

Estimation of the Baseline for Assessment of Economic Impacts of the
Gulf of Mexico Oil Spill
on Mississippi's Commercial Fishing Sector



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INTRODUCTION

The National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling (2011) reported that on “April 20, 2010, the Macondo well blew out, costing the lives of 11 men and beginning a catastrophe that sank the Deepwater Horizon drilling rig and spilled nearly 5 million barrels of crude oil into the Gulf of Mexico. The spill disrupted an entire region’s economy, damaged fisheries and critical habitats, and brought vividly to light the risks of deepwater drilling for oil and gas — the latest frontier in the national energy supply.”

Damages to the Gulf of Mexico (GOM) natural resources due to the 2010 Gulf of Mexico oil spill (GOMOS) are taking some time to clean up, and the restoration period to return these resources to their original pre-GOMOS status is still indefinite. Several early restoration projects in affected states are in the process of implementation with initial funding from British Petroleum (BP) amounting to \$1 billion (NOAA Gulf Spill Restoration, 2012). In the meantime, the production and consumption of goods and services by economic sectors located in the GOM states are adversely affected, leading to possible reductions in economic activity, tax revenues, and employment and personal income.

GOMOS resulted in closure of significant portions of GOM federal and state waters to commercial and recreational fishing, as well as closure of beach resources to human uses. These closures altered the recreational and consumption decisions of residents and tourists in affected communities. Changes in the market perceptions and flow of goods and services generated by the damaged natural resources affected not only households but also communities dependent on these natural resources.

Commercial fishing corresponds to economic sectors 114111 (finfish fishing) and 114112 (shellfish

fishing) in the North American Industrial Classification System (NAICS, 2011). Finfish fishing comprises establishments primarily engaged in the commercial catching or taking of finfish from their natural habitat. Shellfish fishing comprises establishments primarily engaged in the commercial catching or taking of shellfish from their natural habitat.

In order to understand the magnitude of the potential economic impacts of the GOMOS to the commercial fishing sector in Mississippi, we compiled multiyear baseline economic information about the sector from various secondary sources. The baseline periods selected for this determination covered 5 years before and after Hurricane Katrina (2000–2004, 2005–2009) (Posadas, 2008). Secondary data used in the determination of the baseline period included the annual volume (pounds), landing values (dollars), and imputed ex-vessel prices (dollars per pound) of the commercial fishing sector from 2000 to 2010 as reported by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries). The commercial fishing sector included shrimp, oysters, blue crabs, menhaden, and miscellaneous species.

Our overall goal was to measure the direct economic impacts of the GOMOS on the commercial fishing sector in Mississippi. The first specific objective of this bulletin was to determine the appropriate baseline period by comparing the commercial landings during the 5 years before and the 5 years after Hurricane Katrina. Secondly, it aimed to evaluate the economic recovery of the commercial fishing sector from the damages associated with recent natural disasters by comparing the commercial landings during the post-Katrina period with landings in the pre-Katrina period.

Finally, the bulletin sought to measure the immediate direct impacts of the oil spill on the commercial fishing sector by comparing the 2010 commercial landings with the appropriate baseline period.

The significance of this determination is that the choice of the baseline period influenced the estimates of damages and the recovery period for the commercial fishing sector after the oil spill. The baseline period covered the immediate past decade starting from 2000. The pre-Katrina period refers to the years 2000–2004. The post-Katrina period covers the years 2005–2009, while the GOMOS period starts in 2010. In this bulletin, statistical comparisons of the pre-Katrina and the post-Katrina economic performance of the commercial harvesting sector was conducted for all species combined and by major species landed in the Mississippi, primarily shrimp, oysters, crabs, menhaden, and miscellaneous species.

The determination of the baseline period was based on the statistical comparison of the pre-Katrina to the

post-Katrina period. If the means of the two periods were not significantly different from one another, then either period was used as the baseline period. If the means of the two periods were significantly different, both the pre- and post-Katrina baseline periods were used as baseline data and reported in this bulletin. If the post-Katrina data were significantly lower than the pre-Katrina data, then it was noted that the commercial fishing sector had not yet fully recovered from the damages associated with the recent natural disasters (Posadas, 2008).

After the baseline period was selected, the ratio of the current year's output was compared with the expected output during the baseline period. If the ratio was less than 100%, then the economic sector suffered a loss in current year's output as compared with the expected output. If the ratio was greater than 100%, then the commercial fishing sector generated a gain in current year's output. A neutral economic impact on the fishing sector occurred when the ratio was equal to 100%.

COMMERCIAL AND RECREATIONAL FISHING CLOSURES

The decision to close or open federal and state waters to commercial and recreational fishing was made by NOAA Fisheries and the Food and Drug Administration (FDA). The closures of significant portions of GOM federal and state waters to commercial and recreational fishing and closures of beach resources to human uses due to GOMOS altered the recreational and consumption decisions of residents and tourists in affected counties and communities. These fishing closures have serious economic implications to the commercial seafood industry and the recreational fishing industry of the state.

More than one-third of the GOM federal waters were closed to commercial and recreational fishing starting on May 2, 2010. Figure 1 shows the daily record of the number of square miles of federal waters closed to fishing. Between June 2010 and July 2010, more than 80,000 square miles were closed to commercial and recreational fishing, representing more than one-third of the total federal waters in the entire region (Figure 2). By April 19, 2011, all

the federal waters in the GOM were opened to both commercial and recreational fishing.

Up to 97 percent of the Mississippi state waters were closed to commercial and recreational fishing starting on June 1, 2010. Figure 3 shows the daily summary of the number of square miles of Mississippi waters closed to fishing. In July 2010, almost all of the Mississippi state waters were closed to commercial and recreational fishing (Figure 4). By August 7, 2010, all the Mississippi state waters were opened to both commercial and recreational fishing.

