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Hurricane Damage Sustained Across the Galveston Bay System and the Sabine-Neches Area by the Oyster Industry, Commercial Fishermen, Seafood Processors and Dealers, and Fishing Guides

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Hurricane Damage Sustained Across the Galveston Bay System and the Sabine-Neches Area by the Oyster Industry, Commercial Fishermen, Seafood Processors and Dealers, and Fishing Guides[a]

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Acknowledgment

Organizational Challenges to the Recovery Process

Hurricane Ike tested the capability of all organizations involved with the storm recovery process. Two programs within the Texas A&M System, the Texas AgriLife Extension Service and the Sea Grant College Program, were no exception. These outreach programs work diligently to train their personnel in a variety of recovery and emergency management activities. However, with a storm as powerful as Hurricane Ike virtually everyone in the impact zone is affected.

As luck would have it, our established, locally-knowledgeable Coastal & Marine Resources Agent in Galveston County ended up with major property damage, and found herself in the same assistance lines as most of her neighbors. In the weeks after the storm, she was dealing with the same frustrating litany of completing disaster assistance applications, endless on-holds with insurance call centers, and unfulfilled site visits promised by overwhelmed claims adjustors.

Recovery Efforts for Sea Grant Audiences

Recreational boat owners. Within two days of landfall, Terrie Looney and Rhonda Cummins, two County Coastal & Marine Resources Extension Agents, started initial recovery efforts that stretched from Galveston County to the Louisiana border. Terrie Looney, headquartered in Beaumont, and Rhonda Cummins, who offices in Port Lavaca, photographed, marked, and recorded GPS locations of recreational vessels swept from their moorings. The storm surge deposited many of these vessels in pastures miles from the water. In all, some 30 boats were located. State registration numbers from the lost vessels were then cross-referenced with Texas Parks and Wildlife records to identify the owners. Once identified, owners were contacted with instructions about getting vessel information. The creativity and resourcefulness exhibited by Terrie and Rhonda in these early days helped streamline the insurance claim process for many of these vessel owners.

Commercial crab fishermen. As days since landfall became weeks, Terrie worked with federal, state, and local organizations to obtain recovery assistance for Asian-American crab fishermen who lived on Oak Island. Many of these residents lost everything in the storm, and thus did not have the resources to apply for assistance. Terrie collaborated with a local church to secure interpreters and arranged transportation to both (a) FEMA centers so these fishing families could apply for immediate assistance and file for SBA disaster loans, and (b) offices of the Texas Workforce Commission in Beaumont to begin the application process for unemployment assistance.

Estimating storm damage. Rhonda prepared and mailed several damage-assessment surveys for commercial bay fishermen, seafood dealers, and fishing guides across the impact zone. After preparing the questionnaires, Rhonda and Terrie hand-delivered them to impacted groups who had no mail service.

These agents also organized informational meetings so seafood-linked businesses could hear first-hand from FEMA recovery specialists and resource management agencies like Texas Parks and Wildlife.

Summary. Our recovery efforts spanned the gamut: from identifying locations and owners of lost vessels, to helping fishing families secure recovery assistance, to measuring damages sustained by seafood-linked industries. Despite such a broad scope of recovery work, two common themes were repeated. First, all activities started with the *commitment and motivation* to help those who are traditional or new audiences for our outreach efforts. Second, there is no *field manual* for these recovery efforts; perseverance, creativity, and resourcefulness are key ingredients to the success of recovery efforts.

As we began measuring damage to seafood-dependent firms, industry leadership and state/local officials kept saying that Sea Grant was the one organization that could successfully complete a damage assessment for these industries. We are encouraged by the confidence others have in us, and hope these assessments help industry move forward.

Next Steps for Outreach Organizations

Historically local employees of the Texas AgriLife Extension Service and the Sea Grant College Program have been part of county Emergency Management teams. Today however, entire organizations are being asked to formalize their response plans and shoulder additional responsibility in both storm preparedness and recovery. Since Ike, Texas AgriLife Extension has established plans that would ensure timely recovery assistance using staff from outside the impact zone. Sea Grant is also assessing how best it can contribute to the larger storm preparedness and recovery efforts. Emergency preparedness is one area where Sea Grant has a successful track record. Coastal & Marine Resources Agents have offered coastal residents emergency preparedness training for many years. In this era of more formalized agency-wide response planning, the Sea Grant contribution will be shaped by those traits which have served us so well for the past thirty years: personal commitment and motivation, perseverance, creativity, and resourcefulness

Executive Summary

Three weeks after Hurricane Ike made landfall, faculty with the Texas A&M System began assessing damage to seafood-linked and recreational-fishing enterprises across the Galveston Bay system (GBS) and the Sabine-Neches area (SNA).

Several slightly-different surveys were developed and distributed to four primary business types: (a) those who hold leases within the GBS for the cultivation of oysters and/or process or distribute oysters nationwide, (b) commercial bay fishermen, (c) seafood dealers and processors, and (d) all licensed fishing guides. Estimated costs to repair or replace damaged or lost assets across the various business types are summarized below. Following the damage summary, we consider employment and payroll effects and conclude with revenue impacts that resulted from Hurricane Ike.

Estimates of Physical Damage

Damage to GBS Oyster Resources & Industry Assets. In late Fall, Texas Parks and Wildlife biologists began a survey of the public oyster grounds across the bay and concluded that about 60% of the public oyster crop had smothered under sediments and debris deposited by the storm surge.

Responses from GBS oyster ground leaseholders, processors and distributors indicated most of the $38 million damage to assets controlled by the oyster industry (83%) was attributed to resource damage or destruction. Lost live inventory and destruction of privately-built oyster reefs on leased bay bottom were estimated at $31.6 million. Damage to infrastructure – vessels, docks, buildings, processing equipment, and inventories – totaled $6.39 million (17% of total). Importantly, damage to private assets are a fraction of the total losses that will continue to impact the Texas oyster industry and others who depend upon the bay.

