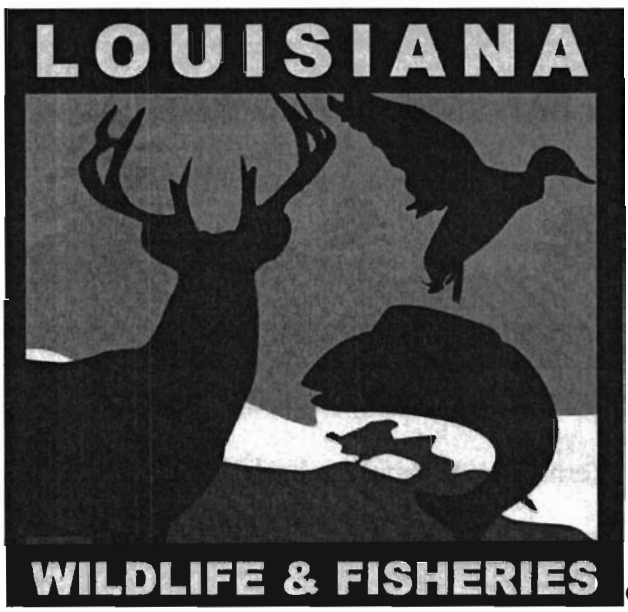
OYSTER STOCK ASSESSMENT REPORT

OF THE

PUBLIC OYSTER AREAS IN LOUISIANA

SEED GROUNDS and SEED RESERVATIONS



Oyster Data Report Series
No. 15
July, 2009

Louisiana Department of Wildlife and Fisheries

Office of Fisheries

Marine Fisheries Division

TABLE OF CONTENTS

(Updated: 7/28/09)

Statewide Overview - 2009 Oyster Stock Assessment

Patrick D. Banks, Biologist Program Manager
LDWF Marine Fisheries Division
Baton Rouge, LA 70806

Introduction

The oyster resource in Louisiana is one of the largest and most valuable in the nation. Its value is derived from both the economic benefits it provides to the state and the ecological benefits it provides to the estuarine environment. Due to Louisiana's vast coastal wetland area, ample habitat exists where oysters thrive under a variety of environmental conditions. The Department of Wildlife and Fisheries (LDWF) is charged with managing the oyster resource on the public grounds by closely monitoring the size and health of oysters on nearly 1.7 million acres of public water bottoms. Oyster management on these public grounds includes activities such as setting oyster seasons, monitoring harvest levels, and cultch planting (reef building) projects (Figure 1).

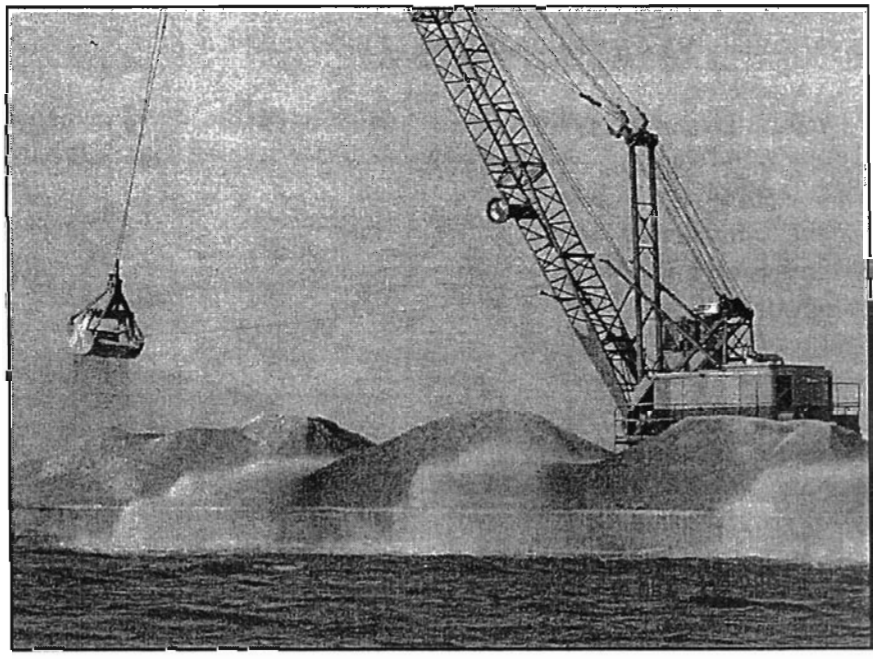


Figure 1. Cultch planting (reef building) activities being performed in Black Bay (Plaquemines Parish) in May 2007.

Typically, the oyster industry utilizes the public oyster grounds as a source of seed oysters (< 3") for transplant to private leases. The public grounds, however, also yield a supply of sack-sized oysters (≥ 3") and these oysters may be taken directly to market. The manner in which both the public grounds and private leases are utilized in combination helps to keep Louisiana's industry as a national leader in oyster production with annual value well in excess of $30 million worth of dockside sales.

Oysters also play an important ecological role in the estuarine ecosystem. Oyster reefs provide the majority of hard substrate required by other sessile invertebrate species such as barnacles, bryozoans, tunicates, and anemones. Reefs are also utilized as shelter and forage habitat for many species of crabs, worms, fish, and meiofauna. Estuarine water quality can be affected by the filter-feeding activities of oysters, and reefs may also play a role in stabilizing shorelines.

Louisiana Oyster Landings

Louisiana regularly leads the nation in the production of oysters and accounted for an average of 34% of the nation's oyster landings from 1997-2007 (Figure 2). Recently, and for the first time in over two decades, Louisiana was not the top producer of oysters when in 2006 the state of Washington produced approximately 12.2 million pounds of Pacific oysters (*Crassostrea gigas*) and Louisiana produced approximately 11.4 million pounds of American (=Eastern) oysters (*Crassostrea virginica*). Louisiana rebounded in 2007, regaining its status as the nation's top producer with approximately 12.9 million pounds landed[1]. Among Gulf of Mexico states, Louisiana consistently ranks #1 in landings accounting for over 50% of all oysters landed.

Oysters have been a part of the Louisiana economy for many years; starting from meager beginnings and growing into a multi-million dollar industry. In 2008, the dockside value of oysters was the second-highest on record, totaling just under $40 million and harvest yielded approximately 12.8 million pounds of meat (LDWF Trip Ticket Data).

The public oyster grounds can be considered the backbone of the Louisiana oyster resource. Those grounds are a valuable contributor to overall Louisiana oyster landings each year, while also supplying seed oysters transplanted to private leases for grow-out purposes. The trend from 1970 – 1992 showed the majority of Louisiana oyster landings came from private reefs. From 1992 to 2001, however, the public ground stock size increased, in general, and landings from the public grounds increased as well. Although the general trend since 1992 shows an increased reliance of the oyster industry on the public grounds for sack-sized oysters, recent decreases in public ground oyster availability has lead to decreased harvest from the public grounds since 2002. In 2008, harvest levels significantly increased on the public grounds over 2007 levels and the public grounds produced approximately 47% of all oyster landings for the calendar year (Figure 4). When comparing the price per pound on public grounds and private leases, those values are nearly identical in 2008 as public ground oysters sold for $3.01 compared to $3.04 per pound of oysters from private leases. This was just the second year since 2001 that private lease oysters yielded a higher price per pound than public ground oysters.

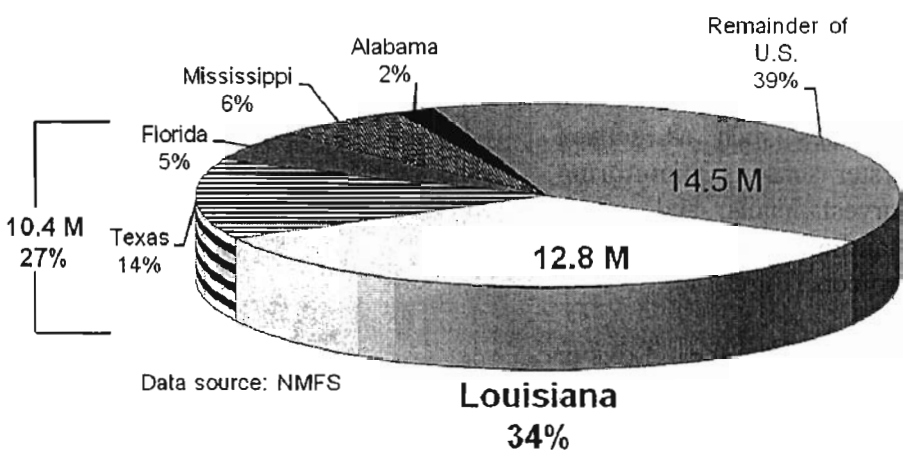


Figure 2. Average 1997 - 2007 oyster landings (all species combined, pounds of meat).

[1] Finalized 2008 landings by state were not available from the National Marine Fisheries Service (NMFS) at the time of this publication.

Statewide Oyster Stock Assessment Overview

Each summer, LDWF biologists from each Coastal Study Area (CSA) of the Marine Fisheries Division perform quantitative evaluation of the oyster resource on the public oyster areas. This biological evaluation includes using SCUBA to collect replicate oyster samples from within a square meter frame from multiple locations in each public oyster ground. Sampling that is undertaken as part of the annual stock assessment also plays a valuable role in predicting the success of the upcoming oyster season, which generally opens in early September and runs through April of the following year (although the season may be closed or delayed if biological concerns or enforcement problems are encountered). Square-meter sampling is conducted each summer and used in conjunction with estimated reef acreage to estimate the stock size of the resource and to make recommendations to the Wildlife and Fisheries Commission for the setting of the oyster season. Although known reefs are estimated at approximately 38,000 acres, it is likely that additional reef acreage exists on the public oyster grounds. Recent projects employing side-scan sonar technology to map water bottoms was completed in Drum Bay, Morgan Harbor (CSA I), as well as southern portions of Calcasieu and Sabine Lakes (CSA 7). Reef acreage in Drum Bay, Morgan Harbor, and Sabine Lake was unknown until completion of these projects. Drum Bay and Morgan Harbor reef information has now been incorporated into the LDWF oyster management program and is included in the CSA 1 stock assessment report on the following pages. Additional assessments need to be performed in Calcasieu and Sabine Lakes before that information is fully incorporated into the oyster management program.

Most natural populations of species exhibit cyclical trends in abundance over time. Abundance of the oyster resource on the public areas in Louisiana also follows this general trend as periods of lower abundance were observed in the 1980's followed by a period of increasing abundance during the 1990's through 2001. Since 2001, however, the general trend of oyster abundance has been decreasing with small amounts of inter-annual variability in abundance since 2002. Oyster stock size (abundance) over the past eight years has generally decreased from record levels in 2001, and 2008 levels have now approached those observed between 1982 and 1990 resulting in the smallest statewide oyster stock size since 1989 (Figure 5).

Statewide oyster stock size in 2009 has shown a marked decrease of 46.3% compared to 2008 as approximately 1,169,764 barrels of oysters are available on the public oyster areas of Louisiana this year (Figure 5 and Table 1). This decrease represents an approximate drop in total oyster availability of over 1 million barrels of oysters over 2008 levels and the lowest statewide oyster stock assessment since 1989. Seed stocks (oysters 1" to <3") dropped approximately 30% from 798,285 barrels in 2008 to 558,916 barrels in 2009 (Figure 3 and Table 1). The

Table 1. Estimated statewide oyster stock size on the public oyster areas of Louisiana.

CSA	Seed (bbls)	Sack (bbls)	Total (bbls)
1	87,867	178,097	265,964
2	241,762	78,450	320,212
3	11,402	141	11,543
4	2,236	270	2,506
5	89,602	43,387	132,989
6	N/A	N/A	N/A
7	126,047	310,503	436,550
Totals	***558,916***	***610,848***	***1,169,764***

largest portion of the 2009 seed oyster stock is located in the primary productive seed grounds east of the Mississippi River in Coastal Study Area 2 (Table 1).

Market-size oysters (≥3") also suffered extensive decreases in availability, dropping over 51% in 2009 as compared to 2008 levels. Although nearly 1.4 million barrels of market-size oysters were available last year, levels have plunged to only 610,88 barrels in 2009 (Figure 3 and Table 1). The primary public oyster seed grounds east of the Mississippi River shows a very slim resource entering the 2009/2010 oyster season with an estimated market-size oyster availability of only 256,547 barrels. This represents a reduction in market-size oyster stocks of 76% in CSA I and 37% in CSA II. Calcasieu Lake again holds a significant portion of the statewide market-size oyster stock with approximately 310,503 barrels of oysters available (Table 1).

Factors Affecting the 2009 Oyster Stock Assessment

A variety of factors, both natural and anthropogenic, affect the oyster stock size on the public grounds in any given year. Natural threats to oyster survival include extreme low salinities caused by high river discharge and localized rainfall, as well as predation and disease typically associated with periods of high salinity and high temperature. Harvest and construction activities (i.e. oil and gas production) can serve to reduce oyster abundance as well. Harvest can lead to reductions in stock size due to the physical removal of both broodstock oysters (adult oysters that significantly contribute to reproduction) and shell habitat critical for oyster settlement. Construction activities and environmental perturbations (i.e. hurricanes) can impact oyster reproduction and survival by increasing sedimentation on reef habitat.

Table 2. Harvest estimates for the 2008/2009 oyster season on the public oyster grounds of Louisiana.

CSA	Seed Oysters (barrels)	Market Oysters (sacks)	Total (barrels)
1*	87,180	170,187	172,274
2	77,003	265,581	209,794
3	1,985	3,270	3,620
4	205	17	214
5	600	7,004	4,102
6	0	0	0
7	0	69,484[a]	34,742
Total	***166,973***	***515,543***	***424,746***

* Harvest totals include harvest from Morgan Harbor and Drum Bay, two areas in which oyster stock size information was unavailable prior to the 2008/2009 oyster season. [a] = preliminary - finalized data not yet available.

Hurricane Gustav and Ike impacted the Louisiana coast in September 2008, with Gustav making a direct hit near Cocodrie, Louisiana in Terrebonne Parish. As with strong tropical events in past years, oyster reefs were impacted through direct burial by sediment and vegetative overburden. Primary public seed grounds east of the Mississippi River showed combined seed and sack mortalities as high as 27% on some reefs in St. Bernard Parish. As expected based on the location of Gustav's landfall, the central coast reefs suffered larger impacts as combined seed and sack oyster mortalities reached as high as 75% on selected reefs, although Sister Lake oyster mortalities remained below 27% in samples taken on a weekly basis following the storms.

Harvest pressure during the 2008/2009 oyster season, although far below 2007/2008 levels, served to reduce available oyster resources on the public grounds, especially in CSA 2 (Table 2). Based on market-size oyster estimated harvest during the 2008/2009 oyster season in CSA 2, over 100% of the available resource was taken by the time the season was closed on March 14, 2009. Increased harvest pressure on reefs due to the Private Oyster Lease Rehabilitation (POLR) program also likely played a role in reducing the oyster stock size on the public grounds again this year. The POLR program, funded by federal hurricane disaster monies, provides reimbursement assistance to leaseholders who performed qualifying rehabilitation work on their private leases. One such qualifying activity was the bedding of seed oysters and this reimbursement opportunity may have provided extra incentive during the past year to harvest more seed oysters than normal.

Recent Legislation

The 2009 regular legislative session included three bills filed with direct ties to oysters (Table 3). The most notable of the three were HB587 which expanded the qualifying criteria the Oyster Seed Ground Vessel Permit. This new permit was required as of January 1, 2009 for any vessel fishing the public oyster seed grounds.

Table 3. Summary of oyster-related legislation of the 2009 Louisiana regular legislative session.

Bill	Author(s)	Description	Passed?	Act
HB191	Dove	Provides requirements for selection of a biologist by the Oyster Lease Damage Evaluation Board	Yes	363
HB390	Henderson	Allows certain exemptions from certain National Shellfish Sanitation Program management plans	Yes	417
HB587	Harrison	Oyster Seed Ground Permit states that a vessel owner shall only be eligible for a permit for each vessel which can be used for qualification	Yes	376

Conclusion and Acknowledgements

The following report includes both biological stock assessment and historical oyster landings data from each CSA in Louisiana (CSA map depicted on page ix), as well as a brief report on the most recent oyster season in each area. Biological data was generated from quantitative square-meter sampling (see above) and landings data was generated from field boarding runs and trip ticket information. Countless hours were spent by the biologists of each CSA and Oyster Program, especially Tommy Rowley, Carl Britt, Nicole Cantore, Christy Lavergne, Gary Vitrano, Bill Hano, Jason Adriance, Denise Kinsey, Mike McDonough, Lisa Abernathy, Mike Harbison, and Amanda Shahan who voluntarily performed square-meter sampling via SCUBA. In addition, Oyster Program staff Vince Cefalu, Prince Robinson, Lisa Abernathy, Ty Lindsey, and Kristin Morgan greatly assisted with editorial review of this report. These efforts are greatly appreciated. Questions and/or comments can be directed to the individual CSA Biologist Managers (page x) or Patrick Banks at 225.765.2370 or pbanks@wlf.louisiana.gov.

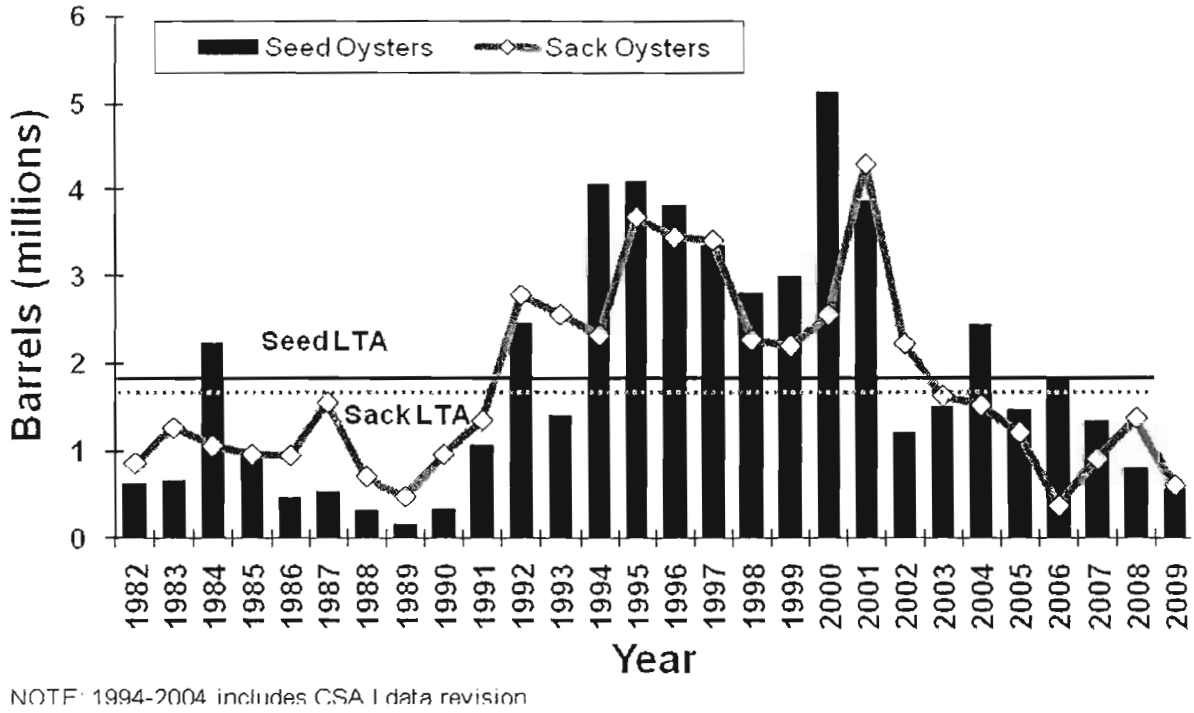


Figure 3. Historical Louisiana oyster stock size on the public oyster areas (estimated based on square meter sample analysis). LTA denotes the long-term average of 1982 – 2008.

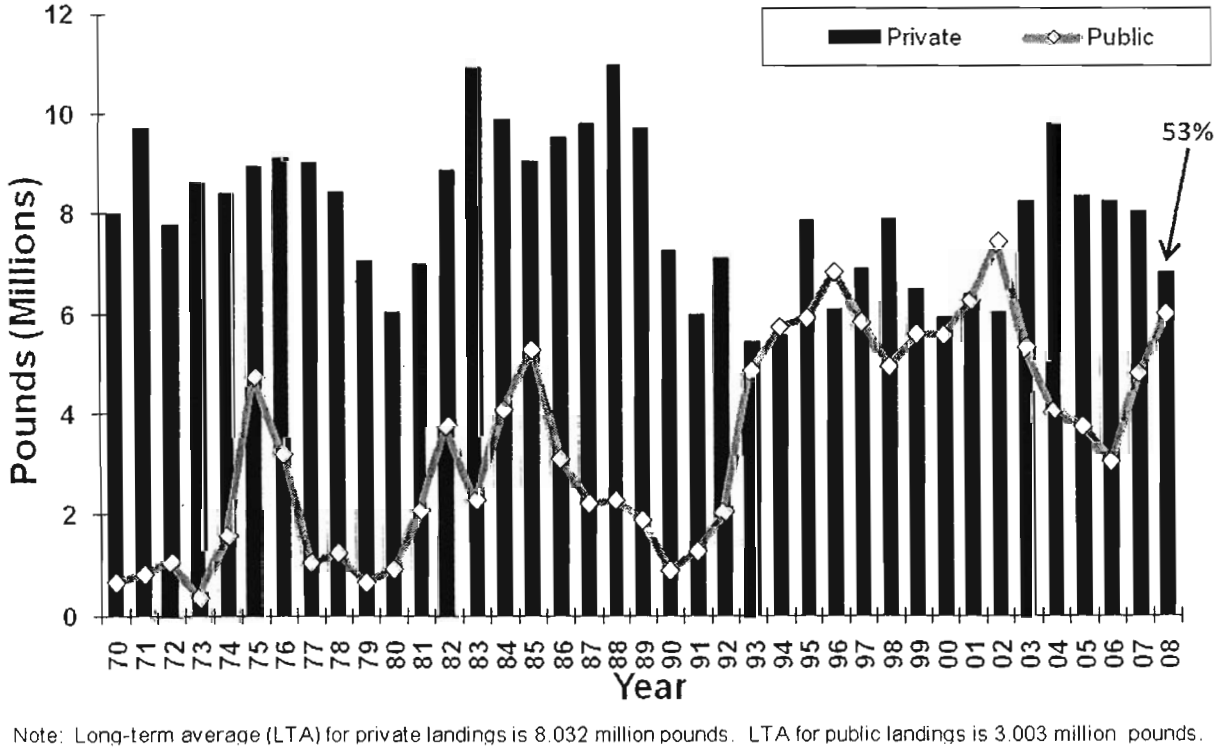


Figure 4. Historical Louisiana oyster landings from the public oyster areas and the private oyster leases (LDWF and NMFS data). 2008 harvest from private leases equaled 53% of total.

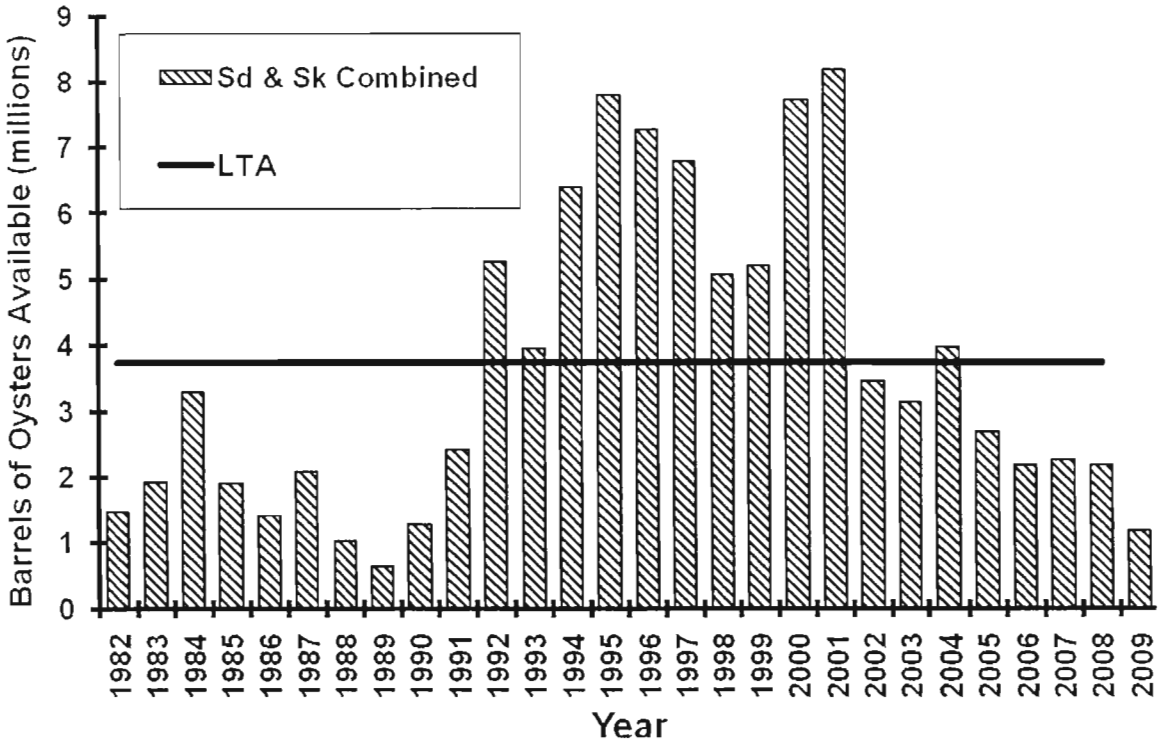
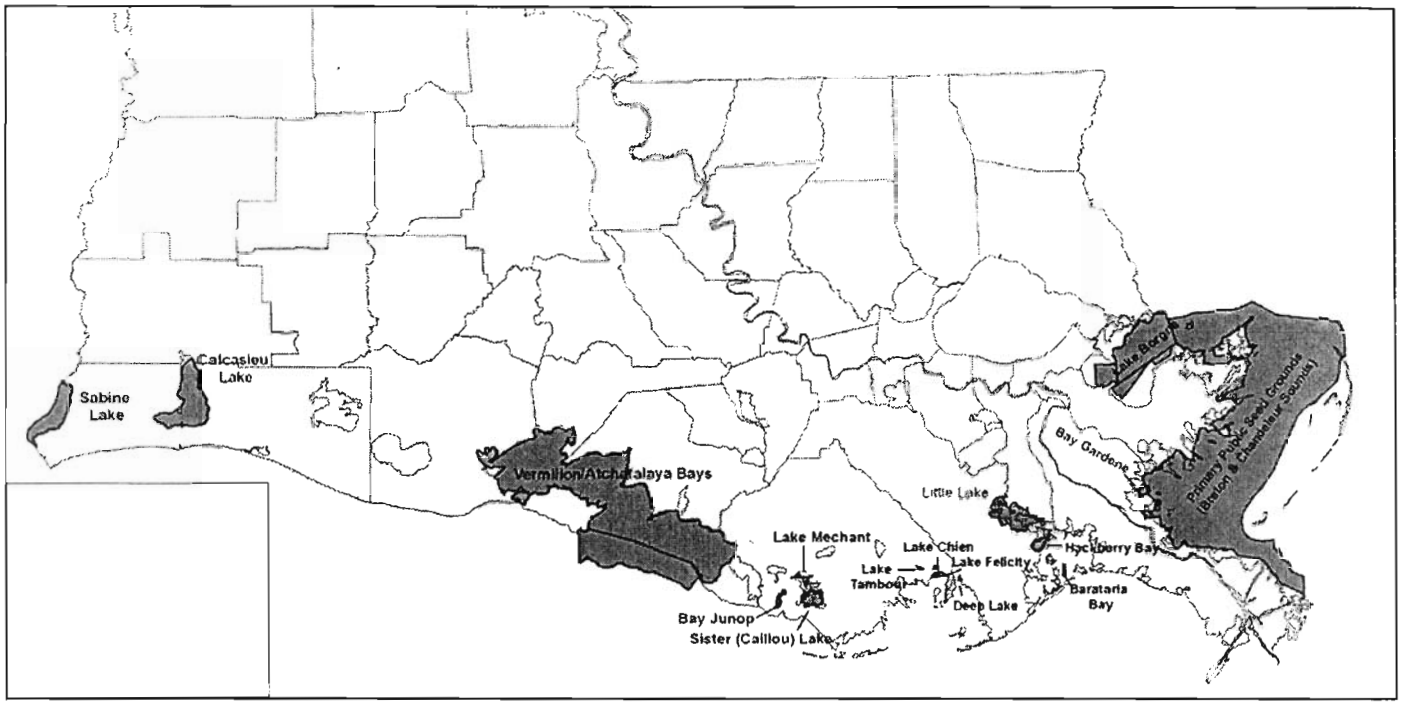


Figure 5. Historical estimated oyster stock size (Sd = seed oysters; Sk = sack oysters) on the public oyster areas of Louisiana. 1994 – 2004 data includes CSA I data revision. LTA denotes long-term average.

Public Oyster Areas



Public Seed Grounds

Lake Borgne
Chandeleur/Breton Sound
(Primary Seed Grounds)
Barataria Bay
Little Lake
Deep Lake
Lake Chien
Lake Felicity
Lake Tambour
Lake Mechant
Vermilion/Cote Blanche/Atchafalaya Bays

Public Seed Reservations

Bay Gardene
Hackberry Bay
Sister (Caillou) Lake
Bay Junop

Public Oyster Areas

Calcasieu Lake
Sabine Lake

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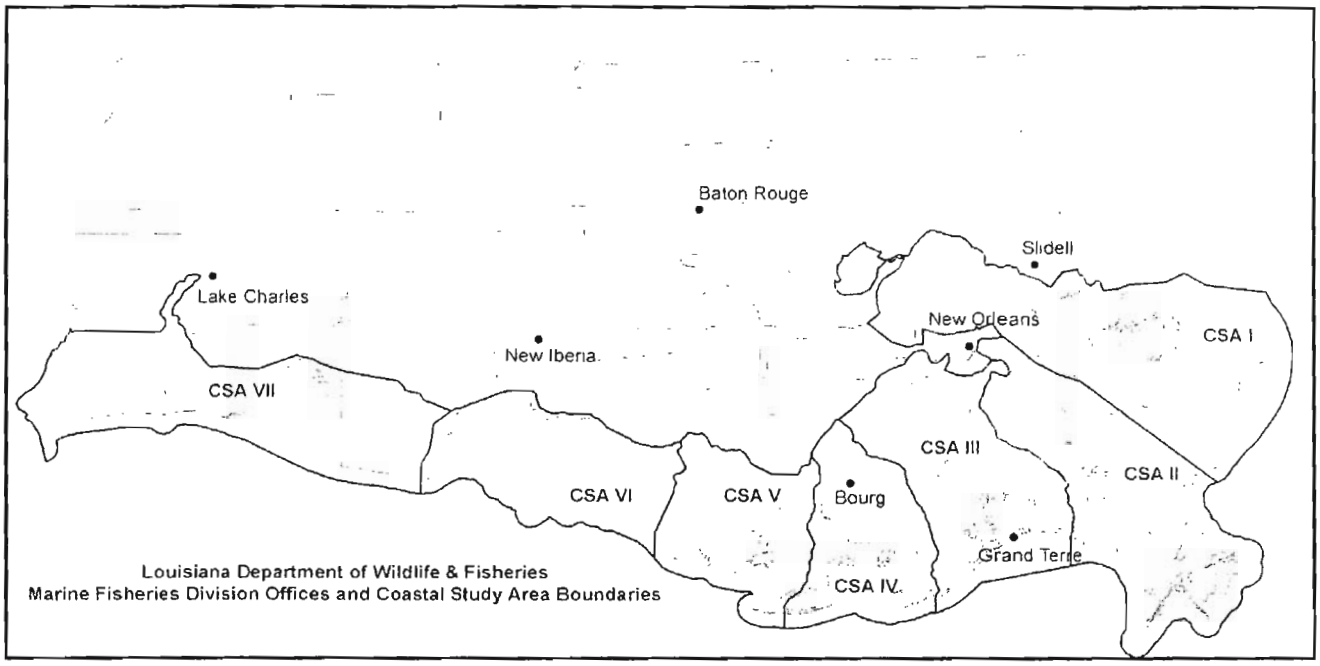
* Seed grounds are designated by the Wildlife and Fisheries Commission.
Seed reservations, Calcasieu Lake, and Sabine Lake are designated by the state legislature.

LDWF Marine Fisheries' Coastal Study Areas (CSAs)



CSA	*Biologist Manager*	*Address*	*Phone Number*	*FAX Number*
1	Brian Lezina	P.O. Box 1190 Lacombe, LA 70445	(985) 882-0027	(985) 882-0029
2	Keith Ibos	2021 Lakeshore Drive New Orleans, LA 70122	(504) 284-2030	(504) 284-5263
3	Jason Adriance	2021 Lakeshore Drive New Orleans, LA 70122	(504) 284-2030	(504) 284-5263
4	Vince Guillory	P.O. Box 189 Bourg, LA 70343	(985) 594-4139	(985) 594-7317
5	Steve Hein	P.O. Box 189 Bourg, LA 70343	(985) 594-4139	(985) 594-7317
6	Paul Cook	2415 Darnall Road New Iberia, LA 70560	(337) 373-0032	(337) 373-0032
7	Michael Harbison	1213 N. Lakeshore Drive Lake Charles, LA 70601	(337) 491-2573	(337) 491-2009

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Coastal Study Area (CSA) 1 – Oyster Stock Assessment

Brian Lezina, Biologist Manager
LDWF Marine Fisheries Division
Lacombe Field Office, Lacombe, LA 70445

Introduction

The public oyster areas within Coastal Study Area 1 (CSA1) consist of approximately 690,000 water bottom acres and are located in the Louisiana portion of Mississippi Sound, Lake Borgne, Chandeleur Sound and adjacent waters. These areas have historically been used by both Louisiana and Mississippi fisherman, and have recently been areas of high oyster production within the state of Louisiana. Although managed as public oyster seed grounds by the state for many decades, the majority of this area was officially designated by Louisiana Wildlife and Fisheries Commission rule in 1988. Much of Lake Borgne was later added as a public oyster seed ground in 1995 and was expanded in 2004. The Department also continually expands and enhances the public oyster reefs with the placement of cultch. The latest cultch plant has added over 40 acres of densely cultched reef to the Three-mile Bay area in the Biloxi Marsh system.

