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Louisiana Oyster

Fishery Management Plan

Louisiana Department of Wildlife and Fisheries

Office of Fisheries

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Executive Summary

SHUCKED OYSTERS AND SHELLS.

CLOSEUP OF AN OYSTER.

Oysters thrive in Louisiana's estuaries and provide important socioeconomic and ecological value to the state. They have been harvested commercially in Louisiana since the mid 1800s and continue to be the foundation of one of the state's most important seafood industries. Today, Louisiana's oyster resource supports the fifth largest fishery (by volume) and fourth most valuable fishery in the state. Louisiana is the top harvester of oysters in the U.S. Gulf of Mexico (Gulf) and has led the United States in oyster landings every year since 2000. Louisiana also benefits from the ecological services oysters provide, including habitat for a variety of fish and invertebrates, shoreline stabilization, and improved water quality.

In general, oysters in Louisiana are a productive and resilient natural resource, which is a result of the stock's large spatial distribution, fast growth, and high fecundity.

This fishery management plan creates a centralized document that summarizes current information about the biology and status of the oyster resource in Louisiana, Louisiana's commercial and recreational fisheries for oyster, effects of Louisiana's oyster fishery on the ecosystem, and environmental influences on Louisiana's oyster resource. In addition, this plan describes management approaches within the state and regional framework, defines long-term management goals and objectives, identifies management issues, recommends options to address these issues, and outlines future research needs.

Introduction

Definition of Management Unit

The management unit consists of the Eastern (American) oyster (*Crassostrea virginica*) and its fisheries on natural and artificially constructed hard-bottom habitat in the nearshore estuarine environment along the coast of Louisiana.

Management Authority and Process

The Louisiana State Legislature (Legislature), the Louisiana Wildlife and Fisheries Commission (Commission), and the Louisiana Department of Wildlife and Fisheries (LDWF) are responsible for managing the oyster fishery in Louisiana's state waters, which extend seaward from the shoreline to 9 nautical miles.

Louisiana Revised Statutes Title 56 provides for the preparation and implementation of fishery management plans that will prevent overfishing and will achieve and maintain plentiful fish populations to ensure, on a continuing basis, the optimum yield from each fishery. Louisiana's fishery management plans are developed according to applicable principles and standards of the Food and Agriculture Organization of the United Nations' (FAO) Code of Conduct for Responsible Fisheries.

Responsible fisheries management requires an ongoing process of continual improvement, with active monitoring of fishery resources and fisheries and timely response to any observed changes. Fishery management plans are flexible and can be improved with collection and analyses of relevant data. Plan work groups will continuously review new research and monitoring information, document progress toward management goals and objectives, and fully review and revise fishery management plans as managers and stakeholders prioritize issues and identify and refine options.

Management Goals and Objectives

The goal of the Louisiana Oyster Fishery Management Plan is to assist with long-term conservation and sustainable use of the oyster resource for the maximum ecological, social, and economic benefit to the state of Louisiana, its citizens, and visitors. LDWF will use the following objectives to achieve this goal:

1. Develop and adopt reference points for fishing mortality and population abundance that incorporate habitat maintenance, and determine the status of the oyster stock and fishery according to these habitat-based reference points.
2. Prevent overfishing and rebuild depleted populations.
3. Maintain an ecologically successful and reproductively stable population of oysters within each major estuarine basin of the state where oyster resources currently exist.
4. Define and achieve a level of fishing capacity that provides for a sustainable harvest and allows for a profitable fishery.
5. Minimize conflicts among user groups, when possible.
6. Minimize fishery and non-fishery impacts to oyster habitat.
7. Determine and carry out necessary fishery independent and dependent sampling for collecting data to support oyster stock assessments, Sustainable Oyster Shellstock (shell budget) modeling (Soniat et al. 2014), and other monitoring programs.
8. Promote prudent biological research to improve management activities and to better understand environmental and anthropogenic factors that impact oyster populations.
9. Promote applied research to improve knowledge of commercial and recreational fisheries for oyster, including harvest and socioeconomic data, to assist with maintaining or enhancing the economic and social benefits of the public oyster resource in Louisiana.

Description of the Stock

OYSTER RESILIENCE

Productivity is a function of fecundity, growth rates, natural mortality, age at maturity, and longevity and can be a reasonable proxy for resilience.

Oysters in Louisiana are a resilient natural resource, due to several factors including oyster's fast growth rate, early age at maturity, and high fecundity, as well as the stock's large spatial distribution.

Biological Profile

Numerous well-known texts such as Galtsoff (1964), Bahr and Lanier (1981), Burrell (1986), Kilgen and Dugas (1989), Kennedy et al. (1996), and VanderKooy (2012) thoroughly describe all aspects of Eastern oyster biology, and ecology.

Physical Description

The Eastern oyster is an invertebrate bivalve mollusk. It has a soft inner body and two hard outer shells composed primarily of calcium carbonate ($CaCO_3$). Complete physical characteristics are described in Galstoff (1964).

Distribution

The Eastern oyster is found along the East Coast of North America from the Gulf of St. Lawrence in Canada to the Yucatan Peninsula in the Gulf (Kilgen and Dugas 1989). Its natural range has also been reported throughout the Caribbean Sea to as far south as Brazil (Gunter 1951). It has also been introduced on the U.S. West Coast (Bahr and Lanier 1981).

Within Louisiana, the Eastern oyster's distribution ranges from the Louisiana/Mississippi state line in the east to the Louisiana/Texas state line in the west. It is commonly found in water bodies where salinities are conducive to oyster survival and reproduction.

Habitat

Eastern oysters prefer hard, clean substrate, including existing oyster reef as well as non-native substrates such as limestone rock, concrete, dock pilings, and bulkheads. They also prefer moderate salinities (5 to 15 parts per thousand, ppt), which minimize predator or disease threats and do not inhibit physiological processes. The shallow, well-mixed estuarine waters of Gulf coast states, especially the extensive coastal marshes, bays, and bayous of Louisiana, create large areas of optimal subtidal oyster habitat with sufficient freshwater input for moderating salinities, adequate tidal exchange for providing food and removing wastes, and appropriate hard substrate for larval settlement to maintain abundant, healthy oyster populations.

Reproduction

Oysters reach sexual maturity quickly (within their first year), although smaller and younger oysters generally play a minor role in the overall reproductive output of a population. Oysters approximately 35 millimeters (1.4 inches) in shell height in Virginia were found to hold sperm (Andrews 1979, Thompson et al. 1996). Eastern oysters are generally considered protandric hermaphrodites, beginning life as males, maturing and spawning, then gradually changing sex to female. In the Gulf, oysters spawn in all but the coldest months (VanderKooy 2012). Rising water temperature in spring and falling temperature in fall initiate spawning in oysters (Shumway 1996). Literature suggests that 25˚C (77˚F) is the critical temperature for stimulating gamete production in adult oysters in the northern Gulf (Hopkins 1931, Mandelli 1975, Bahr and Lanier 1981, Shumway 1996). Oysters are broadcast spawners—males and females simultaneously release millions of gametes into the water column. Depending on their size, each female can produce between 10 million and 100 million eggs during a spawning season (Davis and Chanley 1955, Galtsoff 1964). Eggs and sperm meet to produce planktonic, free-swimming larvae. The larvae develop through several stages over the following 10 to 14 days. Larvae then actively gravitate toward the bottom and search for appropriate substrate on which to settle and permanently attach.

Age and Growth

Anecdotal evidence indicates that Eastern oysters live up to 20 years (Powell and Cummings 1985, Mann et al 2009), although oysters older than five years are rarely harvested on reefs in Louisiana.

As is the case with most animals, oysters grow rapidly during early life stages; their normal growth rate is 10 millimeters (0.4 inches) per month during the first three months (Mackin 1959). Hatchery-raised oyster spat placed on public reefs in coastal Louisiana during the summer of 2014 exhibited growth rates as high as 19 millimeters (0.75 inches) in the first month and an average of 10.4 millimeters (0.4 inches) after two months (LDWF unpublished data). Growth slows considerably in the following months, although the warm waters of the northern Gulf allow faster growth rates than those in Eastern oysters along the upper East Coast of the United States. In Louisiana, oysters can reach market size (approximately 3 inches) in 18 to 24 months. Reports of oyster shells measuring more than 8 inches are common in Louisiana.

Assuming sufficient food is available in the surrounding waters, temperature is the most important natural environmental factor affecting oyster growth, although salinity also plays a role (Shumway 1996). In general, growth rates are higher at higher temperatures, with maximum growth of oyster larvae at 30˚C (86˚F; Davis and Calabrese 1964, Shumway 1996). Juvenile and adult growth is more rapid in warmer waters as well. According to Lough (1975), optimal conditions for larval survival and growth occur not only when water temperatures are above 30˚C (86˚F) but also when salinity is between 18 and 35 ppt. Salinity less than or equal to 5 ppt almost completely inhibits oyster growth (Loosanoff 1965, Shumway 1996). High water temperatures can negatively impact oyster growth and survival when salinities are low for extended periods of time (La Peyre et al. 2013).

Predator-Prey Relationships

Known predators of oyster spat (less than 1 inch) include several species of mud crab (family Xanthidae), blue crab (*Callinectes sapidus* and *C. similus*), southern oyster drill snail (*Stramonita haemastoma*), stone crab (*Menippe adina*), black drum (*Pogonias cromis*), and cownose ray (*Rhinoptera bonasus*). Several of these predators also prey on larger oysters.

Oysters are filter feeders, straining food particles out of the water. Early larvae depend on phytoplankton without rigid cell walls, while older larvae can also feed on phytoplankton with cell walls (Davis 1953, Davis and Guillard 1958). Juvenile and adult oysters feed primarily on plankton and organic detritus (Morse 1944, Flint 1956). Because oysters are immobile, they rely on food-rich water flowing by them. Newell and Langdon (1996) found that water flow across oyster reefs influences oyster growth rates. Grizzle et al. (1992) found that low flow rates might limit the availability of food particles, resulting in slower oyster growth.

Stock Status and Assessment Methods

Stock Unit Definition

For the purposes of this management plan, the oyster stock unit consists of naturally-occurring Eastern oysters located within the coastal waters of Louisiana. Other species of oysters such as the crested oyster (*Ostrea equestris*) and Atlantic pearl oyster (*Pinctada imbricata*) may inhabit artificial structures or natural hard-bottom outcroppings off of the Louisiana coast, but they are adapted to high salinity areas where Eastern oysters typically do not thrive. Eastern oysters could possibly overlap with these other species in the easternmost reaches of Louisiana waters near the Chandeleur Islands. As oyster larvae are free-swimming plankton for approximately 14 days post-fertilization, there is an opportunity for genetic transfer between stocks of oysters located within different basins and across state lines.

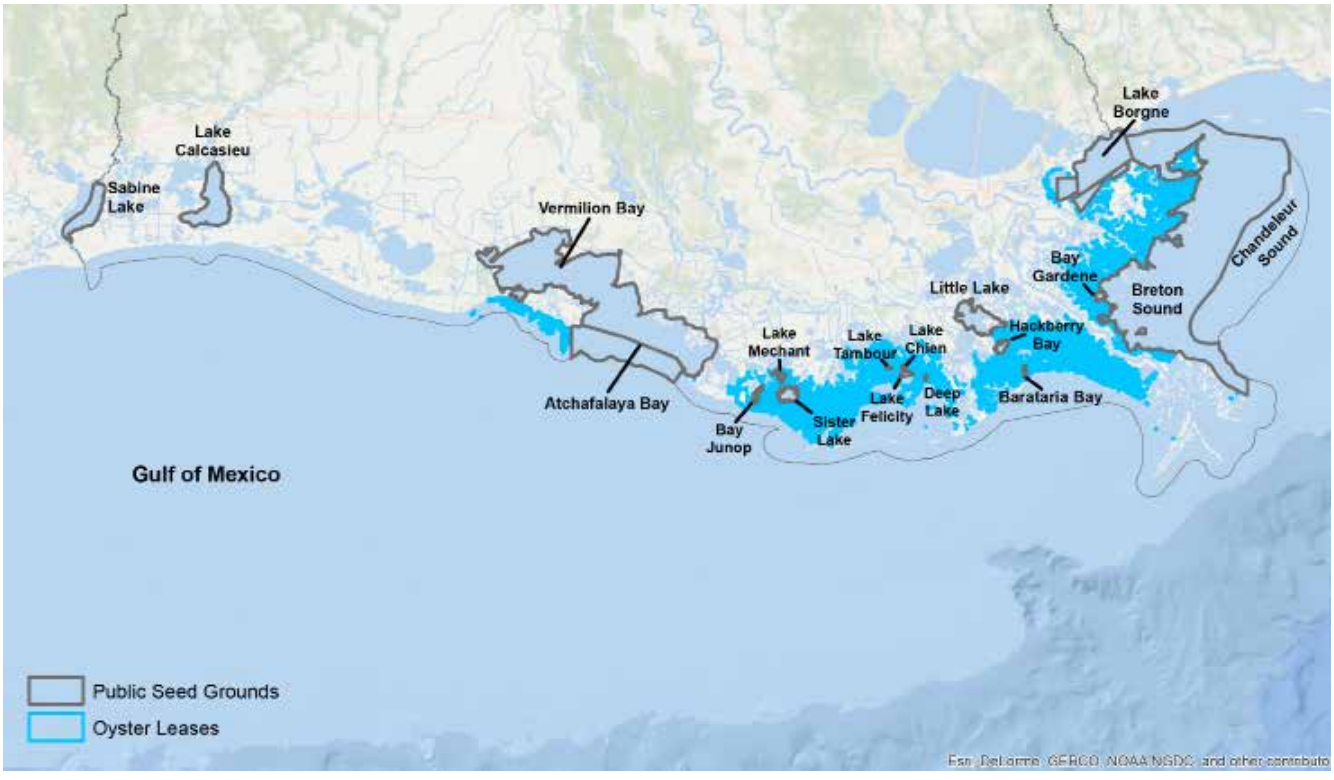
Although the management unit can be subdivided in many ways (by parish, basin, bay, etc.), it is most useful from a management perspective to consider oysters which occur in four main areas: 1) public oyster areas, 2) state-issued private oyster leases, 3) unleased state-owned water bottoms, and 4) privately-owned water bottoms. Most information is known about the oyster resources within public oyster areas, followed by oyster resources on state-issued private oyster leases (Figure 1). Very little information is known about oyster resources on privately-owned water bottoms and unleased state-owned water bottoms.

Current Stock Assessment

LDWF annually reports on the status of the oyster stock located on the 1.68 million acres of public oyster areas along the Louisiana coast. This stock assessment report is based on oyster density sampling on approximately 60,000 acres of oyster reefs within the public oyster areas and additional information collected throughout the year. The report serves as the basis for seasonal framework recommendations (opening and closing dates) to the Louisiana Oyster Task Force and the Commission for the upcoming oyster season. LDWF also monitors the oyster resource between the time the next oyster season is set and the season's opening date and may recommend delays to the opening if biological data indicate a need (e.g. recent spat set that should be protected from impacts of harvest).

According to the most recent assessment of public oyster areas (2014), the estimated stock size was 1,881,114 barrels (one barrel equals two sacks) of oysters greater than or equal to 1 inch in length (LDWF 2014; Appendix I). The 2014 estimated stock size is approximately 44 percent below the 1982-2013 long-term average of 3.3 million barrels. It should be noted that the public oyster resource in the Vermilion Bay/Cote Blanche Bay area is not included

Figure 1. Map of Louisiana's public and private oyster areas.



in these estimates, as the actual acreage of reef in that area is unknown. The largest portion of the 2014 stock occurs in the southwest portion of the state within the Calcasieu and Sabine Public Oyster Areas. However, a sizeable portion also occurs in the public oyster areas east of the Mississippi River and north of the Mississippi River Gulf Outlet in the general area of Mississippi Sound. The recent reduction in the statewide oyster stock on public reefs will not result in statewide management changes as the reduction may only be driven by particular areas. For example, the oyster stock is at an all-time low east of the Mississippi River and in southeast Calcasieu Lake, so management changes may be implemented for these areas in response to low oyster abundance. In southeastern Calcasieu Lake, harvest closures have been in effect since March 2011 due to low oyster abundance.

Stock size estimates apply to the public reefs as biologists only sample public reefs for annual oyster assessments. Similar stock size estimates are not available for oysters on private leases, privately-owned water bottoms, or unleased state-owned water bottoms.

Reference Points

Traditional stock assessments typically attempt to evaluate species biomass according to specific reference points and are most effectively applied to long-lived fish species with relatively stable populations. These assessments do not incorporate habitat maintenance as a key component of the stock evaluation. Oyster populations regularly exhibit large natural variations in number and, most importantly, create the very habitat upon which they depend (Soniat et al. 2014). Therefore, to properly assess oyster stocks, metrics for evaluating reef habitat are as necessary as those which evaluate oyster biomass.

In Louisiana, managers consider a variety of important metrics when setting the seasonal framework (when to open the upcoming season on the public oyster areas), determining harvest allowances and/or sack limits, or making emergency harvest closures. Managers also use these metrics to meet long-term management goals of rebuilding and maintaining oyster populations. Such metrics include:

1. Current estimates of oyster stock size relative to the previous year's estimates and long-term averages
2. Current estimates of fishing mortality (the amount of oysters, in sacks or barrels, harvested by the commercial fishing industry during the harvest season) determined through trip tickets or boarding report surveys, relative to existing stock size, historic harvest levels, and shell budget model thresholds
3. Weekly calculations of harvest fraction: the percentage of the available oyster resource harvested by the commercial industry, relative to previous levels and long-term averages. This is also referred to as percent utilization.
4. The amount (percentage) of nonliving reef material (e.g. shell and other cultch materials) removed by harvest vessels during seed harvest. In general, conservation concerns arise when shell/cultch comprises greater than 25 percent of the load; managers will consider harvest closures to protect the reef from further shell removal. LDWF recently developed the 25 percent threshold based on:
    a. On-vessel cultch percentage sampling by LDWF biologists
    b. Indications from the shell budget model that harvest of seed oysters can more heavily impact reef mass than harvest of market oysters
    c. Discussions with oyster harvesters.
5. Catch-Per-Unit-Effort (CPUE)
    a. Fishery dependent: weekly estimate of the amount of oysters (in sacks or barrels) harvested per vessel per day. Historically, managers considered closing areas to harvest when this metric dropped below 30 sacks per vessel. Based on professional judgment, managers determined that the 30-sack threshold indicated a sustainable level of resource use on the public oyster seed grounds.
    b. Fishery independent: the amount of oysters collected per sample for each sampling event as part of LDWF's routine biological sampling programs. Managers carefully consider both short-term and long-term trends in this metric when assessing the overall health of the oyster resource.
6. Harvest thresholds, i.e. the level of harvest allowed at which there is no net loss of shell on the reef, as predicted through the shell budget model. This threshold could be considered an estimate of maximum sustainable yield (MSY) and provides a useful biological reference point for oyster fishery management. This metric has only recently been developed and is currently being tested in Louisiana.

Harvest Control Rules

LDWF implements a variety of harvest control measures for oysters, many based on the aforementioned metrics. Typically, managers consider, and often order, harvest closures if one or more of the following occur:

1. Biological sampling indicates the presence of a recent successful spat set in an area with a high probability

of survival in the absence of fishing

2. Harvest fraction exceeds 50 percent of available oyster resource in an area
3. Harvest fraction exceeds 15 percent of available oyster resource in Calcasieu Lake
4. Percentage of nonliving reef material in bedding loads regularly exceeds 25 percent (seed harvest may be restricted in this case, but market harvest usually continues)
5. Harvest exceeds the thresholds established by the shell budget model
6. CPUE by market-harvest vessels drops below 30 sacks per day in an area
7. Enforcement issues occur at an unmanageable level
8. Significant mortality reduces oyster stock size in excess of 50 percent of the original estimated stock size.

Oyster Monitoring and Assessment Methods

LDWF uses three primary data sources to directly monitor and assess the oyster resource: 1) the annual oyster stock assessment; 2) monthly and semi-monthly dredge sampling; and 3) oyster harvest monitoring. Both the stock assessment and dredge sampling provide fishery independent data while harvest monitoring provides fishery dependent data.

Annual Oyster Stock Assessment

The stock assessment derives abundance information from quadrat sampling of the oyster stock (Table 1). Every July, biologists dive on multiple locations on the public reefs within each of LDWF's Coastal Study Areas (CSAs; Figure 2). They place a square-meter frame (quadrat) on the reef and collect all oysters, reef-associated organisms, and exposed reef material within that quadrat. They replicate this process five times at each sampling location. They typically sample 100 locations, although the number of sampling locations may vary slightly each year due to the presence of newly-constructed cultch plants (reef rehabilitation projects). Biologists may also slightly modify sampling methods for recent cultch plants, often sampling these sites with a smaller, quarter meter quadrat due to the high volume of cultch material. They may also increase the number of sampling sites within a new cultch plant to better evaluate the progress of that plant and sometimes to measure metrics toward the goal of the program under which the plant was constructed.

Table 1. Statewide quadrat sampling program summary for 2015. These numbers do not include special samples collected from recently-constructed reefs (cultch plants).

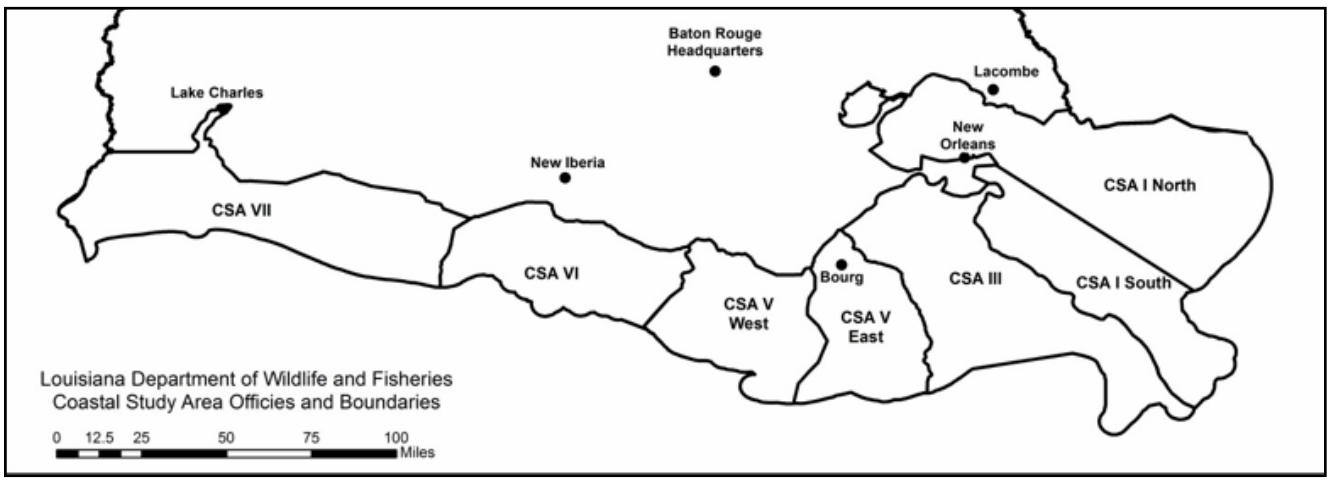
CSA	Number of Sample Stations	Reef Acreage*	Number of Replicates	Total Samples Taken
1N	18	22,427	5	90
1S	30	27,762	5	150
3	9	370	5	45
5E	3	78	5	15
5W	16	2,563	5	80
6	11	unknown	5	55
7	20	6,830	5	100
Total	**107**	**60,030**		**535**

**Total reef acreage in each CSA may be larger.*

Although the sampling gear and replication may differ among sites, biologists evaluate all samples in a similar fashion. They mainly collect the number and size of live oysters from quadrat samples, using the following size designations:

- Spat: young oysters measuring 1 to 24 millimeters

Figure 2. Map of Louisiana's CSAs.



(0.04 to 0.94 inches) in length.

- Seed: oysters measuring 25 to 74 millimeters (0.98 to 2.91 inches)
- Sack: market-size oysters measuring greater than or equal to 75 millimeters (2.95 inches).

These quadrat samples provide a known number of oysters in a given area (square meter), which can then be extrapolated over the entire known reef acreage to estimate the oyster stock size. Biologists multiply the number of oysters per location by the associated reef acreage to obtain an estimate of the total number of oysters present on the reefs. Biologists also record the number and size of recently dead oysters to estimate natural mortality of the oyster population. They record additional data on oyster predators and competitors.

Biologists typically report stock size estimates by CSA. CSA 1 South holds the most sample stations (30) while CSA 5 East holds the fewest (3). Biologists sample more densely in Black Bay (CSA 1 South) and Sister Lake (CSA 5 West) due to their high level of oyster production in past years and increased historical importance to the oyster industry.

Since 2012, biologists have also measured reef density (grams of reef material per square meter, or g/m^2) from each quadrat sample. Using these data, along with oyster density (number of live oysters per square meter) and size frequency gathered from the quadrat samples, a group of researchers led by the University of New Orleans developed the shell budget model (Soniat et al. 2014). This model separates all surface reef material (shell, limestone cultch, concrete, etc.) from buried reef material and weighs the surface reef material to estimate reef density. The shell budget model evaluates existing oyster abundance, oyster size, and reef mass (shell and cultch), along with expected oyster growth, natural mortality, and fishing mortality. It then provides an additional biological reference point by estimating the level of harvest at which no net loss of reef mass would occur. The model is flexible, allowing estimates of harvest thresholds for seed harvest, market harvest, or a combination of the two. It also allows for estimates of harvest thresholds for individual reefs or groups of reefs. Researchers have tested this model directly and indirectly during each harvest season since its development; the model has shown great potential to predict changes in reef mass in response to varying levels of fishing pressure. Interannual variations in reef mass help explain changes in oyster abundance over time, as documented by the annual oyster stock assessment.

Dredge Sampling

Biologists also collect fishery independent data through monthly or semi-monthly dredge surveys (Table 2) to continuously monitor the health of the oyster resource throughout the year. Biologists monitor 80 sites along the Louisiana coast and conduct 15 sampling events per year. During most months, biologists collect one set of dredge samples at each site. However, they collect two sets of samples in some months to more closely monitor oyster recruitment. Biologists do not collect dredge samples in July during quadrat sampling.

Table 2. Statewide dredge sampling program summary for 2015. These numbers do not include special samples collected from recently-constructed reefs (cultch plants).

CSA	Sampling Events	Sampling Stations	Replicates	Total Samples Taken
1N	15	13	2	390
1S	15	11	2	330
3	15	12	2	300
5E	15	3	2	90
5W	15	10	2	270
6	15	10	2	300
7	15	21	2	540
Total		**80**		**2,220**

Sampling Events	Jan	Feb	Mar	Apr	May	Jun
	1	1	1	1	2	2
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	0	1	2	2	1	1

At each dredge sampling site, biologists first probe the water bottom to ensure they will be sampling on existing oyster habitat (reef, scattered shell, etc.). They then drop a 609.6 millimeter (24-inch)-wide "hand" dredge to the bottom and pull it along the bottom for three minutes. They retrieve the dredge and examine the sample. Biologists measure live and recently dead oysters to the nearest 5 millimeter (0.2 inch) increment and collect additional data on the number of reef-associated organisms such as mud crabs in the family Xanthidae, hooked mussels (*Ischadium recurvum*), and oyster drill snails present in the sample. They collect two replicate dredge samples at each sampling site per sampling event.

Biologists primarily evaluate these data to estimate oyster mortality and recruitment, although they also examine oyster size frequency and reef-associated organisms. Dredge sampling is especially useful following extreme weather events such as floods or hurricanes when the primary concern is oyster mortality. Biologists can compare oyster mortality data generated through dredge sampling with annual oyster stock assessment data to determine the severity of impacts of such events on oyster populations.

If mortalities significantly reduce the oyster stock size, managers may consider commercial oyster harvest restrictions.

Harvest Monitoring

After the oyster harvest season opens on public reefs, LDWF collects fishery dependent data to monitor harvest. LDWF interviews harvesters on the water and conducts post-harvest interviews with dealers (boarding report surveys) throughout the open season. LDWF also requires monthly reporting of harvest by the industry through Louisiana's trip ticket program and considers trip ticket data to be the official landings (harvest) of the commercial industry.

If a particular harvest area is set to only open for a short time (e.g. a few days to a few weeks), field staff typically conduct boarding report surveys multiple times each week. If an area is open for several months, field staff typically conduct boarding report surveys on a weekly basis. These surveys produce direct harvest data, which are critical for closely tracking fishing mortality (i.e. harvest) during the season, especially when compared with harvest fractions and thresholds. The real-time data generated from boarding report surveys also allow managers to make decisions quickly in response to fishing-related impacts to the oyster resource.

In addition, boarding report surveys document the removal of nonliving reef material (cultch) by harvest vessels, especially vessels harvesting seed oysters for bedding purposes. It is important to monitor removals each season as excessive removal of the reef base threatens the long-term sustainability of reefs on the public oyster seed grounds. LDWF has conducted standardized sampling of cultch removal since the beginning of the 2011-2012 oyster season. Field staff randomly select bedding vessels and collect three 1-cubic foot samples of bedding material from the deck of each vessel. They divide those samples into the portion containing live oysters attached to reef material and the portion with no live oysters attached to nonliving reef material. They calculate a percentage of each group based on weight to the nearest tenth of a pound.

Through Louisiana's trip ticket program, implemented in 1999, LDWF collects commercial harvest data on a trip basis from wholesale/retail seafood dealers and commercial fishermen holding fresh products licenses. LDWF requires that dealers purchasing oysters from commercial fishermen submit trip tickets to capture information about their catch—for example, what it is, where it was caught, how it was caught, and how much was caught. Commercial fishermen who sell their catch directly to consumers are also required to submit trip tickets. Information from this program is typically not available until the following month and only tracks the harvest of market-size oysters. Because of these limitations, boarding report surveys are more useful in managing the oyster fishery in real time (e.g. emergency closures and/or modifications to the oyster season).

LDWF does not collect data on recreational oyster harvests as such landings are very small and likely contribute less than 0.1 percent of the overall oyster harvest. Recreational fishermen are limited to harvesting two sacks of oysters per day, except in Calcasieu Lake where the daily sack limit is one.

Regional Assessment Efforts

Assessing oyster stocks on a regional Gulf-wide basis is challenging—abundance varies by state, estuary, and even reef and is impacted by a number of factors beyond fishing (including natural and manmade environmental conditions). Each Gulf state routinely conducts population assessments, but their sampling methods and coverage vary, producing inconsistent data across the Gulf. Harvest regulations also vary greatly state-by-state.

In its 2012 regional fisheries management plan for Gulf oysters, the Gulf States Marine Fisheries Commission (GSMFC) discussed these challenges in depth and recommended that the states map the distribution of oyster reefs across the Gulf, develop and evaluate fishery and resource monitoring programs, standardize their population sampling methods, develop a method to accurately assess oyster populations and reef habitat, and share these data across the Gulf. See additional details in VanderKooy (2012).

Stock Resilience

In general, oysters in Louisiana are a resilient natural resource. Several factors contribute to the resilience of the oysters in Louisiana including oyster's fast growth rate and high fecundity (as previously described in the **Biological Profile**), as well as the stock's large spatial distribution. Oysters inhabit a large spatial area in Louisiana—they are found from Sabine Lake in the west to Mississippi Sound in the east and in nearly every bay and bayou along the coast. They also occur in multiple habitat types, from subtidal reefs in moderate salinities to intertidal reefs in high-salinity areas.

In addition, productivity is a function of fecundity, growth rates, natural mortality, age of maturity, and longevity and can be a reasonable proxy for resilience, i.e. 'the ability to rebound after perturbation' (Holling 1973). The FAO developed a classification scheme to determine the productivity for exploited aquatic species (FAO 2001; Table 3). Each life history characteristic is assigned a rank and then averaged to compute an overall productivity score.

The overall productivity score for Eastern oyster stocks in Louisiana is three, indicating high productivity and resilience.

Table 3: FAO proposed guideline for indices of productivity for exploited aquatic species. Parameter values from Soniat pers. comm.

Parameter	Productivity			Species	Score
	Low = 1	Medium = 2	High = 3	Oyster	
Natural mortality rate (M)	<0.2	0.2 - 0.5	>0.5	>0.5	**3**
von Bertalanffy growth rate (K)	<0.15	0.15 - 0.33	>0.33	>0.33 (average of slow growth: 0.43, moderate growth: 0.57, and fast growth: 0.86)	**3**
Age at maturity (t_{mat})	>8	3.3 - 8	<3.3	<1	**3**
Maximum age (t_{max})	>25	14 - 25	<14	<10	**3**
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	**Oyster productivity score = 3.0**	

Louisiana's oyster stock is routinely subjected to natural forces such as hurricanes and fresh water flooding and is able to withstand many environmental perturbations. In addition, man has exploited this stock for centuries, intensively so over the past 100-plus years. Yet, oysters have remained a relatively stable part of Louisiana's coastal ecosystem. However, the effects to Louisiana's natural resources, including oysters, from the *Deepwater Horizon* oil spill were investigated through the Natural Resource Damage Assessment (NRDA) process. Prior to the oil spill, the northern Gulf had one of the few populations of oysters that could withstand annual harvest (zu Ermgassen et al. 2012). Impacts of the spill on oyster abundance and reproduction have resulted in reduced spawning stock, larval production, spat settlement, and spat substrate availability that compromise the long-term sustainability of oyster reefs throughout the northern central Gulf (Trustees 2016). The long-term sustainability of oyster reefs depends on the balance between factors that decrease numbers (e.g., mortality, predation, sedimentation, and harvest) and factors that maintain or expand reef structures (e.g., reproduction and larval settlement, growth, and new shell production). The *Deepwater Horizon* NRDA trustees (federal and state agencies) will conduct activities to restore oyster abundance, resilience, and habitat from impacts of the spill. Restoration activities will potentially include directly restoring reef habitat, enhancing oyster reef productivity, and restoring regional oyster recruitment by increasing oyster spawning stock populations and, subsequently, the regional larval supply.

Description of the Fishery

FISHERY MONITORING

LDWF monitors commercial landings and fishing effort through a trip ticket program. Through this program, LDWF collects commercial landings data on a trip basis from wholesale/retail seafood dealers and commercial fishermen holding fresh products licenses.

LDWF also interviews harvesters on the water and conducts post-harvest interviews with dealers throughout the open oyster season.

LDWF conducts economic research pertaining to Louisiana and Gulf region fishery resources using information from the trip ticket program and surveys.

Comprehensive descriptions of the Louisiana commercial oyster fishery prior to 2000, including development and history of exploitation, effort and harvest, economics, markets, value, and processing are available through numerous publications (Zacharie 1898, Owen 1953, Chatry et al. 1983, Dugas 1988, Perret and Chatry 1988, Soniat 1988, Dugas et al. 1997, Deseran and Riden 2000, Keithly et al. 2000, Wirth and Minton 2004).

Data Collection and Analyses

In Louisiana, fishermen have been harvesting oysters commercially since the mid 1800s, with the earliest documented landings reported from 1909 when 2,385,042 bushels of oysters were harvested (Louisiana Conservation Commission 1910). However, landings statistics are discontinuous through 1950. LDWF implemented a trip ticket program in 1999 to monitor commercial landings and fishing effort. Through this program, LDWF collects commercial landings data on a trip basis from wholesale/retail seafood dealers and fresh products licenseholders (commercial fishermen licensed to sell their catch directly to consumers). LDWF requires that dealers purchasing oysters from commercial fishermen and fresh products licenseholders submit trip tickets to capture information about their catch—for example, what it is, where it was caught, how it was caught, and how much was caught. As of 2000, dealers and fresh

products licenseholders could submit trip tickets through a computerized electronic trip ticket program. In 2014, 127 seafood dealers and fresh products licenseholders (out of 792 total) used electronic trip tickets to submit their data; 17 out of 81 seafood dealers and fresh products licenseholders handling oysters used electronic trip tickets.

LDWF's Socioeconomic Research and Development Section conducts economic research pertaining to Louisiana and Gulf region fishery resources using information from Louisiana's trip ticket program and surveys. This section publishes results in LDWF reports and peer-reviewed scientific journals, presents research findings at professional and scientific meetings, and provides information to LDWF and other agencies to support scientific research and resource management.

Unless otherwise noted, the data presented throughout this section are sourced from Louisiana's trip ticket program. All data collected by LDWF are published in aggregate form, meaning the sum of data submitted by three or more individuals; data submitted by less than three individuals are confidential and are denoted as such in the tables below. Data are presented from 2000 (when the electronic trip ticket program was implemented) through 2014 (the most recent data year available when this document was created). Value is presented in constant, inflation-adjusted 2009 dollars (calculated using the U.S. Bureau of Economic Analysis' Implicit Price Deflator); volume is presented in pounds of oyster meat.

Commercial Fishery

The Eastern oyster supports the fifth largest fishery (by volume) and fourth most valuable fishery in Louisiana, with landings totaling 12.7 million pounds and $62.1 million in real dockside value in 2014. Louisiana continues to account for the majority of U.S. Eastern oyster landings in the Gulf, averaging 57 percent (by volume) and 60 percent (by value) of Gulf-wide Eastern oyster landings since 2000 (Table 5). Similarly, Louisiana has led the United States in Eastern oyster landings in every year during the 2000-2014 period, averaging nearly 50 percent (by volume) and 41 percent (by value) of total U.S. Eastern oyster landings from 2000 to 2014.

Volume and Value of Landings

All Oyster Species

According to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries), U.S. commercial fishermen also harvest four other species of oyster in addition to Eastern oyster: European (*Ostrea edulis*), Kumamoto (*Crassostrea sikamea*), Olympia (*Ostrea lurida*), and Pacific (*Crassostrea gigas*). However, Eastern oysters are the most commonly commercially harvested oyster in the United States and are the only species harvested commercially in the Gulf and other states outside the Pacific Region, except for Maine which also harvests European flat oysters.

Total U.S. production of all oyster species averaged 36.8 million pounds per year between 2000 and 2014; Eastern oysters made up 69 percent of the national total during that period (Tables 4 and 5). The Gulf Region (Texas, Louisiana, Mississippi, Alabama, and western Florida) produced most of the oysters in United States for most of this period, accounting for 50 percent (2014) to 66 percent (2003) of the total national commercial oyster harvests in any particular year (Figure 3). Gulf oyster landings, exclusively Eastern oysters, averaged 21.8 million pounds between 2000 and 2014, ranging from a low of 15.8 million pounds in 2010 to a high of 27 million pounds in 2003. Louisiana, specifically accounted for an average of 34 percent of total U.S. oyster production for this time period.

For most of the 2000 to 2014 period, the Pacific Region (California, Oregon, and Washington) produced the second highest amount of oysters in the United States (averaging 11.5 million pounds annually, or 31 percent of total U.S. production). Most of the oysters harvested in the Pacific region are Pacific and Olympia oysters.

In the Chesapeake Region (Virginia and Maryland), the average oyster harvest was 1.7 million pounds, about five percent of total U.S. production. Oyster harvests in the South Atlantic Region (North Carolina, South Carolina, Georgia, and eastern Florida) averaged 853 thousand pounds, or about two percent of total U.S. production. Oyster harvests in the Mid-Atlantic Region (New York, New Jersey, and Delaware) averaged 510 thousand pounds, about one percent of total U.S. production. Oyster harvests in New England (Maine, Massachusetts, Rhode Island, and Connecticut) averaged 404 thousand pounds between 2000 and 2014, also about one percent of total U.S. production.

The real dockside value of U.S. commercial oyster landings averaged $142 million per year between 2000 and 2014, ranging from $118.5 million in 2001 to $211.7 million in 2014 (Table 4). During this time period, the Gulf Region continued to lead the nation in average dockside value of commercial oyster landings, averaging $65.9 million per year between 2000 and 2014 (46 percent of the total national average; Figure 4). Gulf average dockside value ranged from a period low of $54.5 million in 2010 to a peak of $85.4 million in 2014. Louisiana, specifically accounted for an average of 28 percent of total value of U.S. oyster landings for this time period.

Real dockside value in the Pacific Region averaged $45.4

million per year for the 2000 to 2014 period (32 percent of the total national average), ranging from $36.9 million in 2000 to $63.3 million in 2011. In New England, real dockside value averaged $10.4 million per year between 2000 and 2014, approximately seven percent of the total national average. Value ranged from a low of $3.4 million in 2004 and a high of $25.5 million in 2014. In the Chesapeake Region, real dockside value averaged $7.9 million between 2000 and 2014 (six percent of the total national average), varying considerably from a low of $423 thousand in 2004 to a high of $40.2 million in 2014. The real dockside value of commercial oyster landings in the Mid-Atlantic Region averaged $4.8 million (three percent of the total national average) between 2000 and 2014. Mid-Atlantic oyster harvests dropped from a period high of approximately $9 million in 2002 and 2003 to period low of approximately $1.8 million in 2009. South Atlantic real dockside value averaged $4.2 million between 2000 and 2014 (three percent of the total national average). Value varied between $2.5 and $3.6 million from 2000 to 2005 and peaked at $7.1 million in 2010.

Figure 3. Average volume of oyster landings by region, 2000-2014.

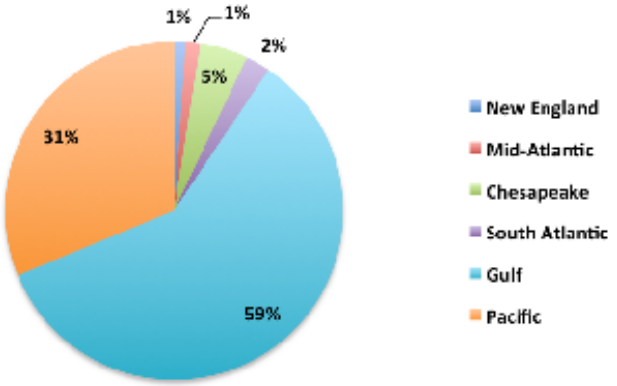
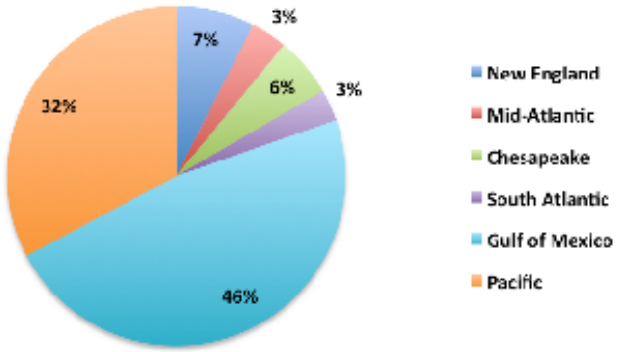


Figure 4. Real value of oyster landings by region, 2000-2014.



Source: NOAA Fisheries except Louisiana data.

Table 4. Volume (millions of pounds) and real value (millions of dollars) of oyster landings by region, 2000-2014.

Year	New England	Mid-Atlantic	Chesapeake	South Atlantic	Gulf	Pacific	Total
2000	0.8 / $6.9	0.4 / $2.8	2.5 / $9.4	0.5 / $2.5	25.8 / $64.9	10.5 / $36.9	40.5 / $123.4
2001	0.5 / $5.1	0.7 / $5.0	1.5 / $5.2	0.6 / $2.7	25.6 / $62.4	11.4 / $38.1	40.4 / $118.5
2002	0.3 / $3.8	1.0 / $8.6	0.7 / $2.9	0.6 / $2.5	24.1 / $59.7	11.9 / $42.0	38.7 / $119.6
2003	0.3 / $4.1	1.3 / $9.1	0.2 / $1.1	0.6 / $2.7	27.0 / $71.0	11.8 / $42.2	41.3 / $130.3
2004	0.3 / $3.4	0.8 / $5.9	0.1 / $0.4	0.7 / $3.3	25.0 / $68.3	13.1 / $47.0	40.0 / $128.3
2005	0.2 / $5.0	0.5 / $3.6	0.7 / $3.7	0.7 / $3.6	20.2 / $61.4	13.5 / $45.6	35.8 / $122.9
2006	0.3 / $10.4	0.7 / $5.4	0.3 / $1.3	0.8 / $4.1	19.8 / $66.2	12.6 / $41.6	34.4 / $129.0
2007	0.4 / $13.2	0.2 / $3.2	2.2 / $6.1	0.8 / $3.9	22.5 / $71.3	12.6 / $47.9	38.7 / $145.7
2008	0.2 / $9.0	0.8 / $5.9	1.0 / $5.4	0.9 / $4.1	21.1 / $62.2	11.7 / $45.3	35.6 / $131.8
2009	0.3 / $9.9	0.1 / $1.8	1.3 / $7.6	0.9 / $4.6	22.8 / $73.3	11.7 / $47.8	37.1 / $145.0
2010	0.3 / $12.5	0.2 / $2.4	1.6 / $9.5	1.4 / $7.1	15.8 / $54.5	10.9 / $43.6	30.3 / $129.5
2011	0.3 / $12.4	0.2 / $2.4	1.9 / $10.2	1.2 / $6.6	18.8 / $63.4	11.5 / $63.3	33.8 / $158.4
2012	0.5 / $15.8	0.2 / $2.4	2.6 / $16.8	0.9 / $4.9	21.2 / $72.4	9.4 / $48.8	34.7 / $161.2
2013	0.6 / $19.2	0.3 / $4.3	4.0 / $30.7	1.0 / $5.6	19.3 / $71.8	9.9 / $45.3	35.1 / $176.9
2014	0.7 / $25.5	0.5 / $9.0	4.8 / $40.2	1.1 / $6.6	17.9 / $85.4	9.7 / $45.1	36.1 / $211.7
Average	0.4 / $10.4	0.5 / $4.8	1.7 / $7.9	0.9 / $4.2	21.8 / $65.9	11.5 / $45.4	36.8 / $142.1

Source: NOAA Fisheries except Louisiana data.

Eastern Oyster

Between 2000 and 2014, average U.S. landings of Eastern oysters were 25.4 million pounds per year (Table 5). The national volume of Eastern oysters dropped from about 29 million pounds in 2000 and 2001 to 19.4 million pounds in 2010. Since 2012, U.S. production of Eastern oysters has been more than 25 million pounds. The real dockside value of Eastern oyster landings in the United States between 2000 and 2014 averaged $97.2 million, fluctuating from a low of $77.4 million in 2002 and 2005 to a high of $167 million in 2014.

The Gulf accounted for 86.2 percent of the volume and 69.2 percent of the real dockside value of all Eastern oysters landed in the United States between 2000 and 2014. The average volume of Eastern oyster landings between 2000 and 2014 in the Gulf was 21.8 million pounds, and the average real dockside value was $67.2 million. The volume of Gulf landings averaged about 25.5 million pounds from 2000 to 2004, fell to 20 million pounds in 2005 and 2006, and then rose to nearly 23 million pounds in 2009. Landings slid to 15.8 million pounds in 2010 and 18.8 million pounds in 2011. Gulf landings increased to 21.2 million pounds in 2012, then fell to 19.3 million pounds in 2013 and 17.9 million pounds in 2014.

The real dockside value of Eastern oysters in the Gulf fell from $64.9 million in 2000 to $59.7 million in 2002, rose to $71 million in 2003, and dropped to $61.5 million in 2005. Value subsequently rose to $71.3 million in 2007 and $73.3 million in 2009 then fell to $54.5 million in 2010. The real dockside value of Gulf oyster landings was approximately $72 million in 2012 and 2013 and $85.5 million in 2014.

Louisiana oyster landings made up the majority of the volume and real dockside value of all oysters harvested in the Gulf between 2000 and 2014. The volume of Louisiana oysters declined from 15.2 million pounds in 2001 to 12.1 million pounds in 2005 and 2006 and thereafter rose to nearly 15.0 million pounds in 2009. Harvests dropped to 6.9 million pounds in 2010 then increased to more than 11 million pounds from 2011 to 2013 and 12.7 million pounds in 2014. The real dockside value of Louisiana oyster landings fluctuated from $33.7 million in 2000, up to $39.1 million in 2004, and down to $36.2 million in 2005. Value rose to around $41 million in 2007 and 2008 to $50.8 million in 2009 but then dropped to period low of $24.7 million the following year. Value exceeded $40 million from 2011 to 2013 and $62.1 million in 2014.

A relatively small percentage of Eastern oyster landings are harvested outside of the Gulf. Though the Chesapeake Region produced 6.7 percent of the total national volume and 10.3 percent of the value between 2000 and 2014, the percentage of national production from that region varied widely across the period from 0.3 percent in 2004 to 19.1 percent in 2014. The South Atlantic produced 3.4 percent of the volume and 4.4 percent of the value of total U.S. Eastern oyster landings. The Mid-Atlantic produced 2.0 percent of the volume and 4.9 percent of the dockside value, and New England accounted for 1.6 percent of the volume and 10.7 percent of the dockside value of total U.S. Eastern oyster landings between 2000 and 2014.

Landings by Season

The average monthly volume and real dockside value of Louisiana oyster landings tend to be lower in the winter and higher in the spring and summer (Table 6). Between 2000 and 2014, the average monthly volume was less than 1 million pounds in November, December, January, and February. The average volume was 1.3 million pounds in March, 1.2 million pounds in April, 1.3 million pounds in May, and 1.2 million pounds in June and July.

The average price per pound was highest in December ($3.39 per pound) and lowest in March ($3.15 per pound). However, average monthly prices are not significantly different, and price per pound within a particular year is not necessarily likely to be highest in December and lowest in March. In fact, the highest price per pound was observed in December in only six years (2002, 2005, 2009, 2011, 2013, and 2014) of the time period measured. The lowest monthly price occurred in March only three times (2002, 2011, and 2012). Interestingly, the highest price per pound occurred in March in one year (2007) while the lowest monthly price per pound occurred in December twice (2003 and 2010).

Landings by Gear Type

Most Louisiana commercial fishermen use scrapers, or dredges, to harvest oysters. (In 2016, legislation officially changed the name of dredge to scraper.) Oyster scrapers accounted for 96.4 percent of the cumulative volume of Louisiana commercial oyster landings between 2000 and 2014 (Table 7). The percentage of individual years' total landings harvested with scrapers ranged from 92.5 percent in 2000 to 99.1 percent in 2002. Three percent of the cumulative volume of oysters was harvested by hand. Most of the oysters harvested by hand were harvested from private oyster reefs. Oyster tongs accounted for 0.6 percent of the cumulative volume of Louisiana commercial oyster landings between 2000 and 2014. For six of the fifteen years during this period (2006 and 2008 through 2012), there were no reported oyster landings harvested with tongs. Most of the oysters harvested with tongs were taken from public oyster areas.

Table 5. Volume (millions of pounds) and real value (millions of dollars) of Eastern oyster landings by region and Gulf state, 2000-2014.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	30.0 / $86.3	28.9 / $80.3	26.7 / $77.4	29.5 / $88.1	26.9 / $81.3	22.3 / $77.4	22.5 / $87.6	26.1 / $98.0	24.1 / $87.9
Gulf	25.8 / $64.9	25.6 / $62.4	24.1 / $59.7	27.0 / $71.0	25.0 / $68.3	20.2 / $61.5	20.4 / $66.2	22.5 / $71.3	21.1 / $62.2
Alabama	0.8 / $2.1	0.6 / $1.5	0.8 / $1.9	0.8 / $1.9	0.9 / $2.4	1.0 / $3.3	0.9 / $3.8	0.8 / $2.8	0.1 / $0.2
Florida West Coast	2.5 / $4.7	2.6 / $4.6	1.9 / $3.7	1.8 / $3.4	1.6 / $3.2	1.4 / $3.1	2.4 / $5.7	3.0 / $6.8	2.5 / $5.6
Louisiana	12.8 / $33.7	15.2 / $38.0	14.0 / $35.7	13.6 / $38.4	13.9 / $39.1	12.1 / $36.2	12.1 / $38.4	12.8 / $41.1	13.2 / $40.6
Mississippi	3.5 / $7.5	2.7 / $5.0	2.7 / $5.2	4.0 / $8.3	3.0 / $6.8	0.6 / $1.6	0.0 / —	0.3 / $0.8	2.6 / $6.9
Texas	6.2 / $16.9	4.7 / $13.3	4.7 / $13.3	6.8 / $19.0	5.6 / $16.8	5.0 / $17.3	4.9 / $18.2	5.6 / $19.8	2.7 / $8.9
New England	0.7 / $6.8	0.5 / $5.0	0.3 / $3.7	0.3 / $4.1	0.3 / $3.4	0.2 / $5.0	0.3 / $10.4	0.4 / $13.2	0.2 / $9.0
Mid-Atlantic	0.4 / $2.8	0.7 / $5.0	1.0 / $8.6	1.3 / $9.1	0.8 / $5.9	0.5 / $3.6	0.7 / $5.4	0.2 / $3.2	0.8 / $5.9
Chesapeake	2.5 / $9.4	1.5 / $5.2	0.7 / $2.9	0.2 / $1.1	0.1 / $0.4	0.7 / $3.7	0.3 / $1.3	2.2 / $6.1	1.0 / $5.4
South Atlantic	0.5 / $2.5	0.6 / $2.7	0.6 / $2.5	0.6 / $2.7	0.7 / $3.3	0.7 / $3.6	0.8 / $4.1	0.8 / $3.9	0.9 / $4.1
Pacific	— / —	— / —	— / —	— / —	0.0 / $0.0	0.0 / $0.1	0.0 / $0.2	0.0 / $0.3	0.1 / $1.4

	2009	2010	2011	2012	2013	2014	Average	% of Total
Total	25.5 / $97.9	19.4 / $86.1	22.4 / $95.2	25.3 / $112.4	25.6 / $134.7	25.1 / $167.0	25.4 / $97.2	
Gulf	22.8 / $73.3	15.8 / $54.5	18.8 / $63.4	21.2 / $72.4	19.3 / $71.8	17.9 / $85.5	21.8 / $67.2	86.2% / 69.2%
Alabama	0.0 / $0.1	0.1 / $0.4	0.3 / $1.3	0.3 / $1.2	0.1 / $0.7	0.1 / $0.4	0.5 / $1.6	2.0% / 1.6%
Florida West Coast	2.9/ $7.0	2.2 / $6.2	3.1 / $8.3	3.3 / $9.2	1.3/ $5.4	0.7 / $3.7	2.2 / $5.4	8.7% / 5.5%
Louisiana	15.0 / $50.8	6.9 / $24.7	11.2 / $40.5	11.4 / $40.1	11.4 / $42.2	12.7 / $62.1	12.5 / $40.1	49.5% / 41.3%
Mississippi	2.2 / $6.1	1.5 / $4.2	0.2 / $0.9	0.4 / $1.5	0.3 / $1.4	0.3 / $1.6	1.6 / $3.9	6.4% / 4.0%
Texas	2.7 / $9.4	5.3 / $18.9	3.9 / $12.4	5.8 / $20.3	6.1 / $22.0	4.1 / $17.7	4.9 / $16.3	19.5% / 16.7%
New England	0.3 / $9.9	0.3 / $12.5	0.3 / $12.4	0.5 / $15.8	0.6 / $19.2	0.7 / $25.5	0.4 / $10.4	1.6% / 10.7%
Mid-Atlantic	0.1 / $1.8	0.2 / $2.4	0.2 / $2.4	0.2 / $2.4	0.3 / $4.3	0.5 / $9.0	0.5 / $4.8	2.0% / 4.9%
Chesapeake	1.3 / $7.6	1.6 / $9.5	1.9 / $10.2	2.6 / $16.8	4.0 / $30.7	4.8 / $40.3	1.7 / $10.0	6.7% / 10.3%
South Atlantic	0.9 / $4.6	1.4 / $7.1	1.2 / $6.6	0.9 / $4.9	1.0 / $5.6	1.1 / $6.6	0.9 / $4.3	3.4% / 4.4%
Pacific	0.1 / $0.7	0.0 / $0.2	0.0 / $0.2	0.0 / $0.1	0.4 / $3.1	0.0 / $0.0	0.0 / $0.4	0.2% / 0.4%

Source: NOAA Fisheries except Louisiana data.

Table 6. Average monthly volume and real value of Louisiana oyster landings, 2000-2014.

Month	Average Volume	Average Real Dockside Value	Average Real Price per Pound
January	884,892	$2,772,805	$3.20
February	918,553	$2,864,917	$3.21
March	1,273,577	$3,974,859	$3.15
April	1,163,557	$3,757,390	$3.20
May	1,339,184	$4,350,110	$3.22
June	1,189,997	$3,874,613	$3.29
July	1,157,381	$3,704,926	$3.21
August	1,014,357	$3,245,509	$3.20
September	870,220	$2,749,298	$3.20
October	1,039,090	$3,374,378	$3.32
November	758,246	$2,455,726	$3.31
December	891,644	$2,959,394	$3.39

Table 7. Volume of Louisiana oyster landings by gear type, 2000-2014.

Year	Scraper	Tongs	By Hand	Unidentified	Total
2000	11,757,889	290,849	656,433	0	12,705,171
2001	14,418,253	211,912	519,593	0	15,149,758
2002	13,707,039	131,069	0	0	13,838,108
2003	13,162,771	145,079	233,448	0	13,541,298
2004	13,354,007	106,574	424,969	0	13,885,550
2005	11,663,638	86,290	336,958	0	12,086,886
2006	11,410,078	0	124,515	0	11,534,593
2007	12,637,573	453	179,970	0	12,817,996
2008	12,966,981	0	271,235	0	13,238,216
2009	14,556,304	0	407,254	0	14,963,558
2010	6,732,143	0	154,484	0	6,886,627
2011	10,691,389	0	460,082	2,323	11,153,794
2012	10,699,536	0	645,089	0	11,344,625
2013	10,767,968	42,760	588,453	7,343	11,406,524
2014	12,047,435	118,604	531,670	0	12,697,709
Average	12,038,200	75,573	368,944	644	12,483,361

Landings by Vessel Length

The size of vessels used in Louisiana's oyster fishery can be categorized into seven groups ranging from vessels 20 feet and shorter to vessels 71 feet and longer. From 2000 to 2014, the percentage of total oyster landings harvested by smaller vessels appears have increased while the percentage harvested by larger vessels decreased (Table 8). The percentage of annual landings of oysters harvested by vessels between 21 and 30 feet long rose from approximately 11 percent in 2000, 2001, and 2002 to approximately 33 percent in 2013 and 2014.

The percentage of annual landings harvested by vessels between 31 feet and 40 feet long varied throughout the period, but generally ranged around 20 to 25 percent. In contrast, the share of annual landings from vessels between 41 feet and 50 feet long was about one-third of the total harvests in 2001 and 2002, respectively, but only 13.1 percent in 2013 and 11.5 percent in 2014. Vessels between 51 feet and 60 feet long harvested approximately 21 percent of the annual harvest in 2000 and 2001 but only 11.9 percent in 2013 and 13.3 percent in 2014.

Table 8. Percentage of total volume of oysters landed by vessel category, 2000-2014.

Year	20 Feet or Shorter	21-30 Feet	31-40 Feet	41-50 Feet	51-60 Feet	61-70 Feet	71 Feet or Longer	Unknown
2000	3.7%	10.9%	23.7%	29.8%	21.8%	0.5%	*	6.7%
2001	2.9%	10.1%	26.9%	34.8%	20.8%	0.6%	*	1.4%
2002	1.7%	11.2%	27.3%	33.1%	23.4%	1.2%	*	0.9%
2003	3.9%	15.3%	28.1%	28.7%	19.7%	2.0%	1.1%	1.1%
2004	5.0%	18.7%	27.3%	26.6%	16.7%	2.5%	1.0%	2.2%
2005	6.4%	19.6%	26.1%	25.4%	15.6%	3.2%	1.6%	2.1%
2006	4.4%	18.3%	26.1%	26.4%	14.0%	3.0%	*	1.7%
2007	4.3%	16.9%	30.5%	27.3%	14.8%	3.7%	0.7%	1.7%
2008	4.0%	12.0%	25.6%	30.6%	18.9%	5.5%	1.2%	2.3%
2009	5.5%	18.7%	26.1%	27.2%	16.9%	4.4%	0.6%	0.6%
2010	8.8%	25.8%	23.6%	21.5%	15.5%	3.2%	0.8%	0.9%
2011	5.8%	32.6%	24.9%	18.0%	12.7%	2.3%	*	3.7%
2012	4.9%	35.0%	22.8%	16.0%	10.9%	2.6%	0.2%	7.6%
2013	5.7%	33.0%	24.2%	13.1%	11.9%	2.6%	0.3%	9.2%
2014	7.4%	33.3%	19.3%	11.5%	13.3%	1.9%	1.0%	12.3%

**Confidential data.*

Landings by Area

In Louisiana, commercial fishermen harvest oysters in public oyster areas and on water bottoms leased from the state or private landowners. Historically, fishermen have primarily used the public oyster areas as a source of seed oysters to support leased areas where they grow oysters to market size. However, when market-size oysters are available in the public oyster areas, some fishermen harvest them commercially for market purposes.

Oysters from private leases have comprised the majority of Louisiana commercial oyster landings for all but two years (2001 and 2002) from 2000 to 2014 (Table 9). The percentage of annual oyster landings from private leases has generally increased over this time period from 44 percent in 2002 to 76 percent in 2009 to 95 percent in 2012 and 2014. Specifically, landings from private leases rose from 6.8 million pounds (and $17.9 million) in 2000 to 9.8 million pounds (and $26.5 million) in 2004 but then declined to about 8 million pounds (and $25.7 million) in 2007 and 7.0 million pounds (and $21.6 million) in 2008. Oyster landings from private leases climbed to 11.4 million pounds (and $38.5 million) in 2009 and dropped sharply to 4.8 million pounds (and $17.1 million) in 2010. Landings subsequently rose to 8.9 million pounds (and $31.9 million) in 2011, 10.8 million pounds (and $37.8 million) in 2012, and 12.0 million pounds (and $58.7 million) in 2014.

During much of this same period, oyster landings from public oyster areas declined. They initially rose from 6.0 million pounds (and $15.8 million) in 2000 to 7.9 million pounds (and $20.4 million) in 2002 before starting a four-year decline to 3.2 million pounds (and $10.8 million) in 2006. Landings from public oyster areas rose over the next few years to 4.8 million pounds (and $15.3 million) in 2007 and 6.2 million pounds (and $18.9 million) in 2008. They then declined to 564 thousand pounds (and $2.3 million) in 2012, rose to 986 thousand pounds (and $4.0 million) in 2013, and declined again to 676 thousand pounds (and $3.4 million) in 2014.

The average price per pound of oysters harvested from private leases rose from $2.50 per pound in 2002 to $4.88 per pound in 2014. The average price per pound of oysters harvested from public oyster areas rose from $2.44 in 2001 to $5.07 in 2014. From 2000 to 2014, the average price per pound of oysters harvested from public oyster areas was higher than oysters from private leases in all but four years (2000, 2001, 2007, and 2008).

When commercial fishermen land oysters in Louisiana, they are required to identify on their trip tickets the area, by major estuarine basin, in which they harvested the majority of their oysters during each trip. The average annual volume and real dockside value of oysters harvested from 2000 to 2014 were highest in the Lake Pontchartrain Basin—47.2 percent of the cumulative volume and 47.8 percent of the cumulative value were harvested in this area (Table 10). The Barataria Basin accounted for 23.1 percent of the volume and 27.0 percent of the real dockside value. The Terrebonne Basin was associated with 22.1 percent of the volume but only 17.6 percent of the value. The Atchafalaya/Vermilion-Teche Basin produced about five percent of the volume and value of oysters. The Calcasieu River Basin produced approximately three percent of the volume and real dockside value of oysters harvested during this period.

The real average price per pound was lowest in the Terrebonne Basin ($2.48 per pound) and highest in the Barataria Basin ($3.62 per pound) from 2000 to 2014. The real average price per pound was $3.53 in the Lake Pontchartrain Basin, $3.25 in the Calcasieu River Basin, and $2.76 in the Atchafalaya/Vermilion-Teche Basin.

The volume of oysters harvested within each basin has fluctuated widely during the 2000 to 2014 period but has generally increased in the Barataria and Terrebonne basins and decreased in the Lake Pontchartrain Basin (Table 11). In the Barataria Basin, oyster harvests rose from a low of nearly 1 million pounds in 2002 to a high of 4.4 million pounds in 2014. Oyster harvests in the Terrebonne Basin rose from 1.5 million pounds in 2002 to a high of 4.4 million pounds in 2011 through 2013 then dropped to 3.7 million pounds in 2014. In the Lake Pontchartrain Basin, oyster harvests were as high as 10.9 million pounds in 2002 but have since declined to 3.7 million pounds in 2014 (up from a low of about 2 million pounds in 2012).

Calcasieu Lake

In Calcasieu River Basin, oysters are only harvested within the Calcasieu Lake public oyster area; there are no leased areas within this basin. Calcasieu Lake is unique in terms of its oyster resource and industry, namely due to changes in permitted fishing gear and its separation from the rest of the state's oyster stock. Oystermen were only allowed to use tongs to harvest oysters in Calcasieu Lake until 2004 when legislation allowed the use of hand scrapers in this area. Since then, landings of oysters harvested from Calcasieu Lake gradually increased (Table 11). In 2006, legislation allowed use of mechanical scrapers in Calcasieu Lake as well. With subsequent increase in harvest efficiency and ample oyster stock in this area, landings remained strong through 2011. Landings were especially high after the 2010 *Deepwater Horizon* oil spill, as the market relied on Calcasieu Lake for supply when other areas of the state were closed to oyster harvest. Landings significantly decreased beginning in 2012 as managers implemented harvest closures in the East Cove of Calcasieu Lake in

Table 9. Volume, real value, and price per pound of Louisiana oyster landings, public vs. private oyster areas, 2000-2014.

Year	Area	Pounds	Real Value	Real Price per Pound	Year	Area	Pounds	Real Value	Real Price per Pound
2000	**Total**	**12,772,757**	**$33,671,759**	**$2.64**	2008	**Total**	**13,240,300**	**$40,561,694**	**$3.06**
	Private	6,760,621	$17,878,244	$2.64		Private	7,015,262	$21,612,027	$3.08
	Public	6,012,136	$15,793,514	$2.63		Public	6,225,037	$18,949,667	$3.04
2001	**Total**	**15,160,549**	**$38,030,914**	**$2.51**	2009	**Total**	**14,970,908**	**$50,800,591**	**$3.39**
	Private	7,529,393	$19,424,400	$2.58		Private	11,391,454	$38,525,953	$3.38
	Public	7,631,156	$18,606,514	$2.44		Public	3,579,454	$12,274,638	$3.43
2002	**Total**	**13,991,402**	**$35,661,837**	**$2.55**	2010	**Total**	**6,888,794**	**$24,726,624**	**$3.59**
	Private	6,132,251	$15,302,082	$2.50		Private	4,828,468	$17,143,820	$3.55
	Public	7,859,151	$20,359,755	$2.59		Public	2,060,326	$7,582,804	$3.68
2003	**Total**	**13,606,594**	**$38,438,823**	**$2.83**	2011	**Total**	**11,165,614**	**$40,485,106**	**$3.63**
	Private	8,217,145	$23,140,925	$2.82		Private	8,943,857	$31,855,101	$3.56
	Public	5,389,449	$15,297,898	$2.84		Public	2,221,757	$8,630,005	$3.88
2004	**Total**	**13,887,329**	**$39,100,387**	**$2.82**	2012	**Total**	**11,368,230**	**$40,112,422**	**$3.53**
	Private	9,787,140	$26,511,005	$2.71		Private	10,804,471	$37,777,089	$3.50
	Public	4,100,189	$12,589,383	$3.07		Public	563,759	$2,335,333	$4.14
2005	**Total**	**12,103,126**	**$36,225,379**	**$2.99**	2013	**Total**	**11,406,641**	**$42,154,722**	**$3.70**
	Private	8,345,223	$24,254,819	$2.91		Private	10,420,936	$38,108,515	$3.66
	Public	3,757,903	$11,970,561	$3.19		Public	985,705	$4,046,207	$4.10
2006	**Total**	**11,565,973**	**$38,437,991**	**$3.32**	2014	**Total**	**12,703,856**	**$62,085,019**	**$4.89**
	Private	8,386,919	$27,645,821	$3.30		Private	12,028,129	$58,657,698	$4.88
	Public	3,179,054	$10,792,170	$3.39		Public	675,727	$3,427,321	$5.07
2007	**Total**	**12,822,207**	**$41,092,849**	**$3.20**	Average	**Total**	**12,510,285**	**40,105,741**	**$3.24**
	Private	8,030,264	$25,748,728	$3.21		Private	8,574,769	28,239,082	$3.22
	Public	4,791,943	$15,344,121	$3.20		Public	3,935,516	11,866,659	$3.38

Table 10. Average volume, real value, and price per pound of Louisiana oyster landings by major estuarine basin, 2000-2014.

Basin	Average Volume	% of Total	Average Value	% of Total	Price per Pound
Lake Pontchartrain	5,902,173	47.2%	$19,153,871	47.8%	$3.53
Barataria	2,884,606	23.1%	$10,825,679	27.0%	$3.62
Terrebonne	2,756,730	22.1%	$7,061,965	17.6%	$2.48
Atchafalaya/Vermilion-Teche	604,778	4.8%	$1,820,690	4.5%	$2.76
Calcasieu River	350,730	2.8%	$1,192,279	3.0%	$3.25
Total	**12,499,018**		**$40,054,485**		

response to decreasing oyster stock size in this area. The West Cove of the lake is also subject to seasonal public health-related closures. Current landings are below historic levels due to reductions in stock size resulting primarily from a combination of harvest pressure and shifts in hydrologic conditions within the lake.

Seed Harvest

Commercial fishermen primarily harvest seed oysters from Louisiana's public oyster areas then take them to private leases to grow out to market size. Seed oyster harvest has fluctuated greatly from 2000 to 2014 (Table 12), peaking during the 2003/2004 and 2007/2008 seasons, when approximately 371,000 and 430,000 barrels were harvested statewide, respectively. The high seed harvest from 2007 to 2008 was largely the result of the Private Oyster Lease Rehabilitation program offered to leaseholders in the aftermath of hurricanes Katrina and Rita (2005). This program encouraged rehabilitation of oyster resources on private leases by reimbursing participating leaseholders for a portion of the expenses incurred during rehabilitation activities. Transplanting seed from public oyster areas to

private leases qualified as a rehabilitation activity; many leaseholders participated in this activity as part of the program.

During productive seasons, CSA 1 North and CSA 1 South often contributed more than 90 percent of the statewide seed oyster harvest. Seed oyster harvest was low during the 2005/2006 season and has been low since 2010, often less than 50,000 barrels. During low harvest years, the largest decreases in harvest occurred in CSA 1 North and CSA 1 South. CSA 3, CSA 5 West, and CSA 6 contributed most to statewide totals in the 2013/2014 season. Since there are no private leases in CSA 7, there is no seed harvest in this area.

Table 11. Volume of Louisiana oyster landings by major estuarine basin, 2000-2014.

Year	Atchafalaya/ Vermilion-Teche	Barataria	Calcasieu River	Lake Pontchartrain	Terrebonne	Total
2000	101,864	2,780,357	289,439	7,799,579	1,795,327	**12,766,565**
2001	950,158	2,081,013	211,912	9,926,979	1,990,487	**15,160,549**
2002	589,786	918,167	131,069	10,855,582	1,496,798	**13,991,402**
2003	267,224	3,114,893	145,079	7,451,794	2,581,745	**13,560,734**
2004	336,550	4,131,105	167,237	6,895,073	2,354,576	**13,884,540**
2005	614,145	3,040,020	284,100	5,528,458	2,636,403	**12,103,126**
2006	1,709,432	2,440,441	282,221	4,601,537	2,532,341	**11,565,973**
2007	1,592,964	2,486,447	299,856	5,749,549	2,693,391	**12,822,207**
2008	377,143	2,090,920	412,204	8,157,913	2,173,491	**13,211,670**
2009	0	3,715,935	690,720	8,209,921	2,351,188	**14,967,764**
2010	334,907	1,185,149	996,018	2,578,845	1,767,058	**6,861,976**
2011	345,058	3,383,317	616,563	2,400,771	4,415,984	**11,161,693**
2012	787,088	3,938,824	227,658	1,992,462	4,421,149	**11,367,182**
2013	512,955	3,611,074	165,166	2,682,318	4,429,719	**11,401,232**
2014	552,402	4,351,435	341,707	3,701,817	3,711,295	**12,658,656**

Table 12. Volume of seed harvest (in barrels) by CSA, 2000-2014.