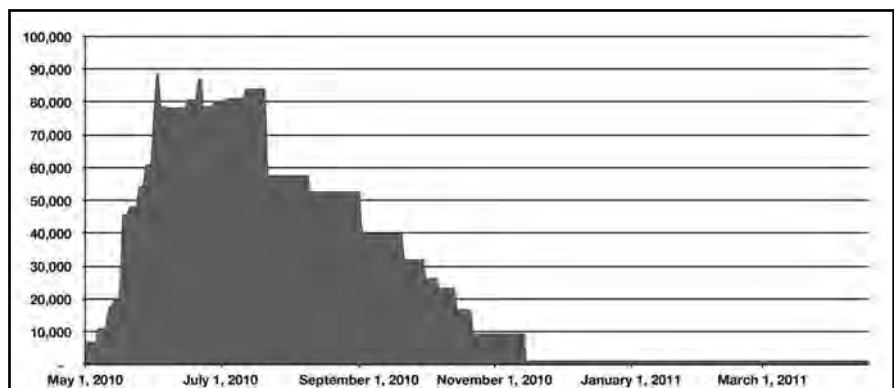
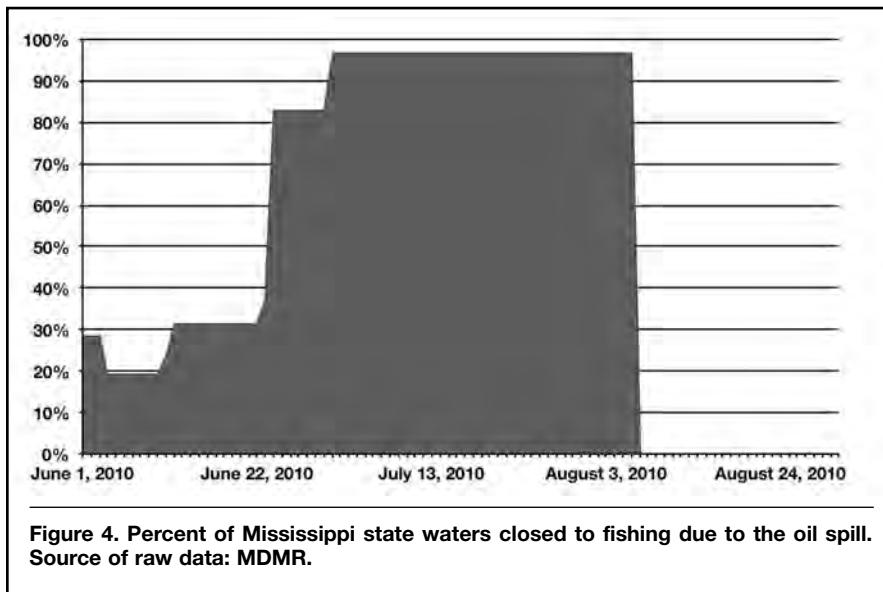
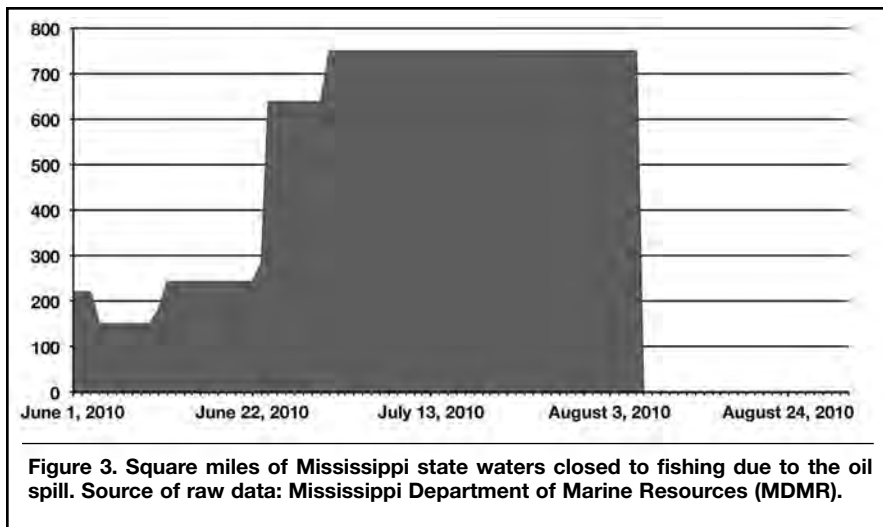
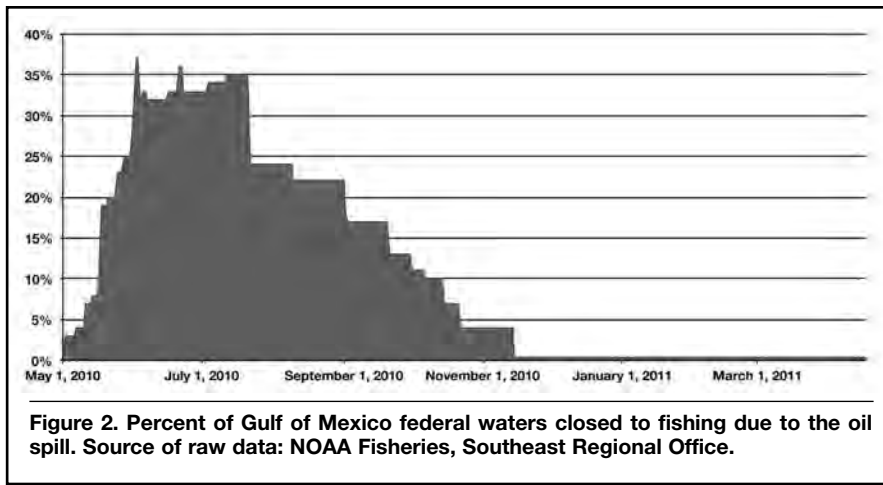


Figure 1. Square miles of Gulf of Mexico federal waters closed to fishing due to the oil spill. Source of raw data: NOAA Fisheries, Southeast Regional Office.



MISSISSIPPI SEAFOOD INDUSTRY

The Mississippi seafood industry consisted of the commercial harvesting sector, seafood processors and dealers, seafood wholesalers and distributors, and retail sectors. Recent annual estimates showed that the seafood industry generated total sales impacts amounting to \$289.241 million (Table 1). The industry created a total of 6,392 jobs and generated personal income totaling \$112.624 million in 2009.

The commercial harvesting sector included commercial fishermen using various gears onboard vessels (more than 5 tons) and boats (less than 5 tons). Recent annual estimates of the economic impact of this sector showed that it produced \$60.857 million in total sales, created 1,238 jobs, and generated \$18.835 million in personal

income. Figure 5 shows the annual values of major species harvested by commercial fishermen from 2000 to 2010, including shrimp, oysters, blue crabs, and finfish. The bulk of the finfish landings consisted of menhaden.

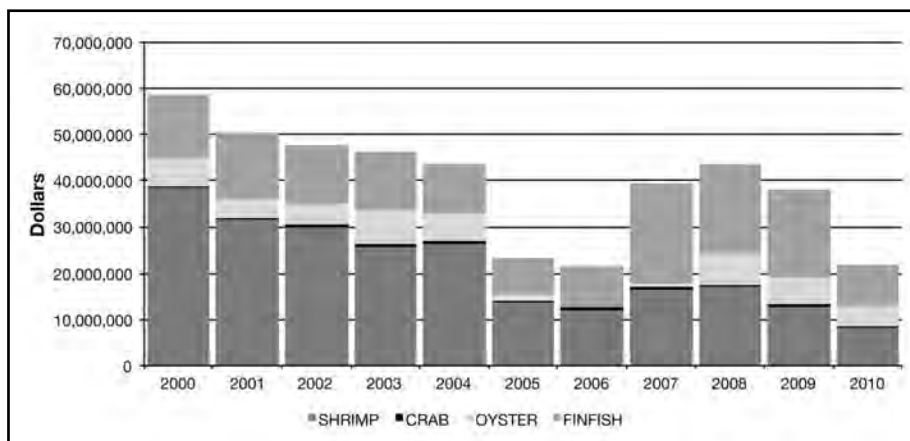


Figure 5. Mississippi annual commercial landing values by major species, 2000–2010 (in dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 1. Economic impacts of Mississippi commercial seafood industry for all species combined by sector, 2009.¹

Sector	Sales impacts	Income impacts	Employment impacts
	\$M	\$M	jobs
Commercial harvesters	60.857	18.835	1,238
Seafood processors and dealers	78.907	31.217	1,046
Importers	13.652	2.188	50
Seafood wholesalers and distributors	10.450	3.688	112
Retail sectors	125.376	56.697	3,946
Total impacts	289.241	112.625	6,392

¹Includes direct, indirect, and induced economic effects. Source of data: NOAA Fisheries Economics & Social Sciences Program.

