Extension Service. https://www.ext.msstate.edu/news/crop-report/2015/shrimp-season-interruption-low-prices-make-tough-year?page=8
7. Corbin, J., & Strauss, A. (2015). *Basics of qualitative research,14*. London, England: SAGE Publications.
8. Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. London, England: SAGE Publications.
9. Dalyander, P.S., Ramseur, G., Pahl, J., Averion, D., Linhoss, A., Miner, M., Mickle, P. (2022). *Structured decision making to co-produce an actionable science plan in support of Louisiana, Mississippi, Alabama Coastal System Water Quality Management: Research and Development Plan*. The Water Institute of the Gulf. Supported by the NOAA RESTORE Program. Baton Rouge, LA.
10. Demski, J. (2020). *Understanding IMPLAN: Direct, indirect, and induced effects*. Understanding IMPLAN: Direct, Indirect, and Induced Effects. https://blog.implan.com/understanding-implan-effects
11. Federal Emergency Management Agency. (2020). *Preliminary damage assessment guide*. FEMA Preliminary Damage Assessment Guide. https://www.fema.gov/
12. Gallardo-Gómez, D., Richardson, R. & Dwan, K. (2024). Standardized mean differences in meta-analysis: A tutorial. *Cochrane Evidence Synthesis and Methods, 2*(3), e12047.
13. Hennink, M., & Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine*, *292*, 114523.
14. Hennink, M. M., Kaiser, B. N., & Weber, M. B. (2019). What influences saturation? Estimating sample sizes in focus group research. *Qualitative Health Research, 29*(10), 1483-1496.
15. Hesse-Biber, S. N. (2016). *The practice of qualitative research*. London, England: SAGE Publications.

16. IMPLAN Group LLC. (2024). *Who we are: Discover IMPLAN's history, vision, and values*. IMPLAN: Economic Impact Modeling. https://implan.com/company/

17. Lee, A. (2023a, April). *It Works in Louisiana. Will this New Law Save the Oyster Industry on the MS Coast?* Sun Herald. https://www.sunherald.com/news/business/article273648135.html

18. Lee, A. (2023b, December). *MS is granting private oyster leases to 15 businesses. Could it save the coast industry*. Sun Herald. https://www.sunherald.com/news/business/article282646913.html

19. Lightcast. (2024). *Lightcast data*. Lightcast. https://lightcast.io/products/data/overview

20. Mississippi Department of Environmental Quality. (2019). *MDEQ Issues Two Additional Beach Closures.* Mississippi Department of Environmental Quality. https://dmr.ms.gov/on-bottom-molluscan-shellfish-leases/

21. Mississippi Department of Marine Resources. (2024). *On-Bottom Molluscan Shellfish leases.* Mississippi Department of Marine Resources. MDEQ Issues Two Additional Beach Closures – MDEQ (ms.gov)

22. National Oceanic and Atmospheric Administration (2024). *National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters*. https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73

23. Posadas, B. C. (2022). *Effects of Higher Fuel and Lower Dockside Prices on Gulf Shrimping*. Mississippi MarketMaker Newsletter, 12(8).

24. Posadas, B.C., & Posadas, B.K. (2017). Economic Impacts of the Opening of the Bonnet Carré Spillway to the Mississippi Oyster Fishery. *Journal of Food Distribution Research*, 48.

25. Pruett, J., Otts, S., Willett, K., Fairbanks, L., Darnell, K., and Gochfeld, D. (2024). A Past, Present, and Future Outlook on the Mississippi Oyster Fishery. *Journal of Shellfish Research 43*(1), 1-13.

26. Sanchez, M. (2024, June). *Imported Seafood is Killing a MS Coast Industry. Could truth in restaurant menus help?* Sun Herald. https://www.sunherald.com/entertainment/restaurants/article289002449.html

27. Seubert, E. (2019). *Bonnet Carré openings stir trouble for Gulf Coast.* Mississippi State University Extension Service. http://extension.msstate.edu/news/extension-outdoors/2019/bonnet-carr%C3%A9-openings-stir-trouble-for-gulf-coast

28. Snow, C., Bargu, S., Hammond, C. N., Hiatt, M., & White, J. R. (2024). Effect of Mississippi River discharge plume on temporal and spatial variability of toxic cyanobacteria in an oligohaline estuary. *Hydrobiologia, 851*(1), 87-103.

29. Southern Shrimp Alliance. (2024). *Commissioner Alvaro Bedoya Meets with Gulf Coast Shrimp Industry*. https://shrimpalliance.com/commissioner-alvaro-bedoya-meets-with-gulf-coast-shrimp-industry/

30. U.S. Army Corps of Engineers. (n.d.). *Bonnet Carré' Spillway Overview*. US Army Corps of Engineers New Orleans District Website. www.mvn.usace.army.mil/Missions/Mississippi-River-Flood-Control/Bonnet-Carré-Spillway-Overview/

Appendix A: Glossary of Terms

Industry Classifications

Industries used in this analysis were identified using North American Industry Classification System (NAICS) codes. Analyses were conducted on the Charter Boat industry, the Hotels and Lodging industry, the Other Tourism, Excluding Hotels and Charter Boats industry, and the Seafood Processing Industry.

It should be noted that "Tourism" does not have a standardized industry definition. The definition used in this analysis was created based on published research from the Headwater Economics and the University of Texas at San Antonio.

The NAICS codes and NAICS titles for each sector used to define the industries in this analysis are listed below.

Charter Boats

487210	Scenic and Sightseeing Transportation, Water

Hotels and Lodging

721110	Hotels (except Casino Hotels) and Motels
721120	Casino Hotels
721191	Bed-and-Breakfast Inns
721199	All Other Traveler Accommodation
721211	RV (Recreational Vehicle) Parks and Campgrounds
721214	Recreational and Vacation Camps (except Campgrounds)

Other Tourism, Excluding Hotels and Charter Boats

457110	Gasoline Stations with Convenience Stores
457120	Other Gasoline Stations
483112	Deep Sea Passenger Transportation
483114	Coastal and Great Lakes Passenger Transportation
483212	Inland Water Passenger Transportation
487110	Scenic and Sightseeing Transportation, Land
487990	Scenic and Sightseeing Transportation, Other
532284	Recreational Goods Rental
561510	Travel Agencies
561520	Tour Operators
561591	Convention and Visitors Bureaus
561599	All Other Travel Arrangement and Reservation Services
711110	Theater Companies and Dinner Theaters
711120	Dance Companies
711130	Musical Groups and Artists
711190	Other Performing Arts Companies

711211	Sports Teams and Clubs
711212	Racetracks
711219	Other Spectator Sports
712110	Museums
712120	Historical Sites
712130	Zoos and Botanical Gardens
712190	Nature Parks and Other Similar Institutions
713110	Amusement and Theme Parks
713120	Amusement Arcades
713210	Casinos (except Casino Hotels)
713290	Other Gambling Industries
713910	Golf Courses and Country Clubs
713920	Skiing Facilities
713930	Marinas
713940	Fitness and Recreational Sports Centers
713950	Bowling Centers
713990	All Other Amusement and Recreation Industries
722410	Drinking Places (Alcoholic Beverages)
722511	Full-Service Restaurants
722513	Limited-Service Restaurants
722514	Cafeterias, Grill Buffets, and Buffets
722515	Snack and Nonalcoholic Beverage Bars

Seafood Processing

311710	Seafood Product Preparation and Packaging

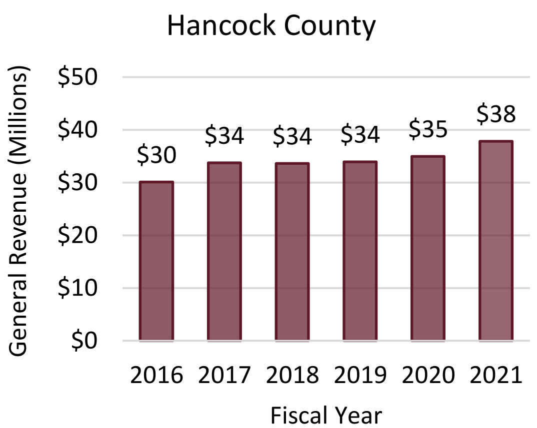
APPENDIX B: MUNICIPAL GENERAL REVENUES

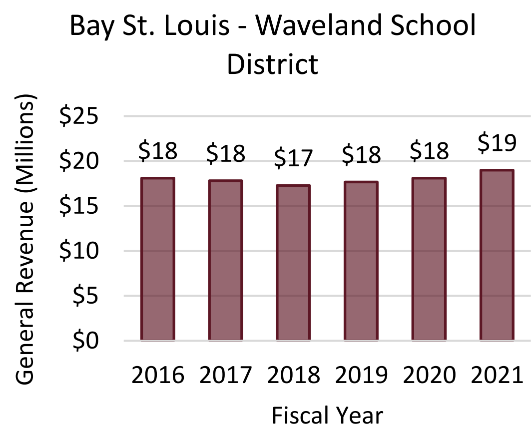
This appendix presents the general revenues for the county governments of Hancock County, Harrison County, and Jackson County, as well as the school districts and cities within these counties.

