REPORT TO CONGRESS ON THE IMPACTS OF HURRICANES KATRINA, RITA, AND WILMA ON ALABAMA, LOUISIANA, FLORIDA, MISSISSIPPI, AND TEXAS FISHERIES

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U.S. Department of Commerce
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1 EXECUTIVE SUMMARY

Gulf of Mexico fisheries produce nearly 20 percent of U.S. commercial landings and support over 30 percent of marine recreational fishing trips (NMFS 2007a). In 2005, a large fraction of the fishing and fishing-related businesses of the northern Gulf and southwest Florida were devastated by Hurricanes Katrina, Rita, and Wilma. U.S. Commerce Secretary Carlos Gutierrez made two formal fishery failure determinations in recognition of the storms' impacts. These determinations authorized Congress to appropriate fishery disaster relief funds through four emergency supplemental appropriations bills passed in 2005 and 2006. Since then, NOAA's National Marine Fisheries Service (NMFS) has been partnering with existing fishery institutions and other interest groups to leverage available resources to conduct hurricane-related damage and impact assessments and to coordinate high-priority recovery and restoration efforts. Partners include state marine fishery agencies, the Gulf States Marine Fisheries Commission, the Gulf of Mexico Fishery Management Council, state universities, and affected fishermen.

Through the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) of 2006, Congress asked NMFS to provide two reports by July 2007 on the impacts of these three major hurricanes on Gulf of Mexico fisheries and habitat. This is the first of these reports, which is to describe the impacts of the hurricanes on "(1) commercial and recreational fisheries in the States of Alabama, Louisiana, Florida, Mississippi, and Texas; (2) shrimp fishing vessels in those States; and (3) the oyster industry in those States." NMFS prepared this report in collaboration with the Gulf States Marine Fisheries Commission, and the marine fisheries agency of each Gulf Coast state. Given the short timeframe for completing the report and resource limitations, we developed the report using data and information available at the time the report was completed. The report focuses on the more direct impacts of the 2005 hurricanes on Gulf Coast fisheries. It does not address the impacts of the storms on fish habitat because that information is being provided in a separate report to Congress. However, these two topics are closely interconnected — recovering and restoring the habitat essential to the growth and development of Gulf fish stocks will be critical to recovering and rebuilding Gulf fisheries and fishing communities over the long term.

The primary sources used in preparing this report include: preliminary assessments developed by each individual Gulf Coast state at the end of the 2005 hurricane season for the purpose of initiating recovery strategies; follow-up assessments contracted by several Gulf Coast states; and a more comprehensive assessment of the impacts of Hurricane Katrina on fishing communities in Mississippi, Louisiana, and Alabama, which was conducted by Impact Assessment, Inc. (IAI) and completed in March 2007.

The report describes fishery conditions before and after the 2005 hurricane season, but is cautious about making causal linkages between the hurricanes and fishery trends. Readers should take care in interpreting the information herein. For example, a declining trend in fishery landings may be attributable to regulatory, environmental, or other factors not associated with the storms. Similarly, a stable or upward trend in the landings or value of some fisheries should not be interpreted to mean the fisheries were unaffected by the storms. Seafood production benefits were likely redistributed across the Gulf region after the storms, from directly impacted to relatively unaffected fishing communities. Additionally, the storms exacerbated various

socioeconomic problems that existed prior to August 2005, accelerating a general regional trend of significant decline in fishery participation and production that began in 2001. This trend was influenced by high fuel costs, poor market prices for domestic shrimp, fishery overcapitalization, rising insurance costs, and the erosion and conversion of waterfront property in some areas from fishing industry use to tourism-based and alternative uses. All of these factors continue to burden the fisheries today, and make it difficult to fully understand the impacts of the hurricanes on Gulf Coast fisheries. Readers also should be cautious in interpreting information about the direct economic impacts of the storms. The monetary estimates of losses provided in the report are not directly comparable across states because they were often calculated using different methodologies.

The report is organized around the topical areas Congress asked NMFS to address. These include: trends in fishery status, landings, capacity, and infrastructure before and after the 2005 hurricanes; the type and extent of marine debris created by the storms; how funds Congress provided through the fourth emergency supplemental appropriations bill are being utilized for Gulf Coast fishery restoration and recovery; and NMFS' recommendations for how to address additional resource needs.

With the exception of oysters, available information indicates Gulf Coast marine resources were not significantly impacted by the 2005 hurricanes. Commercial and recreational fishery landings declined dramatically immediately following the storms, but also appear to be rebounding. The fishermen and fishing communities impacted by the storms have been less resilient. Many fishing vessels were damaged or destroyed and have not yet resumed operations. Those vessels that have returned to the fisheries are threatened by millions of tons of hurricane-related marine debris hazards in nearshore, coastal, and even offshore waters. The hurricanes caused extensive damage to fishing-related infrastructure in Alabama, Louisiana, and Mississippi, and also impacted the infrastructure and services that support Texas and Florida fisheries, albeit to a lesser extent. In some areas, the destruction is so complete and pervasive that long-term recovery of the fisheries may take years.

NOAA's comprehensive plan for recovering Gulf of Mexico fisheries focuses on four major recovery areas: (1) providing short-term financial assistance and other types of support services to fishermen adversely affected by hurricane events; (2) restoring the infrastructure needed to support commercial and recreational fisheries; (3) developing and funding capacity reduction, bycatch reduction, data collection, monitoring, and enforcement programs intended to improve conservation and management of Gulf of Mexico fisheries over the long term; and (4) recovering essential fish habitat and building more resilient coastal areas supporting fish and fisheries. The habitat-related programs and activities needed to satisfy the fourth major recovery area are being addressed in a separate report to Congress. As a result, the following recommendations identified in this report address only the first three major recovery areas, which focus on responding to the short-term and direct impacts of the storms, and developing healthy and resilient fisheries and fishing communities over the long term:

1. **Providing short-term financial assistance and support services**
   - Continue removing marine debris from oyster beds, tidal creeks, salt marshes, coastal wetlands, barrier islands, and the nearshore marine environment.
   - Continue cleaning oyster beds of excess sediment, using hydraulic methods, and preparing for spat fall by planting sufficient amounts of cultch.
   - Provide direct financial assistance to fishermen and seafood workers to undertake cleanup activities and begin repairing damaged facilities.
   - Continue employing fishermen and vessel owners in marine debris and living marine resource assessment activities.
   - Continue utilizing NOAA's charting and mapping capabilities to help identify and recovery marine debris fields and other obstructions to fishing and navigation.

2. **Restoring the infrastructure to support commercial and recreational fisheries**
   - Redevelop marinas, piers, docks, wharves, and warehouses to support commercial and recreational fishing and, especially, investments in public facilities supporting working waterfronts.
   - Plan for and support marine fishing-related industrial parks that cluster processing and marine support businesses in ways that increase access to key facilities and services and enhance intermodal transportation of fishery products.
   - Replace private fisheries infrastructure through loan programs and other investments to be repaid.

3. **Restructuring Gulf of Mexico fisheries to become more economically sustainable**
   - Develop buyback programs to ease overcapitalization and overfishing of Gulf marine resources.
   - Coordinate effort reduction in federal and state waters to avoid potentially significant loopholes.
   - Develop and implement a seafood promotion strategy for those Gulf fisheries that have restructured to become sustainable.
   - Institute job retraining programs to ease the transition of displaced fishery workers into alternative occupations.
   - Replace fishing gear that was damaged or destroyed by the hurricanes and that belongs to vessels remaining in fisheries that have restructured.
   - Deploy more efficient turtle exclusion devices and bycatch reduction devices in the remaining fleet of shrimp vessels.
   - Purchase and provide 1 year of associated fees to equip all federally permitted shrimp vessels with electronic vessel monitoring systems.
   - Equip all federally permitted fishing vessels with electronic logbooks to record catch data.
   - Provide at least 1 percent of the shrimp and reef fish fisheries with at-sea observer coverage to document the catch, bycatch, and profitability of these fisheries for 3 years.

- Develop and fund a cooperative research program to test various gears and to monitor the recovery of Gulf fishery resources and fisheries, including the socioeconomic impacts of restructuring programs.

These recommendations are based on ideas that have been proposed by a variety of local, state, and regional fishery institutions and can be accomplished in concert with regional partners. NOAA is currently working with its partners to address these recommendations within the confines of available resources. Funds provided the Gulf Coast states through the fourth emergency supplemental appropriations act are being applied to the first major recovery area. However, additional resources will be needed to fully address NOAA's recommendations for short-term assistance and support services. Additional funding and/or legislative changes will be required to implement the items recommended under the second and third major recovery areas. However, implementing these recommendations will assist an industry devastated by the hurricanes in a way that simultaneously resolves chronic, longer-term problems affecting the sustainability of Gulf fisheries. Investing in these programs and recommendations will support and revitalize a multi-billion-dollar seafood industry (accounting for multiplier effects from first sale value) in the Gulf of Mexico, and will have significance far beyond the fisheries sector.

On May 25, 2007, the President signed into law a fifth emergency supplemental appropriations act, which provides NOAA an additional $110 million for expenses related to the consequences of Hurricanes Katrina and Rita on the shrimp and fishing industries. NOAA is currently working with its partners to determine how best to allocate these funds to continued recovery efforts. However, the magnitude of the problems related to recovering and rebuilding Gulf fisheries remain far greater than can be addressed with available resources.

2 INTRODUCTION

2.1 Background

Gulf of Mexico fisheries produce nearly 20 percent of U.S. commercial landings and support over 30 percent of marine recreational fishing trips (NMFS 2005). In 2005, a large fraction of the fishing and fishing-related businesses of the northern Gulf and southwest Florida experienced extensive and long-term damage from three major hurricanes: (1) Hurricane Katrina, (2) Hurricane Rita, and (3) Hurricane Wilma.

Hurricane Katrina first damaged southern Florida when it moved across the Florida Keys as a Category One[1] storm on the Saffir-Simpson Hurricane Scale. After strengthening to Category Five[2] intensity over the central Gulf of Mexico, Katrina weakened slightly to a Category Four,[3] then a Category Three[4] storm, before making landfall on August 29, 2005, first near Buras, Louisiana, then again near the Louisiana/Mississippi border. The most severe storm of the 2005

[1] 74–95 mph winds; minimal damage.
[2] > 155 mph winds; catastrophic damage.
[3] 131–155 mph winds; extreme damage.
[4] 111–130 mph winds; extensive damage.

hurricane season and one of the worst natural disasters on record, Katrina devastated much of the Louisiana, Mississippi, and Alabama coast, and caused unprecedented damage to commercial and recreational fisheries in the affected areas.

The U.S. Coast Guard initially estimated that Katrina sank or drove ashore 3,500 to 5,000 vessels (NMFS 2006), the majority of which were commercial fishing boats. The storm also significantly damaged much of the infrastructure that supports the region's commercial and recreational fisheries, including boat yards, ice houses, processors, recreational docks and marinas, bait and tackle shops, seafood restaurants and retail markets, offloading facilities, repair shops, and net makers. Infrastructure losses were particularly significant in the Biloxi/Gulfport areas of Mississippi and in the Venice/Empire area of southeast Louisiana.

Katrina's storm surge—which reached 28 feet and penetrated some areas 6 miles inland from the coast and up to 12 miles inland along bays and rivers—clogged coastal waterways, bayous, rivers, and bays with debris, and permanently changed the shape of the northern Gulf coastline. This storm surge also indirectly impacted regional fisheries by damaging or destroying large areas of the highly productive coastal marshes, estuaries, and artificial reefs that support the growth and development of Gulf fish stocks, as well as a significant portion of the region's valuable oyster reefs.

Less than 1 month after Katrina made landfall on the northern Gulf Coast, Hurricane Rita came ashore near Sabine Pass, Texas, on September 24, 2005, also as a Category Three storm. Rita inflicted major flooding and fishery infrastructure damage on coastal communities in Texas and Louisiana, exacerbating and compounding Katrina's impacts on northern Gulf fisheries. Hurricane Wilma was the third major hurricane to hit the Gulf Coast during the 2005 season, and the most intense hurricane ever recorded in the Atlantic basin. Wilma made landfall in southwest Florida as a Category Three storm on October 24, 2005.

The devastating impacts of the 2005 hurricanes on Gulf fisheries led U.S. Commerce Secretary Carlos Gutierrez to announce formal fishery failure determinations on September 9, 2005, and again on October 4, 2005. The first determination, made in response to Hurricane Katrina, applied to the Florida Keys and coastal areas from Pensacola, Florida, to the Texas border. The second determination, made in response to Hurricane Rita, applied to the coastal areas of Texas and Louisiana. Both determinations, which were made under the authority of the Magnuson-Stevens Fishery Conservation and Management Act and the Interjurisdictional Fisheries Act, authorized Congress to appropriate federal funds for the purpose of assessing the impacts of the storms, restoring Gulf Coast fisheries and fishing communities, and preventing future fishery failures.

Congress appropriated fishery disaster relief funds through five emergency supplemental appropriations bills passed between 2005 and 2007. Since then, NMFS has been partnering with federal and state agencies, existing fishery institutions (including state marine fishery agencies, the Gulf States Marine Fisheries Commission, and the Gulf of Mexico Fishery Management Council), state universities, and affected fishermen to leverage available resources to conduct

hurricane-related damage and impact assessments and to coordinate high-priority recovery and restoration efforts. However, the impacts of these storms are far-reaching and long-term, and a great deal more time and resources will be required to fully restore Gulf Coast fisheries and fishing communities.

2.2 Origins of this report to Congress

Section 213 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) of 2006 requires NMFS to provide two reports to Congress by July 2007 on the impacts of Hurricanes Katrina, Rita, and Wilma. This is the first of these reports, which is to describe the impacts of the hurricanes on "(1) commercial and recreational fisheries in the States of Alabama, Louisiana, Florida, Mississippi, and Texas; (2) shrimp fishing vessels in those States; and (3) the oyster industry in those States." The second of these reports, which is to describe the impacts of the hurricanes on "habitat, including the habitat of shrimp and oysters in those States," is being developed separately, but concurrently with this report.

Additional guidance provided to NMFS after the MSRA was enacted requested the report on Gulf Coast fisheries include specific information regarding the impacts of the 2005 hurricanes on:

1. Gulf of Mexico fish stocks.
2. Obstructions, hazards, and debris that could impact fishermen.
3. Observed trends in commercial and recreational fishing (e.g., species fished/volumes harvested, including oysters) currently as compared to before the hurricanes.
4. Fishing capacity (i.e., number of boats damaged/repaired, percentage of fleet damaged, buyout potential), including shrimp.
5. The status of fishing-related infrastructure and services (e.g., docks, launches, ice houses, processors).
6. The impact of the fourth emergency supplemental appropriations bill passed by Congress.
7. The additional resource needs of fishermen.
8. Recommended actions.

This report summarizes available information on each of these topics.

2.3 Approach/methodology used in preparing the report

NMFS, the Gulf States Marine Fisheries Commission, and the marine fisheries agency of each Gulf Coast state cooperated in preparing this report. Given the short timeframe for completing the report and resource limitations, we developed the report using data and information available at the time the report was completed. The report focuses on the more direct impacts of the 2005 hurricanes on Gulf Coast fisheries. It does not address the indirect impacts of the storms on fish habitat because that information is being provided in a separate report to Congress. However, these two topics are closely interconnected—recovering and restoring the habitat essential to the

growth and development of Gulf fish stocks will be critical to recovering and rebuilding Gulf fisheries and fishing communities over the long term.

The primary sources used in preparing the report include: preliminary assessments developed by each individual Gulf Coast state at the end of the 2005 hurricane season for the purpose of initiating recovery strategies; follow-up assessments contracted by several Gulf Coast states; and a more comprehensive assessment of the impacts of Hurricane Katrina on fishing communities in Mississippi, Louisiana, and Alabama, which was conducted by Impact Assessment, Inc. (IAI) and completed in March 2007. NMFS commissioned the comprehensive assessment in the weeks immediately following Hurricane Katrina to determine how a subset of previously profiled towns and communities had been impacted by that storm. Researchers visited 38 fishing-involved communities in affected areas multiple times between October 2005 and June 2006 to observe and document the damage to shoreside fishing infrastructure and related aspects of the commercial and recreational fishing industries, and documented recovery efforts through June 2006. The assessment is based on data produced through standard social science rapid assessment and ethnographic interview methods conducted by these researchers, as well as on scientific review and analysis of documents and data provided by state and federal agencies, and other public sources.

This report describes fishery conditions before and after the 2005 hurricane season, but is cautious about making causal linkages between the hurricanes and fishery trends. Readers should take care in interpreting the information herein. For example, a declining trend in fishery landings may be attributable to regulatory, environmental, or other factors not associated with the storms. Similarly, a stable or upward trend in the landings or value of some fisheries should not be interpreted to mean the fisheries were unaffected by the storms. For example, although the total value of fish landed in Louisiana in 2006 compares to the value of fish landed before the storms, some fishermen in Louisiana who had no or few losses may be doing relatively well in areas of the state that escaped the direct impacts of both hurricanes Katrina and Rita, but many others are not faring as well. Some fishermen also may have delivered seafood product to relatively unaffected ports in Alabama, Texas, and Florida. As a result, although the benefits of seafood production may not have been significantly reduced in certain cases, those benefits have likely been redistributed from directly impacted to relatively unaffected fishing communities across the Gulf region.

The storms also exacerbated various socioeconomic problems that existed prior to August 2005, accelerating a general regional trend of significant decline in fishery participation and production that began in 2001. This trend was influenced by high fuel costs, poor market prices for domestic shrimp, fishery overcapitalization, rising insurance costs, and the erosion and conversion of waterfront property in some areas from fishing industry use to tourism-based and alternative uses. All of these factors continue to burden the fisheries today, and make it difficult to fully understand the impacts of the hurricanes on Gulf Coast fisheries. Finally, readers also should be cautious in interpreting information about the direct economic impacts of the storms because the monetary estimates of losses provided in the report were often calculated using different methodologies and are not directly comparable across states.

2.4 Structure/organization of report

This report is organized around the topical areas Congress asked NMFS to address, which are described in Section 2.2:

- Section 1.0 provides an Executive Summary of the report's contents.
- Section 2.0 provides background information on the 2005 hurricanes and the origins of this report.
- Section 3.0 summarizes available information on the general Gulf-wide trends in fishery status, landings, capacity, and infrastructure before and after the 2005 hurricane season, and on the marine debris problems created by the hurricanes.
- Section 4.0 summarizes available information on the impacts of the hurricanes on fishery status, landings, capacity, and infrastructure in each individual Gulf Coast state.
- Section 5.0 describes the impacts of the resources Congress provided for Gulf Coast fishery restoration and recovery through the fourth emergency supplemental appropriations bill.
- Section 6.0 describes NOAA's recommendations for how to address the additional resource needs of affected fishermen and fishing communities.
- Section 7.0 describes the references used to develop this report.
- Section 8.0 lists the fishery experts who contributed to the report's development.

3 GULF-WIDE IMPACTS

3.1 Status of Gulf of Mexico fish stocks pre- and post-hurricanes

With the exception of oysters, available information indicates Gulf Coast marine resources were not significantly impacted by the 2005 hurricanes. A recent NMFS survey of Gulf of Mexico (offshore) fishery populations indicated that shrimp and finfish abundance is the same or slightly higher than pre-Katrina levels (NOAA 2006). However, scientists continue analyzing long-term fishery-independent survey data to investigate trends in the abundance of economically and ecologically important fish and crustacean species in Mississippi and Alabama coastal waters. Some declines in estuarine finfish and shellfish species have been detected. However, it is difficult to determine whether these declines represent natural fluctuations in population abundance or whether they are linked to one or more influencing factors. Further scientific work is needed to better understand the effects of hurricanes on estuarine species, because many factors may influence abundance trends (Sea Grant 2006).

3.1.1 Oysters

Oysters are typically the fishery species most severely impacted by hurricane events in the northern Gulf. Hurricane Katrina caused extensive damage to Gulf Coast oyster beds. Oyster beds lie in shallow coastal areas, and can be subjected to direct physical damage and to burial by mud and other hurricane-related debris. Oysters must have a suitable substrate upon which larval oysters (spat) can settle in order to reproduce successfully. Old oyster shell (cultch) provides such substrate. Consequently, if existing cultch is covered with mud, silt, or other

debris, then settlement is likely to fail. Oysters generally take about 2 years to reach marketable size in the Gulf of Mexico after they settle. Therefore, the timeliness of oyster reef restoration and rehabilitation efforts is critical to recovering oyster resources.

Alabama's Department of Conservation and Natural Resources was in the process of replanting the oyster reefs adversely impacted by Hurricane Ivan when Hurricane Katrina struck the Gulf Coast. Ivan severely damaged up to 80 percent of Alabama's oyster resources when it made landfall in August 2004. Katrina damaged about 20 percent of the recovering reefs. Despite storm damages to Alabama's oyster reefs, commercial oyster trips, landings, and value in 2006 were above the 2001–2004 mean. High product demand due to the loss of Mississippi and Louisiana product, coupled with record dockside prices, has fueled the increased harvest rate in Alabama (see Section 4.1.1).

Louisiana's commercial oyster landings were 26 percent below the 2000–2004 average in the 12-month period immediately following the 2005 hurricane season, but also appear to be increasing. Stock assessment data collected in July 2006 indicate oyster stocks on Louisiana's public grounds declined nearly 18 percent between 2005 and 2006, primarily because of a statewide decline in market-size oyster stocks. However, seed oyster stocks increased in 2006, indicating the oyster resource is rebounding (see Section 4.2.1).

Commercial landings and trips in Florida's oyster fishery decreased 32 percent and 35 percent, respectively, during the 2004–2005 fishing season compared to the 2001–2004 average. Increasing landings trends in some state waters suggest fishermen may be increasing effort in some areas that were not directly impacted by the storms to compensate for the loss of oysters imported by Louisiana and Mississippi processors. Fishery managers are uncertain about whether Florida's oyster resources will be able to sustain such an increase in effort (see Section 4.3.1).

IAI (2007) estimates Hurricane Katrina destroyed 90 percent of Mississippi's primary oyster reefs. Mississippi's commercial oyster landings declined sharply in 2005, totaling about 0.5 million pounds compared to a 2000–2004 average of about 3.4 million pounds. This declining landings trend appears to be continuing into 2006 (see Section 4.4.1). Commercial oyster landings in Texas totaled about 5.0 million pounds in 2005, compared to a 2000–2004 average of 5.6 million pounds. Only 2.8 million pounds of oyster landings were reported for 2006, but this value does not include data for November and December of that year. Landings are generally high during that 2-month period, particularly in November. Consequently, it is unknown at this time whether Texas's commercial oyster landings were above or below average in 2006 (see Section 4.5.1).

3.1.2 Shrimp

Recent fishery-independent surveys conducted by NMFS indicate none of the Gulf shrimp stocks were significantly impacted by the 2005 hurricane season, and that most of the changes in catch-per-unit-effort recorded in 2005 were within the range of past inter-annual variation (Figures 3.1-1, 3.1-2, and 3.1-3).

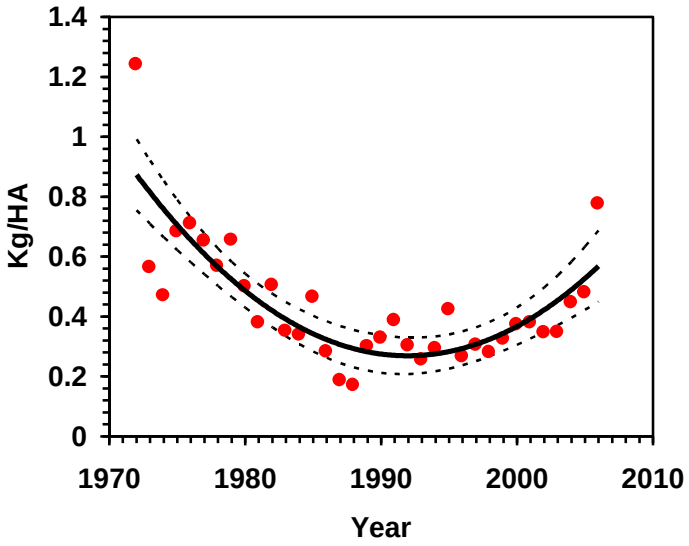

Figure 3.1-1. Trend analysis (1972–2006) of brown shrimp (*Farfantepenaeus aztecus*) biomass. Solid line represents fitted trend and dashed lines represent 95 percent confidence limits for mean values. Source: Fall Resource Assessment Survey, NMFS , Southeast Fisheries Science Center, Pascagoula Laboratory.

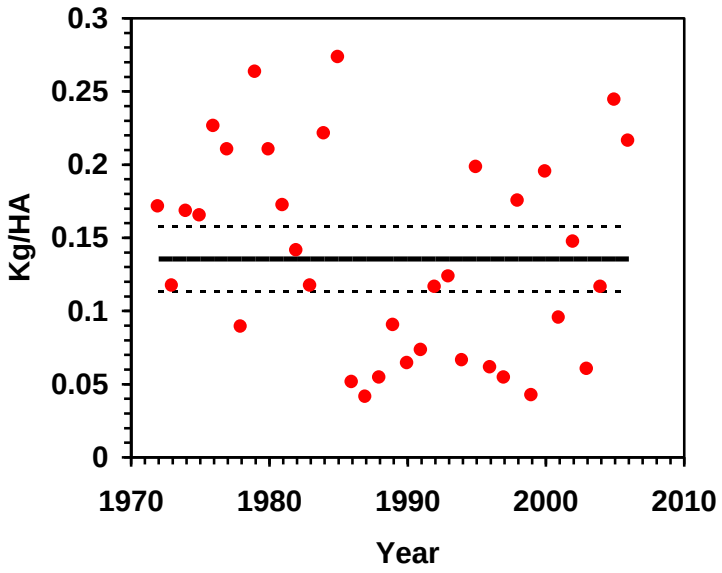

Figure 3.1-2. Trend analysis (1972–2006) of white shrimp (*Litopenaeus setiferus*) biomass. Solid line represents the value of the overall 1972–2005 mean catch rate and dashed lines represent 95 percent confidence limits for mean values. Source: Fall Resource Assessment Survey, NMFS, Southeast Fisheries Science Center, Pascagoula Laboratory.

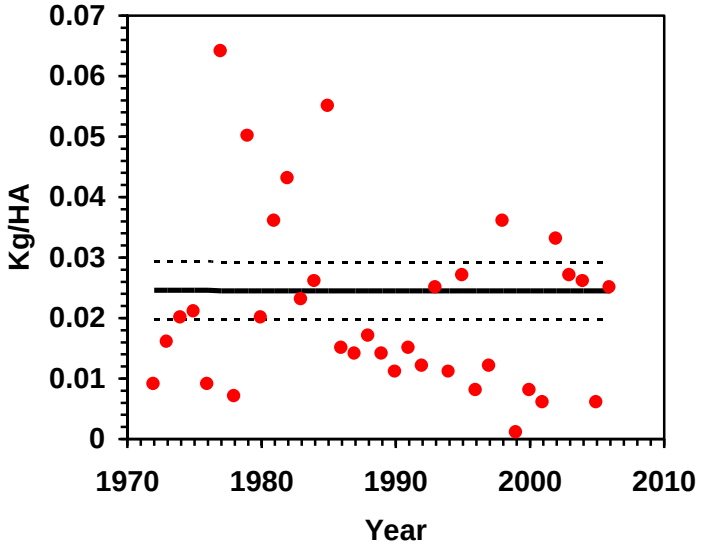

Figure 3.1-3. Trend analysis (1972–2006) of pink shrimp (*Farfantepenaeus duorarum*) biomass. Solid line represents the value of the overall 1972–2005 mean catch rate and dashed lines represent 95 percent confidence limits for mean values. Source: Fall Resource Assessment Survey, NMFS, Southeast Fisheries Science Center, Pascagoula Laboratory.

3.1.3 Finfish

Recent data collected by the NMFS Southeast Fisheries Science Center and not yet incorporated into fishery stock assessments indicate the hurricanes did not reduce the catch-per-unit-effort of finfish (in weight) or adversely affect seafood quality. These surveys indicate most of the changes in catch-per-unit-effort of finfish observed in 2005 were well within the range of past inter-annual variation (Figure 3.1-4).

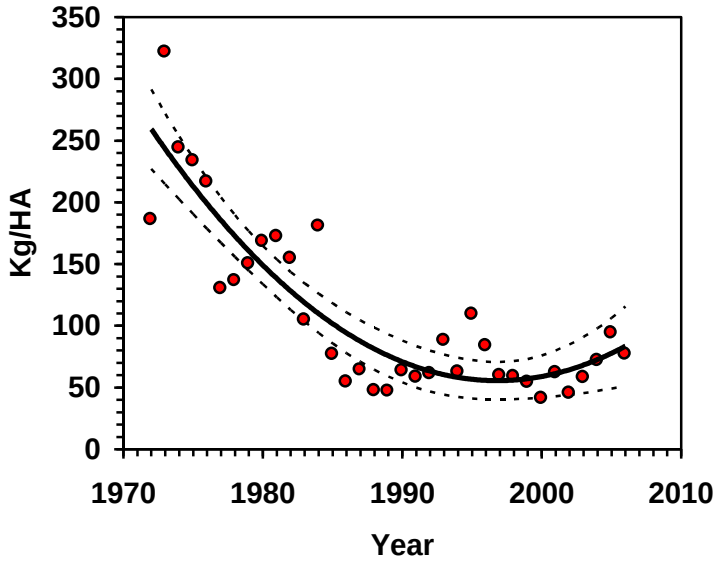

Figure 3.1-4. Trend analysis (1972–2006) of finfish (ray-finned and cartilaginous fishes) biomass. Solid line represents fitted trend and dashed lines represent 95 percent confidence limits for mean values. Source: Fall Resource Assessment Survey, NMFS, Southeast Fisheries Science Center, Pascagoula Laboratory.

3.1.4 Crabs, lobsters, and other invertebrates

Fishery-independent surveys conducted by NMFS indicate the 2005 hurricanes did not significantly impact crab populations and that most of the changes in catch-per-unit-effort recorded in 2005 were within the range of past inter-annual variation (Figure 3.1-5). Commercial landings trends of crab and lobster species appear to be driven primarily by trends in effort and other factors not associated with the storms (see Section 4).

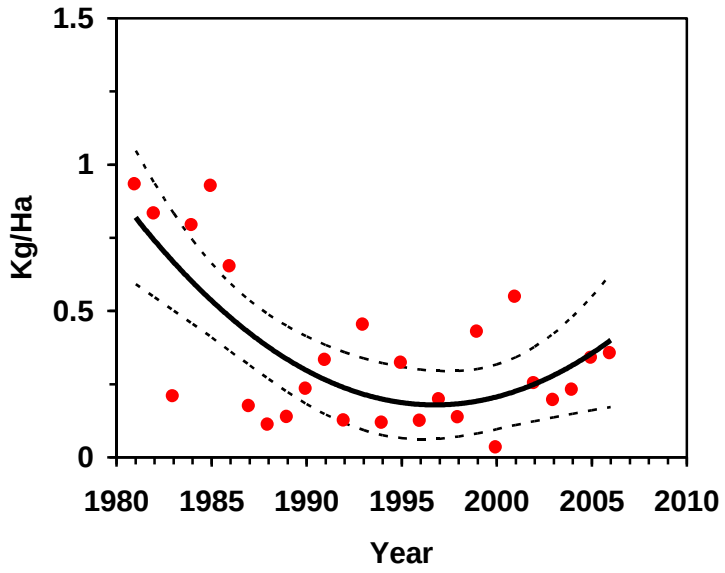

Figure 3.1-5. Trend analysis (1972–2006) of lesser blue crab (*Callinectes similis*) biomass. Solid line represents fitted trend and dashed lines represent 95 percent confidence limits for mean values. Source: Summer Resource Assessment Survey, NMFS, Southeast Fisheries Science Center, Pascagoula Laboratory.

3.2 Fishery trends pre- and post-hurricanes

3.2.1 Commercial fisheries

3.2.1.1 Commercial landings and revenue

<u>All species combined</u>

In 2005, commercial fishermen at U.S. ports along the Gulf of Mexico landed 1.2 billion pounds of fish and shellfish with a dockside value of approximately $621 million.[5] Between 1977 and 2006, commercial landings ranged from a peak of 2.6 billion pounds in 1984 to a low of 1.2 billion pounds in 2005, with an overall average of 1.85 billion pounds annually (Figure 3.2-1). Landings declined significantly during the late 1980s and early 1990s. Commercial landings exceeded the overall average 10 times during the 12-year period from 1977–1988, but exceeded the average only twice from 1989–2005, in 1994 and in 1999. Landings in 2005 were the lowest

[5] Commercial landings and revenues data are collected cooperatively by individual states and NMFS, and were summarized from the Accumulated Landings System (ALS) maintained by NMFS. Landings of bivalve mollusks, such as oysters, clams and scallops, are recorded as pounds of meats. Landings of all other species are recorded as pounds of whole (live) weights. ALS data were summarized on May 18, 2007. Data are incomplete for December 2006.

during the 30-year period from 1977–2006, in part due to the effects of the extraordinarily destructive hurricane season.

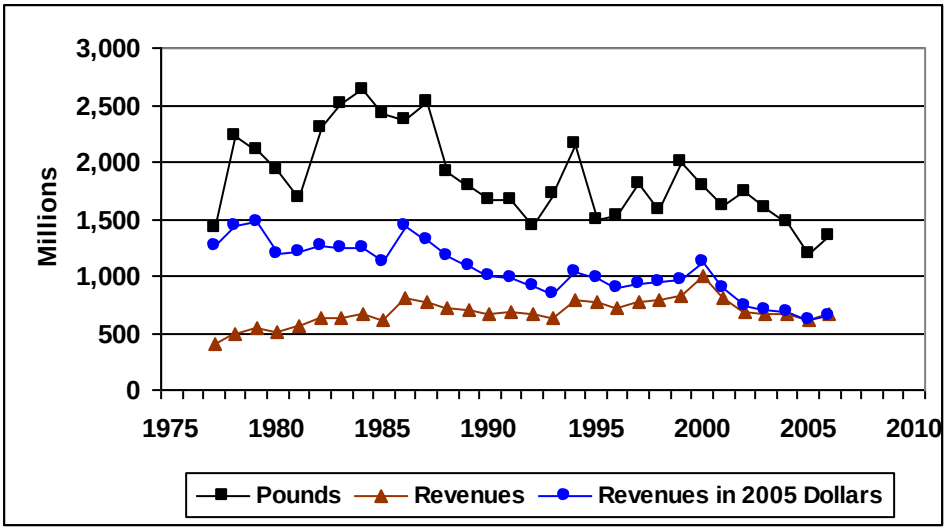

Figure 3.2-1. Total pounds landed at U.S. ports in the Gulf of Mexico and total dockside revenues, all species combined, 1977–2006.

Commercial landings and revenues are compared for months following landfall of Hurricane Katrina in late August 2005 with corresponding months in 2004 and the average from the most recent 5-year period prior to landfall.[6] Commercial landings in September 2005 declined to less than 20 percent of the 5-year average for September and remained below average for most of the following year (Figure 3.2-2). Dockside revenues were noticeably lower than average during August, September, October, and November 2005 (Figure 3.2-3). The decline in recorded landings and revenues during August was greater than the decline that actually occurred because records for an unknown number of fishing trips were destroyed during the hurricane and never entered into state or federal databases. Revenues for all species combined returned to approximately average levels in December 2005. Nevertheless, for the 12 months ending in July 2006, Gulf-wide landings were 33 percent below average and dockside revenues were 14 percent below average. Commercial landings were 42 percent below average in Louisiana, 15 percent below average in Mississippi, 17 percent below average on the west coast of Florida, 5 percent above average in Texas, and 25 percent above average in Alabama.

[6] Five-year averages were constructed for comparisons with monthly data following landfall of Hurricane Katrina in August 2005. The most recent 5-year averages were calculated with data for 2000–2004 for comparisons with landings for August through December 2005, and with data for 2001–2005 for comparisons with landings for January through July 2006.

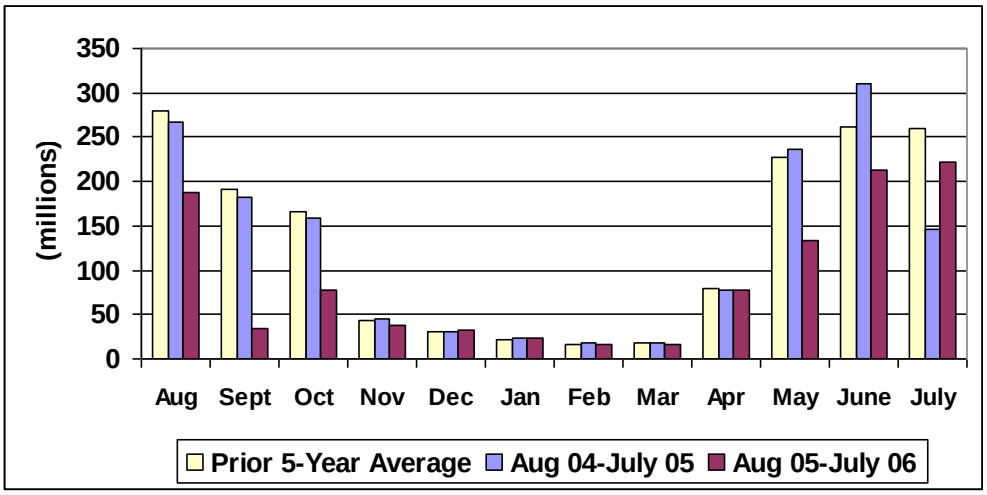

Figure 3.2-2. Gulf-wide commercial landings, by month, before and after Hurricane Katrina, all species.

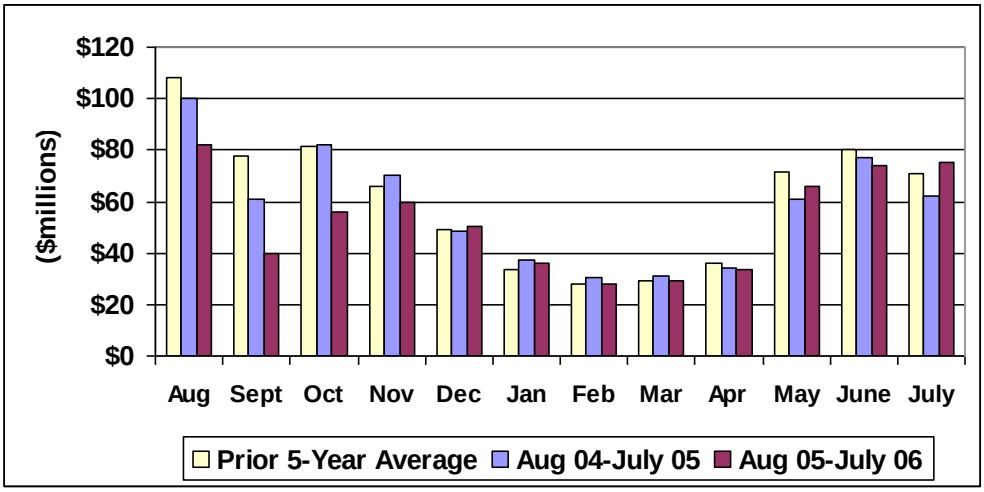

Figure 3.2-3. Gulf-wide commercial fishing revenue (dockside), by month, before and after Hurricane Katrina, all species.

Oysters

Oysters support a low-volume, high-value fishery that contributed about 1 percent of total annual commercial landings and 6 percent of dockside revenues for commercial fishermen in the U.S. Gulf of Mexico between 1977 and 2006. Commercial landings of oyster meats peaked at 29.2 million pounds in 1983, declined to a low of 12.3 million pounds in 1990 and 1991, and then peaked again at 27.0 million pounds in 2003 (Figure 3.2-4). The dockside value of oysters in constant 2005 dollars peaked during the mid-1980s, bottomed out in 1993, and returned to approximately average levels until hurricane Katrina destroyed Gulf oyster beds in 2005 (Figure

3.2-4). On average between 2000 and 2004, commercial fishermen landed 25.5 million pounds of oyster meats worth $55.7 million. Landings declined to 20.2 million pounds worth $56.6 million in 2005 and to 18.7 million pounds worth $59.1 million in 2006.

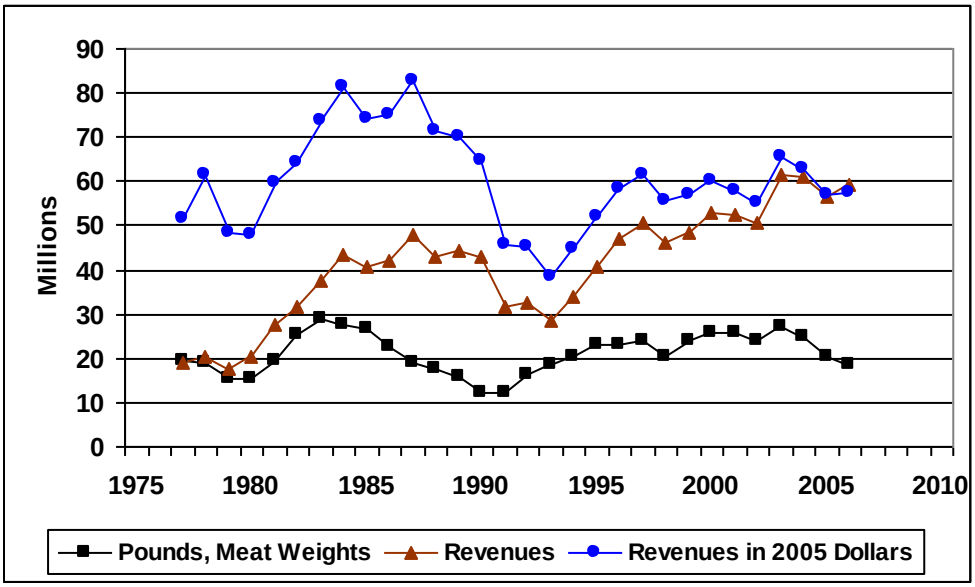

Figure 3.2-4. Pounds of oyster meats landed at U.S. ports in the Gulf of Mexico, and dockside revenues in current and constant U.S. dollars.

The 2005 hurricane season had a significant impact on the Gulf oyster industry because about two-thirds of total oyster production normally occurs in Louisiana and Mississippi. Louisiana is the leading producer of oyster meats in the Gulf of Mexico. Between 2000 and 2004, Louisiana commercial fishermen accounted for 54 percent of total landings of oyster meats, followed by fishermen in Texas (22 percent), Mississippi (13 percent), west Florida (8 percent), and Alabama (3 percent).

The oyster fishery is seasonal, with peak activity occurring in the months between October and April. In September 2005, following Hurricane Katrina's landfall, commercial fishermen landed only 0.4 million pounds of oysters worth $1.1 million (Figure 3.2-5). Gulf-wide landings in September were 28 percent of the most recent 5-year average for landings in September, and dockside revenues were 33 percent of the 5-year average (Figure 3.2-5). Landings increased to 0.8 million pounds in October 2005 due to the seasonal nature of the fishery, but were only 32 percent of the 5-year average. Landings increased to 1.3 million pounds in November 2005, which was 49 percent of the 5-year average. By December 2005, Gulf-wide landings increased to about 71 percent of the 5-year average, and fluctuated between 62 percent and 74 percent of their most recent 5-year averages between January and April 2006. However, little to no oyster production has occurred in Mississippi since Hurricane Katrina made landfall in August 2005. Total landings of oysters during the 12 months following landfall of Hurricane Katrina were below 2004 levels and below the 5-year average in every Gulf state except Alabama.