The impacts of damaged reefs, both public and private, extend far beyond those who depend upon oysters. Major damage to oyster reefs in the GBS is a significant concern to the long-term ecological health of the estuary because this habitat provides numerous environmental benefits. Chief among these is ensuring environmental water quality despite receiving millions of gallons of municipal wastewater each day as well as episodic storm runoff. Good environmental water quality translates into a wide mix of large, direct economic impacts. For example, the GBS supports commercial shrimp, crab, and oyster fisheries as well as a tourism industry predicated on boating, contact water sports (e.g., swimming, kayaking, etc.), and sportfishing. Reef habitats are productive angling grounds. In Louisiana 23% of marine angling days each year were spent over oyster reefs.

Restoring oyster populations within the GBS is critical because of the multiple benefits reefs provide. The question remains however about how to fund such a large restoration project. Therefore:

- Industry, organizations, agencies, and lawmakers need to explore funding available through the President's stimulus package. Because of the GBS, Texas is the second-largest supplier of Eastern oysters in the country. The bay also supports other commercial fisheries and a water-based recreation and tourism industry that includes sportfishing, boating, and contact, water-based activities. All of these uses depend upon oyster habitat. Planting shell on public oyster grounds would restore essential estuarine habitat, create jobs, and stimulate the regional economy.

Rebuilding private reefs is a process that every oyster leaseholder implements each year. The difference in per-acre productivity between leased and publicly-managed bottom (more than a 3-fold increase in oyster meat production from leases) is standing testimony to the effectiveness of annual shell-planting and oyster transplanting efforts. That said, lessees are continually plagued by the inability to (a) protect the value of their living oyster inventory or (b) ensure adequate funding for annual reef improvement work because of economic risk generated by storms, disease, etc. Hurricane Ike demonstrated that a reef in a shallow bay system is no match for the destructive power of waves created by hurricane-force winds or a storm surge. Therefore:

- GBS leaseholders should explore a Group Risk Plan for oysters offered under the authority of the Federal Crop Insurance Corporation, a USDA-owned corporation. Such a program was created for leaseholders in Louisiana in Spring, 2009. Preliminary discussions are underway with USDA leadership responsible for overseeing the federal crop insurance program.

Damage to GBS Fishermen, Processors and Dealers. The damage assessment survey of commercial fishermen across the GBS reflects roughly $4.6 million in casualty losses to respondents. Damage to vessels, docks, and piers accounted for 82% ($3.8 million).

Processors/dealers collectively reported physical damage of $8.2 million. The largest sources of damage were to processing buildings and equipment at 55%

($4.5 million), docks and piers at 20% ($1.65 million), and inventories also at 20% ($1.6 million).

Damage to SNA Commercial Fishermen. Reported damage among commercial fishermen in the SNA was $822,000, with vessels accounting for 61% of physical losses and lost or damaged fishing gear amounting to $318,500 or 39%.

Damage Estimate Summary – All Entities. All surveys of seafood-linked enterprises sought similar information about physical damage, the estimated cost to repair or replace assets damaged or destroyed by the storm, and the expected time required to return damaged or destroyed assets to full operational status. Across both the GBS and the SNA, estimated dollar damage to seafood-linked respondents amounted to $51.7 million. Leaseholders and oyster processors/distributors across the GBS accounted for 74% of total dollar damage to the seafood-linked industries across both regions, primarily because of substantial losses on privately-held oyster leases. Seafood processors and dealers within the GBS indicated collective damage of $8.2 million, or 16% of total seafood-linked enterprise damage while commercial fishermen from both the GBS and the SNA experienced $5.5 million in damaged or lost assets.

Employment and Payroll Changes

GBS Employment and Payroll Changes. Employment and payroll data for commercial fishermen and processors and dealers of other seafoods were collected for two like time periods: September – December 2007 and 2008. Across this four-month time frame in 2007, commercial fishing enterprises employed an average of 178 crew members in each of four months along with a cumulative payroll valued at $1,533,973. Across the same four months after Hurricane Ike, employment dropped to 77 workers (a 57% decline) with a cumulative payroll of just $442,249 (a 71% decline).

Between September and December 2007, GBS seafood dealers and processing firms employed an average of 141 workers in each of four months along with a cumulative payroll valued at $584,797. Across the same four months after Hurricane Ike, employment dropped to 66 workers (a 54% decline) with a cumulative payroll of $391,164 (a 33% decline).

SNA Employment and Payroll Changes. Commercial fishermen employed an average of 40 crew members each month with a payroll value of $560,700. After Hurricane Ike, crew members declined to 33 with a payroll of $275,564. Employment of crews decreased by roughly 18% and payroll declined by almost 51%.

Revenue Changes

Revenue Changes in the Oyster Industry. Revenues among oyster-dependent firms dropped precipitously following Hurricane Ike. In the 12 months before Hurricane Ike (Sept. 2007 – Aug. 2008), respondents to the oyster-industry survey reported revenues of $30.1 million. Sixty-two percent of these annual revenues were realized from the sale of GBS oyster products, with another 4% from other GBS seafoods. Actual and projected revenues for the 12 months after Hurricane Ike were $6.9 million; a 77% reduction from the amount generated in the previous 12-month interval.

Revenue Changes Among Fishing Guides. Although fishing guides from both geographic areas did not report any physical damage, they did experience revenue losses due to trip cancellations. GBS fishing guides reported losses of $749,843 while SNA guides estimated revenue losses of $47,450.

Hurricane Damage Sustained Across the Galveston Bay System and the Sabine-Neches Area by the Oyster Industry, Commercial Fishermen, Seafood Processors and Dealers, and Fishing Guides

Introduction & Purpose

Three weeks after Hurricane Ike made landfall, faculty with the Texas AgriLife Extension Service and the Texas Sea Grant College Program – both part of the Texas A&M University System – began assessing damages sustained by seafood-linked firms and fishing guides. Several, slightly-different surveys were developed and distributed to targeted, impacted groups across the Galveston Bay system including (a) those who hold leases within the Galveston Bay system for the cultivation of oysters and/or those who process and distribute oysters nationwide, (b) commercial bay fishermen, (c) dealers and processors of other seafoods, and (d) all licensed fishing guides. In addition, commercial fishermen and fishing guides from the Sabine-Neches area were also queried about their respective, storm-related damage.