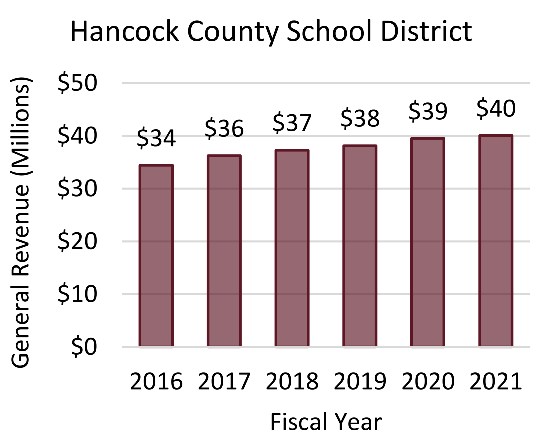
Readers should note that county government graphs (i.e., Hancock County, Harrison County, and Jackson County) provide the revenues for the county government, and do not represent a total of all the municipalities contained within the county's boundaries.

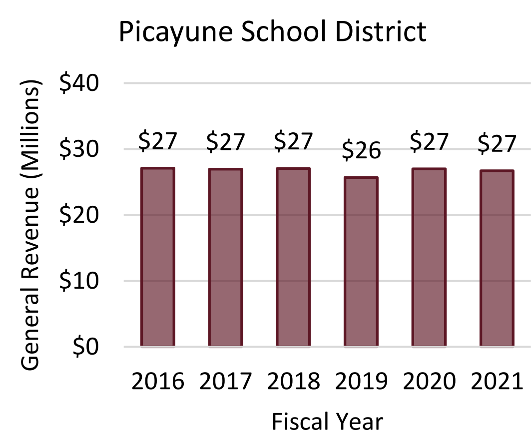
These data were obtained from publicly available audit statements published on the website of Mississippi's Office of the State Auditor. For brevity, individual source notations are not included on each graph.

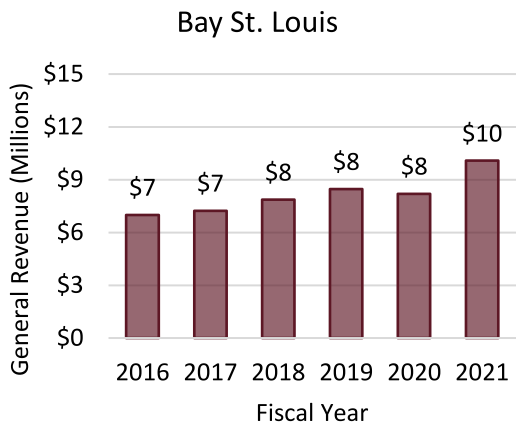
HANCOCK COUNTY MUNICIPALITIES

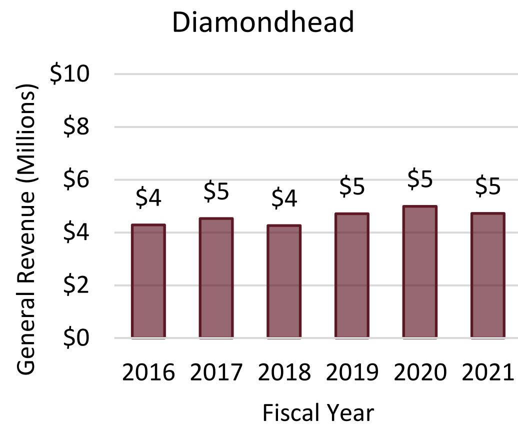


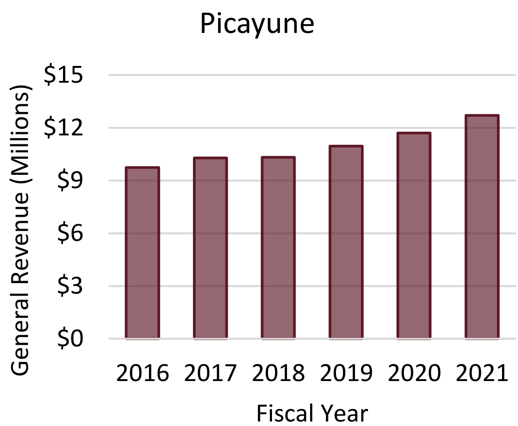


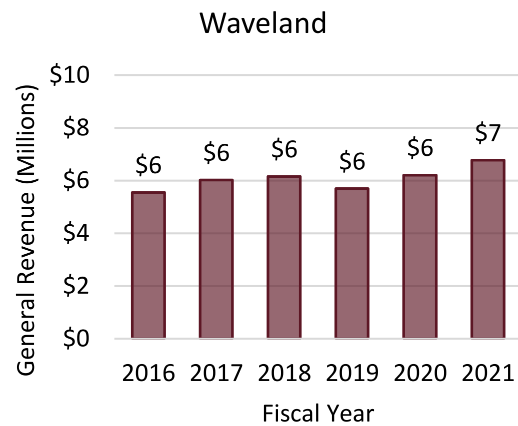




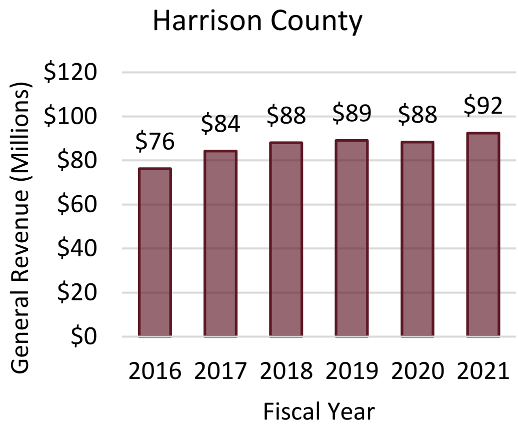

Bay St. Louis
General Revenue (Millions)
$15
$12
$9
$6
$3
$0
$7
$7
$8
$8
$8
$10
2016 2017 2018 2019 2020 2021
Fiscal Year

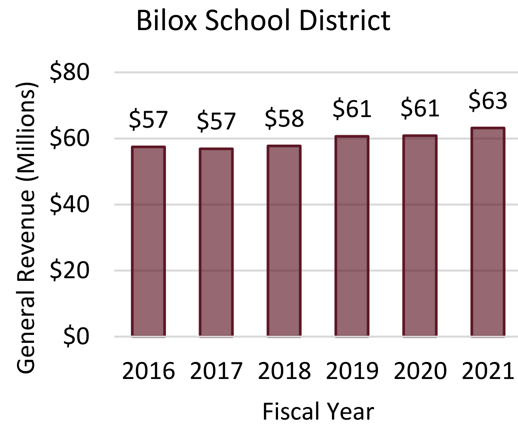

Diamondhead
General Revenue (Millions)
$10
$8
$6
$4
$2
$0
$4
$5
$4
$5
$5
$5
2016 2017 2018 2019 2020 2021
Fiscal Year