Dockside prices for oysters increased as production declined. As a result, dockside revenues for oysters were about equal to their most recent 5-year averages in December 2005 and from February through April 2006 despite lower-than-average landings during those months. For the 12 months ending in July 2006, dockside revenues for oysters were lower than average in Louisiana and in Mississippi, and for all Gulf states combined, but higher than average in Texas, Alabama, and the west coast of Florida.

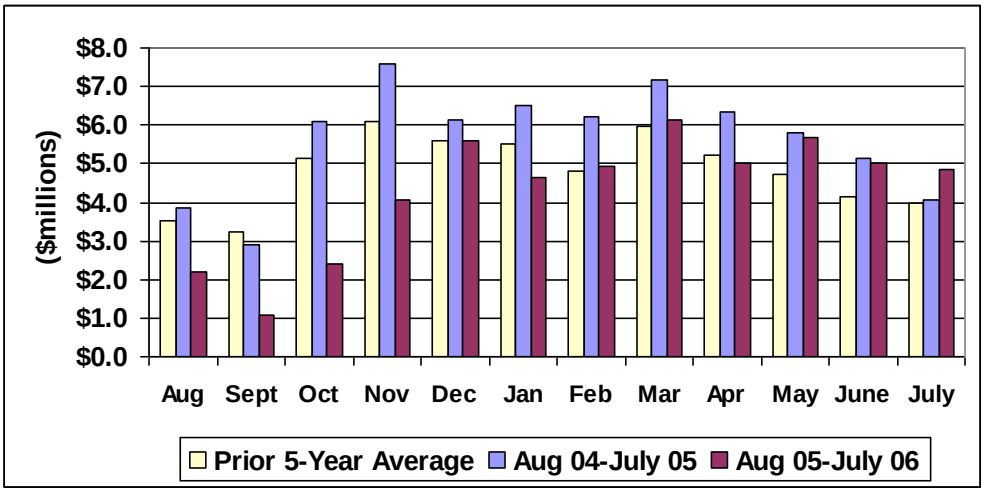

Figure 3.2-5. Gulf-wide commercial fishing revenue (dockside) for oysters, by month, before and after Hurricane Katrina.

Shrimp

The shrimp fishery contributes about 13 percent of total annual commercial landings, and accounts for the greatest source (62 percent) of dockside revenues for commercial fishermen in the U.S. Gulf of Mexico. Shrimp landings fluctuated without trend between 1977 and 2006, with a low of 200 million pounds in 1979 and a high of more than 305 million pounds in 1986, and with an overall annual average of nearly 241 million pounds, heads-on weight (Figure 3.2-6). Dockside revenues averaged $420 million, and ranged from $289 million in 1977 to nearly $656 million in 2000 (Figure 3.2-6). Since 2000, however, dockside revenues have declined in both current and inflation-adjusted 2005 dollars. The real, inflation-adjusted dockside value of shrimp landings in 2006 was about 40 percent of the value of approximately the same quantity landed 30 years ago in 1977.

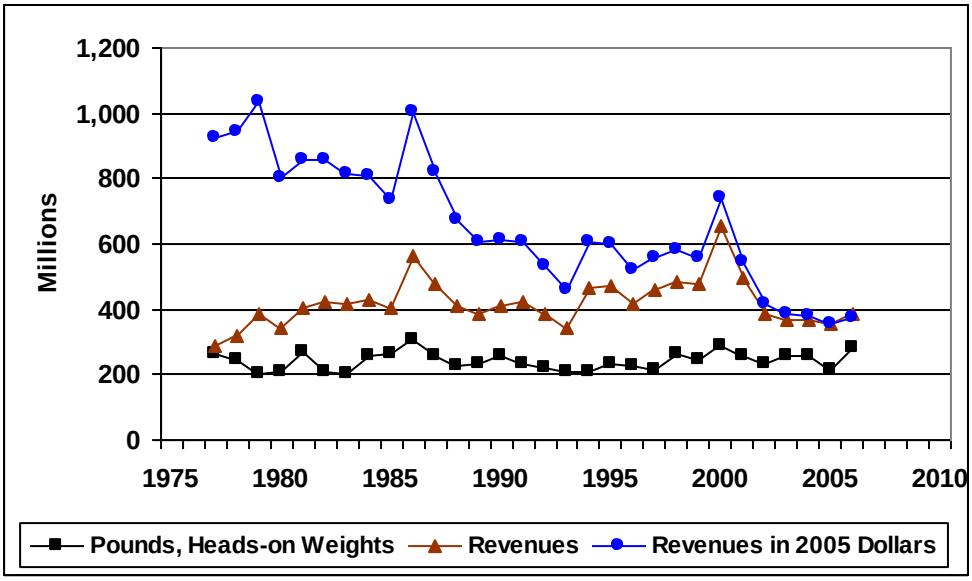

Figure 3.2-6. Pounds of shrimp landed at U.S. ports in the Gulf of Mexico, and dockside dollars in current and constant U.S. dollars.

Clearly, the shrimp fishery is beset with economic problems, and the profitability of owning and operating shrimp boats has declined. Average annual dockside prices[7] increased gradually in the late 1970s and then remained relatively constant until the late 1990s, but declined in real terms after accounting for the effects of inflation (Figure 3.2-7). More importantly, average annual dockside prices declined since 2000, and fell to their lowest levels since 1977 in real terms after accounting for inflation (Figure 3.2-7). At the same time, fuel costs have doubled since 2000 and have quadrupled since 1998 (Figure 3.2-7). Rising fuel prices affected fishermen in all fisheries, but were especially devastating for shrimpers when combined with declines in dockside prices in both current and real terms. The increase in fuel prices correlates with improved employment opportunities for boat owners and crewmen in the Gulf oil industry, which contributed to a decline in the number of shrimp fishing trips. Also, the shrimp industry has faced increasing regulatory pressures since the early 1990s to reduce the incidental bycatch and discard of sea turtles and finfishes.

Total offshore effort in the shrimp fishery was about 52 percent below the 2001-2003 average in 2006 (GMFMC 2007). Shrimp effort in the 10- to 30-fathom depth zone of the western Gulf was estimated to be 65 to 66 percent below the 2001–2003 average in 2006. Current analyses indicate the overall rate of shrimp fishing effort decline may be stabilizing near the 2006 level. However, further decline is expected in 2007 due to regulatory controls, an inability to maintain

[7] Shrimp are priced by market size category, with larger shrimp receiving higher dockside prices per pound. The average annual dockside prices reported here were calculated as total annual revenues divided by total annual pounds landed, and represent an index of dockside prices across market size categories and time within each calendar year.

current catch rates, and increasingly adverse market conditions (LGL Ecological Research Associates 2007).

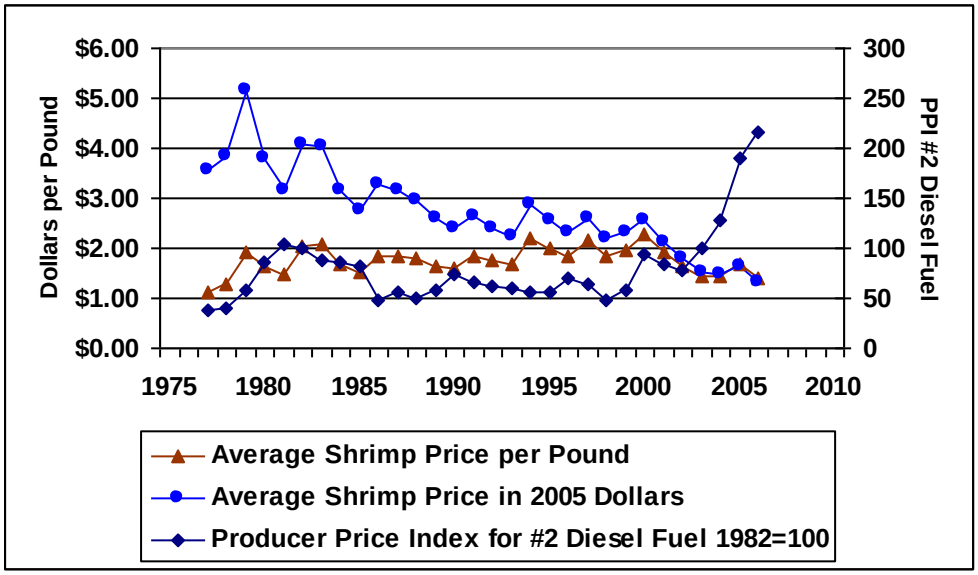

Figure 3.2-7. Average annual dockside prices per pound (heads-on weight) for shrimp, in current and constant 2005 dollars.

Louisiana is the leading producer of shrimp by weight in the Gulf. On average from 2000–2004, Louisiana fisheries landed 128 million pounds of shrimp (49 percent of total shrimp landings in the Gulf) worth $171 million (38 percent of total shrimp revenues). Texas fisheries averaged 80 million pounds of shrimp (31 percent of total shrimp landings) worth $177 million (39 percent of total shrimp revenues) during the same time period. Texas fishermen tend to land larger and higher-valued shrimp, and hence that state is the leading producer in terms of dockside revenues. Between 2000 and 2004, Mississippi fisheries landed an average of nearly 17 million pounds of shrimp (6.4 percent of total shrimp landings) worth $30 million (6.7 percent of total shrimp revenues). Alabama fisheries also landed an average of nearly 17 million pounds of shrimp, with dockside revenues of nearly $37 million (8.1 percent of total shrimp revenues). Along the west coast of Florida, fishermen landed an average of 17.6 million pounds of shrimp (6.8 percent of total shrimp landings) worth $38.3 million (8.4 percent of total shrimp revenues).

The landings and average dockside revenue of shrimp declined to only 57 percent and 53 percent, respectively, of the 5-year average during the month after Hurricane Katrina struck the Gulf Coast (Figure 3.2-8). Landings and revenues increased to 80 percent of their 5-year averages in October, and recovered to average levels in November 2005 (Figure 3.2-8). From August 2005 through July 2006, commercial shrimp landings were about equal to their 5-year average, and dockside revenues were about 7 percent below average.

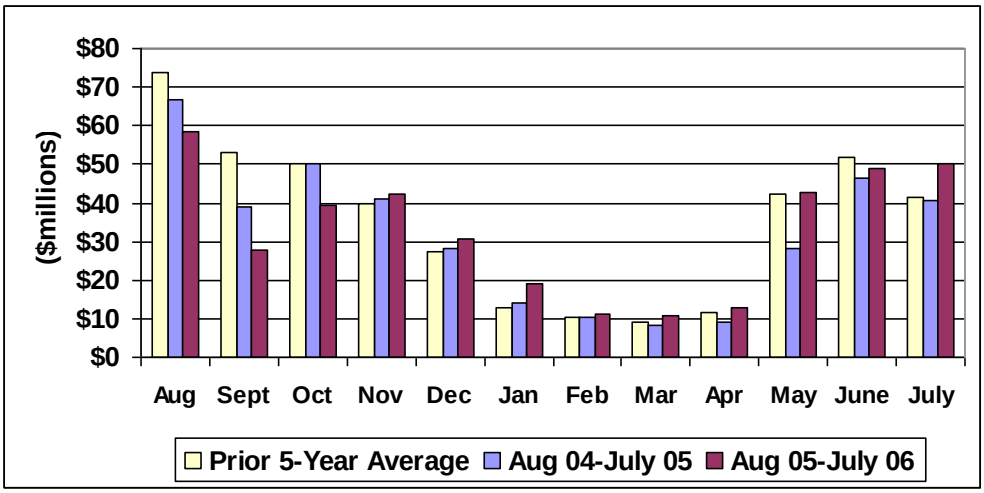

Figure 3.2-8. Commercial fishing revenue (dockside) for shrimp, by month, before and after Hurricane Katrina in August 2005, all Gulf states.

May and June are the peak months for Louisiana shrimpers, followed by August through November. Louisiana shrimp landings during September 2005 were 57 percent below landings in September 2004 and 64 percent below the 2000–2004 average for September. Dockside revenues were 54 percent lower in September 2005 compared to September 2004 and 68 percent lower than the 5-year average. Fishermen landed only 4.3 million pounds of shrimp worth $6.3 million, compared to the 5-year average of 12.1 million pounds worth $19.5 million. Louisiana shrimp landings in October 2005 were 33 percent lower than in October 2004, and 24 percent lower than the 5-year average for October. Dockside revenues were 24 percent lower in October 2005 compared to October 2004 and 19 percent lower than the 5-year average. Fishermen landed 11.6 million pounds worth $17.3 million compared to the 5-year average of 15.6 million pounds worth $21.5 million. Landings and revenues exceeded their 5-year averages by the end of November 2005. For the 12 months ending in July 2006, Louisiana shrimp landings were 98 percent of average levels and dockside revenues were 92 percent of average levels.

Mississippi shrimp landings occur primarily between May and December, with peak activity occurring in June. The shrimp landings of this state were below average in 2005 before Katrina made landfall. From May through August 2005, Mississippi fisheries landed 5.7 million pounds of shrimp worth $9.2 million, compared to a 5-year average for that same time period of 11.2 million pounds and $18.5 million. No shrimp were landed in Mississippi during September 2005. The 5-year average for that month is 1.35 million pounds worth $3.0 million. Mississippi's shrimp fishery did not recover as quickly as the Louisiana fishery. Less than 0.2 million pounds of shrimp worth $0.43 million were landed in October, compared to the 5-year average of 1.45 million pounds worth slightly more than $3.15 million. About 0.4 million pounds worth $0.85 million were landed in November compared to the 5-year average of 1.3 million pounds worth $2.7 million. Then, 0.7 million pounds worth $1.3 million were landed in December compared to the 5-year average of 0.8 million pounds worth $1.6 million. Landings and revenues were above average in January 2006, but were below average through the

remainder of 2006. Mississippi shrimp fisheries landed less than 7.8 million pounds of shrimp worth $12.0 million from August 2005 through July 2006. Landings were 49 percent of the 5-year average for the August through July period, and dockside revenues were 43 percent of average levels.

Alabama shrimp landings declined immediately after Katrina made landfall in August 2005, with landings and dockside revenues in September 2005 approximately 50 percent lower than the 5-year average for that time period. However, in October 2005, shrimp landings were less than 5 percent below average while dockside revenues were about 16 percent below average. And landings and revenues were above their 5-year averages from November 2005 through July 2006. Alabama shrimp landings increased by more than 40 percent between August 2005 and July 2006. Fishermen landed 22.7 million pounds of shrimp from August 2005 through July 2006 compared to the 5-year average of 15.9 million pounds, with dockside revenues of $39.3 million compared to an average of $33.9 million.

Texas shrimp fishermen experienced similar, but less dramatic, effects following the 2005 hurricane season. Commercial fishermen landed 9.2 million pounds of shrimp in Texas during September 2005, which was 17 percent below the 5-year average for that time period, and earned dockside revenues of $18.4 million, which was 26 percent below the 5-year average. Shrimp landings in October 2005 were 4 percent below average, and dockside revenues were 16 percent below average. Landings and dockside revenues were above their 5-year averages during most months from November 2005 through July 2006. Texas fisheries landed 83.1 million pounds of shrimp from August 2005 through July 2006, compared to the 5-year average of 76.3 million pounds, with dockside revenues of $158.5 million compared to an average of $164.2 million.

The commercial shrimp fishery off the west coast of Florida was minimally affected by the 2005 hurricane season, as landings and dockside revenues following the hurricanes were consistent with normal seasonal patterns. Florida west coast fisheries landed 17.7 million pounds of shrimp between August 2005 and July 2006 compared to the 5-year average of 17.6 million pounds, with dockside revenues of $37.4 million compared to an average of $37.1 million.

<u>Finfish</u>

Menhaden

Commercial fishery landings in the Gulf of Mexico are dominated by the industrial menhaden fishery. Menhaden is a small, oily fish that is processed into fishmeal, oil, and condensed solubles. The menhaden fishery, with reduction plants in Louisiana and Mississippi, contributes an average of 76 percent of total commercial landings at U.S. ports in the Gulf. The fishery had as many as 14 reduction plants in 1968 (Vaughan et al. 2007). Since then, economic forces have resulted in fewer reduction plants that employ fewer boats and expend less fishing effort. Currently, three menhaden plants are located in Louisiana and one plant is located in Mississippi, although small quantities of menhaden are landed and sold for bait in other states. Menhaden have a low unit price, and hence account for an annual average of less than 10 percent of the total

dockside value earned by commercial fishermen at Gulf ports.[8] Menhaden typically are landed from April through October or November each year.

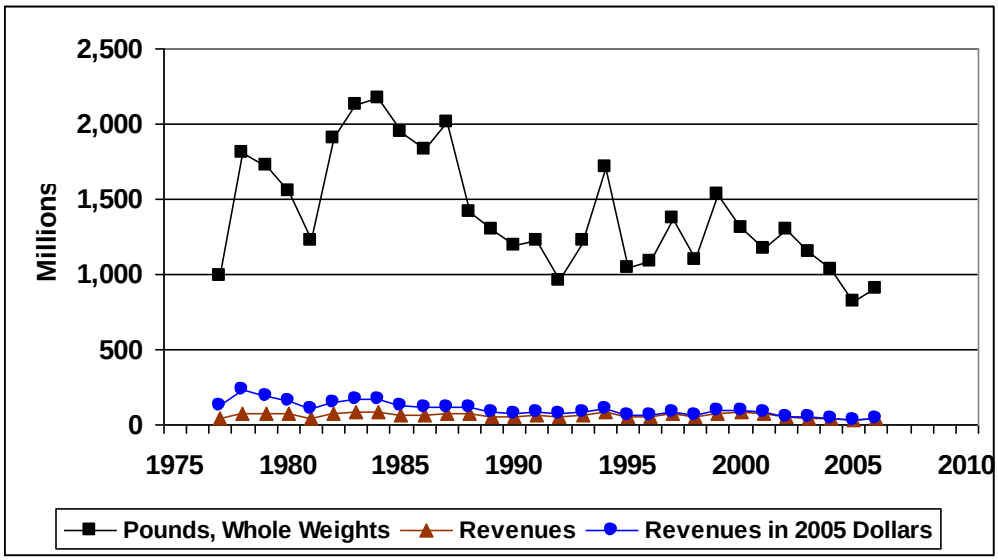

Figure 3.2-9. Pounds of menhaden landed at U.S. ports in the Gulf of Mexico, and dockside revenues in current and constant U.S. dollars.

All four menhaden plants were damaged in the 2005 hurricane season, and landings declined to the lowest level recorded during the 30-year period from 1977 through 2006 (Figure 3.2-9).

> The fish factory at Empire, LA, suffered severe damage from Hurricane Katrina in late August 2005 and did not operate for the remainder of the fishing season. Likewise, the fish factory at Cameron, LA, sustained heavy damage from Hurricane Rita in late September, and it too closed for the rest of the year. The factories at Moss Point, MS, and Abbeville, LA, also suffered considerable damage, but managed to process fish on a limited basis during the waning weeks of the 2005 fishing season. The fact that all four menhaden factories were back on line by mid-June 2006—with total landings comparable to recent years—is quite remarkable. (NMFS 2007b)

For the 12 months ending in July 2006, the menhaden fishery landed 669 million pounds of fish, which was 42 percent lower than the 5-year average of 1.15 billion pounds for the August–July period.

Other Finfishes

Finfishes other than menhaden accounted for about 6 percent of total pounds landed commercially in the Gulf and 12 percent of dockside revenues between 1977 and 2006. Landings of these species were relatively constant from 1977 through 1985, whereas their unit

[8] Menhaden are landed and processed by vertically integrated firms. Hence, dockside prices are not quoted in markets and dockside revenues are approximated by state and federal port agents.

prices and total dockside revenues increased (Figure 3.2-10). Landings were above average from 1986 through 1994 and have declined since then (Figure 3.2-10). Landings in 2005 and 2006 were the lowest during the 30-year period from 1977 through 2006 (Figure 3.2-10). Dockside revenues remained relatively constant since 1990, but have declined to their lowest levels since 1977 in real terms after adjusting for inflation (Figure 3.2-10). Fishermen landed 69.6 million pounds worth $89.0 million in 2005 compared to the 5-year averages for 2000–2004 of 84.8 million pounds worth $95.2 million.

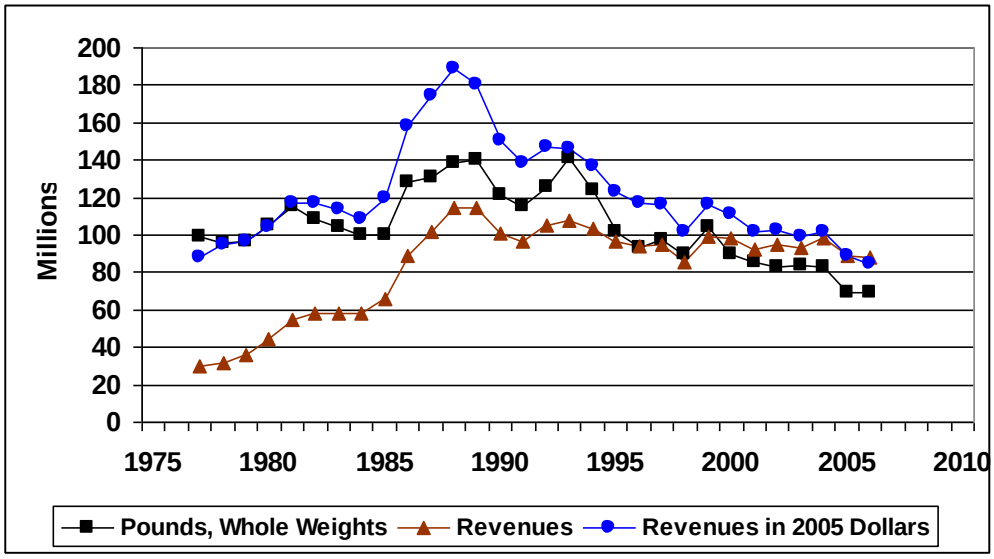

Figure 3.2-10. Pounds of finfish other than menhaden landed at U.S. ports in the Gulf of Mexico, and dockside revenues in current and constant U.S. dollars.

Historically, Florida's west coast fisheries were the leading producers of finfish other than menhaden in the Gulf, but their share of Gulf landings of finfish has declined over time. From 1977 through 1985, west Florida fisheries averaged 64 million pounds, which represented 63 percent of total landings of finfish other than menhaden in the Gulf. Louisiana fisheries averaged 23 million pounds and 22 percent of Gulf-wide finfish landings during the same period. From 1986–1994, west Florida fisheries averaged 73 million pounds and 56 percent of total Gulf landings of finfish other than menhaden, while Louisiana fisheries averaged 41 million pounds and 32 percent of total finfish landings. However, from 1995–2006, west Florida fisheries averaged 38 million pounds and 43 percent of total Gulf landings of finfish other than menhaden, while Louisiana fisheries averaged 33 million pounds and 37 percent of total Gulf landings of finfish. Most of these species are managed, which may have contributed to the overall decline in landings since the mid-1990s.

Commercial fisheries in the Gulf landed 65.1 million pounds of finfish worth $82.7 million between August 2005 and July 2006. Landings were 22 percent below the 5-year average for the August–July period, and dockside revenues were 13 percent below average. Landings and dockside revenues were below average during 10 of the 12 months between August 2005 and

July 2006, and were especially below average during October and November 2005 after the grouper and tilefish quotas were filled and the fisheries were closed (Figure 3.2-11). West Florida fisheries landed 32.3 million pounds from August through July, which was 19 percent below average, and earned $45.6 million, which was 12 percent below average. During the same period, Louisiana fisheries landed 19.6 million pounds worth $20.2 million compared to the 5-year averages of 30.8 million pounds and $29.6 million. Landings in Louisiana were 36 percent below the 5-year average and dockside revenues were 32 percent below average. Mississippi fisheries landed 0.9 million pounds worth $0.5 million, which was 73 percent and 60 percent, respectively, below the 5-year average.

In contrast, Alabama and Texas finfish fisheries exceeded their 5-year averages for the August–July period. Alabama fisheries landed 6.0 million pounds of finfish worth $4.7 million, compared to the 5-year average of 4.7 million pounds worth $3.2 million. Similarly, Texas fisheries landed 6.4 million pounds of finfish worth $11.6 million, compared to the 5-year averages of 5.5 million pounds worth $9.1 million.

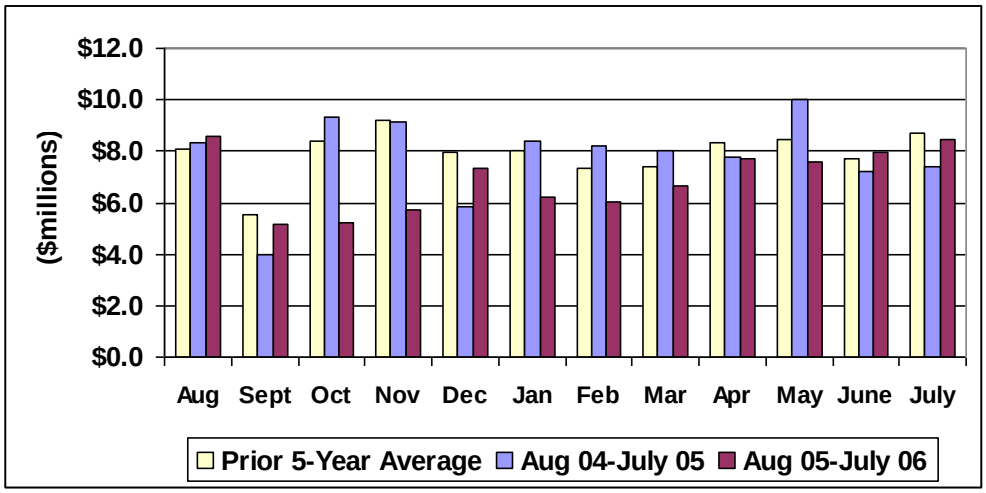

Figure 3.2-11. Gulf-wide commercial fishing revenue (dockside) from finfish other than menhaden, by month, before and after Hurricane Katrina.

Crabs, lobsters, and other invertebrates

Shellfishes other than shrimp and oysters (other shellfish) include blue crab, stone crab, lobsters, crawfish, clams, and scallops, among others. These other shellfish accounted for about 4.5 percent of total commercial landings in the U.S. Gulf of Mexico and 10.6 percent of dockside revenues during the 30-year period 1977–2006. In aggregate, landings ranged from a low of 53.7 million pounds in 1981 to a peak of 131.4 million pounds in 1993 (Figure 3.2-12).[9] Dockside revenues generally increased over time, even in constant 2005 dollars, until they began

[9] Crab and lobster landings are recorded as whole (live) weights, whereas clam, scallop, and other bivalve mollusk landings are recorded as meat weights.

declining in 1999 (Figure 3.2-12). Commercial fishermen landed 73.2 million pounds of other shellfish worth $84.7 million in 2005, compared to the 5-year average of 82.7 million pounds worth $98.0 million. Fishermen landed 72.4 million pounds of other shellfish worth $90.4 million in 2006.

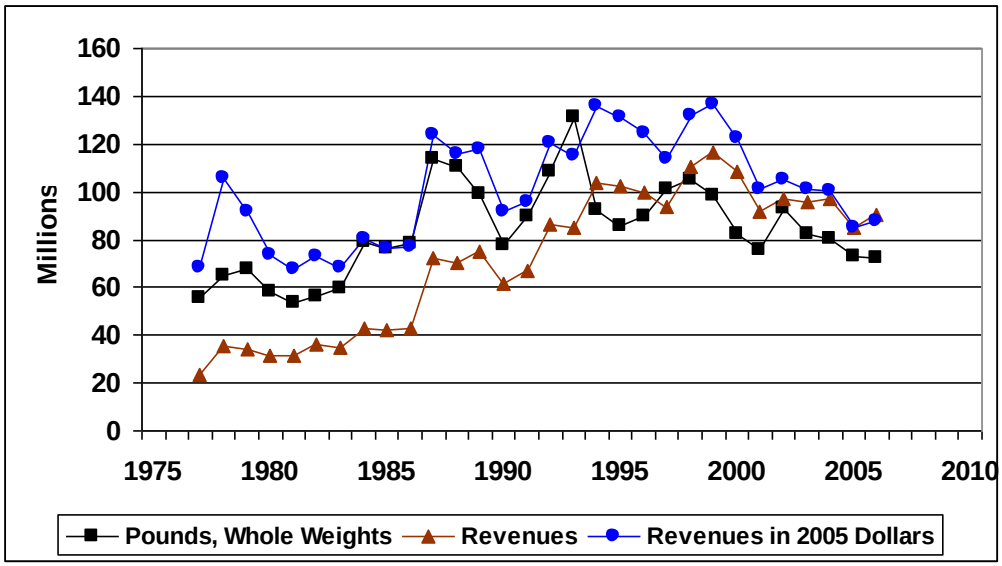

Figure 3.2-12. Pounds of other shellfish (blue crab, stone crab, lobsters, crawfish, clams, scallops, etc.) landed at U.S. ports in the Gulf of Mexico, and dockside revenues in current and constant U.S. dollars.

Louisiana, with its large commercial blue crab fishery, is the leading producer of other shellfish in the Gulf. Between 2000 and 2004, Louisiana's commercial fisheries accounted for 67 percent of total Gulf landings of other shellfish. Florida, with its blue crab, stone crab, and spiny lobster fisheries, is the second-leading producer and accounts for 21 percent of Gulf landings. However, stone crab and spiny lobster are higher-valued than blue crab. As a result, west Florida fishermen, including those in the Florida Keys, earned 55 percent of the dockside revenues from other shellfish, and Louisiana fishermen earned 38 percent. Texas, Alabama, and Mississippi fisheries accounted for 11 percent of the landings and 7 percent of the dockside revenues, with blue crab the primary species landed in each of those states.

In September 2005, the month after Hurricane Katrina made landfall, Gulf of Mexico commercial fisheries landed 3.0 million pounds of other shellfish worth $5.2 million (Figure 3.2-13). These totals were 46 percent and 59 percent of the most recent 5-year average for landings and dockside revenues, respectively, during September. Landings and dockside revenues gradually increased in the following months, but rarely achieved levels matching their 5-year averages (Figure 3.2-13). Florida stone crab landings and dockside revenues were well below their 5-year averages in the peak months of October and November 2005, and Louisiana blue crab landings and revenues were well below average during April and May 2006. From August 2005 through July 2006, west Florida fisheries landed 14.9 million pounds worth $41.2 million.

Total landings on the west coast of Florida were 15 percent below the 5-year average for the August–July period, while dockside revenues were 23 percent below average. Florida fisheries landed 46.6 million pounds of other shellfish worth $28.9 million during the same period. Total landings in Louisiana were 19 percent below the 5-year average for the August–July period, while dockside revenues were 26 percent below average. Alabama landings were 47 percent below average, while Texas landings were 43 percent below average during the 12 months ending in July 2006. Mississippi landings were almost nil from September through December 2005, but increased above average from January through July 2006, resulting in about average landings and dockside revenues between August 2005 and July 2006.

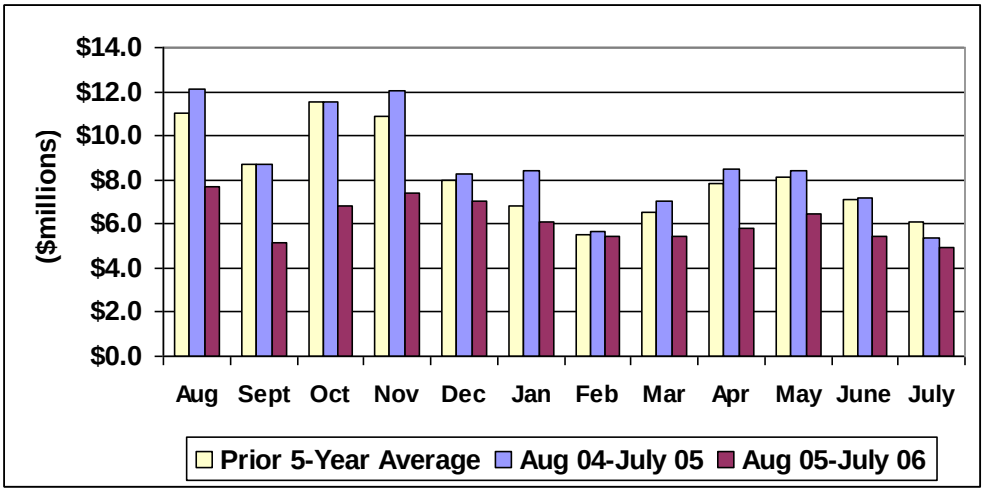

Figure 3.2-13. Gulf-wide commercial fishing revenue (dockside) for other shellfish (blue crab, stone crab, lobsters, crawfish, clams, scallops, etc.) by month, before and after Hurricane Katrina.

3.2.2 Recreational fisheries

3.2.2.1 Recreational landings and effort

Three separate data collection programs are used in the Gulf of Mexico to collect recreational landings and effort data. The Marine Recreational Fisheries Statistics Survey (MRFSS) estimates recreational landings and effort for private, shore, and charter fishing modes from Louisiana to Florida. The Texas Parks and Wildlife Department estimates recreational landings and effort for private and charter fishing modes solely off Texas. The NMFS Southeast Fisheries Science Center's Headboat Survey provides landings and effort estimates for headboats throughout the Gulf. The following section summarizes trends in recreational landings and effort for the MRFSS and Headboat surveys. MRFSS landings data through 2006 were available for incorporation into this report, but headboat landings data through 2006 were not. Texas landings and effort data are summarized in Section 4.5.2. All landings are reported in pounds of fish.

3.2.2.1.1 Marine Recreational Fisheries Statistics Survey landings estimates

Finfish

Private and charter boat anglers from Louisiana to west Florida landed an estimated 63.1 million pounds of fish during 2005, and 74.9 million pounds of fish during 2006 (Figure 3.2.14). Between 1986 and 1990, landings declined from a peak of 96.5 million pounds in 1986 to a low of 51.5 million pounds in 1990. Since 1991, landings have generally fluctuated between 60 and 80 million pounds annually. Landings in both 2005 and 2006 were within this range, although 2005 landings were less than landings during each of the 6 previous fishing years.

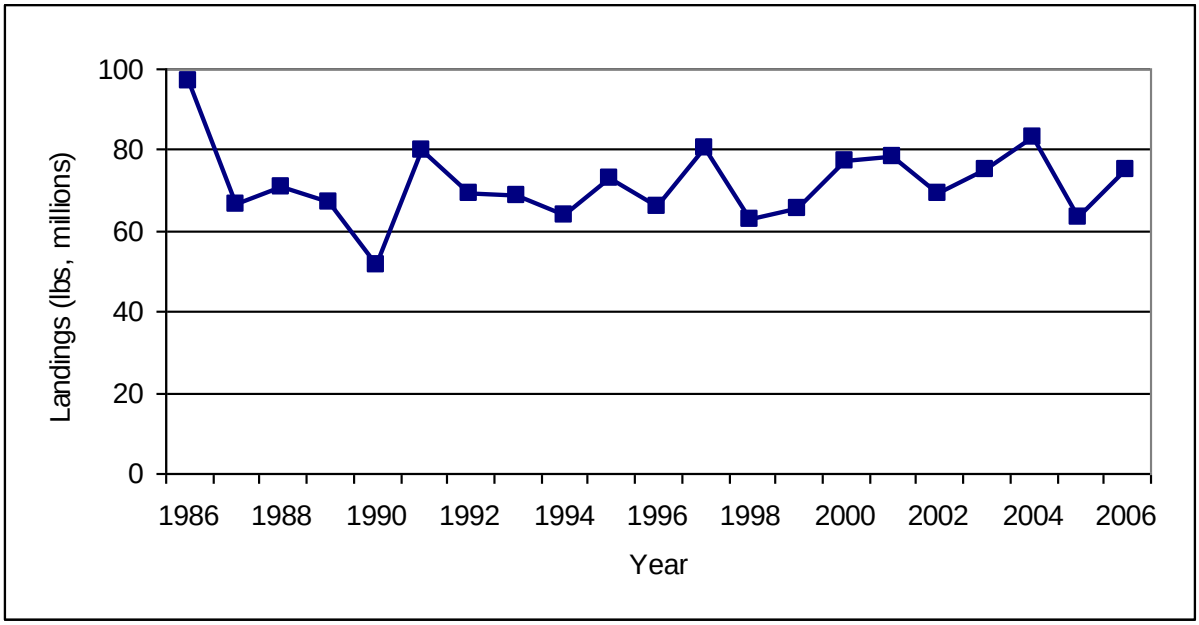

Figure 3.2-14. Total recreational finfish landings (1986–2006) by charter boats and private anglers in the U.S. Gulf of Mexico, excluding Texas.

Figure 3.2-15 compares recreational landings for months following landfall of Hurricane Katrina in late August 2005 with corresponding months in 2006 and the average from the most recent 5-year period prior to landfall. Recreational landings in September–October 2005 declined to 57 percent of the 5-year average and remained below average until May–June 2006. Total annual landings since May–June 2006 have been comparable to the 5-year landings average.

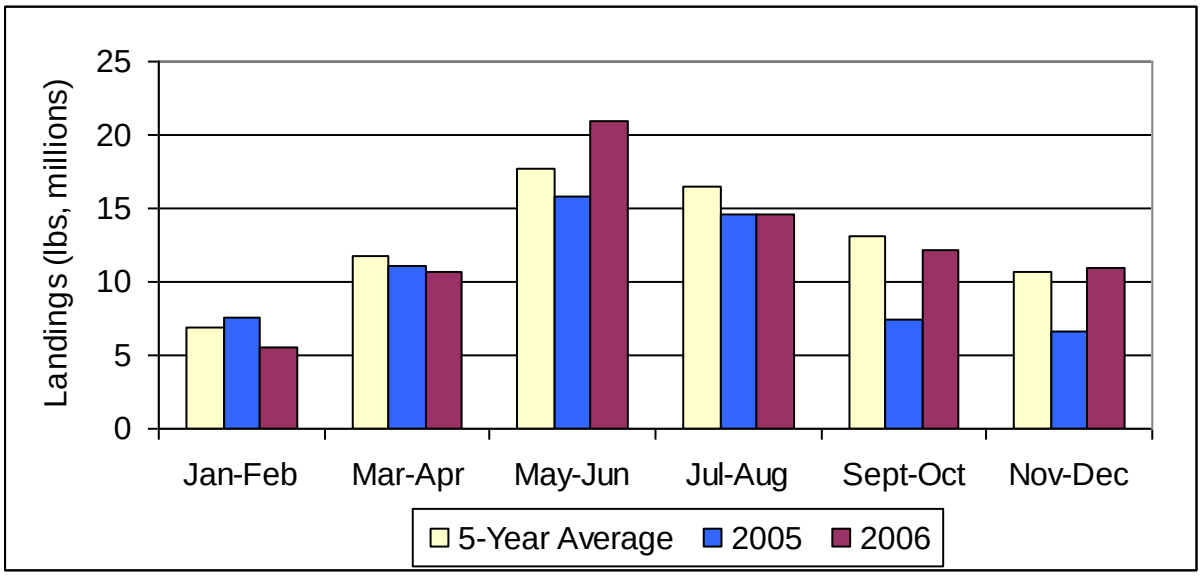

Figure 3.2-15. MRFSS recreational landings (lbs) by 2-month wave before and after Hurricane Katrina.

Reef Fish

NMFS regulates the harvest of 42 reef fish species in the Gulf of Mexico. Reef fish include snappers, jacks, groupers/seabasses, and tilefishes. Recreational anglers primarily harvest reef fish from federal waters, which extend greater than 9 miles offshore of Florida and Texas and greater than 3 miles offshore of Alabama, Louisiana, and Mississippi. During 2005, private and charter anglers from Louisiana to Florida landed 6.0 million pounds of snappers, 5.3 million pounds of groupers/seabasses, and 2.33 million pounds of jacks. Long-term landings for each of these species groups have been relatively stable since the early 1990s. Snapper landings generally increased between 2000 and 2004, before declining in 2005 (Figure 3.2-16). Snapper landings in 2006 increased slightly relative to 2005 landings. Snapper landings for 2005 and 2006 were similar to 5-year average landings prior to Hurricane Katrina (Figure 3.2.17). Recreational landings of grouper/seabasses increased slightly between 1996 and 2004, largely due to increases in the abundance of gag and red grouper (Figure 3.2-16). Since 2004, grouper/seabass landings have sharply declined. Grouper/seabass landings in 2005 were 18 percent less than the 5-year average, and 2006 landings were 49 percent less than the 5-year average (Figure 3.2-17). This significant decrease is attributed, in part, to regulatory restrictions implemented to reduce recreational red grouper landings in 2005 and 2006. Also, recreational anglers reported record red grouper landings in 2004, which inflated the 5-year average landings estimate. Landings of jacks have generally increased since 1995, but declined in 2005 to levels observed in the mid- to late-1990s (Figure 3.2-16) before rebounding in 2006 (Figure 3.2-17).

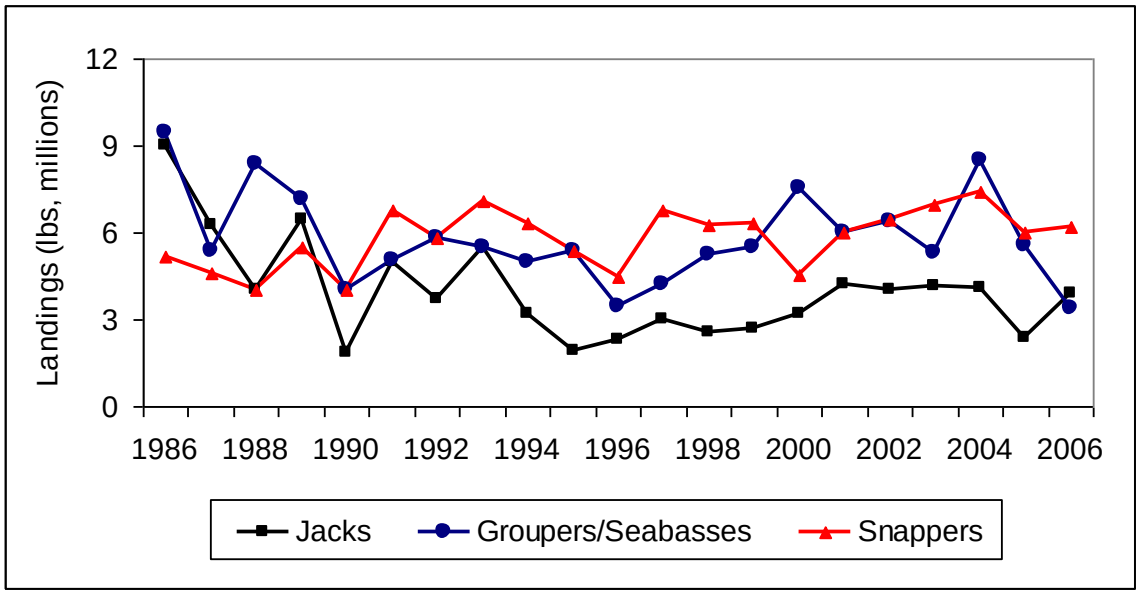

Figure 3.2-16. Recreational landings of jacks, groupers/seabasses, and snappers (1986–2006) by charter boats and private anglers in the U.S. Gulf of Mexico, excluding Texas.