Each survey asked about the extent of damage to each type of asset (e.g., vessels, bulkheaded areas, piers, fuel storage and distribution systems, buildings, equipment, inventories, etc.) and the estimated expense necessary to repair or replace those damaged or destroyed assets. Survey recipients also were asked to estimate how long they thought it would take to repair or replace those damaged or lost assets and return them to *"full operational status."* This last question can be combined with either the appropriate physical measure (like numbers of vessels, linear feet of docks, or square feet of buildings) or the estimated repair/replacement expense to determine how long it will take to put what fraction of each asset class back into service. This line of questioning is important because the elapsed time between landfall and returning to full operational status has a direct impact upon revenue generation, employment, and payroll.[1] Surveys also asked about employment and associated payroll prior to and after Hurricane Ike made landfall.

The storm surge was the source of significant damage generated by Hurricane Ike. Losses to many coastal homeowners were catastrophic because of the storm surge. Much of this "built environment" and millions of cubic yards of soil were washed into the Galveston Bay system and across the south and southwest sides of Chambers County. These varied materials covering the bay bottom smothered a large fraction of the Galveston Bay system oyster crop, and also impacted commercial fishermen as they attempted to trawl for shrimp after the storm. Therefore, commercial fishermen were asked about their trawling experiences after the storm and the damage caused by debris incidentally picked up in trawl gear.

Collective responses from several impacted groups were, understandably, low. A relatively low response rate without information about size of the enterprise (expressed as gross revenues, acreage, throughput, etc.) makes it impossible to ascertain the relative sizes of the firms that responded. Response data could be skewed toward smaller operators, larger firms, or normally distributed across size. Therefore, it is difficult to project the impacts across the larger impacted industry, so reported impacts will be limited to sample responses. Nevertheless, the information presented here can be used to better understand the magnitude of damage sustained by the seafood-dependent sector and for-hire recreational fishing guides.

1. For example, if analysis showed that 70 percent of all damaged or destroyed vessels were estimated to be back on the water by the time the survey was distributed, we could conclude that fishing effort would have been slightly impacted by the storm. On the other hand, if 90 percent of the bulkheaded areas would not be expected to be operational for 12 to 18 months, major moorage and offloading bottlenecks could be expected.

Impacts Upon Seafood Industries and Fishing Guides Across the Galveston Bay System

Damages to The Galveston Bay System Oyster Industry[2]

Galveston Bay has historically been the largest producer of oysters in Texas, averaging 77 percent of statewide oyster production between 1981 and 2007. Within the Galveston Bay system, oysters are harvested from publicly-managed reefs and leased bay bottom. Leases, offered for the cultivation of oysters, are extremely productive. Since 1981, harvests from leases have averaged 435 pounds of meat per acre; more than a 3-fold difference over publicly-managed oyster reef harvests within the Galveston Bay system which have averaged 132 pounds of meat per acre.

Hurricane Ike hit the oyster industry hard! Eighty-three percent of the $38 million in total, estimated casualty losses to respondents occurred on leased bottom, either from lost inventory or the expense required to rebuild privately-developed reefs (Table 1, Figure 1). Damage to vessels, docks, buildings, processing equipment, and inventories totaled $6.39 million (17 percent of total).

Table 1. The Estimated Cost to Repair or Replace All Oyster Industry Assets Damaged or Destroyed by Hurricane Ike

Asset Class	Dollars	Percent
Oyster Leases	$31,646,765	83.2%
Vessels	$1,630,000	4.3%
Docks, Piers, Roads & Parking	$1,845,000	4.9%
Fuel Systems	$169,550	0.4%
Plant & Equipment	$2,394,800	6.3%
Inventories	$351,750	0.9%
Total Cost to Repair or Replace all Damage	$38,037,865	100.0%

2. This section summarizes information contained in Haby, Michael G., Russell J. Miget, and Lawrence L. Falconer. *"Hurricane Damage Sustained by the Oyster Industry and the Oyster Reefs Across the Galveston Bay System with Recovery Recommendations."* A Texas AgriLife Extension Service / Sea Grant Extension Program Staff Paper. The Texas A&M University System, College Station, Tx. TAMU-SG-09-201. 51 pp. (June, 2009). This report is available from Haby (see contact information on the title page) or Texas Sea Grant at [http://texas-sea-grant.tamu.edu/Outreach/extension.html].

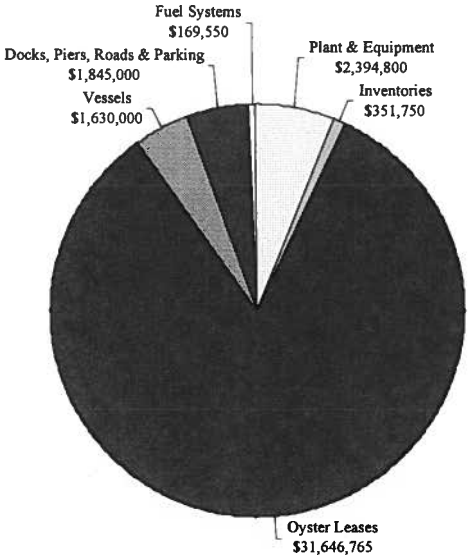

Figure 1. The Estimated Cost to Repair or Replace All Oyster Industry Assets Damaged or Destroyed by Hurricane Ike

Storm-related Revenue Impacts Sustained by Oyster-dependent Firms. Storm-related revenue impacts were acute for oyster firms within the Galveston Bay system because 62 percent of the revenues generated in the twelve months prior to Hurricane Ike were derived from shellstock ($5.44 million) and shucked meats ($13.2 million) harvested off publicly-managed and privately-created reefs. Adding in another 4 percent for revenues earned from the sale of other Galveston Bay system seafoods, two-thirds of annual revenues for oyster-dependent firms that responded to this survey are generated from the bay. Oyster-dependent firms collectively reported gross revenues of $30.1 million for the twelve months preceding Hurricane Ike, but the reported mix of actual and estimated quarterly revenues generated for the twelve months since the storm (September, 2008 through August, 2009) amount to just $6.9 million; a 77 percent reduction from the $30.1 million generated in the twelve months prior to Ike.

