Louisiana Department of Wildlife and Fisheries

Office of Fisheries - Fisheries Division

OYSTER STOCK ASSESSMENT REPORT

OF THE

PUBLIC OYSTER AREAS IN LOUISIANA

SEED GROUNDS and SEED RESERVATIONS

Oyster Data Report Series
No. 16
July, 2010

TABLE OF CONTENTS

NOTE: The Dermo (*Perkinsus marinus*) Summary and Analysis section that appears in previous years' reports does not appear in this year's document due to a change in timing of the field collections for the Dermo project. The change resulted from actions taken by the Louisiana Oyster Task Force (OTF) in 2010 whereby they voted to collect oysters for Dermo analysis in August rather than in July. The OTF funds this project each year and the results of which have previously been included in the annual stock assessment report.

Statewide Overview - 2010 Oyster Stock Assessment

Patrick D. Banks, Biologist DCL-B
LDWF Fisheries Division
Baton Rouge, LA 70808

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).

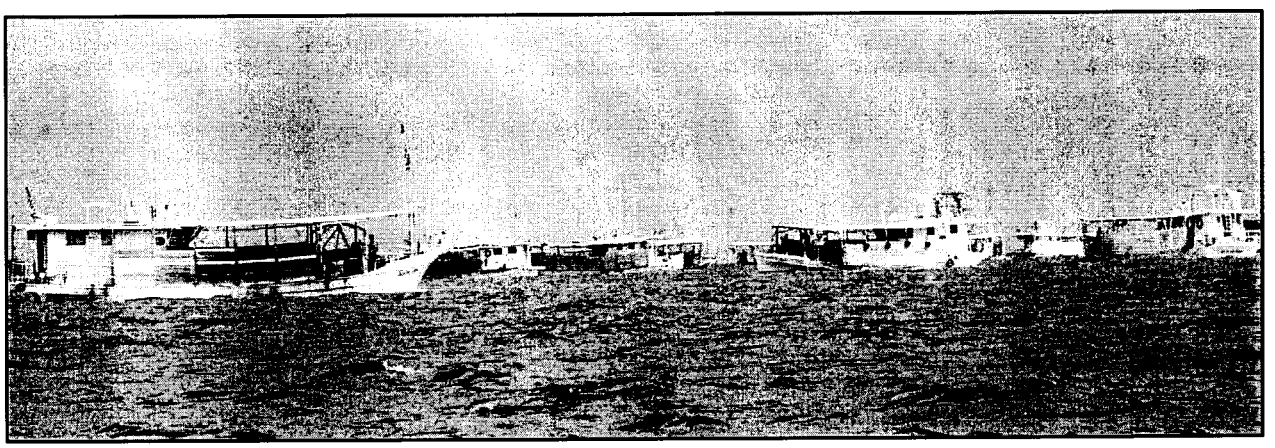


Figure 1. Oyster fishermen fish for seed oysters on opening day of the 2009/2010 oyster season (September 9, 2009) on a cultch plant in Black Bay (Plaquemines Parish) that was constructed in May 2007. Approximately 75 vessels were documented fishing on the 200-acre reef on opening day, the first day this new reef was opened to commercial harvest.

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 $35 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 1998-2008 (Figure 2). Louisiana was again the top producer of American (=Eastern) oysters in 2008 with landings of approximately 12.8 million pounds of oysters (*Crassostrea virginica*)[1]. Among Gulf of Mexico states, Louisiana consistently ranks #1 in landings accounting for over 50% of all oysters landed.

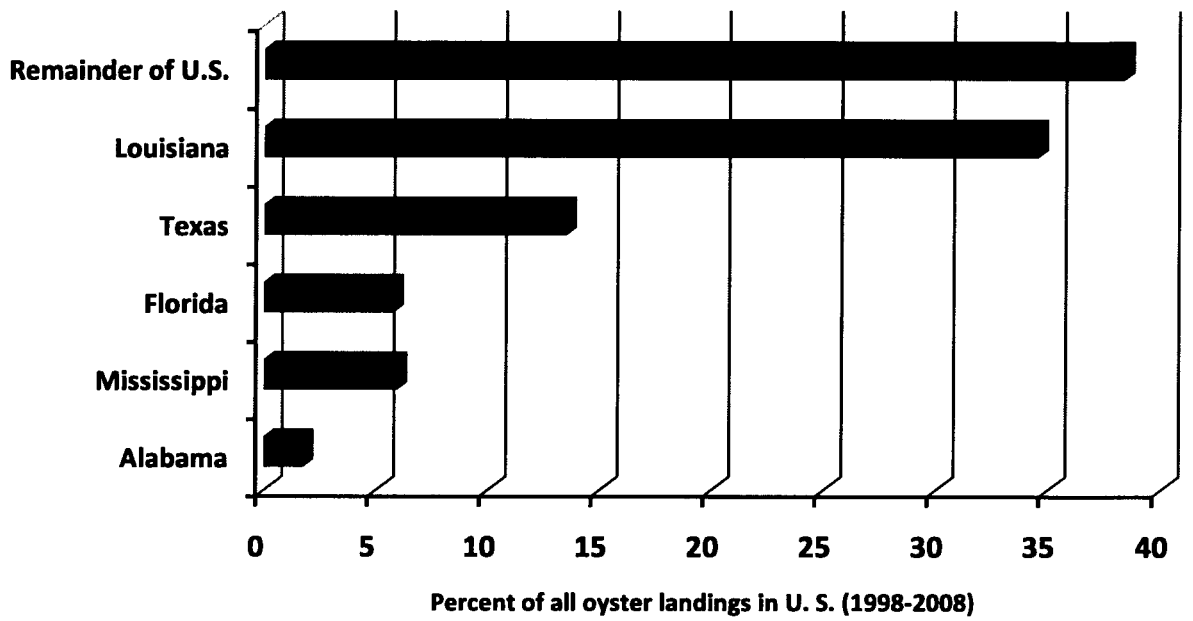


Figure 2. Percent of landings of all species of oysters based on pounds of oyster meat (Data source: NMFS).

Oysters have been a part of the Louisiana economy for many years; starting from meager beginnings and growing into a multi-million dollar industry. The year 2009 marked another milestone for oyster harvest in Louisiana as the dockside value of oysters was the highest on record, totaling just over $50 million. Overall harvest during the year was the second-highest level on record at approximately 14.9 million pounds of meat (preliminary LDWF Trip Ticket Data).

The public oyster grounds can be considered the backbone of the Louisiana oyster resource. These 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

[1] Finalized 2009 landings by state were not available from the National Marine Fisheries Service (NMFS) at the time of this publication.

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. This reliance on the public grounds reversed in 2009 as approximately 77% of all oysters landed in Louisiana came from private leases (Figure 3).

When comparing the price per pound of oysters on public grounds and private leases, it is clear that public ground oysters hold their value well as compared to oysters from private leases. In 2009, public ground oysters fetched $3.43 per pound at the dock while private lease oysters valued slightly less at $3.38 per pound. Overall average price per pound for all Louisiana oysters in 2009 ($3.39) was higher than in 2008 ($3.03) according to LDWF Trip-Ticket data. Although the increase in value of oysters in 2009 would seem to indicate a decrease in the supply of oysters, a look at overall landings does not support the theory that oyster value was driven upwards by a lack of Louisiana supply as compared to 2008. An overall decrease in U.S. market supply may be the driving force, however. At the time of this publication, nationwide 2009 landings were not available from the National Marine Fisheries Service (NMFS).

Statewide Oyster Stock Assessment Overview

Each summer, LDWF biologists from each Coastal Study Area (CSA) of the 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 were completed in Drum Bay, Morgan Harbor (CSA I), southern portions of Calcasieu and Sabine Lakes (CSA 7), and portions of Mississippi Sound (CSA I). Reef acreage in Drum Bay, Morgan Harbor, and Sabine Lake was unknown until completion of these projects. Drum Bay, Morgan Harbor, and Calcasieu Lake reef information has now been incorporated into the LDWF oyster management program and is included in the respective stock assessment reports on the following pages. Additional assessments should be performed in Sabine Lake before that information is fully incorporated into the oyster management program. Additionally, mapping projects are needed within CSA VI (Vermilion Bay area) so that reef acreage can be obtained in order to provide a true estimate of oyster stock availability in that system.

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 2009 levels have now approached those observed between 1982 and 1990 resulting in the 2nd-smallest statewide oyster stock size since 1989 (Figure 4).

Despite the general downward trend, statewide oyster stock size in 2010 has shown a slight increase compared to 2009 as approximately 1,224,377 barrels of oysters are available on the public oyster areas of Louisiana this year (Figure 4, Table 1). The 2010 stock size represent an approximate 4.7% increase (+54,354 barrels) over 2009 levels and was largely driven by gains in seed oyster stocks (1" - <3"). The historic primary public ground in the Breton Sound basin (CSA II) showed troubling decreases in both seed and market-size oyster stocks and experienced an overall 54.5% decrease in 2010. Calcasieu Lake (CSA VII) again showed strong stock levels accounting for approximately 50% of the statewide stocks.

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

CSA	Seed (bbls)	Sack (bbls)	Total (bbls)
1	120,188	94,833	215,021
2	105,836	39,739	145,575
3	5,020	1,207	6,227
4	2,021	499	2,520
5	154,340	36,971	191,311
6	N/A	N/A	N/A
7	307,265	356,458	663,723
Totals	***694,670***	***529,707***	***1,224,377***

Several CSAs, including CSA I, V, and VII showed significant increases in seed stocks as compared to the previous season and statewide seed stocks rose by 24.3% from 558,915 barrels of seed in 2009 to 694,670 barrels in 2010 (Figure 5). Calcasieu Lake showed the largest gains in seed oysters with an increase of 143% over 2009 levels. Statewide seed oyster stocks were again bolstered somewhat by habitat enhancement projects (i.e. cultch planting) that took place in May/June 2009. For example, an approximately 45-acre reef (Shell Point) was constructed in CSA I and sampling at this location indicate the presence of approximately 39,000 barrels of seed. Although five new cultch plants were constructed in 2009, not all were sampled for stock assessment purposes.

While increases in seed oysters indicate positive news for the future, it is market-size oyster stocks (oysters 3" and greater) that translate into immediate return to the oyster industry. Unfortunately, stocks of market-size oysters in 2010 showed a 13.2% drop in availability as compared to 2009 levels (Figure 5). Significant drops in market-size oyster stocks were noted in CSA I, II, V, and the east side of Calcasieu Lake (CSA VII).

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 2009/2010 oyster season on the public oyster grounds of Louisiana. Data derived from fisheries dependent surveys of harvesting vessels (=boarding reports) and not from LDWF Trip-Ticket data (except CSA 7).

CSA	Seed Oysters (barrels)	Market Oysters (sacks)	Total (barrels)
1	57,055	158,028	136,069
2	82,688	167,614	166,495
3	7,885	504	8,137
4	0	0	0
5	4,610	13,676	11,448
6	0	0	0
7	0	137,074[2]	68,537
Total	***152,238***	***476,896***	***390,686***

Environmental Conditions

Scientific research indicates that reproduction of oysters becomes limited as salinities drop below seven parts per thousand (ppt). Additionally, salinities below five ppt coupled with water temperatures above 23° Celsius has been documented to cause significant oyster mortalities. As depressed salinities continue into the hotter summertime months, physiological stress on oysters increases and mortalities can occur. This is a somewhat regular occurrence in areas such as the Vermilion Bay system (CSA VI), but can also occur periodically in other areas of Louisiana's public oyster grounds.

The public oyster seed grounds east of the Mississippi River and in the Barataria basin experienced a third straight year of depressed salinities during the spring and early summer. Freshwater entering the Breton Sound (CSA II) and Barataria (CSA III) basins in 2010 severely reduced salinities (Figures 6 and 7) during the critical reproductive period for oysters. Significant mortalities were noted in samples from both CSA II and III during stock assessment sampling. Although an absolute link between these mortalities and low salinity conditions cannot be made, it appears that the low salinity/high water temperature conditions likely played a significant role in observed mortalities. Elevated mortalities were noted both in Hackberry Bay (CSA III – Barataria basin) and the Black Bay area (CSA II – Breton Sound basin) during annual square-meter sampling.

Commercial Harvest

Estimated harvest pressure during the 2009/2010 oyster season, although slightly below 2008/2009 levels, served to reduce available oyster resources on the public grounds, especially in CSAs II and VII (Table 2). Based on estimated harvest of market-size oysters in CSA 2 during the 2009/2010 oyster season, over 52% of the available resource was taken by the time the

[2] Data for CSA 7 (Calcasieu Lake) harvest obtained using LDWF trip-ticket data and not fisheries dependent surveys.

season was closed on April 1, 2010 and this included the harvest of 106% of the estimated market-size oysters available. Likely due to the scarcity of market-size oysters in other parts of the public oyster grounds, Calcasieu Lake (CSA VII) received increased harvest pressure during this past season resulting in the highest harvest since the 1986/1987 season. The majority of this harvest occurred on the east side of the lake and may have contributed to the reduced market-size oyster resources found in this area during the 2010 stock assessment.

Deepwater Horizon Oil Spill

The "Deepwater Horizon" drilling rig exploded in the northern Gulf of Mexico on April 20, 2010 approximately 40 miles southeast of the mouth of the Mississippi River. The rig subsequently sank, damaging the well-head and associated well structures at the ocean floor. This resulted in the release of millions of barrels of oil into the Gulf of Mexico and oil impacting many coastal areas of Louisiana. Ongoing research is being conducted on the impacts of the oil spill to Louisiana's nearshore environment, including to oysters and oyster habitat. During the annual stock assessment sampling, no direct oiling of sampled reefs was noted. However, persistent oil sheens and oiled marsh shorelines were present in and around many areas of the public oyster grounds such as Half-Moon Island (CSA I), Bay Gardene (CSA II), and Hackberry Bay (CSA III). Due to safety concerns, a commercial dive company was hired to perform sample collection in areas where oil/sheen persisted.

In response to the threat of oil entering coastal marshes, the state of Louisiana opened all available freshwater diversions and siphons along the Mississippi River, except for the Bonnet Carre Spillway. The largest of the diversions include those at Caernarvon (CSA II), Bayou Lamoque (CSA II), and Davis Pond (CSA III). In addition to a high Mississippi River, these structures provided sources of freshwater to both the Breton Sound and Barataria basins.

Increases in Sample Replication

In an effort to strengthen the precision of the annual stock assessment and reduce site-specific variability, an increase in replication was performed at all sample locations. In previous years, two replicate square-meter samples were taken at each location. Due to the small sample size, site-specific variability was oftentimes very large resulting in poor estimation of available oyster resources. Therefore, estimates of only large-scale areas could be made. By increasing the replication at each sample location, a stronger estimate of stock availability at each location can be made. Statistical analysis to compare variability of data generated from two replicates and five replicates is planned to assist management decisions in future years.

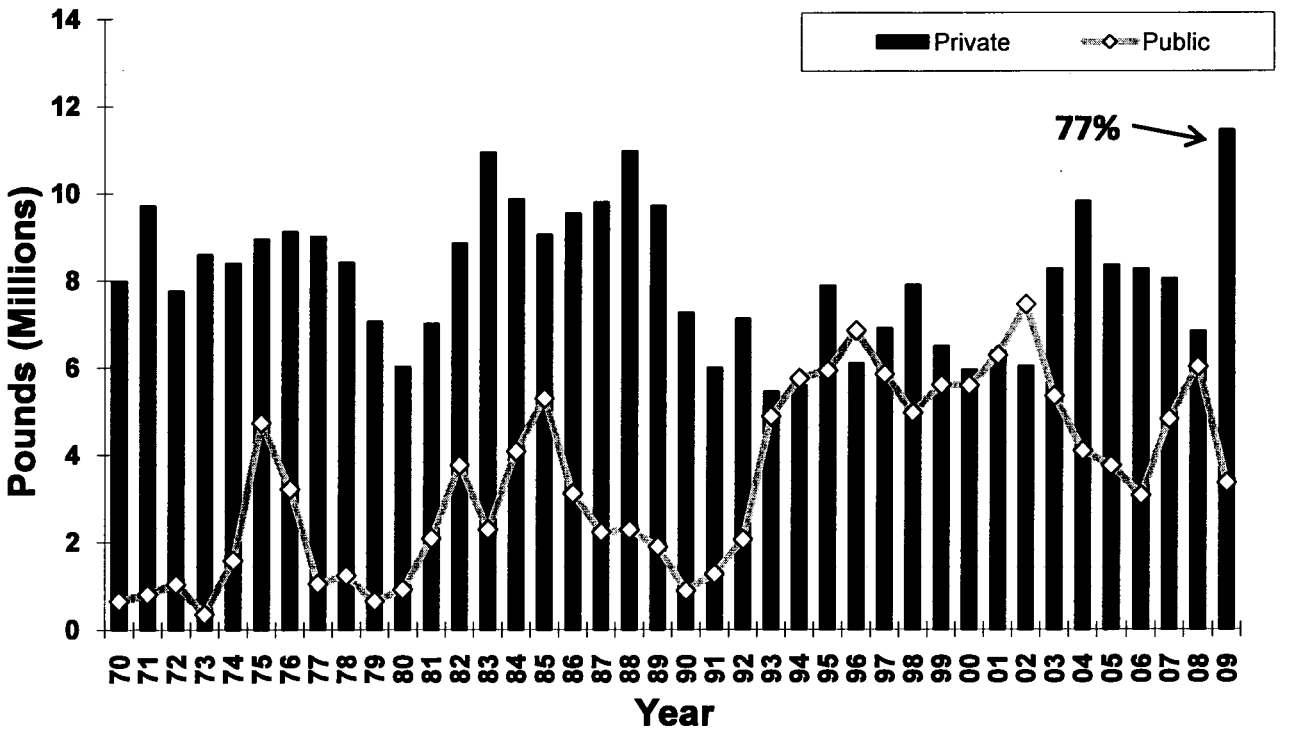
Recent Legislation

The 2010 regular legislative session included several bills filed with direct ties to oysters (Table 3). Most legislation had implications on private lease practices. However, HB712 provides for certain restrictions on the taking of oysters from the public oyster seed grounds during the "seed-only" portion of the oyster season.

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, especially in light of this year's significant increase in sampling effort (five replicate samples were collected at each site instead of only two). Additionally, Ty Lindsey and Denise Kinsey greatly assisted with editorial review and preparation of this document. The efforts of both the field and office staff are greatly appreciated as this report could not be produced without the hard work and dedication of these many people. Questions and/or comments can be directed to the individual CSA Biologist Managers (page xiii) or Patrick Banks at 225.765.2370 or pbanks@wlf.louisiana.gov.



Note: Long-term average (LTA) for private landings is 8.007 million pounds. LTA for public landings is 3.065 million pounds.

Figure 3. Historical Louisiana oyster landings for the public oyster areas and the private oyster leases (LDWF and NMFS data). 2009 harvest from private leases accounted for approximately 77% of the total.

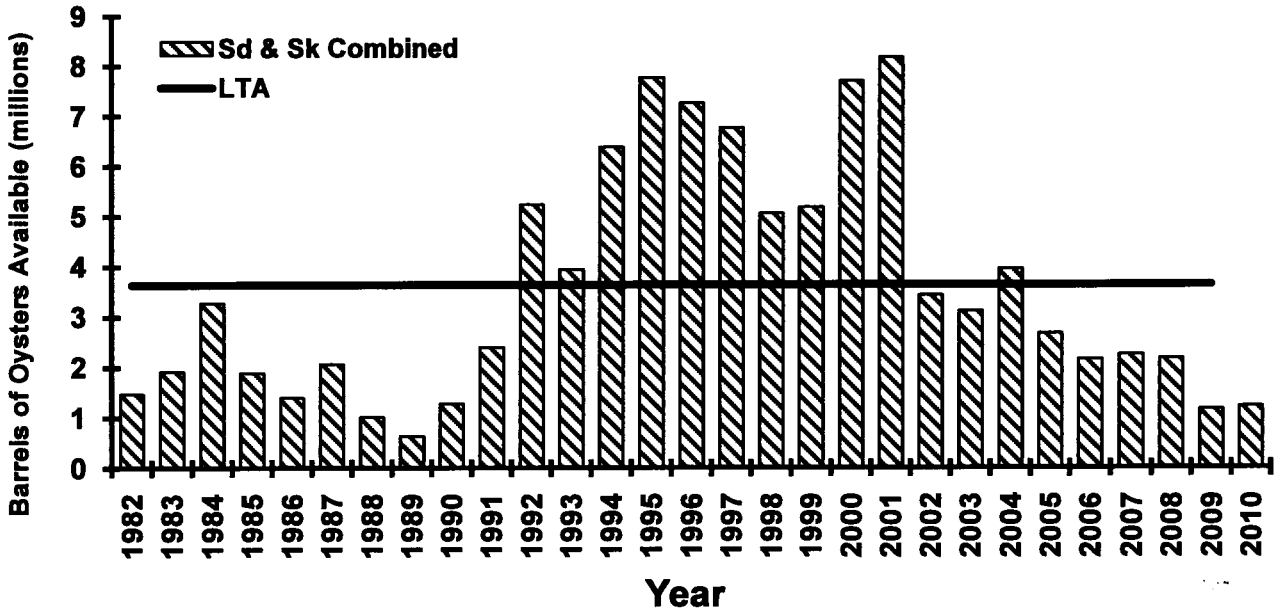


Figure 4. Historical estimated oyster stock size (Sd = seed oysters; Sk = sack or market-size oysters) on the public oyster areas of Louisiana. 1994 through 2004 data includes CSA I data revision. LTA denotes the long-term average of 1982 - 2009.

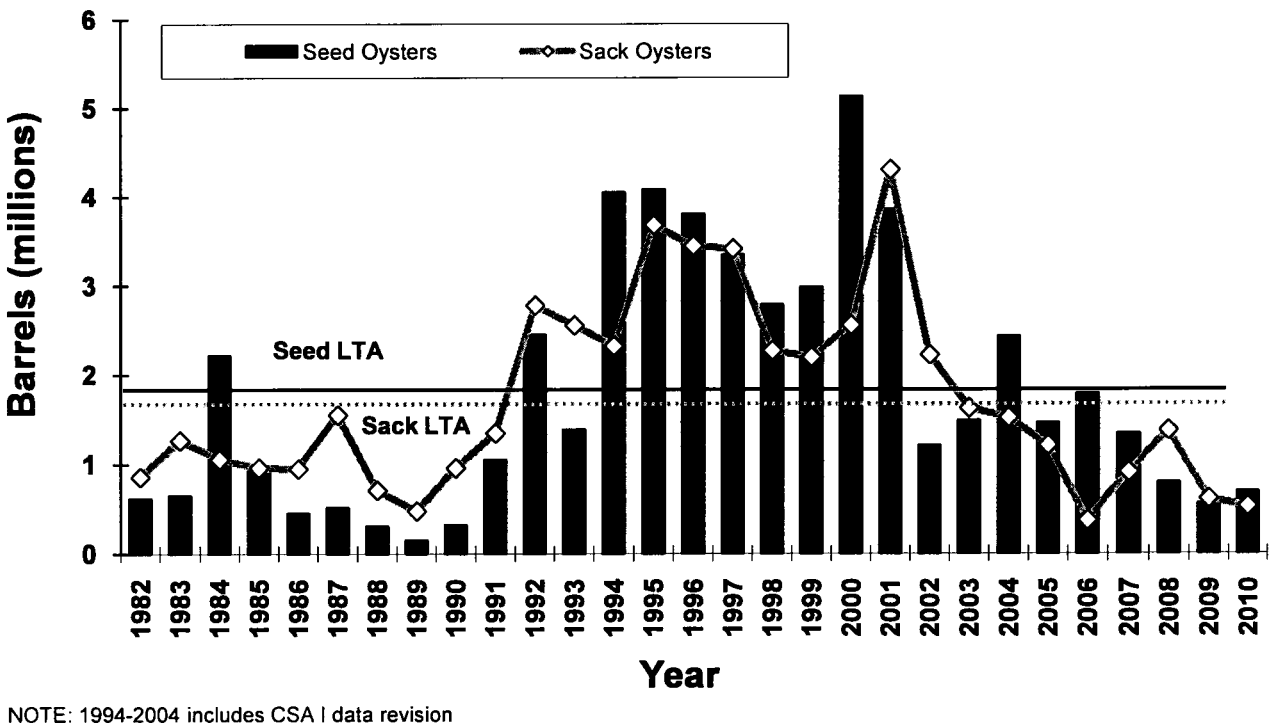


Figure 5. Historical Louisiana oyster stock size on the public oyster areas. LTA denotes the long-term average of 1982 - 2009.

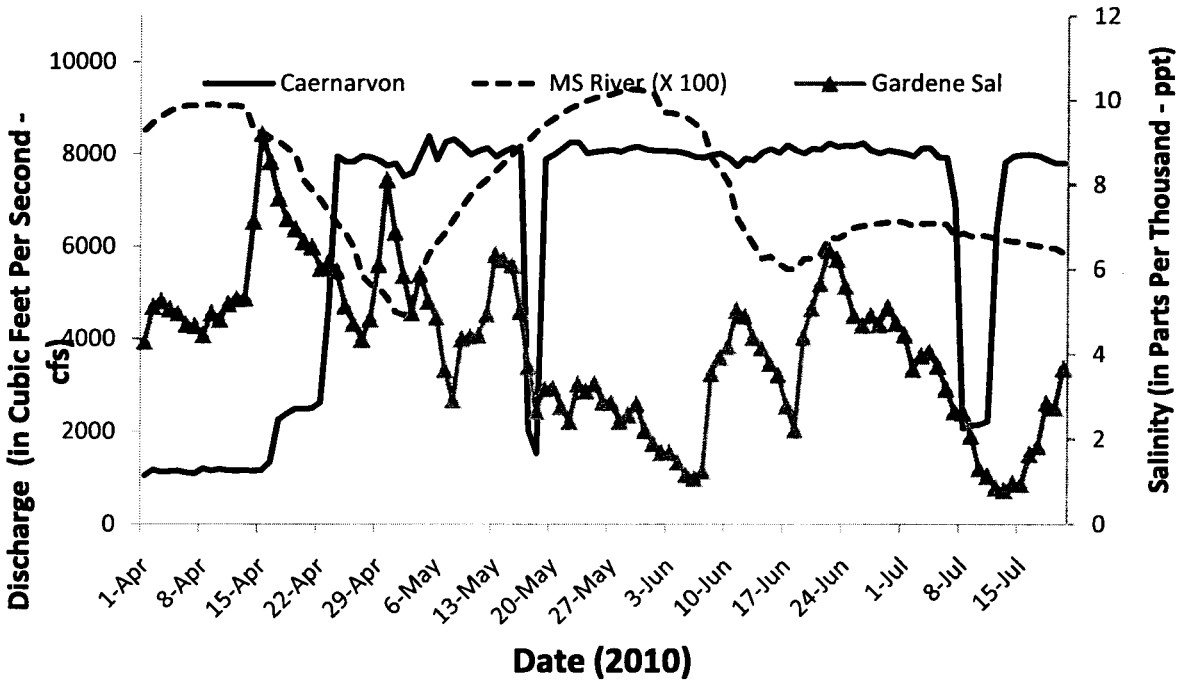


Figure 6. Graphical representation of relationship between Bay Gardene salinity and freshwater discharge from the Mississippi River and the Caernarvon Freshwater Diversion.

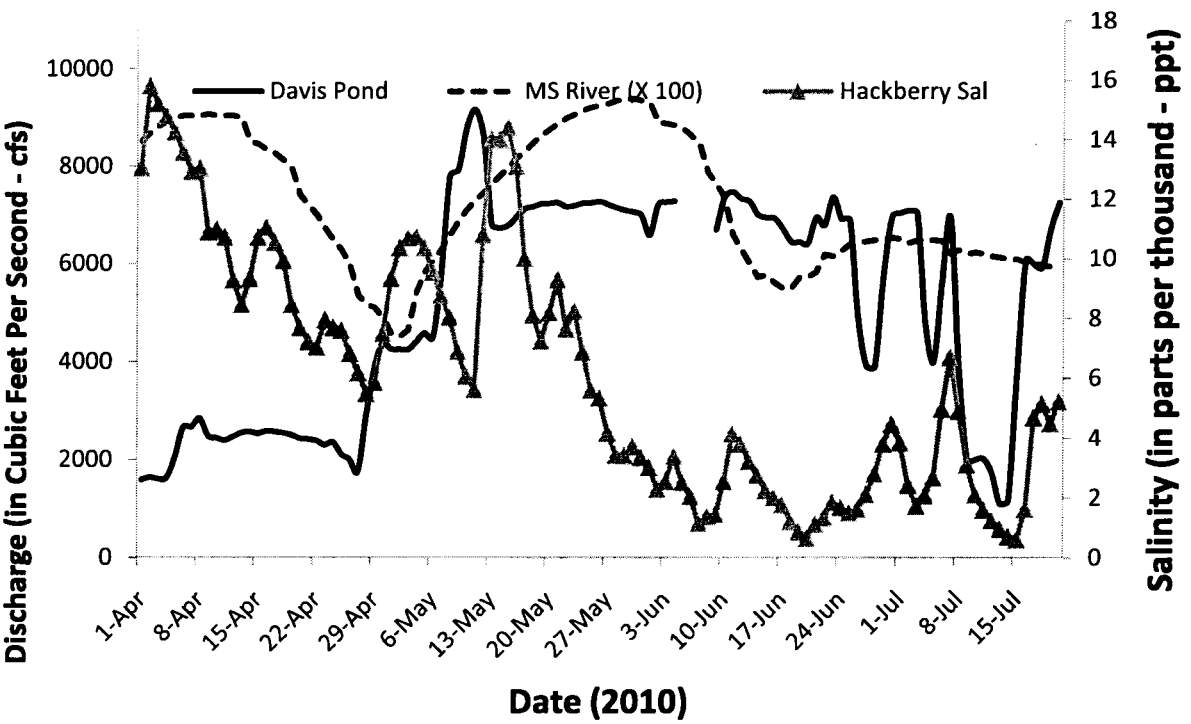
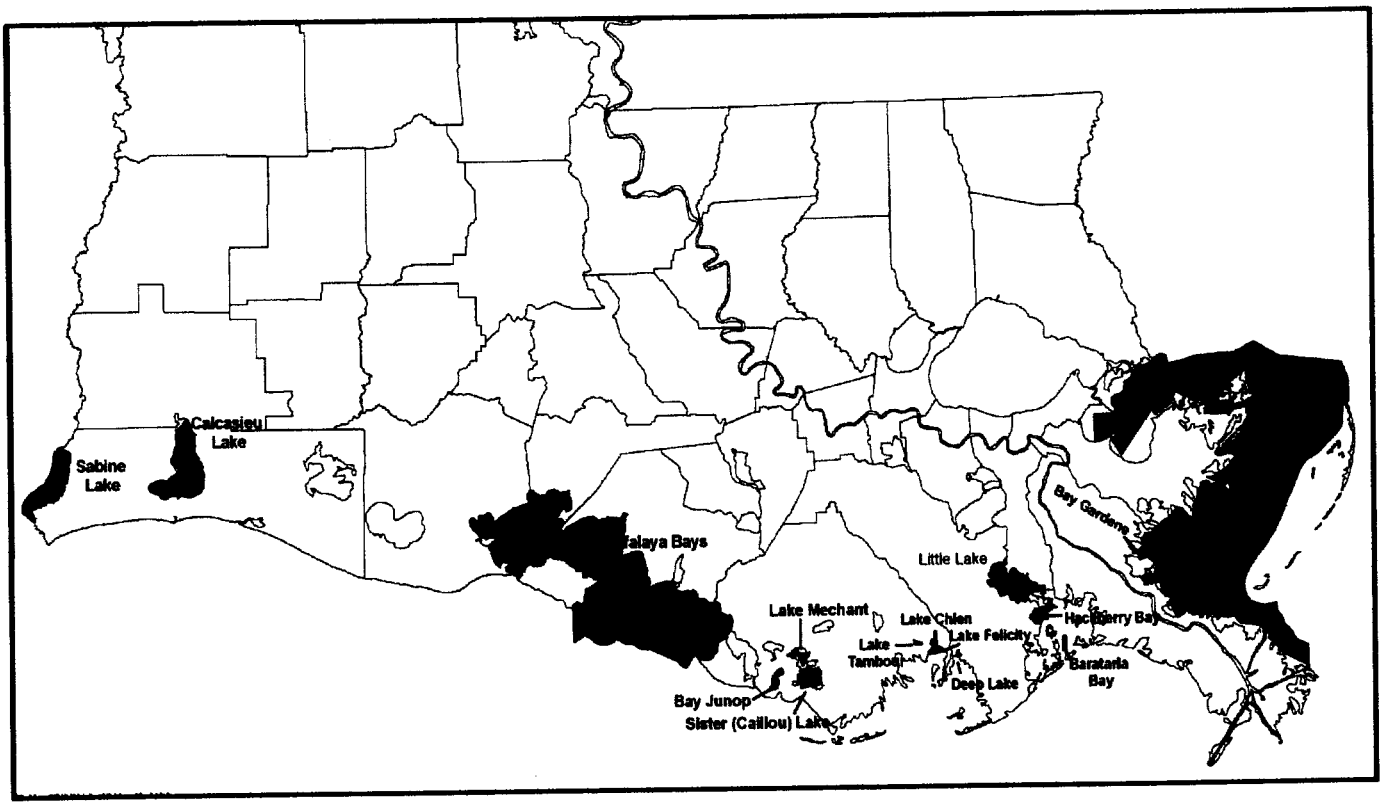


Figure 7. Graphical representation of relationship between Hackberry Bay salinity and freshwater discharge of the Mississippi River and the Davis Pond Freshwater Diversion.