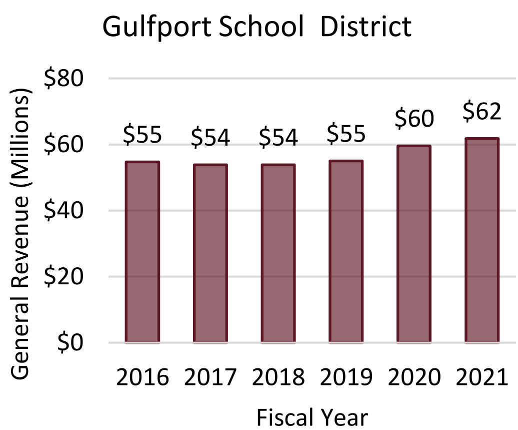

Picayune
General Revenue (Millions)
$15
$12
$9
$6
$3
$0
2016 2017 2018 2019 2020 2021
Fiscal Year

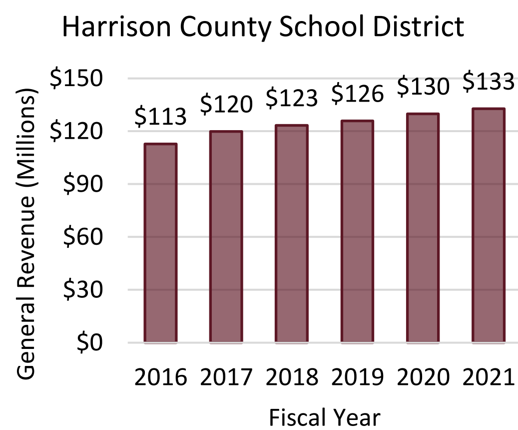

Waveland
General Revenue (Millions)
$10
$8
$6
$4
$2
$0
$6
$6
$6
$6
$6
$7
2016 2017 2018 2019 2020 2021
Fiscal Year

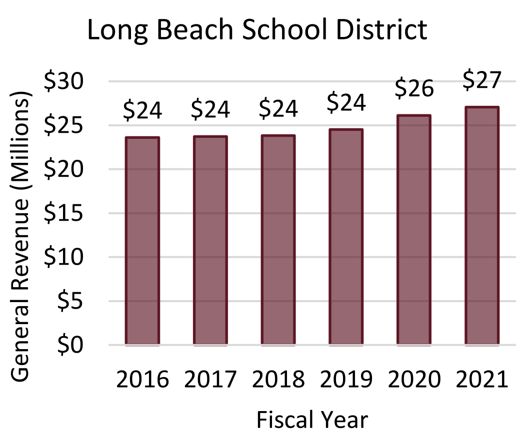
Harrison County Municipalities

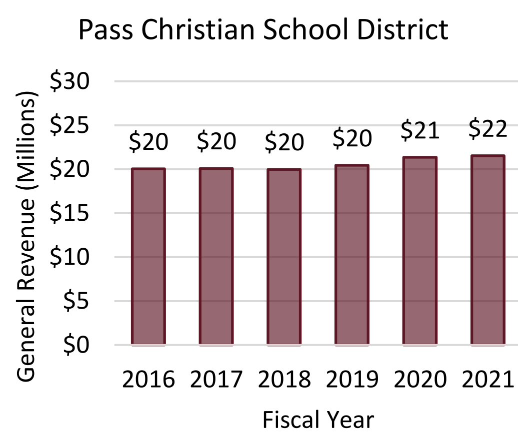


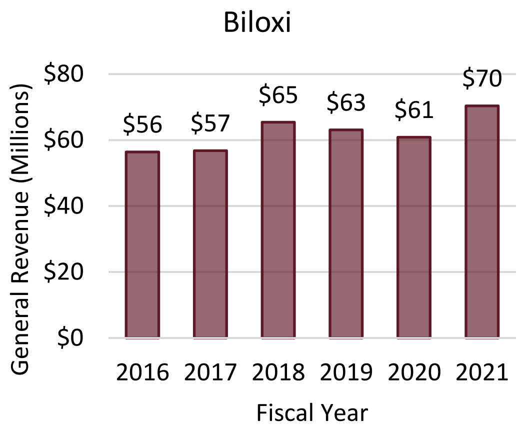


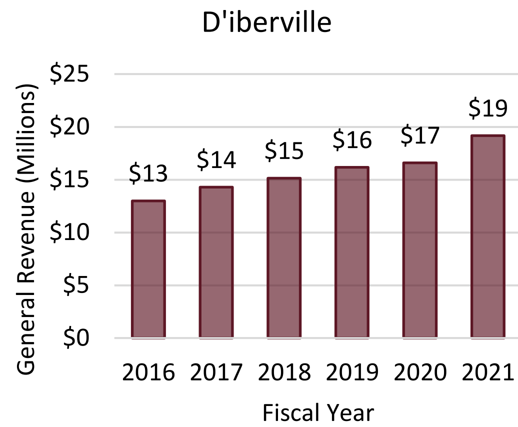


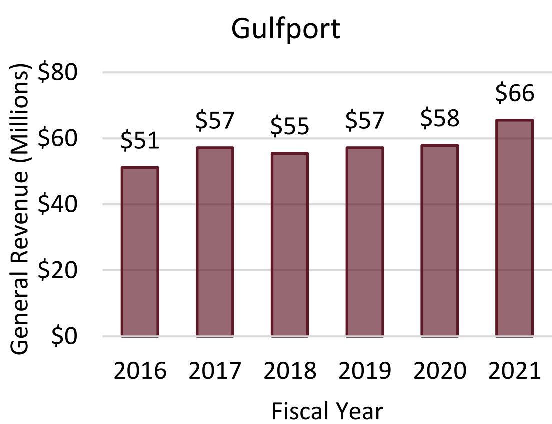


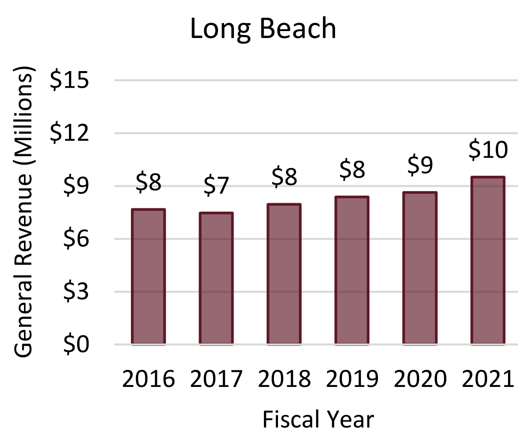


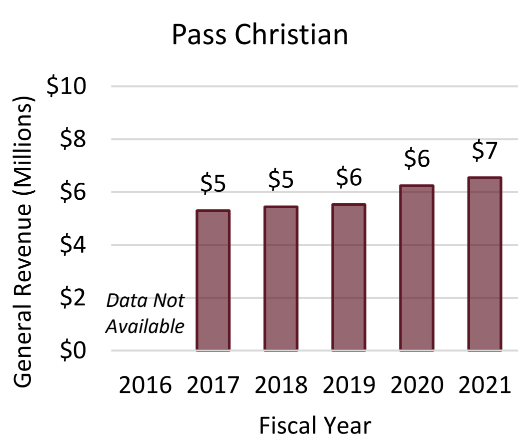



Biloxi
General Revenue (Millions)
$80
$60
$40
$20
$0
$56
$57
$65
$63
$61
$70
2016
2017
2018
2019
2020
2021
Fiscal Year

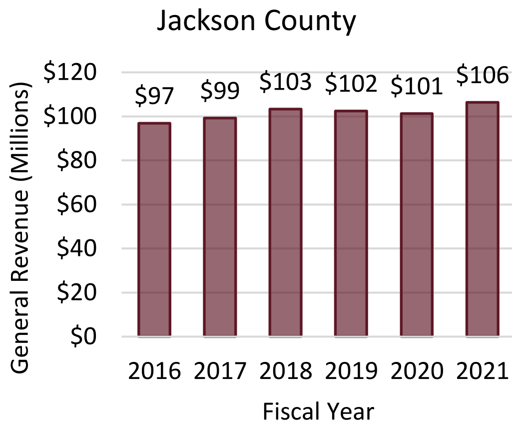

D'iberville
General Revenue (Millions)
$25
$20
$15
$10
$5
$0
$13
$14
$15
$16
$17
$19
2016
2017
2018
2019
2020
2021
Fiscal Year