Season	CSA 1N	CSA 1S	CSA 3	CSA 5E	CSA 5W	CSA 6	Total
1999/2000	4,300	69,028	N/A	N/A	29,934	N/A	**103,262**
2000/2001	16,000	100,780	N/A	N/A	700	N/A	**117,480**
2001/2002	7,600	159,245	N/A	N/A	18,183	6,667	**191,695**
2002/2003	94,400	140,883	3,389	N/A	285	0	**238,957**
2003/2004	39,085	313,160	7,254	N/A	11,840	0	**371,339**
2004/2005	25,240	195,536	0	N/A	5	0	**220,781**
2005/2006	1,200	29,135	0	368	3,900	0	**34,603**
2006/2007	61,635	110,567	15,890	1,940	10	60,390	**250,432**
2007/2008	157,085	173,285	13,245	2,627	39,115	45,121	**430,478**
2008/2009	87,180	77,003	1,985	205	600	0	**166,973**
2009/2010	57,055	82,688	7,885	0	4,610	0	**152,238**
2010/2011	10,000	0	0	1,008	0	0	**11,008**
2011/2012	16,810	19,350	1,659	827	15,765	0	**54,411**
2012/2013	2,540	0	2,517	0	1,075	375	**6,507**
2013/2014	3,685	2,170	4,695	0	10,705	22,825	**44,080**

N/A: no data available.

Commercial Oystermen

To legally harvest oysters commercially, fishermen must hold an oyster harvester license, appropriate to their residency status. Between 2000 and 2014, 88 to 94 percent of these licenses were issued to Louisiana residents (Table 13). The total number of oyster harvester licenses, both resident and nonresident licenses, generally trended upward from 1,015 in 2000 to 1,115 in 2005, dropped to 938 in 2006, and then rose to a period high of 1,283 in 2011. The number of oyster harvester licenses thereafter declined to approximately 1,144 per year in 2013 but rose again to 1,240 in 2014.

The number of commercial fishermen who reported landing and selling at least 1 pound of oysters exhibited no discernible trend from 2000 through 2014. This number ranged from a low of 647 in 2006 to a high of 885 in 2011. This number fell to 725 in 2013 then rose to 840 in 2014.

Fishing Effort

In addition to commercial fishing and oyster harvester licenses, commercial fishermen must hold a separate license for each piece of gear they use to harvest oysters commercially. One individual may thus hold multiple gear licenses. The number of gear licenses may be used as a rough measure of potential fishing effort or capacity.

The total number of gear licenses issued (resident and nonresident tong and scraper licenses) ranged from approximately 1,300 per year from 2000 through 2004 to 1,527 in 2005, 1,364 in 2006, 1,757 in 2010, down to approximately 1,100 per year from 2012 through 2014 (Table 14). The majority of gear licenses are resident oyster scraper licenses—making up more than 75 percent of all commercial oyster gear licenses issued in every year from 2000 to 2014. The number of resident oyster scraper licenses rose from 1,043 in 2000 to 1,300 in 2005 and declined to about 1,200 per year from 2006 through 2008. The number rose to nearly 1,500 in both 2010 and 2011 but then declined to 968 licenses in 2014. The number of nonresident oyster scraper licenses nearly doubled from 2000 to 2011, then declined to 133 in 2014.

The number of resident commercial oyster tong licenses dropped from 210 in 2000 to 95 in 2005, and fell further from 40 in 2006 to 29 in 2014. Resident oyster tong licenses made up 15.4 percent of all commercial oyster gear licenses in 2000 but only 6.2 percent in 2005 and less than 3 percent in 2014. The number of nonresident oyster tong licenses has remained relatively low throughout the 2000 to 2014 period, varying from three in 2000 and 2001, 12 in 2006, four in 2012, and two in 2014. In five of the 15 years during that period, LDWF issued no nonresident oyster tong licenses. The decrease is number of tong licenses could be attributed to the Legislature allowing hand scrapers in Calcasieu Lake as of 2004 and mechanical scrapers in Calcasieu Lake as of 2006.

The number of commercial fishing trips reporting oyster landings averaged 37,603 per year between 2000 and 2014, ranging from a low of 29,602 trips in 2010 to a high of 46,608 trips in 2014 (Table 15).

The number of trips reporting landings of oysters harvested from public oyster areas averaged 13,236 trips per year between 2000 and 2014, peaking in 2001 at 18,616 trips and falling to 9,890 trips in 2006. Trips on public oyster areas rose again, up to 17,032 in 2008, but then fell to 4,756 trips in 2013. Trips on public oyster areas climbed to 7,071 in 2014.

The number of trips reporting landings of oysters harvested from private leases averaged 24,388 trips per year between 2000 and 2014, fluctuating from lows of 14,761 in 2002 and 13,768 in 2010 up to a high of 39,537 in 2014.

Most oyster trips are completed within a single day—in every year since 2000, at least 92 percent of all commercial fishing trips reporting oyster landings were 12 hours long or less (Table 16). Several measures point to a general decrease in the length of commercial oyster harvesting trips since LDWF first started collecting this sort of data through its trip ticket program. In 2000, the average and median trip lengths were at least nine hours long. Nearly 35 percent of the trips were 10 to 12 hours long, 38.7 percent were seven to nine hours long, and 16.1 percent were 4 to 6 hours long. In 2011, the average and median trip lengths were approximately six hours. In that year, 46.2 percent of the trips were four to six hours long, 34.6 percent were between seven and nine hours long, and 7.9 percent were ten to twelve hours long. In 2014, the average and median trip lengths were, respectively, 7.2 hours and six hours. Forty-two percent of the commercial oyster harvesting trips were between four and six hours long, 43.0 percent were between seven and nine hours long, and 8.8 percent were between 10 and 12 hours long. Recent increases in refrigeration requirements could be affecting trip length, either by shortening trips for vessels without refrigeration or forcing more vessels to install refrigeration units and enabling longer trips. However, vessel capacity, sack limits, resource availability, and fuel cost are likely the more dominant factors that influence trip length.

The average volume of oyster landings per trip for each year was calculated as the product of the total pounds of oysters landed commercially divided by the total number of commercial oyster-harvesting trips made during the year (Table 17). This parameter has followed a generally downward trajectory for much of the 2000 to 2014 period.

Average pounds per trip dropped from 411 pounds per trip in 2001 and 420 pounds in 2002 to 328 pounds per trip in 2005. The measure rose over the next few years to 357 per pounds trip in 2006 and 392 pounds per trip in 2008 then dropped to a period low of 233 pounds per trip in 2010. The average rose to 299 pounds per trip in 201 and 304 pounds per trip in 2013 but declined to 273 pounds per trip in 2014.

For all but two years (2002 and 2007) during the 2000 to 2014 period, the average pounds per trip from private oyster areas was larger than average pounds per trip from public oyster areas. For the early part of this period (2000 through 2008), the difference between the average for private ground trips and the average for public oyster areas trips was 54 pounds or less. Since 2008, the difference between the two has widened, ranging from a difference of 111 pounds per trip in 2013 to 221 pounds per trip in 2010.

For the first nine years of the 2000 to 2014 period, average pounds per trip from public oyster areas followed a pattern similar to that for the average pounds per trip from private oyster areas. The average pounds per trip from private oyster areas rose from 362 pounds in 2000 to 415 pounds in 2002, dropped to 332 pounds in 2005, and then climbed to 419 pounds in 2008. Similarly, the average pounds per trip from public oyster areas increased from 328 in 2000 to 423 in 2002, decreased to 317 pounds in 2004, and then increased to 368 pounds in 2007.

Since 2008, the two averages have diverged. Each has declined, but the decrease has been steeper for trips on public oyster areas than for trips on private oyster areas. The average pounds of oysters harvested per private ground trip declined from 393 pounds in 2009 to 347 pounds per trip in 2011 to 304 pounds per tip in 2014. In comparison, the average pounds of oysters harvested per public oyster areas trip dropped from 231 pounds per trip in 2009 to 154 pounds per trip in 2011 to 96 pounds per trip in 2014.

Table 13. Number of commercial fishermen with resident and nonresident oyster harvester licenses and number reporting oyster landings in Louisiana, 2000-2014.

Year	Resident	Nonresident	Total	% Resident	Commercial Fishermen Reporting Oyster Sales
2000	946	69	1,015	93.2%	831
2001	928	97	1,025	90.5%	754
2002	904	71	975	92.7%	689
2003	968	78	1,046	92.5%	819
2004	939	64	1,003	93.6%	842
2005	1,026	89	1,115	92.0%	862
2006	845	93	938	90.1%	647
2007	925	88	1,013	91.3%	755
2008	894	119	1,013	88.3%	711
2009	942	126	1,068	88.2%	819
2010	1,142	124	1,266	90.2%	811
2011	1,146	137	1,283	89.3%	885
2012	1,092	144	1,236	88.3%	825
2013	1,024	120	1,144	89.5%	725
2014	1,092	148	1,240	88.1%	840

Table 14. Number of commercial oyster gear licenses issued by LDWF, 2000-2014.

Year	Resident Tong	Resident Scraper	Nonresident Tong	Nonresident Scraper	Total
2000	210	1,043	3	111	**1,367**
2001	184	1,052	3	141	**1,380**
2002	141	1,059	0	123	**1,323**
2003	149	1,110	0	117	**1,376**
2004	112	1,147	0	102	**1,361**
2005	95	1,300	2	130	**1,527**
2006	40	1,180	12	132	**1,364**
2007	37	1,230	0	144	**1,411**
2008	35	1,218	1	214	**1,468**
2009	32	1,302	2	211	**1,547**
2010	36	1,494	0	227	**1,757**
2011	33	1,486	1	224	**1,744**
2012	36	995	4	144	**1,179**
2013	35	958	5	129	**1,127**
2014	29	968	2	133	**1,132**

Table 15. Number of commercial fishing trips reporting oyster landings in Louisiana, total and public vs. private oyster areas, 2000-2014.

Year	Trips Reporting Oyster Landings	Trips Reporting Oyster Landings Harvested from Public Oyster Areas	Trips Reporting Oyster Landings Harvested from Private Oyster Areas
2000	36,959	18,305	18,687
2001	36,904	18,616	18,301
2002	33,348	18,601	14,761
2003	38,753	15,883	22,879
2004	42,242	12,937	29,314
2005	36,909	11,765	25,148
2006	32,363	9,890	22,475
2007	36,557	13,031	23,530
2008	33,777	17,032	16,747
2009	44,432	15,481	28,953
2010	29,602	15,834	13,768
2011	40,206	14,440	25,769
2012	37,980	4,904	33,080
2013	37,405	4,756	32,874
2014	46,608	7,071	39,537
Average	37,603	13,236	24,388

Table 16. Length (in hours) of commercial fishing trips reporting oyster landings in Louisiana, 2000-2014.

Year	Average	Median	1-3 Hours	4-6 Hours	7-9 Hours	10-12 Hours	12+ Hours
2000	9.9	9	3.4%	16.1%	38.7%	34.8%	7.0%
2001	9.7	9	5.1%	11.9%	40.9%	34.8%	7.3%
2002	10	9	4.1%	14.5%	38.1%	35.9%	7.4%
2003	9.3	8	2.9%	17.5%	45.2%	28.8%	5.6%
2004	8.8	8	2.3%	19.3%	49.8%	24.0%	4.6%
2005	9.1	8	4.0%	20.7%	43.5%	25.0%	6.9%
2006	8.8	8	4.0%	22.7%	41.2%	26.2%	5.9%
2007	8.8	8	2.1%	21.5%	46.2%	24.9%	5.3%
2008	8.8	7	5.8%	34.5%	32.6%	18.6%	8.5%
2009	7.9	7	6.1%	42.2%	29.1%	18.0%	4.6%
2010	6.9	6	5.0%	48.6%	33.8%	9.7%	2.8%
2011	6.2	6	9.7%	46.2%	34.6%	7.9%	1.5%
2012	9	6	7.7%	40.1%	37.6%	11.9%	2.7%
2013	7.5	6	5.9%	40.1%	41.3%	10.2%	2.4%
2014	7.2	6	3.9%	42.0%	43.0%	8.8%	2.3%

Table 17. Average volume of oysters landed per commercial oyster harvesting trip, total and public vs. private oyster areas, 2000–2014.

Year	Total	Public	Private	Year	Total	Public	Private
2000	346	328	362	**2008**	392	365	419
2001	411	410	411	**2009**	337	231	393
2002	420	423	415	**2010**	233	130	351
2003	351	339	359	**2011**	278	154	347
2004	329	317	334	**2012**	299	115	327
2005	328	319	332	**2013**	304	207	318
2006	357	321	373	**2014**	273	96	304
2007	351	368	341				

Seafood Dealers

Under Louisiana regulations, unless a commercial fisherman holds a fresh products license, he must sell his catch to a licensed wholesale/retail seafood dealer. A seafood dealer is any person or business, such as a dock or seafood market, that purchases seafood products directly from commercial fishermen or another licensed seafood dealer for resale to any other business or individual. Seafood dealers must hold some form of dealer license depending on their residency status and other characteristics. They are required to complete trip tickets for each transaction involving the purchase of seafood directly from commercial fishermen.

LDWF analyzed 2000 to 2014 licensing and trip ticket information to measure oyster transactions between dealers and commercial fishermen. During this time period, an average of 69.5 resident and nonresident seafood dealers purchased oysters directly from commercial fishermen; this number fluctuated from a low of 48 in 2006 to a high of 83 in 2004 (Table 18). In every year but one (2000), at least 90 percent of the dealers that purchased oysters directly from commercial fishermen held wholesale/retail seafood dealer business licenses.

Wholesale/retail seafood dealer vehicle licenseholders are individuals or businesses licensed to sell seafood from their vehicles. The number of wholesale/retail seafood dealer vehicle licenseholders purchasing oysters directly from commercial fishermen between 2000 and 2014 averaged 5.7 per year and ranged from 3 in 2006 through 2009 to 10 in 2000.

In every year between 2000 and 2014, wholesale/retail seafood dealer business licenseholders purchased 94 percent or more of the total volume and value of oysters sold to dealers by Louisiana commercial fishermen (Table 19). The volume of oysters purchased by wholesale/retail seafood dealer business licenseholders ranged from 6.7 million pounds in 2010 to 14.6 million pounds in 2009. The value of oysters purchased by wholesale/retail seafood dealer

business licenseholders ranged from $24.2 million in 2010 to $65.2 million in 2014.

The volume of oysters wholesale/retail seafood dealer vehicle licenseholders purchased from commercial fishermen averaged more than 458,000 pounds annually between 2000 and 2014, ranging from 187,494 in 2010 to 751,971 pounds in 2003. Wholesale/retail seafood dealer vehicle licenseholders purchased an average of $1.4 million of oysters from 2000 to 2014. Purchases ranged from a low of $766,355 in 2010 to a high of $2.2 million in 2014. These numbers may not account for all the dealers in these categories, as the number of dealers in an individual category may have been smaller than three, the minimum number required for public disclosure in summary format according to LDWF's confidentiality standards.

Fresh Products Licenseholders

Commercial fishermen who hold a fresh products license may sell their catch directly to end consumers. The spouse of a commercial fisherman may also purchase a fresh products license, allowing the spouse to sell the catch while providing the commercial fisherman the opportunity to continue fishing. Fresh products license holders are required to complete trip tickets detailing sales made to consumers.

The number of fresh products licenseholders retailing oysters averaged nearly 11 per year between 2000 and 2014, fluctuating between five in 2005 up to 18 in 2011 (Table 20). The volume and value of oysters retailed by fresh products licenseholders averaged 14,639 pounds and $48,580 per year between 2000 and 2014, about 0.12 percent of total Louisiana oyster landings during this period.

Oyster Processors

NOAA Fisheries annually surveys seafood processors to measure seafood processing activity in Louisiana. Participation in the survey is optional, and all individual data are strictly confidential. The number of survey participants in Louisiana who reported selling processed oyster products decreased from 19 in 2000 to 10 in 2006 and 2007 to nine per year in 2008 through 2013 (Table 21).

The volume of oyster products averaged 2.9 million pounds from 2000 to 2013, ranging from a low of 1.3 million pounds in 2012 to a high of 4.5 million pounds in 2003. The real value of oyster products averaged $12.7 million from 2000 to 2013, from a low of $6.1 million in 2012 and 2013 to a high of $20.2 million in 2007.

During the time period measured, the volume of oyster products per processor averaged 239,314 pounds, fluctuating between 148,410 pounds in 2012 to 363,103 pounds in 2010. The real value of oyster products per processor averaged $1.1 million, ranging from $0.6 million in 2000 to $2 million in 2007.

According to a survey of Gulf seafood processors conducted by LDWF and the GSMFC (Miller et al. 2014), sales of fresh, whole oysters represented 56.9 percent of the combined oyster products sales among all respondents who processed oysters. Shucked oysters comprised 31.4 percent, frozen oysters comprised 11.4 percent, and other oyster products comprised 0.3 percent of all oyster sales.

Approximately three quarters (75.2 percent) of the combined oyster sales of all respondents who processed oysters were made to purchasers within the Gulf, 24.5 percent to purchasers in states outside the Gulf, and 0.3 percent to purchasers in other countries.

Table 18. Number of licensed Louisiana seafood dealers reporting oyster transactions, 2000-2014.

Year	Business	Vehicle	Total	Year	Business	Vehicle	Total
2000	72	10	82	**2008**	61	3	64
2001	64	7	71	**2009**	63	3	66
2002	63	6	69	**2010**	59	5	64
2003	71	7	78	**2011**	67	5	72
2004	75	8	83	**2012**	65	7	72
2005	71	7	78	**2013**	60	5	65
2006	45	3	48	**2014**	68	7	75
2007	53	3	56	**Average**	63.8	5.7	69.5

Table 19. Total volume (millions of pounds) and value (millions of dollars) of oysters purchased, by dealer license type, 2000-2014.

Year	Business	Vehicle	Total	% of Total
2000	12.0 / $26.0	0.7 / $1.6	12.7 / $27.6	94.5% / 94.2%
2001	14.5 / $30.4	0.7 / $1.4	15.2 / $31.8	95.4% / 95.6%
2002	13.3 / $28.7	0.7 / $1.5	14.0 / $30.2	95.0% / 95.0%
2003	12.7 / $31.2	0.8 / $1.8	13.5 / $33.0	94.1% / 94.5%
2004	13.0 / $32.8	0.7 / $1.7	13.7 / $34.5	94.9% / 95.1%
2005	11.5 / $31.6	0.4 / $1.2	11.9 / $32.8	96.6% / 96.3%
2006	11.3 / $35.5	0.3 / $1.0	11.6 / $36.5	97.4% / 97.3%
2007	12.5 / $39.1	0.3 / $0.9	12.8 / $40.0	97.7% / 97.8%
2008	13.0 / $39.3	* / *	* / *	* / *
2009	14.6 / $49.5	0.3 / $1.2	14.9 / $50.7	98.0% / 97.6%
2010	6.7 / $24.2	0.2 / $0.8	6.9 / $25.0	97.1% / 96.8%
2011	10.9 / $40.4	0.3 / $1.2	11.2 / $41.6	97.3% / 97.1%
2012	11.0 / $40.7	0.3 / $1.3	11.3 / $42.0	97.3% / 96.9%
2013	9.7 / $38.5	0.4 / $1.6	10.1 / $40.1	96.0% / 96.0%
2014	12.3 / $65.2	0.4 / $2.2	12.7 / $67.4	96.9% / 96.7%
Average	11.9 / $36.9	0.5 / $1.4	12.3 / $38.1	96.9% / 96.8%

**Confidential data.*

Table 20. Number of Louisiana fresh products licenseholders and their retail oyster sales by total volume and value, 2000-2014.

Year	Licenseholders	Volume	Value	Year	Licenseholders	Volume	Value
2000	8	8,097	$21,204	**2008**	13	16,593	$60,073
2001	8	13,639	$37,366	**2009**	13	19,969	$72,593
2002	13	19,574	$53,553	**2010**	16	24,933	$92,437
2003	10	13,639	$34,923	**2011**	18	24,459	$73,812
2004	12	8,125	$18,671	**2012**	11	32,167	$131,701
2005	5	2,789	$8,542	**2013**	10	16,718	$52,316
2006	6	7,231	$22,320	**2014**	6	5,707	$26,475
2007	9	5,944	$22,710	**Average**	10.5	14,639	$48,580

Table 21. Volume and real value of oyster products reported as processed in Louisiana, 2000-2013.

Year	Survey Respondents	Volume	Real Value	Volume per Processor	Real Value per Processor
2000	19	3,099,960	$10,970,224	163,156	$577,380
2001	18	3,926,125	$12,017,482	218,118	$667,638
2002	18	3,788,648	$15,187,840	210,480	$843,769
2003	14	4,519,652	$18,607,033	322,832	$1,329,074
2004	15	4,108,624	$19,524,385	273,908	$1,301,626
2005	13	3,731,065	$15,752,517	287,005	$1,211,732
2006	10	2,501,259	$15,895,871	250,126	$1,589,587
2007	10	2,454,302	$20,237,185	245,430	$2,023,719
2008	9	2,746,123	$11,020,004	305,125	$1,224,445
2009	9	2,234,523	$9,517,853	248,280	$1,057,539
2010	9	3,267,925	$11,179,979	363,103	$1,242,220
2011	9	1,436,795	$6,362,705	159,644	$706,967
2012	9	1,335,686	$6,112,124	148,410	$679,125
2013	9	1,393,046	$6,094,354	154,783	$677,150
Average	12.2	2,895,981	$12,748,540	239,314	$1,080,855

Source: NOAA Fisheries Seafood Processors Survey data; 2014 data are not yet available.

Oyster Imports

According to NOAA Fisheries' U.S. Foreign Trade database, total U.S. imports of oyster products averaged 22 million pounds and $53 million between 2000 and 2014, ranging from a low of 18.4 million pounds in 2001 and $43.4 million in 2002 to a high of 26.7 million pounds and $71.6 million in 2011 (Table 22).

Most of the oyster products imported into the United States are classified in the following product forms: oysters in prepared dinners; canned oysters; canned smoked oysters; fresh, frozen, dried, salted, and brined oysters from farmed sources; and live, fresh, frozen, dried, salted, and brined oysters from wild sources. Seed oysters were not considered in this analysis because the volume of imports of this product form is relatively low (less than 12,000 pounds in any given year) and because they are not a direct part of the food product market.

The composition of imported oyster products has recently shifted away from canned oysters to other product forms. The volume and value of imported canned oysters declined from 7.1 million pounds and $10.8 million in 2003 to 4.0 million pounds and $7.7 million in 2014 (Figures 5 and 6). Imports of canned smoked oysters fluctuated from 6.7 million pounds ($20.3 million) in 2000 and 7.3 million pounds ($19.7 million) in 2005 to 9.0 million pounds ($29.6 million) in 2011 then down to 5.3 million pounds ($16.7 million) in 2014. In contrast, the volume and value of live, fresh, frozen, dried, salted, and brined oysters from farmed sources rose from 5.1 million pounds ($10.6 million) in 2000 to 11.1 million pounds ($29.8 million) in 2014.

Imports in the live, fresh, frozen, dried, salted, and brined oyster categories may be more relevant to the Louisiana commercial oyster fishery than imports of other oyster products because they are arguably the closest substitute to Louisiana oyster products. Combined imports of live, fresh, frozen, dried, salted, and brined oysters from both farmed and wild sources, once a minority of imported oyster products, now make up the majority of oysters imported into the United States. The combined value of live, fresh, frozen, dried, salted, and brined oysters from both farmed and wild sources constituted about one-third of the annual value of oyster imports between 2000 and 2004 but more than 40 percent of the annual value of oyster imports between 2009 and 2012, 52 percent of the value of imports in 2013, and 58.2 percent in 2014.

Canada and South Korea have been the two leading source countries for imports of live, fresh, frozen, dried, salted, or brined oysters in almost every year from 2000 to 2014. Imports from these two countries constituted between 65 percent and 94 percent of the volume and 76 percent and 88 percent of the real value of these categories of oyster products imported into the United States in every year from 2000 to 2014 (Figures 7 and 8). Japan has also numbered among the five leading sources for live, fresh, frozen, dried, salted, or brined oysters in every year from 2000 to 2014. Imports of live, fresh, frozen, dried, salted, or brined oysters from Mexico have grown from 6,607 pounds (0.09 percent of total volume) and $5,887 (0.03 percent of total value) in 2000 to 3.3 million pounds (25.4 percent of total volume) and $5.0 million (14.7 percent of total value) in 2014.

The U.S. Customs Office categorizes ports through which oyster products enter the United States into six regions: New England, Mid-Atlantic, South Atlantic, Gulf, Pacific, and Inland Regions. More oyster products enter the United States through ports in the Pacific Region than any other single U.S. region (Figures 9 and 10).

Since 2003, the Gulf Region has ranked fourth or fifth in terms of volume and value of oyster products entering the United States. From 2000 through 2014, the average volume and value of oyster products imported into the United States through ports in the Gulf were 1.8 million pounds and $4 million. The volume oyster products imported through Gulf ports during this period reached to a period high of 2.6 million pounds in 2003. Both volume and value of Gulf oyster imports dropped to a period minimum of 998 thousand pounds and $2.3 million in 2005. Value of Gulf oyster imports climbed to a period high of $5.9 million in 2011. Of the total value of oyster products imported into the United States, the percentage entering through Gulf ports declined from 11.5 percent in 2000 to 6.5 percent in 2014.

Table 22. Volume (millions of pounds) and real value (millions of dollars) of total U.S. oyster imports, 2000-2014.

Year	Volume	Real Value		Year	Volume	Real Value
2000	20.8	$49.8		**2008**	20.5	$47.1
2001	18.4	$44.1		**2009**	20.5	$47.7
2002	19.0	$43.4		**2010**	23.8	$55.0
2003	22.2	$48.9		**2011**	26.7	$71.6
2004	23.1	$52.7		**2012**	19.7	$50.4
2005	22.9	$52.8		**2013**	21.6	$61.2
2006	24.5	$56.2		**2014**	22.3	$58.9
2007	24.0	$55.4		**Average**	22.0	$53.0

Figure 5. Volume (millions of pounds) of imported oyster products by product form, 2000-2014.

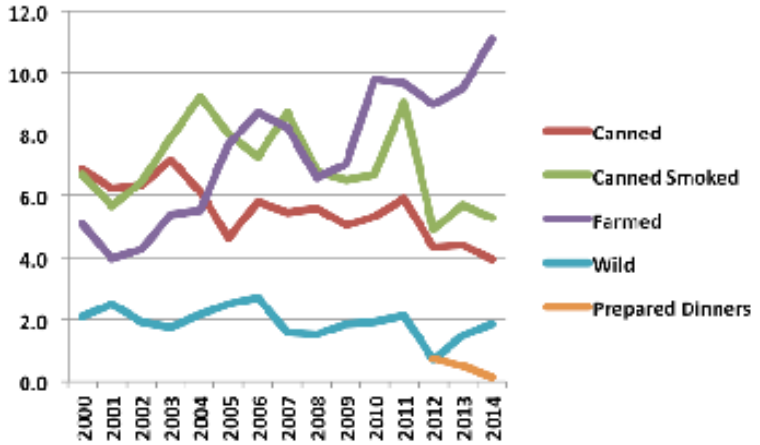


Figure 6. Real value (millions of dollars) of imported oyster products by product form, 2000-2014.

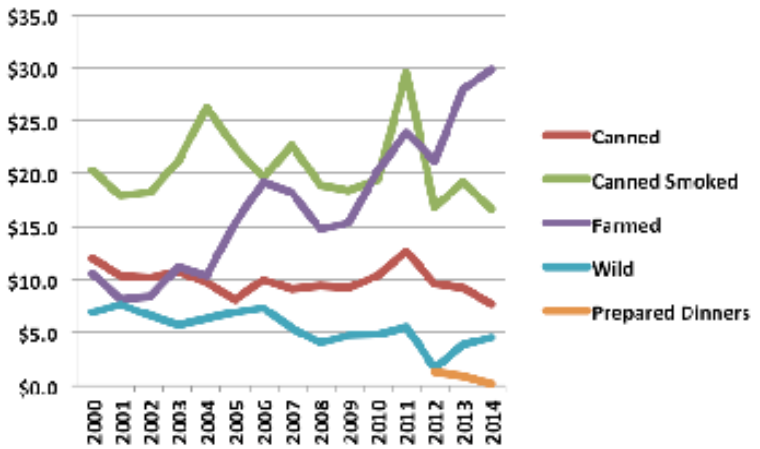


Figure 7. Top source countries for U.S. imports of farmed and wild live, fresh, frozen, dried, salted, or brine oysters by volume, 2000-2014.

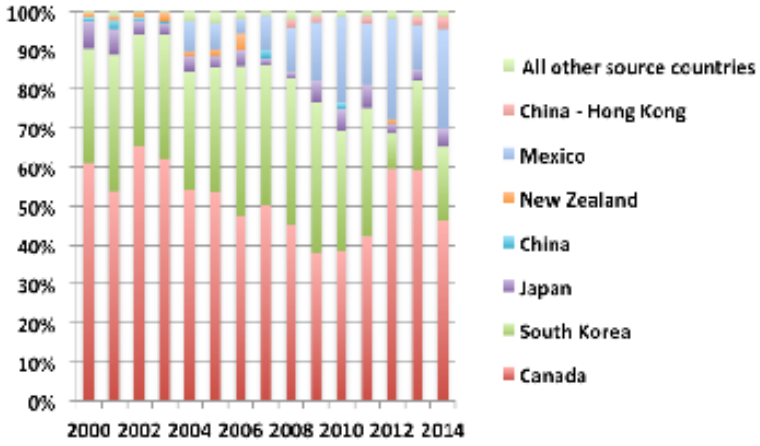


Figure 8. Top source countries for U.S. imports of farmed and wild live, fresh, frozen, dried, salted, or brine oysters by value, 2000-2014.

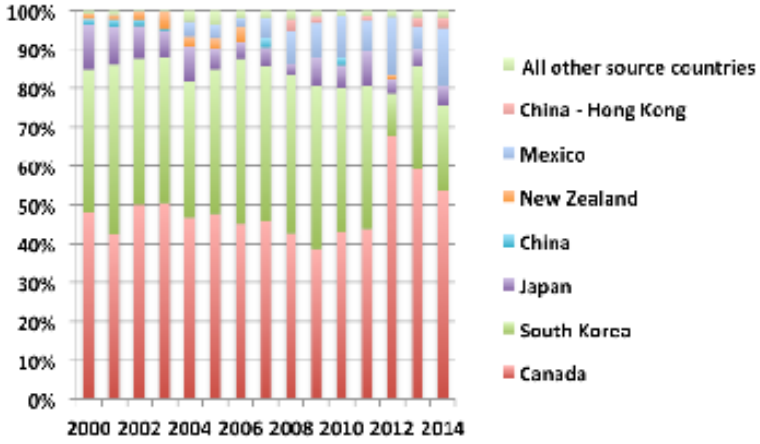


Figure 9. Volume (millions of pounds) of oyster products imported into the United States by U.S. region, 2000-2014.

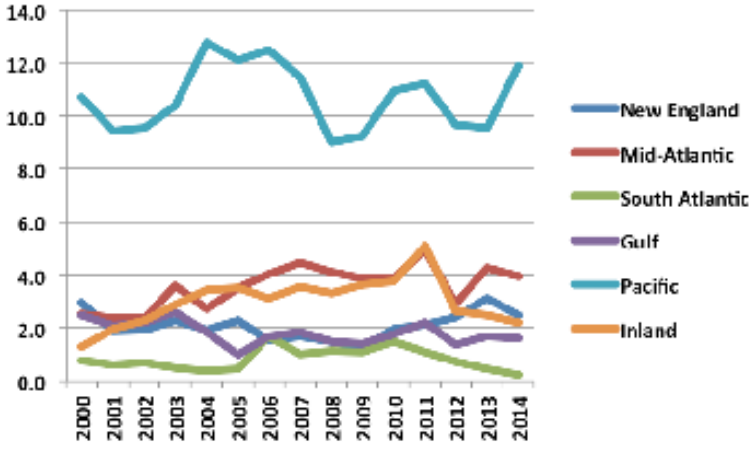
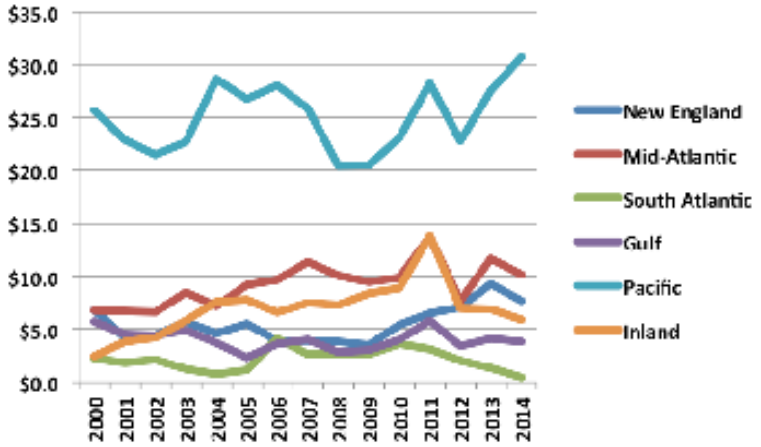


Figure 10. Real value (millions of dollars) of oyster products imported into the United States by U.S. region, 2000-2014.



Recreational Fishery

Although recreational fishermen likely harvest oysters on a localized scale, recreational landings are small and their contribution to overall oyster landings is likely negligible. Recreational harvest is limited to two sacks of oysters per person per day, except in Calcasieu Lake where the daily limit is one sack.

Recreational fishermen may harvest oysters by hand or with tongs. If using tongs, recreational fishermen must have a recreational oyster tong license, in addition to basic and saltwater fishing licenses. Sales of recreational oyster tong licenses help indicate the number of fishermen participating in the recreational oyster fishery from year to year, but little data are available concerning recreational oyster fishing effort and harvest. NOAA Fisheries' Marine Recreational Information Program (MRIP) and LDWF do not collect data related to recreational oyster landings.

The average number of resident recreational oyster tong licenses issued from 2000 to 2014 was 59.3 per year, ranging from a low of 33 in 2006 to a high of 83 in 2012 (Table 23). The average number of nonresident recreational oyster tong licenses issued during this period was 1.9 per year. In five of the years within this period, only one nonresident oyster tong license was issued, and in two of those years, none were issued.

Table 23. Number of resident and nonresident recreational oyster tong licenses issued by LDWF, 2000-2014.

Year	Resident Recreational Oyster Tong Licenses	Nonresident Recreational Oyster Tong Licenses	Total	Year	Resident Recreational Oyster Tong Licenses	Nonresident Recreational Oyster Tong Licenses	Total
2000	74	2	76	**2008**	50	2	52
2001	69	1	70	**2009**	37	3	40
2002	77	1	78	**2010**	54	2	56
2003	70	1	71	**2011**	59	4	63
2004	62	0	62	**2012**	83	4	87
2005	51	1	52	**2013**	60	4	64
2006	33	0	33	**2014**	64	3	67
2007	46	1	47	**Average**	59.3	1.9	61.2

Economic Conditions

Of the 2,909 respondents to a survey of commercial fishermen conducted by LDWF in 2009, 9.8 percent said they specifically targeted oysters and captured oysters most or all of the time while fishing commercially. Of these, about 20 percent also caught shrimp; 2.5 percent also caught crabs; and 1.8 percent also caught crawfish. Most (69.6 percent) said they never caught any species other than oysters when fishing commercially. The following are highlights of the survey's findings of the respondents who targeted oysters:

- About 84 percent owned at least one commercial fishing vessel.
- The average value of the vessels owned by oyster-targeting respondents was $111,542.
- Almost half (45.8 percent) carried debt at the end of the study year. Among those carrying debt, the average debt was $63,349.
- The average crew on an oyster-harvesting trip was 2.6 people.
- Average gross revenue from all commercial fishing operations was $92,901.
- About 44 percent reported net income from fishing operations of less than $25,000 in 2009. Net fishing income was between $25,000 and $49,999 for 29.7 percent, between $50,000 and $74,999 for 13.6 percent, and between $75,000 or more for 11.6 percent.
- Less than one in eight reported earning any revenue from any source other than commercial fishing in 2009.

Interactions with Other Fisheries or User Groups

In general, operation of the oyster fishery does not conflict with operation of other fisheries, although localized issues may occur. For example, state law prohibits shrimp trawling over privately leased bedding grounds for one year immediately after such area is seeded, which attempts to reduce or eliminate any possible damage (whether perceived or real) from shrimping gear. The take of non-target species in oyster fishing gear is minimal, with bycatch of crabs and bottom-dwelling finfish only occurring occasionally. Regulations require fishermen to immediately separate any bycatch species from the oyster harvest and return them to the water alive.

Conflicts sometimes arise between oyster harvesters and recreational finfish fishermen due to competition for physical fishing space, perceived impacts to finfish habitat by dredging operations, or the taking of finfish by oyster fishermen during oyster protection activities. For example, in the 1990s, recreational finfish fishermen became concerned over the take of red drum in gill nets employed by oyster leaseholders to protect bedded oysters from black drum predation. Eventually, gill nets were prohibited by law in Louisiana, except for in certain instances, and oyster leaseholders have indicated that oyster predation by black drum increased as a result.

Following the opening of the Caernarvon Diversion structure in 1994, oyster leaseholders began claiming oyster losses due to reduced salinities. Leaseholders in the diversion outfall area filed lawsuits, and lower court judgments against the state totaled more than $1 billion. To reduce further potential liability from coastal restoration activities, the Office of the Governor requested that the Commission place a moratorium on the issuance of new leases. The Commission ratified this moratorium in 2002. In *Avenal v. State of Louisiana* (2004), the Louisiana Supreme Court overturned lower court judgments and absolved the state of liability for oyster losses. State and federal agencies are now held harmless from coastal restoration-related impacts to oyster leases, as stated in the Louisiana Revised Statutes and oyster lease documentation. The Louisiana Coastal Protection and Restoration Authority (CPRA) may purchase oyster leases if they determine a coastal restoration project will directly impact such leases. The Legislature recently passed legislation to resume the leasing process through several phases and ultimately lift the lease moratorium.

State law provides lessees of state-owned water bottoms with exclusive use of the water bottoms to cultivate oysters. Leaseholders maintain the right to be compensated for damages to the oyster resources on the lease (for example, from other commercial fishermen, oil and gas operators, etc.) but are not entitled to compensation for damages from state and federal agencies' coastal protection, conservation, or restoration activities, as previously mentioned. Potential damages primarily include, but are not limited to, oyster mortality related to installation and/or maintenance of oil and gas infrastructure and discharge of explosives or other energy devices near reefs during seismic exploration. The Louisiana Department of Natural Resources' (LDNR) Oyster Lease Damage Evaluation Board addresses conflicts and compensation amounts between mineral interests and leaseholders. LDWF's Seismic Section administers and enforces regulations related to geophysical exploration. Administrative rule requires that preparation, operation, and cleanup of seismic exploration activities must be conducted at least 250 feet away from reefs. LDWF evaluates and determines required compensation for damages to oyster resources on public oyster areas.

Ecosystem Considerations and Environmental Factors

ADDRESSING POTENTIAL IMPACTS

LDWF actively monitors the impact of the oyster fishery on habitat and other species through general resource surveys and assessments. LDWF has implemented a number of management measures to reduce the amount of shell loss, prevent harvest-related mortality of spat, and mitigate their potential impacts. LDWF conducts several activities, including hatchery production of oyster larvae and cultch planting, to restore oyster populations, habitat, and the ecological services they provide and to enhance the oyster fishery.

Ecosystem Considerations

Habitat

The oyster fishery can directly impact oyster reef habitat through the removal of shell and live oysters. Oysters need clean, stable substrate to survive—free-floating oyster larvae settle and attach themselves to oyster shells and other hard surfaces to grow. If oyster shells are not replaced with shucked shell or other suitable cultch material, the reef can become fragmented and reduced in height. Louisiana currently experiences shell deficit, as oysters harvested in Louisiana are shipped out of state for processing or direct consumption and shell is not returned to coastal waters. Reduced reef height may place oysters within hypoxic (low oxygen) water common in many estuaries (Lenihan and Peterson 1998). Hypoxic water can be stressful or lethal to oysters, especially spat or seed, inhibiting growth and reproduction and making them more vulnerable to disease (Baker and Mann 1992, Fogelson 2007). Reef fragmentation and reduced reef height can also make oysters more vulnerable to hurricane-induced disturbance and sedimentation. Sediment can smother live oysters and bury cultch material, inhibiting oyster larvae from settling on the reef and growing (Quast et al. 1988, VanderKooy 2012). However, oyster industry representatives contend that certain harvest activities may also resuspend sediment and reduce sedimentation on natural shell.

Damage to oyster reef habitat can not only impact oyster populations but also the

ecological benefits oyster reefs provide to other species (VanderKooy 2012). Oysters are considered "ecosystem engineers" (Jones et al. 1994)—they create their own habitat and provide important shelter and forage habitat for most estuarine species (LDWF 2014, Soniat et al. 2014, Casas et al. 2015). In Louisiana, a comparison of actively harvested reefs to reefs closed to harvest did not indicate substantial impacts to the reef community despite differences in reef structure (Beck and La Peyre 2015). Oyster reefs are also considered Essential Fish Habitat (EFH) for brown, white, and pink shrimp as well as stone crab and red drum (GMFMC 1998). (As defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA), EFH is habitat necessary for fish to complete their life cycle. The MSA requires that fishery management plans for federally managed species describe and identify EFH for that species at all life stages for which information is available and that NOAA Fisheries to work with other federal agencies to conserve and enhance EFH.)

The habitat built as a result of shell growth from oysters and other shell-forming reef-associated species provides a variety of ecosystem services including water quality maintenance and shoreline protection (Piazza et al. 2005). Damage to oyster reef habitat can impair these services as well.

As oysters create their own habitat, biologists are able to monitor the health of oyster habitat through general resource surveys and assessments. As described in the **Description of the Stock**, LDWF continually collects data on public oysters reefs through the annual oyster stock assessment, monthly and semi-monthly dredge sampling, and oyster harvest monitoring. In particular, LDWF measures reef density and is currently working with university researchers to test using these measurements in the shell budget model to more accurately determine how much shell (living and dead) can be removed and still allow for the sustainability of the reef and fishery. This will help better manage the available oyster reef habitat and limit habitat loss in the future. In addition, LDWF randomly samples loads of seed oysters from harvest vessels during the open season to determine what percentage of the load is comprised of nonliving reef material. Knowing how much of the reef base is removed each season helps managers implement measures that will protect the long-term sustainability of reefs on the public oyster seed grounds.

Louisiana statute states that no fishing gear shall impair or destroy any water bottoms. LDWF has implemented several management measures to reduce the amount of shell loss and its potential impacts. There are restrictions on the size, type, and number of scrapers commercial fishermen may use to prevent overfishing and destruction of the natural reefs. LDWF requires that oyster fishermen sort through (cull) their harvest and return undersized oysters and any dead shell back to the reefs from which they were taken. This ensures important reef material and young oysters are returned to the reef. They must limit sacks of oysters to have no more than 15 percent of nonliving reef material (shell) and/or undersized oysters to prevent excess shell loss.

LDWF conducts several activities, including hatchery production of oyster larvae and cultch planting, to restore oyster populations, habitat, and the ecological services they provide and to enhance the oyster fishery. LDWF recently completed construction on a new oyster hatchery in Grand Isle, Louisiana. The hatchery was originally intended to supplement spat production on six cultch plants built between 2011 and 2013 as part of a *Deepwater Horizon*/NRDA restoration project and is capable of producing a target of one billion oyster larvae each season. The hatchery now provides larvae for direct and/or spat-on-cultch deployments on public oyster areas and provides larvae and/or spat-on-cultch to the oyster industry to reduce dependence on the public oyster areas. LDWF will soon complete a remote setting facility in Buras, Louisiana. This facility will provide a location where hatchery-produced larvae can be attached onto oyster shell and quickly transported and deployed to public oyster areas. Oyster shell and other cultch materials will be stored on site.

Since 1917, the State of Louisiana has conducted cultch planting projects on public water bottoms to restore and enhance oyster habitat and combat loss of shell. Cultch planting refers to depositing hard, clean substrate such as shells, limestone, and crushed concrete on water bottoms

while oysters are reproducing to provide additional sites on which oyster larvae can settle and grow. Private entities also use this restoration technique on private leases. Cultch planting is a long-proven strategy for enhancing oyster resources; in fact, LDWF has calculated the benefit-cost ratio for its cultch planning projects to be as high as 20 to 1. For example, a cultch plant on the public oyster seed grounds in Mississippi Sound (St. Bernard Parish) cost $1.4 million to construct in 2011 and produced approximately $14 million worth of oysters during a 5-day harvest season in 2015. See Appendix II for a detailed history of cultch plants on Louisiana's public water bottoms.

LDWF and the Coalition to Restore Coastal Louisiana (CRCL) have also created an oyster shell recycling program, collecting shucked oyster shells from New Orleans-area restaurants and returning them to Louisiana waters to restore oyster reefs in public oyster areas. Oyster shell collected through this program will be stored at the Buras remote setting facility. A majority of shell will be used for CRCL projects, with the remainder contributing to the remote setting program. In addition, local and state government and non-governmental organizations have invested in constructing oyster reefs for shoreline protection benefits. In fact, Louisiana's 2012 Comprehensive Master Plan for a Sustainable Coast (CPRA 2012) includes constructed oyster reefs as a coastal restoration technique, which may also benefit the oyster resource.

Finally, oyster scrapers can also physically impact oysters, especially spat and juveniles. This is especially significant where there is extensive mechanical harvesting after spat has recently settled on the reef, as the spat shells are not strong enough to protect young oysters from harvest-related damage (VanderKooy 2012). To prevent harvest-related mortality of spat, the Commission routinely delays the opening of harvest seasons on public oyster areas where LDWF has documented recent successful spat sets.

Bycatch and Discards

Undersized Oysters

Unless oystermen are harvesting seed oysters and reef material for bedding on private leases, LDWF requires that they sort through their harvest and return any oysters smaller than 3 inches from hinge to mouth and any dead shell back to the reefs from which they were taken. This ensures young oysters are returned to the reef so they can grow, reproduce, and contribute to the population and fishery. Sacks of market-size oysters may have no more than 15 percent undersized oysters and/or nonliving reef material (shell) to help further protect young oysters and reef resources (shell).

Other Species

Finfish and Shellfish

On-water interviews of harvesters and anecdotal information suggest that the oyster fishery does not produce much bycatch. The fishery targets only oysters and likely has low direct impact on other species. Oyster scrapers can incidentally catch species such as crabs and bottom-dwelling finfish that live on or near oyster reefs; however, fishermen must immediately separate any bycatch species from the oyster harvest and return them to the water alive as scrapers are not an allowed gear for harvesting crabs and finfish.

Threatened or Endangered Species

The oyster fishery is not known to adversely affect any species listed as threatened or endangered under the Endangered Species Act (ESA; VanderKooy 2012).

Marine Mammals

Under Section 118 of the Marine Mammal Protection Act (MMPA), NOAA Fisheries is required to classify all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals. The Gulf oyster dredge (scraper) fishery is listed as a Category III fishery, meaning there is remote likelihood of/no known incidental mortality or serious injury of marine mammals. Owners of vessels or gear engaged in a Category III fishery are not required to register with NOAA Fisheries or obtain a marine mammal authorization to lawfully take non-endangered and non-threatened marine mammals incidental to commercial fishing operations. However, they must report to NOAA Fisheries all incidental mortalities and injuries of marine mammals that occur during commercial fishing operations, regardless of the category in which the fishery is placed (I, II, or III) within 48 hours of the end of the fishing trip. In addition, any animal that ingests fishing gear or any animal that is released with fishing gear entangling, trailing, or perforating any part of the body is considered injured and must be reported.

Lost or Abandoned Fishing Gear

Oyster fishermen primarily use scrapers to harvest oysters. Scrapers are typically secured to vessels by a high-strength cable, chain, or rope. Scrapers rarely become disconnected from vessels, but if they do, the shallow waters where they are used, along with their high cost, helps ensure prompt recovery.

The increasing interest in oyster cage culture will increase the amount of equipment deployed in estuaries and, thus, increase risk of lost equipment including oyster cages, ropes, posts, and buoys. Oyster cages are enclosed and

not designed to entrap mobile organisms; therefore, ghost fishing is not a concern. Oyster cage culture is still new to Louisiana, and there are not many fishermen using this technique.

Environmental Factors

A variety of environmental factors, both natural and manmade, can affect the abundance and health of oysters. An extensive discussion of these factors can be found in VanderKooy (2012). Oysters can withstand a wide range of environmental conditions. LDWF biologists actively monitor these conditions and their impacts on oyster populations by analyzing water quality and oyster population data. Water quality data, including salinity, temperature, dissolved oxygen, and pH, can be analyzed with fishery independent oyster data to determine if environmental factors are influencing oyster populations.

Hydrological Conditions

Oysters in the Gulf coast region can tolerate a wide range of water temperatures and salinities. A summary of temperature and salinity tolerances can be found in Shumway 1996. Observations show that oysters can tolerate temperatures ranging from -2°C to 49°C (28°F to 120°F) and salinities ranging from 0 to 42.5 ppt. A recent study in Breton Sound, Louisiana found that adult oyster mortality increases with temperature but also when salinities occur below 9 ppt and above 13 ppt (La Peyre et al. 2016). Water temperature and salinity also influence whether developing larvae survive and can successfully settle and attach themselves to hard substrate on the water bottom (Quast et al. 1988). A critical component of salinity and temperature induced oyster mortality is the duration of exposure to extreme conditions. It is generally accepted that oysters are more tolerant of extreme salinities at lower temperatures due to decreased metabolic activity, where higher temperatures lead to decreased salinity tolerance.

Prolonged exposure to fresh water during flood events can significantly impact oysters, depending on water temperatures. In cold weather, oysters can withstand prolonged exposure to fresh water; in warmer weather, prolonged exposure to fresh water can increase oyster mortality (Hofstetter 1990). Minor flooding can actually benefit oysters, delivering nutrient-rich water to the bay and stimulating growth of plankton, a primary food source for oysters. Fresh water can also reduce oyster diseases such as Dermo and predators such as oyster drills (VanderKooy 2012). On the other hand, warmer and saltier water can increase the presence of predators such as oyster drills and oysters' susceptibility to diseases such as Dermo, threatening their survival.

The oxygen requirements for oysters depend on water temperature and salinity; oysters consume more oxygen in warmer water and lower salinities (Shumway 1982). While oysters can tolerate hypoxic conditions and can even survive brief exposures to anoxic conditions (Quast et al. 1988), hypoxic water can be stressful or lethal to oysters, especially spat or seed, inhibiting growth and reproduction and making them more vulnerable to disease (Baker and Mann 1992, Fogelson 2007).

Harmful algal blooms within surrounding waters can sometimes impact oyster resources and cause fishery closures. "Red tide" events are algal blooms, which are typically comprised of the marine dinoflagellate *Karenia brevis* in the Gulf. Oysters can accumulate this organism within their tissue, and the neurotoxin produced by *K. brevis* can cause sickness in humans. Additional information can be found in VanderKooy (2012). Other types of harmful algal blooms are known to occur in Louisiana such as *Pseudo-nitzchia* spp. (Corcoran et al. 2013); however, *K. brevis* is the most widespread and most frequently encountered.

Pollutants, including solid wastes, excessive nutrients, pesticides, and herbicides, degrade water quality and habitat and expose oyster populations to serious threats since oysters are sedentary and cannot move to more favorable environments. Pollutants, directly or in combination with other factors, can stress oysters, impair oyster reproduction, and adversely affect survival of all life stages. Additional information can be found in VanderKooy (2012).

Invasive Species

In Louisiana, invasive species have not yet posed a serious threat to existing oyster resources, but LDWF continues to monitor potential threats from other areas. For example, the green mussel (*Perna viridis*) has established populations in Tampa Bay, Florida to as far west as Pensacola Bay (Benson et al. 2001). A similar species, the brown mussel (*P. perna*), has been established in Texas (Ray 2005). These mussels attach to hard substrates and compete with oysters for space and resources.

Predation

Multiple predators limit oyster populations in coastal Louisiana, especially in high salinity waters (greater than 15 ppt) where oysters' main predators are most abundant. The most well-documented and devastating impacts on oyster populations are from oyster drills, stone crabs, and black drum (VanderKooy 2012). Menzel and Hopkins (1955) reported stone crab densities as high as 8,000 crabs per hectare on reefs in Louisiana. Their experiments indicated such populations could destroy

more than 700,000 oysters per acre, or about 1,000 bushels annually. Butler (1954) indicated oyster drills were the most destructive oyster predator in Gulf waters. Black drum are an especially voracious predator of seed oysters (oysters less than 3 inches); Brown et al. 2003 found that black drum cause extensive oyster mortalities on private oyster leases following transplanting operations. Salinities below 15 ppt appear to greatly reduce predation from most oyster predators, although spat mortality due to predation continues even at moderate and low salinity levels.

Competition from Other Species

Numerous animals compete for habitat space and food with oysters, including all members of the fouling community such as barnacles, bryozoans, hydroids, and mussels. In lower salinity environments (less than 10 ppt), hooked mussels can cover the reefs. These mussels compete both with oyster larvae for settlement surfaces and with older oysters for food sources as they are both filter feeders. While the severity of this impact is unclear, it is likely that competition for food impacts oyster growth rates, fecundity, and overall fitness.

Diseases and Parasites

A variety of parasites are known to infect oysters. Parasites can reduce growth, inhibit general development, and lead to massive mortalities. An extensive review of such can be found in VanderKooy (2012). Most significantly, the parasite *Perkinsus marinus*, commonly called Dermo, is highly prevalent in oyster populations throughout the Gulf and has been implicated in mass mortalities, especially during the summer in high salinity, high temperature waters (Mackin 1961, Soniat et al. 2012). Low water temperatures or salinities usually lessen the distribution and effects of the parasite. University researchers are conducting studies to better understand the impact Dermo on oysters to assist managers and the industry. For example, Dr. Tom Soniat at the University of New Orleans annually evaluates oysters from public oyster areas throughout Louisiana for the presence and relative amount of Dermo infestation (LDWF 2014). Although the protozoan parasite MSX (*Haplosporidium nelson*) is known to cause extensive mortalities of oysters on the mid and upper Atlantic coast, the presence of this parasite has not been confirmed in Gulf waters.

Climate and Weather

Environmental disturbances such as hurricanes can destroy entire reef systems. Storm surge and waves can physically scour the reef, transported sediment can bury the reef, and large amounts of debris or vegetation can overburden the reef. In addition, local rainfall might drastically increase the freshwater inflow to the reef (Switzer et al. 2006). However, oyster reefs have shown remarkable ability to reestablish thriving populations after impacts from natural phenomena such as floods, drought, or hurricanes. The reef's ability to recover depends on the magnitude and frequency of the disturbance (VanderKooy 2012). LDWF monitors the impacts of environmental disturbances on reefs and reef recovery through regular dredge sampling, as detailed in the **Description of the Stock**.

Ocean Acidification

Studies have shown that shelled mollusks such as oysters are particularly sensitive to ocean acidification, which refers to the decrease in the pH of ocean water due to the ocean's absorption of carbon dioxide from the atmosphere (Ekstrom et al. 2015). Ocean acidification impacts increase the mortality of larval bivalves by impairing their ability to form shells. Areas along the Gulf are particularly vulnerable to ocean acidification due to additional localized factors such as the influx of river water and eutrophication (excessive nutrients in the water that can cause excessive production of algae, as discussed above). While there is likely some time before ocean acidification reaches critical levels in the Gulf, it has already impacted the oyster resource and fishery in other areas such as the Pacific Northwest, costing the industry more than $100 million and thousands of jobs. Future research and management efforts should consider the potential impacts of ocean acidification in Louisiana and the Gulf and work to reduce vulnerability to ocean acidification.

Other Fisheries and Aquaculture

Gear such as bottom trawls can scour the water bottom, resuspend sediment, and directly impact oysters (Wilber et al. 2005). State law prohibits fishermen from using trawls, seines, or skimmer nets over privately leased bedding grounds for one year immediately after such area is seeded to protect that habitat and young oysters.

Aquaculture operations in or near oyster reefs can compete for habitat space and other critical resources (Burrell 1997). Currently, there are only a few oyster cage culture operations in Louisiana, although there are laws and regulations in place to regulate this activity and minimize conflicts with other user groups, including traditional on-bottom culture of oysters.

Habitat Loss and Restoration

Marsh loss may affect the abundance of estuarine dependent species such as oysters. Eighty percent of the coastal marsh loss in the United States occurs annually in Louisiana. CPRA monitors and measures coastal habitat loss and has proposed and/or implemented a number

of coastal protection and restoration projects through Louisiana's Coastal Master Plan to help combat and slow some of these impacts. These projects, including building oyster reefs, will have a range of impacts on oyster abundance and may also impact the oyster fishery. However, the rapidly changing coast of Louisiana will impact the oyster fishery, oysters, and other estuarine dependent species, even if nothing is done to counteract the natural and manmade causes of coastal land loss.

Freshwater Diversions

Freshwater diversions can disrupt the flow of fresh water for prolonged periods of time, potentially impacting estuarine ecology and oyster production. For example, the Bonnet Carre Spillway, located on the Mississippi River in Louisiana, controls river stages and flow rates. It has been an important feature in controlling floodwaters and can effectively divert fresh water into Lake Pontchartrain and around New Orleans. The introduction of freshwater, when the spillway is opened, may simulate the natural flooding cycle of the river and result in favorable long-term effects on oyster production but can also have detrimental short-term impacts on oyster mortality. LDWF monitors the impacts of freshwater diversions through regular dredge sampling, as detailed in the **Description of the Stock**.

In 2010, multiple freshwater diversions along the Mississippi River in Louisiana were opened for several months to prohibit surface oil from the *Deepwater Horizon* oil spill from reaching the marshes of southeast Louisiana. The impacts of these diversions were investigated through the NRDA process; more information is available in the *Deepwater Horizon* Oil Spill section below. (VanderKooy 2012)

Deepwater Horizon Oil Spill

The effects from the *Deepwater Horizon* oil spill and response activities to Louisiana's natural resources, including oysters, were investigated through the NRDA process. Impacts of the spill and response activities on oyster abundance and reproduction have resulted in reduced spawning stock, larval production, spat settlement, and spat substrate availability that compromise the long-term sustainability of oyster reefs throughout the northern central Gulf (Trustees 2016). The *Deepwater Horizon* NRDA trustees (federal and state agencies) will conduct activities to restore oyster abundance, resilience, and habitat from impacts of the spill and response activities. Restoration activities will potentially include directly restoring reef habitat, enhancing oyster reef productivity, and restoring regional oyster recruitment by increasing oyster spawning stock populations and, subsequently, the regional larval supply.

Fishery Management Program

COLLABORATIVE FISHERY MANAGEMENT

Louisiana's fishery management authorities collaborate with the other Gulf states, other aquatic and coastal resource management authorities, public health and safety authorities, industry, and other stakeholders in the management of the state's oyster resource and fishery.

Management Framework

The Constitution of Louisiana provides the foundation for the sustainable management of the state's fishery resources, including oysters, recognizing their importance to Louisiana's environment, citizens, and economy. According to the Constitution of Louisiana, "The freedom to hunt, fish, and trap wildlife, including all aquatic life, traditionally taken by hunters, trappers, and anglers, is a valued natural heritage that shall be forever preserved for the people. Hunting, fishing, and trapping shall be managed by law and regulation consistent with Article IX, Section I of the Constitution of Louisiana to protect, conserve and replenish the natural resources of the state".

Louisiana's legislative statutes and administrative code provide the legal and administrative framework for the state's fishery management system. Louisiana Revised Statutes 56:638.1-5 define the legislative intent, findings, purposes, policy, and standards for the conservation, management, and sustainability of all species of fish in Louisiana and are similar to those found in the MSA, the law that guides U.S. federal fishery management. According to these statutes, fishery conservation and management in Louisiana should sustain:

- Louisiana's fishery resources (fish and shellfish)
- The ecosystems in which they live (habitat and other aquatic species)

- The people that depend upon these resources (commercial and recreational fishing industries and coastal communities).

See Appendix III for specific details of these statutes.

Authorities

Louisiana

Legislature

The primary authority for managing the oyster fishery in Louisiana's state waters rests with the Legislature. The Legislature is the lawmaking body of the state and enacts Revised Statutes defining the legal framework for fisheries management. The Constitution of Louisiana empowers the Legislature to enact laws to protect, conserve, and replenish the natural resources of the state, with consideration for the health, safety, and welfare of the people. The Legislature has delegated some of its authority to the Commission and the Secretary of LDWF. In general, management actions such as gear changes, licensing, and entry limitations are under the authority of the Legislature.

The Legislature adopts laws according to Louisiana's legislative process. LDWF, in coordination with the Louisiana Oyster Task Force, often develops proposed legislation specific to the oyster industry and assists in finding sponsors for those particular bills. Legislators also develop bills of their own. See Appendix IV for a diagram outlining Louisiana's legislative process.

Wildlife and Fisheries Commission

The Commission is charged with the control and supervision of the wildlife of the state, including all aquatic life. Part of the executive branch, the Commission consists of seven members appointed by the governor, subject to confirmation by the Senate. The Commission operates as a policy-making and budgetary control board, with no administrative function.

The Commission receives and reviews biological, socioeconomic, and other technical data and management recommendations from LDWF, gathers public input, and ultimately votes on which actions will best achieve long-term management goals. In general, the Commission is charged with setting seasons, times, places, size limits, quotas, daily take, and possession limits based upon biological data and setting fees for nonresident recreational fishing licenses, among other authorities. With respect to oysters, specific authorities include regulating public oyster seed grounds and related permits and requirements and protecting natural oyster reefs. See Appendix V for complete details on the Commission's authorities as outlined in Louisiana Revised Statutes Title 56.

The Commission adopts rules according to the process defined in Louisiana's Administrative Procedure Act (APA). The APA requires that the Commission give appropriate notice of their intended action, make the proposed rule available for public review and comment, and include a Fiscal and Economic Impact Statement (FEIS), summarizing what social and economic impacts the proposed rule might have. In addition to the FEIS, a proposed rule must also include Family Impact, Poverty Impact, and Provider Impact Statements. Once the rule has gone through the process and is approved, it is published as final in the Louisiana Register and is compiled with other Commission rules in Louisiana Administrative Code Title 76.

Department of Wildlife and Fisheries

LDWF serves as the administrative and operational arm of the Commission. The Secretary of LDWF is appointed by the governor, subject to confirmation by the Senate. The Secretary is the executive head and chief administrative officer of LDWF. In general, LDWF monitors fishery populations by collecting and analyzing fishery dependent and independent data; conducts scientific research; provides data and management recommendations to the Commission and Legislature; and administers and enforces laws, rules, and regulations as adopted by the Commission and Legislature.

The Legislature and Commission may grant the Secretary of LDWF additional authorities to create administrative rules. For example, the Secretary, when authorized, can make a "declaration of emergency" in times when public health, safety, and welfare are in jeopardy and quick and

immediate action is required.

See Appendix VI for complete details of the Secretary and LDWF's authorities related to oysters as described in Louisiana Revised Statutes Title 56.

Governor

The Governor of Louisiana also has authority to issue executive orders, which are not statutes like those passed by the Legislature but do have the force of law.

Louisiana Oyster Task Force

Louisiana's Legislature established the Louisiana Oyster Task Force to study and monitor the molluscan industry and to make recommendations for the maximization of benefit from that industry for the State of Louisiana and its citizens. The Louisiana Oyster Task Force is composed of 14 voting and six non-voting members. Voting members include:

- Four members appointed by the Louisiana Oyster Dealers and Growers Association. One member shall be from Lafourche Parish and one member shall be from Jefferson Parish.
- Two members appointed by the Plaquemines Oyster Association
- One member appointed by the Terrebonne Oyster Association
- One member appointed by the Calcasieu Lake Oyster Task Force
- One member appointed by the Southwest Pass Oyster Leaseholder Association
- Two members appointed by the United Commercial Fisherman's Association
- One member appointed by the Delta Commercial Fisherman's organization
- One member who is an oyster grower appointed by the president of the Louisiana Farm Bureau Federation
- One member appointed by the Louisiana Oystermen Association.

Non-voting members include:

- The governor's executive assistant for coastal activities or his designee
- Two members appointed by the Secretary of LDWF
- One member appointed by the Secretary of LDNR
- One member appointed by the Secretary of the Louisiana Department of Health and Hospitals (LDHH)
- One member appointed by the executive director of CPRA.

The Louisiana Oyster Task Force has no direct management authority for the oyster fishery. However, state law directs that certain oyster management decisions be made only after consideration of recommendations by the Louisiana Oyster Task Force. According to Louisiana Revised Statutes 56:421, the Louisiana Oyster Task Force is responsible for:

- Monitoring the water quality and management requirements of the state's molluscan shellfish propagating areas
- Coordinating efforts to increase oyster production and salability
- Studying the decline in molluscan shellfish salability, the degradation of water quality which could adversely affect consumer health, and the reasons for such declines and degradations, and making recommendations to resolve such problems
- Making recommendations with respect to issues pertaining to the oyster industry and oyster production to the various state agencies charged with responsibility for differing elements of the oyster industry in this state, including LDWF, LDNR, CPRA and its board, LDHH, the governor's executive assistant for coastal activities, and the Legislature
- Employing such personnel as necessary
- Developing markets and marketing strategies for the development of new and expanded markets for Louisiana oysters
- Representing the interests of the Louisiana oyster industry before federal and state administrative and legislative bodies on issues of importance to the Louisiana oyster industry
- Contracting for legal services to represent the interests of the Louisiana oyster industry in judicial, administrative, and legislative proceedings
- Administering the funds in the Oyster Development Fund
- Performing any acts deemed necessary and proper to carry out its duties and responsibilities.

The activities of the Louisiana Oyster Task Force are funded through the through the Oyster Development Fund.

Calcasieu Lake Oyster Task Force

To address challenges facing the oyster industry in Calcasieu Lake, the Cameron Parish Police Jury, the governing body for the parish in which Calcasieu Lake is

located, formally established the Calcasieu Lake Oyster Task Force in 2004, although this task force existed informally since before 1999. Made up of local oyster harvesters, buyers, and businessmen, this task force serves a similar function as the Louisiana Oyster Task Force, although focused on Calcasieu Lake issues. Given the isolated nature of Calcasieu Lake and the unique characteristics of their fleet, the Calcasieu Lake oyster industry faces different challenges than the oyster industry in the rest of the state. The Calcasieu Lake Oyster Task Force appoints a member to the Louisiana Oyster Task Force and presents issues on behalf of the Calcasieu Lake oyster industry.

Other Oyster Industry Stakeholder Groups

The oyster industry actively participates in Louisiana's oyster management through stakeholder groups including the Louisiana Oyster Dealers and Growers Association. In addition, industry members often provide feedback on oyster management during Commission meetings and legislative committee meetings.

Other Aquatic Resource Management Authorities

Although not involved in marine fisheries management directly, several state and local agencies are involved in managing other aquatic or coastal resources, such as protecting habitat or monitoring water quality. LDWF collaborates with these agencies in relevant activities. LDNR is charged with regulating development activities and managing resources in Louisiana's coastal zone. Several coastal parishes have also developed their own coastal zone management programs. The Louisiana Department of Environmental Quality (LDEQ) is responsible for setting pollution standards and monitoring all waters of the state, including the Gulf. CPRA is responsible for developing, implementing, and enforcing a comprehensive coastal protection and restoration Master Plan, including monitoring and measuring coastal habitat loss and coordinating habitat restoration projects. LDWF often coordinates and collaborates with CPRA in oyster matters relating to coastal restoration activities, advises CPRA during activities such as the oyster lease appraisal process and coastal restoration project planning, and provides CPRA with fishery independent and dependent oyster data. The agencies closely communicate, especially during planning of oyster rehabilitation projects (e.g. cultch planting) when such projects are in close proximity to coastal restoration projects.

Public Health and Safety Authorities

Oysters are highly regulated with respect to public health and safety due to the risk of foodborne illnesses associated with consuming raw animal protein. Oysters are filter feeders and can accumulate contaminants and microorganisms present in the water. People, especially if they are immune-compromised, can contract these commonly occurring bacteria, parasites, and viruses from eating raw or under-processed oysters. Public health agencies including LDHH and the U.S. Food and Drug Administration (FDA) play a vital role in oyster fishery management to ensure they are safe to eat. These agencies strictly regulate the harvesting, handling, processing, and shipping of oysters to reduce the risk of illness in consumers, in accordance with state code and federal standards set by the Interstate Shellfish Sanitation Conference (ISSC) through the National Shellfish Sanitation Program (NSSP). These regulations, such as refrigerating oysters within certain time frames following harvest, reduce risks to public health while also helping to maintain product quality. LDWF coordinates with these agencies on public health-related actions such as such as oyster relays, oyster recalls, and participation in ISSC and is largely responsible for enforcing public health-related rules and regulations.

In addition, all seafood produced and processed in Louisiana must meet quality and safety standards set forth in the Louisiana Sanitary Code (Louisiana Administrative Code Title 51). LDHH routinely inspects the state's approximately 350 seafood processing plants using federal Hazard Analysis Critical Control Point (HACCP) requirements to ensure safe handling practices and that only safe product reaches the market. More details on these programs are available from LDHH.

Public Participation and Engagement

Louisiana's fishery management authorities encourage public participation throughout the management process to not only ensure stakeholders' interests are considered but also to ensure they understand the regulatory process and resulting management actions. All meetings of the Legislature's natural resources committees and Commission are open to the public, according to Louisiana's Open Meetings Law (Louisiana Revised Statutes 42:11–28). This law ensures that government decisions are made in an open forum, ensuring state integrity and the public's trust and awareness of its governing officials. Meetings must be announced at least 24 hours before the meeting, provide opportunities for public comment, allow for audience recording of the meeting, and have recorded minutes of the proceedings.

Regional

Other Gulf States

The other U.S. states bordering the Gulf are responsible for the conservation and management of oyster fisheries

within their respective waters. Because Louisiana shares water bodies which contain natural oyster reefs with both Texas (Sabine Lake) and Mississippi (Mississippi Sound), effective coordination and communication with those respective state resource management agencies is especially important both from a biological and fisheries enforcement perspective. The State of Louisiana cooperates with the other Gulf states in the scientific research and management of fisheries that cross jurisdictional boundaries, including oysters, through the GSMFC. Louisiana Revised Statutes 56:71-87 establish Louisiana's authority to enter into the Gulf States Marine Fisheries Compact with other states. The GSMFC has no direct authority over the oyster fishery but is authorized to make recommendations to the governors and legislatures of the five Gulf states on programs beneficial to management of shared fisheries. See Appendix VII for Louisiana's compliance with GSMFC recommendations for oyster.

The GSMFC also consults with and advises member states over fishery conservation problems, advises U.S. Congress, and testifies on legislation and marine policies affecting the Gulf states. Specific to the oyster fishery, the GSMFC has assisted in addressing issues of importance to oysters on a regional scale, such as transferring hatchery-raised oysters between states and coordinating development of compatible oyster regulations in water bodies shared with Louisiana by Texas and Mississippi to reduce harvest-related threats to the resource and the possibility of illegal harvest in Louisiana waters by out-of-state fishermen (Banks et al. 2014).

Federal Authorities

The Gulf of Mexico Fishery Management Council (Gulf Council) and NOAA Fisheries are responsible for monitoring and managing fishery resources in Gulf federal waters (from the seaward boundary of state waters to 200 nautical miles offshore). The oyster fishery operates exclusively within state waters, so federal agencies do not directly manage oysters. However, through their administration of laws, regulations, and policies, certain federal agencies may influence the oyster resource and fishery and management thereof. For example, LDWF collaborates with the FDA on public health related issues and with the U.S. Army Corps of Engineers (Corps) on permitting cultch planting activities. See Appendix VIII for a list of related federal management institutions and their authorities and jurisdictions and Appendix IX for a list of related federal laws, regulations, and policies.