TOTAL COMMERCIAL LANDINGS

Figure 6 shows the 2010 Mississippi commercial landings of all species combined presented side by side with the baseline data covering 5 years before and after Hurricane Katrina. The total commercial landings of all species combined dropped to 111.2 million pounds in 2010, which was valued at \$21.9 million at current market prices.

Analysis of variance (ANOVA) results revealed that the average commercial landings (ALLMSLBS) during the pre-Katrina period were not significantly different ($p=0.05$) from those during the post-Katrina period (Appendices A and B). Test results suggested that either period or the entire past decade could be used as baseline period in determining the impacts of the GOMOS on the combined landings of all species.

Table 2 shows that the total pounds landed by commercial fishermen in Mississippi (ALLMSLBS) in 2010 was 53% of the average annual amount during the past decade (ALLMSLBS = 209.6 million pounds). This percentage indicated that the 2010 landings were about 47% or 98.4 million pounds short of the expected commercial landings based on the landings reported during the last decade.

ANOVA results demonstrated that total commercial landing values (ALLMSDOL) were significantly higher during the pre-Katrina period than the post-Katrina period (Appendices A and B). Average commercial landing values during the pre-Katrina period (ALLMSDOL =

\$49.3 million) were significantly higher than those during the post-Katrina period (ALLMSDOL = \$33.2 million).

Total landing values of all species in 2010 were about 44% of the average annual values from 2000 to 2004. Total values in 2010 fell by 56% of the average in the pre-Katrina period, which amounted to \$27.4 million. When compared with the average values from 2005 to 2009, the 2010 value was about 66% of that amount. Foregone annual gross sales of the commercial fishing sector in 2010 were 34% (or \$11.3 million) of the average amount during the post-Katrina period. When the post-Katrina baseline was used, foregone annual gross sales were less than those seen when the pre-Katrina baseline was used.

Total deflated commercial landings (ALLMSDEF) and deflated imputed ex-vessel prices (ALLMSEVP) were significantly higher during the pre-Katrina period than during the post-Katrina period (Appendices A and

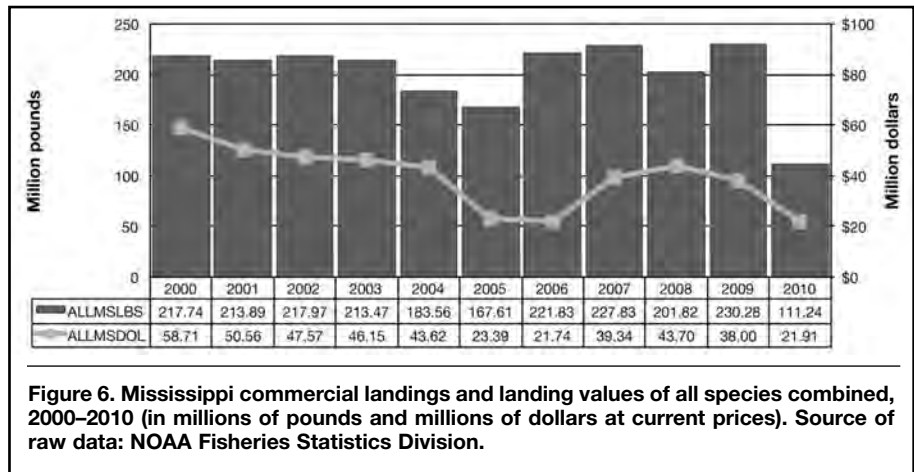


Figure 6. Mississippi commercial landings and landing values of all species combined, 2000-2010 (in millions of pounds and millions of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 2. Comparison of 2010 total commercial landings of all species combined to the baseline periods.

Baseline period	ALLMSLBS ¹	ALLMSDOL ²	ALLMSDEF ³	ALLMSEVP ⁴
Pre-Katrina	53%	44%	37%	69%
Post-Katrina	53%	66%	63%	119%
Past decade	53%	53%	46%	87%

¹Commercial landings of all species combined.
²Commercial landing values (at current prices) of all species combined.
³Commercial landing values (at constant prices) of all species combined.
⁴Deflated imputed ex-vessel prices of all species combined.

B). Table 2 shows a comparison of the baseline periods with the 2010 deflated total landing values and imputed ex-vessel prices of all species combined.

Commercial landings of all species combined during the GOMOS-affected period in 2010 were not significantly different from landings during the two baseline periods. Commercial landings declined by 98.4 million pounds when compared with the pre- and

post-Katrina periods. The overall impacts of the oil spill on 2010 commercial landing values of all species combined were significantly different using the two baseline periods. Foregone annual gross sales of all species combined were \$27.4 million when compared with the pre-Katrina period. When compared with the post-Katrina period, foregone annual gross sales of all species combined were \$11.32 million.

COMMERCIAL SHRIMP LANDINGS

Figure 7 shows the 2010 Mississippi commercial landings of all shrimp species as compared with the baseline data covering the 5 years before and after Hurricane Katrina. Total commercial landings of all shrimp species combined dropped to 2.5 million pounds (headless) in 2010, which was valued at \$8.3 million in current prices.

ANOVA results (Appendices A and B) showed that average commercial shrimp landings during the pre-Katrina period (SHRMSLBS = 10.4 million pounds) were significantly higher than those during the post-Katrina period (SHRMSLBS = 5.7 million pounds). The total weight of all shrimp species landed by commercial fishermen in Mississippi in 2010 was 24% of the average annual shrimp landings during the 5 years before Hurricane Katrina. The decrease in 2010 shrimp landings reached 76% of the expected landings based on the pre-Katrina baseline data. When weighed against the post-Katrina baseline data, 2010 landings were approximately 44% of the 5-year average annual shrimp

landings. The decline in shrimp landings amounted to 3.2 million pounds or 56% as compared with post-Katrina baseline data.