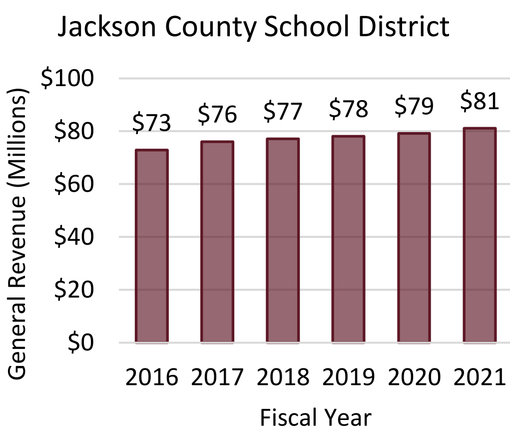

Gulfport
General Revenue (Millions)
$80
$60
$40
$20
$0
$51
$57
$55
$57
$58
$66
2016
2017
2018
2019
2020
2021
Fiscal Year

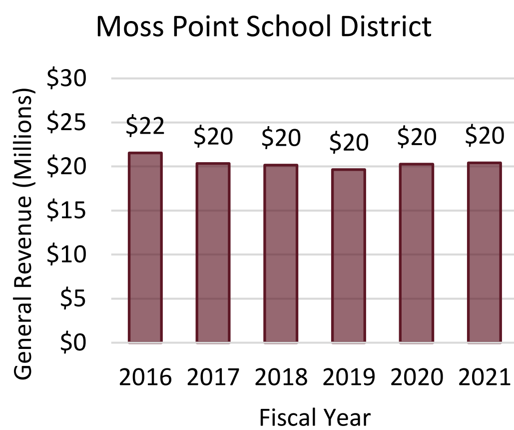

Long Beach
General Revenue (Millions)
$15
$12
$9
$6
$3
$0
$8
$7
$8
$8
$9
$10
2016
2017
2018
2019
2020
2021
Fiscal Year

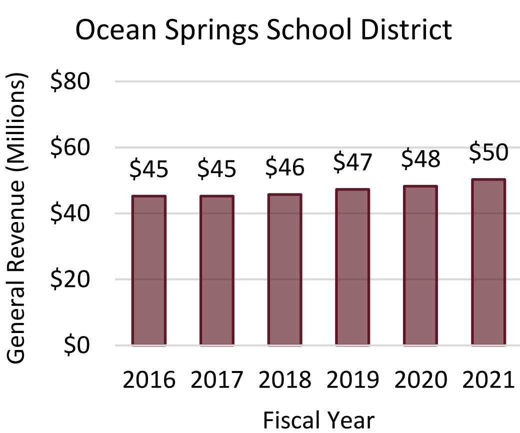

Pass Christian
General Revenue (Millions)
$10
$8
$6
$4
$2
$0
Data Not Available
$5
$5
$6
$6
$7
2016
2017
2018
2019
2020
2021
Fiscal Year

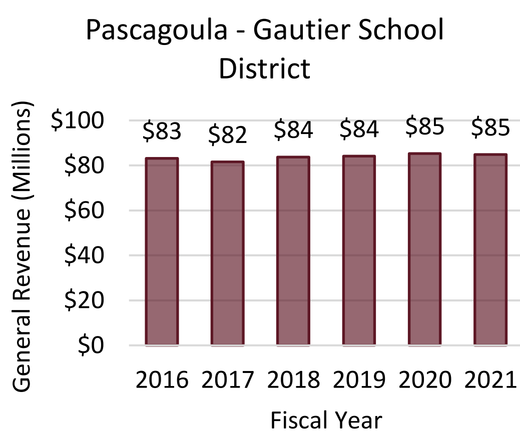
JACKSON COUNTY MUNICIPALITIES

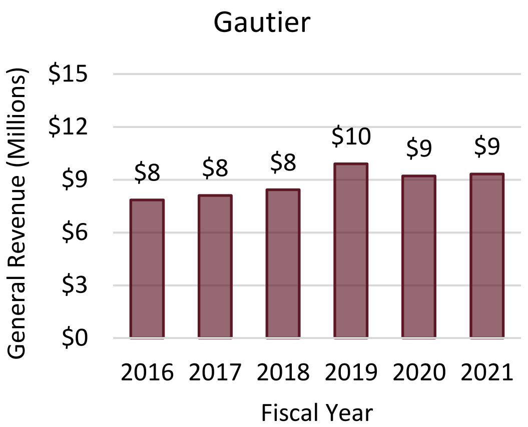


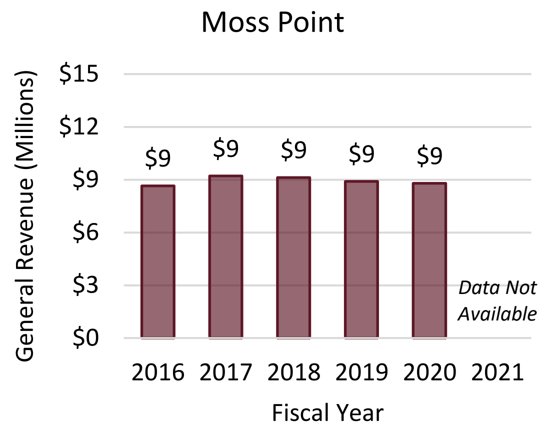


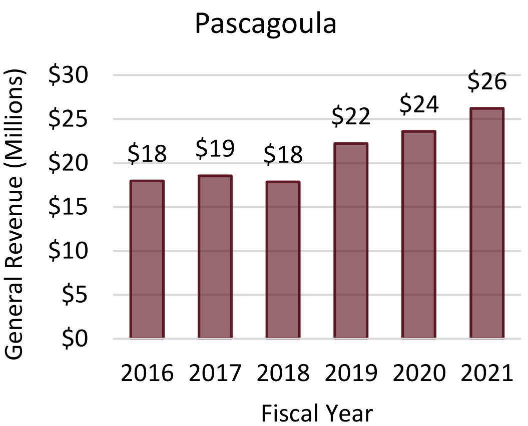


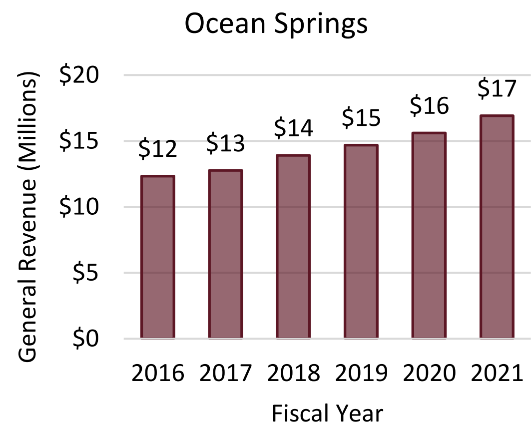





Gautier
General Revenue (Millions)
$15
$12
$9
$6
$3
$0
$8
$8
$8
$10
$9
$9
2016
2017
2018
2019
2020
2021
Fiscal Year


Moss Point
General Revenue (Millions)
$15
$12
$9
$6
$3
$0
$9
$9
$9
$9
$9
Data Not
Available
2016
2017
2018
2019
2020
2021
Fiscal Year


Pascagoula
General Revenue (Millions)
$30
$25
$20
$15
$10
$5
$0
$18
$19
$18
$22
$24
$26
2016
2017
2018
2019
2020
2021
Fiscal Year


Ocean Springs
General Revenue (Millions)
$20
$15
$10
$5
$0
$12
$13
$14
$15
$16
$17
2016
2017
2018
2019
2020
2021
Fiscal Year

APPENDIX C: INFLATION-ADJUSTED TABLES AND FIGURES

TABLE C1: VALUE OF SEAFOOD LANDINGS BEFORE AND AFTER 2019 BONNET CARRÉ SPILLWAY OPENINGS; ADJUSTED FOR INFLATION, 2019 DOLLARS