Existing Management Measures

Plans

The GSMFC's "The Oyster Fishery of the Gulf of Mexico, United States: A Regional Management Plan—2012 Revision" summarizes, references, and discusses relevant scientific information and studies regarding the management of Gulf oysters to provide an understanding of past, present, and future management efforts; describes the biological, social, and economic aspects of the Gulf oyster fishery; reviews state and federal management authorities and their jurisdictions, laws, regulations, and policies affecting Gulf oysters; and recommends management strategies to ensure the maintenance and health of oysters stocks, habitat, and ecosystem services and ensure the sustainability of the fishery. Louisiana has implemented all applicable GSMFC management recommendations (Appendix VII).

General Management Process

Louisiana leads the nation in oyster production largely due to the state's successful public-private oyster cultivation partnership developed in the late 1800s and early 1900s. Parish governments used to lease local water bottoms to citizens for oyster cultivation. In 1899, the U.S. Bureau of Fisheries (precursor to the U.S. Fish and Wildlife Service, USFWS) extensively reviewed Louisiana's coastal area for possible expansion of oyster culture and made several recommendations for oyster fishery management, including that the states promote private investment in oyster cultivation (Moore 1899). Soon after, parish governments ceded control of leasing water bottoms to Louisiana's state government. Over the following decades, Louisiana passed numerous laws to assist and protect leaseholders. Today, state law specifies that LDWF "shall assist in protecting all lessees of private oyster bedding grounds in the enjoyment of their rights" [Louisiana Revised Statutes 56:6(16)].

Public Oyster Areas

In general, public water bottoms designated for oyster harvest in Louisiana are divided into public oyster seed grounds, public oyster seed reservations, and the public oyster areas of Calcasieu and Sabine Lakes. The main purpose of the state's public oyster seed grounds and reservations is to provide seed oysters for transplanting to leased water bottoms for cultivation. State law directs LDWF to properly maintain and preserve these areas as a perpetual source of seed supply for the oyster industry and requires that all seed oysters produced on oyster seed grounds or reservations to be had and held for the use and benefit of the oyster industry. LDWF must manage those areas designated as seed reservations in the best interests of the oyster industry. LDWF is also mandated to improve,

enlarge, and protect Louisiana's natural oyster reefs as conditions may warrant.

Louisiana manages its public oyster areas with a goal of balancing the economic viability of the fishery and the biological sustainability of the resource. Using the best data available from annual stock assessments and seasonal harvest monitoring, managers focus on controlling harvests, sustaining productive oyster populations, and maintaining and restoring oyster reef habitat. The annual management cycle for Louisiana's public oyster areas typically begins in early July and ends in late June of the following year, proceeding as follows:

1. LDWF samples the public reefs to estimate oyster stock size.
2. LDWF produces an annual oyster stock assessment, comparing the current stock size estimate to the previous year's estimate and long-term average estimates and presenting additional oyster information collected during the previous 12 months.
3. Using the stock assessment, LDWF recommends opening and closing dates for the upcoming oyster season to the Louisiana Oyster Task Force for their consideration.
4. LDWF presents the stock assessment to the Commission, typically in August. The Commission considers oyster seasonal framework recommendations from LDWF and the Louisiana Oyster Task Force and sets the oyster season during a public meeting.
5. After the Commission sets the season and before the season opens, LDWF monitors the oyster resource through dredge sampling to determine if biological data indicate a need to delay the season opening (e.g. a recent spat set that should be protected from harvest impacts).
6. After the season opens, LDWF conducts boarding report surveys, interviewing vessels on the water and dealers post-harvest, to estimate harvests and track fishing mortality (i.e. harvest) throughout the season. They also document the removal of nonliving reef material (cultch), especially by vessels which harvest seed oysters for bedding purposes. LDWF compares this information with a variety of metrics to determine if any harvest control measures (emergency closures and/or modifications to the oyster season) are necessary. If action is warranted, they develop recommendations and forward them to the Secretary and the Assistant Secretary for Fisheries of LDWF for final decision. Typically, LDWF considers harvest control measures if one or more of the following occur:
    a. Biological sampling indicates the presence of a successful spat set in an area with a high probability of survival in the absence of fishing
    b. Harvest fraction exceeds 50 percent of available oyster resource in an area
    c. Percentage of nonliving reef material in bedding loads regularly exceeds 25 percent (seed harvest may be restricted in this case, but market harvest usually continues)
    d. Harvest exceeds the thresholds established by the shell budget model
    e. CPUE by market-harvest vessels drops below 30 sacks per day in an area
    f. Enforcement issues occur at an unmanageable level
    g. Significant mortality event that reduces oyster stock size in excess of 50 percent of the original estimated stock size.
7. In the winter, LDWF plans cultch planting projects, pending funding availability, and typically implements them in May.
8. Monthly dredge sampling continues through June to monitor the overall health of the oyster resource.

Special Management Areas

LDWF manages Calcasieu and Sabine Lakes as part of the overall public oyster area system but under specific, separate statutes which recognize the isolated nature and unique ecology of these two lakes. As such, there is a need for a more stringent management approach (different seasonal framework and very strict harvest (sack) limits). Sabine Lake has not been open to harvest in the past 40 years, primarily due to water quality concerns. However, LDHH completed a sanitary survey of the lake in 2009 and developed a restricted time frame for allowing harvest during the year, addressing any water quality concerns. The decision to open an oyster harvest season now lies solely with the Commission; thus far, the Commission has opted to keep this area closed.

Due to the geographic isolation of Calcasieu and Sabine Lakes, the oyster populations within these water bodies could be considered true separate ecological populations, unable to genetically mix naturally with oysters from other parts of Louisiana's coast. Without the benefit of recruitment of oysters from other areas of the state, the oyster resources in Calcasieu and Sabine Lakes must rely on themselves for population maintenance. As a result, depressed oyster population densities typically take many years to recover.

Louisiana manages the public oyster areas of Calcasieu Lake with the same goals and functions and under the

same annual management cycle as its other public oyster areas, as described above. To account for the isolation of the oyster resource in Calcasieu Lake and to ensure the long-term sustainability of this population, LDWF uses a few additional measures to monitor and manage harvest in this area. LDWF monitors oyster harvest in this area through a combination of on-water interviews with oyster harvesters and telephone interviews with local seafood dealers. LDWF staff conduct boat counts and on-water interviews typically two times per week while the oyster season is open; they typically interview approximately 25 percent or more of the boats observed fishing. Through these interviews, they collect data on the number of sacks harvested per day and the time required to harvest the daily sack limit. Boat counts help determine overall fishing pressure and localized pressure on specific reefs and serve as a minimum standard for comparison with estimates from weekly dealer interviews. LDWF compares harvest estimates to the total oyster resource availability as determined by the annual stock assessment as well as harvest thresholds provided by the shell budget model. LDWF considers harvest control measures if more than 15 percent of the available oyster resource in Calcasieu Lake has been harvested, if substantial time is required to harvest the daily sack limit, or if the shell budget model harvest threshold is reached. Harvest control measures include reducing daily sack limits, reducing the season length, or a combination of the two. Frequent LDHH closures in this area often allow the season to extend to the statutorily mandated closure date of April 30, at which point harvest remains closed until the next season.

Private Oyster Leases

The State of Louisiana owns water bottoms and the oysters located upon them. Oyster fishermen apply to lease state-owned water bottoms through LDWF's Oyster Lease Survey Section. LDWF reviews each application and may issue a lease for a typical term of 15 years, currently at a rate of $3.00 per acre (as of January 1, 2016). The leaseholder may renew the lease after the term ends but must first have the lease resurveyed by a licensed surveyor. LDWF reviews such surveys and issues a renewal upon a satisfactory review.

Although water bottoms and oysters are technically property of the state, leaseholders primarily manage the oyster resources on their private oyster leases as state law provides the lessee with exclusive use of the water bottom. Very few state regulations apply to leases—leaseholders are free to actively cultivate and harvest oysters on their leased acreage. Leaseholders also maintain the right to be compensated for damages to the oyster resources on their lease (e.g. from other commercial fishermen, oil and gas operators, etc.); however, state and federal agencies are held harmless from coastal restoration-related impacts to oyster leases.

The timing and amount of harvest from private leases vary greatly among leaseholders and are driven largely by market conditions. Fishermen typically harvest oysters from private leases from May through September when public oyster areas are closed to harvesting oysters for market purposes. Fishermen often transplant seed oysters from public oysters areas to their leases whenever the public oyster areas are open, most frequently during September, October, March, and April.

Statutes and Rules

Louisiana's oyster fishery is governed by both legislative statutes (Louisiana Revised Statutes Title 56) and rules promulgated by the Commission (Louisiana Administrative Code Title 76). Specific regulations are described below. This summary of regulations does not retain their exact language and should be not be relied on for legal purposes. See Appendix X for detailed text of these regulations. See Appendix XI for a chronological history of major changes to Louisiana's oyster regulations.

Additional regulations governing harvesting, handling, processing, and shipping of oysters with respect to quality and safety can be found in Louisiana Revised Statutes Titles 3 and 40 and Louisiana Administrative Code Titles 7, 49, and 51.

Commercial

Licensing

Both resident and nonresident fishermen must have the appropriate commercial fishing licenses to commercially harvest or possess oysters in Louisiana waters. They must also have the appropriate gear licenses for scrapers and tongs. Gear licenses may be temporarily transferred between licensed commercial fishermen with the same residency status. Nonresidents may not purchase licenses for commercial fishing gear that is not permitted in the state in which they reside. Vessel owners must also have the appropriate vessel licenses (e.g. Commercial Vessel License, Oyster Cargo Vessel Permit, etc.). The captain of the harvest vessel must also have an Oyster Harvester License. Beginning in 2017, to obtain an Oyster Harvester License, applicants must complete LDWF's oyster harvester education program which covers information on LDWF and LDHH oyster regulations and best harvest practices for conserving the species. Five dollars from the sale of each fishing, vessel, and gear license is deposited in the Seafood Promotion and Marketing Fund.

To harvest oysters from privately leased water bottoms in Louisiana and land them outside of Louisiana, a

leaseholder (or his agent) must have an Out-of-State Landing Permit for his vessel.

To harvest oysters from public oyster seed grounds and/or seed reservations, a vessel owner must have a Public Oyster Seed Ground Vessel Permit.

Licensed commercial fishermen may transport and sell their own catch to any licensed Louisiana wholesale/retail seafood dealer located within Louisiana. They must have a Fresh Products License to sell their catch directly to a consumer; they may purchase a secondary Fresh Products License for their spouse for a reduced fee. Commercial fishermen that sell their catch to anyone other than a consumer or licensed dealer and anyone else that buys, acquires, handles, transports, or exports oysters for sale or resale must have the appropriate licenses. A portion of each license fee is deposited in the Seafood Promotion and Marketing Fund.

Licenses may be suspended, denied or revoked for failure to pay child support, nonpayment of unemployment compensation overpayment, and nonpayment of individual income taxes.

Fishery Access

Only vessels with an LDWF-issued Public Oyster Seed Ground Vessel Permit may take oysters from public oyster seed grounds and reservations. The permit cannot be sold, exchanged, or transferred. Vessel owners must meet certain qualification criteria to get the permit; these criteria were outlined to restrict access to the permit. However, most existing and past fishermen easily qualified for the permit, and over 700 permits were issued during the first year the permit was in place. LDWF implemented this form of limited entry under the direction of the Legislature to reduce the users of the resource to increase the economic viability of the industry and reduce fishing mortality. The Legislature recently provided the Commission the authority to limit the number of permits that may be issued each year, after they consult with the Louisiana Oyster Task Force. LDWF is currently prohibited by law from accepting applications for new permits, except for applications from individuals who own an oyster vessel, have completed requirements of a professionalism program, and meet the requirements listed above. The goal of this recent legislation was to enable LDWF to issue new permits but limit the total number of permits available, thereby continuing to limit the number of vessels harvesting on public oyster areas.

Access to private oyster leases is limited to the leaseholder and/or his designated agent (with written permission).

Legal Gear and Gear Requirements

Commercial fishermen may harvest oysters in public oyster areas with scrapers and tongs. There are restrictions on the size, type, and number of scrapers to prevent overfishing and destruction of the natural reefs. In most public oyster areas, scrapers may be no longer than 4-½ feet (54 inches) wide measured along the tooth bar and weigh no more than 175 pounds. Scraper teeth may be no longer than 5 inches and must be spaced at least 2-¼ inches, measured from the center of a tooth to center of the adjacent tooth. A tooth may be no larger than 11/16 inches in diameter. The scraper bag must be single mesh with a minimum mesh size of 3 inches stretched. Vessels may not use more than two scrapers at one time. In addition, vessels are prohibited from using diving boards or any scraper attachment intended to increase downward pressure.

Leaseholders may use any implements or appliances on their private leases, as long as they do not impair or destroy the water bottom.

Seasons and Times

The oyster harvest season for public oyster areas is specified in statute and generally runs from the first Wednesday following Labor Day in September for seed oysters and the second Monday in October for market oysters through April 30 of the following year. However, statute allows the Commission to adjust the season based on scientific data. The Commission typically cedes some authority to the Secretary of LDWF for emergency delays, closures, and reopenings after the Commission has set annual season dates.

The owner of an oyster lease or his agent may fish oysters on the lease at any time of year, unless the lease is closed by LDHH for public health reasons.

In all areas, harvesting oysters is prohibited from one-half hour after sunset until one-half hour before sunrise.

Size and Possession Limits

Oysters harvested for market purposes from public oyster areas must be 3 inches from hinge to mouth or larger to conserve oyster populations. Sacks of market oysters from public oyster areas may contain no more than 15 percent undersized oysters and nonliving reef material.

If permitted to do so, leaseholders may take undersized oysters from public oyster areas to cultivate on their private leases.

When harvesting oysters for market purposes, commercial fishermen must immediately return any oysters under legal size and any nonliving reef material (shell and/or other cultch) back to the natural reefs from which they were taken. This does not apply if a fisherman is lawfully removing seed oysters from public oyster areas or harvesting oysters from a lease he owns or is authorized to

harvest oysters.

There is no size limit for oysters harvested from private leases, allowing private leaseholders to provide a smaller product to the half-shell market.

The Commission may regulate the amount of oysters that may be harvested per day per vessel or the amount allowed to be located on a vessel at any given time to conserve oyster resources.

Area Restrictions

Commercial fishermen may only harvest oysters from open public oyster areas, state-issued oyster leases, or privately-owned water bottoms. Commercial fishermen may not take, carry away, or attempt to take or carry away any oysters, shell, or cultch from a leased area, unless they have permission from the lessee. Leaseholders must properly mark their leased water bottoms, and fishermen may not harvest oysters from unmarked leases for enforcement reasons.

The Commission determines where and when licensed fishermen can fish by opening and closing public oyster areas based on scientific information about oyster populations from LDWF. This area management technique, similar to crop rotation in agriculture, rotates harvest pressure among areas or reefs. Certain areas may remain closed for periods of time to allow recovery while other areas are opened to harvest. LDWF has used this technique for decades, most notably with the public oyster seed reservations in Bay Gardene, Hackberry Bay (Bay Du Chene), Sister (Caillou) Lake, and Bay Junop.

Culling of undersize oysters and/or shell from market oysters is allowed only on open public oyster areas or leases on which the fisherman is authorized to take oysters. Culling is prohibited in areas closed to harvesting oysters.

LDHH may close areas opened by the Commission for public health reasons. It is illegal to harvest oysters from an area that has not previously been approved by LDHH. While the primary goal of LDHH closures is to prevent unsafe oysters from reaching the market, these closures are independent of population and harvest-based season recommendations and have the indirect benefit of providing additional time for populations to recover from harvest activities.

Commercial fishermen may not harvest oysters from any wildlife management area (WMA), except from private oyster leases and public oyster seed grounds located within a WMA, when authorized by the Commission and upon approval by LDHH. There are two areas where harvestable water bottoms overlap with WMAs:

1. State-issued oyster leases are found in several waterways within the Biloxi WMA boundaries.
2. A large portion of the open water area of the Atchafalaya WMA covers water bottoms designated as a public oyster seed ground.

Commercial fishing including oyster harvesting is restricted, or completely prohibited, in certain state wildlife refuges and other areas; however, there are very few oyster resources available within these areas of the state.

Operational Requirements and Restrictions

Each vessel and scraper harvesting oysters must display the name, license number, and state or federal vessel registration number in a way that is easily visible from air.

Commercial fishermen may not remove or alter any object that designates bedding or propagating grounds.

Fishermen harvesting oysters from Louisiana's public oyster areas for sale or consumption must land them in Louisiana. Fishermen may land oysters harvested from a private lease in Louisiana's waters outside of the state, provided they have the proper permit from LDWF and have properly tagged the oysters. Fishermen must install a vessel monitoring system (VMS) acceptable to LDWF's Law Enforcement Division on the vessel used to transport oysters to another state and allow LDWF access to the system. A VMS is a Global Positioning System (GPS) that uses satellites to indicate where a vessel is located at all times, providing valuable data on fishing and landing location for enforcement purposes.

Interactions with Other Fisheries or User Groups

Fishermen may not use a trawl, seine, or skimmer net over privately leased bedding grounds for one year immediately after such area is seeded. The area must be marked or posted as required by law. If a fisherman knowingly uses a trawl, seine, or skimmer net upon such marked areas, they are liable for damages.

State law recognizes potential conflicts between oyster leasing and coastal restoration activities as administered by CPRA. To reduce potential liability from coastal restoration activities, the Commission placed a moratorium on the issuance of new oyster leases. However, state and federal agencies are now held harmless from coastal restoration-related impacts to oyster leases. CPRA may also purchase oyster leases if they determine a coastal restoration project will directly impact such leases. The Legislature recently passed legislation to resume the leasing process through several phases and ultimately lift the lease moratorium.

Every activity proposed within the coastal zone must be authorized or approved by LDNR. All activities proposed within the boundaries of a public oyster seed ground or reservation must also have a water bottom assessment

completed, unless waived by LDWF. Examples of proposed activities include construction of a dock, an oil/gas well, pipelines, and platforms; dredging operations; shoreline restoration; seismic activities; etc.). These activities are reviewed and managed as necessary though the coastal use permitting process to minimize or eliminate impacts to oysters and their habitat. While these activities do not usually conflict with oyster management, LDWF must be compensated for damage to public oyster seed grounds and reservations from activities conducted under a Coastal Use Permit. In addition, no seismic exploration can occur without LDWF's approval. Anyone who wishes to conduct seismic exploration must apply to LDWF in writing and guarantee compensation for any damage to oysters.

Post-Harvest Practices

When harvesting oysters from Louisiana state waters for sale, fishermen must identify sacks and any other type of container used to hold oysters in their shells with official oyster harvest tags purchased from LDWF. These tags are identified with and traceable to the harvester's license. Fishermen must complete all information on the tag. If fishermen sack or put oysters into containers on the harvest vessel, they must tag them prior to removing them from the vessel. If fishermen sack or put oysters into containers at the dock, they must tag them immediately upon arrival at the dock prior to shipment. There is a zero tolerance policy for untagged oyster sacks or containers—any untagged or improperly tagged sack or container (other than on board the vessel or on the dock prior to shipment) are considered to have been taken from polluted waters, deemed a health hazard, seized, and disposed of. It is illegal to possess untagged sacks or containers of oysters (other than on board the vessel or at the dock prior to shipment). Fishermen may not sell for resale untagged sacks or containers of oysters.

When harvesting oysters for raw consumption during March to November, fishermen may not also possess oysters intended for shucking, post-harvest processing, relay, or bedding until all they offload the oysters intended for raw consumption (unless they follow refrigeration and time/temperature requirements for raw oysters for all product on board).

LDHH requires additional post-harvest practices such as specific refrigeration requirements to meet applicable public health and safety and quality standards.

Packaging

All shucked oysters must be labeled and packaged as required by the National Shellfish Sanitation Program and the National Institute of Standards and Technology. All licensed oyster captains, harvesters, and/or certified wholesale/retail dealers of shellstock and shucked oysters must verify that the oysters being sold adhere to these measurement standards. Shellstock refers to live oysters in their shells; shucked refers to oysters from which both shells have been removed.

The Secretary of LDWF has the authority to adopt rules and regulations to establish standards for the packaging of seafood in Louisiana for wholesale or retail sale. These standards may govern the quality, contents, and weight of all seafood packaged in this state. The Louisiana Seafood Promotion and Marketing Board may make recommendations to the Secretary for standards for the packaging of seafood.

Shipments containing fish shall be plainly marked, the tags or certificates to show the date and names of the consignor and the consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. Bills of lading issued by a common carrier for such shipments shall state the number of packages which contain fish, and the date and names of the consignor and consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein.

The Louisiana Department of Agriculture and Forestry (LDAF) and LDHH have additional packaging requirements for oysters including labeling and measurement standards.

Recreational

Licensing

Recreational fishermen must have basic and saltwater fishing licenses and the appropriate gear license, if using gear, to harvest oysters.

Legal Gear and Gear Requirements

Recreational fishermen may use tongs to harvest oysters or gather them by hand.

Size and Possession Limits

When harvesting oysters on public oyster areas, recreational fishermen are limited to two sacks per person per day and oysters 3 inches in length or longer.

Area Restrictions

Recreational fishermen may harvest oysters for personal consumption from:

- Public oyster areas when the oyster season is open
- Leased areas with written permission from the owner
- Personally leased areas

No one may harvest oysters from areas closed by LDHH for public health reasons.

Operational Restrictions

Recreational fishermen may only cull oysters on open public oyster areas or on private lands or leases on which they are authorized to take oysters. They may not cull oysters on areas closed by LDHH.

Recreational fishermen may not take oysters at night and may only land oysters taken from Louisiana waters in Louisiana, unless they hold an Out-of-State Oyster Landing Permit.

Special Management Areas

Calcasieu Lake

To commercially harvest oysters in the Calcasieu Lake Public Oyster Area, a fisherman must have a Calcasieu Lake Oyster Harvester Permit, in addition to all other licenses and permits required to harvest oysters commercially, except the Oyster Seed Ground Vessel Permit. Commercial fishermen may only harvest oysters with tongs, a hand scraper, or a single scraper with mechanical assist and a flat bar no longer than 3 feet. Commercial vessels must be self-propelled (defined as traveling under its own power). All other relevant commercial oyster-harvesting regulations apply.

The Commission sets harvest seasons in Calcasieu Lake based on scientific data and recommendations of the Calcasieu Lake Oyster Task Force and the Louisiana Oyster Task Force to effectively manage the unique oyster population in this lake. The season must begin on any date between October 15 and November 1 and must close by April 30; however, the Commission may open or close the season as biological data indicate and may manage the East Cove and West Cove of the lake separately. The Calcasieu Lake oyster season is heavily influenced by closures mandated by LDHH based on the level of the Calcasieu River at Kinder, Louisiana. The East Cove is closed to harvest when the river stage exceeds 13.5 feet, and the west cove is closed to harvest when the river stage exceeds 9 feet. Long-term water quality data gathered by LDHH indicate that once those river levels are reached, counts of fecal coliform bacteria in water samples exceed NSSP standards. LDHH can reopen harvest when the river falls below these levels for 48 hours. Areas within Calcasieu Lake have been open to harvest annually since 1985. However, LDHH has currently closed the northern portion of Calcasieu Lake to harvest due to consistently poor water quality and the presence of heavy metals in sediment and oyster tissue. The southeastern portion of Calcasieu Lake has been closed by the Commission since 2011 due to limited resource in the area.

Fishermen may only harvest market-size oysters (3 inches in length or longer) from Calcasieu Lake. Although not specifically restricted from doing so, fishermen do not remove seed oysters or reef material for bedding purposes due to the lack of private leases in the area. Commercial harvests may not exceed 25 sacks per vessel per day, although the Commission typically sets a lower daily sack limit (e.g. 10 sacks per day). Only one permit holder may harvest from each licensed vessel per day, and no vessel may take more than one trip per day.

Recreational fisherman must have the same licenses and permits required in other areas of the state. Recreational fishermen may only harvest oysters using tongs or by hand. They are limited to one sack per person per day and oysters 3 inches in length or longer.

Sabine Lake

Commercial fishermen may only harvest oysters with tongs, a hand scraper, or a scraper with a tooth or flat bar no longer than 3 feet. Harvests may not exceed 25 sacks per vessel per day to effectively manage the unique oyster population in this lake. Commercial vessels must be self-propelled.

The Commission may set different seasons in Sabine Lake based on scientific data and recommendations of the Louisiana Oyster Task Force to effectively manage the unique oyster population in this lake. Sabine Lake has not been open to harvest in the past 40 years, primarily due to water quality concerns. The oyster reefs in Sabine Lake are considered to be in excellent condition compared to most reefs in North America, with the area of relatively undisturbed oyster reef totaling almost 2,500 acres.

Other

Alternative Oyster Culture

Off-bottom oyster culture is highly successful in other parts of the United States, most notably in the Pacific and Chesapeake Regions. In Louisiana, off-bottom oyster culture is still in early stages of development; in 2008, the Legislature created an "aquaculture park" near Grand Isle that currently contains 25 acres available for development of off-bottom oyster culture. The site was permitted through state and federal agencies. Private sector oyster growers can obtain 2-acre plots from the Grand Isle Port Commission to use for oyster culture. Currently, two growers use space in this area and supply cultured oysters to restaurants in New Orleans and Baton Rouge.

In addition, the Legislature legalized alternative oyster culture (AOC) activities on existing oyster leases in 2012. A lease qualifies as long as it is outside of areas where user group conflicts could occur. The grower must obtain an

LDWF-issued AOC permit in addition to a coastal use permit issued through LDNR and the Corps. Growers using this technique must also hold all applicable licenses required for normal oyster harvest, except for the oyster scraper license. All other oyster regulations, such as tagging, recordkeeping, and reporting (e.g. trip tickets) requirements, apply. As of 2015, only two leaseholders have applied for and received AOC permits; one of these leaseholders is actively growing off-bottom oysters on his lease in the Barataria Basin.

Oyster Transplant Program

On occasion, LDWF and LDHH may offer leaseholders the opportunity to obtain an oyster transplant permit (for a fee) to move oysters from closed areas where water quality does not meet public health standards to open, clean private leases for purging and later harvest. Additional regulations, such as date, time, and location for transplant and later harvest, apply to permitted transplant activities.

Restoration and Enhancement Activities

LDWF conducts several activities including cultch planting and hatchery production of oyster larvae to restore oyster populations, habitat, and the ecological services they provide and to enhance the fishery. In Calcasieu Lake, LDWF has created nine cultch plants since 1963, totaling nearly 160 acres. This includes cultch plants which were completed in 2009 and 2015. Recent biological sampling on the 2015 cultch plants revealed the presence of numerous spat, indicating that these cultch plants were successful. Additionally, LDWF has released hatchery-raised larvae and spat to increase oyster abundance and mitigate for damage to oyster habitat in this area. Since 2012, hatchery releases include more than 750 million larvae and 34 million spat. LDWF and partners have also constructed finfish reefs which likely benefit the oyster population by maintaining broodstock. Refer to **Ecosystem Considerations and Environmental Factors** for additional details on stock and habitat restoration and enhancement activities throughout Louisiana's coast. See Appendix II for a detailed history of cultch plants on Louisiana's public water bottoms.

Louisiana Seafood Promotion and Marketing Board

The Louisiana Seafood Promotion and Marketing Board (LSPMB) works to enhance the public image of commercial fisheries products, promote the consumption of these products, and assist the seafood industry, including commercial fishermen and wholesale and retail dealers, in market development to better use existing markets and help establish new markets. One member of the LSPMB is to be appointed from a list of three names submitted by the Louisiana Oyster Dealers and Growers Association, and one is to be appointed from a list of three names submitted by the Louisiana Oyster Task Force.

Louisiana Wild Seafood Certification Program

LDWF established the Louisiana Wild Seafood Certification Program (LWSCP) to build a brand that guarantees the origin of Louisiana wild-caught seafood. Through strict chain of custody requirements, the program guarantees that all seafood products bearing the Certified Louisiana Wild Seafood logo were caught in Louisiana or Gulf waters by a licensed Louisiana fisherman, landed at a Louisiana dock, and processed and packaged by a Louisiana-based company. The program provides education for participants on best seafood handling and sanitation practices to ensure the utmost safety and quality. When a buyer sees this logo, they can be confident they are buying authentic Louisiana wild-caught seafood, a premium product known for fresh flavor, consistent quality, and sustainability, and that they are supporting our local fishing communities.

By branding and showcasing Louisiana seafood, LWSCP helps suppliers increase the value of their seafood products and remain competitive in seafood marketplace. LWSCP participants benefit from free program marketing support, such as:

- Market portal linking Certified Louisiana Wild Seafood suppliers with buyers
- Promotions through the program website, social media, and events including seafood festivals and industry conventions
- Free point-of-sale materials such as window clings, apparel, brochures, stickers, and decals
- Access to program partners including the LSPMB, Audubon GULF, NOAA Fisheries, Louisiana Sea Grant, and other in- and out-of-state partners who purchase and promote Certified Louisiana Wild Seafood.

Licensed Louisiana commercial fishermen are automatically eligible for the program; licensed Louisiana wholesale/retail seafood dealers must apply for and receive a permit to participate. They must also comply with all state and federal reporting requirements and have all legally required permits to operate their business.

Seafood Technology Equipment Program

To support the LWSCP, LDWF has developed the Seafood Technology Equipment Program (STEP), a cost-share assistance program for the commercial seafood community. STEP provides LWSCP participants with funding opportunities to improve their equipment and practices to increase the quality and value of their seafood,

critical components for establishing a premium Louisiana seafood brand. The Legislature allocated funding for STEP in 2009 by setting aside 10 percent of Artificial Reef Trust Fund revenues. Since 2012, STEP has provided more than $1.7 million to members of Louisiana's commercial fishing industry, including the Oyster Refrigeration Program which offered a grant for 50 percent (up to $10,000) of the cost of new or existing refrigeration equipment to assist oyster harvesters in meeting new FDA refrigeration requirements. LDWF is currently assessing future needs of the industry and will be developing funding initiatives to meet those needs.

Professionalism Programs

Beginning in 2017, anyone applying for an oyster harvester license must complete LDWF's oyster harvester education program. The goal of the program is to develop professionalism in the oyster harvest industry. The program will include training in the Louisiana Shellfish Sanitation Program, regulations for the preparation and handling of seafood for market, and best practices for oyster conservation.

LDWF, in collaboration with Louisiana Sea Grant and the Louisiana State University AgCenter, developed Louisiana Fisheries Forward, a multi-year, multi-phase professionalism program for all sectors of Louisiana's commercial fishing industry, including fishermen, dock owners, processors, and distributors. Launched in 2014, this program provides education and training essential for the continued economic success of the industry. This program delivers training videos and corresponding fact sheets on a number of topics such as how to be a commercial fisherman and seafood business finance and management as well as hands-on workshops, training days, and demonstrations to showcase new technology for vessel refrigeration/cooler systems, seafood freezing equipment, fuel efficiency equipment, and fishing/harvesting equipment and seafood handling and processing best practices.

LDWF and LDHH have also sponsored the Louisiana Oyster Fisheries Training (LOFTSeries) program in past years to provide education for harvesters and dealers on the latest issues of interest to the oyster industry from harvesting to health and safety requirements. LOFTSeries workshops offered Spanish and Vietnamese translators to ensure workshops were accessible to the entire oyster harvesting community. LDWF and LDHH may hold more LOFTSeries workshops in the near future to address new industry issues.

Fisheries Outreach

Through outreach efforts, LDWF promotes public awareness and advises the public on stewardship and best practices in preserving the unique nature of the state's natural resources. Via a strong presence at recreational events, industry-related expos, workshops, seminars, and other state sponsored events, LDWF strives to foster a community sense of resource and habitat stewardship. At these events, LDWF distributes an assortment of printed materials which focus on fishing regulations, commercial and recreational fishing topics, as well as species profile brochures which highlight the life cycle and habitat requirements of oysters and other native Louisiana species. Through participation in events, distribution of educational materials, and other activities, LDWF reaches more than 200,000 Louisiana citizens each year.

Compliance

Reporting Methods and Requirements

Boarding Surveys

LDWF conducts boarding report surveys throughout open oyster seasons, interviewing harvesters on the water in public oyster areas and interviewing dealers post-harvest. Depending on the length of the season, field staff conduct boarding surveys at least once per week. These surveys produce direct harvest data, which are critical for closely tracking fishing mortality (i.e. harvest) during the season, especially when compared with harvest fractions and thresholds. The real-time data generated from boarding report surveys also allow managers to make decisions quickly in response to fishing-related impacts to the oyster resource. In addition, boarding report surveys document the removal of nonliving reef material (cultch) by harvest vessels, especially vessels harvesting seed oysters for bedding purposes.

Trip Tickets

Since 1999, LDWF has monitored harvest of market-size oysters at the point of initial sale through its trip ticket program. Landings records from trip tickets are considered the official landings for the fishery. Under the program, wholesale/retail seafood dealers purchasing or acquiring oysters from commercial fishermen must complete a commercial trip ticket at the time of purchase or transfer of the catch from the fisherman to the dealer. The trip ticket must have the following information:

- Wholesale/retail seafood dealer's name and license number
- Commercial fisherman's name and license number
- Vessel license number
- Vessel registration or U.S. Coast Guard (USCG) documentation number

- Transaction date
- Species identification
- Quantity and units of each species
- Size and condition of each species
- Unit price of each species
- Permit number for species requiring a permit to harvest.

Both the commercial fisherman and the dealer must sign the trip ticket, attesting that the information on the trip ticket is correct. The fisherman and the dealer each keep a copy of the trip ticket. The dealer must transmit trip tickets from all of its transactions to LDWF once a month.

A commercial fisherman selling oysters under a Fresh Products License must also complete trip tickets, except they record their name and license number in place of the wholesale/retail seafood dealer's name and license number. They must sign these trip tickets, confirming their accuracy, and submit them to LDWF once a month.

Trip ticket records must be maintained for three years and are open to inspection by LDWF. Trip ticket information is protected by both state and federal law to limit access to business-specific information. However, LDWF and approved contractors may analyze and compile individual trip information into reports to provide reliable information for monitoring harvest from locations across the state, while still protecting sensitive information. LDWF enforces its trip ticket program; violation of statutes related to the program can result in citations written by LDWF or other law enforcement officials.

Recordkeeping Requirements

Wholesale/retail seafood dealers, retail seafood dealers, restaurants, and retail grocers must keep records of the following:

- The quantity and species of oysters acquired, the date the oysters were acquired, and the name and license number of the wholesale/retail seafood dealer or the out-of-state seller from whom the oysters were acquired
- The quantity and species of oysters sold, the date the oysters were sold, and the name and license number of the person to whom the oysters were sold. When sold to a consumer, the records shall indicate the quantity, species, and date and shall state that the oysters were sold to the consumer.

Anyone who containerizes shucked oysters must keep accurate records of the source of the oysters so they can be traced back to the identifying oyster harvest tag.

Enforcement

Through events, outreach materials, and other resources, LDWF informs commercial and recreational fishermen about programs, projects, and most importantly, relevant rules and regulations to prevent illegal activities. LDWF's Law Enforcement Division is responsible for ensuring compliance with all commercial and recreational licensing and harvesting regulations through regular patrols and investigations. LDWF's Law Enforcement Division is also responsible for enforcing laws as provided for in the Constitution of Louisiana, Louisiana Revised Statutes, and numerous federal laws including the MSA, ESA, MMPA, and Lacey Act.

Local parishes also assist in enforcement, primarily through the legal functions of each parish's district attorney. Local sheriff's offices sometimes assist LDWF's Law Enforcement Division as well. Local and state sanitarians and health department employees help enforce public health and safety related regulations.

Penalties

Classes of violations vary by legislative statute or Commission rule. Specific penalties for violations vary with the severity of the violation and include fines, jail time, loss of fishing license, and forfeiture of property. There are other penalties for oyster-related violations including community service, suspension or revocation of oyster harvester license and/or permit, and mandatory use of a VMS on the harvest vessel. In addition, LDWF may seize any oysters in connection with the violation. Specific penalties are listed in Appendix XII.

A person who kills, catches, takes, possesses, or injures any aquatic life in violation of an applicable state statute or regulation or a federal statute or regulation is also liable to the state for the value of each aquatic life unlawfully killed, caught, taken, possessed, or injured. Civil restitution for oysters is currently assessed at $0.45 per pound (in-shell weight). If the product is not in whole form, a conversion factor of 16.23 is applied to convert oyster meat weight to in-shell weight.

Other States' Oyster Rules and Regulations

While the individual Gulf states are responsible for oyster in their respective waters, management measures are fairly consistent across the Gulf. See Appendix XIII for a table of other states' commercial regulations for oyster.

Current Issues and Management Options

ACHIEVING MANAGEMENT GOALS

Addressing current issues facing Louisiana's oyster fishery through options identified in this section or through stakeholder participation will advance this fishery toward meeting long-term management goals.

This section identifies current issues facing Louisiana's oyster resource and fishery, provides a description of each issue, and recommends options for future action to address these issues. LDWF will work with stakeholders to prioritize these issues and identify preferred recommendations. Before implementing any recommendation, LDWF will evaluate the feasibility and potential impacts of the action on the resource and fishery.

Degradation of Habitat on Public Oyster Areas

The oyster fishery can directly impact oyster reef habitat through the removal of shell and live oysters. Oysters need clean, stable substrate to survive—free-floating oyster larvae settle and attach themselves to oyster shells and other hard surfaces to grow. If harvested oyster shells are not replaced with shucked shell or other suitable cultch material, the reef can become fragmented and reduced in height. Louisiana currently experiences a shell deficit, as oysters harvested in Louisiana are shipped out of state for processing or direct consumption and shell is not returned to coastal waters. The loss of oyster reef habitat is not only the most critical threat to the long-term sustainability of Louisiana's oyster resources, but it also can affect the ecosystem services oyster reefs provide (habitat for other species, water quality maintenance, and shoreline protection).

Management strategies should focus on returning oyster shell to public reefs to restore and maintain oyster reef habitat, which is critical for future oyster production and a healthy ecosystem.

Options:

- Expand oyster shell recycling efforts such as the CRCL oyster shell recycling program.
- Continue existing cultch planting program and expand when and where possible.
- Assess all public oyster areas to determine reef locations and size, similar to past assessments performed via side-scan sonar technology.
- Continue to implement harvest thresholds estimated from the shell budget model, if model continues to show positive results for cultch sustainability. In addition, consider using the shell budget model to set harvest thresholds that build reef in addition to ensuring no net loss of reef.
- Establish a legal threshold of cultch removal during oyster seed harvest to protect and conserve existing cultch/shell resources on public reefs.
- Consider gear modifications to reduce gear damage to reefs.
- Allow the Commission the authority to determine gear type (scraper or tong) to be allowed each season in Calcasieu Lake.
- Increase tag fees, severance taxes, license fees, and/or other fees, as appropriate, to fund oyster rehabilitation activities.
- Develop oyster larval transport models to optimize cultch placement.
- Explore supplemental harvest control measures such as reducing the number of vessels harvesting on public oyster areas by increasing license fees, increasing license requirements, and/or establishing limits on the number of licenses issued.
- Recommend operational plans for Mississippi River diversions that will maintain or improve oyster production.

Decline in Oyster Abundance on Public Oyster Areas

According to the most recent oyster stock assessment (2014), the current estimated oyster stock size on public oyster areas is approximately 44 percent below the 1982-2013 long-term average. The recent reduction on oyster abundance on public oyster areas may only be driven by reduced abundance in particular areas; for example, the oyster stock is at an all-time low east of the Mississippi River and in southeast Calcasieu Lake. Management strategies and restoration and enhancement activities could focus on these areas, rather than statewide.

Options:

- Formally adopt current metrics used for implementing harvest control measures.
- Continue to refine stock assessment methods, including development and adoption of habitat-based reference points and analysis of more conservative metrics for harvest control measures.
- Continue oyster hatchery and remote-setting efforts to increase oyster abundance in public oyster areas and reduce the oyster industry's reliance on the public oyster seed grounds for seed oysters.
- Refine area management plan for rotating harvest pressure among public oyster areas on a seasonal basis, allowing recovery in closed areas while other areas are open to harvest.
- Develop "no-take" reefs within the public oyster areas as a broodstock protection measure.
- Promote and foster private investment in oyster culture, including creating incentives for participating in alternative oyster culture.
- Continue existing cultch planting program and expand when and where possible.
- Consider transplanting live adult oysters from productive areas to areas where successful recruitment has waned in recent years (e.g. Black Bay, southeast Calcasieu Lake, etc.).

- Reduce the number of vessels harvesting on public oyster areas through increasing license fees, increasing license requirements, and/or establishing limits on the number of licenses issued.
- Establish a limit for the amount of seed and/or market oysters that may be harvested per vessel per day to protect and conserve oyster resources on public reefs in certain areas.

Coastal Restoration, Flood Control, and Freshwater Diversion Projects

CPRA monitors and measures coastal habitat loss and has proposed and implemented a number of coastal protection, restoration, and flood control projects through Louisiana's Coastal Master Plan. Both oyster fishermen and oyster industry representatives recognize the importance and benefits of flood protection and coastal restoration projects. However, many have expressed concern about the potential loss of suitable oyster habitat associated with freshwater diversions. Oyster fishermen as well as other fishermen have witnessed how flow rates of existing freshwater diversion projects have influenced estuarine conditions and affected oyster abundance.

With the expansion of coastal restoration activities, especially continued emphasis on large sediment diversions, estuarine areas conditions are expected to drastically change. Many areas historically productive for oysters are likely to experience salinity levels below those necessary to support successful oyster populations. Oyster production areas will likely shift down-estuary, if there is a suitable substrate for them to settle upon, impacting production on existing public and private oyster areas. However, the degree of impact and location of optimal oyster habitat in the future will depend on where diversions are constructed, the size of the diversions, and how they are operated.

In addition, CPRA has proposed a coastal restoration project in Calcasieu Lake. This proposed project would lower salinities in the lake by isolating the ship channel to restore surrounding freshwater and brackish marshes. This salinity control project may affect oyster populations in this special management area.

Options:

- Allow oysters to be relocated to areas anticipated to become productive after coastal restoration projects are completed.
- Redesignate some current public oyster seed grounds as available for lease by private entities for oyster cultivation.
- Promote alternative oyster culture efforts to provide the flexibility to relocate these resources in response to changing salinities.
- Maintain strong involvement with coastal restoration project design, modeling, and implementation.
- Recommend operational plans for Mississippi River diversions that will maintain or improve oyster production.
- Assess potential impacts to oyster resources in Calcasieu Lake from proposed salinity control project.

Water Quality

A variety of pollutants can threaten oyster populations both locally and regionally. Pollutants can adversely affect oysters directly or in combination with other factors, such as excessive nutrients that can promote the formation of hypoxic areas and harmful algal blooms. In addition, existing and proposed diversions of the Mississippi River for coastal restoration purposes have the potential to not only relocate present oyster production areas, as previously mentioned, but also introduce large quantities of pollutants into estuaries.

Options:

- Encourage maintenance and improvement of municipal/industrial discharge treatment systems to improve estuarine water quality.
- Consider methods to update and improve current public health control procedures for oysters.
- Encourage improved coordination among jurisdictions for identifying, permitting, and monitoring pollution.
- Continue to work toward more comprehensive management of shellfish waters and growing threats from pollution, including engaging in coastal development planning.
- Encourage the restoration and maintenance of riparian buffer zones in agricultural and residential areas.
- Promote operational regimes for existing and proposed Mississippi River diversions that will minimize impacts to existing oyster populations, such as setting limits on timing, duration, and magnitude of opening events. If it is determined that diversions are to be operated in manner that will decrease salinities in existing oyster production areas throughout the year, then the operational regime should be consistent intra- and inter-annually to allow for the successful transition of oyster

populations further down the estuary.

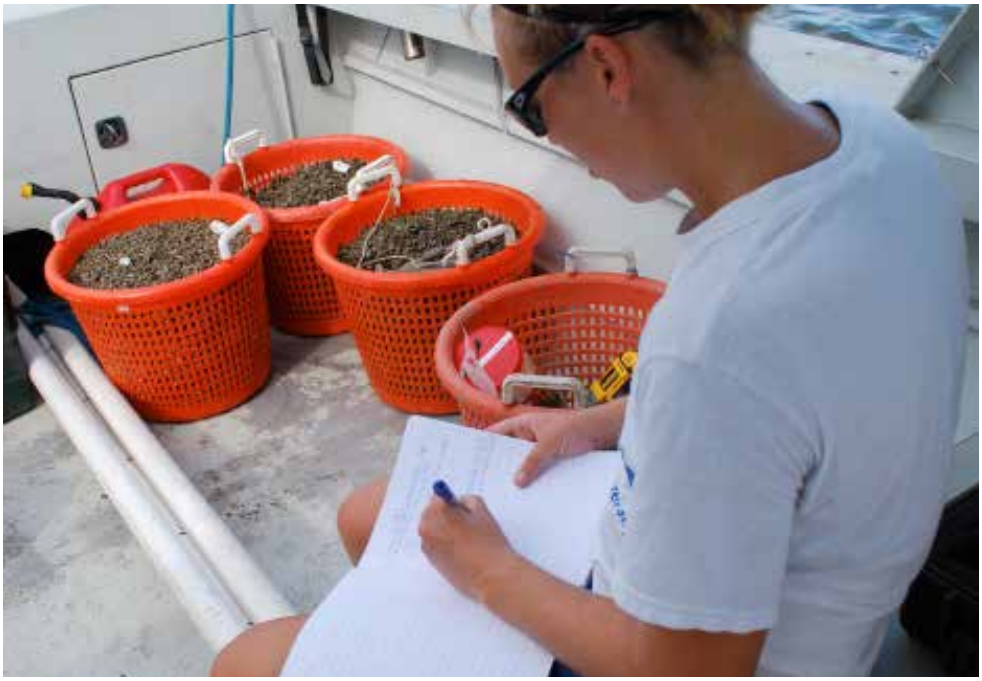
Strengthening and Supporting Enforcement Capabilities

Effective enforcement of oyster fishery regulations is essential to reducing illegal fishing activity, increasing resource conservation, increasing fishing safety, reducing health risks from consumption of illegally harvested oysters, improving compliance with the NSSP, and identifying habitual offenders, who should be removed from the fishery. Effective enforcement is a high cost operation, especially as state agencies must provide, in addition to their regular responsibilities, financial resources, logistics, and manpower to transport and accompany FDA staff on inspections related to patrolling for and enforcing NSSP requirements.

Options:

- Continue to strengthen enforcement operations, including requiring mandatory VMS.
- Request that the FDA provide a funding mechanism to cover the costs of their inspections related to FDA mandates. This could be similar to Joint Enforcement Agreements that already exist between the Louisiana and other federal agencies.

Future Research and Data Needs



SCIENCE TO SUPPORT MANAGEMENT

Throughout the development of this fishery management plan, LDWF has identified several research projects that would provide data to address some of the issues and data gaps in the fishery or species biology. For example, there is a general lack of scientifically based biological reference points from which to control harvest. The recent development of the shell budget model, as previously discussed, is a significant step in addressing issue. However, it could be strengthened with more accurate and up-to-date data. Additional data needs include information on larval transport, stock-recruitment relationships, oyster resources on private leases, and reef size/location in certain public oyster areas.

Specific research projects are listed below. Additional research needs are listed in VanderKooy (2012).

1. Assess all public oyster areas to determine reef location and areal extent. Water bottom assessments will provide much-needed reef acreage information from which stock size estimates can be calculated. This need is greatest in all of CSA 6, portions of CSA 1 North (portion of Mississippi Sound, Bay Boudreau, and Lake Eloi), and a portion of CSA 3 (Little Lake).
2. Estimate annual natural mortality and growth of oysters within differing salinity regimes. These estimates would be beneficial to the shell budget model.
3. Obtain additional water quality data throughout the public oyster seed grounds. Although many continuous data recorders are currently in operation, additional recorders are needed in many hydrologic basins to help better characterize water quality parameters such as salinity near oyster resources and to track changes in parameters over short- and long-term temporal scales.
4. Develop hydrologic and particle-tracking models to determine larval distribution and transport within and among hydrologic basins. This information would identify potential sources and sinks of oyster larvae and maximize the benefits of oyster restoration and enhancement activities, such as cultch planting and hatchery-raised oyster larvae/spat deployments.
5. Consider oyster dredge efficiency studies as a possible means to replace traditional quadrat sampling for annual oyster stock assessment with dredge sampling. Dredge

efficiency calculations can be coupled with dredge data to produce an abundance estimate comparable to that which would have been obtained via quadrat sampling.

6. Research potential for modifying existing sampling programs, such as:
    a. Dredge sampling: Explore using a volumetric sample (1 cubic foot samples) as opposed to a timed sample.
    b. Quadrat sampling: Explore randomly selecting a larger number of sample locations within reef areas as opposed to visiting fewer historic sample locations and collecting replicate samples.
7. Extrapolate data on bycatch from fishery independent dredge surveys to support existing anecdotal information on bycatch.
8. Support research to better understand the impacts of stressors associated with climate change (rising water temperatures and sea levels, ocean acidification, nutrient loads, etc.) on oyster production in the Gulf.
9. Promote research to improve knowledge of the socioeconomics impacts of commercial and recreational oyster fisheries to help maintain and/or enhance the socioeconomic benefits of the public oyster resource in Louisiana. Specific research projects include:
    a. Determine economic effects of targeted harvest closures
    b. Study the economic feasibility of alternative oyster production methods
    c. Investigate the costs and benefits of using public oyster areas as a source of seed and transplant oysters
    d. Determine costs and benefits of cultch planting projects
    e. Assess the economic effects of seafood inspection practices
    f. Investigate the economic feasibility of post-harvest processing
    g. Evaluate the impact of imported oyster products on the market share of and market demand for Louisiana oysters
    h. Evaluate consumer attitudes toward oyster consumption including consumption-related health risks and preferences for raw and cooked oysters
    i. Develop social indicators to assess impacts of management actions on commercial oyster fishermen
    j. Determine the community structure of the oyster

Research Priorities, Funding, and Publication

LDWF prioritizes future research according to several factors, including whether or not it:

- Fits the agency's mission
- Can be adequately funded
- Can be reasonably expected to produce answers to specific management questions
- Can be reasonably undertaken without compromising other capabilities and efforts
- Has or will have the support of stakeholders
- Has or can engender cooperation with other researchers, managers, user groups, and/or the general public.

Research is typically funded through state license fees and federal, state, and private (nonvgovernmental organization) grants and programs; funding is allocated based on priority as described above.

LDWF analyzes all research and reports results in multiple formats, as appropriate. Ultimately, all information is publicly available (other than information linked to private enterprises, e.g. confidential landings data).

industry

k. Investigate the share of household income derived from commercial fishing among commercial oyster fishermen.

10. Assess effects of pollution on oysters including the effects of formation of hypoxic zones and harmful algal blooms associated with excessive nutrients and the effects of pharmaceuticals and microplastics on oyster reproduction.
11. Identify pollution sources impacting oyster reefs, specifically the nature and severity of pollution, relative impacts of point and nonpoint sources, and the feasibility of reduction, mitigation, and/or cleanup.
12. Improve estimates of oyster mortality from predation and methods to prevent oyster mortality from predation.

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Appendices

Appendix I.
2014 Oyster Stock Assessment Report

2014 Oyster Stock Assessment Report

of the Public Oyster Areas of Louisiana
Seed Grounds and Seed Reservations

Oyster Data Report Series No. 20
2014

September, 2014

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Statewide Overview - 2014 Oyster Stock Assessment

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 (see map on page xiii). Oyster management on these public grounds includes activities such as setting oyster seasons, monitoring harvest levels, and habitat enhancement (i.e. cultch planting, reef building) projects.

Typically, the oyster industry utilizes the public oyster grounds as a source of seed oysters (< 3") for transplant to private leases. The public grounds 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 typically 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 enhanced by the filter-feeding activities of oysters, and reefs can also play a role in stabilizing shorelines.

Louisiana Oyster Landings

Oysters have been a part of the Louisiana economy for many years and support a multi-million dollar industry. Louisiana regularly leads the nation in the production of oysters and accounted for an average of 34% of the nation's oyster landings over the 1997 – 2012 time period (Figure 1). After depressed oyster (*Crassostrea virginica)* landings in 2010 totaling under 7 million pounds, Louisiana harvested approximately 11.3 million pounds in 2013 (preliminary LDWF data), although harvest location within the state shifted to areas along the central and western coast. Among Gulf of Mexico states, Louisiana consistently ranks #1 in landings and accounted for nearly 55% of all oysters landed in the region in 2012[1].

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. In 2008, harvest levels significantly increased on the public grounds over 2007 levels and the public grounds produced approximately 47% of all oyster

[1] Finalized state-by-state landings for 2013 were not available from the National Marine Fisheries Service (NMFS) at the time of this publication, so data comparisons between Louisiana and other states were not possible.

landings for the calendar year. This reliance on the public grounds reversed during the 2009-2013 time period and preliminary harvest data showed that over 90% of all oysters landed in Louisiana came from private leases in 2013 (Figure 2).

Statewide Oyster Stock Assessment Overview

Methods

During the 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 (Figure 3). This biological evaluation includes using SCUBA to collect oyster samples from within a square meter frame from multiple locations (sample stations) in each public oyster ground. At each station, five replicate square-meter samples are collected and data is combined to produce average numbers of spat, seed, and sack oysters per station. Rather than using five square-meter samples at each of the newly constructed cultch plants (2012 & 2013), 20 random ¼ meter-square samples were collected. Spat are young oysters measuring one to 24 millimeters (mm) in length. Seed oysters measure 25 to 74 mm and sack (= market-size) measure 75 mm and above. The numbers of oysters per station is then multiplied by the associated reef acreage to obtain an estimate of the total oysters present on the reefs. Oyster mortality estimates are also generated by dividing the total number of recently dead animals by the total number of animals (both live and dead) collected. Sampling undertaken as part of the annual stock assessment 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). This stock size information is used to make recommendations to the Wildlife and Fisheries Commission for the setting of the oyster season.

A total of 106 sample stations were visited by LDWF biologists during the 2014 assessment and 620 individual samples were gathered. Information gathered from sampling is divided into the respective CSAs and data are presented by CSA. Coastal Study Area 1 South holds the most sample stations (33) while CSA 5 East holds the fewest (3). A higher density of sampling occurs in the Black Bay (CSA 1 South) and Sister Lake (CSA 5 West) areas due to their high level of oyster production in past years and increased historical importance to the oyster industry. During the 2014 assessment, six of the 106 stations were located on newly-constructed cultch plants.

Annual Stock Size

The statewide oyster stock size in 2014 increased over 2013 levels as approximately 1,881,114 (±439,117) barrels of oysters are available on the public oyster areas of Louisiana this year (Table 1). Although this stock size represents an approximate increase of 10% from 2013 levels, comparison of the two estimates shows no significant statistical difference. The 2014 statewide stock availability is heavily influenced by oyster stocks in the Mississippi Sound area (CSA 1), as well as Sabine Lake (CSA 7), but still remains well below the long-term mean of 3.37 million barrels (Figure 4)[2]. Despite stocks remaining below the long-term mean, 2014 represents the second consecutive year of increasing stock size. Statewide seed oyster

[2] Oyster stocks in Sabine Lake have only been assessed from 2010 to present, and are, therefore, only included in statewide totals since 2010.

availability remained nearly unchanged, showing a small 5.3% increase over 2013 levels, while market-size availability increased over 16% (Figure 5).

As indicated above, positive signs were noted in CSA 1-North where an approximate 31% increase in oyster stocks was estimated from biological sampling. This increase was driven largely by significant gains in market oyster stocks which rose 520% over 2013 levels to 153,520 (±72,683) barrels. The largest contributor to the market oyster increase is the 2011 Mississippi Sound (Round Island) cultch plant (291 acres). Reefs in this area continued to show strong production of seed oysters as well with over 438,000 barrels estimated during the 2014 stock assessment sampling (+2.8% over 2013 levels).

Table 1. Estimated Statewide oyster stock size on the public oyster areas of Louisiana. CSA denotes Coastal Study Area. Percentage columns (%) indicate percent of statewide total. Data in **barrels** and 1 barrel = 2 sacks.

CSA	Seed	Seed %	Sack	Sack %	Total	Total %
1N	438,016	42.5%	153,520	18.1%	591,536	31.4%
1S	29,442	2.9%	55,991	6.6%	85,433	4.5%
3	34,924	3.4%	1,783	0.2%	36,707	2.0%
5E	2,154	0.2%	255	0.0%	2,409	0.1%
5W	274,853	26.6%	36,835	4.3%	311,688	16.6%
7	252,009	24.4%	601,332	70.8%	853,341	45.4%
Total	***1,031,398***		***849,716***		***1,881,114***	

Oyster production on public grounds in CSA 1-South continue to exist far below long term averages as reefs were only sparsely populated with oysters again in 2014. While an uptick of approximately 201% in market-size oysters was encountered during 2014, the estimated stock size of this oyster size class was only 55,991 (±29,938) barrels. Seed stock in this area fell sharply by nearly 90% to 29,442 (±10,515) barrels. The largest contributor to the seed oyster decline was the Wreck station where over 100,000 barrels of seed were found during the 2013 assessment and zero were located in 2014.

Public oyster resource trends west of the Mississippi River in the Barataria-Terrebonne estuary are largely driven by oyster availability in two public oyster seed reservations – Hackberry Bay and Sister Lake. The Hackberry Bay Public Oyster Seed Reservation (CSA 3) in the Barataria basin showed significant differences in oyster stock levels in 2014 as seed increased over 111% to 34,924 (±13,490) barrels, yet market-size oysters decreased nearly 70% to 1,783 (±1,104) barrels. The increase in seed was driven by seed production on the 2012 and 2014 cultch plants that combined to hold over 31,000 barrels of the total seed stock estimated in the bay.

Oyster stocks in the Sister Lake Public Oyster Seed Reservation in 2014 rose significantly over levels estimated in 2013. Seed oysters increased to over 900% to 269,893 (±24,167) barrels while market-size oysters dropped slightly (-9%) to 33,563 (±4,921) barrels. The successful harvest season during October 2013 in Sister Lake may have played a role in the small decrease in market-oyster stocks as the commercial oyster industry harvested an estimated 86,804 sacks of oysters from the lake during the 10-day season. The large increase in seed oyster stocks was

driven by the 2012 cultch plant where approximately 95% of the seed oysters in Sister Lake were found.

Public oyster areas in CSA 7 (Calcasieu and Sabine Lakes) account of over 45% of the statewide oyster resource in 2014 (Table 1, Figure 6), and 2014 marks the sixth year in a row that this area holds the largest fraction of the overall oyster resource. Although Sabine Lake holds nearly three times as much oyster stock as Calcasieu Lake, Calcasieu oyster stocks increased during 2014 over 2013 levels. Market-size oyster stocks in Calcasieu Lake rose 11.6% to 94,308 (±21,933) barrels, while seed oysters increased over 300%. This was the first year since 2011 that live oysters were located in stock assessment samples from the east side of Calcasieu Lake.

2013-2014 Commercial Harvest Season

Estimated commercial harvest increased substantially during the 2013/2014 oyster season (Table 2) as compared to the previous season and was largely due to the successful oyster season in Sister Lake (CSA 5 West) where over 86,000 sacks of market oysters were harvested. An oyster relay was allowed by LDWF and the Louisiana Department of Health and Hospitals from a portion of the public oyster seed grounds in CSA 6 during April 2014. This relay resulted in the transplant of nearly 23,000 barrels of oysters from public reefs to private leases, accounting for 52% of the total seed harvest during the season. Harvest in Calcasieu Lake was again restricted to the west cove portion of the lake, yet harvesters were able to produce just over 40,000 sacks of market oysters during the 2013/2014 season (Table 2).

Table 2. Harvest estimates for the 2013/2014 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). Percentages indicate the change from the previous season. 1 barrel = 2 sacks.

CSA	Seed Oysters (barrels)	Market Oysters (sacks)	Total (barrels)
1 North	3,685	4,016	5,693
1 South	2,170	315	2,328
3	4,695	1,390	5,490
5 East	0	0	0
5 West	10,705	87,510	54,460
6	22,825	3,031	24,341
7	0	40,163	20,082
Total	***44,080 (+577%)***	***136,425 (+130%)***	***112,394 (+211%)***

Special Oyster Management Projects

LDWF biologists continue to participate in several important projects aimed at increasing oyster production on the public oyster seed grounds and reservations. Cultch planting is a reef rehabilitation method employed by LDWF since 1917 and one cultch plant was constructed since the 2013 stock assessment. Additionally, LDWF again partnered with the Louisiana Sea Grant oyster hatchery on Grand Isle to provide hatchery-raised oyster larvae and spat to specific areas on the public grounds. Additional projects include shell-budget modeling, monitoring of reef removal during commercial harvest, and investigating fouling and disarticulation rates of oyster shells.

Cultch Planting

One small cultch plant was constructed during the spring of 2014 in Hackberry Bay (CSA 3). This 30-acre site received approximately 3,760 cubic yards of limestone and biological sampling of the site during the 2014 oyster stock assessment indicated the presence of a successful spat set and the growth of some spat into the seed-oyster size category.

Hatchery-Raised Larvae and Spat

Oyster larvae and spat raised at the Louisiana Sea Grant bivalve hatchery on Grand Isle were again supplied to various public oyster areas as part of an extensive re-seeding effort in the late summer of 2013 and spring of 2014. The 2014 efforts largely centered on remote-setting of approximately 10.5 million oysters (spat-on-shell) onto four plots in Hackberry Bay utilizing oysters produced by the hatchery. Each plot consisted of an experimental plot with hatchery-raised spat-on-shell as well as an associated control plot of shell without spat. These, and subsequent plots planned for California Bay east of the Mississippi River, will be sampled for spat growth and survival at months 1, 2, 6, 12, and 18 post-deployment. The lessons learned from this project will be helpful in planning and preparation for an expansion of the remote-setting program at a larger facility in Buras, La in future years. Additionally, the hatchery produced over 180 million larvae during June and July 2014 and these larvae were released on the east side of Calcasieu Lake.

Recent Legislation

The 2014 regular legislative session included just one bill with a direct tie to oysters. House Bill 1046 was passed as Act 217 and clarified packaging and labeling requirements for oysters. The act requires that all oysters sold by weight, volume, or count be of market size and wholesome.

Conclusion and Acknowledgements

The following report includes both biological stock assessment and historical oyster landings data from each CSA in Louisiana, 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 field biologists of each CSA, both in gathering the samples and producing the report. Additionally (listed in alphabetical order), Harry Blanchet, Denise Kinsey, Brian Lezina, and Ty Lindsey 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 Patrick Banks at 225.765.2370 or pbanks@wlf.louisiana.gov.

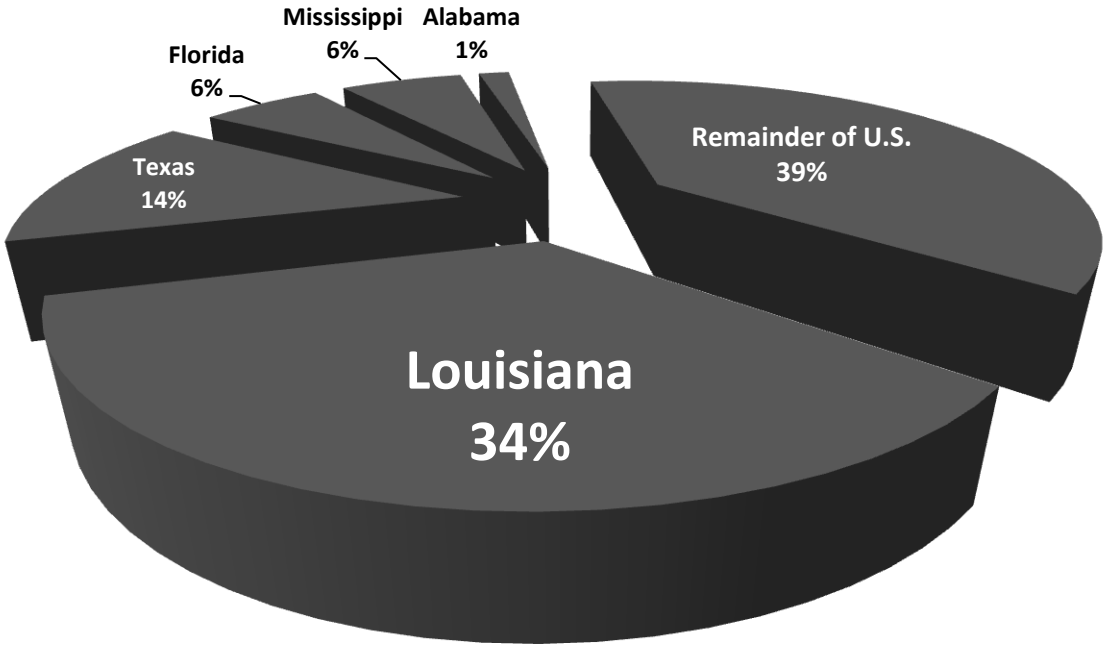


Figure 1. Percentage contribution to average annual landings of all oysters in the United States over the time period of 1997 through 2012. Data provided by National Marine Fisheries Service (NMFS).

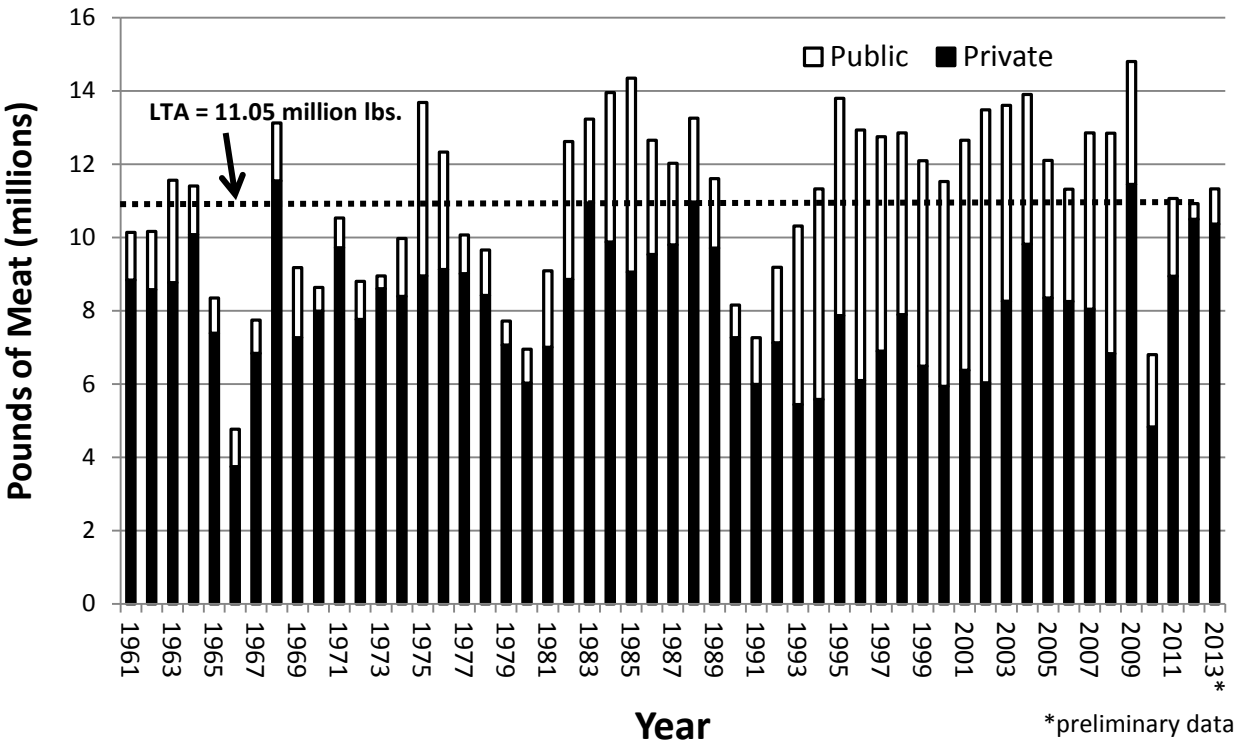


Figure 2. Historical Louisiana oyster landings for the public oyster areas and the private oyster leases (LDWF and NMFS data). 2013 harvest from private leases accounted for approximately 92% of that year's total.

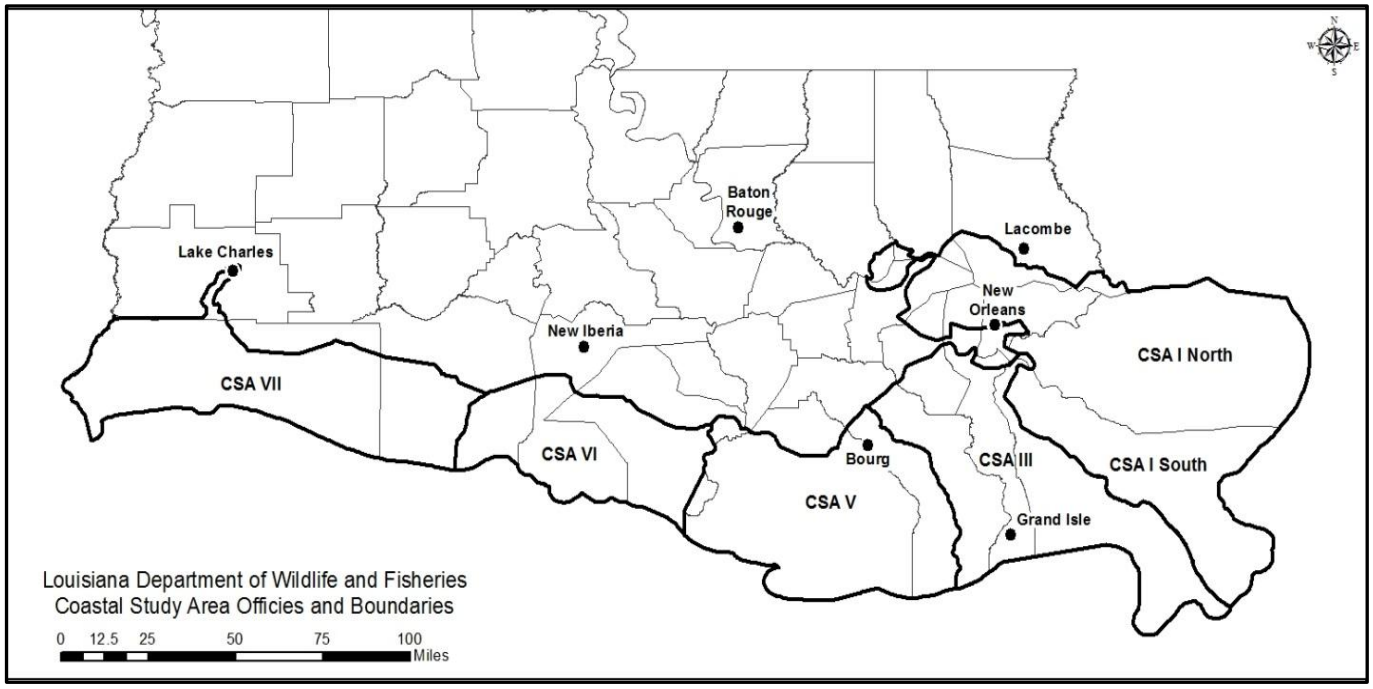


Figure 3. Map of LDWF Fisheries Division Coastal Study Areas (CSAs).