ANOVA results (Appendices A and B) showed that average commercial shrimp landing values during the pre-Katrina period (SHRMSDOL = \$30.3 million) were significantly different from those during the post-Katrina period (SHRMSDEF = \$14.4 million). Total value of all shrimp species landed by commercial fishermen in 2010 was about 27% of the average annual landing value from 2000 to 2004. The drop in value reached 73% of the pre-Katrina baseline average, or

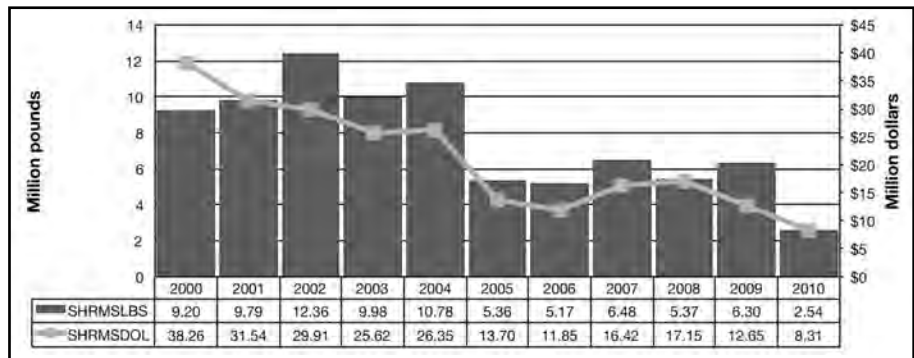


Figure 7. Mississippi commercial landings and landing values of all shrimp species, 2000-2010 (in millions of pounds of headless shrimp and millions of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 3. Comparison of 2010 commercial shrimp landing data to the baseline periods.

Baseline period	SHRMSLBS ¹	SHRMSDOL ²	SHRMSDEF ³	SHRMSSEVP ⁴
Pre-Katrina	24%	27%	23%	91%
Post-Katrina	44%	58%	55%	123%
Past decade	32%	37%	32%	104%

¹Commercial landings of all shrimp species combined.

²Commercial landing values (at current prices) of all shrimp species combined.

³Commercial landing values (at constant prices) of all shrimp species combined.

⁴Deflated imputed ex-vessel prices of all shrimp species combined.

approximately \$22 million. When compared with the 2005–2009 baseline data, the 2010 shrimp landing value was about 58% of the average annual value. Shrimp landing value dropped by 42% when using the post-Katrina baseline average, or approximately \$6 million.

Deflated shrimp commercial landings (SHRMSDEF) were significantly higher during the pre-Katrina period than the post-Katrina period (Appendices A and B). Deflated average shrimp ex-vessel prices (SHRMSEVP) were not significantly different during the two baseline periods. Comparisons of 2010 deflated shrimp landings and imputed ex-vessel prices to the baseline periods are shown in Table 3.

Note that during the past decade, there have been continued declines in the ex-vessel prices of various wild shrimp species and counts harvested from the GOM states. Gulf commercial landings accounted for 7.5% of the total U.S. consumption of all shrimp species in 2009 due to the continued increase in imports of both farmed and wild-caught shrimp species.

Overall impacts of the GOMOS on 2010 shrimp commercial landings were significantly different when compared to the two baseline periods. These differences during the two periods indicate that the commercial shrimping sector has not yet fully recovered from damages associated with the recent disasters. The reduction in commercial shrimp landings in 2010 reached 7.9 million pounds when compared with the pre-Katrina period. When compared with the post-Katrina period, shrimp landings fell by 3.2 million pounds in 2010.

Similarly, overall impacts of the GOMOS on 2010 commercial shrimp landing values were significantly different when compared with the two baseline periods. Foregone annual gross sales of all shrimp species combined were \$22 million when compared with the pre-Katrina period. When compared with the post-Katrina period, foregone annual gross sales of all shrimp species combined were \$6 million.

COMMERCIAL OYSTER LANDINGS

Combined commercial oyster landings from the five GOM states accounted for 56% of the total U.S. oyster harvest in 2009. Figure 8 shows 2010 Mississippi commercial oyster landings compared with baseline data covering the 5 years before and after Hurricane Katrina. Total commercial oyster landings fell to 1.45 million pounds in 2010, which was valued at \$4.27 million at current prices.

ANOVA outcomes (Appendices A and B) showed that average commercial oyster landings during the pre-Katrina period (OYMSLBS = 3.2 million pounds) were significantly higher than those during the post-Katrina period (OYMSLBS = 1.43 million pounds). Note that the massive damage caused by Hurricane Katrina closed state oyster reefs for two harvesting seasons from September 2005 to March 2007. The total weight of oysters landed by Mississippi commercial fishermen in 2010 was about 45% of the average annual poundage during the 5 years before Hurricane Katrina. The drop in the 2010 landings was 1.7 million pounds or 55% of expected landings based on

pre-Katrina baseline data. When compared with post-Katrina baseline data, 2010 landings were approximately 102% of the 5-year average annual amount.

Total commercial oyster landing values (OYMSDOL) were not significantly different during the pre-Katrina period when compared with the post-Katrina period (Appendices A and B). These results suggested that either period or the entire decade could be used as the baseline period. The total value of oysters landed by commercial fishermen in 2010 was about 76% of the average annual value from 2000 to

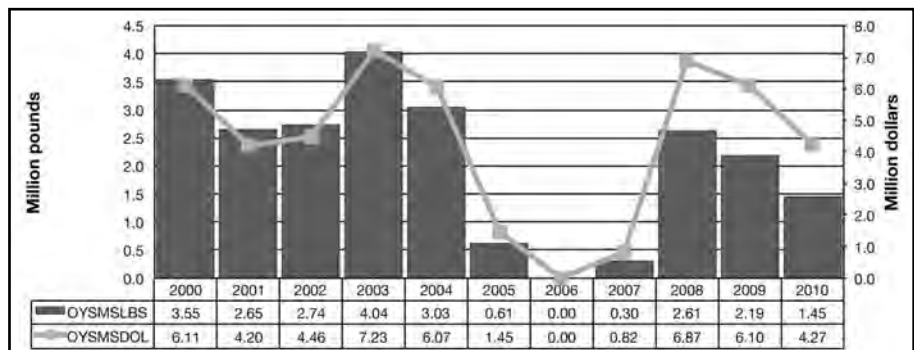


Figure 8. Mississippi commercial landings and landing values of oysters, 2000–2010 (in millions of pounds of meat and million of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

2004 (OYSMSDOL = \$5.6 million). The total loss in 2010 output as compared with the expected output of oysters amounted to \$1.3 million.

When compared with the past decade's average output (OYSMSDOL = \$4.8 million), 2010 oyster landings were about 89%, or \$0.5 million, short of the expected annual value. When compared with the post-Katrina period (OYSMSDOL = \$3.8 million), the 2010 oyster landing value rose by 12%, or \$0.5 million.

Deflated oyster commercial landings (OYSMSDEF = \$2.5 million) were not significantly different during the two baseline periods (Appendices A and B). Deflated average oyster ex-vessel prices (OYSMSEVP = \$1 vs. \$1.3 per pound of oyster meat) were significantly higher during the post-Katrina period than in the pre-Katrina period. Comparisons of 2010 deflated oyster-landing values and imputed ex-vessel prices to the baseline periods are shown in Table 4.

Overall impacts of the GOMOS on 2010 oyster commercial landings were significantly different when using the two baseline periods. Significant differences in average landings during the two periods demonstrated that the commercial oystering sector was still recovering from damages associated with the recent disasters. The decrease in commercial oyster landings in 2010 was 1.7 million pounds when compared with the pre-Katrina period. When compared with the post-Katrina period, 2010 oyster landings rose by 2%.

Overall impacts of the GOMOS on 2010 commercial oyster landing values were significantly different when compared with the two baseline periods. Foregone annual gross sales of oysters were \$1.3 million when compared with the pre-Katrina period. When matched with the post-Katrina period, annual gross sales increased \$0.5 million.