Storm-related Employment and Payroll Effects Sustained by Oyster-dependent Firms. In the twelve months preceding Hurricane Ike, industry members hired 159 individuals who earned an average of $27,759 over the 12-month interval. Collectively, $4.4 million was paid out in wages and salaries. Estimating employment and payroll going forward was difficult because of three unanswered questions: First, no one knew the quantity of oysters available for the 2008-2009 harvest. Second, no one knew how long the remaining reefs could sustain harvests. Third, with damage to their leaseholds and processing facilities there was much uncertainty about when plants could support harvesting and processing operations. Some oyster operations completed the actual and projected employment and payroll for the twelve months following Hurricane Ike. However, the number of complete responses was too low to make any meaningful industry-wide estimates.

Damages to Oyster Resources Within the Galveston Bay System[3]

The Galveston Bay system supports multiple uses. This estuary continuously receives large volumes of municipal wastewater and episodic storm water runoff while supporting several commercial fisheries and a water-based recreational economy that includes sportfishing, boating, and swimming. These uses might seem at odds, and would be, were it not for the oyster reefs.

3. A more thorough discussion of the environmental benefits provided by thriving oyster reefs and the expected impacts originating from storm damage can be found in the report entitled *"Hurricane Damage Sustained by the Oyster Industry and the Oyster Reefs Across the Galveston Bay System with Recovery Recommendations"* referenced above in footnote 2.

Oysters feed by pumping and filtering large quantities of water. Under ideal conditions, **one** average-sized oyster can filter up to 50 gallons of water per day! This process reduces algal blooms generated as a result of nutrient loading and suspended solids, and simultaneously initiates a food-web that results in higher-order predators like red drum. Biofiltration also improves light penetration which supports the expansion of other preferred estuarine habitats like sea grasses.

After Hurricane Ike made landfall, Texas Parks and Wildlife personnel evaluated storm damage to the publicly-managed oyster reefs within the Galveston Bay system using a SONAR-based survey. Results indicated that as much as 60 percent of the oyster crop was smothered under sediment and debris deposited by the storm surge.

Damage to oyster reefs impacts a variety of direct and indirect users including those who depend upon oysters for their livelihoods, other commercial fishing interests, sportsfishers, recreational boaters and contact, water-based recreational enthusiasts (swimmers, kayakers, etc.). In addition, a damaged reef system impacts the long-term ecological health of the Galveston Bay ecosystem. Thriving oyster reefs ensure water quality in estuarine systems. Unfortunately, several notable examples across the country demonstrate that when the filtering capacity of oysters diminishes because of their reduced abundance, environmental water quality problems follow. With a sharply diminished oyster resource, today the Chesapeake Bay faces degraded environmental water quality, loss of submerged aquatic vegetation, and in some cases prohibitions against contact water sports because of risks to human health. Therefore, the impact of hurricane-damaged oyster reefs within the Galveston Bay system extends far beyond those who rely upon oysters and oyster reefs for their livelihoods and recreational opportunities.

Actions Recommended to Restore Public Oyster Resources and Protect Private Oyster Leases

Both the physical damage assessment of the publicly-managed reefs and the assessment of damages to oyster-dependent firms indicate that a large fraction of the oyster inventory and reef habitat within the Galveston Bay system was severely damaged by Hurricane Ike. The SONAR-based assessment of public reefs conducted by Texas Parks and Wildlife confirmed that 60 percent of the oyster crop was smothered under sediment and debris generated by the storm surge. Texas Parks and Wildlife Department managers estimate that planting cultch on the consolidated reefs within the Galveston Bay system could range from $161 million to $481 million depending upon the level of mortality. Leaseholders estimated a 67 percent loss of private oyster inventory, with lost inventory either smothered under silt or swept away. Private inventory losses and physical damage to reefs translated into a $31.6 million casualty loss that accounted for 83 percent of total, reported damage to assets controlled by industry. In a few hours, the storm surge literally destroyed a large fraction of living inventory as well as the reef structures themselves. Therefore, recommended actions include (a) restoring publicly-managed reefs and (b) establishing some means of economically protecting the value of private reefs. In accomplishing both of these recommended actions, the benefits thriving reefs provide to commercial fishermen, recreational anglers, boaters, and swimmers can continue.

Recovery Efforts Funded with Public Monies. Survey respondents were queried about their preferences for four potential recovery projects funded from public sources. The most important issue was removal of debris off the bay bottom. This work is underway. The second-most important recovery project was to plant shell on public reefs. Those either connected with the oyster business or charged with ensuring estuarine water quality would agree on the importance of this activity since rebuilding suitable substrate is the first step in restoring oyster populations. However, the cost is high, and many unfamiliar with either the industry or estuarine ecosystems have asserted that investing several hundred million dollars for an industry that generates about $10 million in annual landed value (i.e., the amount paid to fishermen) does not represent the best use of public monies. Unfortunately, this assertion ignores the fact that oyster reefs ensure a diverse mix of significant, measurable economic benefits *in addition to the market value of oysters.*

Restoring oyster populations within the Galveston Bay system is critical because of the multiple benefits reefs provide. Biofiltration reduces algal blooms and initiates a food-web that results in higher-order predators like red drum. Oyster reefs support other beneficial estuarine habitats that establish the basis for the large economic impacts derived through various uses of the Galveston Bay system. The U.S. Army Corps of Engineers has documented the high marginal environmental benefits of oyster reefs, and has stated that creating these structures has a relatively low marginal cost when compared against marsh or sea grass restoration efforts. The question remains, however, about how best fund such a recovery project.

