

# **Economic Assessment of the Impacts of Hurricane Katrina on Mississippi Charter Boats for Hire, Marinas, and Livebait Dealers**



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# **Economic Assessment of the Impacts of Hurricane Katrina on Mississippi Charter Boats for Hire, Marinas, and Livebait Dealers**

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# Economic Assessment of the Impacts of Hurricane Katrina on Mississippi Charter Boats for Hire, Marinas, and Livebait Dealers

## INTRODUCTION

An economic assessment of the recreational fishing industry in Mississippi was designed to assess the level of damage caused by Hurricane Katrina. The assessment included the three coastal counties of Hancock, Harrison, and Jackson, where almost all the marine establishments under consideration are located. It identified all the livebait dealers, charter boats for hire, and commercial and municipal marinas in the affected areas that were in operation before the hurricane. The assessment also attempted to identify the original physical characteristics and production levels for these facilities and boats, and it provided estimates of the costs of rebuilding or repairing them to their pre-Katrina state so that recreational fishing can resume.

This assessment was a collaborative effort arising from the urgent and compelling need of the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) and the Mississippi Department of Marine Resources (DMR) to complete damage assessments in the affected areas (Posadas et al., 2008). They needed an accurate assessment of the damages to ensure that federal funds were adequate and allocated to the appropriate sectors and recipients. NOAA Fisheries developed damage assistance programs for the Gulf region that were approved by Congress in 2006 and administered in Mississippi by DMR to participating licensed for-hire charter boats and participating licensed finfish, shrimp, and oyster fishermen.

The Mississippi State University Coastal Research and Extension Center (CREC) and the Mississippi-Alabama Sea Grant Extension Program (MASGEP) responded to the need for information on hurricane-related damages (Posadas et al., 2008). This assessment aided in identifying critical relief, support, and rebuilding needs to assist the recreational fishing industry and associated communities in recovering their economic vitality. It was a necessary first step in providing the necessary aid to the affected businesses and communities. Providing the proper levels of assistance in a timely manner reduced the wasteful and inefficient assistance and, ultimately, reduced the cost to the government and the nation.

Damage assessment included the following information about the industry: (1) inventory of charter boats, marinas, and livebait dealers that existed at each port or community; (2) original capital investment made in the industry; (3) estimate of physical damages to the industry and the dollar value of that damage by community; (4) estimate of the replacement cost of the capital needed to rebuild the industry; and (5) the level of insurance that existed for the industry, along with remaining unpaid capital debt. Researchers simultaneously conducted similar economic assessments of the damages on seafood processors and dealers, commercial fishing fleets, and recreational boats in Mississippi (Posadas, 2006a, 2006b, 2006d, 2007, 2008), Alabama (Chang et al., 2006), Louisiana (Caffey et al., 2006, 2007, 2008), and Florida (Adams and Gregory, 2006).

# MATERIALS AND METHODS

## Scope of Assessment

This economic assessment of the impacts of the catastrophic hurricane included all of the resident “charter boats for hire,” commercial and municipal marinas, and livebait dealers licensed by the Mississippi Department of Marine Resources (DMR) and/or operating in the state when Katrina landed on August 29, 2005. The decision to include these marine establishments in the damage assessment was made by DMR because they fall under its jurisdiction as a state marine resources regulatory agency.

Total damages associated with natural disasters consist of public and private losses, as well as direct and indirect losses. Direct public damages from Katrina included clean-up, inventory losses, damage to marine resources, debris removal and disposal, and damage to publicly owned and operated marine infrastructures (Posadas et al., 2008). Direct private damages included clean-up, inventory losses, debris removal and disposal, lost revenues of directly affected marine establishments, and structural damages to privately owned and operated establishments. Indirect losses are those foregone economic activities of business sectors associated with the production of marine recreational fishing services.

In this bulletin, the scope of damage assessment was limited to private and direct damages to Mississippi resident charter boats, livebait dealers, and municipal and commercial marina establishments licensed by DMR and/or operating in Mississippi on August 29, 2005. Total damages included inventory losses; damages to equipment and other accessories; damages to buildings, boats, or vessels; and costs of clean-up and debris removal and disposal. The replacement costs of the capital needed to rebuild these marine sectors to pre-Katrina levels were calculated by tallying the costs of total damages and subtracting insurance payments received.

The original capital investment was measured by the initial investments made before Hurricane Katrina. The original investment in the charter boat fleet consisted of initial investments on boat/vessel, engine, gear, and other accessories (Appendix A). Among marinas, the original investment would include investments on buildings, facilities, and structures (Appendix B). With livebait dealers, original investment would include initial investments on buildings, livehaul equipment, livebait-holding equipment, and other accessories (Appendix C). It should be pointed out that values for initial investments were

based on the owners’ or operators’ recollections of the original prices paid for these fixed assets. There were no attempts to determine the then-current market values of the fixed assets used by the marine establishments at the time of the hurricane. To not overburden the interview or survey process, it was deemed sufficient that the original investment data would adequately provide the information requested by DMR and NOAA Fisheries.