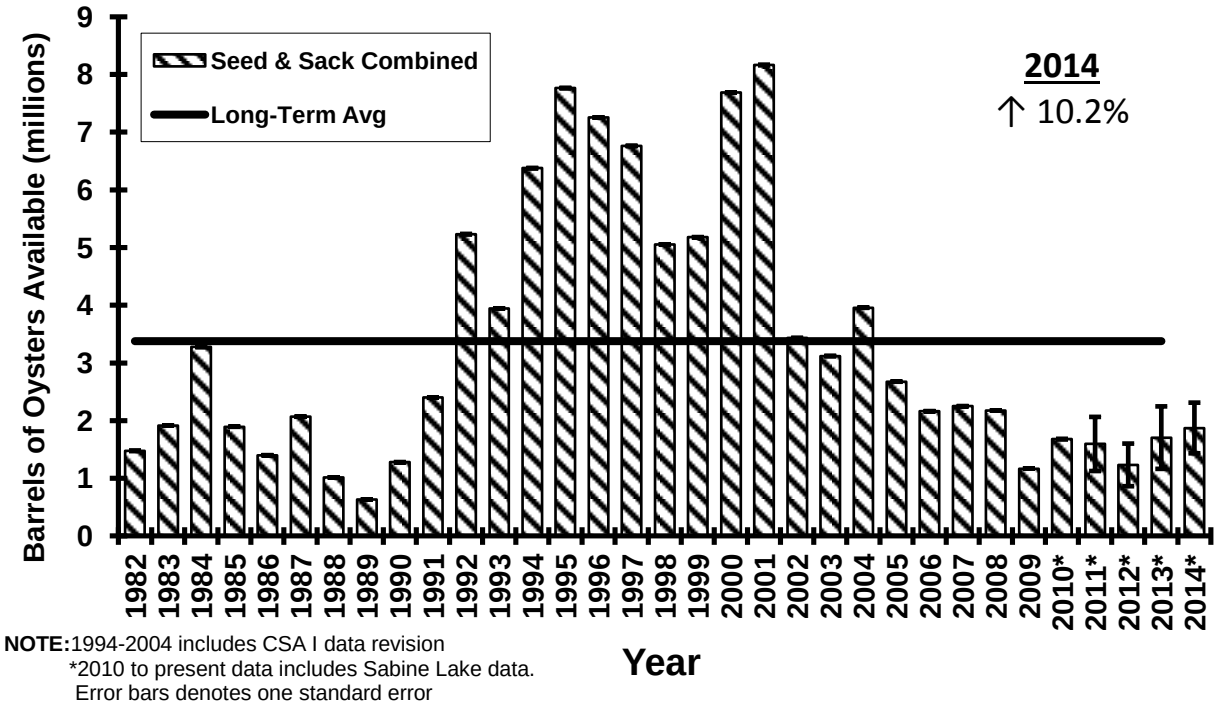


Figure 4. Historical estimated oyster stock size on the public oyster areas of Louisiana. 1994 through 2004 data includes CSA 1N data revision. LTA denotes the long-term average of 1982 - 2013.

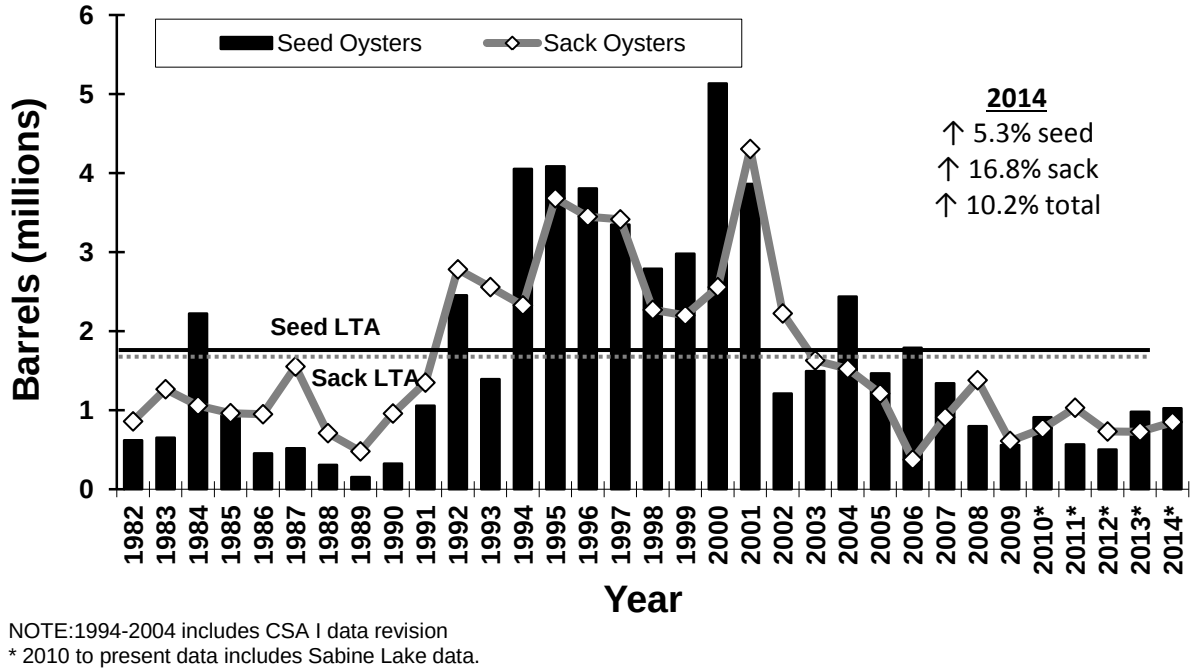


Figure 5. Historical Louisiana oyster stock size on the public oyster areas. LTA denotes the long-term average of 1982 - 2013.

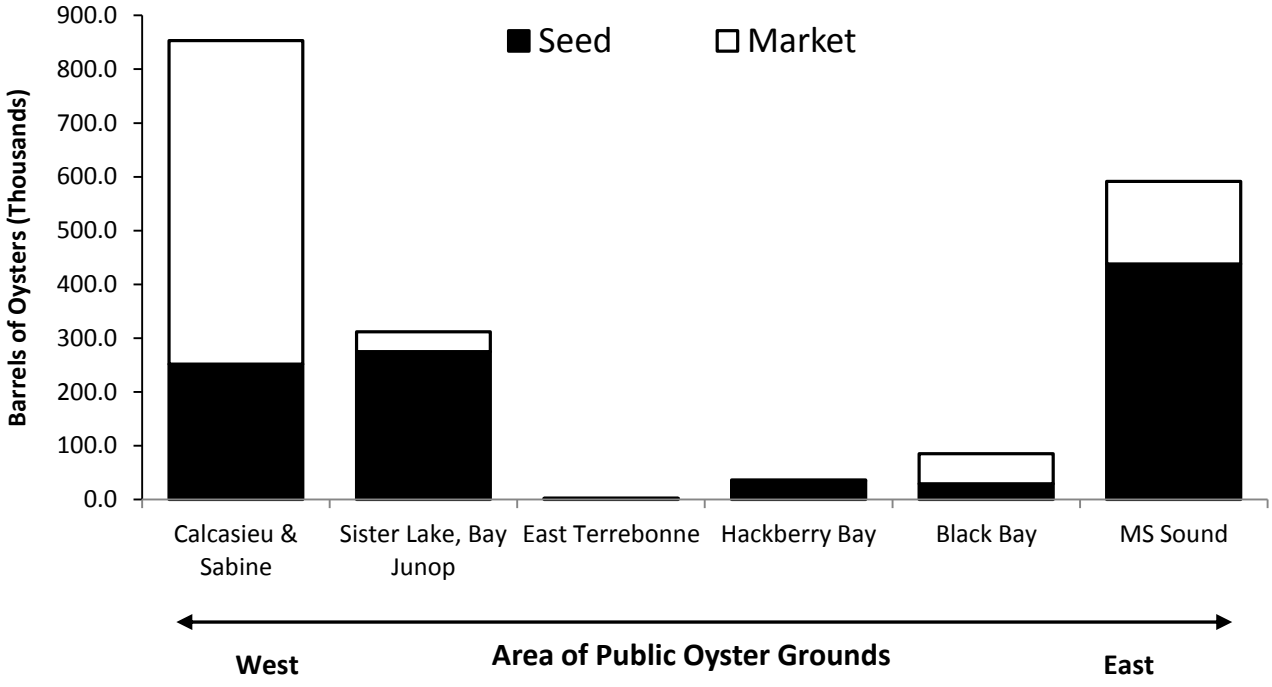
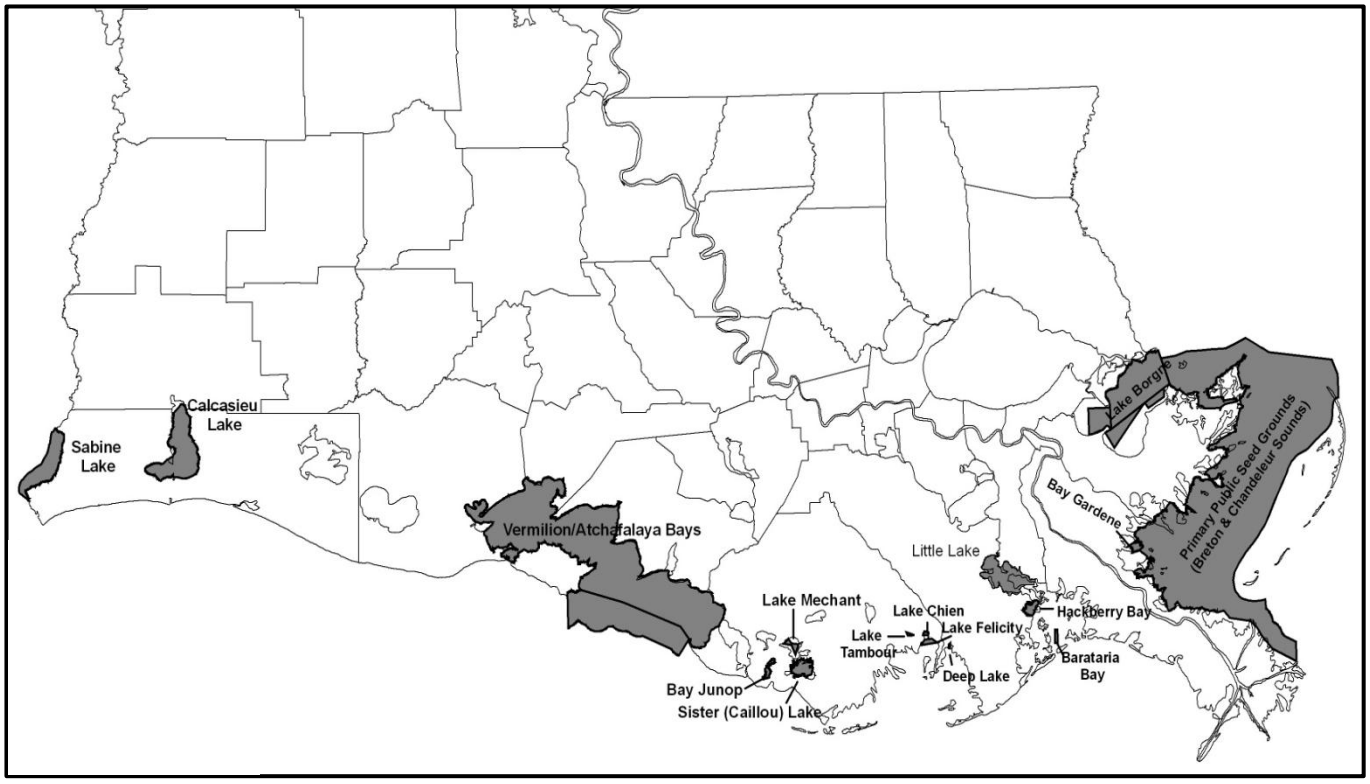


Figure 6. Statewide distribution of oyster stocks in the public oyster areas of Louisiana in 2014.

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

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North Pontchartrain Basin (CSA1N) – 2014 Oyster Stock Assessment

Introduction

The Public Oyster Seed Grounds (POSG) in the North Pontchartrain Basin consist of approximately 690,000 water bottom acres located within Lake Borgne, the Louisiana portion of Mississippi Sound, Chandeleur Sound and adjacent waters. These oyster areas are harvested by Louisiana, Mississippi and Texas fisherman, and have historically been areas of high oyster production within the state of Louisiana. Although managed as public oyster seed grounds by the State for many decades before, the majority of this area was not designated as such by Louisiana Wildlife and Fisheries Commission rule until 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. Most recently cultch plants were completed in Three-Mile Bay (Shell Point) in 2009, Mississippi Sound (Round Island) in 2011, Three-Mile Pass in 2013, and Drum Bay in 2013.

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 this Basin.

Methods

Data for this Oyster Stock Assessment (OSA) was collected between July 01 and July 16, 2014. Divers removed by hand all live and dead oysters, as well as any surficial cultch material from within a one square-meter frame placed directly on the water bottom. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. Cultch material types collected were identified and weighed. A total of 17 stations were sampled with five square-meter replicates taken at each station (Figure 1.1). 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. Likewise, data was collected at the 2011 cultch plant site in Mississippi Sound (Round Island), with the only difference in methodology being that divers used a frame measuring one-quarter (¼) meter square. The 2013 Early Restoration cultch plant sites, Three-Mile Pass and Drum Bay, were sampled with twenty ¼ meter square replicates. The resulting numbers from these dive samples were adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized (sack) 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.

As stated in the previous paragraph, the average density of oyster resource per reef system was multiplied by the total area of the reef system to find the total estimated oyster resource. The amount of assessed reef acreage in years preceding the 2013 Oyster Stock Assessment was estimated at 20,442.48 water bottom acres, based upon water bottom surveys completed in the mid-1970's. In an effort to better locate and assess the oyster resource in the Public Oyster Seed Grounds, a number of side-scan sonar studies of water bottoms in these areas were conducted in recent years. These side-

scan studies coupled with historic reef and cultch plant information resulted in a more up-to-date and realistic designation of productive water bottoms for use in the annual Oyster Stock Assessment (Table 1.1).

Table 1.1. Comparison of historical and current reef complex acreages

Change in Reef Acreages			
Station Name	**Station Number**	**Historical Reef Acreage**	**Current Reef Acreage**
Grassy Island	3005	6559.17	5327.98
Halfmoon Island	3010		
Petit Island	3009		
Grand Banks	3044		
Millenium	3011	70	
Three Mile Bay	3008	3058.65	3058.65
East Karako Bay	3040		
West Karako Bay	3041		
Grand Pass	3007	1801.76	5410.97
Cabbage	3006		
Turkey Bayou	3004		
Martin Island	3046	4155.7	3183.26
Holmes Island	3045		
Johnson Bayou	3051	200	200
Drum Bay	3049	1596	1596
Morgan Harbor	3050	2954	2954
Shell Point	3052	47.2	47.2
Round Island	3056	Not Assessed	291
Drum Bay Cultch (2013)		Not Assessed	200
Three Mile Pass Cultch (2013)		Not Assessed	158
	Total	**20,442.48**	**22,427.06**

This 2014 Oyster Stock Assessment, as well as the previous year's assessment, is based on the updated reef assessment of 22,427.06 water bottom acres, which includes 649 acres of recent cultch plants. As those cultch plants are sampled by a slightly different method and are likely distinctly different from surrounding, existing reef in terms of oyster productivity, the cultch plant acreages are assessed separately and not as part of the surrounding reef complex. It is noted beginning with the 2013 Oyster Stock Assessment, that the reef acreage for Millennium Reef, in western Mississippi Sound, was added to a reef complex that includes Grassy Island, Halfmoon Island, Petit Island and Grand Banks. Prior to 2013, Millenium Reef's 70 acres had been assessed as a separate reef since its construction in 2000. Side-scan sonar studies revealed that the majority of this reef fell within the Halfmoon Island reef complex and biological sampling indicated that it was no longer distinctively different from surrounding reef acreage. It is also noted that only those productive Public Oyster Seed Grounds for which an accurate acreage can be determined are included in the Oyster Stock

Assessment. For this reason some areas are not included is this assessment due to a lack of reef acreage information, such as those Public Seed Grounds located within Lake Borgne.

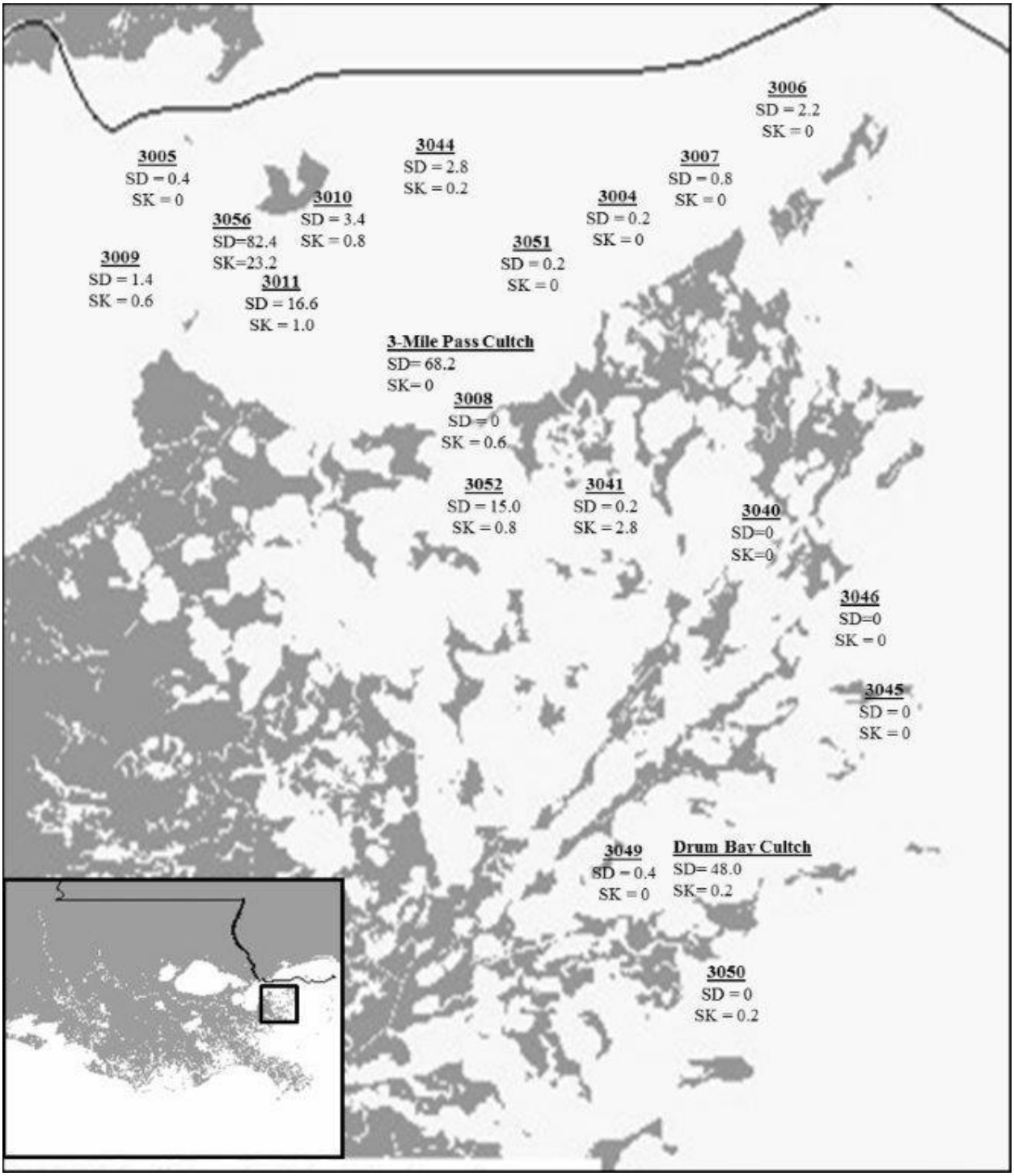

Figure 1.1. Map showing North Pontchartrain Basin oyster stock assessment stations. Numbers below stations are average numbers of seed (SD) and sack (SK) oysters per m^2.

Results and Discussion

Seed and Sack Stock

The current stock size is estimated at 438,016 barrels (bbls) of seed-size oysters and 153,520 bbls of market-size (sack) oysters, for a total of 591,536 bbls of overall stock (Figure 1.2). Compared to 2013, there was a 2.8% increase in the seed-size estimate and a 520.2% increase in the sack-size estimate. This year's assessed seed stock is up 39.7% over the previous ten years' average, while assessed sack stock is down 30.6% from the previous ten years' average. This year's sack stock estimate is, however, the highest recorded since 2009. Total assessed oyster stock for 2014 is up 31.3% from 2013, and is 10.6% above the previous ten years' average. It is important to note that this year's stock estimate is largely driven by the oyster densities observed on the Round Island cultch plant in Mississippi Sound, which accounted for an estimated 75,892 bbls (49%) of sack oysters, and an estimated 134, 774 bbls (31%) of seed oysters. Stock size estimated for the Three-Mile Pass cultch plant in Mississippi Sound is 60,566 bbls of seed oysters. Stock size estimated for the cultch plant in Drum Bay is 53,958 bbls of seed oysters and 450 bbls of sack oysters. Oyster density and abundance were not evenly distributed among areas (Table 1.2). The highest density estimates of seed stock were found at the three recently established cultch plants. Aside from these, Millenium Reef and Shell Point showed the highest seed oyster densities among harvested reefs. The highest density estimates of sack oysters were found at the Round Island, West Karako, and Millenium sites. Highest overall abundances of seed and sack oysters combined were at Round Island and the Halfmoon Island reef complex including Grassy Island, Halfmoon Island, Petit Island, Grand Banks and Millenium Reef (Figure 1.1, Table 1.2).

Table 1.2. Mean densities of oysters collected at each station.

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 Island	3005	5328.0	0.4	0	147,338	31,145
Halfmoon Island	3010		3.4	0.8		
Petit Island	3009		1.4	0.6		
Grand Banks	3044		2.8	0.2		
Millennium Reef	3011		16.6	1.0		
Three-Mile Bay	3008	3058.7	0	0.6	1,146	38,968
West Karako Bay	3041		0.2	2.8		
East Karako Bay	3040		0	0		
Grand Pass	3007	5411.0	0.8	0	32,441	0
Cabbage Reef	3006		2.2	0		
Turkey Bayou	3004		0.2	0		
Martin Island	3046	3183.3	0	0	0	0
Holmes Island	3045		0	0		
Shell Point	3052	47.2	15.0	0.8	3,979	424
Johnson Bayou	3051	200.0	0.2	0	225	0
Drum Bay	3049	1596.0	0.4	0	3,588	0
Morgan Harbor	3050	2954.0	0	0.2	0	6,641
Round Island	3056	291.0	82.4	23.2	134,774	75,892
Drum Bay Cultch		200.0	48.0	0.2	53,958	450
Three-Mile Pass Cultch		158.0	68.2	0	60,566	0
2014 Total					**438,016**	**153,520**

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 between annual assessments can be dramatic on an individual reef basis and often only limited areas of large resource availability are identified.

Over the past ten years, the Pontchartrain Basin has experienced heavy localized harvest, high mortality events, strong tropical events such as Hurricanes Katrina in 2005 and Isaac in 2012, the 2010 Deepwater Horizon oil spill and related spill response activities and continual limits to recruitment that appear to have severely reduced market-size abundances. As a result, the estimated sack oyster stock continues to be well below the previous ten years' average (Figure 1.2). There is, however, marked increase in the 2014 assessed sack stock coming behind three years of increases in seed oyster availability. These seed stock increases have been primarily due to the abundance of seed oysters on the 2011 Round Island and the 2013 Three-Mile Pass and Drum Bay cultch plants.

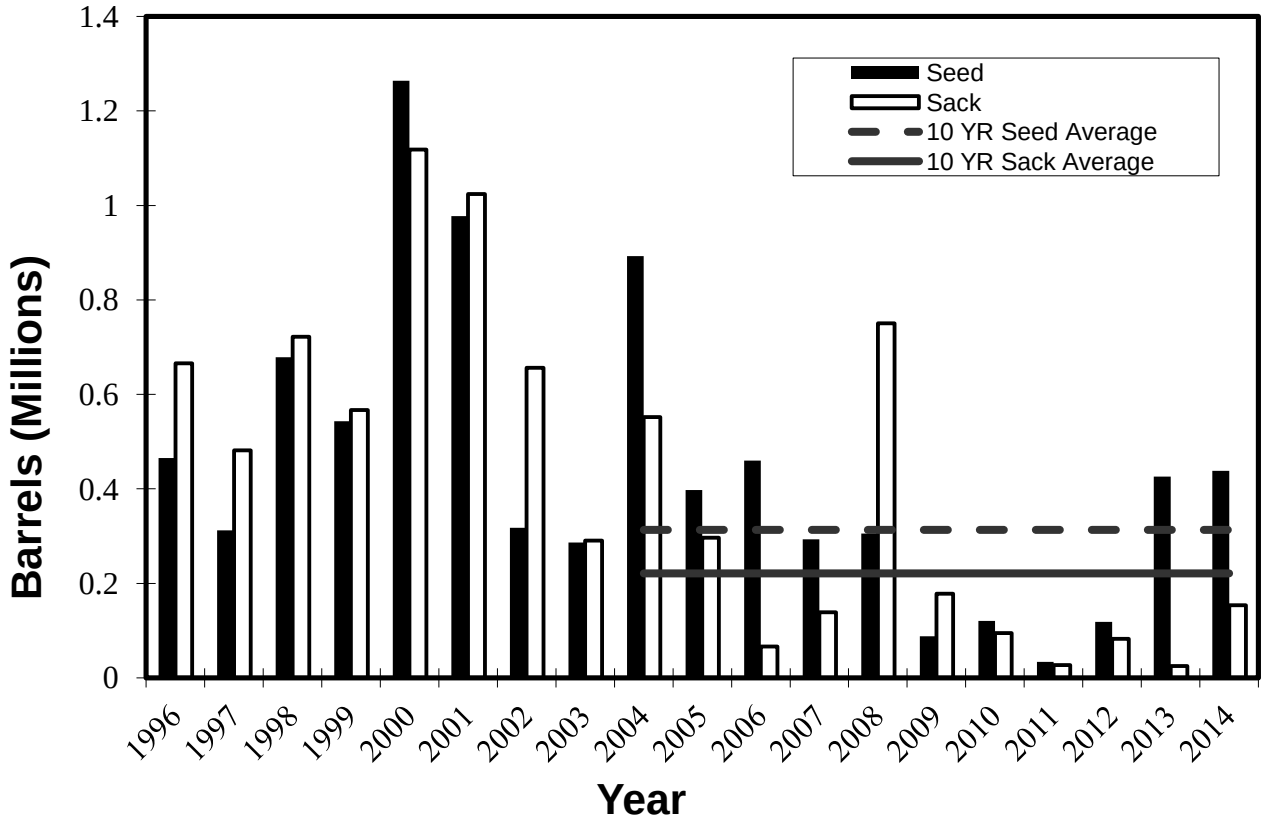

Figure 1.2. Current and historical Stock Assessment (seed and sack oysters) values. Horizontal lines represent the previous ten-years' seed and sack averages.

Spat Production

Live spat were observed at 8 of the 20 sites sampled during this assessment. At these sites, mean densities ranged from 0.2 to 3.8 individuals per m^2 with the maximum value occurring at the Three-Mile Pass cultch plant. Occurrence of spat oysters was once again down substantially from the previous year's assessment. Overall, spat densities were low with the exception of Millenium Reef, Cabbage Reef and the Three-Mile Pass cultch plant. Based on previous years' data, annual square-meter samples may occur between seasonal spawning events in some areas. It is important to note that spat numbers are biased by the amount of substrate collected in a given sample. However, this continues an observed lack of spat set over several of the reef areas during the spring spawning events.

Fouling Organisms

The hooked mussel, *Ischadium recurvum*, a sessile bivalve that is often times associated with oyster reefs and likely competes with oysters for food and settlement surfaces were observed at 9 of the 20 sample stations. The highest densities of mussels were 14.0/m^2 at Petit Island and 5.8/m^2 at the Three-Mile Pass cultch plant. (Table 1.3) Higher mussel densities were generally restricted to southern and western Mississippi Sound. Additional fouling organisms, such as Spionid polychaetes' mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and other small hydroids found during the previous two year's stock assessments, were not observed at this time on reefs in the northern Pontchartrain Basin.

Table 1.3. Mean density of the hooked mussel, *Ischadium recurvum*, and the southern oyster drill, *Stramonita haemastoma*, at each station.

Station	*I. recurvum* density/(m^2)	*S. haemastoma* density/(m^2)
Grassy Island	0	0
Petit Island	14.0	0
Halfmoon Island	5	0
Grand Banks	0	0
Millenium Reef	0	0
Three-Mile Bay	1.2	0
East Karako Bay	0	0
West Karako Bay	0	0
Grand Pass	0	0
Turkey Bayou	1.8	0
Cabbage Reef	0	0
Johnson Bayou	0.2	0
Shell Point	4.2	0
Drum Bay	0	0
Morgan Harbor	0	0
Martin Island	0	0
Holmes Island	0	0
Round Island	3.2	0
Drum Bay Cultch	0.2	0
3-Mile Pass Cultch	5.8	0

Oyster Predators and Disease

The southern oyster drill (*Stramonita haemastoma*) is a predatory marine gastropod 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 oyster drills were collected during this year's sampling event, nor were any oyster drill egg casings observed. No stone crabs, *Menippe adinia*, or blue crabs, *Callinectes* spp., were collected in the square meter samples. Other Xanthid crabs were noted in the samples that contained shell for substrate.

Dermo, *Perkinsus marinus*, a protozoan parasite that infects live oyster tissue, is known to cause extensive oyster mortalities especially under high salinity and water temperature conditions. Oyster tissue samples to be tested for presence of this parasite were collected at two sites in North Pontchartrain Basin, Cabbage Reef and Three-Mile Bay. Results of the Dermo tests are presented in another section of this report.

Mortality

Mortality estimates are highly variable between size classes and stations during this sampling event (Table 1.4).

Table 1.4. Mean recent oyster mortality estimates from North Pontchartrain Basin m^2 sample stations; N/A = no live or dead oysters were collected for mortality estimates.

Station	Spat Mortality (%)	Seed Mortality (%)	Sack Mortality (%)
Grassy Island	N/A	0	N/A
Petit Island	N/A	0	0
Halfmoon Island	N/A	0	0
Grand Banks	0	0	0
Millennium Reef	0	0	0
Three-Mile Bay	N/A	100	0
West Karako Bay	N/A	0	0
East Karako Bay	N/A	N/A	N/A
Shell Point	0	2.6	0
Johnson Bayou	N/A	0	N/A
Turkey Bayou	100	87.5	N/A
Cabbage Reef	20	26.7	N/A
Grand Pass	0	20	N/A
Drum Bay	N/A	0	N/A
Morgan Harbor	N/A	N/A	0
Martin Island	N/A	N/A	N/A
Holmes Island	N/A	N/A	N/A
Round Island	0	0.7	0
Drum Bay Cultch	0	0.4	N/A
3-Mile Pass Cultch	0	0	N/A

Spat mortalities show a marked decrease compared to last year, with observations made at only two sample sites. Turkey Bayou and Cabbage Reef had spat mortality percentages of 100% and 20% respectively. Seed mortalities were observed at seven of the 20 sampled reefs, which was an increase from last year's assessment. Three-Mile Bay had a seed mortality of 100% and Turkey Bayou had a seed mortality of 87.5%. Seed mortalities at other locations ranged from 0.4-26.7%. There was no sack mortality observed in the assessment sampling. It is important to take into consideration that these mortality estimates are often based on an extremely small number of animals. For many of these areas, assessment samples were taken after apparently large mortality events that have either subsided or have severely depleted abundances.

Cumulative Impacts and Mortalities

This section will focus on greater detail concerning environmental conditions observed, as well as direct impacts that have occurred since the previous stock assessment in 2013. It is important to note that many of the topics listed below are correlated with one another, i.e. freshwater inputs-salinity stratification-hypoxia.

Deepwater Horizon Oil Spill and Related Response Actions
The 2010 *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

Tropical and Climatic Events
There were no significant tropical systems impacting the public oyster seed grounds in the Pontchartrain Basin during this assessment period. The area has experienced monthly rainfall amounts well above the average for the months of February through June of 2014.

The Pearl River system provided a large volume of fresh water into the western Mississippi Sound during the months of February through June 2014. This event depressed the salinities on the reef systems in the Mississippi Sound. The salinities at Grassy Island and Petit Island were consistently less than 5 parts per thousand (ppt) for the months of March through July 2014 (Figure 1.3).

Freshets
The Pearl River system had a much higher than normal discharge rate in the winter and spring months of 2014. The POSG in western Mississippi Sound are impacted by this higher discharge rate. This is evidenced by salinities being recorded as low as 1.4ppt at Grassy Island and 2.2ppt at Petit Island during the month of May. These two reefs experienced salinities below 5ppt for the months of March through July 2014. Although these values are discrete measurements, similar low salinity values were also collected by non-related observations, as well as data derived from continuous salinity recorders within the area.

While freshets often provide benefits to the reef system, either by reducing disease or predation, or by enhancing cultch opportunities via the empty shells of recently dead oysters, there are often other cumulative impacts that may affect recovery from any one event. The impacts and subsequent recovery are also modified by not only the magnitude of a freshet, but perhaps also by the duration and timing.

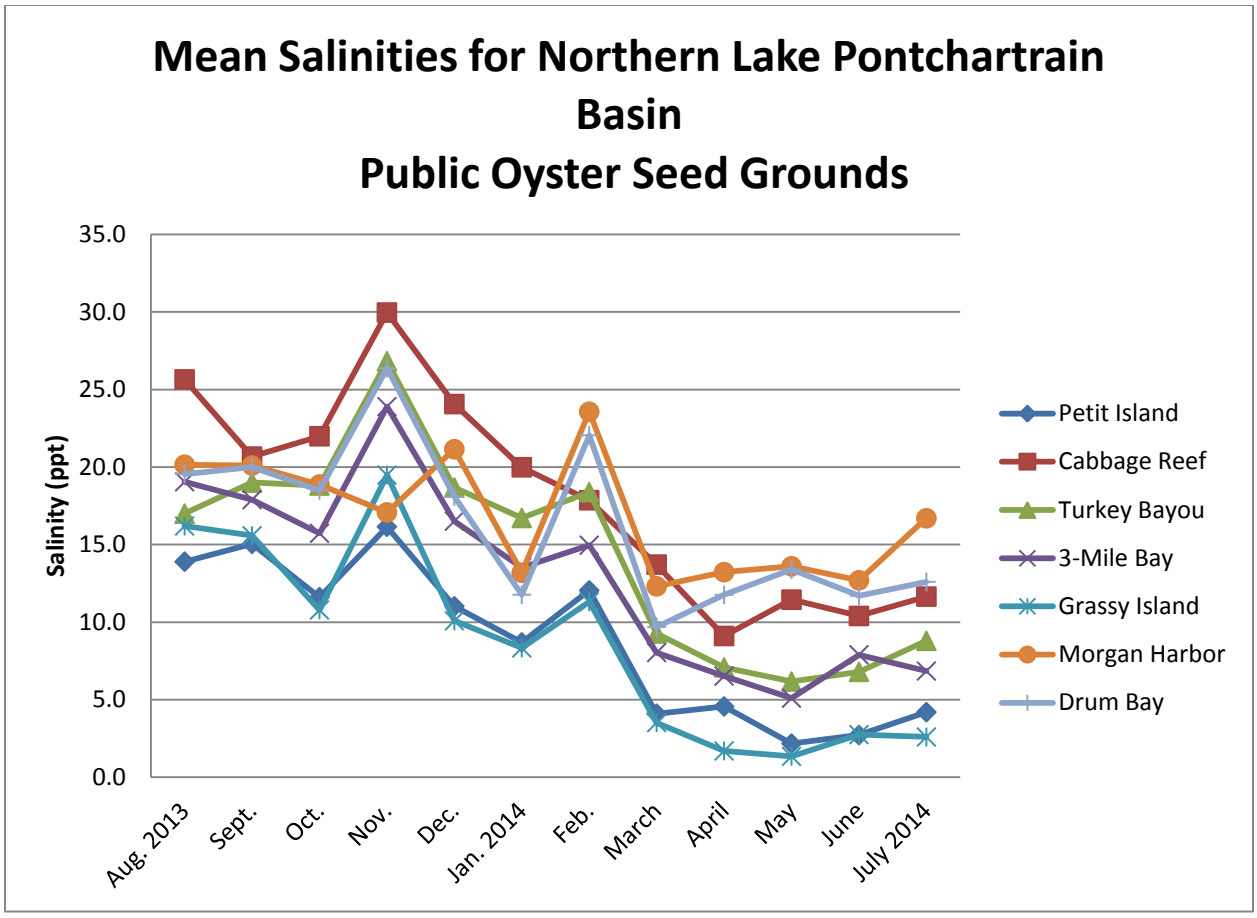

Figure 1.3. Salinities for the Northern Lake Pontchartrain Basin Public Oyster Seed Grounds since 2013 Assessment. Data presented are from discrete measurements on each reef.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area, hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per liter (mg/L). As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary, the most common driver of hypoxia over reef systems is the stratification of the water column due to density differences in water masses. These density differences are oftentimes driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column. This is common in areas that have experienced high fresh water inputs, especially after the return of higher salinity waters once fresh water inputs subside. In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to hypoxia, although localized. Some instances of hypoxia are "usual" in most areas, but prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality. At the time of the 2014 assessment, there was no hypoxia detected on North Pontchartrain Basin reef systems and no major hypoxic event was documented to have impacted oysters on the public grounds during the months preceding stock assessment sampling.

Sedimentation/Subsidence
Sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2014 assessment, divers noted on many reefs, especially in the Mississippi Sound and Three-Mile Bay areas (with the exception of the 2013 cultch plant in Mississippi Sound), that much of the cultch had a covering of silt or was completely buried. Both of these conditions can limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation process.

Cultch Condition
Any successful spat set is dependent upon clean, stable cultch for larval attachment. Aside from recent cultch plants, the condition of the cultch and live oyster shell within the North Pontchartrain Basin continually appears to be poor. As noted above, many areas are buried or covered with a layer of silt. On some reefs, the addition of shell has become so infrequent that the cultch on hand is being transformed into small "hash" particles that may not provide optimal substrate for larval attachment.

2013/2014 Oyster Season Summary
Several tools are used by research personnel to estimate harvest and associated activities by the commercial oyster industry during the harvest season.

Harvest estimates are obtained by monitoring the users and by 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. This data is obtained weekly during the oyster season and is used to estimate harvest in a particular reef complex. Harvest data is also obtained via the trip ticket system in place for this fishery. However, trip ticket data is consolidated by geographic region and is considered preliminary until well after the season concludes, and provides a limited resolution.

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

The season within the North Pontchartrain Basin oyster seed grounds opened on October 15, 2013 and closed on April 30, 2014. During this time period, the total harvest estimates for the grounds, as determined by harvest surveys (boarding reports) were 3,685 barrels of seed-sized oysters and 4,016 sacks of market-sized oysters for a combined total of 5,693 barrels of oysters. This represents a 32.4% increase over the 2012/2013 harvest of 4,300 bbls. When 2013/2014 harvest estimates within stock-assessed areas are compared with the 2013 stock assessments, there was an estimated utilization of 0.9% of the seed resource, 8.1% of the sack resource, and 1.3% utilization overall. In a general spatial context, this harvest was variable throughout the Basin (Table 1.5). The largest fraction of observed seed harvest was from Shell Point, as 23.5% of the total seed harvest occurred on this reef. The

largest fraction of market-sized resource was observed to be harvested from Three-Mile Bay, which accounted for 34.7% of the combined harvested market-sized oyster resource.

Harvest amounts as well as observed vessels were not constant over time. Seed oyster harvest was most prominent during the first week of the season with an estimated 1,235 barrels harvested. The majority of market oyster harvest was during the months of December through February with 3,713 sacks collected within that period.

Table 1.5. Harvest estimates from the 2013/2014 public season within CSA1.

Station	Seed-size (bbls)	Market-size (sacks)
Grassy Island	0	0
Halfmoon Island	0	0
Petit Island	0	0
Lake Borgne	850	62
Millennium Reef	0	0
Grand Banks	0	0
Three-Mile Bay	760	1394
Turkey Bayou	0	0
Johnson Bayou	0	125
Grand Pass	0	0
Cabbage Reef	10	0
West Karako	600	1203
East Karako	600	275
Drum Bay	0	0
Morgan Harbor	0	779
Bay Eloi	0	0
Shell Point	865	178
Total	**3,685**	**4,016**

It is notable that although some harvest was observed within the northeastern part of Lake Borgne, the southern and western areas of the lake continue to show no viable resource. There was no public harvest observed in those areas during the 2013/2014 season.

While obtaining fishery dependent data, LDWF biologists routinely collect random samples of oyster seed loads from vessels working on the public grounds to determine the percent of cultch (non-living reef material) being harvested. Eleven such samples were collected from fourteen vessels observed collecting seed oysters from the West Karako, Three-Mile Bay, Shell Point and Lake Borgne seed grounds. The percentage of cultch material in five samples taken from Shell Point ranged from 28.1-59.5%. Three samples from Lake Borgne yielded non-living cultch material percentages ranging from 36.4-68.3%. The percentages of cultch material in two samples from Three-Mile Bay were calculated to be 54.2% and 2.5%. A single sample from West Karako was found to be 67.1% non-living cultch material. Excessive cultch removal from public reef systems by bedding vessels continues to be a major concern within the Pontchartrain Basin.

South Pontchartrain Basin (CSA 1S) - 2014 Oyster Stock Assessment

Introduction

The public oyster seed grounds in the South Pontchartrain Basin (formerly Coastal Study Area 2) consist of approximately 300,000 water bottom acres located from the Mississippi River Gulf Outlet (MRGO) southward to South Pass in the Mississippi River delta, and eastward from the eastern extent of private leases east of the Mississippi River to the Breton National Wildlife Refuge. These seed grounds include Bay Gardene Public Oyster Seed Reservation, as well as areas designated as "sack harvest only" in Lake Fortuna, Lake Machias, and Bay Long. Historically, this area has provided seed- and market-sized oysters for oyster fishermen from Louisiana, Mississippi and Texas. Hydrology in the area is influenced at high Mississippi River stages by discharge through gaps in the Mississippi River levee south of Pointe a la Hache, such as the Bohemia spillway and Mardi Gras Pass; discharge from the Caernarvon and Bayou Lamoque fresh water diversion structures; and main-stem river distributaries in the southern portion of the Basin.

The Department of Wildlife and Fisheries continually expands and enhances the public oyster reefs through the placement of cultch material (i.e. shell, limestone, crushed concrete) on suitable water bottoms. Numerous cultch plants have been constructed throughout this Basin since 1917, including sites in Bay Gardene and Black Bay. Most recently cultch plants were completed near Stone Island in 2009 and California Bay in 2011, as well as in Bay Crabe and Lake Fortuna in 2012 as part of the *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment (NRDA) Early Restoration - Louisiana Oyster Cultch Project.

Currently, this area is 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 this Basin.

Methods

Data was collected between July 01 and July 16, 2014. Divers removed by hand all live and dead oysters, as well as any surficial cultch material from within a one square-meter frame randomly placed on the water bottom. Live and dead oysters, spat, fouling organisms, and oyster predators were identified and enumerated. A total of 30 stations were sampled with five square-meter replicates taken at each station (Figure 2.1). 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. Likewise, data was collected at the 2011 California Bay cultch plant, with the only difference in methods being that divers used a frame measuring ¼ meter square. The NRDA Early Restoration cultch plants in Bay Crabe and Lake Fortuna were each sampled with twenty ¼ meter square replicates. The resulting numbers were adjusted into a barrel unit of measure where one barrel equals 720 seed-sized oysters or 360 market-sized (sack) 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.

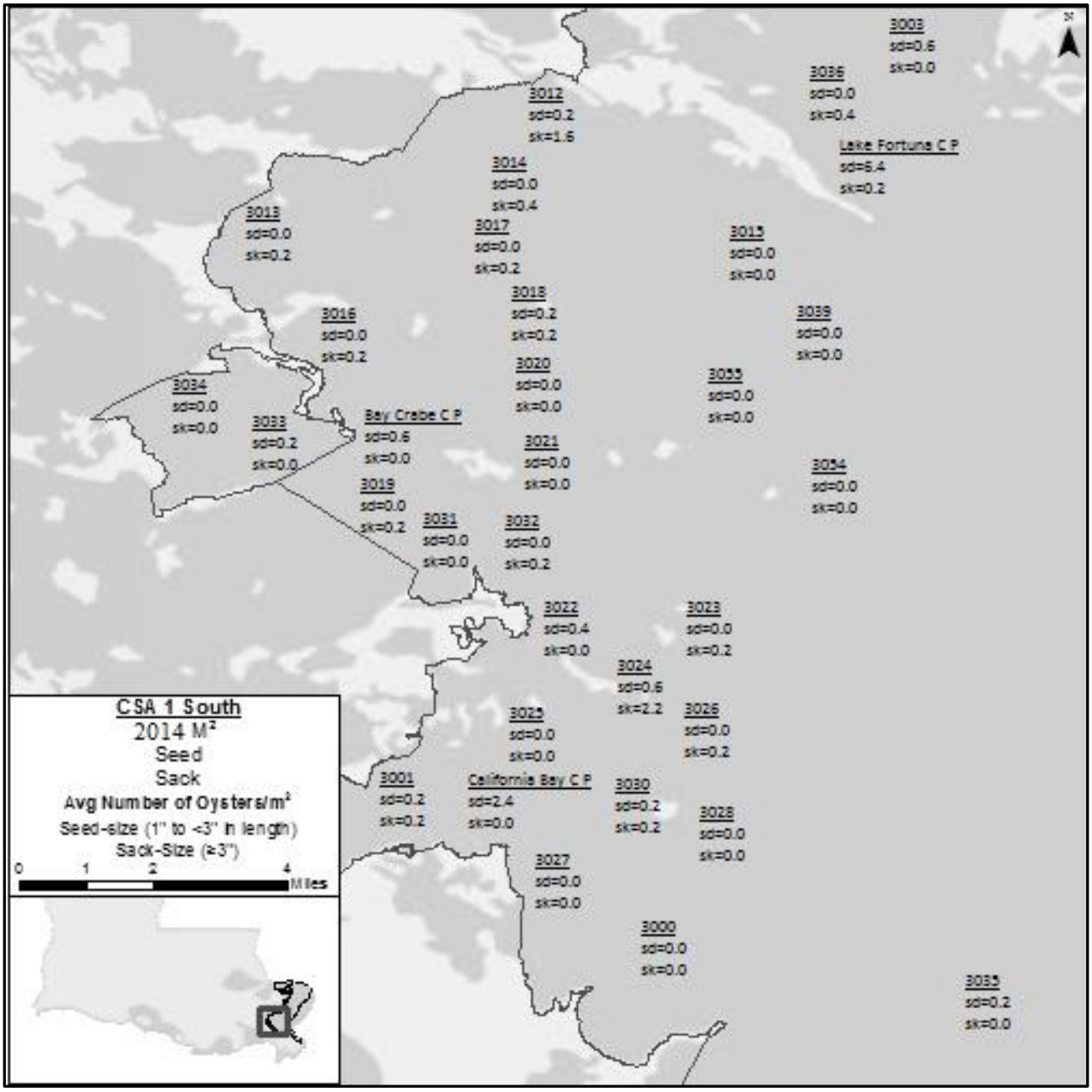

Figure 2.1. Map showing stock assessment sample stations within Coastal Study Area 1-South. Station numbers are in bold and data below indicate the average number of seed (SD) and sack (SK) oysters collected per sample at that station.

Prior to 2013, stock assessments for the South Pontchartrain Basin had been based upon an acreage value of 16,644 acres, as was determined by water bottom surveys completed in the mid-1970's. In an effort to better locate and assess the oyster resource in the public oyster seed grounds, a number of side-scan sonar studies of water bottoms in the South Pontchartrain Basin have been conducted in recent years. These side-scan studies coupled with historic reef and cultch plant information have resulted in a more up-to-date and realistic designation of productive water bottoms for use in the annual Oyster Stock Assessment (Table 2.1).

Table 2.1. Comparison of historical and current reef complex acreages

Complex Name	Station Name	Station Number	Old Number	Historic Acreage	Current Acreage
East Black Bay	Jessies Island	3013	2	59.00	
	Bayou Lost	3016	5	118.00	549.89
Bay Gardene	Bay Gardene	3034	24	69.00	
	East Bay Gardene	3033	23	28.00	1,262.64
Bay Crabe	West Bay Crabe	3019	8	501.00	
	Bay Crabe	3031	21	659.00	
	East Bay Crabe	3032	22	122.00	1,531.96
Elephant Pass	Elephant Pass	3022	11	339.00	202.21
California Bay	Sunrise Point	3027	16	174.00	
	California Bay	3025	14	7.00	
	West Pelican Island	3030	20	293.00	
	Bay Long	3001	17	572.00	3,392.78
Mangrove	Mangrove	3000	19	937.00	
	East Pelican	3028	18	782.00	2,889.11
South Black Bay	Stone Island	3020	9	461.00	
	South Black Bay	3021	10	145.00	
	Curfew Island	3023	12	425.00	
	North California Bay	3024	13	109.00	
	Telegraph Island	3026	15	127.00	3,575.74
Lonesome Island	Snake Island	3012	1	506.00	
	North Lonesome Island	3014	3	896.00	
	Lonesome Island	3017	6	716.00	
	Black Bay	3018	7	301.00	2,861.94
Lake Fortuna	Lake Fortuna South	3036	27	2,144.00	
	Lake Fortuna North	3003	30	2,144.00	3,453.85
Horseshoe Reef	North Black Bay	3015	4	157.50	
	Horseshoe Reef	3039	26	157.50	
	East Stone Island	3055	29	1,138.00	2,485.81
Wreck	Wreck	3054	28	1,138.00	4,485.79
Battledore Reef	Battledore Reef	3035	25	1,419.00	270.57
California Bay CP (2011)					300.00
Bay Crabe CP (2012)					200.00
Lake Fortuna CP (2012)					300.00
			Total	16,644.00	***27,762.29***

The 2014 Oyster Stock Assessment, as well as the previous year's assessment, is based on the updated reef acreage of 26,962.29 water bottom acres. This stock assessment further includes 800 acres of recent cultch plants bringing the total assessed acreage to 27,762.29. As those cultch plants are sampled by a slightly different method and are likely distinctly different from surrounding, existing reef in terms of oyster productivity, the cultch plant acreages are assessed separately and not as part of the surrounding reef system. Additionally, beginning with the 2013 Stock Assessment, oyster reefs within the South Pontchartrain Basin, each of which was previously represented by one of thirty square-meter sample stations, were grouped into reef complexes. The reefs placed within a reef complex were those closely related in regards to location, hydrology, oyster productivity, and response to environmental stressors. A total of twelve reef complexes were designated, each with 1 to 5 representative square-meter sample stations (Figure 2.2). An additional 1,524 acres of oyster habitat (reef and scattered shell) was identified by the recent water bottom assessments, but is not included in the annual stock assessment acreage, as it was felt that no current oyster sampling station adequately described this acreage.

Figure 2.2. Reef complex designations in Coastal Study Area 1-South based on recent water bottom assessments (side-scan sonar).

Results and Discussion

Seed and Sack Stock

The current stock size for the South Pontchartrain Basin is estimated at 29,442.36 barrels (bbls) of seed oysters and 55,991.08 bbls of market sized oysters for a total of 85,433.44 bbls of overall stock. These numbers are based upon assessed reef acreage of 27,762.29 water bottom acres, including 800 acres of recent cultch plants. Compared to 2013, there was an 89.57% decrease in the seed-size estimate and a 201.25% increase in the sack-size estimate. Overall abundance decreased 71.61% from last year's Oyster Stock Assessment. Overall oyster stock for the South Pontchartrain Basin is down 82.74% from the previous 10 years' average, and down 93.98% from the long term average of 1982-2013 (Figure 2.3). The seed oyster stock estimate is down 91.49% from the previous 10 years' average, and down 96.58% from the long term average. The 2014 sack stock estimate is 62.45% below the previous ten years' average, and 89.96% less than the long-term average.

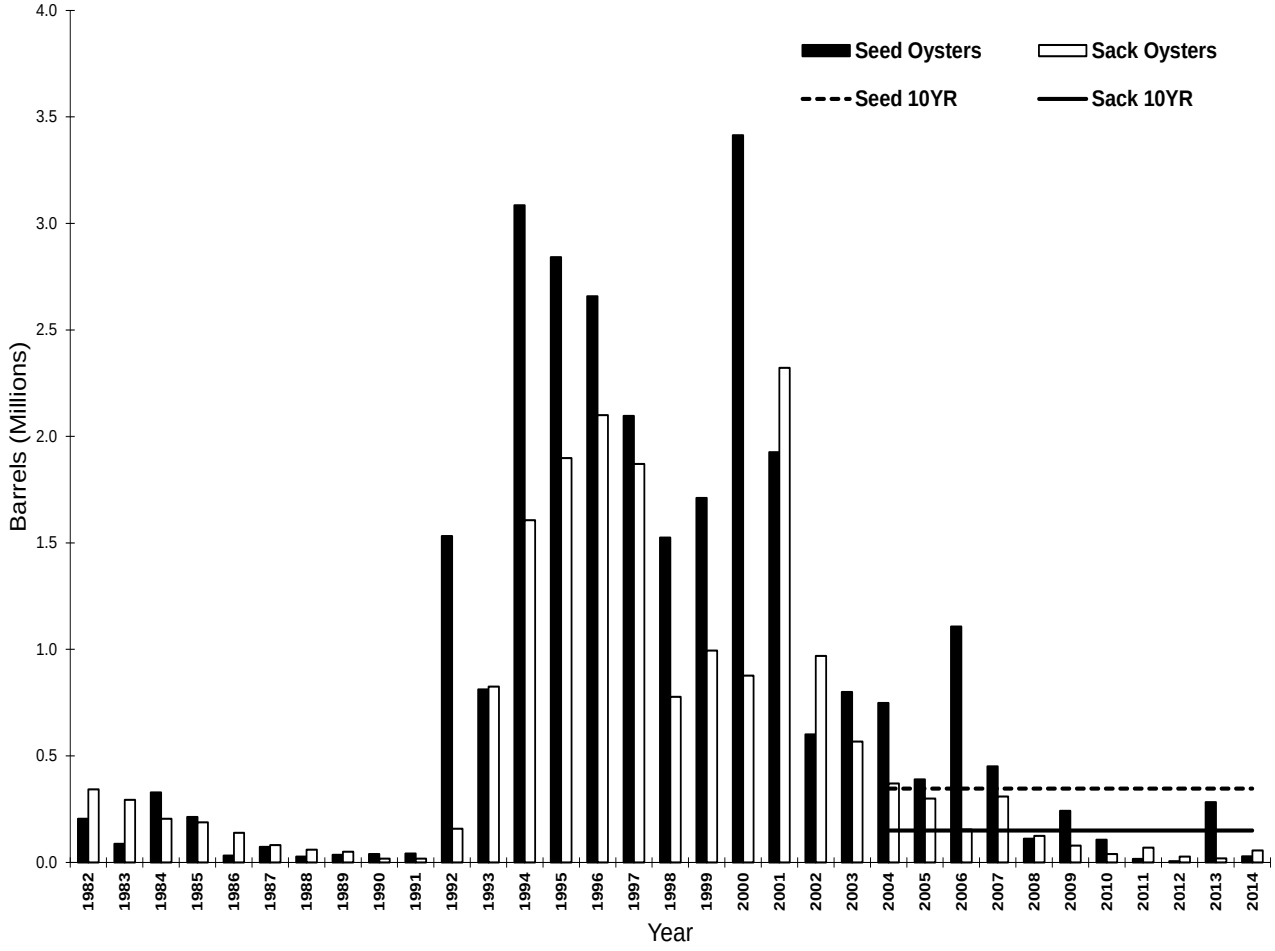

Figure 2.3. Current and historical stock assessment (seed and sack oysters) values.

Table 2.2. Mean densities of oysters collected at each station.

Station Name	Station Number	Mean densities			Barrels of seed oysters	Barrels of sack oysters
		spat	seed	sack		
Jessies Island	3013	0.2	0.0	0.2	0	1236.30
Bayou Lost	3016	0.0	0.0	0.2		
Bay Gardene	3034	0.0	0.0	0.0	1,419.37	0
East Bay Gardene	3033	0.0	0.4	0.0		
West Bay Crabe	3019	0.0	0.0	0.2	0	2,296.11
Bay Crabe	3031	0.0	0.0	0.0		
East Bay Crabe	3032	0.0	0.0	0.2		
Elephant Pass	3022	0.0	0.4	0.0	454.62	0
Sunrise Point	3027	0.0	0.0	0.0	1,906.97	3,813.93
California Bay	3025	0.0	0.0	0.0		
West Pelican Island	3030	0.0	0.2	0.2		
Bay Long	3001	0.0	0.2	0.2		
Mangrove	3000	0.0	0.0	0.0	0	0
East Pelican	3028	0.0	0.0	0.0		
Stone Island	3020	0.0	0.0	0.0	2,411.76	20,901.93
South Black Bay	3021	0.0	0.0	0.0		
Curfew Island	3023	0.0	0.0	0.2		
North California Bay	3024	0.0	0.6	2.2		
Telegraph Island	3026	0.0	0.0	0.2		
Snake Island	3012	1.4	0.2	1.6	1,608.60	19,303.18
North Lonesome Island	3014	0.0	0.0	0.4		
Lonesome Island	3017	0.0	0.0	0.2		
Black Bay	3018	0.0	0.2	0.2		
Lake Fortuna South	3036	0.0	0.0	0.4	5,823.87	7,765.16
Lake Fortuna North	3003	3.2	0.6	0.0		
North Black Bay	3015	0.0	0.0	0.0	0	0
Horseshoe Reef	3039	0.0	0.0	0.0		
East Stone Island	3055	0.0	0.0	0.0		
Wreck	3054	0.0	0.0	0.0	0	0
Battledore Reef	3035	0.4	0.2	0.0	304.16	0
California Bay CP (2011)		0.0	2.4	0.0	4,046.87	0
Bay Crabe CP (2012)		0.0	0.6	0.0	674.48	0
Lake Fortuna CP (2012)		1.2	6.4	0.8	10,791.66	674.48
2014 Total					**29,442.36**	**55,991.08**

Oyster density and abundance was not evenly distributed among areas (Figure 2.1, Table 2.2). The highest density estimates of seed stock were found at the three recently established cultch plants, where estimated seed stock ranged from 0.6/m^2 at the Bay Crabe cultch plant to 6.4/m^2 at the Lake Fortuna cultch plant. Among harvested reefs, North California Bay and North Lake Fortuna showed the highest seed oyster densities with an estimated 0.6 seed oysters per square-meter. Highest abundance of seed stock was observed within the Lake Fortuna reef complex, which includes the North and South Lake Fortuna sample sites, as well as the Lake Fortuna cultch plant. Nearly 60% of estimated available seed oyster stock was found to be in this area, which has historically been designated as sacking only and is not available for bedding. The highest average density of sack-sized oysters was located at the North California Bay and Snake Island sample sites. The highest total abundance of sack oysters was found at the South Black Bay Reef complex, which includes the Stone Island, South Black Bay, Curfew Island, Telegraph Island and North California Bay stations.

Spat Production

Live spat were observed at just 5 of the 33 stations sampled during this assessment. Spat densities observed during this Oyster Stock Assessment ranged from 0 to 3.2/m2. Although these assessment events may occur outside of the peak spawning period, it is evident that there has been only minimal spat catch on these reefs. This marks a continuation of poor spat catches within this Basin.

Mortality

Recent spat mortalities were observed at three sites during this assessment. Jessie's Island had a spat oyster mortality value of 80%, and Horseshoe Reef had 100% spat mortality with a single recent dead spat oyster observed. There was 14.3% recent mortality of spat oysters at the Lake Fortuna cultch plant. There was recent seed mortality observed at three of the 33 sample stations. Jessie's Island had 100% seed oyster mortality and Snake Island had seed oyster mortality of 50%. The Lake Fortuna cultch plant was observed to have 8.6% recent mortality of seed oysters. There was no recent sack-sized oyster mortality observed during this assessment.

Fouling Organisms

Hooked mussels (*Ischadium recurvum*) are a sessile bivalve that is oftentimes associated with oyster reefs and compete with oysters for food and settlement surfaces. During this assessment hooked mussels were present at 31 of the 33 stations sampled and ranged in density from 0.1 to 2,248.2 individuals / m^2 (Table 2.3). Overall, hooked mussel density has increased over the previous assessment with the largest increase in density observed at the West Pelican Island and North Lonesome Island sample sites. Increases in hooked mussel density were observed at twenty of the 33 stations. There were however notable large decreases in hooked mussel densities at Bay Gardene and Mangrove Point. Additionally, Spionid polychaete mud tubes,

ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and other small hydroids continue to be found on live oysters and the exposed shell in the assessment area, as was noted in the 2012 and 2013 Oyster Stock Assessments.

Table 2.3. Mean density of the hooked mussel, *Ischadium recurvum*, and the southern oyster drill, *Stramonita haemastoma*, at each m^2 station.

Complex Name	Station Name	Station Number	*I. recurvum* density/(m^2)	*S. haemastoma* density/(m^2)
East Black Bay	Jessies Island	3013	96.4	0
	Bayou Lost	3016	18.6	0
Bay Gardene	Bay Gardene	3034	36.6	0
	East Bay Gardene	3033	41.0	0
Bay Crabe	West Bay Crabe	3019	79.0	0
	Bay Crabe	3031	33.8	0
	East Bay Crabe	3032	293.0	0
Elephant Pass	Elephant Pass	3022	345.0	0
California Bay	Sunrise Point	3027	0.1	0
	California Bay	3025	16.4	0
	West Pelican Island	3030	2248.2	0
	Bay Long	3001	1098.8	0
Mangrove	Mangrove	3000	0	0
	East Pelican	3028	159.4	0
South Black Bay	Stone Island	3020	27.6	0
	South Black Bay	3021	69.0	0
	Curfew Island	3023	27.8	0
	North California Bay	3024	730.2	0
	Telegraph Island	3026	593.6	0
Lonesome Island	Snake Island	3012	384.2	0
	North Lonesome Island	3014	2051.0	0
	Lonesome Island	3017	523.0	0
	Black Bay	3018	438.0	0
Lake Fortuna	Lake Fortuna South	3036	20.2	0
	Lake Fortuna North	3003	4.4	0
Horseshoe Reef	North Black Bay	3015	43.0	0
	Horseshoe Reef	3039	15.2	0
	East Stone Island	3055	112.8	0
Wreck	Wreck	3054	47.2	0
Battledore Reef	Battledore Reef	3035	11.8	2.2
California Bay CP (2011)			0	0
Bay Crabe CP (2012)			319.6	0
Lake Fortuna CP (2012)			156.0	0

Oyster Predators/Disease

The southern oyster drill (*Stramonita haemastoma*) is a predatory marine gastropod 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. Snails and egg cases were found at only the Battledore Reef sample site. Recent extended periods of low salinity may have limited snail abundance in the area. Three stone crabs (*Mennipe adinia*), and no blue crabs (*Callinectes sapidus*) were observed in the samples.

Perkinsus marinus (= Dermo), a protozoan parasite that infects oyster tissue, is known to cause extensive oyster mortalities especially under high salinity and high water temperature conditions. Dermo samples were attempted at 7 stations throughout the area. Results of the Dermo tests are presented in another section of this report.

Tropical and Climatic Events

There were no significant tropical systems impacting the public oyster seed grounds in the Pontchartrain Basin during this assessment period. The area did experience monthly rainfall amounts well above the average for the months of February through June of 2014. Much of these elevated rainfall amounts were associated with the passages of cold fronts well into late spring.

The majority of the input of freshwater to the Basin was from discharge through fresh water diversion structures and through gaps in the levee south of Pointe a la Hache, as well as main-stem distributaries during high Mississippi River stages. Salinities across the entire Basin were consistently at or above 5 parts per thousand (ppt) throughout most of the assessment year (Figure 2.4). There was a notable decrease in salinity across most of the Basin between the months of March and June 2014. During this period, salinities at East Bay Gardene and East Bay Crabe fell to 5.3 and 6.6ppt respectively.

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

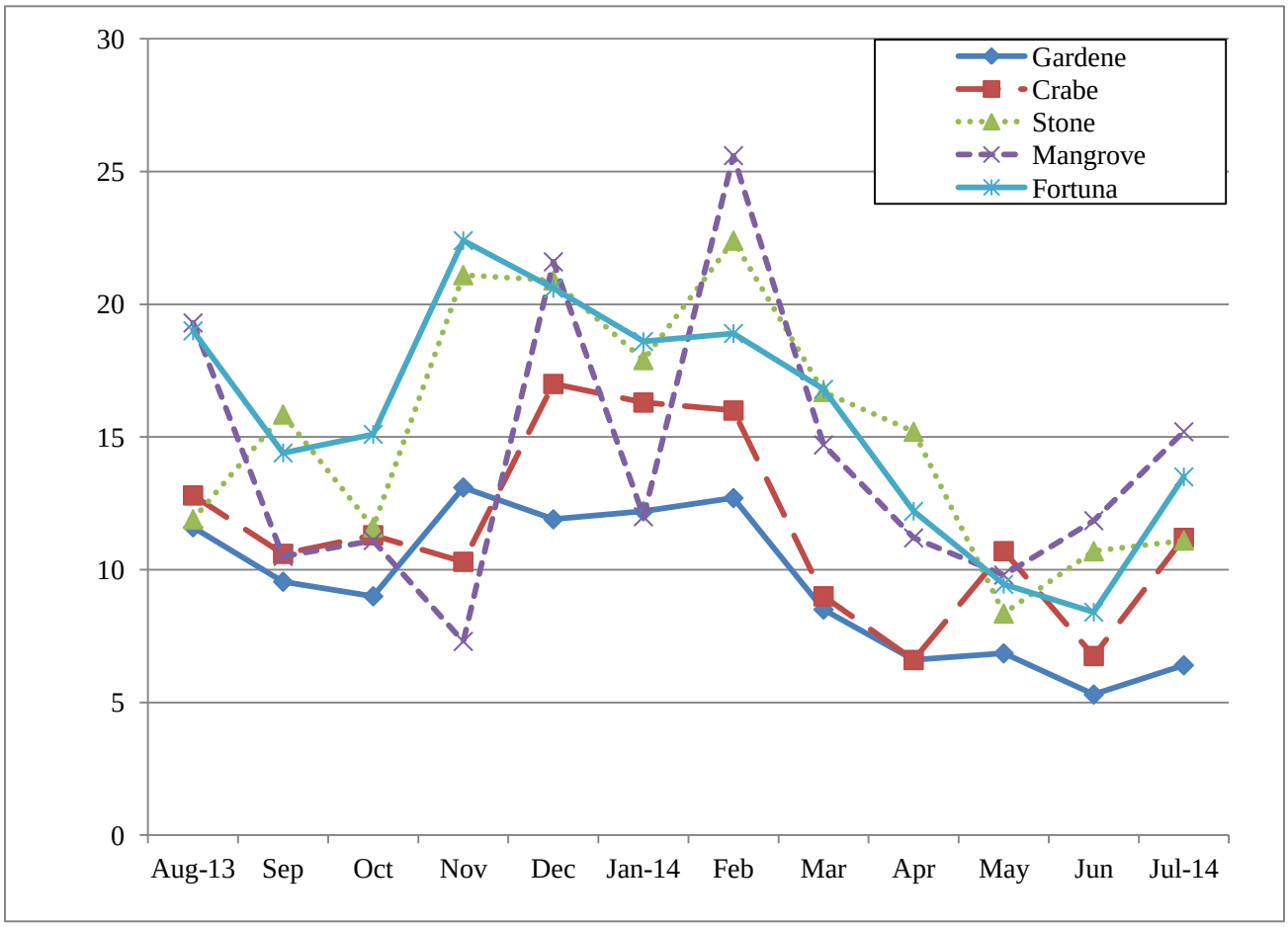

Figure 2.4. Salinities (ppt) for the South Pontchartrain Basin Public Oyster Seed Grounds since 2013 Assessment. Data presented are from discrete measurements on each reef during monthly oyster sampling events.

Hypoxia

The definition of hypoxia varies as it is based on the percent saturation of water by oxygen. This varies with temperature and amount of other solutes. For most environmental assessments in this area, hypoxia can be viewed as concentrations of dissolved oxygen below 3 milligrams per Liter (mg/L). As oysters are a sessile species, reef systems can often be impacted by hypoxia in an estuarine setting. Within the Pontchartrain Basin estuary, the most common driver of hypoxia over reef systems is the stratification of the water column due to density differences in water masses. These density differences are oftentimes driven by salinity and temperature. Basically, warmer, fresher water overrides denser salt water and does not allow the diffusion of oxygen throughout the water column. This is common in areas that have experienced high fresh water inputs, especially after the return of higher salinity waters once fresh water inputs subside. In other cases, in relatively confined areas, increases in biological oxygen demand can also lead to

hypoxia, although localized. Some instances of hypoxia are "usual" in most areas, but prolonged exposure can result in reduced growth, decreased disease resistance, or direct mortality. At the time of the 2014 assessment, reef complexes in the California Bay area were experiencing a period of hypoxia as was evidenced by dissolved oxygen measurements of 2.5 mg/L at Mangrove Point, 1.5 mg/L at Elephant Pass, 0.9 mg/L at North California Bay, and 0.6 mg/L at East Pelican Island. The remainder of the public grounds, by in large, has had adequate oxygen saturation during this assessment period (Figure 2.5).

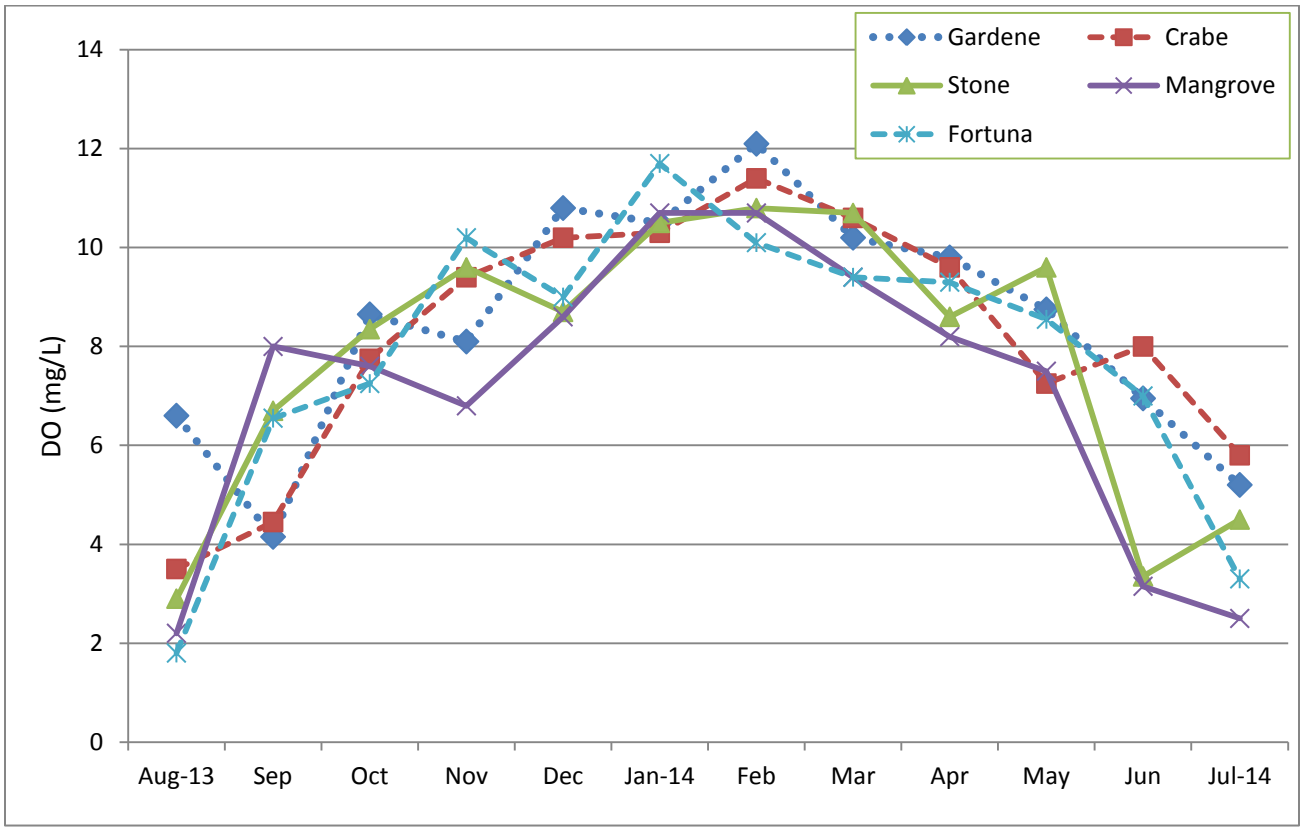

Figure 2.5 Dissolved oxygen levels for the South Pontchartrain Basin Public Oyster Seed Grounds since 2013 Assessment. Data presented are from discrete measurements on each reef.