Average Value of Landings Before 2019 BCS Openings (Mean Value, 2014-2018)		Value of Landings After 2019 BCS Openings			
		2019	2020	2021	2022
Eastern Oyster	$1,168,933	$0	$0	$0	$0
Blue Crab	$985,797	$1,274,797	$1,324,139	$1,542,809	$125,786
Brown Shrimp	$8,489,595	$2,292,786	$3,612,972	$4,128,854	$3,236,788
White Shrimp	$7,166,912	$12,905,558	$9,240,797	$7,458,973	$5,120,783
Spotted Seatrout	$153,687	$128,191	$70,993	$80,144	$97,386

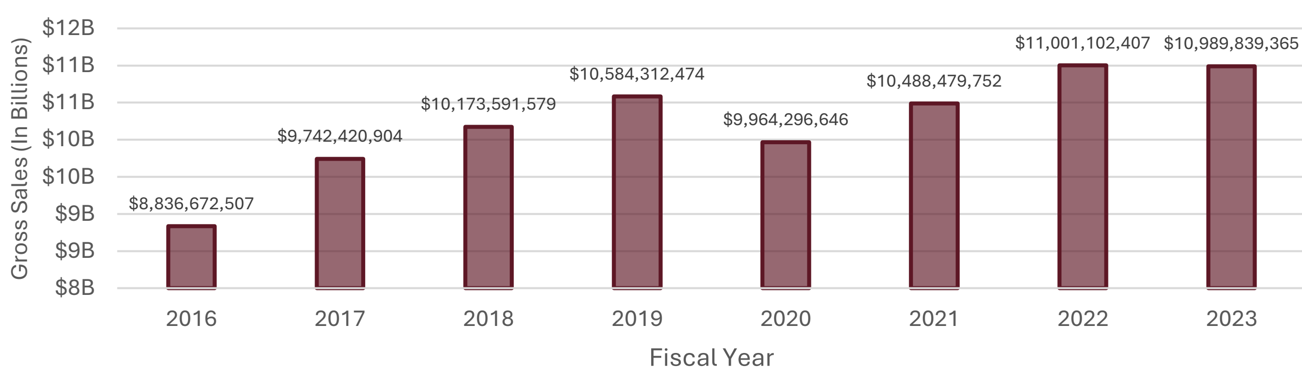
Source: NOAA Fisheries

TABLE C2: FOREGONE VALUE OF LOST SEAFOOD LANDINGS, 2019-2022; ADJUSTED FOR INFLATION, 2019 DOLLARS

Average Value of Landings Before 2019 BCS Openings (Mean Value, 2014-2018)		Foregone Value of Landings				
		2019	2020	2019	2022	Total
Eastern Oyster	$1,168,933	-$1,168,933	-$1,168,933	-$1,168,933	-$1,168,933	-$4,675,733
Blue Crab	$985,797	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*
Brown Shrimp	$8,489,595	-$6,196,809	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	-$6,196,809
White Shrimp	$7,166,912	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Identifiable Loss (Value Increased)*	*No Attributable Loss*	*No Attributable Loss*
Spotted Seatrout	$153,687	-$25,496	*No Attributable Loss*	*No Attributable Loss*	*No Attributable Loss*	-$25,496
Total	**$17,964,924**	**-$6,869,502**	**-$1,093,890**	**-$1,093,890**	**-$1,093,890**	**-$10,151,172**

Source: NOAA Fisheries, 2024; Posadas, 2022

FIGURE C1: ANNUAL GROSS SALES IN COASTAL TOURISM INDUSTRIES, 2016-2023; ADJUSTED FOR INFLATION, 2019 DOLLARS



Source: Mississippi Department of Revenue, 2024

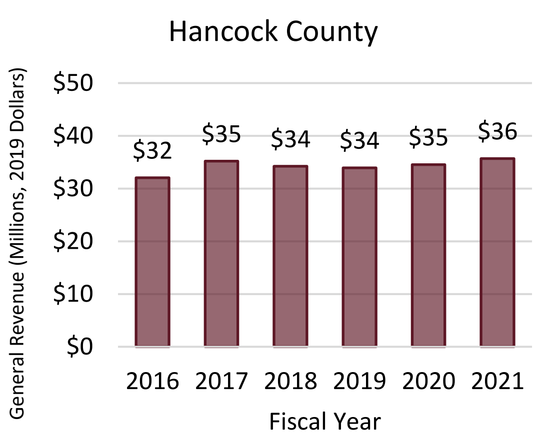
APPENDIX D: INFLATION-ADJUSTED MUNICIPAL GENERAL REVENUES

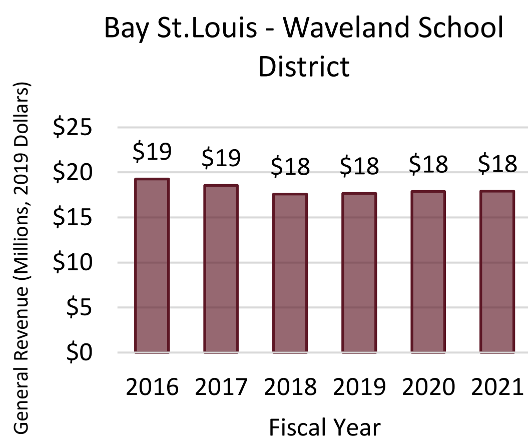
This appendix presents the general revenues for the county governments of Hancock County, Harrison County, and Jackson County, as well as the school districts and cities within these counties. These figures have been adjusted for inflation, equating all figures to 2019 dollars.

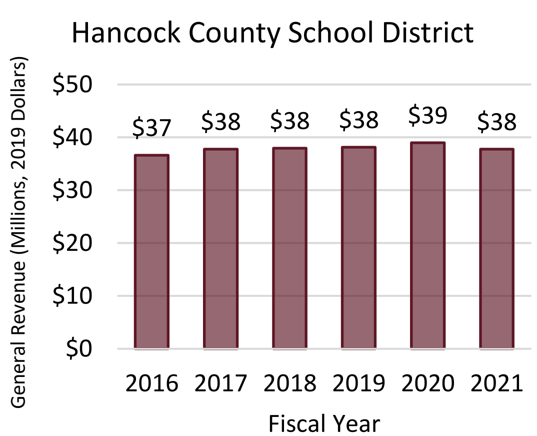
Readers should note that county government graphs (i.e., Hancock County, Harrison County, and Jackson County) provide the revenues for the county government, and do not represent a total of all the municipalities contained within the county's boundaries.

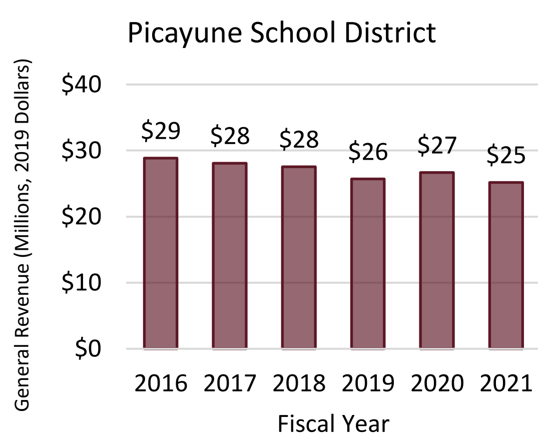
These data were obtained from publicly available audit statements published on the website of Mississippi's Office of the State Auditor. Data on inflation were obtained from the U.S. Bureau of Labor Statistics. For brevity, individual source notations are not included on each graph.