- Industry, organizations, agencies, and lawmakers need to explore the use of "shovel-ready" efforts established as part of the President's stimulus package. Texas is the second-largest nationwide supplier of Eastern oysters, primarily because of the Galveston Bay system. The bay also supports other commercial fisheries and a water-based recreation and tourism industry. Each of these uses depends upon oyster habitat. Oyster reefs are the preferred fishing locations for many sports fishermen. In Louisiana, anglers indicated that roughly 23 percent of their total marine-angling days each year occurred over oyster reefs. Planting shell on public oyster grounds would restore essential coastal habitat, create jobs, and stimulate the regional economy.

Recovery Efforts Funded by Industry. Refurbishing oyster reefs is a process that every leaseholder understands, and implements each year. The three-fold difference in per-acre productivity between leased and publicly-managed bottom is standing testimony to the effectiveness of annual shell-planting and oyster transplanting efforts. However, leaseholders are continually plagued by the inability to protect the value of their oyster inventory on private reefs. Hurricane Ike demonstrated that a reef in a shallow bay system is no match for the destructive power of large breakers or a storm surge that carries debris and sediment.

- Leaseholders within the Galveston Bay system should explore a Group Risk Plan for oysters offered under the authority of the Federal Crop Insurance Corporation, a USDA-owned corporation. Such a program was created for leaseholders in Louisiana in Spring, 2009. Annual reef-improvement work could also be easier to finance with a Group Risk Plan in place. Preliminary discussions are underway with USDA leadership about how such a program could work for leaseholders across the Galveston Bay system.

Damages to Commercial Fishing Enterprises in the Galveston Bay System

Damage to Commercial Vessels. One hundred fourteen commercial fishermen located across the Galveston Bay system responded to the survey. All but one respondent owned commercial vessels. The 113 vessel owners maintained 186 different vessels licensed for commercial harvest. Regarding damage to commercial vessels, 9 percent were not damaged, 34 percent had minor damage, 39 percent were severely damaged, and 18 percent were destroyed or lost (Table 2). Respondents estimated repair or replacement costs for the 170 vessels at $2.4 million.

Table 2. Classification of Damage to the Commercial Fleet by Fishermen Across the Galveston Bay System

Damage Classification:	Number	Percent
No damage	16	9%
Minor damage – a few repairs needed	64	34%
Substantial damage – hull or engine repairs needed	73	39%
Destroyed or lost – replacement required	33	18%
Total number of vessels reported	186	100%

By the time the survey was distributed, 43 vessels damaged by Hurricane Ike had returned to full operational status, suggesting that roughly 32 percent of the vessels owned by respondents were ready to fish (Table 3). As Table 3 also illustrates, work continued on vessels throughout the spring, and by August 132 vessels (71

percent) were back on the water. Expressed in dollar terms, by August, 2009 $1.36 million (56 percent) of estimated repair/replacement dollars would have been used to return 71 percent of respondents' vessels to the fisheries. Beyond August, 2009 however, optimism dims for returning damaged or lost vessels to commercial fishing. Owners of 3 vessels indicated it may take until 2011 to be back on the water. Owners of six vessels estimate that 60 months will be required, and owners of 37 vessels cannot say when their work boats will be operational.

Table 3. Summarizing Fleet Damage Across the Galveston Bay System by Expected Time Vessels will Return to Service and the Estimated Costs to do so

Time to Repair or Replace	Number	Pct.	Cum. %	Dollars	Pct.	Cum. %
Not Damaged in Storm	16	8.6%	8.6%	$0	0.0%	0.0%
Already operational	43	23.1%	31.7%	$230,550	9.5%	9.5%
Ready in 1 mo. (03/09)	10	5.4%	37.1%	$169,000	7.0%	16.5%
Ready in 2 mo. (04/09)	15	8.1%	45.2%	$234,200	9.7%	26.2%
Ready in 3 mo. (05/09)	13	7.0%	52.2%	$180,200	7.5%	33.7%
Ready in 4 mo. (06/09)	3	1.6%	53.8%	$58,750	2.4%	36.1%
Ready in 6 mo. (08/09)	32	17.2%	71.0%	$483,000	20.0%	56.1%
Ready in 12 mo. (02/10)	7	3.8%	74.7%	$178,000	7.4%	63.5%
Ready in 24 mo.	3	1.6%	76.3%	$100,000	4.1%	67.6%
Ready in 60 mo. or more	6	3.2%	79.6%	$153,000	6.3%	73.9%
Never	1	0.5%	80.1%	$15,000	0.6%	74.6%
Don't Know / Not Answered	37	19.9%	100.0%	$615,057	25.4%	100.0%
Total	186	100.0%		$2,416,757	100.0%	

Damage to Docks and Piers. Most commercial fishermen who completed this survey did not own docks. Of the 114 surveys returned, 87 respondents (76 percent) answered "No" to the question. Of the 16 that owned docks when Hurricane Ike made landfall, 15 indicated some level of damage was sustained.[4] Respondents reported extensive damage to bulkheads. Of the 7,307 linear ft. owned by respondents, 6,591 ft. (90 percent) of bulkheads sustained damage severe enough to warrant replacement; an expensive proposition. As Table 4 shows, respondents cannot say when two-thirds of all the damaged bulkhead (4,821 ft.) will be repaired or replaced. Not surprisingly, repairing or replacing this much bulkheaded dock is estimated to cost just over $1 million; 82 percent of the total, estimated repair/replacement budget for this asset class.[5]

Table 4. Summarizing Bulkhead Damage by Expected Time to Become Operational and the Estimated Costs to do so

Time Necessary to Repair or Replace	Linear Feet	Pct.	Cum. %	Dollars	Pct.	Cum. %
Not Damaged in Storm	486	6.7%	6.7%	$0	0.0%	0.0%
Already operational	110	1.5%	8.2%	$16,000	1.2%	1.2%
Ready in 1 mo. (03/09)	250	3.4%	11.6%	$15,000	1.2%	2.4%
Ready in 2 mo. (04/09)	520	7.1%	18.7%	$13,000	1.0%	3.4%
Ready in 3 mo. (05/09)	20	0.3%	19.0%	$2,000	0.2%	3.6%
Ready in 12 mo. (02/10)	1,100	15.1%	34.0%	$190,000	14.7%	18.3%
Don't Know / Not Answered	4,821	66.0%	100.0%	$1,055,000	81.7%	100.0%
Total	7,307	100.0%		$1,291,000	100.0%	

4. Of the 7,307 ft. of bulkheads owned by respondents, 6,707 ft. was treated wood and 600 ft. was vinyl.

5. The cost to repair or replace bulkheaded areas averaged $189 per foot. This figure seems quite low since in most instances twice the man- and machinery-hours will be required since the damaged material must first be removed prior to replacement.