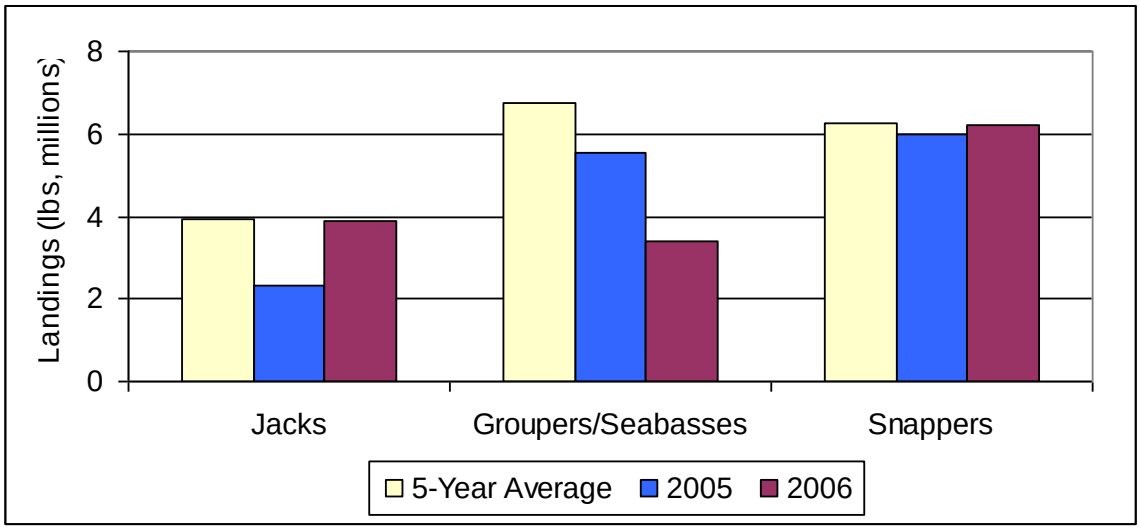

Figure 3.2-17. MRFSS recreational landings of jacks, groupers/seabasses and snappers before and after Hurricane Katrina.

Mackerels and Tunas

Mackerels and tunas are coastal migratory species primarily caught in offshore waters of the Gulf of Mexico. King and Spanish mackerel are the two primary coastal migratory species caught by recreational anglers. These species represent about 70 percent of the total annual landings of mackerels and tunas. NMFS regulates King and Spanish mackerel, as well as tunas, which include yellowfin, blackfin, and other tuna species. Landings of all tunas and mackerels have declined since the early 1990s (Figure 3.2-18). Mackerel and tuna landings in 2005 were significantly lower than landings in years prior to Hurricane Katrina (3.2-19), but increased in 2006 to levels comparable to the 5-year average (Figure 3.2-19). King and Spanish mackerel landings also declined in 2005 relative to the previous 5-year average, but increased in 2006 to levels consistent with the 5-year average (Figures 3.2-18 and 3.2-19).

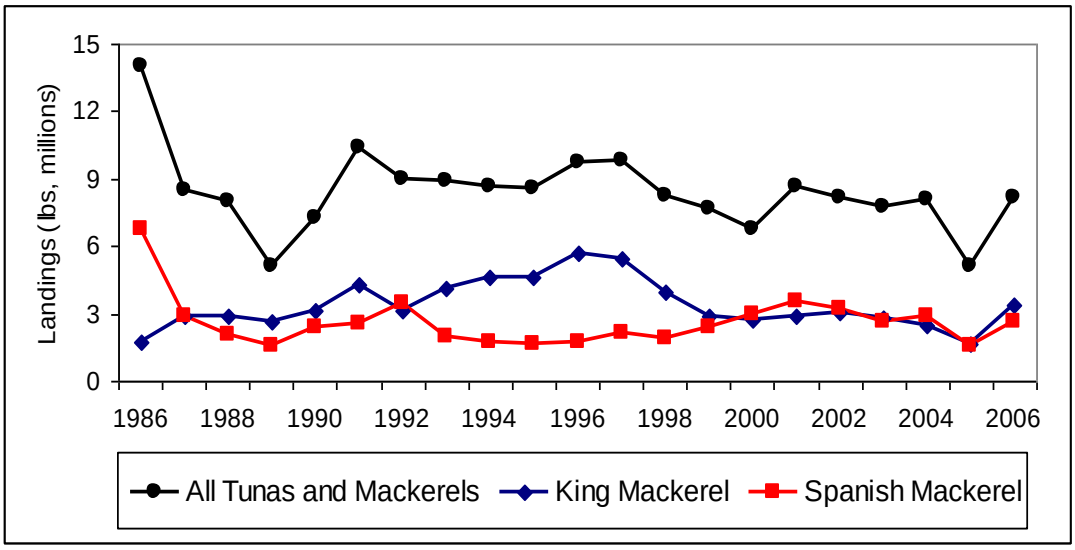

Figure 3.2-18. Recreational landings of tunas and mackerels (1986–2006) by charter boats and private anglers in the U.S. Gulf of Mexico, excluding Texas.

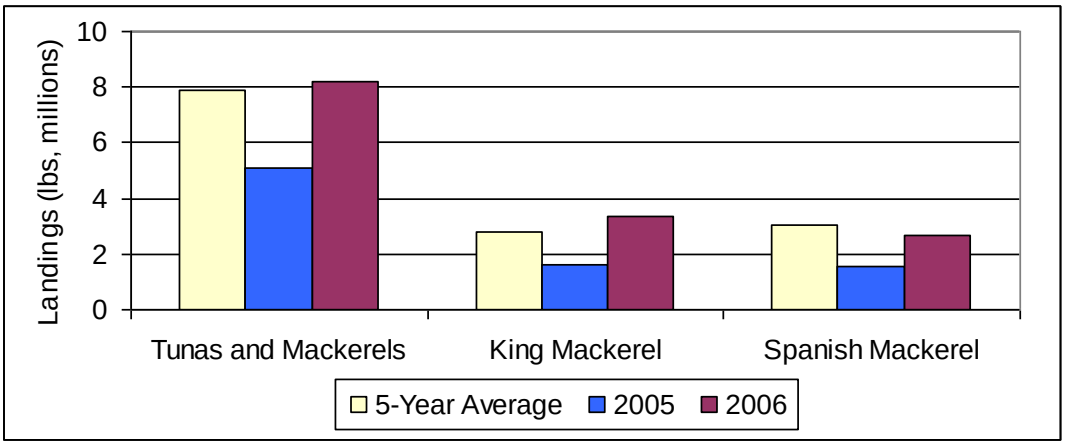

Figure 3.2-19. MRFSS recreational landings of tunas and mackerels before and after Hurricane Katrina.

Drums

Drums, which primarily include red drum and spotted sea trout, annually account for 40 to 50 percent of the total private and charter boat landings of finfish from Louisiana to west Florida. Landings of all drums have increased over time, ranging from a minimum of 13.2 million pounds in 1990 to a maximum of 37.9 million pounds in 2006 (Figure 3.2-20). Drum landings in 2005 were 17 percent lower than the previous 5-year average (3.2-20), but increased in 2006 to levels 20 percent greater than the 5-year average (Figure 3.2-21). Landings of red drum also declined in 2005 relative to the previous 5-year average, but increased in 2006 to levels comparable to the 5-year average (Figures 3.2-20 and 3.2-21). Landings of spotted sea trout in 2005 were similar to the 5-year average, but increased to a level well above the 5-year average in 2006 (Figures 3.2-20 and 3.2-21).

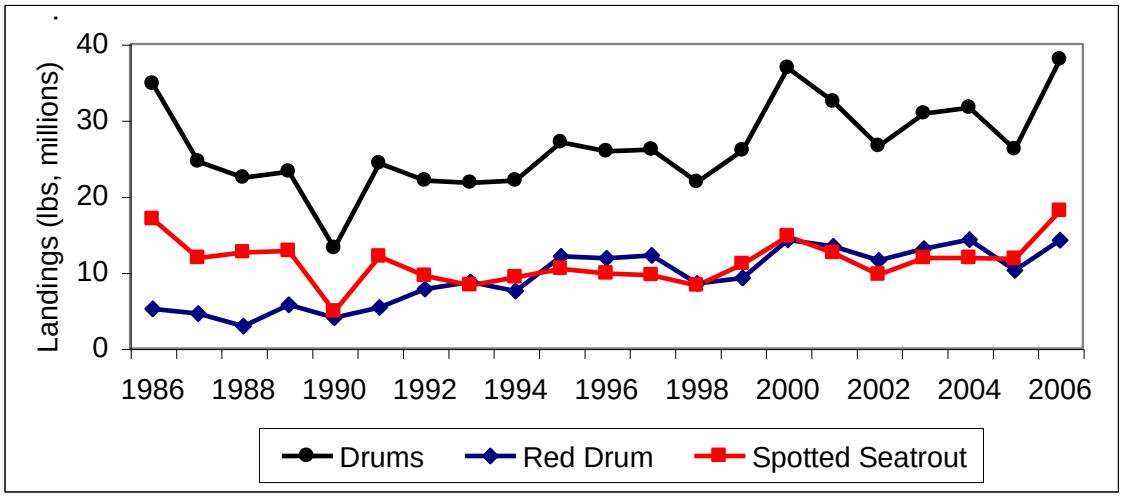

Figure 3.2-20. Recreational landings of drums (1986–2006) by charter boats and private anglers in the U.S. Gulf of Mexico, excluding Texas.

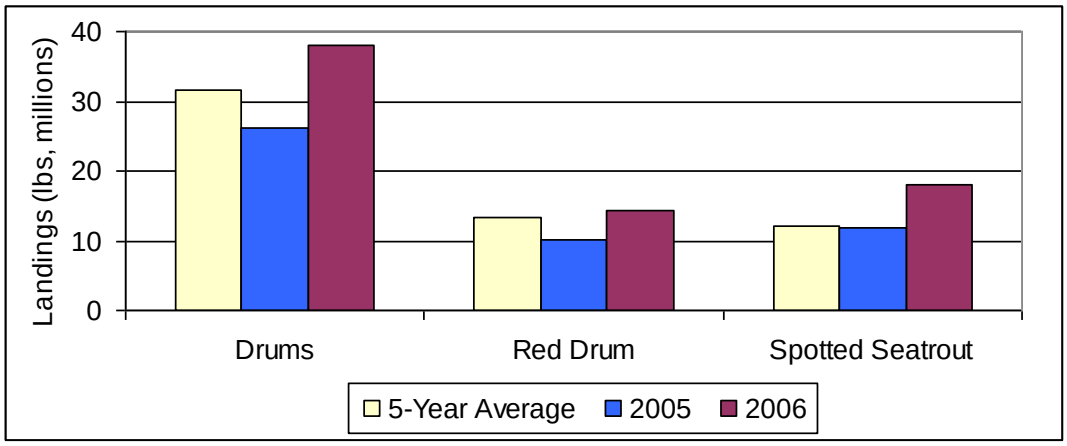

Figure 3.2-21. MRFSS recreational landings of drums before and after Hurricane Katrina.

3.2.2.1.2 Headboat Survey landings estimates

Headboats are large-capacity vessels that charge a fee per person to go fishing. NMFS' Southeast Fisheries Science Center obtains landings data annually from over 200 headboats operating in the Gulf of Mexico. Landings, reported in both pounds and numbers of fish landed, are submitted through logbooks. Species commonly caught on headboats include snappers, groupers, jacks, mackerels, and sharks.

All species combined

In 2005, headboat anglers landed 2.57 million pounds of fish in the Gulf of Mexico. Headboat landings were stable during 1986 to 1994, peaking in 1993 at 4.63 million pounds. Between 1995 and 2001, headboat landings declined, reaching a low of 2.41 million pounds in 2001 (Figure 3.2-22). Landings increased during 2001–2004, but declined once again in 2005 (Figure 3.2-22). Declines in landings are partly explained by a reduction in the number of days anglers fished during the past 2 decades. Headboat landings during January through August 2005 were 4 percent below the 5-year landings average for that same period. Headboat landings were 19 percent below the 5-year average in September 2005 following Hurricane Katrina, 36 percent below average in October 2005, 32 percent below average in November 2005, and 24 percent below average in December 2005 (Figure 3.2-23). No data are currently available for 2006 landings.

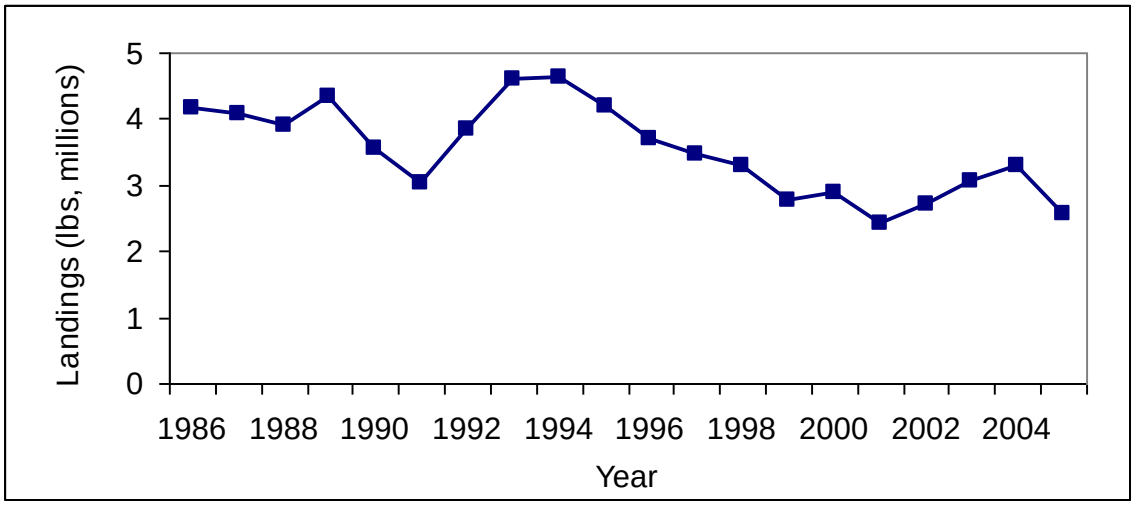

Figure 3.2-22. Recreational headboat landings (1986–2005) in the U.S. Gulf of Mexico.

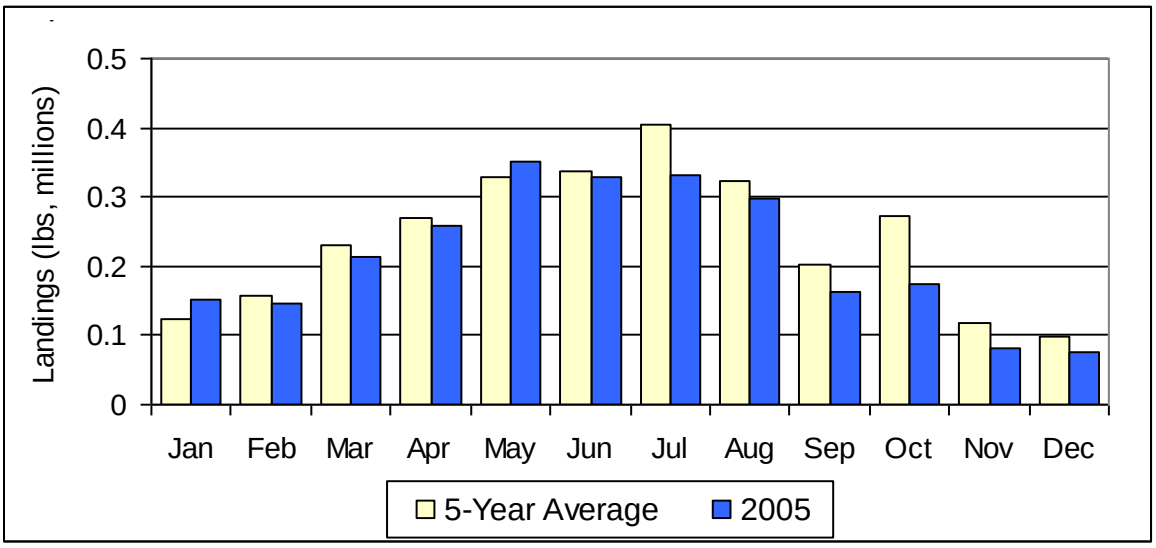

Figure 3.2-23. Headboat recreational landings (lbs) by month before and after Hurricane Katrina.

Finfish

Reef Fish

The primary species of reef fish caught on headboats are snappers, groupers/seabasses, grunts, and jacks. Over the past 20 years, red snapper, white grunt, vermilion snapper, and greater amberjack have been the four most commonly caught species on headboats. Snapper landings increased during the early 1990s, but have declined since 1994 (Figure 3.2-24). In 2005, snapper landings were 10 percent below the 5-year average (Figure 3.2-25). Landings of groupers/seabasses, jacks, and grunts have been stable for the last 20 years (Figure 3.2-24). In 2005, grouper/seabass landings increased by 23 percent when compared to the 5-year average, while landings of grunts and jacks declined by 47 percent and 26 percent, respectively, relative to the 5-year average (Figure 3.2-25). However, grouper/seabass landings in 2005 were less than grouper/seabass landings reported in 2004.

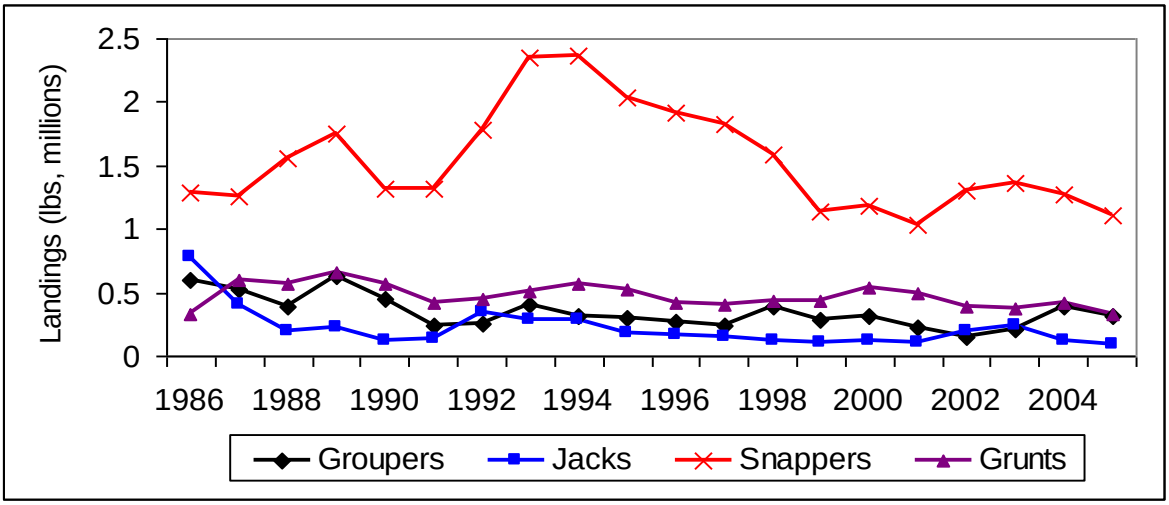

Figure 3.2-24. Recreational headboat landings (1986–2005) of reef fish in the U.S. Gulf of Mexico.

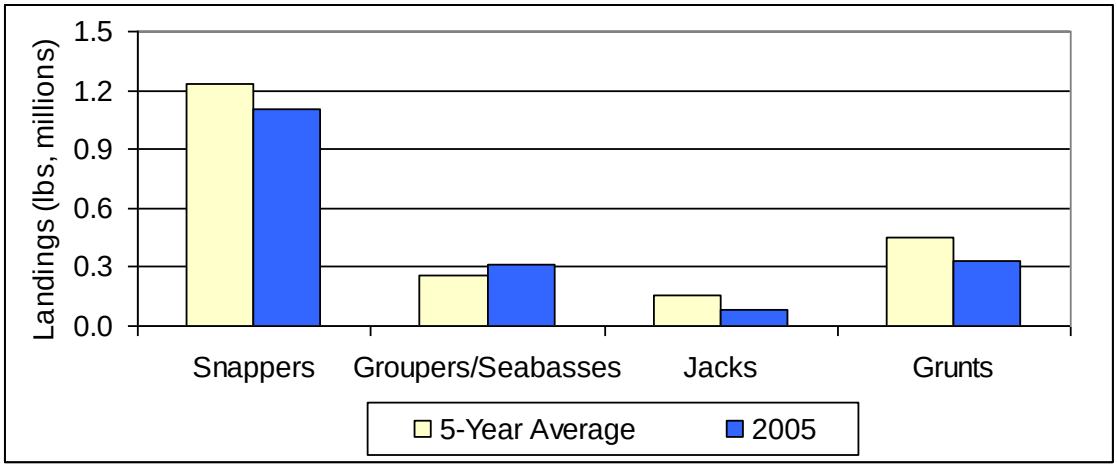

Figure 3.2-25. Headboat landings of reef fishes in 2005 compared to the previous 5-year average.

Mackerels, Sharks, and Tunas

King mackerel, blackfin tuna, sharpnose sharks, and blacktip sharks are among the 20 most commonly caught species on Gulf headboats. In 2005, shark and tuna landings significantly declined relative to the prior year, while mackerel landings remained stable. Mackerel landings increased in the early to mid-1990s, declined in the late 1990s, and have remained relatively stable since 2000 (Figure 3.2-26). Mackerel landings in 2005 were 5 percent greater than the previous 5-year average (Figure 3.2-27). Shark landings declined in the mid- to late-1980s, remained stable in the 1990s, and then sharply increased beginning in 2003 (Figure 3.2-26).

Shark landings in 2005 sharply declined relative to 2004 landings, but still remained above the 5-year average (Figure 3.2-27). Tuna landings increased between 1986 and 1998, then decreased sharply in 1999 and 2000, before increasing again until 2004 (Figure 3.2-26). In 2005, tuna landings were 31 percent below the 5-year average (Figure 3.2-27).

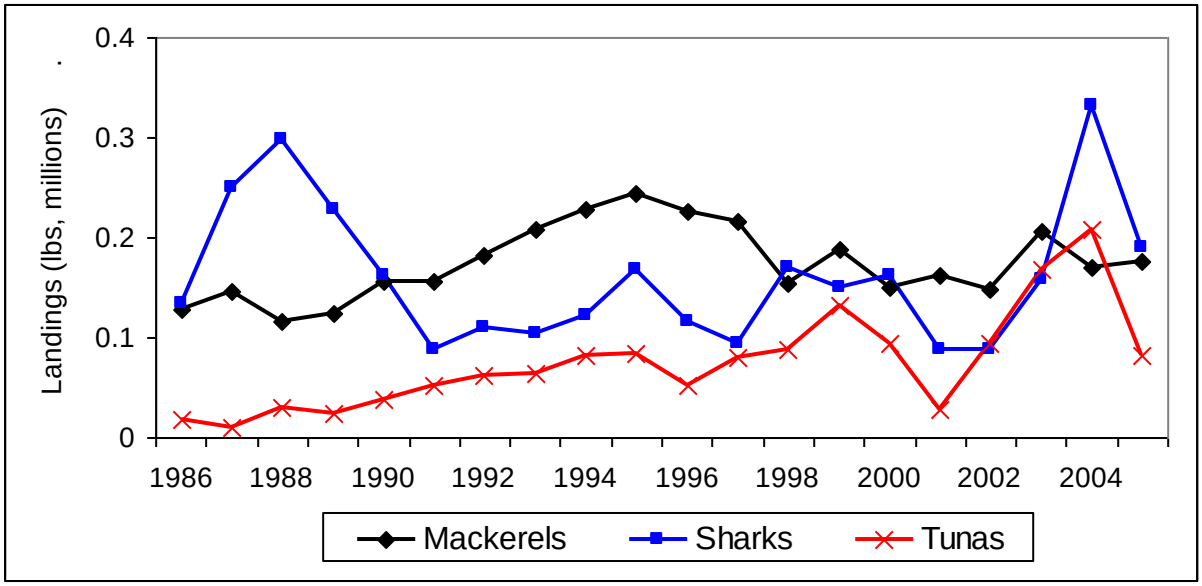

Figure 3.2-26. Recreational headboat landings (1986–2005) of mackerels, sharks, and tunas in the U.S. Gulf of Mexico.

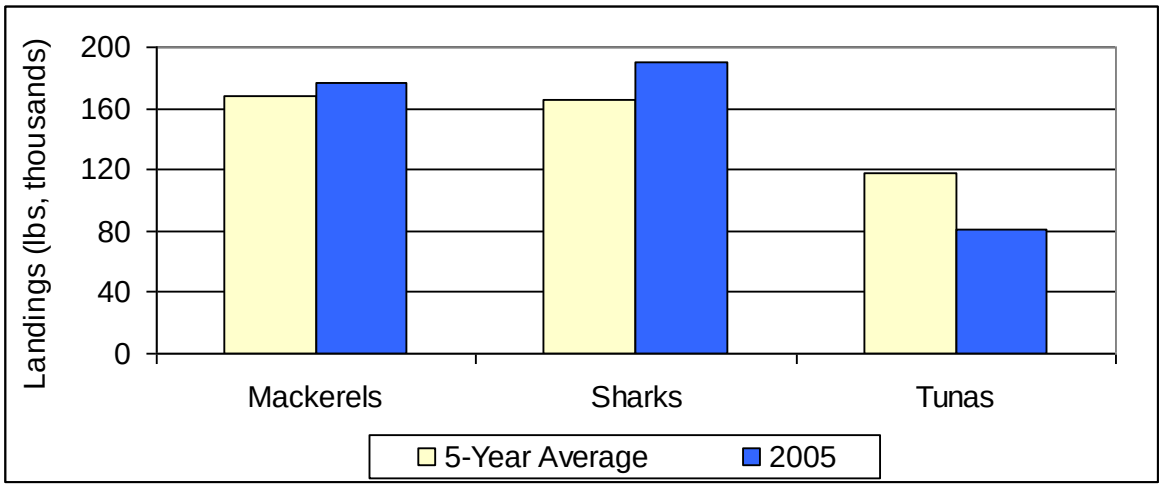

Figure 3.2-27. Headboat landings of mackerels, sharks, and tunas in 2005 compared to the previous 5-year average.

Crabs, lobsters, and other invertebrates

The MRFSS, Headboat, and Texas Parks and Wildlife Department recreational fishing surveys do not collect data on recreational landings of invertebrates, such as lobsters, stone crabs, shrimp, and blue crabs. With the exception of spiny lobster landings, recreational landings of these other invertebrate species are extremely small when compared to commercial landings. In contrast, recreational landings of spiny lobster represent a significant component of the overall fishery landings. Annually, the Florida Fish and Wildlife Conservation Commission conducts a recreational survey to estimate spiny lobster landings. Recreational spiny lobster landings averaged 1.8 million pounds in the 1990s, fluctuating between 1.3 and 1.9 million pounds (Figure 3.2-28). Landings began to decline in the 1999–2000 fishing year, before stabilizing in the 2001–2002 fishing season at around 1.3 million pounds. During the 2005–2006 fishing season, recreational spiny lobster landings were the lowest recorded, averaging 35 percent lower than the four previous years for which data were available (Figure 3.2-28). No landings data were available for the 2004–2005 fishing year because the survey was not conducted due to Hurricane Charley.

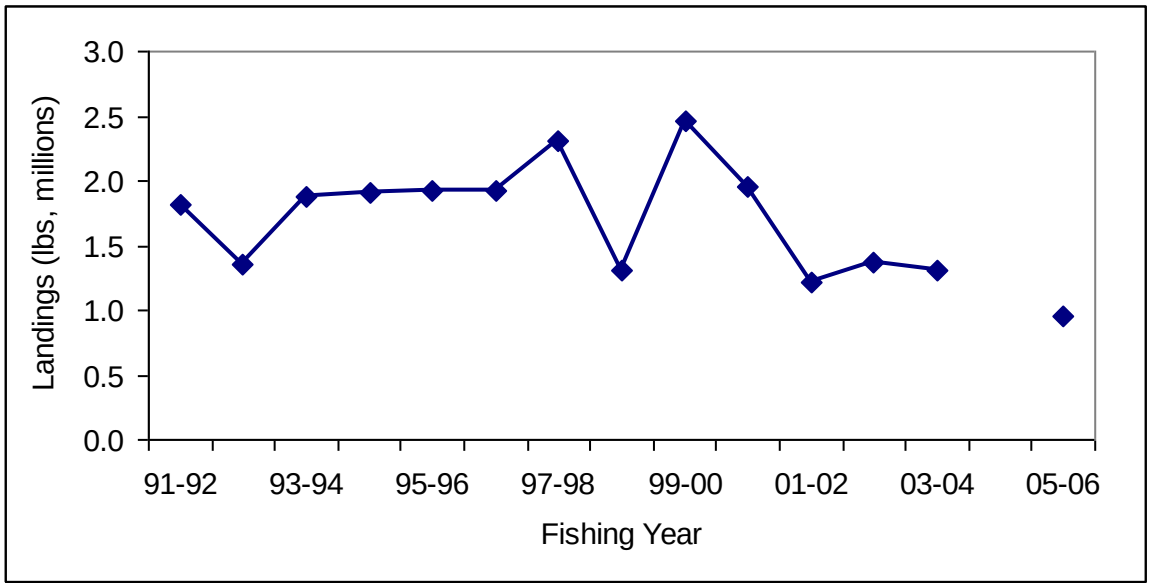

Figure 3.2-28. Recreational spiny lobster landings in Florida (1991–1992 to 2005–2006).

3.2.2.1.3 Marine Recreational Fisheries Statistics Survey effort estimates

The MRFSS estimates fishing effort in terms of numbers of trips by mode (charter, private, shore), state (Louisiana through west Florida), and 2-month wave (January–February, March–April, etc.). The total number of private fishing trips was relatively stable during the 1990s, but has increased since 2000 (Figure 3.2-29). In 2005, recreational anglers took an estimated 12.6 million private fishing trips. Shore-based fishing trips have remained fairly stable over time. In

2005, anglers took an estimated 8.5 million shore-based fishing trips. The number of charter trips taken annually is much lower than the total number of private or shore-based fishing trips. The average number of charter fishing trips made annually since the early 1990s exceeds 800,000. In 2005, 820,000 charter fishing trips were taken. A majority of trips occur in nearshore and inshore waters (Figure 3.2-30). Trips in nearshore and inshore waters have generally increased since the late 1990s (Figure 3.2-30). Offshore trips have remained relatively stable over the past 20 years (Figure 3.2-30). In 2005, 13.1 million inshore trips, 7.0 million nearshore trips, and 1.8 million offshore trips were taken. There was virtually no change in the number of trips taken by each mode in the year immediately following Hurricane Katrina (Figure 3.2-31), but the number of trips in inshore and offshore waters decreased while the number of trips in nearshore waters increased (Figure 3.2-32).

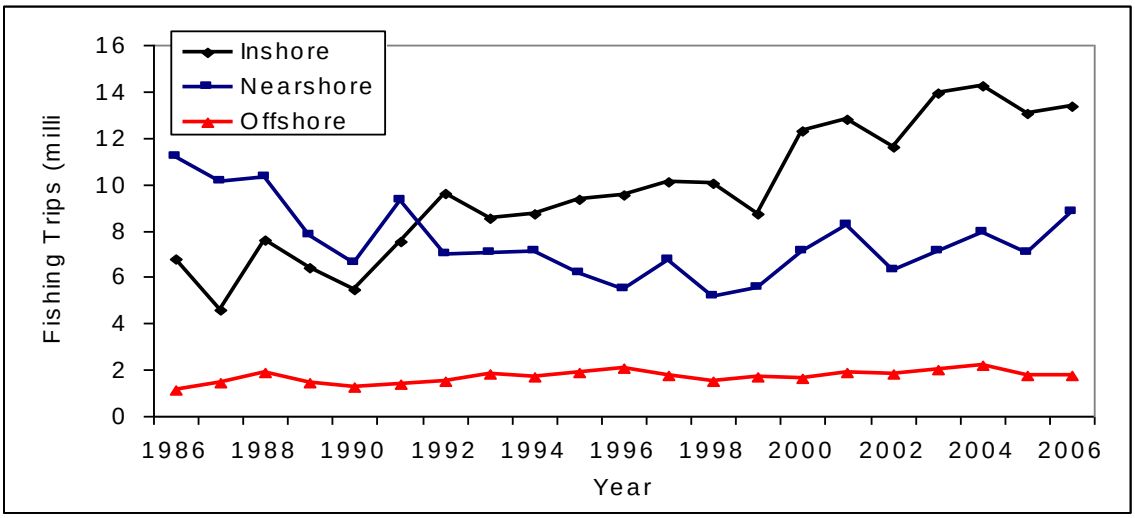

Figure 3.2-29. Total fishing trips in the Gulf of Mexico (excluding Texas) by fishing mode and year.

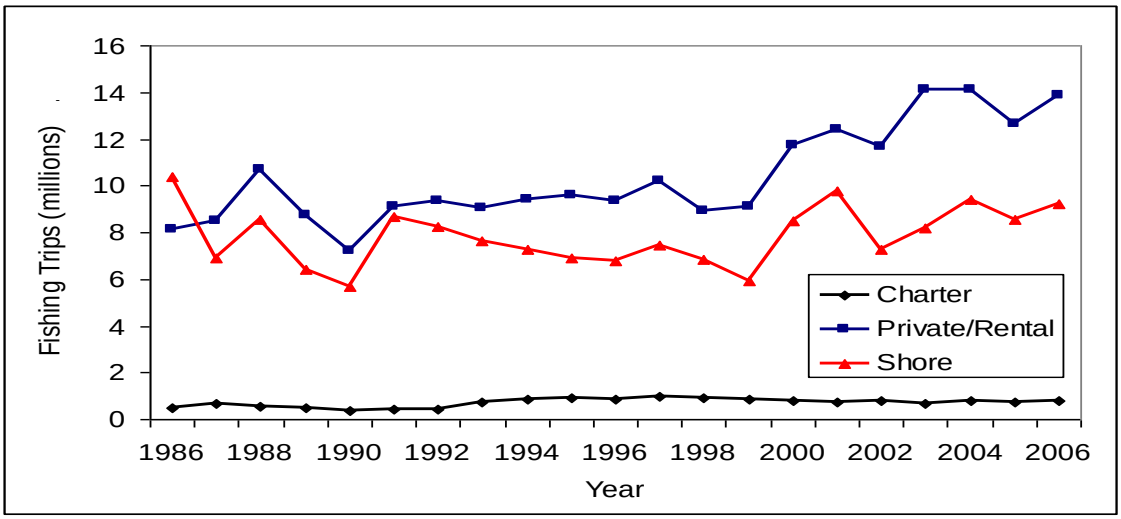

Figure 3.2-30. Total fishing trips in the Gulf of Mexico (excluding Texas) by area fished and year.

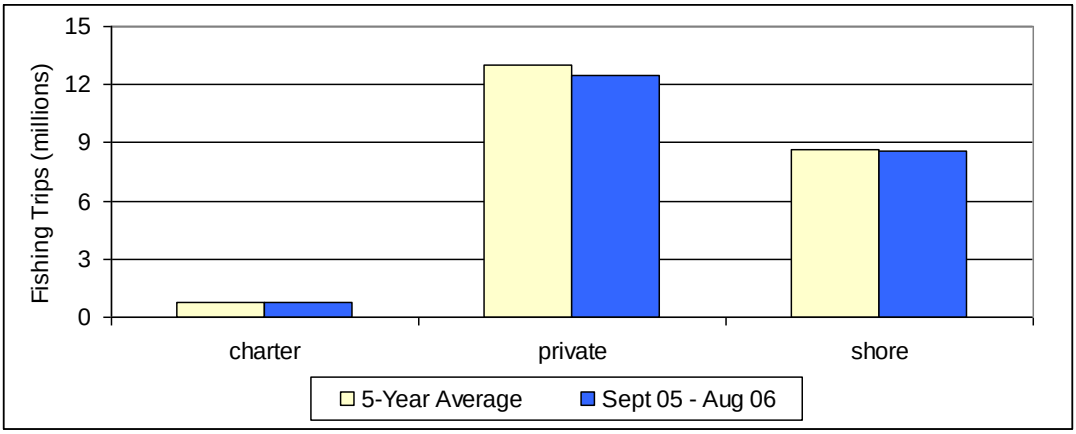

Figure 3.2-31. MRFSS fishing trips before and after Hurricane Katrina by mode.

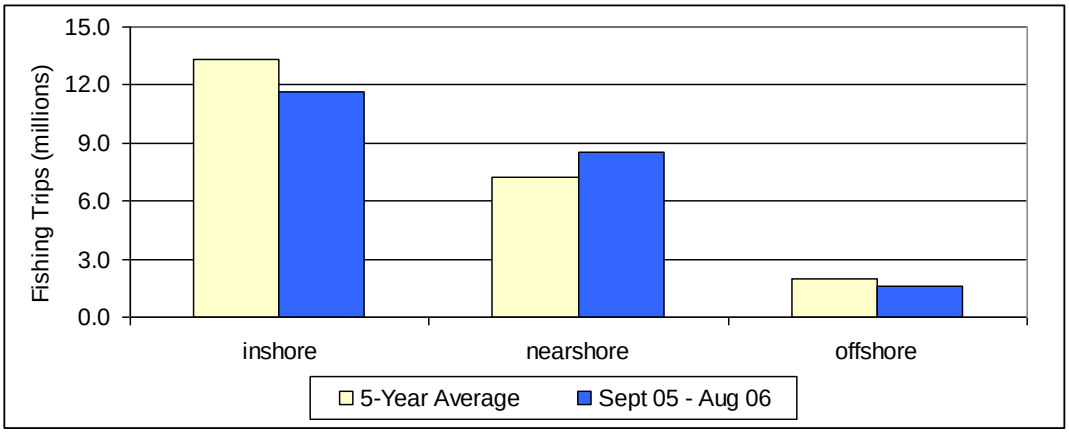

Figure 3.2-32. MRFSS fishing trips before and after Hurricane Katrina by area fished.

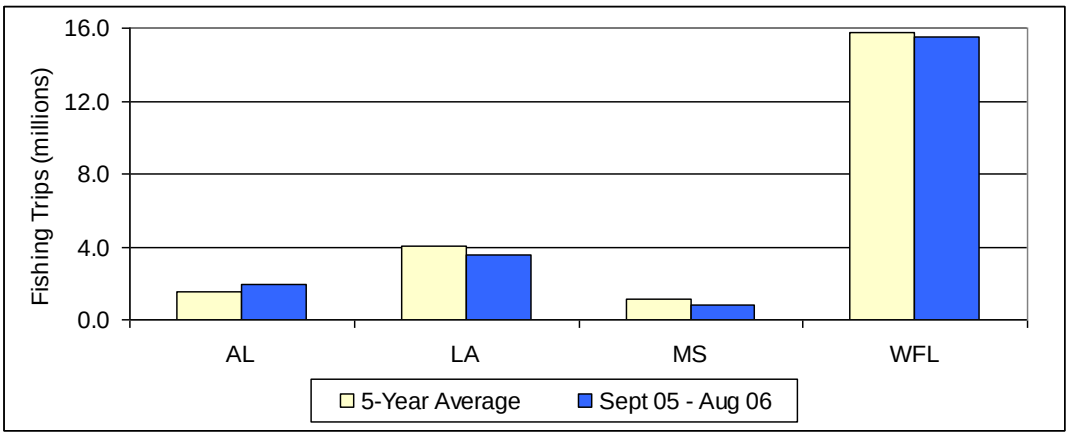

Figure 3.2-33. MRFSS fishing trips before and after Hurricane Katrina by state.

Total recreational fishing trips between September 2005 and August 2006 decreased by 11 percent in Louisiana, 32 percent in Mississippi, and 1.5 percent in Florida when compared to the previous 5-year averages (Figure 3.2-33). Overall fishing trips in Alabama between September 2005 and August 2006 increased by 22 percent when compared to the previous 5-year average.

3.2.2.1.4 Headboat Survey effort estimates

The NMFS Southeast Fisheries Science Center's Headboat Survey reports fishing effort in angler days rather than in number of trips taken. The number of days anglers have spent fishing on headboats has declined over the past 20 years (Figure 3.2-34). The total number of days anglers spent fishing in 2005 was 241,000. The number of days anglers spent fishing in 2005 declined in all areas except the Florida Keys (Figure 3.2-35). No data were available for Louisiana during 2004 and 2005. The number of days anglers spent fishing in the Florida Keys and off of northwest Florida between September and December 2005 was comparable to the previous 5-year average for that same period (Figure 3.2-36). The number of days anglers spent fishing off Texas and west Florida was substantially lower than the previous 5-year average. The number of days anglers spent fishing off west Florida declined by 26 percent and off Texas by 32 percent.

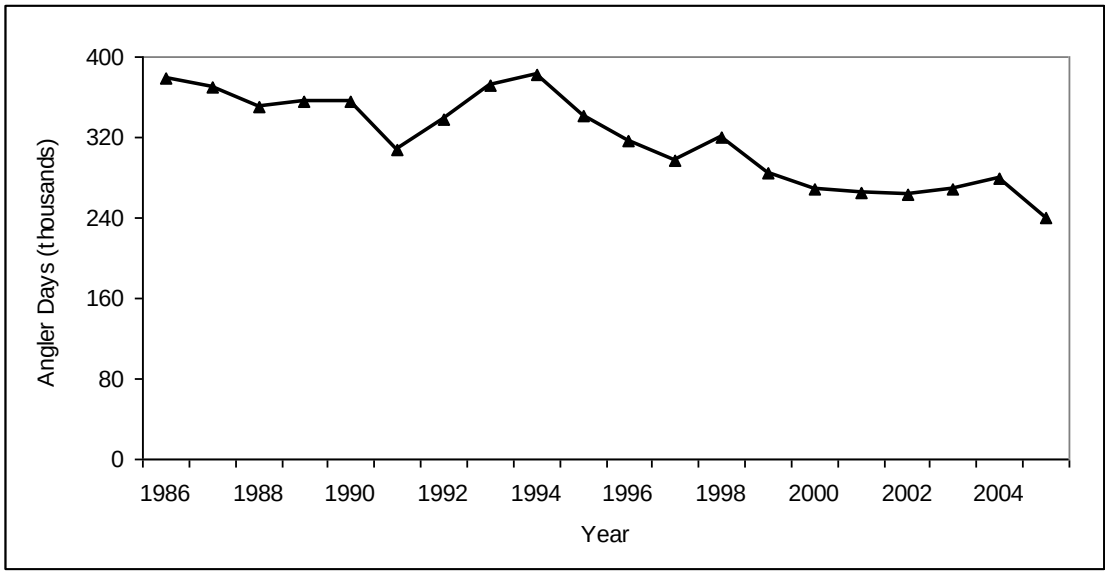

Figure 3.2-34. Total number of days anglers fished on headboats, 1986–2005.

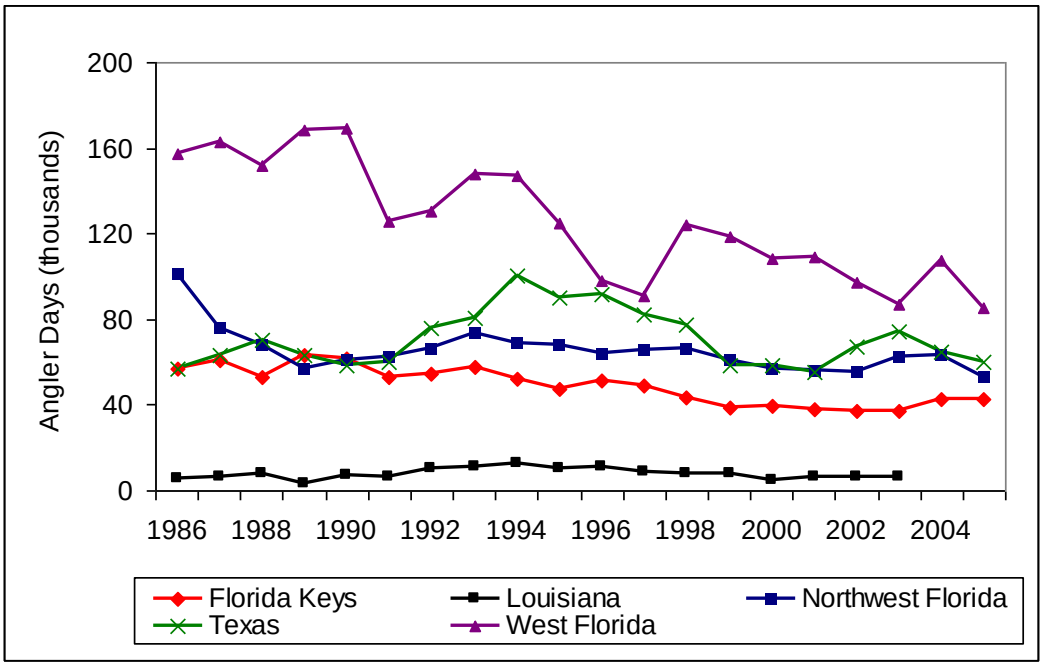

Figure 3.2-35. Total number of days anglers fished on headboats, 1986–2005, by area.