Currently, these areas are managed to balance the economic viability of the fishery with the biological sustainability of the resource. This management is contingent upon obtaining and utilizing the best fishery dependent and independent data available. This includes monitoring the harvest and resource availability throughout the fishing season and performing yearly stock assessments. The information these data provide allow resource managers to implement management changes to both protect the current resource as well as protect long term viability. This report will fulfill one of those data needs by providing estimates of the current stock size of the oyster resource within CSA1.

Methods

Samples were taken between July 8 and July 13, 2009 using a one square-meter frame placed directly on the bottom. Divers removed all enclosed live and dead oysters, as well as shell, by hand. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 13 stations were visited with two square-meter replicates taken at each station except for the 2007 cultch plant. At the cultch plant five $0.25m^2$ replicates were made. The average of the replicates was then pooled within reef systems. This average density per reef system was multiplied by the total area of the reef systems. The resulting number was adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized oysters. Seed oysters are those measuring between 25 and 74 mm with market oysters being greater than 74 mm. Spat oysters are those less than 24mm. The Lake Borgne Public Seed Ground was not sampled due to a lack of reef acreage information.

Results and Discussion

Seed and Sack Stock

The current stock size is estimated at 87,868 barrels (bbls) of seed-size oysters and 178,098 bbls of market-sized oysters. These numbers include all of the currently assessed reefs with the exception of the 2009 Three-mile cultch plant (Figure 1.1). Comparing with last year's assessment, there was a 71% decrease in the seed-size estimate and a 76% decrease in the sack-size estimate. Oyster density and abundance was not evenly distributed among areas (Table 1.1) with the highest density estimates

of seed and sack oysters at the 2007 cultch plant. It is important to note variability both within and among stations when comparing estimates. This variability is magnified when extrapolating low sample sizes to large areas.

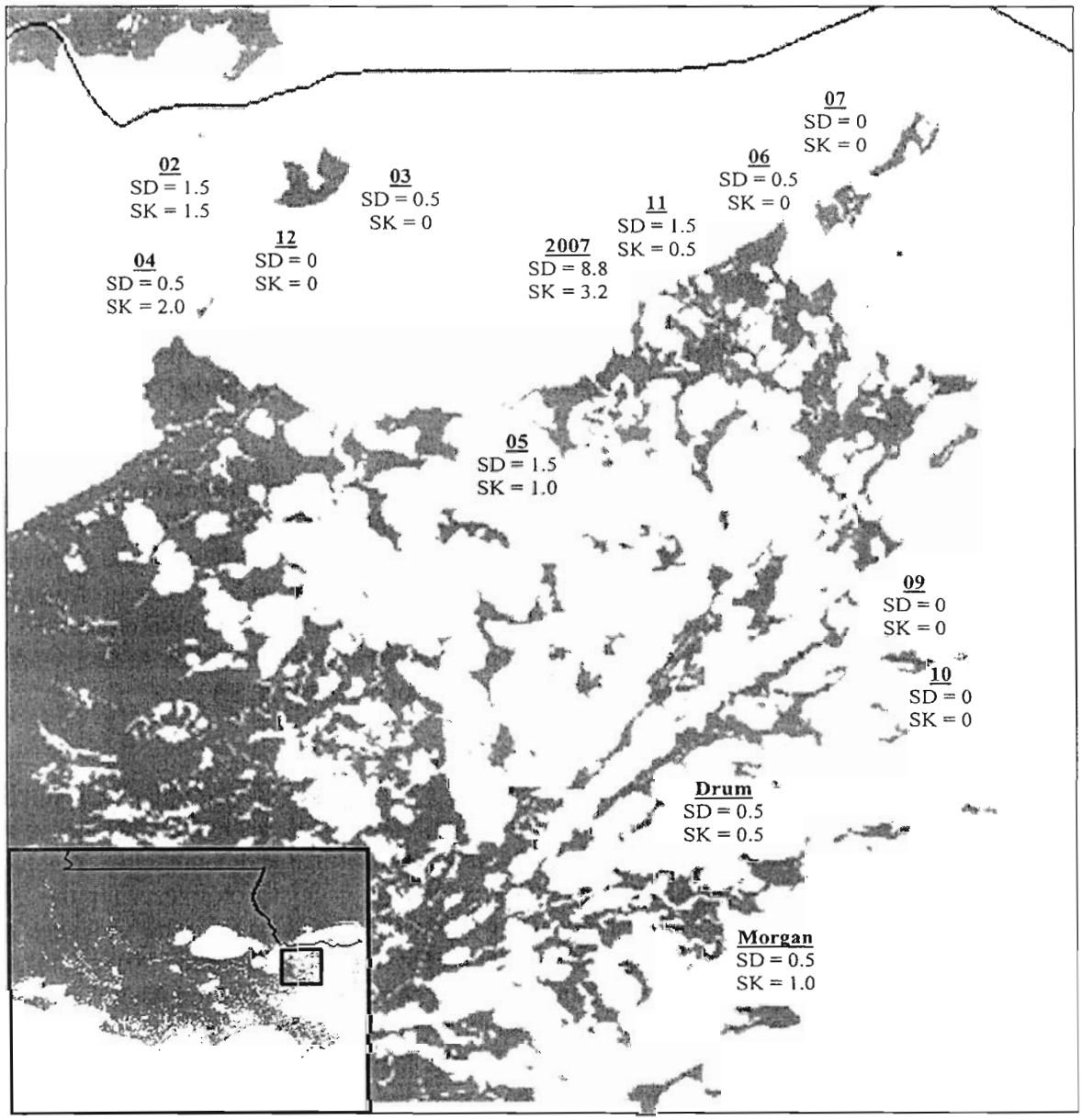

Figure 1.1.. Map showing Coastal Study Area 1 oyster stock assessment stations within the Mississippi and Chandeleur Sounds. Numbers below stations are average numbers of seed (SD) and sack (SK) oysters per m^2.

The current estimate falls well below the previous ten years' average for both seed and sack oysters for both "historically" sampled areas and with the additional acreages added in 2008 (Figure 1.2). However, that long-term average is largely driven by availability in 2000 and 2001. There was a large amount of sack and seed harvest during the 2008/2009 season as well as tropical activity (See *further*

descriptions below). This combined with continued low recruitment and high recent mortalities appear to have severely limited seed abundance, being on a general decline since 2004.

Spat Production
Live spat were not present in all samples containing a suitable substrate. Numbers ranged from 0 to 45 individuals per square meter. The highest spat occurrences were in the Cabbage and Grand Pass Reefs. Based on previous years' data, the square meter samples may have occurred between seasonal spawning events in some areas. While dredge and square meter data are used to compare spawning times and magnitude between reefs, it is important to note that spat numbers are biased by the amount of substrate collected in a given sample.

Fouling Organisms
The hooked mussel, *Ischadium recurvum*, was present at only two of the sample stations. Mussel densities at the Petit Island station were 157.5 individuals per square meter and were 2.4 per square meter at the 2007 cultch plant. While these density estimates are relatively low; high densities of mussels have been noted at the Petit Island station and the Lake Borgne Area in previous years.

Oyster Predators
The southern oyster drill, *Stramonita haemastoma*, was not collected at any of the sample stations although high numbers were reported during the harvest season and concurrent with present samples (West Karako, leases around Morgan Harbor, etc.). Although no adults were found, *S. haemastoma* egg cases were noted at Cabbage, Grand Pass, and Morgan Harbor reefs. Mud crabs (*Xanthidae, et al.*) were found in each sample containing shell. However, these organisms are not identified to species and several "mud crabs" are not known oyster predators. There were no blue crabs (*Callinectes sapidus*) collected. Although no stone crabs, *Menippe adinia*, were collected in dive samples, several were collected in subsequent dredge samples for Dermo analyses. A description of Dermo (*Perkinsus marinus*) prevalence and infection on selected CSA1 reefs is provided at the end of the main document.

Mortality
Mortality estimates were highly variable between size classes and stations (Table 1.2). Spat mortalities ranged from 0 to 100% with no clear trend in location. Seed mortalities ranged from 0.0 to 66.7%. Those stations with high seed mortalities were not all located adjacent to each other and in several cases were located in close proximity to lower mortality reefs. The 2007 cultch plant was the only station with recently dead sack-sized oysters.

Tropical and Climatic Events
There were two major tropical events since the 2008 stock assessment, hurricanes Gustav and Ike. The increase in local sedimentation, placement of vegetative overburden, and change in water quality all contributed to a mortality event in area oysters. Mortality estimates conducted post-storms showed an average mortality of 31.5% for seed- and 11.3% for sack-sized oysters. There were also significant freshwater inputs into the system associated with high Mississippi and near record Pearl River discharges in the spring and early summer of 2009. (Figure 1.3) There is some evidence that the introductions may have increased mortalities via stratification, oxygen depletion, and increased sedimentation.

Table 1.1. Mean densities of oysters collected at each station. * - note – station temporarily suspended. Values in parenthesis are percent changes from the 2008 assessment

Station	Station Number	Reef Group Acreage	Seed Oysters per m2	Sack Oysters per m2	Number of seed oysters (bbls)	Number of sack oysters (bbls)
Grassy Is.	2		1.5	1.5		
Halfmoon Is.	3	6,850	0.5	0	32,086 (-72%)	89,842 (-82%)
Petit Is.	4		0.5	2.0		
Three-mile Bay	5	3,059	1.5	1.0	25,788 (-64%)	34,384 (-80%)
Grand Pass	6		0.5	0.0		
Cabbage Rf.	7	1,802	0	0	6,752 (-80%)	3,376 (-75%)
Turkey Bayou	11		1.5	0.5		
Martin Is.	9		0	0	0	0
Holmes Is.	10	4,156	0	0	(0%)	(0%)
2007 Cultch Plant	N/A	200	8.8	3.2	9,892 (-80%)	7,194 (none present 2008)
2000 Cultch Plant	12	70	0	0	0 (197 in 2008)	0 (3935 in 2008)
Drum Bay	N/A	1,796	0.5	0.5	5,047 (-74%)	10,095 (-54%)
Morgan Harbor	N/A	2,954	0.5	1.0	8,302 (+8%)	33,206 (-14%)
Hospital Wall*	1	376				
2009 Total					**87,867 (-71%)**	**178,097 (-76%)**

2008/2009 Oyster Season Summary

Several tools are used by research personnel to estimate harvest and assess the biological condition of the resource. Harvest estimates are obtained by monitoring the users and obtaining fishery dependent data. Fisherman are contacted while fishing and asked to provide estimates of current and past catch and effort as well as an estimate of future effort. These data are obtained weekly and are used to estimate harvest in a particular reef complex. Harvest data are also obtained via the trip ticket system in place for this fishery. However, these data are consolidated by geographic region, are considered preliminary until well after the season concludes, and provide a limited resolution.

Fishery independent methods are used to obtain the health and condition of the resource both prior to and during the final stages of the fishing season. Techniques used in these assessments are oyster dredging and visual census. It is important to note that both fishery dependent and independent sources are subject to several large biases and should be used in conjunction to provide a better estimate of the available resource.

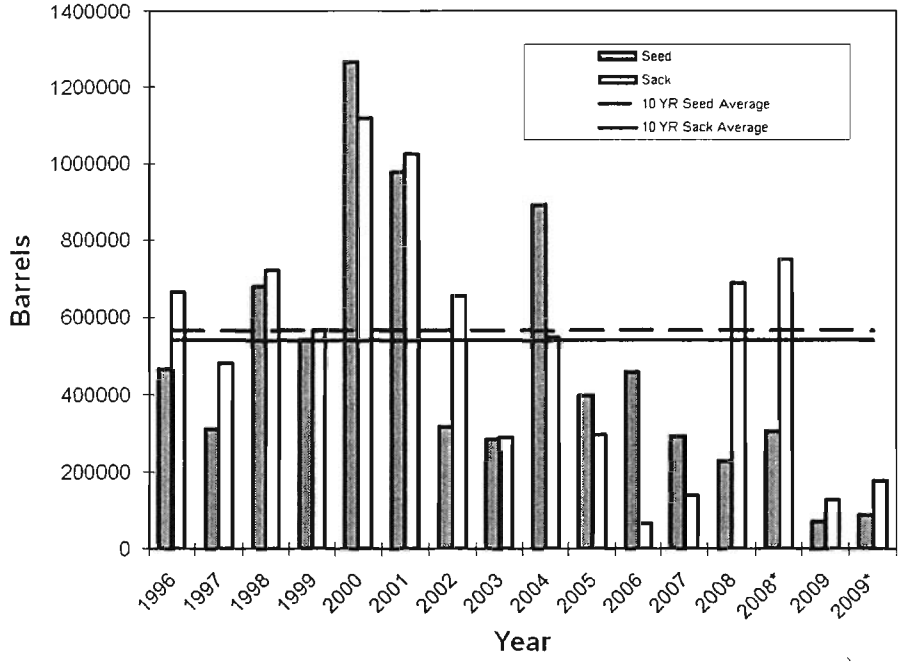

Figure 1.2.. Current and historical stock assessment values. Horizontal lines represent the ten-year seed and sack average. * Values include new cultch plant and assessed areas

Table 1.2.. Mean oyster mortality estimates from each square-meter sample station. N/A – no live or dead oysters were collected for mortality estimates.

Station	Spat Mortality (%)	Seed Mortality (%)	Sack Mortality (%)
Grassy Island	33.0	0	0
2000 Cultch Plant	100	N/A	N/A
2007 Cultch Plant	0	0	20.0
Petit Island	0	0	0
Half Moon Island	N/A	66.7	N/A
Three-Mile Bay	0	0	0
Turkey Bayou	2.8	25.0	0
Cabbage Reef	1.4	N/A	N/A
Grand Pass	0	0	N/A
Drum Bay	16.7	50.0	0
Morgan Harbor	33.3	50.0	0
Martin Island	N/A	N/A	N/A
Holmes Island	N/A	N/A	N/A

Figure 1.3. Monthly average bottom salinities on selected reefs from March 2008 to July 2009

The season within the Coastal Study Area 1 public grounds was originally set by the Louisiana Wildlife and Fisheries Commission as September 3 to October 12, 2008 for seed only harvest, with seed and sack harvest scheduled from October 13, 2008 to April 30, 2009. With the passage of hurricanes Gustav and Ike, the seed grounds were not opened to seed harvest until September 19, 2008 and subsequently closed to all harvest on October 6, 2008. The grounds were reopened to all harvest on October 13, 2008 and were finally closed on March 14, 2009. In addition, a relay for leaseholders was held within the DHH seasonally closed area around Grassy Island from March 1 to March 14, 2009.

Total harvest estimates for the grounds were 170,187 sacks of market-sized oysters and 87,180 bbls of seed-sized oysters for a combined total of 172,274 bbls. When harvest estimates within stock-assessed areas are compared with 2008 assessments, there was an estimated utilization of 8% of the sack resource, 31% of the seed resource, and 14% utilization overall. When harvest data are compared to availability data adjusted for hurricane impacts, the utilization climbs to 45% for seed, 9% for sack and 17% overall. In general, this harvest was not spread evenly throughout the area (Table 1.3). The majority of the sack harvest was taken from the northern reefs, with only 14% taken from Drum Bay and Morgan Harbor. The majority of the seed harvest (52%) was taken from the reefs in the western Mississippi Sound and northern Lake Borgne. Of particular note was the taking of 28,245 bbls of seed from the Grassy Island area during the relay event.

Compared to the 2007/2008 season, overall seed harvest decreased by 45% with a 38% reduction in sack harvest. The specific causes for this reduction are unclear as the availability of the resource and

the economics of the industry are hard to separate. For example, an abundant resource may exist with little harvest if markets are saturated, or overall demand is low.

Table 1.3. Harvest estimates from the 2008/2009 public season within CSA1.

Station	Seed-size (bbls)	Market-size (sacks)
Grassy Island	28,245	50
Half-moon Island	2,465	15,288
Petit Island	3,620	34,395
Lake Borgne	8,995	47,649
2000 Shell Plant	2,400	10,336
Grand Banks	5,550	1,082
Three-Mile Bay	13,730	12,653
Turkey Bayou	0	15
Grand Pass	9,160	7,552
Cabbage Reef	6,175	0
West Karako/ Bay Boudreau	5,825	16,724
Drum Bay	815	10,767
Morgan Harbor	200	13,431
Bay Eloi	0	245
Total	**87,180**	**170,187**

Harvest amounts and types as well as total observed vessels were not constant over time. Market oyster harvest reached a peak of 23,688 sacks $week^{-1}$ in early November with seed oyster harvest reaching a peak of 30,420 bbls $week^{-1}$ during the relay period in March. Similarly, the amount of vessels observed fluctuated, ranging from 8 to 90 (Figure 1.4).

Although a large amount of harvest continues within northeastern Lake Borgne, the southern and western areas continue to show the effects of Hurricane Katrina. There was no public harvest noted, in those areas, during the 2008/2009 season.

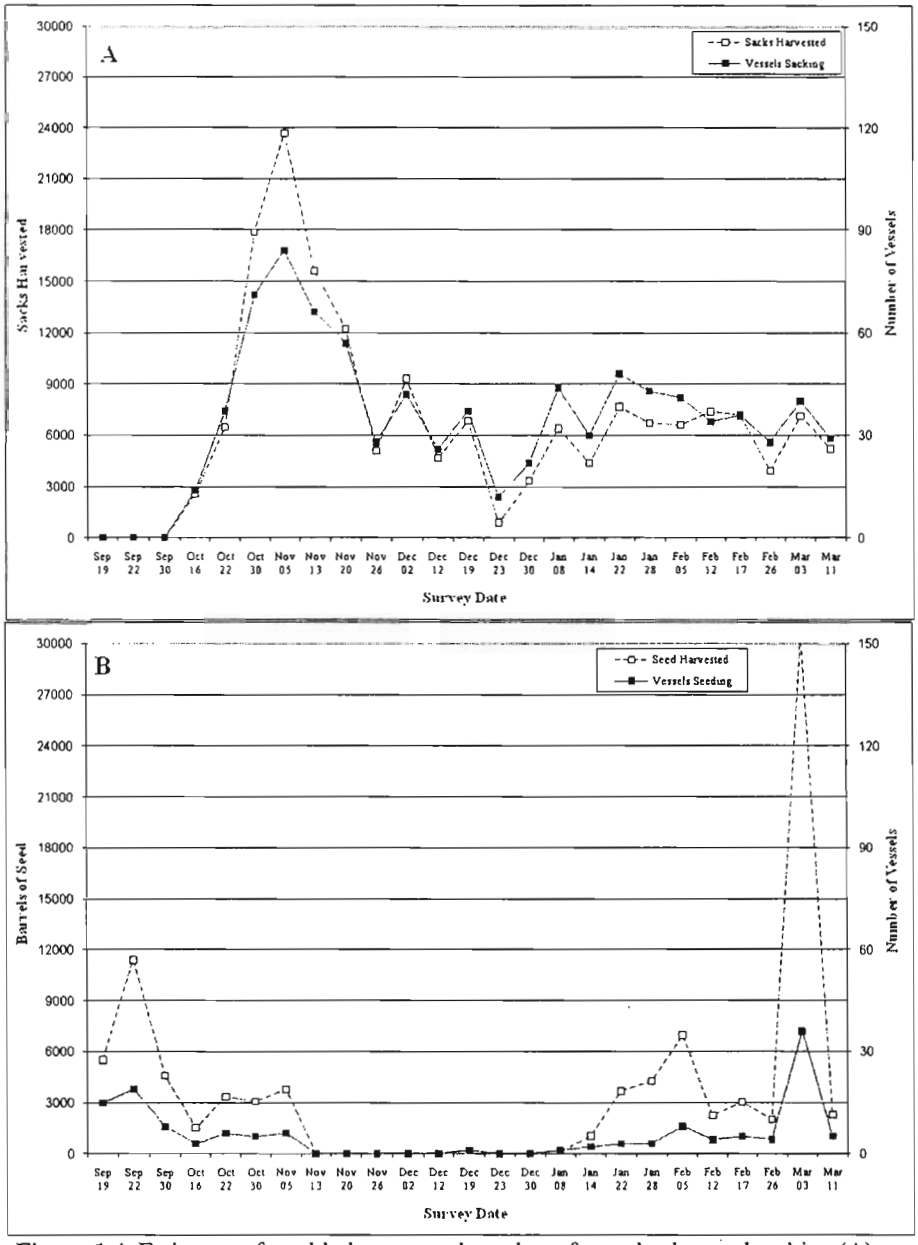

Figure 1.4. Estimates of weekly harvest and number of vessels observed sacking (A) and seeding (B).

Coastal Study Area (CSA) 2 – Oyster Stock Assessment

Keith Ibos, Biologist Manager
LDWF Marine Fisheries Division
New Orleans Field Office, New Orleans, LA 70122

Introduction

The Primary Public Oyster Grounds located in Coastal Study Area 2 include the area south of the Mississippi River Gulf Outlet (MRGO) to the Mississippi River, and from the "Red Line" (most eastern extent of privately leased areas) out to The Breton National Wildlife Refuge. This area encompasses approximately 300,000 of the 880,597 total acres of Primary Public Oyster Grounds east of the Mississippi River and includes Sacking Only Areas in Lakes Fortuna, Machias, and Bay Long, as well as the Bay Gardene Public Oyster Seed Reservation. Historically this area has provided seed stock and market oysters for oyster fishermen both east and west of the Mississippi River. Hydrology in the area is affected at high Mississippi River stages by discharge through gaps in the levee south of Pointe a la Hache and also from discharge from the Caernarvon and Bayou Lamoque freshwater diversion structures as well as the siphon at White's Ditch.

In May 2007, 32,235 cubic yards of size #57 limestone were spread over approximately 200 acres in Black Bay just northeast of Lonesome Island. This project was funded by the National Oceanic and Atmospheric Administration (grant # NA06NMF4540319) through the Gulf States Marine Fisheries Commission as part of a $53 million federal fisheries rehabilitation appropriation for Louisiana in the wake of hurricanes Katrina and Rita (2005). In May 2009, under the same NOAA grant, an additional 22,250 cubic yards of size #57 limestone were spread over approximately 243 acres in Black Bay just southeast of the 2007 culch plant. This was the latest in a long history of oyster reef building/rehabilitation projects (cultch plantings) that have taken place within CSA 2. Numerous cultch plants have been constructed throughout the area since 1917 in places such as Bay Gardene, Bay Crabe, Black Bay, and California Bay.

The Private Oyster Lease Rehabilitation Program (POLR), implemented at the beginning of the 2007/2008 and extending through the 2008/2009 season, provides reimbursement assistance to oyster leaseholders during their efforts to rehabilitate private oyster leases. This program reimburses oyster fishermen for a portion of their expenses associated with bedding oysters from the public grounds to private leases. Consequently, the public oyster grounds in CSA 2 received considerable pressure from bedding operations.

Methods

Personnel from Coastal Study Area 2 and Baton Rouge began meter square samples on July 1, 2009 and all samples were completed by July 8, 2009. Samples were collected by randomly placing aluminum square meter frames on known reef substrate at 29 stations located throughout

CSA 2 in areas such as Lake Fortuna, Bay Gardene, Bay Crabe, Black Bay, California Bay, and Battledore Reef in Breton Sound (Figure 2.1). All live and dead oysters as well as shell in the upper portion (exposed) of the substrate were removed by SCUBA divers. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and counted. Oysters were measured in 5 millimeter (mm) size groups and divided into three categories: spat (<25mm), seed (25-74mm) and sack (75mm and larger). The average of two or more replicates at each station was used in conjunction with estimated reef acreage to estimate current oyster stock availability.

Two additional stations are included in this year's stock assessment. Reef acreages were recalculated at station 17 in California Bay/Bay Long sacking only area (last included in the 1980's). Public reef acreage in that area was reduced by acreage attributed to private leases. Station 30 was added in Lake Fortuna to better characterize available resource in the area.

Five replicate 1/4 meter square samples were taken at random locations on the 2007 cultch plant at Lonesome Island. All live and dead oysters as well as limestone in the frame were removed by SCUBA divers. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and counted. Oysters were measured and categorized by size.

Dermo (*Perkinsus marinus*) samples were taken at seven locations throughout the study area. Twenty seed and twenty sack oysters are collected at each site for analysis by Dr. John Supan of LSU.

Results and Discussion

Seed and Sack Stock

Oyster stock for the area is estimated at 241,762 barrels of seed oysters and 78,450 barrels of market sized oysters for a total of 320,212 barrels of overall stock. Overall availability is up 36% from last year, down 82.5% from the 10 year average of years 1999 thru 2008, and down 80.6% from the long term yearly average since 1982. Seed oyster stock is up 118 % from last year, but 78.5% below the past 10 year average, and 75.7% less than the long term yearly average since 1982. Sack oyster stock is down 37% from 2008 and is 88.8% below the average for the past ten years, and 88% less than the long term yearly average since 1982 (Figure 2.2). The highest numbers of sack oysters were found on the 2007 Cultch plant (closed during the 2008/2009 oyster season), in Bay Crabe and Black Bay.

Seed oysters stock size increased over 2008 levels and seed oysters were found at every station except station 25 and 27. However, the numbers were not as high as hoped for or expected. The anticipated (predicted) boom in seed stock after last year's high river and resulting freshet was not realized. The highest seed numbers were found on the 2007 cultch plant and in California Bay. Approximately 9% percent of seed oysters (not available for bedding) are located in areas

designated as sacking only (Lake Fortuna and Bay Long). Seed oysters averaged 1.91 inches overall with approximately 57% in the 1-2 inch size range. Most of these animals are not expected to reach market by the end of the season. Sack oysters averaged 3.6 inches overall with approximately 71% in the 3-4 inch size range.

Spat Production

Live spat were observed at 25 stations including the new 2007 cultch plant at Lonesome Island. While occurrence was up from last season, overall spat set was low with the exception of good sets at stations one and twenty-four (Table 2.1). Seventy-three percent of spat measured were less than one half inch in length and are not expected to reach seed size by the start of the season.

Mortality

The 2009 assessment shows a decrease in recent mortalities as compared to last year. Recent spat mortalities in meter square samples ranged from 0-50% with an average of 10.7% (22% in 2008). Recent seed mortalities ranged from 0-14.3% with an average of 3% (23% in 2008), and recent sack mortalities at 0% (less than 1% in 2008). (Table 2.2)

Fouling Organisms

Hooked mussels (*Ischadium recurvum*) are a sessile bivalve that is oftentimes associated with oyster reefs and competes with oysters for food and settlement surfaces. Mussel densities in the area have increased since last year. This year, mussels occurred in all stations except Battledore reef. This may be a result of low salinities throughout the area last year due to high Mississippi River levels.

Oyster Predators/Disease

The Southern Oyster Drill (*Stramonita haemastoma*) is a predatory marine snail known to prey on oysters and other sessile animals using a small tooth-like scraping organ called a radula to bore a hole through the oyster shell. No snails or egg casings were found in any of the meter square samples. However, egg casings were observed in dermo samples taken at Horseshoe Reef, and South Black Bay. Two Shark Eye Snails (*Neverita duplicata*) were found at East Pelican Island, station18. These snails are also known to prey on small oysters by boring a hole through the oyster shell. No stone crabs (*Mennipe adinia*) or blue crabs (*Callinectes sapidus*) were observed in the samples. Mud crabs (*Xanthidae spp.*) were observed in nineteen samples including the 2007 cultch plant.

Dermo (*Perkinsus marinus*), a protozoan parasite that infects live oyster tissue, is known to cause extensive oyster mortalities especially under high salinity, high water temperature conditions. Results of Dermo tests are included in a later section.

Tropical and Climactic Events

Hurricane Gustav made landfall near Cocodrie on September 1, 2008. Mortality associated with the hurricane reduced seed stock in the area by an estimated 26%, and sack stock by 2%. Overall stock reduction was estimated at 13%.

In 2009, the average monthly Mississippi River discharge as measured at the Tarbert gauge, peaked at 1,040,000 cfs in May. A corresponding peak occurred at the Carrolton gauge at 16.59 feet in work week 22 (June 2). These peaks occurred approximately 4 weeks later than they had in 2008 when the Tarbert gauge peaked in April at 1,363,000 cfs with a corresponding Carrolton gauge peak at 16.8 feet in work week 18 (April 27). Caernarvon discharge in 2009 remained below both the 4 year median and last year's discharge until mid May (Figure 2.10). With lower river discharge levels and Caernarvon flow rates early this year average salinity, with the exception of 3 weeks in late January/early February, one week in March, and two weeks in June, as measured at 23 weekly isohaline stations throughout area was higher than the same period in 2008 (Figure 2.9).

2008/2009 SEASON SUMMARY

Methods

Harvest totals are estimated by obtaining fisheries dependent data from the monitoring of users. "Board Runs" are conducted weekly during the season. Biologists survey the entire area observing fishermen, recording locations, and making harvest estimates for each vessel for that day. This estimate is projected over the amount of "fishable days" (winds less than 25 mph) for the week and a total harvest of seed and market oysters for the week is made. Vessels collecting seed are often boarded to determine if excessive amounts of culch (non-living reef material) are being removed from area reefs.

Results and Discussion

The Primary Public Oyster Grounds in CSA2, with the exception of the 2007 cultch plant at Lonesome Island and Bay Gardene Public Oyster Seed Reservation, were scheduled to open for bedding from September 3 to October 12, 2008, and for both bedding and sacking from October 13 to April 30, 2008. However, as a result of Hurricane Gustav, LDHH issued a precautionary closing of oyster harvest areas 1-28 effective September 2, 2008. The closure was lifted in Harvest Areas 5, 6, 7, 9, and 10 effective September 24, 2008. These areas remained open for bedding until LDWF Secretary Robert J. Barham issued an emergency closure of the Primary Public Seed Grounds east of the Mississippi River effective one-half hour after sunset on Monday, October 6, 2008 until one-half hour before sunrise on Monday, October 13, 2008. Bedding pressure, oyster mortalities due to Hurricanes Gustav and Ike, as well as excessive removal of non-living reef material by vessels harvesting seed oysters, prompted the closure in an attempt to ensure long-term sustainability of the remaining oyster resources.

The already low resource in CSA2 was further reduced by Hurricane Gustav. As the season progressed, weekly board run survey data indicated that at current harvest rates, a theoretical 100% harvest of available stock would occur by mid March. In order to protect remaining oyster resources, LDWF Secretary Robert J Barham issued an emergency closure of all the Public Seed Grounds east of the Mississippi River effective one-half hour after sunset on Saturday, March 14, 2009.

Harvest totals for market sized oysters in 2008/2009 were estimated at 265,581 sacks (132,790 barrels). The number of total boats observed sacking was down 3% from last year. While the estimated harvest was 4.7% lower than last year, it represented a 109% (post Gustav stock) utilization of the estimated available market stock for the season. Sack harvest was evenly distributed throughout the area with Black Bay at 24%, Bay Crabe at 20%, Lake Fortuna at 19%, Bay Long at 19%, and California Bay at 18%. The apparent drop in percent harvest in California Bay from last year is due to the allocation of part of the bay to the new sacking only area. Combining this year's Bay Long sacking only area totals with California Bay increases the harvest percent to 37% which is essentially the same as California Bay in 07/08 (38%) (Figures 2.3-2.6).

Harvest totals for seed were estimated at 77,003 barrels. The number of boats observed bedding was lower by 42.4% from last year. Estimated harvest was 55.6% lower than last season but represented a 93.6% (post Gustav stock) utilization of the estimated available seed. The majority of seed harvested came from California Bay at 42% (59% in 07/08), followed by Bay Crabe at 29% (22% in 07/08), and Black Bay at 29% (12% in 07/08). The reduction of percent harvest in California Bay and shift in seed harvest to Black Bay is may be due to the closure of Bay Gardene (7% in 07/08) and the reduction of acreage available for seed harvest with creation of the new sacking only area in Bay Long/California Bay (Figures 2.3-2.6).

Harvest totals for seed and sack combined in 2008/2009 were estimated at 209,794 barrels. This 32.9% reduction in harvest compared to 2007/2008 still represented a 102.9 (post Gustav stock) utilization of estimated available resource for 2008/2009. (Figures 2.3 and 2.5)

Eleven vessels were boarded by CSA2 biologists and checked for the percent cultch in seed stock harvested. Percentages of cultch taken ranged from 12.5-50% with an overall average cultch take of 34% per bedding load. Excessive cultch take by bedding vessels remains a concern.