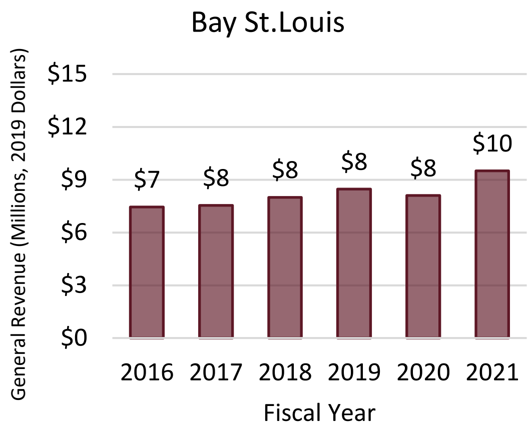
HANCOCK COUNTY MUNICIPALITIES

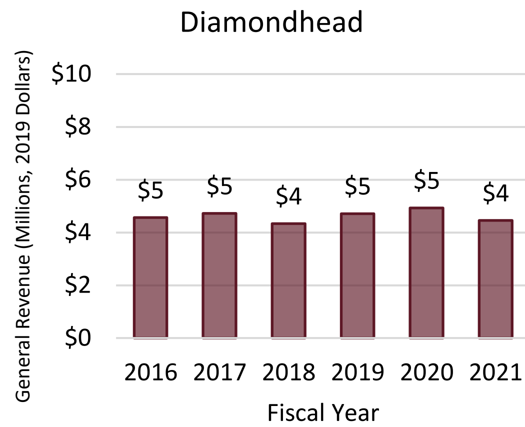


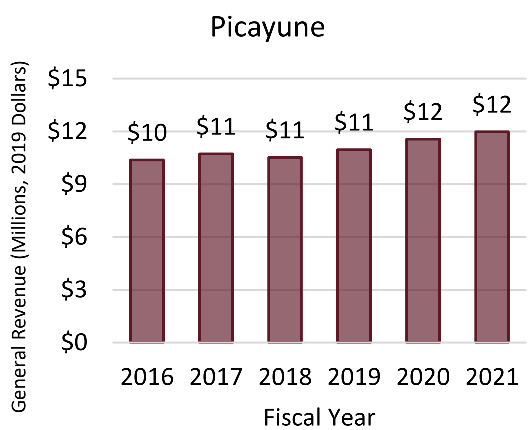


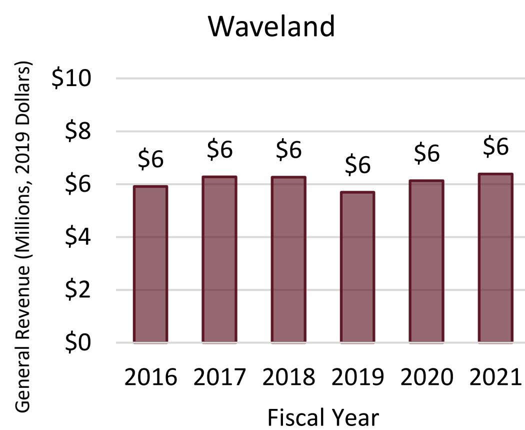




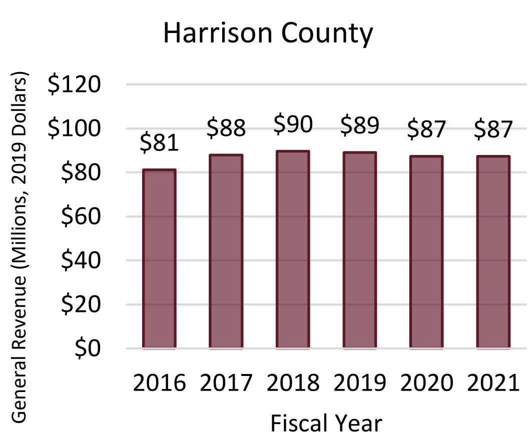


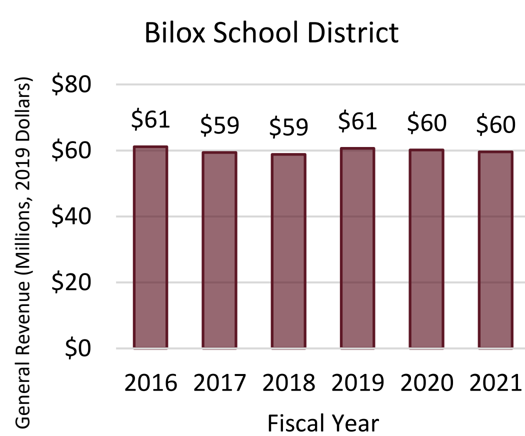


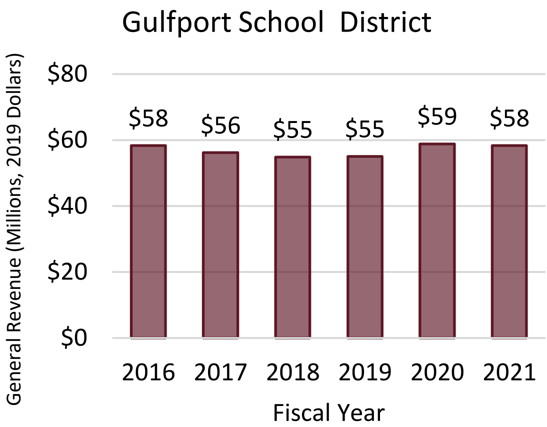


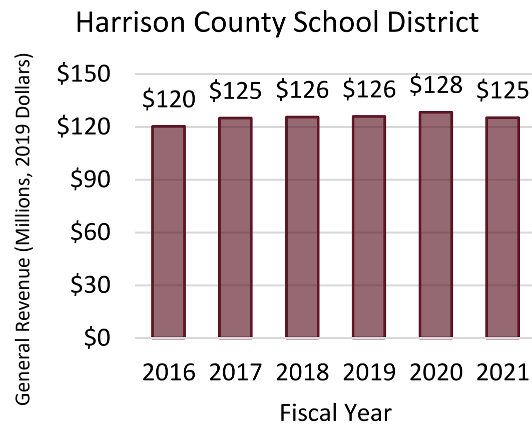


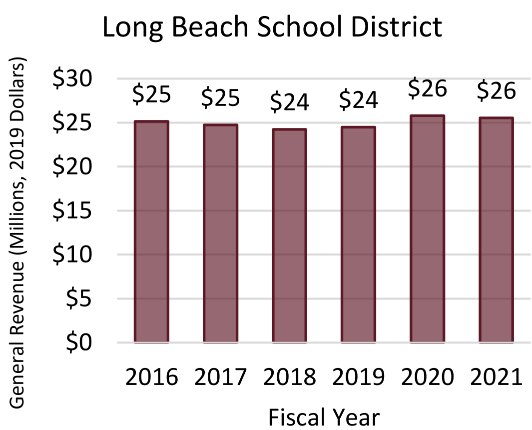
Harrison County Municipalities

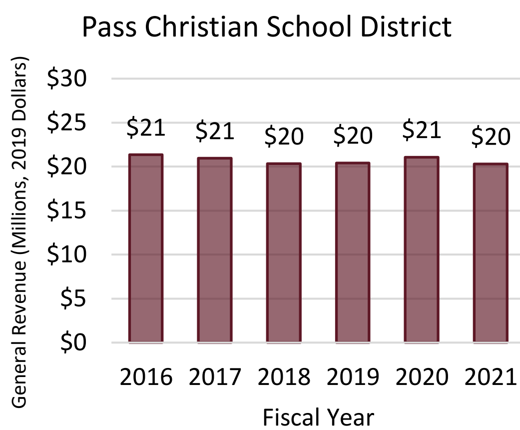


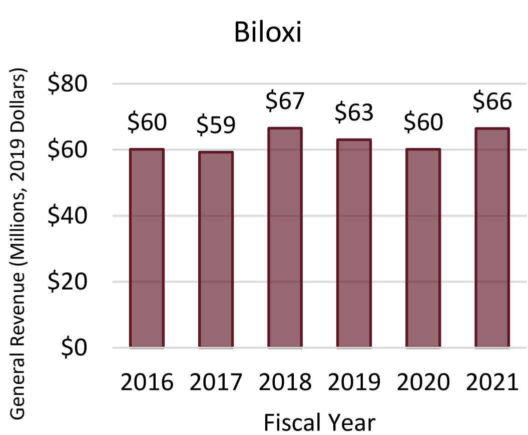


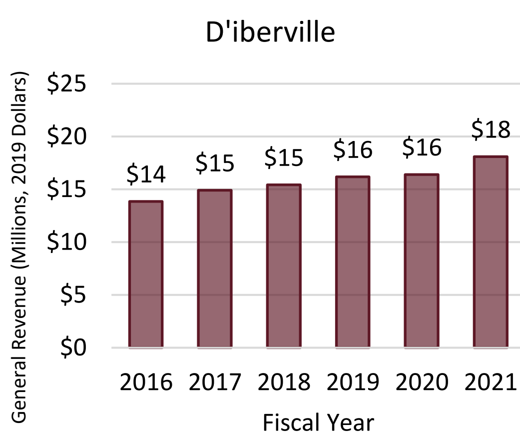

Gulfport School District
General Revenue (Millions, 2019 Dollars)
$80
$60
$40
$20
$0
$58
$56
$55
$55
$59
$58
2016
2017
2018
2019
2020
2021
Fiscal Year