The level of insurance existing at the time of the hurricane was measured by the amount of insurance coverage the operating vessels and facilities were expecting for damages sustained by their boats/vessels, marinas, or facilities. Insurance coverage is generally required for vessels or facilities financed with loans from private and federal lending institutions, such as the U.S. Small Business Administration (SBA).

The capital debt remaining to be paid off was measured by the amount of outstanding loans owners or operators had on their vessels or facilities at the time of the hurricane. Outstanding loans were broken down by major sources, including loans from SBA and loans from other sources. It was assumed that these loans were incurred to finance the purchase or construction of fixed assets used by the marine establishments before Hurricane Katrina landed in Mississippi.

## Sources of Data

From the official list of licenses issued by DMR, it was determined that the entire charter boats fleet consisted of 100 boats when the hurricane landed in Mississippi on August 29, 2005. Most of the charter boats (67) were located in Harrison County, while 7 boats were in Hancock County, 22 boats were in Jackson County, and 4 boats were in the adjacent counties of Stone, Lamar, and Pearl River (Table 1).

From an earlier survey conducted by Burrage et al. (2000), an online marina directory in coastal Mississippi was developed and maintained at <http://coastal.msstate.edu/access.html>. With this online database, the marina listings on the DMR website, and the marina listings in telephone directories (online and print), a comprehensive list of 37 marinas in the three coastal counties was compiled. The distribution of marinas by county was as follows: Harrison County, 16 marinas; Jackson County, 12 marinas; and Hancock County, 9 marinas (Table 1). Many of the devastated

coastal cities generally had municipal marinas in operation when the hurricane landed, including Lakeshore in Hancock County; Pass Christian, Long Beach, Gulfport, and Biloxi in Harrison County; and Ocean Springs and Pascagoula in Jackson County.

The master list of 30 livebait dealers was retrieved from the licenses issued by DMR in 2005. There were 13 livebait dealers located in Harrison County, 12 in Jackson County, and 5 dealers in Hancock County when the hurricane landed in the state.

### Data Collection

The survey instrument used in this assessment was based on a template developed for the commercial fishing fleet by NOAA Fisheries (Posadas, 2008). Survey questionnaires for charter boats (Appendix A), marinas (Appendix B), and livebait dealers (Appendix C) were mailed to 167 marine recreational facilities and boats in November and December 2005, more than 3 months after Hurricane Katrina devastated the Mississippi Gulf Coast on August 29, 2005. Personnel of the Mississippi Department of Marine Resources (DMR) Seafood Technology Bureau and the Mississippi State University Coastal Research and Extension Center (CREC) also conducted personal interviews in four coastal locations from November to December 2005. Interview centers were at the Pass Christian Harbor, CREC main office in Biloxi,

DMR temporary trailer office in Biloxi, and the DMR check station in Pascagoula.

Survey questionnaires were initially mailed to the last known addresses of the 167 marine establishments included in the 2005 official lists provided by DMR. Given the massive dislocation caused by Katrina, no further attempts were made to contact establishments whose questionnaires were returned without forwarding addresses. Questionnaires that were returned with forwarding addresses were sent again to the new mailing addresses. Aside from these efforts, there were no further attempts to contact marine establishments regarding Hurricane Katrina.

### Projected Probability of Marine Sector Damages

The average values of each variable included in the assessment and the number of marine establishments operating in August 29, 2005, were used to estimate the total projected values in each sector under consideration. With the means and standard deviations of the total reported damages, the cumulative distribution functions (CDF) were computed to show the probability distributions of the total projected damages of the three sectors due to Hurricane Katrina. The cumulative distribution functions were computed by using the CDF Graph Menu Function of Simetar (2006).

**Table 1. Number of resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

County	No. licensed or operating <sup>1</sup>	Percent distribution	No. responding to survey	Returned without forwarding address	Response rate (%) <sup>2</sup>
<b>Charter Boats</b>					
Hancock County	7	7	0	1	0
Harrison County	67	67	38	0	57
Jackson County	22	22	4	0	18
Other counties	4	4	0	0	0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>42</b>	<b>1</b>	<b>42</b>
<b>Marinas</b>					
Hancock County	9	24	4	0	44
Harrison County	16	43	1	0	6
Jackson County	12	32	5	0	42
<b>Total</b>	<b>37</b>	<b>100</b>	<b>10</b>	<b>0</b>	<b>27</b>
<b>Livebait Dealers</b>					
Hancock County	5	17	2	0	40
Harrison County	13	43	3	5	38
Jackson County	12	40	4	1	36
<b>Total</b>	<b>30</b>	<b>100</b>	<b>9</b>	<b>6</b>	<b>38</b>

<sup>1</sup>Sources of data: marinas — MSU Coastal Research and Extension Center online marina directory (<http://coastal.msstate.edu/access.html>) and marina listings in telephone directories; charter boats and livebait dealers — Mississippi Department of Marine Resources.

<sup>2</sup>Response rate = [Number of units that participated in the survey] / {[number of units licensed or operating on August 29, 2005] - [number of questionnaires returned without forwarding addresses]}.