Piers that extend from bulkheaded areas increase the linear footage available for mooring vessels in the area that comprises a commercial harbor. Respondents reported some 4,063 linear feet of piers, all constructed of treated wood. Roughly 2,900 feet (71 percent) of piers sustained damage. Minor repairs are required on 165 feet, Major repairs are necessary across 410 feet, and 2,318 feet of piers must be completely replaced. Respondents estimated repair/replacement costs at $75,500 or $26.00 per ft. which seems very low.

Gear Damage and Losses after Hurricane Ike. Eighty-six commercial bay fishermen within the Galveston Bay system (75 percent) reported resuming fishing and 80 reported gear entanglements with storm debris. The estimated cost to repair or replace trawl gear because of bottom obstructions amounted to $674,150.

Estimated Costs Required to Restore Commercial Fishing Enterprises Across the Galveston Bay System. The damage assessment survey of commercial fishermen across the Galveston Bay system reflects roughly $4.6 million in casualty losses to respondents (Table 5, Figure 2). However, the extent of this casualty loss across respondents varied by asset class. Of course, 113 of 114 commercial fishermen who responded to the commercial fishermen's survey owned licensed, commercial vessels. Yet, ownership of docks, piers, and fuel storage systems was not widespread among commercial fishermen. Specifically, just 15 of 114 respondents had docks and piers, and 14 of 114 maintained fuel storage and distribution systems (presumably the same ones who owned docks and piers). Eighty of 114 respondents had resumed fishing and sustained gear damage from debris across the bottom the bay.

Table 5. Estimated Costs to Repair/Replace Physical Damage to Commercial Fishing Enterprises

Asset Class	Dollars	Percent
Vessels	$2,416,757	52%
Docks & Piers	$1,366,500	29%
Fuel Systems	$179,000	4%
Gear Damage/Losses	$674,150	15%
Total Reported Damage	$4,636,407	100%

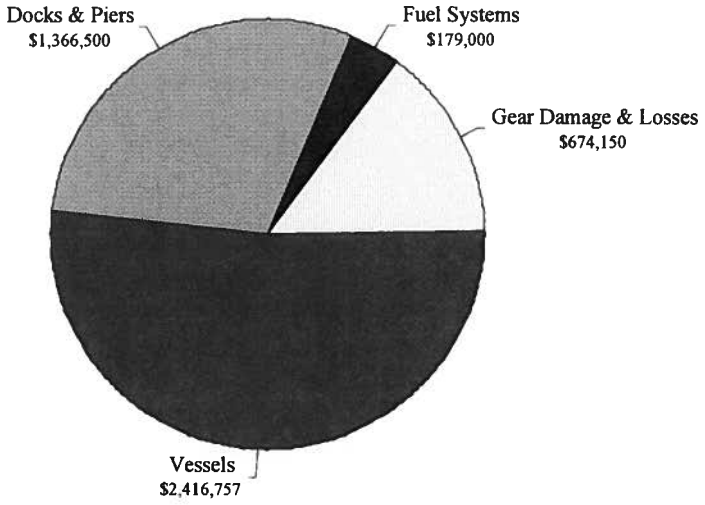

Figure 2. Estimated Costs to Repair/Replace Physical Damage to Commercial Fishing Enterprises

Storm-related Employment and Payroll Effects Sustained by Commercial Fishing Enterprises. Employment and payroll associated with commercial fishing enterprises suffered in the wake of Hurricane Ike. Between September and December 2007, these 114 commercial fishing enterprises collectively employed an average of 178 crewmembers in each of four months along with a cumulative payroll valued at $1,533,973. Across the same four months after Hurricane Ike, employment dropped to 77 workers (a 57 percent decline) with a cumulative payroll of just $442,249 (a 71 percent decline).

Damage Assessment of Seafood Processors and Dealers Across the Galveston Bay System

All 100 active seafood processors and dealers were closed after Hurricane Ike with most operations sustaining significant damage. Understandably, the response rate from this segment of impacted seafood-linked firms was low, with just sixteen firms responding.

Damage to Commercial Vessels. The 16 processors and dealers that responded to the survey owned and maintained 26 vessels. Seafood processors and dealers collectively reported 12 of the 26 vessels incurred substantial damage or were lost or destroyed (Table 6). The collective cost of repairing or replacing the 23 damaged vessels was reported to be $314,000.

Table 6. Classification of Damage to Commercial Vessels Owned by Seafood Processors and Dealers Across the Galveston Bay System

Damage Classification	Number of Vessels	Percent
No damage	3	12%
Minor damage - a few repairs needed	11	42%
Substantial damage - hull or engine repair needed	4	15%
Destroyed or lost - replacement required	8	31%
Total number of vessels reported	26	100%

Damage to Bulkheaded Docks and Piers. Seafood processors and dealers are generally the first-receivers of harvested seafoods, so safe, efficient offloading facilities are essential in most cases. Survey respondents owned 23,424 linear feet (4.4 miles!) of bulkheaded dock area. Thirteen of the sixteen respondents who owned bulkheaded docks sustained damage to 6,048 linear feet of these assets which amounts to about 26 percent of the total linear footage owned. Damage to 5,110 ft. (84 percent of all damaged docks) was classified as either requiring major repairs or replacement (Table 7). The estimated cost to repair or replace 6,048 feet of bulkhead was reported to be $1,349,880, or about $223.00 per foot.