Table 3. Summary of oyster-related legislation of the 2010 Louisiana regular legislative session.

Bill	Author (s)	Description	Passed?	Act
HB641	Henderson	Repeals the sunset date for the use of devices to prevent predation on oyster leases	Yes	263
HB642	Henderson	Adds a member from the Louisiana Oystermen Association to the Oyster Task Force	Yes	264
HB643	Henderson	Specifies certain conditions necessary for the issuance of a coastal use permit in certain public oyster seed ground areas	No. Referred to Committee, no further action.	
HB644	Henderson	Allows the relocation of certain classes of oyster leases	Yes	265
HB692	Wooton and Hutter	Extends the time within which an oyster lease renewal must be recorded	Yes	267
HB693	Wooton, Harrison, and Hutter	Requires DHH to notify oyster harvesters and dealers of possible state exemption from the National Shellfish Sanitation program's Vibrio management plan	Yes	268
HB695	Wooton and Hutter	Allows the sale within the state of Louisiana Oysters for raw consumption at all times of the year	Yes	269
HB712	Wooton and Hutter	Provides for certain restrictions on the taking of oysters	Yes	270
HB876	St. Germain, Dove, and Gautreaux	Removes the requirement for payment of a survey fee for oyster leases	Yes	392
HB889	St. Germain, Dove, and Gautreaux	Authorizes the Wildlife and Fisheries Commission to promulgate rules to protect oyster habitat from harvest-related damage	No. Referred to Committee, no further action.	
HB1234	Labruzzo	Requires that fishermen submit trip tickets to the Department of Wildlife and Fisheries to document oyster harvest and sales	No. Referred to Committee, no further action.	
HB1334	Lambert	Provides relative to fisheries management by the Department of Wildlife and Fisheries	No. Vetoed by Governor	
HB1359	Wooton	Provides for relocation for those oyster leases located within a public oyster seed ground	No. Referred to Committee, no further action.	
HB1451	Henderson	Provides relative to the authority of the secretary of the Department of Wildlife and Fisheries to levy and collect compensation for damages to public oyster seed grounds and reservations	No. Referred to Committee, no further action.	
SB308	Marionneaux	Requires that all rules and regulations of the Wildlife and Fisheries Committee be subject to legislative oversight	Yes	777

Public Oyster Areas



Public Seed Grounds*

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

Public Seed Reservations**

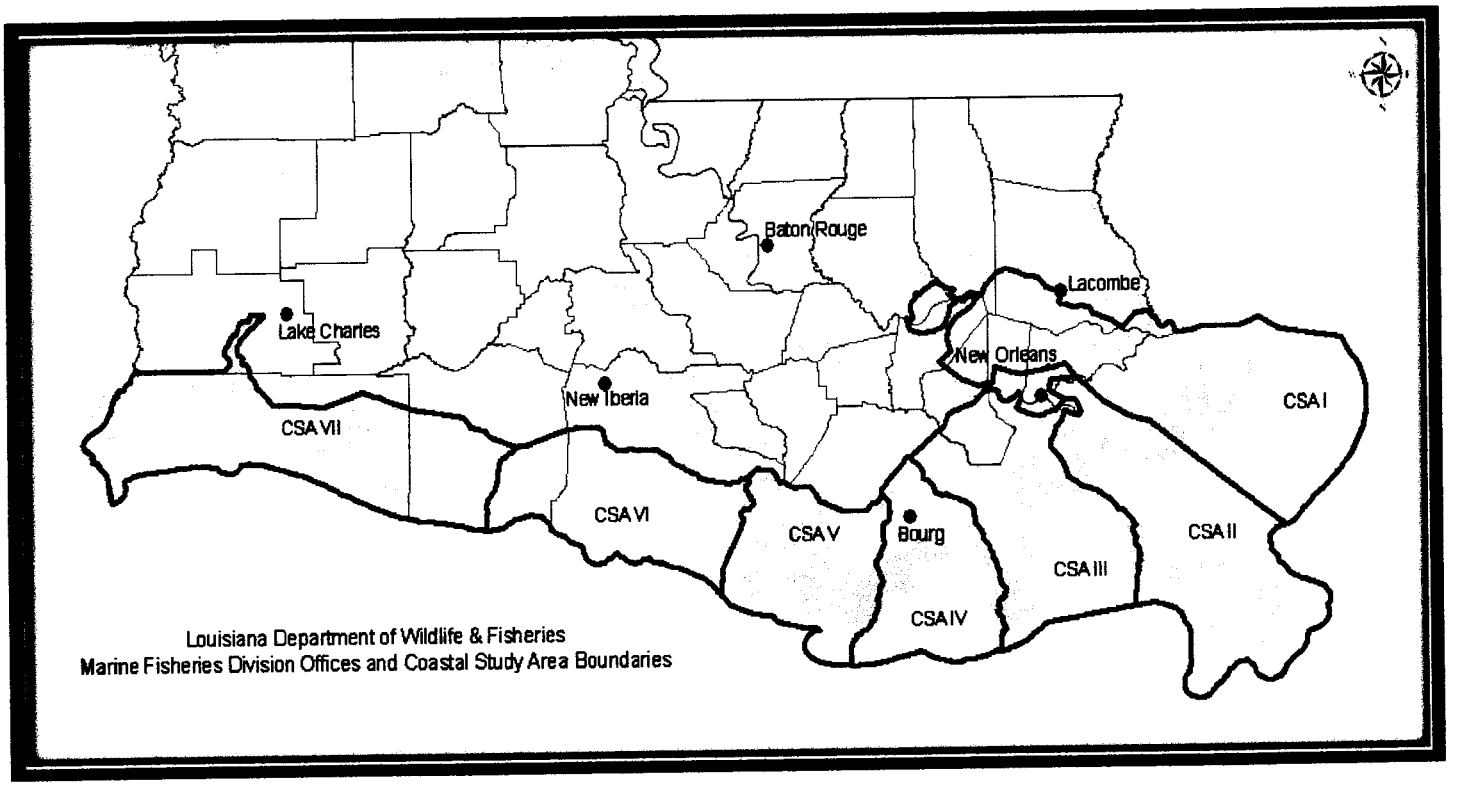
- Bay Gardene
- Hackberry Bay
- Sister (Caillou) Lake
- Bay Junop

Public Oyster Areas**

- Calcasieu Lake
- Sabine Lake

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

LDWF Fisheries' Coastal Study Areas (CSAs)



CSA	*Biologist Manager*	*Physical Address*	*Mailing Address*	*Phone Number*	*FAX Number*
1	Brian Lezina	61384 Fish Hatchery Road Lacombe, LA 70461	P.O. Box 1190 Lacombe, LA 70445	985.882.0027	985.882.0029
2	Keith Ibos	2021 Lakeshore Drive, Suite 407 New Orleans, LA 70122	*Same*	504.284.2030	504.284.5263
3	Jason Adriance	2021 Lakeshore Drive, Suite 407 New Orleans, LA 70122	*Same*	504.284.2030	504.284.5263
4	Vince Guillory	468 Texas Gulf Road Bourg, LA 70343	P.O. Box 189 Bourg, LA 70343	985.594.4139	985.594.7317
5	Steve Hein	468 Texas Gulf Road Bourg, LA 70343	P.O. Box 189 Bourg, LA 70343	985.594.4139	985.594.7317
6	Paul Cook	2415 Darnall Road New Iberia, LA 70560	*Same*	337.373.0032	337.373.0032
7	Michael Harbison	1213 N. Lakeshore Drive Lake Charles, LA 70601	*Same*	337.491.2573	337.491.2009

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 only recently designated by Louisiana Wildlife and Fisheries Commission rule as such 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 through the placement of cultch material (i.e. shell, limestone, crushed concrete) on suitable water bottoms.

Currently, these areas are managed to balance the economic opportunity 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 effectively utilize 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 14 and July 21, 2010 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 14 stations were visited with five square-meter replicates taken at each station except for the Shell Point cultch plant (= 2009 cultch plant). This represents an increase in replicates from 3 to 5 over previous assessments. At the Shell Point 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 24mm and less. 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 120,188 barrels (bbls) of seed-size oysters and 94,833 bbls of market-size oysters. These numbers include all of the currently assessed reefs and the 2009 Shell Point cultch plant (Figure 1.1). Comparing with last year's assessment, there was a 36% increase in the seed-size estimate and a 47% decrease in the sack-size estimate. The seed increase, however is largely

attributable to the Shell Point cultch plant. When comparable 2009 and 2010 data are used, there is actually a 7% decrease in the seed estimate.

Oyster density and abundance was not evenly distributed among areas (Table 1.1) with the highest density estimates of seed oysters at the Shell Point cultch plant, and highest sack oyster densities at Grassy Island and Drum Bay. It is important to note variability both within and among stations when comparing estimates. This variability is magnified when extrapolating small sample sizes to large areas. In short, changes since last assessment have been dramatic on an individual reef basis and have limited areas of large resource availability.

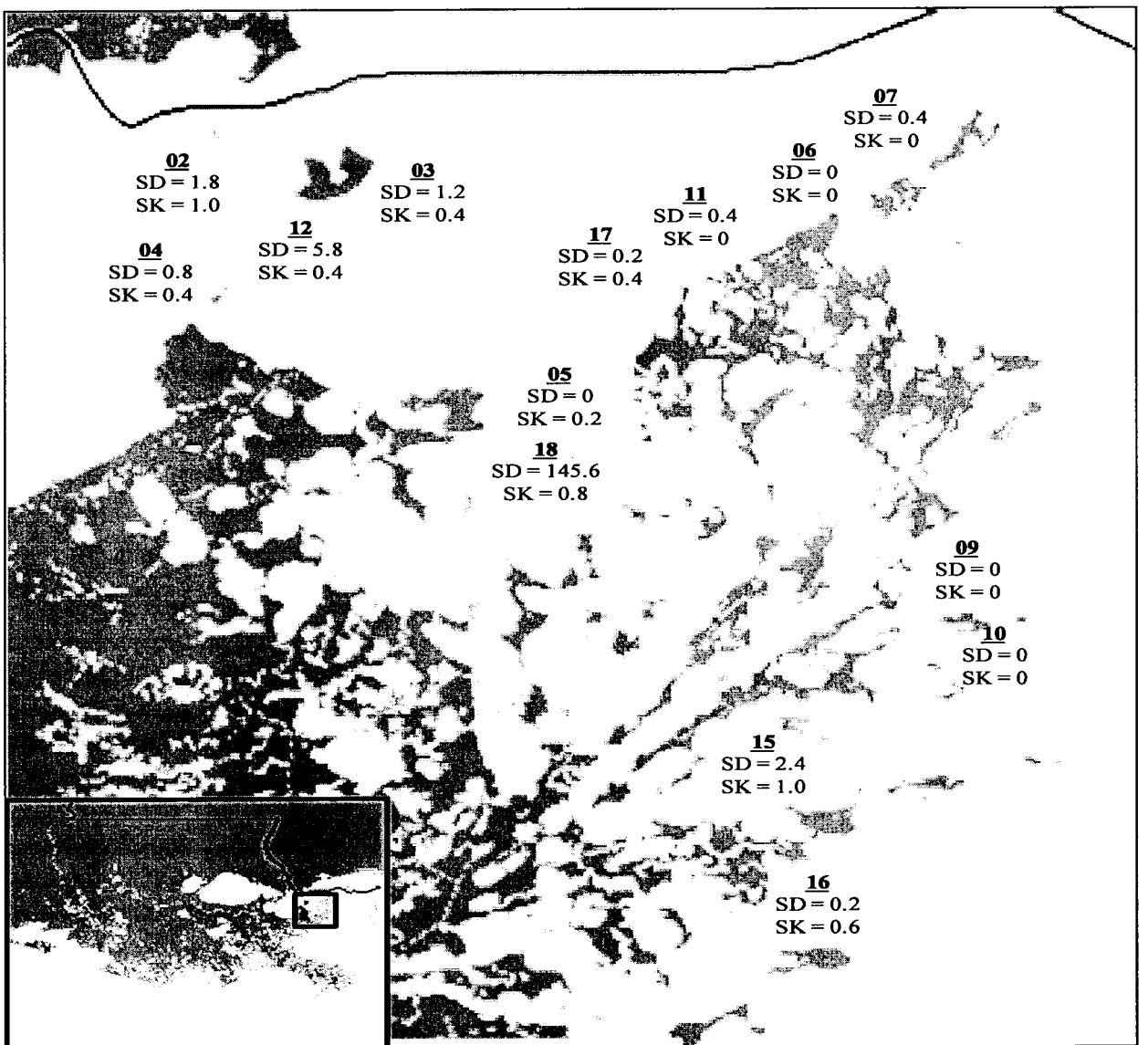


Figure 1.1. Map showing Coastal Study Area 1 oyster stock assessment stations within the Mississippi and Chandeleur Sounds. Numbers below stations are average numbers of seed (SD) and sack (SK) oysters per m^2.

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, the long-term average is largely driven by availability in 2000 and 2001. There have been

several years of heavy localized harvest, high recent mortalities, strong tropical events such as Hurricane Katrina in 2005, and limits to recruitment that appear to have severely limited abundances.

Spat Production
Live spat were not present in all samples containing a suitable substrate. Means ranged from 0 to 47.2 individuals per m^2. The highest spat occurrences were at the Shell Point cultch plant when adjusted to a square meter. Spat densities were fairly consistent among replicates. The only other sites with appreciable spat densities were Millennium Reef (=2000 cultch plant) and Halfmoon Reef. 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 9 of the 14 sample stations. The highest density of mussels was 143 individuals / m^2 at the Halfmoon station. Higher mussel densities were generally restricted to the lower salinity reefs in Lake Borgne and western Mississippi Sound.

Oyster Predators
The southern oyster drill, *Stramonita haemastoma*, was not collected at any of the sample stations although high numbers were reported in some reefs in the early part of the season. Only dead eggs were found at the Cabbage Reef station. The lack of this predator is probably due to extremely cold winter temperatures, and reduced salinities at time of sampling; such conditions which scientific literature show can limit the drill's abundance and distribution. Furthermore, hypoxic conditions in the Study Area may have had direct effects on the population as well as the indirect effect of removing the oyster resource within the usually high salinity areas. Although no stone crabs, *Menippe adinia*, were collected in dive samples, there were several adults collected on eastern reefs in unrelated sampling activities.

Mortality
Mortality estimates were highly variable between size classes and stations (Table 1.2) during this sampling event. Spat mortalities ranged from 0 to 55.8%. Highest spat mortalities were located at Turkey Bayou which was experiencing near anoxic bottom conditions at the time along with the Three-mile and Johnson Bayou stations. Seed mortalities ranged from 0 to 100% and were highest at the stations listed above. Sack mortalities ranged from 0 to 100% with all recorded mortalities attributed to the same hypoxic stations. This hypoxia has been recorded before in these areas and will be discussed in section below.

Tropical and Climatic Events
There were three tropical systems affecting the northern Gulf of Mexico since the last stock assessment, Tropical Storm Claudette, Hurricane Ida in 2009, and Hurricane Alex in 2010. Only Hurricane Ida came close to the Louisiana Coastal Zone. Although making landfall as a tropical storm it was notable in that it formed in November. There was a minor storm surge associated with this system without noticeable impact to the resource. The largest impact of Hurricane Alex was the movement of oil from the Deepwater Horizon spill into the western reefs of CSA1.

Table 1.1. Mean densities of oysters collected at each station. [1] - note – station temporarily suspended. Values in parenthesis are percent changes from the 2009 assessment[2] – includes data from 2009 Cultch Plant (Shell Pt.).

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		1.8	1.0		
Halfmoon Is.	3	6,850	1.2	0.4	48,771 (+66%)	46,204 (-49%)
Petit Is.	4		0.8	0.4		
Three-mile Bay	5	3,059	0	0.2	0 (N/A)	6,877 (-%)
Grand Pass	6		0.0	0		
Cabbage Rf.	7	1,802	0.4	0	2,734 (-60%)	0 (-100%)
Turkey Bayou	11		0.4	0		
Martin Is.	9		0	0	0	0
Holmes Is.	10	4,156	0	0	(0%)	(0%)
Shell Point	18		145.6	0.8	38,627 (no 2009 data)	424 (no 2009 data)
Johnson Bayou	17	200	0.2	0.4	225 (-98%)	899 (-88%)
Millennium Reef	12	70	5.8	0.4	2,282 (0 in 2009)	315 (0 in 2009)
Drum Bay	15	1,796	2.4	1.0	24,227 (+480%)	20,189 (+200%)
Morgan Harbor	16	2,954	0.2	0.6	3,321 (-60%)	19,924 (-48%)
Hospital Wall[1]	1	376				
2010 Total					**120,188 (+36%)**	**94,833 (-47%)**

A hard freeze event occurred since the last stock assessment but appears to have had minimal to no impact on the public reef resources. The vast majority of the CSA1 reefs are in waters deeper than 6 feet. Any damages to intertidal resources have not been quantified.

The major impacts to the resource have come in the duration, timing, and magnitude of freshwater inflows into the system. A large amount of freshwater entered the system starting in early fall and persisted through the winter (Figure 1.3). Although continuous water measurements are not taken, evidence suggests that these freshwater inputs led to stratification of the water column reducing bottom dissolved oxygen (DO). This condition appears to have contributed to moderate mortality in late October either by hypoxia or other physiological stress to the animals. Although freshwater inputs moderated slightly, levels were again elevated in late spring persisting through the writing of

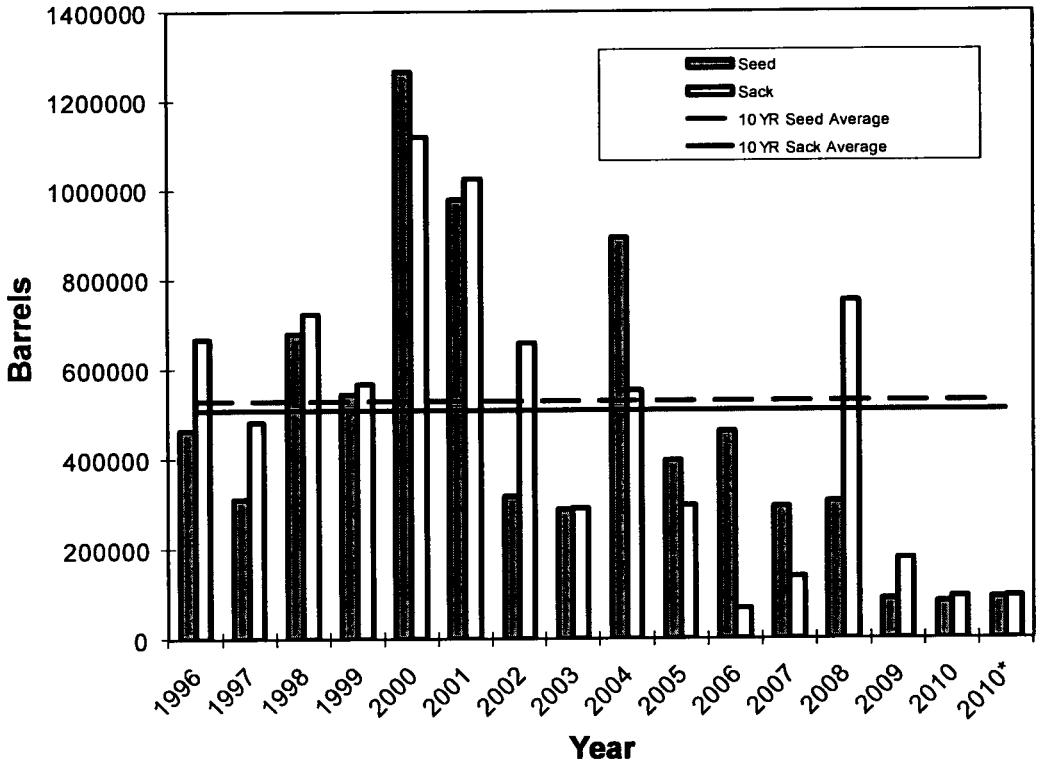


Figure 1.2. Current and historical Stock Assessment values. Horizontal lines represent the ten-year seed and sack average. * Values include 2009 Shell Point cultch plant.

this document. During calm conditions, this has led to stratification of several reefs, especially those eastern reefs with deeper water and closer proximity to the Gulf. During square meter sampling Turkey and Johnson Bayous had bottom DO readings of 0.4mg/L and 0.9 mg/L, respectively. The Three-mile site had values only slightly better at 3.9 mg/L. There was a 10 part per thousand (ppt) difference between surface and bottom salinities at Turkey Bayou. This density stratification does not allow for water column mixing during calm conditions. This was readily apparent in the mortalities from these three sites, all elevated. It is too soon to fully judge the impacts on the resource as the events are still on-going.

Deepwater Horizon Oil Spill

The Transocean "Deepwater Horizon" exploded in the northern Gulf of Mexico (Gulf) on April 20, 2010 resulting in the loss of 11 lives and the release of millions of gallons of oil and natural gas into the offshore waters. At the time of writing, the majority of the reefs within CSA1 have had oil at least in the surface waters. With a multitude of direct and indirect impacts possible from this event, research is ongoing.

2009/2010 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. Fishermen 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 the fishery. However, these data are consolidated by geographic region, are considered preliminary until well after the season concludes, and provide a limited resolution.

Table 1.2. Mean oyster mortality (recent) 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	0.0	6.7	0
Millennium Reef	6.3	0	0
Johnson Bayou	N/A	50.0	33.3
Petit Island	50.0	0.0	0.0
Half Moon Island	0.0	0.0	0.0
Three-Mile Bay	N/A	100	50.0
Turkey Bayou	55.8	93.5	100
Cabbage Reef	0	0	N/A
Grand Pass	N/A	N/A	N/A
Shell Point	6.2	1.1	0
Drum Bay	N/A	0.0	0.0
Morgan Harbor	N/A	0.0	0.0
Martin Island	N/A	N/A	N/A
Holmes Island	N/A	N/A	N/A
AVERAGE	16.9	22.8	18.3

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 biases and should be used in conjunction to provide a better estimate of the available resource.

The season within the Coastal Study Area 1 public seed grounds was set by the Louisiana Wildlife and Fisheries Commission (LWFC) for seed only September 9-23, 2009 and seed and sack October 28, 2009 to April 1, 2010. During this time two important management strategies were put in place and will be described in sections below. All public areas were closed to harvest on April 1, 2010.

Management Closures

The LWFC chose to not re-open a portion of the public seed grounds within St. Bernard Parish in October – April in order to protect a late spat set on the reefs of the eastern Mississippi Sound and northern Biloxi marsh. This closure included areas north of 30° 00' 00" to the Louisiana-Mississippi state line, and east of 89° 22' 50" to the Louisiana state-federal boundary. This measure was necessary to ensure the protection of recently settled spat and allow for enhanced growth before the winter.

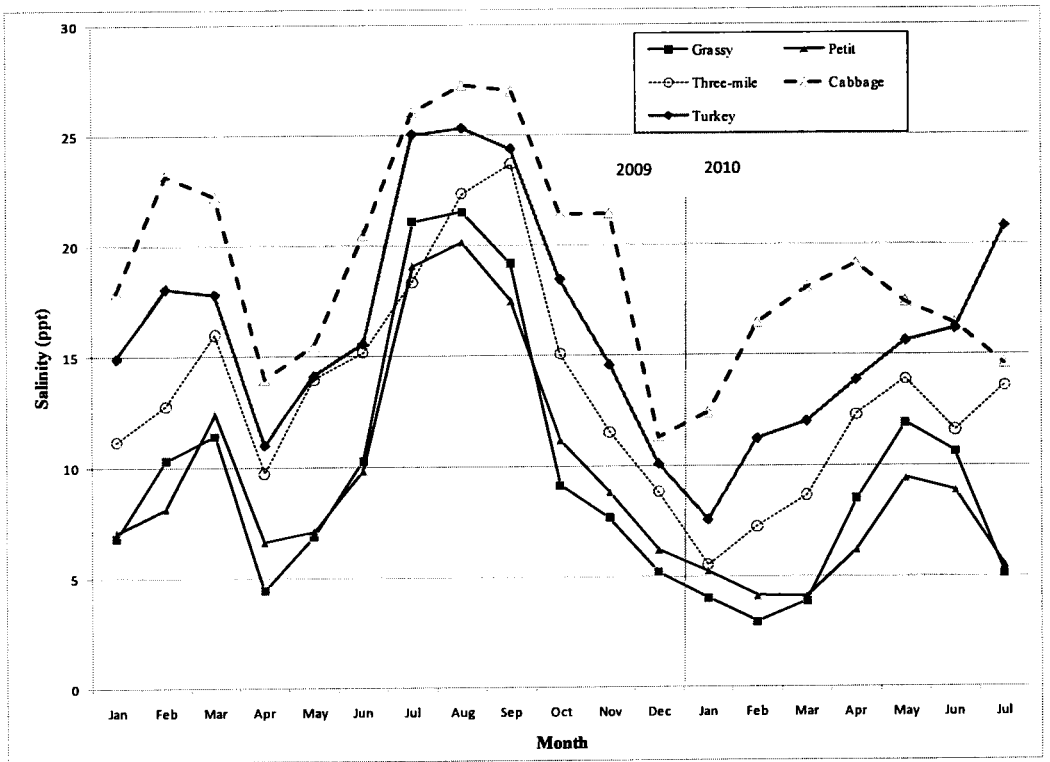


Figure 1.3. Mean monthly salinities for the northern Mississippi Sound public seed grounds 2009 to present.

Lake Borgne Temporary Natural Reef

On December 4, 2009, acting on a request by fishermen, the LWFC designated certain portions of Lake Borgne as the "Lake Borgne Temporary Natural Reef (TNR)". This addition consisted of unleased state water bottoms in eastern Lake Borgne bounded by the Lake Borgne Seed Grounds to the west and the Biloxi marsh to the east. A 60 sack daily limit was placed within the TNR as well as the adjacent Lake Borgne Seed ground. In addition, the harvest of seed oysters was prohibited in both areas. The TNR opened on December 14, 2009 and closed on April 1, 2010. This TNR and adjacent areas of Lake Borgne were heavily harvested and were responsible for 92% of the harvest within the CSA1 monitoring area.

Harvest and Activity Estimates

Total harvest estimates for the public grounds in CSA1 were 158,028 sacks of market-sized oysters and 57,055 bbls of seed-sized oysters for a combined total of 136,069 bbls. When harvest estimates within stock-assessed areas are compared with 2009 assessments, there was an estimated utilization of 3.6% of the sack resource, 39% of the seed resource, and 15% utilization overall. There are also additional factors that must be examined when looking at these utilizations. For example, the Johnson Bayou shell plant was only open to harvest during the seed only season. However, the 2009 stock assessment showed that 42% of the available resource was sack-sized oysters. Based on this percentage an additional 25,000 sacks of market-sized oysters could have been harvested from this area. This is corroborated by usage statistics that show more seed harvested from the reef than available in the 2009 estimate. Also, there are myriad economic reasons that may lead harvesters to choose one reef complex over another. Those discussions are outside the scope of this document.