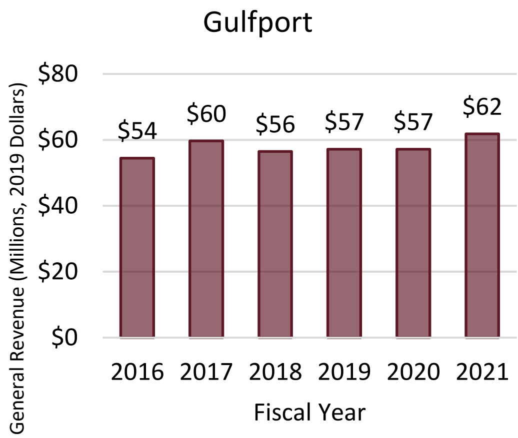

Harrison County School District
General Revenue (Millions, 2019 Dollars)
$150
$120
$90
$60
$30
$0
$120
$125
$126
$126
$128
$125
2016
2017
2018
2019
2020
2021
Fiscal Year

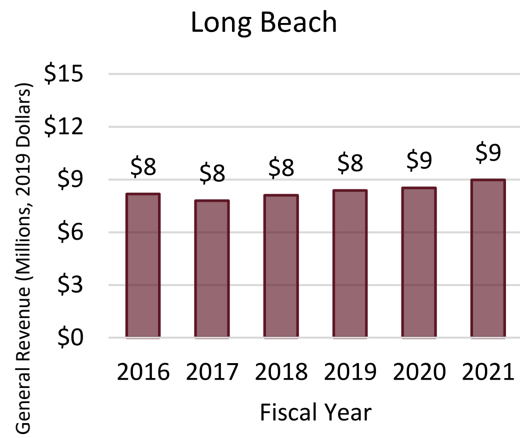

Long Beach School District
General Revenue (Millions, 2019 Dollars)
$30
$25
$20
$15
$10
$5
$0
$25
$25
$24
$24
$26
$26
2016
2017
2018
2019
2020
2021
Fiscal Year

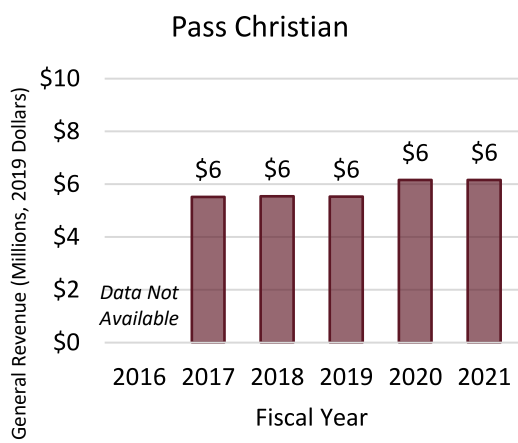

Pass Christian School District
General Revenue (Millions, 2019 Dollars)
$30
$25
$20
$15
$10
$5
$0
$21
$21
$20
$20
$21
$20
2016
2017
2018
2019
2020
2021
Fiscal Year


Biloxi
General Revenue (Millions, 2019 Dollars)
$80
$60
$40
$20
$0
$60
$59
$67
$63
$60
$66
2016
2017
2018
2019
2020
2021
Fiscal Year

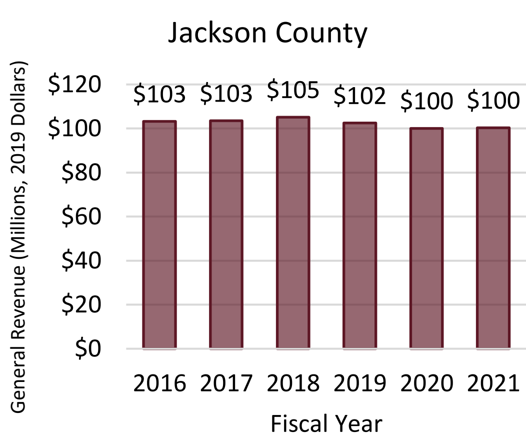

D'iberville
General Revenue (Millions, 2019 Dollars)
$25
$20
$15
$10
$5
$0
$14
$15
$15
$16
$16
$18
2016
2017
2018
2019
2020
2021
Fiscal Year