Table 4. Comparison of 2010 commercial oyster landing data to the baseline periods.

Baseline period	OYSMSLBS ¹	OYSMSDOL ²	OYSMSDEF ³	OYSMSEVP ⁴
Pre-Katrina	45%	76%	63%	139%
Post-Katrina	102%	112%	109%	107%
Past decade	60%	89%	78%	123%

¹Commercial landings of oysters.
²Commercial landing values (at current prices) of oysters.
³Commercial landing values (at constant prices) of oysters.
⁴Deflated imputed ex-vessel prices of oysters.

COMMERCIAL CRAB LANDINGS

Combined commercial blue crab landings from the GOM states accounted for 38% of the total U.S. blue crab harvest in 2009. Figure 9 shows 2010 Mississippi commercial blue crab landings compared with baseline data covering 5 years before and after Hurricane Katrina. Total commercial blue crab landings declined to 0.37 million pounds in 2010, which was valued at \$0.37 million at current prices.

Results of the ANOVA on commercial blue crab landings (CRAMSLBS = 0.7 million pounds) indicated that the pre-Katrina period was not significantly different from the post-Katrina period (Appendices A and B). These results implied that either of the two periods or the entire past decade could be used as the baseline. The total weight of blue crabs landed by Mississippi commercial fishermen in 2010 was 53% of the average annual amount of the past decade (CRAMSLBS = 0.7 million pounds). Compared with the past decade, 2010 commercial blue crab landings were about 47% or 0.3 million pounds short of the expected landings.

Results of the ANOVA on commercial blue crab landing values (CRAMSDOL = \$0.6 M) revealed that the pre-Katrina period was not significantly different from the post-Katrina period (Appendices A and B). These results implied that either

period or the entire past decade could be used as the baseline. The total ex-vessel value of blue crabs (CRAMSDOL = \$0.37 million) landed by commercial fishermen in 2010 was about 60% of average value from 2000 to 2009. The 2010 landing value was about 40% of the average value during the past decade, amounting to about \$0.2 million.

The overall impacts of the GOMOS on 2010 commercial blue crab landings were similar when compared with the two baseline periods. Commercial blue crab landings fell by 0.3 million pounds in 2010. Overall impacts of the GOMOS on 2010 commercial blue crab landing values were not different when compared with the two baseline periods. The foregone annual gross sales of blue crabs were \$0.2 million when compared with the entire past decade.

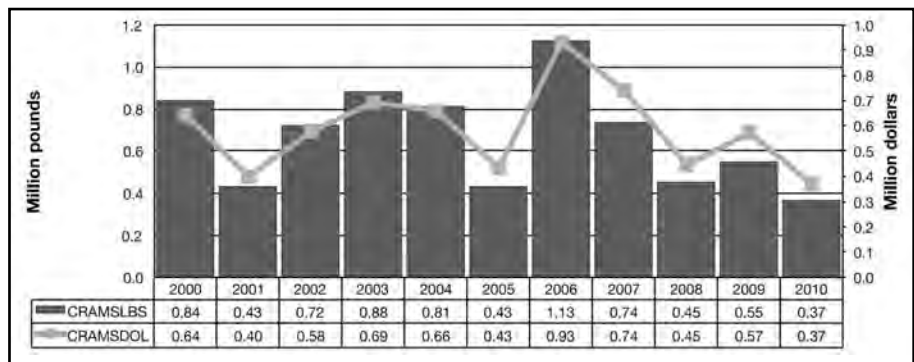


Figure 9. Mississippi commercial landings and landing values of blue crabs, 2000–2010 (in millions of pounds and millions of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 5. Comparison of 2010 commercial crab landing data to the baseline periods.

Baseline period	CRAMSLBS ¹	CRAMSDOL ²	CRAMSDEF ³	CRAMSEVP ⁴
Pre-Katrina	50%	62%	52%	102%
Post-Katrina	56%	59%	55%	97%
Past decade	53%	60%	53%	99%

¹Commercial landings of blue crabs.

²Commercial landing values (at current prices) of blue crabs.

³Commercial landing values (at constant prices) of blue crabs.

⁴Deflated imputed ex-vessel prices of blue crabs.

COMMERCIAL MENHADEN LANDINGS

The combined commercial menhaden landings from GOM states accounted for 74% of total U.S. landings of menhaden in 2009. Figure 10 shows the 2010 Mississippi commercial menhaden landings compared with the 10-year baseline landings data. Total commercial menhaden landings dropped to 104.7 million pounds in 2010, which was valued at \$8.4 million at current prices.

Outcomes of the ANOVA on commercial menhaden landings implied that the pre-Katrina period was not significantly different from the post-Katrina period (Appendices A and B). Total menhaden pounds landed by Mississippi commercial fishermen in 2010 were about 55% of the average annual menhaden landings during the past decade (MENMSLBS = 191.5 million pounds). The 2010 landings fell short by about 45% or 86.7 million pounds of the expected menhaden harvest based on landings reported during the past decade.

ANOVA results on commercial menhaden landing values suggested that the pre-Katrina period was not significantly different from the post-Katrina period (Appendices A and B). The total value of menhaden landed by commercial fishermen in 2010 was about 64% of the

average annual value from 2000 to 2009 (MENMSDOL = \$13 million). The 2010 value fell short by 36% of the expected amount based on that reported for the past decade, amounting to total annual loss of at least \$4.7 million.

Overall impacts of the GOMOS on 2010 commercial menhaden landings were similar when compared with the two baseline periods. Commercial menhaden landings fell by 86.7 million pounds in 2010. Overall impacts of the GOMOS on 2010 commercial menhaden values were not different when compared with the two baseline periods. The foregone annual gross sales of menhaden were \$4.7 million when compared with the entire past decade.

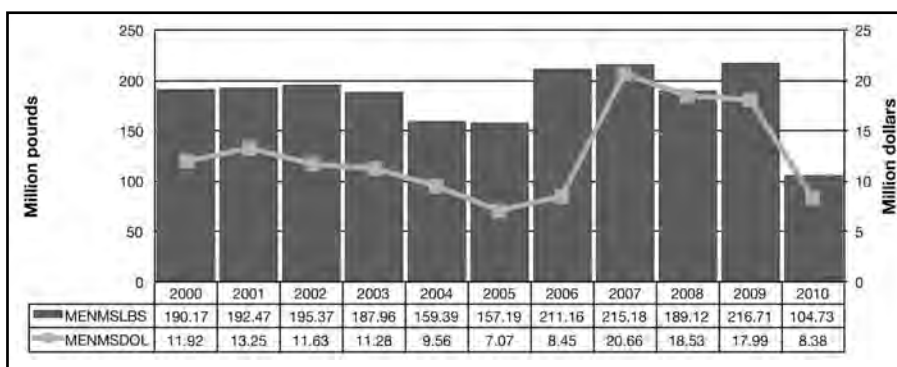


Figure 10. Mississippi commercial landings and landing values of menhaden, 2000–2010 (in millions of pounds and millions of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 6. Comparison of 2010 commercial menhaden landings data to the baseline periods.