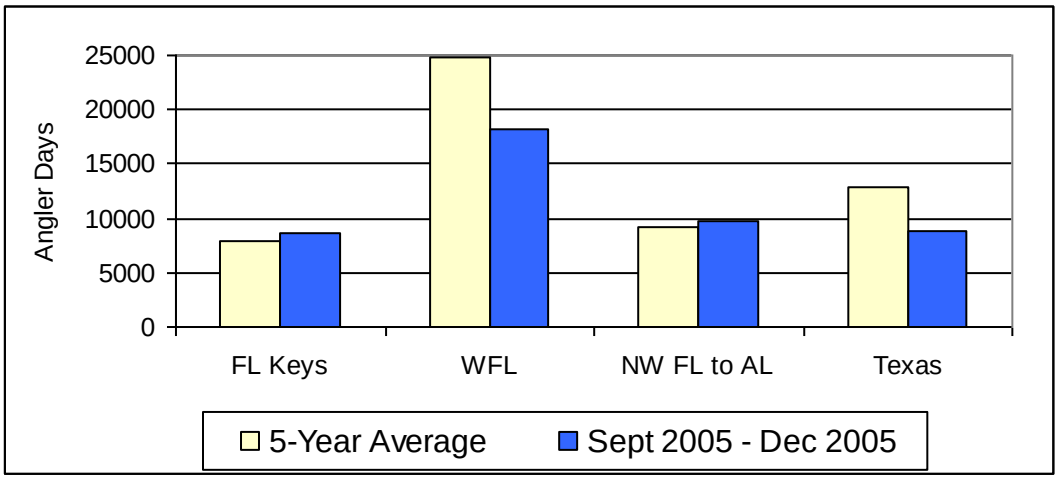

Figure 3.2-36. Total number of days anglers spent fishing before and after Hurricane Katrina by area.

3.2.2.2 Estimated charter boat losses

The National Association of Charterboat Operators surveyed 926 charter boat operators about the impacts of the 2005 hurricanes on their operations. Information from this survey indicates the overall projected economic loss to the charter boat fleet across all five Gulf states in the affected areas totaled an estimated $124.9 million. Included in this value are: the gross revenue associated with trips lost immediately after the storms and the associated reduction in the gross income of support personnel (e.g., deckhands, hired captains, boat cleaners, fish cleaners, and booking agents); the projected gross income reportedly lost the year following the storms; the value of physical loss or damage to vessels; the value of a fishing lodge that was destroyed in Louisiana; and the value of lost tackle from Louisiana vessels. The authors of the study indicate this estimate may be low because it does not account for possible physical loss to the 794 charter boat operators who did not participate in the survey (Walker et al. 2006).

This study reported 419 charter boat vessels were affected by damaged or destroyed marinas, 97 marinas were temporarily closed, 16 marinas were permanently closed, and seven marinas were sold for private development. The value of waterfront property has increased significantly over time, providing increased incentive for private development and threatening the ability of charter boat fleets to access coastal waters (Walker et al. 2006).

3.3 Hurricane-related obstructions, hazards and debris that could impact fishermen

Marine debris and obstructions have significantly impacted Gulf of Mexico fisheries since the 2005 hurricane season. The storms caused millions of tons of terrestrial debris to be washed into nearshore, coastal, and even offshore areas, adding to the wreckage of oil rigs and other permanent offshore structures. Although many obstacles have been marked, much of the debris outside primary navigation routes remains, posing a hazard to fishing vessels. NOAA and other agencies have taken a number of actions to address the impacts of marine debris on Gulf of Mexico fishermen.

3.3.1 Regulatory actions to address hazards

Immediately following the hurricanes, the states of Louisiana, Alabama, and Mississippi asked NMFS to exempt shrimp fishermen from the regulatory requirement to use turtle excluder devices (TED) on their trawl nets because of excessive storm-related debris on shrimp fishing grounds. In response to these requests, NMFS issued six 30-day variances of the TED requirements between September 2005 and March 2006 for waters off those states. Initial variances were initially issued for 50 nautical miles. Subsequent variances were scaled back to 20 nautical miles, then 10 nautical miles, after determining the offshore debris remaining in those areas no longer reasonably precluded the use of TEDs in shrimp trawl gear.

3.3.2 Marine debris mapping, characterization, and removal

NOAA's Marine Debris Program, Office of Coast Survey, and NMFS have partnered with the Gulf Coast states and local fishermen to design and conduct the largest nearshore and coastal bay surveying effort ever implemented by NOAA for hazards characterization and removal. NOAA's program—along with other federal, state, and local business efforts—is making progress in characterizing the location, size, and density of marine debris, and in removing the debris in some areas. Gulf Coast state marine resource agencies, in conjunction with Sea Grant and local businesses, also have undertaken efforts to identify and remove local debris. One example is the Calcasieu Marine Debris Surveying, Marking and Mapping Project.[10]

NOAA's primary debris mapping/characterization effort is funded through $20 million allocated to NOAA's National Ocean Service through the fourth emergency supplemental appropriations bill passed by Congress in 2006. In addition to side-scan sonar mounted on ships, the NOAA project team is using autonomous survey vessels, which run side-scan sonar and single beam aboard a 15-foot autonomous hull, as well as interferometric sonar. These tools allow for a wider swath and maximize ship time in the more shallow waters of the Gulf of Mexico.

Some debris removal also is being completed as a result of the 2006 supplemental funding allocated to NMFS to restore and rehabilitate oyster beds and shrimp grounds and to monitor the recovery of Gulf of Mexico fisheries from the devastating impacts of the 2005 hurricanes (see Section 5.0). These funds, granted to the Gulf Coast states through the Gulf States Marine Fisheries Commission, are supporting small-scale removal efforts conducted largely by local fishermen. Other ongoing larger-scale removal efforts have been funded through the Federal Emergency Management Agency and the U.S. Coast Guard.

3.3.2.1 Marine debris mapping/characterization

The NOAA project team has mapped approximately 75 percent of the 754 square nautical miles currently designated for survey. To date,[11] surveys along the Alabama and Mississippi coast have been completed, and survey work in Louisiana is ongoing. However, significant amounts of marine debris are believed to be present in areas of Louisiana not covered by this survey.

Over 4,000 marine debris items have been mapped.[12] Water clearance data have been collected on about 90 percent of these items, and 49 percent of the items with water clearance data have estimated less than 5 feet of clearance between the top of the debris item and the water surface (measured as Mean Lower Low Water [MLLW])[13]. The large number of debris items near the water surface presents a hazard not only to large vessels, but also to smaller boats.

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[10] Details about this project are available online at http://www.laseagrant.org/debris/.
[11] May 8, 2007.
[12] The total of marine debris hits mapped is smaller than the total hits surveyed to date, because the data must be reviewed and processed—a time-consuming effort. On average, it takes about 3 weeks from the time an area is surveyed to the time the survey data is posted on the project website.
[13] The MLLW definition is available online at http://tidesandcurrents.noaa.gov/mllw.html.

Volume data have been collected on about 75 percent of the marine debris items. About 20 percent of the items for which volume data are known fall into the small size category,[14] about 57 percent of these items are in the medium size category,[15] and the remaining 23 percent of these items are in the large volume category.[16]

Survey areas were chosen based on input from Gulf Coast state marine resource agencies, local U.S. Coast Guard offices, the U.S. Fish and Wildlife Service, and local fishermen. Areas to be surveyed were prioritized based on stakeholders' estimation of where debris is most concentrated and where mapping, characterization, and removal efforts will provide the greatest benefit to local fishermen (specifically, the shrimp fleet).

Figure 3.3-1 provides a visual summary of marine debris density in the areas surveyed. The number of marine debris items identified by the survey varies greatly from area to area, ranging from 724 objects in Bay St. Louis, Mississippi, to less than 10 objects in other areas, such as Mullet Point, Alabama. Translated into marine debris density, Bay St. Louis has nearly 84 items per square nautical mile surveyed, and Mullet Point has 0.15 items per square nautical mile surveyed. Other areas of high marine debris density are Gulfport and Biloxi/Ocean Springs, which experienced severe infrastructure damage from Katrina and had some infrastructure washed out to sea. The density map in Figure 3.3-1 does not cover the entire area affected by Hurricane Katrina. Much of the Louisiana coastline is not covered by this survey.

[14] Small is defined as a volume of less than 10 cubic feet.
[15] Medium is defined as a volume of 10 to 100 cubic feet.
[16] Large is defined as volume greater than 100 cubic feet.

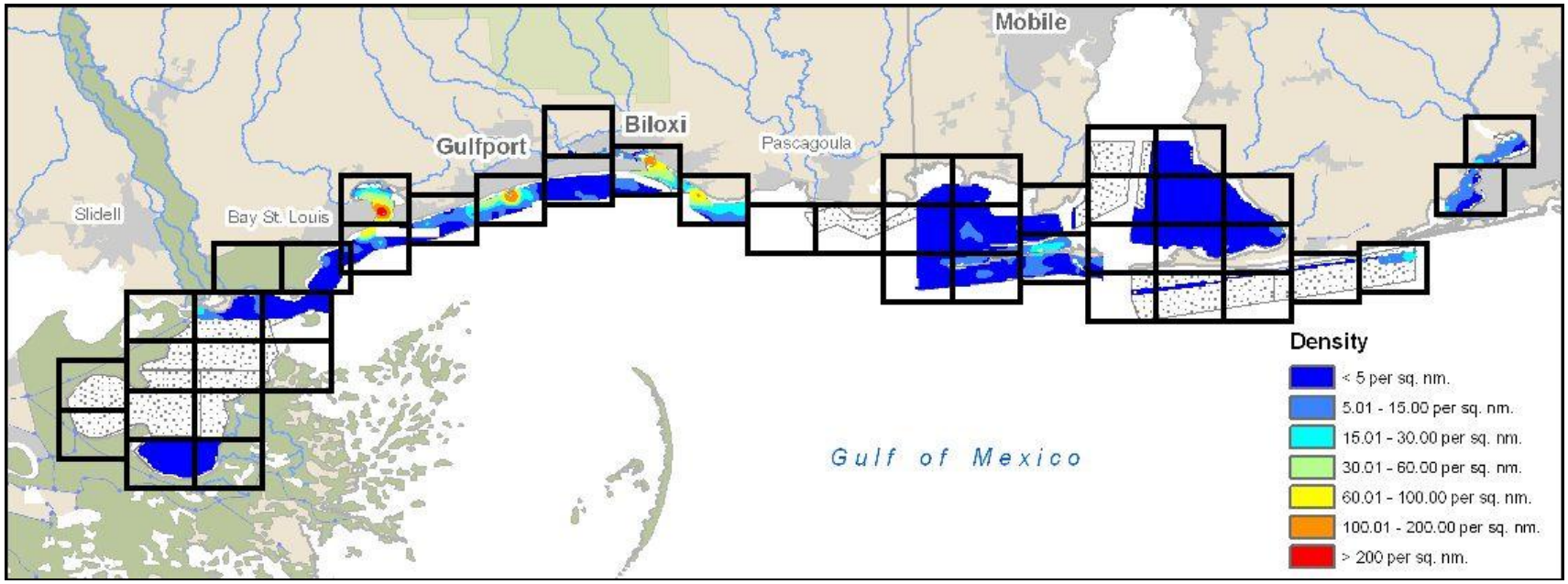

Figure 3.3-1. Density map of marine debris in areas surveyed.

The size of marine debris distribution also varies from area to area. For example, consider the marine debris size distribution for Biloxi Bay, Mississippi, and for Gulfport, Mississippi—two areas with a high density of marine debris. In Biloxi Bay, about 36 percent of the surveyed debris is categorized as small, 54 percent as medium, and only 10 percent as large. In contrast, only about 4 percent of the debris surveyed in Gulfport is categorized as small, 47 percent as medium, and 49 percent as large. The size of debris distributed within various geographic areas may be an important consideration in the marine debris removal strategies implemented by Gulf Coast states. Fifty size-distribution histograms have been disseminated for important coastal areas.

The large number of marine debris items surveyed, along with information on the size, density, and surface proximity of these items, strengthens the anecdotal information provided by local fishermen after the 2005 hurricane season regarding the damaging impacts of marine debris on their fishing operations, and indicates that marine debris is a significant problem.

3.3.2.2 Marine debris removal

The Federal Emergency Management Agency has funded the U.S. Coast Guard to conduct marine debris removal projects in some Gulf Coast state waters, particularly off Mississippi, where the presence of significant amounts of debris threatens fishermen's safety. Figure 3.3-2 shows areas where the U.S. Coast Guard had removed marine debris as of April 30, 2007.

The additional marine debris removal projects funded through the Gulf States Marine Fisheries Commission grant will begin once NOAA concludes its survey operations and the states complete the contract process (see Section 5.0). The grant project area extends from Galveston Bay, Texas, to Waccasassa Bay, Florida, but debris removal efforts under this grant are concentrated on areas off the coasts of Alabama and Louisiana.

Florida's Monroe County Division of Marine Resources, in concert with the Florida Fish and Wildlife Conservation Commission and the Federal Emergency Management Agency, reported impressive debris recovery efforts following the 2005 hurricane season. Principal recovery efforts focused on the removal of lobster traps and approximately 500 displaced derelict vessels measuring up to 80 feet in length. This debris is expected to have directly impacted seagrass beds, mangrove wetlands, and hard bottom habitats of the Florida Keys National Marine Sanctuary. However, such impacts have not been quantified. A total of 45,129 abandoned and lost lobster traps have been recovered since the storm events, at distances of up to 15 miles from their points of origin.

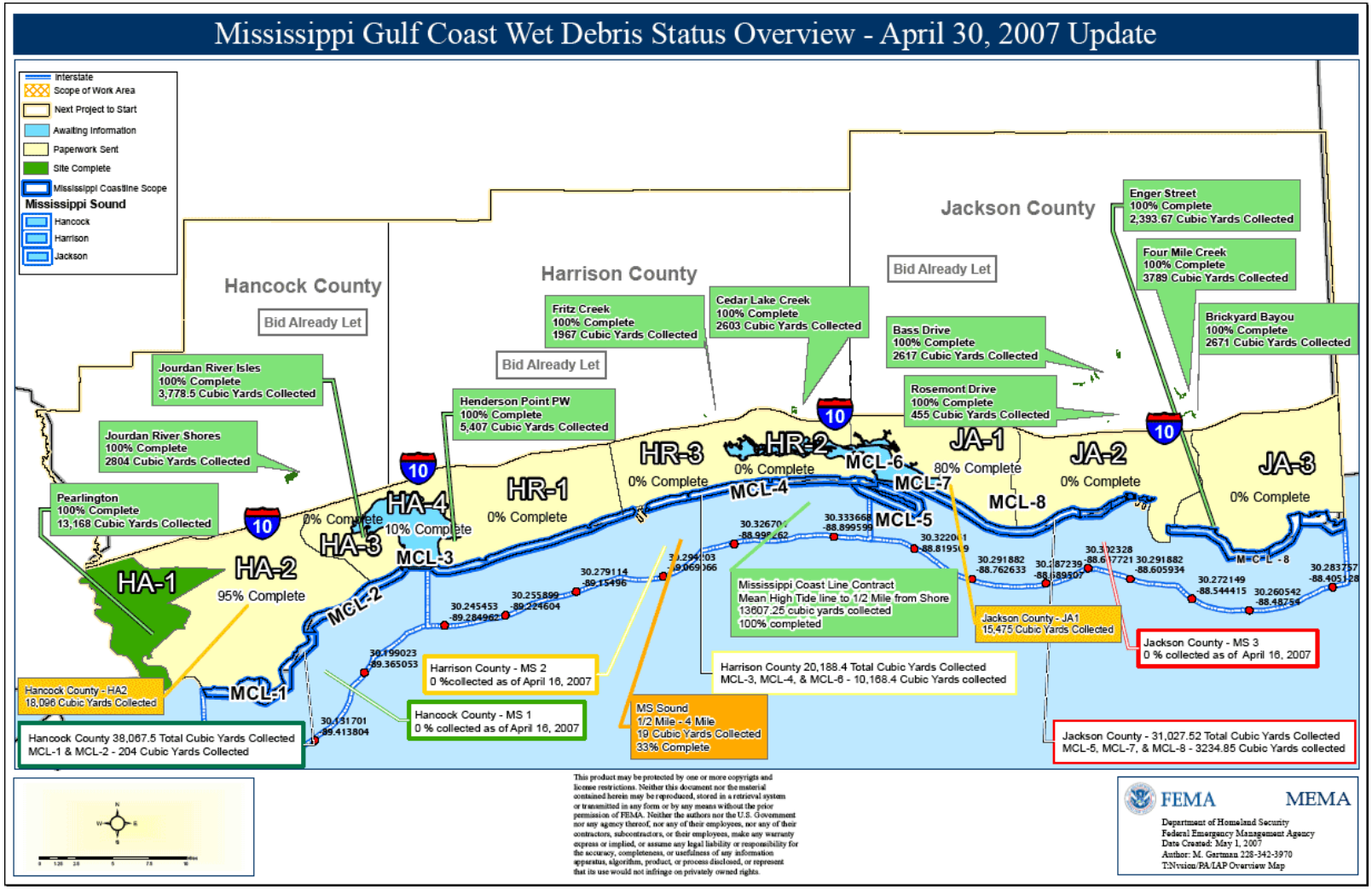

Figure 3.3-2. Status of U.S. Coast Guard marine debris removal activities as of April 30, 2007.

3.3.3 Marine debris products and outreach developed by NOAA

To date, the NOAA Gulf of Mexico Marine Debris Project website[17] has made available to the public geographic information system (GIS) maps for 70 percent of the areas currently designated for survey. The maps include single point features indicating the location of marine debris, and display location and water clearance height information on the debris items, as well as the debris volume category (i.e., small, medium, or large). The project website also provides sheet size maps, or an interactive GIS tool, which allows users to zoom into specific areas of interest. The website is visited by an increasing number of users from the Gulf of Mexico region, as well as others outside the region.

Fishermen and other stakeholders participated in workshops held in Biloxi, Mississippi, and in Louisiana to solicit feedback on prototype GIS and web-based products. Furthermore, after the project website was launched, NOAA conducted a series of meetings to request additional comments and suggestions, which have since been incorporated into project products.

The project team has established a rotation regime in the Gulf of Mexico (with an office in New Orleans), and maintains nearly constant presence in the region. Team members continue to meet with stakeholders, coordinate outreach efforts, and provide much needed on-site support to project customers. Working closely with the Louisiana and Mississippi/Alabama Sea Grant programs, the team has completed planning for a comprehensive outreach program for fishermen and boaters in those Gulf Coast states. Outreach work has been initiated and will continue into the future.

4 IMPACTS BY STATE

4.1 Alabama

Alabama possesses about 500 square miles of marine and brackish waters, and about 54 miles of Gulf of Mexico coastline spanning two counties: Mobile and Baldwin. The state's commercial seafood industry is primarily located in these two counties, with the greatest concentration in Mobile County. Southwest Alabama also is a popular tourist destination, attracting vacationers from around the country who are interested in the area's many outdoor recreational activities, including recreational fishing.

Sections 4.1.1 and 4.1.2 summarize the immediate and short-term impacts of the unusually active 2005 hurricane season on Alabama's commercial and recreational fisheries. The 2005 storm events exacerbated impacts on fisheries already damaged by the direct landfall of Hurricane Ivan in August 2004. Chang et al. (2006) estimate that Alabama's seafood industry, including the charter boat sector, lost $112.3 million as a result of the 2005 hurricane season. This estimate includes damages to seafood dealer and processor facilities; commercial and charter vessel damages and removal; and lost wages, invoices, inventories, revenues, and future sales to dealers and processors, commercial vessels, and charter vessels. OSAA (2005, pers. comm.)

[17] http://gulfofmexico.marinedebris.noaa.gov/.

independently estimated the losses specifically assumed by seafood processing facilities at $30.2 million.

4.1.1 Commercial fisheries

Alabama's commercial fisheries contributed 2 percent of commercial landings and 6 percent of the value of commercial landings Gulf-wide in 2004 and 2005 (NMFS 2007a). These fisheries contributed 0.3 percent of total U.S. commercial landings and 1.3 percent of the total value of U.S. commercial landings, on average, from 1995 through 2004 (IAI 2007). The city of Bayou La Batre in Mobile County and the surrounding areas of Coden, Irvington, Grand Bay, and Theodore have historically been cited as the center of Alabama's seafood production, securing the position as the nation's top processor of blue crab meat and oysters, as well as a leader in the production of shrimp (IAI 2007).

4.1.1.1 Commercial landings

All commercial landings data for Alabama are collected by the Marine Resources Division of Alabama's Department of Conservation and Natural Resources (MRD/ADCNR) utilizing a trip ticket reporting system. Landings data collected through this system are submitted to the Fisheries Information Network (FIN) and ultimately to NMFS for inclusion in the federal landings database. Because this trip ticket reporting system was not initiated until late 2000, the trip level information presented here begins with the 2001 calendar year.

Alabama's commercial fisheries landed a mean of 25.5 million pounds of seafood valued at $38.6 million in the 4 years preceding the 2005 hurricane season (2001–2004) (Table 4.1-1). These landings were calculated from more than 31,000 commercial trips, as reported by 106 Alabama seafood dealers.

Table 4.1-1. Alabama total seafood landings and trip summary. Source: MRD/ADCNR.

Year	Landings (lbs)	Value	# of Reporting Dealers	# of Reported Commercial Trips
2001	25,717,162	$44,328,835	95	31,953
2002	23,849,805	$35,850,022	103	33,652
2003	25,616,356	$36,780,728	110	29,507
2004	26,911,403	$37,406,609	115	29,109
2005	24,029,812	$39,673,028	98	25,915
2006[18]	34,052,303	$48,565,403	85	29,089
2001-2004 Mean	**25,523,682**	**$38,591,549**	**106**	**31,055**

The number of fishing trips decreased 17 percent in 2005 from the 2001–2004 mean, resulting in a 6 percent reduction in total landings and a 3 percent increase in total value (Table 4.1-2). Both

[18] Preliminary data.

landings and number of fishing trips decreased 11 percent between 2004 and 2005, while total value increased 6 percent. But landings, number of fishing trips, and value increased between 2005 and 2006. Data for 2006 show a 33 percent increase in pounds landed and a 26 percent increase in value relative to the 2001–2004 mean, with a 6 percent decrease in the number of reported trips. The number of reporting seafood dealers has declined since 2004, and remained 20 percent below the 2001–2004 mean in 2006.

Table 4.1-2. Percent change in Alabama seafood landings. Source: MRD/ADCNR.

Comparison	2005 Change from 2001-2004 Mean	2006[18] Change from 2001-2004 Mean	2005 Change from 2004	2006[18] Change from 2004	2006[18] Change from 2005
Landings (lbs)	-6%	33%	-11%	27%	42%
Value	3%	26%	6%	30%	22%
# of Reporting Seafood Dealers	-7%	-20%	-15%	-26%	-13%
# of Reported Commercial Trips	-17%	-6%	-11%	0%	12%

Seafood processing is a primary component of Alabama's seafood industry. Alabama seafood dealers processed, on average, 39.9 million pounds of product valued at over $140.3 million annually during the 4 years prior to the 2005 hurricane season. These processors reported 36.0 million pounds valued at $111.8 million during 2005, which represents losses of 10 percent and 20 percent, respectively, compared to the 2001–2004 mean. Although 2006 processed product data indicate an increase from 2005, pounds of product produced and product value remain 6 percent and 11 percent, respectively, below the 2001–2004 mean.

Oysters

In August 2004, Hurricane Ivan severely damaged up to 80 percent of Alabama's oyster reefs. The Alabama Department of Conservation and Natural Resources was in the process of replanting these reefs when Hurricane Katrina struck in 2005, damaging approximately 20 percent of the recovering reefs. The agency is currently using federal funds to replant state reefs.

Despite storm damages to Alabama's oyster reefs, both commercial oyster trips and landings have increased in recent years. The fishery landed 1.1 million pounds of oyster meat in 2005, valued at $3.1 million (Table 4.1-3), which represents a 35 percent and 83 percent increase over the 2001–2004 mean landings and value, respectively (Table 4.1-4). The number of commercial trips in 2005 and 2006 exceeded the 2001–2004 mean by 13 percent and 37 percent, respectively. Landings increased 16 percent between 2004 and 2005, but then decreased 11 percent between 2005 and 2006, even though the number of reported trips increased 22 percent in 2006. The value of landings increased 45 percent from 2004 to 2005, and another 19 percent from 2005 to 2006, reflecting an overall increase of 72 percent from 2004 to 2006. These value increases are supported by increases in the average annual price per pound.

Table 4.1-3. Alabama oyster landings and trip summary. Source: MRD/ADCNR.

Year	Category	Meat (lbs)[19]	Value	# of Reporting Dealers	# of Reported Commercial Trips	Price/lb
2001	Oyster	623,056	$1,326,805	35	12,670	$2.13
2002	Oyster	759,112	$1,600,875	33	14,212	$2.11
2003	Oyster	810,849	$1,622,934	35	10,861	$2.00
2004	Oyster	908,823	$2,112,521	37	12,716	$2.32
2005	Oyster	1,050,659	$3,053,519	35	14,216	$2.91
2006[18]	Oyster	939,614	$3,639,305	34	17,293	$3.87
2001-2004 Mean		**775,460**	**$1,665,784**	**35**	**12,615**	**$2.15**

Table 4.1-4. Percent change in Alabama oyster landings. Source: MRD/ADCNR.

Comparison	2005 Change from 2001-2004 Mean	2006[18] Change from 2001-2004 Mean	2005 Change from 2004	2006[18] Change from 2004	2006[18] Change from 2005
Landings (lbs)	35%	21%	16%	3%	-11%
Value	83%	118%	45%	72%	19%
# of Reporting Seafood Dealers	0%	-3%	-5%	-8%	-3%
# of Reported Commercial Trips	13%	37%	12%	36%	22%
Price/lb	35%	80%	25%	67%	33%

Historically, Alabama has been considered a national leader in processed oyster products, relying heavily on the harvest of oysters from neighboring states, particularly Mississippi, Louisiana, and Texas. During 2001 through 2004, Alabama processed an average of just under 4.9 million pounds of oyster meat valued at over $21.9 million per year. Over 80 percent of the oysters processed in Alabama during this period were obtained from reefs outside the state's jurisdiction. Oyster meat production in 2005 declined 35 percent from 2004, and 22 percent from the 2001–2004 mean. The value of oysters processed in 2005 declined 27 percent from 2004, but only 6 percent from the 2001–2004 mean. Oyster meat production remained constant from 2005 to 2006, whereas the value of processed product increased 17 percent during that same period.

Alabama oyster landings have increased over mean pre-storm landings. This trend is influenced more by anthropogenic factors than by the health of Alabama's oyster reefs. While the demand for oysters remains high, the current Gulf of Mexico oyster supply is extremely limited due to the loss of product from Mississippi and Louisiana. The high oyster demand, coupled with

[19] Oyster landings are presented in pounds of meat (excludes shell weight).

record dockside prices, has fueled the increased harvest rate in Alabama. This is apparent from examining the annual mean prices. Mean prices during 2006 reflect an 80 percent increase over the 2001–2004, pre-storm mean. In 2005, the MRD/ADCNR allowed highly monitored and restricted mechanical dredging for the first time on Alabama's public oyster reefs to help ease the out-of-state product losses on Alabama oyster processors, and to aid in the cultivation of the state's reefs. It is uncertain whether Alabama's oyster reefs can maintain current state product production rates in future years.

Shrimp

The shrimp fishery has historically been the greatest contributor to Alabama's commercial seafood landings. From 2001 through 2004, shrimp landings represented more than 60 percent of Alabama's total landings and more than 80 percent of Alabama's total landings values. During that time, the mean shrimp landings were about 15.9 million pounds, with a mean dockside value of $31.8 million (Table 4.1-5). In 2005, Alabama's shrimp landings increased only 3 percent from the 2001–2004 mean and reflected no change from 2004, whereas landings values reflected no change from the 2001–2004 mean, but increased 8 percent from 2004 (Table 4.1-6). The number of reported commercial shrimp trips decreased 45 percent in 2005 from the 2001–2004 mean and 30 percent from 2004. Alabama's greatest change was observed in 2006, when annual landings increased 51 percent from the 2001–2004 mean and 47 percent from 2004. Landings values for 2006 exhibited a similar trend, increasing 21 percent from the 2001–2004 mean and 30 percent from 2004. Although the number of reported commercial trips increased slightly (8 percent) between 2005 and 2006, it remained well below (41 percent) the 2001–2004 mean. The annual price per pound in 2006 ($1.61) was 20 percent less than the mean price per pound from 2001–2004 and 18 percent less than the price per pound in 2005.

Table 4.1-5. Alabama shrimp landings and trip summary. Source: MRD/ADCNR.

Year	Category	Landings (lbs)	Value	# of Reporting Dealers	# of Reported Commercial Trips	Price/lb
2001	Shrimp	16,413,708	$37,815,121	41	6,369	$2.30
2002	Shrimp	14,940,338	$29,534,614	53	6,009	$1.98
2003	Shrimp	15,851,697	$30,287,269	59	5,290	$1.91
2004	Shrimp	16,365,586	$29,550,370	64	4,307	$1.81
2005	Shrimp	16,308,250	$31,951,792	50	3,008	$1.96
2006[18]	Shrimp	23,976,346	$38,527,465	44	3,241	$1.61
2001-2004 Mean		**15,892,832**	**$31,796,844**	**54**	**5,494**	**$2.00**

Table 4.1-6. Percent change in Alabama shrimp landings. Source: MRD/ADCNR.

Comparison	2005 Change from 2001-2004 Mean	2006[18] Change from 2001-2004 Mean	2005 Change from 2004	2006[18] Change from 2004	2006[18] Change from 2005
Landings (lbs)	3%	51%	0%	47%	47%
Value	0%	21%	8%	30%	21%
# of Reporting Seafood Dealers	-8%	-19%	-22%	-31%	-12%
# of Reported Commercial Trips	-45%	-41%	-30%	-25%	8%
Price/lb	-2%	-20%	9%	-11%	-18%

Prior to 2005, Alabama shrimp processors produced an average of 28.2 million pounds of product valued at $93.8 million. In 2005, production decreased 6 percent by volume and 22 percent by value as compared to the historical average. When compared to 2004, production levels in 2005 fell 8 percent by volume and 12 percent by value. Shrimp production increased 14 percent by volume and 19 percent by value between 2005 and 2006. The volume of product processed in 2006 was 7 percent above pre-storm production levels even though the number of reporting seafood dealers was 19 percent below the 2001–2004 mean and product values remained 6 percent below average that year.

The 2005 hurricanes dealt another crippling blow to Alabama's shrimp fishery, which was already experiencing severe adverse economic impacts from low-priced shrimp imports and high fuel prices. Although Alabama shrimp landings increased in 2006 to a 15-year high, average annual prices reached record lows. For many months following the 2005 storm season, Alabama possessed the only ports between Alabama and western Louisiana/eastern Texas where shrimp could be offloaded, vessels could be refueled, and supplies could be purchased. Because landings location data refer to "point of first sale" and not to the area of harvest, it is likely that shrimp harvested in the impacted areas were transported to and offloaded in Alabama, resulting in increased landings. Additionally, personal communication with shrimp fishermen and seafood dealers indicate that shrimp aggregated in large volumes around hurricane debris fields and in other areas, making them easier to catch. Finally, the decrease in the number of active vessels also may have contributed to the increase in landings by increasing the catch per trip of those fishermen who were able to continue operating after the storm. This is supported by the low number of commercial trips reported with the corresponding increased landings.

Many Alabama processors were forced to close for several months following Hurricane Katrina because of flood-related damages. Returning to full operating capacity was difficult and often restricted by labor shortages. Shrimp fishermen were paid $1.30 per pound for head-on shrimp regardless of count size from 10–15 count up to 31–35 count. Alabama seafood dealers suggested through personal communication that this was done to encourage shrimpers to head their catches due to labor shortages in processing plants. Loss of market shares (i.e., consumers)

likely contributed to reduced prices. Alabama shrimp fishermen were afforded some relief when Saudi Arabia donated 600,000 gallons of fuel through Aramco Services, Inc. However, the ongoing competition created by shrimp imports, coupled with rising fuel costs and low dockside prices, continues to jeopardize the survival of Alabama's commercial shrimp industry.

Finfish

Alabama finfish landings declined in 2005 to 5.6 million pounds (Table 4.1-7), which is 7 percent below the 2001–2004 mean and 10 percent below 2004 landings (Table 4.1-8). The number of commercial finfish trips decreased 10 percent between 2004 and 2005. Despite this decrease, the value of finfish landings in 2005 increased 16 percent from the 2001–2004 mean and 2 percent from the 2004 value. Finfish landings and values increased 20 percent and 29 percent, respectively, between 2005 and 2006, even though the number of trips decreased 4 percent during that period. The annual price per pound has been increasing since 2004.

Table 4.1-7. Alabama finfish landings and trip summary. Source: MRD/ADCNR.

Year	Category	Landings (lbs)	Value	# of Reporting Dealers	# of Reported Commercial Trips	Price/lb
2001	Fish	6,205,539	$3,431,264	28	5,904	$0.55
2002	Fish	5,556,429	$3,167,017	31	7,111	$0.57
2003	Fish	6,123,657	$3,190,351	26	7,274	$0.52
2004	Fish	6,293,958	$3,897,319	25	6,723	$0.62
2005	Fish	5,636,297	$3,955,923	25	6,073	$0.70
2006[18]	Fish	6,778,869	$5,096,860	17	5,846	$0.75
2001-2004 Mean		**6,044,896**	**$3,421,488**	**28**	**6,753**	**$0.57**

Table 4.1-8: Percent change in Alabama finfish landings. Source: MRD/ADCNR.

Comparison	2005 Change from 2001-2004 Mean	2006[18] Change from 2001-2004 Mean	2005 Change from 2004	2006[18] Change from 2004	2006[18] Change from 2005
Landings (lbs)	-7%	12%	-10%	8%	20%
Value	16%	49%	2%	31%	29%
# of Reporting Seafood Dealers	-9%	-38%	0%	-32%	-32%
# of Reported Commercial Trips	-10%	-13%	-10%	-13%	-4%
Price/lb	24%	33%	13%	21%	7%

Alabama's processed finfish figures are limited by NMFS' definition of processed fish products. Only fish fillets that are stuffed and/or breaded, or fish processed for roe, are considered to be

processed products. Dress orders and gutted finfish are not considered to be processed product and thus are not included in this definition. Alabama processed, on average, 3.8 million pounds of fish products annually, valued at $7.2 million, from 2001–2004. The amount of fish products processed in the state was severely reduced in 2006 due to the closure of a large processing facility in Bayou La Batre. This closure was due, in part, to flood damage incurred during Hurricane Katrina, and the owners relocated to another state.

Overall, Alabama's commercial finfish fishery has remained stable between 2001 and 2006. Poor weather conditions likely limited fishing opportunities and reduced landings during 2005. However, landings and dockside values rebounded in 2006, despite a reduction in the number of commercial finfish trips.

Crabs, lobsters, and other invertebrates

Alabama's commercial crab landings were greatly impacted during the 2005 hurricane season. Crab landings declined to 1.0 million pounds in 2005 (Table 4.1-9), which represents a 63 percent reduction from the 2001–2004 mean and a 69 percent reduction from the amount of crab landed in 2004 (Table 4.1-10). The number of commercial trips reported in 2005 declined 57 percent from the 2001–2004 mean and 49 percent from 2004. The 129 percent increase in landings between 2005 and 2006 suggests the fishery is recovering. However, 2006 landings and value are still 16 percent and 22 percent, respectively, below the 2001–2004 mean. The number of commercial trips reported in 2006 was 56 percent below the 2001–2004 mean.

Table 4.1-9. Alabama crab landings and trip summary. Source: MRD/ADCNR.

Year	Category	Landings (lbs)	Value	# of Reporting Dealers	# of Reported Commercial Trips	Price/lb
2001	Crabs	2,468,184	$1,746,485	31	7,636	$0.71
2002	Crabs	2,577,879	$1,492,110	35	6,954	$0.58
2003	Crabs	2,820,896	$1,643,712	32	6,733	$0.58
2004	Crabs	3,334,022	$1,806,757	31	5,760	$0.54
2005	Crabs	1,024,390	$663,835	23	2,909	$0.65
2006[18]	Crabs	2,350,832	$1,296,957	19	3,007	$0.55
2001-2004 Mean		**2,800,245**	**$1,672,266**	**32**	**6,771**	**$0.60**

Table 4.1-10. Percent change in Alabama crab landings. Source: MRD/ADCNR

Comparison	2005 Change from 4yr Mean	2006[18] Change from 4yr Mean	2005 Change from 2004	2006[18] Change from 2004	2006[18] Change from 2005
Landings (lbs)	-63%	-16%	-69%	-29%	129%
Value	-60%	-22%	-63%	-28%	95%
# of Reporting Seafood Dealers	-29%	-41%	-26%	-39%	-17%
# of Reported Commercial Trips	-57%	-56%	-49%	-48%	3%
Price/lb	9%	-8%	20%	1%	-15%

Prior to 2005, Alabama produced 3.1 million pounds of crab products (crab meat, stuffed crabs, and crab cakes) valued at $15.5 million per year (mean 2001–2004). About 1.1 million pounds of this product was crab meat. Alabama produced 16 percent less crab product in 2005 compared to the 2001–2004 mean, and experienced a 36 percent decline in product value. Production increased 25 percent between 2005 and 2006, but product value in 2006 remained 21 percent below the 2001–2004 mean.

About 60 percent of the crab meat produced in Alabama is derived from out-of-state sources, including Louisiana fisheries. Damages to out-of-state facilities contributed to the decreased production levels immediately following the storms. Landings trends appear to be related to trends in fishing effort rather than to resource abundance, as crab stocks appear to be stable. Inclement weather greatly reduced fishing effort in 2005, and the reduced effort in the shrimp fishery is believed to be at least partially responsible for the reduction in crab effort observed in 2006. Shrimp fishermen are required to possess a commercial crab license to retain crabs taken as bycatch in the shrimp fishery in an amount that exceeds the recreational limit. Competition from imported crab meat is suspected to have affected domestic crab prices in recent years, which reached a low of $0.55 per pound of live crab (annual mean) during 2006.

Conclusion

Alabama's fish stocks generally appear healthy. However, poor market prices, rising fuel costs, and storm-related impacts continue to threaten the viability of Alabama fishermen. Recent increasing trends in the landings and values of some fisheries may suggest that Alabama has recovered from the devastating impacts of the 2005 hurricane season. However, these data could be misleading. In the months following the storms, Alabama ports were virtually the only ports operational where fishermen from Alabama to western Louisiana/eastern Texas could refuel, unload, and obtain supplies. The accessibility of these ports, along with a decrease in the number of working vessels and high market demand, may be responsible for the increasing trends. If this is correct, then these trends may be temporary. Recovery efforts are ongoing, as oyster reefs are being replanted and valuable habitat is being reclaimed and/or enhanced with the

assistance of emergency funds. Alabama fishermen will soon participate in supplemental programs to further aid their recovery. Assistance, such as the fuel grant donated by Saudi Arabia through Aramco Services, Inc., has helped shrimp fishermen recover lost revenues. However, additional resources are needed.

4.1.1.2 Commercial fishing capacity

4.1.1.2.1 Commercial licenses

The Marine Resource Division of Alabama's Department of Conservation and Natural Resources issues all commercial seafood licenses in Alabama. These licenses are issued annually based on the fiscal year (October 1 through September 30), with the ending year defining the license year (i.e., the 2006 license year is based on the period October 1, 2005 through September 30, 2006). Table 4.1-11 describes the number of licenses issued annually by license type. The table describes the number of participants by fishery and not the total number of state participants, because many fishermen purchase multiple licenses.

Table 4.1-11. Summary of Alabama commercial seafood licenses. Source: MRD/ADCNR.

License Type	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY01-04 Mean
Oyster	770	772	662	665	630	675	717
Oyster Dredge	20	18	14	26	16	72	20
Shrimp	1,390	1,350	1,166	1,029	942	782	1,234
Crab	184	179	162	174	164	123	175
Gill Net	156	153	139	130	126	113	145
Mullet/Mackerel Endorsement	110	101	94	94	85	81	100
Hook-and-Line	83	120	103	112	97	85	105
Purse Seine	11	8	7	7	0	0	8
Seafood Dealer	569	601	625	691	662	605	622
Seafood Dealer Vehicle	24	34	29	40	42	31	32
Live Bait	40	39	45	45	38	40	42
Yearly Total	**3,357**	**3,375**	**3,046**	**3,013**	**2,802**	**2,607**	**3,198**

Comparisons between license years are detailed in Table 4.1-12. Total license sales have declined from 2001 through 2006, reflecting an overall reduction of 22 percent during that period. Sales of most types of licenses exhibit this declining trend. Anecdotal information indicates fishermen will continue to leave the seafood business for higher paying construction and restoration jobs, which have increased in availability since the 2005 hurricane season.

Table 4.1-12. Percent change in Alabama's license sales. Source: MRD/ADCNR.

License Type	FY05 Change from FY01-04 Mean	FY06 Change from FY01-04 Mean	FY05 Change from FY04	FY06 Change from FY04	Change FY05-FY06	Change FY01-FY06
Oyster	-12%	-6%	-5%	2%	7%	-12%
Oyster Dredge	-18%	260%	-38%	177%	350%	260%
Shrimp	-24%	-37%	-8%	-24%	-17%	-44%
Crab	-6%	-30%	-6%	-29%	-25%	-33%
Gill Net	-13%	-22%	-3%	-13%	-10%	-28%
Mullet/Mackerel Endorsement	-15%	-19%	-10%	-14%	-5%	-26%
Hook-and-Line	-7%	-19%	-13%	-24%	-12%	2%
Purse Seine	-100%	-100%	-100%	-100%	0%	-100%
Seafood Dealer	7%	-3%	-4%	-12%	-9%	6%
Seafood Dealer Vehicle	32%	-2%	5%	-23%	-26%	29%
Live Bait	-10%	-5%	-16%	-11%	5%	0%
Yearly Total	-12%	-18%	-7%	-13%	-7%	-22%

Oyster Fishery

The number of oyster licenses issued during 2006 was 12 percent below the number of licenses issued in 2001 (Table 4.1-12). License sales decreased 5 percent between 2004 and 2005 following Hurricane Ivan, but increased 7 percent between 2005 and 2006 following the 2005 storm season. The 2006 increase was likely caused by record oyster prices and the authorization of restricted dredging activities on public reefs during 2005. All individuals wishing to participate in the oyster dredge fishery are required to purchase an oyster license before they can purchase a dredge license. The number of oyster dredge licenses issued in 2006 was 350 percent greater than the number of dredge licenses issued in 2005.