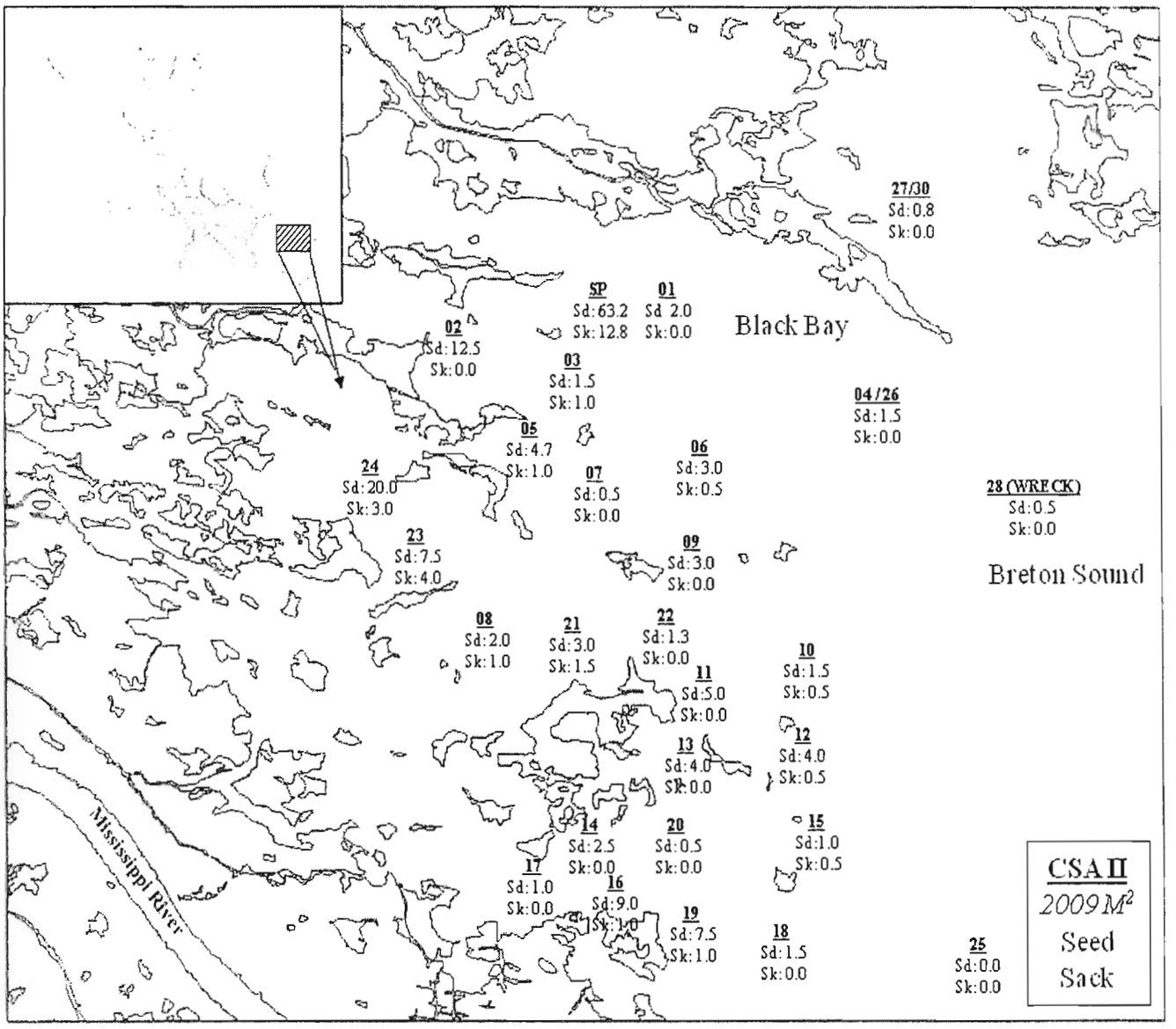

Figure 2.1. CSA2 square meter stations and results. Numbers below stations are average numbers of seed (Sd) and sack (Sk) oysters per square meter.

Table 2.1. 2009 square meter sample results for Coastal Study Area II

Stations		Approx. Reef Acres	Average # of Live Seed Oysters/m^2	Average # of Live Sack Oysters/m^2	Barrels of Seed Oysters Available	Barrels of Sack Oysters Available	Oyster Spat/m^2
1	Snake	506	2.0	0.0	5,688	0	77.5
2	Jessie	59	12.5	0.0	4,927	0	24.5
3	N. Lonesome	896	1.5	1.0	7,554	10,073	22.5
5	Bayou Lost	118	4.7	1.0	3,097	1,327	17.3
6*	Lonesome	273	3.0	0.5	4,603	1,534	5.0
*	07 Shell plant	200	63.2	12.8	71,047	28,779	28.0
7	Black Bay	301	0.5	0.0	846	0	1.5
8	W. Bay Crabe	501	2.0	1.0	5,632	5,632	16.5
9	Stone	461	3.0	0.0	7,774	0	2.0
10	S. Black Bay	145	1.5	0.5	1,223	815	8.0
11	Elephant	339	5.0	0.0	9,527	0	2.5
12	Curfew	425	4.0	0.5	9,555	2,389	6.5
13	N. California	109	4.0	0.0	2,451	0	1.0
14	California	7	2.5	0.0	98	0	1.5
16	Sunrise	174	9.0	1.0	8,802	1,956	23.5
17**	California Bay	572	1.0	0.0	3,215	0	7.5
19	Mangrove	937	7.5	1.0	39,500	10,533	22.0
20	W. Pelican	293	0.5	0.0	823	0	0.0
21	Bay Crabe	659	3.0	1.5	11,112	11,112	17.5
22	E. Bay Crabe	122	1.3	0.0	912	0	7.3
23	E. Gardene	28	7.5	4.0	1,180	1,259	1.0
24	Bay Gardene	69	20.0	3.0	7,757	2,327	94.5
4,26	N. Black Bay	315	1.5	0.0	2,656	0	1
15	Telegraph	127	1.0	0.5	714	714	0.0
18	E. Pelican	1,528	1.5	0.0	6,593	0	1.0
25	Battledore	1419	0.0	0.0	0	0	0.0
27,30	L Fortuna	4288	0.8	0.0	18,077	0	19.3
28	Wreck	2276	0.5	0.0	6,397	0	0.5
Sub Total		**17,390**			**241,762**	**78,450**	
ALL TOTAL					**320,212**		

	2008***	2009	% Change
Seed	**110,751**	**241,762**	**+118.3%**
Sack	**124,393**	**78,450**	**-36.9%**
Total	**235,144**	**320,212**	**+36.2%**

*Acreage at station 6 reduced 200 acres attributed to the 2007 Culch Plant and by 243 acres attributed to the 2009 Culch Plant

**Original 659 Acres reduced by 87 acres attributed to private leases

*** Pre Gustav totals

Table 2.2. 2009 square meter predator/mortality results CSA2

Stations		Hooked Mussels/m^2	Oyster Drill Presence	Spat Percent Mortality	Seed Percent Mortality	Sack Percent Mortality	Seed & Sack Percent Mortality	All Size Percent Mortality
1	Snake	13.5		3.7	0	na	0	3.6
2	Jessie	28.5		3.9	0	na	0	2.6
3	N. Lonesome	16.5		6.3	0	0	0	5.7
5	Bayou Lost	5.0		8.8	0	0	0	6.8
6	Lonesome	170.0		9.1	0	0	0	5.6
	07 Shell plant	121.6		14.6	2.5	0	2.1	5.8
7	Black Bay	537.0		0	0	na	0	0
8	W. Bay Crabe	100.5		2.9	0	0	0	2.5
9	Stone	37.0		50	0	na	0	28.6
10	S. Black Bay	40.0		0	0	0	0	0
11	Elephant	25.0		0	0	na	0	0
12	Curfew	236.0		13.3	11.1	0	10	12
13	N. California	185.0		0	0	na	0	0
14	California	95.0		0	0	na	0	0
16	Sunrise	365.0		4.1	5.3	0	4.8	4.3
17	California Bay	294.0		6.3	0	na	0	5.6
19	Mangrove	287.5		4.3	0	0	0	3.2
20	W. Pelican	182.5		na	0	na	0	0
21	Bay Crabe	405.5		14.6	0	0	0	12
22	E. Bay Crabe	72.7		0	0	na	0	0
23	E. Gardene	655.0		0	6.3	0	4.2	3.8
24	Bay Gardene	34.5		23.8	7	0	6.1	20.9
4,26	N. Black Bay	2.3		0	14.3	na	14.3	9.1
15	Telegraph	365.0		na	0	0	0	0
18	E. Pelican	127.5	2 Shark eye snails	33	0	na	0	16.7
25	Battledore	0.0		na	na	na	na	na
27,30	L Fortuna	4.5		1.3	0	na	0	1.2
28	Wreck	20.5		50	0	na	0	33.3

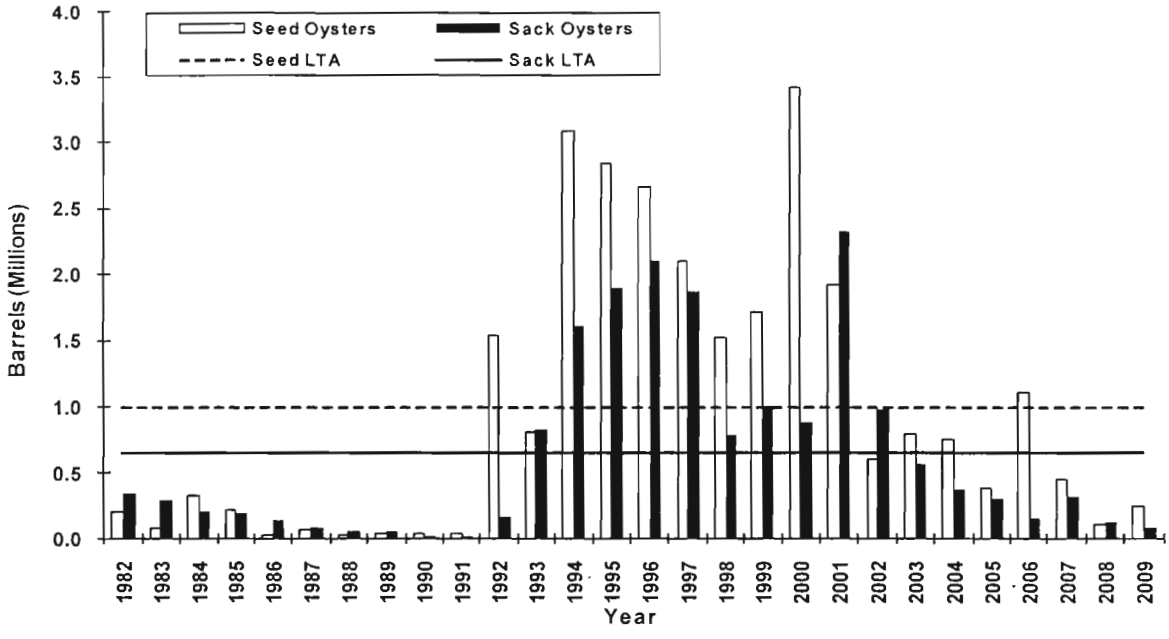

Figure 2.2. Historical Coastal Study Area 2 oyster stock size (estimates based on square meter sample analysis).

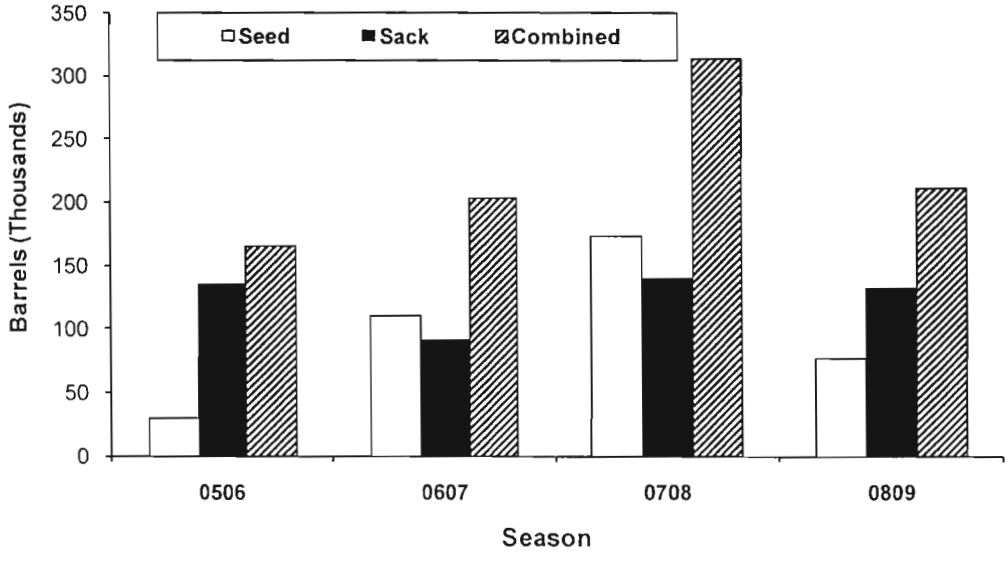

Figure 2.3. Estimated total harvest by season.

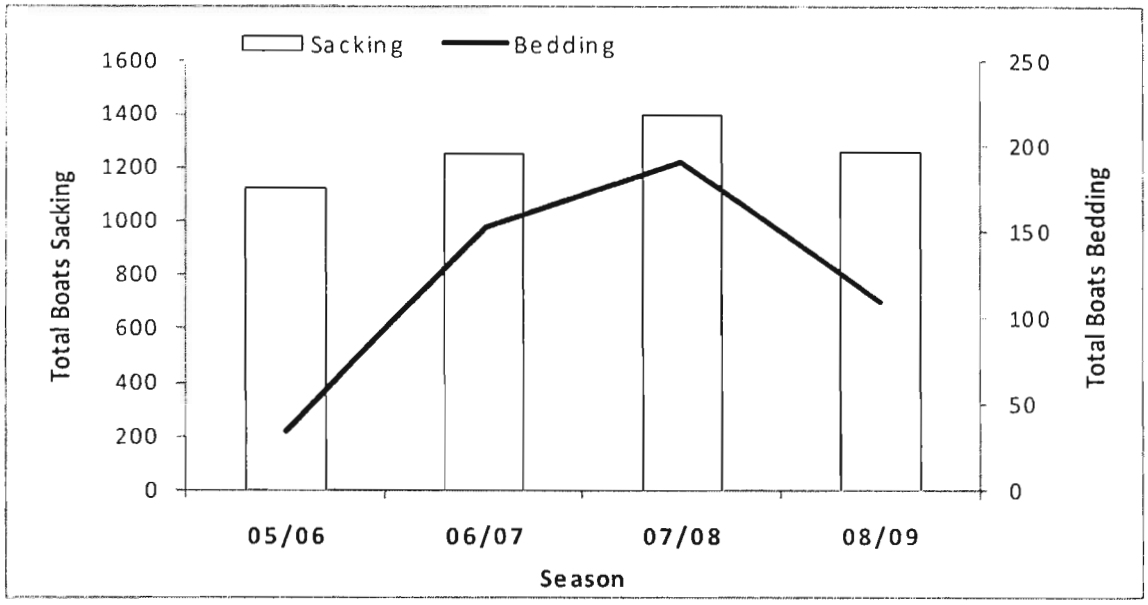

Figure 2.4. Total numbers of vessels observed by season.

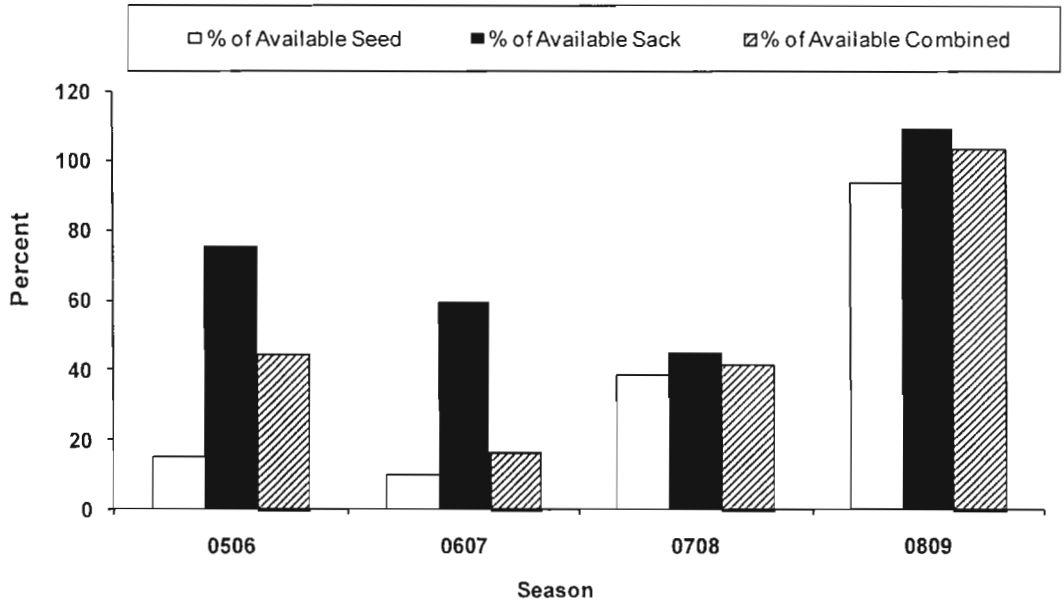

Figure 2.5. Percent of available resource utilized by season.

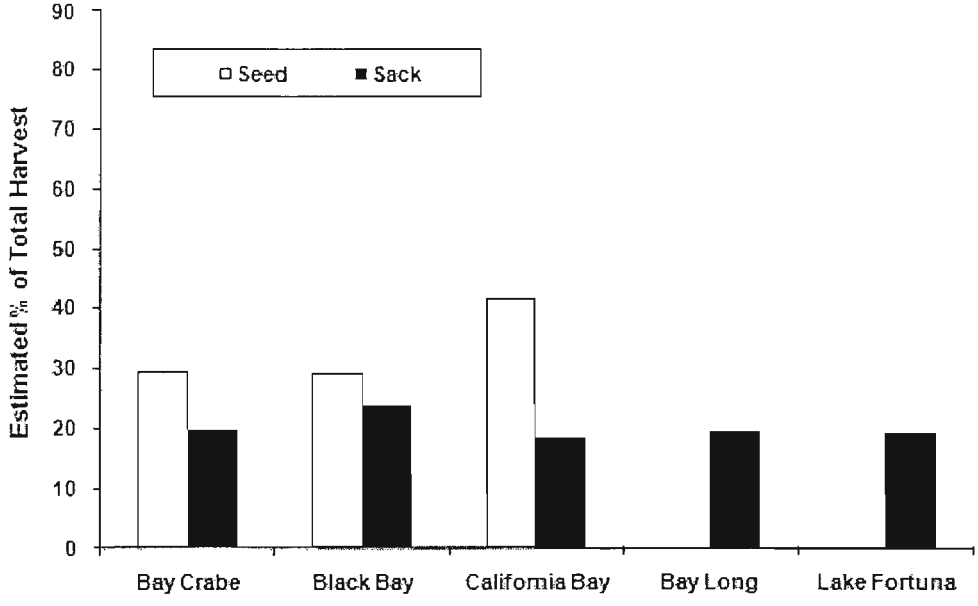

Figure 2.6. Percent of estimated total harvest by bay system within CSA2.

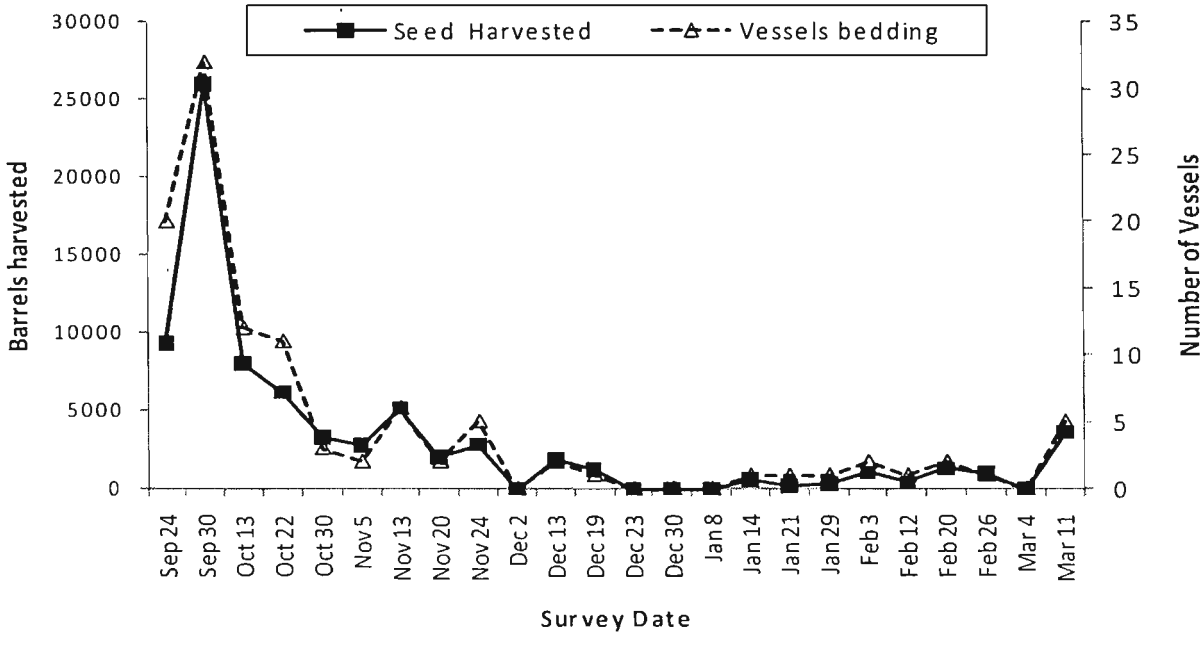

Figure 2.7. Estimated weekly seed harvest and number of vessels bedding observed

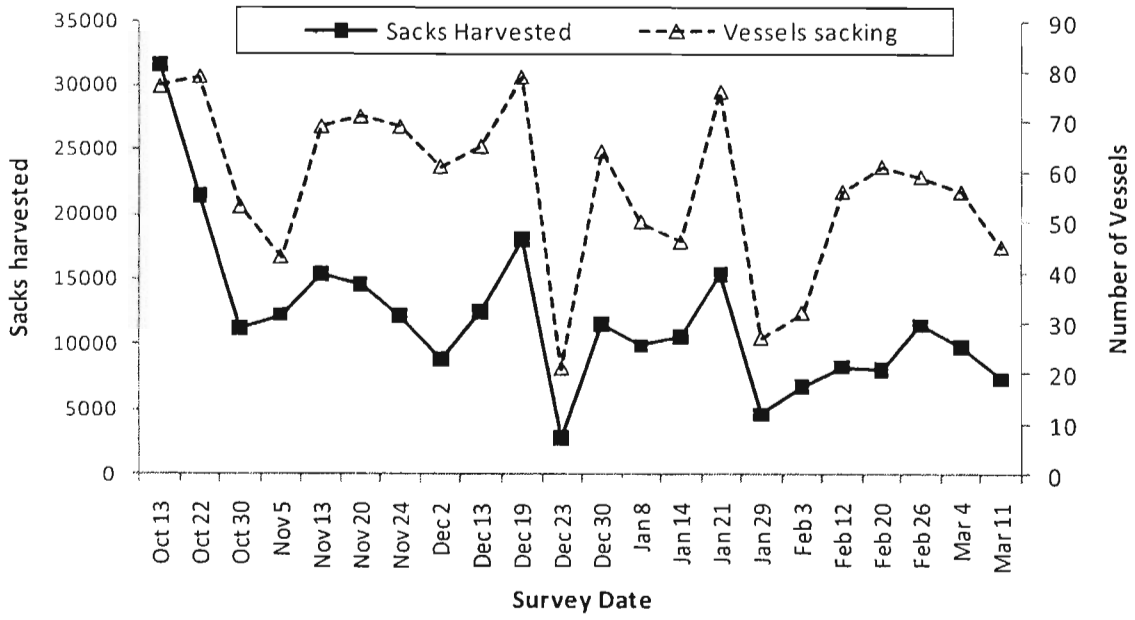

Figure 2.8. Estimated weekly sack harvest and number of vessels sacking observed.

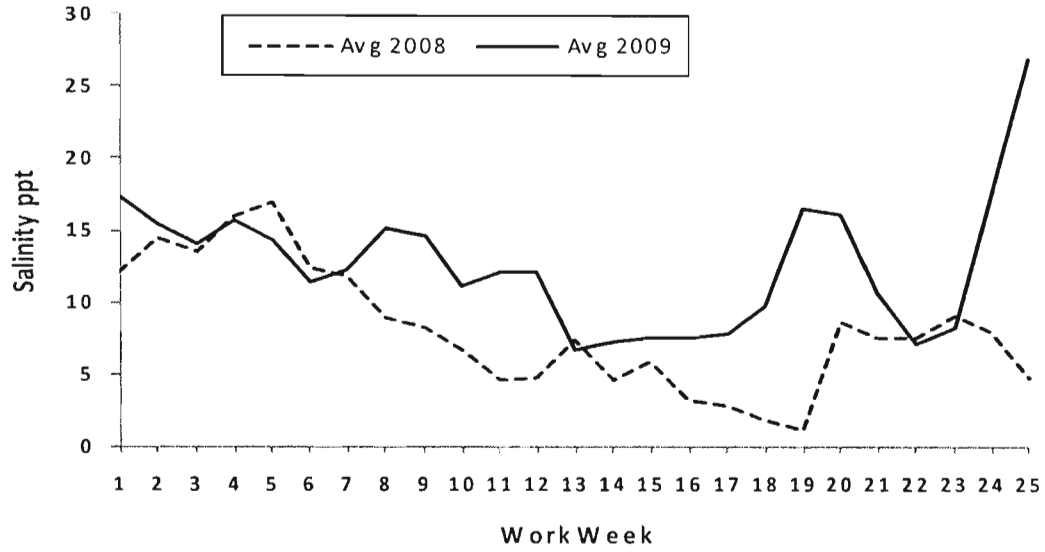

Figure 2.9. Average of 23 weekly isohaline station salinities for 2008 and 2009

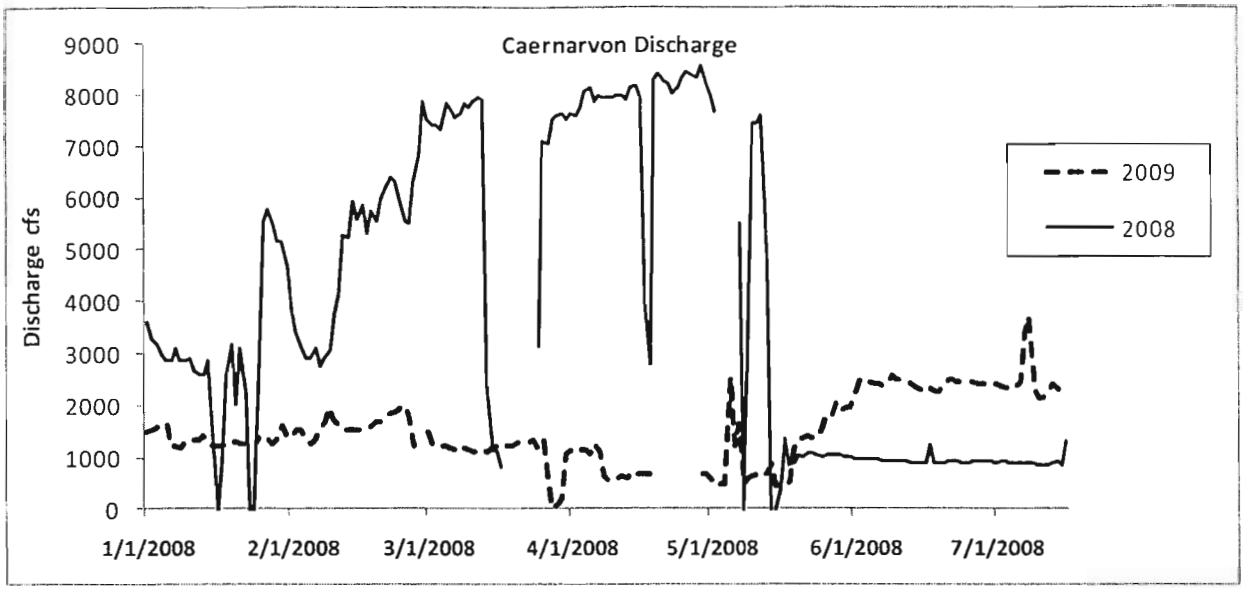

Figure 2.10. Comparison of 2008 and 2009 Caernarvon flow rates

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Coastal Study Area (CSA) 3 – Oyster Stock Assessment

Jason Adriance, Biologist Manager
LDWF Marine Fisheries Division
New Orleans Field Office, New Orleans, LA 70122

Introduction

For the purpose of oyster management, Coastal Study Area (CSA) 3 consists of three public oyster areas distributed generally in a north-south direction within the Barataria Bay estuary: 1) Little Lake Public Oyster Seed Grounds, 2) Hackberry Bay Public Oyster Seed Reservation, and 3) Barataria Bay Public Oyster Seed Grounds. Hackberry Bay is the oldest of the three as it was designated by the Louisiana Legislature as a public oyster seed reservation in 1944. Barataria Bay was designated by the Louisiana Wildlife and Fisheries Commission (LWFC) as a public oyster seed ground in 2000 and Little Lake was designated by the LWFC in 2007. Coastal Study Area 3 (CSA 3) has historically monitored three sampling sites for annual oyster stock assessment, all in Hackberry Bay. Sampling as expanded in recent years, however, with the addition of the Barataria Bay Public Oyster Seed Ground, and the addition of newly constructed oyster reefs in Hackberry Bay.

Hackberry Bay (Jefferson/Lafourche Parishes) is an approximately 8,000 acre euryhaline lake with a mostly soft silt and clay bottom. The three historical sampling sites within Hackberry Bay are the upper, middle, and lower Hackberry sampling sites. The middle Hackberry site is the only site located over historical existing reef while the upper and lower sites are over former cultch plants (=constructed oyster reefs) placed on top of historical reefs. The upper Hackberry sampling site was the result of a 1994 cultch plant using federal disaster funds from Hurricane Andrew in 1992. The 1994 cultch site was comprised of six different sections of substrate. The substrates were crushed concrete, shucked shell, reef shell, mixed shell, Kentucky limestone, and Bahamian limestone. The lower Hackberry sampling site is on a reef that was part of a 1973 cultch plant.

In response to impacts from Hurricane Lilly in 2002, two cultch plants were placed in Hackberry Bay in 2004. The northern Hackberry Bay cultch plant, 10 acres, was planted near the old 1994 cultch plant on May 10, 2004 using approximately 2,322 cubic yards of #57 limestone. The southern Hackberry Bay cultch plant, 25 acres, was planted between May 10 and 12, 2004 using approximately 4,005 cubic yards of #57 limestone.

In 2008, a new cultch plant was placed in the northeastern portion of Hackberry Bay using federal funds dedicated to the impacts of Hurricanes Katrina and Rita. The 2008 cultch plant is approximately 50 acres in size and was planted between May 20 and 25, 2008 using approximately 75% number 57 limestone, 15% crushed concrete, and 10% cleaned oyster shell. The total amount of material was approximately 10,171 cubic yards weighing approximately 13,223 tons.

The Barataria Bay Public Oyster Seed Ground was designated as a public oyster ground in response to possible changes in the salinity regime of the estuary stemming from the proposed Davis Pond project. The Davis Pond project is a large Mississippi River diversion project that aims to reintroduce freshwater and nutrients into the Barataria Bay estuary. As this new coastal restoration project was anticipated to freshen the estuary, LDWF felt that an additional public oyster seed ground farther down-estuary may be productive during years with high freshwater input. The only known reef in existence on the Barataria Bay Public Oyster Seed Ground is a 40-acre reef (= cultch plant) constructed in 2004 utilizing Coastal Impact Assistance Program (CIAP) and Oyster Seed Ground Development Account (compensation from oil and gas impacts) funding. The reef is comprised of approximately 7,536 cubic yards of crushed concrete. The Barataria Bay cultch plant was placed onsite from May 6 to 8, 2004 and is located in the northeast section of the Barataria Bay Public Oyster Seed Ground.

On February 1, 2007 the Wildlife and Fisheries Commission created the Little Lake Public Oyster Seed Ground. This area had been utilized in the past as a temporary natural reef area, last in 2004, and was once covered with private oyster leases. These leases all fell within the Davis Pond impact area and were either purchased or moved by the state and federal government prior to the opening of Davis Pond. As Davis Pond has not been utilized to its maximum extent since it first opened in 2002, environmental conditions have allowed oysters to continue to exist in Little Lake. Therefore, the LWFC designated this area a public oyster ground so that oysters could be harvested and reefs could be actively managed by LDWF. The Little Lake Public Oyster Seed Ground has allowed oyster farmers and harvesters more access to seed and sack oysters in the Barataria Bay basin when favorable conditions, such as higher salinities in the northern portion of the basin exist. Although very little information on reef acreage exists for Little Lake, LDWF plans to embark on a water bottom assessment of the area in the future.

Materials and Methods

Square meter samples used in this assessment were collected by CSA 3 staff on July 1, 2009. All samples, except on the 2008 cultch plant in Hackberry Bay, were taken using a one square-meter frame placed randomly on the bottom at each sampling location. Due to the small size of the recently-planted cultch material and the large amount of cultch collected within a square-meter frame, sub-sampling of the 2008 cultch plant in Hackberry Bay was employed. This new cultch plant was sampled using a one-quarter square-meter frame placed at five, randomly-selected bottom locations on the 50-acre reef.

All live and dead oysters, as well as shell, were removed from the area enclosed in the frame by divers using S.C.U.B.A. (Self Contained Underwater Breathing Apparatus). Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. All oysters were measured in 5 millimeter work groups and divided into size groups of spat (0-24mm), seed (25-74mm), and sack oyster (75mm and greater). A total of seven stations were visited (Figure 3.1) with three replicate square meter samples taken at each of the six existing

stations and five replicate quarter square meter samples taken at the 2008 Hackberry Bay cultch plant. The average of the replicate samples at each station was used, in combination with reef acreage, to estimate the current oyster availability for CSA 3. The Little Lake Public Oyster Seed Ground was not sampled due to lack of reef acreage information.
On July 6, 2009 oysters from samples obtained by dredging in the Hackberry Public Oyster Seed Reservation, separated by size into sack and seed, were collected and transported to Dr. John Supan (L.S.U. Cooperative Extension Service) for an analysis of *Perkinsus marinus* (Dermo) content. Results of the Dermo analysis are presented later in this assessment.

Results and Discussion

The Hackberry Bay Public Oyster Seed Reservation (Hackberry Bay POSR) sample sites, including the 2004 and 2008 cultch plants, averaged 4.4 spat oysters per square meter, 4.8 seed oysters per square meter, and 0.69 sack oysters per square meter (Figure 3.2, Figure 3.3). Spat oyster estimates in the Hackberry Bay POSR are 70% lower in 2009 than in 2008 and 22% lower than the 2001 to 2008 average of 5.6 per square meter. Seed oyster estimates in the Hackberry POSG are 81% lower in 2009 than 2008 and 67% lower than the 2001 to 2008 average of 14.6 per square meter. Despite lower seed oysters per square meter in 2009 than 2008 there is a higher estimated availability of total barrels of seed oysters this year due to the addition of the 2008 cultch plant which effectively doubled the estimated Hackberry Bay POSR reef acreage. Sack oyster estimates in the Hackberry POSG are 95% lower in 2009 than 2008 and 86% lower than the 2001 to 2008 average of 5.1 per square meter.