# RESULTS AND DISCUSSION

## Participating Establishments

A total of 42 charter boat operators participated in the mail survey or personal interviews between November 2005 and February 2006 (with one questionnaire returned without a forwarding address), representing a response rate of 42% (Table 1). The charter fleet consisted of boats ranging from 22–97 feet long, averaging 37 feet. Thirty-eight out of the 42 participating charter boat operators were located in Harrison County. The rest were located in Jackson County. No responses were received from Hancock and other counties. By June 2008, DMR had issued 76 resident licenses to charter/fishing/party boats, as compared with 83 licenses in 2007, 64 licenses in 2006, and 100 licenses in 2005. For the purpose of this assessment, a total of 100 charter boats was used in estimating the damages to the sector by Hurricane Katrina.

There were 37 commercial and municipal marinas in the three coastal counties when Hurricane Katrina hit the Mississippi Gulf Coast (Table 1). All of these facilities were damaged by the hurricane. Ten marinas responded to the survey, representing a response rate of 27%. Very low response rate (6.3%) was received from Harrison County, where most of the marinas were located. In estimating the damages to the municipal and commercial marinas, the number of facilities operating when the hurricane landed was used. By August 2009, 4 years after Hurricane Katrina, more than 40 private, commercial, and municipal marinas were operating in the three coastal Mississippi counties.

Nine livebait dealers out of the 30 licensed dealers responded to the survey (with six livebait dealer questionnaires returned without forwarding addresses), representing a 38% response rate. All of the livebait dealers were damaged by the hurricane. DMR issued about 15 resident licenses to livebait dealers in 2008, as compared with 13 licenses in 2007, 11 licenses in 2006, and 30 licenses in 2005. For this assessment, a total of 30 livebait dealers was used in estimating the total damages to the sector associated with Hurricane Katrina.

## Total Damages

Hurricane Katrina caused approximately \$2.2 million in total damages to the resident Mississippi charter boat fleet (Table 2). Damages to boats and engines accounted for three-fourths of total damages to the charter fleet. Reported damages ranged from \$0 to \$111,000 per boat, with an average of \$22,012 per boat and standard deviation (SD) of \$30,140 per boat. Sixty-nine percent of the participating boat operators reported damages on their boats, engines, fishing gear, and other accessories.

The estimated value of damages to Mississippi municipal and commercial marinas located in the three coastal counties reached \$41.38 million (Table 2). Individual damages reported by participating marinas ranged from \$800,000 to \$5,392,000, with an average of \$1.11 million per marina and standard deviation of \$1.49 million per marina. Approximately 80% of the

**Table 2. Reported and projected damages to resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

Sector	No. licensed or operating	Damages reported in the survey		Projected damages (\$)³
		Total (\$)¹	Avg. (\$/unit)²	
Charter boats	100	924,500	22,012 (30,140)	2,201,190
Marinas	37	11,184,870	1,118,487 (1,492,739)	41,384,018
Livebait dealers	30	1,251,250	139,028 (136,046)	4,170,833
<b>Total</b>	<b>167</b>	<b>13,360,620</b>		<b>47,756,041</b>

¹Total damages reported by units that participated in the survey = [damages to buildings, boats, or vessels] + [damages to equipment and other accessories] + [cleaning, removal, and disposal costs] + [inventory losses].  
 ²Average reported damages = [Total damages reported by units that participated in the survey] / [number of units that participated in the survey]. Values in parentheses are standard deviations.  
 ³Total projected damages of units licensed or operating on August 29, 2005 = [Average reported damages] X [total number of boats or facilities licensed or operating on August 29, 2005]

**Table 3. Reported and projected insurance payments received by resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

Sector	No. licensed or operating	Reported payments received by units participating in the survey				Projected payments received (\$)²
		Pct. units receiving payments	Total payments (\$)	Pct. of total damages	Avg. payment (\$)¹	
Charter boats	100	26	233,625	25	5,563 (13,200)	556,250
Marinas	37	40	1,004,500	9	100,450 (181,019)	583,333
Livebait dealers	30	44	175,000	14	19,444 (25,793)	3,716,650
<b>Total</b>	<b>167</b>	<b>31</b>	<b>1,413,125</b>			<b>4,856,233</b>

¹Average insurance payments received = [Total insurance payments received by units which participated in the survey] / [number of units which participated in the survey]. Values in parentheses are standard deviations.

²Total projected insurance payments received by units licensed or operating on August 29, 2005 = [Average insurance payments received] X [total number of boats or facilities licensed or operating on August 29, 2005].

reported damages involved buildings, slips, and storage facilities. All of the participating marinas sustained damages from Hurricane Katrina.

The estimated value of total damages to livebait dealers in Coastal Mississippi ranged from \$35,700 to \$415,000, which averaged \$139,028 per facility (SD = \$136,046 per facility), for total damages of \$4.17 million (Table 2). All of the livebait dealers who participated in the survey reported damages from Hurricane Katrina.