Shrimp Fishery

Sales of commercial shrimp licenses declined 44 percent between 2001 and 2006 (Table 4.1-12). Sales decreased 8 percent between 2004 and 2005 following Hurricane Ivan, then another 17 percent between 2005 and 2006 following the 2005 storm season, resulting in a total reduction of 24 percent between 2004 and 2006. The number of shrimp licenses sold in 2006 was 37 percent below the 2001–2004 mean. Resident sales were primarily responsible for the decline, decreasing 33 percent between 2004 and 2005 in contrast to non-resident sales, which increased 27 percent during the same period. However, resident and non-resident sales decreased 11 percent and 33 percent, respectively, between 2005 and 2006. Many recreational fishermen,

particularly those who are Alabama residents, purchase commercial shrimp licenses so they may exceed the recreational creel limit. These fishermen most commonly fish in vessels less than 30 feet in length. Sales of commercial shrimp licenses issued for vessels greater than 30 feet in length decreased 23 percent between 2004 and 2006, and 41 percent since 2001.

The 2005 hurricanes likely contributed to the decline in sales of commercial shrimp licenses. But poor dockside prices are the most likely cause for the decline, which began before the 2004 and 2005 hurricanes struck. Since 2001, shrimp prices have consistently decreased and fuel prices have increased. Many shrimp fishermen have been unable to catch enough shrimp to cover their operational expenses, pay their vessel loans and insurance, and compensate their crews. Consequently, many fishermen have been forced to tie up or sell their vessels, and many vessels have been repossessed by brokers.

Finfish Fishery

Alabama's commercial finfish fishermen must possess one of the following three license types: gill net, hook-and-line, or purse seine. Additionally, gill net fishermen who wish to target Spanish mackerel or mullet during the roe season must purchase a mullet/mackerel endorsement.

Entry to the gill net fishery is limited. Participants must either demonstrate (through filed Alabama tax returns) that 50 percent of their prior annual gross income was derived from commercial fishing or that they filed an Alabama tax return for the prior year. Gill net permits are classified according to the method of qualification. Non-resident fishermen who operate in waters outside Alabama's jurisdiction and wish to land their catch in Alabama must possess either an Alabama commercial fishing license or a license to sell seafood in their state of residency. The number of gill net licenses issued by the state declined 13 percent between 2004 and 2006, and 28 percent between 2001 and 2006 (Table 4.1-12). Alabama residents held 96 percent of the gill net licenses issued in 2006. The number of mullet/mackerel endorsements issued by the state shows a similar trend, decreasing 14 percent between 2004 and 2006, and 26 percent between 2001 and 2006.

Sales of hook-and-line licenses also have declined. Sales in 2006 were 24 percent below sales in 2004, and 19 percent below the 2001–2004 mean (Table 4.1-12). Alabama issues few purse seine licenses. Only 8 purse seine licenses were issued, on average, during the 4 years prior to 2005, and all of those licenses were issued to vessels operating out of Mississippi and Louisiana. No purse seine licenses have been issued to residents since 2001, and no purse seine licenses have been issued to any fisherman since 2004.

Crab Fishery

Data on sales of commercial crab licenses in 2006 suggest the number of participants in this fishery is declining (Table 4.1-12). The number of crab licenses issued in 2005 was only 6 percent below the 2001–2004 mean and the 2004 value. However, license sales decreased another 25 percent between 2005 and 2006, causing 2006 sales to fall 30 percent below the

2001–2004 mean. Although this decreasing trend can be partly attributed to poor dockside prices and hurricane impacts, it is likely also related to a decrease in the volume of shrimp licenses issued. Shrimp fishermen who retain crabs taken incidental to their shrimp trawl operations are required to possess a commercial crab license in order to exceed the recreational limit.

4.1.1.2.2 Commercial vessels

Several studies have estimated the number of vessels damaged, destroyed, and/or beached in Bayou La Batre following Hurricane Katrina. Chang et al. (2006) cited several sources of strandings data, one estimating 48 vessel strandings and another estimating 80 vessel strandings. IAI (2007) reported that Hurricane Katrina damaged or destroyed between 72 and 80 vessels, including 60 percent of the commercial shrimp boats in Bayou La Batre. U.S. Coast Guard data indicate Hurricane Katrina stranded or destroyed 48 commercial vessels, 47 of which were fishing vessels. Eleven of those 48 vessels were destroyed, and the remaining 37 were ultimately returned to the water.

4.1.1.3 Commercial fishing-related infrastructure and services

Seafood dealers and processors are the primary components of seafood infrastructure. Alabama does not distinguish between wholesalers, retailers, and processors when licensing seafood dealers. In accordance with the Alabama Code, "Any person, firm, or corporation who engages in the selling, brokering, trading, bartering, or processing of any fresh or frozen seafood, whether on a consignment basis, is a seafood dealer …" This includes all retailers, wholesalers, processors, and chain grocers. In recent years, an increasing number of Alabama shrimp fishermen have purchased seafood dealer licenses, as have individuals "pedaling" seafood, because both are able to make a better profit by selling directly to the public given the continual downward trend in dockside prices.

The mean number of seafood dealer licenses Alabama issued annually from 2001 through 2004 was 622 (Table 4.1-11). Of these seafood dealers, 106 actively reported seafood landings to the Alabama Department of Conservation and Natural Resources during that period. During 2004, Alabama issued 691 dealer licenses, and collected landings reports from 115 seafood dealers. In 2006, only 605 dealer licenses were issued and 85 dealer reports were collected, representing a 12 percent decrease in the number of licenses issued between 2004 and 2006 (Table 4.1-12) and a 26 percent decrease in the number of dealers reporting seafood landings during that period.

The Alabama Department of Public Health (ADPH) requires all businesses processing or handling seafood to be permitted based on the product being processed or handled. Not all permitted processors actively process (peel, shuck, pick, etc.) seafood. Some of these processors are simply permitted to repack seafood. Three types of such processing permits are issued: shellfish, crab, and general seafood. A single processor may possess more than one type of permit. To date in 2007, the ADPH has issued 48 shellfish, 17 crab, and 48 general seafood permits, compared to the 54 shellfish, 22 crab, and 45 general seafood processing permits issued

before the 2005 hurricane season. This represents an 11 percent decrease in shellfish permits, a 23 percent decrease in crab permits, and a 7 percent increase in general seafood permits. These data are only an index to total losses at the state level. As of May 2006, only 50 percent of commercial docking facilities and 67 percent of seafood processors had resumed operations (IAI 2007). Labor shortages directly following Hurricane Katrina continue to plague the recovery efforts of Alabama processors today. As a result, processors who are operational have found it difficult to handle the relatively high volume of seafood product coming from other areas in the Gulf that were more directly impacted by Hurricanes Katrina and Rita. Significant increases in construction costs have also slowed recovery efforts in this sector. Anecdotal information from seafood dealers indicates many of the "mom and pop" dealers who also process seafood product have found it difficult to meet the customer demand for processed product because of the labor shortage, and have lost sales to larger facilities that can pay higher wages.

IAI (2007) indicates greater progress has been made in recovering other components of fishing infrastructure, such as fuel docks, ice plants, gear suppliers, and transport operations. However, the availability of working waterfront (docks) remains a topic of concern. The availability of such property has been limited in recent years by competition from developers who want the valuable property for condominiums and hotels.

4.1.2 Recreational fisheries

Recreational angling and charter boat fishing generate millions of dollars in sales and revenue in Alabama each year (IAI 2007). Alabama's marine recreational fisheries harvested and released 4.9 million and 7.0 million finfish, respectively, during 2.0 million fishing trips in 2004, and 3.5 million and 5.3 million finfish, respectively, during 1.6 million fishing trips in 2005 (NMFS 2007a). These fisheries were responsible for about 7 percent of the marine recreational fishing trips made in the Gulf of Mexico in 2005 (NMFS 2007a).

The 2005 hurricanes struck southwest Alabama at a time when recreational fisheries were still recovering from the impacts of Hurricane Ivan, which made landfall in 2004. Although Alabama's charter fleet remained mostly intact following Hurricane Katrina (24 charter boats were damaged/destroyed), nearly 84 percent of charter boat operators received trip cancellations in the months following the storm, resulting in an estimated loss of over 5,000 trips valued at $5.3 million (Walker et al. 2006). Walker et al. estimate the total projected loss of Alabama's charter fleet at $20 million.

The decline in the number of recreational fishing trips off the Alabama coast observed during 2004 and 2005 was reversed in 2006. This trend is partly attributed to the state's condominium/hotel inventory, which has a positive relationship on the number of anglers fishing along Alabama's coast. Hurricane Ivan severely damaged or destroyed many condominiums and hotels in the fall of 2004. Alabama coastal communities needed the remainder of 2004 and 2005 to recover and achieve pre-Ivan condominium inventories.

4.1.2.1 Recreational catches

Table 4.1-13 summarizes Alabama recreational landings by fishing mode from 2000 through 2005. The mean of the annual landings recorded during that period was 7.7 million pounds. Landings were lowest in 2000 (5.9 million pounds) and highest in 2001 (9.6 million pounds). Storm activity could be responsible for the significant decrease in landings observed between 2001 and 2002 and between 2004 and 2005. However, no such decrease was observed between 2003 and 2004, the year Hurricane Ivan struck the Alabama coast.

Table 4.1-13. Alabama recreational harvest (pounds) by fishing mode, 2000–2005. Source: NMFS.

Year	Mode				
	Shore	Charter	Private/Rentals	Totals	% Difference
2000	1,039,357	1,099,129	3,710,205	5,848,691	--
2001	1,780,777	1,178,188	6,595,875	9,554,840	63.4
2002	973,724	1,393,762	4,513,445	6,880,931	-28.0
2003	1,311,570	1,424,115	5,574,404	8,310,089	20.8
2004	2,020,020	1,474,466	5,498,491	8,992,977	8.2
2005	970,539	1,071,534	4,753,731	6,795,804	-24.4
Mean	1,349,331	1,273,532	5,107,692	7,730,555	--

Charter landings increased steadily from 1.1 million pounds in 2000 to 1.5 million pounds in 2004, before decreasing to 1.1 million pounds in 2005 (Table 4.1-13). Almost 125,000 pounds (31 percent) of the 403,002-pound decrease observed in 2005 is attributed to decreased landings of three fish species: red snapper, gray triggerfish, and greater amberjack. These fish are commonly referred to as reef fish, as they are typically associated with reef habitats. The decrease in landings of these species may be attributed to Hurricane Ivan's negative impacts on Alabama's natural and artificial reefs. Ivan damaged or destroyed many privately constructed artificial reefs and moved large amounts of sediment, which may have been deposited on reef habitat. Local fish were physically displaced by the storm and could have relocated to areas where more suitable habitat remained.

The landings of shore anglers fluctuated greatly between 2000 and 2005, reaching lows in 2002 and again in 2005 (Table 4.1-13). The decreases in landings during 2002 and 2005 were likely caused by poor weather associated with storm events those years, in addition to storm-related damage to fishing access points (piers, bulkheads, etc.), which made it more difficult for the public to access the water. Large changes in the landings of shore anglers or of shore anglers and private boat fishermen influenced annual landings trends. For example, shore anglers landed just over 2.0 million pounds of fish in 2004, which represents a 708,450-pound increase from the

2003 shore mode harvest. The net increase in landings for all modes combined in 2004 was 628,888 pounds. Also, shore anglers landed 970,539 pounds of fish in 2005, which was 1,049,481 pounds less than this mode landed in 2004. The landings of all modes combined in 2005 were just under 2.0 million pounds less than the combined landings of those modes in 2004. The private/rental mode was responsible for the majority of the remaining shortfall in 2005. The decline in landings of this group also is attributed largely to reduced catches of red snapper, gray triggerfish, and greater amberjack.

Table 4.1-14 ranks the top 15 species recreationally harvested by Alabama charter fishermen from 2000 through 2005 according to pounds landed. With a few exceptions, the same species remained in the top 10 ranking each year during that period. Greater amberjack, king mackerel, and Atlantic sheepshead were identified as top 10 species in 5 of the 6 years. Spotted sea trout and Spanish mackerel were identified as top 10 species in 4 of the 6 years. Gag was identified as a top 10 species in just 2 of the 6 years.

Table 4.1-14. Rankings by weight (lbs) of the top 15 species landed in Alabama by charter fishermen, 2000–2005. Source: NMFS.

Fish Species	Annual Ranking					
	2000	2001	2002	2003	2004	2005
Red snapper	1	1	1	1	1	1
Gag grouper	2	15	14	14	11	3
King mackerel	3	11	7	6	5	6
Greater amberjack	4	13	5	2	3	4
Gray triggerfish	5	3	2	3	2	2
Spotted sea trout	6	4	11	8	10	11
Red drum	7	10	6	4	6	10
Spanish mackerel	8	5	9		9	
Atlantic sheepshead	9	8	4		7	5
Vermilion snapper	10	2	3	7	4	8
Little tuna (tunny)	11				15	13
Gray snapper	12	9	12	9		12
Bluefish	13			11		
Wahoo	14					
Blackfin tuna	15			12	12	7
Bluefish		6		11		
Red porgy		7	8		13	15
White sea trout		12		15		14
Pompano dolphin		14				
Blue runner			10			
Dolphin			13			
Black drum			15			

Fish Species	Annual Ranking					
	2000	2001	2002	2003	2004	2005
Yellowfin tuna				5		
Red grouper				10	8	9
Cobia				13		

Table 4.1-15 ranks the top 15 species recreationally harvested by Alabama shore anglers from 2000 through 2005 according to pounds landed. The species composition of shore angler landings varied considerably throughout this 6-year period. Only four of the top 10 species landed in 2000 were identified as top 10 species through 2005: striped mullet, Spanish mackerel, Atlantic sheepshead, and southern flounder.

Table 4.1-15. Rankings by weight (lbs) of the top 15 species landed in Alabama by shore fishermen, 2000–2005. Source: NMFS.

Fish Species	Annual Ranking					
	2000	2001	2002	2003	2004	2005
Striped mullet	1	10	2	1	10	2
Spanish mackerel	2	6	4	4	4	8
Atlantic sheepshead	3	5	1	2	3	1
Silver mullet	4		12	13		13
Gulf kingfish	5	4		10		7
Bluefish	6	12	9	9	2	
Crevalle jack	7					
Southern flounder	8	1	5	3	5	6
Black drum	9	15	8		8	14
Southern kingfish	10	9	6	11	11	4
Red drum	11	2	3	7	1	3
Spotted sea trout	12	8	7	6	6	5
White sea trout	13	7	10	12		9
Blue runner	14		11	14	12	
Pinfish	15	11	15		7	12
King mackerel		3		15		
Atlantic croaker		13	13	8	13	11
Scaled sardines		14				
Gulf flounder			14			
Gafftopsail catfish				5		
Spadefish					9	
Pompano					14	
Ladyfish					15	10
Hardhead catfish						15

Table 4.1-16 ranks the top 15 species recreationally harvested by Alabama private/rental boat fishermen from 2000 through 2005 according to pounds landed. Eight of the species ranked in the top 10 in 2000 remained in the top 10 each year through 2005: king mackerel, red snapper, Atlantic sheepshead, red drum, white sea trout, spotted sea trout, southern kingfish, and greater amberjack. Spanish mackerel and bluefish were the two exceptions. Only seven other fish species made the top 10 list during the 6-year period.

Table 4.1-16. Rankings by weight (lbs) of top 15 species landed in Alabama by private/rental boat fishermen, 2000 – 2005. Source: NMFS.

Fish Species	Annual Ranking					
	2000	2001	2002	2003	2004	2005
King mackerel	1	4	3	3	3	6
Red snapper	2	2	1	1	1	2
Atlantic sheepshead	3	1	4	2	2	1
Red drum	4	3	2	4	4	3
White sea trout	5	8	7	7	5	7
Spotted sea trout	6	6	5	6	8	4
Spanish mackerel	7	7	12	9	9	11
Southern kingfish	8	5	9	8	6	8
Bluefish	9	11	11			
Greater amberjack	10	9	6	5	7	5
Dolphin	11					
Spadefish	12		15	14	12	15
Cobia	13	14		12	10	
Atlantic croaker	14	12		15		
Little tuna (tunny)	15		13			
Black drum		10	8			13
Vermilion snapper		13	14		13	9
Southern flounder		15		11		10
Gray triggerfish			10	10	11	12
Gag grouper				13		14
Gray snapper					14	
Striped mullet					15	

4.1.2.2 Recreational license/effort information

Since 1992, Alabama has required all fishermen over the age of 16 to possess a recreational saltwater fishing license to fish in designated waters. Alabama residents 65 and older are exempted from this licensing requirement, as are fishermen operating in federal waters (between 3 and 200 miles from shore) or from a licensed charter boat. The Alabama Department of

Conservation and Natural Resources maintains a database of fishing licenses sold each year. Table 4.1-17 summarizes data on the number of resident versus non-resident licenses sold each year between 2000 and 2006. Total license sales peaked during the 2004 license year (August 2003 through July 2004), then decreased 22 percent between 2004 and 2005 following the landfall of Hurricane Ivan. The state sold 10,993 (18 percent) fewer resident licenses in 2005 compared to 2004, and 8,789 (30 percent) fewer non-resident licenses in 2005 compared to the previous year.

Table 4.1-17. Number of Alabama recreational saltwater fishing licenses sold, 2003–2006. Source: MRD/ADCNR.

License Type	License Year[20]						
	2000	2001	2002	2003	2004	2005	2006
Resident	53,675	54,875	55,747	55,772	60,482	49,489	52,854
Non-Resident	21,487	23,008	24,390	26,172	29,264	20,475	21,399
TOTALS	75,162	77,883	80,137	81,944	89,746	69,964	74,253

Total license sales increased 6.1 percent between 2005 and 2006, but remained below the mean number of licenses sold each year from 2000 through 2004. Several factors explain the decline in total license sales observed in 2005 and 2006. First, inclement weather during 2005 (record spring rainfall in coastal Alabama and unusually high tropical storm activity) reduced the number of trips taken by all recreational fishing modes that year. Second, the Alabama coast was recovering from the impacts of the 2004 and 2005 hurricanes during that period. Hurricane Ivan–related damage to coastal areas of Alabama caused many visitors to cancel condominium and hotel reservations in 2004, and also affected bookings for the 2005 summer season. Table 4.1-18 describes the impact of Hurricane Ivan on the availability of condominiums and hotels in the resort area of Baldwin County, Alabama. The number of units available in 2004 was the lowest recorded during the 8-year period from 2000 through 2007.

Table 4.1-18. Number of condominiums and hotel units located in Baldwin County, Alabama, 2000–2007. Source: Alabama Gulf Coast Convention and Visitors Bureau.

YEAR	Condominium / Hotel Units	% Change Relative to Prior Year
2000	12,520	--
2001	13,043	4.18
2002	13,758	5.48
2003	13,367	-2.84
2004	12,481	-6.63

[20] License year is from August 1 through July 31.

YEAR	Condominium / Hotel Units	% Change Relative to Prior Year
2005	12,957	3.81
2006	14,323	10.54
2007[21]	15,422	7.67

Because the license year begins and ends near the middle of a calendar year, both 2005 and 2006 non-resident license sales were most likely affected by the increased storm activity during the 2005 hurricane season. License sales are expected to increase in 2007 to levels seen prior to Hurricane Ivan.

Even though anglers fishing from Alabama licensed charter vessels are not required to possess a license, sales of both charter boat licenses and recreational fishing licenses show a similar trend (Tables 4.1-17 and 4.1-19.). Charter license sales declined in 2003, increased in 2004, then declined again in both 2005 and 2006 (Table 4.1-19).

Table 4.1-19. Number of Alabama charter boat licenses (resident and non-resident) sold, 2000–2006. Source: MRD/ADCNR.

	License Year[22]						
License	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Charter	143	155	170	146	158	153	141

Trends in charter license sales may not accurately reflect trends in the number of charter fishing trips because charter vessels are not required to possess an Alabama charter boat license if they do not fish in Alabama waters. The Alabama Department of Conservation and Natural Resources' Marine Resources Division, working with NMFS, maintains a directory of charter boats known to be active within Alabama state waters. Table 4.1-20 identifies these vessels by size category.

[21] Predicted number.
[22] License year is from October 1 through September 30.

Table 4.1-20. Number of Alabama charter boats identified in the NMFS's For-Hire survey by size category, 2003-2007. Source: NMFS.

Vessel Length	Year				
	2003	2004	2005	2006	2007[23]
Less than 25'	62	65	56	64	51
25' to 39'	81	83	81	84	70
40' to 49'	34	36	36	30	26
50' or larger	30	28	31	34	33
Totals	207	212	204	212	180

The number of active vessels recorded in each size category has remained relatively stable over time. The number of vessels recorded in 2007 is significantly lower than previous years, but this information is based on data reported only through March 31, 2007.

Since 1981, NMFS has estimated the number of angler trips in Alabama for each fishing mode. Table 4.1-21 summarizes fishing activity data from 2000 through 2006. The total number of trips taken by all modes, combined, ranges from a low of 1.1 million trips in 2000 to a high of 2.1 million trips in 2006. The 2006 estimate, which is based on preliminary data, reflects high values in both the shore angler and charter boat modes. The total number of trips taken by all modes decreased significantly in 2002 and 2005, similar to the trend in landings data (Table 4.1-13). The number of charter trips increased about 13.5 percent between 2003 and 2004, before declining in 2005 to the lowest number recorded during the 2000–2006 time series. The number of trips taken by shore anglers and private/rental boats also decreased between 2004 and 2005.

Table 4.1-21. Number of Alabama angler trips by mode fished and year, 2000–2006. Source: NMFS.

Year	Number of Trips by Mode			
	Shore	Charter	Private / Rental	Total
2000	479,432	62,143	545,243	1,086,818
2001	747,904	62,664	825,230	1,635,798
2002	515,553	68,163	606,288	1,190,004
2003	587,502	66,564	845,923	1,499,989

[23] 2007 data through March 31, 2007.

Year	Number of Trips by Mode			
	Shore	Charter	Private / Rental	Total
2004	1,056,379	76,909	906,752	2,040,040
2005	704,802	54,792	806,477	1,566,071
2006[18]	1,176,998	79,513	835,589	2,092,100

4.1.2.3 Recreational fishing-related infrastructure and services

Walker et al. (2006) and Chang et al. (2006) summarize the economic impacts of the 2005 hurricanes on charter boat operators in Alabama and the surrounding Gulf states. IAI (2007) describes Hurricane Katrina–related damages to recreational fishing infrastructure, including marinas, fueling facilities, boat dealers, and other support services. Currently, fishing-related services and infrastructure are at or above pre-2004 capacity. All boating access sites that were open for public use prior to 2004 were open to the public in 2006. Additionally, the retail bait and tackle shops, boat dealerships, and repair facilities damaged by the storms have reopened, and one or two new retail bait and tackle shops has opened. All except one of Alabama's coastal marinas that offered boat storage/use for charter vessels pre-Katrina continue to offer these services in 2007. There has been a significant decline in the trend observed in the months immediately following Hurricane Ivan to convert marinas from charter boat facilities to private use facilities. However, charter boat and private boat access to waterfront remains a concern today. Coastal Alabama municipalities have begun investigating the potential costs and benefits of purchasing waterfront real estate to address this concern. For instance, the Baldwin County city of Orange Beach is considering purchasing a marina/restaurant complex that would provide mooring space for up to 30 vessels. This complex may be developed as a condominium/private marina if the property is not purchased by the city, forcing about 14 existing charter boats moored in the mixed-used marina to relocate to another area.

4.2 Louisiana

Louisiana fisheries were directly impacted by Hurricanes Katrina and Rita, which crossed the eastern and western portions of the Louisiana coast in August and September 2005, respectively. The impacts of each individual storm would have been significant; combined, the storms' impacts were devastating. Sections 4.2.1 and 4.2.2 summarize available information on the storms' immediate impacts on Louisiana's commercial and recreational fisheries, respectively. As explained in Section 2.3, this document addresses the impacts of the storms only on marine fisheries. It does not describe the storms' impacts on the state's freshwater fisheries or habitat. Additionally, the material in this section does not attempt to assign total monetary estimates to the loss of fishing vessels, fishery infrastructure, or the impacts of the storms on fishing communities. The findings and conclusions herein are considered interim, and should be re-analyzed and updated as additional information becomes available.

4.2.1 Commercial fisheries

Louisiana's commercial fisheries contributed 74 percent of commercial landings and 41 percent of the value of commercial landings Gulf-wide in 2004, and 71 percent of the total commercial landings and 41 percent of the total value of commercial landings Gulf-wide in 2005 (NMFS 2007a). These fisheries contributed 13 percent of total U.S. commercial landings and 9 percent of the total value of U.S. commercial landings, on average, from 1995 through 2004 (IAI 2007). Most (93 percent) of the state's seafood is produced in Plaquemines, Vermilion, Cameron, Jefferson, Terrebonne, and Lafourche parishes. Venice-Empire, Dulac-Chauvin, Grand Isle, Lafitte, Cameron, Delacroix, Delcambre, Intracoastal City, and Morgan City-Berwick are the state's leading ports in shrimp production. The Venice-Empire and Cameron ports also lead oyster production in the state (IAI 2007).

The 2005 hurricanes damaged and destroyed thousands of commercial vessels throughout coastal Louisiana, causing sharp declines in commercial landings and revenues. Few commercial fishermen in southeastern Louisiana had anything left with which to operate after the storms. Fishermen whose vessels remained intact and who were able to reach fishing grounds had no means to sell or distribute their product as a result of the mass destruction to the onshore infrastructure. Thus, seafood landings shifted west to Texas and east to Alabama. Lack of ice, diminished processing and cold-storage capacity, infrastructure damage, marine debris, fuel costs, and scarcity of marine supplies and services have severely constrained recovery efforts. The Louisiana Department of Wildlife and Fisheries' (LDWF) 2005 preliminary estimates of losses to the state's seafood industry as a result of Hurricane Katrina were $1.3 billion (annual total retail value), which represents about 40 percent of the industry's annual total retail value (Wulfhorst 2005). This is not a complete estimate of monetary losses.

Data on commercial landings and values were obtained from the Louisiana commercial trip ticket system. The values reported here represent dockside value only, which does not include any estimate of economic multipliers for the products as they move through the local or state economies. Landings data are described in pounds, whole weight, with the exception of oyster landings, which are reported as shucked weight (pounds of meat).

One aspect of the storm effects not addressed in this section is the differential impacts of the storms across the Louisiana coast. Fisheries on the central part of the Louisiana coast were lightly impacted compared to those on the eastern and western portions of the coast. It is not always possible to characterize the amount of geographic variation based on available information. In some cases, fishermen redirected their fishing effort to less impacted areas where needed infrastructure was available and where debris problems were less critical.

4.2.1.1 Commercial landings

The landings of several Louisiana marine fisheries were significantly reduced during the initial 12-month period following Hurricanes Katrina and Rita (Table 4.2-1). Post-storm landings and

value are compared to average landings and value during the 5 years that preceded the storms in order to minimize the effects of variation in harvest between years when analyzing trends in landings before and after the hurricane season. Some fisheries continued to show significant declines in landings and/or value from September through November 2006, when compared to the average landings and values during the same period in the 5 years prior to the storms (Table 4.2-2). Although the landings and value of most fisheries from September through November 2006 increased significantly when compared to the 3-month period immediately following the passage of the storms (September through November 2005) (Table 4.2-3), at that time most of these fisheries still had not recovered to levels seen in pre-storm years (Table 4.2-2).

Table 4.2-1. Change in dockside landings and estimated gross dockside revenue from individual fisheries during the period September 2005 through August 2006 compared to the 5-year average from August 1999 through September 2004.[24] Source: LDWF Trip Ticket Program (03/2007).

Fishery	Avg Landings 1999-2004 (lbs)	2005-2006 Landings (lbs)	% Difference	Avg Value 1999-2004	2005-2006 Value	% Difference
Blue crab	47,195,350	47,217,309	0%	$31,964,340	$28,840,964	-10%
Menhaden	984,858,144	597,462,985	-39%	$34,703,606	$23,548,823	-32%
Other saltwater finfish	21,524,523	9,026,764	-58%	$27,615,671	$16,237,012	-41%
Shrimp	126,987,747	127,356,924	0%	$176,555,917	$148,320,495	-16%
Oysters	13,850,442	10,194,126	-26%	$31,045,641	$31,358,698	1%

Table 4.2-2. Change in dockside landings and estimated gross dockside revenue from individual fisheries during the period September 2006 through November 2006 compared to the 5-year average for that period from 2000 through 2004.[24] Source: LDWF Trip Ticket Program (03/2007).

Fishery	Avg Landings (lbs) Sep-Nov 2000-2004	Landings (lbs) Sep-Nov 2006	% Difference	Avg Value Sep-Nov 2000-2004	Value Sep-Nov 2006	% Difference
Blue crab	12,833,836	11,533,369	-10%	$7,941,375	$6,333,055	-20%
Menhaden	210,563,041	185,570,905	-12%	$7,522,736	$7,499,029	0%
Other saltwater finfish	7,366,844	5,382,867	-27%	$7,816,004	$5,761,019	-26%
Shrimp	40,824,853	37,665,542	-8%	$57,479,827	$39,366,336	-32%
Oysters	3,414,894	1,996,403	-42%	$7,930,210	$6,479,872	-18%

[24] Data are preliminary and subject to correction.

Table 4.2-3. Change in landings and estimated gross dockside revenue from individual fisheries during the period September 2006 through November 2006 compared to that same period in 2005.[24] Source: LDWF Trip Ticket Program (03/2007).

Fishery	Landings (lbs) Sep-Nov 2006	% Difference from 2005	Value Sep-Nov 2006	% Difference from 2005
Blue crab	11,533,369	49%	$6,333,055	45%
Menhaden	185,570,905	281%	$7,499,029	348%
Other saltwater finfish	5,382,867	124%	$5,761,019	64%
Shrimp	37,665,542	29%	$39,366,336	-5%
Oysters	1,996,403	126%	$6,479,872	170%

Oysters

The 2005 hurricane season significantly impacted Louisiana's oyster landings. Oyster landings in the 3 months following the storms (September through November 2005) decreased by about 54 percent from the 1999–2004 average during that same period, and remained 26 percent below average in the 12-month period following the storms (Table 4.2-1). Although landings from September through November 2006 were still 42 percent below the 1999–2004 average for that period (Table 4.2-2), they were 126 percent above the level observed during that period in 2005 (Table 4.2-3). The decline in landings in the months immediately following the storms may be attributed, in part, to a shortened season on public oyster grounds, which translated into lost fishing opportunities.

The Louisiana Department of Wildlife and Fisheries estimates the availability of market-size and seed oysters on public grounds each year. Stock assessment data collected in July 2006 indicate oyster stocks on public grounds declined sharply (nearly 18 percent) between 2005 and 2006. This trend was driven primarily by a statewide decline in market-size oyster stocks (≥ 3"), which decreased from about 1.2 million barrels in 2005 to just over 375,000 barrels in 2006. However, seed oyster stocks (< 3") increased from about 1.5 million barrels in 2005 to nearly 2 million barrels in 2006, indicating the resource is rebounding.

Shrimp

Louisiana shrimp landings remained relatively stable in the 12-month period following the hurricanes, when compared to average landings from 1999–2004 (Table 4.2-1). However, the value of shrimp landed during this period was about 16 percent below the 1999–2004 average. Shrimp landings and value from September through November 2006 declined by 8 percent and 32 percent, respectively, from the 2000–2004 average for that period (Table 4.2-2). Shrimp landings and value from September through November 2006 increased 29 percent and decreased

5 percent, respectively, when compared to landings and value from September through November 2005 (Table 4.2-3).

Finfish

Menhaden

The 2005 hurricane season had an immediate and severe impact on menhaden harvest. From September through November 2005, trips were reduced 70 percent, landings were reduced 77 percent, and the number of operating vessels was reduced 41 percent from the 2000–2004 average during that period. The menhaden season ends on the third Monday in October of each year, with the exception of a smaller bait menhaden fishery, which continues to operate until December. Consequently, the fleet was able to begin recovering from the extensive loss of fishing vessels; equipment; and processing, storage, and maintenance facilities during the "off-season." However, monthly effort and landings did not recover to near normal conditions until near the mid-season of 2006, and landings that year were 39 percent below the 1999–2004 average (Table 4.2-1).

Saltwater Finfish

A wide variety of harvesters participate in the saltwater commercial finfish fishery and use many different fishing methods to harvest a diverse array of species. Many of the commercial saltwater finfish fisheries are seasonal in nature. As such, the impacts of the hurricanes on this fishery varied widely, with the harvest of some species less affected than the harvest of other species. The average annual landings and value of all commercial saltwater finfish, combined, declined substantially (58 percent and 41 percent, respectively) in the year following the storms when compared to average annual landings and value from 1999–2004 (Table 4.2-1). Average combined landings and value during the September through November 2006 period were 26 to 27 percent below the 5-year average for that period (Table 4.2-2). Overall, changes in the landings and value of this fishery can be attributed to a reduction in the harvest of several species that generate relatively low prices per pound, including striped mullet, black drum, and sheepshead. However, more minimal losses also were observed in other higher value fisheries, such as yellowfin tuna and red snapper.

Crabs, lobsters, and other invertebrates

The impacts of the 2005 hurricanes on Louisiana's crab fishery are difficult to assess. Landings remained relatively stable in the 12-month period following the 2005 hurricanes, when compared to average landings from 1999–2004 (Table 4.2-1). However, the value of that fishery declined slightly (10 percent) during that same period (Table 4.2-1). Average landings and value from September through November 2006 decreased 10 percent and 20 percent, respectively, compared to average landings and value for that period from 2000–2004 (Table 4.2-2). Changes in value could be attributed to declining dockside prices, resulting from increasing levels of inexpensive fresh crab meat imports.

4.2.1.2 Commercial fishing capacity

4.2.1.2.1 Vessels and trips

Shrimp

It is difficult to determine how the 2005 hurricanes impacted Louisiana's shrimp fishery because landings levels remained unchanged in the year following the storm (Table 4.2-1) and changes in value could be attributed to declining dockside prices. Estimates of the number of shrimp vessels damaged or lost to the storms, as well as the number of vessels repaired since the storms, vary widely and cannot be verified. As a result, changes in fishing capacity can perhaps best be characterized by evaluating pre- and post-storm changes in the number of active shrimp vessels and trips. The hurricanes appear to have most significantly impacted participation in the fishery, specifically by reducing the number of active vessels and trips. The number of active vessels and trips in the year immediately following the hurricanes declined 58 percent and 50 percent, respectively, compared to the 5-year average for that period (Tables 4.2-4 and 4.2-5).

Table 4.2-4. Change in vessel participation in commercial fisheries during the period September 2005 through August 2006 compared to the 5-year average for that period from 1999 through 2004[24&25]. Source: LDWF Trip Ticket Program (03/2007).

Fishery	Avg # of Vessels 1999-2004	# of Vessels 2005-2006	% Difference
Blue crab	3,733	1,533	-59%
Menhaden	40	37	-7%
Other saltwater finfish	1,905	601	-68%
Shrimp	7,799	3,313	-58%
Oysters	900	558	-38%

[25] These totals do not account for overlap between fisheries.

Table 4.2-5. Change in the number of commercial trips during the period September 2005 through August 2006 compared to the 5-year average for that period from 1999 through 2004. [24&25] **Source: LDWF Trip Ticket Program (03/2007).**

Fishery	Avg. # of Trips 1999-2004	# of Trips 2005-2006	% Difference
Blue crab	135,702	81,525	-40%
Menhaden	379	271	-29%
Other saltwater finfish	16,583	6,026	-64%
Shrimp	95,429	47,372	-50%
Oysters	37,791	26,018	-31%

The number of active vessels and trips from September through November 2006 decreased 42 percent from the 2000–2004 average for that period (Tables 4.2-6 and 4.2-7), but increased 40 percent and 70 percent, respectively, from the September through November 2005 values (Tables 4.2-8 and 4.2-9).

Table 4.2-6. Change in vessel participation in commercial fisheries during the period September 2006 through November 2006 compared to the 5-year average for that period from 2000-2004.[24&25] **Source: LDWF Trip Ticket Program (03/2007).**

Fishery	Avg # of vessels Sep-Nov 2000-2004	# of vessels Sep-Nov 2006	% Difference
Blue crab	1,736	1,018	-41%
Menhaden	34	29	-14%
Other saltwater finfish	1,120	591	-47%
Shrimp	3,914	2,255	-42%
Oysters	484	384	-21%

Table 4.2-7. Change in the number of commercial trips during the period September 2006 through November 2006 compared to the 5-year average for that period from 2000 through 2004.[24&25] Source: LDWF Trip Ticket Program (03/2007).

Fishery	Avg # of Trips Sep-Nov 2000-2004	# of Trips Sep-Nov 2006	% Difference
Blue crab	35,783	22,618	-37%
Menhaden	96	85	-12%
Other saltwater finfish	5,986	3,252	-46%
Shrimp	33,746	19,463	-42%
Oysters	9,165	6,392	-30%

Table 4.2-8. Change in vessel participation in fisheries during the period September 2006 through November 2006 compared to the same period in 2005.[24&25] Source: LDWF Trip Ticket Program (03/2007).

Fishery	# of Vessels Sep-Nov 2005	# of Vessels Sep-Nov 2006	% Difference
Crab	655	1,018	55%
Menhaden	20	29	45%
Oyster	159	384	142%
Saltwater Fish	274	591	116%
Shrimp	1,608	2,255	40%
Total	2,716	4,277	57%

2

Table 4.2-9. Change in the number of commercial trips during the period September 2006 through November 2006 compared to that same period in 2005.[24&25] Source: LDWF Trip Ticket Program (03/2007).

Fishery	# of Trips Sep-Nov 2005	# of Trips Sep-Nov 2006	% Difference
Crab	12,634	22,618	79%
Freshwater Fish	3,394	3,723	10%
Menhaden	29	85	193%
Oyster	2,097	6,392	205%
Saltwater Fish	1,414	3,252	130%
Shrimp	11,434	19,463	70%
Total	27,608	51,810	88%

Crabs, lobsters, and other invertebrates

The most significant change observed in the crab fishery following the 2005 hurricane season is a decline in the number of active vessels and fishing trips. The number of active vessels and trips declined 59 percent and 40 percent, respectively, in the 12-month period following the storms, when compared to the average number of active vessels and trips from 1999–2004 (Tables 4.2-4 and 4.2-5). The number of active vessels and trips from September through November 2006 was 41 percent and 37 percent, respectively, below the average for that period from 2000–2004 (Tables 4.2-6 and 4.2-7), but greater than the number of active vessels and trips during that same period in 2005 (Tables 4.2-8 and 4.2-9).

The observed decline in participation in the crab fishery may be directly attributable to hurricane impacts. The storms' impact on crab vessels and on trap loss appears to be a significant factor influencing fishery trends. Many commercial fishing families were displaced following the storms, and some have left the fishery altogether. The number of vessels damaged or lost to the storms, as well as the number of vessels that have since been repaired, cannot be quantified.

Finfish

Menhaden

The 2005 hurricanes reduced processing capacity and directly damaged menhaden fishing vessels, both of which affected participation in the fishery (NMFS 2007b). The number of trips targeting menhaden declined 29 percent in the 1-year period following the 2005 hurricane season, when compared to the 1999–2004 average (Table 4.2-5). However, the number of active vessels declined by only 7 percent during this 1-year period, as additional vessels re-entered the fishery over the course of the year (Table 4.2-4).

4.2.1.2.2 Commercial saltwater fishing license sales

The commercial saltwater fishing license year runs from November 15 of one year through December 31 of the following year. Most commercial saltwater fishery participants, with the exception of mullet fishermen, had purchased their 2005 licenses before the 2005 hurricanes made landfall. Mullet permit holders often purchase their licenses immediately before the mullet season, which begins in mid-October. As a result, the 5-year average used to compare changes in the number of saltwater licenses purchased pre- and post-hurricanes (Tables 4.2-10 through 4.2-13) is based on a September 1–August 31 timeframe.

Commercial fishing license sales decreased 85 percent in the 3 months immediately following the 2005 hurricanes (September through November 2005), when compared to 2000–2005 average sales during that period (Table 4.2-10). Shrimp license sales decreased 90 percent, oyster license sales decreased 78 percent, crab license sales decreased 79 percent, and no menhaden licenses were purchased during that period. License sales for all remaining saltwater finfish decreased 72 percent.

Commercial fishing license sales decreased 26 percent in the 1-year period following the 2005 hurricane season relative to average sales from 2000–2005 (Table 4.2-11). Shrimp license sales decreased 31 percent, oyster license sales decreased 13 percent, menhaden and crab license sales decreased 3 percent, and license sales for all saltwater finfish other than menhaden decreased 24 percent.

Table 4.2-10. Change in commercial license sales during the period September 2005 through November 2005, compared to the 5-year average for that period from 2000 through 2005.[24&26] Source: LDWF Commercial and Recreational License databases (04/2007).

Fishery	Avg # of Licenses Sep-Nov 2000-2005	# of Licenses Sep-Nov 2005-2006	% Difference
Commercial Fisherman	1,816	274	-85%
Blue crab	402	84	-79%
Menhaden	6	0	-100%
Other saltwater finfish	804	227	-72%
Shrimp	1,741	170	-90%
Oysters	148	33	-78%

Table 4.2-11. Change in commercial license sales during the period September 2005 through August 2006 compared to the 5-year average for that period from 2000 through 2005.[24&26] Source: LDWF Commercial and Recreational License databases (04/2007).

Fishery	Avg # of Licenses 2000-2005	# of Licenses 2005-2006	% Difference
Commercial Fisherman	17,144	12,640	-26%
Blue crab	3,344	3,253	-3%
Menhaden	44	43	-3%
Other saltwater finfish	2,542	1,927	-24%
Shrimp	19,436	13,501	-31%
Oysters	1,048	914	-13%

An increase in commercial fishing licenses sales from September through November 2006 relative to that same period in 2005 indicates the fisheries are beginning to recover (Table 4.2-

[26] These totals are for all gear licenses for each fishery.

12). However, the number of licenses sold from September through November 2006 remained below the 2000–2005 average for that period in all categories (Table 4.2-13).

Table 4.2-12. Change in commercial license sales during the period September 2006 through November 2006 compared to that same period in 2005.[24&26] Source: LDWF Commercial and Recreational License databases (04/2007).

Fishery	# of Licenses Sep-Nov 2005	# of Licenses Sep-Nov 2006	% Difference
Commercial Fisherman	274	779	184%
Crab	84	196	133%
Menhaden	0	0	0%
Oyster	33	89	170%
Saltwater Fish	227	425	87%
Shrimp	170	605	256%
Total Commercial	514	1,316	156%

Table 4.2-13. Change in commercial license sales during the period September 2006 through November 2006 compared to the 5-year average for that period from 2000 through 2005.[24&26] Source: LDWF Commercial and Recreational License databases (04/2007).