Baseline period	MENMSLBS ¹	MENMSDOL ²	MENMSDEF ³	MENMSEVP ⁴
Pre-Katrina	57%	73%	60%	106%
Post-Katrina	53%	58%	55%	106%
Past decade	55%	64%	57%	106%

¹Commercial landings of menhaden.

²Commercial landing values (at current prices) of menhaden.

³Commercial landing values (at constant prices) of menhaden.

⁴Deflated imputed ex-vessel prices of menhaden.

COMMERCIAL LANDINGS OF MISCELLANEOUS SPECIES

Figure 11 shows the 2010 Mississippi commercial landings of miscellaneous species combined — mostly foodfish such as mullet, flounder, trout, red drum, black drum, and sheephead — compared with the baseline data covering the 5 years before and after Hurricane Katrina. Total commercial landings of all species combined dropped to 2.51 million pounds in 2010, which was valued at \$0.96 million at current market prices.

ANOVA results showed that average commercial landings during the pre-Katrina period (MISCMSLBS = 10.6 million pounds) were significantly higher than during the post-Katrina period (MISCMSLBS = 5.12 million pounds) (Appendices A and B). The total weight of miscellaneous species landed by Mississippi commercial fishermen in 2010 was about 49% of the expected annual amount using the post-Katrina period as baseline. However, the 2010 weight of miscellaneous species was 24% of the average amount seen in the pre-Katrina period. These results suggested that this commercial fishing sector was still recovering from the damages to its support infrastructure due to the recent disasters.

Landing values and imputed ex-vessel prices of miscellaneous species were also significantly different during the pre- and post-Katrina periods. The total annual loss to the landing values of miscellaneous species was 52% and 74% of the expected landing values during the pre- and post-Katrina periods, respectively. Pre-Katrina landing values averaged \$1.8 million dollars, while post-Katrina landing values averaged \$1.3 million dollars. Among these commercial species, the

choice of the baseline period led to differences in the annual losses to the commercial fisheries: \$0.89 million when using the pre-Katrina period and \$0.34 million when using the post-Katrina period.

Overall impacts of the GOMOS on 2010 commercial landings of miscellaneous species were significantly different when compared with the two baseline periods. These differences indicated that the commercial fishing sector was still recovering from the damages associated with the recent natural disasters. The decrease in 2010 commercial landings was 8.1 million pounds when compared with the pre-Katrina period. When compared with the post-Katrina period, 2010 commercial landings fell by 2.6 million pounds.

Overall impacts of the GOMOS on 2010 commercial landing values of miscellaneous species were significantly different when compared with the two baseline periods. The foregone annual gross sales of miscellaneous species totaled \$0.9 million when compared with the pre-Katrina period. When compared with the post-Katrina period, the decrease was \$0.3 million.

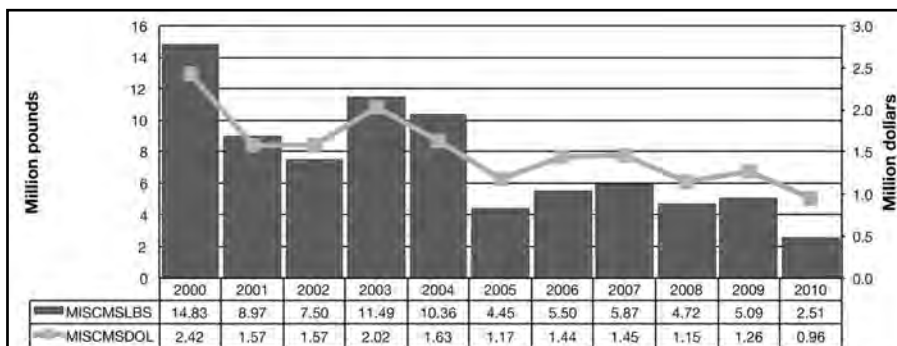


Figure 11. Mississippi commercial landings and landing values of other species combined, 2000–2010 (in millions of pounds and millions of dollars at current prices). Source of raw data: NOAA Fisheries Statistics Division.

Table 7. Comparison of 2010 commercial landings of miscellaneous species to the baseline periods.

Baseline period	MISCMSLBS ¹	MISCMSDOL ²	MISCMSDEF ³	MISCMSSEVP ⁴
Pre-Katrina	24%	52%	43%	178%
Post-Katrina	49%	74%	70%	143%
Past decade	32%	61%	53%	158%

¹Commercial landings of all miscellaneous species combined.

²Commercial landing values (at current prices) of all miscellaneous species combined.

³Commercial landing values (at constant prices) of all miscellaneous species combined.

⁴Deflated imputed ex-vessel prices of all miscellaneous species combined.

SUMMARY AND IMPLICATIONS

The closure of significant portions of Gulf of Mexico federal and state waters to commercial fishing after the Gulf of Mexico oil spill altered the harvesting decisions of commercial fishermen in affected communities. More than one-third of Gulf of Mexico federal waters were closed to commercial and recreational fishing starting on May 2, 2010. Between June 2010 and July 2010, more than 80,000 square miles were closed to commercial and recreational fishing. By April 19, 2011, all federal waters in the gulf were opened to both commercial and recreational fishing.

Up to 97 percent of Mississippi state waters were closed to commercial and recreational fishing starting on June 1, 2010. In July 2010, almost all of the Mississippi waters were closed to commercial and recreational fishing. By August 7, 2010, all state waters were opened to both commercial and recreational fishing.

In order to understand the magnitude of the economic impacts of the oil spill on the commercial fishing sector in Mississippi, multiyear baseline economic information about the sector was compiled from various secondary sources. The baseline periods selected for this determination covered the 5 years before and the 5 years after Hurricane Katrina.

Overall impacts of the oil spill on the 2010 commercial landings of all species combined were not significantly different when compared with the two baseline periods. Commercial landings declined by 98.4 million pounds when compared with both pre-Katrina and post-Katrina baseline periods. Overall impacts of the oil spill on the 2010 commercial landing values of all species combined, however, were significantly different using the two baseline periods. Foregone annual gross sales of all species combined were \$27.4 million when compared with the pre-Katrina period. When compared with the post-Katrina period, foregone annual gross sales of all species combined were \$11.32 million.

Overall impacts of the oil spill on 2010 shrimp commercial landings were significantly different when compared with the two baseline periods. These differences in landings during the two periods indicated that

the commercial shrimping sector has not yet fully recovered from damages associated with the recent disasters. The reduction in commercial shrimp landings reached 7.9 million pounds, or \$22 million, when compared with the pre-Katrina period. When compared with the post-Katrina period, shrimp landings fell by 3.2 million pounds, or \$6 million.

Overall impacts of the oil spill on the 2010 oyster commercial landings were significantly different when using the two baseline periods. The significant differences in average landings during the two periods demonstrated that the commercial oyster sector was still recovering from damages associated with the recent disasters. The decrease in commercial oyster landings in 2010 was 1.7 million pounds, or \$1.3 million, when compared with the pre-Katrina period. When compared with the post-Katrina period, 2010 oyster landings rose slightly by \$0.5 million.