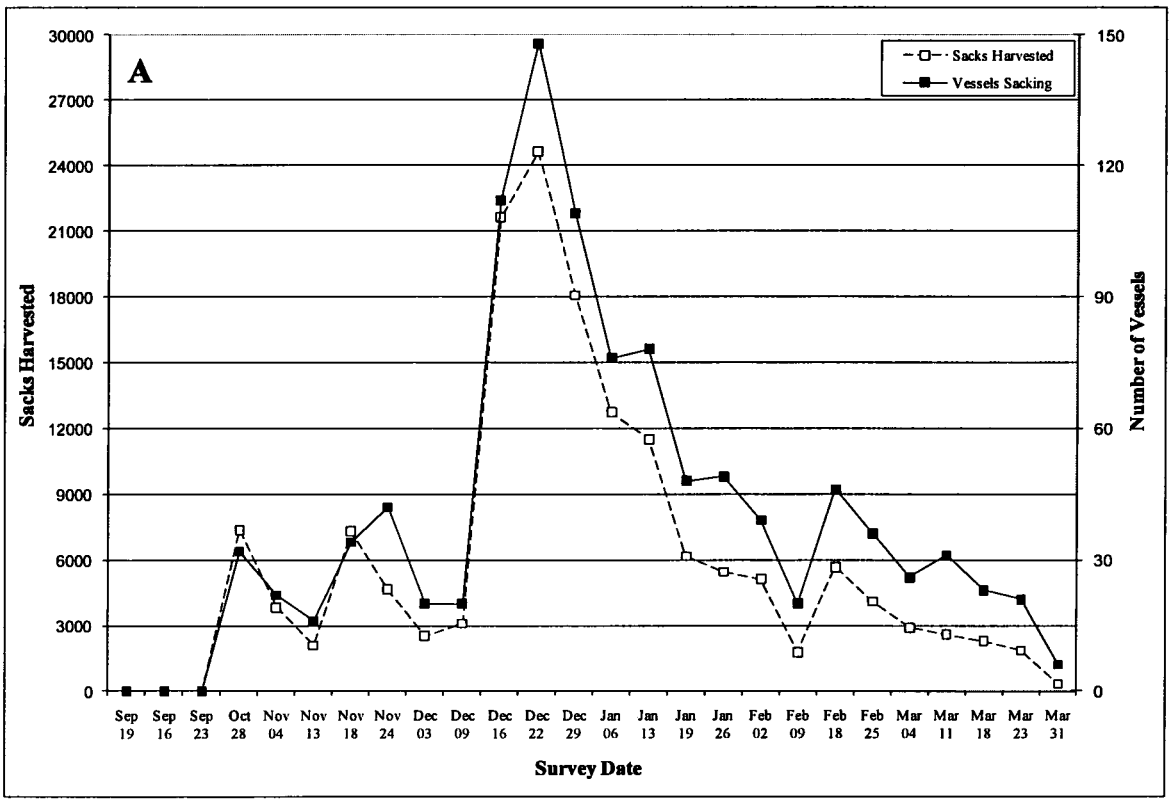
In general, harvest was not spread evenly through the area (Table 1.3). The majority of the sack harvest (92%) was taken within the Lake Borgne areas with secondary areas including the reefs of Petit Pass and Morgan Harbor. The majority of the seed harvest (52%) was from the Johnson Bayou cultch plant followed closely (40%) by the Lake Borgne areas. Seed harvest in other areas was minimal.

Table 1.3 Harvest estimates from the 2009/2010 public season within CSA1. [1]Area closed during sack season.

Station	Seed-size (bbls)	Market-size (sacks)
Grassy Island	0	0
Half-moon Island	0	1,458
Petit Island	2,815	6,630
Lake Borgne	22,755	145,293
Millennium Reef	0	600
Grand Banks	0	0
Three-Mile Bay	0	0[1]
Turkey Bayou	0	0[1]
Johnson Bayou	29,783	0[1]
Shell Point	Closed	Closed
Grand Pass	800	0[1]
Cabbage Reef	0	0[1]
West Karako / Bay Boudreau	900	0[1]
Drum Bay	0	550
Morgan Harbor	2	3,497
Bay Eloi	0	0
Total	**57,055**	**158,028**

Compared to the 2008/2009 season, overall seed harvest decreased by 35% with a 7% reduction in sack harvest. The seed harvest reductions may be based on availability of the resource as well as economic reasons to concentrate on sack harvest. Harvest of sack oysters shows only a moderate decline, however actual specific reductions were mitigated by the large amount of harvest within the Lake Borgne TNR. Effectively this area made up for lost availability brought on by management and environmental action.

Harvest amounts and types as well as total observed vessels were not constant over time (Figure 1.4). Market oyster harvest reached a peak of 24,634 sacks week^{-1} during the week of Christmas with seed oyster harvest reaching a peak of 34,227 bbls week^{-1} during opening week of seed only season. Similarly, the amount of vessels observed fluctuated, ranging from 6 during the last week of the season to 148 during Christmas week.



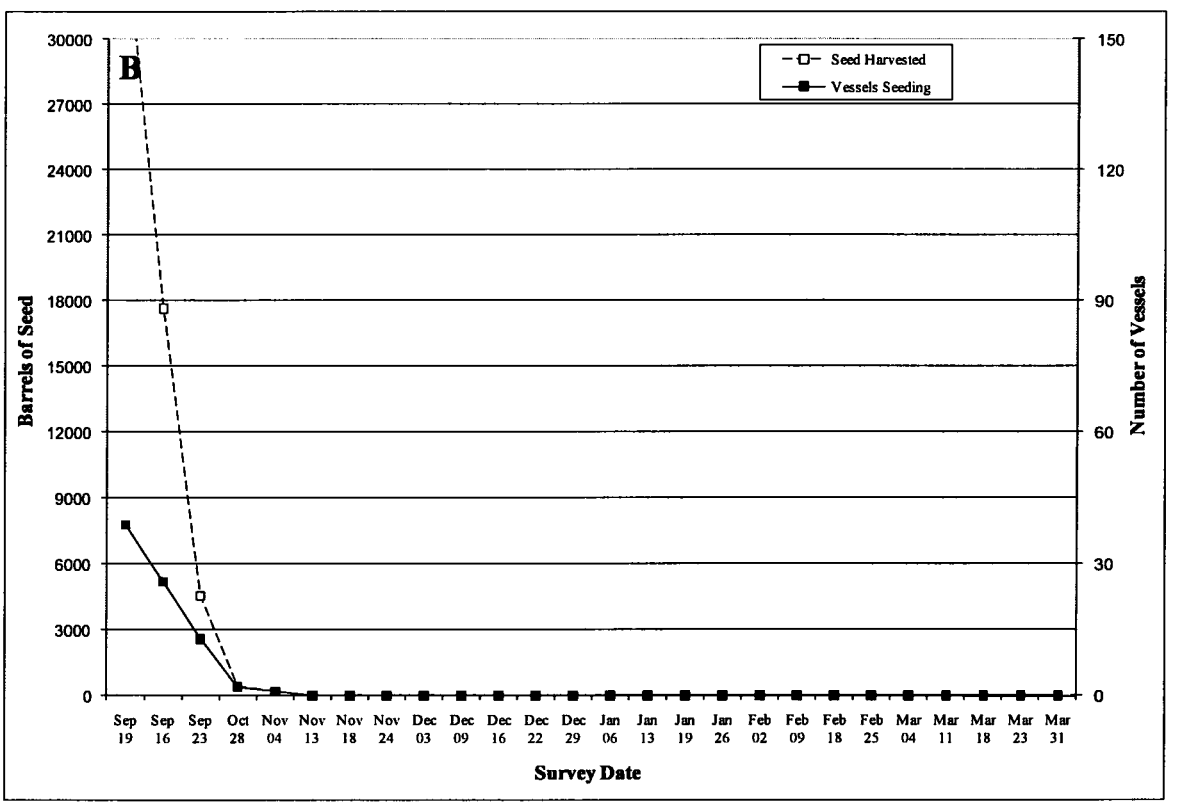


Figure 1.4. Estimates of weekly harvest and number of vessels observed sacking (A) and seeding (B)

(This page intentionally left blank)

Coastal Study Area (CSA) 2 – 2010 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 near Bohemia, and also from discharge from the Caernarvon and Bayou Lamoque freshwater diversion structures as well as the siphon at White's Ditch.

In May 2009, 22,250 cubic yards of size #57 limestone were spread over approximately 243 acres in Black Bay 1.75 miles north of Stone 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). 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 to December 31, 2009, provided reimbursement assistance to oyster leaseholders during their efforts to rehabilitate private oyster leases. This program reimbursed 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 began meter square samples on June 28, 2010. Twenty-one stations were completed by LDWF personnel. After tar balls were observed in the area, contract divers were hired to complete remaining eight stations and the 2007 and 2009 cultch plants. All samples were completed by July 16, 2010. Samples were collected by randomly placing aluminum square meter frames on known reef substrate at 29 stations located throughout CSA 2 in areas of Lake Fortuna, Bay Gardene, Bay Crabe, Black Bay, California Bay, Bay Long, and

Battledore Reef in Breton Sound (Figure 2.1). In an effort to improve precision, replicate samples were increased from two to five at each station. 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 five replicates at each station was used in conjunction with estimated reef acreage to estimate current oyster stock availability.

Five 1/4 meter square samples were taken at random locations on the 2009 cultch plant north of Stone 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.

Results and Discussion

Seed and Sack Stock

Oyster stock for the area is estimated at 105,836 barrels of seed oysters and 39,739 barrels of market sized oysters for a total of 145,576 barrels of overall stock. Overall availability is down 54.5% from last year, down 90.8% from the 10 year average of 2000 to 2009, and down 90.9 % from the long term yearly average since 1982. Seed oyster stock is down 56.2 % from last year, 89.2% below the past 10 year average, and 89.1% less than the long term yearly average since 1982. Sack oyster stock is down 49.3% from 2009, 93.5% below the average for the past 10 years, and 93.7% less than the long term yearly average since 1982 (Figure 2.2). The highest numbers of sack oysters were found in California Bay followed by Black Bay.

Seed oyster stock decreased from 2009 levels. The highest numbers of seed oysters were found on the 2009 cultch plant and in Black Bay. Approximately 28% percent of seed oysters are located in areas designated as sacking only (Lake Fortuna and Bay Long). Approximately 21 % of seed are located on the 2009 Cultch plant. Seed oysters averaged 1.74 inches overall with approximately 67% in the 1-2 inch size range. Most of these animals are not expected to reach market size by the end of the season. Sack oysters averaged 3.56 inches overall with approximately 82% in the 3-4 inch size range.

Spat Production

Overall spat set was extremely low (Table 2.1). Live spat were observed at only 11 stations including the 2007 cultch. Station 24 in Bay Gardene had the highest average spat catch at 7.0 spat per square meter. Eighty-eight percent of spat measured were greater than one half inch in length and may reach seed size by the start of the season.

Mortality

The 2010 assessment shows an increase in recent mortalities as compared to last year. Recent spat mortalities in meter square samples ranged from 0-100% with an average of 56.6% (10.7% in 2009). Recent seed mortalities ranged from 0-98% with an average of 34.2% (3% in 2009), and recent sack mortalities at 8.6% (0% in 2009). (Table 2.2) Highest seed and sack combined mortalities were observed at stations in North Black Bay (Stations 2, 3, 4, 6), at both cultch plants, and at stations near California Point (Stations 14, 16, 19). This increase in mortality may be attributed to lower salinities due to increased fresh water inputs into the area.

Fouling Organisms

The Hooked mussel (*Ischadium recurvum*) is 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 decreased in every station since last year with the exception of Lake Fortuna.

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. Shark Eye snails (*Neverita duplicata*), known to prey on small oysters by boring a hole through the oyster shell, were not found in any samples. No stone crabs (*Mennipe adinia*) or blue crabs (*Callinectes sapidus*) were observed in the samples. Mud crabs (*Xanthidae spp.*) were observed at nine stations.

Tropical and Climactic Events-

December 2009 was the wettest December on record for Louisiana with New Orleans getting 25.9 inches of rain for the month.

Oil Spill Impacts

On April 20, 2010, the Deepwater Horizon oil rig exploded off the Louisiana coast flooding the Gulf of Mexico south of Venice with oil. In an attempt to prevent oil from entering the estuary, the freshwater diversion structure at Caernarvon was opened and has been operating for the most part at 7,000- 8,000 cfs since April 24. Structures at Bayou Lamoque, Bohemia, the White's Ditch siphon, and the Ostrica locks were also opened. To date, numerous oil sheens have been observed throughout CSA 2 and oil has impacted shorelines in several bays including Bay Gardene. However, no evidence of direct oiling of subtidal oyster reefs has yet been found.

2009/2010SEASON SUMMARY

Methods

Harvest totals are estimated by obtaining fisheries dependent data from the monitoring of commercial fishing activity. "Board Runs" are conducted weekly during the season to estimate

harvest levels. 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 2009 cultch plant north of Stone Island, opened for bedding from September 9 to September 23, 2009, and for both bedding and sacking from October 28 to April 1, 2010.

Harvest totals for market sized oysters in 2009/2010 were estimated at 167,614 sacks (83,807 barrels). The number of total boats observed sacking was down 11.7% from 2008/2009. While the estimated harvest was 36.9% lower than 2008/2009, it represented a 107 % utilization of the estimated available market stock for the season. This comes on top of the 109% utilization of estimated available market resource in the 2008/2009 season. Estimated sack harvest by area was as follows: Bay Long at 28%, Black Bay at 23%, Bay Crabe at 18%, California Bay at 13%. Lake Fortuna at 8%, Bay Gardene at 8%, and the 2007 Cultch Plant at 1% (Figures 2.3-2.6).

Harvest totals for seed were estimated at 82,688 barrels. The number of boats observed bedding was up by 45.5% from 2008/2009. Estimated seed harvest was 7.4% higher than 2008/2009 and represented a 34.2% utilization of the estimated available seed. The majority of seed harvested came from the 2007 Cultch plant at 46% (38,133 barrels), followed by California Bay at 20%, Bay Crabe at 15%, Black Bay at 10%, and Bay Gardene at 9%.

Harvest totals for seed and sack combined in 2009/2010 were estimated at 166,495 barrels. This 20.6% reduction in harvest compared to 2008/2009 still represents a 52% utilization of estimated available resource for 2009/2010. (Figures 2.3 and 2.5)

Sixteen vessels were boarded by CSA2 biologists and checked for the percent cultch in seed stock harvested. Percentages of cultch taken ranged from 1-50% with an overall average cultch take of 18.3% per bedding load. Excessive removal of non-living reef material by vessels harvesting seed oysters remains a concern regarding the long-term sustainability of the remaining oyster resources.

Eleven people in Mississippi became ill with Norovirus after eating Louisiana oysters on March 10, 2010. As a result, LDHH closed Louisiana Shellfish Harvest Area 7 in Plaquemines Parish effective sundown, March 24. LDHH also ordered a recall of all oysters harvested from the area since March 6 including shucked, frozen, breaded, and post-harvest processed oysters and oysters for the half shell market. Harvest Area 7 was re-opened on May 15, 2010.

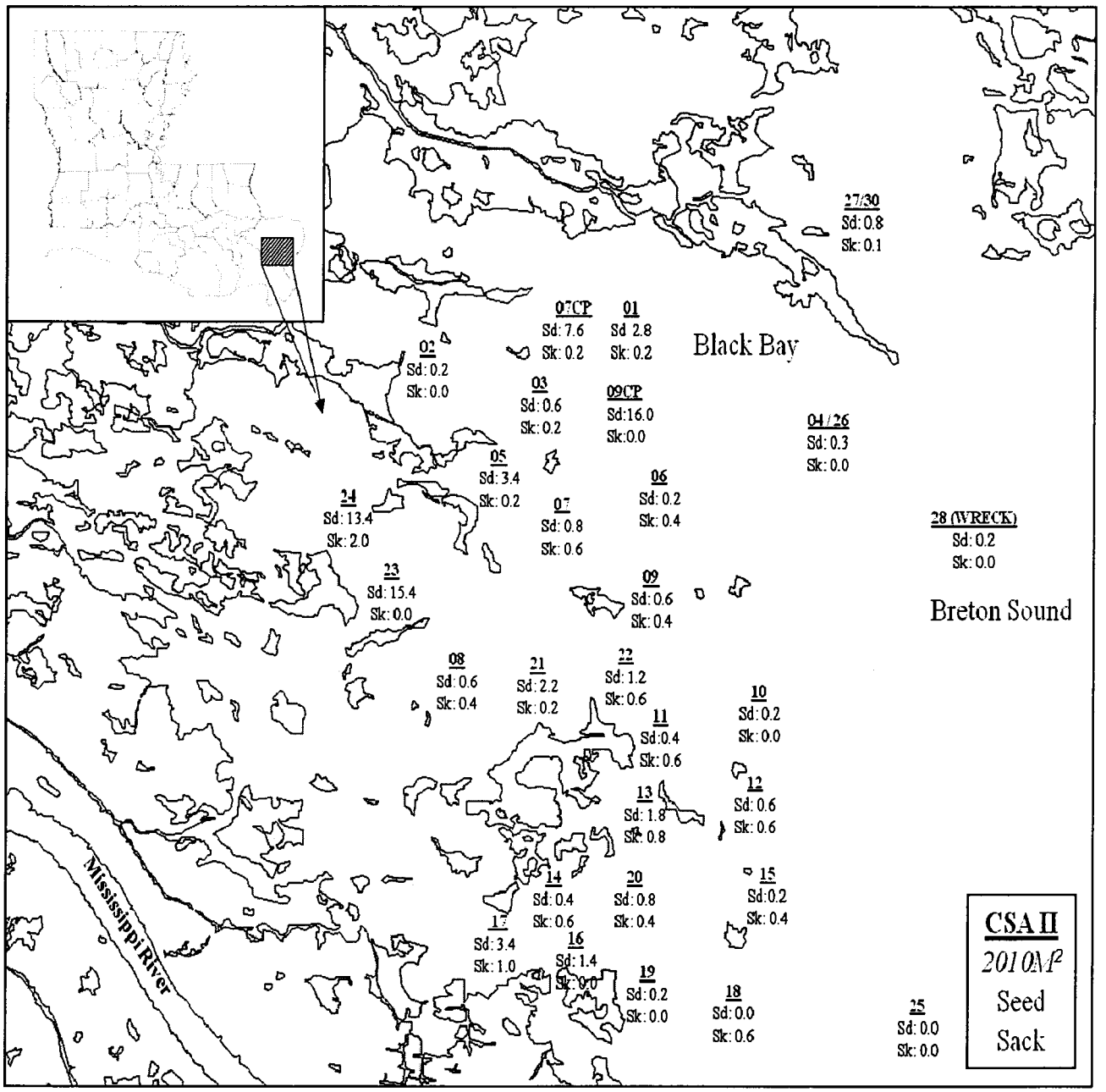


Figure 2.1 CSA2 square meter stations and results. Numbers below stations are average numbers of seed (Sd) and sack (Sk) oysters per square meter (N=5 replicates per station).

Table 2.1 2010 square meter sample results for Coastal Study Area II

Stations		Approx. Reef Acres	Average # of Live Seed Oysters/m2	Average # of Live Sack Oysters/m2	Barrels of Seed Oysters Available	Barrels of Sack Oysters Available	Oyster Spat/m2
1	Snake	506	2.8	0.2	7,964	1,138	0.8
2	Jessie	59	0.2	0.0	79	0	0.4
3	N. Lonesome	896	0.6	0.2	3,022	2,015	0.2
5	Bayou Lost	118	3.4	0.2	2,255	265	0.0
6*	Lonesome	273	0.2	0.4	266	1,066	0.2
--	07 Shell Plant	200	7.6	0.2	8,544	450	3.0
--	09 Shell plant	243	16.0	0.0	21,854	0	0.0
7	Black Bay	301	0.8	0.6	1,353	2,030	0.0
8	W. Bay Crabe	501	0.6	0.4	1,690	2,253	0.0
9	Stone	461	0.6	0.4	1,555	2,073	0.0
10	S. Black Bay	145	0.2	0	163	0	0.0
11	Elephant	339	0.4	0.6	762	2,287	0.0
12	Curfew	425	0.6	0.6	1,433	2,867	0.2
13	N. California	109	1.8	0.8	1,103	980	0.0
14	California	7	0.4	0.6	16	47	0.0
16	Sunrise	174	1.4	0.0	1,369	0	0.0
17	Bay Long	572	3.4	1.0	10,931	6,430	0.2
19	Mangrove	937	0.2	0.0	1,053	0	0.0
20	W. Pelican	293	0.8	0.4	1,318	1,318	0.0
21	Bay Crabe	659	2.2	0.2	8,149	1,482	0.0
22	E. Bay Crabe	122	1.2	0.6	823	823	0.0
23	E. Gardene	28	15.4	0.0	2,424	0	1.4
24	Bay Gardene	69	13.4	2.0	5,197	1,551	7.0
4,26	N. Black Bay	315	0.3	0.0	531	0	0.0
15	Telegraph	127	0.2	0.4	143	571	0.0
18	E. Pelican	1,528	0.0	0.6	0	5,275	0.0
25	Battledore	1419	0.0	0.0	0	0	0.0
27,30	L Fortuna	4288	0.8	0.1	19,282	4,820	0.5
28	Wreck	2276	0.2	0.0	2,559	0	0.0
Sub Total		**17,390**			**105,836**	**39,739**	
ALL TOTAL							

	2009	2010	% Change
Seed	**241,762**	**105,836**	**-56.2%**
Sack	**78,450**	**39,739**	**-49.3%**
Total	**320,212**	**145,576**	**-54.5%**

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

Table 2.2 2010 square meter predator/mortality results Coastal Study Area 2

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	2.8	0	42.9	17.6	0	16.7	24
2	Jessie	4.6	0	80	98	100	98.1	95.2
3	N. Lonesome	0.0	0	75	50	0	42.9	54.5
5	Bayou Lost	0.0	0	na	5.6	0	5.3	5.3
6	Lonesome	1.2	0	0	75	0	50	42.9
--	07 Shell plant	8.6	0	61.5	44.9	0	44.3	50.5
--	09 Shell Plant	41.6	0	100	66.7	na	66.7	69.2
7	Black Bay	1.4	0	na	33.3	0	22.2	22.2
8	W. Bay Crabe	36.6	0	100	40	0	28.6	58.3
9	Stone	7.4	0	100	40	0	28.6	44.4
10	S. Black Bay	9.0	0	na	0	na	0	0
11	Elephant	18.4	0	na	0	0	0	0
12	Curfew	87.4	0	80	25	0	14.3	41.7
13	N. California	114.4	0	na	0	0	0	0
14	California	43.6	0	na	75	25	58.3	58.3
16	Sunrise	127.0	0	100	46.2	na	46.2	50
17	Bay Long	94.8	0	50	32	16.7	29	30.3
19	Mangrove	5.2	0	100	50	na	50	66.7
20	W. Pelican	36.4	*0*	na	33.3	0	25	25
21	Bay Crabe	25.6	0	100	15.4	0	14.3	20
22	E. Bay Crabe	51.4	0	100	0	0	0	18.2
23	E. Gardene	16.0	0	22.2	1.3	na	1.3	3.4
24	Bay Gardene	2.0	0	7.9	2.9	0	2.5	4.3
4,26	N. Black Bay	0.5	0	100	25	100	40	83.3
15	Telegraph	41.6	0	100	0	0	0	62.5
18	E. Pelican	5.6	0	na	na	0	0	0
25	Battledore	0.0	0	na	na	na	na	na
27,30	L Fortuna	15.6	0	66.7	27.3	0	25	48.1
28	Wreck	0.4	0	100	0	na	0	50
	AVERAGE			***74.3***	***29.8***	***11.0***	***25.3***	***36.7***

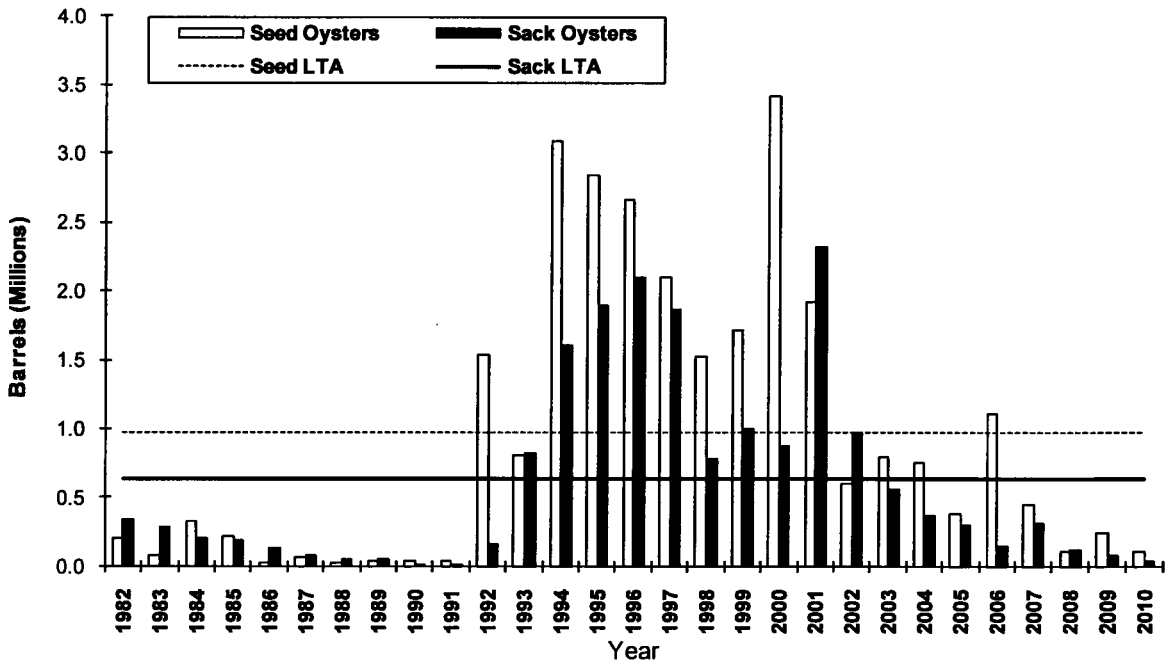


Figure 2.2 Historical Coastal Study Area 2 oyster stock size (estimates based on square meter sample analysis).

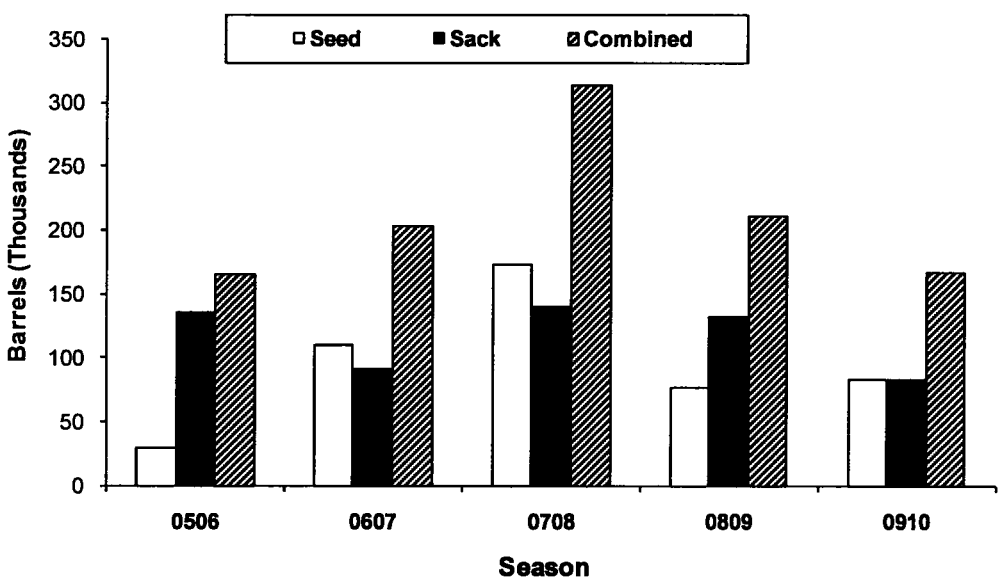


Figure 2.3 Estimated total harvest by season.

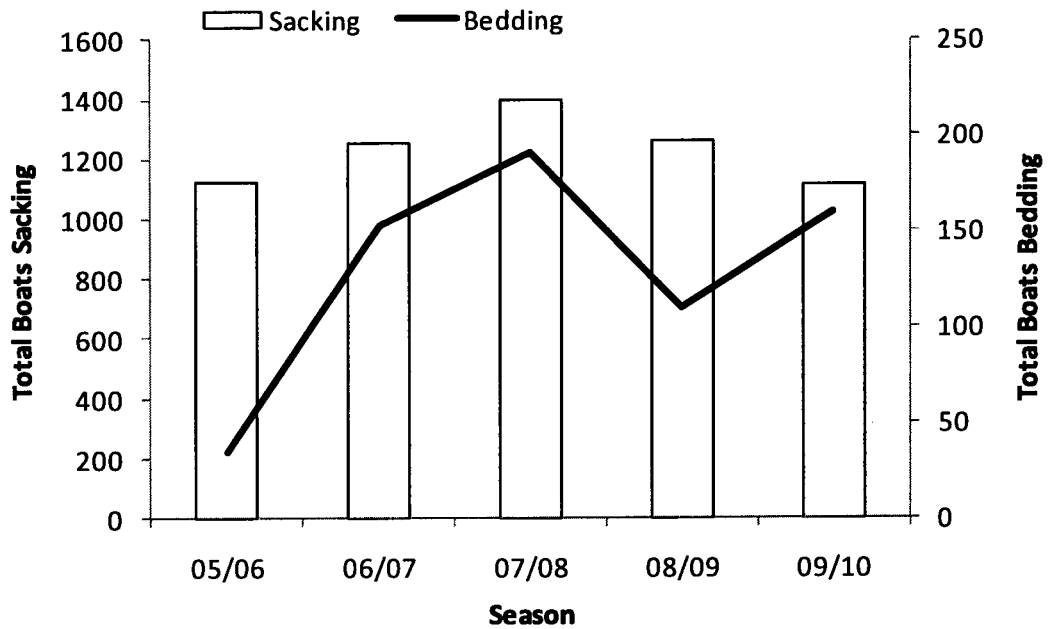


Figure 2.4 Total numbers of vessels observed by season.

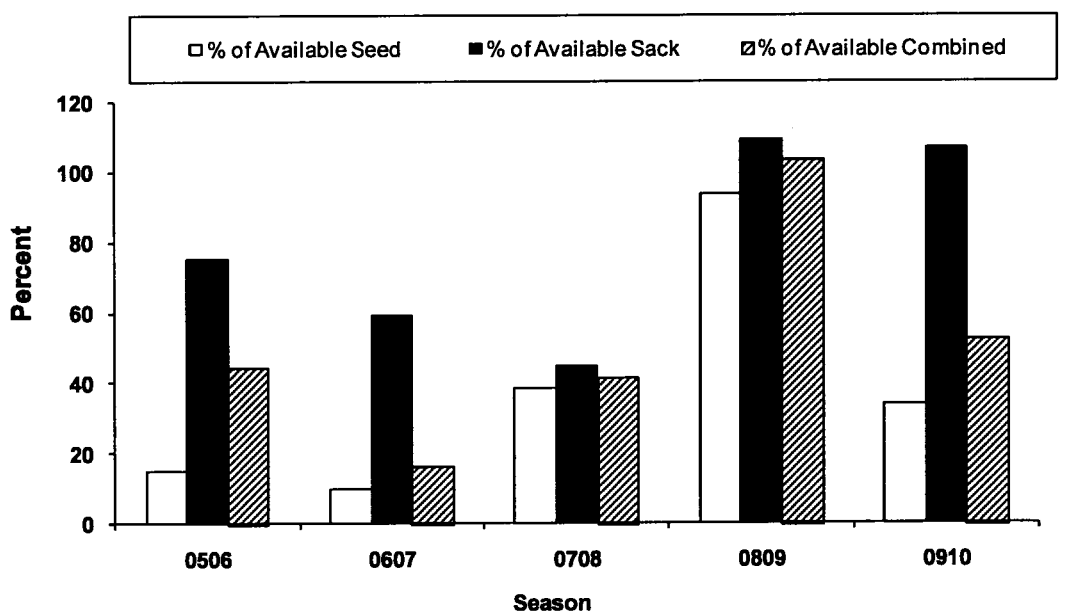


Figure 2.5 Percent of available resource utilized by season.