Fishery	Avg # of Licenses Sep-Nov 2000-2005	# of Licenses 2006	% Difference
Commercial Fisherman	1,816	779	-57%
Blue crab	402	196	-51%
Menhaden	6	0	-100%
Other saltwater finfish	804	425	-47%
Shrimp	1,741	606	-65%
Oysters	148	89	-40%

4.2.1.3 Commercial fishing-related infrastructure and services

Hurricanes Katrina and Rita severely impacted Louisiana's commercial fishing facilities and related infrastructure. Katrina destroyed nearly 100 percent of the marine-related infrastructure and much of the housing in Plaquemines Parish. Only 60 percent of the commercial docks and facilities were fully or partially operational in November 2005. However, 85 percent of these facilities were fully or partially operational in April 2007. Lack of ice, diminished processing and cold-storage capacity, infrastructure damage, and scarcity of marine supplies and services have constrained recovery efforts (IAI 2007). Accelerated labor shortages have also significantly constrained production capacity, as processors in parishes affected by Katrina have lost 35 to 40 percent of their labor force (IAI 2007). Labor shortages have also undercut the operational capacities of seafood retail markets and restaurants. Facilities currently in operation

may have modified their business practices to adjust to changing conditions. Many facilities have reduced the type and/or amount of services they provide. For example, many ice houses have been operating below their pre-hurricane capacities and, in some cases, have been relying on generators for electricity. The Louisiana Department of Wildlife and Fisheries continues to monitor the recovery of commercial fishing-related infrastructure and services.

4.2.2 Recreational fisheries

The number of registered recreational vessels in Louisiana ranks among the top 10 of all states in the nation (IAI 2007). Recreational angling and charter boat fishing generate substantial annual revenues for the state (IAI 2007). Louisiana's marine recreational fisheries harvested and released 14.9 million and 21.0 million finfish, respectively, during 4.8 million fishing trips in 2004, and 13.5 million and 18.7 million finfish, respectively, during 4.0 million fishing trips in 2005 (NMFS 2007a). These fisheries were responsible for about 17 percent of the marine recreational fishing trips made in the Gulf of Mexico in 2005 (NMFS 2007a).

IAI (2007) estimates about 40,000 of the state's recreational vessels were lost to Hurricane Katrina. The revenue loss to the recreational fishing industry in the parishes affected by Katrina is estimated at $199 million (LDWF 2005). Charter boat industry losses include $13 million in lost trips and $8 million in lost and damaged vessels (Walker et al. 2006). This is not a complete estimate of monetary losses to the recreational fishing sector.

One aspect of the storms' impacts on recreational fisheries not addressed in this section is the variation in impacts along the Louisiana coast. The eastern and western portions of the coast were much more greatly impacted than was the central portion of the coast. However, it is not possible to characterize the amount of this variation based on available information. In some cases, recreational fishing effort was redirected to less impacted areas, where launch or other facilities were available and debris problems were less critical.

Another aspect not addressed in this section is the storms' effect on the relocation of fishing activities. Costs associated with the movement of charter operations from heavily impacted areas to less impacted areas, including rebuilding damaged or destroyed infrastructure, such as docks and camps used for accommodations, are not available to include in this report, but are believed to be substantial.

4.2.2.1 Recreational catches/effort

Information on harvest and effort in Louisiana's recreational fisheries was derived from data collected through the Marine Recreational Fishery Statistics Survey (MRFSS) (Source: NOAA, http://www.st.nmfs.gov/st1/recreational/queries/index.html). All values described in the tables herein are point estimates produced by the survey, each of which has an associated level of error that is not presented for the purpose of simplification.

Data suggest the fishing activity of private anglers declined significantly following the 2005 hurricane season, but has since increased to pre-storm levels. Overall, the landings and effort (measured in number of trips) of private anglers (shore and private boat) decreased by 14 and 24 percent, respectively, in the 12-month period following Hurricanes Katrina and Rita when compared to average landings and effort from 2000 through 2005 (Table 4.2-14). Declines in the landings and effort of this user group were even more pronounced (45 percent and 49 percent, respectively) during the 4 months immediately following the hurricanes, demonstrating the severe and immediate effect of the storms on the private boat angler (Table 4.2-15). However, private angler landings and effort increased dramatically in the last 4 months of 2006 when compared to that same period in 2005 (Table 4.2-16) and to average landings and effort during that period from 2000 through 2005 (Table 4.2-17).

Table 4.2-14. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through August 2006 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) 2000-2005	Landings (lbs) 2005-2006	% Difference	Avg # of Trips 2000-2005	# of Trips 2005-2006	% Difference
Private	23,632,169	20,237,445	-14%	3,907,901	2,956,893	-24%
For-hire	3,780,510	3,889,576	3%	119,961	131,826	10%

Table 4.2-15. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through December 2005 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) Sep-Dec 2000-2005	Landings (lbs) Sep-Dec 2005	% Difference	Avg # of Trips Sep-Dec 2000-2005	# of Trips Sep-Dec 2005	% Difference
Private	8,728,425	4,840,049	-45%	1,169,328	594,872	-49%
For-hire	1,004,440	277,570	-72%	31,576	7,175	-77%

Data on the for-hire sector suggest this user group also suffered immediate and severe impacts following Hurricanes Katrina and Rita, but that fishing levels have since returned to pre-storm levels. The greatest impact of the hurricanes on the for-hire industry appears to have occurred in the initial 4-month period following the storms. The landings and effort of the for-hire sector decreased substantially (72 percent and 77 percent, respectively) during that period, when compared to average landings and effort during that period from 2000 through 2005 (Table 4.2-15). However, for-hire landings and effort increased slightly in the 1-year period following the hurricanes (Table 4.2-14) and increased dramatically in the last 4 months of 2006 when compared to the same period in 2005 (Table 4.2-16) and to the 5-year average for that period (Table 4.2-17). This increase is consistent with an increasing trend of activity observed for this user group in the years leading up to the 2005 hurricane season.

Table 4.2-16. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through December 2005 compared to that same period in 2006.

Fishery	Landings (lbs) Sep-Dec 2005	Landings (lbs) Sep-Dec 2006	% Difference	# of Trips Sep-Dec 2005	# of Trips Sep-Dec 2006	% Difference
Private	4,840,049	10,018,996	107%	594,872	1,244,592	109%
For-hire	277,570	1,721,683	520%	7,175	53,155	641%

Table 4.2-17. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2006 through December 2006 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) Sep-Dec 2000-2005	Landings (lbs) Sep-Dec 2006	% Difference	Avg # of Trips Sep-Dec 2000-2005	# of Trips Sep-Dec 2006	% Difference
Private	8,728,425	10,018,996	15%	1,169,328	1,244,592	6%
For-hire	1,004,440	1,721,683	71%	31,576	53,155	68%

4.2.2.2 Recreational license/effort information

The recreational saltwater fishing license year runs from June 1 of one year through June 30 of the following year. As a result, many recreational saltwater fishermen had already purchased their licenses for the 2005–2006 fishing year before the 2005 hurricanes struck the Louisiana coast. Sales of recreational saltwater fishing licenses (including sales of lifetime, senior, and other licenses that include saltwater fishing privileges) decreased by 19 percent in the year following the hurricanes, when compared to average sales from 2000–2005 (Table 4.2-18). This decline was most notable during September–December 2005, when license sales decreased by 54 percent compared to average sales during this period from 2000–2005 (Table 4.2-19). However, license sales from September through December 2006 were 132 percent above average sales during that period in 2005 (Table 4.2-20), and about 6 percent above average sales during that period from 2000–2005 (Table 4.2-21).

Table 4.2-18. Change in recreational license sales during the period September 2005 through August 2006 compared to the 5-year average for that period from 2000 through 2005.[x,z&27] Source: LDWF Commercial and Recreational License databases (04/2007).

License Type	Avg # of Licenses 2000-2005	# of Licenses 2005-2006	% Difference
Recreational[28]	365,047	296,620	-19%

[27] Recreational sales include both season and trip licenses for all saltwater license types.

Table 4.2-19. Change in recreational license sales during the period September 2005 through December 2005, compared to the 5-year average for that period from 2000 through 2005.[24,26,28&29]
Source: LDWF Commercial and Recreational License databases (04/2007).

License Type	Avg # of Licenses Sep-Dec 2000-2005	# of Licenses Sep-Dec 2005-2006	% Difference
Recreational	82,557	37,850	-54%

Table 4.2-20. Change in recreational license sales during the period September 2006 through December 2006 compared to that same period in 2005. [24,26,28&29]
Source: LDWF Commercial and Recreational License databases (04/2007).

License Type	# of Licenses Sep-Dec 2005	# of Licenses Sep-Dec 2006	% Difference
Recreational	37,850	87,910	132%

Table 4.2-21. Change in recreational license sales during the period September 2006 through December 2006 compared to the 5-year average for that period from 2000 through 2005. [24,26,28&29]
Source: LDWF Commercial and Recreational License databases (04/2007).

License Type	Avg # of Licenses Sep-Dec 2000-2005	# of Licenses 2006	% Difference
Recreational	82,557	87,910	6%

4.2.2.3 Recreational fishing-related infrastructure and services

Hurricanes Katrina and Rita severely impacted Louisiana's recreational fishing facilities and related infrastructure. Only 56 percent of recreational fishing facilities were fully or partially operational in November 2005. However, 81 percent of these facilities were fully or partially operational in April 2007. Facilities currently in operation may have modified their business practices to adjust to changing conditions. For example, many facilities have reduced the type and/or amount of services they provide. The Louisiana Department of Wildlife and Fisheries continues to monitor the recovery of recreational fishing-related businesses and boat ramps.

[28] Recreational sales are from the September through December period to be comparable with MRFSS wave information.

4.3 Florida

Florida experienced eight hurricanes and two tropical storms during the 2004 and 2005 hurricane seasons, all of which, at the very least, disrupted commercial and recreational fishing effort. Sections 4.3.1 and 4.3.2 summarize available information on the storms' impacts on Florida's commercial and recreational fisheries, respectively. Hurricanes Charley and Ivan were the most destructive of the 2004 season. Hurricane Wilma, which came ashore in southwest Florida, was the most destructive of the 2005 season. However, wind and wave action from Hurricane Katrina, which made landfall near Buras, Louisiana, then again near the Louisiana/Mississippi border, is believed by some to have further impacted Florida's fisheries by pushing an offshore red tide bloom into the nearshore waters of northwest Florida.

4.3.1 Commercial fisheries

Commercial fisheries on Florida's west coast contributed 6 percent of commercial landings and 22 percent of the value of commercial landings Gulf-wide in 2004, and 6 percent of commercial landings and 21 percent of the value of commercial landings Gulf-wide in 2005 (NMFS 2007a). The port of Key West, Florida, which produces seafood from both the South Atlantic and Gulf of Mexico, was the state's greatest contributor to U.S. commercial fishery landings and value between 2004 and 2005 (NMFS 2007a).

4.3.1.1 Commercial landings

<u>Oysters</u>

Commercial landings and trip data were obtained from the Florida Fish and Wildlife Conservation Commission (FWC). Oyster landings and effort, measured in number of trips, decreased significantly in the 2004–2005 fishing season compared to the average landings and number of trips recorded from 2001 through 2004, before declining even further in the 2005–2006 fishing season (Table 4.3-1). Oyster fisheries in areas not directly impacted by the storms have moderately improved. Landings in the Apalachicola Bay area increased over the past year, a trend that likely reflects increased effort to compensate for the loss of oysters imported by Louisiana and Mississippi processors. The Florida Department of Agriculture and Consumer Services is uncertain whether the oyster resource will sustain the increased effort.

Table 4.3-1. Florida commercial harvest by fishery before and after the 2004 and 2005 hurricane seasons. Landings for all species groups except tropicals are reported in pounds. Landings of tropicals are reported in number of individuals. Source: FWC.

Species Group	Fishing Year[29]							
	2001-2004 Avg		2004-2005		2005-2006		2006-2007[30]	
	Landings	# Trips	Landings	# Trips	Landings	# Trips	Landings	# Trips
Finfish								
Bait fish	7,296,885	6,216	8,657,064	5,118	4,654,393	5,241	3,073,565	2,445
Inshore bottom	11,566,113	44,343	9,312,476	36,079	8,925,277	34,826	7,078,409	20,241
Inshore pelagics	6,223,358	26,724	7,219,101	24,571	6,208,124	25,230	2,827,585	11,144
Offshore bottom	2,307,676	9,113	1,799,611	7,162	2,681,712	7,171	1,106,101	3,641
Offshore pelagics	8,860,581	22,846	8,141,712	19,335	8,324,355	19,269	3,738,260	8,115
Reef fish	18,498,038	33,622	18,492,843	28,024	14,086,666	22,381	6,445,946	10,250
Other finfish	1,455,353	1,029	1,174,192	1,008	348,187	881	350,526	434
Invertebrates								
Blue crab	8,892,129	39,525	12,233,214	38,314	11,449,549	38,251	5,512,699	18,459
Lobster	4,360,559	23,356	5,480,048	20,656	2,975,020	15,245	4,280,377	14,541
Stone crab	3,111,820	29,728	3,073,072	27,390	2,016,481	22,582	1,482,663	11,961
Shrimp	24,976,920	33,066	29,590,803	27,446	22,971,698	25,865	10,936,269	11,169
Other crustaceans	547,082	395	366,257	511	498,346	496	241,600	191
Oysters	2,189,141	25,810	1,797,084	19,461	1,489,261	16,706	1,459,054	14,349
Other mollusks	801,757	11,387	381,327	5,853	321,548	4,071	116,597	1,609
Other invertebrates	983,040	672	4,028,001	999	408,759	522	177,186	158
Tropicals	6,639,535	4,993	8,791,100	5,445	9,018,096	4,828	3,556,784	2,428

Shrimp

Shrimp landings and trips during the 2005–2006 fishing year were about 8 percent and 22 percent less, respectively, than the average landings and number of trips recorded from 2001 through 2004 (Table 4.3-1). Landings and trips in the first three quarters of the 2006–2007 fishing season are 56 percent and 66 percent of the average landings and number of trips recorded prior to the storms. The influence of the storms on this downward trend is uncertain. Landings and effort in the shrimp fishery also are influenced by regulations and economic factors, such as fuel prices and market conditions.

[29] Fishing year is defined as July 1 through June 30.
[30] 2006–2007 data are very preliminary (based on edited data received through 2/19/2007).

Finfish

Finfish landing were generally lower in the 2005–2006 fishing year compared to the average landings of the previous four fishing seasons (Table 4.3-1). Baitfish landings were significantly lower (36 percent lower in 2005–2006 than the average landings recorded from 2001 through 2004). Landings and trip data for the offshore bottom and pelagic fisheries were comparable to those recorded in pre-storm years. A number of factors—including the hurricanes, regulatory actions, and market conditions—could have caused variations in the landings of reef fish species, inshore pelagic species, and inshore bottom species over the past 6 years.

Crabs, lobsters and other invertebrates

The number of blue crab trips in the 2005–2006 fishing year was comparable to the 2001–2004 average, but the number of blue crab landings in the 2005–2006 fishing season exceeded the prior year average (Table 4.3-1). Stone crab and spiny lobster landings in the 2005–2006 season decreased 35 percent and 32 percent, respectively, from the 2001–2004 average, while effort in those fisheries decreased 24 percent and 35 percent, respectively, during that same period. Anecdotal reports from fishermen and dealers in Southwest Florida and the Florida Keys indicate Hurricane Wilma affected trips in both the stone crab and spiny lobster fisheries, and limited the availability of wood needed to repair traps damaged by the hurricane or to build new traps. Landings of other invertebrates show similar declines. However, declines in the blue crab, stone crab, spiny lobster, and marine life (tropicals) fisheries could be attributed, at least in part, to effort management programs in these fisheries initiated by the state during the past 5 years.

4.3.1.2 Commercial fishing capacity

There was a 26.5 percent decline in the number of applications for the commercial saltwater products license for the 2005–2006 fishing year, compared to the average number of applicants in the 2000–2001 through 2002–2003 fishing years (Table 4.3-2). The numbers of applicants for saltwater products wholesale and retail licenses in 2005–2006 were comparable to those of pre-storm years. Participation in the stone crab, spiny lobster, blue crab, and marine life (tropicals) fisheries has declined in recent years, primarily because of effort management regulations implemented by the State of Florida.

Table 4.3-2. Commercial saltwater fishing licenses and permits. Source: FWC.

License Types	Applicants (2000/2001 – 2002/2003 Avg)	Applicants (2004/2005)	Applicants (2005/2006)	Applicants (2006/2007)[31]
Saltwater Products	11,307	9,406	8,310	7,584
Apalachicola Oyster License	886	814	754	914
Blue Crab[32]	2,576	1,964	1,788	1,512
Spiny Lobster[32]	1,948	2,000	1,822	1,681
Stone Crab[32]	1,867	1,421	1,338	1,257
Sponge	322	456	441	411
Tampa Bay Food Shrimp[33]	8	7	5	5
St. Johns Food Shrimp[33]	57	53	52	45
St. Johns Bait Shrimp	21	17	16	14
Wholesale Dealer	1,399	1,403	1,364	1,318
Retail Dealer	2,804	2,862	2,753	2,598

4.3.1.3 Commercial fishing-related infrastructure and services

The impacts of the 2004 and 2005 hurricanes on Florida's commercial fishing infrastructure and services have not been quantified. However, anecdotal information indicates Hurricane Wilma damaged docks, fish houses, and commercial fishing vessels.

4.3.2 Recreational fisheries

Florida's marine recreational fisheries (east coast and west coast, combined) harvested and released 97.6 million and 89.9 million finfish, respectively, during 27.0 million fishing trips in 2004, and 74.4 million and 79.5 million finfish, respectively, during 28.0 million fishing trips in 2005 (NMFS 2007a). Florida's west coast fisheries were responsible for about 68 percent of marine recreational fishing trips made in the Gulf of Mexico in 2005 (NMFS 2007a).

4.3.2.1 Recreational catches

Table 4.3-3 summarizes trends in the landings of recreational species groups from the 2000–2001 through the 2005–2006 fishing years in both west Florida (Gulf Coast counties and Monroe County) and east Florida (Atlantic coast counties from Dade County north to Nassau County). Anecdotal reports to the Florida Fish and Wildlife Conservation Commission suggest the decline in landings observed in 2005–2006 could be at least partially attributed to the hurricanes'

[31] Applicants as of February 23, 2007.
[32] Effort management implemented.
[33] No new licenses issued; failure to renew constitutes forfeiture.

impacts on tourism. The storms created both real and perceived impacts on the availability and cost of fuel and on hotel inventory along the west coast of Florida. The decline in reef fish landings also could be influenced by regulatory restrictions implemented in 2005 and 2006 to reduce recreational grouper landings.

Table 4.3-3. Florida recreational harvest (numbers of fish) by fishery before and after the 2004 and 2005 hurricane seasons. Source: FWC.

Species Group	2000–2004 Avg		2004–2005		2005–2006	
	West FL	East FL	West FL	East FL	West FL	East FL
Inshore Bottomfish	3,140,540	2,079,944	3,615,064	2,785,649	1,040,743	969,358
Inshore Pelagics	3,853,359	2,985,110	2,470,723	1,899,272	510,193	1,377,374
Offshore Pelagics	744,048	1,110,700	624,444	652,400	148,070	265,729
Reef Fish	3,164,344	825,487	3,172,812	1,048,092	1,343,856	670,969

4.3.2.2 License/effort information

Shore effort in the northwest part of the state was below average during the 2004–2005 and 2005–2006 fishing years because the hurricanes damaged or destroyed access facilities in that area. However, private boat and for-hire effort in northwest Florida was similar to that recorded in pre-hurricane years. Fishing effort in the west central area remained generally stable during 2004 and 2005, but for-hire effort declined slightly during the 2004–2005 fishing year.

Table 4.3-4 summarizes data on the sale of recreational saltwater fishing licenses from 2000–2001 through 2006–2007. The number of captain's licenses issued the for-hire sector (i.e., guides, headboat captains, and charter boat captains) during the 2005–2006 fishing year was only slightly (4 percent) below the number of for-hire licenses issued in previous years.

Table 4.3-4. Recreational saltwater fishing license sales (July-June). Source: FWC.

License Type	Avg Sales (2000–2001 through 2003–2004)	Avg Sales (2004–2005)	Avg Sales (2005–2006)	Avg Sales (2006–2007)[34]
Resident	634,419	596,878	653,896	377,199
Non-Resident	408,477	420,816	418,650	249,916
Captain's[35]	3,303	3,557	3,157	1,802
Snook Permit	199,857	164,788	230,334	132,922
Spiny Lobster Permit	127,838	101,413	136,724	92,781

The number of recreational saltwater fishing licenses issued to residents in 2005–2006 was slightly higher than the number of resident licenses issued the previous year and, on average,

[34] Sales as of February 28, 2007.
[35] Charter boats, headboats, and guides.

between 2000–2001 and 2003–2004. Permits issued for the recreational harvest of snook and spiny lobster also increased in 2005–2006 compared to prior years. Non-resident license sales have remained fairly constant over time.

4.3.2.3 Recreational fishing-related infrastructure and services

No quantitative or anecdotal information is available on the impacts of the 2004 and 2005 hurricanes on Florida's recreational fishing infrastructure and services.

4.4 Mississippi

Hurricane Katrina resulted in tremendous loss of life and property to Mississippi residents and fishing communities. Hurricane-related impacts to Mississippi's marine fisheries were estimated at nearly $484 million (GMFMC 2005). Sections 4.4.1 and 4.4.2 summarize available information on the storm's immediate impacts on Mississippi's commercial and recreational fisheries, respectively. The storm's impacts on the state's fishery resources were less severe, as fish are renewable resources. Preliminary investigations indicated Katrina caused large fish kills in upper estuaries, rivers, and tributaries, but had no major adverse long-term effects on the state's shrimp, crab, and finfish stocks. Field investigations indicate the fish kills impacted mostly freshwater species, but some estuarine and marine species also were affected in smaller numbers.

Katrina reduced both the total acreage and function of Mississippi's estuarine and vegetative wetland habitats, and deposited a large amount of marine debris in these valuable coastal habitats. As of April 2, 2007, a total of 75,226 cubic yards of marine debris had been removed form the estuarine waters of Mississippi's three coastal counties, and debris removal is expected to continue through the end of 2007. Resource agencies continue to monitor the impacts of habitat damage and loss on the productivity of Mississippi's fisheries, as estuarine and wetland ecosystems are critical to the life history of Mississippi's marine resources.

4.4.1 Commercial fisheries

Mississippi's commercial fisheries contributed 12 percent of commercial landings and 7 percent of the value of commercial landings Gulf-wide in 2004, and 14 percent of commercial landings and 4 percent of the value of commercial landings Gulf-wide in 2005 (NMFS 2007a). These fisheries contributed 2 percent of total U.S. commercial landings and one percent of the total value of U.S. commercial landings, on average, from 1995 through 2004 (IAI 2007). Most of the state's seafood is produced in Jackson (Pascagoula-Moss Point) and Harrison (Gulfport-Biloxi) counties (IAI 2007).

Hurricane Katrina caused catastrophic damage to Mississippi's commercial fisheries. IAI (2007) reports commercial landings revenues declined 79 percent from September through December 2005 relative to that same period in 2004. Damages to the resident commercial fishing fleet were estimated at $35 million (Posadas 2006b). One hundred percent of these economic losses

occurred in Hancock, Harrison, and Jackson Counties where, according to Posadas (2006b), 87 percent of commercial vessels were damaged. Losses to the commercial fishing sector were estimated at $160 million (Jones 2006). Immediate impacts included loss of basic necessities, such as shelter and food, as fishermen were unable to work. Additional, longer-term impacts that have created much hardship for the industry include damaged or lost vessels; marine debris (obstructions), which created a safety hazard and threatened damage to fishing vessels and gear; extremely high fuel prices; scarce to no availability of ice/refrigeration units and the dockage space needed to unload or sell their catch; and public concerns about seafood safety.

4.4.1.1 Commercial landings

Oysters

Mississippi's Department of Marine Resources (MDMR) reported average annual commercial oyster landings of approximately 2.5 million pounds from 2000 through 2006 (Figure 4.4-1). The average dockside value of this catch was $4.2 million dollars, and the total economic output (including harvesting, processing, and distribution) of the fishery is about $34 million per year. Annual landings during 2005 totaled just over 0.5 million pounds. No oysters were landed in Mississippi in 2006.

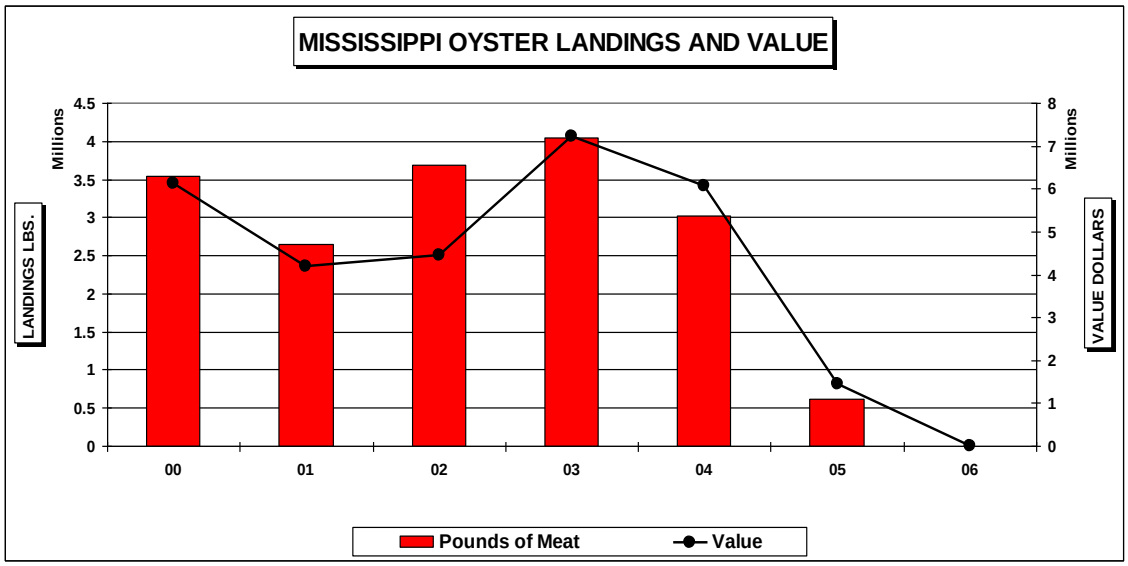

Figure 4.4-1. Mississippi oyster landings and value. Source: MDMR.

IAI (2007) estimates Hurricane Katrina destroyed 90 percent of Mississippi's primary oyster reefs. Over 14,000 cubic yards of cultch material has been planted to rehabilitate 175 acres of oyster reef damaged by Katrina. Over 75,000 sacks of oysters were harvested during Mississippi's Hurricane Katrina Oyster Relay Project (Figure 4.4-2), which began November 13, 2006, and ran through January 10, 2007. Eighty-two Mississippi licensed commercial oyster

vessels participated in the project. Oyster restoration projects are ongoing (see Section 5). Details on the state's spring 2007 cultch plant are presented in Figure (4.4-3).

Shrimp

Average annual commercial shrimp landings totaled approximately 14 million pounds from 2000 through 2006 (Figure 4.4-4). The average dockside value of this catch was $25 million, making shrimp the most commercially valuable fishery in the state. The total economic output (including harvesting, processing, and distribution) of the fishery is about $437 million per year. Only about 8 million pounds of shrimp were landed in 2005 and 2006. Low dockside prices and rising fuel prices likely contributed to this decline.

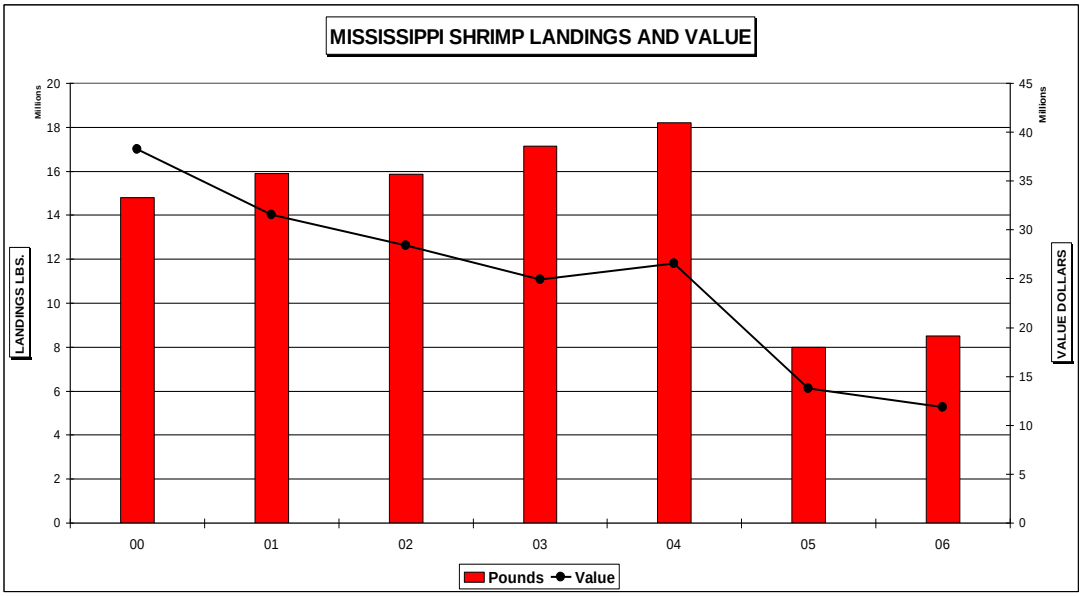

Figure 4.4-4. Mississippi shrimp landings and value. Source: MDMR.

Monitoring the recovery of the shrimp fisheries is vital to the survival of this historic way of life on Mississippi's Gulf Coast. The only way to understand the biological impacts of catastrophic hurricanes on shrimp populations is to monitor long-term changes in harvest. The Mississippi Department of Marine Resources contracted with 281 Mississippi commercial shrimp fishermen after the storm to obtain information on the post-Katrina recovery of the shrimp fishery, using a form developed by agency staff. This data collection program complements federal reporting systems already in place for Gulf state fisheries, but will not duplicate any ongoing programs. Shrimp fishermen recorded monthly data on catch, effort, area, season, and gear type during 8,718 trips they made in November and December 2006. These data will be collected again during the 2007–2008 shrimp season, which begins in June 2007. Additionally, Mississippi commercial shrimp fishermen will be contracted to participate in a deep-water crab trap removal program to coincide with the opening of shrimp season in June 2007.

Hurricane Katrina Oyster Relay Project

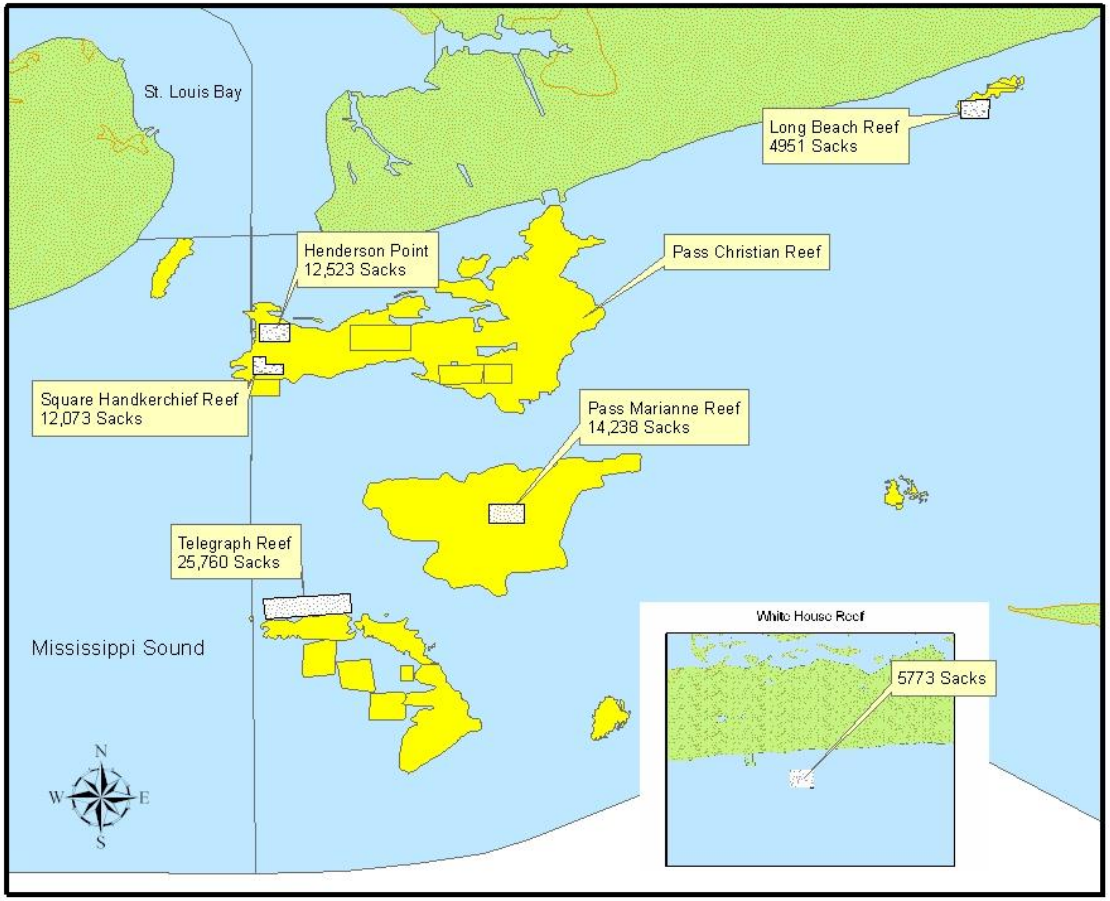

Figure 4.4-2. Hurricane Katrina oyster relay project.

Mississippi Hurricane Katrina Oyster Reef Restoration Spring ,2007

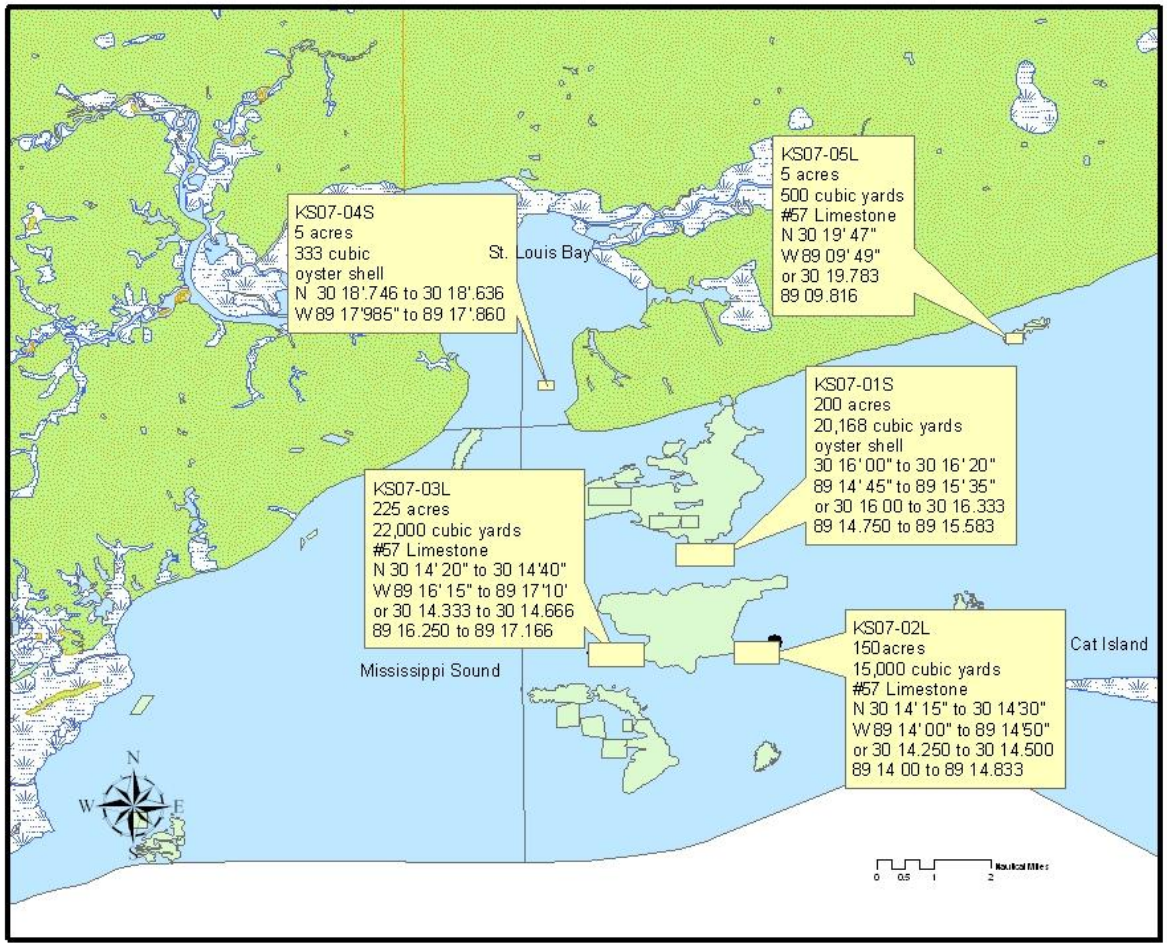

Figure 4.4-3. Mississippi Hurricane Katrina oyster reef restoration, spring 2007.

Finfish

Menhaden

Average annual commercial menhaden landings totaled approximately 185 million pounds from 2000 through 2006 (Figure 4.4-5). The average annual dockside value of this catch was $11.5 million. Annual landings in 2005 and 2006 totaled about 160 million pounds and 220 million pounds, respectively.

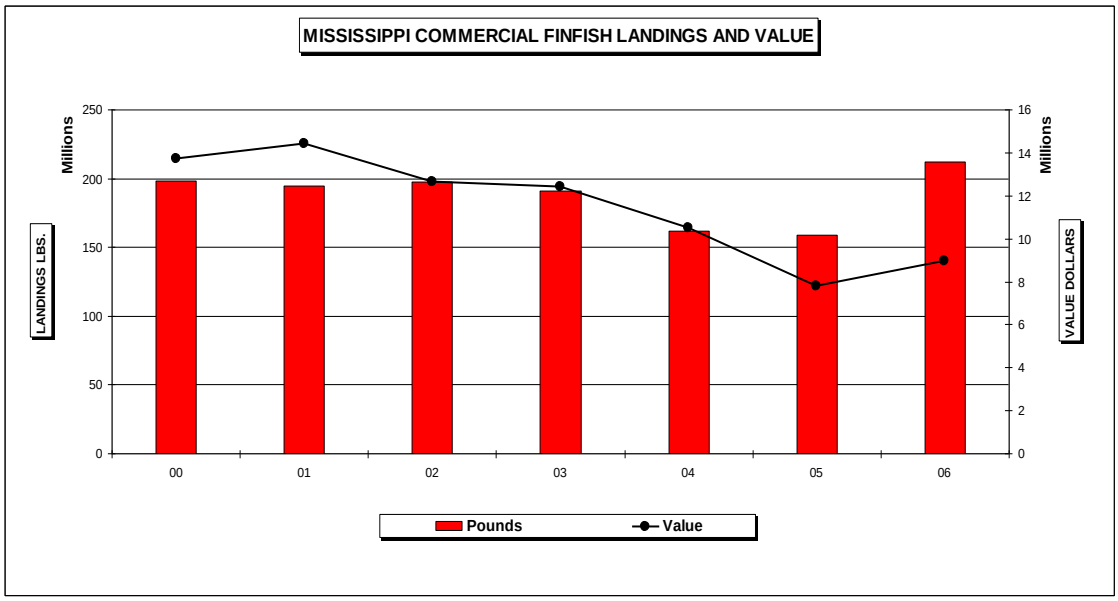

Figure 4.4-5. Mississippi commercial finfish landings and value. Source: MDMR.

Other finfish

Average annual landings of other commercial finfish (excluding menhaden) totaled approximately 3.6 million pounds from 2000 through 2006. The average dockside value of this catch was $1.2 million, and the total economic output (including harvesting, processing, and distribution) for edible finfish is about $46 million per year.

To date, 180 concrete pyramid-shaped artificial reef structures have been deployed on Mississippi's offshore permitted reefs (Figure 4.4-6). Sixty additional pyramids will be deployed as soon as weather permits, and 25 nearshore artificial reefs were deployed between April and July 2007.

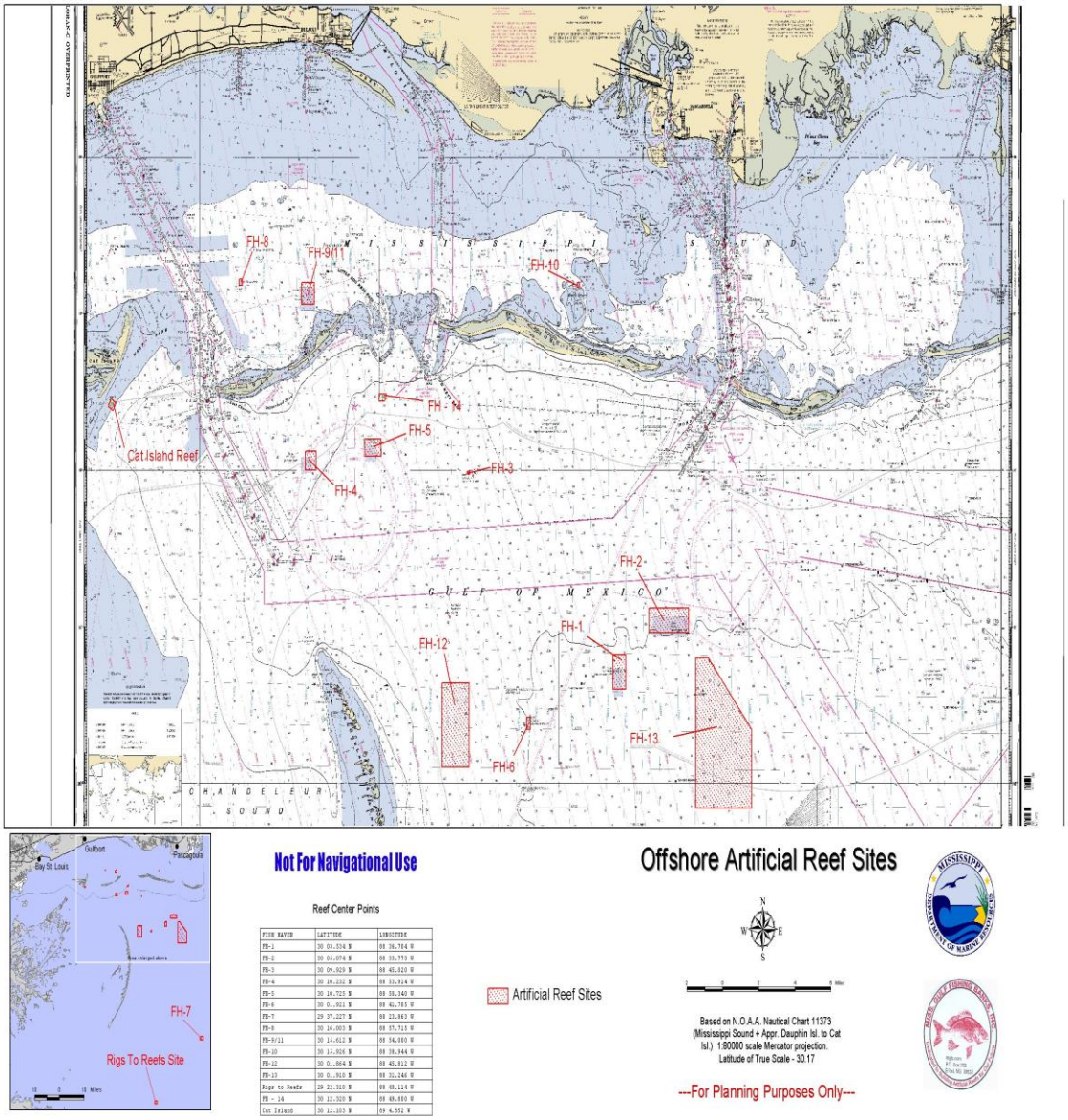

Figure 4.4-6. Offshore artificial reef sites. Source: MDMR.