Overall impacts of the oil spill on 2010 commercial menhaden landings were similar when matched with the two baseline periods. Commercial menhaden landings fell by 86.7 million pounds in 2010. The foregone annual gross sales of menhaden fishing were at least \$4.7 million when compared with the entire past decade.

Overall impacts of the oil spill on 2010 commercial landings of miscellaneous species were significantly different when compared with the two baseline periods. These differences indicated that the commercial fishing sector was still recovering from damages associated with the recent disasters. The decrease in commercial landings in 2010 was 8.1 million pounds, or \$0.9 million, when compared with the pre-Katrina period. When compared with the post-Katrina period, 2010 commercial landings fell by 2.6 million pounds, or \$0.3 million.

The choice of the baseline period influenced the extent of damages and length of the recovery period of commercial fishing sectors affected by the oil spill. The final selection of the baseline period considered both the statistical results and the state of economic recovery of each sector from damages associated with Hurricane Katrina.

LITERATURE CITED

- National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling.** Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling, Report to the President, January 2011. <http://www.oilspillcommission.gov/final-report>. Last accessed: August 19, 2011.
- North American Industrial Classification System (NAICS).** <http://www.census.gov/eos/www/naics/>. Last accessed: August 19, 2011.
- NOAA Fisheries.** Southeast Fishery Bulletins. National Oceanic and Atmospheric Administration Fisheries Service, Southeast Regional Office. <http://sero.nmfs.noaa.gov/bulletins/2010BulletinArchive.htm>. Last accessed: December 19, 2010.
- NOAA Fisheries.** Southeast Fishery Bulletins. National Oceanic and Atmospheric Administration Fisheries Service, Southeast Regional Office. [http://sero.nmfs.noaa.gov/bulletins/2011 BulletinArchive.htm](http://sero.nmfs.noaa.gov/bulletins/2011BulletinArchive.htm). Last accessed: April 30, 2011.
- NOAA Fisheries.** Commercial Fisheries Landings. National Oceanic and Atmospheric Administration. Fisheries Statistics Division. <http://www.st.nmfs.noaa.gov/st1/commercial/index.html>. Last accessed: May 21, 2012.
- NOAA Fisheries. Interactive Fisheries Economic Impacts Tool.** National Oceanic and Atmospheric Administration, Fisheries Economics and Social Sciences Program. <http://www.st.nmfs.noaa.gov/st5/index.html>. Last accessed: August 31, 2011.
- NOAA Gulf Spill Restoration.** Damage Assessment, Remediation, and Restoration Program. National Oceanic and Atmospheric Administration. <http://www.gulfspillrestoration.noaa.gov/restoration/>. Last accessed: May 7, 2012.
- Posadas, B.C.** 2008. Economic Assessment of the Impacts of Hurricane Katrina on Mississippi Commercial Fishing Fleet. Mississippi Agricultural and Forestry Experiment Station Bulletin 1165. Mississippi State, Mississippi. <http://msucares.com/pubs/bulletins/b1165.pdf>. Last accessed: May 21, 2012.

Appendix A. Descriptive characteristics of commercial landings and values.

		N	Mean	Std. deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower Bound	Upper Bound		
ALLMSLBS	0	5	209.325374	14.5558442	6.5095714	191.251906	227.398842	183.5583	217.9676
	1	5	209.876456	26.1401950	11.6902506	177.419117	242.333795	167.6098	230.2844
	Total	10	209.600915	19.9485138	6.3082739	195.330608	223.871222	167.6098	230.2844
ALLMSDOL	0	5	49.321507	5.8191943	2.6024228	42.096022	56.546991	43.6181	58.7149
	1	5	33.232440	9.9815718	4.4638946	20.838681	45.626198	21.7411	43.6965
	Total	10	41.276973	11.4558300	3.6226515	33.081966	49.471980	21.7411	58.7149
ALLMSDEF	0	5	27.451463	4.2139107	1.8845182	22.219202	32.683724	23.0906	34.0970
	1	5	15.947998	4.2901630	1.9186192	10.621057	21.274939	10.7843	20.2953
	Total	10	21.699731	7.2684587	2.2984884	16.500188	26.899273	10.7843	34.0970
ALLMSEVP	0	5	.130931	.0155299	.0069452	.111648	.150214	.1175	.1566
	1	5	.076162	.0188921	.0084488	.052704	.099620	.0486	.1006
	Total	10	.103547	.0331520	.0104836	.079831	.127262	.0486	.1566
SHRMSLBS	0	5	10.421400	1.2220038	.5464967	8.904082	11.938718	9.1990	12.3610
	1	5	5.736220	.6062220	.2711107	4.983496	6.488944	5.1717	6.4842
	Total	10	8.078810	2.6314439	.8321356	6.196388	9.961232	5.1717	12.3610
SHRMSDOL	0	5	30.336265	5.0621858	2.2638783	24.050731	36.621799	25.6192	38.2576
	1	5	14.354014	2.3249632	1.0397552	11.467191	17.240837	11.8544	17.1461
	Total	10	22.345140	9.2057085	2.9111006	15.759773	28.930507	11.8544	38.2576
SHRMSDEF	0	5	16.905426	3.4180532	1.5285998	12.661353	21.149500	13.9235	22.2169
	1	5	6.934854	1.0268638	.4592274	5.659834	8.209874	5.8802	7.9637
	Total	10	11.920140	5.7685056	1.8241617	7.793600	16.046681	5.8802	22.2169
SHRMSSEVP	0	5	1.653763	.4737684	.2118757	1.065502	2.242024	1.2946	2.4151
	1	5	1.217369	.2026220	.0906153	.965781	1.468958	.9367	1.4830
	Total	10	1.435566	.4134068	.1307307	1.139833	1.731300	.9367	2.4151
OYMSLBS	0	5	3.202175	.5856736	.2619212	2.474965	3.929385	2.6533	4.0421
	1	4	1.427886	1.1437018	.5718509	-.391999	3.247771	.2991	2.6103
	Total	9	2.413602	1.2395562	.4131854	1.460795	3.366410	.2991	4.0421
OYMSDOL	0	5	5.613049	1.2666782	.5664757	4.040260	7.185837	4.1955	7.2276
	1	4	3.808775	3.1163931	1.5581965	-1.150102	8.767652	.8185	6.8692
	Total	9	4.811149	2.3126782	.7708927	3.033468	6.588831	.8185	7.2276
OYMSDEF	0	5	3.107785	.6752842	.3019963	2.269309	3.946262	2.3690	3.9280
	1	4	1.792442	1.4280895	.7140447	-.479967	4.064851	.3948	3.1905
	Total	9	2.523188	1.2138308	.4046103	1.590155	3.456221	.3948	3.9280
OYMSSEVP	0	5	.966215	.0696810	.0311623	.879695	1.052735	.8929	1.0613
	1	4	1.263385	.0532063	.0266032	1.178721	1.348048	1.2140	1.3199
	Total	9	1.098290	.1673912	.0557971	.969622	1.226959	.8929	1.3199
CRAMSLBS	0	5	.735709	.1789549	.0800311	.513507	.957911	.4337	.8765
	1	5	.657647	.2892439	.1293538	.298503	1.016790	.4286	1.1268
	Total	10	.696678	.2304542	.0728760	.531821	.861535	.4286	1.1268
CRAMSDOL	0	5	.588934	.1185149	.0530015	.441778	.736090	.3909	.6870
	1	5	.624291	.2101418	.0939783	.363366	.885217	.4328	.9279
	Total	10	.606613	.1619145	.0512019	.490786	.722439	.3909	.9279
CRAMSEVP	0	5	.326036	.0628942	.0281271	.247943	.404130	.2207	.3734
	1	5	.302771	.1057472	.0472916	.171469	.434074	.2075	.4603
	Total	10	.314404	.0829362	.0262267	.255075	.373733	.2075	.4603
MENMSLBS	0	5	185.070944	14.6157967	6.5363830	166.923035	203.218853	159.3923	195.3705
	1	5	197.873244	25.3105001	11.3191997	166.446107	229.300381	157.1938	216.7092
	Total	10	191.472094	20.6201598	6.5206671	176.721320	206.222868	157.1938	216.7092
MENMSDOL	0	5	11.528027	1.3282502	.5940115	9.878787	13.177267	9.5637	13.2516
	1	5	14.539730	6.2873281	2.8117786	6.732981	22.346479	7.0741	20.6575
	Total	10	13.033878	4.5686718	1.4447409	9.765648	16.302109	7.0741	20.6575
MENMSDEF	0	5	6.411986	.9097459	.4068507	5.282387	7.541585	5.0628	7.4825
	1	5	6.953483	2.8538554	1.2762829	3.409954	10.497013	3.6222	9.9630
	Total	10	6.682734	2.0171917	.6378920	5.239722	8.125747	3.6222	9.9630