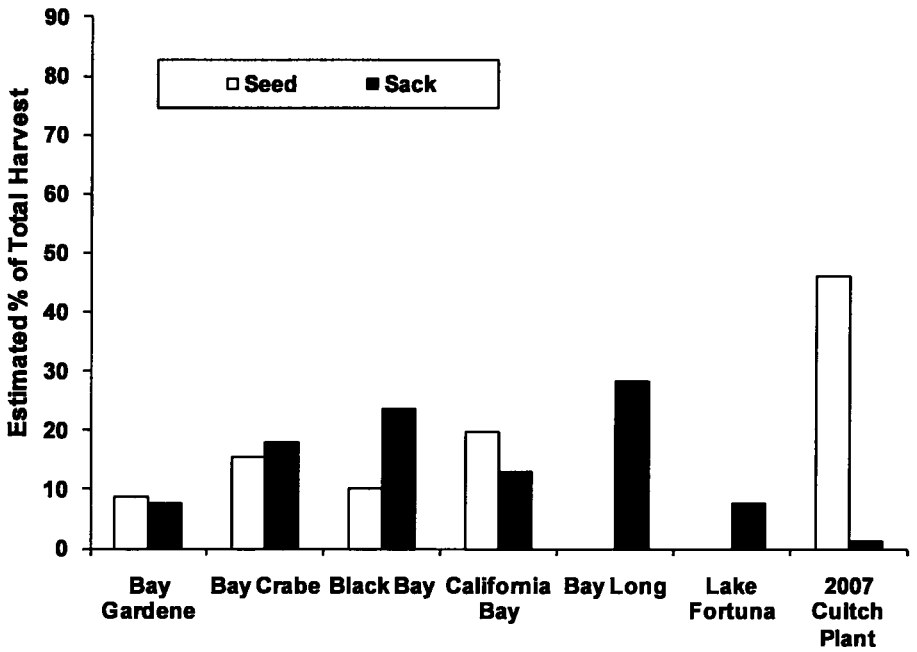


Figure 2.6 Percent of estimated total harvest by bay system within CSA2.

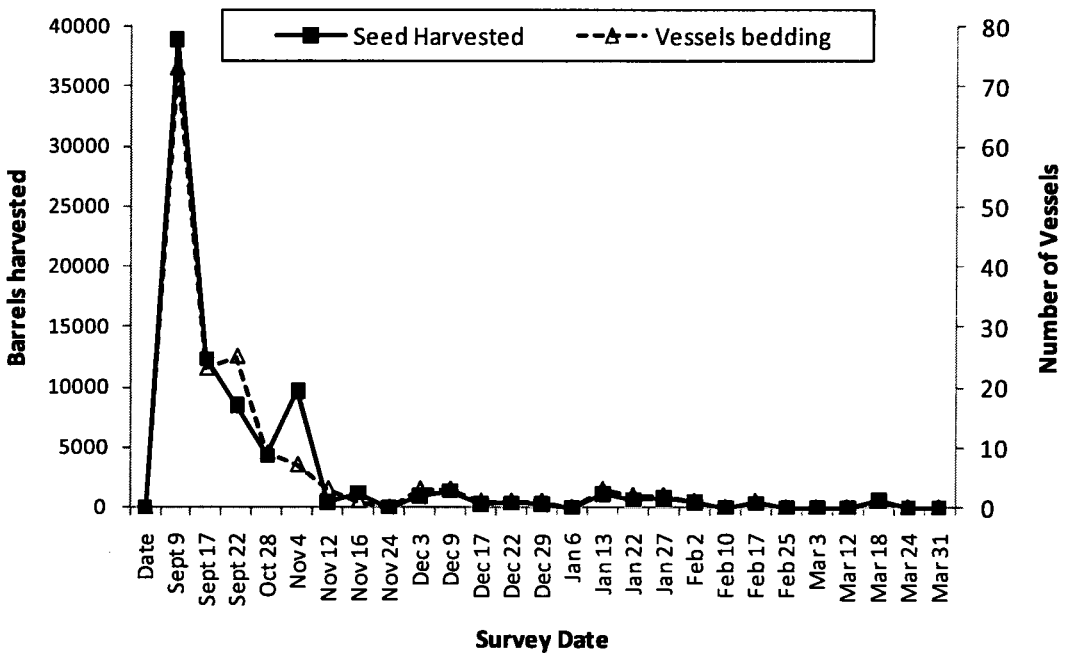


Figure 2.7 Estimated weekly seed harvest and number of vessels observed bedding.

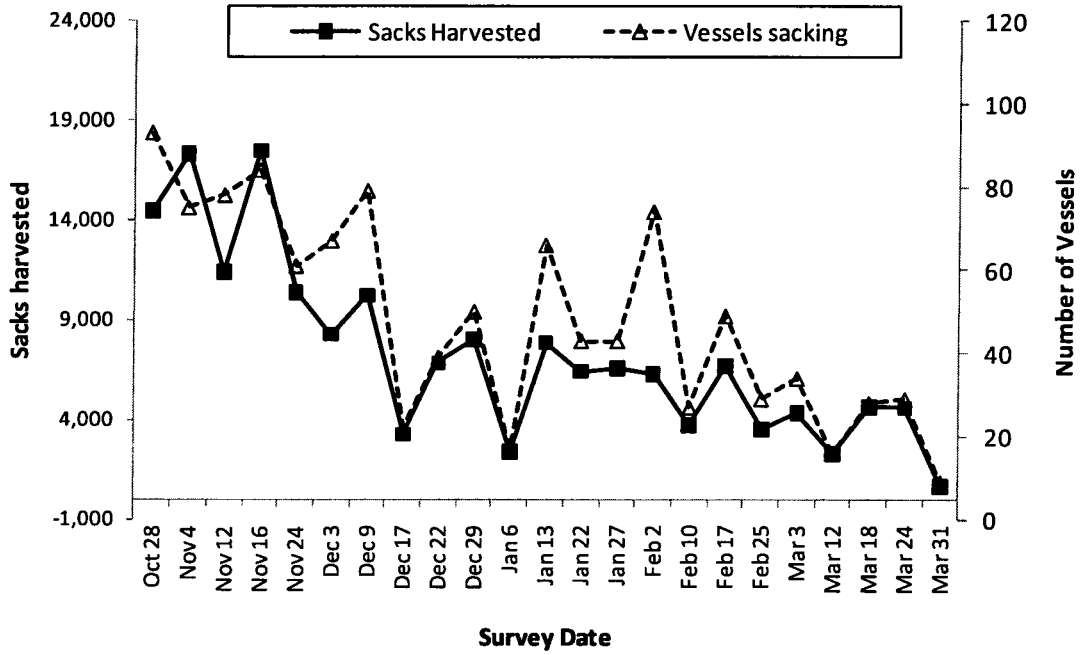


Figure 2.8 Estimated weekly sack harvest and number of vessels sacking observed.

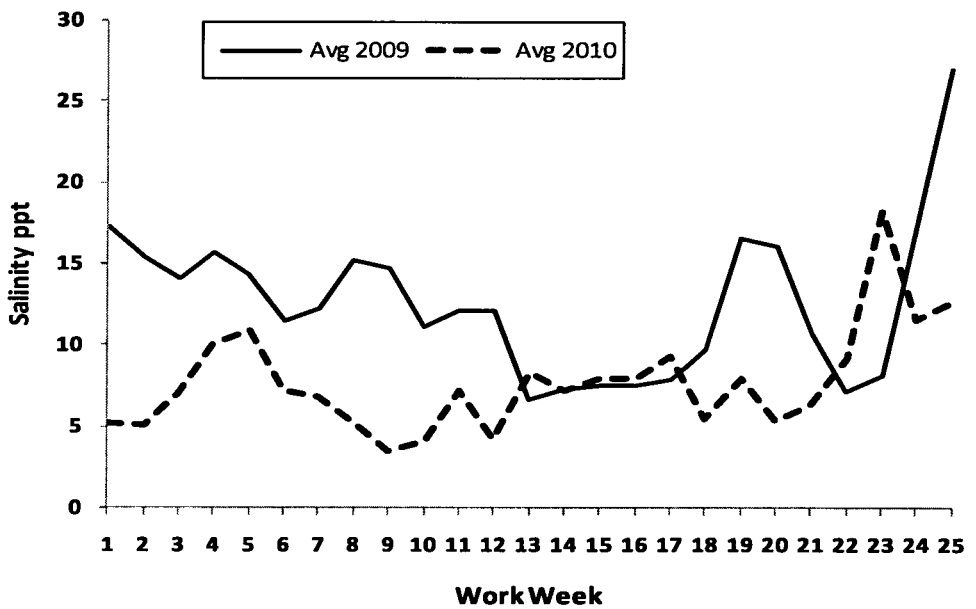


Figure 2.9 Average of 23 weekly isohaline station bottom salinities for 2009 and 2010.

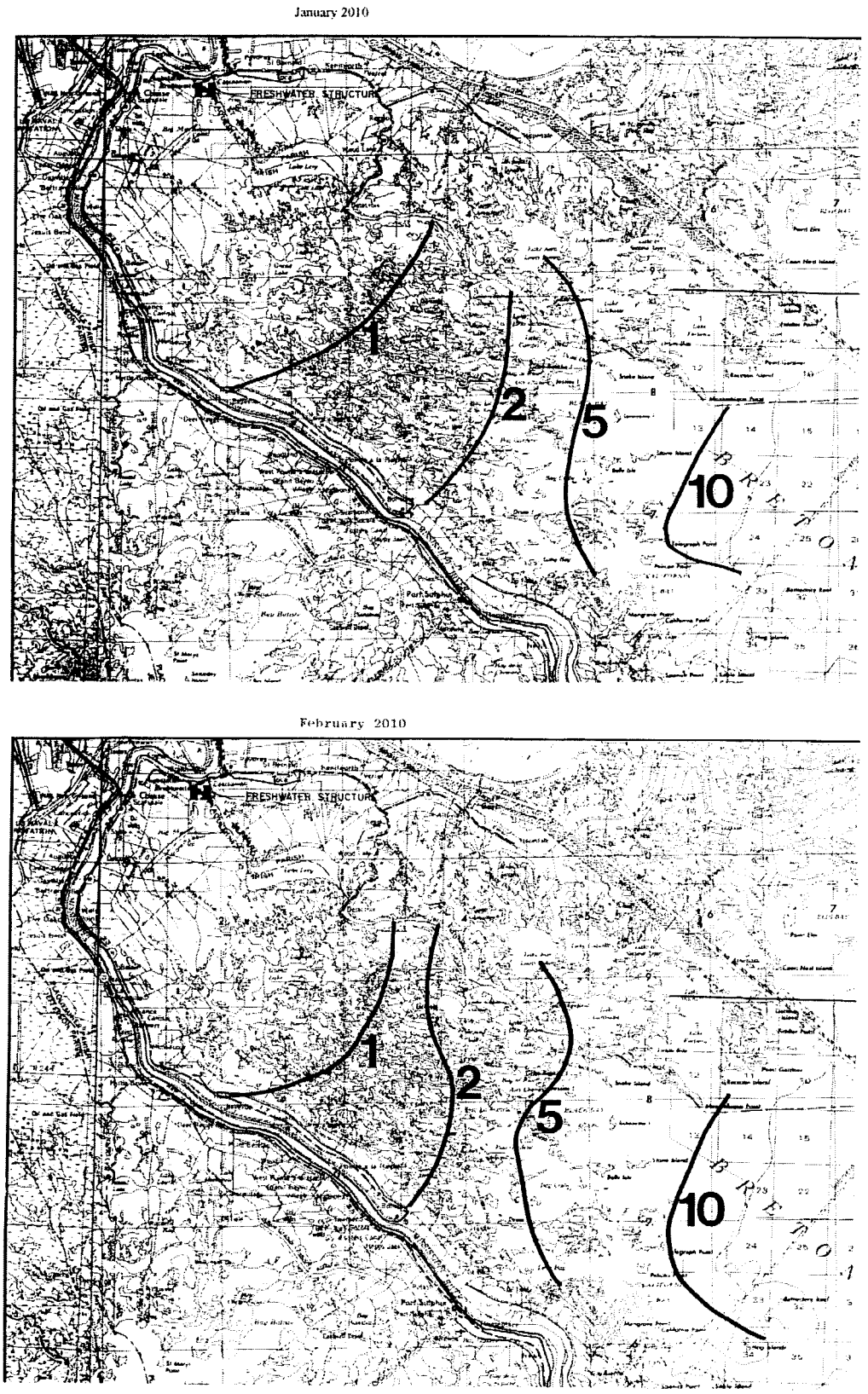
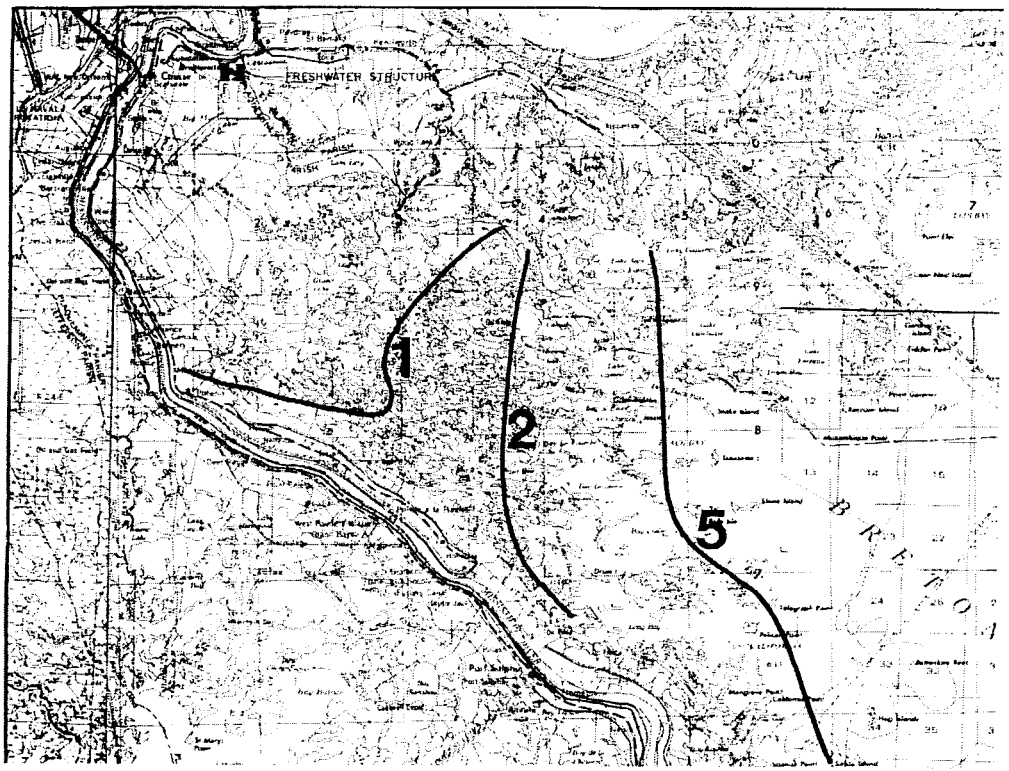


Figure 2.10 CSA2 2010 isohaline maps for January and February.

March 2010



April 2010

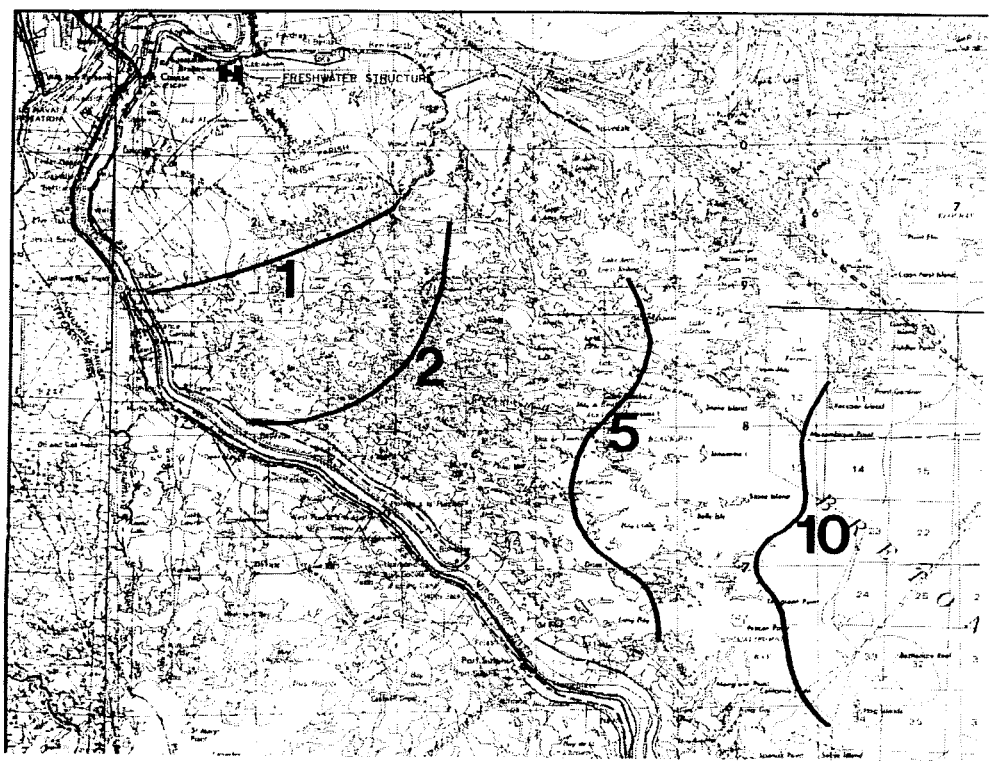
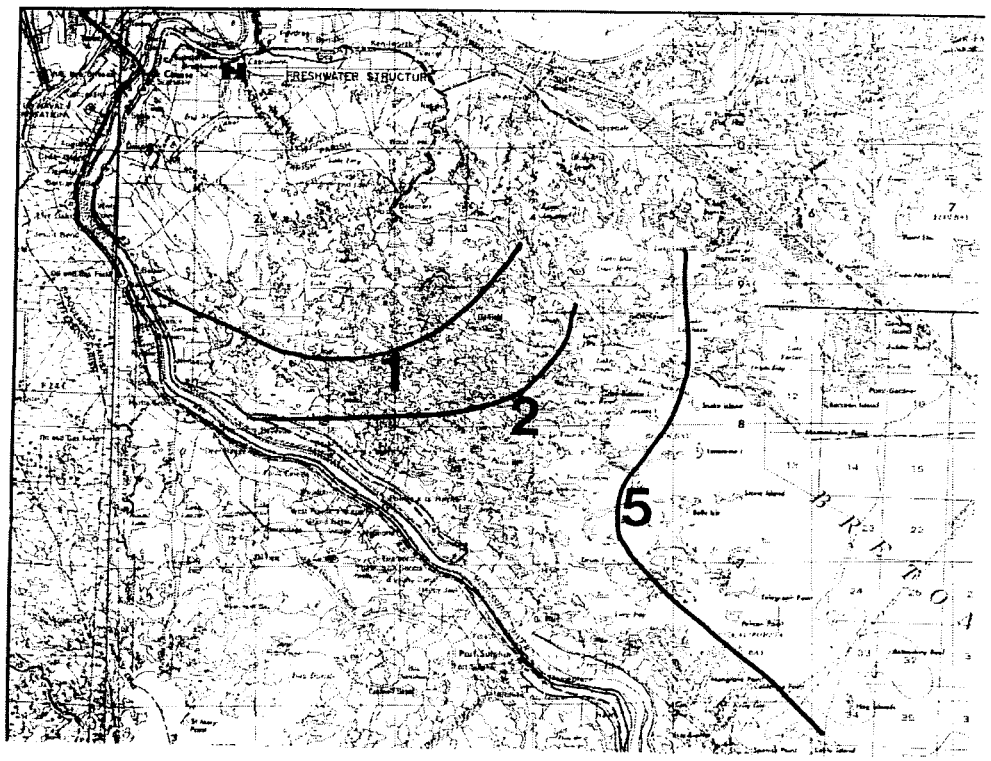


Figure 2.11 CSA2 2010 isohaline maps for March and April.

May 2010



June 2010

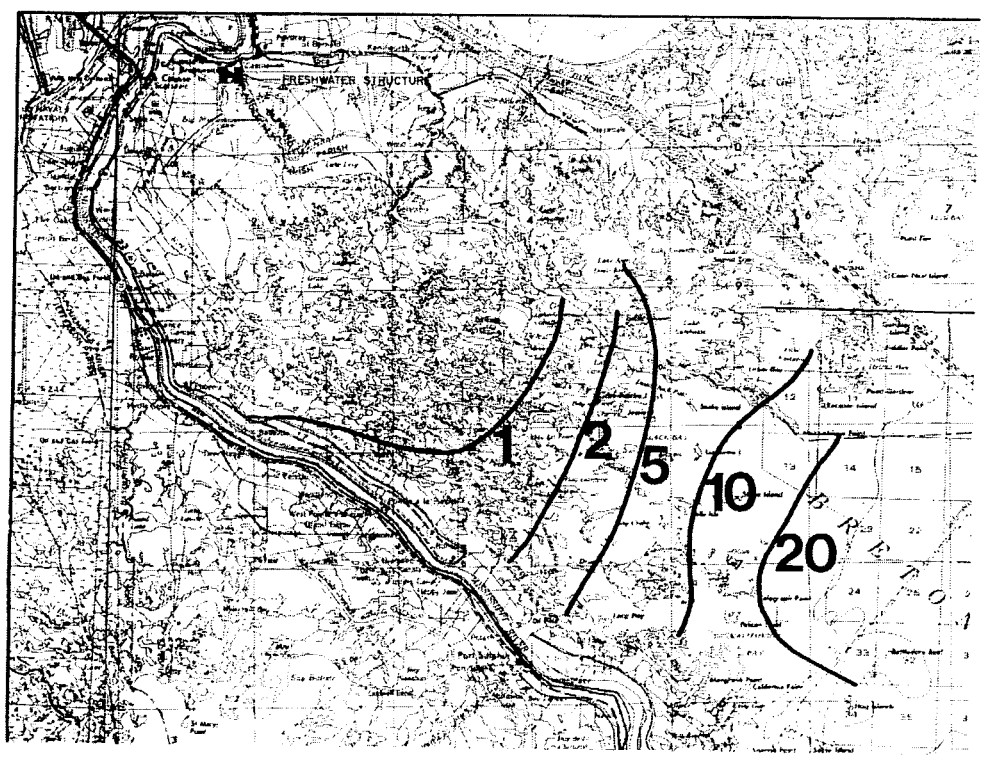


Figure 2.12 CSA2 2010 isohaline maps for May and June.

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 has 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 mesohaline lake with a mostly soft silt and clay bottom, of which approximately only 14.7 acres is naturally occurring reef material. 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 upper site had also been the location of cultch plants in 1943 (140 acres), 1945 (70 acres), 1946 (92 acres) and 1981 (67 acres). The 1994 cultch site was comprised of six different sections of substrate for a total of 145 acres. 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 450 acre 1973 cultch plant. Since very little natural reef exists in the Hackberry Bay Public Oyster Seed Reservation, production is highly dependent upon and reflective of when and where cultch plants are placed in the bay.

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 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 reduce salinities in 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 freshwater diversion impact area and were either purchased or moved by the state and federal government prior to the opening of Davis Pond. To date Davis Pond has not been utilized to its maximum extent consistently since it first opened in 2002 and 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 contracted divers in conjunction with CSA 3 staff on July 09, 2010. All samples were taken using a one square-meter frame placed randomly on the bottom over reef at each sampling location. All live and dead oysters, as well as shell, were removed from the area enclosed in the frame by contracted divers using S.C.U.B.A. (Self Contained Underwater Breathing Apparatus) who then released the sample to CSA 3 staff. 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 five square meter samples taken at each of the seven

locations. The average of the five 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.

Results and Discussion

The Hackberry Bay Public Oyster Seed Reservation (Hackberry Bay POSR) sample sites, including the 2004 and 2008 cultch plants, averaged 0.1 spat oysters per square meter, 5.5 seed oysters per square meter, and 1.4 sack oysters per square meter (Figure 3.2, Figure 3.3). Spat oyster estimates in the Hackberry Bay POSR are 97% lower in 2010 than in 2009 and 98% lower than the 2001 to 2009 average of 5.5 per square meter. Seed oyster estimates in the Hackberry POSG are 14% higher in 2010 than 2009 but still remain 59% lower than the 2001 to 2009 average of 13.5 per square meter. The increase in seed oysters per square meter in the Hackberry POSG this year is a direct result of the 2008 cultch plant which effectively doubled the estimated Hackberry Bay POSR reef acreage. Sack oyster estimates in the Hackberry POSG are 100% higher in 2010 than 2009 but still remain 70% lower than the 2001 to 2009 average of 4.6 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 5,019 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 3,647 bbls and 2,226 bbls respectively. The Hackberry POSR also contains an estimated 1,206 bbls of market-size sack oysters available for harvest (Figure 3.4, Table 3.1), which is above the five and ten year averages of 1,132 bbls and 948 bbls respectively.

The Hackberry Bay POSR market-size (≥ 3") oyster availability is the sixth highest availability since 1996. Seed oyster availability estimates from the Hackberry Bay POSG are above the five and ten year average and higher than nine of the previous twelve years. Despite higher seed oyster numbers in the Hackberry POSR, estimates are still below the historic highs of the 70's, 80's and late 90's (Figure 3.4). The higher amount of available seed can be directly attributed to the 2008 cultch plant, which effectively doubled acreage in the reservation, containing an estimated 16.0 seed oysters per square meter. The southern portion of the Hackberry Bay POSR appears to be overburdened with approximately 1 to 2 inches of soft mud which is most likely accounting for the decreased production from this portion of the Hackberry Bay POSR. Estimated numbers of spat per square meter in the Hackberry Bay POSR are the lowest since 1993 when no spat were encountered in samples.

The Barataria Bay Public Oyster Seed Ground (Barataria Bay POSG) sample sites, measured in 5mm groups (Figure 3.5), averaged an estimated 5.8 spat, 0.0 seed, and 0.0 sack oysters per square meter. Spat were documented on the Barataria Bay POSG for two consecutive years now and for the second time since 2005. Seed oyster estimates on the Barataria Bay POSG dropped to zero after a high of 31.7 last year. Market-size sack oyster estimates on the Barataria Bay POSG are 0.0 per square meter which is identical to the previous five years. Market-size oyster

availability has not been documented on the Barataria Bay POSG since it was created in 2004. Despite plenty of exposed cultch materials, the Barataria Bay POSG yielded very low spat numbers.

Using reef acreage, oyster availability estimates can be extrapolated from the average number of oysters sampled per square meter. There are no seed oysters or market-size sack oysters estimated to be available for harvest on the Barataria Bay POSG (Figure 3.7, Table 3.1). While the Barataria Bay POSG had significant seed resource last year, 100% mortality existed by the opening of the 2009/2010 season, most likely due to predation and salinity conditions. Biologists had documented the presence of southern oyster drills, (*Stramonita haemastoma)*, and their associated egg cases during square meter sampling in 2009. Predation from southern oyster drills and possible stressors (i.e. Dermo) due to increased salinities during the summer and fall of 2009 most likely left no seed resource available to reach market-size in 2010. Given that 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. The Barataria Bay POSG is located in a higher salinity regime it is more vulnerable to the previously mentioned predators such as oyster drills and stressors (i.e. Dermo) associated with higher salinities.

The Little Lake Public Oyster Seed Ground (POSG) was not sampled due to a lack of information on reef acreage. Given the reduced salinities in the Little Lake POSG 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, freshwater input from the Intracoastal Waterway and 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 in the Barataria Bay POSG (29 alive, 17 dead) and in the Hackberry POSR (3 live, 1 dead) at the 2004 southern cultch plant, middle Hackberry Bay and 2008 Hackberry Bay cultch plant sampling locations. Overall numbers are well 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 1 spat for samples taken in the Hackberry Bay POSR and 3 to 9 spat per square meter for samples taken in the Barataria Bay POSG. Overall spat production appears to be very poor on public grounds in CSA 3.

Increased spat production on the Barataria Bay POSG most likely can be attributed to reduced salinities near the coast. However, given the amount of exposed cultch material in the Barataria Bay POSG this year, spat numbers are still low. While lower salinities may have aided the small amount of spat production in the Barataria Bay POSG, lower salinities may have reduced production in the Hackberry Bay POSR. The Hackberry Bay POSR is further from more saline coastal waters and can be influenced more by freshwater sources from the northern portion of the

basin such as freshwater diversions, leakage through the Intracoastal Waterway and rainfall. The 2008 cultch plant in the Hackberry Bay POSR contains abundant exposed suitable substrate for spat, but yielded only one spat in the five 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, it is likely that more 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. Hooked mussels were present at six of seven sampling locations, all of which were in the Hackberry Bay POSR. The highest densities of hooked mussels were at the 2008 cultch plant and middle Hackberry Bay POSR sampling locations. The average number of hooked mussels per square meter in the Hackberry Bay POSR was 19.7, which is 75% higher than the average of the previous eight years ($11.3/m^2$). This increase in hooked mussels over last year may be attributable to lower salinities in the basin throughout 2009 and early 2010. 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 not observed from any samples on the Barataria Bay POSG or the Hackberry Bay POSR. If salinities remain lower than normal, due to freshwater diversion flow and/or more rainfall, conditions may not be conducive for oyster drills to survive and flourish on the public oyster areas of CSA 3.