Due to the large standard deviations observed in the total reported damages of the marine establishments included in the assessment, the probability distributions of the total projected values were computed. The total projected damages of the marine sectors were estimated at a probability of 0.5. At a higher probability that the estimating random model is 70% accurate, the potential total projected damages sustained by Coastal Mississippi charter boats during Katrina could reach \$4 million (Figure 1). Among Coastal Mississippi livebait dealers, the potential total damages could be more than \$6 million if the probability of the accuracy of the estimating random model approaches 0.7 (Figure 2). The potential total projected damages among Coastal Mississippi marinas could reach more than \$70 million if the probability is close to 0.7 (Figure 3).

### Insurance Payments Received

Marine recreational establishments can mitigate risks and uncertainty associated with natural disasters by purchasing insurance coverage. Costs of repairing damages to the fleet and facilities are reduced by the insurance payments received.

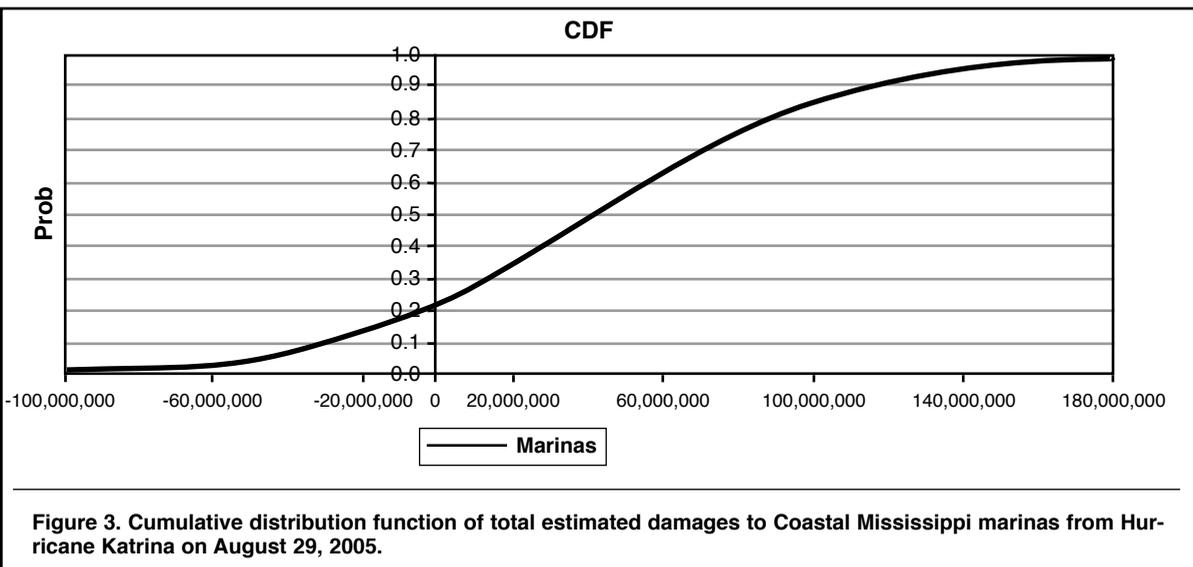
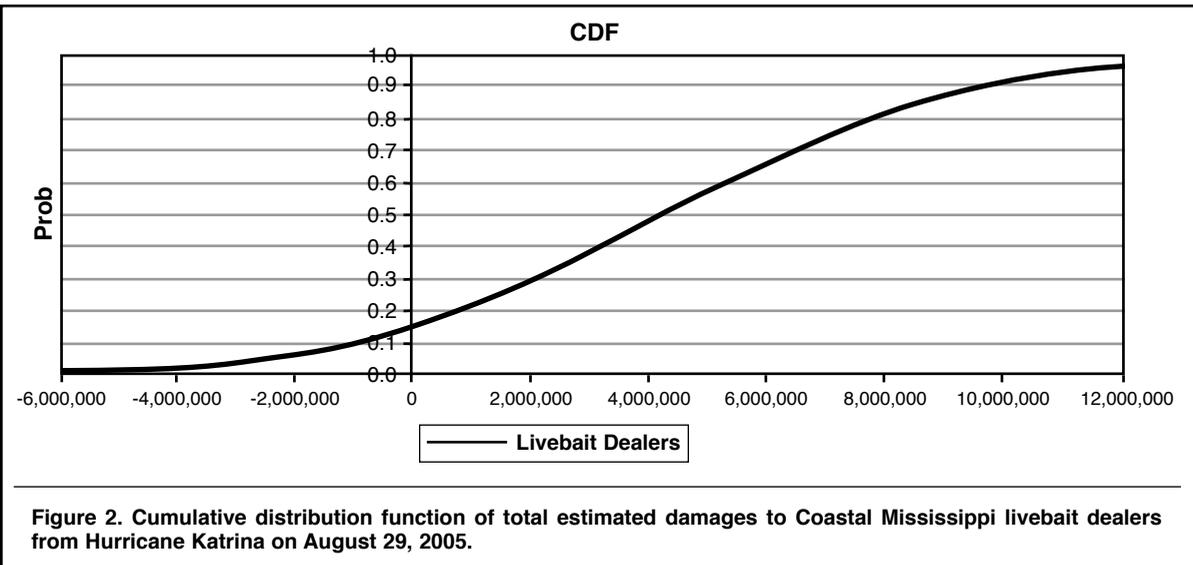
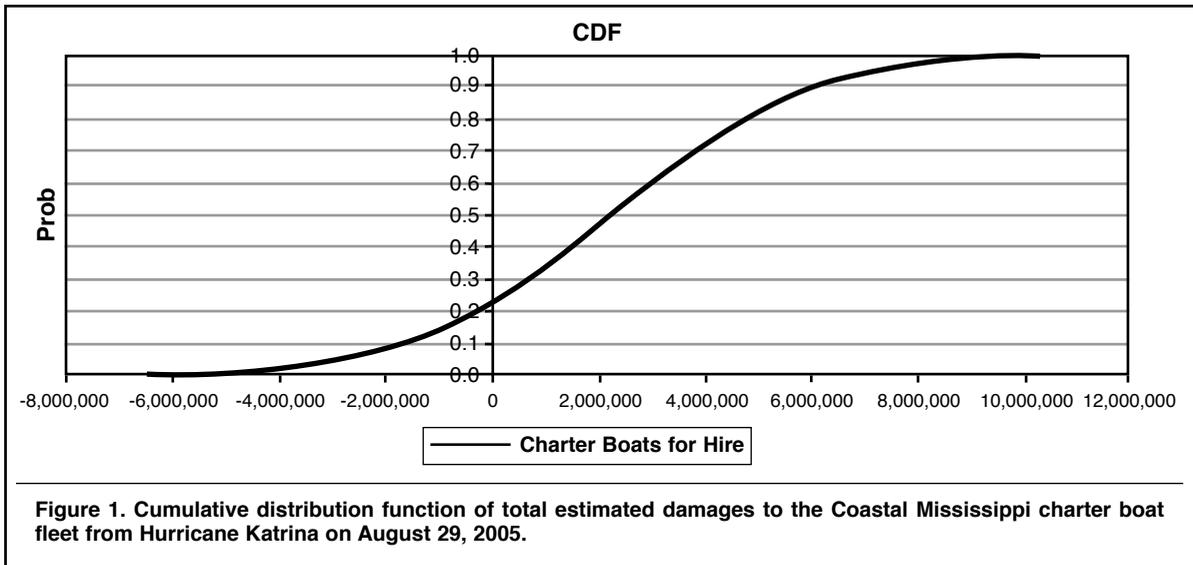
More than one-fourth (26%) of the Coastal Mississippi charter boat owners who participated in the survey received or expected to receive insurance payments for damages associated with Hurricane Katrina (Table 3). Total insurance proceeds reported by charter boat owners in the survey accounted for 25% of total damages, which averaged \$5,563 per boat and had a SD of \$13,200 per boat.