Using reef acreage, oyster availability estimates can be extrapolated from the average number of oysters sampled per square meter. For the Hackberry POSR there are an estimated 4,275 barrels (bbls) of seed oysters available for harvest (Figure 3.4, Table 3.1). This estimate is above the five and ten year averages of 2,905 bbls and 2,038 bbls respectively. The Hackberry POSR also contains an estimated 141 bbls of market-size sack oysters available for harvest (Figure 3.4, Table 3.1), which is well below the five and ten year averages of 1,192 bbls and 1,018 bbls respectively.

The Hackberry Bay POSR market-size (≥ 3") oyster availability is the second lowest availability since 1996. The only year with lower market-size sack oyster availability was 2006 when market-size sack oyster availability was estimated to be 0.0 per square meter. Seed oyster estimates from the Hackberry Bay POSG are above the five and ten year average and higher than eight of the previous thirteen years as well as being above the long term average (Figure 3.4). The higher amount of available seed can be directly attributed to the 2008 cultch plant which contains an estimated 13.6 seed oysters per square meter. The 2004 southern Hackberry Bay POSR cultch plant along with the southern portion of the Hackberry Bay POSR appear to be below approximately 6 to 12 inches of soft mud which is most likely accounting for the decreased production from this portion of the Hackberry Bay POSR. In 2009 samples, from the 2004 northern Hackberry Bay POSR cultch plant, there are an estimated 0.0 bbls of available seed and market-size sack oysters. While suitable cultch material was exposed on the bottom at

the 2004 northern Hackberry Bay POSR cultch plant, no oysters of any size were sampled in square meter frames. Estimated numbers of spat per square meter in the Hackberry Bay POSR are higher than five of last eight years, but still below the 2001-2008 average.

The Barataria Bay Public Oyster Seed Ground (Barataria Bay POSG) sample sites, measured in 5mm groups (Figure 3.5), averaged an estimated 53.3 spat, 31.7 seed, and 0.0 sack oysters per square meter. Spat and seed oysters were documented on the Barataria Bay POSG for the first time since 2005 (2.0 spat and 4.0 seed per square meter in 2005). Market-size sack oyster estimates on the Barataria Bay POSG are 0.0 per square meter which is identical to the previous four years. The most recent record of oysters, prior to 2009, on the Barataria Bay POSG was in 2005 when an estimated 899.3 barrels of seed oysters were available after square meter sampling assessments.

Using reef acreage, oyster availability estimates can be extrapolated from the average number of oysters sampled per square meter. For the Barataria Bay POSG, there are an estimated 7,127 bbls of seed oysters available for harvest (Figure 3.7, Table 3.1). This estimate is 690% higher than the 899.3 bbls of seed that were estimated to be available in 2005. There are no market-size sack oysters estimated to be available on the Barataria Bay POSG. Increased fresh water input into the system throughout 2008 and into 2009 have most likely contributed to oyster survival on the Barataria Bay POSG. Since the location of the Barataria Bay POSG hinders productivity until salinity regimes in the basin change due to natural forces or coastal restoration efforts, consistent production is usually not expected. Given that the Barataria Bay POSG is located in a higher salinity regime it is more vulnerable to predators such as oyster drills and stressors (i.e. Dermo) associated with higher salinities. While oysters were available in samples, southern oyster drills (*Stramonita haemastoma)*, a predatory marine snail, and their egg cases were also noted in samples on the Barataria Bay POSG, so future predation on oysters by snails is expected. Therefore, it is unknown how long and how much of this available oyster resource will survive.

The Little Lake Public Oyster Seed Ground (POSG) was not sampled due to a lack of information on reef acreage. Given the reduced spring and summer salinities in the Little Lake POSG during late 2008 and early 2009 production is expected to be low. The location of the Little Lake POSG makes it vulnerable to freshwater input from the northern portion of the basin such as heavy rainfall as well as outflow from the Davis Pond freshwater diversion. Reduced salinities caused by these sources of freshwater can have a negative impact on oyster survival and availability in the Little Lake POSG.

Spat Production

Live spat were present at the Barataria Bay POSG sampling location and in the Hackberry POSR at the upper, middle and 2008 cultch plant sampling locations. Overall numbers are below average for the Hackberry Bay POSR and above average for the Barataria Bay POSG. The number of live spat sampled per square meter ranged from 0 to 28 spat for samples taken in the

Hackberry Bay POSR and 22 to 83 spat per square meter for samples taken in the Barataria Bay POSG. Throughout the fall of 2008 and spring of 2009, more suitable hydrologic conditions for spat production, such as lower salinities near the coast, existed in the lower half of the basin.

Increased spat production on the Barataria Bay POSG most likely can be attributed to reduced salinities near the coast. While lower salinities may have aided spat production in the Barataria Bay POSG, they may have also reduced production in the Hackberry Bay POSR since it is further from more saline coastal waters and influenced more by freshwater sources from the northern portion of the basin. One sample location on the 2004 northern Hackberry Bay POSR cultch plant contained abundant suitable substrate for spat, but contained no spat in the three replicate samples. It is important to note that the time of year when square meter samples are taken most likely reflects the period between seasonal spawning events. However, if larval recruitment occurred as a result of the spring spawning event, spat (even if dead) should have been observed in the July square-meter samples.

Fouling Organisms

The hooked mussel (*Ischadium recurvum*), is a reef-associated benthic bivalve species that competes with oysters for food and settlement surfaces. It was present at three of seven sampling locations, all of which were in the Hackberry Bay POSR. Those sampling locations with hooked mussels were also the only locations that contained live oysters in the Hackberry Bay POSR. The highest densities of hooked mussels were at the upper and middle Hackberry Bay POSR sampling locations. The average number of hooked mussels per square meter in the Hackberry Bay POSR was 10.7, which is 5% lower than the average of the previous seven years ($11.3/m^2$). This increase in hooked mussels over last year may be attributable to lower salinities in the basin throughout 2008 and early 2009. The Barataria Bay POSG had no hooked mussels in any samples.

Oyster Predators

The Southern oyster drill (*Stramonita haemastoma)* is a predatory marine snail that feeds on oysters and other sessile organisms using a radula (a small tooth-like rasping organ) to bore a hole through the shell. These snails and their associated egg cases were noted from samples on the Barataria Bay POSG. The Barataria Bay POSG averaged 3.7 oyster drills per square meter. Most of the oyster drills encountered measured between 30 to 50 millimeters in shell length. Several pieces of cultch material from the Barataria Bay POSG samples contained oyster drill egg cases. This finding is not unusual given the proximity of the Barataria Bay POSG to the coast and the associated salinity regime. If salinities remain closer to normal, due to less freshwater diversion flow and/or less rainfall, prior to this fall, conditions could be conducive for oyster drills to survive and flourish on the Barataria Bay POSG. No oyster drills were noted within any sample from the Hackberry Bay POSR.

Mortality

Recent mortality was noted on both the Hackberry Bay POSR and the Barataria Bay POSG. Spat mortality ranged from 0 to 33% for the Hackberry Bay POSR and from 8 to 19% on the Barataria Bay POSG. It should be noted that the 33% spat mortality observed in the Hackberry Bay POSR was from one sample containing 2 live spat and 1 dead spat. Seed oyster mortality ranged from 0 to 20% in the Hackberry Bay POSR and from 2 to 5% in the Barataria Bay POSG. No recent market-size oyster mortality was noted in either the Hackberry Bay POSR or the Barataria Bay POSG. However, there was evidence of previous market-size oyster mortalities such as older buried dead valves and dead boxes (box = both valves still attached at the hinge) in the Hackberry Bay POSR, especially in the southern portion of the POSR. This southern portion of the Hackberry POSR currently has a layer of 6 to 12 inches of soft mud over any oyster shells present.

There was some mortality associated with Hurricanes Gustav and Ike in September of 2008 in the Barataria Basin. There was no resource documented during 2008 sampling on the Barataria Bay POSG to impact, however the Hackberry Bay POSR experienced approximately 30 to 40% mortality as result of post-storm conditions with the heaviest mortalities impacting oyster spat. While the hurricanes of 2008 had an immediate and direct impact on the oyster resources in Barataria Bay there was no evidence on the Barataria Bay POSG or the Hackberry Bay POSR of any long-term or large-scale mortality events. One hundred percent mortality had been noted on a set of two Nestier trays containing 20 oysters each placed in the Little Lake POSG in late January of 2009 by late May 2009.

Tropical and Climatic Events

Hurricanes Gustav and Ike impacted the Barataria Bay system in late August and early September of 2008 (see Mortality section above). Output through the Davis Pond Freshwater Diversion continued to be above the Long Term Average (LTA) in the second half of 2008 and during the first half of 2009 helping to depress salinities in the basin, according to the United States Geologic Survey (USGS) constant data recorder located near the structure's outflow. Davis Pond flow averaged 3,604 cubic feet per second (cfs) from August 2008 to June 2009 and 5,322 cfs from January 2009 through June 2009. According to data supplied by the United States Army Corps of Engineers (USACE) website, Mississippi River flow was above the LTA from August 2008 through October 2008 then fell below the LTA for November and December of 2008. In 2009, Mississippi River flow was slightly above the LTA in January and below the LTA in February and March. River flow then increased to near the LTA in April and continued increasing for May and June of 2009. August 2008 to June 2009 Davis Pond flow and Mississippi River discharge are compared to the LTA and presented in Figure 3.8.

Salinities in the Hackberry Bay POSR, according to the USGS constant data recorder located in the bay, averaged 4.9 parts per thousand (ppt) for the month of June in 2009 which is well below the 2001 to 2008 average of 11.1 ppt. June temperatures averaged 29.8 degrees Celsius (C) in 2009 which is 0.4 degrees C above the 2001 to 2008 average of 29.4 degrees C. June averages

of constant recorder data are presented in Figure 3.9. Freshwater input into the Barataria system has been constant and consistent this year with increased flow out of the Davis Pond diversion structure.

Salinities from the Barataria Bay POSG, according to the USGS constant data recorder located in the seed ground, have averaged 14.5 ppt since February of 2008 (Figure 3.10). No data are available from September 2008 to February 2008 due to damage to the constant recorder from Hurricanes Gustav and Ike. June averages of salinity and temperature in the Barataria Bay POSG were 15.3 ppt and 29.5 degrees C respectively.

2008/2009 Oyster Season Summary

The 2008/2009 oyster season in Hackberry Bay POSR and Little Lake POSG was originally scheduled to open for seed harvest only between September 3, 2008 and October 12, 2009, and for both seed and market-oyster harvest from October 13, 2008 through April 30, 2009. However, harvest was not allowed in the entire Barataria Basin due to Department of Health and Hospitals (DHH) closures issued on September 2, 2008 related to the impacts of Hurricanes Gustav and Ike. The DHH harvest restriction was lifted on September 27, 2008 allowing harvesters to access both the Hackberry Bay POSR, including the 2004 cultch plants, and the Little Lake POSG. An emergency early closure was declared in Hackberry Bay POSR and Little Lake POSG due to low stock availability and these areas were closed on March 14, 2009. The Barataria Bay POSG was closed for the entirety of the 2008/2009 season. Average fishing effort was observed on the public oyster areas in CSA 3 during the 2008/2009 season.

Total harvest from the public oyster areas in CSA 3 during the 2008/2009 season was estimated at 3,270 sacks of marketable oysters and 1,985 barrels of seed oysters (Table 3.2), with all of this harvest coming from Hackberry Bay. Harvest of market-size oysters in Hackberry Bay increased 409% from the previous season while harvest of seed oysters decreased by 28% compared to the 2007/2008 season. Lower seed harvest during the 2008/2009 season was likely the result of a combination of low salinities in the basin and the impacts of Hurricanes Gustav and Ike. The Little Lake POSG showed no production due to the impacts of low salinities during much of 2008, oyster mortality in Lower Little Lake was already near 100% in February of 2008 as observed in Nestier Tray sampling from the lake.

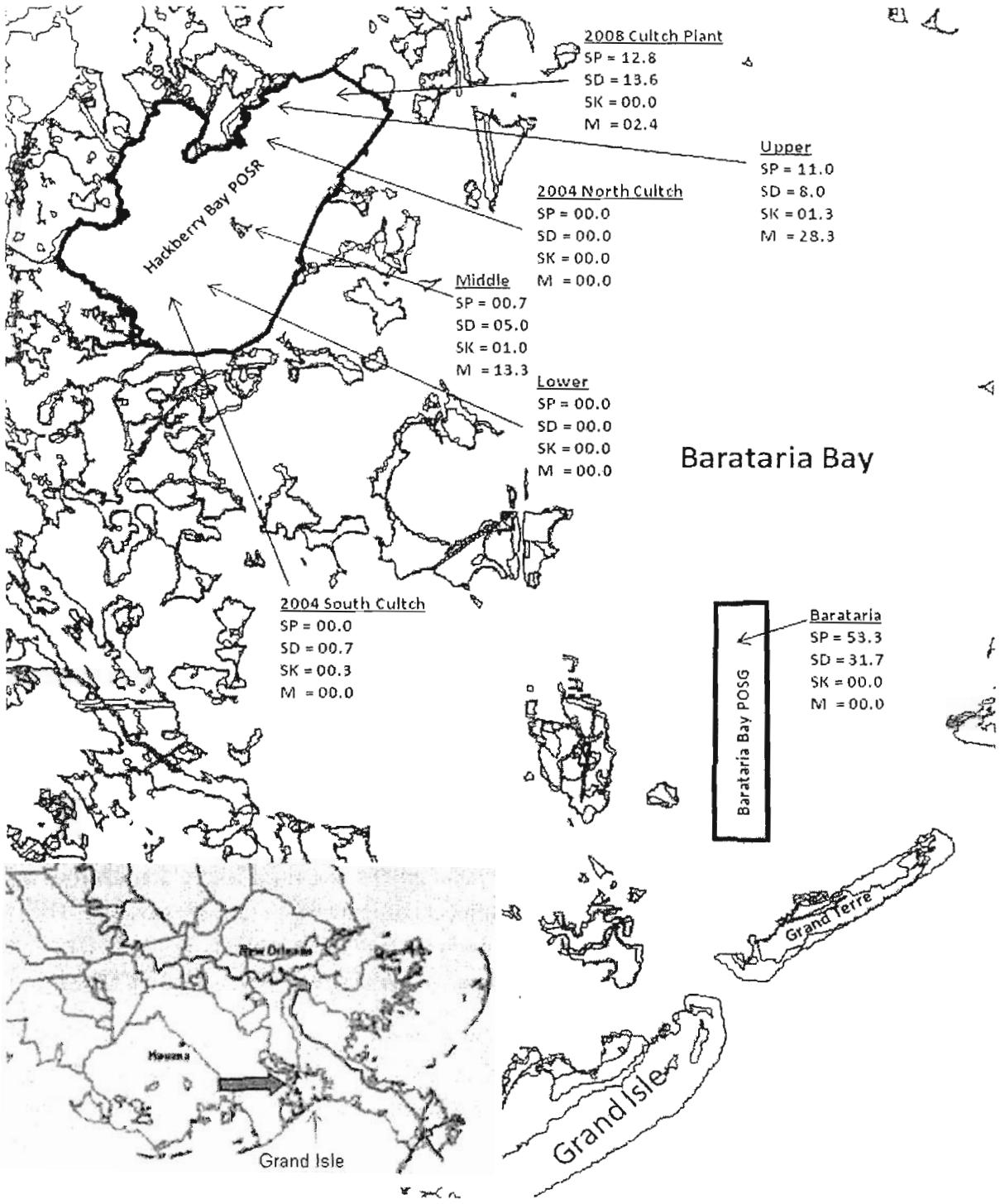

Figure 3.1. 2009 Hackberry Bay POSR and Barataria Bay POSG sample results as an average per square meter (SP=Spat, SD=Seed, SK=Sack, and M=Mussels) and map of sample locations.

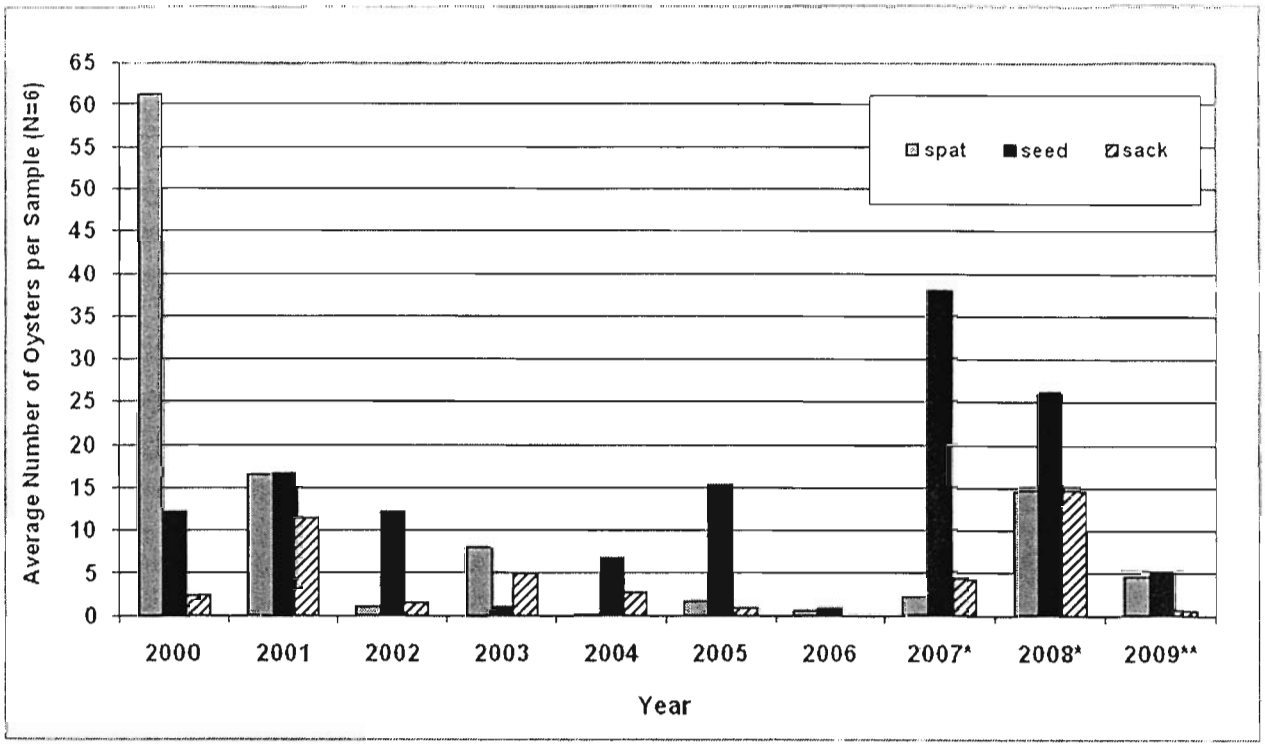

Figure 3.2. Historical oyster density in the Hackberry Bay Public Oyster Seed Reservation square meter samples from 2000-2009. *includes the 2004 cultch plants **includes the 2008 cultch plant.

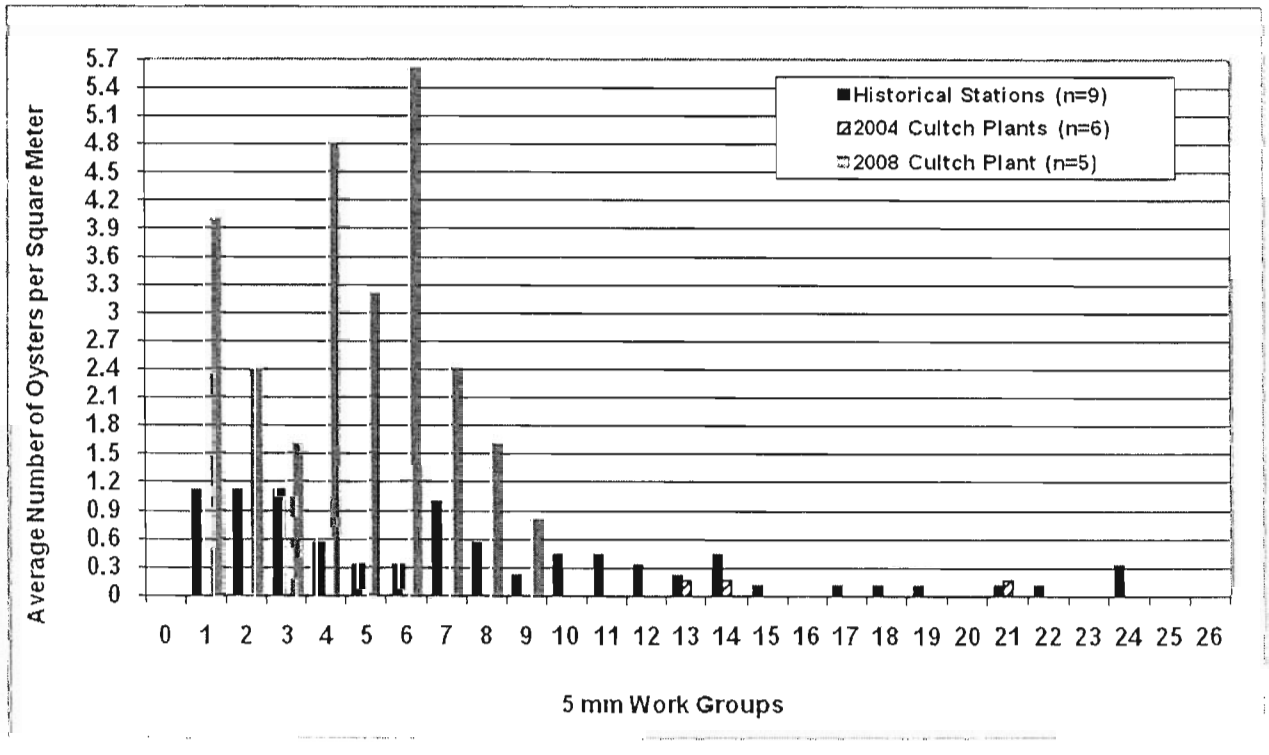

Figure 3.3 Oyster size distribution by 5 mm work groups in square meter samples collected from the Hackberry Bay Public Oyster Seed Reservation during 2009.

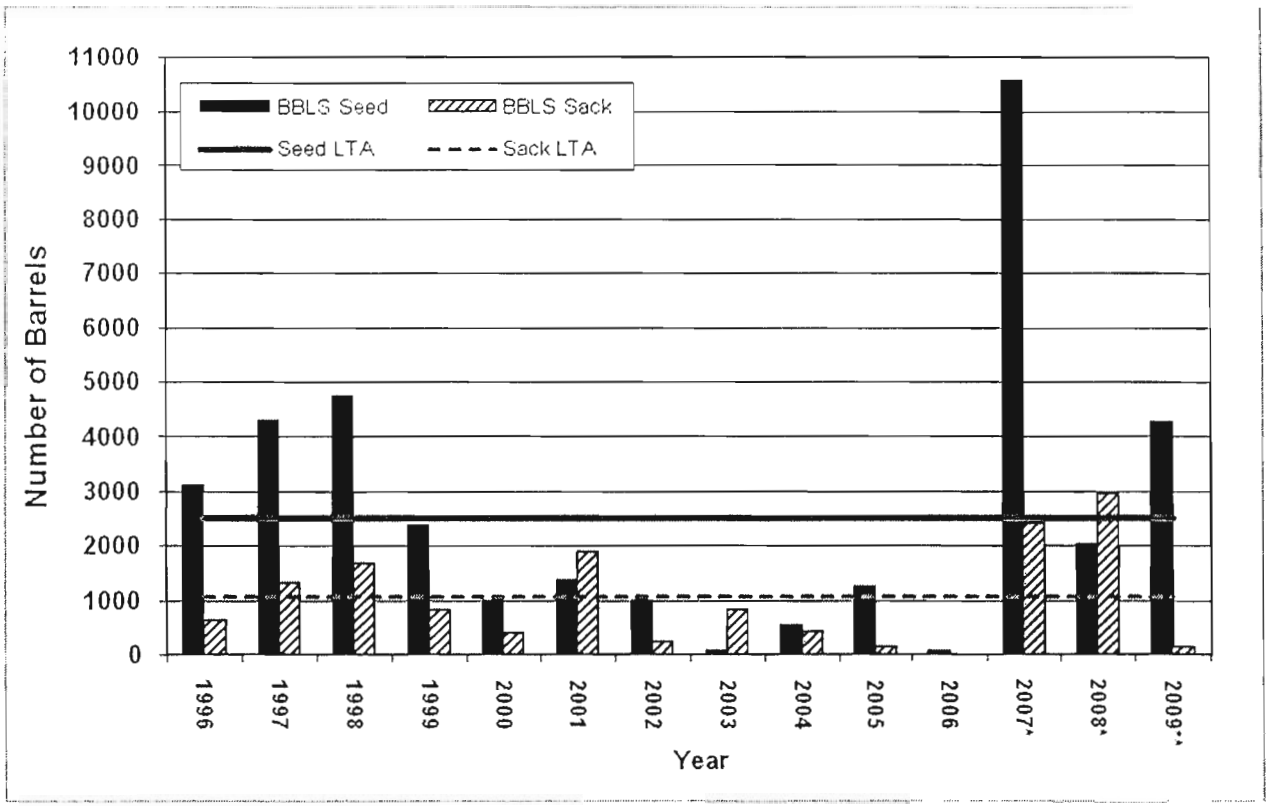

Figure 3.4. Historical oyster availability in the Hackberry Bay Public Oyster Seed Reservation from 1996 to 2009. * includes the 2004 cultch plants **includes the 2008 cultch plant.

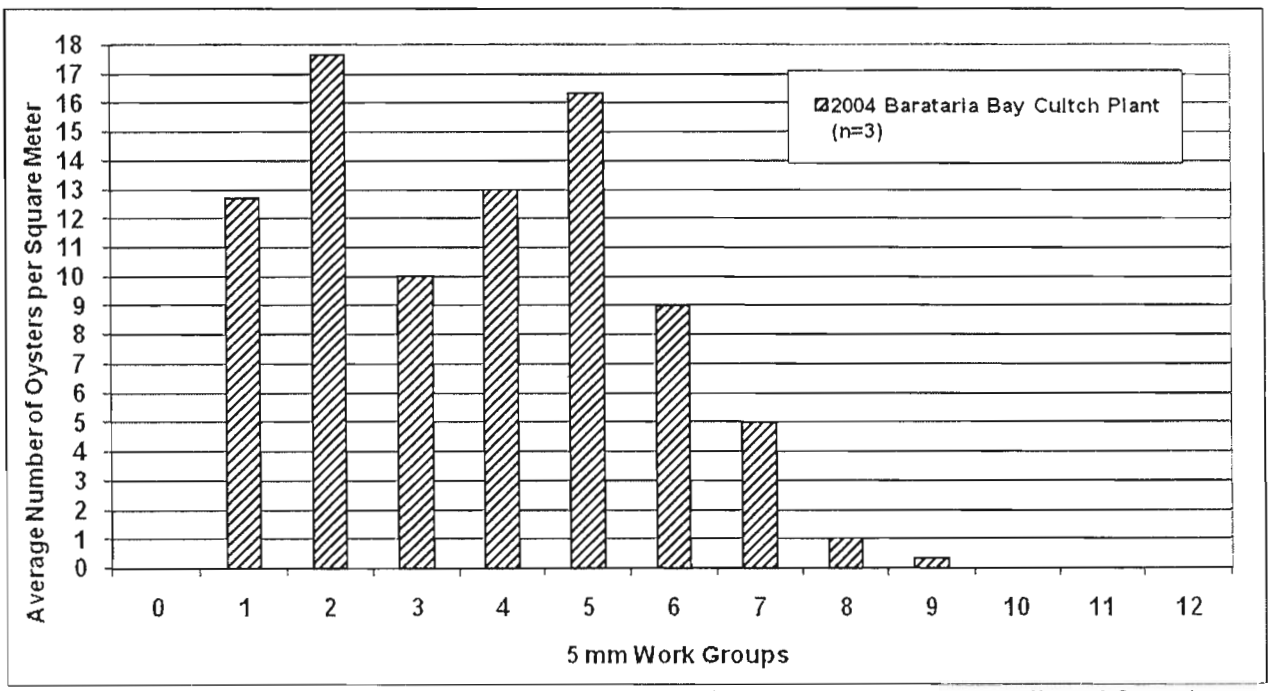

Figure 3.5. Oyster size distribution by 5 mm work groups in square meter samples collected from the Barataria Bay Public Oyster Seed Ground.

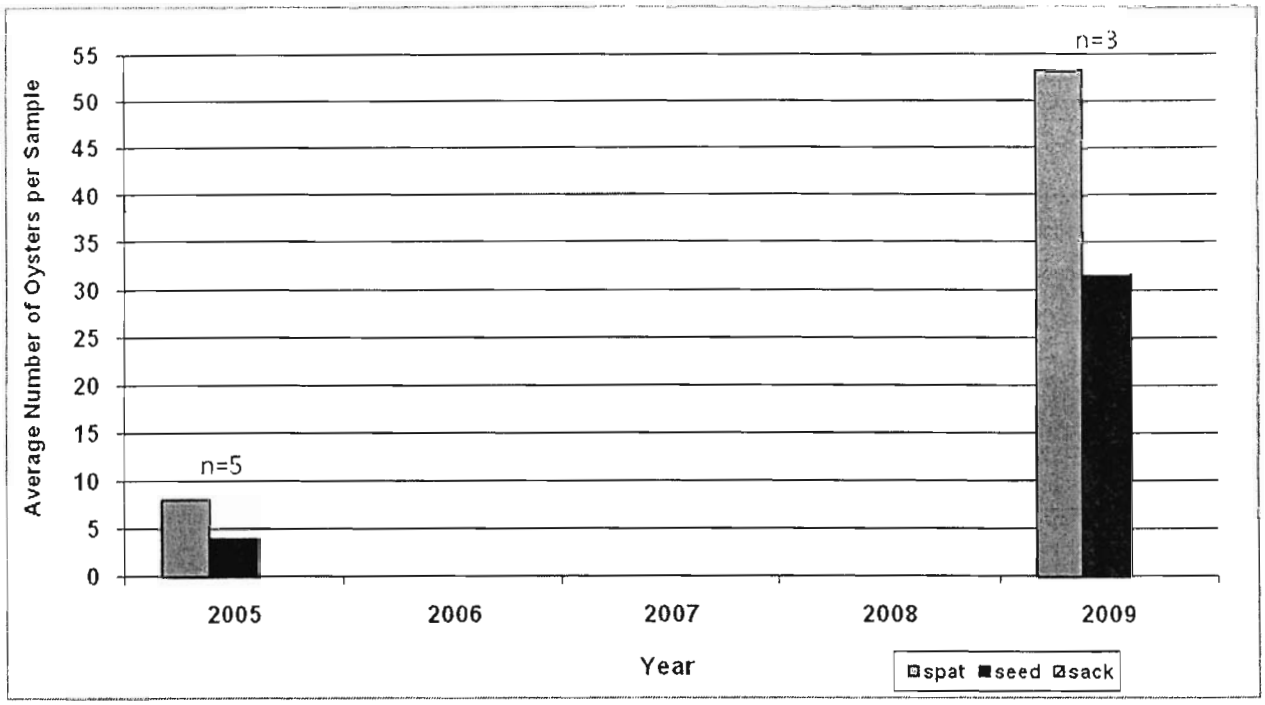

Figure 3.6. Historical oyster density in the Barataria Bay Public Oyster Seed Ground from 2005 to 2009.

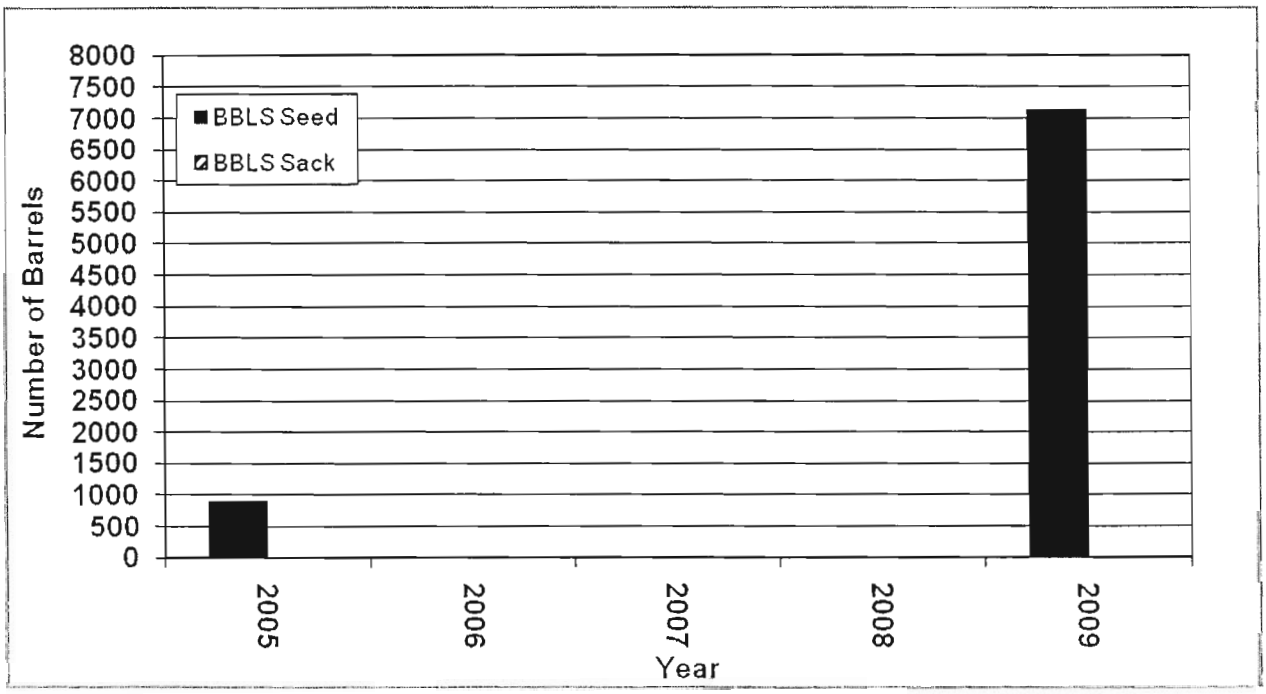

Figure 3.7. Historical oyster availability in the Barataria Bay Public Oyster Seed Ground from 2005 to 2009.