Mortality

Widespread oyster mortalities have been documented by LDWF in the Barataria Bay system for the years 1961, 1963, 1965, 1971, 1973, 1973, 1975, 1977, 1979, 1980, 1983, 1985, 1986, 1987, 1991, 1993, 1997, 1999, and 2004. Recent mortality was noted on the Hackberry Bay POSR. Spat mortality ranged from 0 to 100% (average = 25.0%), in locations where spat was observed, for the Hackberry Bay POSR and from 36 to 57% (average = 41.6%) on the Barataria Bay POSG. It should be noted that the 100% spat mortality observed in the Hackberry Bay POSR was from one sample containing 1 dead spat. Seed oyster mortality ranged from 0 to 66% (average = 11.7%) in the Hackberry Bay POSR. No alive or recently dead seed oysters were observed on the Barataria Bay POSG. However, the Barataria Bay did show evidence of older seed and spat mortality, which most likely was last year's resource that did not remain alive until the opening of the 2009/2010 season. Recent market-size oyster mortality, at locations where market-size oysters were observed, was noted in the Hackberry Bay POSR ranging from 0 to 90% (average = 12.5%). No recent mortality was noted in the Barataria Bay POSG as no market-size oysters were observed. 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 1 to 2 inches of soft mud over any oyster shells present. There was also evidence of older mortalities in the northern portion of the Hackberry POSR near the 2004 and 2008 cultch plants.

Tropical and Climatic Events

Hurricane Ida, which made landfall in Alabama as a tropical storm, did not account for any observable biological impacts on the public oyster grounds in CSA 3 in 2009. Output through the Davis Pond freshwater diversion continued to be above the Long Term Average (LTA = since the structure opened in 2002) in the second half of 2009 and during the first half of 2010, according to the United States Geologic Survey (USGS) constant data recorder located near the structure's outflow. Davis Pond flow averaged 3,292 cubic feet per second (cfs) from August 2009 to June 2010 with monthly flow rates varying between 969 cfs and 6,755 cfs. According to data supplied by the United States Army Corps of Engineers (USACE) website, Mississippi River flow was above the LTA from August 2009 through June 2010 and only fell below the LTA for the month of March 2010. August 2009 to June 2010 Davis Pond flow and Mississippi River discharge are compared to the LTA and presented in Figure 3.8. According to the Louisiana Office of State Climatology, December 2009 was the 5th wettest December on record statewide and a record 25.92 inches of rain was recorded at New Orleans International Airport for the month.

Salinities in the Hackberry Bay POSR, according to the USGS constant data recorder located in the bay, averaged 2.1 parts per thousand (ppt) for the month of June in 2010 which is well below the 2001 to 2009 average of 10.4ppt (Figure 3.9). For the time period of July 2009 to June 2010 salinities in the Hackberry Bay POSR averaged 6.7 ppt (Figure 3.10). June temperatures averaged 30.8 degrees Celsius (C) in 2010 which is 1.4 degrees C above the 2001 to 2009 average of 29.4 degrees C.

Salinities in the Barataria Bay POSG, according to the USGS constant data recorder located in the seed ground, have averaged 17.2 ppt since July of 2009 (Figure 3.10). June averages of salinity and temperature in the Barataria Bay POSG were 15.2 ppt and 29.7 degrees C respectively. These conditions are very similar to last year with the exception of February and March 2010 which averaged 4 to 5 ppt higher in 2010 than 2009.

Salinities in the Little Lake POSG, according to the USGS constant data recorder located in the southern portion of the seed ground, have averaged 3.1 ppt between July 2009 and June 2010 (Figure 3.10). June 2010 averages of salinity and temperature in the Little Lake POSG were 0.5 ppt and 30.7 degrees C respectively.

Non-Climatic Events

Oil from the British Petroleum Mississippi Canyon 252 (BP MC252) spill began noticeably impacting Barataria Bay on May 22, 2010 with sheen in the Barataria Bay POSG and heavy oiling occurring near Grand Isle, Grand Terre and the Four Bayou Pass area. Gray and rainbow sheen was first observed, by LDWF biologists, in the Hackberry Bay POSR by May 24, 2010. Booming of the Hackberry Bay POSR began on May 24, 2010. By May 29, 2010 ribbons of sheen were observed throughout the Little Lake POSG. Another major wave of oil from the BP MC252 spill entered Barataria Bay on June 5, 2010 causing extensive oiling up to St. Mary's Point, Wilkinson Bayou, Bay Jimmy and Bay Batiste. Heavy oil was present in the Barataria Bay POSG and sheens were present in the Little Lake POSG and the Hackberry Bay POSR. Oil from the BP MC252 spill continues to impact Barataria Bay and be a potential threat to the public oyster areas of CSA 3 as of the writing of this assessment.

2009/2010 Oyster Season Summary

The 2009/2010 oyster season in the Little Lake and Barataria Bay POSG opened on September 9, 2009 for the harvest of seed oysters for bedding purposes only. The Barataria Bay POSG closed on September 30, 2009 and did not reopen during the 2009/2010 season. The Little Lake POSG closed on September 23, 2009 and reopened on October 28, 2009 for the taking of both seed and market oysters and was scheduled to close again on April 1, 2010. A Department of Health and Hospitals (DHH) emergency closure, due to the outbreak of illness, effective at sunset on March 30, 2010 closed the Little Lake POSG for the remainder of the season. The Hackberry Bay POSR, including the 2008 cultch plant, opened on October 28, 2009. The 2008 cultch plant in the Hackberry Bay POSR closed on October 31, 2009 with the remainder of the Hackberry Bay POSR closing on November 4, 2009. Average fishing effort was observed on the public oyster areas in CSA 3 during the 2009/2010 season.

Total harvest from the public oyster areas in CSA 3 during the 2009/2010 season was estimated at 504 sacks of marketable oysters and 7,885 barrels of seed oysters (Table 3.2), with 79% of the seed harvest and 100% of the market harvest coming from Hackberry Bay. Harvest of market-size oysters in Hackberry Bay decreased 85% from the previous season while harvest of seed oysters increased by 214% compared to the 2008/2009 season (all CSA 3 seed harvest in 2008/2009 was estimated to be from the Hackberry Bay POSR). Harvest from the Little Lake POSG was estimated to be 1,650 barrels of seed oysters and zero sacks of market-size oysters. Increased seed harvest during the 2009/2010 season in the Hackberry POSR was likely the direct result of increased seed resource available on the 2008 cultch plant. The Little Lake POSG showed very little production which was most likely due to the impacts of low salinities during much of 2008 and 2009. Oyster mortality, on two Nestier trays, placed in the southern portion of the Little Lake POSG was 100% by May of 2009 as observed in Nestier Tray sampling.

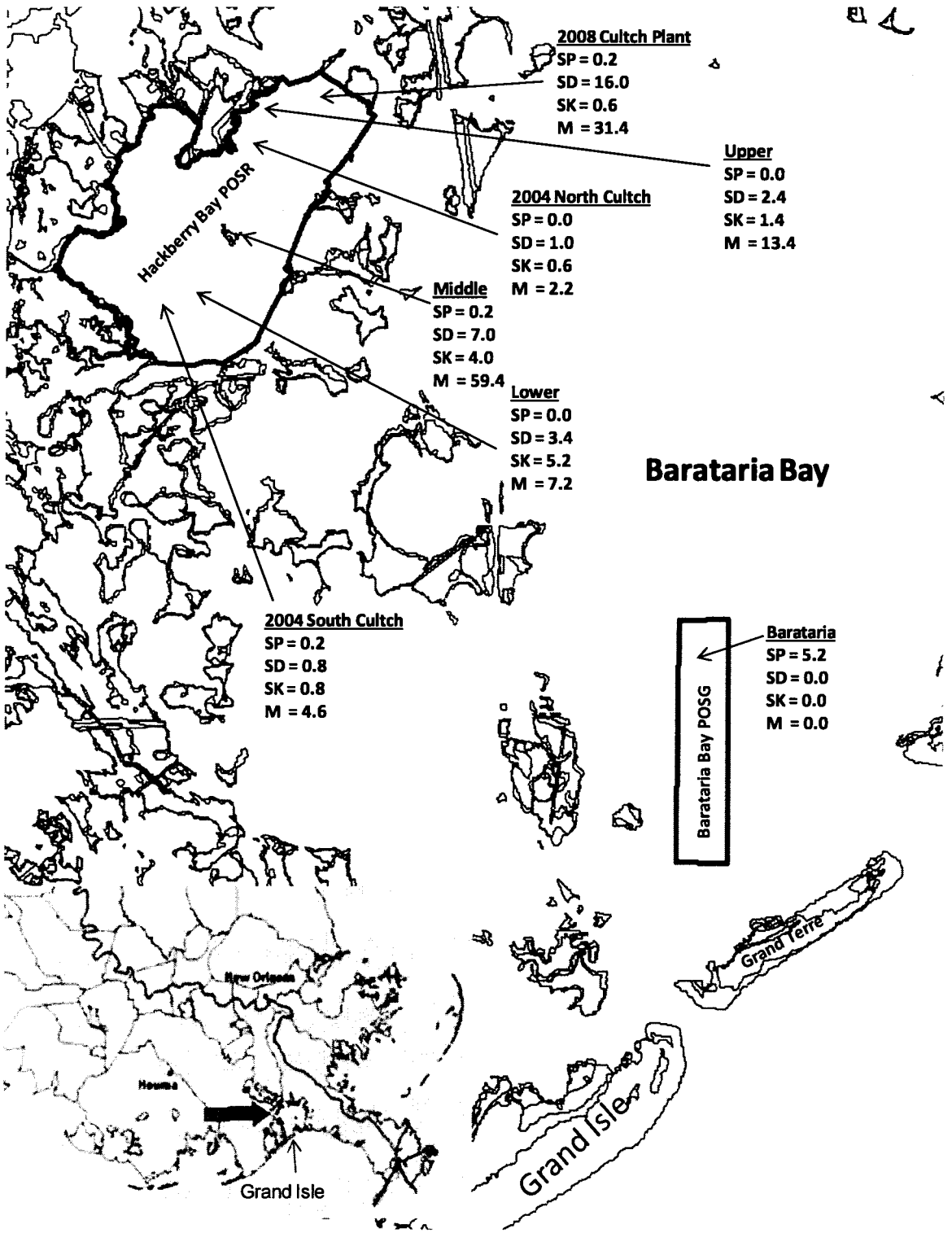


Figure 3.1. 2010 Hackberry Bay POSR and Barataria Bay POSG sample results as an average per square meter (SP=Spat, SD=Seed, SK=Sack, and M=Mussels) and map of sample locations.

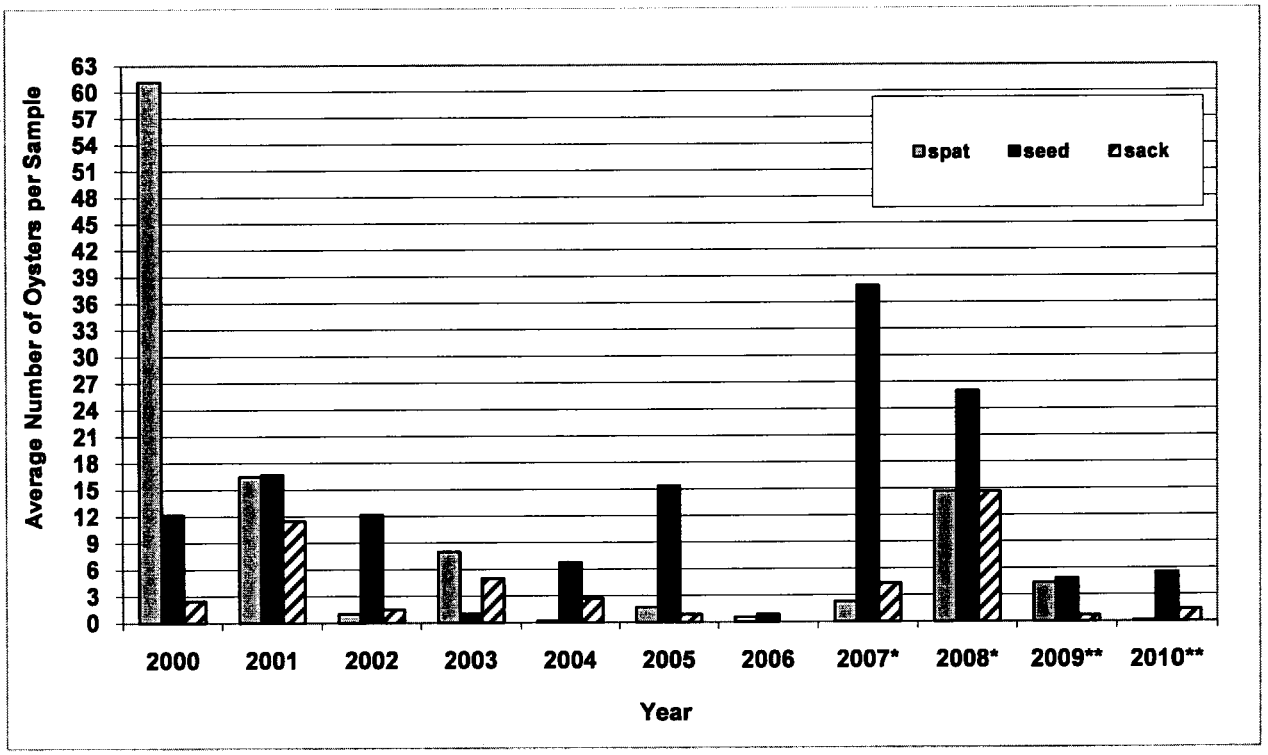


Figure 3.2. Historical oyster density in the Hackberry Bay Public Oyster Seed Reservation square meter samples from 2000-2010. *includes the 2004 cultch plants **includes the 2004 and 2008 cultch plants.

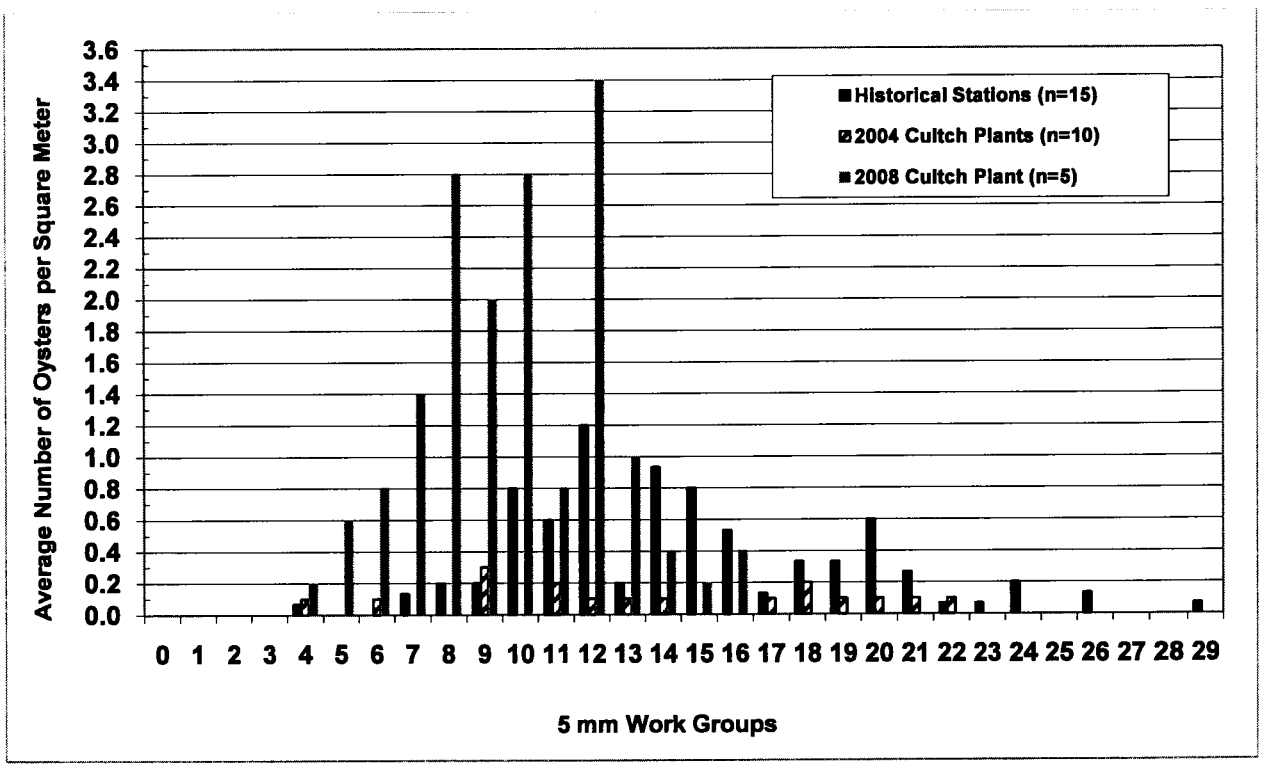


Figure 3.3 Oyster size distribution by 5 mm work groups in square meter samples collected from the Hackberry Bay Public Oyster Seed Reservation during 2010.

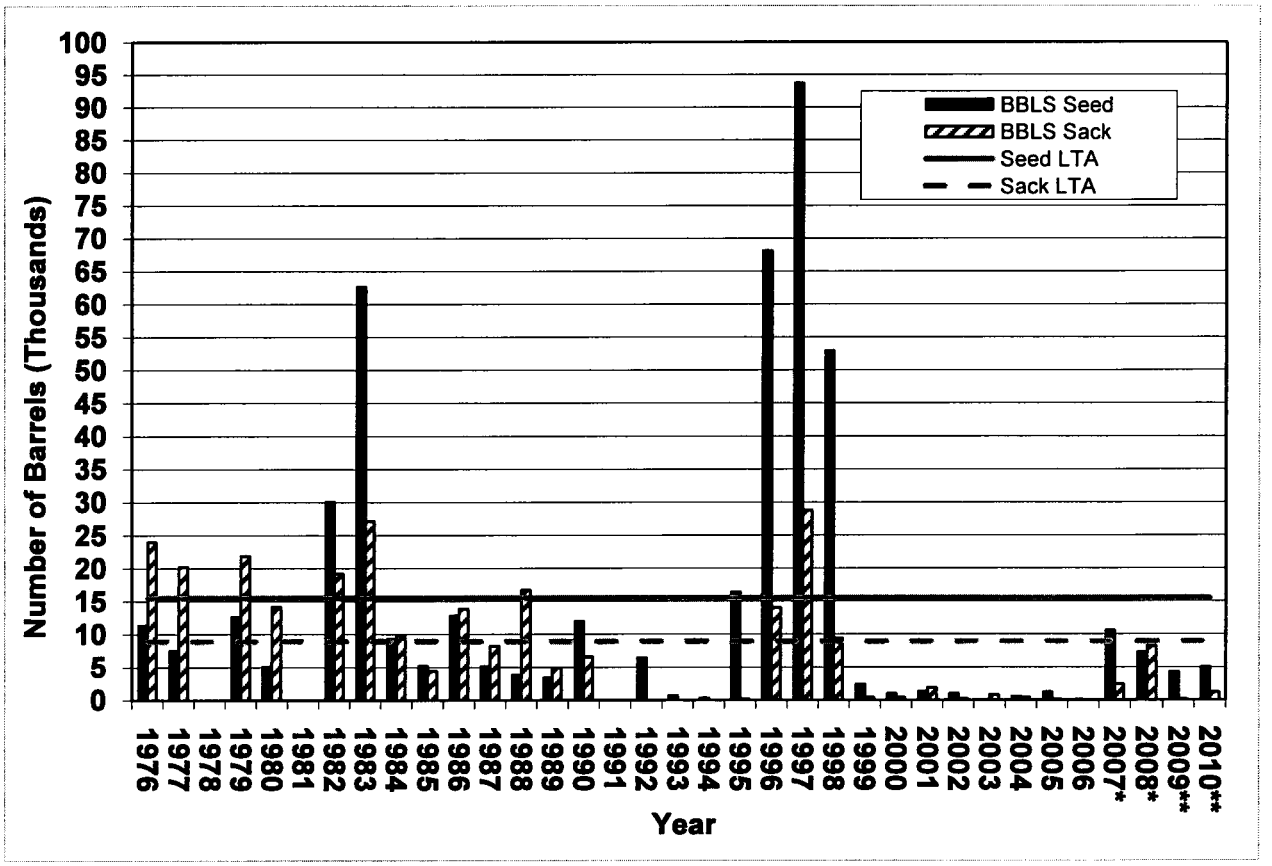


Figure 3.4. Seed and sack oyster availability in the Hackberry Bay Public Oyster Seed Reservation from 1976 to 2010. * includes the 2004 cultch plants **includes the 2008 cultch plant.

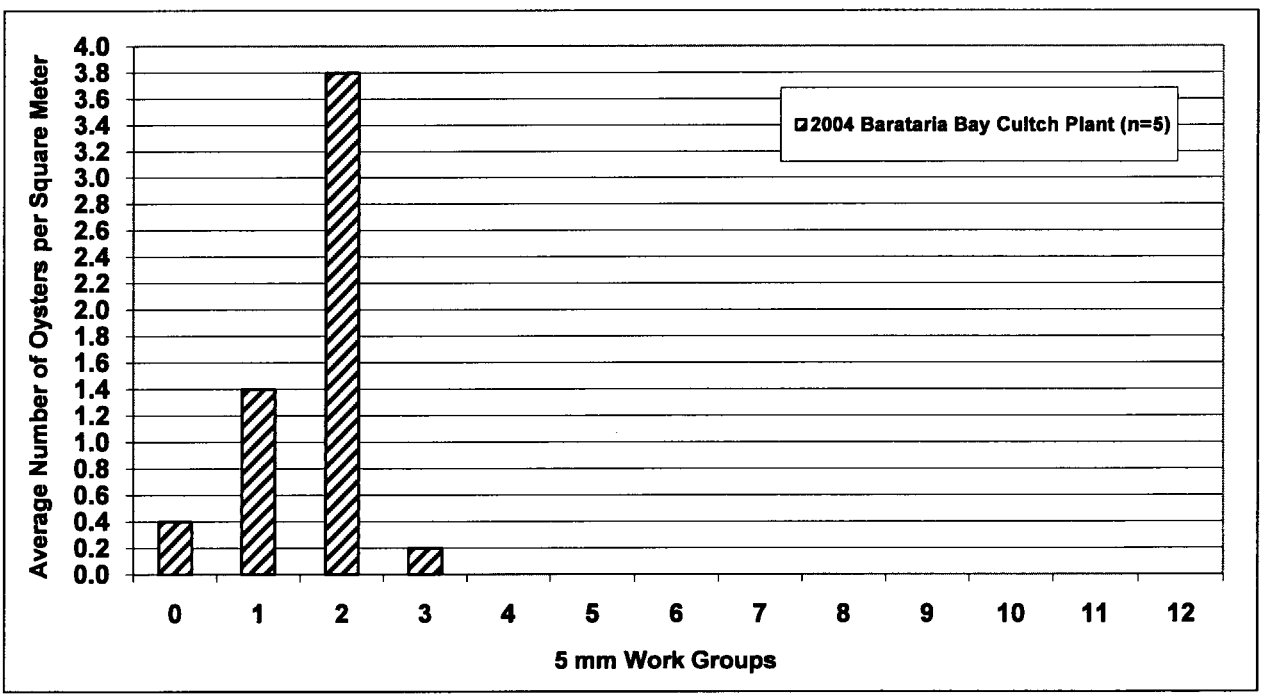


Figure 3.5. Oyster size distribution by 5 mm work groups in square meter samples collected from the Barataria Bay Public Oyster Seed Ground during 2010.

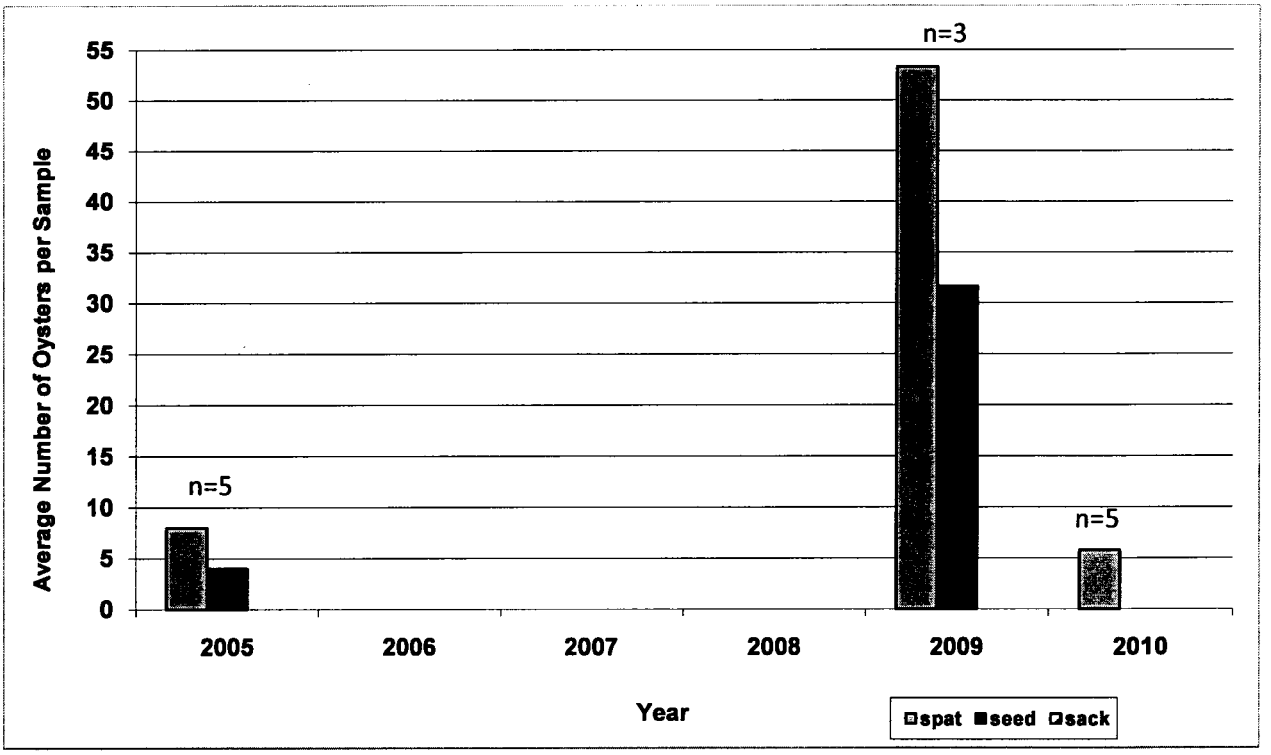


Figure 3.6. Spat, seed and sack oyster density in square meter samples from the Barataria Bay Public Oyster Seed Ground from 2005 to 2010.

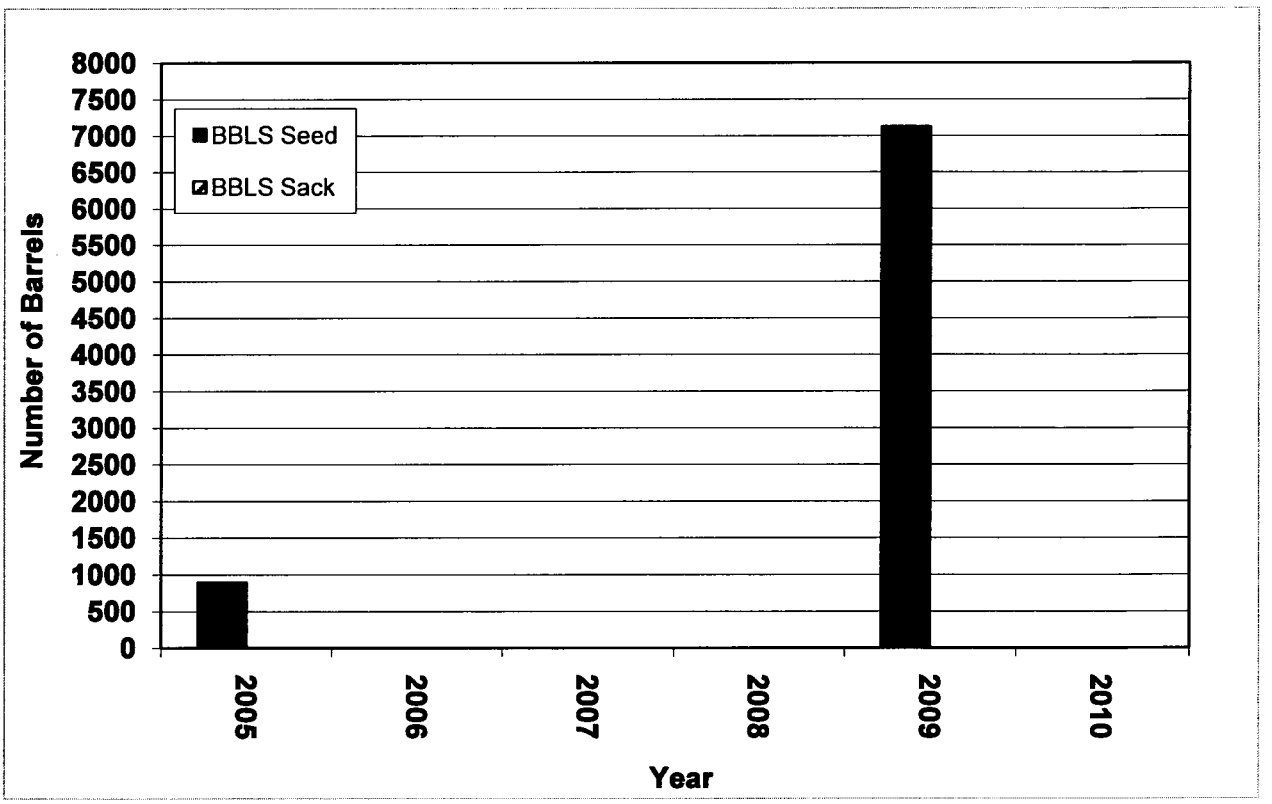


Figure 3.7. Seed and sack oyster availability in the Barataria Bay Public Oyster Seed Ground from 2005 to 2010.