Less than one-tenth (9%) of total hurricane-related damages reported by marina operators in Coastal Mississippi who participated in the survey were covered by insurance (Table 3). Approximately 40% of marinas in the survey received or were expecting insurance payments that averaged \$100,450 per marina and had a SD of \$181,019.

Only 14% of total hurricane-related damages sustained by Coastal Mississippi livebait dealers who participated in the survey were covered by insurance (Table 3). Less than one-half (44%) of the livebait dealers in the survey received or were expecting to receive insurance payments that averaged \$19,444 per dealer and had a SD of \$25,793 per dealer.

### Foregone Revenues and Employment Opportunities

In addition to damages to the fleet and facilities, these marine establishments also incurred revenue losses associated with lost markets for their products or services as a result of Hurricane Katrina. Foregone revenues were estimated by using the 2004 annual gross sales (AGS) as an estimate of the expected 2005 AGS without Hurricane Katrina, along with the owners' or



**Table 4. Reported, projected, and foregone annual gross sales for resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

Sector	No. licensed or operating	2004 sales reported in survey		2004 projected gross sales <sup>2</sup>	2005 foregone annual sales	
		Total annual gross sales (\$)	Avg. annual gross sales (\$/unit) <sup>1</sup>		Pct. of gross sales losts	Projected sales lost (\$) <sup>3</sup>
Charter boats	100	2,372,808	57,873 (57,501)	5,787,337	62 (30)	3,606,499
Marinas	37	2,084,762	260,595 (272,590)	9,642,024	53 (24)	5,110,273
Livebait dealers	30	1,306,000	163,250 (212,325)	4,897,500	60 (37)	2,938,500
Total	167	5,763,570		20,328,865		11,655,272

<sup>1</sup>2004 average annual gross sales = [2004 total annual gross sales reported by units which participated in the survey] / [number of units which participated in the survey]. Values in parentheses are standard deviations.

<sup>2</sup>2004 projected annual gross sales of units licensed or operating on August 29, 2005 = [2004 average annual gross sales] X [total number of boats or facilities licensed or operating on August 29, 2005].

<sup>3</sup>2005 projected annual gross sales foregone due to lost market channels of units licensed or operating on August 29, 2005 = [Percent of foregone annual gross sales due to lost market channels] X [2004 projected annual gross sales].

operators' perceptions of the proportion of 2005 AGS lost due to the hurricane. Their perceptions of the magnitudes of the foregone revenues were probably influenced by their understanding of market demands for their services by Mississippi residents and tourists during the years they were in operation before Hurricane Katrina. There were no further attempts to explore the reasoning behind their perceptions to avoid overburdening the survey or interview process.