Freshets

While freshets often provide benefits to the reef system, either by reducing disease or predation, or enhancing cultch opportunities via empty shells of recently-dead oysters, we must also realize that other variables are also operating at the same time. The impact/recovery are also modified by not only the magnitude of a freshet, but perhaps more important are the duration and timing. Specifically, this area experienced such an event over the assessment period occurring during, or very near, peak spring spawning times in the spring and early summer of 2014.

Sedimentation/Subsidence

Sedimentation can affect the reef either through direct mortality (burial) or through reduced growth and reproduction (both production and clean places for larval attachment). During the 2014 assessment, divers noted on several reefs that some of the cultch had a covering of silt and still others had buried cultch. Both of these conditions are known to limit the amount of suitable substrate available for larval settlement.

Subsidence of the reefs is usually balanced by reef accretion or growth. If no appreciable shell is added over a period of time, the reefs, especially those in less than optimal environments, will subside to the point of shell burial. The lowering of the reef profile also subjects associated organisms to more frequent hypoxia events as well as changing the local water flow and sedimentation processes.

Cultch Condition

Any successful spat set is dependent upon clean, stable cultch for larval attachment. The condition of the cultch and live oyster shell within the South Pontchartrain Basin currently appears to be poor. As noted above, many areas are buried or covered with a layer of silt. On some reefs within the Basin, the cultch is nearly completely covered by fouling organisms such as hooked mussels (*Ischadium recurvum*), Spionid polychaete mud tubes, ctenostome and fairy lace bryozoans, the tube dwelling amphipod, *Apocorophium*, and small hydroids, all of which can pose hindrance to larval oyster settlement. In other areas, the addition of shell to a reef has become so infrequent that the cultch on hand is being transformed into small "hash" particles that provide minimal substrate for larval attachment.

<u>2013/2014 Oyster Season Summary</u>

The 2013/2014 oyster season on the South Pontchartrain Basin public oyster seed grounds opened on October 15, 2013 and closed on April 30, 2014. The Bay Gardene seed reservation, as well as the recent cultch plants at California Bay, Bay Crabe and Lake Fortuna remained closed to harvest throughout the 2013/2014 oyster season.

Harvest Monitoring Methods

Harvest totals for the 2013/2014 season were estimated by obtaining fisheries dependent data from the monitoring of users. "Boarding Surveys" were conducted weekly during the season. LDWF 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 cultch (non-living reef material) are being removed from area reefs. Harvest data is also obtained via the trip ticket system in place for this fishery. However, this data is

consolidated by geographic region and is considered preliminary until well after the season concludes, and provide a limited spatial resolution.

Harvest Results and Discussion

Harvest totals for 2013/2014 were estimated at 315 sacks of market oysters and 2,170 barrels of seed oysters. When harvest estimates within stock-assessed areas are compared with the 2013 stock assessment, there was an estimated utilization of 0.8% of the sack resource and 0.8% of the seed resource. Harvest amounts as well as observed vessels were not constant over time. Sack harvest effort was primarily in the Black Bay area, with a majority of harvest effort observed in the Lonesome Island Reef Complex. Lesser amounts of sack harvest were recorded at Jessie's Island and Lake Fortuna. Seed harvest during this assessment period also occurred primarily in the Lonesome Island Complex and to a lesser extent in the South Black Bay Complex.

While obtaining fishery dependent data, LDWF biologists collected random samples of loads from vessels harvesting seed oysters on the public grounds to check the percent of cultch (non-living reef material) being harvested. Samples were collected from four of the seven vessels observed collecting seed oysters from during the 2013/2014 oyster season. Two samples from the Lonesome Island reef complex yielded 92.6% and 76.6% non-living cultch material. The percentages of cultch material in two samples taken from the South Black Bay reef complex were measured to be 83.5% and 87.6% non-living cultch material. This marks a continuation of excessive cultch removal from public reef systems by bedding vessels on a percentage basis, although total cultch removal during the 2013/2014 season was relatively low due to the low amount of overall harvest pressure. However, the loss of adequate cultch material continues to be a major concern for public seed grounds within the Pontchartrain Basin.

Coastal Study Area (CSA) 3 – 2014 Oyster Stock Assessment

Introduction

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 (POSG), 2) Hackberry Bay Public Oyster Seed Reservation (POSR), and 3) Barataria Bay Public Oyster Seed Grounds (POSG). 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. Historically, CSA 3 has 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 POSG, and the addition of newly constructed oyster reefs in Hackberry Bay.

Hackberry Bay (Jefferson/Lafourche Parishes) is a 4,402 acre mesohaline embayment with a primarily soft silt and clay bottom, of which 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 existing natural reef, while the upper and lower sites are over former cultch plants 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 including: crushed concrete, shucked shell, reef shell, clam shell, Kentucky limestone and Bahamian limestone totaling 145 acres. 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 POSR, production is highly dependent upon and reflective of when and where cultch plants are placed in the bay. It is unknown how much, if any, cultch material from the 1994 and earlier cultch plants remains exposed above the surface of the mud. Therefore, the acreage of these cultch plants is not factored into the annual oyster stock assessment.

Since 2004, five reef rehabilitation projects (cultch plants) have occurred in Hackberry Bay and one in Barataria Bay. In Hackberry Bay, two cultch plants were constructed in 2004 totaling 35 acres and one in 2008 totaling 50 acres. In 2004, a 40-acre cultch plant was constructed in the Barataria Bay Public Oyster Seed Ground.

In May 2012, utilizing funds from the *Deepwater Horizon* Oil Spill NRDA Early Restoration Louisiana Cultch Project, 26,086 cubic yards of limestone were placed on approximately 200 acres in the northwest portion of Hackberry Bay. Additionally, a 30-acre cultch plant was constructed in May 2014 in the northeastern portion of Hackberry Bay utilizing 3,572 cubic yards of limestone rock. These recent cultch plants have increased the estimated reef acreage on the Hackberry Bay POSR from 99.7 to 329.7 acres.

The Barataria Bay POSG was designated as a public oyster ground in response to possible changes in the salinity regime of the estuary stemming from the Davis Pond Freshwater Diversion project. Davis Pond is a 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 couldbe productive during years with high freshwater input. The only known existing reef in the Barataria Bay POSG is a 40-acre cultch plant constructed in 2004. The reef is comprised of 7,536 cubic yards of crushed concrete. The Barataria Bay cultch plant was constructed in between May 2004 and is located in the northeast section of the Barataria Bay POSG. It is vulnerable to predators such as oyster drills and the protozoan parasite *Perkinsus marinus* - (Dermo) during periods of higher salinities. Consistent production is not expected until salinity regimes in the basin change due to natural forces or coastal restoration efforts.

On February 1, 2007 the Wildlife and Fisheries Commission created the Little Lake POSG. Previously, this area had been utilized as a temporary natural reef area, 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 the Davis Pond diversion. The Davis Pond diversion has not been consistently utilized to its maximum capacity since it first opened in 2002, and environmental conditions during some years 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 location of the Little Lake POSG makes it vulnerable to depressed salinities from rainfall, inflow from the Intracoastal Waterway, and discharge from the Davis Pond freshwater diversion. Reduced salinities from increased freshwater input can have a negative impact on oyster survival and availability. However, when higher salinities exist, the Little Lake POSG has provided the oyster industry with additional seed and sack oysters in the Barataria basin.

Materials and Methods

Quantitative samples used in this assessment were collected by CSA 3 biologists on 1-10 July and on 14 August, 2014. Samples were obtained using a one square-meter (m^2) frame placed randomly on the bottom over reef at each sampling location. Using SCUBA, all live and dead oysters, as well as shell, in the upper portion (exposed) of the substrate were removed from the area within the frame. Live and dead oysters, fouling organisms, and oyster predators were identified and enumerated. All oysters were measured (mm) and placed into 5 millimeter work groups and further classified by size as spat (0-24mm), seed (25-74mm), and sack oyster (75mm and greater), then weighed in 10 gram increments. Seven stations were visited (Figure 3.1) with five replicate square meter samples taken at each location. The recent cultch plants in Hackberry Bay (2012 and 2014) were quantitatively sampled using replicate ¼ m^2 quadrats. Twenty random samples were collected on the 2012 cultch plant and five were collected on the 2014

cultch plant. The average of all replicates at each station was used, in combination with reef acreage, to estimate the current oyster availability for CSA 3.

The Little Lake POSG was not sampled due to a lack of available reef acreage information.

Results and Discussion

Seed and Sack Stock

Stock for the Hackberry Bay POSR, including the productive cultch plants, is estimated at 34,924 barrels (bbls) of seed size oysters and 1,783 bbls of market size oysters for a total of 36,707 bbls of overall stock. Seed were present at all stations, except for the 2004 Barataria Bay Cultch Plant. There was an overall 112% increase in seed availability from 2013. Seed availability is up 379% above the past 10 year average (34,924 vs. 7,285), and 137% above the long term average from 1976-2013 (34,924 vs. 14,722). Sack oysters were present at all stations with the exception of the Upper Hackberry Bay cultch plant, the 2014 Hackberry Bay cultch plant, and the Barataria Bay 2004 cultch plant. The Hackberry Bay 2012 cultch plant also had fewer sack oysters available compared to 2013 ($0.2/m^2$ vs. $0.8/m^2$) with Middle Hackberry Bay cultch plant having the highest density at $3/m^2$ (Figure 3.2). Including the Hackberry Bay 2012 and 2014 cultch plants, sack stock was down 47% from 2013, 5% below the past 10 year average of 3,309.4, and 60% below the long term average of 7,848 (1976-2013) (Table 3.1, Figure 3.3). Combined stock showed an overall 70% increase over 2013, and 259% above the 10 year average of 10,595, while also being 69% above the long term combined stock average (38,056 vs. 22,570). Some of the combined stock increase may be attributable to an increase in seed oysters at the Hackberry Bay 2012 Cultch Plant. There was an average density of 25.4 seed oysters per meter squared at the 2012 Cultch Plant; although there was a 75% decline in abundance of sack oysters versus 2013. The monthly average size of seed and sack oysters, from combined dredge and square meter samples, was 2.3 inches, ranging from 1.7 to 2.81 inches (Figure 3.4 and 3.5). The overall average size from July 2013 to July 2014 was 2.29 inches (Figure 3.5). No live seed or sack oysters were observed in the Barataria Bay (POSG) (Figure 3.1, Table 3.1). Market-size oyster availability has not been documented on the Barataria Bay (POSG) since it was created in 2004. The July 2014 monthly average catch-per-unit-effort (CPUE) for both seed and sack oysters, as well as combined total, was lower than July 2013 (Figure 3.6).

Spat Production

Unlike the total catch of 29 spat seen in 2013, there were 77 total spat collected in 2014. Despite the increase in spat during the 2014 sampling event, spat abundance was well below the long term average since 1976 of 9.1 spat/square meter (2014 = 2.48 spat/square meter). The highest numbers were found at the 2004 North Cultch Plant with 32 of the 77 total spat coming from that reef. One spat was collected on the Barataria Bay POSG in 2014. Since inception, the only stock assessments on the Barataria Bay POSG with a record of spat were in 2005 (8 spat per m^2), 2009 (53.5 spat per m^2), 2010 (5.2 spat per m^2), and 2013 (2.6 spat per m^2).

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 all sampling stations except in Barataria Bay POSG and the 2008 Cultch Plant. Highest densities were again observed at the Middle Hackberry Bay station (Table 3.2). The average number of hooked mussels observed in the Hackberry Bay POSR was 28.5/m^2, reduced from last year's average of 100/m^2. The Middle Hackberry Bay site accounted for most of the overall decrease with only 102 mussels per square meter in 2014 versus the 646 mussels per square meter in 2013. Monthly average salinities in Hackberry Bay were below the long term average (LTA) since November 2013 prior to square meter sampling (Figure 3.7). The average salinity for Hackberry Bay POSR in June 2014 was 8ppt. still below the long term average salinity for June of 10ppt.

Mortality

Recent spat mortality at each station on the Hackberry Bay POSR ranged from 0 to 33% with an overall average of 10.5%, slightly below the 11.2 % overall average in 2013. Recent seed oyster mortality at each station ranged from 0 to 10.6% averaging 4.3%. There was no recent mortality in sack-size oysters at 0% and a combined overall spat, and seed mortality of 5.0% (Table 3.2). No live or recently dead spat, seed, or market size oysters were observed on the Barataria Bay POSG.

Additional sources of oyster mortality data available since the 2013 oyster stock assessment are the monthly dredge samples. Dredge samples revealed an overall monthly mortality of 4.6% between July 2013 and June 2014 (Figure 3.8). This is similar to the 4.7% overall monthly mortality observed during the same period prior to the 2013 stock assessment sampling. No tropical systems have affected the study area since Hurricane Isaac in 2012.

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. During the 2013 stock assessment no snails were observed at any of the sampling stations. During sampling for the 2014 stock assessment only one oyster drill was sampled from the Barataria Bay POSG. Since 2009 only 19 oyster drills have been sampled during dredge and square meter sampling and most of those have come from the Barataria Bay POSG. Mortalities of oyster drills have been reported from Mississippi Sound when salinities fell below 8-10 parts per thousand (ppt), therefore, the absence of oyster drills from 2014 samples is most likely due to the low overall average salinities throughout the basin beginning in November of 2013 (Figure 3.9).

Tropical and Climatic Events

The United States Army Corps of Engineers (USACE) Tarbert gauge recorded Mississippi River discharge from January 2013 through June 2014 as below the long term average (1961-2010) of 665,000 cubic feet per second (cfs), and reaching a peak discharge for 2014 at 643,000 cfs in April. Discharge levels remained above the average in June at 582,000 cfs prior to our sampling effort in July 2014 (Figure 3.9).

The United States Geologic Survey (USGS) constant data recorder, located near the Davis Pond diversion structure, recorded a monthly average rise above the long term monthly average of 1831 cfs in January 2013. This coincided with the rise in discharge of the Mississippi River and reached 376,610 cfs on the Davis Pond gauge, but subsequently began to fall the next month. Average monthly discharge rates were below the long term average (2003 to 2010) from September 2013 through June 2014 (Figure 3.10).

Hackberry Bay POSR salinities from January 2013 to June 2014 averaged 9.2 parts per thousand (ppt) with a range of 4.3 to 13.6 ppt (Figures 3.7, 3.9, & 3.10). The average salinity for June 2014 was 8.8 ppt which remained slightly below the 1996 to 2012 June long term monthly average of 10 ppt. With the exception of the month of May 2014, monthly average salinities for Hackberry Bay POSR have been below the long term monthly average since November 2013. Salinities in the Barataria Bay POSG from January 2013 to June 2014 averaged 18.3 ppt with a range of 11.8 to 26.9 ppt (Figure 3.9 and 3.10). Salinities in the Little Lake POSG from January 2013 to June 2014 averaged 4.1 ppt with a range of 1.2 to 8.5 ppt (Figure 3.9 and 3.10).

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

2013/2014 Oyster Season Summary

The Little Lake POSG and Barataria Bay POSG opened on September 4th, 2013 and closed on April 30th, 2014. The opening of the 2013/2014 public seed/sack harvest season in the Hackberry Bay POSR occurred on October 15th, 2014 with the exception of the 2012 Cultch Plant in Hackberry Bay which remained closed to harvest. The Hackberry Bay seed grounds remained open for 5 days closing on October 20, 2014. Total harvest from public grounds in CSA 3 during the 2013-2014 season was estimated at 2,490 bbls of seed oysters from Little Lake POSG and 2,205 bbls of seed oysters from Hackberry Bay POSR. Hackberry Bay POSR seed harvest constituted a 13.4% utilization of the estimated available resource (as determined by

2013 stock assessment). There were 1,390 sacks of market oysters harvested, resulting in an 11.8% utilization of available market oysters (Figure 3.11). Using the Sustainable Oyster Shellstock (SOS) budget model for Hackberry Bay, the 2013-2014 harvest season should provide a theoretical sustainable harvest threshold of 675 barrels of seed. The 2,205 barrels of seed harvested was 327% of that threshold. The SOS model for Hackberry Bay also provided an estimated sustainable harvest threshold of 1,085 sacks of market oysters, and the 1,390 sacks harvested during the open season represented 128% of the model threshold. As harvest exceeded the model thresholds, it was expected that reef shell mass would be reduced during this year's stock assessment. This expectation held true as grams/m2 of cultch in Hackberry Bay was greatly reduced in 2014 as compared to 2013.

The removal of reef material from public reefs during seed-oyster harvest has long been a concern to LDWF biologists as the practice threatens the long-term sustainability of the oyster resource on the public grounds. To assess the amount of reef material being removed, LDWF biologists collected three random one-cubic foot samples from each harvest vessel, when available. In each sample, any material having live seed or sack oysters was separated from material without live oysters. Large clusters were culled. The percentage of cultch removed was calculated by dividing the weight of the material without seed or sack oysters by the total weight of the material contained in the cubic foot container. Data from the three samples were averaged to obtain a percent cultch estimate for each vessel.

Eleven vessels were boarded and samples taken to determine the percent of non living reef material removed from the reefs. The range of non-living reef material per vessel was 1.9 to 56%. The overall average of cultch removed per vessel was 27.4%.

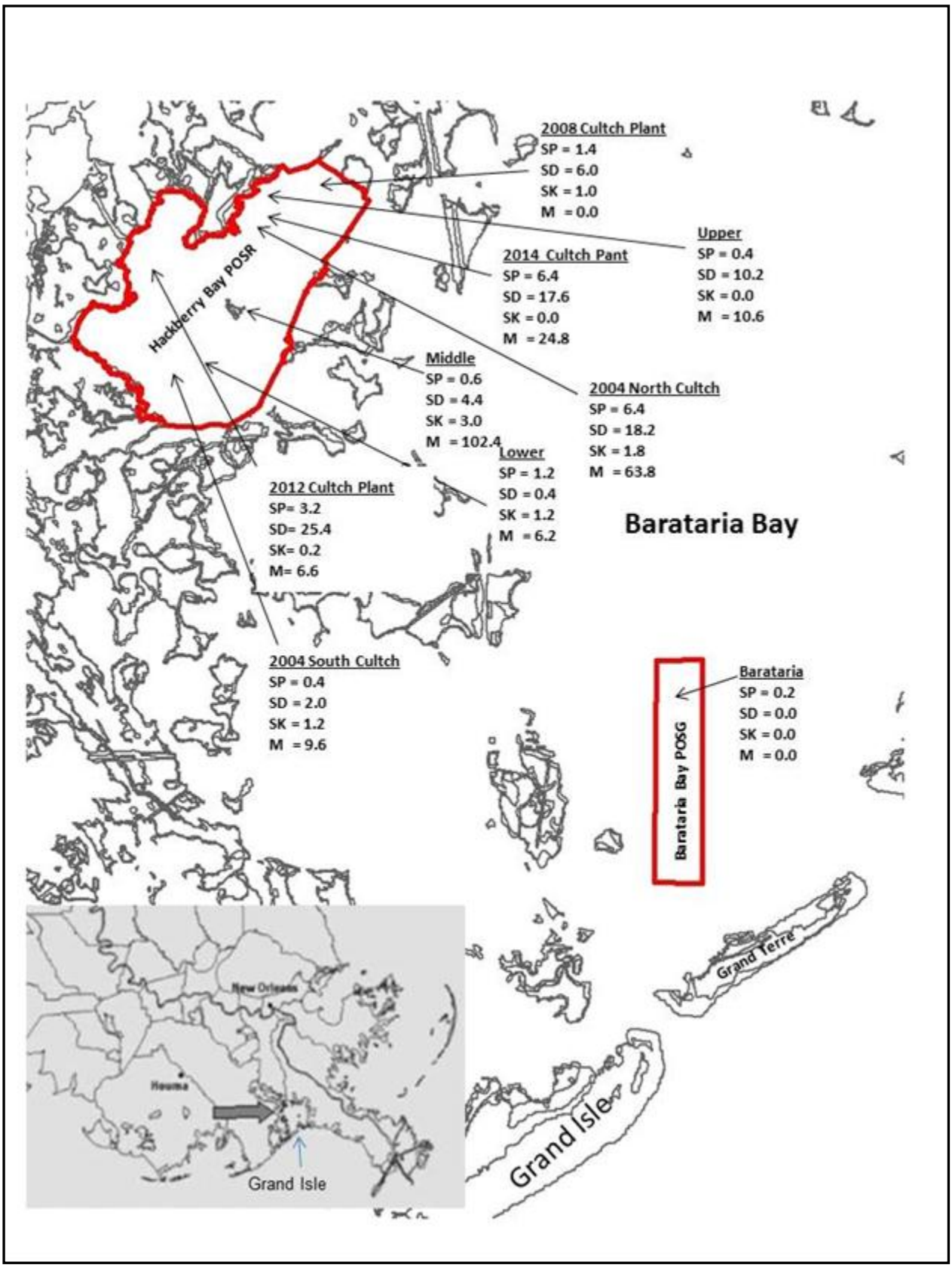

Figure 3.1 Map showing 2014 Hackberry Bay POSR and Barataria Bay POSG sample results as an average per square meter (SP=Spat, SD=Seed, SK=Sack, and M=Mussels

Table 3.1 2014 square meter results for the Barataria Basin (CSA 3).

Station	No.	Approx Reef Acres	Average Live Seed Oysters / M2	Average Live Sack Oysters / M2	Barrels of Seed Available	Barrels of Sack Available	Oyster Spat/M2
Hackberry Bay 2004 North Cultch Plant	6	10	18.2	1.80	1,023.0	202.3	6.4
Hackberry Bay 2004 South Cultch Plant	7	25	2.00	1.2	281.0	337.2	0.4
Hackberry Bay 2008 Cultch Plant	9	50	6.00	1.00	1,686.2	562.1	1.4
Hackberry Bay 2012 Cultch Plant	10	200	25.40	0.2	28,552.9	449.7	3.2
Hackberry Bay 2014 Cultch Plant	11	30	17.6	0	2,967.7	0.0	6.4
Lower Hackberry Bay	1	4.9	0.4	1.20	11.0	66.1	1.2
Middle Hackberry Bay	2	4.9	4.4	3.0	121.2	165.2	0.6
Upper Hackberry Bay	3	4.9	10.2	0.0	280.9	0.0	0.4
Barataria Bay 2004 Cultch Plant	8	40	0.0	0.0	0.0	0.0	0.2
Little Lake		Unknown	Unknown	Unknown	Unknown	Unknown	
Totals		369.7			34,923.9	1,782.6	20.2

	2013	2014	% Change
Seed	16,506.9	34,924.0	111.57%
Sack	5,896.8	1,782.6	-69.77%
Total	22,403.7	36,706.6	63.84%

Table 3.2 2014 square meter predator/mortality results for the Barataria Basin (CSA 3).

Station	Station No.	Hooked Mussels/m^2	Drills Present	Percent Mortality	Percent Mortality	Percent Mortality	Percent Mortality	Percent Mortality
Hackberry Bay 2004 North Cultch Plant	6	64	0	0.0%	0.0%	0.0%	0.0%	0.0%
Hackberry Bay 2004 South Cultch Plant	7	10	0	33.3%	0.0%	0.0%	6.3%	5.3%
Hackberry Bay 2008 Cultch Plant	9	0	0	12.5%	3.2%	0.0%	5.6%	4.5%
Hackberry Bay 2012 Cultch Plant	10	26	0	30.4%	10.6%	0.0%	15.4%	13.3%
Hackberry Bay 2014 Cultch Plant	11	99	0	0.0%	0.0%	0.0%	0.0%	0.0%
Lower Hackberry Bay	1	6	0	0.0%	0.0%	0.0%	0.0%	0.0%
Middle Hackberry Bay	2	102	0	0.0%	0.0%	0.0%	0.0%	0.0%
Upper Hackberry Bay	3	11	0	0.0%	0.0%	0.0%	0.0%	0.0%
Barataria Bay 2004 Cultch Plant	8	0	1	N/A	N/A	N/A	N/A	N/A
Little Lake		N/A						

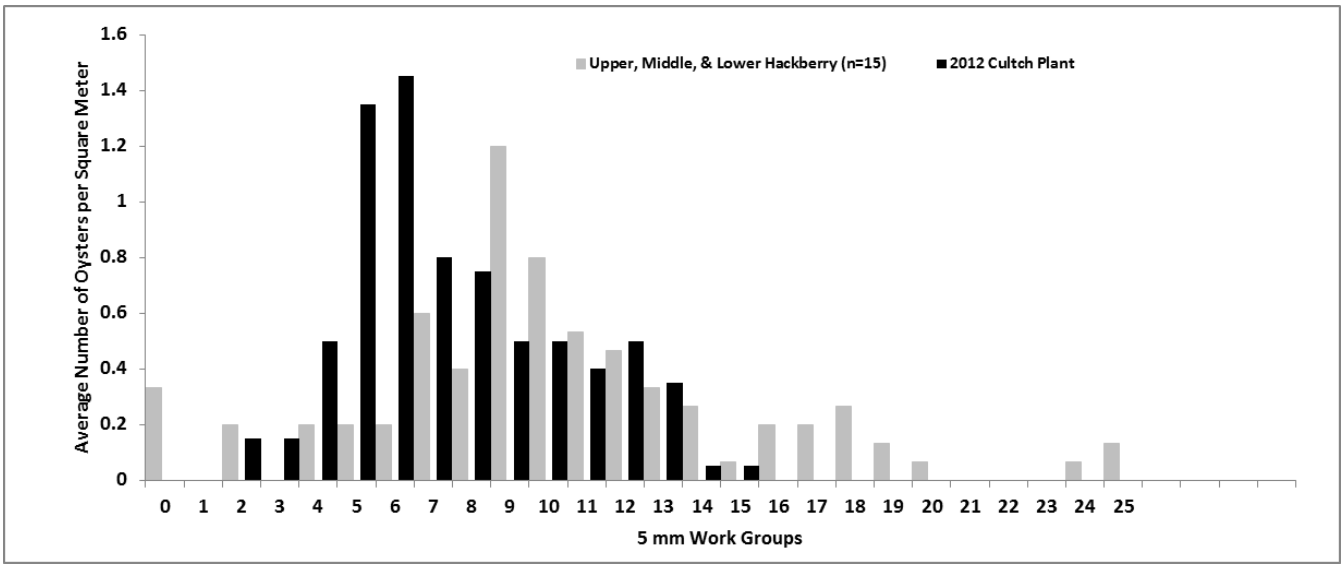

Figure 3.2 Oyster size distribution by 5 mm work groups in historic square meter samples compared to those collected from the 2012 Hackberry Bay Cultch Plant in 2014.

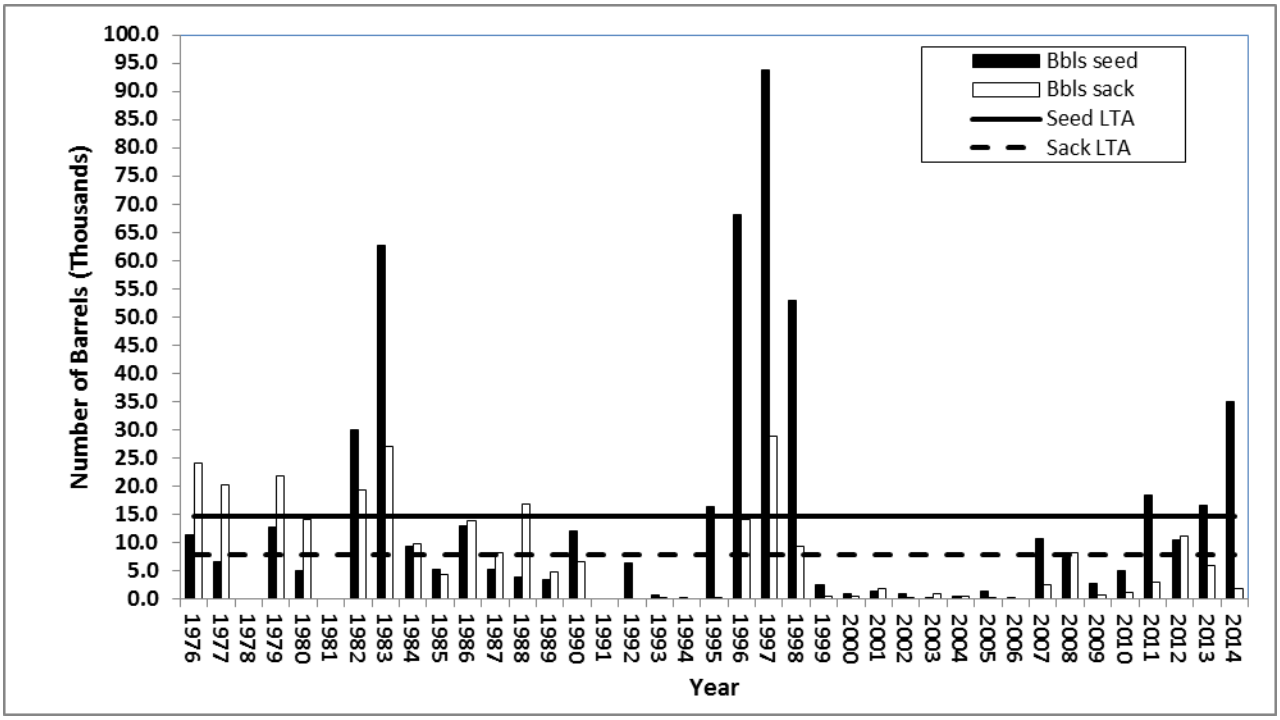

Figure 3.3 Estimated seed and sack oyster availability in the Hackberry Bay POSR from 1976 to 2014 compared to long term average seed and sack abundance.

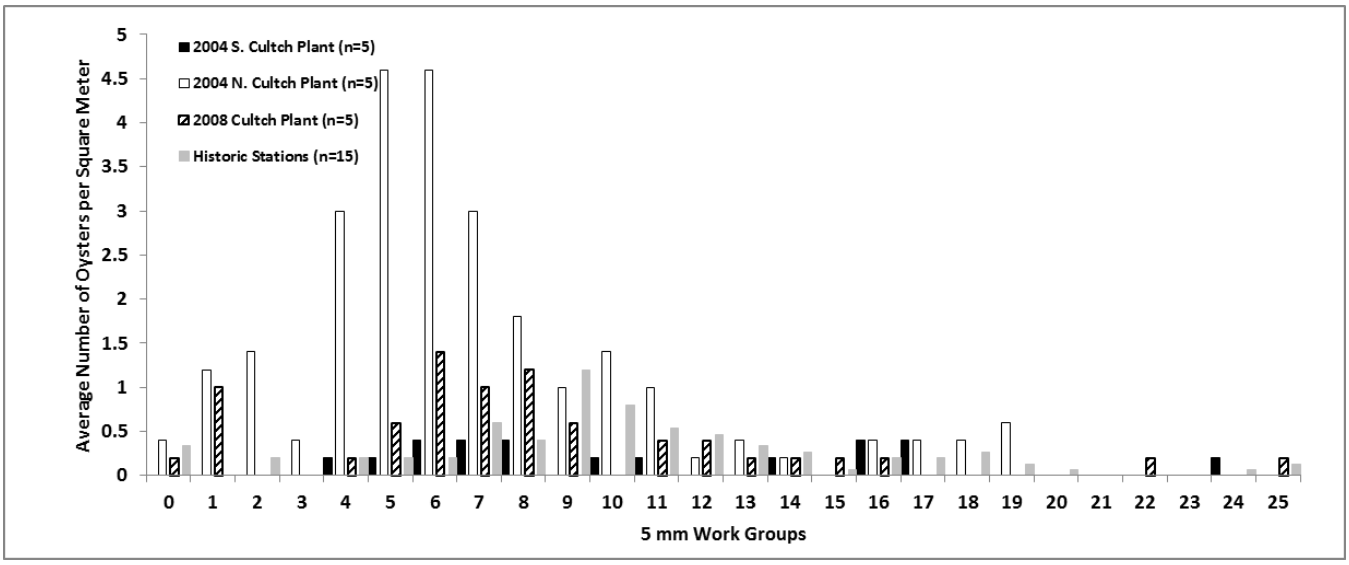

Figure 3.4 Oyster size distribution by 5 mm work groups in square meter samples collected from the Hackberry Bay POSR during 2013.

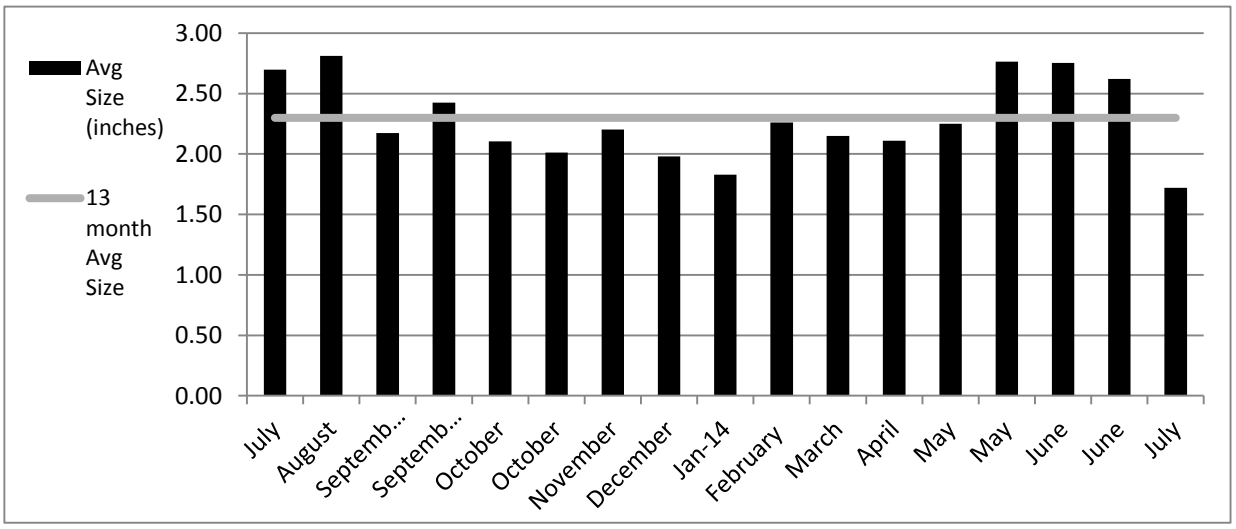

Figure 3.5 Monthly average oyster size for dredge samples and square meter (July 2013/2014) samples.

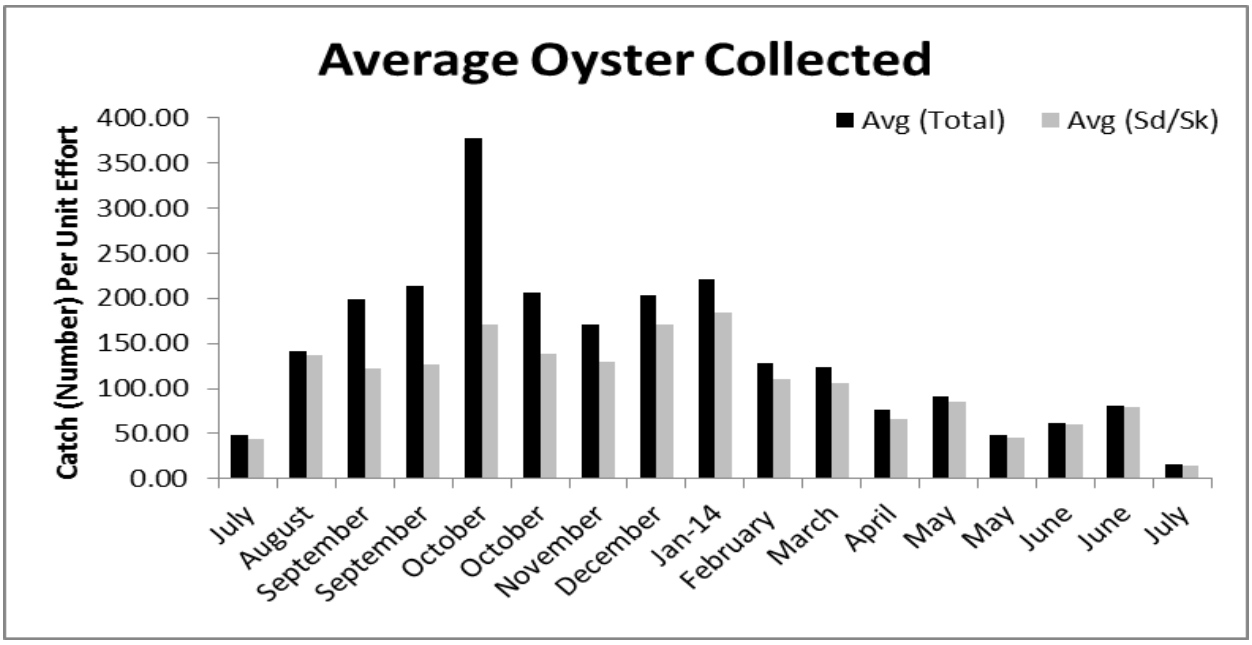

Figure 3.6 Monthly Catch Effort for 2 replicate dredge samples taken at 6 Hackberry stations combined per month. July Catch Effort based on square meter samples.

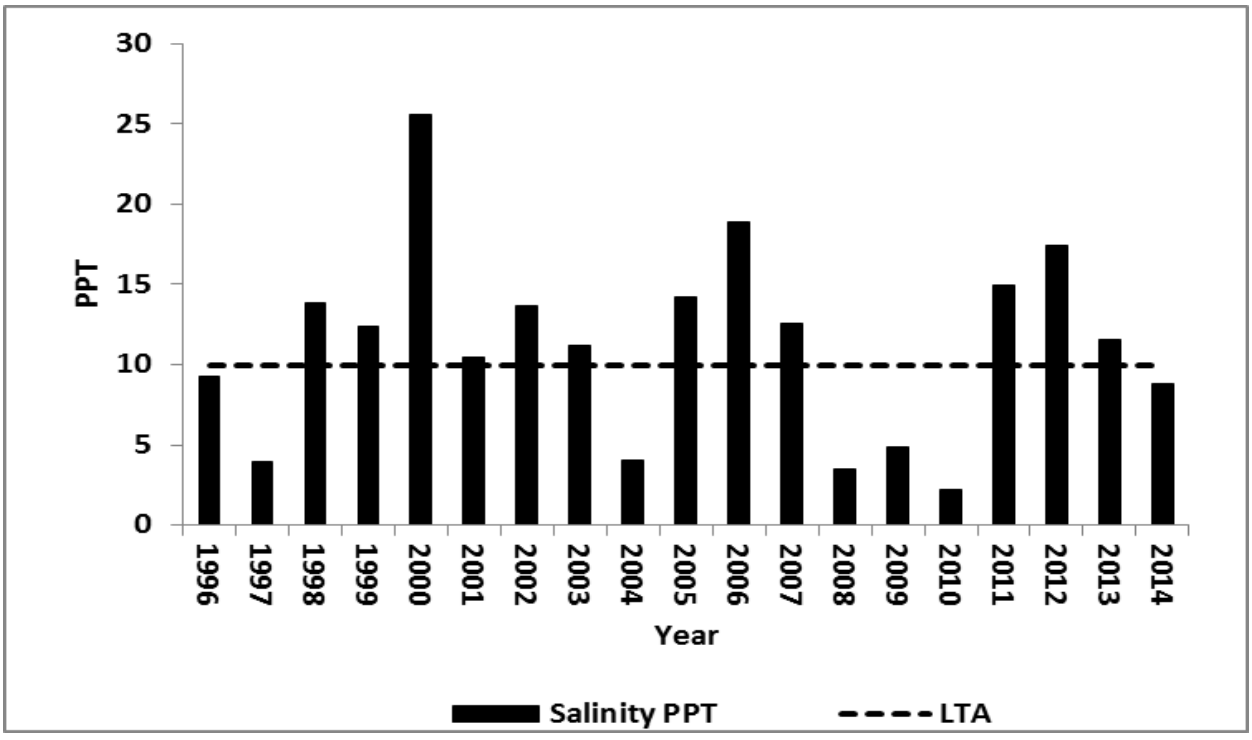

Figure 3.7 Historical annual and long-term average monthly salinity in Hackberry Bay from 1996-2014. Data supplied by the United States Geological Survey (USGS) constant data recorder located in Hackberry Bay.

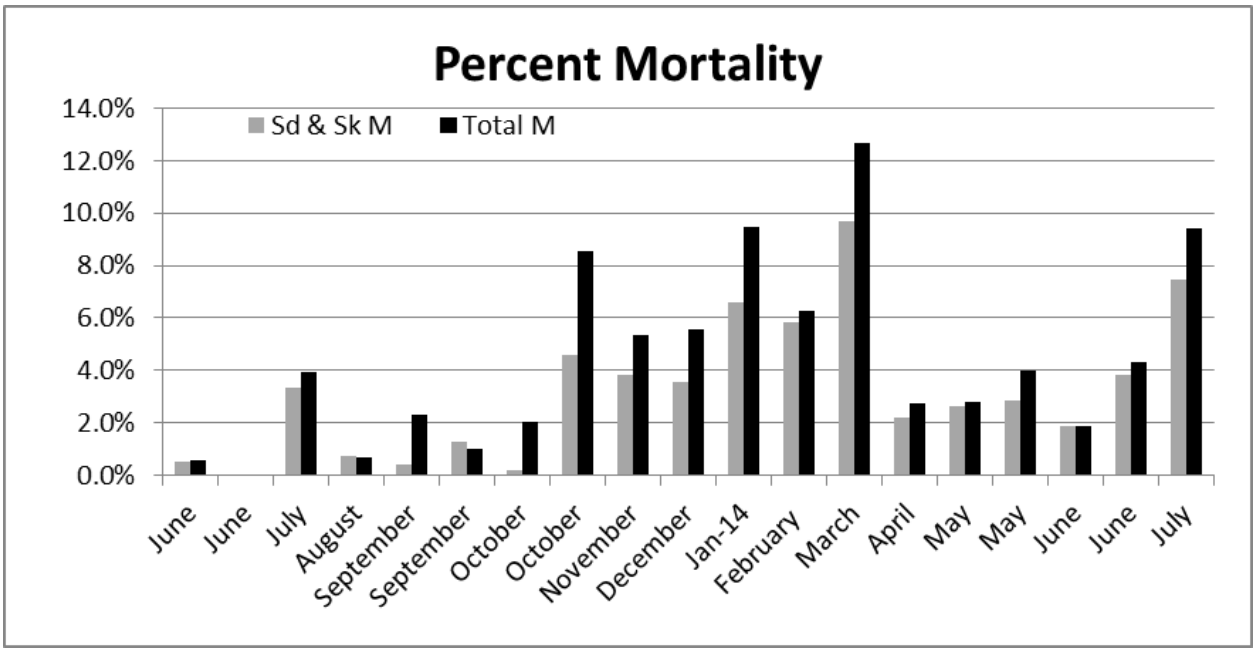

Figure 3.8 Overall oyster percent mortality and seed/sack combined.

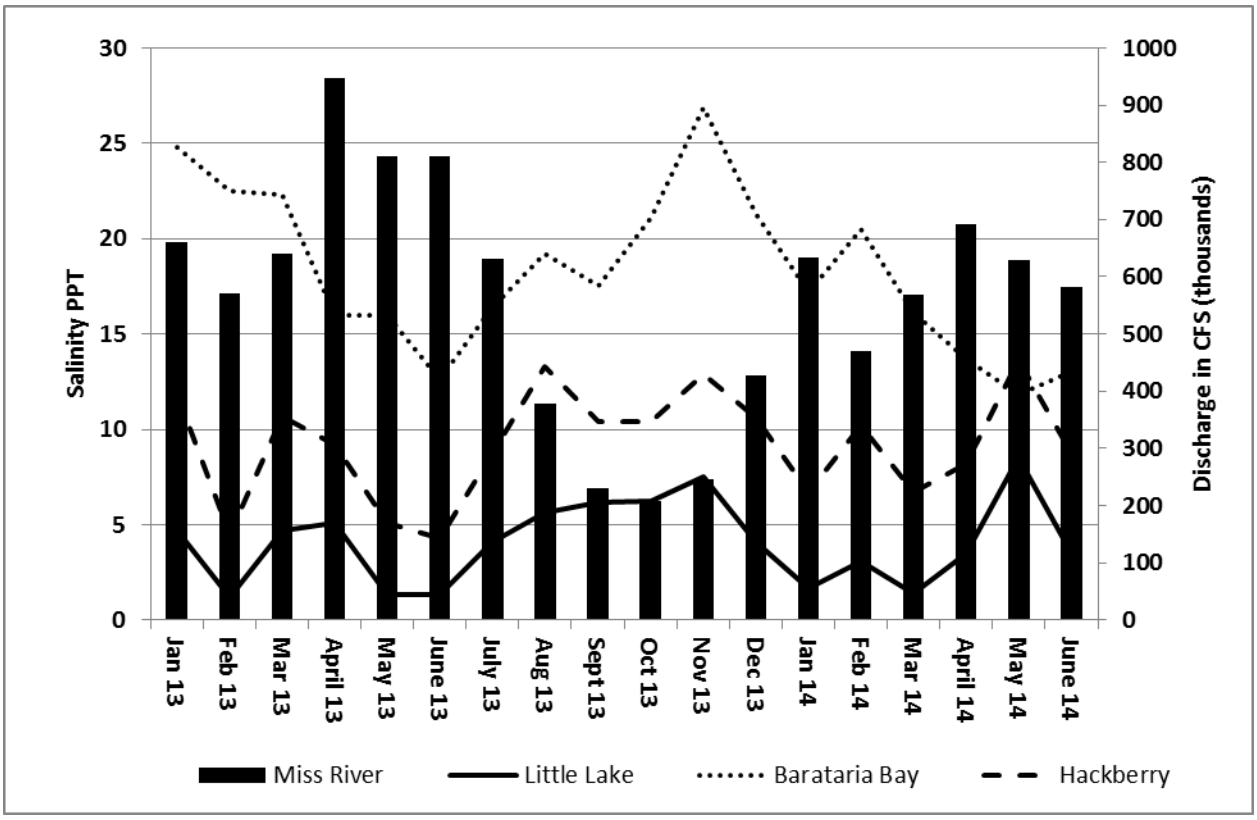

Figure 3.9 Mississippi River discharge vs. average monthly salinities in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR. Mississippi River discharge data supplied by the United States Army Corps of Engineers (USACE).

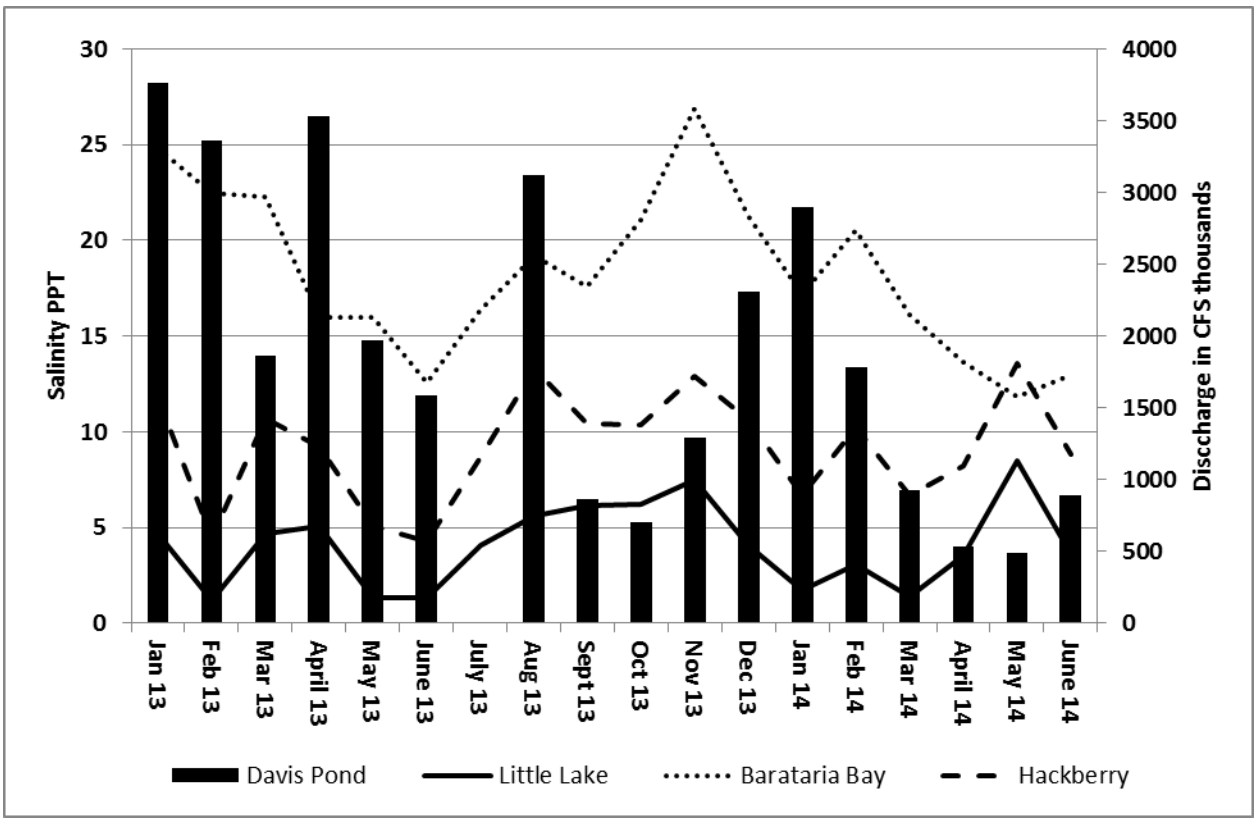

Figure 3.10 Davis Pond discharge vs. average monthly salinities in the Barataria Bay POSG, Little Lake POSG and Hackberry Bay POSR. Davis Pond discharge data supplied by the United States Geological Survey (USGS) constant data recorder located near the Davis Pond structure.

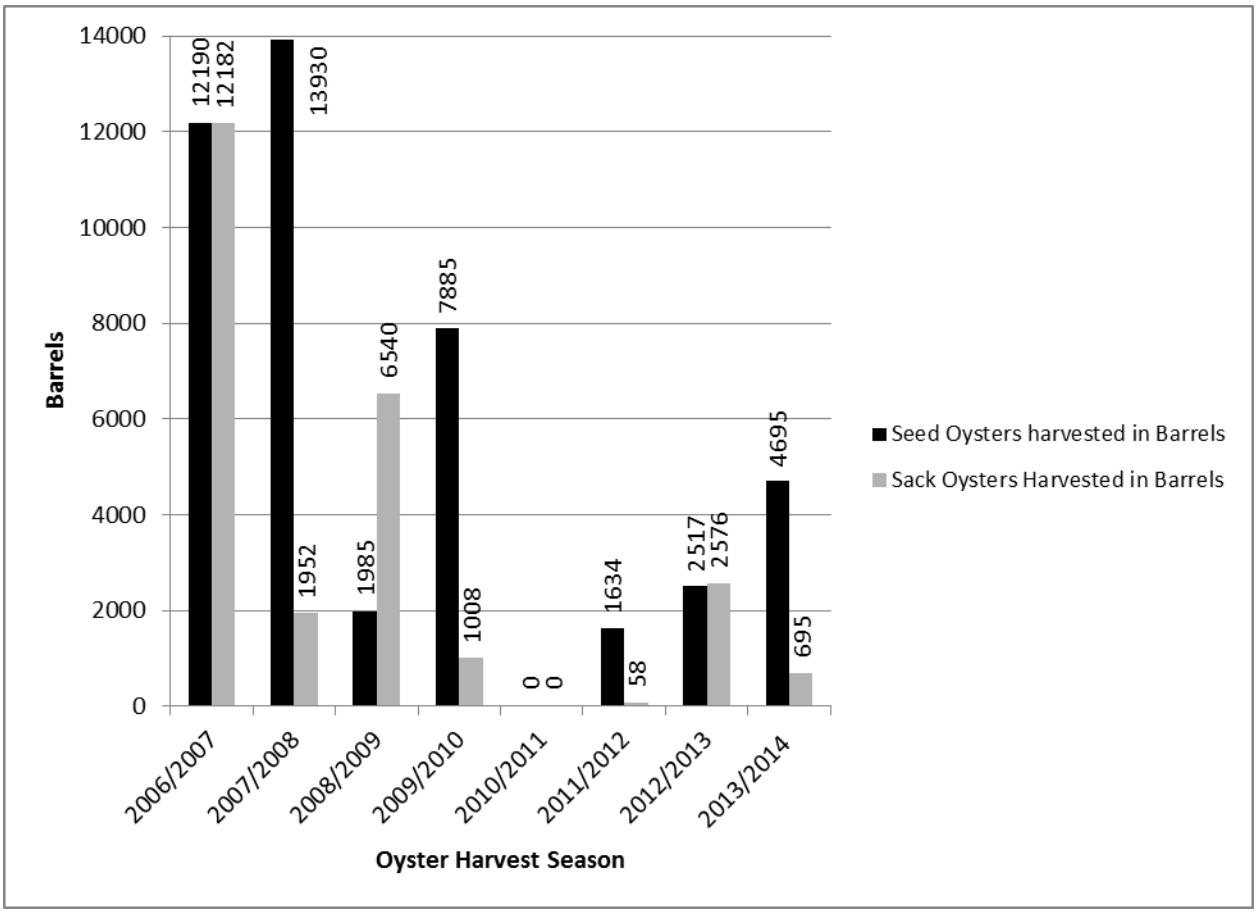

Figure 3.11 Estimates of oyster harvest from the public oyster areas in Coastal Study Area 3 for the past seven harvest seasons based on boarding report surveys (on-water interviews of harvesters).

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Coastal Study Area (CSA) 5 – 2014 Oyster Stock Assessment

Introduction

The Terrebonne Basin (TB) includes that area from Bayou Lafourche west to the Atchafalaya River, and includes Terrebonne Bay and Timbalier Bays, Sister Lake, Lake Mechant, and Caillou Bay. Assessments are grouped into the eastern and western portions of the TB for presentation purposes.

There are currently eight different Public Oyster Seed Reservations (POSR) or Public Oyster Seed Grounds (POSG) within the Terrebonne Basin; these include Sister Lake (Caillou Lake) POSR, Bay Junop POSR, Lake Mechant POSG, Deep Lake POSG, Lake Felicity POSG, Lake Chien POSG, and Lake Tambour POSG. Sister Lake, Bay Junop, and Lake Mechant are located in the western TB while Deep Lake, Lake Felicity, Lake Chien, and Lake Tambour are found in the eastern TB (Figures 5.1 and 5.2).

Sister Lake (Caillou Lake) (Figure 5.1) was designated as a POSR in 1940 and includes 9,150.5 acres of water bottoms. The first known cultch deposition projects were established here between 1906 and 1909 by the U.S. Bureau of Fisheries. Subsequent plantings by the State of Louisiana began in Sister Lake in 1917; since then 21 cultch plants totaling 4,862.5 acres have been constructed, with some cultch plants being located on top of older ones or on top of existing reef habitat. Recent Sister Lake cultch deposition projects included a 67- acre site in 2004, a 156- acre site in 2009, and a 358- acre site in 2012. The majority of the 2012 cultch plant was placed atop existing reef and made a minimal addition, less than 100 acres, to the total available reef acres in Sister Lake. For stock assessment purposes, the cultch plant was combined with a small amount of adjacent reef acreage and, thus, sampling on this cultch plant will represent oyster conditions on 364.8 acres of reef. The current total reef acreage for Sister Lake is estimated to be 2,375.36 acres.

The Bay Junop POSR (Figure 5.1) was established in 1948 and consists of approximately 2,646.5 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. Available public reef acreage in this bay is estimated at approximately 252 acres.

The Lake Mechant POSG (Figure 5.1) was designated in 2001 with approximately 2,100 acres of water bottoms. In 2004, a 30 acre cultch plant was established. In 2007, un-leased water bottoms between the POSG and private oyster leases were added, increasing water bottom acreage within the public oyster seed ground to 2,583 acres. The total reef acreage outside of the 2004 cultch plant remains unavailable.

The Lake Tambour, Lake Chien, Lake Felicity, and Deep Lake POSGs (Figure 5.2) were established 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.

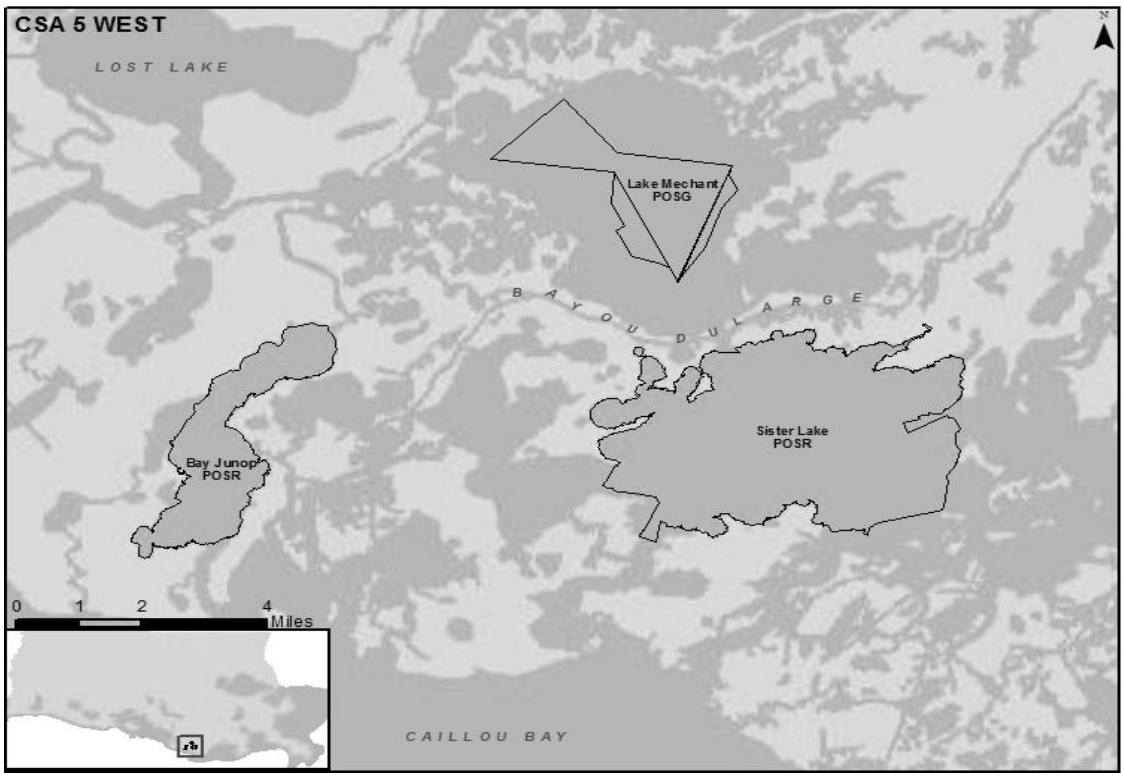

Figure 5.1 Public oyster areas within the western portion of Coastal Study Area (CSA) 5.

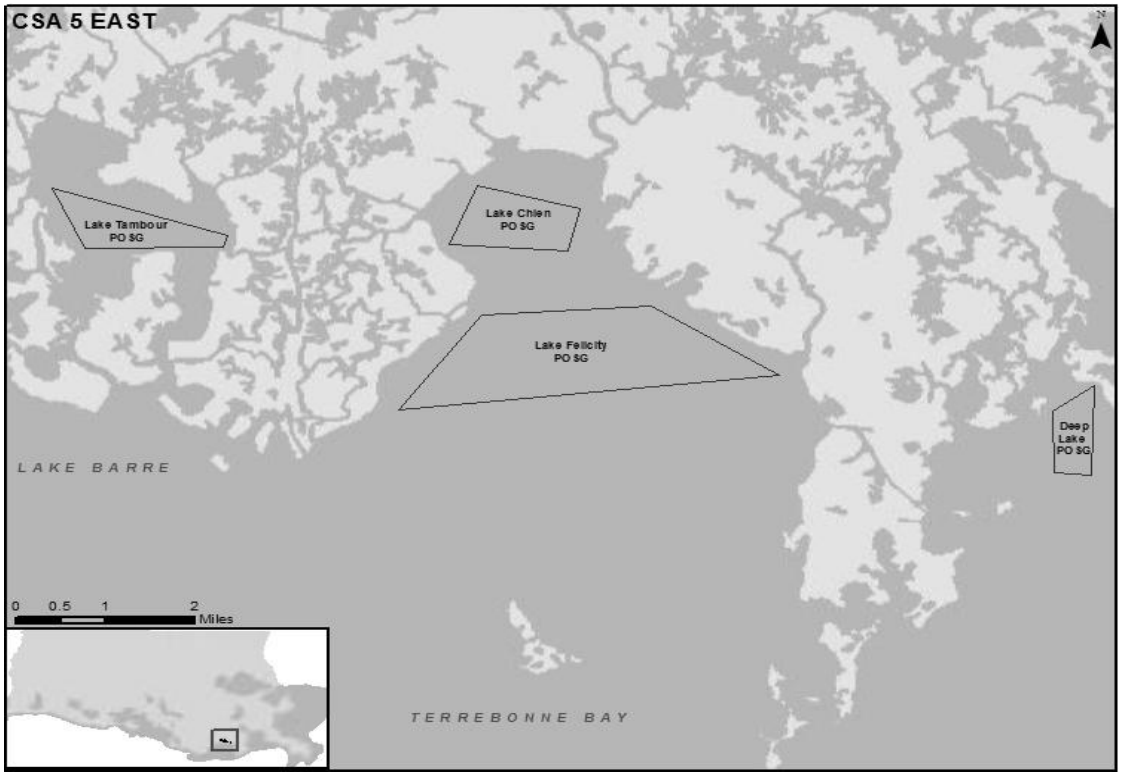

Figure 5.2 Public oyster areas within the eastern portion of Coastal Study Area (CSA) 5.

Lake Chien and Lake Felicity POSGs together have three cultch plants. Cultch deposition projects in Lake Chien (15.5 acres) and Lake Felicity (40 acres) were completed in the summer of 2004. Another 22.3 acre cultch plant was created in Lake Chien in May 2009 due east of the initial Lake Chien cultch plant. Outside of these cultch plants, reef information is unavailable for these areas and no reef development projects have been implemented in Lake Tambour or Deep Lake.

Materials and Methods

Square-meter field samples were collected on July 8, 2014 on existing oyster reefs in Lake Felicity and Lake Chien. Sampling was conducted at Sister Lake, Bay Junop, and Lake Mechant on July 15 – 16, 2014.

SCUBA divers collected five replicate samples at each station using an aluminum square meter quadrat that was tossed randomly over the reef. At the 2012 cultch plant location, a ¼ square-meter quadrat was utilized in lieu of a square-meter quadrat and twenty replicates were taken at randomly-chosen locations on the cultch plant. All oysters, loose shell and other organisms were removed from the upper portion of the substrate within the quadrat. Live and dead oysters, oyster predators, and hooked mussels (*Ischadium recurvum*) were separated and counted. Oysters were measured in 5 millimeter (mm) size groups and subsequently divided into three categories: spat (<25 mm), seed (25-74 mm), and sack (75 mm and larger) oysters. In conjunction with square meter oyster samples, water temperature and salinity data were also collected.

The average number of seed and sack oysters per square meter sample at each station was used to estimate oyster stock availability by extrapolation using historical known reef acreage. The footprint of the 2012 cultch plant, along with the combining of stations on overlapping reefs, resulted in a small adjustment of acreage in Sister Lake for the 2013 assessment. This adjustment in acreage was maintained for the 2014 assessment, details on stations and reef complexes affected can be found in the 2013 Oyster Stock Assessment Report (LDWF, 2013).

Results and Discussion

Resource Availability

The overall 2014 estimated resource availabilities in the Terrebonne Basin POSGs and POSRs are 274,853 barrels of seed oysters and 36,835 barrels of sack oysters in the western basin (Sister Lake, Bay Junop, and Lake Mechant), and 2,154 barrels of seed oysters and 255 barrels of sack oysters in the eastern basin (Lake Felicity and Lake Chien) (Tables 5.1 – 5.3).

Average number of oysters per square meter sample station ranged from 0 to 125.2 for seed sized, and 0 to 5.8 for sack sized oysters (Figures 5.3 - 5.5). Except for seed production on the 2012 Cultch Plant in Sister Lake, all estimates of seed and sack oyster resource availability in 2014 were below long-term historic means (Figures 5.6 - 5.10). In Sister Lake, the most productive oyster area in the Terrebonne Basin, estimated 2014 seed oyster availability was 55% above and sack oyster availability 75% below long-term means. However, 95% of the available seed resource and 71% of market sized oysters are located on the 2012 Cultch Plant. In the eastern basin, Lakes Chien and Felicity's oyster resource availability was 73% below long-term

means for seed and 87% below long-term means for market oysters, yet above 2013 levels for overall oyster abundance.

Spat Production

Average number of oyster spat ranged from 0.1 to 6.4/sample in 2014 (Table 5.5). Lake Chien had the highest number per sample but still showed a decline from 2013. Lake Felicity and Lake Mechant were the only two areas to show an increase in spat from last year's assessment, although both had zero spat present in 2013.

Table 5.1 2014 Sister Lake oyster availability by sample station.

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS	OYSTER SPAT/m^2
200*	320.31	1,296,252.93	2.53	1.73	4,560.89	6,229.22	0.10
203	140.43	568,301.95	0.20	0	157.86	0	0.20
207	55.77	225,693.94	0	0	0	0	0
213	191.04	773,114.04	0	0	0	0	0
214	552.44	2,235,652.86	0	0	0	0	0
215	512.79	2,075,194.47	0	0	0	0	0
218	82.26	332,895.53	2.80	0.80	1,294.59	739.77	0
219	155.52	629,369.22	8.20	1.60	7,167.82	2,797.20	0.40
2012 CP	364.80	1,476,298.18	125.20	5.80	256,711.85	23,784.80	2.40
TOTAL	2,375.36	9,612,773.12	138.93	9.93	269,893.01	33,550.98	

* Average of stations 200, 202, and 216 to represent the Grand Pass reef complex.

Table 5.2 2014 Bay Junop Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS	OYSTER SPAT/m^2
251	17.20	69,606.16	10.00	5.40	966.75	1,044.09	0.40
252/255	67.36	272,597.16	0.80	1.00	302.89	757.21	0
253	73.26	296,473.70	2.00	1.80	823.54	1,482.37	0
TOTAL	157.82	638,677.02	12.80	8.20	2,093.18	3,283.68	

Table 5.3 2014 Lake Mechant/Lake Chien/Lake Felicity Oyster Availability

METER² STATION	REEF ACREAGE	#METER²	#SEED OYSTERS	#SACK OYSTERS	BARRELS SEED OYSTERS	BARRELS SACK OYSTERS	OYSTER SPAT/m^2
Lake Mechant	30.0	121,406.10	17.00	0	2,866.53	0	2.40
Lake Felicity	40.0	161,880.00	0.4	0	89.9	0	1.2
Lake Chien 2009	22.3	90,248.10	3.4	0.6	426.2	150.4	3.2
Lake Chien 2004	15.5	62,728.50	18.8	0.6	1,637.9	104.5	9.6
TOTAL	107.8	436,262.70	39.6	1.2	5,020.5	254.9	

Table 5.4 Oyster availability and percent change from the 2013 to 2014 assessment for both regions of Coastal Study Area (CSA) 5.

		Barrels of Seed Oysters			Barrels of Sack Oysters		
Region	Area	2013	2014	*Change*	2013	2014	*Change*
Western TB	Sister Lake	26,400.1	269,893.01	922.3%	36,827.0	33,550.98	-8.9%
	Bay Junop	782.8	2,093.18	167.4%	1,341.7	3,283.68	144.7%
	Lake Mechant	67.5	2,866.53	4,149.9%	0	0	0
Eastern TB	Lake Chien	144.9	2,064.08	1,324.5%	440.2	254.96	-42.1%
	Lake Felicity	45.0	89.90	99.9%	0	0	0

Table 5.5 Average oyster spat per square-meter sample for the 2013 and 2014 assessment, for all areas within Coastal Study Area 5. (TB= Terrebonne Basin).

		Oyster Spat/m^2	
Region	Area	*2013*	*2014*
Western TB	Sister Lake	2.4	0.1
	2012 Cultch Plant	9.6	2.4
	Bay Junop	12.4	0.1
	Lake Mechant	0.0	2.4
Eastern TB	Lake Chien	8.2	6.4
	Lake Felicity	0.0	1.2

Hydrological Data

Mean water temperatures, for May and June 2014, on each public oyster area ranged from 26.2 - 28.1 C^o and were below the long-term means. Mean salinities were below average for all areas except Sister Lake and Bay Junop for the two months prior to sampling (Tables 5.6 and 5.7). Temperature and salinity measurements collected concurrently with the square-meter sampling in July averaged: 29.97 C^o and 15.40ppt in the eastern basin, 29.49 C^o and 5.30ppt in Sister Lake, 29.35 C^o and 7.13ppt in Bay Junop, and 29.30 C^o, 0.50ppt in Lake Mechant.

Table 5.6 Mean May-June and historic means (excluding 2014) of water temperature (°C) and salinity (ppt) from Sister Lake, Bay Junop, and Lake Mechant dredge samples (X= not designated as seed ground or reservation and, thus, no data were collected).

	TEMPERATURE			SALINITY		
YEAR	Sister Lake	Bay Junop	Lake Mechant	Sister Lake	Bay Junop	Lake Mechant
1996	29.4	29.3	X	17.2	18.2	X
1997	29.0	28.8	X	7.7	10.1	X
1998	29.0	28.8	X	10.5	8.6	X
1999	28.2	27.5	X	14.1	13.4	X
2000	29.6	29.2	X	24.9	23.8	X
2001	27.5	27.5	X	12.1	14.0	X
2002	28.4	27.9	X	11.0	11.4	X
2003	29.1	28.9	X	7.5	9.2	X
2004	29.4	28.7	X	14.1	17.2	X
2005	28.3	27.9	X	16.1	19.0	X
2006	28.1	26.1	X	22.7	20.4	X
2007	27.6	27.5	27.8	19.3	20.0	11.5
2008	26.7	28.1	28.1	6.2	6.9	0.4
2009	29.5	29.1	28.6	10.3	12.0	2.6
2010	29.8	28.3	28.9	17.8	15.4	15.1
2011	26.4	26.5	25.7	16.1	16.1	5.5
2012	29.3	29.3	29.0	16.5	17.7	9.4
2013	28.1	27.8	27.8	9.3	11.0	1.9
2014	28.1	27.7	27.5	15.4	16.3	6.5
Mean	28.5	28.2	27.9	14.1	14.8	6.6

Table 5.7 Mean May-June and historic means (excluding 2014) of water temperature (^{o}C) and salinity (ppt) from Lake Felicity and Lake Chien dredge samples.

YEAR	TEMPERATURE		SALINITY	
	Felicity	Chien	Felicity	Chien
2006	27.6	27.8	24.9	25.0
2007	27.4	27.6	20.9	20.7
2008	28.2	28.6	16.0	16.0
2009	28.3	28.6	21.3	21.1
2010	29.2	29.5	18.6	17.8
2011	27.2	27.5	25.0	24.9
2012	29.0	29.0	20.0	19.2
2013	25.2	25.3	15.0	13.6
2014	26.2	26.5	19.8	18.3
Mean	28.1	28.4	21.0	20.7

Mortality

Sister Lake was the only location to show recent mortality of sack oysters in the 2014 square meter samples for Terrebonne Basin (Table 5.8). Bay Junop was the only area where spat and seed oyster mortality was observed.

Table 5.8 Overall percent mortalities of spat, seed and sack oysters in 2014 for all areas within Coastal Study Area (CSA) 5.

Region	Area	Spat	Seed	Sack
Western TB	Sister Lake	0	0.7	2.6
	Bay Junop	60	6.9	0
	Lake Mechant	0	0	0
Eastern TB	Lake Felicity	0	0	0
	Lake Chien	0	0	0

Fouling Organisms / Predators / Disease

Three incidental species (hooked mussels, mud crab, and stone crab) were collected in square meter samples (Table 5.9). Hooked mussels were the incidental species most abundant and were more prevalent in the western TB samples, having an overall average of 11.9/sample. Of this overall average, Sister Lake had the highest occurrence with 14.1/sample; Eastern TB samples showed an average of 1.27/sample.

Table 5.9 Average numbers of hooked mussels, oyster drills, and select crab species per sample by seed ground or reservation and overall (TB=Terrebonne Basin).