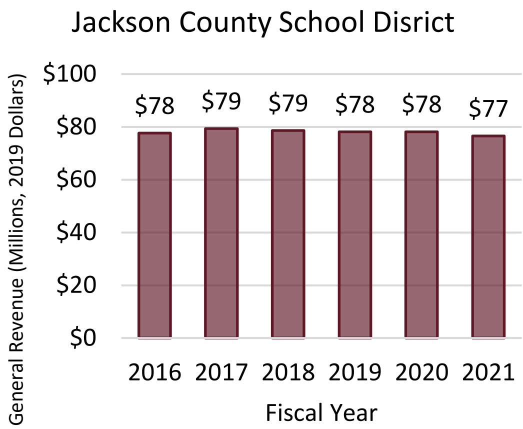


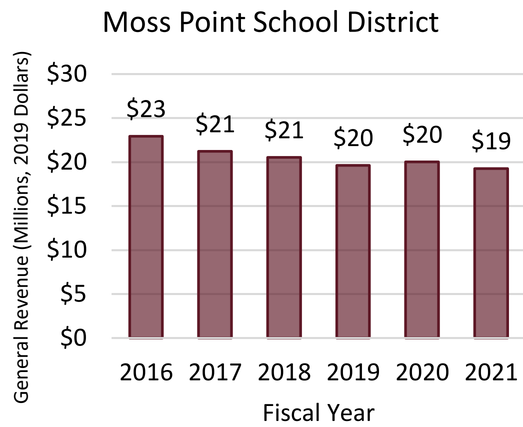


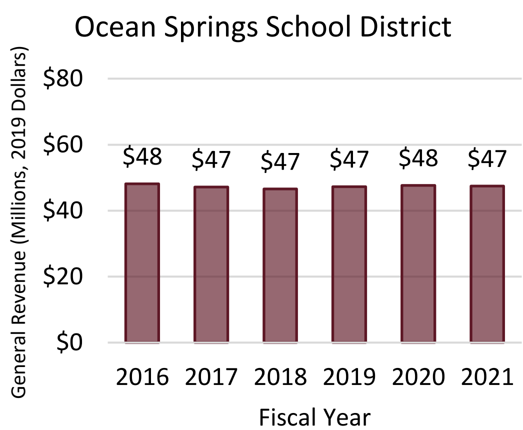


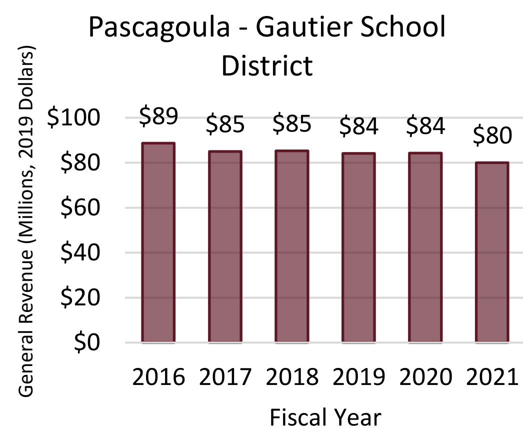
Jackson County Municipalities

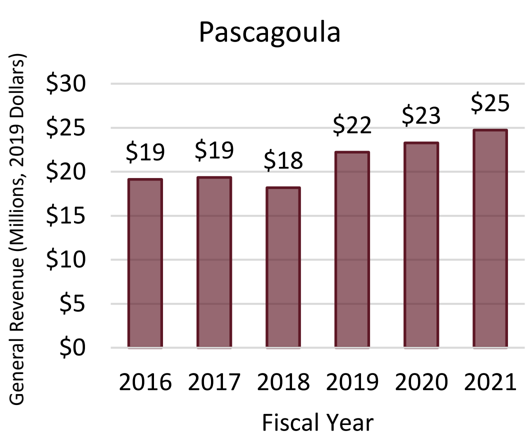


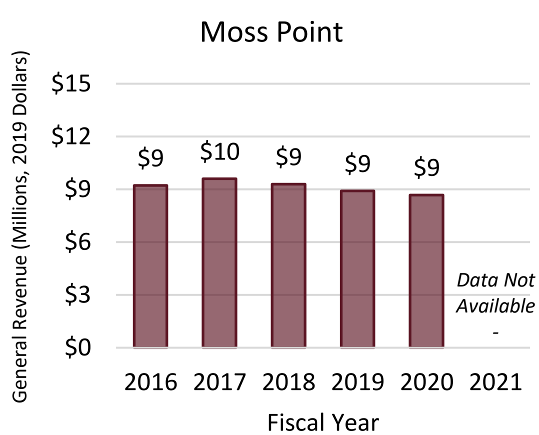

Jackson County School Disrict
General Revenue (Millions, 2019 Dollars)
$100
$80
$60
$40
$20
$0
$78 $79 $79 $78 $78 $77
2016 2017 2018 2019 2020 2021
Fiscal Year

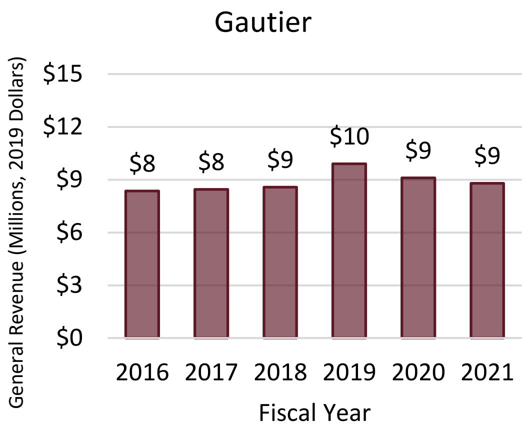

Moss Point School District
General Revenue (Millions, 2019 Dollars)
$30
$25
$20
$15
$10
$5
$0
$23 $21 $21 $20 $20 $19
2016 2017 2018 2019 2020 2021
Fiscal Year


Ocean Springs School District
General Revenue (Millions, 2019 Dollars)
$80
$60
$40
$20
$0
$48 $47 $47 $47 $48 $47
2016 2017 2018 2019 2020 2021
Fiscal Year

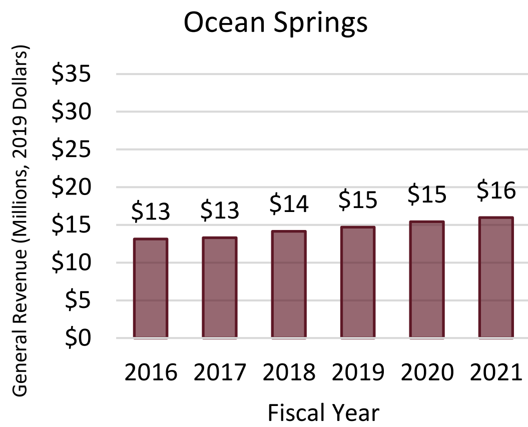

Pascagoula - Gautier School District
General Revenue (Millions, 2019 Dollars)
$100
$80
$60
$40
$20
$0
$89 $85 $85 $84 $84 $80
2016 2017 2018 2019 2020 2021
Fiscal Year


Pascagoula
General Revenue (Millions, 2019 Dollars)
$30
$25
$20
$15
$10
$5
$0
$19 $19 $18 $22 $23 $25
2016 2017 2018 2019 2020 2021
Fiscal Year


Moss Point
General Revenue (Millions, 2019 Dollars)
$15
$12
$9
$6
$3
$0
$9 $10 $9 $9 $9
Data Not Available
-
2016 2017 2018 2019 2020 2021
Fiscal Year



Gautier
General Revenue (Millions, 2019 Dollars)
$15
$12
$9
$6
$3
$0
$8
$8
$9
$10
$9
$9
2016
2017
2018
2019
2020
2021
Fiscal Year



Ocean Springs
General Revenue (Millions, 2019 Dollars)
$35
$30
$25
$20
$15
$10
$5
$0
$13
$13
$14
$15
$15
$16
2016
2017
2018
2019
2020
2021
Fiscal Year

Appendix E: Focus Group and Interview Survey Guide

Interviewers

Research Scientists from NSPARC at Mississippi State University

Target Audience

Industry Key Informants

Research Sponsor

Mississippi Sound Coalition and the Harrison County Board of Supervisors

Background Information

The Bonnet Carré Spillway was opened twice in 2019 to redirect floodwaters from the Mississippi River to prevent flooding around New Orleans, LA. Over the course of 123 days, nearly 6 trillion gallons of freshwater was redirected into Lake Pontchartrain, eventually carrying over into the Mississippi Sound. Falling salinity levels and subsequent algae blooms impacted coastal Mississippi marine life, affecting dolphins, sea turtles, oysters, and brown shrimp. Due to the algae blooms, the Mississippi Department of Environmental Quality issued closures in June 2019 for all public beaches as a preventative measure.

To accurately capture the impacts of the 2019 Bonnet Carré Spillway openings on the Mississippi Gulf Coast, we would like to focus on how you, your community, and local businesses were affected from February 2019 through December 2019. This will allow the conversation to focus on the impacts throughout the openings and the immediate aftermath prior to the COVID-19 pandemic.

Responses will be recorded so we do not miss any of your comments. Your responses will be confidential, and pseudonyms will be used in any future reports to ensure your privacy. In addition, your name will not be shared with the research sponsor.

Semi-Structured Topics

<u>Topic 1: Impact on Business Operations</u>

1. How were local businesses impacted by the 2019 Bonnet Carré Spillway openings?
2. What specific challenges did local employees face due to the 2019 Bonnet Carré Spillway openings?
3. Was it harder for local businesses to hire qualified employees due to the 2019 Bonnet Carré Spillway openings? If so, why?
4. What changes did local businesses need to implement in their operational or business models due to the 2019 Bonnet Carré Spillway openings?
5. Aside from local businesses, how did the 2019 Bonnet Carré Spillway openings affect other aspects of Gulf Coast industries?

<u>Topic 2: Impact on Consumer Perceptions</u>

1. How did customers' perceptions of local businesses change due to the 2019 Bonnet Carré

Spillway openings?

2. What were customers' biggest concerns due to the 2019 Bonnet Carré Spillway openings?
3. Have customers' perceptions of local businesses returned to normal?

Topic 3: Individual and Community Well-Being

1. How important is the Mississippi Sound to local communities' traditions and way of life?
2. How did the 2019 Bonnet Carré Spillway openings affect general perceptions of the Mississippi Gulf Coast?
3. How did the 2019 Bonnet Carré Spillway openings affect Gulf Coast culture?
4. How did the 2019 Bonnet Carré Spillway openings affect you personally?
5. How did the 2019 Bonnet Carré Spillway openings affect your community?
6. Have general perceptions of the Mississippi Gulf Coast returned to normal?
7. How concerned are you about the impact of future Bonnet Carré Spillway openings on Mississippi Gulf Coast communities and culture? Please describe any concerns.

MISSISSIPPI STATE UNIVERSITY™

NATIONAL STRATEGIC PLANNING & ANALYSIS RESEARCH CENTER

CONTACT

301 E Main Street, Suite 210
Starkville, MS 39759

P.O. Box 6027
Mississippi State, MS 39762
Mail stop: 9622

P: 662.325.9242

info@nsparc.msstate.edu
www.nsparc.msstate.edu