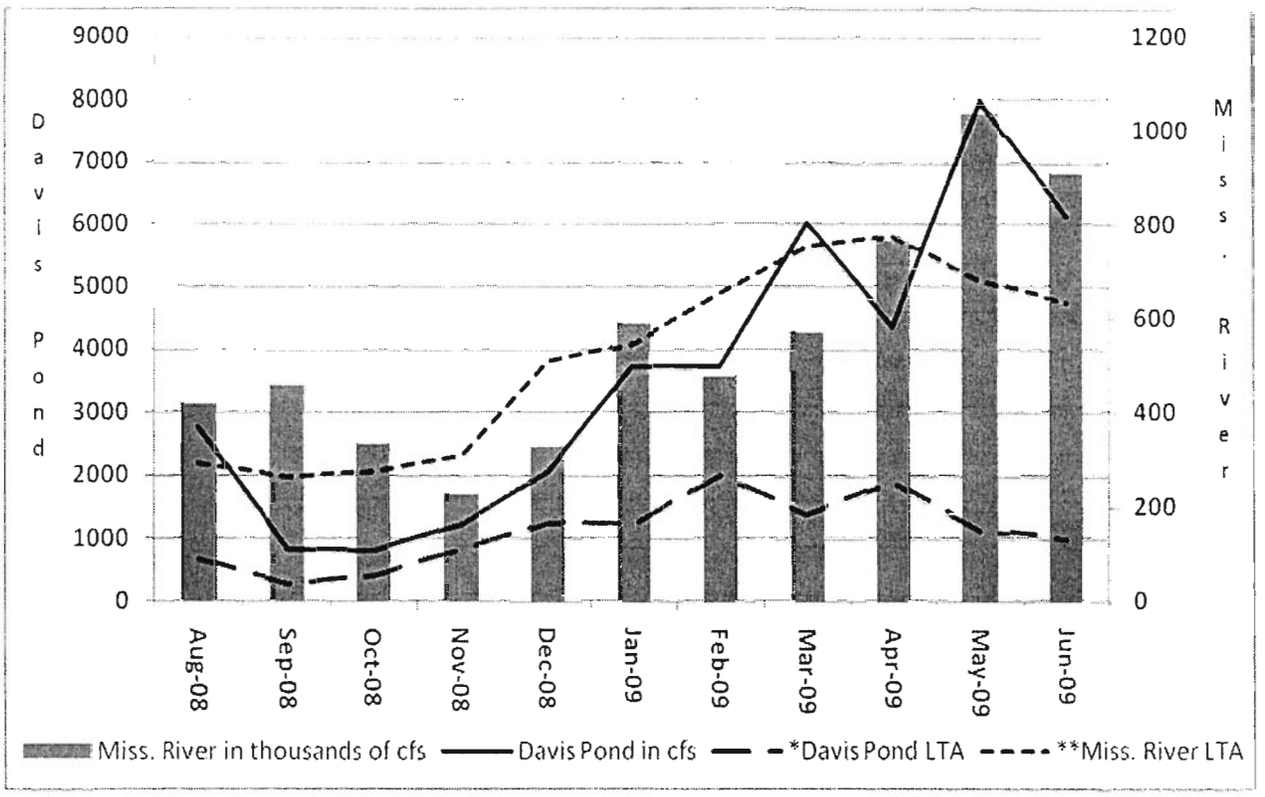

Figure 3.8. August 2008 to June 2009 Davis Pond flow in cubic feet per second (cfs) and Mississippi River discharge in thousands of cfs compared to the Long Term Average (LTA). *Davis Pond LTA 2002-2008. **Mississippi River LTA 1997-2008. Davis Pond discharge data supplied by the United States Geological Survey (USGS) constant data recorder located near the Davis Pond structure. Mississippi River discharge data supplied by the United States Army Corps of Engineers (USACE).

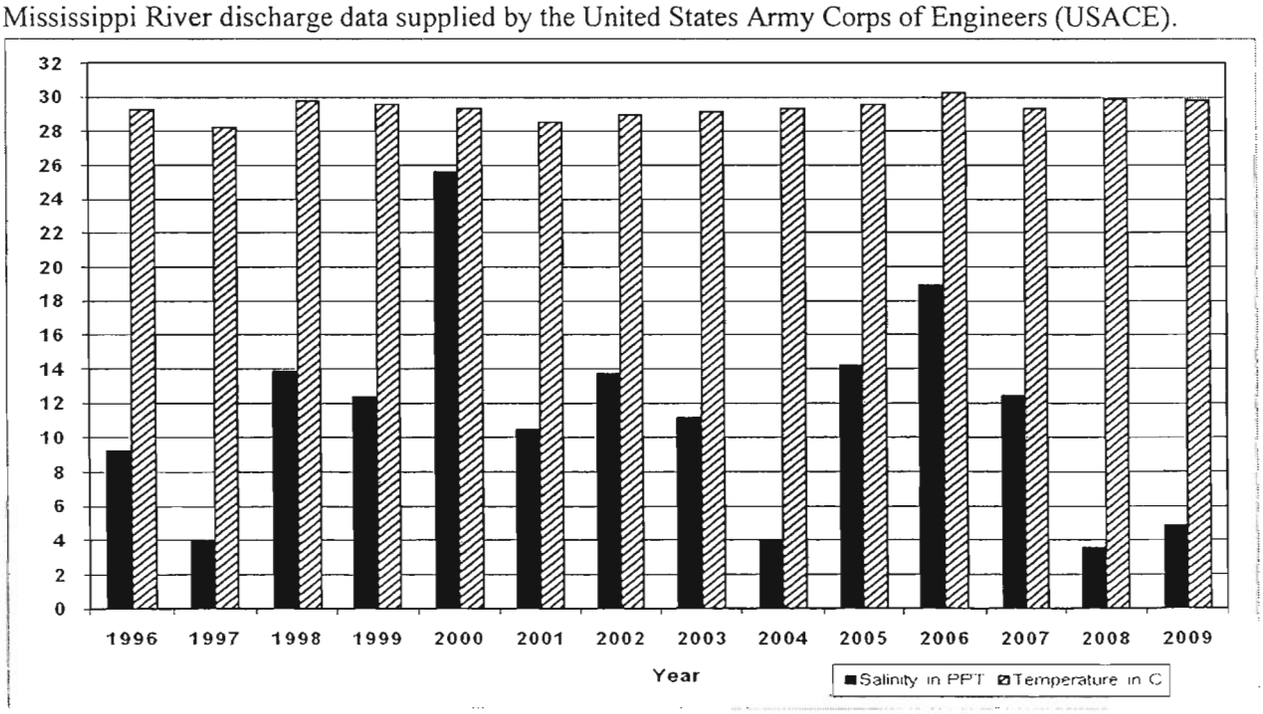

Figure 3.9. Historical average daily June salinity (in ppt) and temperature (in degrees C.) in Hackberry Bay from 1996-2009. Data supplied by the United States Geological Survey (USGS) constant data recorder located in Hackberry Bay.

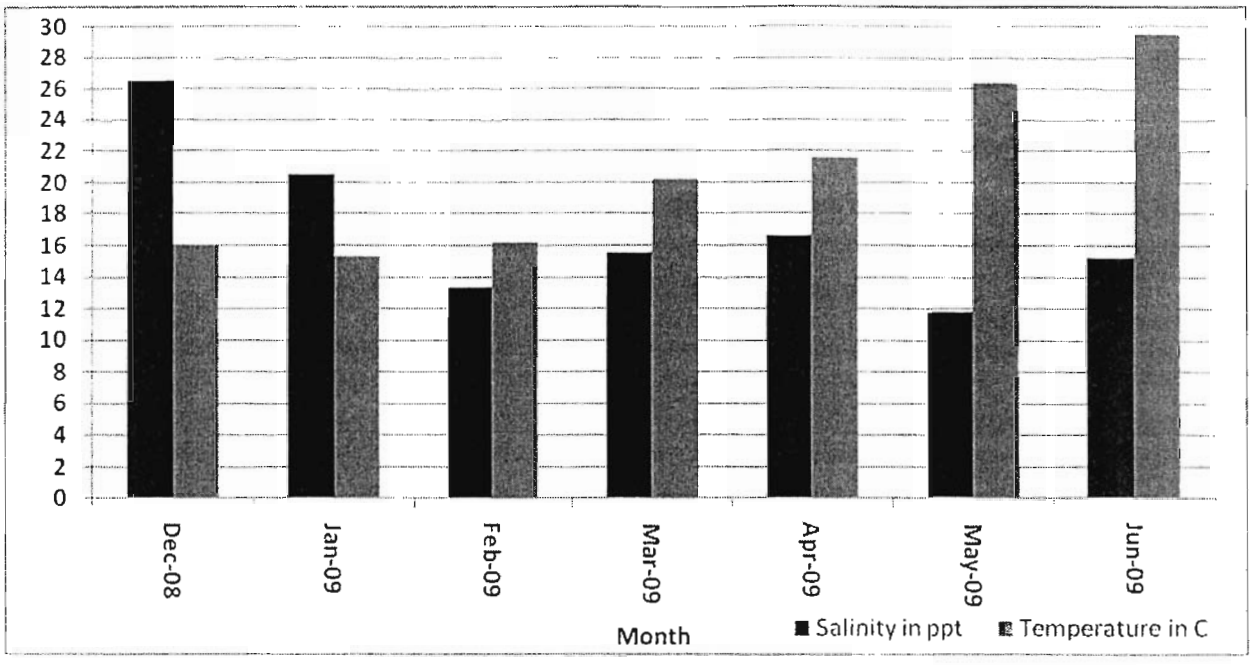

Figure 3.10. Average monthly salinity (in ppt) and temperature (in degrees C.) in the Barataria Bay POSG from December 2008 through June 2009. Data supplied by the United States Geological Survey (USGS) constant data recorder located in the Barataria Bay Public Oyster Seed Ground.

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Table 3.1. Estimated 2009 oyster availability on the public oyster areas in Coastal Study Area III.

Public Oyster Area	Reef Acreage	Square Meters	Seed Oysters Per M^2	Sack Oysters Per M^2	Seed Oysters (BBLS)	Sack Oysters (BBLS)
Barataria Bay (2004 Cultch Plant)	40.0	161,875	31.7	0.0	7,127.0	0.0
Hackberry Bay (2004 North Cultch Plant)	10.0	40,469	0.0	0.0	0.0	0.0
Hackberry Bay (2004 South Cultch Plant)	25.0	101,172	0.7	0.3	98.4	42.2
Hackberry Bay (2008 Cultch Plant)	50.0	202,344	13.6	0.0	3,822.1	0.0
Hackberry Bay (Existing Reefs)	14.7	59,380	4.3	1.2	354.6	99.0
Little Lake	Unknown	Unknown	Unknown	Unknown	--	--
2009 CSA 3 Totals	***139.7***	***565,240***			***11,402.1***	***141.2***
2008 CSA 3 Totals	***89.7***	***362,896***			***2,036.2***	***2,949.1***

Table 3.2. Estimates of oyster harvest from the public seed grounds in Coastal Study Area 3 for the 2008/2009, 2007/2008, and 2006/2007 season.

Public Oyster Area	**Seed Oysters Harvested (BBLS)**	**Sack Oysters Harvested (Sacks)**
Hackberry Bay POSR	1,985	3,270
Little Lake POSG	0	0
Barataria Bay POSG	0	0
2008/2009 CSA 3 Totals	***1,985***	***3,270***
2007/2008 CSA 3 Totals	***13,930***	***976***
2006/2007 CSA 3 Totals	***12,190***	***6,091***

Coastal Study Area (CSA) 4 – 2009 Oyster Stock Assessment

Vince Guillory, Biologist Manager
LDWF Marine Fisheries Division
Houma Field Office, Bourg, LA 70343

Introduction

Public oyster seed grounds in CSA IV, which include Lake Tambour, Lake Chien, and Lake Felicity in Terrebonne Parish and Deep Lake in Lafourche Parish, were established by the Louisiana Wildlife and Fisheries Commission (LWFC) in 2001. The upper portion of Lake Felicity was used as a public seed reservation during the 1940s and early 1950s, but was discontinued because salinities were usually too high for oyster production. It was re-established by the LWFC in response to planned coastal restoration efforts that had the potential to return the area to a more favorable salinity regime for oyster production. Most of Timbalier-Terrebonne estuary is in the high-salinity zone (where oyster populations are primarily intertidal because of extensive predation) or wet zone (where subtidal oysters may be found when salinities are suppressed).

Two cultch deposition projects using size number 57 limestone rock were performed in the Lake Chien (Figure 4.1) and Lake Felicity (Figure 4.2) seed grounds in summer of 2004. Approximately 6,000 cubic yards were deposited on 15.5 acres in Lake Chien and approximately 9,000 cubic yards on 40 acres in Lake Felicity. The seed grounds were first opened to harvest in 2005, and have continued each year. Another cultch plant was created in Lake Chien in May 2009 due east of the initial Lake Chien cultch plant; approximately 11,348 cubic yards of size number 57 limestone rock was deposited on approximately 22.3 acres.

Materials and Methods

Square meter samples were taken from five stations each on the Lake Felicity and Lake Chien cultch plants on July 2, 2009. The aluminum square meter frame was tossed randomly over the cultch plant. All live and dead oysters within the top portion of the bottom were removed by SCUBA divers. Oysters collected in each sample were measured in 5-mm size classes and divided into three groups: spat (<25 mm), seed (25-74 mm), and sack (>74 mm).

In conjunction with the square meter oyster samples, bottom water temperature and salinity data were also taken. Oysters were also collected from each reef for "Dermo" (*Perkinsus marinus*) analysis.

Results

Salinity

Average salinities associated with 2009 square meters were 15.8 ppt on the Lake Felicity cultch plant and 16.4 ppt on the Lake Chien cultch plant. These salinities were similar to those observed in other years with the exception of the high salinity years in 2006 and 2007 (Figure 4.3).

Salinity recordings were also made monthly on the Lake Felicity and Lake Chien seed grounds from 2000 to 2005 (Figure 4.4). Mean salinities were above 15 ppt except for Lake Chien in 2005.

Seed and Sack Oysters

The average numbers of seed and sack oysters per square meter in 2009 were 4.6 seed and 0.6 sack oysters for the Lake Felicity cultch plant and 13.8 seed and 0 sack oysters for the Lake Chien cultch plant (Table 4.1). Numbers of seed oysters in both cultch plants have declined since the 2004 peak in Lake Felicity (Figure 4.5) and the 2005 peak in Lake Chien (Figure 4.6). No sack oysters were found in Lake Chien square meter samples while sack oyster numbers in Lake Felicity were very low. Numbers of seed oysters in both cultch plants declined from 2008.

Spat Production

The average numbers of live spat per square meter in 2009 were 79.2 and 16.8 for the Lake Felicity cultch plant and Lake Chien cultch plant, respectively (Table 4.1). Recruitment as measured by spat numbers was lower in 2009 than in 2008 but higher than for 2006 and 2007. The highest numbers of spat were collected in the first year immediately after the cultch plant deposition.

Fouling Organisms / Predators

Fouling organisms and/or predators were documented in square meter samples on the Lake Chien or Lake Felicity cultch plants. Documented organisms included two hooked mussels, three stone crabs, and two mud crabs.

Mortality

No recent mortality among spat, seed or sack oysters were observed in square meter samples (Table 4.1). However, mortality data from dredge samples following Hurricanes Gustav and Ike in September, 2008 indicate that high mortalities occurred at that time. Average mortalities of spat, seed, and sack oysters were 10.5%, 11.4%, and 7.4%, respectively, on the Lake Chien cultch plant and 51.2%, 33.3%, and 57.1%, respectively, on the Lake Felicity cultch plant.

Resource Availability

A total of 2,236 barrels of seed oysters and 539 sacks of sack oysters for both cultch plants are estimated for Lake Felicity and Lake Chien (Table 4.2). Estimated resource availabilities by year for each cultch plant are found in Figures 4.7 and 4.8.

2008 Oyster Season Summary

Overall harvest and effort for the 2008 oyster season (10/29-10/31) was very low. Only 17.2 sacks of sack oysters and 205 barrels of seed oysters were harvested from a total of 11 vessel-days of effort (Table 4.3). The only recorded harvest or documented effort was on the Lake Chien cultch plant.

The commercial fishery has evolved with age of the cultch plants (Table 4.3). Fishing effort in vessel-days and overall harvest initially increased each year as spat from the initial spat set grew into seed and sack oysters but then declined sharply in 2008. Only seed oysters were harvested the first two years, while in 2007 the harvest of sack oysters was almost three times greater than the seed harvest. Overall production on the two initial cultch plants is declining because of persistent high salinities, continued subsidence of the reef materials, and the detrimental effects of silt overburden from Hurricanes Katrina and Rita in 2005 and Gustav and Ike in 2008.

Cultch/reef samples were taken from three boats that contained seed oysters on the Lake Chien cultch plant. A shovel full of seed oysters was taken from each boat, placed in a small basket, and brought back to the lab for processing. Non-living reef material averaged 26.5% by weight of the total material.

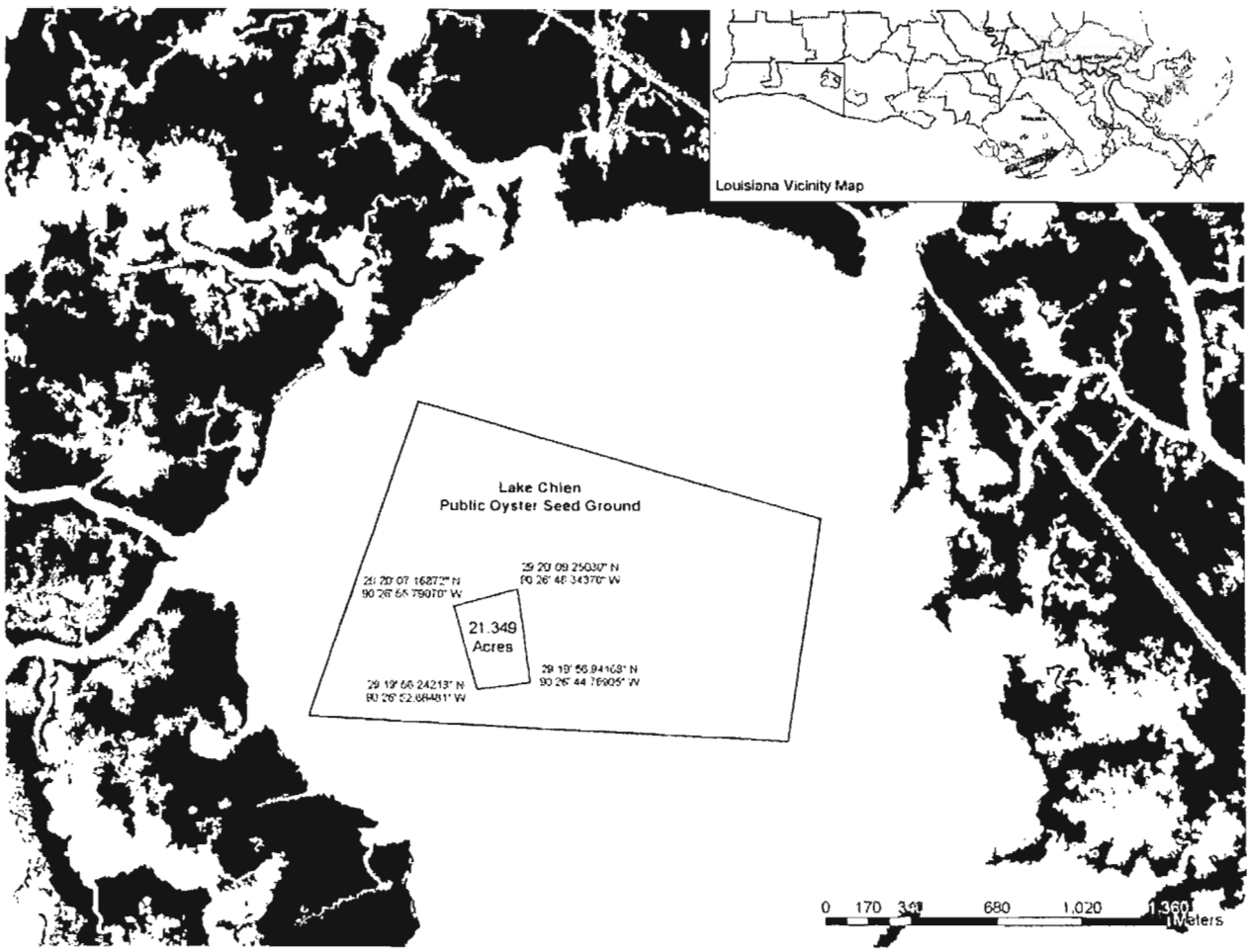


Figure 4.1. The Lake Chien Public Oyster Seed Ground and the approximate location of the 2004 cultch plant.

Figure 4.2. The Lake Felicity Public Oyster Seed Ground and the approximate location of the 2004 cultch plant.

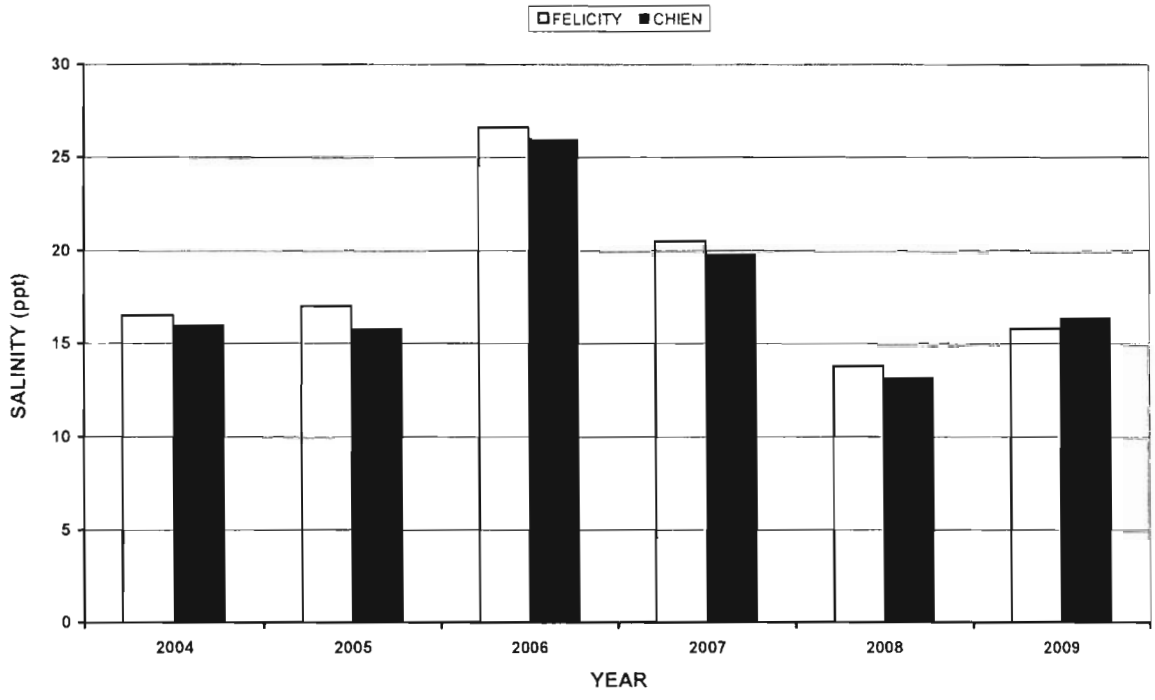


Figure 4.3. Mean salinities from annual square meter crop oyster samples

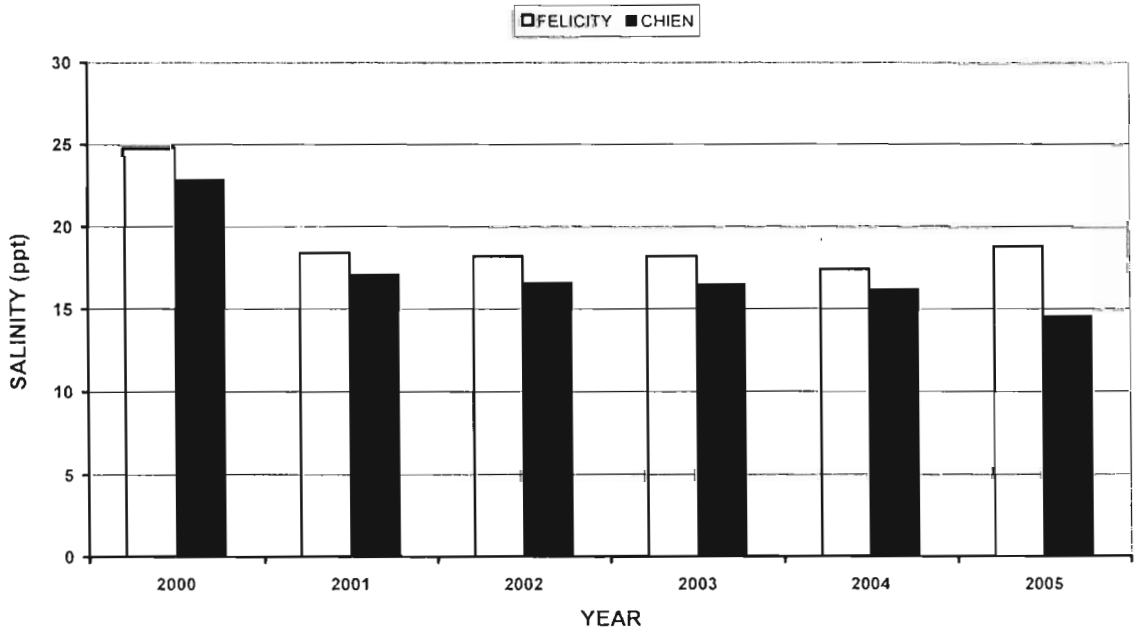


Figure 4.4. Mean salinities from pre-cultch plant hydrological monitoring

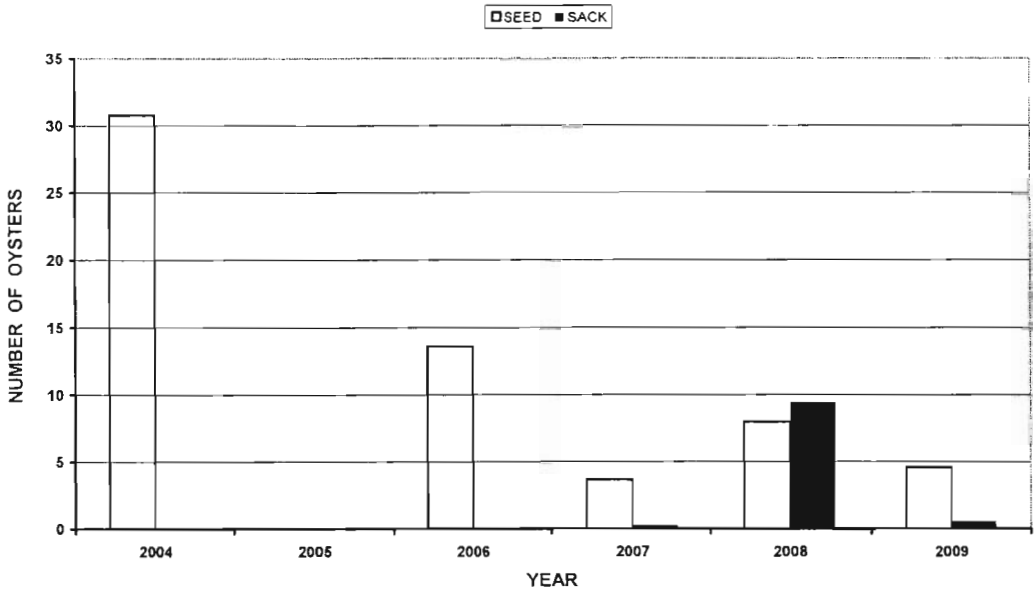


Figure 4.5. Mean numbers of seed and sack oysters per square meter, Lake Felicity cultch plant

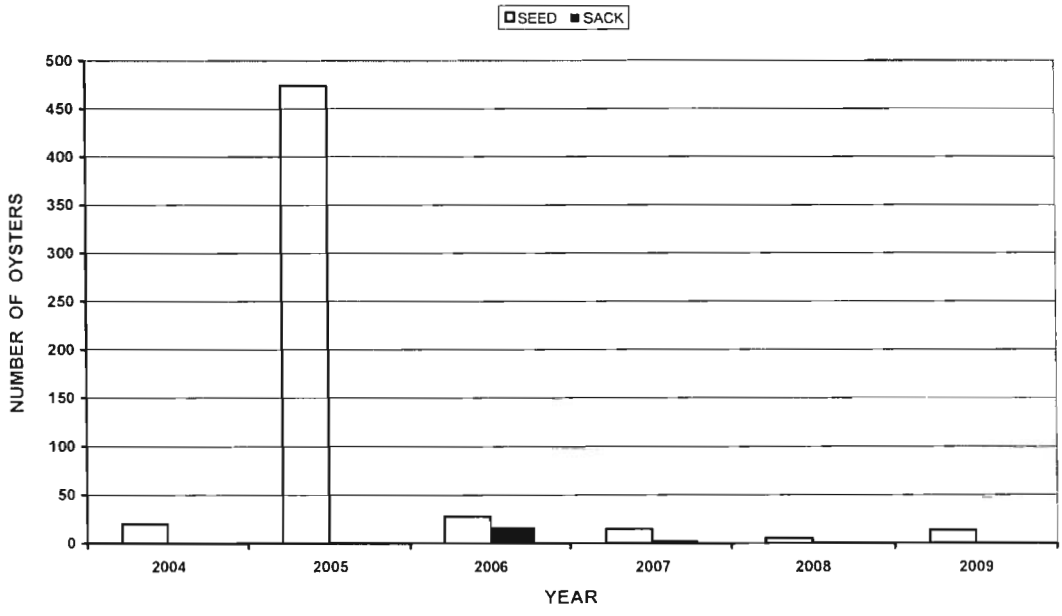


Figure 4.6. Mean numbers of seed and sack oysters per square meter, Lake Chien cultch plant

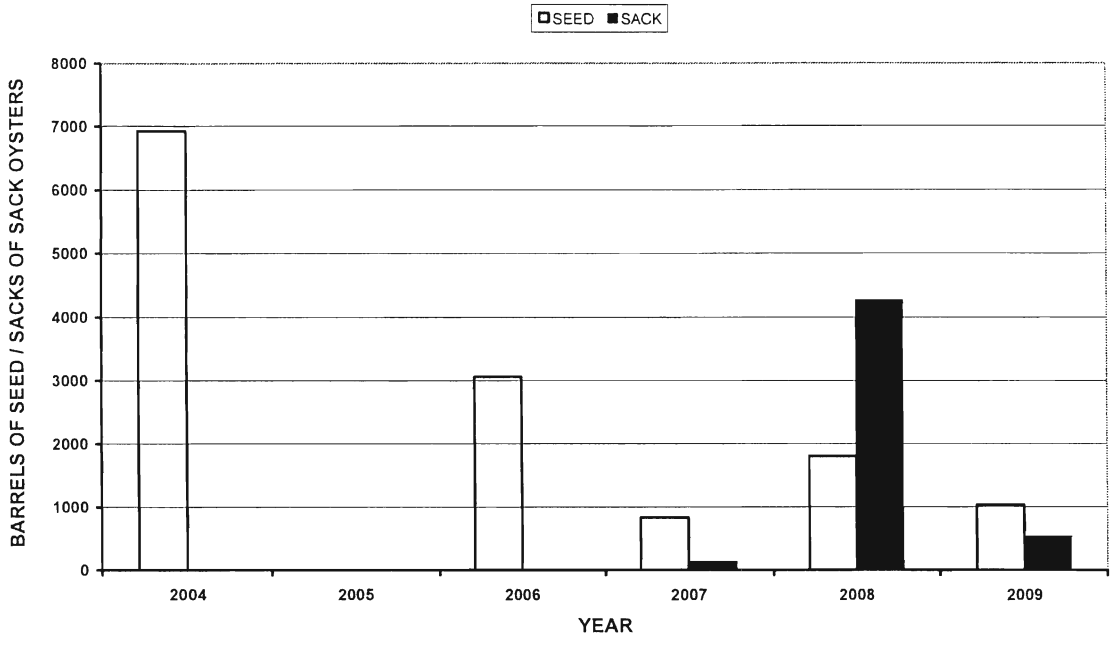


Figure 4.7. Estimated resource availability of seed and sack oysters, Lake Felicity cultch plant

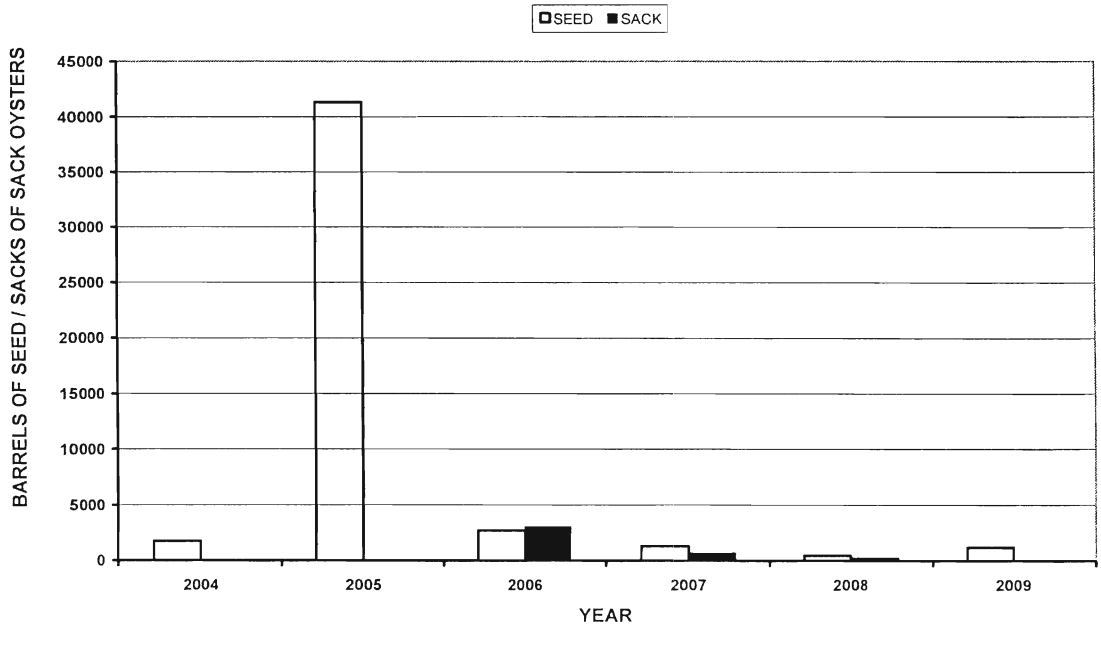


Figure 4.8. Estimated resource availability of seed and sack oysters, Lake Chien cultch plant

Table 4.1. Numbers per sample of live spat, seed, and sack oysters and percent mortalities from square meter samples, July 2009.