Region	Seed Ground	Numbers Per Sample				
		Hooked Mussels	Mud Crab	Oyster Drill	Stone Crab	Blue Crab
Western TB	Sister Lake	14.1	0.3	0	0.1	0
	Bay Junop	5.2	0.6	0	0.4	0
	Lake Mechant	8.8	0	0	0	0
	Overall	11.9	0.3	0	0.2	0
Eastern TB	Lake Felicity	0	0	0	0	0
	Lake Chien	1.9	0.4	0	0.1	0
	Overall	1.27	0.27	0	0.07	0

Scientific literature suggests that Dermo (*Perkinsus marinus*) may cause extensive oyster mortalities in conditions of high salinities and water temperatures. Oysters from the Terrebonne Basin public oyster areas were collected and provided to Dr. Tom Soniat at the University of New Orleans for Dermo analysis.

Deepwater Horizon Oil Spill and Related Response Actions

The *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

Tropical Weather / Flooding Events

Tropical Storm Karen threatened the Louisiana coast in the beginning of October, 2013. Storm surge was minimal in the Terrebonne Basin, two feet or less, and the effects on the seed grounds and reservations were minimal as well.

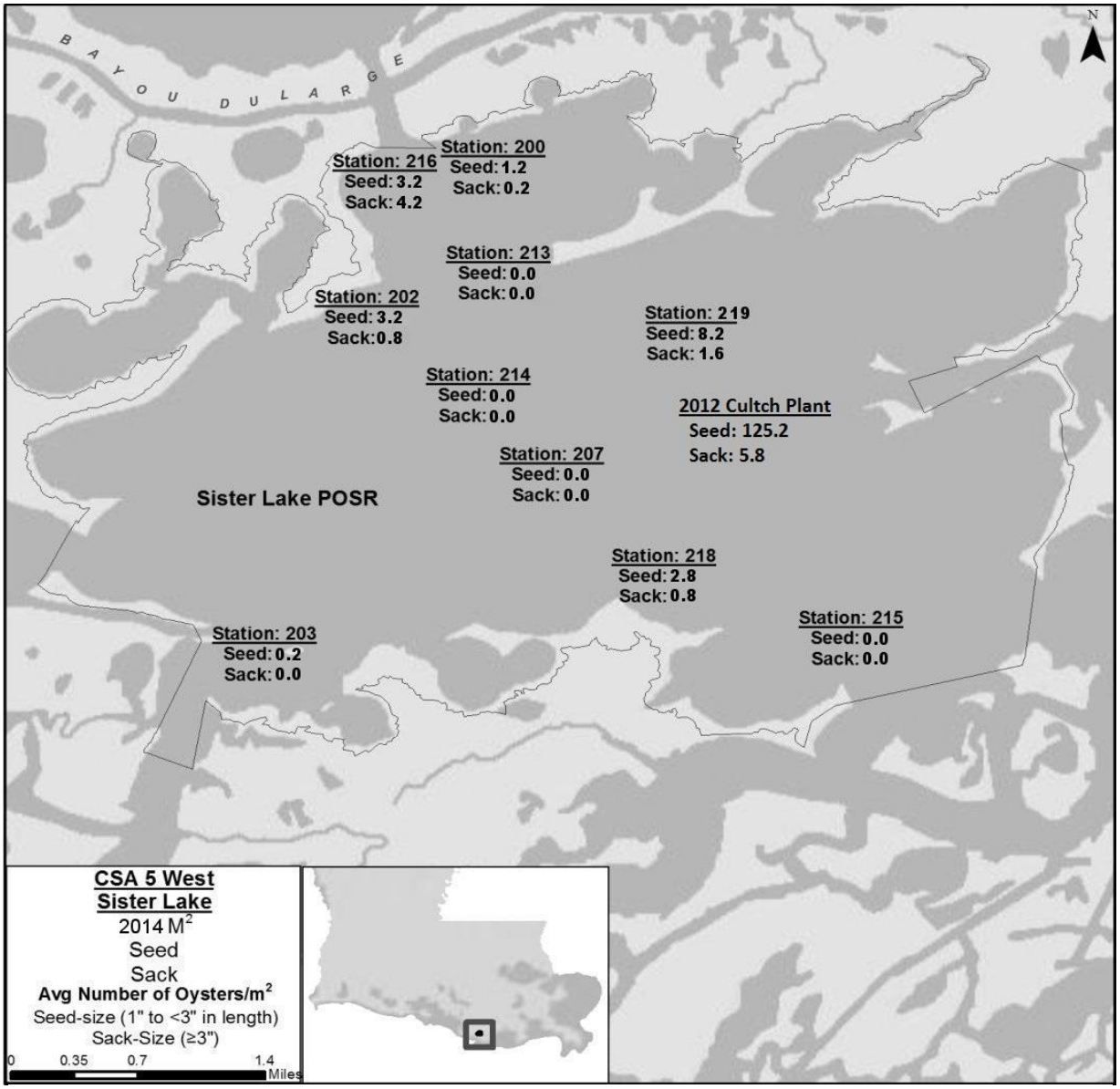

Figure 5.3 Results from each square-meter sampling station within Sister Lake.

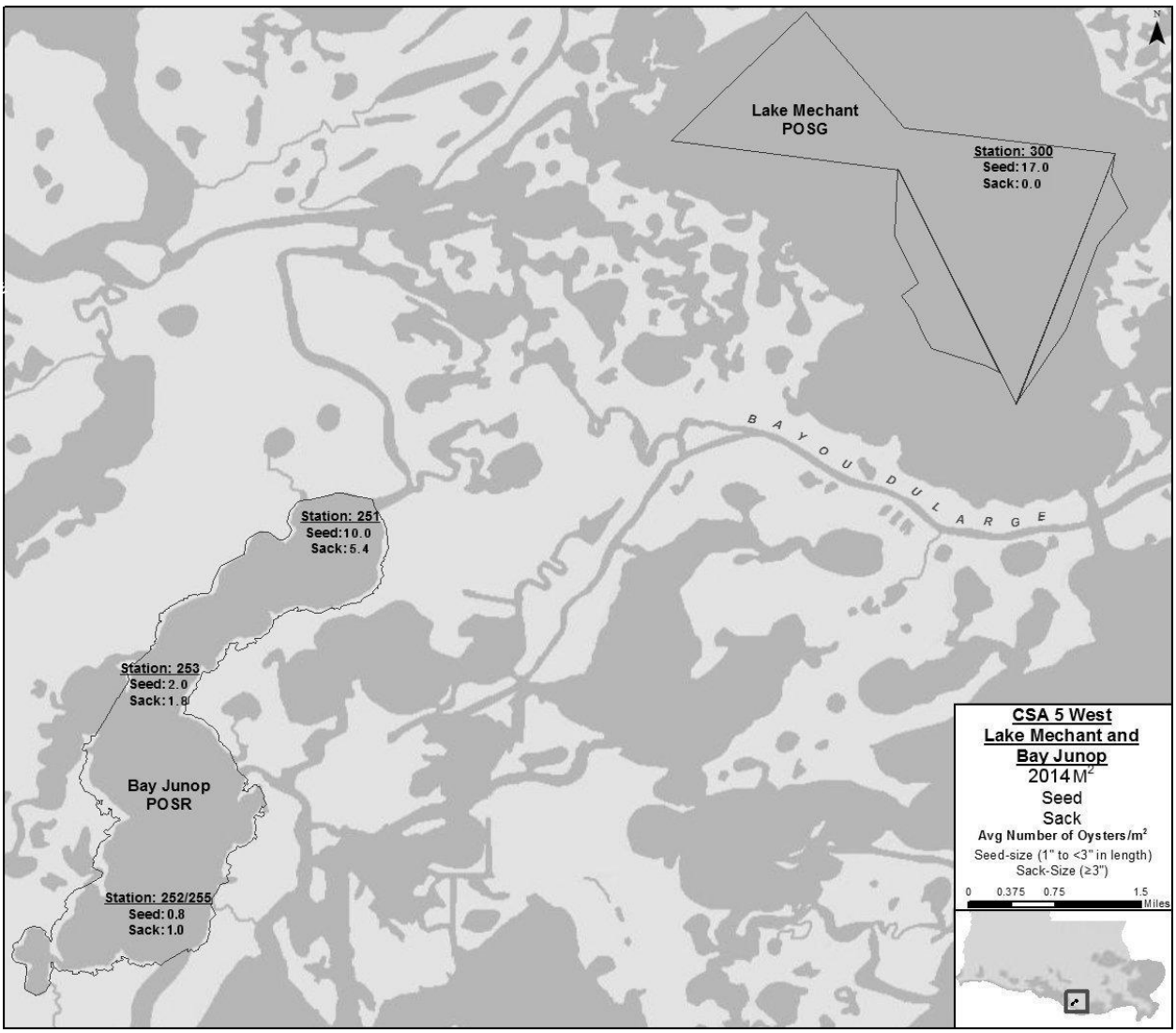

Figure 5.4 Results from square-meter sampling stations within Bay Junop and Lake Mechant.

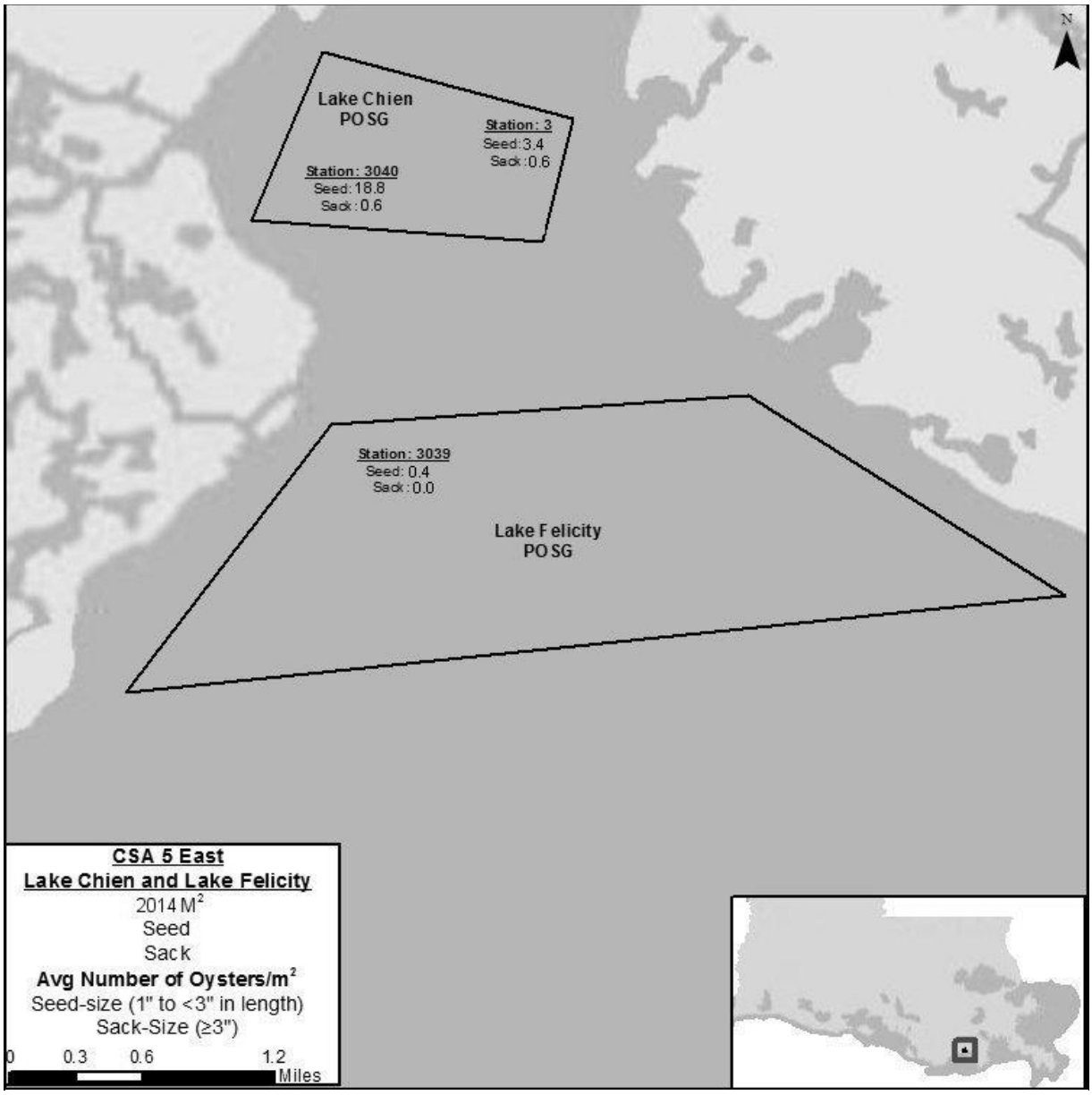

Figure 5.5 Results from square-meter sampling stations within Lake Chien and Lake Felicity.

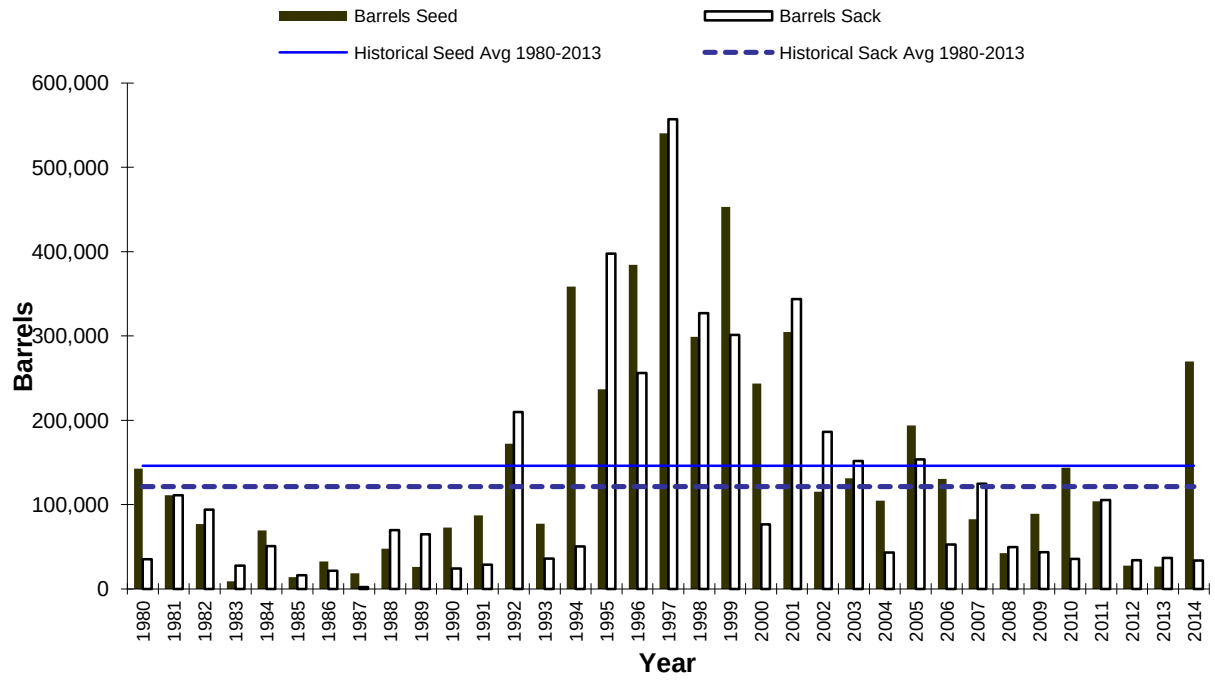

Figure 5.6 Sister Lake historic oyster stock availability.

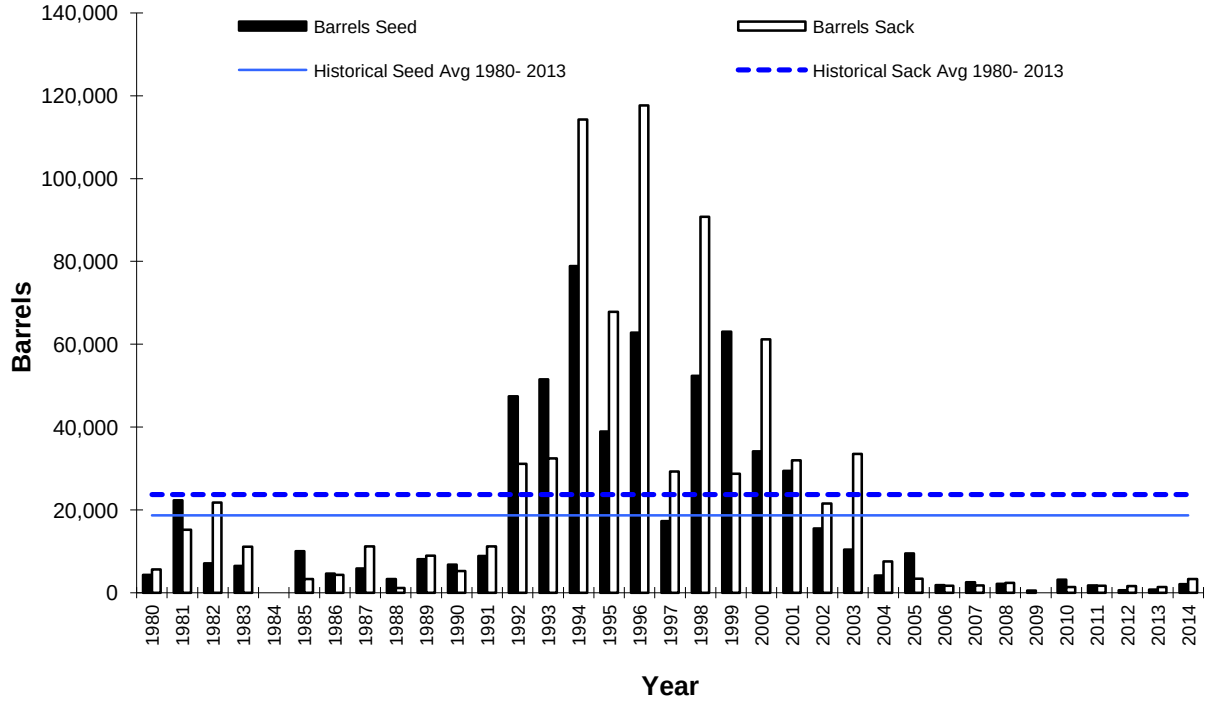

Figure 5.7 Bay Junop historic oyster stock availability.

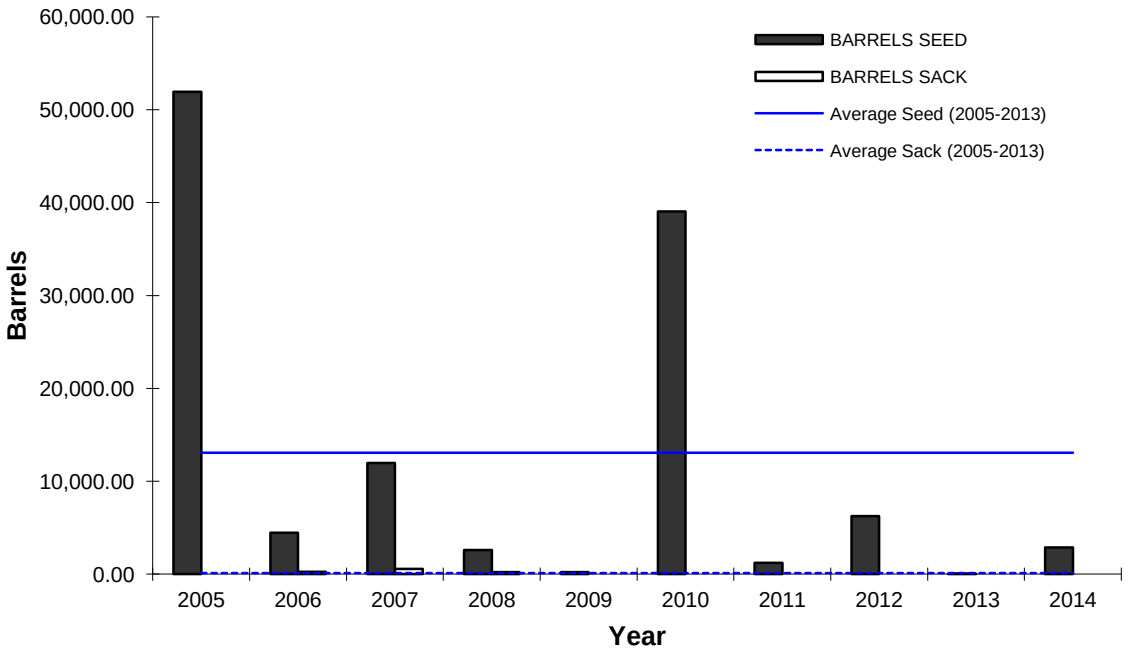

Figure 5.8 Lake Mechant historic oyster stock availability.

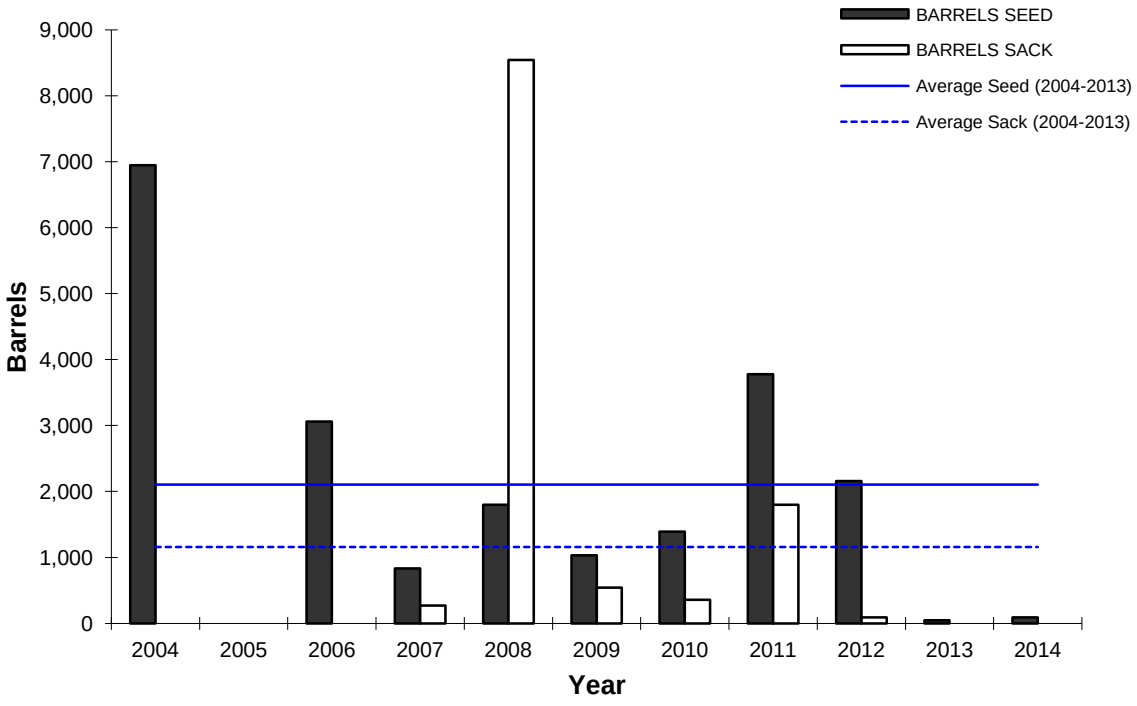

Figure 5.9 Lake Felicity historic oyster stock availability.

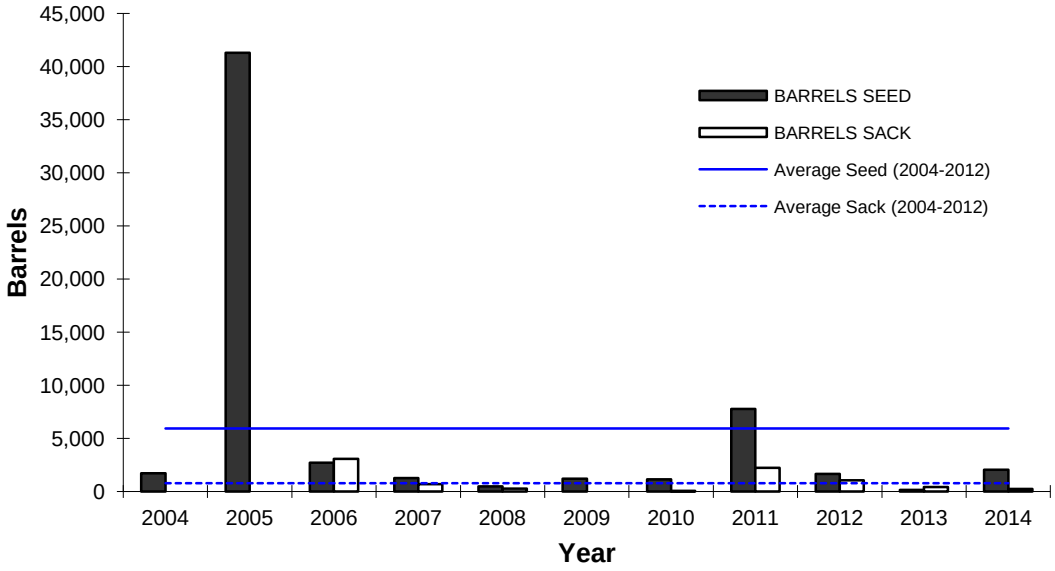

Figure 5.10 Lake Chien historic oyster availability.

2013/2014 Oyster Season Summary

Oyster harvests on the POSGs and POSRs were monitored through boarding reports and trip ticket records. These data were used to calculate annual estimates for each public oyster area (Tables 5.10 and 5.11).

Sister Lake: The Sister Lake POSR was opened on October 15, 2013 and was closed on October 25, 2013. Total fishing effort was estimated at 1167 vessel-days, of which 1128 were for the harvest of market oysters and 39 for the harvest of seed oysters. Total estimated harvest was 86,804 sacks of market oysters and 7,315 barrels of seed oysters based on boarding reports (daily, on-water monitoring).

Lake Mechant: Lake Mechant opened on October 15, 2013 and was open until the Department of Health and Hospitals (DHH) implemented a seasonal public health closure on November 1, 2013. Total fishing effort was 40 vessel-days, of which 24 vessel-days were for the harvest of market oysters and 16 for the harvest of seed oysters. Total estimated harvest was 706 sacks of market oysters and 3,390 barrels of seed oysters based on boarding reports.

Bay Junop: Bay Junop was was closed for the 2013 – 2014 season, and no harvest was documented via LDWF boarding runs.

Lake Chien / Lake Felicity: Lakes Chien and Felicity were closed for the 2013 – 2014 season, and no harvest was documented via LDWF boarding runs.

Lake Mechant and Sister Lake were the only areas in the Terrebonne Basin where seed sized oysters were harvested during the 2013 season. Seventeen samples were collected from six bedding vessels during the 10-day season in Sister Lake, and five samples from 3 vessels in Lake Mechant to determine the percent cultch in seed stock harvested. Percentages of cultch taken from Sister Lake ranged from 5 – 82% with an overall average cultch take of 24% per bedding load. Lake Mechant cultch percentages ranged from 21 - 40% and had an overall average cultch take of 31% per bedding load.

Table 5.10 Annual totals and long-term means (excluding 2013) of commercial seed oyster (barrels) and sack oyster (sacks) harvests from Sister Lake, Lake Mechant, and Bay Junop (NS=no season; X=not designated as seed ground or reservation).

YEAR	SISTER LAKE		BAY JUNOP		LAKE MECHANT	
	Seed	Sack	Seed	Sack	Seed	Sack
1995	51,160	48,824	NS	NS	X	X
1996	20,055	40,019	3,770	26,908	X	X
1997	31,668	43,727	NS	NS	X	X
1998	15,228	16,510	6,205	20,345	X	X
1999	29,934	47,586	NS	NS	X	X
2000	NS	NS	NS	NS	X	X
2001	18,183	34,060	NS	NS	X	X
2002	NS	NS	40	1,031	X	X
2003	11,840	92,580	NS	NS	X	X
2004	NS	NS	5	2,623	0	2,211
2005	3,200	81,788	NS	NS	NS	NS
2006	NS	NS	10	3,890	NS	NS
2007	16,960	42,514	NS	NS	19,665	13,703
2008	600	5,530	0	737	NS	NS
2009	4,610	13,676	NS	NS	NS	NS
2010	NS	NS	0	433	0	91
2011	15,765	86,812	0	100	0	0
2012	NS	NS	0	1,163	1,075	2,243
2013	86,804	7,315	NS	NS	3,390	706
MEAN	18,267	46,136	1,254	7,008	4,148	1,136

Table 5.11 Annual totals and long term means of seed oyster (barrels) and sack oyster (sacks) harvests from Lake Felicity and Lake Chien cultch plants (NS=no season).

YEAR	LAKE FELICITY		LAKE CHIEN TOTAL	
	Seed	Sack	Seed	Sack
2005	15	0	253	0
2006	0	0	1,940	0
2007	470	4,830	2,157	2,439
2008	0	0	205	17
2009	NS	NS	NS	NS
2010	0	205	0	405
2011	671	351	156	2,458
2012	0	37	0	1022
2013	NS	NS	NS	NS
MEAN	165	775	673	906

Coastal Study Area (CSA) 6 – 2014 Oyster Stock Assessment

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. 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 oyster abundance and distribution permitted.

The Vermilion/Cote Blanche/Atchafalaya Bays Complex is a large, primarily open-water brackish system with the public oyster 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, 2007, and 2013 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. In addition, information regarding the 2013/2014 oyster season harvest on the Vermilion Bay area public oyster seed grounds will be presented.

Methods

Field sampling was conducted on July 16 and 25, 2014. A total of ten stations (Figures 6.1 and 6.2) were sampled with five replicate quadrat samples collected at each station, characterizing the spatial distribution of sampling effort on the hard-bottom areas found within the system. 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 five millimeter (mm) intervals, then classified as spat (<25 mm), seed (25 mm to < 75mm), or

sack oysters (≥75mm). Shells from recently 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. Water temperature and salinity data were collected in conjunction with square meter oyster samples.

Results and Discussion

Seed and Sack Stock

Live seed oysters were found at seven of the ten sample sites. Density numbers at the sites with live seed ranged from 0.2 per replicate at South Point and Middle Reef to a high of 6.4 at Lighthouse Point (Figures 6.1 and 6.2). Sack sized oysters were found only at the Lighthouse Point station, where the average catch per replicate was 0.8.

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% oyster mortality on the grounds was noted in eight of the previous ten years and is reflected by the results of the annual oyster stock assessment data (Figure 6.3).

Spat Production

Despite the presence of suitable substrate at all locations, live spat were found at only four of the 10 sample locations (Figures 6.1 and 6.2). Density numbers at the sites with spat ranged from 0.2 per replicate to a high of 1.0 at Bayou Blanc. Low spat productivity during periods of high Atchafalaya River flow (with associated low salinity conditions) are common in this bay system.

Fouling organisms

An overall decrease of 18% in hooked mussel (*Ischadium recurvum*) abundance on the seed ground compared to last year's assessment was documented. A decrease in numbers was noted at five of the stations while density increased at the remaining sites. (Table 6.1).

Oyster Predators

No evidence of the southern oyster drill (*Stramonita haemastoma*) was noted during sampling, which is not surprising considering the depressed salinities normally found in this area. These predatory marine snails are more often associated with high salinity waters where they are known to prey heavily on oysters and other bivalve species. An overall increase of 73% in mud crab *(Xanthidae spp.)* occurrence on sampled reefs was observed compared to the previous year's assessment. While five of the ten sites had no mud crabs, density reached a high of 3.6 crabs per replicate at Lighthouse Point. No blue crabs *(Callinectes sapidus)* were collected. Only one Stone crab *(Menippe adinia)* was collected (Bayou Blanc site) during the 2014 square meter square survey.

Dermo

Dermo (*Perkinsus marinus*), a protozoan parasite prevalent in oysters, may cause extensive mortalities in conditions of high salinities and water temperatures. As in previous years, an attempt to collect samples from the eastern and western part of the system for analysis of the presence of this pathogen was made. An oyster dredge was used to collect a sufficient number of

seed and sack-sized oysters from the Indian Point (west) and Middle Reef (east) sites. All samples were forwarded to Dr. Tom Soniat (University of New Orleans) for quantification of the protozoan infestation. Results of Dermo analysis are contained within a separate section of this document.

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 (Figure 6.4).

Following the July 2013 square meter stock assessment, August dredge samples found promising numbers of spat, seed and sack sized oysters at the western sites in the vicinity of Southwest Pass. Salinity levels were very low at the eastern sites where very little live resource was found (the exception was Middle Reef, where hydrologic conditions were more conducive to productivity). A positive spat set throughout the system was documented in September, with favorable hydrologic conditions recorded at all stations. Salinity levels remained relatively high through the year's end, but began to fall in the eastern part of the system in early 2014 as the Atchafalaya began to rise and reach 12.4 feet (Butte La Rose gauge) on January 11. By March, mortality at the Rabbit Island site was documented. While salinity levels remained low (<1ppt) at the eastern sites through May, no mortality was documented at any other eastern site. No mortality was found on sample sites in the vicinity of Southwest Pass. By June salinity levels were at more favorable levels (Figure 6.4). Dredge samples collected in June 2014 indicated the presence of viable oyster resource at sites in the vicinity of Southwest Pass and South Point/Marsh Island.

Tropical and Climatic Events

No tropical storms or significant climatic events affected the Vermilion area seed grounds since the 2013 assessment.

Deepwater Horizon Oil Spill and Related Response Actions

The 2010 *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

2013 Cultch Plant

A twenty five acre cultch plant, funded by the Environmental Defense Fund (EDF), was constructed on the outside portion of the seed ground approximately 0.7 miles southeast of South Point/Marsh Island. The washed limestone cultch material was deployed in mid-August 2013 and was placed in approximately seven feet of water. The northwest corner of the plant was recorded as 29° 28' 56.7" / 91° 45' 17.0". The cultch plant was not sampled for the 2014 Stock Assessment.

2013/2014 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 September 4, 2013 and remained open until one-half hour after sunset on April 30, 2014.

An estimated 3,031 sacks of market-size oysters were harvested from reefs on the public seed ground in the vicinity of Southwest Pass, with effort concentrated in the area around Indian Point, Vermilion Bay.

A fourteen day DHH permitted oyster relay opened on the outside portion of the seed ground on April 1, 2014. The relay harvest area ("Closed" under DHH classification system) was designated to include reefs from South Point/Marsh Island eastward to Pt. Au Fer. An estimated 45,650 sacks were transplanted from the seed ground in the vicinity of Nickle Reef to privately owned leases during the relay period.

Station Name	Station Code	Latitude	Longitude
Big Charles	002	29.61433	-91.98621
Indian Pt	003	29.68633	-91.90183
Vermillion Bay	004	29.62500	-92.00833
Sally Shoal	020	29.65444	-91.87111
Lighthouse Pt.	022	29.57944	-92.03444

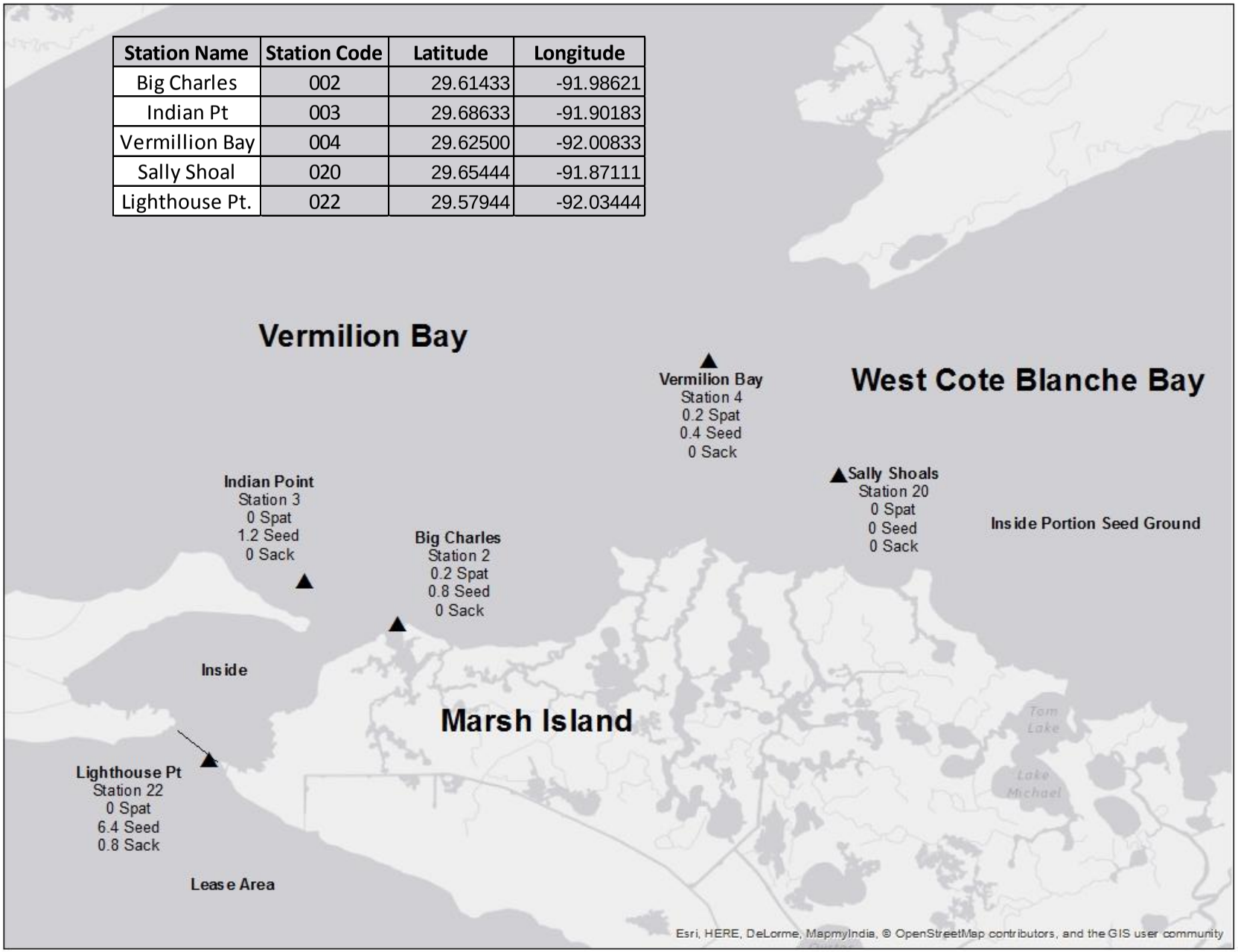

Figure 6.1 Map designating CSA6 2014 oyster square meter sample stations in the western part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data displayed below station numbers represent average spat, seed and sack oysters per square meter sample.

Station Name	Station Code	Latitude	Longitude
South Pt.	001	29.48333	-91.75750
Bayou Blanc	005	29.51333	-91.75833
Rabbit Island	021	29.51106	-91.59756
Middle Reef	023	29.45281	-91.72397
North Reef	024	29.47892	-91.80803

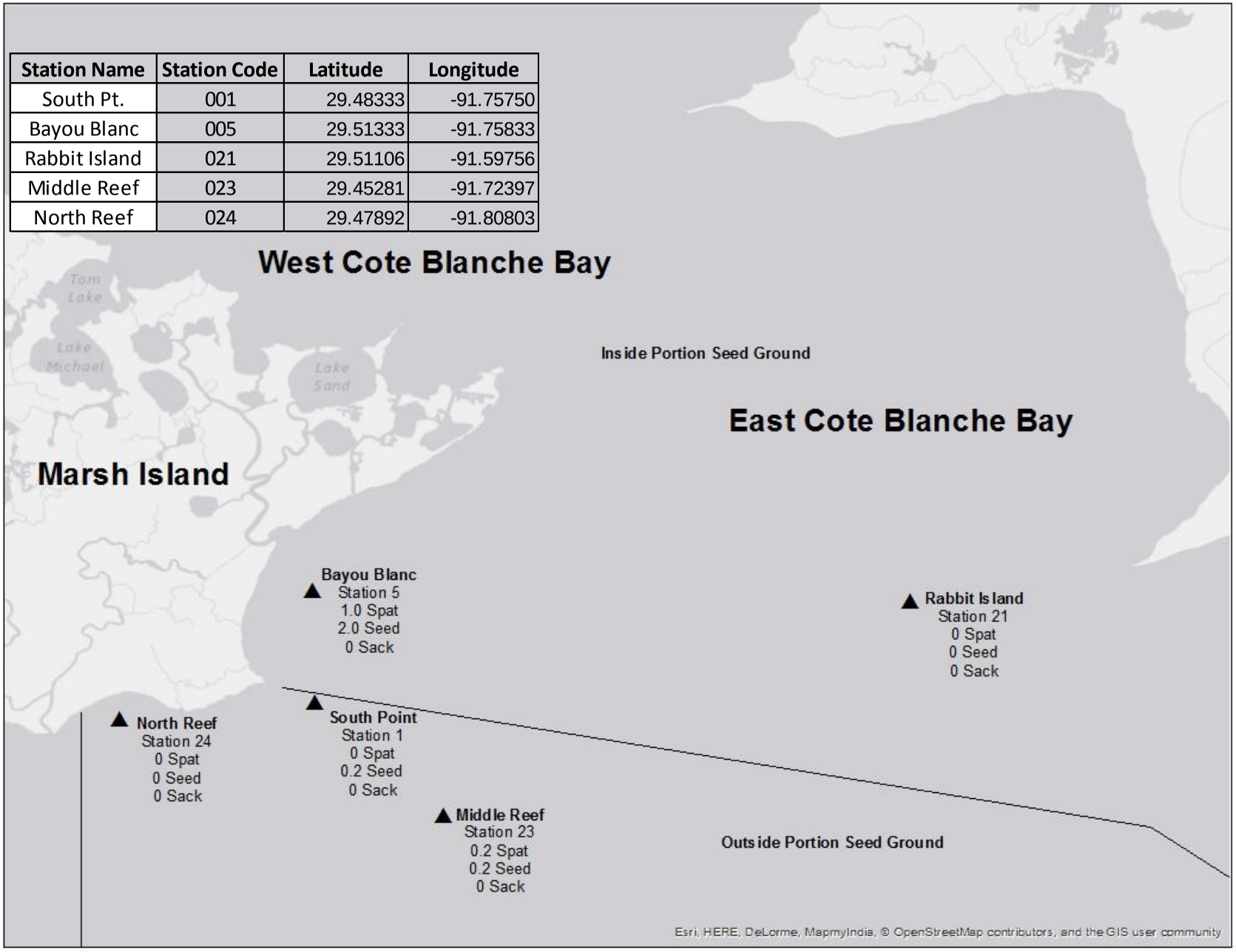

Figure 6.2 Map designating CSA6 2014 oyster square meter sample stations in the eastern part of the Vermilion, East and West Cote Blanche and Atchafalaya Bays public oyster seed ground. Data displayed below station numbers represent average spat, seed and sack oysters per square meter sample.

Year	mean density seed/sample	mean density sack/sample	Seed/sack ratio
2000	81.4	3.3	24.7:1
2001	28.8	4.8	6.0:1
2002	2.25	0.25	9.0:1
2003	1.2	0	No Sack Oysters
2004	4.3	0	No Sack Oysters
2005	14.8	0	No Sack Oysters
2006	16.1	0.5	32.2:1
2007	11.6	0.8	14.5:1
2008	1.3	0	No Sack Oysters
2009	3.4	0	No Sack Oysters
2010	0.8	0.12	6.7:1
2011	0.32	0.02	16.0:1
2012	1.78	0.04	44.5:1
2013	0.3	0.02	15.0:1
2014	1.12	0.08	14:01

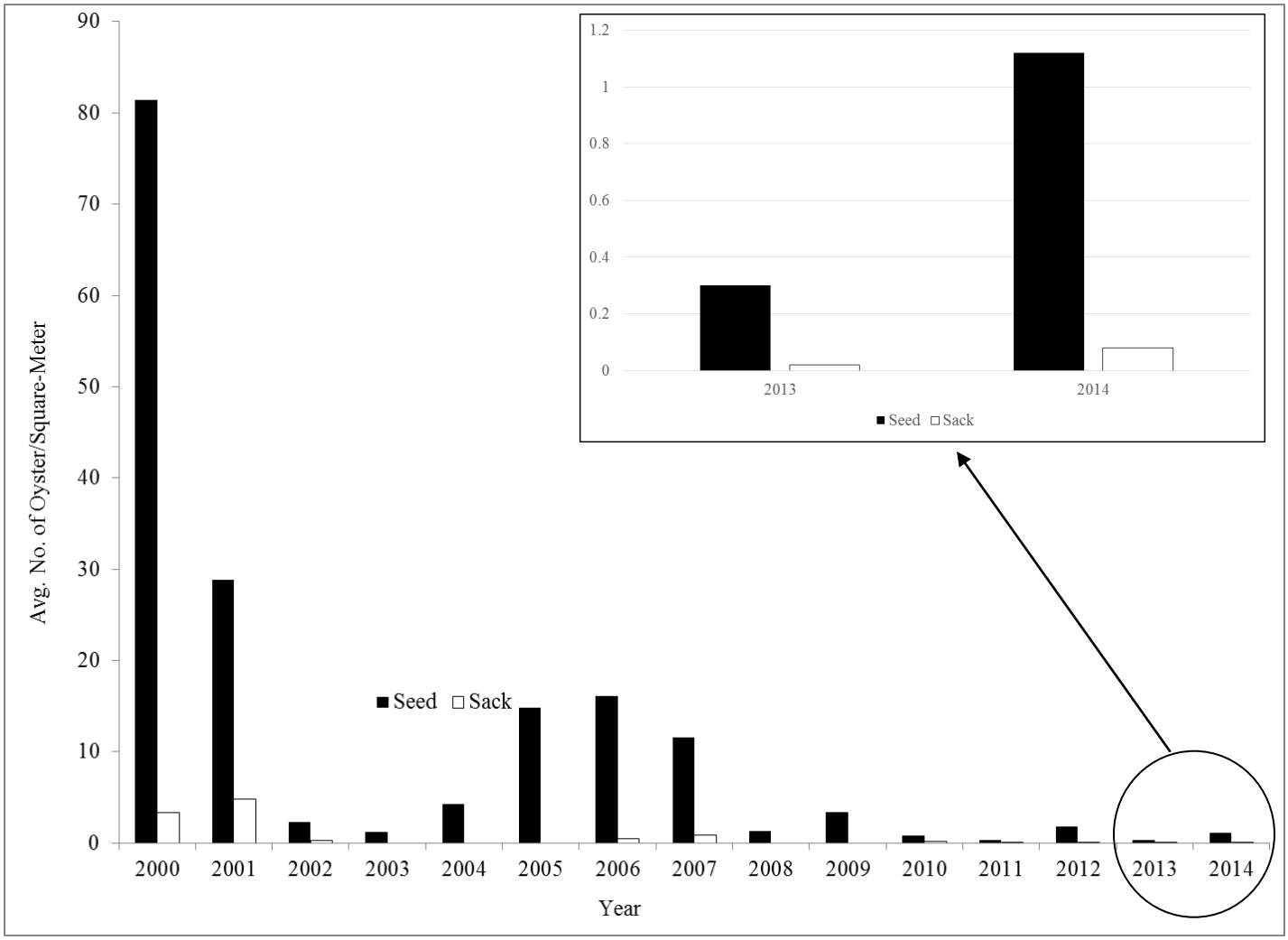

Figure 6.3. Graph depicting mean density of live seed and sack size oysters collected in CSA6 square meter samples (by year). Data table included.

Table 6.1. Mean density of the hooked mussel, *Ishadium recurvum*, recorded at each CSA6 square meter station (by year).
** 2011 was the first year for square meter samples for these stations*

Station no.	Station name	2007	2008	2009	2010	2011	2012	2013	2014
001	South Pt./Marsh Island	26.0	1.0	0.0	11.2	1.4	46.4	0.0	2.6
002	Big Charles	16.0	2.5	0.0	18.4	5.2	21.2	4.8	1.0
003	Indian Point	33.5	0.5	16.0	18.2	20.4	16.6	5.4	8.0
004	Dry Reef/Vermilion Bay	0.0	2.0	37.0	0.0	6.6	29.8	38.2	25.2
005	Bayou Blanc	18.5	2.5	0.0	4.0	2.0	13.4	9.0	4.6
020*	Sally Shoals	*	*	*	*	3.8	25.2	4.8	12.4
021*	Rabbit Island	*	*	*	*	0.0	0.0	0.0	0.2
022*	Lighthouse Point	*	*	*	*	11.8	5.2	0.8	1.4
023*	Middle Reef	*	*	*	*	0.2	11.8	0.8	0.4
024*	North Reef	*	*	*	*	4.4	12.6	4.6	0

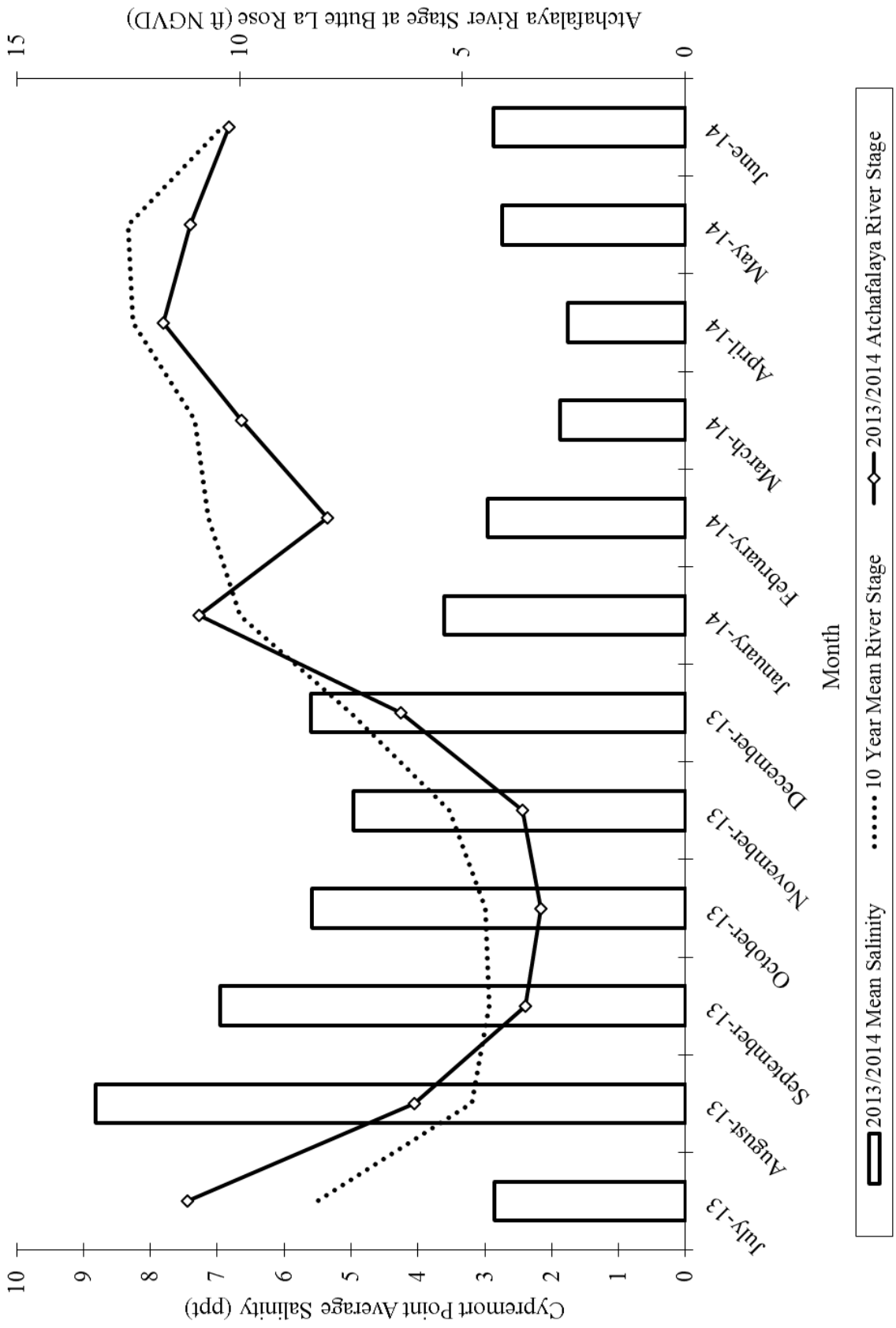

Figure 6.4. Graph depicting Atchafalaya River levels at Butte La Rose gauge and average salinity for Cypremort Point, LA during the period July 1, 2013 through June 30, 2014. Ten year average monthly river stage at Butte La Rose is included.

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Coast Study Area (CSA) 7 – 2014 Oyster Stock Assessment

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 Calcasieu River basin in Calcasieu and Cameron parishes. It consists of approximately 58,260 water bottom acres with oyster reefs located throughout the lake, especially in the southern end. The Mermentau River basin has no oyster harvesting areas. Sabine Lake is located at the southern end of the Sabine River basin in Cameron parish. It consists of approximately 55,057 water bottom acres with approximately 34,067 acres in the Louisiana portion and the remainder in the Texas portion. Oyster reefs are located mainly in the very southern portion of the lake.

It is unclear when commercial oyster harvesting began on Calcasieu Lake and to what extent it took place. In 1967 Calcasieu Lake was closed to oyster harvesting and the closure remained until 1975 when oyster harvesting was reopened. Oyster harvesting resumed in 1975, but gear restrictions were placed on harvesting which allowed only taking by hand or tongs. The gear restriction remained in effect until 2004, when legislation (HB160; ACT479) was passed allowing for the use of hand oyster dredges of three feet wide or less in Calcasieu Lake. In 2006, legislation (HB802; ACT398) was passed allowing the use of mechanical retrieval systems for dredges. In 2011, legislation (SB73, ACT329) was passed restricting oyster harvest in Calcasieu Lake to those who possessed a Calcasieu Lake Oyster Harvest Permit. The number of permits granted was restricted to 126 oyster harvesters, of which 63 had to have historical oyster landings from Calcasieu Lake, with the remaining being first come first serve. In 2012, legislation (SB202, ACT541) removed the landings requirement as well as the restriction on the number of harvesters that could possess the permit.

Oyster seasons in Sabine Lake haven't occurred since the early 1960's based on anecdotal information; neither Texas nor Louisiana can document harvest beyond that time and no concrete harvest data has been located.

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 shellfish harvest areas – Calcasieu Lake Conditional Managed Area (CLCMA) and West Cove Conditional Managed Area (WCCMA). Because the areas are classified as conditionally managed, LDHH has the authority to set closure regulations based on health related concerns due to poor water quality. Originally, LDHH established health related closures of oyster harvest in Calcasieu Lake based on the river stage of the Calcasieu River at Kinder, LA. CLCMA would be closed to oyster harvest when the river stage reached 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 adjusted the CLCMA river stage threshold in 1998 to 13.5 feet. In 2004 LDHH reclassified the Louisiana Public Oyster Harvest Areas into Oyster Growing Areas. The Eastside of Calcasieu Lake and West Cove are classified currently as Growing Area 29 (GA-29) and Growing Area 30 (GA-30) (Figure 7.1).

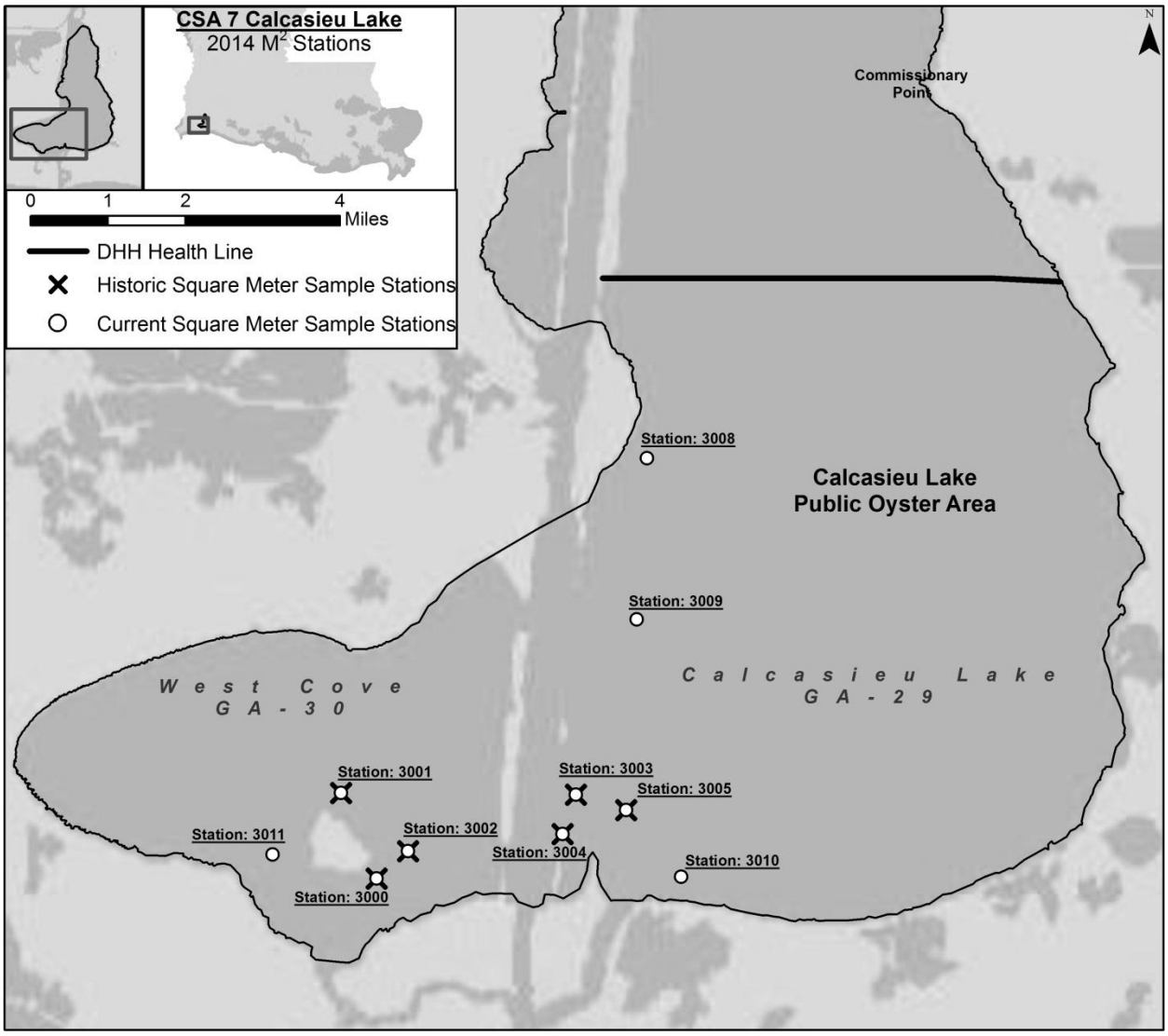

Figure 7.1. LDHH public oyster harvest areas (GA-29, GA-30) and LDWF meter square sampling station locations, Calcasieu Lake, Cameron Parish, Louisiana.

Prior to the start of the 2013-2014 oyster harvest season LDHH changed the Calcasieu River stage threshold for health related closures for GA-30 from 7ft. to 9ft. at Kinder.

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 (GA29) where water quality meets minimum standards. The total area has been changed several times over the years with the current acreage being approximately 26,736 water bottom acres. GA30 has remained the same at approximately 9,248 acres of water bottom. The Louisiana portion of Sabine Lake (GA 31) has approximately 34,067 water bottom acres. This area was cleared by LDHH in March of 2011 for harvesting, but the Louisiana Wildlife and Fisheries Commission (Commission) has not opened a season on this area at this time. Since it is cleared for harvesting by LDHH, LDWF has added the area to be assessed for oyster stocks (Figure 7.2).

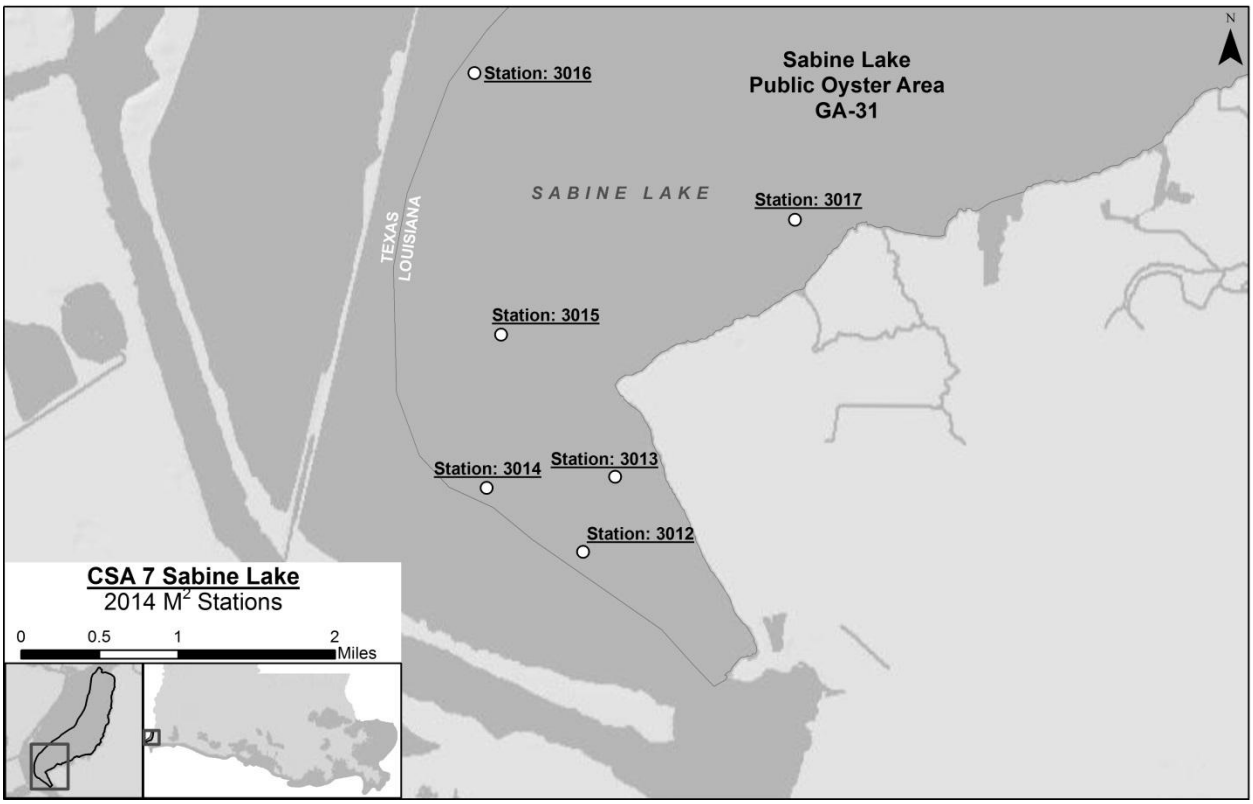

Figure 7.2. LDHH public oyster harvest area (GA-31) and LDWF meter square sampling station locations, Sabine Lake, Cameron Parish, Louisiana.

Prior to 2011, oyster reef acreage in Calcasieu Lake was estimated to total approximately 1,690.95. West Cove was estimated to contain 726.98 acres of reef and the Eastside approximately 963.97 acres. Since 2011, the LDWF oyster stock assessments in Calcasieu and Sabine Lakes have utilized acreage estimates determined by side-scan sonar water bottom assessments performed in 2008 and 2011. All suitable oyster habitat (Bottom Type IIIB) within the LDHH CM Harvest areas of Calcasieu and Sabine Lakes was identified and categorized into two classification types: Reef and Exposed Shell. Based on the results of the side-scan surveys it is estimated GA-29 has a total of 1,962.3 acres of suitable oyster habitat which includes 435.8 acres of Reef and 526.5 acres of Exposed Shell bottom type and GA-30 has a total of 3,387.8 acres of oyster habitat which includes 1,119.6 acres of Reef and 2,268.2 acres of Exposed Shell bottom type (Figure 7.3). These estimated acreage figures generated from the side-scan surveys only include those areas of Calcasieu Lake that lie within the LDHH-allowed harvest area.

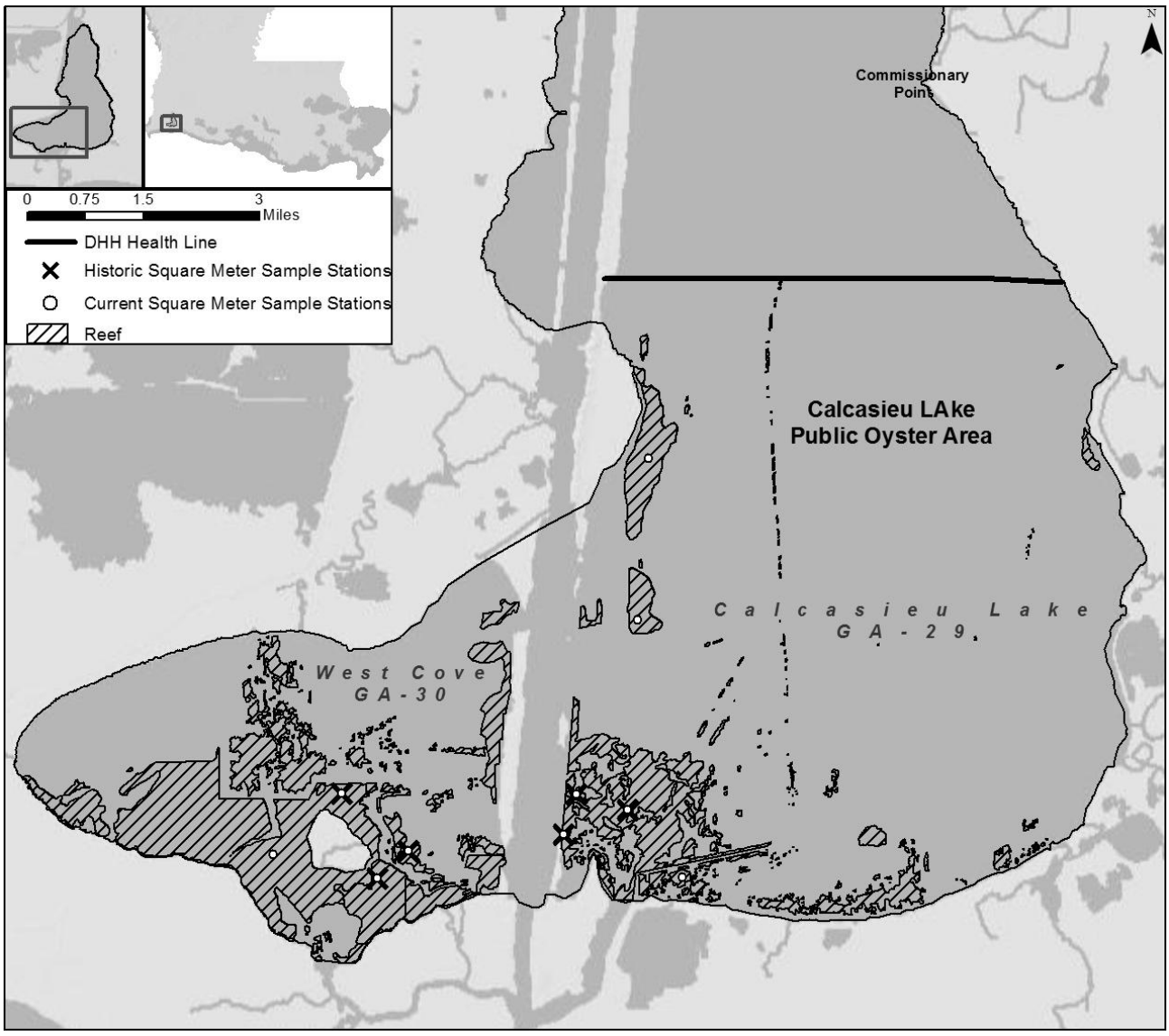

Figure 7.3. Estimated oyster habitat (Bottom type IIIB) coverage as delineated by side-scan sonar water bottom assessments Calcasieu Lake, Cameron Parish, Louisiana. "Reef" describes both consolidated and exposed, scattered shell water bottoms.

It is estimated GA-31 has a total of 1479.5 acres oyster habitat which includes 1,041.0 acres of Reef and 438.5 acres of Exposed Shell bottom type (Figure 7.4).

LDWF placed a 14.3 acre cultch plant in the southern portion of GA-29 (on the south side of the "Old Revetment") in May of 2009. This area has failed to develop into a sustainable area suitable for harvest.

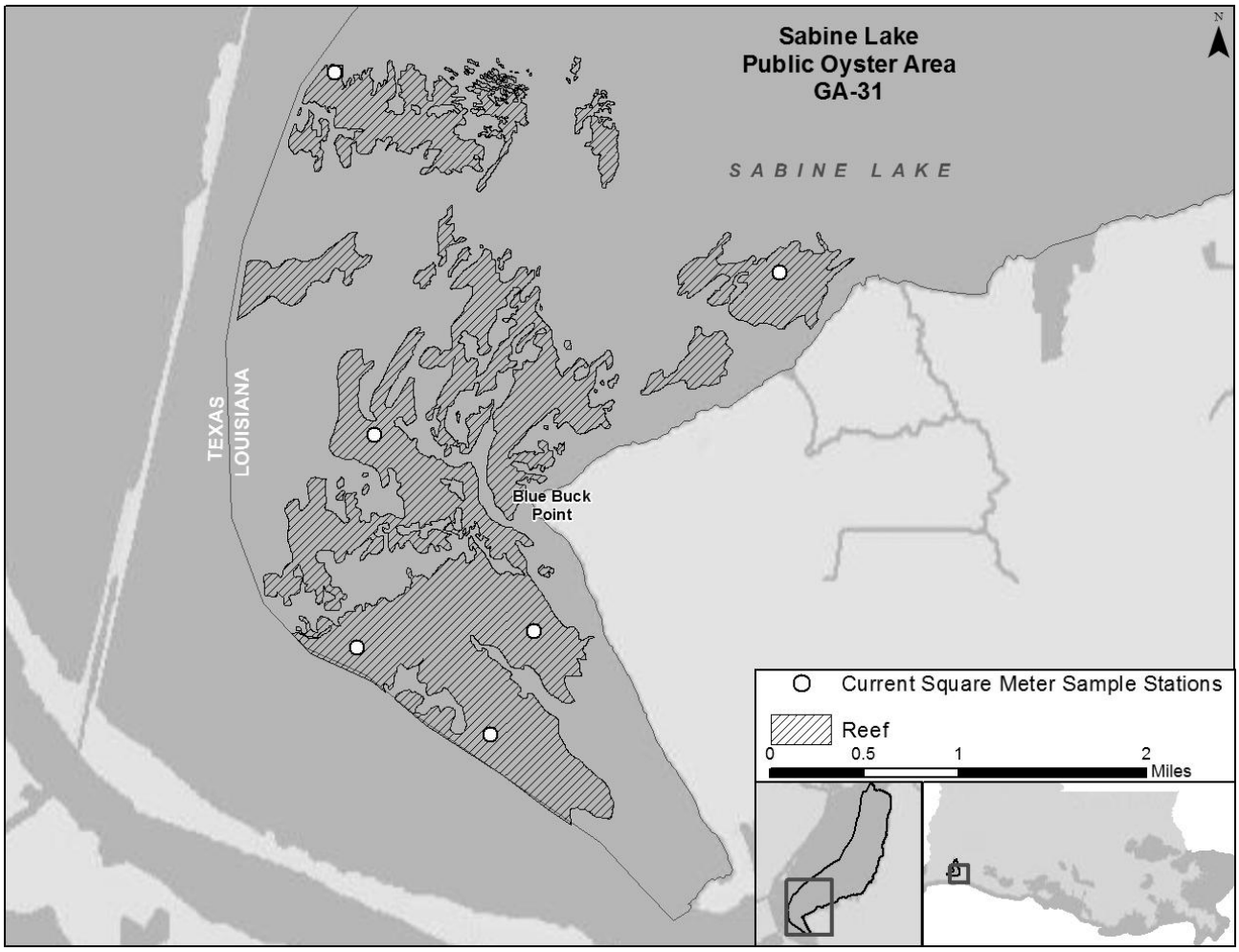

Figure 7.4. Estimated oyster habitat (Bottom type IIIB) coverage as delineated by side-scan sonar water bottom assessments Sabine Lake, Cameron Parish, Louisiana.