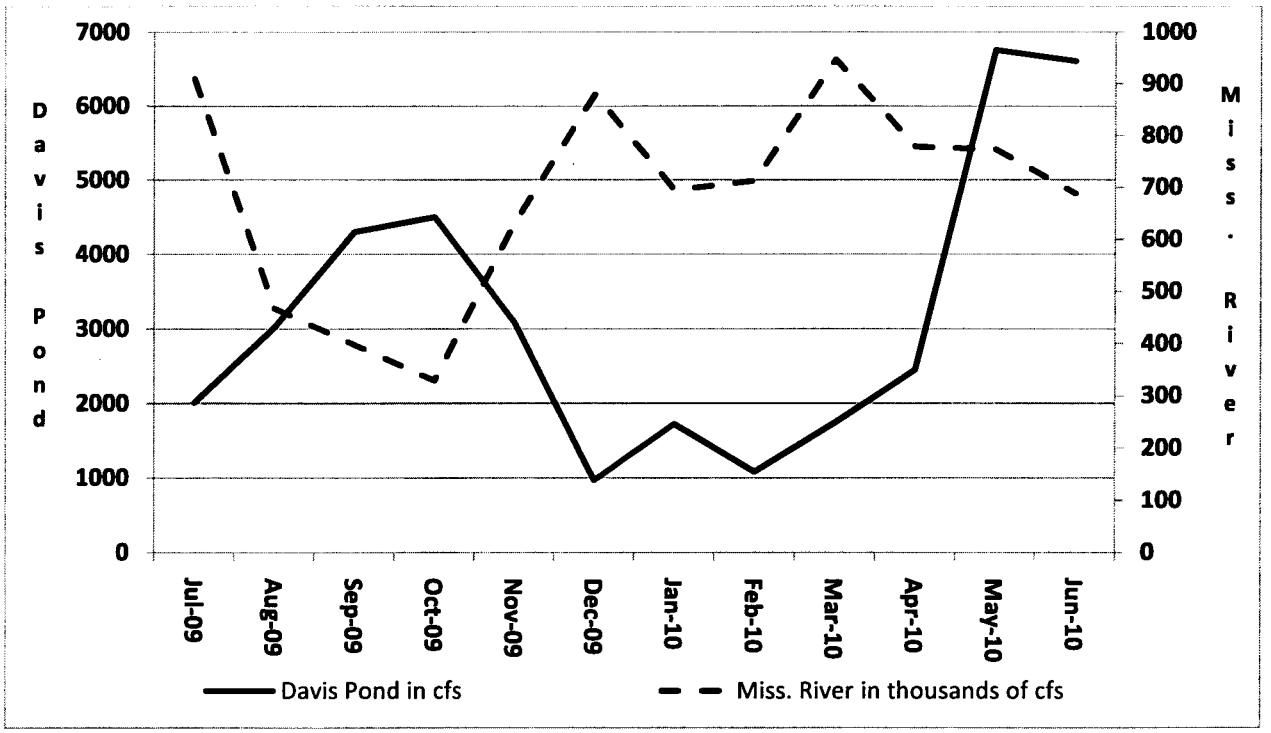


Figure 3.8. July 2009 to June 2010 Davis Pond flow in cubic feet per second (cfs) and Mississippi River discharge in thousands of cfs. Davis Pond discharge data supplied by the United States Geological Survey (USGS) constant data recorder located near the Davis Pond structure. Mississippi River discharge data supplied by the United States Army Corps of Engineers (USACE).

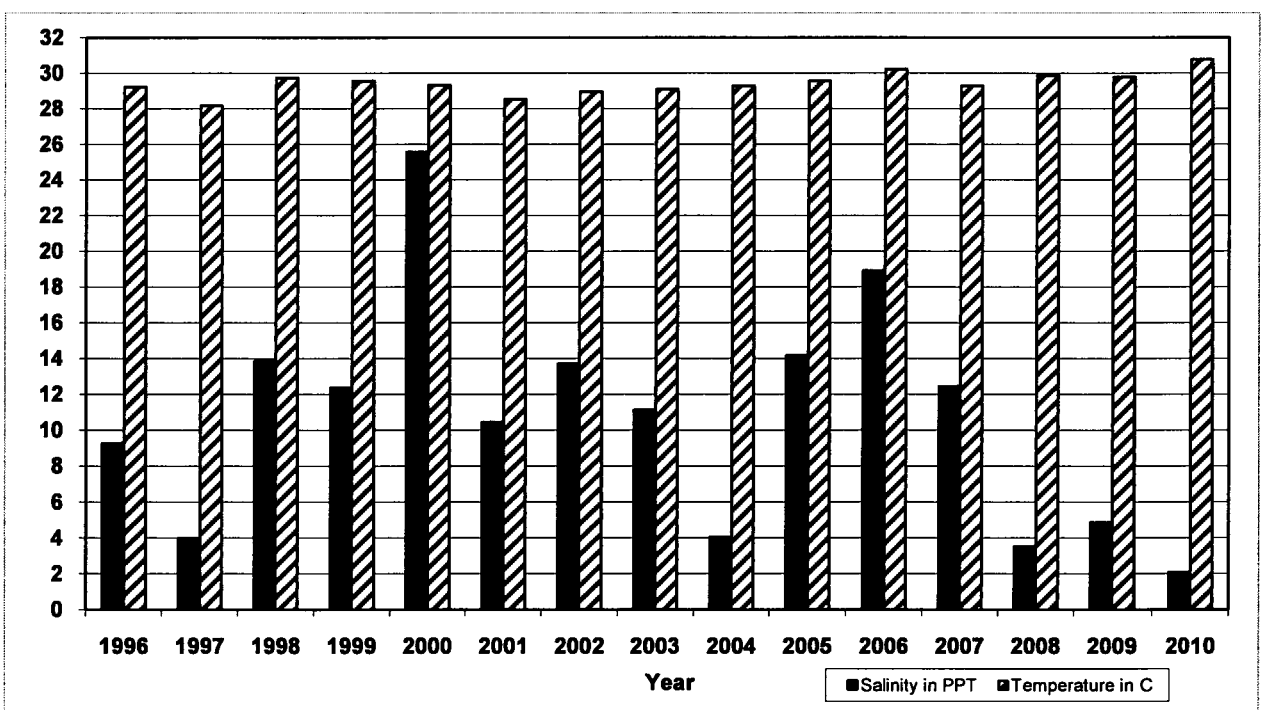


Figure 3.9. Historical average daily June salinity (in ppt) and temperature (in degrees C.) in Hackberry Bay from 1996-2010. Data supplied by the United States Geological Survey (USGS) constant data recorder located in Hackberry Bay.

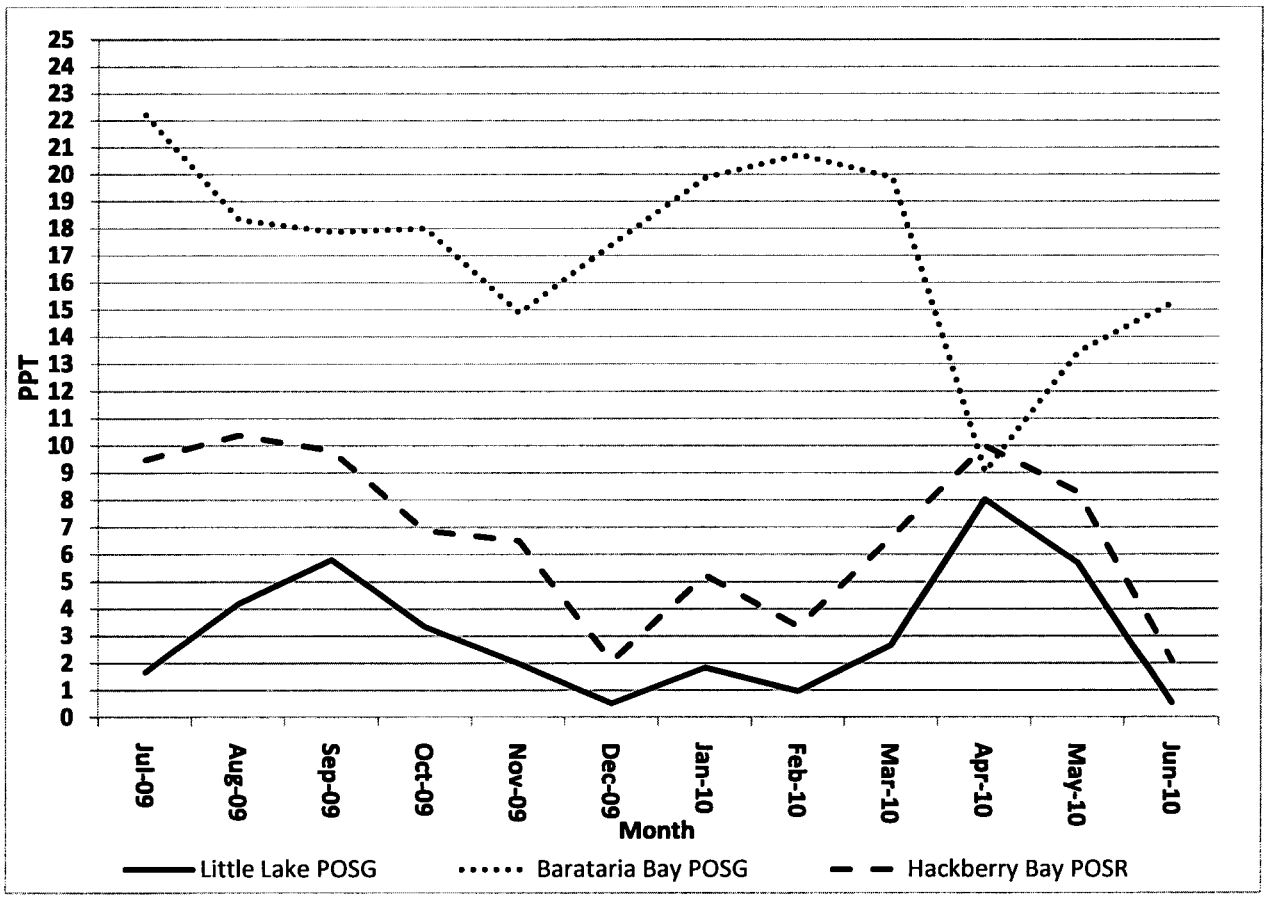


Figure 3.10. Average monthly salinities (in ppt) in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR from July 2009 through June 2010. Data supplied by the United States Geological Survey (USGS) constant data recorders located in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR.

Table 3.1. Estimated 2010 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	0.0	0.0	0.0	0.0
Hackberry Bay (2004 North Cultch Plant)	10.0	40,469	1.0	0.6	56.2	67.4
Hackberry Bay (2004 South Cultch Plant)	25.0	101,172	0.8	0.8	112.4	224.8
Hackberry Bay (2008 Cultch Plant)	50.0	202,344	16.0	0.6	4,496.5	337.2
Hackberry Bay (Existing Reefs)	14.7	59,380	4.3	3.5	354.6	577.3
Little Lake	Unknown	Unknown	Unknown	Unknown	--	--
2010 CSA 3 Totals	***139.7***	***565,240***			***5,019.7***	***1,206.7***
2009 CSA 3 Totals	***139.7***	***565,240***			***11,402.1***	***141.2***

Table 3.2. Estimates of oyster harvest from the public oyster areas in Coastal Study Area 3 for the 2009/2010, 2008/2009, 2007/2008, and 2006/2007 season.

Public Oyster Area	Seed Oysters Harvested (BBLS)	Sack Oysters Harvested (Sacks)
Hackberry Bay POSR	6,235	504
Little Lake POSG	1,650	0
Barataria Bay POSG	0	0
2009/2010 CSA 3 Totals	***7,885***	***504***
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 – 2010 Oyster Stock Assessment

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

Introduction

Public oyster seed grounds in CSA 4, 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 the 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 open to harvest for short time periods each year from 2005 to 2008.

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. This cultch plant was not sampled for this stock assessment report.

Materials and Methods

Square meter samples were taken on the 2004 Lake Felicity and Lake Chien cultch plants. Five standing crop samples were taken from each cultch plant on July 15, 2010. 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). Contracted divers (ENCOS) took the samples rather than Department employees because of the presence of oil sheen; after the samples were taken, Department employees assumed custody of the oysters in the field. In conjunction with the square meter oyster samples, bottom water temperature and salinity data were also taken.

Results

Salinity

Average salinities on the cultch plants associated with 2010 samples were 15.2 ppt on Lake Felicity and 14.6 ppt on Lake Chien. These salinities were the second lowest observed during square meter samples between 2004 and 2010 (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
Seed oysters per square meter in 2010 averaged 6.2 and 7.2 on the Lake Felicity and Lake Chien cultch plants, respectively (Table 4.1). The average number of sack oysters was 0.4 for both cultch plants (Table 4.1). Numbers of seed oysters in both cultch plants have declined and remained low since the 2004 peak in Lake Felicity (Figure 4.5) and the 2005 peak in Lake Chien 2004 (Figure 4.6).

Spat Production
The average numbers of live spat per square meter in 2010 were 6.4 and 8.0 on the Lake Felicity and Lake Chien cultch plants, respectively (Table 4.1). Recruitment as measured by spat numbers was very low compared to earlier years. The highest numbers of spat were collected in the first year immediately after the cultch plant deposition.

Fouling Organisms / Predators
No fouling organisms and/or predators were documented in square meter samples on the Lake Chien or Lake Felicity cultch plants.

Mortality
Recent mortality among spat, seed or sack oysters was determined in square meter samples (Table 4.1). Very low oyster mortalities were found in square meter samples. Except for Lake Felicity seed oysters with 3.1%, average mortalities of spat, seed, and sack oysters by cultch plant were all 0.0%.

Resource Availability
A total of 2,021.3 barrels of seed oysters and 499.1 sacks of sack oysters for the two cultch plants are estimated (Table 4.2). Estimated resource availability by year for each cultch plant has continued to decline from earlier peaks (Figures 4.7 and 4.8).

2009 Oyster Season Summary
The seed grounds were not opened for harvest in 2009 because of low estimated resource availability on the Lake Chien and Lake Felicity cultch plants.

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. Except for 2007, the Lake Felicity cultch plant was less productive than the Lake Chien cultch plant. 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.

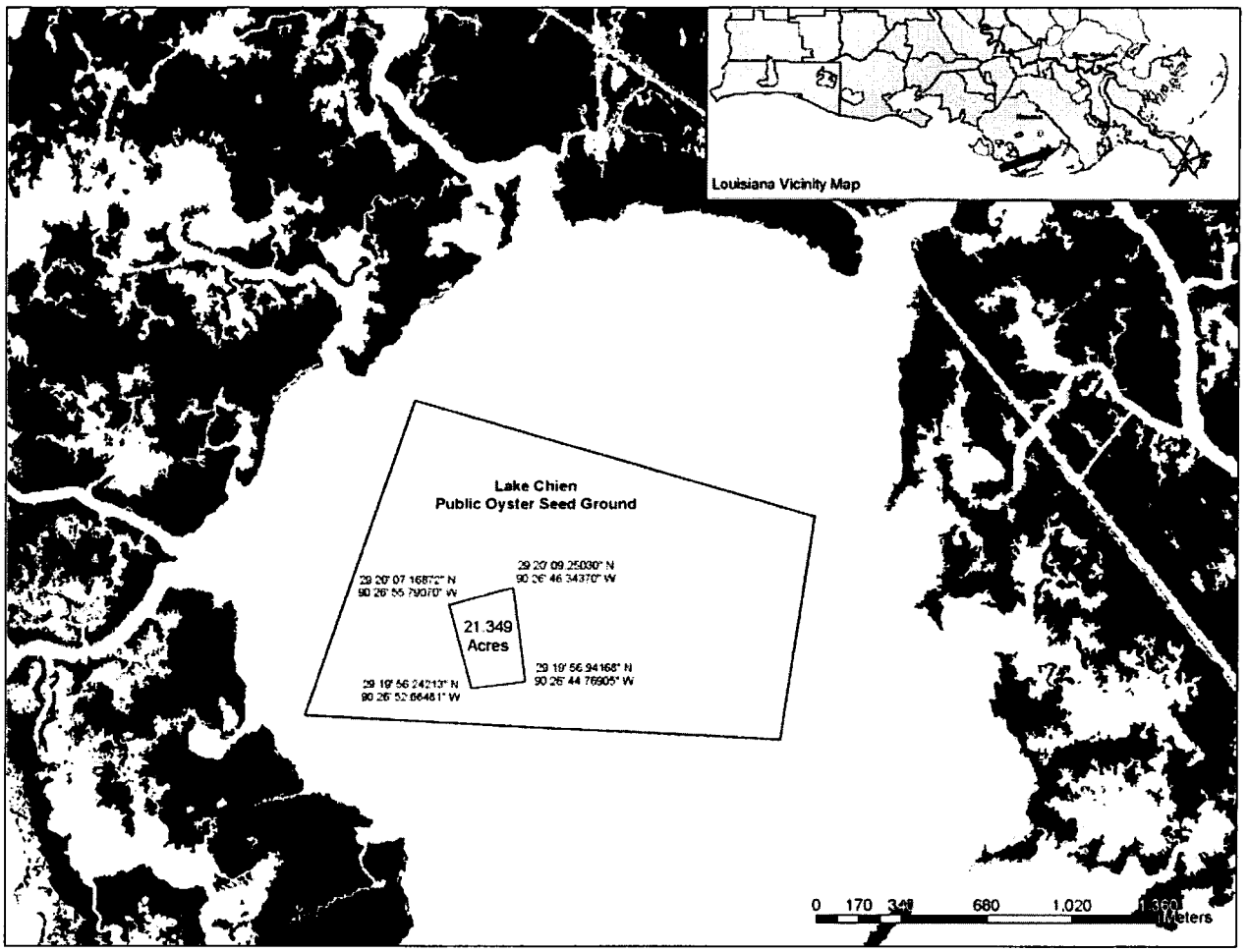


Figure 4.1. The Lake Chien Public Oyster Seed Ground and the approximate location of the 2004 cultch plant.

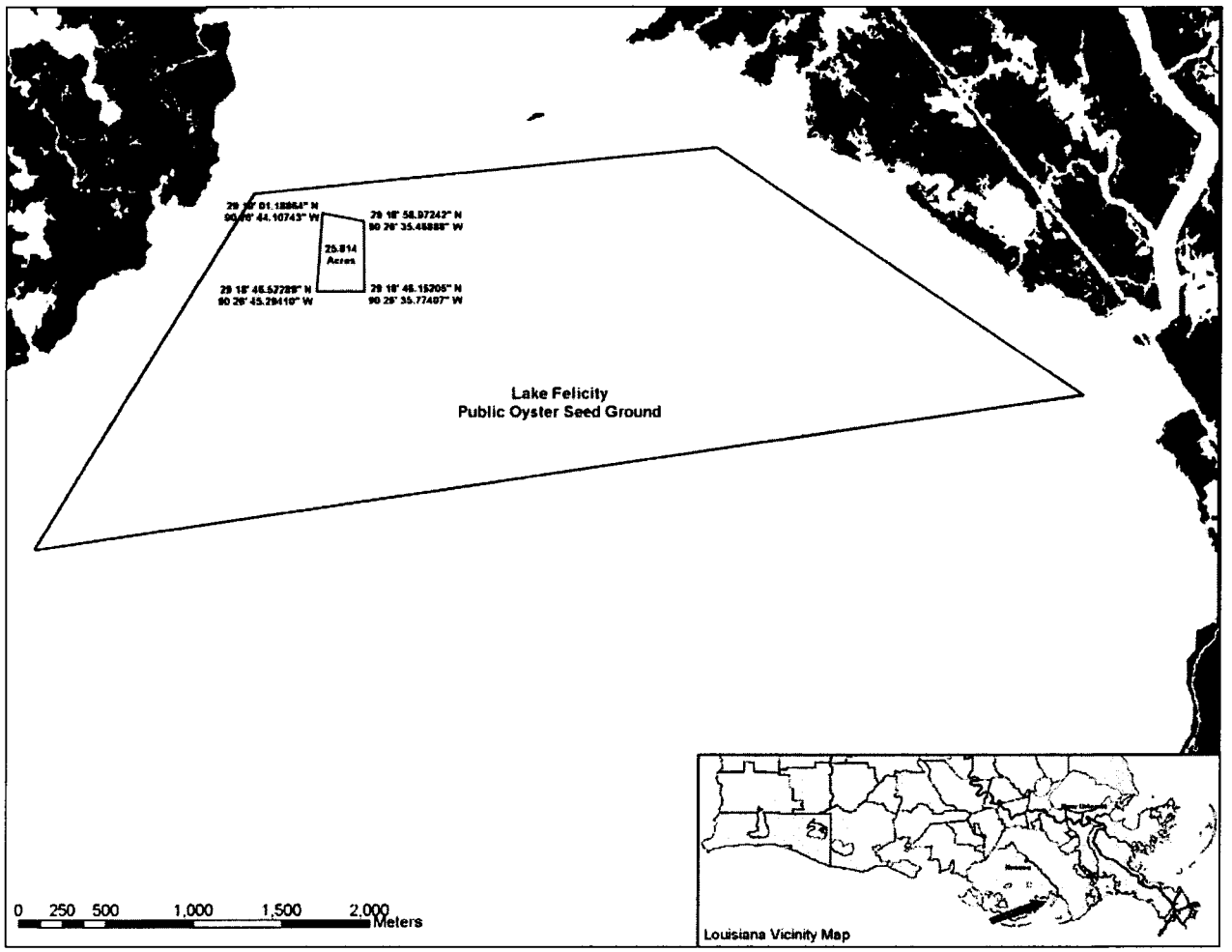


Figure 4.2. The Lake Felicity Public Oyster Seed Ground and the approximate location of the 2004 cultch plant.

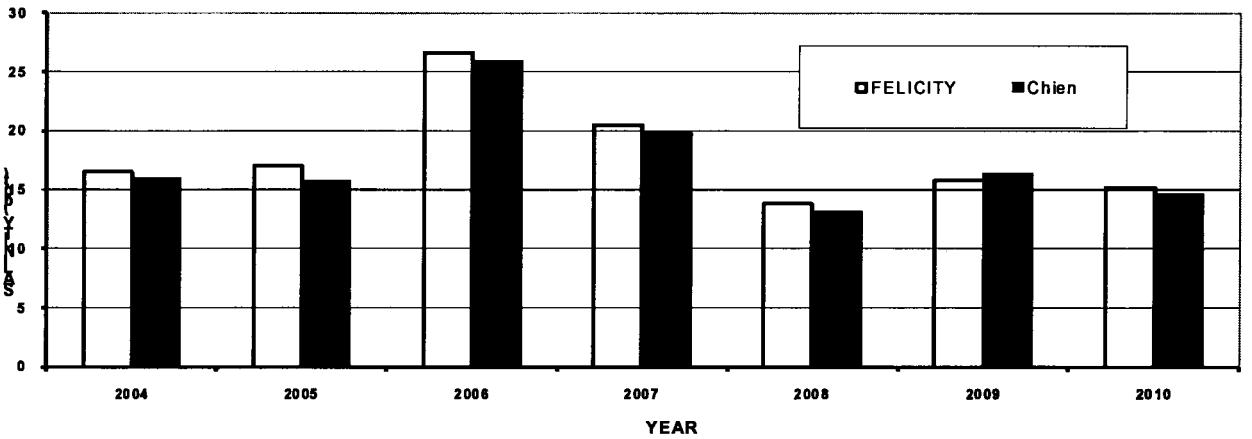


Figure 4.3. Mean salinities from annual square meter oyster samples.

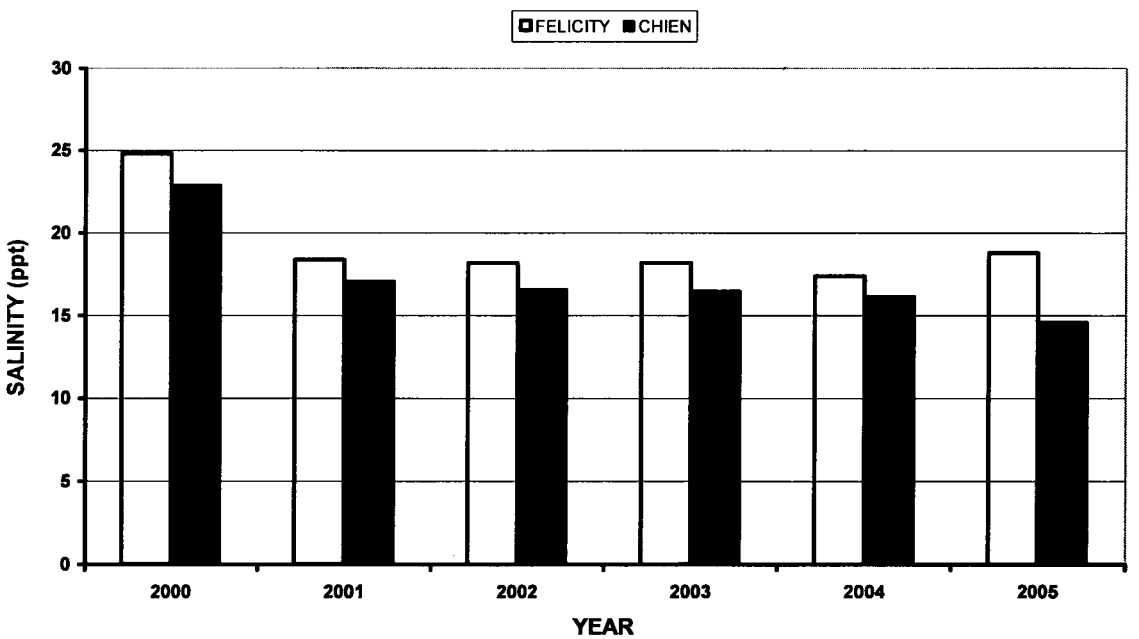


Figure 4.4. Mean salinities from pre-cultch plant hydrological monitoring

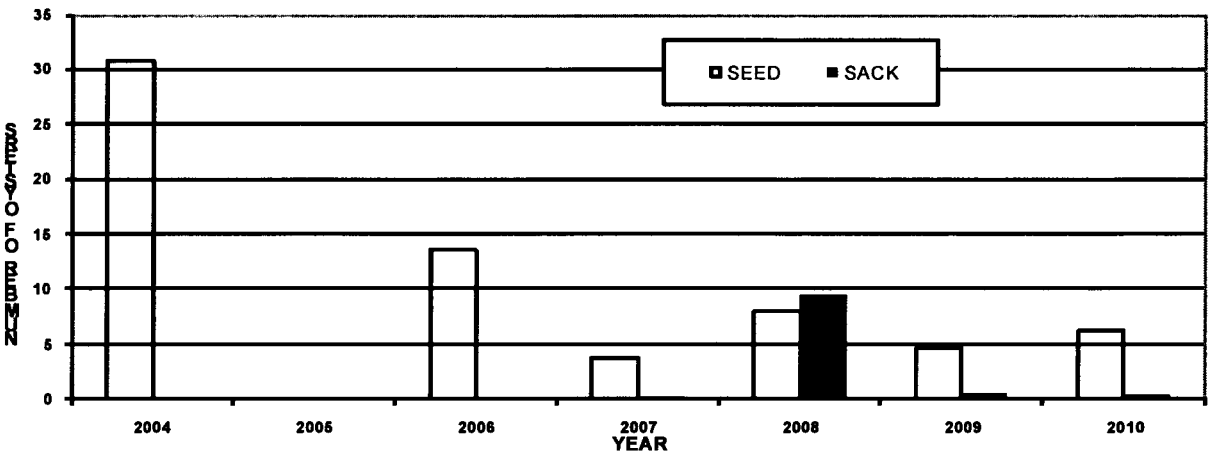


Figure 4.5. Mean numbers of seed and sack oysters per square meter, Lake Felicity cultch plant

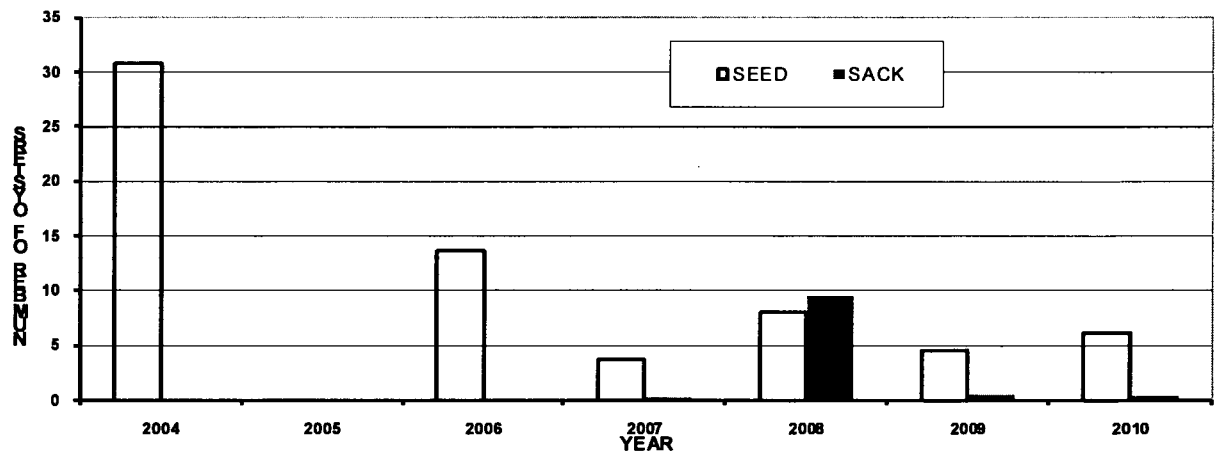


Figure 4.6. Mean numbers of seed and sack oysters per square meter, Lake Chien cultch plant

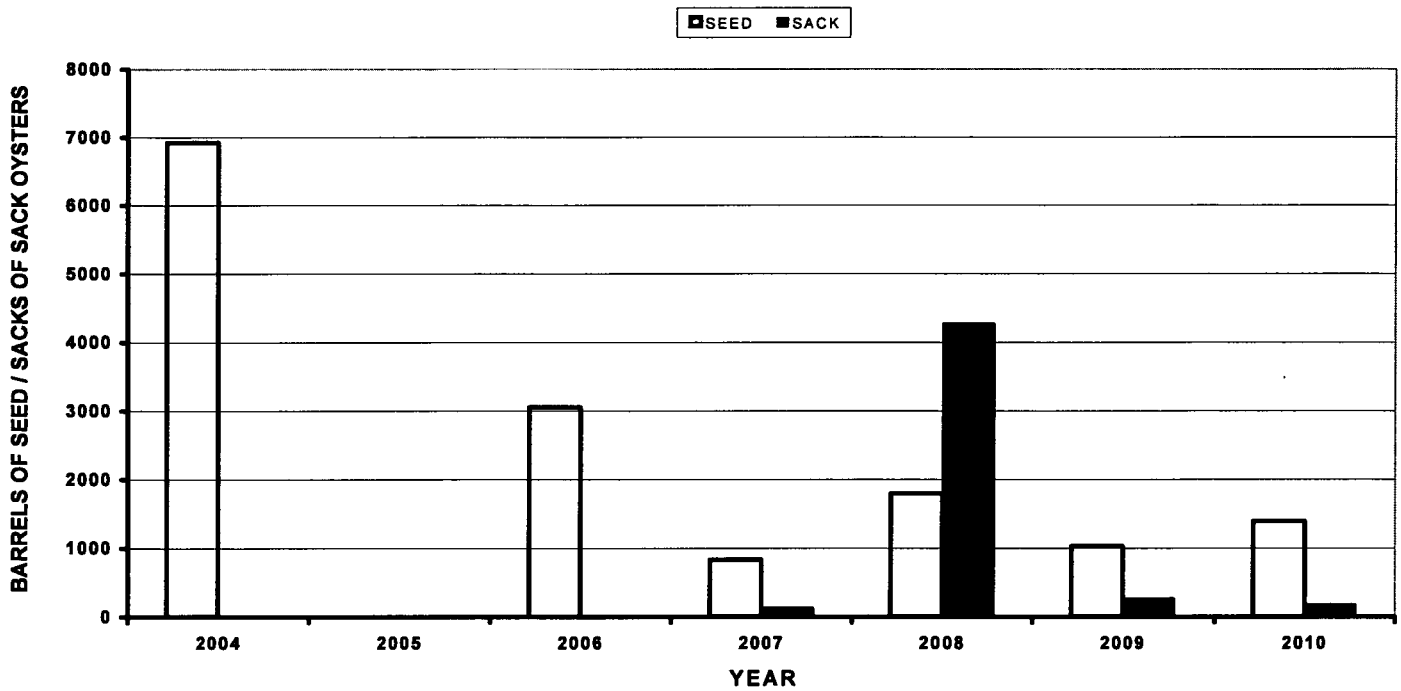


Figure 4.7. Estimated resource availability of seed and sack oysters, Lake Felicity cultch plant

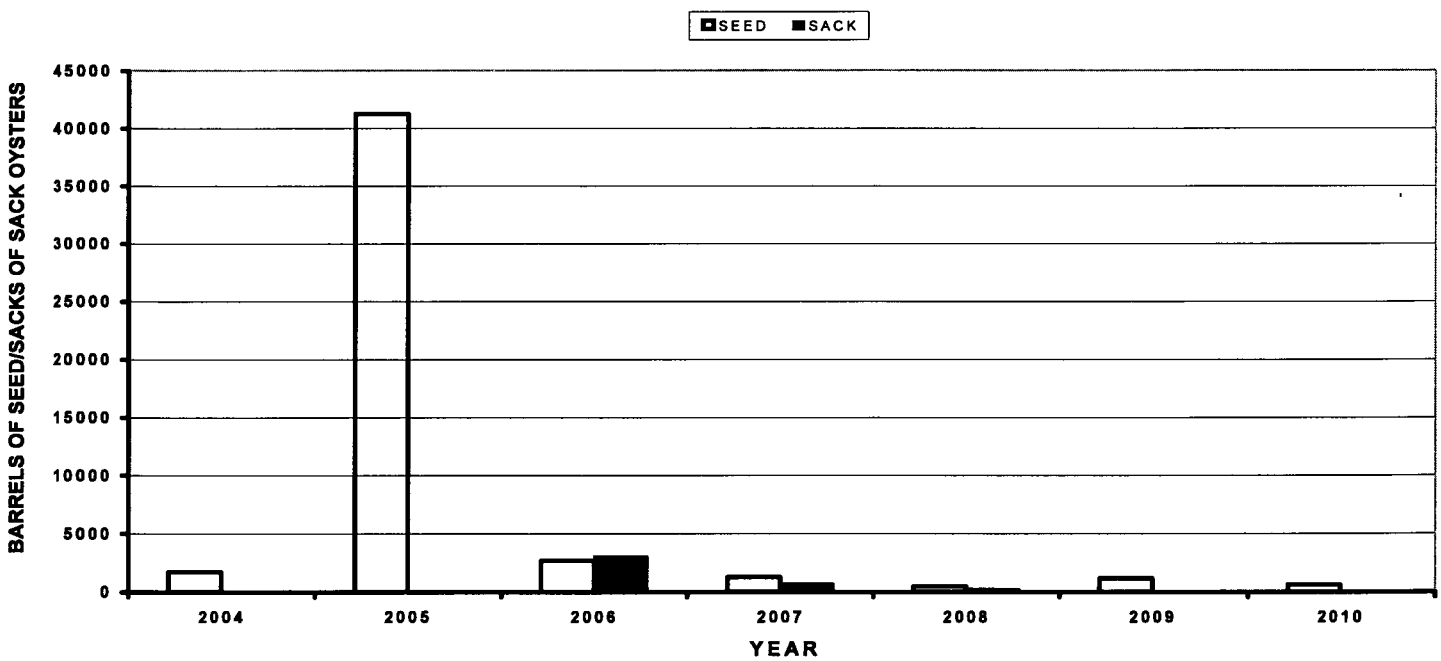


Figure 4.8. Estimated resource availability of seed and sack oysters, Lake Chien cultch plant

Table 4.1. Numbers of live spat, seed, and sack oysters and percent mortalities from the Lake Felicity and Lake Chien cultch plant square meter samples, July 2010.