Charter boat owners estimated that they would lose 62% of the markets for their services after they restored the charter fleet to pre-Katrina levels, representing an AGS reduction of \$3.6 million (Table 4). Marina owners or operators reported that they would lose 53% of their markets, which could have translated into an annual sales reduction of \$5.11 million. Livebait dealers expected the market for their products to decline by 60% or annual gross sales to decline by \$2.93 million.

When considered on a regional basis, these lost markets would be a considerable reduction in the final levels of economic activity, income generation, employment creation, and tax collections. When the backward and forward linkages in the regional economy are considered, additional indirect and induced losses are expected. Backward linkages would include purchases of boats, equipment, nets, fuel, and oil by the recreational fishing fleet.

The impact of Katrina on employment was measured by comparing the number of crew members employed by the marine establishments in 2004 and

the number of crew members employed at the time of the survey. The number of crew members directly employed by the charter boats for hire shrank to 15% of its pre-Katrina level. The workforce employed by marinas in 2009 decreased to 19% of its size before Katrina. The number of employees working the live-bait dealer houses in 2009 dropped to 17% of its size before Katrina.

### Initial Investment Requirements

Rebuilding the damaged recreational fleet and facilities would require new private investments to replace or repair facilities, boats, equipment, and other accessories. The total initial investment in the fleet and facilities included buildings, boats, or vessels, as well as equipment and other accessories. The choice of the original purchase prices as the benchmark for this particular damage assessment was a deliberate decision made by the requesting state and federal agencies. Respondents and interviewers appreciated the convenience of limiting the burden of the interview or survey process, but the resulting data proved to be inadequate when the investigator started further economic analysis. In converting initial investments of marine establishments into one common value, additional data were needed but were not collected, including the year the assets were bought or constructed. A better measurement would have been the estimated market values of the assets of the marine establishments before the hurricane landed in Mississippi.

**Table 5. Reported and projected initial investment in resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

Sector	No. licensed or operating	Initial investment reported in the survey		Projected investment (\$)³
		Total (\$)¹	Avg. (\$/unit)²	
Charter boats	100	5,150,660	139,207 (133,865)	13,920,700
Marinas	37	11,406,370	1,140,637 (1,373,768)	42,203,569
Livebait dealers	30	751,300	83,478 (70,788)	2,504,340
Total	167	17,308,330		58,628,609

¹Average initial investment = [Total initial investment reported by units that participated in the survey] / [number of units that participated in the survey]. Values in parentheses are standard deviations.

²Total projected initial investment of units licensed or operating on August 29, 2005 = [Average initial investment] X [total number of boats or facilities licensed or operating on August 29, 2005].

Total initial investments in the charter fleet amounted to \$13.9 million, which averaged \$139,207 and had a SD of \$133,865 per vessel (Table 5). The average initial investment in commercial and municipal marinas was more than \$1.14 million with a SD of \$1.37 million per facility and a total of \$42.2 million for all the coastal marinas. An average investment of \$83,478 and SD of \$70,788 per house was reported among livebait dealers for a total of \$2.5 million (Table 5).

To encourage new private investments to replace or repair the for-hire charter fleet, new infrastructures were required, including but not limited to loading access, unloading, ice and fuel, and repair facilities. Needless to say, the recreational fleet needed safe access to the state and federal fishing waters without undue risks and uncertainties associated with hurricane debris.

### Outstanding Loans

The recreational fishing fleet and facilities secured loans from the U.S. Small Business Administration (SBA) and private sources such as banks and family members. Participating charter boat owners reported total outstanding loans of \$2.87 million (Table 6). Estimated outstanding loans of \$95,238 were borrowed from SBA, while the bulk of the estimated outstanding loans (\$2.77 million) came from other private sources.

Coastal marinas had a total of \$14.57 million in outstanding loans before the hurricane. Most of this debt (\$10.33 million) came from SBA, and the remaining \$4.24 million was from other sources, including private banks and relatives (Table 6).

Livebait dealers had outstanding loans of more than \$89,453 at the time of the hurricane (Table 6). These livebait facilities borrowed from the SBA, private banks, and relatives.

**Table 6. Reported and projected outstanding loans of resident charter boats, marinas, and livebait dealers licensed and/or operating in Coastal Mississippi when Hurricane Katrina landed on August 29, 2005.**

Sector	No. licensed or operating	Outstanding loans reported in the survey		Projected outstanding loans (\$) <sup>2</sup>
		Total (\$)	Avg. (\$/unit) <sup>1</sup>	
<b>Borrowed from Small Business Administration</b>				
Charter boats	100	40,000	952 (5,372)	95,238
Marinas	37	2,792,000	279,200 (513,550)	10,330,400
Livebait dealers	30	13,840	1,538 (3,052)	46,133
<b>Total</b>	<b>167</b>	<b>2,845,840</b>	<b>281,690</b>	<b>10,471,771</b>
<b>Borrowed from Other Sources</b>				
Charter boats	100	1,136,869	27,729 (59,495)	2,772,900
Marinas	37	1,145,000	114,500 (267,717)	4,236,500
Livebait dealers	30	13,000	1,444 (4,333)	43,320
<b>Total</b>	<b>167</b>	<b>2,294,869</b>	<b>143,673</b>	<b>7,052,720</b>
<b>Borrowed from All Sources of Loans</b>				
Charter boats	100	1,176,869	28,681	2,868,138
Marinas	37	3,937,000	393,700	14,566,900
Livebait dealers	30	26,840	2,982	89,453
<b>Total</b>	<b>167</b>	<b>5,140,709</b>	<b>425,363</b>	<b>17,524,491</b>