Methods

The oyster assessment for Calcasieu and Sabine Lakes is derived by collecting "meter square" samples at designated sampling locations. There are six designated stations in GA-29, four in GA-30 and six in GA-31 (Figures 7.1 and 7.2). Five replicate samples are taken at each station.

A one meter square frame is randomly deployed in an area very near to the designated sample station location. A SCUBA diver collects all live and dead oysters and shell on the top portion of the reef substrate within the meter square frame and places them in number baskets.

All live and recent dead oysters are measured and recorded in five millimeter (mm) groups. Size classes are grouped into three categories – spat (<25mm), seed oysters (25mm – 74mm) and market oysters (75mm and larger). Oyster predators and Hooked mussels (*Ishchadium recurvum*) that are collected are identified and total numbers recorded. As no bedding (seeding) operations occur in Calcasieu and Sabine Lakes, and all harvest is for direct market, the results of data collected are reported in sacks of seed and market sized oysters (seed – 360 oysters equals one

sack, market – 180 oysters equals one sack) rather than in barrels, the standard oyster unit of measure utilized in other parts of coastal Louisiana (two sacks = one barrel).

Results

Market Stock

Based on the data collected during the 2014 stock assessment of public oyster harvest areas in Calcasieu Lake it is estimated that the current stock is approximately 188,616.1 sacks of market-sized oysters and 245,909.5 sacks of seed oysters (Table 7.1). The overwhelming majority of the resources continue to be limited to West Cove (GA-30), but for the first time in two years live oysters were discovered in samples collected in GA-29. Using data from the standardized samples it is estimated that GA-29 contains approximately 31,959 sacks of seed sized oysters.

Table 7.1. Assessment of oyster resources estimated using standardized meter square sampling of public oyster harvest areas located in Calcasieu and Sabine Lakes, Cameron Parish, Louisiana, 2014.

Public Oyster Area	Bottom Type IIIB	Station	Seed Oysters per m2	Sack Oysters per m2	Reef Acreage	Square Meters	Sacks of Seed Oysters	Sacks of Market Oysters
GA29	Reef	3003	0	0	1,421.5	5,752,611.5	31,959.0	0.0
		3004	0.2	0				
		3005	5.8	0				
	Exposed Shell	3008	0	0	526.5	2,130,671.8	0.0	0.0
		3009	0	0				
	Cultch Plant	3010	0	0	14.3	57,870.1	0.0	0.0
						Total	**31,959.0**	**0.0**
GA30	Reef	3000	1.8	0.4	1,119.6	4,530,864.5	17,620.0	5,034.3
		3002	1	0				
	Exposed Shell	3001	2.8	0	2,268.2	9,179,087.9	196,330.5	183,581.8
		3011	12.6	7.2				
						Total	**213,950.5**	**188,616.1**
GA31	Reef	3012	29.4	32	1,041.0	4,212,781.3	224,096.6	810,960.4
		3013	13.2	25.4				
		3014	17.6	38.8				
		3015	16.4	42.4				
	Exposed Shell	3016	8.2	18.8	438.5	1,774,548.1	34,012.2	203,087.2
		3017	5.6	22.4				
						Total	**258,108.7**	**1,014,047.6**

No market-sized oysters were found at the assessed sample sites again this year in GA-29; however dredge samples collected in areas outside our established sampling locations found market-sized oysters to be present.

Total stock of market-sized oysters in Growing Area 30 experienced an 11.6% increase from last year's assessment (Table 7.2), but overall density (numbers/m^2) has declined. While these two estimates seem to contradict each other, both are important in assessing the health of oyster resources in GA-30. Total stock of oysters in GA30 is a function of oyster density and available oyster habitat. For stock assessment purposes oyster habitat is divided into two classifications: "Reef" and "Exposed Shell" and stocks for each habitat type are calculated independently and then added together to produce total overall standing stock. Two stations are sampled from each of the different habitat types. Since the amount of "Exposed Shell" habitat is roughly double that of "Reef" in GA-30 and represents approximately 67% of the total oyster habitat, any change in oyster densities within this habitat type has a significant effect on the overall total stock numbers. This appears to be the case with this year's assessment in GA-30, especially considering the high oyster density collected at one of the "Exposed Shell" habitat stations (Station 3011).

The high oyster density at this station, coupled with that density being applied to large reef acreage, contributed significantly to the 260% increase in seed-sized oyster stock in GA-30. Despite the overall increase in total stock, there continues to be concern about the general low densities of market oysters in GA-30. Overall average density of market-sized oysters for all stations combined in GA-30 is 1.9/m^2, which is a 37% reduction from the 2013 assessment. This is very alarming considering three out of four assessed locations had densities of less than 1 market oyster/m^2 with half not having any market-size oysters at all.

Table 7.2. Oyster stock assessments (in sacks) and percentage change of public oyster harvest areas in Calcasieu and Sabine Lakes, Cameron Parish, Louisiana.

	MARKET OYSTERS (≥ 3")			**SEED OYSTERS (< 3")**		
YEAR	**GA29**	**GA30**	**GA31**	**GA29**	**GA30**	**GA31**
2008	752,061.90	142,199.90	NA	449,720.00	212,483.30	NA
2009[1]	612,687.30	711,613.60	NA	191,435.50	422,520.60	NA
2010[1]	23,540.10	689,375.70	478,985.90	8,545.30	605,983.50	436,409.40
2011[2]	27,007.80	594,744.10	1,031,976.20	52,831.90	308,927.20	406,141.10
2012	0	236,439.50	890,693.90	0	85,171.20	552,007.60
2013	0	169,038.40	1,110,940.90	0	59,510.90	391,261.20
AVERAGE	**235,882.85**	**423,901.87**	**878,149.23**	**117,088.78**	**282,432.78**	**446,454.83**
2014	0	188,616.05	1,014,047.57	31,958.95	213,950.52	258,106.2
% CHANGE FROM AVE.	-100.0	-55.5	15.5	-72.7	-24.2	-42.2
% CHANGE FROM 2013		11.6	-8.7	100.0	259.5	-34.0

1 – assessed using updated reef acreage from ENCOS (3,907.1) in 2008.

2 – assessed using updated reef acreage from ENCOS (2008) and Bio-West (2011).

The oyster assessment for GA31 indicates 1,014,047.6 sacks of market-sized oysters and 258,106.2 sacks of seed oysters present (Table 7.1). These numbers represent an overall decline in both seed and market-sized oysters of 8.7 and 34.0% respectively. Despite the decline, it is expected to have slight fluctuations in population numbers from year to year (Figure 7.5).

Recruitment

The density of oyster spat collected at the assessed sights in GA-30 was estimated to be 1.4 individuals/m^2. This number is considerably higher than the estimate from last year's assessment of 0.15 individuals/m^2. It is hoped that the successful recruitment of spat will translate into an increase in stock of market-sized oysters in the area. However, due to high mortality rates of oysters in this size class, caution should be exercised when forecasting the effects on future stock.

In addition to the presence of seed-size oysters in samples from GA-29, another very encouraging sign that oyster populations in the area may be improving is the occurrence of oyster spat. The density of oyster spat in GA-29 was estimated to be 1.03 individuals/ m^2 which is a great improvement over last year's assessment where no live spat were found.

In an attempt to improve oyster recruitment in GA-29, releases of hatchery reared spat and larvae have been made in the area. Since July 2013 approximately 746,369,000 larvae and 34,300,000 spat have been released in Calcasieu Lake. At this time, the success of these releases is unknown.

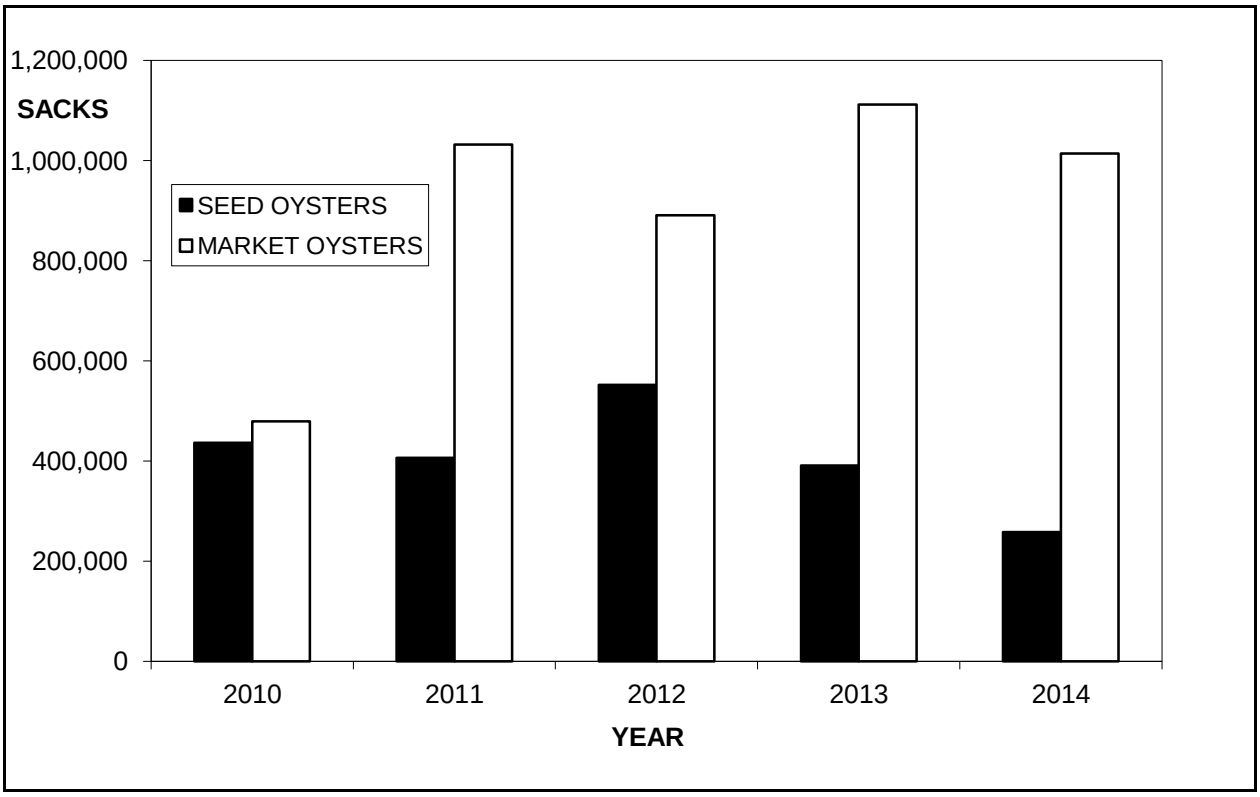

Figure 7.5. Annual oyster stock assessments of public oyster harvest areas (GA-31) located in Sabine Lake, Cameron Parish, Louisiana, 2010 to 2014.

Hydrology

Average water temperatures for Calcasieu Lake in May and June were 25.2^{o}C and 27.7^{o}C respectively. Due to an unseasonable cold winter and relative mild spring, water temperatures were slightly cooler for both months compared to the long term average (LTA) of 1996-2014 (Table 7.3). The average water temperature during the oyster assessment was 30.0^{o}C which is very near the LTA of 29.6^{o}C.

Average salinities (in parts per thousand - ppt) for May and June were 18.5 ppt and 16.9 ppt respectively (Table 7.3). The average salinity during the oyster assessment was 14.4 ppt which is below the LTA of 18.9 ppt.

Table 7.3. Average salinity and water temperature data collected during dredge and meter square sampling efforts of public oyster harvest areas in Calcasieu and Sabine Lakes, Cameron Parish, Louisiana, May-July, 2014.

	GA-29		GA-30		GA-31		LONG TERM (CALCASIEU LAKE)[1]	
MONTH	**AVE. SAL.**	**AVE. TEMP.**	**AVE. SAL.**	**AVE. TEMP.**	**AVE. SAL.**	**AVE. TEMP.**	**AVE. SAL.**	**AVE. TEMP.**
MAY DREDGE SAMLES	17.7	25.4	19.2	25.0	17.9	24.1	17.5	25.6
JUNE DREDGE SAMPLES	17.0	27.7	16.7	27.6	11.5	29.2	18.2	28.7
JULY SQ. MTR. ASSESSMENT	14.4	30.5	14.4	29.4	9.7	30.0	18.9	30.1

1 – Longterm is from Calcasieu Lake – dredge and meter square sampling from 1996 to present.

Disease, Fouling Organisms, and Predators

The southern oyster drill has become a major concern on public oyster harvest areas in Calcasieu Lake. Prior to 2009, very few oyster drill snails were recorded in our standardized monthly samples. Beginning in 2009 oyster drill numbers recorded in monthly dredge samples began to increase and following an extended drought period in mid-2010 through 2011 numbers increased significantly (Figure 7.6). Although a freshwater influx occurred during February – April 2012 the numbers of oyster drills did not appear to be altered significantly based on numbers recorded during dredge sample efforts for that year. The number of oyster drills recorded during meter square sampling continues to be relatively low. Only two oyster drills were collected while sampling this year and they were collected at station 3005.

It appears oyster drill populations may now be declining in the harvest areas of Calcasieu Lake (Figure 7.6). The decline in snail numbers coupled with the extensive release of hatchery-raised larvae may have had an influence on the reappearance of seed sized oysters in GA-29. Oyster drill populations will continue to be monitored in an attempt to better understand the predator-prey relationship and oyster recruitment dynamics in Calcasieu Lake.

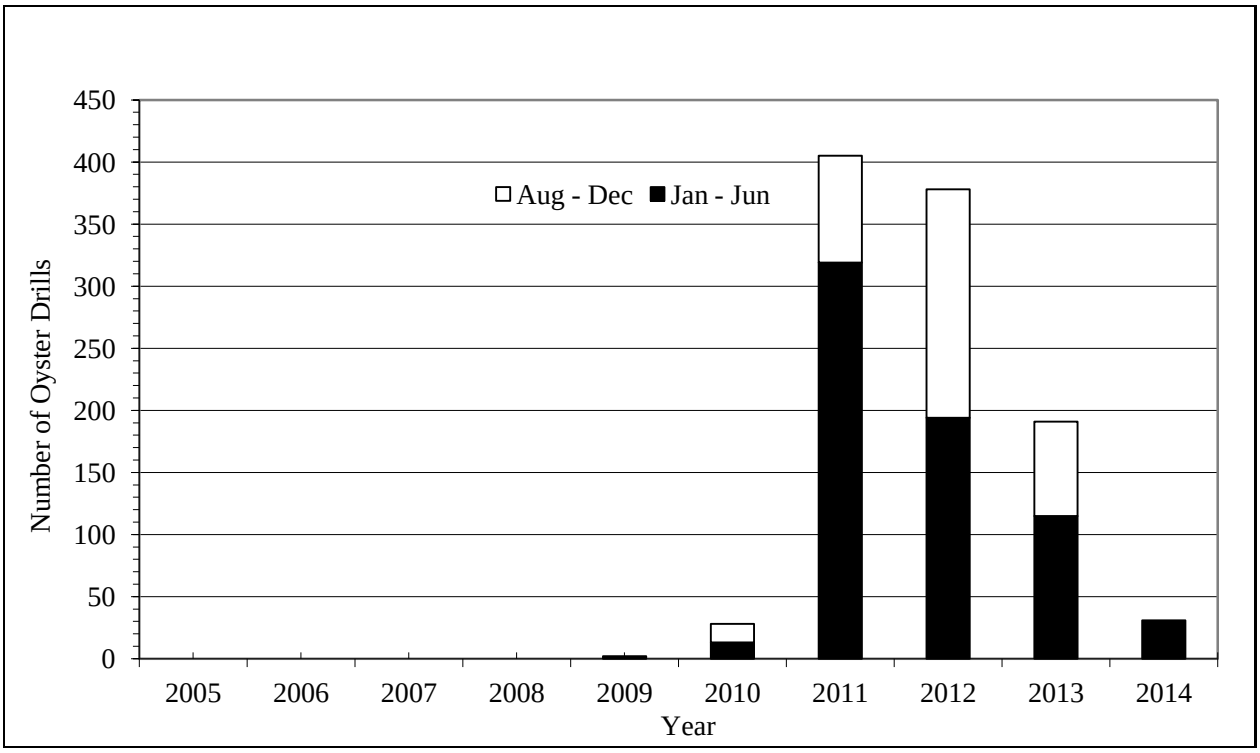

Figure 7.6. Total oyster drills (*Stramonita haemastoma*) collected in standardized dredge samples, Calcasieu Lake, Cameron Parish, Louisiana.

No hooked mussels were found in the GA-29 assessment. In our assessment of GA30, we recorded an average density of 12.4 mussels/m^2, which is an increase from the 2013 assessment density of 8.5/m^2. In the 2014 assessment of GA-31 we found there to be an average density of 242.0 mussels/ m^2 compared to an average density of 203.7/ m^2 per sample station in 2013. The high numbers in GA31 could be attributed to no oyster dredge activity on the reefs and/or environmental conditions conducive for mussel proliferation.

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We recorded a total of 141 unidentifiable mud crabs, 6 gulf stone crabs, and 5 green porcelain crabs from all sample locations within all of the three oyster growing areas. No other species of concern were encountered.

Deepwater Horizon Oil Spill and Related Response Actions

The 2010 *Deepwater Horizon* oil spill released millions of barrels of oil into the Gulf of Mexico affecting the Louisiana coastline. In direct response to the oil spill, in an effort to keep incoming oil from the Gulf out of Louisiana's sensitive marshes and estuaries, freshwater was released from diversions and siphons along the Mississippi River. The impacts of oil and freshwater diversions on oyster health and habitat continue to be of concern. Assessments on the direct and indirect impacts to Louisiana's environment, including oysters and oyster habitat, from oil and response actions are ongoing through the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA).

Future assessments

All the areas open to oyster harvest in GA-29, 30 and 31 that likely have oysters have had bottom surveys completed and reliable estimates of total reef acreages for these areas have been made.

One area of concern with future stock assessments in GA-29 and GA30 is the limited number of sample sites. The current protocol consists of assessing 10 sample locations and collecting five samples per station for a grand total of 50 meter squares assessed. Based on the total oyster habitat in these harvest areas this equates to an assessment of one sample site per 535 acres of available reef. Additional sample sites would provide a more accurate assessment of oyster resources in Calcasieu Lake. Adding six additional stations (three in each growing area) for stock assessment purposes will increase the number of sample sites per reef acreage to one per 334 acres. This would put the sampling intensity of Calcasieu Lake more in line with the Sister Lake Public Oyster Seed Reservation, which has one sampling station per 264 acres of available habitat.

2013-14 Oyster Season

Agreeing with recommendations from LDWF and the Louisiana Oyster Task Force, the Louisiana Wildlife and Fisheries Commission continued to keep GA-29 closed to oyster harvest and opened GA-30 on November 1, 2013 (Table 7.4). The sack limit was set at 10 sacks per day for the entire season. GA31 remained closed.

Calcasieu Lake oyster landings data via the LDWF Trip-Ticket program indicate there were 40,163 sacks reported as landed during the 2013-14 season (Table 7.5, Figure 7.7), which represents a 20.5% increase over last season's report of 33,326 sacks landed. Harvest reported via trip-tickets was slightly above the estimated harvest from LDWF boarding reports (36,304 sacks). If we assume all oyster harvesters are landing a full daily limit of 10 sacks per trip then we can estimate the harvest effort for this past season was slightly higher than the previous year. Using the trip-ticket harvest numbers and comparing them with the 2013 stock assessment we estimate approximately 23.8% of the standing crop of market-sized oysters in GA-30 was harvested last season.

Closures to oyster harvesting in GA-30 due to LDHH health concerns were minimal this past season with closures only accounting for 23 days (Table 7.6). Limited rainfall during the season kept the Calcasieu River flows at low levels. The increase in the LDHH conditional water levels from 7ft. to 9ft. in GA-30 had minimal impact on the number of closure dates this season, but in the future this may significantly reduce closure days and potentially allow an increase in total harvest.

Table 7.4. Public oyster harvest season dates for GA-29 and GA-30, Calcasieu Lake, Cameron Parish, Louisiana

Season		REGULAR SEASON							TOTAL DAYS IN SEASON
		DATES			DHH HEALTH CLOSURES EAST SIDE CALCASIEU LAKE		WEST COVE CALCASIEU LAKE		
		OPEN DATE	CLOSED DATE	TOTAL DAYS	DAYS OPEN	DAYS CLOSED	DAYS OPEN	DAYS CLOSED	
2004-05		10-15	4-30	198	168	30	68	130	198
2005-06	GA29	10-15	4-30	198	187	11			198
	GA30	10-8	4-30	205			165	40	205
2006-07	GA29	11-1	4-30	181	118	63			181
	GA30	10-16	4-30	197			70	127	197
2007-08	GA29	11-1	4-30	182					182
	GA30	10-15	4-30	199					199
2008-09	GA29	10-15	4-30	198	183	15			198
	GA30						125	73	
2009-10	GA29	10-15	4-30	198	157	41			198
	GA30						80	118	
2010-11	GA29	11-15	3-25[2]	131	131	0			131
	GA30[1]	10-15	4-30	196			186	10	196
2011-12[3]	GA29[4]	CLOSED	-	0	0	0			0
	GA30	11-1	4-30	181			92	90	181
2012-13	GA29	CLOSED	-	0	0	0			0
	GA30	11-1	4-30	181			82	99	181
2013-14	GA29	CLOSED	-	0	0	0			0
	GA30	11-1	4-30	181			158	23	181

1 – FROM 10-15 THROUGH 11-14, THE SACK LIMIT WAS 20; SACK LIMIT REVERTED TO 10 FOR THE REMAINDER OF THE SEASON IN BOTH GROWING AREAS.
2 – GA29 CLOSED DUE TO HEAVEY HARVEST PRESURE OF THE RESOURCE; SEE LDWF NEWSRELEASE 3/22/11.
3 – OYSTERING FROM CALCASIEU LAKE FOR THE 2011-12 SEASON WAS BY SPECIAL PERMIT ONLY, SEE NEWS RELEASE FROM 7/7/11 AND 9/15/11.
4 - GA 29 WAS CLOSED. SEE NEWS RELEASE FROM 9/1/2011.

Table 7.5. Historical stock assessments and landings (in sacks) of oysters from public oyster harvest areas in Calcasieu Lake, Cameron Parish, Louisiana.

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	58,960
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[3]	915,625	1,541,893	19,327
2006-07[4]	238,945	463,623	28,341
2007-08	662,747	1,638,496	49,529
2008-09	894,262	1,556,465	63,948[5]
2009-10[6]	621,006	873,099	137,074
2009-10[7]	1,398,437	1,972,920	
2010-11[8]	712,916	1,327,445	82,896
2011-12	594,744	903,671	29,666
2012-13	236,439	321,611	33,326
2013-14	169,038	228,549	40,163
2014-15	188,616	426,777	

1 – STARTED USING DEALER REPORTS FOR LANDINGS.
2 – THE 1999 PORTION OF THE LANDINGS WAS DERIVED FROM PRELIMINARY TRIP TICKET DATA.
3 – HURRICAN RITE MADE LANDFALL ON 9/23/05 IN CAMERON PARISH, DELAYING SEASON OPENING, LIMITING THE NUMBER OF FISHERMEN AND BUYERS.
4 – A SEWAGE LINE BREAK IN BAYOU D'INDE CLOSED THE SEASON FOR THE ENTIRE MONTH OF APRIL, LIMITING THE LANDINGS.
5 – NO DATA WAS AVAILABLE FOR OCT.2008.
6 – ASSESSMENT USING THE REGULAR REEF ACREAGE.
7 – ASSESSMENT USING THE UPDATED REEF ACREAGE FROM ENCOS (2008).
8 – USING THE UPDATED REEF ACREAGE (2008) AND USING FIVE REPLICATES INSTEAD OF TWO.

Table 7.6. Public oyster harvest season lengths and number of days open to harvest as a percentage for GA-29 and GA-30, Calcasieu Lake, Cameron Parish, Lousiaiana

SEASON		TOTAL DAYS	EAST SIDE CALCASIEU LAKE		WEST COVE CALCASIEU LAKE	
			OPEN DAYS	PERCENT	OPEN DAYS	PERCENT
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	GA29	198	187	94		
	GA30	205			165	40
2006-07	GA29	181	118	65		
	GA30	197			70	35
2007-08	GA29	182	165	91		
	GA30	199			131	66
2008-09	GA29	198	183	92		
	GA30				125	63
2009-10	GA29	198	157	79		
	GA30				80	40
2010-11	GA29	131	131	100		
	GA30	196			186	95
2011-12	GA29	Closed	0	-		
	GA30	181			92	51
2012-13	GA29	Closed	0	-		
	GA30	181			82	45
2013-14	GA29	Closed	0	-		
	GA30	181			158	87

1 - 92-93 SEASON STARTED USING CALCASIEU RIVER GAUGE AT KINDER FOR DHH CLOSURES.
2 – STARTING WITH THE 2005-06 SEASON, THE LAKE WAS DIVIDED INTO TWO CONDITIONAL MANAGED AREAS (CMA),WERE MANAGED SEPERATELY AND MAY HAVE DIFFENENT LENGTH SEASONS.
3 – STARTING WITH THE 2010-11 SEASON THE CONDITIONAL MANAGED AREAS WERE CHANGED TO GROWNING AREAS (GA).

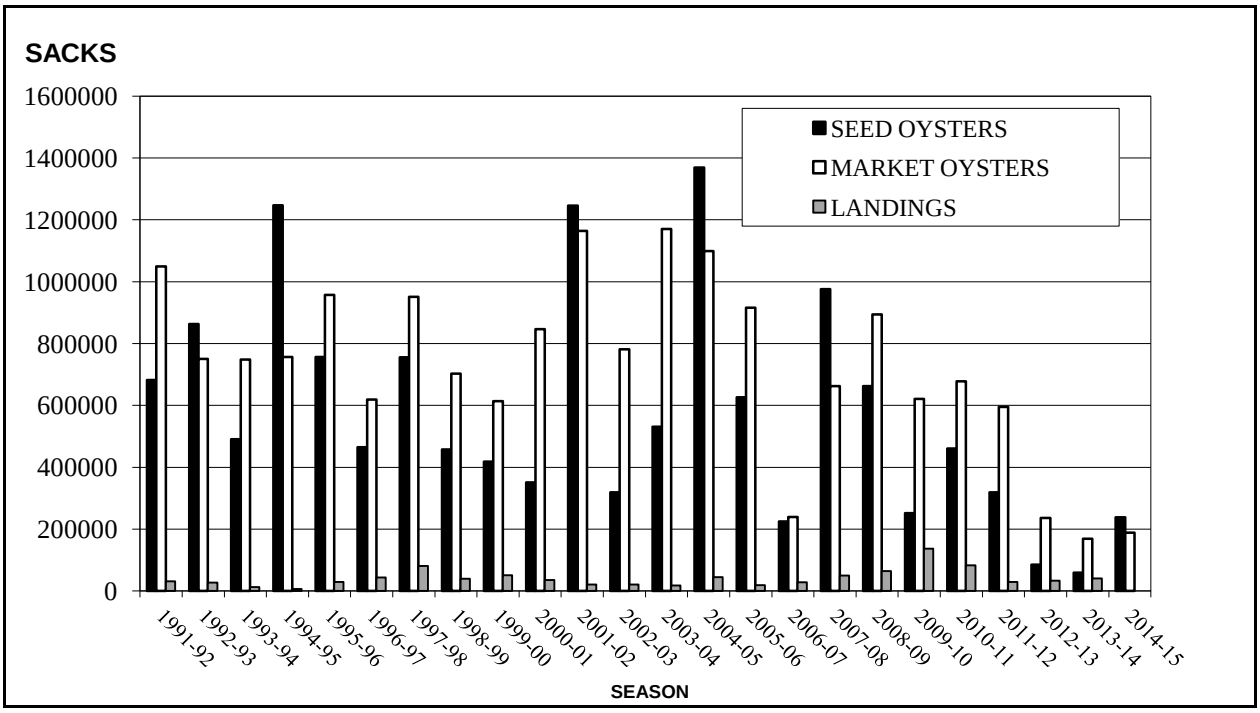

Figure 7.7. Historical stock assessments and landings (in sacks) of oysters from public oyster harvest areas of Calcasieu Lake, Cameron Parish, Louisiana.

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Levels of the parasite *Perkinsus marinus* in sack and seed oysters: Louisiana Public Seed Grounds, Summer 2014

by

Thomas M. Soniat, Ph.D.

29 August 2014

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

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

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

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

oyster tissue is almost entirely obscured by the parasite. Calculations are made of percent infection (PI) and weighted prevalence (WP), which is the sum of the disease code numbers divided by the total number of oysters in the sample. A WP of 1.5 could be considered a level at which disease-related mortalities are occurring (Mackin 1962, Bushek et al. 2012). Mackin (1962) claims a population of live oyster with a weighted prevalence of 2.0 "contains an intense epidemic, and more than half of the population may be in advanced stages of the disease, with all of the individuals infected".

Twenty two sites across coastal Louisiana were sampled for oysters for the summer 2014 study. Samples were taken from Grand Pass (GP1N) and Three Mile Pass (TM) in Mississippi Sound; Mozambique Point (MP). Lonesome Island (LI), North Black Bay (NB), South Black Bay (SB), Telegraph Point (TP), Bay Crabe (BC), and Bay Gardene (BG) in the Breton Sound area; upper Hackberry Bay (HB) in the Barataria system; Lake Felicity (LF) and Lake Chien (LC) in the Terrebonne Bay region; Grand Pass (GP5W) and Old Camp (OC) in Sister Lake; Bayou DeWest (BD) and Buckskin Bayou (BB) in Bay Junop; Middle Reef (MR) and Indian Point (IP) in Vermilion Bay; Northeast Rabbit Island (NE) and Commissary Point (CP) in Lake Calcasieu; and two stations in Sabine Lake (SL2 and SL3).

An attempt was made to assay 10 market-sized (≥ 75 mm) oysters and 10 seed (25-74 mm) oysters from each site. However, in some cases insufficient numbers of oysters were available to satisfy that standard (Table 1).

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

Weighed prevalence (WP) and percent infection (PI) results are shown in Table 1. As compared to last year, this year's WP results show a general decrease in disease. In direct reef-

to-reef comparisons only seed oysters from TM showed an increase in WP (0.03 in 2013 vs. 0.07 in 2014); in all other like comparisons, WP of seed and market oysters deceased or remained the same as compared to 2013. Higher WI was found in seed and market oysters from GP1N in 2014, as compared to nearby Cabbage Reef in 2013.

Overall, disease levels in 2014 have declined in comparison to 2013 levels, and remain low across the state. Records of disease levels from this year and previous years are available from Oyster Sentinel (www.oystersentinel.org).

Table 1. Percent Infection (PI) and Weighted Prevalence (WP) of seed and market-size oysters from Louisiana Public Seed Grounds: Summer 2014. Date is collection date, T = temperature, S = salinity, PI = percent infection, WP = weighted prevalence, NS = number of seed oysters assayed, NM = number of market oysters assayed. No data indicates that insufficient numbers of oysters were collected.

Station	Date	T (°C)	S (ppt)	Seed PI	Seed WP	NS	Market PI	Market WP	NM
Grand Pass (CSA1N)	7/02/14	29.5	10.4	10	0.03	10	50	0.40	10
Three Mile Pass	7/02/14	29.4	4.7	20	0.07	10	0	0	10
Mozambique Point	7/17/14	28.4	16.2	no data	no data	0	0	0	10
Lonesome Island	7/14/14	30.1	9.1	no data	no data	0	0	0	10
North Black Bay	7/17/14	28.5	16.2	no data	no data	0	10	0.03	10
South Black Bay	7/16/14	28.9	14.8	no data	no data	0	0	0	10
Telegraph Point	7/16/14	28.9	16.4	no data	no data	0	40	0.17	10
Bay Crabe	7/15/14	29.5	16.1	no data	no data	0	no data	no data	0
Bay Gardene	7/14/14	29.4	6.9	no data	no data	0	0	0	10
Hackberry Bay (Upper)	7/1/14	30.0	5.2	10	0.03	10	0	0	10
Lake Felicity	7/17/14	28.3	15.0	10	0.07	10	0	0	10
Lake Chien	7/17/14	28.6	14.4	0	0	10	0	0	10
Grand Pass (CSA 5W)	7/17/14	28.4	4.4	0	0	10	0	0.07	10
Old Camp	7/17/14	29.3	7.3	0	0	10	0	0	10
Buckskin Bayou	7/17/14	28.2	4.4	0	0	10	0	0	10
Bayou DeWest	7/17/14	29.2	8.2	0	0	10	0	0	10
Middle Reef	7/10/14	30.2	5.1	0	0	10	10	0.03	10
Indian Point	7/10/14	29.6	7.2	0	0	10	0	0	10
NE Rabbit	7/21/14	28.8	13.3	0	0	10	60	0.37	10
Commissary Point	7/21/14	28.5	10.6	20	0.07	10	10	0.03	10
Sabine Lake2	7/21/14	28.3	6.4	30	0.13	10	10	0.03	10
Sabine Lake3	7/21/14	28.4	8.3	30	0.13	10	30	0.10	10

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Appendix II. History of Cultch Plants on Louisiana's Public Water Bottoms

Year	Location	CSA	Cultch Type	Cubic Yards	Acreage	Cost
1917	Sister Lake	5W		2,243.0	75	$1,287.01
1917	Cabbage Reef	1N		825.0	23	
1917	Not stated			18,941.0	631	
1919	Not stated			166.0	6	
1919	Cabbage Reef	1N		701.0	23	
1919	Sister Lake	5W		2,243.0	75	
1929	Mississippi Sound/Turkey Bayou	1N		8,296.4	276	
1930	Bay Boudreau/Fox Bay	1N		6,216.0	207	
1931	Fox Bay	1N		4,834.0	161	
1932	Quarantine Bay	1S		2,074.1	69	
1933	Bay Boudreau	1N		7,597.0	253	
1934	Bay Boudreau	1N		10,359.0	345	
1935	Quarantine Bay	1S		2,762.0	92	
1936	Not stated			20,740.9	691	
1938	Mississippi Sound/Half Moon Island	1N		4,704.0	157	
1939	Mississippi Sound/Half Moon Island	1N		8,118.1	270	
1941	Mississippi Sound/Half Moon Island	1N		9,679.1	322	
1941	Sister Lake	5W		6,913.6	230	$10,000.00
1943	East of MS River			7,822.0	261	
1943	East of MS River			1,004.0	34	
1943	Bay Du Chene	3		4,211.0	140	
1943	Lake Felicity	5E	Oyster	4,557.0	152	
1943	Sister Lake	5W	Oyster	3,891.0	130	
1944	Lake Felicity	5E	Oyster	4,012.9	118	$10,738.14
1944	Sister Lake	5W	Oyster	4,035.5	118	$10,798.45
1945	Bay Boudreaux	1N		5,664.3	187	$18,024.60
1945	Sister Lake	5W	Oyster	2,741.3	91	$7,137.00
1945	Lake Tambour	5E		2,265.3	75	$5,897.88
1945	Bay Du Chien (Hackberry Bay)	3		2,108.8	70	$5,490.36
1946	Bay Boudreaux	1N	Clam	5,530.9	186	$17,813.75
1946	Vermillion Bay	6		1,381.0	46	
1946	Lake Felicity	5E	Clam	4,076.0	92	$10,317.30
1946	Lake Tambour	5E		2,763.0	92	
1946	Bay Du Chien	3	Clam	2,772.1	92	$7,016.80
1946			Clam	2,656.6	89	6724.55
1948	Bel La Pass	1S	Seed	1,468.2	49	
1948	Mississippi Sound/West of 3-mile Bayou	1N	Reef	2,629.1	88	
1949	Lake Felicity	5E	Oyster	2,425.2	81	$9,734.15
1949	Sister Lake	5W	Oyster	2,981.2	99	$11,965.80
1949	Mississippi Sound	1N	Oyster	1,979.2	66	
1949	Bayou Le Mere		Seed	1,141.4	38	
1950	Grand pass	1N	Clam	362.0	12	
1950	Sister Lake	5W	Clam	4,787.0	159	$19,733.40
1950	Lake Felicity	5E	Clam	2,356.4	78	$9,713.94

1950	Bay Gardene	1S	Seed	2,001.5	67	
1950	Bay Gardene	1S	Seed	1,705.6	57	
1951	Sister Lake	5W	Oyster	5,538.8	184	$26,037.05
1951	Lake Felicity	5E	Oyster	1,382.7	46	$6,300.00
1951	Bay Gardene	1S	Seed	1,472.6	49	
1952	Sister Lake	5W	Oyster	7,068.1	235	$28,114.35
1952	Half-moon Island	1N	Reef	4,955.8	165	
1953	Sister Lake	5W	Oyster	4,213.7	140	$14,627.52
1953	Half-moon Island	1N	Reef	4,122.9	137	
1954	Half-moon Island	1N	Reef	5,006.2	167	
1955	Petit Pass/Bay Boudreaux	1N	Reef	4,823.4	161	
1956	Black Bay	1S	Reef	2,763.0	92	
1956	Snake Island	1S	Reef	2,725.0	91	
1956	Petit Pass	1N	Reef	4,214.8	140	
1958	Black Bay	1S	Reef	3,456.8	300	
1959	Petit Pass	1N	Reef	18,717.9	220	
1959	Black Bay	1S	Clam	34,703.9	1155	
1959	Half-moon Island	1N	Reef	2,127.0	71	
1959	Little Raccoon Island	1N	Steamed oyster	1,198.4	40	
1960	Grassy Island	1N	Reef	14,871.3	321	
1960	Lake la Fortune	1S	Clam	9,890.8	329	
1960	Bay Boudreaux	1N	Reef	755.0	25	
1960	Bay Boudreaux	1N	Reef	5,730.0	191	
1961	Bel La Pass	1S	Clam	19,200.0	640	
1961	Black Bay	1S	Clam	25,370.0	845	
1961	Three Mile Bay	1N	Reef	11,890.0	23	
1961	Little Raccoon Island	1N	Reef	6,840.0	228	
1962	Snake Island	1S	Clam	19,452.1	670	
1963	Calcasieu Lake	7	Live oyster	1,762.9	59	
1966	Black Bay	1S	Clam	19,533.0	550	
1966	Bay Boudreaux	1N	Clam	17,386.0	585	
1967	Half-moon Island	1N	Clam	15,150.0	500	
1967	Black Bay	1S	Clam	18,182.0	549	
1969	Calcasieu Lake	7	Clam	7,200.0	24	
1969	Black Bay	1S	Clam	15,000.0	551	
1969	Three Mile Pass	1N	Clam	15,000.0	446	
1970	California Bay	1S	Clam	8,901.0	360	
1970	Sister Lake	5W	Clam	7,039.0	273	
1970	Bay Crabe	1S	Clam	21,668.0	742	
1970	Bay Boudreaux	1N	Clam	23,830.0	853	
1970	Mississippi Sound	1N	Clam	7,241.0	127	
1970	Lake Pontchartrain	1N	Clam	400.0	8	
1973	Hackberry Bay	3	Clam	22,500.0	450	
1974	Bay Gardene	1S	Clam	33,800.0	676	
1974	Lake Borgne	1N	Clam	23,400.0	468	
1975	Sister Lake	5W	Clam	10,697.9	174	$73,541.44
1975	Bel La Pass	1S	Clam	11,850.0	237	$76,446.28

1977	Black Bay	1S	Clam	10,000.0	200	
1978	Bay Gardene	1S	Clam	750.0	15	
1979	Bay Gardene	1S	Clam	2,950.0	59	
1979	Bay Boudreaux	1N	Clam	50,850.0	1017	
1979	Lake Borgne	1N	Clam	195,000.0	390	
1979	Black Bay	1S	Clam	25,400.0	508	
1979	Black Bay	1S	Clam	29,900.0	598	
1979	Sister Lake	5W	Clam	24,997.6	458	
1981	Hackberry Bay	3			67	
1981	Black Bay	1S	Clam	33,000.0	660	
1981	Bay Gardene	1S	Clam	15,000.0	300	
1983	Black Bay	1S	Clam	32,500.0	650	
1983	Sister Lake	5W	Clam	19,527.2	435	
1983	California Bay	1S	Clam	7,500.0	150	
1984	Sister Lake	5W	Clam	24,352.6	307	
1984	California Bay	1S	Unknown		392	
1984	Bay Gardene	1S	Unknown		297	
1984	Turkey Bayou	1N	Unknown		415	
1984	Black Bay	1S	Unknown		315	
1984	Black Bay	1S	Unknown		207	
1989	Sister Lake	5W	Clam	18,579.0	178	
1989	Black Bay	1S	Unknown		166	
1992	Bay Gardene	1S	Unknown		40	
1994	Sister Lake (3 plants)	5W	Reef	42,576.1	306	$891,118.61
1994	Marsh Island	6	Oyster	19,595.0	27	$410,123.35
1994	Bay Crabe	1S	Oyster	8,594.0	137	$202,130.88
1994	Black Bay	1S	Oyster	29,655.0	708	$697,485.60
1994	Hackberry Bay	3	Shell, limestone, concrete	10,585.0	145	$304,212.90
1995	Sister Lake (3 plants)	5W	Oyster	70,902.0	672	$1,730,008.80
2000	Half-moon Island	1N	Shell, limestone, concrete	3,800.00	70	$138,776.00
2001	California Bay - Pelican Island	1S	Limestone	4,000.00	133	No cost to state; oil company mitigation
2004	Hackberry Bay	3	Crushed concrete	2,322.40	10	$85,835.90
2004	Hackberry Bay	3	Crushed concrete	4,005.00	25	$148,024.80
2004	Barataria Bay	3	Crushed concrete	7,536.30	40	$228,600.00
2004	Lake Chien	5E	Limestone	6,083.00	25	$419,727.00
2004	Lake Felicity	5E	Crushed concrete, limestone	9,179.00	40	$302,907.00
2004	Sister Lake	5W	Shell, limestone, crushed concrete	10,300.00	67	$399,949.00
2004	Lake Mechant	5W	Limestone	9,460.00	40	$406,780.00
2007	Black Bay - Lonesome Island	1S	Limestone	30,421.83	200	$1,725,830.42
2007	MS Sound - Turkey Bayou	1N	Limestone	29,944.98	200	$1,607,446.53
2008	Hackberry Bay	3	Shell, limestone, crushed concrete	10,171.75	50	$559,039.38
2009	MS Sound - 3-mile Bay	1N	Limestone	22,312.59	45	$1,372,224.29
2009	Black Bay	1S	Limestone, oyster shell	22,554.00	243	$1,350,759.06
2009	Lake Chien	5E	Limestone	11,348.00	22	$828,413.29

2009	Sister Lake	5W	Limestone	22,597.00	156	$1,677,618.36
2009	Calcasieu Lake	7	Limestone	7,532.69	14	$600,000.00
2011	Mississippi Sound	1N	Crushed concrete	31,307.76	291	$1,476,160.88
2011	California Bay	1S	Shell, limestone	27,988.00	302	$1,665,006.12
2012	Hackberry Bay	3	Limestone	26,086.00	200	$1,485,084.91
2012	Sister Lake (2 plants)	5W	Limestone	37,681.00	358	$2,166,688.95
2012	Bay Crabe	1S	Limestone	20,172.00	200	$1,068,107.00
2012	Lake Fortuna	1S	Crushed concrete	28,629.00	300	$1,332,657.00
2013	MS Sound - 3-mile Pass	1N	Limestone	40,504.07	158	$1,526,193.27
2013	Drum Bay	1N	Limestone	18,311.79	200	$1,019,783.84
2013	South Point of Marsh Island	6	Limestone, oyster shell	2,776.00	25	$264,000.00
2014	Hackberry Bay	3	Limestone	3,572.10	30	$246,041.67
2015	Calcasieu Lake West Cove	7	Limestone	5,062.15	25	$350,908.31
2015	Calcasieu Lake Commissary Pt.	7	Limestone	3,420.25	20	$237,091.48
2015	Calcasieu Lake Lamberts Bayou	7	Limestone	4,014.59	20	$278,291.09

Appendix III. Louisiana Revised Statutes 56:638.1-5. Fish Conservation, Management, and Sustainability: Legislative Intent, Findings, Purposes, Policy, and Fishery Standards

The legislative intent, findings, purposes, policy and standards for the conservation and management of all species of fish in Louisiana are defined in Louisiana Revised Statutes (LA R.S.) 56:638.1, 56:638.2, 56:638.3, 56:638.4, and 56:638.5, which function similarly to those found in the federal Magnuson-Stevens Fishery and Conservation Act.

LA R.S. 56:638.1. Fish conservation, management, and sustainability; legislative intent

Recognizing that there are ever-increasing numbers of both sport and commercial fishermen utilizing the waters of the state for recreational and commercial pursuits resulting in conflicts over limited space and competition for the same fish, and acknowledging that both the sport and commercial fishing industries are vital to the economy of the coastal region and the entire state, the fishery standards for conservation, management, and sustainability of all species of fish are hereby declared to be fair and in the best interest of the state.

LA R.S. 56:638.2. Findings

The state of Louisiana recognizes that:

1. Its fish resources are of great value and are renewable. These fish resources make many contributions to the state, including but not limited to the food supply, economy, and health of the state and recreational opportunities. With proper regulations of the harvest by fishermen, coupled with protection and enhancement of their freshwater, saltwater, and estuarine habitat, Louisiana's fish resources should be available to provide these benefits to the state indefinitely.
2. As a consequence of increased fishing pressure or other factors and because of the limitations of fish conservation, management, and sustainability practices, certain stocks of fish may have been or will become overfished.
3. The future productivity of renewable fish resources and their supporting habitats may be seriously jeopardized as a consequence of the continued loss of Louisiana coastal wetlands, or because of human actions affecting the functionality and value of the state's renewable fish resources and their supporting habitats.
4. Both commercial and recreational fishing constitute a major source of employment and contribute significantly to the economy of the state. Many coastal areas are dependent upon such fishing and related activities and their economies have been damaged by pollution, habitat degradation, or overfishing.
5. Fish resources are finite but renewable. If timely placed under sound management, the fisheries can be conserved and maintained so as to provide optimum and sustainable yields on a continuing basis.
6. A strong state program for the wise conservation, management, and sustainability of the fish resources of Louisiana is necessary to maintain plentiful fish populations, to prevent overfishing, to rebuild reduced stocks, to ensure conservation, and to realize their full potential.
7. The safe development or improvement of fisheries that are not fully or properly utilized by the Louisiana commercial and recreational fishermen and fishing industries should help to ensure that Louisiana benefits from the employment, food supply, recreation, and social and economic benefit that could be maintained or generated thereby, if pursued in such a fashion that is socially, scientifically, economically, anthropologically, and biologically sound for the state, the species, any related species, and their supporting habitats.
8. A strong state program is necessary to advocate the importance of the functionality and value of Louisiana's waters and coastal wetlands as estuary and habitat for fish resources, the social and economic value of these resources to the state and the nation, and the need to actively seek to avoid any net loss of this functionality and value.

LA R.S. 56:638.3. Purposes

A. In order to implement the objectives and purposes of this Subpart, the commission shall:

1. Take timely action to conserve, manage, protect, and sustain fish species.
2. Promote the use of sound conservation, management, and sustainability principles in the regulation of commercial and recreational fishing.

3. Actively advocate, on behalf of the fish constituency, improvement of or no net loss of the functionality and value of the fisheries' habitat and estuary.
4. Provide for the preparation and implementation of fish management plans, including plans for habitats, estuaries, and their supporting ecosystems, in accordance with this policy that will prevent overfishing and will achieve and maintain plentiful fish populations to ensure, on a continuing basis, the optimum yield from each fishery while ensuring its sustainability.
5. Recognize that fish populations are subject to both natural and man-induced increases and decreases, and that changes in harvest levels may need to be recommended. If changes are required, these increases and decreases should be distributed among all fishermen in a fair and equitable manner that considers among other factors historical usage, ensuring that no historical user groups will be arbitrarily excluded.

B. A sustainable fishery is one that is scientifically monitored and actively managed to be viable today and in the future, conserving fish and their environment and supporting the communities and economies that depend upon these resources.

LA R.S. 56:638.4. Policy

The policy of the state of Louisiana is hereby declared to be the following:

Stewardship of the state's renewable fish resources shall have as its utmost concern the continued health and abundance of the resource and its habitat, shall provide for optimum sustained benefits to the state, shall be responsive to the needs of interested and affected citizens, shall ensure the proper and fair utilization of these resources for the citizens of the state in present and future generations, shall preserve the state's exclusive right to manage the fisheries within or beyond its jurisdiction, shall be based on the best scientific and technical information available. In addition, such stewardship of the state's fish resources shall draw upon federal, state, and academic capabilities and promote efficiency in carrying out research, administration, management, and enforcement.

LA R.S. 56:638.5. Fishery standards

The commission shall adopt such rules and regulations consistent with the authority granted by this Chapter and in accordance with the Administrative Procedure Act, for the harvesting, conservation, management, and sustainability of all species of fish, in accordance with the following standards:

1. Conservation, management, and sustainability measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield while maintaining healthy, plentiful stocks. In fact, every effort will be made at all times to prevent a harvest from exceeding the safe upper limit of harvests which can be taken consistently year after year without diminishing the stocks so that the stock is truly inexhaustible and perpetually renewable.
2. Conservation, management, and sustainability measures shall be based upon the best scientific, economic, biological, anthropological, and sociological information available.
3. To the extent practicable, an individual stock or unit of fish shall be managed as a unit throughout its range within the state's jurisdictional authority and interrelated stocks of fish and other renewable fish resources shall be managed in close coordination while considering their supporting habitats.
4. If it becomes necessary to allocate or assign fishing privileges among various fishermen, such allocations to the extent practicable shall be:
   a. Fair and equitable to all such fishermen.
   b. Reasonably calculated to promote conservation.
   c. Carried out in such a manner that no particular individual, corporation, or other legal entity acquires an excessive share of such privileges.
   d. In the best interest of the citizens of Louisiana.
5. Conservation, management, and sustainability measures shall, where practicable, promote efficiency in the conservation, management, and sustainability of fish resources; except that no such measure shall have economic allocation as its sole purpose.
6. Conservation, management, and sustainability measures shall, where practicable, minimize costs and avoid unnecessary duplication.
7. Conservation, management, and sustainability measures may take into account and allow for variations among, and contingencies in, fisheries, resources, and catches.

Acts 1991, No. 708, §1; Acts 2014, No. 553, §1.

Appendix IV.
Louisiana Legislative Process

How a Bill Becomes a Law

First Reading (Introduced in House) → Second Reading (Referred to Committee) → Committee Hearing → Committee Report → Third Reading (Bill debated on Floor)

Vote on Final Passage

- Passed - Sent to Senate
  - Introduced in Senate (First Reading) → Referred to Committee (Second Reading) → Committee Hearing → Committee Report → Bill reviewed by Legislative Bureau → Bill debated on Floor (Third Reading) → Vote on Final Passage
    - Passed - Sent to House
      - If Bill returned without amendments, sent to governor
        or
        If returned with amendments and House concurs, Bill sent to governor
        or
        If Bill returned with amendments and House rejects, sent to Conference Committee
        - Conference Committee attempts to resolve differences
          - If agreement reached and both houses concur, Bill sent to governor
          or
          - If agreement reached and either house rejects, Bill fails
          or
          - If no agreement, Bill fails
      - Failed - May Be Reconsidered *or* May Receive No Further Action
    or
    Failed - May Be Reconsidered *or* May Receive No Further Action

Governor signs* - Bill becomes an Act
or
If governor vetoes, but then two-thirds of both houses approve Bill - Bill becomes an Act
or
If governor does *not* sign or veto within the constitutionally prescribed time period - Bill becomes an Act

Acts enacted during regular sessions become effective on August 1 *or* on effective date stated in the Act
and
Acts enacted during extraordinary sessions become effective on the 60th day after adjournment or on effective date stated in the Act

* Joint, concurrent, and other resolutions of the legislature do not require the signature of the governor to become effective

Appendix V. Authorities of the Louisiana Wildlife and Fisheries Commission

According to Louisiana Revised Statutes (LA R.S.) Title 56, the Commission's authorities related to oyster include:

LA R.S. 56:2 Supervision and direction of the commission

The Commission has sole authority to establish and define management programs and policies and shall conduct such studies and investigations as necessary.

LA R.S. 56:3 Ownership of shellfish

The Commission has ownership and title to all wild birds, and wild quadrupeds, fish, other aquatic life and water bottoms within the territory and jurisdiction of the state, including all oysters and other shellfish.

LA R.S. 56:6 Special powers and duties

The Commission shall improve, enlarge, and protect the natural oyster reefs of this state.

The Commission shall rigidly enforce all laws relative to the bedding, fishing, selling, shipping, and canning of oysters and all laws relative to the protection, propagation, and sale of all species of saltwater or freshwater fish or shellfish in the state.

The Commission, in general, has full power and control over oysters of this state, found or being within its borders or within any of its waters, whether rivers, lakes, bayous, lagoons, bays, or gulfs.

The Commission shall assist in protecting all lessees of private oyster bedding grounds in the enjoyment of their rights.

The Commission may promulgate rules and regulations to set seasons, times, places, size limits, quotas, daily take, and possession limits based upon biological and technical data and may set fees for nonresident recreational hunting and fishing licenses.

LA R.S. 56:22 Rules and regulations

The Commission may entirely prohibit the taking of any species of fish in any part of the state, particularly in any lake or stream either wholly or partially within the state, for not more than a three-year period.

LA R.S. 56:313 Control of fisheries

The Commission has exclusive control of fish having a game or commercial value.

LA R.S. 56:315 Sanctuaries and propagating places

The Commission may operate and maintain hatcheries, sanctuaries and propagating places for the protection and propagation of fish and may restrict fishing in any manner it deems advisable.

LA R.S. 56:326.1 Size limits

The Commission may set size limits for all freshwater and saltwater fish for which no limits have been set by law.

LA R.S. 56:326.4 Staggered and split seasons

The Commission may split, stagger or otherwise arrange seasons and quotas for fishing in such a manner as to maximize the availability of popular fish for serving in Louisiana restaurants throughout the year.

LA R.S. 56:422(E)

The Commission may regulate the operation of oyster cargo vessels.

LA R.S. 56:433

Considering the recommendations of the Oyster Task Force, the Commission may extend the taking of oysters on natural reefs by setting the last day of the season if it is determined that sufficient quantities of oysters are available to accommodate such additional taking in designated areas.

Considering the recommendations of the Oyster Task Force, the Commission may designate what parts or portions of the natural reefs may be fished for oysters. The Commission may suspend the fishing of oysters altogether from natural reefs not leased by it when such reefs are threatened with depletion as determined by the department.

The Commission shall annually set aside one or more areas east of the Mississippi River for the exclusive use of sackers, based on the best available data by the department for ensuring the economic development of the fisheries. The Commission may, by rule, provide for oyster size restrictions in these sacking areas.

The Commission shall have the option, between January first and the last day of the season of each year, of closing any portion or all of the natural oyster reefs of this state to the harvest of oysters, and of setting harvesting size limits on any portion or all of the natural oyster reefs of this state, as expected conditions warrant.

The Commission shall designate the natural reefs by regulation.

LA R.S. 56:433.1 Oyster Seed Ground Vessel Permit

In an effort to collect data to enable the department to better manage the public oyster resource, the Commission may adopt rules and regulations which require the use of a vessel monitoring system for use by a vessel taking oysters for commercial purposes under the authority of the oyster seed ground vessel permit. The permit requirement sunsets and becomes null and void as of November 16, 2016, unless changed by the Legislature.

The Commission shall promulgate guidelines to be used by the Oyster Seed Ground Vessel Permit Appeals Board to determine an applicant's eligibility and whether or not an applicant should be granted a permit.

LA R.S. 56:434 Oyster Seed Grounds

The Commission shall designate and set aside oyster seed grounds from the water bottoms of the state as it judges best adapted to the planting, propagation, growth, and policing of seed oysters.

The Commission shall establish rules and regulations concerning the time, quantity, and method of taking by which these seed oysters shall be made available to the public.

LA R.S. 56:435.1 Sabine Lake

The Commission shall set open season dates and harvest limits after considering recommendations by the Louisiana Oyster Task Force.

LA R.S. 56:435.1.1 Oyster harvest in Calcasieu Lake

The Commission shall promulgate rules and regulations to delineate the procedures by which special permits for oyster harvesting in Calcasieu Lake shall be issued.

The Commission shall fix the open season for oyster harvest in Calcasieu Lake, and may, in consultation with the Calcasieu Oyster Task Force, open or close the season as biological data indicate a need and may manage East Cove and West Cove separately.

After considering the recommendations by the Calcasieu Oyster Task Force, the Commission shall set the harvest limit so that each permittee may harvest an amount not to exceed twenty-five sacks of oysters per day from one, and only one, licensed vessel.

Appendix VI. Authorities of the Secretary, Louisiana Department of Wildlife and Fisheries

According to Louisiana Revised Statutes (LA R.S.) Title 56, the Secretary's authorities related to oyster include:

LA R.S. 56:6.1 Emergency closures

The Secretary may declare a closed season on any or all species of fish found within the state or may restrict fishing in the closed season in any manner deemed advisable.

LA R.S. 56:6.2 Advisory committees

The Secretary may adopt rules to govern the procedures of advisory committees created in or for the department.

LA R.S. 56:17 Permits

The Secretary may take fish of any kind in any manner or place for the purpose of science and cultivation and distribution and may grant permits to other persons for the same purpose.

LA R.S. 56:318 Permits

The Secretary may issue permits to any persons to take fish for scientific or educational purposes or for propagation or distribution.

LA R.S. 56:327

The Secretary shall have authority to set seasons, regulate type of gear used, and set possession limits for estuarine fish where it is clearly demonstrated that intense fishing competition exists or if pollution levels exceed adopted standards or if biological studies indicate the need.

LA R.S. 56:424 Taking of oysters

The secretary may grant permits for culling and oyster harvesting to those individuals involved in molluscan depuration operations and container relaying operations on a case-by-case basis, provided that the individuals conducting such operations have fully complied with the rules and regulations of the office of public health and have been issued a permit by that office to conduct such operations.

Any person who obtains a permit to land oysters outside the state under the provisions of this Subsection shall be required to install and use a vessel monitoring system on each vessel that will be used to transport oysters taken in Louisiana waters to another state for landing. Access to the monitoring system shall be granted to the Department of Wildlife and Fisheries. The department shall promulgate rules and regulations necessary to implement the provisions of this Paragraph.

LA R.S. 56:425 Lease of water bottoms

The Secretary may lease to any resident, any firm composed of residents, or any corporation domiciled in or organized under the laws of this state any state-owned water bottoms and natural reefs in the water bottoms of this state.

LA R.S. 56:431.1 Devices to protect oysters from predation

The Department may permit the use, with limitations, on leased acreage of devices to protect oysters from predation and shall promulgate rules and regulations for such a permit, with certain requirements.

LA R.S. 56:431.2 Alternative oyster culture

The Department is authorized to issue an alternative oyster culture permit (AOC permit) to a leaseholder holding a valid oyster lease of state water bottoms.

LA R.S. 56:433 Culling oysters taken from natural reefs

The Department may permit lessees of oyster bedding grounds to fish oysters of any size, without charge, from the natural reefs of the waters of this state to be used as seed oysters for bedding purposes only. The Department may

designate from which natural reefs oysters may be fished and the quantity to be taken therefrom by any lessee.

LA R.S. 56:434 Oyster seed grounds

The Department may negotiate for and acquire existing oyster leases required to be abandoned or surrendered which are found within the limits of designated oyster seed grounds. The Secretary may require persons taking, or attempting to take oysters, oyster seed, or cultch from any state owned public oyster seed ground or public oyster seed reservation to obtain a permit from the Department and possess said permit when on the public oyster seed grounds or public oyster seed reservations. The Department shall establish and maintain an adequate and vigilant watch and control over the areas designated as oyster seed grounds and oyster seed reservations, and shall see that all oysters, seed oysters, oyster cultch, or other material improvements found or placed thereon are efficiently protected from trespass, theft, or injury.

LA R.S. 56:434.1 Public Oyster Seed Ground Development Account

The Secretary is authorized to accept and receive funds or materials as compensation for impacts associated with activities occurring on or over the public oyster seed grounds, seed reservations, and tonging areas.

LA R.S. 56:435.1.1 Oyster harvest in Calcasieu Lake

The Department may issue special permits that allow oyster harvesting in Calcasieu Lake.

LA R.S. 56:435 Scrapers

The Department may require lessees of propagating or bedding grounds to procure from it permits to use any implements and appliances the lessees desire for removing oysters.

LA R.S. 56:446 Oyster severance tax

The Department may collect a severance tax on each barrel of oysters fished from leased water bottoms and from the natural reefs either for sale or consumption. The Secretary may examine, inspect, and audit the books, papers, and memoranda of all persons engaged in the oyster industry under licenses issued by the Department. The Department may impose a penalty upon failure to pay severance taxes when due. The Department may demand payment if there is a delinquency in the filing of reports and payment of taxes due, coupled with a warning to revoke the delinquent's license if the report is not made and taxes are not paid. Thereafter, the Secretary may seize any oysters or parts or products thereof in the possession of a person liable for taxes and penalties due and sell them for payment of the tax and penalties. The Secretary may revoke the delinquent's license at any time after demand for payment and warning.

LA R.S. 56:449 Tags

The Department shall have exclusive authority over the distribution of official tags used to identify sacks and any other types on containers used to hold oysters and other mollusks while in their shells. The Department shall establish uniform fees for such tags. The Department is authorized to enforce these provisions, to seize all untagged sacks or containers found in connection with any related arrests, and to dispose thereof. The Department shall require that all persons who containerize shucked oysters or other molluscan species keep accurate records of the source of the oysters in order that said oysters can be traced back to the identifying tag and shall require, further, that such containers be labelled as a source of identification in a manner to be prescribed by the Secretary.

LA R.S. 56:571 Experimental Gear

The Secretary may issue permits to persons who are interested in the development of new gear and equipment to harvest fish.

LA R.S. 56:640.3 Right to fish

The Department shall recommend the elimination or restriction of any fishing gear currently in use or which may be used in recreational or commercial fisheries in implementing its management responsibilities or in response to any emergency situation. While elimination or restriction may have uneven impacts on different groups of fishermen, the proposed measures should be applicable to all people of the state. In addition to acquiring the best available biological data, the department shall use all practicable means to collect all relevant social and economic data in support of such allocation

decision making efforts.

LA R.S. 56: 579.1(B) Mariculture permits

The Secretary may issue permits for mariculture projects within the coastal zone and exempt permittees from statutory limitations to the kind, number or size of fish which may harvested or as to the method of harvesting or taking fish, seasons or other limitations.

Appendix VII. Louisiana's Compliance with Gulf States Marine Fisheries Commission Oyster Fishery Management Recommendations

Key:

I = implemented
NI = not implemented
PI = partially implemented
PR = proposed
N/A = not applicable
FL = Florida
AL = Alabama
MS = Mississippi
LA = Louisiana
TX = Texas

2014 Recommendations	Compliance
Increase cultch planting	I[1]
Develop uniform size limits on reefs that are continuous with two states' boundaries	I
Establish uniform criteria for opening and closing reefs in close proximity to state boundaries (applies to LA and MS only[2])	PR[3] w/ MS N/A[4] w/TX
Increase penalties for harvesting and possessing oysters from restricted or prohibited areas	I
Establish uniform gear requirements in states where fishermen from two or more states may fish*	I w/MS N/A[4] w/TX

[1]Generally yes, varies annually due to fluctuations in available funding.

[2]No common reefs between FL and AL or AL and MS.

[3]There are conditional management plans for closing reefs in adjacent areas within a state as well as across state boundaries. National Shellfish Sanitation Program (NSSP) closure guidelines may make this recommendation moot.

[4]Such oyster reefs are permanently closed.

*This is not a shared reef issue. Potential compliance problems result when fishermen harvest out-of-state. First, the harvester may be required to invest in two or more types of the same or related gear thereby increasing production costs or reducing efficiency. Second, enforcement problems such as the potential possession of both illegal and legal gear arise especially when in transit across state boundaries. Uniform gear allowances enhance enforcement and reduce regulatory burden on fishermen.

2013 Recommendations	Compliance
Resource Monitoring and Assessment	
Resource managers should develop and evaluate fishery and resource monitoring programs to assess the biological condition of oyster resources, population dynamics, fishing pressure, and other parameters required to optimize benefits from the fishery, while protecting and sustaining the resource and construct assessment models for oysters	I
States should collaborate in the development of standardized scientifically and statistically defensible methods to accurately assess oyster populations and reef habitat. Additionally, states should work cooperatively toward converting existing information into a data inventory that can be used system- and Gulf-wide.	PI
Resource managers should evaluate their current fishery-independent sampling protocols to determine if they provide valid and accurate data to assess the abundance and condition of oyster stocks.	I
Resource managers should delineate all reef areas (harvested and non-harvested) so that population models can be used to accurately estimate standing stocks, and to predict the effects of catastrophic mortality events, success of restoration projects, and fishery trends.	PI

States should revisit National Oceanic and Atmospheric Administration's National Marine Fisheries Service's (NOAA Fisheries) conversions and provide accurate conversions to standardize production and product units. A better estimate of shucked meat weights needs to be developed, validated, and used.	PI
Protecting Oyster Habitat	
States should assess the condition of reefs that have been affected by altered freshwater discharge. Adverse impacts to reef habitat and oyster populations should be monitored to determine the source of the problem.	PI
Preventing Destruction of Oyster Habitat and Reefs	
Resource managers should determine the rate of oyster habitat loss and recognize the consequences of losing it.	PI
Resource managers should identify oyster resources and make recommendations to protect and conserve oyster habitat. Management plans should identify the value of all oyster resources, not just those that are managed for commercial fisheries.	PI
Preventing Shell Removal	
Oyster reef habitat should be evaluated and monitored to determine a shell budget with a strategy of no net loss.	PI
All harvesting activities should be evaluated to determine whether they contribute to the destruction of oyster reef habitat or alter reef structural integrity. In cases where activities damage oyster reef structure or substrate, mitigation should require refurbishing impaired oyster reef habitat.	PI
Harvesting Gear	
Develop gear requirements to prevent excessive damage to reefs.	NI
Develop and build specific reefs for dredging (low profile) to establish and maintain public oyster reefs for harvests using specific gears.	I
Shell Retention Fees	
Resource managers should identify, evaluate, and implement strategies which improve their capacity to retain processed oyster shell and return the shell to rehabilitate oyster reef habitat.	NI
Shell/Cultch Planting	
Continue to create and restore oyster reef habitat by depositing cultch materials at appropriate times and places. States should implement programs to increase cultch planting on public reefs and encourage similar practices on privately-held leases.	I
Continue to utilize processed oyster shell, when and where it is available, and use and evaluate alternative cultch materials, such as graded limestone, crushed concrete, and fossil shell.	I
States should evaluate and establish larval-source or sanctuary reefs to provide ecological services and reproductive materials (genetics, spat, and broodstock).	O

Appendix VIII. Federal Management Institutions

The following list of federal management institutions was adapted from a similar list in VanderKooy (2012).

Since virtually all known oyster populations occur in state waters, federal agencies do not directly manage oysters. However, a variety of federal agencies, through their administration of laws, regulations, and policies, may influence the oyster resource and fishery and management thereof.

Regional Fishery Management Councils

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), federal authorities are responsible for monitoring and managing fishery resources in federal waters (from the seaward boundary of state waters to 200 nautical miles offshore). Federal management is based on fishery management plans developed by regional fishery management councils, including the Gulf of Mexico Fishery Management Council (Gulf Council). Each council prepares plans for each fishery requiring management within its geographical area of authority and amends such plans as necessary. Plans are implemented as federal regulation through the U.S. Department of Commerce. As there is no significant fishery for oysters in federal waters of the U.S. Gulf of Mexico (Gulf), the Gulf Council has not developed a management plan for oysters.

U.S. Department of Commerce

The Secretary of the U.S. Department of Commerce (DOC; Secretary of Commerce), acting through the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, has the ultimate authority to approve or disapprove all fishery management plans prepared by regional fishery management councils. Where a council fails to develop a plan, or to correct an unacceptable plan, the Secretary of Commerce may do so.

National Oceanic and Atmospheric Administration's National Marine Fisheries Service

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) collects data and statistics on fisheries and fishermen. It performs research and conducts management authorized by international treaties. NOAA Fisheries has the authority to enforce the MSA and the Lacey Act and is the federal trustee for living and nonliving natural resources in coastal and marine areas under U.S. jurisdiction. NOAA Fisheries exercises no management jurisdiction with respect to oysters in the Gulf. It conducts some research and data collection programs and comments on all projects that affect marine fishery habitat.

National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management (OCRM)

The National Oceanic and Atmospheric Administration's (NOAA) Office of Ocean and Coastal Resource Management (OCRM), in conjunction with coastal states, administers the National Estuarine Research Reserve and National Marine Sanctuaries Programs as authorized under Section 315 of the Coastal Management Act of 1972. Under these programs, OCRM establishes protected areas which serve to provide suitable habitat for estuarine and marine species and serve as sites for research and education activities related to coastal management issues. These areas are managed under specific management plans that may include restrictions on harvest and use of marine and estuarine species. Such plans could directly affect harvest of oysters.

OCRM may also influence fishery management for oysters indirectly through administering the Coastal Zone Management Program and by setting standards and approving funding for state coastal zone management programs. These programs often affect estuarine habitat on which oysters depend.

Department of the Interior's National Park Service

Under the Department of the Interior's (DOI), the National Park Service (NPS) may regulate fishing activities within park boundaries. Such regulations could affect oyster harvest if implemented within a given park area. NPS requires commercial fishermen to have a permit to fish commercially in Jean Lafitte National Historical Park and Preserve.

Department of the Interior's U.S. Fish and Wildlife Service

The Department of the Interior's U.S. Fish and Wildlife Service (USFWS) has no direct management authority over

oysters. However, commercial fishing including oyster harvesting is prohibited in coastal National Wildlife Refuges; there are no public or private oyster grounds in National Wildlife Refuges located in Louisiana. USFWS may also affect the management of oysters through the Fish and Wildlife Coordination Act, under which USFWS and NOAA Fisheries review and comment on proposals for projects such as dredging, filling, and marine construction that could affect oysters and their habitat.

U.S. Environmental Protection Agency

Through its administration of the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES), the U.S. Environmental Protection Agency (EPA) provides protection for oysters and their habitat. The EPA may disapprove or add conditions to applications for permits to discharge pollutants into estuarine waters to protect these marine resources.

Under Section 312 of the CWA, the EPA regulates the equipment that treats or holds sewage (marine sanitation devices) and establishes areas in which the discharge of sewage from vessels is not allowed (No Discharge Zones, or NDZs) to help protect human health and the aquatic environment from disease-causing microorganisms that may be present in sewage from vessels and boats. An individual state can petition the EPA to officially designate an NDZ to: (1) to protect aquatic habitats where pumpout facilities are available, (2) to protect special habitats or species, and/or (3) to protect human drinking water intake zones. Once a designation is official, the state and the U.S. Coast Guard, if applicable, enforce the limits of the NDZ. This means that the discharge of untreated and treated sewage is strictly forbidden and subject to fine if violated. Also, the U.S. Coast Guard can board vessels in an NDZ to verify that they have adequate facilities. Currently, the EPA can only designate areas associated with oyster harvesting as NDZs when there are sufficient pumpout facilities in the area to service vessel traffic.

The EPA and a local sponsor jointly administer the National Estuary Program. This program evaluates estuarine resources, local protection, and development of policies, and seeks to develop future management plans. Numerous user groups including industry, environmentalists, recreational and commercial interests, and policymakers provide input on these plans. The Barataria-Terrebonne estuarine complex in Louisiana became a National Estuary in 1990.

U.S. Army Corps of Engineers

Oyster populations may be influenced by the U.S. Army Corps of Engineers' (Corps) responsibilities pursuant to the CWA and Section 10 of the Rivers and Harbors Act. Under these laws, the Corps issues or denies permits to individuals and other organizations for proposals to dredge, fill, and construct in wetland areas and navigable waters. The Corps is also responsible for planning, construction, and maintenance of navigation channels and other projects in aquatic areas; these projects could affect oysters and their habitat.