CULTCH PLANT	SAMPLE	NUMBER/SAMPLE			PERCENT MORTALITY		
		SPAT	SEED	SACK	SPAT	SEED	SACK
Lake Felicity	1	22	14	2	0	0	0
	2	0	1	0	0	50.0	0
	3	0	2	0	0	0	0
	4	3	5	0	0	0	0
	5	7	9	0	0	0	0
	Mean	6.4	6.2	0.4	0	3.1	0
Lake Chien	1	7	5	1	0	0	0
	2	16	11	0	0	0	0
	3	0	4	1	0	0	0
	4	0	0	0	0	0	0
	5	17	16	0	0	0	0
	Mean	8.0	7.2	0.4	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 square meter samples, July 2010.

CULTCH PLANT	ESTIMATED RESOURCE	
	SEED OYSTERS (Barrels)	SACK OYSTERS (Sacks)
Lake Felicity	1,394.0	359.7
Lake Chien	627.3	139.4
Total	2,021.3	499.1

Table 4.3. Historic commercial effort (vessel-days) and seed oyster harvest (barrels) and sack oyster harvest (sacks) from the Lake Chien and Lake Felicity cultch plants. No harvest was allowed in 2009.

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

(This page intentionally left blank)

Coastal Study Area (CSA) 5 – 2010 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 which increased the POSG water bottoms to 2,631 acres. This expanded area consisted of un-leased water bottoms between the existing grounds and private oyster leases.

Materials and Methods

Approximately half of the CSA-5 meter square field samples were collected on July 12, 2010 with remaining sample collection delayed due to the presence of a fine sheen on the water surface. Samples were completed on July 19, 2010 by a commercial dive company (ENCOS). Following the dive, LDWF took possession of the samples.

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 five samples was used to estimate oyster stock availability at each station.

All live and dead oysters and shell within the upper portion of substrate were 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 75 square meter samples were collected at 15 locations including fifty samples in Sister Lake, twenty in Bay Junop, and five 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). Five new sites located on the 2009, 156-acre shell plant in Sister Lake was also sampled by SCUBA divers utilizing ¼ meter samples.

At request from industry, "dermo" samples will be collected in August when prevalence of disease organisms would be greater.

Results and Discussion

Sister Lake: Estimated oyster availability for 2010-2011 is 112,141 barrels of seed and 35,578 barrels of sack oysters (Table 5.1). This represents an overall increase of 12% from last year's assessment, primarily in increased seed availability. Sack oysters continued to decrease—decreasing by 19% from last year's assessment-- while seed oysters increased 26% from the 2008-2009 assessment. The seed to sack ratio increased from 2.0:1.0 last year to 3.2:1.0 (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 is comparable only to those of 2006. Seed and sack mortality for last year's assessment was 2.2% which was almost identical to this year's overall mortality of 2.1%. Spat count average of 1.1/site was 91% below the five year average (11.8) and represent an 88% 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 59% of seed and 75% 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 45% of available seed and 58% of available sack oysters (Figure 5.1).

No overburden was observed at any of the meter square sites; this represents the first time since before Hurricane Rita (2004) that no mention of reef overburden was noted.

Bay Junop: The 2010-2011 Bay Junop estimated stock availability is 3145 barrels of seed oysters and 1393 barrels of sack oysters. This is a sizeable increase in seed and sack availability from 2009-2010. Seed to sack ratio has increased from last year's assessment of 0.0:1.0 to 2.2:1.0 (Table 5.4). Overall mortality was 1.5%. Spat sets averaged 2.0 spat per station which is 81% less than the five-year average of 10.5 spat/site. There were 406 barrels of seed oysters and 154 barrels of sack oysters available north of the traditional November-February DHH line.

Lake Mechant: The 2010-2011 assessment of the approximate 30-acre site included estimates of 39,054 barrels of seed oysters and 0 barrels of sack oysters available (Table 5.3), which represented a marked increase in available seed oysters. 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. Efforts continue to attain a more complete suitable oyster substrate assessment of this POSG.

Water Temperature and Salinity
There was little significant variation in salinity and temperature at the different locations (Table 5.5).

Predators/Disease/Fouling
Biofouling of hooked mussels in Sister Lake has increased from 98 in 2009 to 421 in this year's assessment. Biofouling rates of hooked mussels in Bay Junop have increased from 8 in the 2009 assessment to 48 this year with the largest number (32) of mussels located at the northern most station. Samples from Lake Mechant contained 442 hooked mussels.

No evidence of oyster drills (*Stramonita haemastoma*) was present in square meter samples. Other potential predators included a total of 103 unidentified mud crabs recorded from 12 stations. Stone crab (*Menippe adina*), blue crabs (*Callinectes sapidus*), and Gulf toadfish (*Opsanus beta*) were not present in samples.

2009/2010 Oyster Season Summary
During the 2009-2010 Sister Lake oyster season, 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. The industry requested and was granted a 50 sack/day limit during this season.

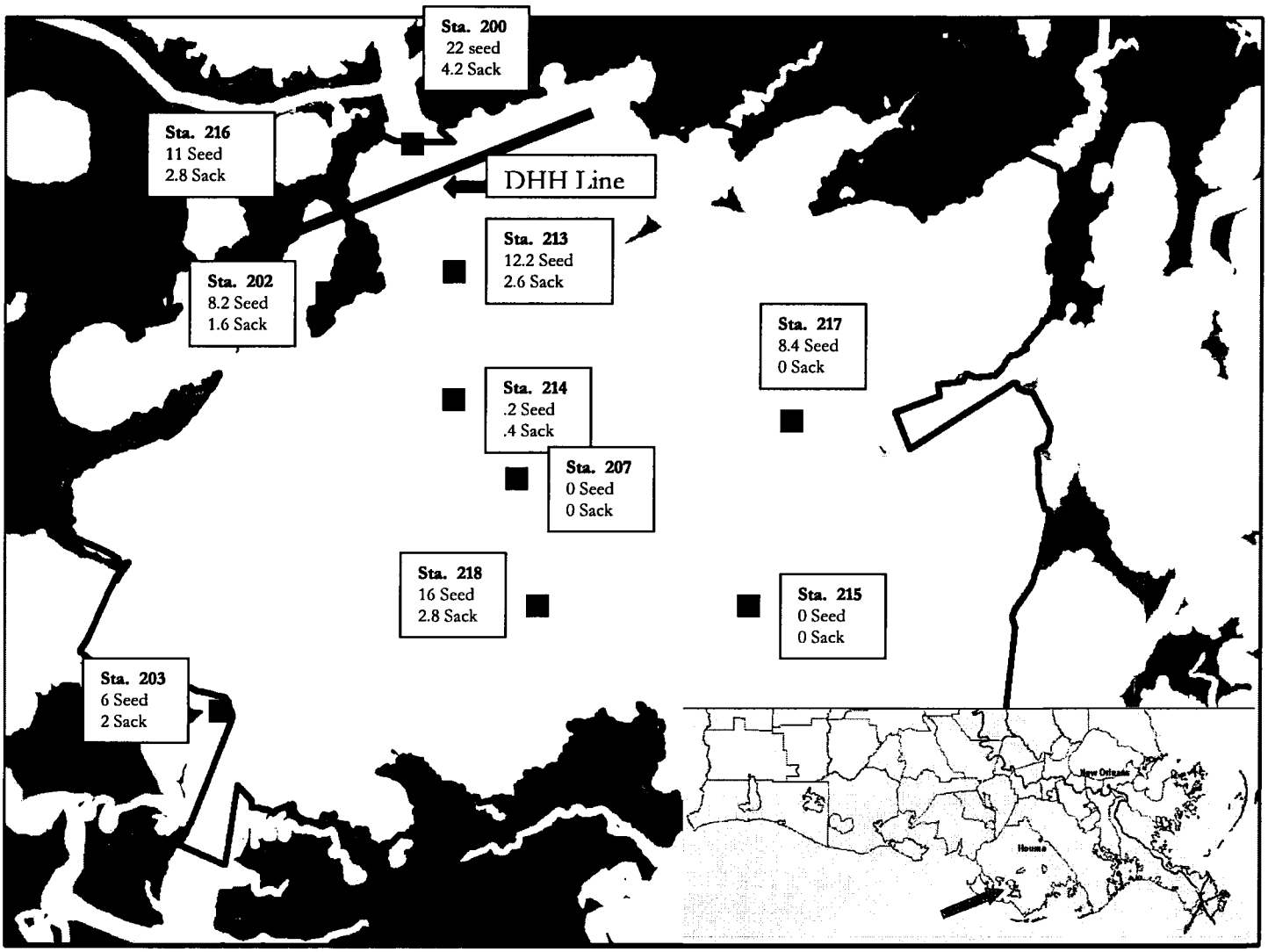
Sister Lake: Sister Lake was opened to commercial oyster harvest from 10/30/09 through 11/12/09 with 102 different vessels participating. The harvest was monitored daily except on 11/09/09 due to high winds caused by passage of Hurricane Ida. Most of the available resource was located in the northern portion of the lake toward Grand Pass with a portion of that area placed under a DHH closure on November 1st.

Sacking vessels totaled 395 boat days and averaged 34.6 sacks /vessel. Of the estimated 86,773 sacks available, 13,676 sacks (15.8%) were harvested. Seed availability was estimated at 88,887 barrels with an estimated harvest of 4,610 barrels (5.2%). Twenty-five boat days were expended on this activity with an average load of 184 barrels/vessel. Total production was 11,488 barrels of sack and seed oysters.

Seventeen samples were collected from bedding vessels. Non-living reef/cultch material (determined to be material with no live oyster > 1") ranged from 4.4% to 31.7% and averaged 18.6%. Average material in the November 2007 and February 2008 season in Sister Lake were 31.7% and 23.7% respectively. It appears that most of the bedding vessels utilizing the lake this year were local and seemed to be more selective in their efforts. Additionally, only one vessel was noted with water cannon in use.

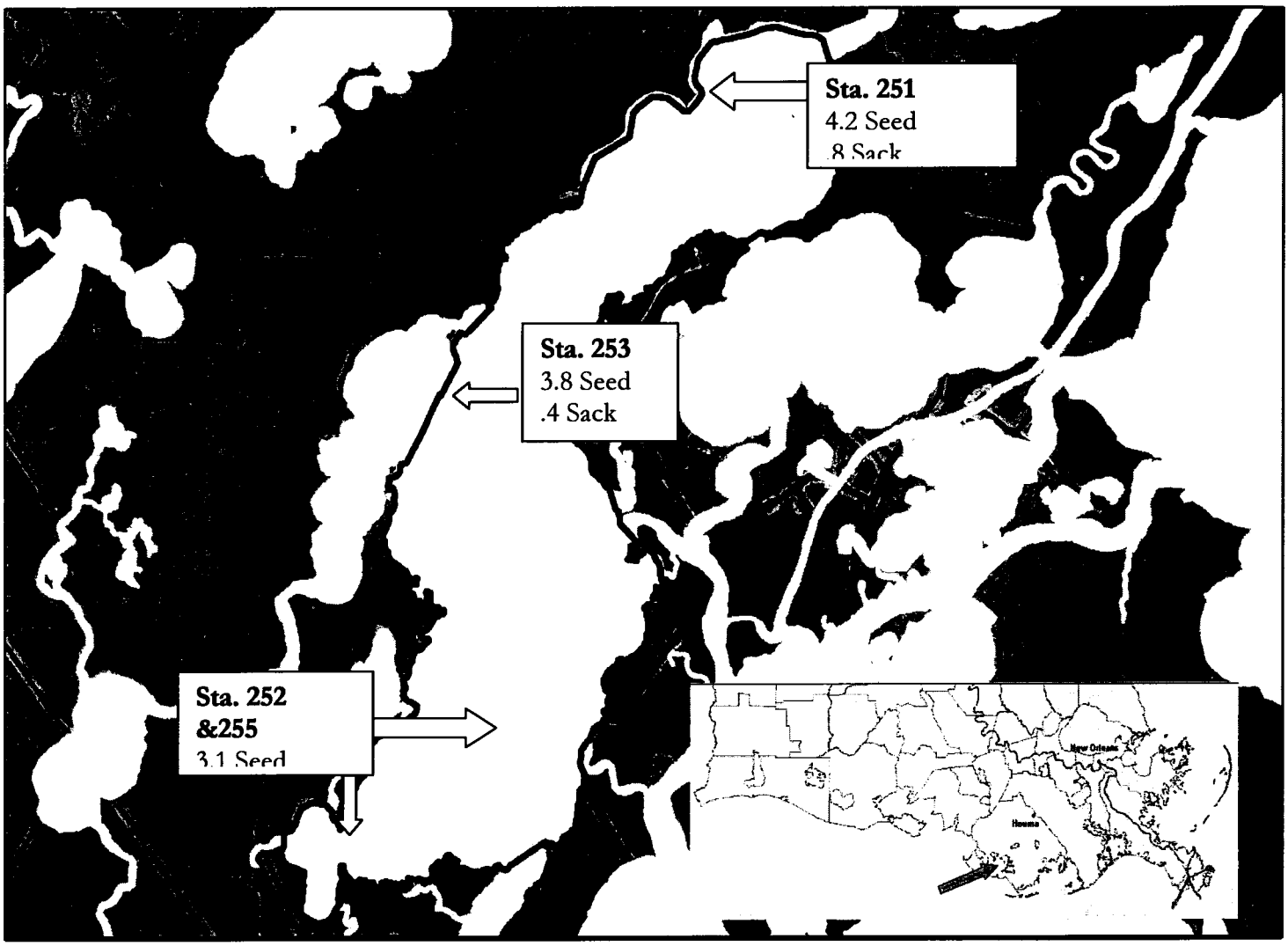
Bay Junop: The Bay Junop POSR was closed for the 2009-2010 season.

Lake Mechant: The Lake Mechant POSG was closed for the 2009-2010 season.



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 2010 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 2010 meter square sample stations (average # of seed and sack oysters at each station).

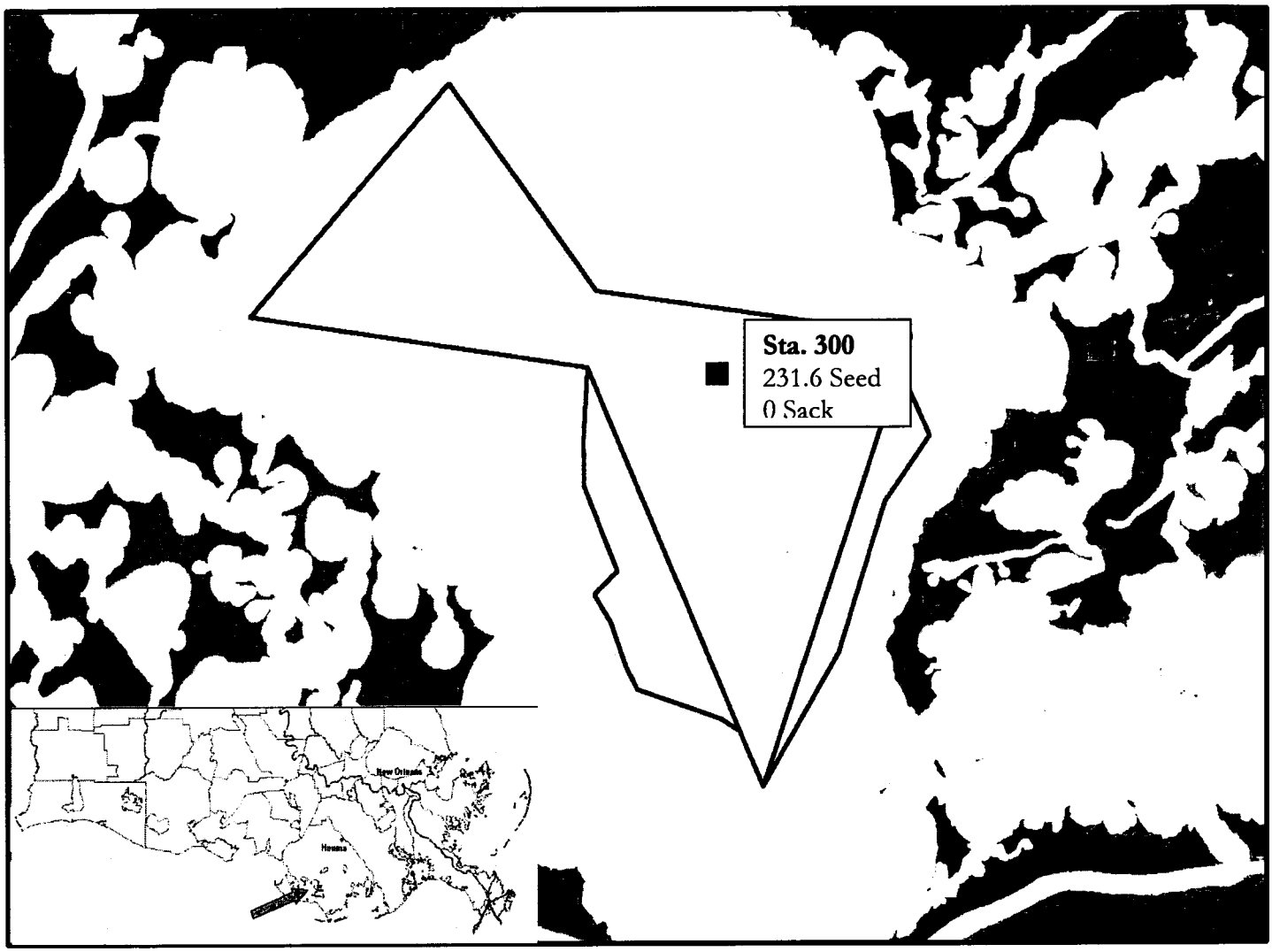


Figure 5.3 Lake Mechant Meter Square Samples (average # of seed and sack oysters at each station)

Table 5.1 2010 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	22.2	4.2	40,229.74	15,222.06
202	81.93	119	482,435.38	8.2	1.6	5,494.40	2,144.16
203	151.31	220	890,971.53	6	2	7,424.76	4,949.84
207	185.72	270	1,093,590.86	0	0	0	0
213*	96	140	565,284.96	12.2	2.6	9,578.44	4,082.61
214*	129	188	759,601.67	.2	.4	211.00	844.00
215*	81	118	476,959.19	0	0	0	0
216**	115	167	677,164.28	11	2.8	10,345.57	5,266.83
217**	438	637	2,579,112.63	8.4	0	30,089.65	0
218***	67	97	394,521.80	16	2.8	8,767.15	3,068.50
TOTAL		**2,279.32**	**9,224,390.64**	**84.2**	**16.4**	**112,140.71**	**35,578.01**

* 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 2010 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	4.2	.8	406.05	154.68
252*	67.36	272,605.92	3.1	1.2	1,173.72	908.69
253	73.26	296,483.22	3.8	0.4	1,564.77	329.43
TOTAL	**157.82**	**638,697.50**	**11.1**	**2.4**	**3,144.54**	**1,392.80**

* Stations 252 and 255 are combined

Table 5.3 2010 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	231.6	0	39,053.55	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
2010	3.2-1.0	2.2-1.0	0.0-1.0
Average ratios (1980-2010)	1.9-1.0	1.1-1.0	9.9-1.0

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
2010	26.4	31.0	28.5	27.7	28.2	32.2
mean	**26.7**	**29.7**	**27.2**	**29.4**	**27.0**	**29.8**

*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
2010	18.7	17.0	20.5	10.4	9.8	1.6
mean	**14.9**	**11.2**	**18.3**	**13.4**	**6.2**	**4.3**

*OYSTER DREDGE SAMPLES

(This page intentionally left blank)

Coastal Study Area (CSA) 6 – 2010 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 the 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 generally north of a line 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 managed the oyster resources found on local state water bottoms in a manner similar to present seed ground management procedures. This allowed limited harvest/relays from the Vermilion Bay area reefs 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, the public oyster seed grounds within CSA 6 are highly influenced by freshwater discharge from the Atchafalaya River. Typically, oyster reproduction occurs in the fall after the river stage abates, with oysters growing to seed size (1 inch to < 3 inches) by the following spring. However, spring and early summer floodwaters depress salinities, placing extreme physiological stress on the organisms. These low salinities, coupled with high water temperatures through the summer months, typically results in extensive oyster mortalities on the public grounds. Occasionally, however, reduced freshwater inflow from the Atchafalaya River leads to higher-than-normal salinities and the normal annual cycle of extensive oyster mortalities is broken, leading to a harvestable population of seed oysters during the following oyster 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 November 2009 through June 2010 will be addressed. In addition, information regarding the 2009/2010 oyster season harvest on the Vermilion Bay area public oyster seed grounds will be presented.

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 conducted on July 8 and July 13, 2010. A total of five stations (Figure 6.1) were sampled with five 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, 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 at the Indian Point, Big Charles, and South Point sites, with replicates averaging 2.4, 1.4, and 0.2 oysters respectively. Similar to last year's survey, seed oysters were found primarily at the sample sites located in Vermilion Bay north of Southwest Pass (Figure 6.1). Very few sack sized oysters were found during the 2010 meter square sampling program, with a total of 3 found in the ten replicates combined at the Indian Pt and Big Charles sites (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, 2008, and 2009 (Table 6.1).

Spat Production

Few spat were found, with live spat taken in single replicate samples at Indian Point, Big Charles, and Bayou Blanc (Figure 6.1). Suitable substrate was present at all sites except Dry Reef, where divers found the reef completely buried under sediment.

Fouling organisms

An increase in hooked mussel *(Ischadium recurvum)* productivity compared to last year's assessment was seen at all stations except the Dry Reef site (reef completely covered by sediment). Many of the mussels were very small and likely a result of the low salinity conditions seen throughout the system beginning in April 2010 (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. A total of five mud crabs *(Xanthidae sp.)* were found at the western stations (three at the Indian Point and two at Big Charles), and a stone crab *(Menippe adinia)* was collected at the Indian Point station. Only one mud crab was

collected in samples from the east side of Marsh Island (Bayou Blanc station). No blue crabs *(Callinectes sapidus)* were captured in the samples.

Disease
No analysis to detect the presence of pathogens was done for this report. An attempt to collect sufficient oysters for analysis of "dermo" *(Perkinsus marinus)* infestation will be made in August 2010.

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 Atchafalaya 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 2009 and spring/early summer of 2010 (Figure 6.2), with its effects on local oysters noted in this year's assessment.

High river levels and associated freshwater conditions beginning in November 2009 produced conditions not conducive to productivity on sampled seed ground reefs. In the months following the July 2009 stock assessment, recovery of the oyster stock was very slow. Dredge samples collected for the monitoring program found very few spat (especially in the eastern part of the system) through the fall of 2009. Seed size oysters were not collected in high numbers, but significant mortality was not observed. Samples taken in spring 2010 again found little recovery in the eastern portion of the seed grounds while sample sites north of Southwest Pass/Vermilion Bay held promising seed numbers with a few sack sized oysters present. As salinity levels fell and summer-time water temperatures rose at designated samples sites, the number of live oysters available each month decreased. By July 2010, few live oysters were available as indicated by the very low numbers documented in this year's stock assessment.

Actual recent mortality levels as recorded in 2010 meter square samples is very low. Samples taken in the eastern part of the system (South Pt. and Bayou Blanc) had zero recordable recent mortality, as there were very few live oysters present in the months leading up to the assessment. For the same reason, there was no recorded mortality at the Dry Reef and Big Charles sites. The Indian Point site had 8% and 0% recent mortality for seed and sack oysters respectively. It should be pointed out that documentation of recently dead oysters for this area is difficult, as the valves are readily separated in the high energy environment and fouling in the turbid, highly organic water is almost instantaneous.

The cycle of recovery from a distressed resource resulting from low salinity/high water temperatures each summer to positive productivity as salinity rises and water temperatures fall in autumn is very common in this system. As occurred in the spring of 2010, the resource becomes stressed as the rising river lowers salinity and raises turbidity levels. Oysters are then hit by rising summer-time water temperatures, leading to a loss in available resource and completion of the cycle.

Tropical and Climatic Events
No tropical storms or significant climatic events affected the Vermilion area seed grounds since the 2009 assessment.

Oil Impacts
Several areas that fall within the boundaries of CSA 6 were impacted by oil beginning May 18, 2010. To date, conclusive evidence tying the oil found on local shorelines to the Deepwater Horizon event (approximately 220 miles east southeast of Southwest Pass/Marsh Island) have not been provided. No direct evidence of oyster oiling in this area has been documented by LDWF.

Areas of coastal shoreline to the west (Paul J. Rainey Wildlife Sanctuary) and east (Marsh Island Wildlife Refuge) of Southwest Pass were oiled in May 2010, resulting in a closure of DHH Harvest Area 28 (leased area) to oyster fishing activity. The closure generally ran from May 18 through June 20, 2010.

DHH Harvest Area 27 (Southwest Pass), which is on the inside oyster seed ground, was closed due to oiling on June 9, and re-opened on June 30, 2010. The LDWF oyster season was closed in this harvest area during the entire closure period.

2009/2010 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. Trip ticket data is analyzed to provide additional harvest information.

Results & Discussion
The Vermilion/East and West Cote Blanche/Atchafalaya Bay Public Oyster Seed Grounds opened one-half hour before sunrise on Sept. 9, 2009 for the harvest of seed oysters for bedding purposes only and remained open until one-half hour after sunset on Oct. 11, 2009. These areas then re-opened at one-half hour before sunrise on Oct. 12, 2009 for the taking of both seed and market-size oysters and closed one half-hour after sunset on April 30, 2010. No harvest of seed or sack oysters was observed or reported on the inside or outside seed grounds for the 2009/2010 season.