CULTCH PLANT	SAMPLE	NUMBER/SAMPLE			PERCENT MORTALITY		
		SPAT	SEED	SACK	SPAT	SEED	SACK
Lake Felicity	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	40	9	2	0	0	0
	4	172	2	0	0	0	0
	5	184	12	1	0	0	0
	Mean	79.2	4.6	.6	0	0	0
Lake Chien	1	3	1	0	0	0	0
	2	0	2	0	0	0	0
	3	22	22	0	0	0	0
	4	39	39	0	0	0	0
	5	20	5	0	0	0	0
	Mean	16.8	13.8	0	0	0	0

Table 4.2. Estimated annual standing crops of seed and sack oysters on the Lake Chien and Lake Felicity cultch plants based on 2009 square meter samples.

CULTCH PLANT	ESTIMATED RESOURCE	
	SEED OYSTERS (Barrels)	MARKET OYSTERS (Barrels)
Lake Felicity	1,202	0
Lake Chien	1,034	270
Total	2,236	270

Table 4.3. Historic commercial effort and seed oyster harvest in barrels and sack oyster harvest in sacks from the Lake Chien and Lake Felicity cultch plants.

DATES	PARAMETER	LAKE FELICITY	LAKE CHIEN	OVERALL
Dec 12-15, 2005	Effort	1	9	10
	Seed Oyster Harvest	15	252.5	267.5
	Sack Oyster Harvest	0	0	0
Nov 13-15, 2006	Effort	0	11	11
	Seed Oyster Harvest	0	1,940	1,940
	Sack Oyster Harvest	0	0	0
Oct 24-26, 2007	Effort	24	48	72
	Seed Oyster Harvest	470	2,157	2,627
	Sack Oyster Harvest	4,830	2,439	7,269
Oct 29-31, 2008	Effort	0	11	11
	Seed Oyster Harvest	0	205	205
	Sack Oyster Harvest	0	17.2	17.2
TOTAL	Effort	25	79	104
	Seed Oyster Harvest	485	4,554.5	5,039.5
	Sack Oyster Harvest	4,830	2,456.2	7,286.2

Coastal Study Area (CSA) 5 – 2009 Oyster Stock Assessment

Stephen Hein, Biologist Manager
LDWF Marine Fisheries Division
Houma Area Field Station, Bourg, LA 70343

Introduction

One of seven coastal study areas established in 1965, CSA-5 lies within the Terrebonne Basin and is located in southwest Terrebonne Parish. Within the nearly half million acres of euryhaline coastal marshland are three Public Oyster Seed Reservations (POSR)/Grounds (POSG):

Sister Lake (Caillou Lake) was designated as a POSR in 1940 and is comprised of 7,752 acres of water bottoms. The first known cultch deposition projects were established in Terrebonne Parish between 1906-1909 by the U.S. Bureau of Fisheries. Subsequent plantings by the State of Louisiana began in Sister Lake in 1917, totaling 25 projects with 4,268 acres of cultch materials. Recent Sister Lake cultch deposition projects include a 67-acre site in 2004 and a 156-acre site in 2009.

Bay Junop POSR was established in 1948 and consists of approximately 2,448 acres of water bottoms. Due to the shallow water depth of the bay and inability of barges and tugs to enter for cultch deposition, no reef-building projects have been implemented in this area to augment natural oyster reef production.

Lake Mechant is the most recent designated seed ground area (2001) with approximately 2,131 acres of water bottoms. In 2004, approximately 30 acres of the Lake Mechant POSG was planted with size 57 limestone to establish a cultch plant. In 2007 the Lake Mechant POSG was expanded to include approximately 500 acres of increased the POSG water bottoms to 2,631 acres. This expanded area was unleased water bottoms between the existing grounds and private oyster leases. This increased the POSG water bottoms to 2,631 acres. This expanded area was unavailable for harvest during the 2007-2008 season.

Materials and Methods

Coastal Study Area 5 meter square field samples were completed on July 1, 2009. Samples were collected using an aluminum square meter frame tossed randomly over known reef substrate at sites located within the Sister Lake and Bay Junop POSR's and the Lake Mechant POSG. Replicate samples were taken at each station and the average of the two was used to estimate oyster stock availability at each station. All live and dead oysters and shell within the upper portion of substrate was removed by SCUBA divers. Live and dead oysters, spat, oyster predators, and hooked mussels (*Ischadium recurvum*) were collected, identified and tallied. Oysters were measured in 5 millimeter (mm) size groups and then divided into three categories: spat (<25 mm), seed (25-74 mm) and sack (75 mm and larger) oysters. Results from these samples were then extrapolated using known reef acreage to yield an estimated stock size throughout the entire POSR or POSG.

A total of 31 square meter samples were collected at 15 locations including twenty samples in Sister Lake, eight in Bay Junop, and three in Lake Mechant (Figures 5.1, 5.2 and 5.3). Sites include the 2004 Sister Lake (MS218) and Lake Mechant (MS300) cultch plants (Figures 5.1 and 5.3). Additionally, eight sites within Lake Mechant's 500 acre extension were sampled utilizing a 24" dredge to

determine mortality in the lake. Five new sites located on the 2009, 156-acre shell plant in Sister Lake were also sampled by SCUBA divers utilizing ¼ meter samples. Four dredge samples were collected from Sister Lake and Bay Junop for "Dermo" (*Perkinsus marinus*) analysis.

Results and Discussion

Sister Lake: Estimated oyster availability for 2009-2010 is 88,887 barrels of seed and 43,387 barrels of sack oysters (Table 5.1). This represents an overall increase of 44% from last year's assessment, primarily in increased seed availability. Sack oysters decreased 13% and seed oysters increased 111% from the 2008-2009 assessment (Figure 5.4). The seed to sack ratio increased from 0.9:1.0 last year to 2.0:1.0 (Table 5.4).

Based upon a 2005 side scan sonar survey in Sister Lake, reef acreage was recalculated and increased 45% from 1,566 to 2,279 acres. This acreage increase was calculated into availability estimates beginning in 2006, thus resource estimates since that time are comparable only to those of 2006. Seed and sack mortality for last year's assessment was 6.2% while this year's overall mortality was 2.2%. Spat counts of 7.6/site were 57% below the five year average (17.8) and represent a 45% decrease from the previous assessment.

Significantly larger numbers of available seed and sack oysters are located in the northern end of Sister Lake. Four sites (stations 200, 202, 213, and 216) account for 76% of seed and 71% of sack oyster availability. Two of these sites (stations 200 and 216) are above the traditional November-February Department of Health and Hospitals (DHH) seasonal reclassification line within the lake and contribute 60% of available seed and 57% of available sack oysters (Figure 5.1).

Seed and sack oyster availability from the 67-acre 2004 cultch plant have been included in Sister Lake seed/sack availability totals since 2006. At its peak production in 2007, this cultch plant contributed 12% of the overall oyster availability (9,863 barrels seed and 20,822 barrels sack) in the lake. Samples this year revealed heavy overburden at this location with no live seed or sack oysters available.

A new 156 acre cultch plant was created in Sister Lake in May, 2009. Preliminary ¼ square meter sampling in July indicate a healthy spat set.

During this year's assessment, up to 6" of overburden was recorded at four of ten sample sites suggesting a lingering negative impact from hurricanes of recent years. These sites include the 1994 (stations 214 and 215), 1995 (station 217) and 2004 (station 218) cultch plants and are located south of the DHH reclassification line within the lake (Figure 5.1). Of these more southerly locations, most are relatively unproductive, contributing less than 24% of total seed availability and 29% of total sack availability.

Bay Junop: The 2009-2010 Bay Junop estimated stock availability is 490 barrels of seed oysters and 0 barrels of sack oysters. This is a 77% decrease in seed availability and 100% decrease in sack availability from 2008 (Figure 5.4). Seed to sack ratio has decreased from last year's assessment of 0.9:1.0 to 0:1.0 (Table 5.4). Overall mortality dropped to nearly zero, but so few oysters were collected during this assessment seed and sack mortality are difficult to discern. Spat sets averaged 9.6 spat per station which is 39% less than the five-year average of 15.7 spat/site. There were no sack

oysters at any site with the most significant decline at the northern end of the bay above the traditional November-February DHH line.

Lake Mechant: The 2009 assessment of the approximate 30-acre site included estimates of 225 barrels of seed oysters and 0 barrels of sack oysters available (Table 5.3), which represented a 92% decrease of seed and a total loss of sack oysters (Figure 5.4). Although additional resources are available on these grounds, lack of known reef locations and amount of productive reef acreage presently prevent an accurate population assessment of this lake. Dredge samples taken at eight random sites showed 100% mortality. Efforts continue to attain a more complete suitable oyster substrate assessment of this POSG.

Water Temperature and Salinity

Water temperatures in Sister Lake, Bay Junop and Lake Mechant were all above the long term average (LTA) for May and June with the greatest deviance being 1.2 degree Centigrade (°C) above the mean (Table 5.5). With one exception (Sister Lake salinity in May), salinities in Sister Lake, Bay Junop and Lake Mechant were all below their respective LTA (Figure 5.5, Table 5.6). Lake Mechant salinity for June [0.5 parts per thousand (ppt)] was below the LTA of 4.6 ppt. Westerly winds combined with high river stages decreased salinity levels throughout the area, but was accentuated in Lake Mechant through a north-south dispersal (Figure 5.5).

Predators/Disease/Fouling

Biofouling of hooked mussels in Sister Lake has increased from last year's assessment with two stations (213 and 217) accounting for 60% of the total hooked mussels observed. The number at the remaining eight stations averaged 7.8 hooked mussels per station. Biofouling rates of hooked mussels in Bay Junop have decreased from 18 in the 2008 assessment to 8 this year with the largest number (4) of mussels located at mid Bay Junop. Samples from Lake Mechant contained no predatory species and one hooked mussel.

Perkinsus marinus ("Dermo") samples were collected during square meter sampling and delivered to the University of New Orleans (UNO) for analysis by Dr. Tom Soniat. Results indicate "disease levels below the threshold of significant oyster mortalities".

No evidence of oyster drills (*Stramonita haemastoma*) was present in square meter samples. Other potential predators included a total of 32 unidentified mud crabs recorded from nine stations. Stone crab (*Menippe adina*), blue crabs (*Callinectes sapidus*), and Gulf toadfish (*Opsanus beta*) were not present in samples.

2008/2009 Oyster Season Summary

During the 2008-2009 Sister Lake and Bay Junop oyster seasons, the commercial fleet was monitored on a daily basis for estimated seed and sack harvests. These efforts, along with post season trip ticket reports are utilized to determine overall harvest. However, due to the time lag in receiving post season trip ticket reports, there is a need to closely monitor ongoing harvests. This allows measures to be taken to protect the remaining resource should problems arise.

Sister Lake: The 2008-2009 Sister Lake POSR opened for harvest from October 13-24, 2008. The industry requested and received a 50 sack daily limit on all boats harvesting Sister Lake seed grounds. Seventy (70) different vessels participated in the harvest for a total of 230 boat days of effort. Total lake harvest in the 12-day season was 3,365 barrels of seed and sack oysters. Of this total, 2,765 barrels were sack and 600 barrels were seed oysters which represents 6% and 1% respectively of the estimated availability. Sacking vessels averaged 26 sacks/day while bedding vessels averaged 46 barrels of spat/seed/sack and non-living cultch/day. This represented a sharp decrease in bedding efforts by industry from the previous season when bedding effort was the highest since the 1970's and was most likely associated with the Private Oyster Lease Rehabilitation Program (POLR) inducements.

Fourteen vessels were observed on the 2004 cultch plant on opening day with only two noted on subsequent days. Only 70 sacks of oysters are believed to have been harvested from this site. Of the lake's total oyster availability during 2007, this cultch plant produced 3,958 sack and 5,150 barrels of seed oysters for a total of 7,129 barrels accounting for 9% of the total sack oysters harvested and 30% of seed harvested. 2008-2009 season production dropped considerably and contributed only 1% of the lake's total production.

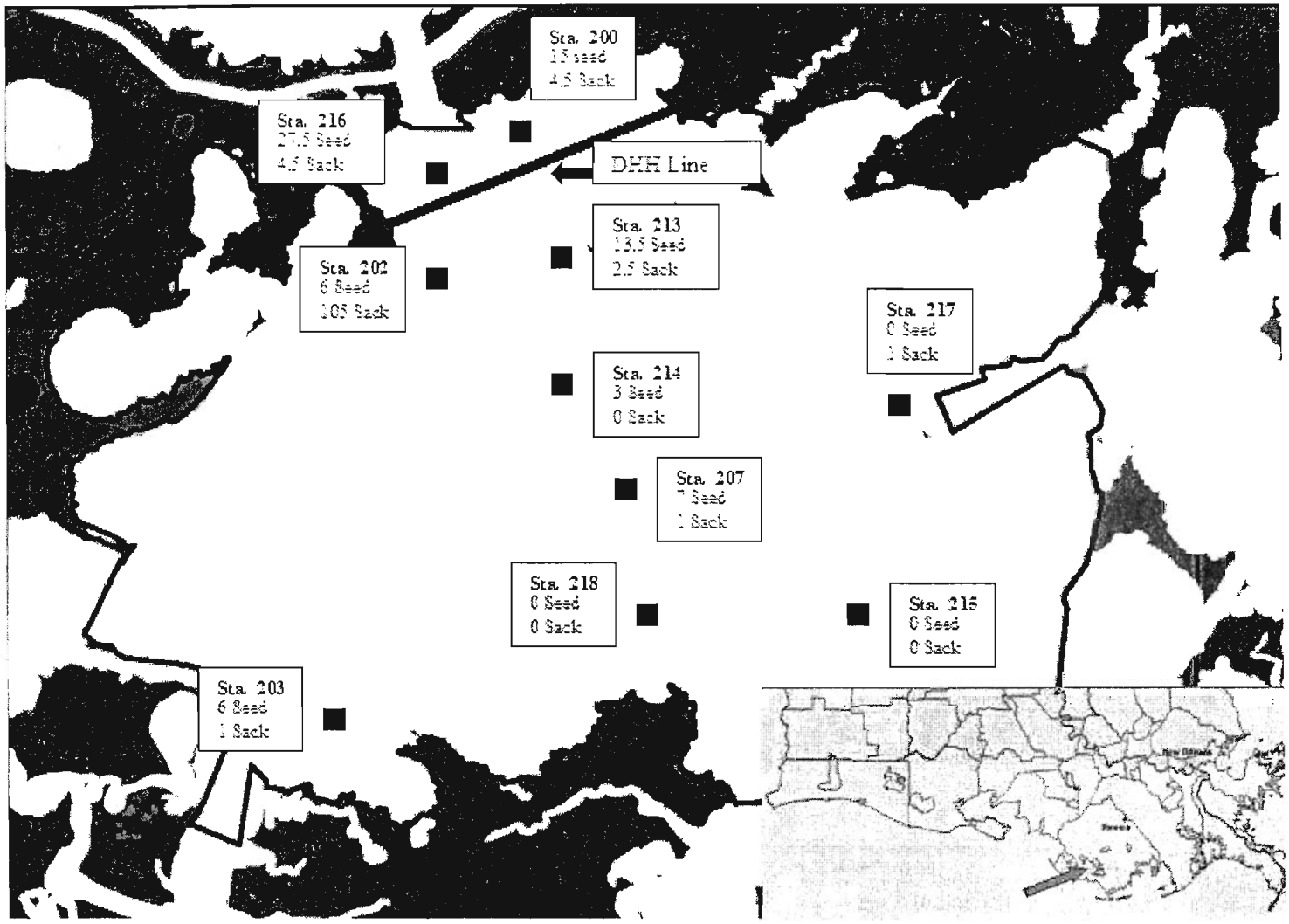
Mortality was continuously monitored as prior samples indicated a large portion of the reef was removed with much of the remaining reef buried during the 2007-2008 harvest operations. Freshly blackened and buried oysters were plentiful as oyster mortality was 16%, 51%, and 65% for sack, seed and spat oysters respectively. Following the 2008-2009 season, overall post harvest mortality was 7.4% but with 100% mortality on the 2004 cultch plant. This suggests that relatively small cultch plants such as this one (approximately 60 acres) cannot withstand the amount of fishing pressure expended by the modern commercial fleet even during a relatively short eight day season (2007-2008). Although the resource was large and healthy on opening day, it was quickly decimated by cultch and oyster removal with the lingering effects of diminished reef area for spat set, buried reef and dead/dying oysters.

Bay Junop: The Bay Junop POSR opened October 29-31 when nine vessels recorded 20 boat/days of effort. Of the estimated sack oyster availability, 737 sacks (16%) were harvested. No bedding effort was observed.

Lake Mechant: The Lake Mechant POSG was not opened for the 2008-2009 season.

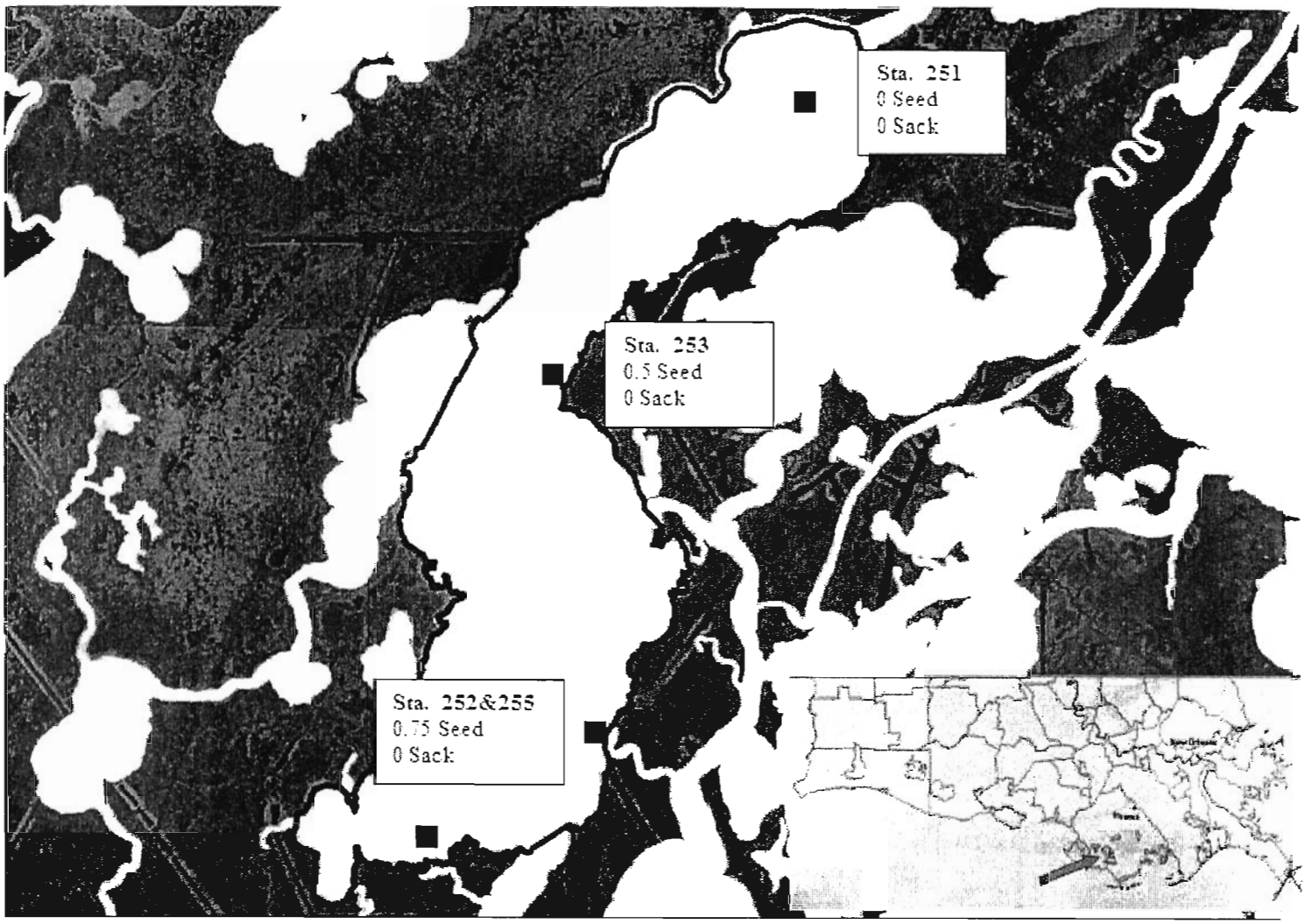
New Projects for CSA5

(1) The Department of Natural Resources Lake Mechant land bridge restoration project located on the northern shoreline of the lake just north of the 2004 cultch plant began in December 2008 and has a completion date of October 2009.
(2) As part of the POSG rehabilitation effort under the Supplemental Appropriation Louisiana Tasks (SALT) grant, portions of two cultch plants (1984 and 1995) were re-planted with approximately 22,600 cubic yards of reef materials during May 2009. This area encompasses 156 acres.
(3) Monitoring of living vs. non-living reef material in bedding loads.
(4) Attempts to quantify reef acreage on the Lake Mechant POSG continue.
(5) Potential project on horizon to enhance the existing land bridge between Sister Lake and the Gulf.



Stn. #	Stn. Name	North Lat.	West Long.	Depth
200	Grand Pass	29°15'28.5"	90°55'45.5"	10'
202	Walkers Pt.	29°14'50.9"	90°56'16.9"	6'
203	Old Camp	29°12'58.2"	90°56'40.2"	4'
207	Mid Sister Lake	29°14'00.1"	90°55'14.7"	6'
213	N '94 Shell Plant	29°15'02.9"	90°55'30.9"	6'
214	Mid '94 Shell Plant	29°14'16.5"	90°55'33.8"	6'
215	S '94 Shell Plant	29°13'14.1"	90°53'53.6"	5'
216	N '95 Shell Plant	29°15'25.1"	90°56'10.1"	5'
217	Camp '95 Shell Plant	29°14'21.8"	90°54'18.3"	5'
218	2004 Cultch Plant	29°13'24.6"	90°54'54 3"	5'

Figure 5.1 Map of the Sister Lake Public Oyster Seed Reservation showing the location of the 2009 meter square sample stations(average # of seed and sack oysters at each station).



Stn. #	Stn. Name	North Lat.	West Long.	Depth
251	Buckskin Bayou	29°15'56.1"	91°01'45.1"	6'
252	Rat Bayou	29°13'06.6"	91°02'52.6"	3'
253	Mid Bay Junop	29°14'43.7"	91°03'08.6"	5'
255	Bayou deWest	29°12'38.4"	91°03'18.2"	4'

Figure 5.2 Map of the Bay Junop Public Oyster Seed Reservation showing the location of the 2009 meter square sample stations (average # of seed and sack oysters at each station).

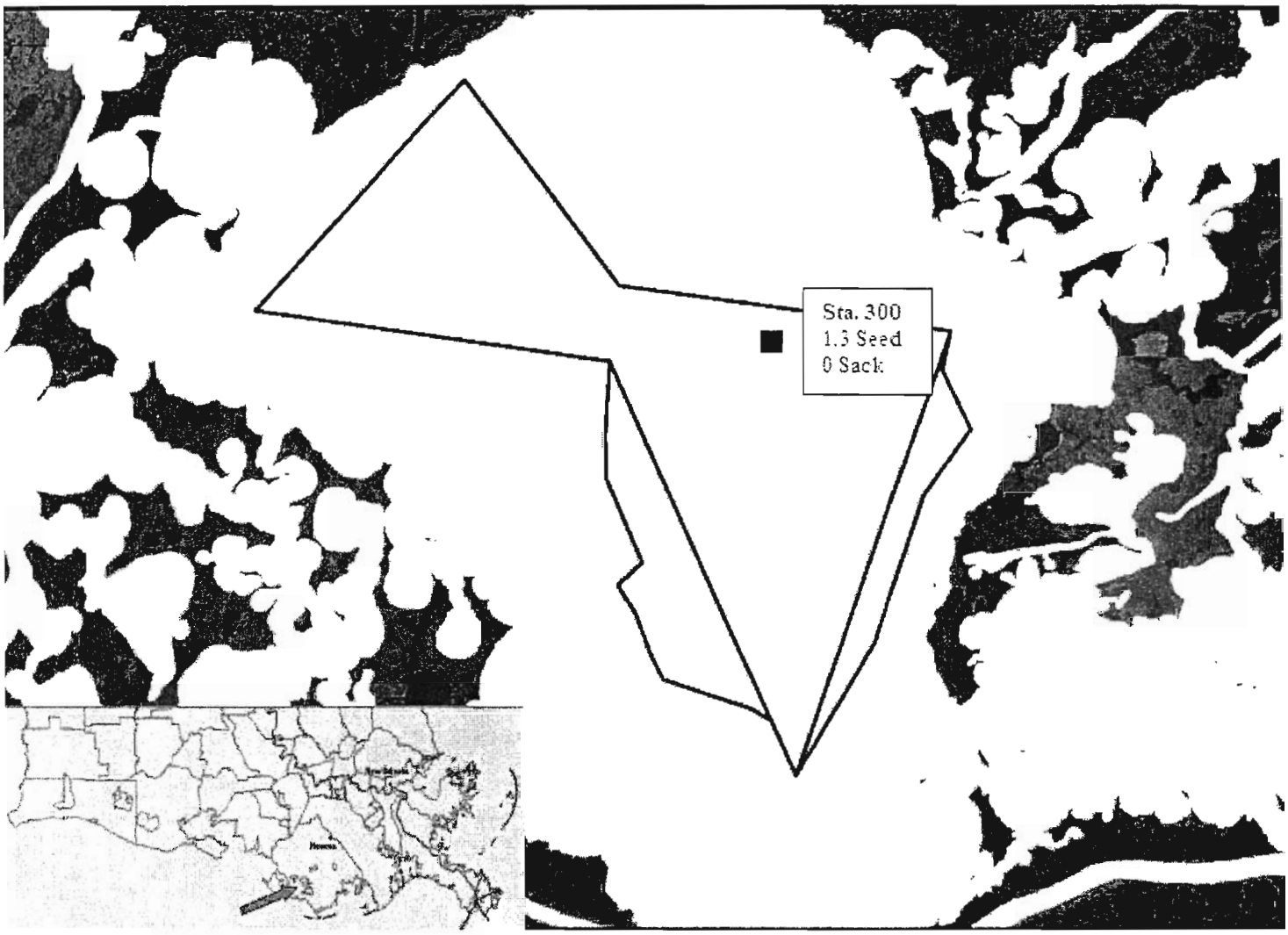
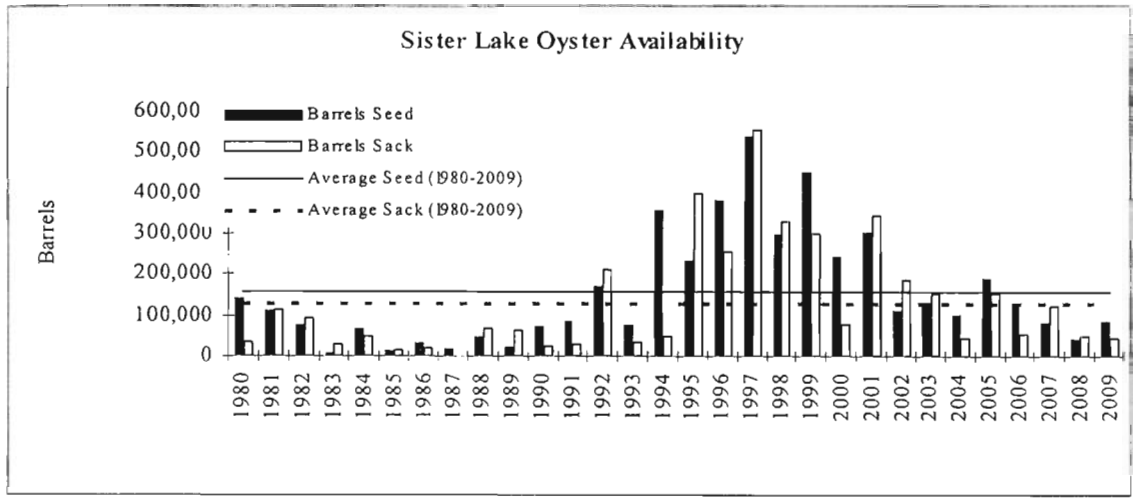
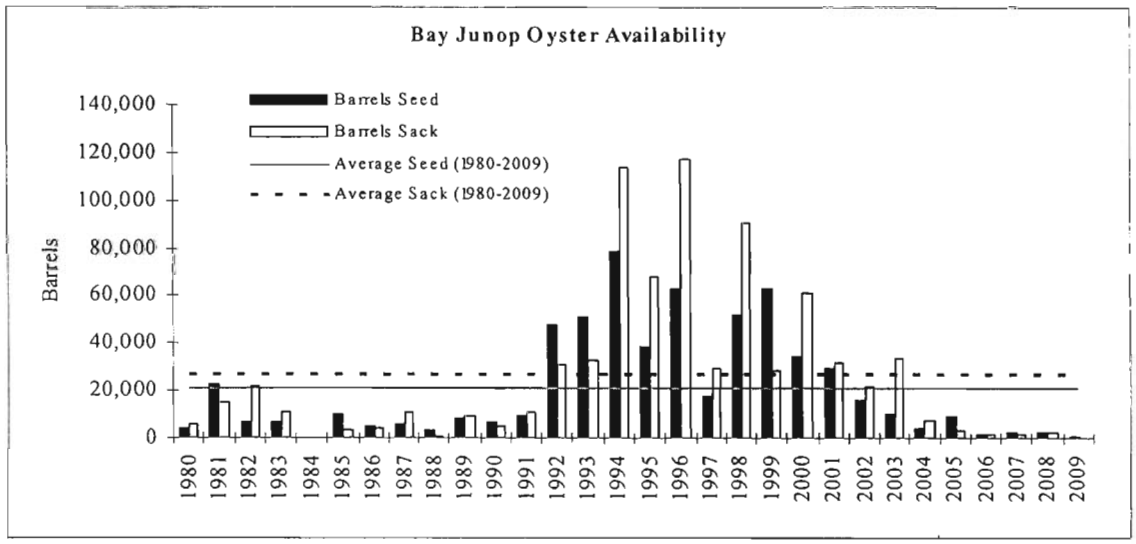


Figure 5.3 Lake Mechant Meter Square Samples (average # of seed and sack oysters at each station)