Table 7. Classification of Damage to Bulkheaded Docks Owned by Seafood Processors and Dealers Across the Galveston Bay System

Damage Classification	Linear Ft.	Percent
Still useable - minor repairs needed	20	≈ 0%
Damaged areas unuseable - major repairs needed	1,900	31%
Severe damage/destruction - replacement req.	3,210	53%
No Answer	918	15%
Total	6,048	100%

Galveston Bay system seafood processors and dealers who responded to the survey collectively reported owning 6,905 ft. of piers. Some 4,658 ft. were damaged, with 97 percent classified as either requiring major repairs or replacement (Table 8). The estimated cost to repair or replace damaged or destroyed piers was $302,500, or roughly $65.00 per ft.

Table 8. Classification of Damage to Piers Owned by Seafood Dealers Across the Galveston Bay System

Damage Classification	Linear Ft.	Percent
Still useable - minor repairs needed	150	3%
Damaged areas unuseable - major repairs needed	2,508	54%
Severe damage/destruction - replacement req.	2,000	43%
Total	4,658	100%

Damage to Roads and Parking Areas, and Fuel Delivery Systems. Half of the respondents owned roads and parking areas. These respondents collectively owned 63,000 sq. ft. of roads and parking areas. Of that, 47,400 sq. ft. were damaged with an estimated repair/replacement cost of $31,700. By August, virtually all (99 percent) of the roads and parking areas were operational. Eight of the sixteen respondents owned fuel storage and distribution systems, and estimated expenditures required to repair or replace these systems amounted to $90,700. By June, 64 percent of damaged fuel systems were back on line.

Damage to Processing Infrastructure and Inventories. Virtually all respondents (15 of 16) owned processing buildings when Hurricane Ike made landfall that collectively amounted to 39,820 sq. ft. Fortunately, most of the damage to buildings (63 percent) was in the minor category (Table 9). As expected, the estimated expense to make major repairs or replace the structure accounted for almost 73 percent ($1.6 million) of the total estimated expense which was $2.2 million.

Table 9. Classification of Damage to Seafood Processing Facilities Across the Galveston Bay System

Damage classification	Sq. ft.	Pct. Sq. Ft.	Dollars	Pct. Dollars
Minor - some refurbishment needed	25,000	62.8%	$603,850	27.4%
Significant -major repairs required	8,420	21.1%	$761,192	34.5%
Destroyed - reconstruction required	6,400	16.1%	$840,000	38.1%
Total	39,820	100.0%	$2,205,042	100.0%

The asset class "processing equipment" represented a major casualty loss for seafood processors across the Galveston Bay system. Respondents estimated that 72 percent of their equipment was completely destroyed at an estimated cost of $1.6 million (Table 10).

Table 10. Classification of Damage to Seafood Processing Equipment Across the Galveston Bay System

Damage classification	Dollars	Pct.
Minor - some refurbishment needed	$7,800	0.3%
Significant -major repairs required	$625,000	27.4%
Destroyed - replacement required	$1,645,000	72.2%
Total	$2,277,800	100.0%

Seafood processors and dealers across the Galveston Bay system also sustained $1.6 million in inventory losses. Compromised quality or safety occurs because of sustained power losses which lead to decomposition or contamination from flood waters.

Estimated Costs Required to Restore Enterprises Owned by Seafood Processors and Dealers. The 16 respondents collectively reported physical damage of $8.18 million (Table 11, Figure 3). The largest contributors to total dollar damages were processing infrastructure (the combined values for buildings and equipment) at 55 percent ($4.5 million), docks and piers at 20 percent ($1.65 million), and inventories also at roughly 20 percent ($1.6 million).

Table 11. Estimated Costs to Repair or Replace Physical Damage to Assets Owned by Seafood Processors or Dealers Across the Galveston Bay System

Asset Class	Dollars	Percent
Vessels	$314,000	3.8%
Docks & Piers	$1,652,380	20.2%
Roads & Parking	$31,700	0.4%
Fuel Storage & Distribution	$90,700	1.1%
Processing Infrastructure	$4,482,842	54.8%
Inventories	$1,606,282	19.6%
Total	$8,177,904	100.0%

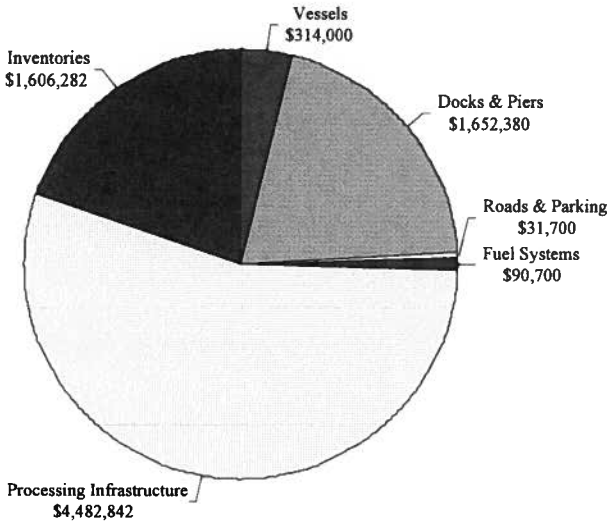

Figure 3. Estimated Costs to Repair or Replace Physical Damage to Assets Owned by Seafood Processors or Dealers Across the Galveston Bay System

Storm-related Employment and Payroll Effects Sustained by Seafood Processing Enterprises. With most seafood processing facilities closed immediately after Hurricane Ike, employment and payroll suffered. From September through December 2007, these 16 seafood processing enterprises collectively employed an average of 141 workers in each of four months along with a cumulative payroll valued at $584,797. Across the same four months after Hurricane Ike, employment dropped to 66 workers (a 54 percent decline) with a cumulative payroll of $391,164 (a 33 percent decline).

Fishing Guides Across the Galveston Bay System

Galveston Bay had 126 licensed fishing guides in the affected counties. Twenty-one surveys were returned representing about 17 percent of the industry. Responses were from small guide services licensed to carry six passengers or less. The surveys indicated that 690 trips were lost due to the storm; a loss on $386,980 in gross revenue. Lost income for 2009 was estimated at $362,863.