<u>Crabs, lobsters, and other invertebrates</u>

Mississippi's average annual commercial blue crab landings and value were approximately 797,000 pounds and $642,000, respectively, from 2000 through 2006 (Figure 4.4-7). Landings decreased to just over 400,000 pounds in 2005, but then increased to about 1.1 million pounds in 2006. The total economic output (including harvesting, processing, and distribution) of this fishery is about $5 million per year.

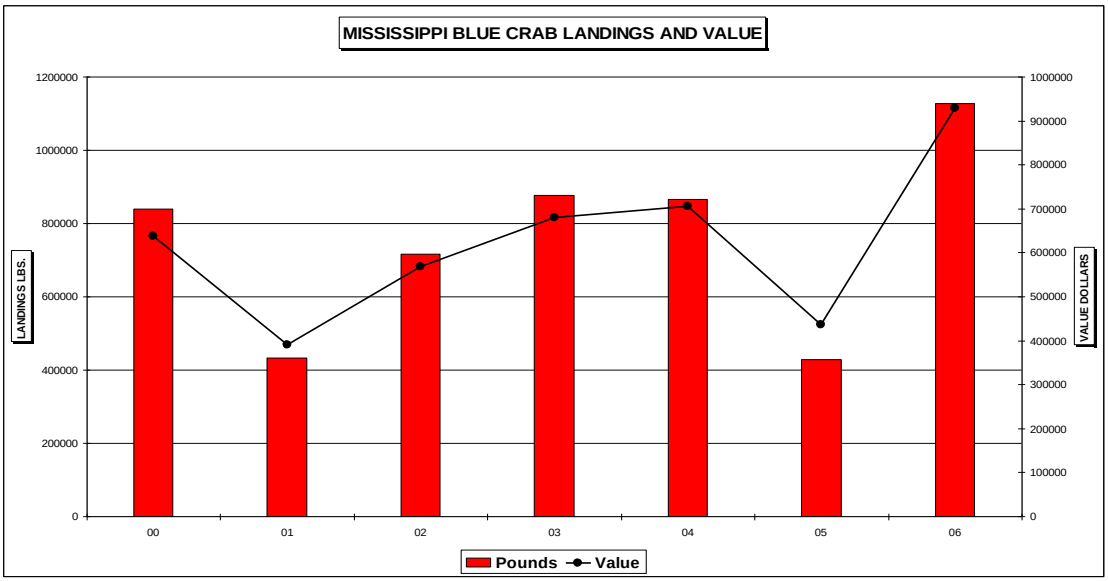

Figure 4.4-7. Mississippi commercial blue crab landings and value. Source: MDMR.

Hurricane Katrina displaced or destroyed many crab traps on Mississippi's coastline, including traps left in the water by fishermen during the storm and traps removed and stored on land. Several fishermen interviewed by state resource personnel indicated they were able to remove their traps from the water before Katrina made landfall, but then lost those traps to the tidal surge generated by the hurricane. Preliminary estimates of trap loss range from 75 to 85 percent.

The state closed trap fisheries from February 11–16, 2007, so fishermen could remove derelict traps from Mississippi waters. Crab fishermen were compensated for each derelict trap collected and turned in for recycling. Fishermen also were offered a new trap, equipped with escape rings, for each trap they turned in to state officials (up to 50 new traps per licensed fisherman, depending on participation). State personnel provided data forms for fishermen to use in documenting the catch of traps equipped with and without escape rings. To date, 9,862 derelict crab traps have been removed from coastal Mississippi marine habitats by contracted commercial crab fishermen using funds provided through the Hurricane Katrina Recovery Grant.

Ongoing monitoring is needed to understand the biological impacts of catastrophic hurricanes on crab populations. The Mississippi Department of Marine Resources contracted with 60 Mississippi commercial crab fishermen after the storm to obtain information on the post-Katrina recovery of the crab fishery, using a form developed by agency staff. This data collection program complements federal reporting systems already in place for Gulf state fisheries, but will not duplicate any ongoing programs. Crab fishermen recorded monthly data on catch, effort, area, season, and gear type, during 2,939 trips they made in November and December 2006. These data will be collected again during the 2007–2008 fishing season, which begins in June 2007.

4.4.1.2 Commercial fishing capacity

Oysters

Preliminary reports indicate Hurricane Katrina destroyed about 35 percent of Mississippi's oyster fleet. Sales of all resident oyster licenses have declined dramatically since Katrina made landfall in 2005 (Figure 4.4-8). Only about 31 and 24 resident commercial oyster licenses were sold for the 2005–2006 and 2006–2007 seasons, respectively, compared to 240 resident commercial oyster licenses sold for the 2004–2005 season.

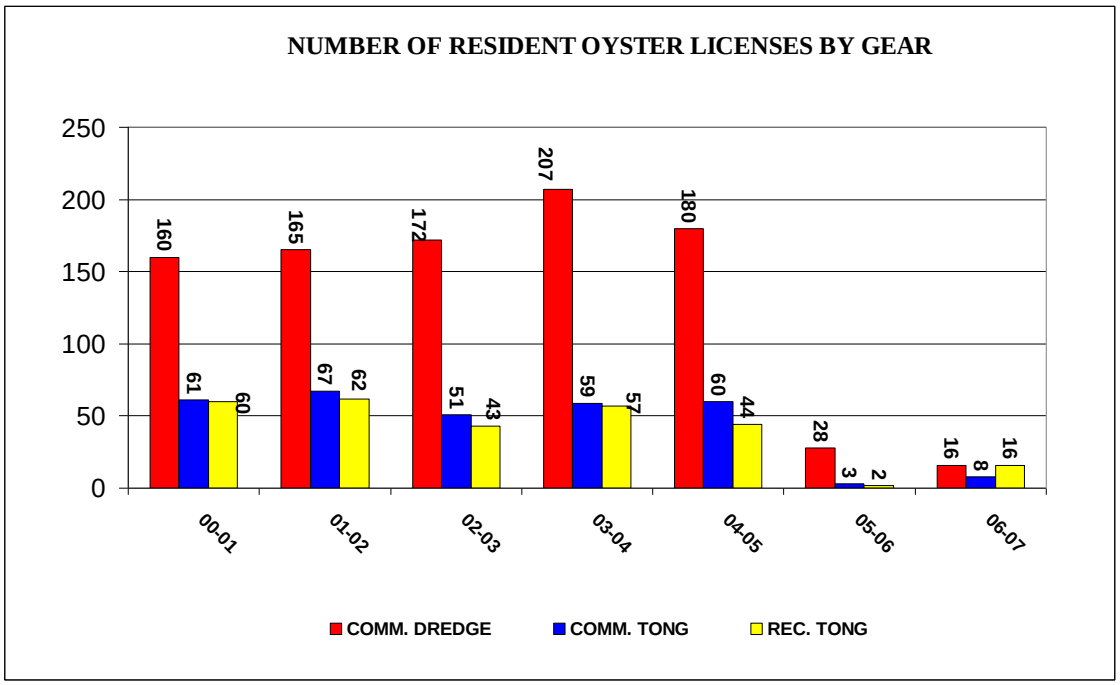

Figure 4.4-8. Number of resident oyster licenses by gear type. Source: MDMR.

Shrimp

Commercial shrimp license sales also have decreased since Hurricane Katrina (Figure 4.4-9). Only about 441 and 413 resident commercial shrimp licenses were sold for the 2005–2006 and 2006–2007 seasons, respectively, compared to 673 resident commercial shrimp licenses sold for the 2004–2005 season.

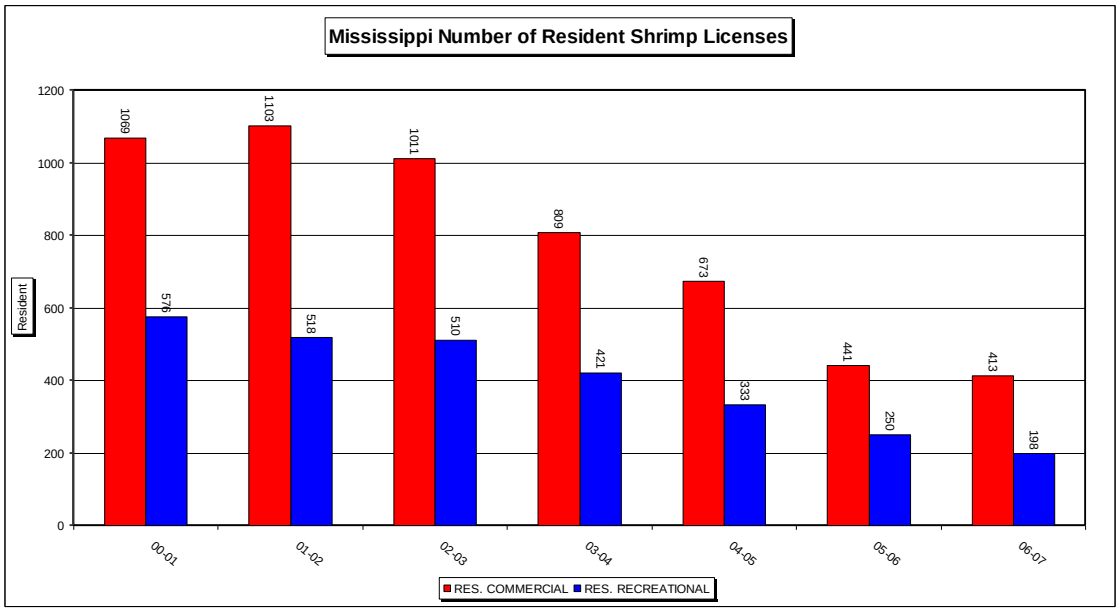

Figure 4.4-9. Number of resident shrimp licenses. Source: MDMR.

Mississippi Department of Marine Resource personnel tried to assess damage to the commercial shrimp fishery through surveys. However, a limited number of fishermen have been able to participate in surveys due to the widespread damage and displacement they experienced as a result of Hurricane Katrina. Available information indicates damage to the commercial shrimp sector is extensive. Although many shrimp fishermen were able to move their boats to locations they anticipated would be less impacted by the storm, preliminary estimates indicate Katrina destroyed about 10 to 20 percent of the Mississippi's shrimp fleet, and damaged an additional 40 to 50 percent of the fleet. Additionally, all of the state's shrimp dealers and processing facilities were damaged by the storm. Types of damage range from lost refrigeration units, to flooding, to complete destruction.

Finfish

Sales of resident commercial hook-and-line vessel licenses (Figure 4.4-10) and commercial net fishing licenses (Figure 4.4-11) declined dramatically in the year following the 2005 hurricane season, but have increased since then. The post-hurricane decline could be attributed to the impacts of the hurricanes on fishery infrastructure. However, sales of commercial hook-and-line vessel licenses had begun to decline much earlier (1998–1999), with the implementation of a new requirement that individual fishermen onboard licensed vessels be licensed (in addition to the vessel).

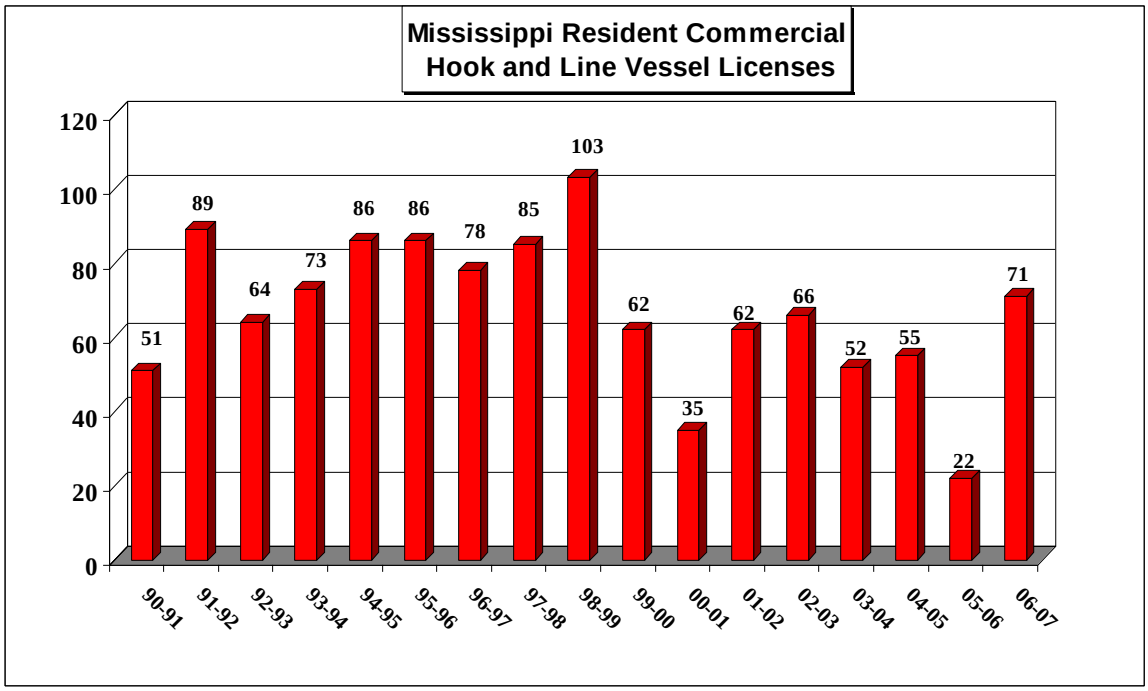

Figure 4.4-10. Number of resident commercial hook-and-line vessel licenses. Source: Mississippi Department of Marine Resources.

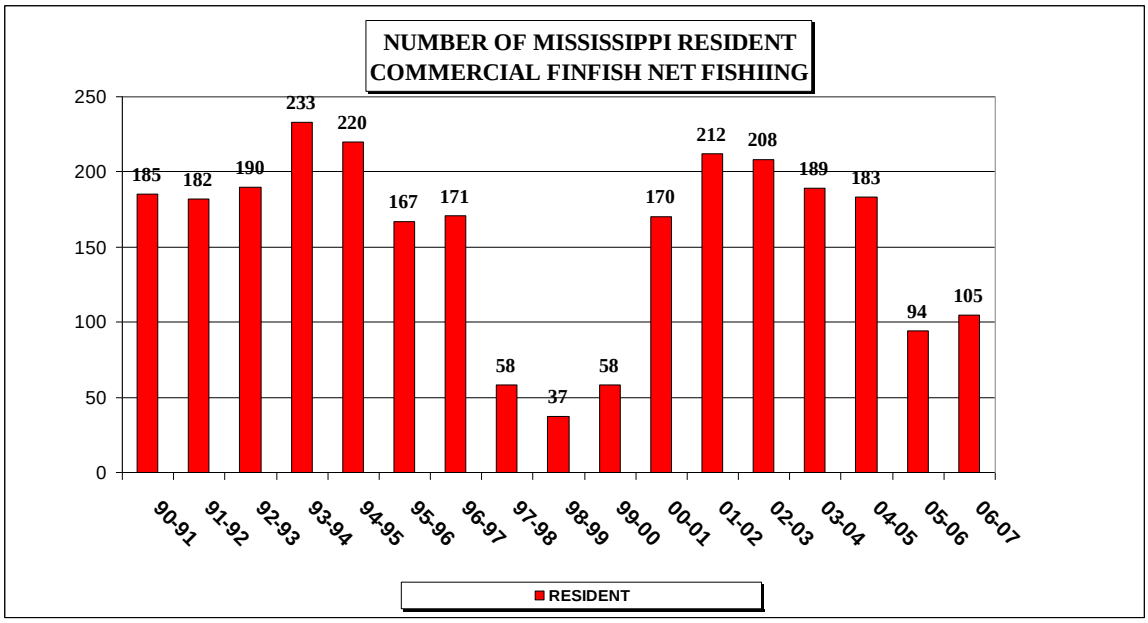

Figure 4.4-11. Number of resident commercial finfish net fishing licenses. Source: Mississippi Department of Marine Resources.

Crabs, lobsters and other invertebrates

The Mississippi Department of Marine Resources issued 147 and 155 resident commercial crab licenses in 2005 and 2006, respectively, compared to 189 resident commercial crab licenses in 2004–2005 (Figure 4.4-12).

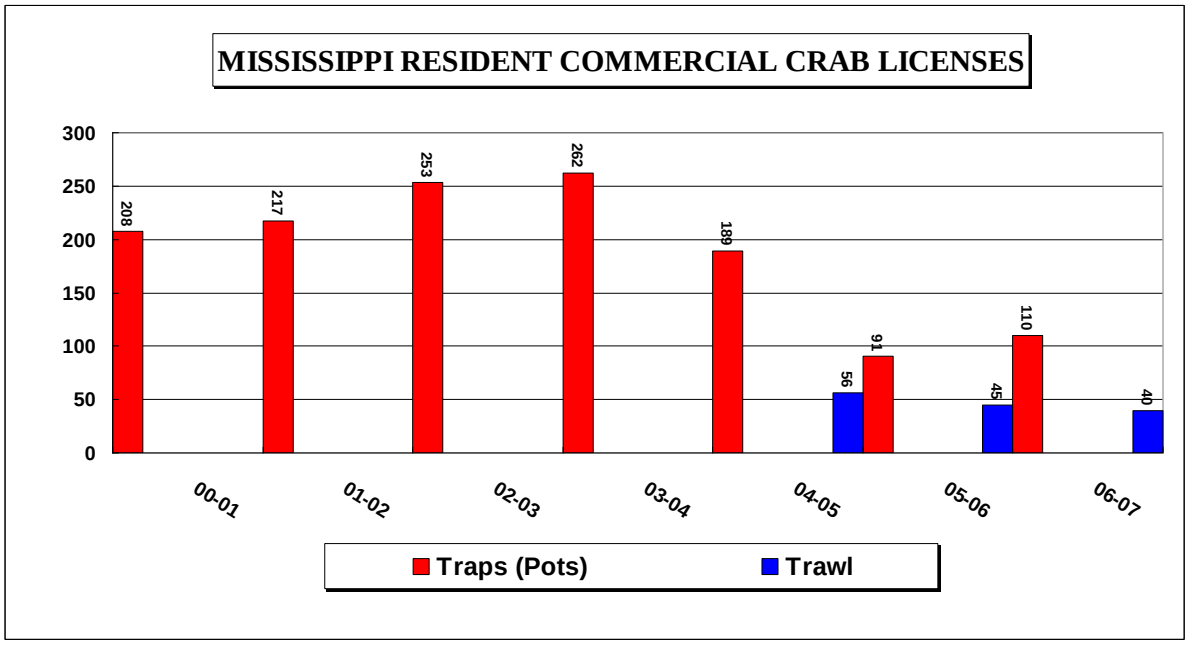

Figure 4.4-12. Number of resident commercial crab licenses. Source: Mississippi Department of Marine Resources.

Preliminary information indicates Katrina's impact on crab vessels was similar to that on shrimp vessels, with 10 to 20 percent of crab vessels destroyed and another 40 to 50 percent damaged to various degrees.

4.4.1.3 Commercial fishing-related infrastructure and services

Hurricane Katrina seriously damaged or destroyed all seafood dealer facilities along the Mississippi Gulf Coast (Posadas 2006a), including six of Biloxi's largest seafood processing plants (Newsom 2006). Posadas (2006a) estimates damages to seafood processing plants and seafood dealers at $101 million, though this estimate assumes the supplies, equipment, and labor required to rebuild will be available. As of May 2006, only 38 percent of fishing-related infrastructure in Hancock, Harrison, and Jackson counties had resumed operations to some extent. Operational seafood processors and retailers have been relying on out-of-state product as a result of the significant decrease in in-state commercial vessels. Operational offloading facilities, seafood processors, and commercial docking facilities are still in short supply. Significant labor shortages have slowed recovery efforts, preventing businesses from attaining pre-Katrina production levels, and dependence on immigrant labor has increased substantially.

Particularly in Biloxi, seafood processors will likely be forced to move inland as a result of development and competition from other industries, particularly casinos (IAI 2007). Communication with the industry continues to be limited, as roads have been destroyed and people displaced. Based on personal communication with about 25 to 35 percent of the state's seafood industry members, state resource agency personnel estimate $16 million in losses to oyster processing facilities (with product losses estimated at almost $2 million), $24 million in losses to shrimp processing facilities (with product losses of $6 million), and $2.6 million in losses to the crab processing industry (with product losses estimated at $1.3 million). Katrina severely impacted the Moss Point menhaden plant and shipyard, located in Jackson County, Mississippi. The revenue losses of that facility over a 12-month period are estimated to exceed $24.5 million. The menhaden industry also is facing additional costs associated with the loss of gear to debris in Mississippi Sound. Eight menhaden vessels use about three nets per year, at about $28,000 per net.

4.4.2 Recreational fisheries

Recreational fisheries are major contributors to Mississippi's tourism-based economy (IAI 2007). Mississippi's marine recreational fisheries harvested and released 2.0 million and 2.7 million finfish, respectively, during 1.1 million fishing trips in 2004, and 1.1 million and 2.3 million finfish, respectively, during 895,000 fishing trips in 2005 (NMFS 2007a). These fisheries were responsible for almost 4 percent of the marine recreational fishing trips made in the Gulf of Mexico in 2005 (NMFS 2007a). Total losses in the recreational fishing sector's economic output as a result of Hurricane Katrina were approximately $293 million (GMFMC 2005).

Hurricane Katrina severely damaged or destroyed the majority of Mississippi Gulf Coast marinas, harbors, roads, and bridges, leaving insufficient hotel accommodations and other infrastructure to support out-of-state recreational anglers (IAI 2007). Walker et al. (2006) estimates that Katrina damaged or destroyed 74 of Mississippi's charter boats at a cost of about $2 million, and resulted in 5,000 lost charter trips in 2005 valued at $7.5 million.

4.4.2.1 Recreational catches/effort

Information on landings and fishing effort for Mississippi's recreational fisheries was derived from data collected through the Marine Recreational Fishery Statistics Survey (MRFSS) (Source: NOAA, http://www.st.nmfs.gov/st1/recreational/queries/index.html). All values described in the tables herein are point estimates produced by the survey, each of which has an associated level of error that is not presented for the purpose of simplification.

Data suggest the fishing activity of private anglers declined significantly following the 2005 hurricane season, but has since increased to pre-storm levels. Overall, the landings and effort (measured in number of trips) of private anglers (shore and private boat) decreased by 41 and 31 percent, respectively, in the 12-month period following Hurricanes Katrina and Rita when compared to average landings and effort from 2000 through 2005 (Table 4.4-1). Declines in the

landings and effort of this user group were even more pronounced (85 percent and 74 percent, respectively) during the 4 months immediately following the hurricanes, demonstrating the severe and immediate effect of the storms on the private boat angler (Table 4.4-2). However, private angler landings and effort increased dramatically in the last 4 months of 2006 when compared to that same period in 2005 (Table 4.4-3). Average private angler fishing trips were comparable to the average number of trips during the previous 5 years, but landings were 35 percent lower than 2000 through 2004 average levels (Table 4.4-4).

Table 4.4-1. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through August 2006 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) 2000-2005	Landings (lbs) 2005-2006	% Difference	Avg # of Trips 2000-2005	# of Trips 2005-2006	% Difference
Private	2,689,201	1,568,986	-41%	1,110,101	766,254	-31%
For-hire	260,225	54,082	-79%	18,455	4.634	-75%

Table 4.4-2. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through December 2005 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) Sep-Dec 2000-2004	Landings (lbs) Sep-Dec 2005	% Difference	Avg # of Trips Sep-Dec 2000-2004	# of Trips Sep-Dec 2005	% Difference
Private	1,032,959	153,910	-85%	304,625	79,572	-74%
For-hire	71,933	0	-100%	4,858	0	-100%

Data on the for-hire sector suggest this group also suffered immediate and severe impacts following Hurricanes Katrina and Rita, and that fishing levels continue to be well below pre-storm levels. The greatest impact of the hurricanes on the for-hire industry appears to have occurred in the initial 4-month period following the storms. No landings or fishing trips were reported during that period (Table 4.4-2). For-hire landings and effort increased during the remaining months of the 1-year period following the hurricanes, but remained well below pre-hurricane levels (Table 4.4-1). Landings and effort during the last four months of 2006 increased dramatically when compared to the same time period in 2005 (Table 4.4.3), but were still well below the 5-year average for that time period (Table 4.4-4).

Table 4.4-3. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2005 through December 2005 compared to that same period in 2006.

Fishery	Landings (lbs) Sep-Dec 2005	Landings (lbs) Sep-Dec 2006	% Difference	# of Trips Sep-Dec 2005	# of Trips Sep-Dec 2006	% Difference
Private	153,910	667,810	334%	79,572	304,175	282%
For-hire	0	35,163	--	0	2,420	--

Table 4.4-4. Change in recreational activity in terms of estimated pounds landed and estimated number of trips for September 2006 through December 2006 compared to the 5-year average for that period from 2000 through 2005.

Fishery	Avg Landings (lbs) Sep-Dec 2000-2004	Landings (lbs) Sep-Dec 2006	% Difference	Avg # of Trips Sep-Dec 2000-2004	# of Trips Sep-Dec 2006	% Difference
Private	1,032,959	667,810	-35%	305,625	304,175	0%
For-hire	71,933	35,163	-51%	4,858	2,420	-50%

4.4.2.2 Recreational license information

Approximately 10 percent of Mississippi's charter boat fleet was lost to Hurricane Katrina. The state issued 95 and 78 charter/party boat licenses for the 2005–2006 and 2006–2007 fishing seasons, respectively, compared to 104 charter/party boat licenses for the 2004–2005 season (Figure 4.4-13).

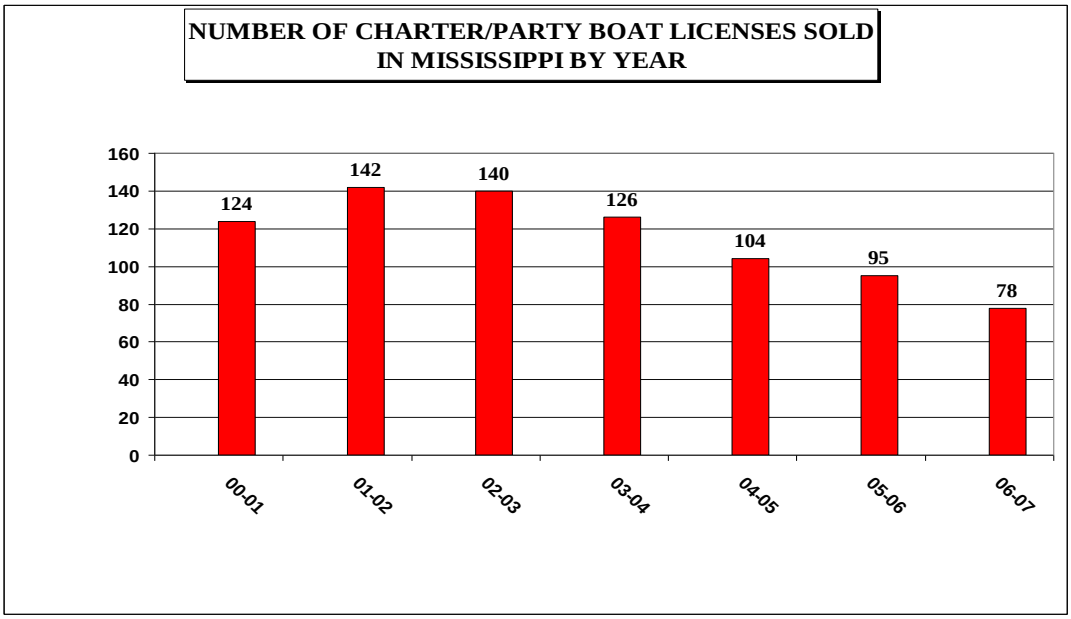

Figure 4.4-13. Number of charter/party boat licenses sold in Mississippi by year.

Sales of recreational saltwater fishing licenses also declined post-Katrina. Over 85,000 such licenses were sold during 2004–2005, compared to about 48,000 during 2005–2006 (Figure 4.4-14).

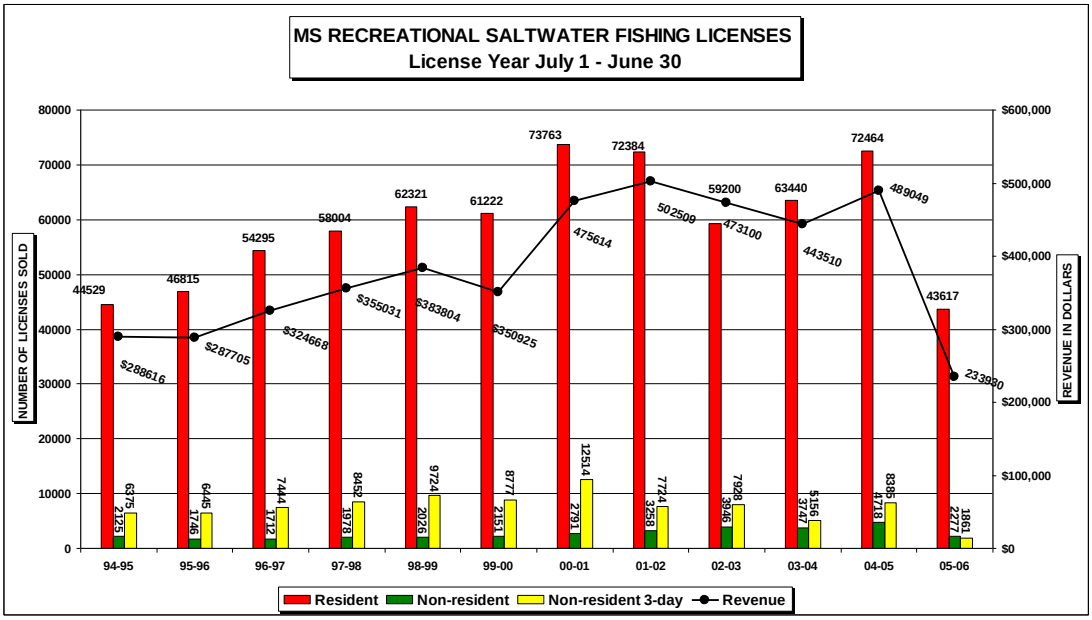

Figure 4.4-14. Mississippi recreational saltwater fishing licenses.

4.4.2.3 Recreational fishing-related infrastructure and services

Most of the infrastructure that supports Mississippi's recreational fishing community has been destroyed. Currently, only portions of public harbors are marginally usable for dockage. Very little dockside fuel, ice, or bait is currently available. About 9,000 feet of public piers were destroyed by Katrina, with an estimated replacement cost of $9 million.

4.5 Texas

Texas residents and fishing communities were not directly impacted by Hurricane Katrina or Wilma. However, less than 1 month after Katrina made landfall on the northern Gulf Coast, Hurricane Rita came ashore on the Texas coast, causing major flooding and infrastructure damage to coastal communities. Sections 4.5.1 and 4.5.2 summarize available information on Hurricane Rita's immediate impacts on Texas' commercial and recreational fisheries, respectively.

4.5.1 Commercial fisheries

Texas' commercial fisheries contributed 6 percent of commercial landings and 25 percent of the value of commercial landings Gulf-wide in 2004, and 7 percent of commercial landings and 28

percent of the value of commercial landings Gulf-wide in 2005 (NMFS 2007a). The ports of Port Arthur and Brownsville-Port Isabel, Texas, were the state's greatest contributors to U.S. commercial fishery landings in 2004 and 2005, respectively. The Brownsville-Port Isabel port was the state's greatest contributor to U.S. commercial fishery value in 2004 and 2005 (NMFS 2007a).

4.5.1.1 Commercial landings

Tables 4.5-1 and 4.5-2 summarize landings and value data, respectively, for Texas commercial fisheries. Information for the years 2000 through 2005 was obtained through NMFS' Office of Science and Technology Commercial Fisheries Landings website. Preliminary data for 2006 were provided by NMFS's Southeast Regional Office (Andy Strelcheck 2007, pers. comm.), and do not include data for the months of November and December 2006.

Table 4.5-1. Annual commercial landings (in pounds) of oysters, shrimp, finfish, and other invertebrates from 2000 to 2006. Source: NMFS.

Year	Oysters	Shrimp	Finfish	Other Invertebrates
2000	6,187,818	93,420,333	6,153,250	4,756,426
2001	4,700,475	82,289,557	5,131,796	5,271,238
2002	4,707,968	75,157,540	6,066,159	7,127,481
2003	6,813,469	79,165,894	5,239,511	4,903,444
2004	5,568,870	70,097,501	5,852,270	4,038,413
2005	5,007,472	70,309,791	5,781,890	3,190,138
2006[36]	2,815,494	103,930,878	4,719,952	1,728,761

Table 4.5-2. Dockside value (in dollars) of annual commercial landings of oysters, shrimp, finfish, and other invertebrates from 2000 to 2006. Source: NMFS.

Year	Oysters	Shrimp	Finfish	Other Invertebrates
2000	$13,846,592	$267,111,534	$9,109,961	$3,541,211
2001	$11,145,755	$195,006,060	$7,636,846	$4,230,131
2002	$11,276,101	$147,701,160	$9,599,962	$4,763,254
2003	$16,493,273	$139,484,700	$9,040,937	$3,297,598
2004	$14,954,140	$137,673,711	$10,684,031	$2,896,346
2005	$15,882,977	$143,044,520	$10,813,480	$2,595,665
2006[36]	$10,143,253	$166,220,074	$9,120,267	$1,352,737

[36] 2006 data do not include data for November and December 2006.

Oysters

Oyster landings were just about average in 2005, the year Hurricane Rita struck the Texas coast. The slight decrease in landings between 2004 and 2005 may be attributed in part to the prohibition on oyster harvest following Hurricane Rita. The dockside value of the 2005 commercial oyster catch was relatively high—second only to the value of the 2003 catch, which was nearly 2 million pounds larger. This indicates oyster fishermen obtained better prices per pound in 2005, relative to earlier years. The price per pound of oysters further increased in 2006, reaching an average value of $3.60.

Only 2.8 million pounds of oyster landings were reported for 2006 (Table 4.5-1), but this value does not include data for November and December of that year. Landings are generally high during that 2-month period, particularly in November (Figure 4.5-1). Consequently, it is unknown at this time whether 2006 landings are above or below average. However, 2006 landings to date are lower than average, suggesting total landings for 2006 may be depressed.

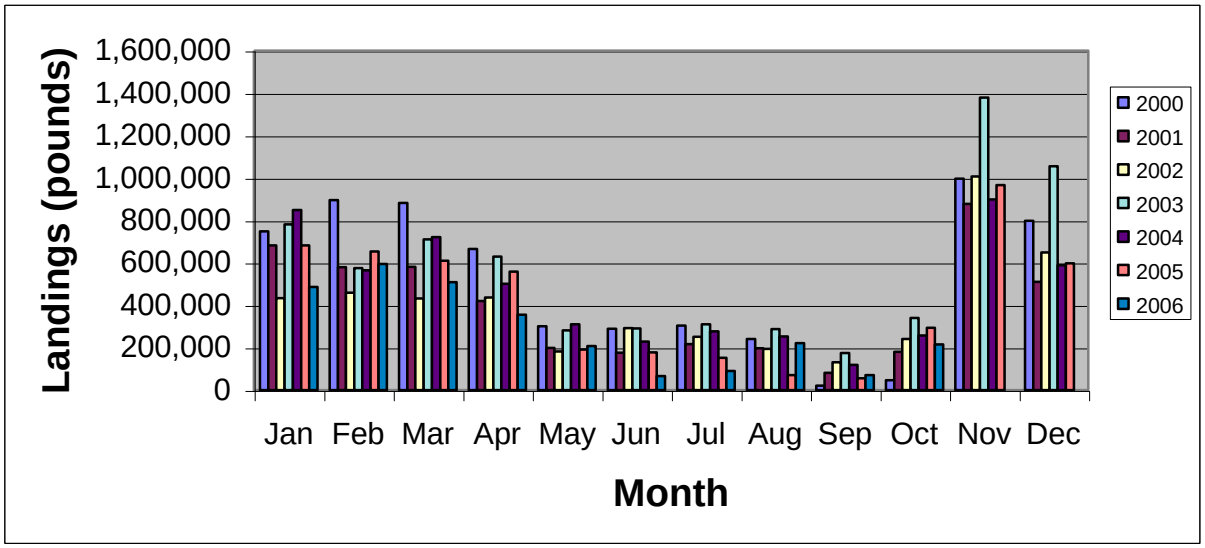

Figure 4.5-1. Texas oyster landings by month for 2000 to 2006[36]. Source: NMFS.

Shrimp

Shrimp landings throughout the Gulf of Mexico have been steadily declining in recent years, as many vessels have exited the fishery due to poor economic conditions related to increased competition from imported shrimp and to high fuel costs. Texas shrimp landings reflect this trend, declining from over 93 million pounds in 2000 to just over 70 million pounds in 2005 (Table 4.5-1). A decrease in landings and in the ex-vessel value of shrimp (GMFMC 2007) has reduced the total dockside value of the state's commercial shrimp fishery over time (Table 4.5-2).

The dramatic increase in shrimp landings observed in 2006 is attributed to an increase in the catch per unit effort of the shrimp fishery, rather than to an increase in the overall effort of the shrimp fishery (James Nance 2007, pers. comm.). Current information indicates the ex-vessel value of shrimp in 2006 (about $1.60 per pound) is substantially less than the 2000–2006 average (about $2.08 per pound).

Finfish

Texas commercial finfish landings fluctuated between 5.1 and 6.2 million pounds from 2000 through 2005 (Table 4.5-1). Finfish landings in 2005 totaled about 5.7 million pounds, which is near the 2000–2005 average. Hurricane Rita does not appear to have affected the dockside value of finfish species, which was at or above average in 2005 and 2006 (Figure 4.5-2). It is unknown whether 2006 finfish landings will meet or exceed the 2005 level because November and December data are not yet available for 2006.

Crabs, lobsters and other invertebrates

Blue crab is the primary invertebrate species caught in Texas, comprising more than 95 percent of the total invertebrate catch. However, stone crab and squid also are included in this category. Landings of other invertebrates in 2005 were the lowest recorded from 2000 through 2005, totaling only 3.2 million pounds compared to an annual average of 4.8 million pounds (Table 4.5-1). The dockside value of this fishery also declined below average in 2005, totaling only $2.6 million (Table 4.5-2). Although incomplete, 2006 data suggest landings will continue this downward trend. Monthly landings data for May through October 2006 are much lower than those for May through October 2005 (Figure 4.5-2). Declines in landings cannot be attributed solely to the impacts of Hurricane Rita. Monthly blue crab landings were below average in 2005, well before Rita came ashore on the Texas coast.

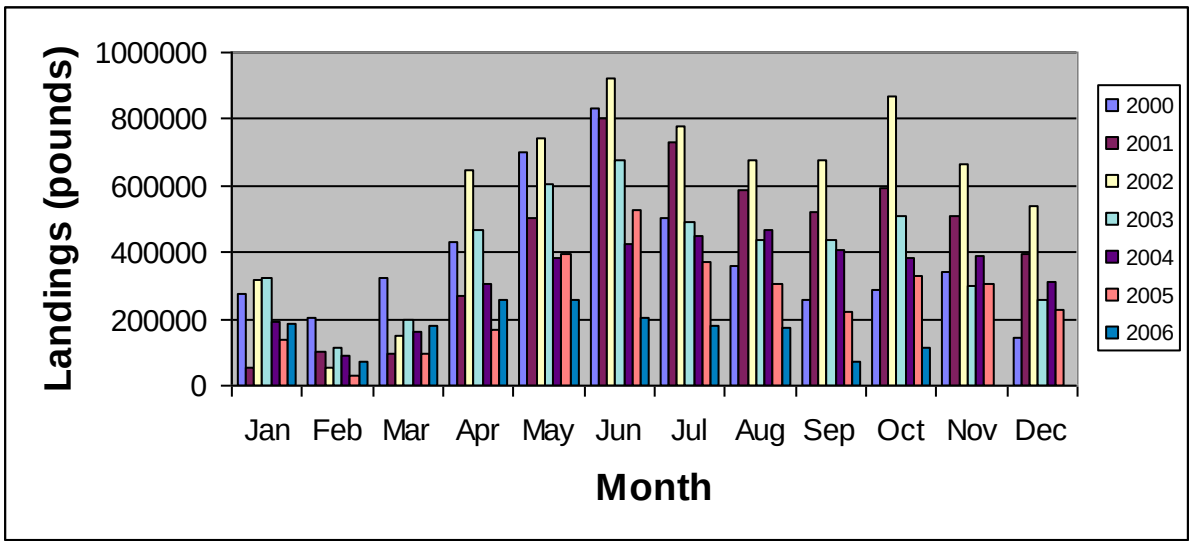

Figure 4.5-2. Texas blue crab landings by month from 2000 to 2006[36]. Source: NMFS.

4.5.1.2 Commercial fishing capacity

Little information is available regarding the impacts of Hurricane Rita on Texas fisheries. The greatest impacts were felt in the Sabine Lake and Galveston Bay areas, which make up about 37 percent of Texas inshore waters and account for about 68 percent of the ex-vessel value of commercial landings (Simpson 2005). However, no information is available to date on the number of vessels damaged by the storm. Storm-related power failures undoubtedly made it difficult for fishermen to fuel their vessels, and the physical damage to docks caused by the storm likely created operational problems.

Simpson (2005) indicates between 43 percent and 54 percent of the commercial oyster, bay shrimp, bait shrimp, and crab vessels in the Sabine Lake and Galveston Bay regions were affected by the storm (Table 4.5-3). These vessels operate primarily in inshore and coastal waters. A smaller percentage of Gulf shrimp and commercial finfish vessels were affected by the storm in that area. These vessels are more likely to operate in offshore waters.

Table 4.5-3. Number and percent of commercial licenses in the Sabine Lake and Galveston Bay regions of Texas affected by Hurricane Rita.[37] Source: Simpson (2005).

License Type	Total Number of Licenses	Number of Licenses Affected	Percent of Licenses Affected
Oyster Boat	694	373	54
Gulf Shrimp Boat	1,122	396	35
Bay Shrimp Boat	772	343	44
Bait Shrimp Boat	766	332	43
Crab Boat	219	94	43
Finfish Fishermen	337	43	13

Overall, commercial license sales declined from 22,291 in 2001 to 16,885 in 2006 (Table 4.5-4). However, sales of some licenses increased or remained stable during that period (Table 4.5-4; Figure 4.5-3). Oyster license sales increased almost 50 percent between 2001 and 2006, which could be attributed to speculative interest in the fishery in the years leading up to a limited entry program implemented in 2005. In contrast, license sales in the limited entry commercial shrimp and finfish fisheries declined about 28 percent and 24 percent, respectively, between 2001 and 2006. A buyback program is currently in place for finfish commercial licenses. License sales in the limited entry commercial crab fishery, which is also under a buyback program, have remained relatively stable since 2001.

[37] The data used in Table 4.5-3 should not be compared with the values provided in Table 4.5-4 because they were provided to Simpson (2005) as a preliminary report.

Table 4.5-4. Number of licenses issued by Texas for commercial fishing operations from 2001 to 2005. Source: Texas Parks and Wildlife Department and GSMFC (2002–2005).