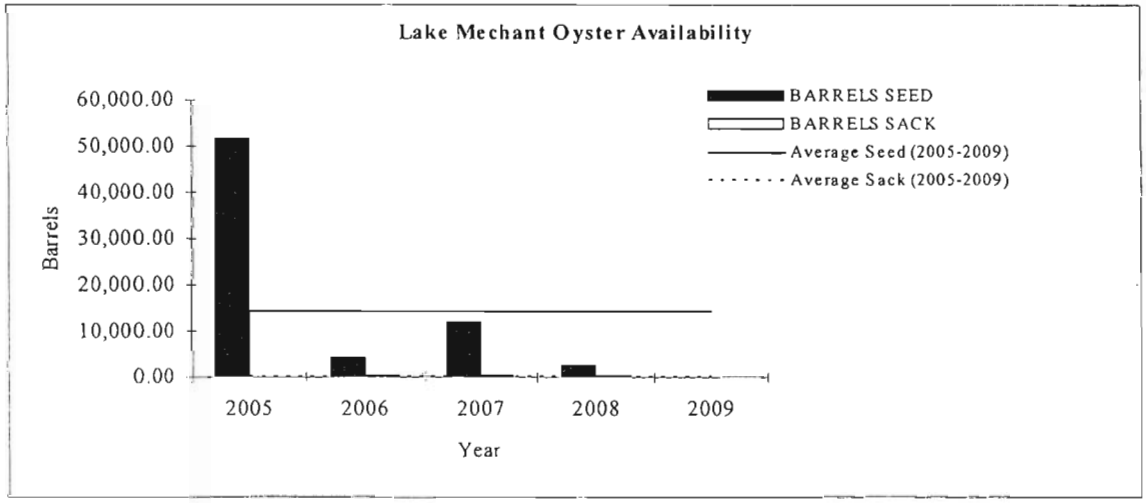
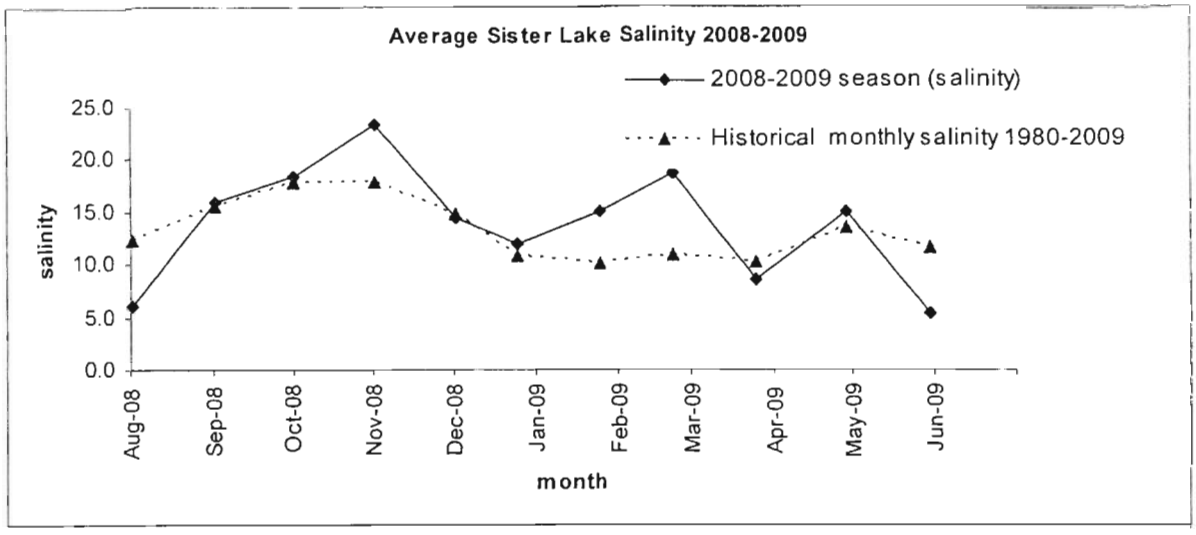
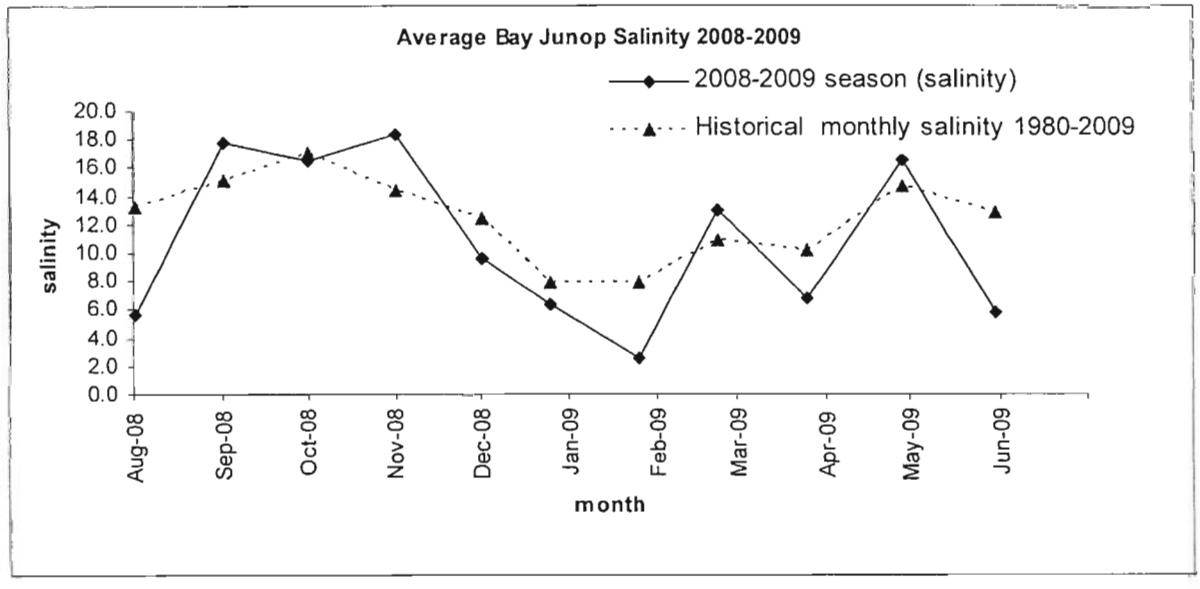
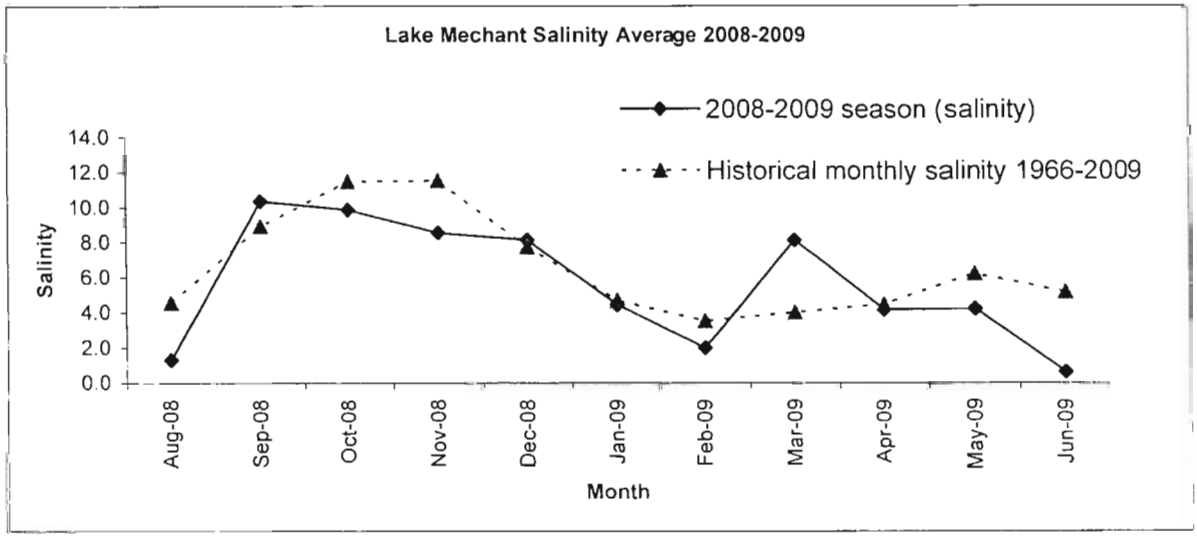


Figure 5.4 CSA 5 Historic Oyster Availability Estimates







Salinity averages calculated from all finfish, shellfish and oyster samples taken in respective lake

Figure 5.5 2008-2009 CSA 5 average salinities in Sister Lake, Bay Junop, and Lake Mechant

Table 5.1 2009 oyster availability at sample stations within Sister Lake

METER² STATION	HISTORICAL REEF ACREAGE	ADJUSTED REEF ACREAGE****	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
200	221.58	322	1,304,748.35	15	4.5	27,182.26	16,309.35
202	81.93	119	482,435.38	6	1.5	4,020.29	2,010.15
203	151.31	220	890,971.53	6	1	7,424.76	2,474.92
207	185.72	270	1,093,590.86	7	1	10,632.13	3,037.75
213*	96	140	565,284.96	13.5	2.5	10,599.09	3,925.59
214*	129	188	759,601.67	3	0	3,165.01	0
215*	81	118	476,959.19	0	0	0	0
216**	115	167	677,164.28	27.5	4.5	25,863.91	8,464.55
217**	438	637	2,579,112.63	0	1	0	7,164.20
218***	67	97	394,521.80	0	0	0	0
TOTAL		**2,279.32**	**9,224,390.64**	**78**	**16**	**88,887.45**	**43,386.51**

* 1994 Shell Plants

** 1995 Shell Plants

***2004 Sister Lake Cultch Plant newly added dredge/meter square site for 2007

****2005 Side Scan Sonar Survey conducted in May 2005 measured Sister Lake reef acreage to be 2,279 acres. This is an increase of 45.5% over prior years' estimates. Beginning in 2007, individual site acreage has been adjusted accordingly to reflect this increase.

Table 5.2 2009 oyster availability at sample stations within Bay Junop

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
251	17.20	69,608.40	0	0	0	0
252*	67.36	272,605.92	.75	0	283.96	0
253	73.26	296,483.22	.5	0	205.89	0
TOTAL	**157.82**	**638,697.50**	**1.25**	**0**	**489.85**	**0**

* Stations 252 and 255 are combined

Table 5.3 2009 oyster availability at sample stations within Lake Mechant

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS
300	30	121,410.00	1.3	0	224.83	0

Table 5.4 CSA 5 Historic meter square Seed to Sack Ratios

Year	Sister Lake	Bay Junop	Lake Mechant
1980	4.1-1.0	0.8-1.0	
1981	1.0-1.0	1.5-1.0	
1982	0.8-1.0	0.3-1.0	
1983	0.3-1.0	0.6-1.0	
1984	1.4-1.0	----	
1985	0.8-1.0	3.0-1.0	
1986	1.5-1.0	1.1-1.0	
1987	9.2-1.0	0.5-1.0	
1988	0.7-1.0	2.8-1.0	
1989	0.4-1.0	0.9-1.0	
1990	3.0-1.0	1.3-1.0	
1991	3.0-1.0	0.8-1.0	
1992	0.8-1.0	1.5-1.0	
1993	2.2-1.0	1.6-1.0	
1994	7.1-1.0	0.7-1.0	
1995	0.6-1.0	0.6-1.0	
1996	1.5-1.0	0.5-1.0	
1997	1.0-1.0	0.6-1.0	
1998	0.9-1.0	0.6-1.0	
1999	1.5-1.0	2.2-1.0	
2000	3.2-1.0	0.6-1.0	
2001	0.9-1.0	0.9-1.0	
2002	0.6-1.0	0.7-1.0	
2003	0.9-1.0	0.3-1.0	
2004	2.4-1.0	0.5-1.0	
2005	1.3-1.0	2.8-1.0	n/a
2006	2.5-1.0	1.1-1.0	16.5:1
2007	0.7-1.0	1.5-1.0	21.3:1
2008	0.9-1.0	0.9-1.0	11.5:1
2009	2.0-1.0	0.0-1.0	0.0-1.0
Average ratios (1980-2009)	1.9-1.0	1.1-1.0	12.3-1.0

Table 5.5 Sister Lake, Bay Junop, and Lake Mechant historic May/June average water temperature (°C)

	SISTER LAKE		BAY JUNOP		LAKE MECHANT	
YEAR	MAY	JUNE	MAY	JUNE	MAY	JUNE
1995	27.3	29.0	29.3	29.3		
1996	27.2	29.5	28.4	30.3		
1997	27.1	30.0	26.4	28.6		
1998	27.8	30.1	28.0	28.9		
1999	25.0	28.8	25.0	28.8		
2000	27.3	28.8	28.3	29.7		
*2001	24.9	29.3	26.0	30.1		
*2002	28.4	28.7	28.4	28.5	25.6	28.2
*2003	27.8	30.0	27.6	30.2	27.1	29.6
*2004	27.8	29.5	27.5	29.2	26.0	29.5
2005	26.5	30.1	26.2	30.2	25.8	29.2
2006	27.1	30.6	25.7	30.9	26.6	30.1
2007	25.9	29.3	25.9	29.0	29.0	29.3
2008	26.7	29.4	26.3	29.5	26.8	29.4
2009	28.2	30.8	28.1	30.2	27.5	30.3
mean	**27.0**	**29.6**	**27.1**	**29.6**	**26.8**	**29.5**

*OYSTER DREDGE SAMPLES

Table 5.6 Sister Lake, Bay Junop, and Lake Mechant historic May/June average salinity (ppt)

	SISTER LAKE		BAY JUNOP		LAKE MECHANT	
YEAR	MAY	JUNE	MAY	JUNE	MAY	JUNE
1995	14.5	8.8	23.3	12.6		
1996	15.8	7.4	24.3	12.2		
1997	4.1	3.4	10.6	10.7		
1998	6.6	4.8	14.4	8.6		
1999	17.7	12.4	19.4	13.0		
2000	22.0	20.5	25.5	27.7		
*2001	17.6	8.2	18.4	9.8		
*2002	14.2	11.1	16.6	15.9	3.1	2.4
*2003	15.4	7.2	18.2	8.9	7.5	2.4
*2004	17.2	12.2	18.9	18.6	4.5	3.1
2005	15.3	17.0	16.9	20.0	2.1	7.2
2006	16.9	18.5	21.3	15.4	10.7	10.3
2007	20.5	18.2	21.8	18.2	12.5	10.4
2008	6.3	6.4	5.7	5.6	0.4	0.5
2009	15.4	5.3	16.9	7.2	4.9	0.5
mean	**14.6**	**10.8**	**18.1**	**13.6**	**5.7**	**4.6**

*OYSTER DREDGE SAMPLES

Table 5.7 Historic oyster harvest (production) in Sister Lake (1944-2009)

Season	Boat Days	Seed (BBLS)	Sack (BBLS)	Total Production (BBLS)	Season Length (days)	Catch/Effort (BBLs)
1944 & 1945	--	--	--	108550 (two years)	--	0
1946 & 1947	--	--	--	217100 (two years)	--	0
1948	--	--	--	no data	--	0
1949	--	--	--	4884	--	0
1950	--	--	--	20677	--	0
1951	closed	--	--	--	--	0
1952	closed	--	--	--	--	0
1953	--	--	--	91588	190	0
1955 (tonging only)	no data	--	--	--	--	0
1956	--	--	--	20000	--	0
1957	--	--	--	11000	45	0
1958-1959	4500 (tonging only) 15000 (tong & dredge)				131	0
1959-1960	closed	--	--	--	--	0
1960-1961	--	--	--	90000	--	0
1961-1962	closed	--	--	--	--	0
1962-1963	--	--	--	50000	292	0
1963-1964	closed	--	--	--	--	0
1964-1965	--	44623	4365	48988	292	0
1965-1966	closed	--	--	--	--	0
1966-1967	--	120614	9848	130462	292	0
1967-1971	no data	--	--	--	--	0
1971-1972	953	36082	16414	52496	260	1.8
1974-1975	204	35683	862	36545	258	0.6
1976-1977	1268	45101	20028	65129	254	1.9
1978-1979	1191	33649	21218	54867	116	2.2
1980-1981	1031	38067	11517	49584	210	2.1
10/12-10/31/81	365	21780	4404	26184	19	1.4
1982-1983	1838	45965	44092	90057	67	2.0
1984-1985	1552	53911	15292	69203	181	2.2
1986-1987	1644	58095	13079	71174	102	2.3
1988-1989	661	26371	7152	33523	197	2.0
1990	780	30427	6751	37178	9	2.1
1992-1993	1203	11215	14873	26088	204	4.6
1993-1994	448	6901	4203	11104	115	4.0
1995-1996	2173	51160	48824	99984	236	2.2
1996-1997	1854	20055	40019	60074	149	3.1
1997-1998	2341	31668	43727	75395	208	3.1
10/5/98-10/12/98	767	15228	16510	31738	12	2.4
1999-2000	3153	29934	47586	77520	255	4.1
2001-2002	1428	18183	34060	52243	196	2.7
2003-2004	1453	11840	51872	63712	30	2.3
2005-2006	2102	3900	61408	65308	42	3.2
2007-2008	1549	19450	40711	60161	27	2.6
2008-2009	230	600	2765	3365	12	6.8

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Coastal Study Area (CSA) 6 – 2009 Oyster Stock Assessment

E. Paul Cook, Biologist Manager
LDWF Marine Fisheries Division
New Iberia Field Office, New Iberia, LA 70560

Introduction

Oyster reefs found in Vermilion/East and West Cote Blanche/Atchafalaya Public Oyster Seed Ground generally fall within the boundaries of Coastal Study Area 6 (CSA6). The inside oyster seed ground, promulgated by the Louisiana Wildlife and Fisheries Commission in 1990, consists of that portion of state water bottoms found in inside waters from the western shore of Vermilion Bay and Southwest Pass eastward to Point Au Fer. The outside area, designated in 1988, consists of Louisiana State Territorial Waters from the private oyster lease boundary near Mound Point/Marsh Island eastward to Point Au Fer (Figure 6.1). Since 1986 (prior to the official designation of these areas as seed grounds) LDWF has managed the oyster resources found on local state water bottoms in a manner similar to present seed ground protocols. This allowed limited harvest/relays from the Vermilion Bay area when hydrological conditions and oyster abundance and distribution permitted.

The Vermilion/Cote Blanche/Atchafalaya Bays Complex is a large, primarily open-water brackish system with the area seed grounds consisting of approximately 541,787 water bottom acres. Primary influences on the bays dynamic salinity regime are the Gulf of Mexico, Atchafalaya River and the adjacent Wax Lake Outlet, and the Vermilion River. In general, oyster productivity on the public oyster seed grounds within CSA 6 is highly influenced by freshwater discharge from the Atchafalaya River. Typically, reproduction occurs in the fall after the river stage abates, with oysters growing to seed sizes (1 inch to < 3 inches) by the following spring. Rising spring and early summer floodwaters depress salinities, placing extreme physiological stress on the animals. Low salinities coupled with high water temperatures through the summer months often result in extensive oyster mortalities on the public grounds. Occasionally, however, reduced freshwater inflow from the Atchafalaya River leads to increased salinity (and an associated reduction in stresses to the oyster resource) and the normal annual cycle of extensive mortalities is broken. These circumstances can lead to the availability of a harvestable population of seed oysters during the following season (September through April). Such was the case in 2000, 2001, 2005, 2006, and 2007 when sizeable quantities of seed oysters were available for harvest.

An overall Vermilion Bay area stock assessment is not possible at this time, as figures relative to oyster reef sizes are not available. However, data collected from this year's sampling program will be compared to previous years' data, with a look at hydrologic conditions, marine fouling, and oyster predators on sampled reefs. The effects of extended high Atchafalaya River levels during the period of March 2009 through June 2009 will be addressed. In addition, information regarding the 2008/2009 oyster season harvest on the Vermilion Bay area public oyster seed grounds will be presented.

Materials and Methods

Square meter field sampling at historically-designated sites on the inside and outside areas of the Vermilion, East and West Cote Blanche and Atchafalaya Bays Public Oyster Seed Ground was completed on July 8, 2009. A total of 5 (five) stations (Figure 6.1) were sampled with two replicate samples collected at each station. Upon reaching the designated site the square meter frame was randomly thrown onto the oyster reef. A SCUBA diver removed all oysters, associated macroscopic organisms, and loose surface shell within the frame. All live oysters and shells from recently dead oysters greater than 25 mm were counted, measured in 5 mm intervals, then classified as spat (<25 mm), seed (25 mm to < 75mm), or sack oysters (>75mm). Shells from dead oysters were defined as "box" (both valves attached) or "valve" (one valve). Oyster size was determined by measuring the "straight-line" distance from the hinge to the apex of the shell. Live predators and fouling organisms were counted. Cultch type and reef condition were noted.

Results and Discussion

Seed and Sack Stock

Live seed-sized oysters were found only at the Indian Point and Big Charles sites (located in Vermilion Bay north of Southwest Pass), with replicates averaging 15.0 and 2.0 oysters respectively. Despite these relatively low numbers, this represents an improvement over the almost complete lack of seed documented for the same area in the 2008 assessment. Similar to last year's survey, no seed oysters were found at the sample sites located near the east end of Marsh Island. No sack oysters were taken at any of the sites surveyed in 2009 (Figure 6.1).

Low production years associated with extended periods of high Atchafalaya River output are not uncommon on the seed grounds of this bay system. Near 100% mortality on the grounds was noted as recently as 2003, 2004, and 2008 (Table 6.1).

Spat Production

One spat was found in single replicate samples at both the South Point and Big Charles sites. Spat were not present at the other sample locations in spite of the presence of suitable substrate at all sites (Figure 6.1).

Fouling organisms

Despite low salinity conditions (usually considered conducive to mussel productivity) seen during the months leading up to the 2009 assessment, the hooked mussel *(Ischadium recurvum)* was found at only two of the five sample sites. Although comparable to mean density numbers observed over the previous five years, a significant increase in mussel numbers since the 2008 assessment was recorded at the Indian Point and Dry Reef sites (Table 6.2).

Oyster Predators

No evidence of the southern oyster drill *(Stramonita haemastoma)* was noted in any of the square meter samples, which is not surprising considering the depressed salinities in this area. These predatory marine snails are more often associated with higher saline waters where they are known to prey heavily on oysters and other bivalve species. Two mud crabs *(Xanthidae sp.)* were

found at the South Point station. There were no blue crab *(Callinectes sapidus)* or stone crab *(Menippe adina)* collected.

Disease
Live oysters were collected at the Indian Point and South Point stations during square meter sampling and delivered to Dr. Tom Soniat at the University of New Orleans for analysis of "dermo" *(Perkinsus marinus)* infestation. Dr. Soniat reported that there was no incidence of infestation at either site. This result is not unexpected as this oyster disease typically thrives in more saline waters.

Mortality
The oyster resource found in the area is highly vulnerable to low salinity/high turbidity conditions often seen as a result of extended freshwater conditions associated with high river discharge. Independent of local rainfall, rising water levels at the Butte La Rose gauge can generally be tied to falling salinity levels in the Vermilion Bays complex. This correlation was documented for the fall/winter of 2008 and spring/early summer of 2009 (Figure 6.2), with its effects on local oysters noted in this year's assessment.

High Atchafalaya River levels and associated freshwater conditions beginning in March 2009 have produced dramatic negative effects that induced significant mortality on sampled seed ground reefs. Following the near 100% mortality event documented on the Vermilion Area seed grounds in the July 2008 stock assessment, the oyster resource began a recovery as early as August of last year. A successful spat set was recorded in September and October 2008, with a succession into plentiful seed-sized oysters by October's end. Atchafalaya River stages and associated salinity levels were conducive to productivity and growth until March 2009 when the Butte La Rose gauge topped 10 feet. By mid-May the high river had driven salinity levels below 2 parts per thousand (ppt) throughout most of the bays system. Rising summer-time water temperatures along with freshwater conditions probably induced the significant mortality event observed in dredge samples in the latter part of May 2009 and early June 2009. Persistent west winds beginning in mid-June and continuing through the first week of July pushed high salinity Gulf waters inshore and caused a rarely seen salinity spike at all sites sampled for the 2009 assessment. Salinity ranged from 16.9 ppt at Dry Reef to 30.0 ppt at Indian Point (near Southwest Pass) while average water temperature across all sampled sites was 29.3° C. This increase in salinity, if it persists, may lead to increased oyster survival in the area.

Tropical and Climatic Events
Hurricane Gustav made landfall on September 1, 2008 as a category 2 storm at Cocodrie, Louisiana. With landfall to the east of the Vermilion area seed grounds, tropical storm force winds were primarily from the north and northwest. As winds moved to the south after the storm's passage, a surge of +3 to +4 feet (NAVD 88) was recorded across Marsh Island and surrounding waters. Dredge samples taken on the seed ground following the tropical event found no silt deposition or vegetative overburden.

Hurricane Ike made landfall at Galveston Island, Texas on September 13, 2008 as a category 2 hurricane. The wind field was unusually large and impacts were observed along the entire Louisiana coast. Storm surge in Vermilion parish was estimated at +10 to +12 feet while Iberia

and St. Mary parishes saw +7 to +9 feet (NAVD88). The surge was similar to that experienced during Hurricane Rita in 2005. Dredge samples taken at designated sites on September 15-16, 2008 found that both Bayou Blanc and Big Charles stations had heavy silt and vegetative overburden, with a storm induced mortality of 30% and 27% respectively.

2008/2009 Oyster Season Summary

Methods

Roving surveys on portions of the seed grounds with "OPEN" designation under DHH's classification system and areas under DHH relay permit are made to obtain fishery dependent data (i.e. harvest estimates). Fishermen working the seed ground are surveyed and asked to provide estimates of past and current catch rates as well as an estimate of future fishing effort. These data are summarized weekly to maintain a cumulative estimate of harvest for specific reef complexes.

Results & Discussion

The Vermilion/East and West Cote Blanche/Atchafalaya Bay Public Oyster Seed Grounds opened one-half hour before sunrise on September 3, 2008 for the harvest of seed oysters for bedding purposes only until one-half hour after sunset on October 12, 2008. The area re-opened at one-half hour before sunrise on October 13 for taking both seed and sack oysters and closed one-half hour after sunset on April 30, 2009. No harvest of seed or sack oysters was observed or reported on the inside or outside seed grounds for the 2008/2009 season.

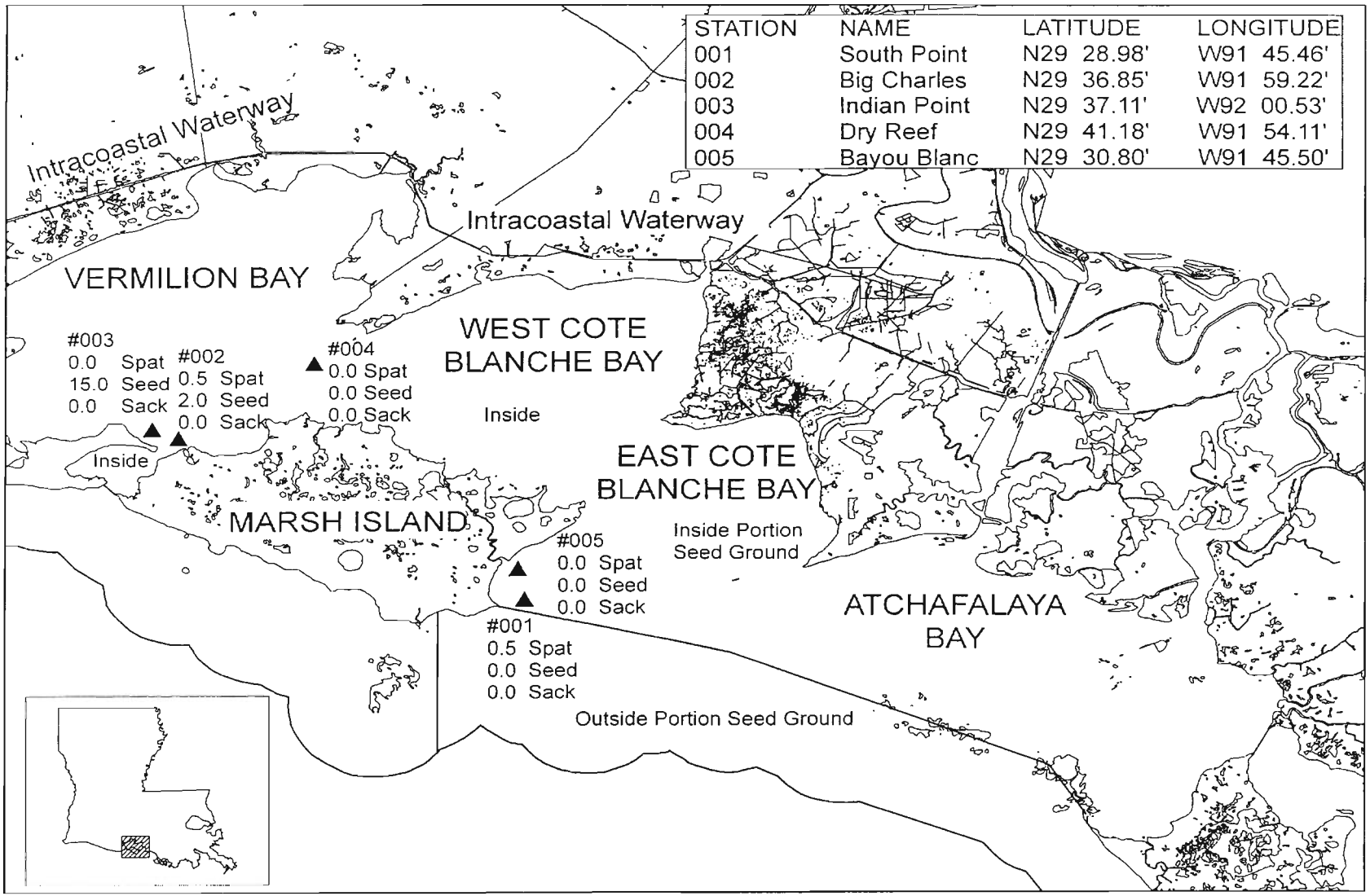

Figure 6.1. Map designating CSA 6 2009 oyster stock assessment stations on the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data below station numbers represent average spat, seed and sack oysters per square meter sample.

Table 6.1. Mean density of live oysters collected in CSA6 square meter samples (by year)

Year	mean density seed/sample	mean density sack/sample	seed/sack ratio
1998	2.70	0	No Sack Oysters
1999	5.50	0.20	27.5:1
2000	81.40	3.30	24.7:1
2001	28.80	4.80	6.0:1
2002	2.25	0.25	9.0:1
2003	1.20	0	No Sack Oysters
2004	4.30	0	No Sack Oysters
2005	14.80	0	No Sack Oysters
2006	16.10	0.5	32.2:1
2007	11.60	0.8	14.5:1
2008	0.30	0.0	No Sack Oysters
2009	3.4	0.0	No Sack Oysters

Table 6.2 Mean density of the hooked mussel, *Ishadium recurvum*, recorded at each CSA6 square meter station (by year)

station no.	station name	2004	2005	2006	2007	2008	2009
001	South Pt./Marsh Island	34	28	16	26.0	1.0	0.0
002	Big Charles	45	12.5	17	16.0	2.5	0.0
003	Indian Point	92	43	9	33.5	0.5	16.0
004	Dry Reef	23	8.5	0	0	2.0	37.0
005	Bayou Blanc	33	9.5	7	18.5	2.5	0.0

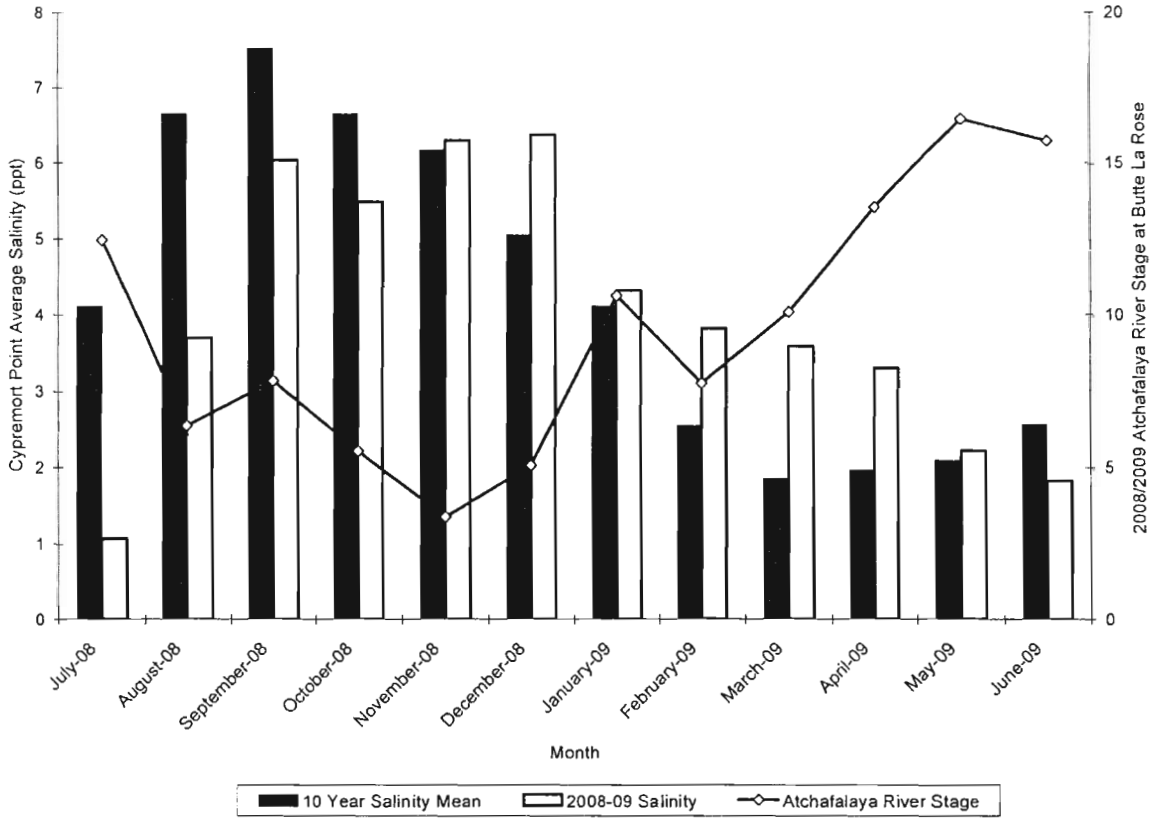

Figure 6.2. Graph depicting monthly Atchafalaya River levels at Butte La Rose gauge and monthly average salinity for Cypremort Point, LA during the period from July 2008 through June 2009. Ten year mean monthly salinity at Cypremort Point included.

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Coast Study Area (CSA) 7 – Oyster Stock Assessment

Michael Dean Harbison, Biologist Manager
LDWF Marine Fisheries Division
Lake Charles Field Office, Lake Charles, LA 70601

Introduction

Louisiana Department of Wildlife and Fisheries' (LDWF) Coastal Study Area VII is located in Southwest Louisiana, from the Louisiana/Texas state line to Freshwater Bayou in Vermilion Parish. It is comprised of Calcasieu and Mermentau River basins and the eastern portion of the Sabine River Basin. Calcasieu Lake is located at the southern end of the basin in Calcasieu and Cameron parishes. It consists of approximately 58,260 water bottom acres with healthy oyster reefs located throughout the lake, especially in the southern end.

Oyster seasons occurred prior to 1967, but were closed from 1967-1975. Oyster harvesting resumed in 1975 with only taking by hand or tongs allowed. In 2004, legislation was passed allowing for the use of hand oyster dredges of three feet wide or less in Calcasieu Lake.