Appendix A (continued). Descriptive characteristics of commercial landings and values.

		N	Mean	Std. deviation	Std. error	95% Confidence interval for mean		Minimum	Maximum
						Lower Bound	Upper Bound		
MENMSEVP	0	5	.034546	.0029950	.0013394	.030828	.038265	.0318	.0389
	1	5	.034678	.0124916	.0055864	.019168	.050189	.0198	.0463
	Total	10	.034612	.0085640	.0027082	.028486	.040739	.0198	.0463
MISCM SLBS	0	5	10.630853	2.7834655	1.2448036	7.174724	14.086982	7.4983	14.8280
	1	5	5.124688	.5729157	.2562157	4.413319	5.836057	4.4476	5.8688
	Total	10	7.877770	3.4656777	1.0959435	5.398574	10.356967	4.4476	14.8280
MISCM SDOL	0	5	1.844165	.3740647	.1672868	1.379703	2.308628	1.5717	2.4218
	1	5	1.291676	.1445969	.0646657	1.112135	1.471217	1.1477	1.4468
	Total	10	1.567921	.3953118	.1250086	1.285132	1.850710	1.1477	2.4218
MISCM SDEF	0	5	1.026266	.2339944	.1046455	.735723	1.316808	.8622	1.4064
	1	5	.625707	.0774725	.0346468	.529512	.721902	.5331	.7143
	Total	10	.825986	.2675277	.0845997	.634609	1.017364	.5331	1.4064
MISCM SEVP	0	5	.097877	.0120853	.0054047	.082871	.112883	.0832	.1167
	1	5	.122243	.0094065	.0042067	.110564	.133923	.1128	.1343
	Total	10	.110060	.0164059	.0051880	.098324	.121796	.0832	.1343

Appendix B. Analysis of variance results.

		Sum of squares	df	Mean square	F	Sig.
ALLMSLBS	Between groups	.759	1	.759	.002	.968
	Within groups	3580.730	8	447.591		
	Total	3581.489	9			
ALLMSDOL	Between groups	647.145	1	647.145	9.695	.014
	Within groups	533.979	8	66.747		
	Total	1181.124	9			
ALLMSDEF	Between groups	330.824	1	330.824	18.297	.003
	Within groups	144.650	8	18.081		
	Total	475.474	9			
ALLMSEVP	Between groups	.007	1	.007	25.077	.001
	Within groups	.002	8	.000		
	Total	.010	9			
SHRMSLBS	Between groups	54.877	1	54.877	58.983	.000
	Within groups	7.443	8	.930		
	Total	62.320	9			
SHRMSDOL	Between groups	638.581	1	638.581	41.157	.000
	Within groups	124.125	8	15.516		
	Total	762.706	9			
SHRMSDEF	Between groups	248.531	1	248.531	39.023	.000
	Within groups	50.950	8	6.369		
	Total	299.481	9			
SHRMSEVP	Between groups	.476	1	.476	3.586	.095
	Within groups	1.062	8	.133		
	Total	1.538	9			
OYMSLBS	Between groups	6.996	1	6.996	9.246	.019
	Within groups	5.296	7	.757		
	Total	12.292	8			
OYMSDOL	Between groups	7.234	1	7.234	1.424	.272
	Within groups	35.554	7	5.079		
	Total	42.788	8			
OYMSDEF	Between groups	3.845	1	3.845	3.389	.108
	Within groups	7.942	7	1.135		
	Total	11.787	8			

Appendix B (continued). Analysis of variance results.

		Sum of squares	df	Mean square	F	Sig.
OYSMSEVP	Between groups	.196	1	.196	49.211	.000
	Within groups	.028	7	.004		
	Total	.224	8			
CRAMSLBS	Between groups	.015	1	.015	.263	.622
	Within groups	.463	8	.058		
	Total	.478	9			
CRAMSDOL	Between groups	.003	1	.003	.107	.752
	Within groups	.233	8	.029		
	Total	.236	9			
CRAMSDEF	Between groups	.001	1	.001	.179	.684
	Within groups	.061	8	.008		
	Total	.062	9			
CRAMSEVP	Between groups	.001	1	.001	.904	.369
	Within groups	.011	8	.001		
	Total	.013	9			
MENMSLBS	Between groups	409.747	1	409.747	.959	.356
	Within groups	3416.972	8	427.121		
	Total	3826.719	9			
MENMSDOL	Between groups	22.676	1	22.676	1.098	.325
	Within groups	165.179	8	20.647		
	Total	187.855	9			
MENMSDEF	Between groups	.733	1	.733	.163	.697
	Within groups	35.889	8	4.486		
	Total	36.622	9			
MENMSEVP	Between groups	.000	1	.000	.001	.982
	Within groups	.001	8	.000		
	Total	.001	9			
MISCMSLBS	Between groups	75.795	1	75.795	18.771	.003
	Within groups	32.304	8	4.038		
	Total	108.098	9			
MISCMSDOL	Between groups	.763	1	.763	9.490	.015
	Within groups	.643	8	.080		
	Total	1.406	9			
MISCMSDEF	Between groups	.401	1	.401	13.204	.007
	Within groups	.243	8	.030		
	Total	.644	9			
MISCMSEVP	Between groups	.001	1	.001	12.657	.007
	Within groups	.001	8	.000		
	Total	.002	9			