License Type	2001	2002	2003	2004	2005	2006
Retail Fish Dealer	2,897	2,674	2,562	2,633	2,679	2,608
Resident Commercial Fishing Boat	315	326	285	279	257	242
Class A Menhaden Boat License	15	13	14	11	12	11
Class B Menhaden Boat License	25	26	22	22	24	21
Saltwater Trotline Tags	5,381	5,532	5,182	5,019	4,518	4,171
Nonresident General Commercial Fisherman	255	22	22	19	18	24
Nonresident Commercial Finfish Fisherman	15	1	1	1	-	-
Resident Commercial Finfish Fisherman	548	495	502	432	386	365
Resident General Commercial Fisherman	1,148	1,022	768	778	700	646
Nonresident Commercial Fishing Boat	13	14	20	20	18	24
Finfish Subtotal	10,612	10,125	9,378	9,214	8,612	8,112
Resident Commercial Gulf Shrimp Boat	1,344	1,266	1,003	1,086	1,179	1,001
Resident Commercial Shrimp Boat Captain	3,116	2,810	2,537	2,350	2,076	1,733
Individual Bait Shrimp Trawl Tags	-	628	585	522	458	387
Resident Commercial Bay Shrimp Boat	342	1,191	1,100	985	891	812
Nonresident Commercial Gulf Shrimp Boat	469	480	360	254	270	135
Nonresident Commercial Shrimp Boat Captain	421	428	319	230	224	126
Nonresident Commercial Bay Shrimp Boat	1	-	1	-	-	-
Resident Commercial Bait Shrimp Boat	1,288	1,172	1,090	984	888	807
Shrimp Subtotal	6,981	7,975	6,995	6,411	5,986	5,001
Resident Commercial Oyster Boat	293	281	319	381	756	726
Resident Commercial Oyster Boat Captain	413	368	433	554	598	672
Resident Commercial Oyster Fisherman	3	2	5	1	2	1
Nonresident Commercial Oyster Boat	17	10	6	85	24	16
Nonresident Commercial Oyster Boat Captain	16	6	5	93	36	33
Oyster Subtotal	742	667	768	1,114	1,416	1,448
Resident Commercial Crab Fisherman	1,265	230	234	229	224	222
Invertebrate other Subtotal	1,265	230	234	229	224	222
Nonresident Shell Buyer	1	1	-	-	-	1
Finfish Import	83	93	87	81	141	174
Bait Dealer Individual	259	248	265	281	267	259
Wholesale Fish Dealer	645	598	569	544	543	559
Wholesale Fish Dealer Truck	65	71	56	56	52	55
Retail Fish Dealer Truck	891	878	836	896	861	824
Bait Shrimp Dealer	697	282	253	238	231	230
Dealer Subtotal	2,641	2,171	2,066	2,096	2,095	2,102
Total	22,241	21,168	19,441	19,064	18,333	16,885

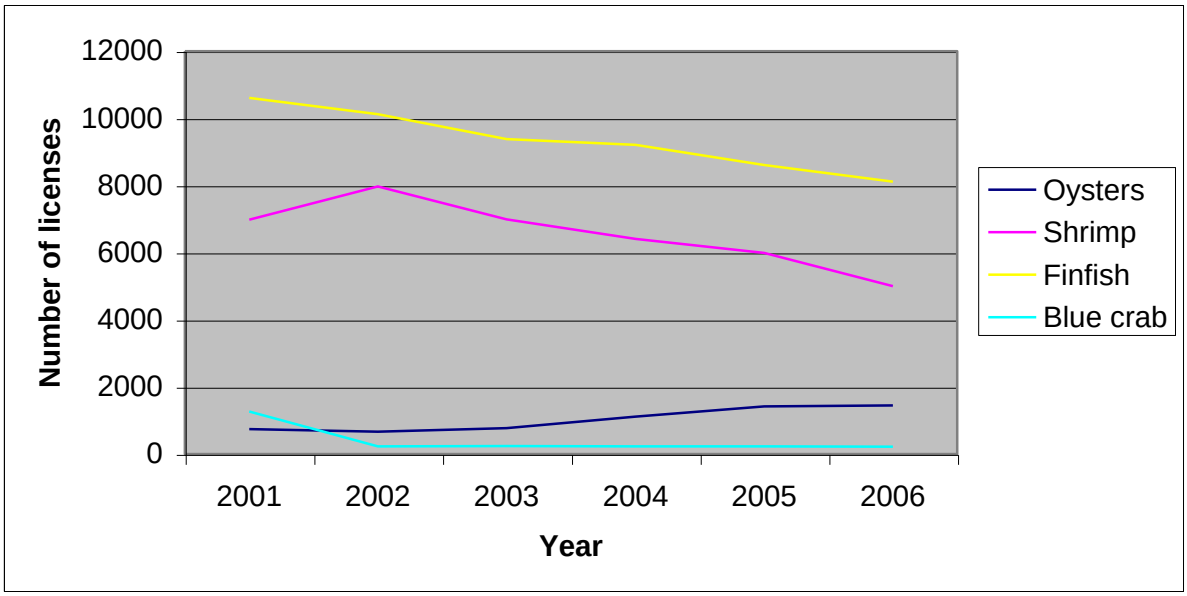

Figure 4.5-3. Number of commercial fishing licenses by fishery from 2001 to 2006. Source: Texas Parks and Wildlife Department and GSMFC (2002-2005).

The 2005 hurricane season did not substantially impact the number of federal permits and licenses issued for commercial vessels based in Texas (Table 4.5-5). The numbers of permits and licenses issued for both coastal migratory pelagic (primarily mackerels) and reef fish fisheries in 2005 and 2006 were similar to the 2001–2004 average (Janet Miller 2007, pers. comm.). The number of permits issued for the Spanish mackerel fishery has steadily declined since 2001, a trend not attributable to hurricanes. Trends in the issuance of commercial shrimp permits were not examined in this report because that permit requirement was implemented only recently.

Table 4.5-5. Number of federal permits and licenses issued for commercial fishing operations based in Texas from 2001 through 2006. Source: NMFS.

Year	King Mackerel	Spanish Mackerel	Reef Fish	Red Snapper Class 1 and 2
2001	39	14	81	71
2002	41	14	85	78
2003	35	12	82	75
2004	32	9	80	74
2005	34	9	85	79
2006	31	6	83	80

4.5.1.3 Commercial fishing-related infrastructure and services

Hurricane Rita undoubtedly affected commercial dealers, fish houses, and marinas. Storm-related power outages are believed to have resulted in the loss of refrigerated and/or frozen fish products. Based on a survey conducted shortly after Rita made landfall of licensed aquatic product dealers in the Galveston Bay area, Simpson (2005) reported 94 of 104 licensed dealers were active. Only 17 of the 58 dealers who had telephone service indicated they suffered no storm-related damage. The number of dealer licenses sold post-Rita is similar to that recorded in the years immediately preceding the storm (Table 4.5-4).

4.5.2 Recreational fisheries

Texas' marine recreational fisheries harvested 1.6 million finfish in 2004 and 1.7 million finfish in 2005 (NMFS 2007a). These fisheries were responsible for over 4 percent of marine recreational fishing trips made in the Gulf of Mexico in 2005 (NMFS 2007a).

4.5.2.1 Recreational catches

The recreational landings data summarized in this section were obtained from the Texas Parks and Wildlife Department (TPWD) and are derived from the state's recreational fishing survey (Mark Fisher 2007, pers. comm.). The recreational fishing year is defined as May 15 through May 14 of the following year. Hurricane Rita struck the Texas coast during the 2006 fishing year, defined as May 15, 2005, through May 14, 2006.

Annual coast-wide recreational landings varied little between 2000 and 2006, ranging from 1.84 million fish to 2.3 million fish (Table 4.5-6). Most landed fish (70 to 80 percent) were captured on private trips rather than on guided trips. In the Sabine Lake and Galveston Bay areas, the percentage of fish caught on private trips was even greater (generally between 85 and 95 percent). Simpson (2005) estimated Galveston Bay and Sabine Lake are responsible for 37 percent of Texas' annual saltwater recreational fishing pressure, resulting in about $232 million in retail sales for fishing and $496 million in total economic impact. The lowest value on record during the 2000–2006 period reflects a large decrease in both private and guided trip landings in the Sabine Lake area the year Hurricane Rita made landfall. Landings of both groups were down 48 percent and 92 percent, respectively, that year relative to the 2004–2005 level.

Table 4.5-6. Total number of fish landed in Texas' Sabine Lake and Galveston Bay for fishing years 1983–2005 for private and guided fishing trips. Source: TPWD.

Year[38]	Coast-wide				Sabine				Galveston			
	Private	Guided	Total	% Private	Private	Guided	Total	% Private	Private	Guided	Total	% Private
99-00	1,983,265	506,505	2,489,770	79.7	181,429	39,634	221,063	82.1	878,311	54,865	933,176	94.1
00-01	1,727,890	577,450	2,305,340	75.0	262,064	100,369	362,433	72.3	639,009	25,231	664,240	96.2
01-02	1,496,281	396,655	1,892,936	79.0	195,812	11,234	207,046	94.6	607,004	19,875	626,879	96.8
02-03	1,383,615	518,447	1,902,062	72.7	114,964	14,698	129,662	88.7	442,100	50,642	492,742	89.7
03-04	1,468,828	423,459	1,892,287	77.6	134,747	18,156	152,903	88.1	501,052	36,442	537,494	93.2
04-05	1,500,195	336,466	1,836,661	81.7	163,154	4,679	167,833	97.2	425,023	27,308	452,331	94.0
05-06	1,440,538	394,982	1,835,520	78.5	85,452	371	85,823	99.6	485,058	54,159	539,217	90.0

4.5.2.2 License/effort information

The number of recreational fishing licenses issued by the Texas Parks and Wildlife Department remained fairly constant from 2001–2004 at just over 2.1 million licenses per year (Table 4.5-7). The decrease in license sales observed in 2005 is attributed to the reclassification of saltwater and freshwater license categories.

Table 4.5-7. Total number of licenses sold from 2001 to 2006 for recreational fishing in Texas, including licenses for guide fishermen. Source: TPWD.

LICENSE TYPE	2001	2002	2003	2004	2005	2006
Resident Combination Hunting & Fishing	201,119	189,205	177,568	156,848	139,397	95,311
Super Combo Package	333,321	345,543	355,385	353,023	345,871	369,490
Senior Combination Hunting & Fishing	16,503	20,307	22,235	24,612	23,473	19,023
Senior Super Combo Hunting & Fishing (w/State Stamps)	10,874	16,021	19,244	23,538	26,390	32,226
Resident Fishing	847,575	819,562	798,038	766,796		
Special Resident Fishing	48,777	56,550	63,721	70,972		
Nonresident Fishing	43,743	43,635	43,223	31,690		
Temporary Nonresident Fishing (5 day)	52,365	29,242	48,932	49,615		
Lake Texoma Fishing		24,827	23,345	27,404	27,709	29,938
Temporary Resident Fishing (14 day)	24,588	22,966	21,722	25,860		
Saltwater Sportfishing Stamp	472,158	459,311	452,515	458,393	26,883	
Freshwater Trout Stamp		16,174	14,929	15,306		
Tarpon Tag	12	22	18	11	17	24

[38] The fishing year is defined as May 15 through May 14 of the following year.

LICENSE TYPE	2001	2002	2003	2004	2005	2006
Temporary Resident Sportfishing (3 day)	92,424	86,346	88,124	101,342		
The Texan Package	367	286	-			
Disabled Veteran Hunting & Fishing	11,471	12,793	15,209	18,321	21,268	24,155
Bonus Red Drum Tag	4,965	5,662	6,688	7,660	7,582	
Lifetime Combination License Purchase	417	469	445	749		
Lifetime Fishing License	43	37	50	168	224	
Lifetime Combination Hunting & Fishing	3,720	3,962	3,250	2,639	3,849	1,090
Lifetime Fishing License	166	246			97	100
Saltwater Sportfishing Stamp					26,883	
Resident Saltwater Fishing Package					104,550	86,292
Resident All Water Fishing Package					152,913	116,445
Special Resident Saltwater Fishing Package					13,312	12,840
Special Resident All Water Fishing Package					15,115	16,129
Resident Year-From-Purchase All Water Package					91,042	132,782
Resident July and August Saltwater Fishing Package					2,201	2,428
Resident July and August All Water Fishing Package					582	597
Resident Saltwater Fishing Day Plus Package					41,106	46,088
Resident All Water Fish Day Plus Package					687	788
Nonresident Salt Water fishing Package					9,897	10,263
Nonresident All Water Fishing Package					4,722	5,134
Nonresident Saltwater Fishing Package					21,776	24,576
Nonresident All Water Fishing Day Plus Package					662	717
Exempt Angler Tag					3,148	3,018
Resident Sport Oyster Boat	53	47	47	58	52	
Resident Saltwater Fishing Day Plus Package Repurchase					2,722	3,419
Resident All Water Fish Day Plus					33	63

LICENSE TYPE	2001	2002	2003	2004	2005	2006
Package Repurchase						
Nonresident Saltwater Fishing Day Plus Package Repurchase					1,363	1,526
Nonresident All Water Fish Day Plus Package Repurchase					39	54
Total	2,164,608	2,153,166	2,154,641	2,134,947	1,115,513	1,034,516

The number of guide licenses issued for the for-hire fishery declined about 50 percent between 2001 and 2006, from about 1,900 licenses issued annually during 2001–2003 to about 900 licenses issued annually during 2004–2006 (Table 4.5-8). This decrease also reflects a restructuring of the license system, as well as a change in the price structure of the licenses. Hurricane Rita is not believed to have impacted the for-hire sector, overall, because for-hire license sales have actually increased slightly since the storm.

Table 4.5-8. Number of licenses issued by Texas for guide fishing operations from 2001 to 2006. Source: Texas Parks and Wildlife Department and GSMFC (2002-2005).

LICENSE TYPE	2001	2002	2003	2004	2005	2006
Fishing Guide	1,887	1,862	1,895	900	918	928

As noted in Table 4.5-6, 2005–2006 landings from guide fishing trips in the Sabine Lake area were much lower than those recorded in previous years. Unfortunately, license data provided in Table 4.5-8 is not site-specific, but based on sales for the entire state. Therefore, it is difficult to assess the consequences of Hurricane Rita on the for-hire sector in affected regions. Simpson (2005) estimated the number of Galveston and Sabine Lake fishing guides, charter boats, and party boats that could have been affected by Hurricane Rita to be 174 operations. However, because neither for-hire sales nor total for-hire landings have decreased, it is possible that affected for-hire operations have relocated to other coastal areas.

Federal for-hire permit data indicate Hurricane Rita had little effect on the for-hire fishery. The decline in the number of federal coastal migratory pelagic and reef fish vessel permits issued for Texas-based vessels between 2003 and 2004 (Table 4.5-9; Janet Miller 2007, pers. comm.) is attributed to the adoption of a limited access program. Sales of both permit types have remained relatively stable since 2004.

Table 4.5-9. Number of federal permits and licenses issued for Texas-based for-hire vessels from 2001 to 2006. Source: NMFS.

Year	Permit Type	
	Coastal Migratory Pelagic	Reef Fish
2001	343	342
2002	343	343
2003	345	346
2004	254	253
2005	273	270
2006	269	262

Walker et al. (2006) surveyed the owners of 40 Texas for-hire vessels with homeports in Nedarland, Galveston, Port Lavaca, and Port Aransas. Twenty of the 40 vessels were used as guide boats, 14 were used as six-pack charter vessels, three were used as multi-passenger vessels, and three were used as headboats. Twenty-three of the vessels fished in federal waters, 29 in state coastal waters, and 26 in inshore waters. None of the vessels were lost to the storm, but eight of the 40 vessels reported Rita-related damage, with a total estimated cost of $36,400. Insurance companies reimbursed only $5,500 of this loss, in part because many affected vessel owners carried high deductibles. Additionally, the 1,056 lost trips reported by respondents were estimated to result in over $1.2 million in lost revenue and $111,650 in lost wages for support personnel (i.e., deckhands). Respondents estimated lost trips in 2006 would result in another $1.6 million in lost income, bringing total projected storm-related losses for the 40 for-hire vessels sampled in this survey to just under $3.0 million.

4.5.2.3 Recreational fishing-related infrastructure and services

The physical damage Hurricane Rita caused to marinas, docks, and boat ramps adversely impacted recreational fishing activities. According to Walker et al. (2006), at least four northeast Texas marinas closed after the storm, but all except one reopened less than 30 days later. Simpson (2005) reports that only 19 of 30 boat ramps in the Galveston Bay and Sabine Lake area were usable after Rita struck the Texas coast. Six of the remaining 11 boat ramps were unusable, and the status of the remaining five ramps was unknown. Only five trailers were observed during a roving survey of boat ramp usage conducted on October 6, 2005, and only three of these trailers were not associated with contractor activity (Simpson 2005). Prior to 2005, the same roving survey reported a daily average of 118 trailers at these same ramps during September and October. Rita-related power failures and outages also adversely impacted recreational fishing by limiting the availability of fuel (Simpson 2005).

5 IMPACT OF THE FOURTH EMERGENCY SUPPLEMENTAL APPROPRIATIONS BILL FOR POST–HURRICANE KATRINA AND RITA GULF COAST NEEDS AND ADDITIONAL RESOURCE NEEDS OF FISHERMEN

5.1 Background

On June 15, 2006, the President signed the *Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery 2006* (P.L. 109-234). This was the fourth appropriations bill enacted since Hurricanes Katrina, Rita, and Wilma made landfall on the Gulf of Mexico coast in 2005. Through this act, Congress provided NOAA $188 million to assist the Gulf Coast states with ongoing recovery efforts in the Gulf of Mexico. Congress allocated the $188 million to the following activities:

- Rehabilitating oyster beds and shrimp grounds, and monitoring the recovery of Gulf of Mexico fisheries through cooperative research ($90 million).
- Reseeding, rehabilitating, and restoring oyster reefs ($38 million).
- Mapping for debris removal ($20 million).
- Rebuilding the NMFS Southeast Science Center laboratory located in Pascagoula, Mississippi ($20 million).
- Replacing an emergency response mapping aircraft to provide information about hurricane damage ($12 million).
- Providing disaster relief assistance to fishermen adversely impacted by fisheries disasters declared in 2005 (not to exceed $5 million).
- Establishing Physical Oceanographic Real-Time Systems (PORTS) along the Gulf of Mexico ($2 million).
- Repairing and replacing tide gauge stations in the northern Gulf of Mexico ($1 million).

On August 25, 2006, NOAA awarded the $128 million provided by Congress for Gulf of Mexico fisheries to the Gulf States Marine Fisheries Commission in the form of a cooperative agreement. Through this agreement, NOAA and the Commission are coordinating the efforts of the Gulf Coast states to restore and rehabilitate oyster beds and shrimp grounds and to monitor the recovery of Gulf of Mexico fisheries from the devastating impacts of the 2005 hurricanes.

Funds are being distributed for a 5-year period ending August 31, 2011, and were based on assessed damages to the fisheries resources of each Gulf Coast state. Of the $1 million provided to NMFS for coordinating the agreement, the Commission was provided $765,817 to administer the award for the states. Individual state allocations are as follows:

- Louisiana ($53 million).
- Mississippi ($37 million).
- Alabama ($30 million).
- Florida ($4 million).
- Texas ($3 million).

Table 5-1 describes how each state has allocated its award among the recovery categories throughout the award period. Table 5-2 describes the specific area in which each state is concentrating its recovery efforts.

Table 5-1. Allocation of funds by recovery category.

Recovery Category	Funds (thousand dollars)					Total by Year	Total by Activity
	AL	FL	MS	LA	TX		
Oyster Reef Reseeding, Rehabilitation & Restoration							
Year 1	33.3	373.7	5,643.3	9632.8	883.5	16,566.6	
Year 2	2,000.0	944.9	3,676.7	8,850.3	311.6	15,783.4	
Year 3	2,000.0	795.9	2,610.0	3,592.0	312.0	9,309.9	
Year 4	2,000.0	846.9	1,888.3	487.5	307.8	5,530.6	
Year 5	1,100.0	846.9	1,181.7	337.5		3,466.1	
Total	**7,133.3**	**3,808.3**	**15,000.0**	**22,900.0**	**1,814.9**		**50,656.6**
Oyster Bed & Shrimp Ground Rehabilitation							
Year 1	1,550.0		1,450.0	5,467.7	157.5	8,625.2	
Year 2	3,950.0		12.5	5,100.0	294.6	9,357.1	
Year 3	2,750.0		12.5	4,816.0	283.6	7,862.1	
Year 4	2,150.0		12.5	4,816.0	232.9	7,211.4	
Year 5	100.0		12.5	4,817.0	8.6	4,938.1	
Total	**10,500.0**		**1,500.0**	**25,016.7**	**977.3**		**37,993.9**
Cooperative Research/Monitoring							
Year 1	2,800.0	219.3	6,704.0	1,000.0	127.6	10,850.9	
Year 2	2,300.0	166.6	5,601.8	1,000.0	127.6	9,196.1	
Year 3	2,300.0	39.2	3,525.8	1,000.0	127.6	6,992.6	
Year 4	2,300.0		2,355.0	1,000.0		5,655.0	
Year 5	2,300.0		2,355.0	1,000.0		5,655.0	
Total	**12,000.0**	**425.0**	**20,541.7**	**5,000.0**	**382.8**		**38,349.5**
Total By State	**29,633.3**	**4,233.3**	**37,041.7**	**52,916.7**	**3,175.0**		**127,000.0**

Table 5-2. Areas identified for restoration, rehabilitation, and monitoring.

State	Area
TX	Existing reef habitat and navigational channels in the Sabine Lake and Galveston Bay ecosystems
LA	Private oyster leases, public oyster seed grounds, fishing/shrimping areas, and navigation channels statewide
MS	Oyster reefs, marsh areas, and fishing/shrimping grounds, as well as navigation channels in Hancock, Harrison, and Jackson Counties
AL	Mobile Bay and Alabama coastal waters
FL	Escambia Bay (Escambia and Santa Rosa Counties), East Bay and Blackwater Bay (Santa Rosa County), Choctawhatchee Bay (Okaloosa and Walton Counties), West Bay, North Bay and East Bay (Bay County), Apalachicola Bay (Franklin County), Ochlochonee Bay and Oyster Bay (Wakulla County), Suwannee Sound and Waccasassa Bay (Dixie and Levy Counties)

5.2 State proposals for restoration, rehabilitation, and monitoring

The key recovery activities to which the states will apply the fourth emergency supplemental appropriations are summarized below.

5.2.1 Oyster reef reseeding, rehabilitation, and restoration

The Gulf Coast states will use a portion of their awards to survey, map, and restore existing and relict oyster reefs. Replacing substrate and transplanting juvenile oysters is the most effective way to increase the natural productivity of oyster populations. Reefs restored in this manner can remain productive for 10 to 20 years.

The states are surveying coastal and estuarine habitat using primarily side-scan sonar technology. In addition to providing states the data needed to determine where to focus their restoration activities, these surveys are providing baseline mapping data that can be used in determining the impacts of future natural disasters, anthropogenic activities, and disease.

The states are using hydrographic data to determine the optimal locations for reseeding, rehabilitating, and restoring existing and relict oyster reefs. Some states are using existing hydrologic monitoring programs. Others are expanding existing programs by installing new sensors, data loggers, and solar panels on existing U.S. Coast Guard navigational beacons and U.S. Geological Survey platforms.

The majority of the funds allocated to each state will be used to acquire and deposit cultch material (oyster shells, clam shells, limestone, and crushed concrete) on existing reef sites that are determined by surveys and hydrographic data to be damaged and/or in other areas where natural reproduction occurs. State marine resource personnel, contractors, and/or fishermen will conduct this work in the spring and fall seasons, when oysters have the greatest chance of reproductive success. Louisiana, Mississippi, and Florida also will reimburse active resident private oyster farmers to restore oyster habitat and oyster stocks on private oyster leases. Combined, the states intend to plant cultch over about 1,950 acres. However, the actual acreage to be cultivated will depend on the findings of the oyster reef surveys and mapping efforts.

Some states will transplant juvenile oysters and oyster spat onto restored reefs to accelerate the recovery process. For example, Louisiana plans to develop a native stock oyster hatchery at the state's Department of Wildlife and Fisheries Marine Research Laboratory located in Grand Isle to seed oyster beds damaged by the hurricanes and to spawn and rear disease-resistant oysters. Mississippi and Florida plan to have state personnel and/or resident commercial oyster fishermen transplant oysters taken from areas of high abundance (or where harvest is restricted because of potential public health risks) to other areas where environmental conditions favor growth, survival, and public health and safety.

5.2.2 Oyster bed and shrimp ground rehabilitation

Each Gulf Coast state will apply a portion of its award to removing marine debris deposited by the 2005 hurricanes on oyster reefs, shrimping grounds, navigational channels, and other sensitive habitats. The marine debris resulting from the hurricanes presents a critical safety issue to shrimp fishermen and others navigating the coastal waters of the Gulf of Mexico. Side-scan sonar technology is being used to locate and map the debris. State and commercial contract vessels will be used to remove large hangs and obstructions. Some states also will compensate resident fishermen, vessel owners, wholesale seafood buyers, and/or seafood processors for locating and/or removing small debris and fish traps lost in inshore waters.

A portion of the funds will be allocated to activities designed to restore marshes, artificial reefs, and/or other coastal fishery habitat adversely impacted by the 2005 hurricanes. The hurricanes destroyed large areas of tidal marsh along the Gulf of Mexico coastline, which provides essential nursery habitat for shrimp, crabs, and finfish. Additionally, the hurricanes deposited sediment and silt along the mouths of many bayous and rivers, which has reduced the outflow of fresh water and altered the hydrological conditions of estuarine habitats that are critical to oyster, shrimp, and finfish reproduction and growth. Sediment dredged from these areas will be used to restore marsh habitat, and wave attenuation devices (e.g., floating or submerged breakwaters) will be constructed to protect restored marsh from future storm events.

Mississippi also will conduct boat and air surveys of coastal and estuarine waters to determine how the hurricanes impacted the distribution of aquatic invasive species, and will use this information to develop an eradication plan. Additionally, Mississippi will use a portion of its funds to restore existing artificial reefs damaged by the hurricanes and create new artificial reefs in shallow water or permitted offshore reef areas to assist in the recovery of Gulf of Mexico fisheries. The storms scoured and/or buried about 85 percent of the state's nearshore low-profile reef habitats and about 90 percent of the state's offshore reefs. The state plans to contract with an aquaculture facility to release and monitor hatchery-raised reef fish on selected offshore artificial reef sites.

5.2.3 Cooperative research and monitoring

All Gulf Coast states will conduct cooperative research and monitoring to ensure contractors have fulfilled their obligations and to determine the success of rehabilitation and restoration efforts once they have been completed. Louisiana, Mississippi, and Alabama will establish or enhance a variety of data collection programs to be used in monitoring the recovery of Gulf of Mexico fisheries. Existing or new logbook programs and/or surveys will be used to collect catch, effort, economic, and other data from commercial fishermen, vessel owners, wholesale seafood buyers, fresh products license holders, seafood processors, for-hire captains, and recreational fishermen. Observers may be used on a voluntary basis. Mississippi will contract with resident charter boat fishermen to monitor the recovery of fish stocks around deepwater artificial reefs, and will work with the U.S. Coast Guard to install and maintain real-time coastal drainage basin meteorological monitoring stations that will provide data needed to effectively

manage oyster fisheries. Louisiana will develop and implement a records management and archiving system for state oyster leasing records to maintain permanent storm-proof records.

Fishery-independent scientific sampling surveys will be used to monitor water quality and the recovery of Gulf of Mexico fisheries. Texas will contract with state agencies and universities to study the impacts of the storms on marine resources, and find possible solutions to mitigate the impacts of future storms. Alabama will evaluate offshore shrimp and fish egg and larval abundance and distributions, and compare the tolerance of these organisms to rapid temperature changes and chemical impacts with that of hatchery-produced shrimp and fish eggs and larvae. Florida will develop a scientific protocol to be used in assessing damage and recovery of the state's oyster resources.

5.3 Achievements to date

The Gulf Coast states' accomplishments to date are summarized in Table 5-3. With few exceptions, accomplishments are primarily administrative in nature. At this stage of the award period, the states are concentrating primarily on bidding materials and contracts, assessing and mapping habitat in need of rehabilitation, and developing project and equipment specifications. Many states have indicated that the actual amount of acreage they will be able to rehabilitate with their award depends greatly on final bids for materials, which are highly uncertain.

Table 5-3. Achievements by state through February 2007.

STATE	ACREAGE CURRENTLY MAPPED OR MARKED	ACRES CULTCHED	ACRES SEEDED
Texas	0	0	0
Louisiana			
Public	400	0	0
Leased	0	0	0
Mississippi		175	175
Alabama	500	0	0
Florida	0	0	0

Mississippi has planted cultch over 175 acres and installed more than 75,000 sacks of seed oysters through March 2007. The state continues identifying oyster beds to be restored, and plans additional cultch plants this spring. Also, that state has installed 240 pyramid reefs under the Artificial Reef Restoration program, removed in excess of 9,600 derelict crab traps from Mississippi fishing grounds, and ordered environmentally friendly replacement traps. Louisiana intends to plant 400 acres of cultch on public oyster grounds in spring and fall of 2007, with additional cultch plants planned for 2008 and 2009. Alabama has identified nearly 500 acres of bottom habitat that would support new cultch plants, but has funds enough to plant only about 83 acres at current prices, which have increased as much as 100 to 150 percent post-Katrina. Texas

and Florida are currently locating and mapping habitat, and intend to begin planting cultch in 2008.

5.4 Summary

NMFS will continue to monitor this important cooperative agreement and to provide the states the technical assistance needed to ensure their overall collective efforts in restoring commercially and recreationally valuable ecological resources and associated habitats is logically planned to achieve beneficial, comprehensive results. This grant was the largest ever awarded by NMFS and is expected to significantly benefit the recovery of Gulf of Mexico fisheries. However, additional funding is needed to more adequately address needs in the resource proper and to expedite the recovery of the harbors/marinas and nearshore access facilities that are needed to support the recovery of markets and processors. The absence of these support industries continues to burden Gulf of Mexico fishermen, particularly fishermen in the states most adversely impacted by the 2005 hurricane season.

6 NOAA RECOMMENDATIONS

6.1 Background

Resources provided to Gulf Coast fisheries to date have been allocated to short-term programs and activities focused on marine debris cleanup, habitat restoration, and temporary jobs for dislocated fishermen and others employed in the seafood industry. Longer-term programs are needed to fully restore fishing-related infrastructure and services and to improve the sustainability of fisheries and the Gulf Coast fishing communities they support. NOAA is seeking to address these complex and interrelated issues through a holistic or ecosystem-based approach that:

- Includes diverse stakeholder views on the proper mix of activities to be undertaken in rebuilding efforts.
- Adapts approaches based on local conditions.
- Incorporates the latest and best scientific information regarding appropriate rebuilding techniques.
- Plans for multiple human activities in the Gulf area, including commercial and recreational fishing, energy development, tourism, and other sustainable uses of marine resources.

In the following sections, NOAA sets forth recommendations for a comprehensive fishery recovery plan. This plan would require substantial coordination among federal, state, local, and regional planning and management bodies; leveraging of existing financial resources, financial accountability, and expertise; and additional funding and/or legislative changes. No single agency or institution alone can accomplish the full suite of recovery programs and activities outlined below. NOAA will rely on input from local and state planning and management groups in determining how, and under what conditions, shoreside fishery infrastructure will be rebuilt. State and regional managers will determine how the various states will participate in Gulf-wide rebuilding efforts. Federal agency partners are essential as well, because a variety of federal

laws govern aspects of ocean management, especially those pertaining to fisheries in the U.S. exclusive economic zone.

Existing management institutions can guide policy decisions and planning for most recovery issues. These institutions have the experience, contacts, and financial and technical expertise required to successfully accomplish the described programs and activities. New institutions created as a result of the President's Ocean Action Plan can potentially be used to expedite planning and multi-agency coordination on issues of science and management at the federal level. The White House Council on Environmental Quality can potentially assist in coordinating rebuilding efforts. Likewise, the Joint Subcommittee on Ocean Science and Technology and the Subcommittee on Integrated Management of Ocean Resources should continue to have the authority to coordinate scientific and management-related issues under the President's Ocean Policy Committee.

Existing fisheries institutions are well placed to help coordinate recovery efforts and can be used to oversee the use of any additional funds appropriated to rebuild Gulf of Mexico fisheries and fishing communities. Existing state marine fisheries agencies in Louisiana, Mississippi, Alabama, Florida, and Texas already have cooperative arrangements for fishery restoration and rehabilitation using their existing authorities. The Gulf States Marine Fisheries Commission and the Gulf of Mexico Fishery Management Council are developing strategies to assist in coordinating and prioritizing recovery efforts among states, and between the states and federal fisheries institutions. Both groups have financial and institutional oversight mechanisms that can be used to efficiently oversee projects. NOAA, has longstanding institutional arrangements with state and local governments for undertaking cooperative conservation, coastal zone management, and fishery rebuilding programs. In addition to these coordination mechanisms, there are a number of specialized arrangements for interagency cooperation specific to the topics discussed below.

6.2 Comprehensive recovery plan

NOAA's comprehensive plan for recovering Gulf of Mexico fisheries has four primary objectives:

(1) Providing short-term relief to displaced workers employed in harvesting, processing, and recreational fishing businesses affected by the storms.
(2) Building more sustainable and profitable commercial and recreational fisheries.
(3) Improving the quality and productivity of nursery and adult habitats for fishery resources.
(4) Rebuilding essential fishing-related facilities in a way that is consistent with coastal planning efforts that improve the resiliency of coastal communities, enabling them to better withstand and recover from the effects of future hurricanes and other disasters.

The plan focuses on four major areas for recovery efforts:

(1) Providing short-term financial assistance and other types of support services to fishermen adversely affected by hurricane events.

(2) Restoring the infrastructure needed to support commercial and recreational fisheries.
(3) Developing and funding capacity reduction, bycatch reduction, data collection, monitoring, and enforcement programs intended to improve conservation and management of Gulf of Mexico fisheries over the long term.
(4) Recovering essential fisheries habitat and building more resilient coastal areas supporting fish and fisheries.

The habitat-related programs and activities needed to satisfy the fourth major recovery area are being addressed in a separate report to Congress. As a result, the recommendations identified in this report address only the first three major recovery areas, which focus on responding to the short-term and direct impacts of the storms and on developing healthy and resilient fisheries and fishing communities over the long term. More detailed discussions of these three recovery areas are provided below, based on ideas proposed by various knowledgeable groups and fisheries management institutions.

6.2.1 Providing short-term financial assistance and support services

Rebuilding Gulf of Mexico fisheries will require short-term assistance and support services focused on restoring the region's valuable oyster reefs, cleaning up marine debris, rebuilding fishery infrastructure, and providing jobs for dislocated fishermen and workers employed in the seafood industry. Many fishing vessels damaged or destroyed by the hurricanes were uninsured due to the precarious financial conditions extant in those fisheries prior to the 2005 hurricane season. Consequently, in many cases, private insurance is not available to help fishermen recover and restore their vessels to productive use. This is particularly true for the shrimp fishery, which has been experiencing a general economic downturn since 2001. Many vessels are expected to become a public liability and to require assistance for removal. Sunken vessels and other hurricane-related marine debris not removed from waterways create pollution or navigation hazards. Funds provided to the Gulf Coast states through the fourth emergency supplemental appropriations act are being allocated to short-term assistance and support services. However, additional resources will be needed to fully address NOAA's recommendations for providing short-term relief.

Recommended short-term assistance and support services include projects that:

- Continue removing marine debris from oyster beds, tidal creeks, salt marshes, coastal wetlands, barrier islands, and the nearshore marine environment.
- Continue cleaning oyster beds of excess sediment, using hydraulic methods, and preparing for spat fall by planting sufficient amounts of cultch.
- Compensate fishermen and seafood workers who undertake cleanup activities and begin repairing damaged facilities.
- Continue employing fishermen and vessel owners in marine debris and living marine resource assessment activities.
- Continue using NOAA's charting and mapping capabilities to help identify and recovery marine debris fields and other obstructions to fishing and navigation.

6.2.2 Restoring the infrastructure to support commercial and recreational fisheries

Surveys conducted by NOAA contractors to date document extensive damage to fishery infrastructure in Alabama, Louisiana, and Mississippi. Recovering fisheries in areas where destruction is complete and pervasive is expected to take years to accomplish. In addition to the short-term projects described above, long-term plans and investments are needed in recovery programs that promote more sustainable and resilient fisheries. Part of these investments will include public funding of projects for marinas, piers, and dockage facilities. The reconstruction of these public access facilities is not guaranteed, and is critical to a vibrant fishing economy.

If coastal areas are rebuilt primarily with private investments, there will be great pressure to convert what were once working waterfronts into luxury housing, commercial properties, and tourism-based structures. Investments in the physical structures that support access to the waterfront and in ancillary working areas and transportation hubs are required to rebuild fishery infrastructure. There has been some interest in developing marine industrial parks in selected areas to concentrate processing, marine support services, and distribution shipment areas (including access to rail lines, airports, and interstate trucking). Developing processing, maintenance, and distribution infrastructure away from vulnerable waterfront areas would increase the likelihood this infrastructure can survive future storms. However, the fishery sector must be involved in such planning and zoning decisions.

Recommended investments in long-term infrastructure redevelopment for fishery support can include:

- Redevelop marinas, piers, docks, wharves, and warehouses to support commercial and recreational fishing and, especially, investments in public facilities supporting working waterfronts.
- Plan for and support marine fishing-related industrial parks that cluster processing and marine support businesses in ways that increase access to key facilities and services and enhance intermodal transportation of fishery products.
- Replace private fisheries infrastructure through loan programs and other investments to be repaid.

6.2.3 Restructuring Gulf of Mexico fisheries to become more economically sustainable

A number of important Gulf of Mexico fisheries were either significantly overcapitalized or subject to severe adverse economic conditions prior to the 2005 hurricane season. These conditions were reducing fishery profitability and, in some cases, leading to overfishing of fishery resources. In particular, the Gulf shrimp fishery has been under severe economic stress as a result of market competition from foreign sources and escalating fuel prices. This fishery also faces potential effort restrictions designed to assist fishery managers in rebuilding the overfished red snapper stock.

Many Gulf of Mexico fishing vessels were damaged by the storms, and may not return to the fishery for a long time unless they are able to secure financing and other support services. However, if relief efforts simply focus on refurbishing vessels and rebuilding fishery infrastructure, many fisheries are likely to return to marginally profitable conditions. Alternatively, relief efforts could use voluntary buyback programs or limited access privilege programs (LAPP), which provide market-based incentives for reducing capacity and improving fishery profitability. NMFS recently implemented an individual fishing quota (IFQ) program for the commercial red snapper fishery, and the Gulf of Mexico Fishery Management Council is currently contemplating the development of a LAPP for the multispecies grouper fishery, for recommendation to NMFS.

The Gulf of Mexico Fishery Management Council also has suggested funding limited buyback programs for the shrimp and for-hire recreational fisheries. The costs of such programs are one-time payments to those who voluntarily retire their permits. The fate of the vessels associated with retired permits is critical to the effectiveness of buyback programs. The goals of such programs will likely be undermined if such vessels are allowed to continue operating in state waters or to move to other fisheries. Consequently, buyback programs must be implemented in close coordination with affected states. Additionally, such programs may require the vessels associated with retired permits to be scrapped.

Direct appropriations would likely be needed to successfully implement buyback programs in the Gulf of Mexico given the current economic conditions in these fisheries and the prospects of protracted long-term recovery. Given poor market conditions and the high price of fuel, some question whether the shrimp fishery will *ever* become profitable. Reducing costs and creating a unique market identity (niche) for the product are necessary to re-establish profitability in the shrimp fishery. Costs will be reduced as the fishery reduces effort and becomes more efficient. The catch-per-unit-effort of the fishery increases as effort is reduced. Finally, industry interest in marketing wild-caught Gulf shrimp as distinct from aquaculture-derived imports is an important strategy to pursue. An improved seafood promotion program could help the industry recover market share lost as a result of the hurricanes.

About $137 million would be needed to purchase 50 percent of the 1,806 shrimp permits that were active in 2005. About 1,700 vessels have been issued permits under the new shrimp moratorium program. However, NOAA Fisheries Service expects to receive additional applications through the October 26, 2007, application deadline. Analyses conducted at the time the shrimp permit moratorium was implemented estimated 2,666 vessels would qualify for a moratorium permit. However, only 1,806 vessels reported shrimp landings in 2005 and are likely to qualify for the moratorium permit, defining the universe of vessels that can reasonably be expected to continue operating in the fishery. The average per-vessel buyback cost of $152,000 represents the average total gross revenue per vessel for 2005; lower-performing vessels would receive less than this amount, and higher-performing vessels would receive more than this amount. This buyback estimate does not include the cost of scrapping vessels.

Job retraining is an essential component of fishing capacity reduction programs. When fishing capacity was reduced in the New England groundfish fishery, 1,000 people were retrained for alternative professions through programs administered through the Department of Labor. The per-person cost of these programs was $10,000. Given the significant rebuilding efforts that will be ongoing in the Gulf of Mexico for many years to come, retraining fishery workers for occupations in building and other trades would provide strong sources of local income and would ease the cost of transitioning to sustainable fisheries.

Finally, fishery restructuring activities also should modernize data collection, improve monitoring, replace outdated and lost gear, and implement new conservation technology to further minimize bycatch and habitat impacts.

Recommended restructuring activities for Gulf fisheries include:

- Develop buyback programs to ease overcapitalization and overfishing of Gulf marine resources.
- Coordinate effort reduction in federal and state waters to avoid potentially significant loopholes.
- Develop and implement a seafood promotion strategy for those Gulf fisheries that have restructured to become sustainable.
- Institute job retraining programs to ease the transition of displaced fishery workers into alternative occupations.
- Replace fishing gear that was damaged or destroyed by the hurricanes and that belongs to vessels remaining in fisheries that have restructured.
- Deploy more efficient turtle exclusion devices and bycatch reduction devices in the remaining fleet of shrimp vessels.
- Purchase and provide 1 year of associated fees to equip all federally permitted shrimp vessels with electronic vessel monitoring systems.
- Equip all federally permitted fishing vessels with electronic logbooks to record catch data.
- Provide at least 1 percent of the shrimp and reef fish fisheries with at-sea observer coverage to document the catch, bycatch, and profitability of these fisheries for 3 years.
- Develop and fund a cooperative research program to test various gears and to monitor the recovery of Gulf fishery resources and fisheries, including the socioeconomic impacts of restructuring programs.

6.3 Summary

NOAA is working with its partners to address the recommendations described above within the confines of available resources. Funds provided to the Gulf Coast states through the fourth emergency supplemental appropriations act are being applied to the first major recovery area, which focuses on responding to the short-term and direct impacts of the storms. However, additional resources will be needed to fully address NOAA's recommendations for short-term assistance and support services. Additional funding and/or legislative changes will be required to implement the items recommended under the second and third major recovery areas, which focus on developing healthy and resilient fisheries and fishing communities over the long term.

However, implementing these recommendations will assist an industry devastated by the hurricanes in a way that simultaneously resolves chronic, longer-term problems affecting the sustainability of Gulf fisheries. Investing in these programs and recommendations will support and revitalize a multi-billion-dollar seafood industry (accounting for multiplier effects from first sale value) in the Gulf of Mexico, and will have significance far beyond the fisheries sector.

On May 25, 2007, the President signed into law a fifth emergency supplemental appropriations act, which provides NOAA an additional $110 million for expenses related to the consequences of Hurricanes Katrina and Rita on the shrimp and fishing industries. NOAA is working with its partners to determine how best to allocate these funds to continued recovery efforts. However, the magnitude of the problems related to recovering and rebuilding Gulf fisheries remain far greater than can be addressed with available resources.

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