For assessment purposes, Calcasieu Lake has always been split into two areas – Eastside and Westcove (the Calcasieu Ship Channel being the dividing line). In 1992, Louisiana Department of Health and Hospitals (LDHH) also split the lake into two separately managed areas – Calcasieu Lake Conditional Managed Area (CLCMA) and West Cove Conditional Managed Area (WCCMA), (Figures 7.1 and 7.2). When this change occurred the two areas were also managed for health related closures based on the river stage of the Calcasieu River at Kinder, LA. CLCMA would close when the river stage reached to 12 feet and the WCCMA would close when the river stage reached 7 feet. Once the river fell below these levels for 48 hours the LDHH would reopen the areas for harvest. LDHH changed the CLCMA river stage threshold in 1998 to 13.5 feet. In 2004 LDHH changed CLCMA to Growing Area (GA) 29 and WCCMA to GA 30.

LDHH also limited the amount of acreage available to oyster harvest on the Eastside due to water quality standards. Oysters can only be harvested in the southern portion of the area where water quality meets minimum standards. The total area has been changed several times over the years with the current acreage being approximately 14,743 water bottom acres. WCCMA has remained the same at approximately 9,248 acres.

Historical reef acreage for all of Calcasieu Lake is 1,690.95. West Cove consists of 726.98 acres and the Eastside consists of 963.97 acres. The reef acreage on the Eastside is made up of reefs that fall both within and outside of the conditional managed area. Therefore, assessments of current stock sizes are based on total reef acreage within the lake and not just that portion of reef acreage that lies within areas accessible to commercial fishing.

LDWF contracted ENCOS to do a comprehensive water bottom assessment of a portion (approximately 10,421 of 52,878 acres) of Calcasieu Lake and a portion of Sabine Lake (approximately 11,405 of 32,200 acres) in the latter half of 2008.

The Calcasieu portion was split with some of the assessment in West Cove and some on the Eastside. The West Cove assessment indicates 2,190.0 acres of Type I (soft mud) bottom, 289.0 acres of Type II

bottom (moderately firm mud, firm mud, and buried shell), 2,472.5 acres of Type III B bottom (slightly covered buried shell and exposed reef). Eastside assessment indicates 4,034.9 acres of Type II bottom, 1434.3 acres of Type III B bottom.

The Sabine Lake assessment indicated 6,125.2 acres of Type I bottom, 3,800.4 acres of Type II bottom and 1,479.5 acres of Type III B bottom.

LDWF placed a 14.3 acre cultch plant in the southern portion of GA 30 (on the south side of the "Old Revetment") in May of 2009. Sampling in early July using "quarter square meter" on five randomly chosen sites indicated no oyster spat. Monitoring of this cultch plant will continue so to ascertain that oyster become established on this site.

Methods

The oyster assessment for Calcasieu Lake was derived by taking "meter square" samples on July 8, 2009. The frame is randomly tossed in the very near vicinity of the sample station located on a known oyster reef. There are two replicate samples taken by a SCUBA diver at each station and there are three stations each in each portion of Calcasieu Lake (Figures 7.1 and 7.2). The diver removes all live and dead oysters and shell on the top portion of the reef substrate. Any live and recent dead oysters are measured in five millimeter (mm) groups and divided into three categories – spat (<25mm), seed oysters (25mm – 74mm) and sack oysters (75mm and larger). Oyster predators and Hooked mussels (*Ishchadium recurvum*) that were collected are identified and tallied. As no bedding (seeding) operations occur in Calcasieu Lake and all harvest is for direct market, the results of data collected are reported in sacks rather than barrels (two sacks equals one barrel).

Results

Eastside

The oyster assessment for the Eastside indicates 411,792 sacks of sack oysters and 127,872 sacks of seed oysters available. Sack oysters showed a decrease of 31.4% over the 2008 assessment of 752,062 sacks (Table 7.2). The availability of seed oysters dropped from the 2008 assessment of 449,720 sacks to 127,872 sacks (Table 7.1 and 7.6); this was a 76.8% decrease (Table 7.2).

West Cove

The oyster assessment for West Cove indicates 209,214 sacks of sack oysters and 124,221 sacks of seed oysters available. Sack oysters showed an increase of 29.3% (Table 7.2) over the 2008 assessment of 142,200 sacks. The availability of seed oysters dropped from the 2008 assessment of 212,483 sacks to 124,221 sacks (Table 7.1 and 7.6); this was a 67.3% decrease (Table 7.2).

Discussion

Sack Oysters

The overall assessment is down 18.5% from the short term average. The 29.3% increase in West Cove was offset by the 31.4% decrease from the Eastside. Even with the below average assessment of the West Cove sack oysters the population continues to be healthy.

Complete landings for the 2008-09 season were not available at the time of this report. The available data for the time frame of November through January shows 19,145 sacks. For the same time period n 2007-08 season showed 32,540 sacks. Though the data is incomplete, this would indicate that the harvest levels continue to be low in comparison to the oysters that are available (Figure 7.4). This is in part because a portion of the reef acreage on the Eastside is not in the LDHH conditional managed area and that West Cove harvest pressure is low and is very susceptible to rainfall with the low closure level of 7.0 feet at Kinder.

Seed Oysters

Seed oyster decreased in both areas of Calcasieu Lake by 76.8 % and 67.3% (Table 7.2). Though there was a decrease in the overall assessment of seed oysters, the population continues to be healthy, but continued decrease may require some action in the future.

Hydrology

Average water temperatures for May and June were 25.3°C and 29.5°C respectively and were below the long term average (LTA), with the maximum deviation of 4.2°C (Table 7.4). May water temperatures were low as there were several late frontal passages. The average water temperature during the oyster assessment was 29.0°C which is at the LTA.

Average salinities (in parts per thousand - ppt) for May and June were 7.3ppt and 13.9ppt respectively; this is just below the LTA with a maximum deviation of 6.6ppt (Table 7.4). the low salinities in May were from late frontal passages, the higher than normal June salinities were caused by very low rain fall. The average salinity during the oyster assessment was 23.2ppt which is above the LTA; this was a continuation of the lack of rainfall into early July.

Disease, Fouling Organisms, and Predators

Oysters from Station 3 and Station 6 were delivered to Dr. Tom Soniat at University of New Orleans to sample for *Perkinsus marinus* ("DERMO"). The results are available in a separate section of the statewide stock assessment report.

Hooked mussel numbers were much higher than the two previous years averaging 319.5 per station, the average in 2008 and 2007 of 68.1 and 35.2 respectively. Station 3 had the highest amount of Hooked mussels totaling 3068 or 80%, but appeared to have had very little dredging as it had high numbers of oysters.

There were no Southern Oyster drills (*Stramonita haemastoma*), a predatory marine snail, present in the meter square samples. There was a total of 6 unidentified mud crabs found in the samples. No other species of concern were found.

Future assessments

Continued evaluation of the ENCOS bottom assessment will probably result in some changes to the Calcasieu Lake assessments. The remainder of the fishable areas need to have an updated bottom assessment, so that the most accurate assessment of Calcasieu Lake can take place.

Additional sampling stations are needed to make a more accurate assessment as this is the first year in which we have none to very low oysters in two stations. I believe that both of these were more due to

the random placement of the square meter frame on an area of the reef that didn't have an oyster on that particular spot.

Sabine Lake assessments will need to be performed if and when the decision is made to open that area for oystering.

2008-09 Oyster Season

For the past three seasons, opening day in West Cove has preceded opening day in Eastside in an attempt to get more oyster fishermen to utilize the resource in West Cove (Tables 7.5 and 7.7). Because there was little use of this short early season opening and most fishermen oyster on the Eastside it was decided to open both areas on the same day of the 2008-09 season as had been done in the past seasons.

Again this was one of the best seasons relating to closures as the Eastside was open 92% of the available days and West Cove was open 63% of the available days (Table 7.5).

As mentioned above, total oyster landings were not available at the time of this writing, so a comparison to previous years is not possible at this time.

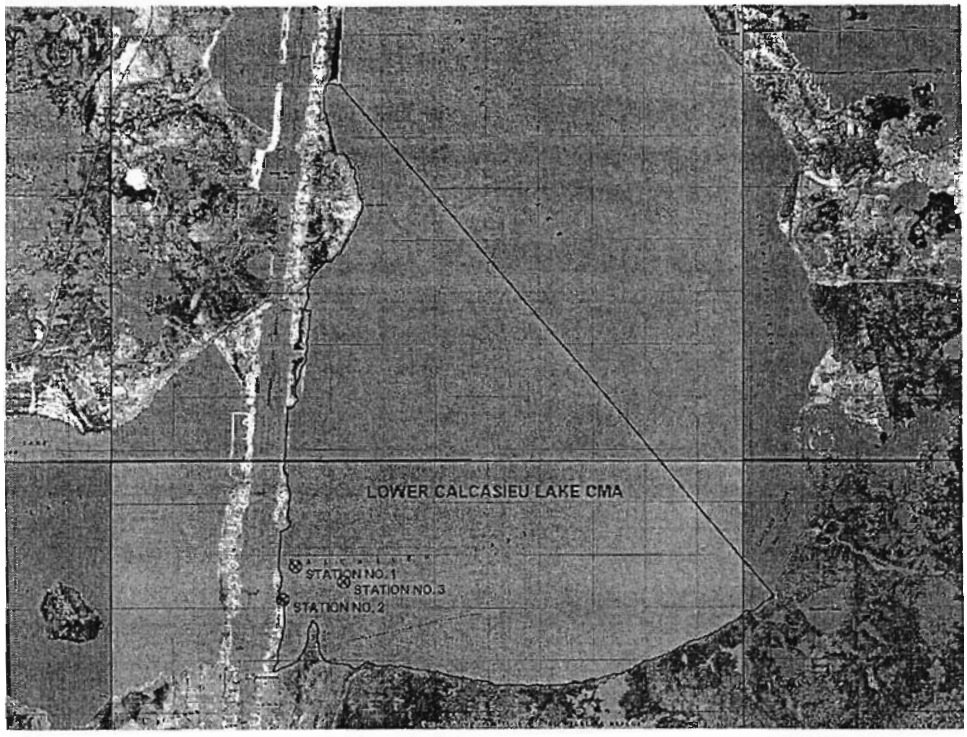

Figure 7.1. Map indicating Growing Area 29 boundary and Meter Square Station locations.

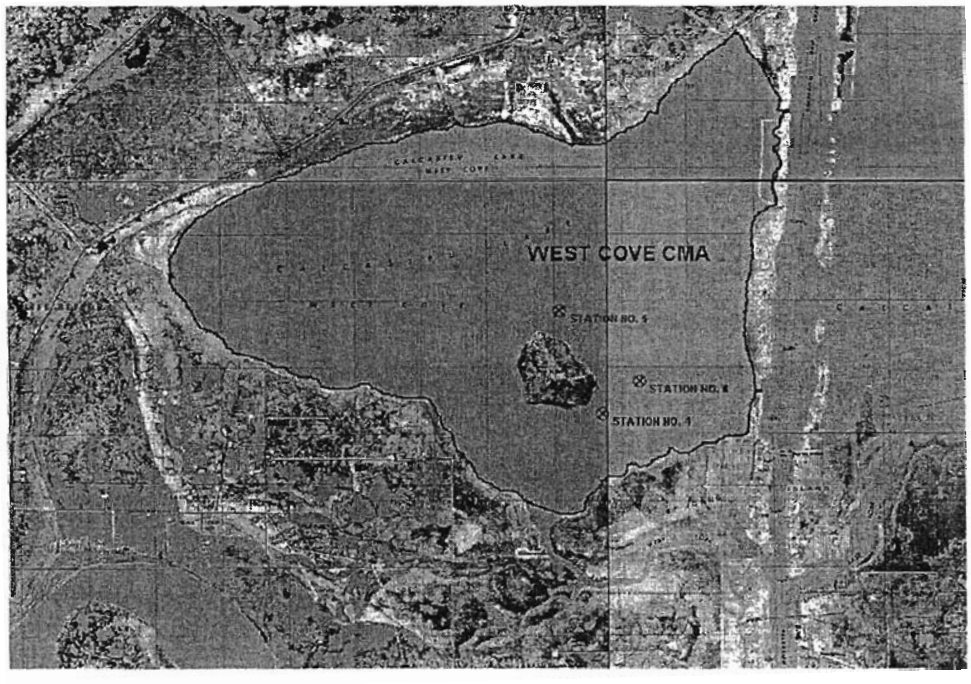

Figure 7.2. Map indicating Growing Area 30 boundary and Meter Square Station locations.

Table 7.1. Calcasieu Lake 2007 Oyster Stock Assessment

CALCASIEU LAKE OYSTER STOCK ASSESMENT
JULY 2009

OYSTER NUMBERS

CALCASIEU LAKE EASTSIDE				
SIZE	STATION			AVE.
	1	2	3	
≥3"	0	3	111	19.0
1-<3"	1	11	54	11.8

WEST COVE				
SIZE	STATION			AVE.
	4	5	6	
≥3"	15	17	45	12.8
1-<3"	39	13	39	15.2

OYSTER PRODUCTION AREA

CALCASIEU LAKE EASTSIDE	WEST COVE
3,901,185.57 SQ. METERS	2,942,076.67 SQ. METERS

PRODUCTION OF ≥3" OYSTERS

CALCASIEU LAKE EASTSIDE		WEST COVE	
OYSTERS:	74,122,525.830	OYSTERS:	37,658,581.376
SACKS:	411,791.8	SACKS:	209,214.3
TOTAL SACKS OF ≥3" OYSTERS:			621,006.1

PRODUCTION OF 1 – < 3" OYSTERS

CALCASIEU LAKE EASTSIDE		WEST COVE	
OYSTERS:	46,033,989.726	OYSTERS:	44,719,565.384
SACKS:	127,872.2	SACKS:	124,221.0
TOTAL SACKS OF 1-<3" OYSTERS:			252,093.2

TOTAL PRODUCTION

TOTAL OVERALL POTENTAL OF OYSTERS (SACKS):	873,099.3

Table 7.2. Calcasieu Short Term Assessments and Percentage Change

ASSESSMENTS BY CONDITIONAL MANAGED AREA						
	SACK OYSTERS (≥ 3")			SEED OYSTERS (< 3")		
YEAR	EASTSIDE	WESTCOVE	TOTAL	EASTSIDE	WESTCOVE	TOTAL
2004	927,615.2	171,621.1	1,099,236.3	1,102,084.9	267,238.6	1,369,323.5
2005	632,859.0	282,766.3	915,625.3	446,469.0	179,793.6	626,267.6
2006	140,876.1	98,069.2	238,945.3	159,298.4	65,379.5	224,677.9
2007	548,333.3	114,414.1	662,747.4	598,181.8	337,566.5	975,748.3
2008	752,061.9	142,199.9	894,261.8	449,720.0	212,483.3	662,203.3
AVERAGE	**600,349.1**	**161,814.1**	**762,163.2**	**551,150.8**	**212,492.3**	**771,644.1**
2009	411,791.8	209,214.3	621,006.1	127,872.2	124,221.0	252,093.2
% CHANGE FROM AVE.	-31.4	+29.3	-18.5	-76.8	-41.5	-67.3

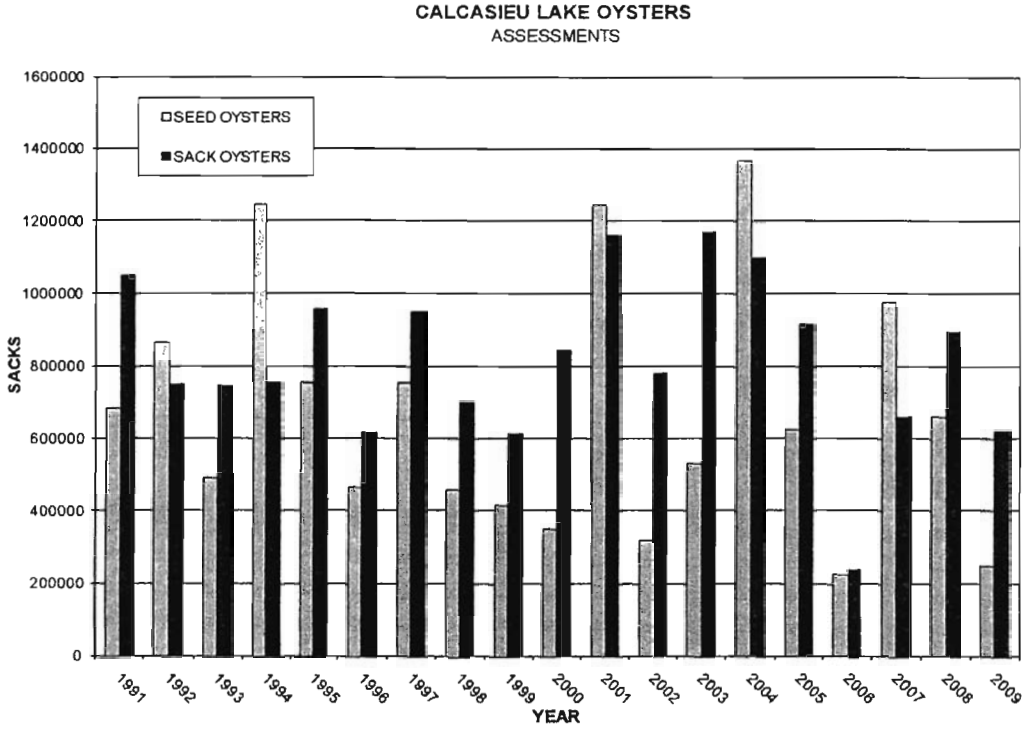

Figure 7.3. Calcasieu Lake Available Seed and Sack Oysters

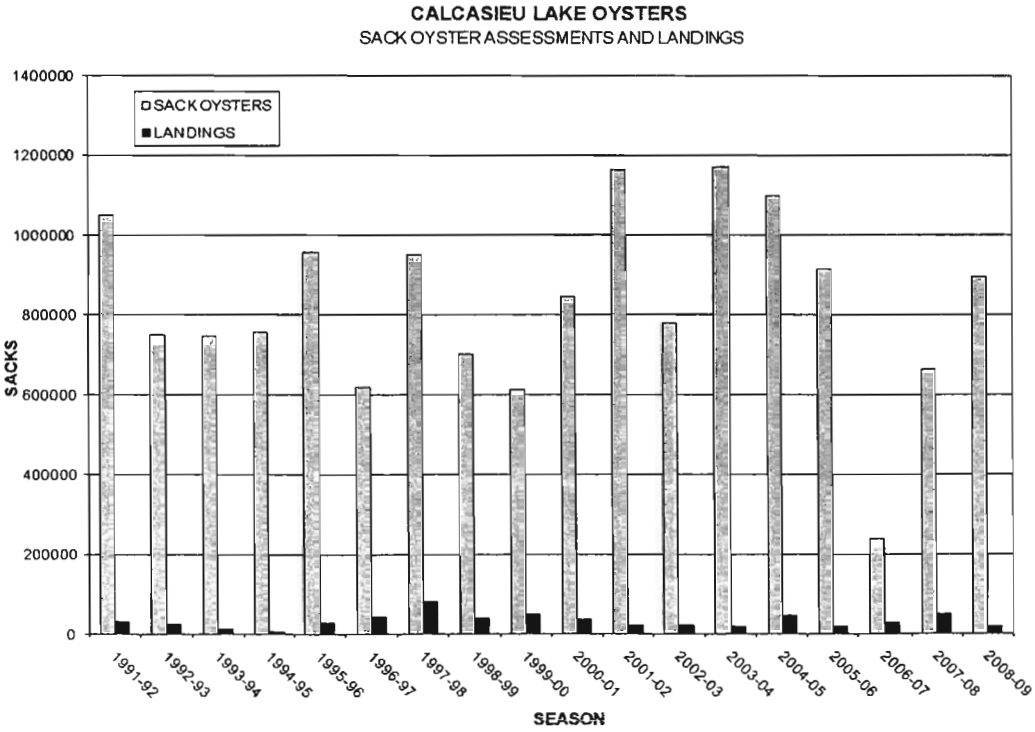

Figure 7.4. Calcasieu Lake Available Oysters and Landings

Table 7.4. Calcasieu Lake Salinity and Temperature

CALCASIEU LAKE HYDROLOGY						
	2009		LONG TERM		2009 OY. ASSESSMENT	
MONTH	AV. SAL.	AV. TEMP	AV. SAL.	AV. TEMP.	AV. SAL.	AV. TEMP.
MAY	7.3	25.3	10.7	27.1		
JUNE	13.9	29.5	10.9	29.0		
JULY					23.2	29.0

Table 7.5. Calcasieu Lake Percent of Season Days Open

SEASON		TOTAL DAYS	LOWER CALCASIEU LAKE CMA		WEST COVE CMA OPEN	
			OPEN DAYS	PERCENTAG	OPEN DAYS	PERCENTAG
1991-92		199	114	57	114	57
1992-93*		165	137	83	76	46
1993-94		181	146	81	84	46
1994-95		181	90	50	9	5
1995-96		188	175	93	115	61
1996-97		197	149	76	114	58
1997-98		197	139	71	96	49
1998-99		197	135	69	120	61
1999-00		197	197	100	182	92
2000-01		198	180	95	106	53
2001-02		198	158	80	61	31
2002-03		198	146	74	66	33
2003-04		199	172	87	126	63
2004-05		198	168	85	68	34
2005-06	LCLCMA	198	187	11		
	WCCMA	205			165	40
2006-07	LCLCMA	181	118	65		
	WCCMA	197			70	35
2007-08	LCLCMA	182	165	91		
	WCCMA	199			131	66
2009-09	LCLCMA	198	183	92		
	WCCMA				125	63

* 92-93 SEASON STARTED USING CALCASIEU RIVER GAUGE AT KINDER FOR DHH CLOSURES.

Table 7.6. Historical Stock Assessments and Landings (in sacks)

CALCASIEU LAKE STOCK ASSESSMENT AND HARVEST ESTIMATES

SEASONS	STOCK ASSESSMENT		ESTIMATED SACKS HARVESTED
	MARKETABLE	TOTAL	
1963	-	-	210,160
1967-74	-	-	NO COMMERCIAL LANDINGS
1975-76	142,726	441,183	40,000
1976-77	694,420	869,475	100,000
1977-78	483,673	621,885	141,976
1978-79	-	-	75,000
1979-80	676-333	979,613	125,000
1980-81	355,664	705,117	150,000
1981-82	608,110	988,575	-
1982-83	-	-	50,000-75,000
1983-84	-	-	150,000
1984-85	125,407	644,788	-
1985-86	315,160	537,760	27,400
1986-87	589,940	1,217,959	200,000
1987-88	796,950	2,703,647	125,000
1988-89	463,331	1,036,580	50,000
1989-90	172,046	640,892	40,000
1990-91	408,961	1,268,962	50,000
1991-92	1,048,882	1,731,367	31,383[1]
1992-93	749,915	1,612,736	27,328
1993-94	748,281	1,238,783	12,818
1994-95	756,525	1,246,480	6,134
1995-56	956,926	1,298,379	29,082
1996-97	618,767	1,083,866	43,441
1997-98	950,979	1,706,510	80,735
1998-99	702,371	1,160,115	39,202[2]
1999-00	614,145	1,032,117	50,592[3]
2000-01	846,176	1,197,311	35,881
2001-02	1,163,750	2,409,482	21,297
2002-03	781,676	1,100,257	21,386
2003-04	1,169,997	1,700,663	18,196
2004-05	1,099,236	2,468,560	44,293
2005-06	915,625	1,541,893	19,327
2006-07	238,945	463,623	28,341
2007-08	662,747	1,638,496	49,529
2008-09	894,262	1,556,465	19,145[6]
2009-10[7]	1,398,436.9	1,972,920.4	

1 - STARTED USING DEALER REPORTS FOR LANDINGS.
2 - THE 1999 PORTION OF THE LANDINGS WAS DERIVED FROM PRELIMINARY TRIP TICKET DATA.
3 - TRIP TICKET DATA WAS UNAVAILABLE, CALLED DEALERS FOR LANDINGS.
4 - HURRICAN RITE MADE LANDFALL ON 9/23/05 IN CAMERON PARISH, DELAYING SEASON OPENING, LIMITING THE NUMBER OF FISHERMEN AND BUYERS.
5 - A SEWAGE LINE BREAK IN BAYOU D'INDE CLOSED THE SEASON IN FOR THE ENTIRE MONTH OF APRIL, LIMITING THE LANDINGS.
6 - PARTIAL LANDINGS DATA; NOV. - JAN.
7 - ASSESSMENT USING THE UPDATED REEF ACREAGE FROM ENCOS.

Table 7.7. Calcasieu Lake Oyster Season Dates

CALCASIEU LAKE OYSTER SEASONS

SEASON	REGULAR SEASON							EXTENDED SEASON							TOTAL DAYS IN SEASON
	DATES			DHH HEALTH CLOSURES				DATES			DHH HEALTH CLOSURES				
				CAL. L. CMA		WEST COVE CMA					CAL. L. CMA		WEST COVE CMA		
	OPEN DATE	CLOSED DATE	TOTAL DAYS	DAYS OPEN	DAYS CLOSED	DAYS OPEN	DAYS CLOSED	OPEN DATE	CLOSED DATE	TOTAL DAYS	DAYS OPEN	DAYS CLOSED	DAYS OPEN	DAYS CLOSED	
1989-90	11-15	3-15	121	79	42	79	42	3-16	4-30	46	40	6	40	6	165
1990-91	11-15	3-1	147	95	52	95	52	3-30	4-20	34	20	0	0	0	181
1991-92	10-15	3-1	139	69	70	69	70	3-2	4-30	60	45	15	15	15	199
1992-93[1]	10-15	3-1	138	123	15	76	62	3-8	4-3	27	14	13	13	27	165
1993-94	11-1	3-1	121	94	27	61	60	3-2	4-30	60	52	8	8	7	181
1994-95[2]	11-1	3-1	121	69	52	9	112	3-2	4-30	60	21	39	39	60	181
1995-96	10-16	3-1	138	125	13	80	58	3-2	3-31	30	30	0	0	0	-
								4-11	4-30	20	20	0	0	15	188
1996-97	10-16	5-1	197	149	48	83	114	-	-	-	-	-	-	-	197
1997-98	10-16	4-30	197	139	58	101	96	-	-	-	-	-	-	-	197
1998-99[3]	10-16	4-30	197	135	62	77	120	-	-	-	-	-	-	-	197
1999-00	10-16	4-30	197	197	0	182	15	-	-	-	-	-	-	-	197
2000-01	10-15	4-30	198	180	18	106	92	-	-	-	-	-	-	-	198
2001-02	10-15	4-30	198	158	40	61	137	-	-	-	-	-	-	-	198
2002-03	10-15	4-30	198	146	52	66	132	-	-	-	-	-	-	-	198
2003-04	10-15	4-30	199	172	27	126	73	-	-	-	-	-	-	-	199
2004-05	10-15	4-30	198	168	30	68	130	-	-	-	-	-	-	-	198
2005-06 LCLCMA	10-15	4-30	198	187	11			-	-	-	-	-	-	-	198
2005-06 WCCMA	10-8	4-30	205			165	40	-	-	-	-	-	-	-	205
2006-07 LCLCMA	11-1	4-30	181	118	63			-	-	-	-	-	-	-	181
2006-07 WCCMA	10-16	4-30	197			70	127	-	-	-	-	-	-	-	197
2007-08 LCLCMA	11-1	4-30	182					-	-	-	-	-	-	-	181
2007-08 WCCMA	10-15	4-30	199					-	-	-	-	-	-	-	198
2008-09 LCLCMA	10-15	4-30	198	183	15			-	-	-	-	-	-	-	198
2008-09 WCCMA						125	73	-	-	-	-	-	-	-	

1 - STARTING WITH THE 92-93 SEASON CALCASIEU LAKE WAS SPLIT INTO TWO UNITS: CAL. LAKE CMA (W/ RIVER STAGE CLOSURE @ 12 FT.) AND WEST COVE CMA (W/ RIVER STAGE CLOSURE @ 7 FT.).

2 - DHH CLOSED THE CAL. LAKE CMA (FROM 11/1-12/10/94) AND WEST COVE (FROM 11/1-1/28/95) WITH A PRECAUTIONARY (POSSIBLE LEAD CONTAMINATION) CLOSURE.

3 - DURING THIS SEASON THE RIVER LEVEL CRITERIA IN THE CAL. LAKE CMA CHANGED FROM 12 TO 13.5 FT.

Dermo
(*Perkinsus marinus*)
Analysis

Data Provided by Dr. John Supan, LSU

2009 DERMO RESULTS
EAST OF RIVER & HACKBERRY BAY

	Seed		Market	
	Prevelance	Weighted Incidence	Prevelance	Weighted Incidence
Bay Gardene	73%	0.4	93%	0.5
Lonesome I.	53%	0.4	80%	0.4
Mozambique Pt.	60%	0.6	92%	0.5
N. Black Bay	20%	0.1	53%	0.3
S. Black Bay	93%	0.5	100%	0.5
Bay Crabe	73%	0.4	93%	1.0
Telegraph Pt.	80%	0.4	100%	0.8
Grand Pass	60%	0.3	100%	1.2
Three Mile	96%	0.4	93%	0.5
Hackberry Bay	60%	0.3	47%	0.2

Mackin Scale used to determine incidence.

Levels of the oyster parasite *Perkinsus marinus* from Louisiana oysters west of the Mississippi River: Summer 2009

by

Thomas M. Soniat, Ph.D.

23 July 2009

Among the most significant causes of oyster mortality is the parasite *Perkinsus marinus* (formerly *Dermocystidium marinum*), which is responsible for annual mortality rates that exceed 50% in most populations of adult eastern oysters, *Crassostrea virginica*. *Perkinsus marinus* was described in 1950 by John Mackin, Malcom Owen and Albert Collier as *Dermocystidium marinum* – hence the common name "Dermo" which is still in use (Mackin et al. 1950).

The discovery of the parasite was the result of investigations (funded by a consortium of oil companies and directed by Texas A&M University) of the impact of oil and gas activities on the Louisiana oyster industry (Mackin and Hopkins, 1962). Extensive studies were conducted on the effects of crude oil, bleedwater, natural gas, drilling mud and seismographic surveys. It was ultimately realized that none of these pollutants or activities explained the widespread mortalities of oysters that were observed. It is now known that the parasite is a major cause of oyster mortality from Maine to Mexico (Soniat, 1996).

The critical environmental factors which favor the proliferation of the parasite are high water temperatures and high salinities. Thus infections are more intense in the late summer, on the seaward side of estuaries and during droughts. Drought conditions on the Gulf Coast are associated with the La Niña phase of El Niño Southern Oscillation, however increases in prevalence (PI) precede sharp increases in intensity (WI) and epizootics of Dermo in Louisiana can lag La Niña events by about 6 months (Soniat et al., 2005). Management techniques to minimize disease and increase oyster harvest include moving infected oysters to lower salinity, early harvest of infected populations, and even freshwater diversion into high-salinity estuaries. Because of the key role of Dermo as a cause of oyster mortality, the success of oyster farming depends on the ability to manage oyster populations in the presence of high levels of disease (Soniat and Kortright, 1998).

The standard assay for determining the level of parasitism is the fluid thioglycollate method (Ray, 1966). A small piece of tissue is removed and assayed for disease after incubation in fluid thioglycollate and antibiotics for one week. *P. marinus* intensity is scored using a 0-to-5 scale developed by Mackin (1962), where 0 is no infection and 5 is an infection in which the

oyster tissue is almost entirely obscured by the parasite. Calculations are made of percent infection (PI) and weighted incidence (WI), which is the sum of the disease code numbers divided by the total number of oysters in the sample. A WI of 1.5 could be considered a level at which disease-related mortalities are occurring. For example, Mackin (1962) claims: "a population of live oyster with a weighted incidence of 2.0 contains an intense epidemic, and more than half of the population may be in advanced stages of the disease, with all of the individuals infected."

Oysters for the summer 2009 study were collected from 10 sites west of the Mississippi River. Samples were taken from one site in Lake Felicity (LF), one site in Lake Chien (LC), two sites in Sister Lake, two sites in Bay Junop, two sites in Lake Calcasieu, and two sites in Vermilion Bay. The Sister Lake sites were Grand Pass (GP) and Old Camp (OC). The Bay Junop sites were Rat Bayou (RB) and Buckskin Bayou (BB). The Lake Calcasieu sites were West Cove (WC) and Mid Lake (ML).

The length of 10 oysters was measured; mantle tissue was removed from each of the 10 oysters, incubated at room temperature in fluid thioglycollate for about a week, and assayed according to the standard Ray (1966) technique. The level of infection (disease code) was scored from 0 to 5, where 0 is no infection and 5 is near total coverage of the oyster tissue by the parasite. Weighted incidence (WI) was calculated by summing the disease code values and dividing by 10, the number of oysters in the sample.

Weighed incidence and percent infection results are shown in Table 8-1. WI values were 0.00 (RB), 0.00 (BB), 0.00 (GP), 0.03 (OC), 0.00 (IP), 0.00 (SP), 0.20 (LC), 0.03 (LF), 0.50 (WC), and 0.57 (NR). Using stations for which direct comparisons are possible, WI levels from the summer 2009 samples are generally lower than those in the summer of 2008. With the exception of LC, that in 2008 had a WI of 0.07, 2009 values lower. All of the WI values are below critical levels, but there is some cause for concern in Lake Calcasieu where prevalences were 70% (ML) and 80% (WC).

Table 8-1. Collection, environmental, oyster and disease data for oysters sampled from west of the Mississippi River: Summer 2009.

Station	Date collected	Salinity (ppt)	Temperature (°C)	Oyster size range(mm)	Percent infection	Weighted incidence
Rat Bayou	7/1/09	17.5	29.4	93-110	0%	0.00
Buckskin Bayou	7/1/09	6.3	31.0	75-105	0%	0.00
Grand Pass	7/1/09	16.0	31.1	81-100	0%	0.00
Old Camp	7/1/09	11.7	31.4	85-120	10%	0.03
Indian Point	7/8/09	28.3	29.9	55-71	0%	0.00
South Point	7/8/09	28.9	29.3	40-59	0%	0.00
Lake Chien	7/2/09	16.4	32.1	80-92	40%	0.20
Lake Felicity	7/2/09	15.8	31.4	82-106	10%	0.03
West Cove	7/13/09	22.0	31.5	78-114	80%	0.50
Mid Lake	7/13/09	23.9	31.3	77-117	70%	0.57

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END OF REPORT