<sup>1</sup>Average outstanding loan = [Total outstanding loans reported by units that participated in the survey] / [number of units that participated in the survey]. Values in parentheses are standard deviations.

<sup>2</sup>Total projected outstanding loans of all units licensed or operating on August 29, 2005 = [Average outstanding loan] X [total number of boats or facilities licensed or operating on August 29, 2005].

## SUMMARY AND IMPLICATIONS

The tasks involved in estimating the economic damages to the Mississippi recreational fishing industry associated with Hurricane Katrina were extremely difficult and very time-consuming. The majority of the operators or owners of the fleet and facilities, however, were extremely cooperative in providing the economic information required in conducting a fairly exhaustive assessment. The results of the assessment indicated massive devastation of all the sectors included in the survey. This information on hurricane damages had been transmitted to DMR and NOAA Fisheries, discussed during interviews with the media, and presented to local, national, and international fisheries-related audiences. The future of this industry depended on the timing and magnitude of the response of DMR and NOAA Fisheries and the private sector to the devastation.

Several methodological shortcomings were realized as the data were entered in the damage assessment models and in later economic analysis involving forecasting and explanatory modeling of the affected marine sectors. Despite the need not to create any additional burden to the survey or interview process by limiting the number of questions, careful attention must be given to the development and testing of the damage assessment models to make sure that the essential variables required are measured according to acceptable methods. It is imperative to clearly identify the marine sectors to be included in the assessment as well as the total number of marine establishments in each sector when the disaster occurs. Whenever possible, all the registered, licensed, operating, or identified marine establishments should be given the same opportunity to participate in the damage assessment.

In order to better understand the decision-making processes involved in mitigating the effects of natural disasters like Hurricane Katrina on the recreational

fleet and facilities, marine resource managers need to have a broader understanding of the nature of their businesses. Multiagency collaboration would greatly improve the accuracy and enhance the usefulness of the information generated in conducting damage assessments associated with widespread natural disasters. Mail surveys and personal interviews take time, and the availability of personnel conversant in other languages is a must for higher participation rates among the non-English-speaking owners and operators of marine establishments.

Although four out of 10 of the marine establishments participated in these surveys, it is imperative that the regulatory and scientific communities develop alternative methods of estimating damages to marine sectors after natural disasters. Advanced analytical tools and Internet survey methodologies may also improve the accuracy and reduce the time involved in assessing damages. The availability of recent satellite data on the affected areas is also necessary in initially assessing the extent of damage caused by a natural disaster. Available region-, state-, county-, or city-level socio-demographic-economic data can also be used to estimate the economic importance of each industry to be assessed when a natural disaster occurs.

Disaster-related decisions made by marine establishments are affected by official forecasts on the timing, location, and magnitude of these natural events. Improvements in the accuracy of these predictions would likely improve the decision-making processes that marine establishments undergo when natural disasters occur. The decision to move vessels to safer areas may be influenced by the expected landfall or magnitude of natural disasters. Further studies evaluating the decision-making processes made by marine establishments in response to natural disasters would improve the overall mitigation process.

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Appendix A. SURVEY OF DAMAGES FROM HURRICANES KATRINA AND RITA ON MISSISSIPPI CHARTER BOATS FOR HIRE

1. BOAT/VESSEL LICENSE NUMBER OR NAME: \_\_\_\_\_
2. LENGTH OF BOAT/VESSEL (IN FEET): \_\_\_\_\_
3. CITY BOAT/VESSEL IS LOCATED: \_\_\_\_\_
4. FISHING LICENSES (Please check all that applies to the boat):
  - Crab
  - Oyster       Tonging       Dredging
  - Shrimp
  - Fish
  - Menhaden
  - Livebait
  - Charter boat

ESTIMATE OF BOAT/VESSEL LOSS

5. Please describe the type, size and initial investment on the boat/vessel, engine, gear and other accessories of your boat/vessel before Katrina:

Category	Description	Number	Initial investment (\$)
Boat/Vessel			
Engine			
Gear			
Other accessories			
Total			

6. If your boat/vessel was damaged, what are your best estimates of the costs of the damages to your boat, engine, gear and accessories that you need to restore to pre-Katrina level?  
(IF NONE, ANSWER 0)

Category	Estimated costs of the damages to restore to pre-Katrina level (\$)	Estimated costs of towing, clean up & disposal (\$)	Amount already spent to restore (\$)
Boat & engine			
Gear & accessories			
Total			

INSURANCE AND LOANS ON BOAT/VESSEL (IF NONE, ANSWER 0)