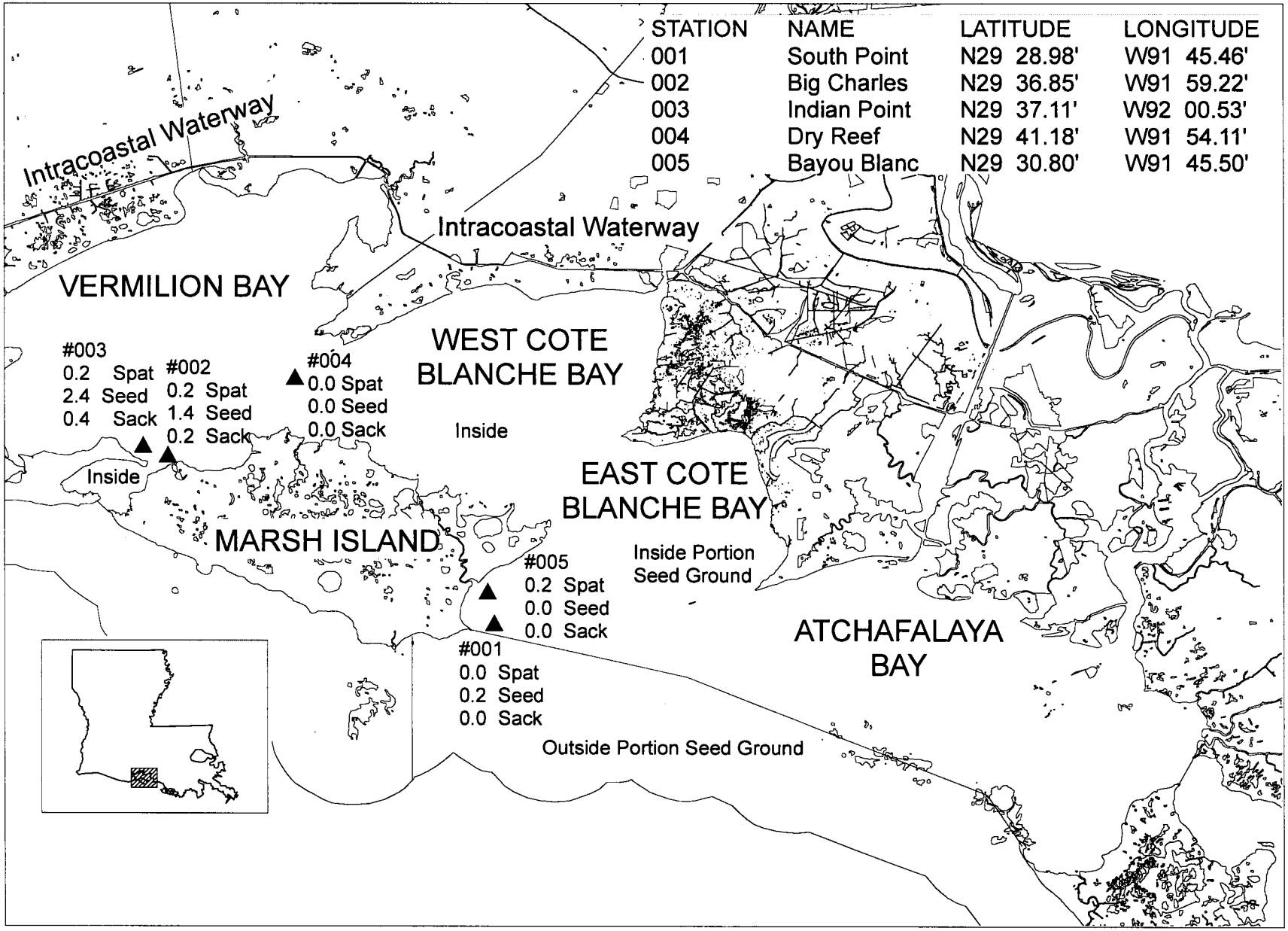


Figure 6.1. Map designating CSA 6 2010 oyster stock assessment stations on the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data below station numbers represent average spat, seed and sack oysters per square meter sample.

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
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
2010	0.8	0.12	6.7:1

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

station no.	station name	2005	2006	2007	2008	2009	2010
001	South Pt./Marsh Island	28	16	26.0	1.0	0.0	11.2
002	Big Charles	12.5	17	16.0	2.5	0.0	18.4
003	Indian Point	43	9	33.5	0.5	16.0	18.2
004	Dry Reef	8.5	0	0	2.0	37.0	0
005	Bayou Blanc	9.5	7	18.5	2.5	0.0	4

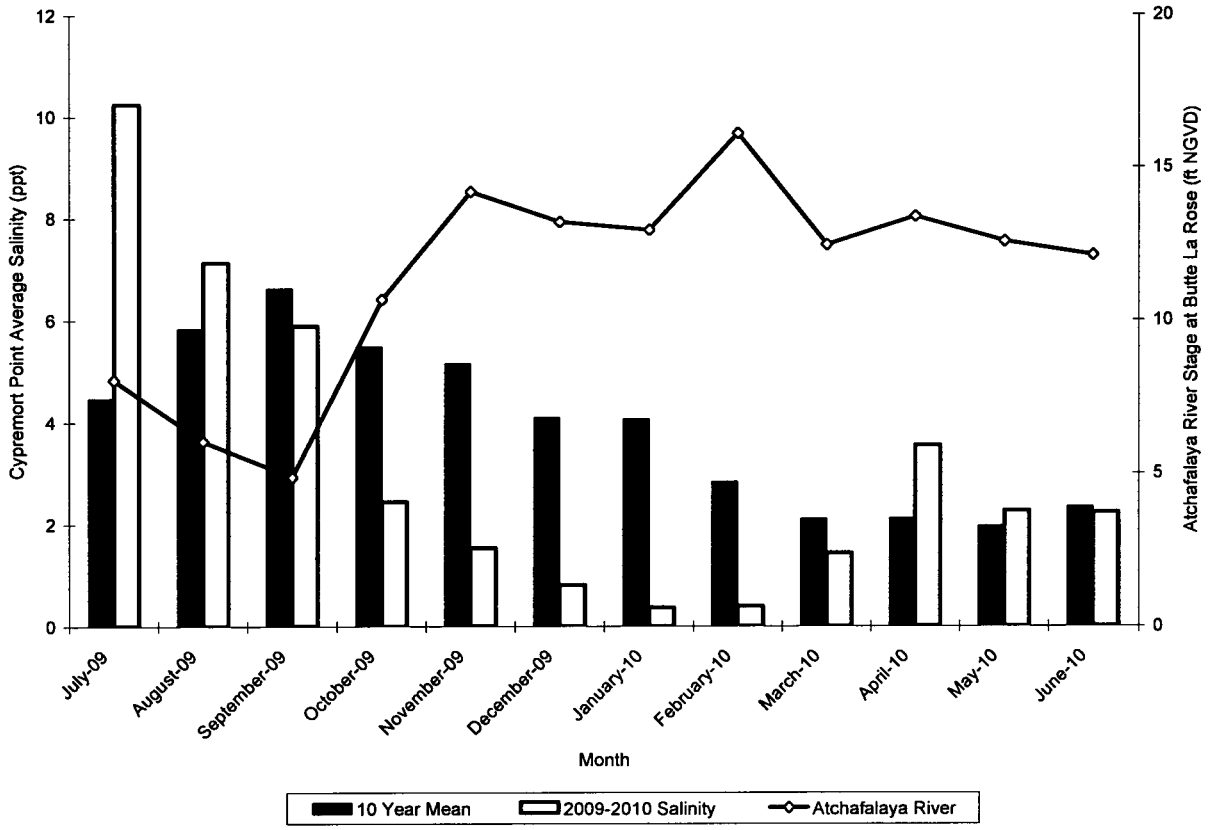


Figure 6.2. Graph depicting monthly Atchafalaya River levels at Butte La Rose gauge and monthly average salinity for Cypremort Point, LA during the period from July 2009 through June 2010. Ten year mean monthly salinity at Cypremort Point included.

(This page intentionally left blank)

Coast Study Area (CSA) 7 – 2010 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 divided into two areas – Eastside and Westcove (the Calcasieu Ship Channel being the dividing line). In 1992, Louisiana Department of Health and Hospitals (LDHH) also divided 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 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, Inc. to perform a comprehensive water bottom assessment of a portion (approximately 10,421 of 52,878 acres) of Calcasieu Lake in the latter half of 2008. GA 29 assessment indicates 4,034.9 acres of Type II bottom and 1434.3 acres of Type III B bottom. GA 30 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).

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. No oystering was allowed by the LDWF Commission during the 2009-2010 season on this cultch plant.

Methods

The oyster assessment for Calcasieu Lake was derived by taking "meter square" samples on July 12th and 14th, 2010. The one meter square frame is randomly tossed in the very near vicinity of the sample station located on a known oyster reef. There are five replicate samples taken by a SCUBA diver at each station and there are three stations 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

Growing Area 29

The oyster assessment for GA29 indicates 23,540 sacks of sack oysters and 8,545 sacks of seed oysters available (Table 7.1). Sack oysters showed a decrease of 94.3% over the 2009 assessment of 411,792 sacks (Table 7.2). The availability of seed oysters dropped from the 2009 assessment of 127,872 sacks to 8,545 sacks (Table 7.1); this is a 93.3% decrease (Table 7.2).

Growing Area 30

The oyster assessment for West Cove indicates 689,376 sacks of sack oysters and 605,983 sacks of seed oysters available. Sack oysters showed an increase of 229.5% over the 2009 assessment of 209,214 sacks (Table 7.2). The availability of seed oysters increased from the 2009 assessment of 124,221 sacks to 605,983 sacks (Table 7.1); this was a 387.8% increase (Table 7.2).

2009 Cultch Plant

The oyster assessment for the 2009 cultch plant indicates the presents of spat and seed oysters, but no sack oysters. Sampling indicates that there are 1,342,585 spat on the cultch plant and 24,434 sacks of seed oysters. The average size of the seed oysters is 41.44 mm (1.63 inches). Mortality on the cultch plant was 4%.

Discussion

Sack Oysters

The overall assessment is up 7.0% from the short term average (2005-009). Though there is an increase in the overall population, and an increase of 307.1% within GA 30, this was offset by the 95.3% decrease within GA 29 (Table 7.2). The decrease in sack oysters in GA29 is a concern. The oysters that are on the reefs are healthy, but the assessments from the past two seasons have declined (Table 7.2). With the low numbers of available oysters on the eastern oyster areas of the state, demand has increased. This has caused more fishing pressure in Calcasieu Lake and in particular in GA 29 with an

increase from an average of 37.8 harvest vessels per month in the 2005-06 season to the high of 148.7 in the 2009-10 season (Fig. 7.3). The highest number of boats landing oysters from Calcasieu Lake was January 2010 at 190.

Complete landings data via the LDWF Trip-Ticket program for the 2008-09 season indicated that there were 63,948 sacks reported landed and 137,074 sacks landed for the 2009-10 season (Table 7.4). This is another increase from the previous year. With the continued increase in fishing pressure mentioned above has come a corresponding increase in harvest from 19,327 in the 2005-06 season to one of the highest on record at 137,074 (Table 7.4). The harvest appears to be affecting the availability of oysters in GA29 where most of the harvest occurs. Increased harvest pressure in GA29 over GA 30 is likely attributable to the differences in the closure levels set by LDHH with GA30 being much more susceptible to rainfall with a closure level of 7.0 feet at Kinder than the level of 13.5 feet for GA29. During the 2009-10 season GA29 was open 79% of the time and GA30 was open only 40% of the time (Table 7.5). GA30 is very susceptible to rainfall with the low closure level of 7.0 feet at Kinder.

Seed Oysters

Seed oyster decreased in GA 29 by 93.3% from the 2009 assessment and increased in GA 30 by 387.3% (Table 7.2). The decreases in seed oyster resources in GA29 may also be attributable to harvest pressure in GA29. GA30 seed oysters show a significant increase of 387.8% from the 2009 assessment (Table 7.2).

Hydrology

Average water temperatures for May and June were 26.1°C and 30.1°C respectively and were above the long term average (LTA) of 1970-2009, with the maximum deviation of 2.0°C (Table 7.6). The average water temperature during the oyster assessment was 30.1°C which is slightly higher that the LTA.

Average salinities (in parts per thousand - ppt) for May and June were 16.8ppt and 11.9ppt respectively; this is very close to the LTA with a maximum deviation of 1.0ppt (Table 7.6). The average salinity during the oyster assessment was 15.9ppt which is above the LTA; this was likely due to low amounts rainfall in late June causing decreased freshwater inputs into the system.

Disease, Fouling Organisms, and Predators

Hooked mussel numbers were much lower for this assessment than last year. GA29 had no hooked mussels in the samples. Increased fishing pressure in that area may have served to reduce mussel numbers. Hooked mussels were present in GA30 averaged 168.3 per sample station with station six having the highest average of 346.0 per sample.

There were a total of 13 Southern Oyster drills (*Stramonita haemastoma*), a predatory marine snail, collected during this assessment. This is a very high number of oyster drills as very few have ever been seen in our samples. There was a total of 39 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 needs 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 three stations. Fishing pressure is now becoming more of a concern, especially in GA29, although landings remain relatively low as a percentage of the available oysters in Calcasieu Lake.

Sabine Lake stock assessments will need to be performed if and when the decision is made to open that area for oystering. The last assessment performed in Sabine Lake was by ENCOS, Inc. during the 2008 side-scan sonar project in which nearly 1.4 million sacks of oysters were estimated to be available within the survey area (approximately the lower 1/3 of the lake).

2009-10 Oyster Season

For the three seasons 2005-2008 (Table 7.4), attempts were made to urge more fishermen to utilize the resource in GA30, but to no avail. Oysters in GA30 have not been fished in that area and many fishermen report that those oysters are less desirable for the market. Since this was the case, the 2008-09 and 200-10 seasons, both GA29 and GA30 were opened at the same time.

This season had some periods of rain and dryness, so was about average for days opened. There was a good dry period towards the end season that allowed more fishermen to utilized GA30. This was also in part to low numbers of available oysters in GA29.

This season had the highest average number of boats per month on record at 148.7 (Fig. 3) and a high for a month in January 2010 of 190 boats landing oysters from Calcasieu Lake. Price per sack had some high periods also contributing to more fishermen working. This accounts for the high landings for this season at 137,047 sacks (Table 7.4) and the highest since dealers started reporting landings in 1991.

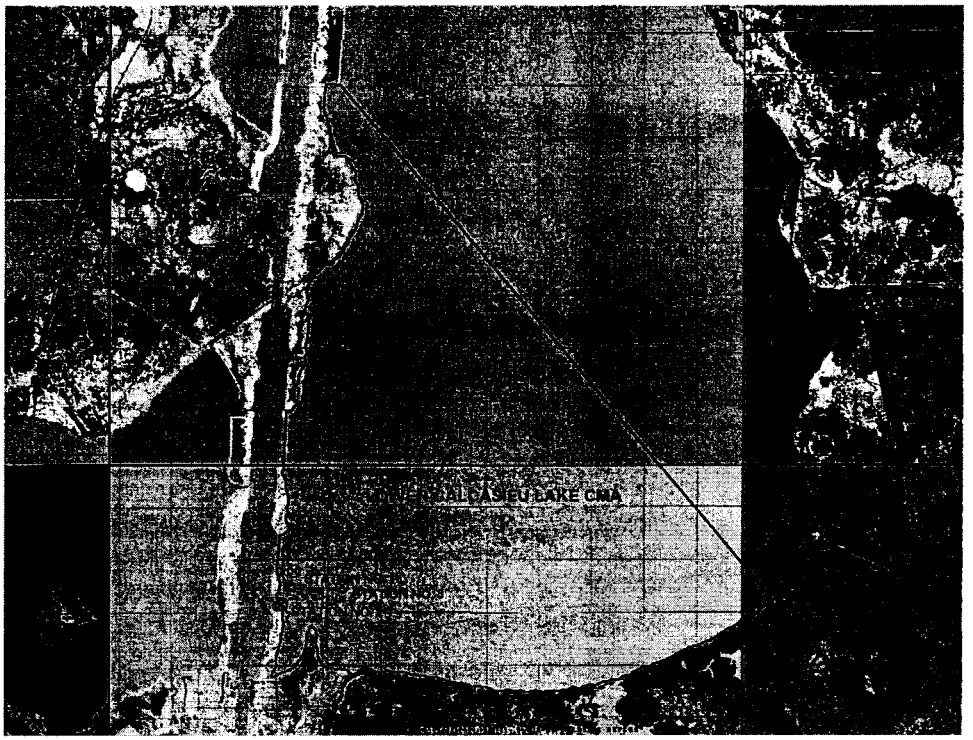


Figure 7.1. Map indicating Growing Area 29 boundary and Meter Square Station locations.

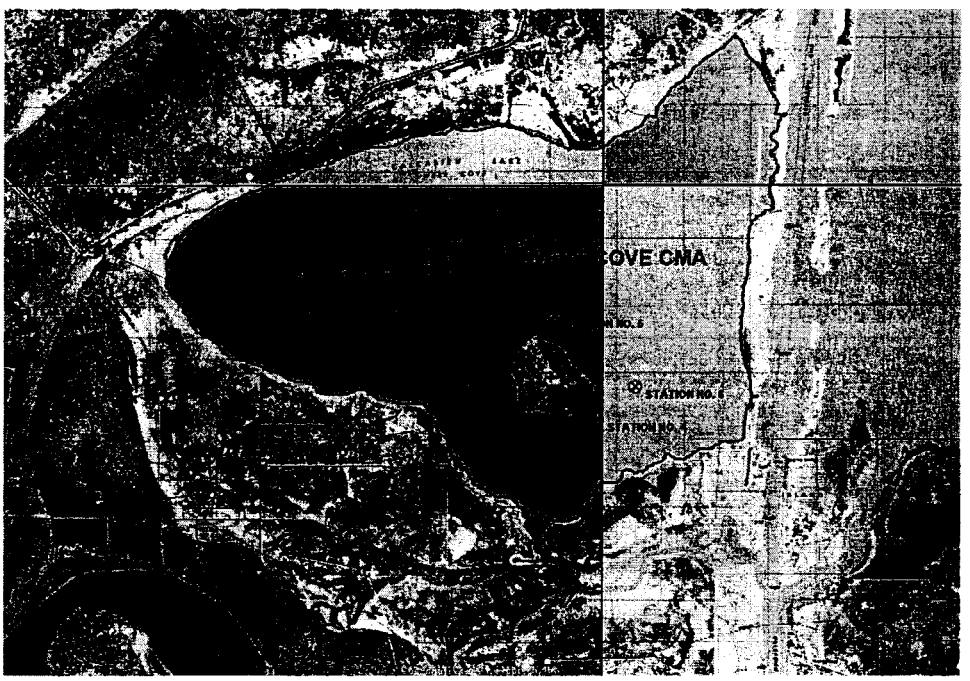


Figure 7.2. Map indicating Growing Area 30 boundary and Meter Square Station locations.

Table 7.1. Calcasieu Lake 2010 Oyster Stock Assessment

CALCASIEU LAKE OYSTER STOCK ASSESMENT
JULY 2010

OYSTER NUMBERS

CALCASIEU LAKE EASTSIDE (GA29)

SIZE	STATION			AVE.
	1	2	3	
≥3"	0	7	4	.73
1-<3"	3	2	3	.53

WEST COVE (GA30)

SIZE	STATION			AVE.
	4	5	6	
≥3"	21	49	116	12.40
1-<3"	47	123	157	21.80

OYSTER PRODUCTION AREA

CALCASIEU LAKE EASTSIDE (GA29)	WEST COVE (GA30)
5,804,406.163	10,007,066.555 SQ. METERS

PRODUCTION OF ≥3" OYSTERS

CALCASIEU LAKE EASTSIDE (GA29)		WEST COVE (GA30)	
OYSTERS:	4,237,216.499	OYSTERS:	124,087,625.282
SACKS:	23,540.09	SACKS:	689,375.70
TOTAL SACKS OF ≥3" OYSTERS:			712,915.8

PRODUCTION OF 1 – < 3" OYSTERS

CALCASIEU LAKE EASTSIDE (GA29)		WEST COVE (GA30)	
OYSTERS:	3,076,335.266	OYSTERS:	218,154,050.899
SACKS:	8,545.37	SACKS:	605,983.47
TOTAL SACKS OF 1-<3" OYSTERS:			614,528.8

TOTAL PRODUCTION

TOTAL OVERALL POTENTAL OF OYSTERS (SACKS):	1,327,445

NOTE: This is using the acreage from the ENCOS, Inc. side-scan sonar survey (2008), which is only performed in part of Calcasieu Lake.

NOTE: This is the first year using five replicates per station (fifteen replicates per side).

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
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
2009[1]	411,791.8	209,214.3	621,006.1	127,872.2	124,221.0	252,093.2
AVERAGE	**497,184.4**	**169,332.8**	**666,517.2**	**356,308.3**	**183,888.8**	**548,198.1**
2010[1]	23,540.1	689,375.7	712,915.8	8,545.3	605,983.5	614,528.8
% CHANGE FROM AVE.	-95.3	+307.1	+7.0	-97.6	+229.5	+12.1
% CHANGE FROM 2009	-94.3	+229.5	+14.8	-93.3	+387.8	+143.7

1 – Assessed using updated reef acreage from ENCOS in 2008.

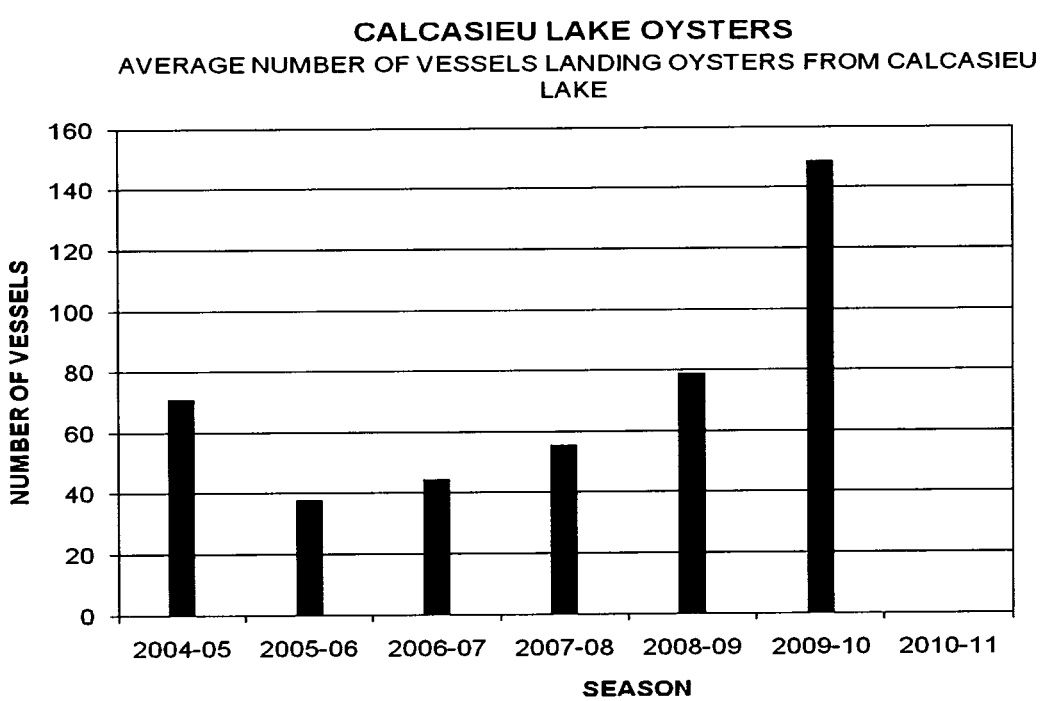


Figure 7.3. Monthly average of boats landing oysters from Calcasieu Lake (GA29 and 30).

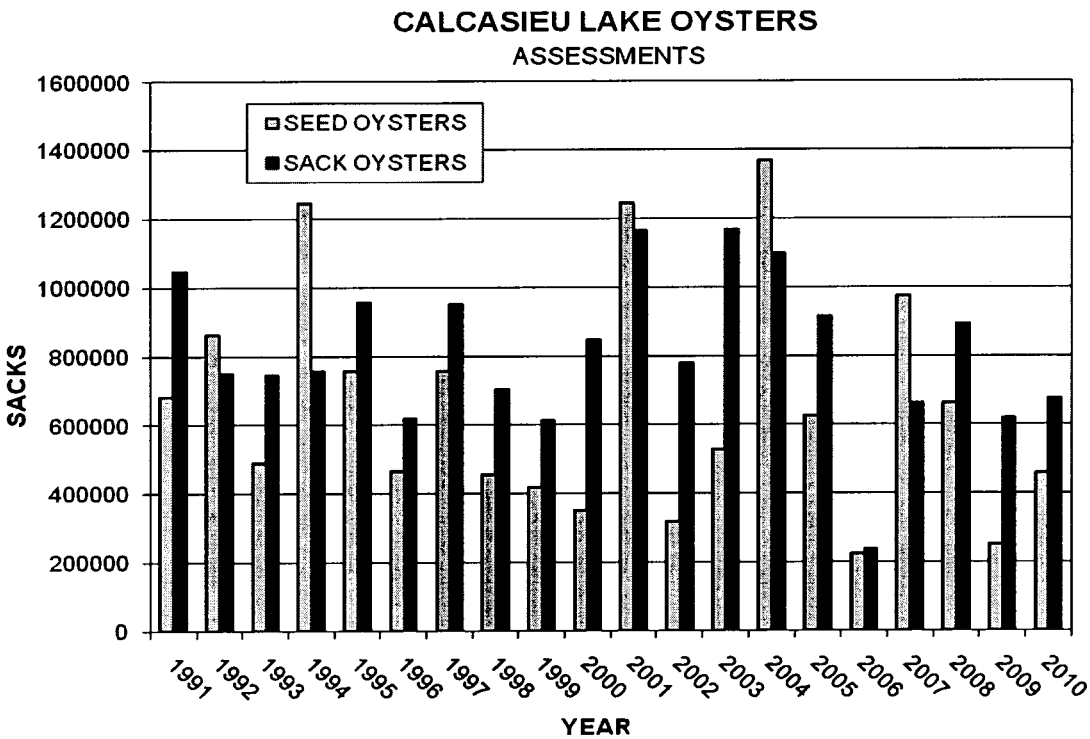


Figure 7.4. Calcasieu Lake Available Seed and Sack Oysters

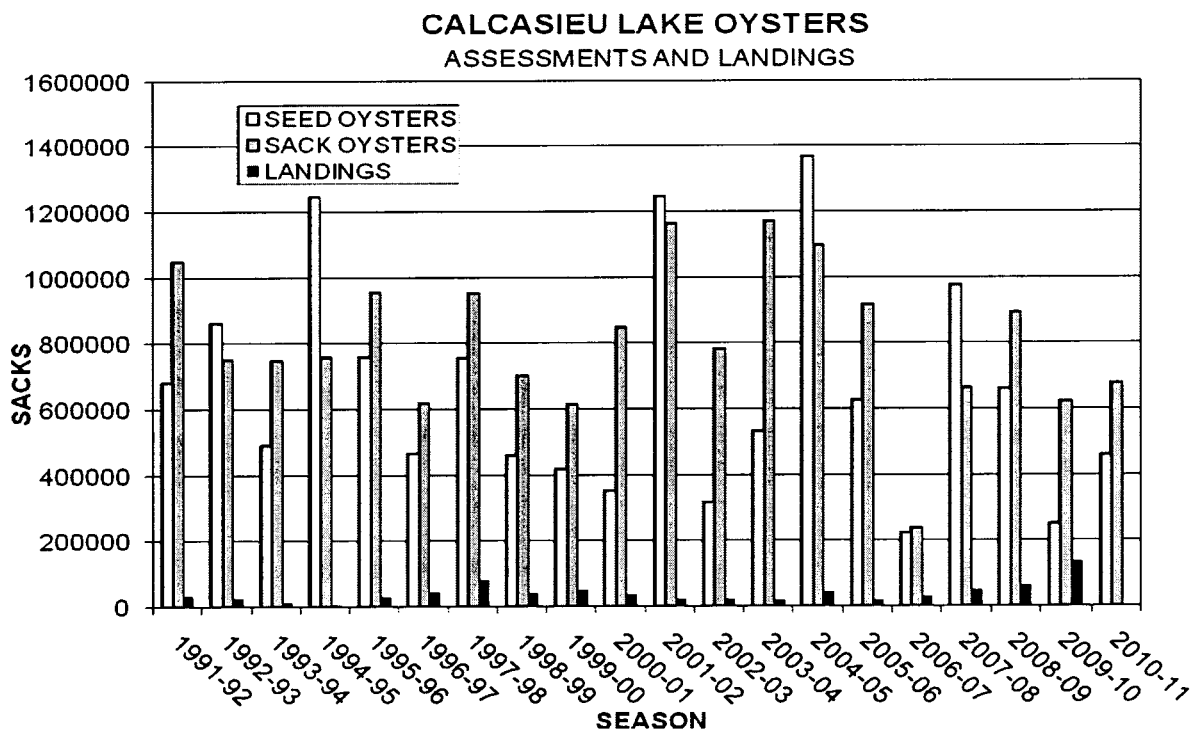


Figure 7.5. Calcasieu Lake Available Oysters and Landings

Table 7.4. 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[4]	915,625	1,541,893	19,327
2006-07[5]	238,945	463,623	28,341
2007-08	662,747	1,638,496	49,529
2008-09	894,262	1,556,465	63,948[6]
2009-10[7]	621,006	873,099	137,074
2009-10[8]	1,398,437	1,972,920	
2010-11[9]	712,916	1,327,445	

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 – NO DATA WAS AVAILABLE FOR OCT.2008.
7 – ASSESSMENT USING THE REGULAR REEF ACREAGE.
8 – ASSESSMENT USING THE UPDATED REEF ACREAGE FROM ENCOS, INC. SIDE-SCAN SONAR SURVEY (2008).
9 – USING THE UPDATED REEF ACREAGE (2008) AND USING FIVE REPLICATE SAMPLES PER SAMPLE SITE INSTEAD OF TWO.

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	LCLCM	198	187	94		
	WCCMA	205			165	40
2006-07	LCLCM	181	118	65		
	WCCMA	197			70	35
2007-08	LCLCM	182	165	91		
	WCCMA	199			131	66
2008-09	LCLCM	198	183	92		
	WCCMA				125	63
2009-10	LCLCM	198	157	79		
	WCCMA				80	40

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

Table 7.6. Calcasieu Lake Salinity and Temperature

CALCASIEU LAKE HYDROLOGY						
	2010[1]		LONG TERM[1]		2010 OY. ASSESSMENT	
MONTH	AV. SAL.	AV. TEMP	AV. SAL.	AV. TEMP.	AV. SAL.	AV. TEMP.
MAY	16.8	26.1	16.5	24.5		
JUNE	11.9	30.1	10.9	28.1		
JULY					15.9	30.1

1 - Averages are derived from the 16' trawl samples for the respective months.

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
	WCCMA	10-8	4-30	205			165	40	-	-	-	-	-	-	-	205
2006-07	LCLCMA	11-1	4-30	181	118	63			-	-	-	-	-	-	-	181
	WCCMA	10-16	4-30	197			70	127	-	-	-	-	-	-	-	197
2007-08	LCLCMA	11-1	4-30	182					-	-	-	-	-	-	-	181
	WCCMA	10-15	4-30	199					-	-	-	-	-	-	-	198
2008-09	LCLCMA	10-15	4-30	198	183	15			-	-	-	-	-	-	-	198
	WCCMA						125	73	-	-	-	-	-	-	-	
2009-10	LCLCMA	10-15	4-30	198	157	41			-	-	-	-	-	-	-	198
	WCCMA						80	118	-	-	-	-	-	-	-	

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.

(This page intentionally left blank)