Impacts Upon the Sabine-Neches Commercial Fishing Industry and Fishing Guides[6]

Sabine-Neches Commercial Fishermen

Surveys were distributed to fishermen with bay and bait shrimp boat licenses that worked on Sabine Lake. One hundred and two surveys were distributed and 18 were returned (a 17.6 percent response rate). The 18 respondents owned 21 vessels. Only one of the 21 vessels was undamaged by Hurricane Ike. Fishermen who responded estimated $503,500 would be required for repairs. Sixty-two percent of the damaged vessels in the Sabine-Neches area were operational by April, with another 21 percent expected to be fishing by August.

None of the commercial fishing enterprises surveyed owned a dock, and only one respondent reported owning a pier. No operator reported owning a fuel storage and distribution system. Six of the eighteen respondents had resumed fishing when the survey was distributed, and these fishermen reported $318,500 in lost or damaged trawl gear. Cumulatively, Sabine-Neches fishermen reported damages totaling $822,000.

Survey responses regarding employment and payroll among the 18 commercial fishermen who responded also showed losses after Hurricane Ike. From September through December 2007, these fishermen employed an average of 40 crew members each month with a payroll value of $560,700. After Hurricane Ike, data for September to December 2008 showed an average of 33 workers employed per month with a payroll of $275,564. Employment of crews decreased by roughly 18 percent, and payroll declined by almost 51 percent.

Fishing Guides in the Sabine-Neches Area

Ten licensed guides operate out of the Sabine-Neches Area, and four responded to the survey. Like Galveston Bay area guides, responses were from small guide services licensed to carry six passengers or less. Respondents reported 56 lost charters immediately after Hurricane Ike which created gross revenue losses of $36,400. Projected lost income for 2009 was estimated at $11,050.

Summary and Conclusions

The Magnitude of Physical Damage Across the Galveston Bay System and the Sabine-Neches Area

All surveys of seafood-linked enterprises sought similar information about physical damage, the estimated cost to repair or replace assets damaged or destroyed by the storm, and the expected time required to return damaged or destroyed assets to full operational status. Across both the Galveston bay system and the Sabine-Neches region, estimated dollar damage to seafood-linked respondents amounted to $51.7 million (Table 12). Entities classified as leaseholders and/or oyster processors/distributors across the Galveston Bay system accounted for 74 percent of total dollar damage to the seafood-linked industries across both geographic regions. Most damage to the oyster industry was attributable to lost living inventory on private leases or damage to the privately-created reefs themselves. Seafood processors and dealers across the Galveston Bay system who responded indicated collective damage of $8.2 million, or 16 percent of total seafood-linked enterprise damage.

6. Seafood dealers and processors in the Sabine-Neches area were also queried about the damage they sustained from the storm. Some twenty-two such operations were sent a damage-assessment survey, but only two recipients responded. To prevent disclosure of private information, these data are not reported.

Table 12. Collective Dollar Damage to Seafood-linked Operations
by Asset Class, Geographic Region, and Business Type

	Galveston Bay System			Sabine-Neches	Total	
	Vertically Integrated Oyster Firms	Commercial Fishermen	Processors & Dealers	Commercial Fishermen	Dollars	Percent
Oyster Leases	$31,646,765	$0	$0	$0	$31,646,765	61.2%
Vessels	$1,630,000	$2,416,757	$314,000	$503,500	$4,864,257	9.4%
Docks, Piers, Roads & Parking	$1,845,000	$1,366,500	$1,684,080	$0	$4,895,580	9.5%
Fuel Systems	$169,550	$179,000	$90,700	$0	$439,250	0.9%
Plant & Equipment	$2,394,800	$0	$4,482,842	$0	$6,877,642	13.3%
Inventories	$351,750	$0	$1,606,282	$0	$1,958,032	3.8%
Lost or Damaged Fishing Gear	$0	$674,150	$0	$318,500	$992,650	1.9%
Total Cost to Repair or Replace	$38,037,865	$4,636,407	$8,177,904	$822,000	$51,674,176	100.0%

Employment and Payroll Impacts

Oyster-dependent Firms. In the twelve months preceding Hurricane Ike, industry members hired 159 individuals who earned an average of $27,759 over the 12-month interval. Collectively, $4.4 million was paid out in wages and salaries. However, estimating employment and payroll for the twelve months after the storm was difficult for most operators, and the number of complete responses was too low to make any meaningful industry-wide estimates.

Galveston Bay System Commercial Fishing Enterprises. Between September and December 2007, commercial fishing enterprises collectively employed an average of 178 crewmembers in each of four months along with a cumulative payroll valued at $1,533,973. Across the same four months after Hurricane Ike, employment among respondents declined to 77 workers (a 57 percent decline) with a cumulative payroll of just $442,249 (a 71 percent decline).

Galveston Bay System Seafood Processing Firms. With most seafood processing facilities closed immediately after the storm, employment and payroll suffered. Between September and December 2007, seafood processing firms collectively employed an average of 141 workers in each of four months, and met a cumulative payroll of $584,797. Across the same four months after the storm, employment dropped to 66 workers (a 54 percent decline) with a cumulative payroll of $391,164 (a 33 percent decline).

Revenue Impacts

Oyster-dependent Firms. In the 12 months before Hurricane Ike (September 2007 through August 2008), respondents to the oyster industry survey reported revenues of $30.1 million. Sixty-two percent of these annual revenues were realized from the sale of Galveston Bay system oyster products, with another 4 percent from other Galveston Bay system seafoods. Actual and projected revenues for the 12 months after Hurricane Ike were $6.9 million; a 77 percent reduction from the amount generated in the previous 12-month interval.

Recreational Fishing Guides. Galveston Bay system fishing guides who responded to the survey did not report any physical damage, but they did sustain revenue losses of $749,843 which were about evenly split between 2008 and 2009. Sabine-Neches charter boat operators who responded to the damage assessment survey estimated $47,450 in lost revenue, with most of that total ($36,400) lost immediately after the storm due to cancellations.

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