7. What is the amount of insurance coverage you expect for the damages? \$ \_\_\_\_\_
8. What is the amount of outstanding loan you have on the boat/vessel?
- Loans from Small Business Administration \$ \_\_\_\_\_
- Loans from other sources \$ \_\_\_\_\_

ESTIMATION OF LOST REVENUES AND MARKETING OPPORTUNITIES

9. What was your gross annual sales in 2004 (before H. Katrina)? \$ \_\_\_\_\_
10. How many crew members did you employ in 2004 (before H. Katrina)? \_\_\_\_\_
11. How many crew members are you employing now (after H. Katrina)? \_\_\_\_\_
12. Once fully recovered, what is your best estimate of the pre-Katrina level of total sales that you will lose due to lost market channels? \_\_\_\_\_ percent

Appendix B. SURVEY OF DAMAGES FROM HURRICANES KATRINA AND RITA ON MISSISSIPPI MARINAS

1. NAME OF COMPANY: \_\_\_\_\_
2. CITY FACILITY IS LOCATED: \_\_\_\_\_
3. MARINA FACILITIES: (Please check all that applies):  
 Wet slips     Dry storage     Refueling station     Pump-out station     Boat ramp

ESTIMATE OF FACILITIES AND PRODUCT INVENTORY LOSSES

4. Please describe the type, size and initial investment on the buildings, facilities, and structures in your marina before Katrina:

Category	Description - type, length, width	Number	Estimated initial investment (\$)
Buildings, pump-out & filling stations			
Wet slips			
Dry storage			
Jetties, piers & ramps			
Equipment & accessories			
Total			

5. If your facility was damaged by H. Katrina, what are your best estimates of the costs of the damages to your facility and inventory of supplies that you need to restore to pre-Katrina level? If not please proceed to questions number 7-10.

Category	Damages to facility to restore to pre-Katrina level	Costs of dredging, removal, disposal & clean up	Amounts already spent to restore	Additional amounts needed to restore
Buildings, slips & storage				
Jetties, piers & ramps				

Equipment & accessories				
Total				

6. How much was the estimated value of supplies that was lost during the hurricanes? \$ \_\_\_\_\_

INSURANCE AND LOANS ON DAMAGED FACILITIES

7. What is the amount of insurance coverage you expect for the damages? \$ \_\_\_\_\_

8. What is the amount of outstanding loan you have on the facilities?

Loans from Small Business Administration \$ \_\_\_\_\_

Loans from other sources \$ \_\_\_\_\_

ESTIMATION OF LOST REVENUES AND MARKETING OPPORTUNITIES

9. What was your gross annual sales in 2004 (before H. Katrina)? \$ \_\_\_\_\_

10. How many workers did you employ in 2004 (before H. Katrina)? \_\_\_\_\_

11. How many workers are you employing now (after H. Katrina)? \_\_\_\_\_

12. Once fully recovered, what is your best estimate of the pre-Katrina level of total sales that you will lose due to lost market channels? \_\_\_\_\_ percent

Appendix C. SURVEY OF DAMAGES FROM HURRICANES KATRINA AND RITA ON THE MISSISSIPPI COMMERCIAL LIVEBAIT DEALERS

1. LIVEBAIT DEALER LICENSE NUMBER OR NAME: \_\_\_\_\_

2. CITY FACILITY IS LOCATED: \_\_\_\_\_

ESTIMATE OF FACILITY LOSS

3 Please describe the type, size and initial investment on the buildings, livehaul equipment, livebait holding equipment and other accessories of your facility before Katrina:

Category	Description	Number	Estimated initial investment (\$)
Buildings			
Holding equipment			
Livehaul equipment			
Other accessories			
Total			

4. If your facility was damaged, what are your best estimates of the costs of the damages to your building, livebait holding equipment, livehaul equipment and other accessories that you need to restore to pre-Katrina level? (IF NONE, WRITE 0)

Category	Estimated costs of the damages to restore to pre-Katrina level (\$)	Estimated costs of towing, clean up & disposal (\$)	Amount already spent to restore (\$)	Additional amounts needed to restore (\$)
Building				
Equipment & accessories				
Total				

5. How much was the estimated value of livebait and supplies that was lost during the hurricanes? \_\_\_\_\_

INSURANCE AND LOANS ON FACILITY (IF NONE, ANSWER 0)

6. What is the amount of insurance coverage you expect for the damages? \$ \_\_\_\_\_

7. What is the amount of outstanding loans you have on the boat/vessel?

Loans from Small Business Administration \$ \_\_\_\_\_

Loans from other sources \$ \_\_\_\_\_

ESTIMATION OF LOST REVENUES AND MARKETING OPPORTUNITIES

8. What was your gross annual sales in 2004 (before H. Katrina)? \$ \_\_\_\_\_

9. How many employees did you employ in 2004 (before H. Katrina)? \_\_\_\_\_

10. How many employees are you employing now (after H. Katrina)? \_\_\_\_\_

11. Once fully recovered, what is your best estimate of the pre-Katrina level of total sales that you will lose due to lost market channels? \_\_\_\_\_ percent



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