U.S. Coast Guard

The U.S. Coast Guard (USCG) is responsible for enforcing fishery management regulations adopted by the DOC pursuant to management plans developed by the Gulf Council. The USCG also enforces laws regarding marine pollution and marine safety, and they assist commercial and recreational fishing vessels in times of need. Although no regulations have been promulgated for oysters in federal waters, enforcement of laws affecting marine pollution and fishing vessels could influence oyster populations.

U.S. Food and Drug Administration

The U.S. Food and Drug Administration (FDA) directly regulates the harvest and processing of seafood and oysters through its administration of the Food, Drug, and Cosmetic Act and other regulations that prohibit the sale and transfer of contaminated, putrid, or otherwise potentially dangerous foods. The FDA has relegated its enforcement authority for molluscan bivalves to the member states of the Interstate Shellfish Sanitation Conference (ISSC). The FDA does reserve the right and authority to enforce the Food, Drug, and Cosmetic Act and other regulations if the states fail to do so. In addition, the FDA maintains the Interstate Certified Shellfish Shippers List (ICSSL). A principal objective of the ICSSL is to provide a mechanism for state health officials and consumers to receive information as to whether lots of shellfish shipped in interstate commerce meet acceptable sanitation criteria. Dealer certification depends on maintaining acceptable operational and sanitary conditions. This determination is based on nationally uniform inspections by standardized inspectors.

U.S. Customs and Border Protection

Imported seafood and oysters cannot legally enter the United States until the shipment has arrived at a port of entry with the appropriate shipping documents and has been released by U.S. Customs and Border Protection.

Interstate Shellfish Sanitation Conference

The Interstate Shellfish Sanitation Conference (ISSC) is made up of state shellfish regulatory officials, industry officials, the FDA, and other federal agencies. The ISSC adopts uniform procedures, incorporated into an Interstate Shellfish Sanitation Program and implemented by all shellfish control agencies; gives state shellfish programs current and comprehensive sanitation guidelines to regulate the harvesting, processing, and shipping of shellfish; provides a forum for shellfish control agencies, the shellfish industry, and academic community to resolve major issues concerning shellfish sanitation; and informs all interested parties of recent developments in shellfish sanitation and other major issues of concern through the use of news media, publications, regional and national meetings, internet, and by working closely with academic institutions and trade associations.

National Shellfish Sanitation Program

The National Shellfish Sanitation Program (NSSP) is the federal/state cooperative program recognized by the FDA and the ISSC for the sanitary control of shellfish produced and sold for human consumption. The purpose of the NSSP is to promote and improve the sanitation of shellfish moving in interstate commerce through federal/state cooperation and uniformity of state shellfish programs. Participants in the NSSP include agencies from shellfish producing and non-producing states, the FDA, the EPA, NOAA, and the shellfish industry. Under international agreements with the FDA, foreign governments also participate in the NSSP. Other components of the NSSP include program guidelines, state growing area classification and dealer certification programs, and FDA evaluation of state program elements. The guidelines of the program have evolved into the NSSP Handbook which is managed and updated by the ISSC.

Appendix IX. Federal Laws, Regulations, and Policies

The following federal laws, regulations, and policies may directly and/or indirectly influence the quality, abundance, and ultimately the management of oysters. This list was adapted from a similar list in VanderKooy (2012).

Fishery Conservation and Management Act of 1976 (later renamed the Magnuson Fishery Conservation and Management Act and then the Magnuson-Stevens Fishery Conservation and Management Act), and subsequent reauthorizations

The Magnuson-Stevens Fishery Conservation Act (MSA) extended U.S. jurisdiction from 12 nautical miles offshore to 200 nautical miles and established regional fishery management councils. The MSA mandates the councils to prepare fishery management plans for important fishery resources within federal waters. These plans must comply with certain conservation and management requirements laid out in the MSA, including national standards for sustainable fisheries management. Congress has reauthorized the MSA twice, once in 1996 and again in 2007. The 1996 reauthorization strengthened requirements to prevent overfishing and rebuild overfished fisheries; added definitions for overfishing, overfished, and fishing communities; added three new national standards to address fishing vessel safety, fishing communities, and bycatch and also revised several existing standards; and addressed needs for improved fishery monitoring, enhanced research, greater consideration of fishing communities, identification of essential fish habitat, formation of constituent advisory panels, and analysis of fishing capacity, among other activities. The 2006 reauthorization featured a number of new requirements to prevent overfishing by establishing annual catch limits and accountability measures; promote market-based management strategies, including limited access privilege programs, such as catch shares; strengthen the role of science through peer review, the councils' Scientific and Statistical Committees, and the Marine Recreational Information Program; and enhance international fisheries sustainability by addressing illegal, unregulated, and unreported fishing and bycatch.

Interjurisdictional Fisheries Act of 1986

The Interjurisdictional Fisheries Act (IJF) established a program to promote and encourage state activities in support of management plans, to promote and encourage management of interjurisdictional fishery resources throughout their range, and to promote and encourage research in preparation for the implementation of the use of ecosystems and interspecies approaches to the conservation and management of interjurisdictional fishery resources throughout their range. The enactment of this legislation repealed the Commercial Fisheries Research and Development Act.

Federal Aid in Sport Fish Restoration Act (SFRA), commonly called the Dingell-Johnson Act or the Wallop-Breaux Act

The Federal Aid in Sport Fish Restoration Act (SFRA) provides funds to states, U.S. Fish and Wildlife Service (USFWS), and the Gulf States Marine Fisheries Commission (GSMFC) to conduct research, planning, and other programs for enhancing and restoring marine sportfish populations.

Marine Protection, Research, and Sanctuaries Act of 1972 (Titles I and III) and the Shore Protection Act of 1988

The Marine Protection, Research, and Sanctuaries Act (MPRSA) provides protection of fish habitat through establishing and maintaining marine sanctuaries. The MPRSA and the Shore Protection Act (SPA) regulate ocean transportation and dumping of dredged materials, sewage sludge, and other materials. Criteria for issuing permits for such activities include considering effects of dumping on the marine environment, ecological systems, and fishery resources.

Federal Food, Drug, and Cosmetic Act of 1938

The Federal Food, Drug, and Cosmetic Act (FDCA) prohibits the sale, transfer, or importation of "adulterated" or "misbranded" products. Adulterated products may be defective, unsafe, filthy, or produced under unsanitary conditions. Misbranded products may have false, misleading, or inadequate information on their labels. In many instances, the FDCA also requires U.S. Food and Drug Administration (FDA) approval for distribution of certain products.

Federal Water Pollution Control Act of 1948, the Clean Water Act of 1972, and amendments

The Federal Water Pollution Control Act (FWPCA) was the first major U.S. law to address water pollution. It was

significantly amended in 1972 and became commonly known as the Clean Water Act (CWA). The CWA's National Pollutant Discharge Elimination System (NPDES) program regulates point sources that discharge pollutants into waters of the United States. Any facility that discharges directly into U.S. waters must have an NPDES permit issued by the U.S. Environmental Protection Agency (EPA). Discharges of pollutants into rivers and estuaries that empty into the Gulf of Mexico can harm or kill marine fishery resources and alter habitats. The EPA has authorized the State of Louisiana to implement its own NPDES program to monitor program compliance and control water pollution.

Section 404 of the CWA regulates the placement of dredged or fill material into wetlands, lakes, streams rivers, estuaries and certain other types of waters to avoid and minimize losses to wetlands and other waters and to compensate for unavoidable loss through mitigation and restoration. The EPA and the U.S. Army Corps of Engineers (Corps) jointly administer Section 404. The Corps issues Section 404 permits and monitors compliance with the issued permits. Both the Corps and EPA are responsible for on-site investigations and enforcement of unpermitted discharges under Section 404. USFWS and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) evaluate impacts of federally permitted projects on fish and wildlife.

The CWA prohibits discharge of oil or hazardous substances to U.S. waters or their adjoining shorelines in quantities that may be harmful to the public health or welfare or the environment. Owners and operators of non-transportation-related oil facilities must make and implement plans to prevent oil discharges. Some oil storage facilities and vessels must also prepare and submit plans for responding to discharges of oil and hazardous substances. If a facility or vessel discharges oil to navigable waters or adjoining shorelines, the owner/operator is required to follow certain federal reporting requirements. National and area response plans must also be developed. EPA regional personnel periodically conduct inspections to ensure compliance with these regulations.

International Convention for the Prevention of Pollution from Ships

International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention that covers prevention of pollution of the marine environment by ships from operational or accidental causes. MARPOL is divided into annexes, each of which regulates a particular group of ship emissions including oil and oily water, bulk noxious liquid substances, harmful substances carried by sea in packaged form, sewage, garbage, and air pollution. As a signatory to MARPOL, the United States implemented the Act to Prevent Pollution from Ships to comply with the provisions of this convention. The Marine Plastic Pollution Research and Control Act later amended the Act to Prevent Pollution from Ships.

Clean Vessel Act of 1992, as amended

Congress passed the Clean Vessel Act (CVA) to help reduce pollution from vessel sewage discharges. The CVA was created to provide a viable alternative to the overboard disposal of recreational boater sewage. All recreational vessels must have access to pumpouts funded under the CVA. The CVA made grants available to the states on a competitive basis for the construction and/or renovation, operation and maintenance of pumpout and portable toilet dump stations. States may sub-grant to public and private marinas to install pumpouts. The USFWS administers this grant program. The CVA also provides a portion of its total funding for educational outreach regarding the effects of boater sewage and how boaters can avoid improper sewage disposal.

Coastal Zone Management Act of 1972 (CZMA), as amended

Under the Coastal Zone Management Act (CZMA), states receive federal assistance grants to maintain federally-approved planning programs for enhancing, protecting, and using coastal resources. These are state programs, but the CZMA requires that federal activities must be consistent with the respective states' coastal zone management programs. Depending upon the individual state's program, the CZMA provides the opportunity for considerable protection and enhancement of fishery resources by regulation of activities and by planning for future development in the least environmentally damaging manner.

Endangered Species Act (ESA) of 1973, as amended

The Endangered Species Act (ESA) provides for the listing of plant and animal species that are threatened or endangered. Once listed as threatened or endangered, a species may not be taken, possessed, harassed, or otherwise molested. It also provides for a review process to ensure that projects authorized, funded or carried out by federal agencies do not jeopardize the existence of these species or result in destruction or modification of habitats that the Secretary of the U.S. Department of the Interior (DOI) determine to be critical.

Oysters in the U.S. Gulf of Mexico (Gulf) are neither endangered nor threatened. NOAA Fisheries conducted an ESA status review of oysters throughout their range in 2007. They concluded that the long term persistence of Eastern oysters throughout their range is not at risk now or in the foreseeable future. In addition, current fishing activities for oysters are not known to adversely affect any threatened or endangered species.

National Environmental Policy Act of 1970

The National Environmental Policy Act (NEPA) requires that all federal agencies recognize and give appropriate consideration to environmental amenities and values in the course of their decision-making. To create and maintain conditions under which man and nature can exist in productive harmony, NEPA requires that federal agencies prepare an environmental impact statement (EIS) prior to undertaking major federal actions that significantly affect the quality of the human environment. Within these statements, federal agencies must carefully assess alternatives to the proposed action that may better safeguard environmental values.

Fish and Wildlife Coordination Act of 1958

Under the Fish and Wildlife Coordination Act, USFWS and NOAA Fisheries review and comment on fish and wildlife aspects of proposals for work and activities sanctioned, permitted, assisted, or conducted by federal agencies that take place in or affect navigable waters, wetlands, or other critical fish and wildlife habitat. The review focuses on potential damage to fish, wildlife, and their habitat; therefore, it serves to provide some protection to fishery resources from activities that may alter critical habitat in nearshore waters. This Act is important because federal agencies must give due consideration to the recommendations of USFWS and NOAA Fisheries.

Fish Restoration and Management Projects Act of 1950

Under this act, DOI is authorized to provide funds to state fish and game agencies for fish restoration and management projects. Funds for protection of threatened fish communities that are located within state waters could be made available under this Act.

Lacey Act of 1981, as amended

The Lacey Act prohibits import, export, and interstate transport of illegally taken fish and wildlife. As such, the Act provides for federal prosecution for violations of state fish and wildlife laws. The potential for federal convictions under this Act has probably reduced interstate transport of illegally possessed fish and fish products.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly called Superfund

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) names NOAA Fisheries as the federal trustee for living and nonliving natural resources in coastal and marine areas under U.S. jurisdiction. It could provide funds for cleanup of fishery habitat in the event of an oil spill or other pollution event.

Fish and Wildlife Act of 1956

This Act provides assistance to states in the form of law enforcement training and cooperative law enforcement agreements. It also allows for disposal of abandoned or forfeited property with some equipment being returned to states. The Act prohibits airborne hunting and fishing activities.

National Aquaculture Act of 1980, National Aquaculture Improvement Act of 1985

The National Aquaculture Act (NAA) established national policy to encourage the development of aquaculture in the United States. The National Aquaculture Improvement Act (NAIA) designated the U.S. Department of Agriculture (USDA) as the lead federal agency for coordinating federal activities and for disseminating aquaculture information. Under this Act, advisory, educational, and technical assistance is provided to encourage the implementation of aquaculture technology in rehabilitation and enhancement of publicly-owned fish and shellfish stocks and in the development of private commercial aquaculture enterprises. The Joint Subcommittee on Aquaculture (JSA), established by the NAA, issued the National Aquaculture Development Plan of 1983, recognizing the status of aquaculture (including oyster culture), current technologies, impediments to development, existing programs, recommended programs and actions, and anticipated impacts.

Appendix X. Commercial and Recreational Oyster Regulations—Detailed Text

In general, oyster management and conservation is covered in state law through Louisiana Revised Statutes (LA R.S.) Title 56, namely sections 421 through 449, and rules promulgated by the Louisiana Wildlife and Fisheries Commission (Commission) within the Louisiana Administrative Code (LAC) Title 76. These regulations are listed below.

The authority to set oyster seasons by emergency declaration is found in LA R.S. 56:6.1 and 49:953(B) as well as provisions of the LAC. Additional regulations governing harvesting, handling, processing, and shipping of oysters with respect to quality and safety can be found in LA R.S. Titles 3 and 40 and LAC Titles 7, 49, and 51. The Louisiana Department of Agriculture and Forestry (LDAF) and the Louisiana Department of Health and Hospitals (LDHH) administer these rules, but the Louisiana Department of Wildlife and Fisheries (LDWF) often enforces many of them.

Existing Commercial Regulations

Licensing

Commercial Fisherman's License

- A commercial fisherman taking oysters for sale must purchase a Commercial Fisherman's License. LA R.S. 56:303(A)1
- Cost is $55 for residents and $460 for nonresidents. LA R.S. 56:303(B)
- Valid for one year beginning January 1 and ending December 31. LA R.S. 56:303.1(A)
- Available for purchase at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:303.1(B)
- A commercial fisherman holding a Commercial Fisherman's License may transport and sell his own catch to any licensed Louisiana wholesale/retail seafood dealer located within the state of Louisiana. LA R.S. 56:303.7(A)
- A licensed commercial fisherman who sells or transfers his catch to a wholesale/retail seafood dealer must present his license to the dealer for verification and provide the dealer with the necessary information needed to complete trip tickets. LA R.S. 56:303.7(B)
- Unlawful for the owner of a commercial fishing vessel to allow any person who does not hold a Commercial Fisherman's License to operate the vessel while commercially fishing or while in possession of fish for sale while on the water. LA R.S. 56:304.2(A)
- Senior Commercial Fisherman's License available to residents 70 years of age or older at a cost of $20; also serves in lieu of any required commercial gear licenses. LA R.S. 56:303(F)
- Certified Commercial Fisherman's license available upon presentation to LDWF of a notarized statement from a tax preparer certifying that based upon his most recent tax return the individual earns at least 50 percent of his income from commercial fishing activities. LA R.S. 56:303(E)1.
- Five dollars of each Commercial Fisherman's License fee is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1

Fresh Products License

- A commercial fisherman selling his catch directly to a consumer must possess a Fresh Products License LA R.S. 56:303(A)2 and LA R.S. 56:303.1.1(A)
- A commercial fisherman may purchase a secondary Fresh Products License for a spouse at a cost of $5.00 LA R.S. 56:303.1.1(E)
- The cost of a Fresh Products License shall be $20 for residents and $120 for nonresidents. The Fresh Products License shall be valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:303.1.1(B)

Commercial Gear Licenses

- A commercial fisherman must possess a commercial gear license indicating that he has paid the applicable gear fee whenever using or possessing any oyster gear on fishing grounds. LA R.S. 56:303.2(A) and LA R.S. 56:305 (A)

- A commercial gear license can only be purchased by a person possessing a valid Commercial Fisherman's License. LA R.S. 56:305.2 (A)
- A gear fee must be paid for each piece of gear or each type of gear, whichever is applicable, being used to take fish; or, if the gear is not in use but is in possession on the fishing grounds, the gear fee must be paid for each piece of gear or type of gear, whichever is applicable, intended for use or used to take fish. LA R.S. 56:305(A) and LA R.S. 56:305(E)
- Gear licenses may be temporarily transferred between licensed commercial fishermen with the same residency status. LA R.S. 56:305.3(A)
- The gear license fee for each oyster scraper in use is $25. LA R.S. 56:305(B)3
- Not available for sale if domiciliary state prohibits the use of similar commercial fishing gear. LA R.S. 56:30(C)2
- Five dollars of each gear license fee is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1
- Valid for one year beginning January 1 and ending December 31. LA R.S. 56:305.1(A)
- Available for purchase at any time of the year for the current license year and from November 15 for the immediately following license year. LA R.S. 56:305.1(B)

Vessel License

- A vessel must be licensed whenever engaged in commercial fishing or whenever possessing fish for sale in freshwater and saltwater areas of the state. LA R.S. 56:304(A)
- Cost of the Vessel License is $15 for residents and $60 for nonresidents. LA R.S. 56:304(B)
- Issued only to the owner of the vessel. LA R.S. 56:304(D)
- Five dollars of each Vessel License fee is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1
- Valid for one year beginning January 1 and ending December 31. LA R.S. 56:304.1(A)
- Available for purchase at any time of the year for the current license year and from October 15 for the immediately following license year. LA R.S. 56:304.1(B)
- Not transferable; also, the name of a vessel for which a Vessel License has been issued cannot be changed without prior notification to LDWF. LA R.S. 56:304.5(A) and LA R.S. 56:304.5(B)

Oyster Harvester License

- Each captain of a vessel harvesting or possessing oysters in state waters must possess an Oyster Harvester License. The cost of an Oyster Harvester License is $100 for residents and $400 for nonresidents. LA R.S. 56:303.6(A)1
- No person, except a Louisiana resident 16 years of age or under, and except the spouse of a vessel's owner while on that vessel, shall harvest oysters unless he possesses a valid Oyster Harvester License. LA R.S. 56:424(A)2
- Beginning in license year 2017, anyone applying for an oyster harvester license must have completed the oyster harvester education program within the previous three years. LA R.S. 56:303.6(D)

Oyster Seed Ground Vessel Permit

- Any oysters taken for commercial purposes from the public natural reefs or the oyster seed grounds or reservations, except those in Calcasieu and Sabine Lakes, shall only be placed on a vessel which has an oyster seed ground vessel permit issued by LDWF. The Commission may establish a limit on the number of permits that may be issued each year after consulting with the Louisiana Oyster Task Force. The permit is issued in the name of the vessel owner and cannot be sold, exchanged or otherwise transferred. The permit is valid for one year, beginning on January 1st of each calendar year and expiring on December 31st of the same calendar year. The annual cost of this permit for a single scraper vessel shall be $250 for residents and $1,000 for nonresidents. The annual cost of this permit for a double scraper vessel shall be $500 for a resident and $2,000 for a nonresident. All revenues from purchase of this permit shall be deposited in the Public Oyster Seed Ground Development Account (LA R.S. 56:434.1). LA R.S. 56:433.1(A)1.
- Except as authorized in LA R.S. 56:433.1(B)4, no application for new permits shall be accepted by after December

31, 2012. LA R.S. 56:433.1(A)2

- A person who owns an oyster vessel and has satisfactorily completed the requirements of a professionalism program may apply for an oyster seed ground vessel permit. The Commission shall develop, establish, and monitor a professionalism program for the purpose of training vessel owners in the appropriate methods and practices of oyster harvest from the public seed grounds. LA R.S. 56:433(B)4
- Vessel owners must meet the eligibility requirements as listed in LAC 76:VII:525(C)
- All vessels operating under an Oyster Seed Ground Vessel Permit must have a fully operable vessel monitoring system (VMS) on board and recording data while the vessel is fishing on public oyster seed grounds. LAC 76:VII:525(E)
- A holder of a valid permit for the current license year may apply for a renewal permit for the immediately following license year. LAC 76:VII.527(A)
- Reissuance permits are allowed to be obtained if 1) the holder of a valid permit discontinues the use of the permitted vessel and requests the valid permit be moved to another vessel which is owned by the permit holder, or 2) a new person acquires a permitted vessel and the original holder of the permit relinquishes such permit and allows the permit to move to the new vessel owner with the transfer of vessel ownership. LAC 76:VII:527(B)
- A permit appeals board, made up of oyster industry members, was created to hear appeals of permit applications previously denied by LDWF. LA R.S. 56:433.1(C) and LAC 76:VII:529

Calcasieu Lake Oyster Harvester Permit

- Oysters may only be harvested in Calcasieu Lake by a person holding a valid Calcasieu Lake Oyster Harvester Permit issued by LDWF. There is no cost for this permit. LA R.S. 56:435.1.1(A)1 and LAC 76:VII:533

Oyster Lessee Out-of-State Landing Permit

- All oysters taken from Louisiana waters must be landed in Louisiana, unless oysters are harvested from an oyster lease under a valid Out-of-State Landing Permit. LA R.S. 56:424(G)1 and LAC 76:VII:515
- The cost of the permit shall not exceed $100 and is currently set by rule at $100. LA R.S. 56:424(G)1 and LAC 76:VII:515(A)
- The permit is valid for one calendar year and expires on December 31 of the permitted year. LAC 76:VII:515(A)
- Any vessel operating under this permit must use a VMS. LAC 76:VII:515(E).
- Permitted vessel must display signs, visible from either side of the vessel and the air, with the words “Oyster Permit” and the permit number in letters at least 12 inches high. LAC 76:VII.515(C)

Oyster Cargo Vessel Permit

- Each person in charge of an oyster cargo vessel shall purchase an Oyster Cargo Vessel Permit from LDWF. The cost of the permit is $250 per license year for residents and $1,105 for nonresidents. The permit is valid for up to one calendar year beginning January 1 and expiring on December 31 of the same calendar year. The permit is issued in the name of the vessel owner. The permit is non-transferrable. LA R.S. 56:422(E) and LAC 76:VII:523
- The purpose of the permit is to assist the oyster industry with meeting LDHH refrigeration requirements. LAC 76:VII:523
- The permit will be suspended and/or revoked if there is any violation of any permit rules, regulations, or statutes while operating under the permit. All oysters placed on-board from another vessel, possessed, or transported by an oyster vessel in violation shall be considered illegally taken, possessed, or transported. LAC 76:VII:523
- Permitted vessel must display signs, visible from either side of the vessel and the air, with the words “OCV Permit” and the permit number in letters at least 12 inches high. LAC 76:VII.523(C)
- Permitted vessels must meet LDHH requirements. LAC 76:VII.523(C)1
- Permitted vessels may only transport oysters from a legally licensed commercial oyster harvester on behalf of a legally licensed certified dealer. The permitholder or agent on-board the permitted vessel must complete all required records pertaining to oysters at the point oysters are transferred to the receiving vessel. No harvester may transfer

oysters to another commercial vessel for refrigeration, sale, or transport unless that vessel has an Oyster Cargo Vessel Permit. LAC 76:VII:523(D)

- All oysters taken from Louisiana waters and transported by a permitted oyster cargo vessel must be landed in Louisiana. LAC 76:VII:523(E)
- All oysters transferred to an oyster cargo vessel must be properly sacked or containerized and tagged in accordance with LA R.S. 56:449 and LDHH requirements. LAC 76:VII:523(F)
- Any vessel operating under this permit must have an operable VMS installed on-board. LAC 76:VII:523(G)

Alternative Oyster Culture Permit

- LDWF may issue such permit to the owner of a valid oyster lease. LA R.S. 56:431.2(A)1
- The permit authorizes the lessee, or duly-authorized designee, to engage in alternative oyster culture activities. LA R.S. 56:431.2(A)2
- The application fee is $100 and the annual permit fee is $2.00 per acre, not to exceed $1,000 per year. LA R.S. 56:431.2(B)1
- The permit is valid for 10 years. LAC 76:VII:535
- The permit is transferrable only with the transfer of the lease containing the permitted area, and only to the transferee of the lease. LAC 76:VII:535

Wholesale/Retail Seafood Dealer License

- Any person buying, acquiring, or handling, from any person, by any means whatsoever, any species of fish, whether fresh, frozen, processed, or unprocessed, in Louisiana from within or outside the state, for sale or resale, including bait species, whether on a commission basis or otherwise, must possess a Wholesale/Retail Seafood Dealer License. LA R.S. 56:306(A)1
- Five dollars of each Wholesale/Retail Seafood Dealer License fee is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1
- If the place of business is a vehicle, the license shall state "vehicle" and shall list the legal mailing address and physical location of the licensee. LA R.S. 56:306(B)1
- Any person shipping fish into or out of the state shall possess a Wholesale/Retail Seafood Dealer License. LA R.S. 56:306(A)2b
- A Wholesale/Retail Seafood Dealer License is required for each place of business. LA R.S. 56:306(B)3
- Must operate from the physical location of the business except for a Wholesale/Retail Seafood Dealer License issued to a vehicle. LA R.S. 56:306(B)1
- A commercial fisherman selling his catch to anyone or any business other than a consumer or licensed wholesale/retail seafood dealer must possess a Wholesale/Retail Seafood Dealer License . LA R.S. 56:303(A)2
- The cost of the Wholesale/Retail Seafood Dealer License is $250 for residents and $1,105 for nonresidents. LA R.S. 56:306.2(A)1
- The license shall be valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:306.3(A)
- The license may be purchased at any time of the year for the current license year and from October 1 for the immediately following license year. LA R.S. 56:306.3(B)

Retail Seafood Dealer License

- Any person buying, acquiring, or handling by any means whatsoever, from a Louisiana wholesale/retail seafood dealer, any species of fish whether fresh, frozen, processed, or unprocessed, that sells to the consumer for personal or household use and any person who ships fish out of or within the state of Louisiana to the consumer for personal or household use shall purchase a Retail Seafood Dealer License. LA R.S. 56:306.1(A)
- A Retail Seafood Dealer License is required for each place of business. LA R.S. 56:306.1(B)3

- Must operate from the physical location of the business except for a Retail Seafood Dealer License issued to a vehicle. LA R.S. 56:306.1(B)1
- Retail seafood dealers, restaurants, and retail grocers shall buy directly only from wholesale/retail seafood dealers licensed in Louisiana. LA R.S. 56:306.4(C)1
- If the place of business is a vehicle, the license shall state "vehicle" and shall list the legal mailing address and physical location of the licensee. LA R.S. 56:306.1(B)1
- Restaurants and retail grocers who only purchase fish, whether fresh, frozen, processed, or unprocessed, from a licensed wholesale/retail seafood dealer and only sell such fish fully prepared by cooking for immediate consumption by the consumer need not be licensed. LA R.S. 56:306.1(B)6
- The cost of the Retail Seafood Dealer License is $105 for residents and $405 for nonresidents. LA R.S. 56:306.2(A)2
- A Retail Seafood Dealer License is valid for one year, beginning on January 1 of each calendar year and expiring on December 31 of the same calendar year. LA R.S. 56:306.3(A)
- A Retail Seafood Dealer License may be purchased at any time of the year for the current license year and from October 1 for the immediately following license year. LA R.S. 56:306.3(B)

Seafood Transport License

- Operators and drivers of any form of commercial transport, except common carriers, who are in the act of loading, unloading, or transporting fish shall have in their possession at least a Commercial Fisherman's License, Wholesale/Retail Dealer License, or Transport License. LA R.S. 56:307(A)
- In lieu of a Wholesale/Retail or Retail Seafood Dealer License, a Seafood Transport License is required for each vehicle when delivering for or on behalf of a wholesale/retail seafood dealer or retail seafood dealer. LA R.S. 56:306(B)4 and LA R.S. 56:306.1(B)4
- No license required to transport processed fish or fish products. LA R.S. 56:307(C)
- Issued in the name of the wholesale/retail or retail seafood dealer licensee. LA R.S. 56:307.1(B)
- Remains transferable between vehicles. LA R.S. 56:307.5
- Employees of a wholesale/retail or retail seafood dealer operating under authority of a Transport License for the dealer, the wholesale/retail or retail seafood dealer remains responsible for all activities taking place under authority of that license. LA R.S. 56:306(B)4
- The cost of a Transport License is $30 per vehicle. The license can only be purchased by a person holding a valid Louisiana Commercial Fisherman's License or valid Louisiana Wholesale/Retail Dealer License. LA R.S. 56:307.1(A)
- If a restaurant or retail grocer buys fish from an out-of-state seller and brings fish into the state, the restaurant or retail grocer must possess a Transport License when bringing such fish into the state. LA R.S. 56:306.4(C)1
- Five dollars from the sale of each Transport License is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1

Commercial Fisherman Seafood Transport License

- A licensed commercial fisherman who possesses a Transport License in his name may allow other individuals to transport his catch, provided these individuals are in possession of the fisherman's Transport License. LA R.S. 56:307.5
- The Transport License must be issued in the name of the commercial fisherman whose catch is being transported. LA R.S. 56:307.1(B)
- Five dollars from the sale of each Transport License is deposited in the Seafood Promotion and Marketing Fund. LA R.S. 56:10(B)1

Licensing/Residency Eligibility

- "Bona fide resident" means any person who is a U.S. citizen or resident alien and has resided in Louisiana

continuously during the 12 months immediately prior to the date on which he applies for any license and who has manifested his intent to remain in this state by establishing Louisiana as his legal domicile, as demonstrated by compliance with all of the following, as applicable (LA R.S. 56:8(16)):

- If registered to vote, he is registered to vote in Louisiana.
- If licensed to drive a motor vehicle, he is in possession of a Louisiana driver's license, or, if over the age of 15 years and not licensed to drive, he is in possession of a special identification card issued by the Department of Public Safety and Corrections under the provisions of LA R.S. 40:1321.
- If owning a motor vehicle located within Louisiana, he is in possession of a Louisiana registration for that vehicle.
- If earning income, he has filed a Louisiana state income tax return and has complied with state income tax laws and regulations.

- As to a corporation or other legal entity, a resident shall be any which is incorporated or otherwise organized under and subject to the laws of Louisiana, and which is domiciled in Louisiana and has a permanent physical location of business in Louisiana where records are held. LA R.S. 56:8(16)B
- Any person, corporation, or other legal entity which possesses a resident license from any other state or country shall not qualify for a resident license in Louisiana. LA R.S. 56:8(16)C
- Helpers, deckhands or any person assisting in commercial fishing while on board a fishing vessel need not have a Commercial Fisherman's License provided the person in charge of the operation of a commercial fishing vessel, whether or not that person is the owner of the commercial fishing vessel, has a Commercial Fisherman's License and is on board the commercial fishing vessel. LA R.S. 56:303.3
- Fishing licenses may be suspended, denied or revoked for failure to pay child support, nonpayment of unemployment compensation overpayment, and nonpayment of individual income taxes. LA R.S. 56:647

Gear Restrictions

- Scrapers used to harvest oysters from public seed grounds and natural reefs shall be no larger than 54 inches in width measured along the tooth bar. No scraper shall weigh more than 175 pounds. No diving boards, hydrofoils, or any other apparatus or attachment intended to create downward pressure shall be attached to any scraper. LA R.S. 56:435(A)
- For scrapers used to harvest oysters from public seed grounds and natural reefs, scraper teeth are limited to 5 inches in length or less, spaced at least 2-1/4 inches apart as measured from the center of a tooth to center of an adjacent tooth. A tooth shall not exceed 11/16 of an inch in diameter. No more than two scrapers may be in used on any one vessel. An oyster scraper bag shall only be single mesh with a minimum mesh size of 3 inches stretched. LA R.S. 56:435(B)
- There are no gear restrictions for private oyster leases, but gear used on the lease must not impair or destroy any water bottoms. LA R.S. 56:435(C)
- In Calcasieu Lake, legal gear is limited to tongs, a hand scraper, or use of a single scraper with mechanical assist and a flat bar length of no more than 36 inches. LA R.S. 56:435.1.1(A)2
- In Sabine Lake, legal gear is limited to tongs, a hand scraper, or a single scraper with mechanical assist with a flat bar length of no more than 36 inches. LA R.S. 56:435.1(A)

Seasons and Times

- Seed oysters may be harvested from natural reefs each year starting the first Wednesday after Labor Day. Beginning on the second Monday in October each year, the seed grounds may be opened for harvest of market oysters in addition to seed oysters. Harvest on the public seed grounds must end April 30. However, the Commission, with consideration for recommendations from the Louisiana Oyster Task Force, may extend this season if sufficient quantities of oysters are available to accommodate additional harvest in designated areas and may designate what areas may be fished for oysters. The Commission may suspend oyster harvest altogether from natural reefs when they are threatened with depletion. LA R.S. 56:433(B)1
- The Commission may close to harvest and/or set harvest limits for any portion or all of the natural reefs between

January 1 and the last day of the season of each year. LA R.S. 56:433(E)

- The Commission sets the open season for oyster harvest in Calcasieu Lake, beginning on any date between October 15 and November 1 and ending on April 30. However, in consultation with the Calcasieu Oyster Task Force, the Commission may open or close the season as biological data indicate a need and may manage East Cove and West Cove separately. LA R.S. 56:435.1.1(C)
- Open season dates for Sabine Lake shall be set by the Commission after consideration of recommendations by the Louisiana Oyster Task Force. LA R.S. 56:435.1(G)
- Taking oysters from the natural reefs of Louisiana and from privately owned bedding grounds between the hours of one-half hour after sunset and until one-half hour before sunrise is prohibited. LA R.S. 56:436

Public Oyster Seed Grounds and Reservations

- The Commission has the authority to designate certain water bottoms of the state as Public Oyster Seed Grounds for planting, propagation, growth, and policing of seed oysters. LA R.S. 56:434(A), LAC 76:VII:507-513, LAC 76:VII:517, and LAC 76:VII:521
- The Commission regulates when, how much, and how these seed oysters are harvested. Unless otherwise opened by the Commission, all public oyster seed grounds and reservations are closed. LA R.S. 56:434(C)
- The Secretary of LDWF may require persons taking (or attempting to take) oysters, seed, and cultch from public oyster seed grounds or reservations to have permit issued by LDWF. LA R.S. 56:434(D)
- The water bottoms located in Sister (Caillou) Lake and Bay Junop in Terrebonne Parish, Hackberry Bay (Bay Duchene) in Lafourche and Jefferson Parishes, and Bay Gardene in Plaquemines Parish are designated as Public Oyster Seed Reservations. LDWF shall manage these areas in the best interests of the oyster industry. LA R.S. 56:434(E)
- LDWF shall maintain and adequate and vigilant watch and control over the public areas and shall see that the oysters, oyster cultch, and water bottoms are protected from trespass, theft, and injury. LA R.S. 56:434(F)
- When the public oyster seed grounds are open for harvest of seed oysters, the following additional restrictions apply: no containers for holding market oysters may be on the vessel; oysters on board the vessel are presumed to be from the public oyster seed grounds; and no harvester shall sell or transport with his vessel market oysters on the same day he harvested seed oysters from the public grounds. LA R.S. 56:434(G)1-3
- Based on the best available data to ensure economic development of oyster fisheries, the Commission shall annually set aside one or more areas east of the Mississippi River for the exclusive use of sackers ("sacking-only areas"); one area must be located in the American Bay area east of the Mississippi River in Plaquemines Parish and the total area must not exceed one quarter of the total area of public seed ground east of the Mississippi. The Commission may set oyster size restrictions in these sacking areas. LA R.S. 56:433(B)2
- It is illegal to take oysters from the natural reefs during closed season; it is also illegal to can, shuck, or pack any oysters from the natural reefs during the closed season. However, a lessee of oyster bedding grounds may harvest his own oysters for personal consumption or for sale during the closed season. LA R.S. 56:433(C)

Leased Water Bottoms

- Only legal Louisiana residents or corporations domiciled in the state may lease public water bottoms for oyster cultivation. Leases are issued by the Secretary of LDWF. LA R.S. 56:425(A).
- The lessee has exclusive use of the leased water bottoms and all oysters and cultch grown or placed thereon. LA R.S. 56:423(A). Exceptions include integrated coastal protection and other activities as provided for in LA R.S. 56:423(A)1-3.
- The lessee may bring action against those damaging the lease, with the exceptions listed above. LA R.S. 56:423(B)1
- No one may trawl, seine, or use skimmer nets over privately leased oyster bedding grounds or propagating place for one year following seeding of that area. The area must be properly staked off, marked, or posted. LA R.S. 56:423(B)2
- All leases are heritable and transferable. LA R.S. 56:423(E)

- Only a leaseholder or his designated agent (with written permission carried on board the vessel) may work on a private oyster lease. LA R.S. 56:424(B)
- The Coastal Protection and Restoration Authority (CPRA) may sample oysters from an oyster lease on state water bottoms for coastal protection purposes. CPRA shall first notify the leaseholder in writing of the date and time of sampling at least 15 days prior to sampling. The leaseholder, or his designee, may accompany CPRA during their sampling. Sampling must follow CPRA procedures developed with recommendations by the Oyster Task Force. LA R.S. 56:424(H)
- Any lease granted by LDWF must be recorded by the lessee within 30 days in the parish where the lease is located. LA R.S. 56:426
- In general, all governmental agencies are held harmless from any lessee claims from coastal protection, conservation, or restoration activities. LA R.S. 56:427.1(A)
- The lease term is for 15 years; the leaseholder has the first right of renewal for subsequent 15-year terms. LA R.S. 56:428(A)
- Both state law and Commission rule set the rental rate at $3.00 per acre per year. LA R.S. 56:428 and LAC 76:VII:503
- Lessees must stake off and mark leased water bottoms with signs which state the lease number or name or initials of the leaseholder. Oysters may not be harvested from any unmarked lease. LA R.S. 56:430(B)1
- Lessees must clearly mark and delineate areas which have been seeded with prominent, durable signs stating "NO TRAWLING OR SEINING—OYSTER LEASE". LA R.S. 56:430(B)2
- It is illegal to remove oysters, shell, or oyster cultch from leases without the permission of the lessee. LA R.S. 56:431(A)
- It is illegal to remove any sort of designation of bedding or propagating grounds placed by the lessee. LA R.S. 56:431(B)
- LDWF may permit leaseholders to use devices to protect oysters from predation on leased acreage and set rules and regulations for such a permit to specify the following: application fee of $100; permit fee of $50 per acre permitted, not to exceed $1,000; construction of the device; approval of the device by the Commission and House and Senate Committees on Natural Resources; data reporting requirements; and enforcement penalties. State law limits amount and location of acreage that can be protected and when these devices may be used. LA R.S. 56:431.1(A)
- An oyster lease acquisition and compensation program outlined in state law allows for an orderly process by which leases can be acquired by the state through CPRA and removed from an impact area of an impending coastal restoration project. LA R.S. 56:432.1
- CPRA shall provide information to the Louisiana Oyster Task Force regarding nature, location, and status of current or planned coastal protection projects. LA R.S. 56:432.2
- It is illegal to lease more than 2,500 acres of water bottoms. LA R.S. 56:432
- It is illegal to stake off water bottoms or bed oysters on the water bottom without leasing that area from LDWF. LA R.S. 56:439
- Additional oyster leasing policies of LDWF include procedures for initial application for leases (LA R.S. 56:427); lease application policies, various fees, and lease posting requirements (LAC 76:VII:501); and lease moratorium details (LAC 76:VII:505 and Act 595 of the 2016 Regular Legislative Session).

Size, Harvest, and Possession Limits

- All oysters taken from Louisiana's public oyster grounds shall measure at least 3 inches from hinge to mouth, except those oysters taken by lessees for bedding purposes. All undersize oysters and dead shell must be culled and scattered back upon the reefs from which they were taken. Any excess of 15 percent undersize oysters and/or dead shells in any cargo lot of oysters, except those to be used for seed oysters for bedding purposes, is prohibited. LA R.S. 56:433(A)
- LDWF may permit lessees of oyster bedding grounds to fish oysters of any size, without charge, from the state's natural reefs as seed oysters for bedding purposes only. LDWF may designate which natural reefs may be fished and

how many oysters may be taken by a lessee. LA R.S. 56:433(B)1

- The Commission may close to harvest and/or set harvest limits for any portion or all of the natural reefs between January 1 and the last day of the season of each year. LA R.S. 56:433(E)
- Harvest limits in Calcasieu Lake shall be set by the Commission not to exceed 25 sacks per day per person per vessel. In addition, one permittee may harvest from each licensed vessel per day and no vessel shall be used for more than one trip per day. LA R.S. 56:435.1.1(D)1
- Harvest limits in Sabine Lake shall be set by the Commission not to exceed 25 sacks per vessel per day. LA R.S. 56:435.1(F-G)
- There are no size, harvest, or possession limits for oysters taken from private oyster leases.

Area Restrictions

- It is illegal to harvest oysters from an area that has not previously been approved by LDHH in accordance with LA R.S. 40:5.3. If a vessel is found harvesting in an unapproved or closed area, all oysters on board the vessel will be deemed from that area and a public health, safety, and welfare hazard. LA R.S. 56:424(E)1
- Culling of undersize oysters and/or shell from market-size oysters is allowed only on the open state designated public grounds or leases on which the fisherman is authorized to take oysters. Culling is prohibited in areas closed to harvesting oysters. LA R.S. 56:424(F)1

Recreational Reefs

LAC 76:VII:535 establishes several recreational artificial reef sites where oyster harvest is prohibited.

Wildlife Management Areas and Wildlife Refuges

- Oysters may not be harvested from any Wildlife Management Area (WMA), except that oysters may be harvested from private oyster leases and state seed grounds located within a WMA, when authorized by the Commission and upon approval by LDHH. LAC 76:XIX:111
- Commercial fishing including commercial oyster harvesting is prohibited in the following areas:
  - Elmer's Island Wildlife Refuge LAC 76:III.337
  - Salvador / Timken WMA LAC 76:XIX.111(A)
  - Pass-a-Loutre WMA LAC 76:XIX.111(A)
  - Pointe aux Chenes WMA except in Cut Off Canal and Wonder Lake LAC 76:XIX.111(A)
  - Marsh Island Wildlife Refuge LAC 76:III.310(4)
  - State Wildlife and Paul J. Rainey Refuge LAC 76:III.323(A)4
  - White Lake Wetlands Conservation Area LAC 76:III.335
  - Rockefeller Wildlife Refuge LAC 76:III.309(5)
  - Isle Dernieres Barrier Island Refuge LAC 76:III.331

Operational Requirements and Restrictions

- The name, license number, state boat registration number, or federal documentation number of each vessel, boat, or dredging apparatus engaged in harvesting oysters shall be displayed on the roof of the cabin or on any other place which is easily visible from the air, at all times. The letters shall be at least 8 inches in height and of an appropriate width. LA R.S. 56:444
- All vessels used for the commercial harvest of oysters on Sabine Lake must be self-propelled. LA R.S. 56:435.1(C)
- In Sabine Lake, oysters can only be transferred to a shoreside facility once harvested. LA R.S. 435.1
- All vessels used for the commercial harvest of oysters on Calcasieu Lake must be self-propelled. LA R.S. 56:435.1.1(B)
- All oysters taken from the water bottoms of Louisiana must be landed in Louisiana. LA R.S. 56:424(G)1. However, a leaseholder legally harvesting oysters from his own lease may land those oysters outside the state under a valid

Out-of-State Landing Permit (LAC 76:VII:515). Leaseholders permitted to land oysters outside the state must have a VMS, accessible by LDWF, on each vessel used to transport oysters from Louisiana waters to another state for landing. LA R.S. 56:424(G)1-2

Transplanting of Shellfish

- A person must obtain a permit from LDHH to transplant shellfish from waters not approved for direct market harvesting to waters which meet or exceed LDHH criteria. Fee is $100. Must file application at least 14 days before proposed transplanting. Shellfish transplanting is permitted only during the first two weeks of each calendar month. LAC 51:IX:141
- Permit applicant must submit a $5,000 cash performance bond and secure the services of an LDHH and LDWF-approved surveillance officer to monitor all harvesting, transporting, and bedding of shellfish for transplanting. LAC 51:IX:143
- Permit applicants must meet the following requirements: must have no violations related to shellfish harvesting within three years of the application data; may only harvest transplanted shellfish for market after at least 15 days of transplant; may not use lease on which shellfish have been transplanted for direct market harvest during active period of transplant permit; may not transplant shellfish within 500 feet of any adjoining lease where shellfish may be harvested for sale during active period of transplant permit; may not sack, store empty shellfish sacks on transplant vessels, or directly market shellfish taken from unapproved waters; may not cull shellfish without LDHH authorization; may use no more than two leases in the restricted area and approved bedding area (may transplant live oysters from a restricted area of a public oyster seed ground at LDWF's discretion only during the open oyster season and bed transplanted oysters on only two LDHH-approved leases; no excessive removal of nonliving reef material in transplant loads, otherwise permit must be forfeited and/or the public oyster seed ground area must be closed to transplanting); must allow on-board inspection and sampling of transplant loads by LDWF; must notify LDWF by phone prior to leaving port to transplant shellfish and immediately upon returning from permitted trip each day; must mark the four outside corners of leases with poles with red flags attached so that they may be easily spotted by aircraft and boats; must only operate during daylight hours and complete all activities no later than 30 minutes after official sunset (applicants may apply for a written exemption to this requirement when the distance between the restricted area and bedding area is such that compliance is not possible); mark both sides of the permitted vessel with the permit number in at least 6-inch high letters on a contrasting background so it is visible from low flying aircraft or any nearby vessel; must keep a copy of the transplant permit and applicable rules on board each authorized vessel at all times during active period of transplant permit; must not harvest shellfish for transplanting purposes within 150 feet of any sewage discharge point from any habitable structure. LAC 51:IX:145
- Surveillance officer must complete and submit an official LDHH "Surveillance Officers Daily Trip Report" after each day of transplanting. LAC 51:IX:147
- Failure to comply with any permitting requirements will result in the following actions: suspension of permit and permitting privileges and permitholder must return all shellfish harvested for transplanting to original waters or destroy them. If charges are upheld, additional penalties apply (forfeit of cash bond and denial of permitting privileges for three years). LAC 51:IX:149

User Group Conflicts

- The Commission designates how geophysical exploration work shall be conducted as it relates to the fish, seafood, aquatic life, oysters, wildlife, and water bottoms of the state. No work shall commence without the Secretary of LDWF's approval. LDWF's Seismic Section administers and enforces regulations related to geophysical exploration. Anyone wishing to conduct geophysical exploration must apply to LDWF in writing and guarantee payment of any compensation for damage to oysters, etc. LAC 76:I:301
- State law recognizes potential conflicts between oyster leasing and coastal restoration activities as administered by CPRA. State and federal agencies are held harmless from coastal restoration-related impacts to oyster leases (LA R.S. 56:427.1), and CPRA may purchase oyster leases if such leases are deemed to be in a direct impact area from a coastal restoration project (LA R.S. 56:432.1).

Severance Tax

- A severance tax of $0.025 per barrel is charged for oysters taken from private leases and $0.03 per barrel for oysters taken from the public oyster areas. The person harvesting oysters or the person on whose behalf oysters are harvested must pay this tax, except when the person sells them to a resident wholesale/retail dealer. In this case, the dealer is responsible. LA R.S. 56:446(A)
- Severance taxes are due before the 10th of the month following the date of sale. Payments must be accompanied by a statement of the quantity of oysters fished, purchased, and/or received. Penalties are incurred upon failure to pay severance taxes; penalties may include an increase in tax due, warnings, seizure of oysters, revoking of license, and loss of privileges to buy and sell oysters. LA R.S. 56:446(C)1-3
- Severance tax applies to nonresident wholesale/retail dealers whenever they buy directly from any Louisiana fishermen for out-of-state shipment and no taxes have been paid on these shipments. LA R.S. 56:446(D)

Post-Harvest Requirements

- All containers of oysters must be tagged with official tags issued by LDWF. Tags are identified with and traceable to the license of the leaseholder or fisherman. The fisherman shall write on the tag all information required by LDHH and LDWF. LA R.S. 56:449(A)
- The tags are sold by LDWF; prices ranges from $0.15 to $0.45 per tag, depending upon the quantity purchased. Five cents of the purchase price of each tag is deposited into the Oyster Development Account of the Seafood Promotion and Marketing Board. LA R.S. 56:449(B)
- Oysters containerized on-board the vessel must be tagged before they are removed from the harvest vessel. Oysters to be containerized dockside must be containerized and tagged immediately upon arriving to the dock prior to shipment. LA R.S. 56:449(C)
- It is illegal to sell for resale or purchase for resale untagged containers of oysters. LA R.S. 56:449(D)
- It is illegal to possess untagged sacks or containers other than on-board the harvest vessel or on the dock prior to shipment. Untagged or improperly tagged sacks or containers of oysters may be seized. LA R.S. 56:449(E)
- All containers of oysters harvested in Louisiana but landed in another state must be tagged with Louisiana tags prior to leaving the jurisdiction of Louisiana. All containers of oysters harvested outside of Louisiana but landed in Louisiana must be tagged according to the rules of the state where harvested. LA R.S. 56:449(F)
- If a container is not tagged or is improperly tagged, it shall be deemed to have been harvested in polluted waters and a hazard to public safety, health, and welfare. Agents may seize all untagged containers. LA R.S. 56:449(G-H)
- It is illegal for any manufacturer, distributor, dealer, supplier, or wholesaler to sell or distribute shucked oysters to anyone that has not been certified by LDHH. The packer, distributor, or purchaser shall not resell the shucked oyster container. A nonresident may not purchase new and unused shucked oyster containers without a valid certificate from an appropriate state agency that regulates the seafood industry. LA R.S. 56:449(I)
- LDWF requires that anyone who containerizes shucked oysters or other molluscan species to keep accurate records of the source of the oysters so that said oysters can be traced back to the identifying tag. Such containers must be labeled. LA R.S. 56:449(J)
- Oysters seized in connection with any violation of tagging requirements shall be disposed of. LA R.S. 56:449(K)
- Oysters which have been harvested from Louisiana waters may be sold for raw consumption within the state at all times during the year provided that from May 1 through October 31 each year, transfer of oysters from harvest to refrigeration does not exceed five hours. LA R.S. 56:437
- The standard measurement of a barrel is 6451.26 cubic inches or three bushels or one barrel; one sack represents 3225.63 cubic inches or one and one-half bushels or one-half barrel. All shucked oysters shall be labeled and packaged as required by the National Shellfish Sanitation Program and the National Institute of Standards and Technology. All licensed oyster captains, harvesters, or certified wholesale/retail dealers of shellstock and shucked oysters shall verify that the oysters being sold adhere to these measurement standards. LA R.S. 56:440(A-C)

Reporting Requirements

- Wholesale/retail seafood dealers purchasing or acquiring fish from commercial fisherman shall complete a commercial receipt form. The commercial receipt form shall be a three-part form signed by both the commercial fisherman and the wholesale/retail seafood dealer or his designee, attesting to that the information required to be provided by each is correct. One part of the receipt form shall be retained by the wholesale/retail seafood dealer, one part shall be given to the commercial fisherman at the time of the transaction, and one part shall be transmitted to LDWF. LA R.S. 56:306.5(B)1
- Wholesale/retail seafood dealers are responsible for recording on the commercial receipt form that information provided by the commercial fisherman and are responsible for the following information at the time of purchase or transfer of possession of the catch from a commercial fisherman to a wholesale/retail seafood dealer: wholesale/retail seafood dealer's name and license number, commercial fisherman's name, license number and signature, transaction date, species identification, quantity and units of each species, size and condition of each species, unit price of each species, and permit number for species requiring a permit to harvest. LA R.S. 56:306.5(B)2
- Required records must be maintained for three years and shall be open to inspection by LDWF. LA R.S. 56:306.5(C)
- Wholesale/retail seafood dealers shall, on or before the 10th of each month, make a return to LDWF of all commercial receipt forms representing actual transactions from every commercial fisherman during the preceding month. All commercial receipt forms submitted by a dealer shall be accompanied by a monthly submission sheet signed by the wholesale/retail seafood dealer certifying that the transactions submitted represent all of the transactions by that dealer from commercial fishermen for that particular month. LA R.S. 56:306.6(A)
- A commercial fisherman selling fish under a Fresh Products License shall record all information required on trip tickets, except that the fresh products license number shall be recorded in place of the wholesaler/retailer seafood dealer's license number. The fresh products licensee shall complete monthly returns to LDWF as specified for wholesale/retail seafood dealers. The commercial fisherman shall sign each commercial receipt form attesting that the information provided therein is correct. LA R.S. 56:303.7(C)

Recordkeeping Requirements

Wholesale/retail seafood dealers, retail seafood dealers, restaurants, and retail grocers shall keep, in the English language the following (LA R.S. 56:306.5(A)):

- Records of the quantity and species of fish acquired, the date the fish was acquired, and the name and license number of the wholesale/retail seafood dealer or the out-of-state seller from whom the fish was acquired. When creel limits apply to commercial species, records shall also indicate the number by head count of such species of fish. LA R.S. 56:306.5(A)1
- Records of the quantity and species of fish sold, the date the fish was sold, and the name and license number of the person to whom the fish was sold. When sold to the consumer, the records shall indicate the quantity, species, and date and shall state that the fish was sold to the consumer. LA R.S. 56:306.5(A)2

Shipping

- Shipments containing fish shall be plainly marked, the tags or certificates to show the date and names of the consignor and the consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. LA R.S. 56:307.7(A)
- Bills of lading issued by a common carrier for such shipments shall state the number of packages which contain fish, and the date and names of the consignor and consignee, with an itemized statement of the number of pounds of fish and the names of each kind contained therein. LA R.S. 56:307.7(A)

Packaging

The Secretary of LDWF is authorized to adopt rules and regulations in accordance with the Administrative Procedure Act establishing standards for the packaging of seafood in Louisiana for wholesale or retail sale. Those standards may govern the quality, contents, and weight of all seafood packaged in this state. The Louisiana Seafood Promotion and Marketing Board may make recommendations to the Secretary for standards for the packaging of seafood. For purposes

of this Section, retail sale shall not include food service establishments which only serve food prepared for on premises or off premises consumption. LA R.S. 56:578.10

Louisiana Oyster Task Force

- Established in state law (LA R.S. 56:421(A)) in 1999 to study and monitor the molluscan industry and make recommendations to maximize the benefit of the oyster industry to the State of Louisiana. The Louisiana Oyster Task Force is composed of the following members (LA R.S. 56:421(B-C)):
  - Nonvoting members:
    - The governor's executive assistant for coastal activities or his designee.
    - Two members appointed by the Secretary of LDWF.
    - One member appointed by the Secretary of the Louisiana Department of Natural Resources (LDNR).
    - One member appointed by the Secretary of LDHH.
    - One member appointed by the executive director of CPRA.
  - Voting members:
    - Four members appointed by the Louisiana Oyster Dealers and Growers Association. One member shall be from Lafourche Parish and one member shall be from Jefferson Parish.
    - Two members appointed by the Plaquemines Oyster Association.
    - One member appointed by the Terrebonne Oyster Association.
    - One member appointed by the Calcasieu Lake Oyster Task Force.
    - One member appointed by the Southwest Pass Oyster Leaseholder Association.
    - Two members appointed by the United Commercial Fisherman's Association.
    - One member appointed by the Delta Commercial Fisherman's organization.
    - One member who has voting authority and is an oyster grower appointed by the president of the Louisiana Farm Bureau Federation.
    - One member appointed by the Louisiana Oystermen Association.
- The Louisiana Oyster Task Force is charged with the following (LA R.S. 56:421(E)1-10):
  - Monitor the water quality and management requirements of the state's molluscan shellfish propagating areas.
  - Coordinate efforts to increase oyster production and salability.
  - Study the decline in molluscan shellfish salability, the degradation of water quality which could adversely affect consumer health, and the reasons for such declines and degradations, and make recommendations to resolve such problems.
  - Make recommendations with respect to issues pertaining to the oyster industry and oyster production to the various state agencies charged with responsibility for differing elements of the oyster industry in this state, including LDWF, LDNR, the CPRA Board, CPRA, LDHH, the governor's executive assistant for coastal activities, and the legislature.
  - Employ such personnel as necessary.
  - Develop markets and marketing strategies for the development of new and expanded markets for Louisiana oysters.
  - Represent the interests of the Louisiana oyster industry before federal and state administrative and legislative bodies on issues of importance to the Louisiana oyster industry.
  - Contract for legal services to represent the interests of the Louisiana oyster industry in judicial, administrative, and legislative proceedings.
  - Administer the funds in the Oyster Development Fund.
  - Perform any acts deemed necessary and proper to carry out its duties and responsibilities.
- The Louisiana Oyster Task Force's activities are funded through the Oyster Development Fund. LA R.S. 56:421(F).

Louisiana Seafood Promotion and Marketing Board

- Established to enhance the public image of commercial fishery products, thereby promoting the consumption of these products and, further, to assist the seafood industry, including commercial fishermen and wholesale and retail dealers, in market development so as to better utilize existing markets and to aid in the establishment of new marketing channels. LA R.S. 56:578.1
- One member shall be appointed from a list of three names submitted by the Louisiana Oyster Dealers and Growers Association. One member shall be appointed from a list of three names submitted by the Louisiana Oyster Task Force. LA R.S. 56:578.2

Louisiana Wild Seafood Certification Program

- A voluntary certification program for Louisiana wild fish, as defined in LA R.S. 56:8, and for Louisiana wild seafood products which are taken, harvested, or landed in Louisiana. LAC 76:I.701
- Must possess one of the following resident or nonresident Louisiana licenses: Commercial Fisherman's License; Senior Commercial Fisherman's License; Fresh Products License; Wholesale/Retail or Retail Seafood Dealer License. LAC 76:I.701(B)1(a)
- Wholesale/retail dealers must have their facility located within Louisiana. Retailers are not required to have their facility located within Louisiana. LAC 76:I.701(B)1(b)
- Eligible participants not requiring a LDWF license include in-state restaurants or grocers who only sell seafood that is fully prepared by cooking for immediate consumption by the consumer, and all out-of state retailers. LAC 76:I.701(B)1(c)
- Must possess and be in compliance with all other state and federal permits, licenses, and laws regarding the buying, acquiring, or handling, from any person, by any means whatsoever, any species of fish or seafood products. LAC 76:I.701(B)1(d)
- Product considered eligible to possess the Louisiana Wild Seafood Certification Program (LWSCP) logo must meet the following criteria (LAC 76:I.701(B)2):
    - Eligible wild seafood includes crab, oysters, freshwater finfish, saltwater finfish, crawfish, and shrimp. Seafood must be wild-caught, taken from Louisiana waters or from the U.S. Gulf of Mexico (Gulf) and any other adjacent state waters, and landed in Louisiana. Farmed and/or aquaculture products are excluded from program participation.
    - Seafood must be taken by a Louisiana licensed commercial fisherman. Seafood must be landed in Louisiana and either be sold under an LWSCP-participating fish products dealer license, or be purchased and/or physically acquired by a wholesale/retail seafood dealer participating in the LWSCP. Transfer of product throughout the supply chain must be between LWSCP participants until the product has been placed in sealed and LWSCP-labeled retail packaging.
- Seafood commingled with any other seafood that does not meet the above requirements, domestic or foreign, shall be prohibited from possessing the LWSCP label.

Existing Recreational Regulations

Most state statutes regarding commercial oyster harvest also apply to recreational oyster harvest. The few specific to recreational oyster harvest are listed below.

- Recreational oyster fishermen may harvest oysters in leased areas with the written permission from the lease holder, in personal leased areas, and in areas open to the public for the harvesting of oysters, but shall be limited to two sacks per person per day. LA R.S. 56:424(C)
- Harvest limits for recreational fishermen shall be one sack per person per day in Calcasieu Lake. LA R.S. 435.1.1(D)2
- Rockefeller, Marsh Island, State Wildlife, and Paul J. Rainey Refuges: Oysters may be harvested by tonging (if properly licensed) or by hand collection from the natural reefs. One gallon per boat or vehicle per day. Oysters must be opened at the reef and the shells returned to the reef. Taking of oysters on the reef is dependent upon LDHH approval and may be closed at any time by LDWF. LAC 76:309(A), 310(A), 323(A)

Appendix XI. Chronology of Major Changes to Louisiana's Oyster Regulations

1850 Parishes establish first private oyster leases

1870 Act 18 closes oyster season from April to September, establishes penalties for taking oysters out of season

1871 Act 91 closes oyster harvest from May 1 to September 15

1872 Oyster Fishing Regulatory Board is created (later becomes the Louisiana Department of Wildlife and Fisheries (LDWF) Law Enforcement Division)

1886 Act 106 divides the state into three oyster districts, authorizes governor to appoint an oyster commissioner for each district, authorizes leasing of water bottoms (3 acres per individual or corporation), and establishes licenses enabling lessees to harvest and protect their oysters and reefs

1892 Act 110 abolishes oyster districts and gives individual parishes exclusive jurisdiction over waters within their boundaries; oysters within a parish are considered parish property, and only parish residents are allowed to harvest them; each parish appoints an oyster inspector and requires licenses

1896-98 Acts 121/183 address closed season adjustments, leasing of state water bottoms, lease area (10 acres per person), and taxation relief for oysters bedded on state-leased water bottoms

1902 Act 153 creates five-member Oyster Commission of Louisiana and gives them statewide control over the oyster industry (Oyster Commission later becomes the Oyster, Water Bottoms, and Seafood Division, the first and oldest division of LDWF); Comprehensive Oyster Law encourages mariculture and establishes basic structure of current industry; Oyster Commission begins to issue leases for all oyster reefs but the offshore reefs, which remain public

1904 Maximum individual oyster lease acreage set at 1,000 acres, lease rate set at $1 per acre per year

1906 U.S. Bureau of Fisheries conducts first cultch planting in Sister (Caillou) Lake (CSA 5 West)

1908 Oyster harvest is closed from May 1 to August 31

1910 Act 258 sets royalty taxes on oyster and clam shells

1914 Act 42 grants the Conservation Commission of Louisiana (Conservation Commission) the right to sell oyster and clam shells and defines methods of leasing water bottoms for shell dredging

Act 54 prohibits dredging on shallow natural beds

1917 State conducts first cultch planting in Sister Lake and Breton Sound (CSA 1 South)

1925 U.S. Public Health Service develops shellfish sanitation guidelines (these guidelines later form the basis of the National Shellfish Sanitation Program)

1933 Conservation Commission issues numerous short-term (one-year) shell dredging permits through 1959

1939 Conservation Commission adopts policy to issue no shell dredging permits or leases where live oyster resource exists

1940 Sister Lake is designated as public oyster seed reservation

1944 Hackberry Bay (CSA 3) is designated as public oyster seed reservation

1948 Bay Junop (CSA 5 West) is designated as public oyster seed reservation

1949 Bay Gardene (CSA 1 South) is designated as public oyster seed reservation

1955 Lake Felicity (CSA 5 East) is designated as public oyster seed reservation

1959 Conservation Commission discontinues short-term shell-dredging permits in favor of long-term (15-year) exclusive leases

1962 Oyster areas are divided into two regions—those set aside for leasing to individuals and those controlled by the state

1967 Calcasieu Lake (CSA 7) closes to oyster harvest due to lack of oyster resource

1975 Calcasieu Lake reopens to oyster harvest by hand or tongs only

1976 Act 346 gives the Louisiana Department of Health and Hospitals (LDHH) authority to develop and enforce state Sanitary Code, including the authority to close oyster harvest areas based on water quality concerns

1980 Act 199 requires private oyster leaseholders to follow laws of the state and regulations set forth by the Louisiana Wildlife and Fisheries Commission (Commission) and increases private oyster lease rates to $2 per acre per year

1981 Act 925 sets regulations on taking, processing, selling, and transporting oysters, implements regulations regarding compensation for impacts to oyster resources, and gives LDWF authority over leasing water bottoms, including authority to settle oyster lease boundary disputes

1982 Regulations are increased on shell dredging industry

1988 Mississippi/Chandeleur Sounds (CSA 1 North) and portions of East Cote Blanche Bay and Atchafalaya Bay (CSA 6) are designated as public oyster seed grounds

1989 Act 504 maintains private oyster lease rate at $2 per acre per year

1990 Southwest Pass, Vermillion Bay, and West Cote Blanche Bay (CSA 6) are designated as public oyster seed grounds

1992 LDHH divides Calcasieu Lake into two conditional management zones and has authority to close harvest based on river stage; LDHH closes northern portion of Calcasieu Lake due to water quality concerns

1995 Act 1304 establishes Oyster Lease Damage Evaluation Board to evaluate impacts to oyster leases resulting from mineral activities and determine appropriate compensation

Large portion of Lake Borgne (CSA 1 North) is designated as public oyster seed ground

1997 Act 1314 charges the Louisiana Department of Natural Resources with developing Oyster Lease Relocation Program to reduce and offset potential adverse impacts of coastal restoration projects on private oyster leases

1999 Act 439 creates the Louisiana Oyster Task Force to provide management recommendations; task force is comprised of industry and state representatives

Act 38 prohibits shell dredging except for oyster harvest or seeding activities

2000 Small portion of Barataria Bay (CSA 3) is designated as public oyster seed ground

2001 Act 152 prohibits taking or selling oysters from closed or unapproved waters

Act 438 removes cultivation certificate requirement and oyster lease production reporting requirements for purposes of coastal restoration and protection planning

Lake Mechant (CSA 5 West) and Lakes Tambour, Chien, and Felicity and Deep Lake (CSA 5 East) are designated as public oyster seed grounds

2002 Moratorium prohibits issuance of new private oyster leases due to coastal restoration conflicts

2003 Act 448 establishes year-round 3-inch minimum size limit for harvested oysters

Act 449 limits new private oyster lease size to 1,000 acres and increases total lease acreage for a person, partnership, or firm to 2,500 acres

Act 451 authorizes out-of-state landings (with permit and vessel monitoring system)

Act 920 creates Public Oyster Seed Ground Development Account to receive compensation for impacts to public oyster seed grounds

2004 Act 479 allows use of hand scrapers less than three feet wide in Calcasieu Lake

2006 Act 398 allows use of mechanical retrieval systems for scrapers in Calcasieu Lake

2007 Little Lake (CSA 3) is designated as public oyster seed ground

2008 Act 808 charges the Commission with promulgating rules for lifting the private oyster lease moratorium

Act 922 creates Oyster Seed Ground Vessel Permit and Permit Appeals Board, establishes limited entry fishery on public oyster seed grounds, and prohibits new Public Seed Ground Vessel Permit applications after 2009

2011 Act 329 restricts harvest in Calcasieu Lake to those possessing a Calcasieu Lake Harvester Permit and limits the amount of available permits to 126, half of which require prior records of harvest to obtain

LDHH lifts Sabine Lake closure; however, it remains closed by LDWF

2012 Act 85 adjusts limited entry fishery on public oyster seed grounds—no new Public Seed Ground Vessel Permit applications shall be accepted after 2012

Act 541 removes Calcasieu Lake Harvester Permit limit and prior harvest requirement

Act 293 authorizes LDWF to permit alternative oyster culture activities

2015 Act 343 increases oyster lease rate to $3 per acre per year beginning in 2016; increases rate to $4 per acre per year beginning in 2018

2016 Act 133 changes the name of dredge to scraper and limits the size and use of scrapers on public seed grounds

Act 134 limits use of the monies in the Public Oyster Seed Ground Development Account to projects that enhance the state's public oyster seed grounds through siting, designing, permitting, constructing, monitoring, and cultch deposition on the public seed grounds, and research into oyster propagation and habitat, oyster hatchery operations, and the administrative functions of LDWF's Oyster Lease and Survey Section

Act 276 requires anyone applying for an oyster harvest license to complete LDWF's oyster harvester education program which covers information on LDWF and LDHH oyster regulations and best harvest practices for conserving the species; effective January 1, 2017

Act 291 provides the Commission the authority to limit the number of Public Oyster Seed Ground Vessel Permits that may be issued each year, after consulting with the Louisiana Oyster Task Force; also LDWF to accept new permit applications from individuals who own an oyster vessel, have completed requirements of a professionalism program, and meet other previously established requirements

Act 595 allows LDWF to resume the leasing process through several phases and ultimately lift the lease moratorium, provides certain terms, conditions, procedures, and requirements for oyster leases, including liability

Appendix XII. Penalties for Regulatory Violations

Classes of violations vary by legislative statute or Louisiana Wildlife and Fisheries Commission rule. Penalties for each class of violation are below (R.S. 56:31-37.1):

- Class One: First offense—fine of $50, imprisonment for no more than 15 days, or both; second offense—fine of $75-250, imprisonment of 30-60 days, or both; third and subsequent offenses—fine of $250-550 and imprisonment of 30-90 days
- Class Two: First offense—fine of $100-350, imprisonment of no more than 60 days, or both; second offense—fine of $300-550 and imprisonment of 30-60 days; third and subsequent offenses—fine of $500-750, imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation
- Class Three: First offense—fine of $250-500, imprisonment of no more than 90 days, or both; second offense—fine of $500-800, imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation; third and subsequent offense—fine of $750-1,000, imprisonment of 90-120 days, and forfeiture of anything seized in connection with the violation. In addition to any other penalty, for a second or subsequent violation of the same provision of law the penalty imposed may include revocation of the permit or license under which the violation occurred for the period for which it was issued and bar the issuance of another permit or license for that same period.
- Class Four: First offense—fine of $400-950, imprisonment of no more than 120 days, or both; second offense—fine of $750-999 and imprisonment of 90-180 days; third and subsequent offenses—fine of $1,000-5,000 and imprisonment of 180 days to two years. All Class Four penalties include forfeiture of anything seized in connection with the violation.
- Class Five-A: First offense—fine of $500-750 and imprisonment of 15-30 days; second offense—fine of $750-1,000 and imprisonment of 60-90 days; third and subsequent offenses—fine of $750-1,000 and imprisonment of 90-120 days. All Class Five penalties include forfeiture of anything seized in connection with the violation. In addition, the license under which the violation occurred shall be revoked and not reinstated at any time during the period for which it was issued and for one year thereafter.
- Class Five-B: First offense—fine of $350-500 and imprisonment of 30 days; second offense—fine of $500-1,000 and imprisonment of 60 days; third and subsequent offenses—fine of $1,000-2,000 and imprisonment of 90 days. All Class Five penalties include forfeiture of anything seized in connection with the violation. In addition, the license under which the violation occurred shall be revoked and not reinstated at any time during the period for which it was issued and for one year thereafter.
- Class Six: For each offense, a fine of $900-950, imprisonment of no more than 120 days, or both, as well as forfeiture of anything seized in connection with the violation.
- Class Seven-A: For each offense, a fine of $5,000-7,500, imprisonment for one year, or both, as well as forfeiture of anything seized in connection with the violation.
- Class Seven-B: For each offense, a fine of $5,000-7,500 and imprisonment for one year, as well as forfeiture of anything seized in connection with the violation.
- Class Eight: For each offense, a fine of $5,000-7,000 and imprisonment for 60 days to six months.

In addition to all other penalties, anyone convicted of Class 1-4, 6, and 7 violations may have their license under which the violation occurred revoked for the period for which it was issued. R.S. 56:38(A)

In addition to all other penalties, violators shall forfeit any oysters seized in connection with their violation upon conviction. R.S. 56:39

Anyone who kills, catches, takes, possesses, or injures any wildlife or aquatic life in violation of Title 56, regulations adopted pursuant to Title 56, or a federal statute or regulation governing fish and wildlife, or, through the violation of any other state or federal law or regulation, kills or injures any wildlife and aquatic life, is liable to the state for the value of each wildlife and aquatic life, unlawfully killed, caught, taken, possessed, or injured. R.S. 56:40.1

In addition to other penalties, for a first violation of the provisions of R.S. 56:424, LDWF will revoke the oyster harvester's license under which the violation occurred and no new license shall be issued for one year from the date of

conviction. In addition, the violator must serve at least 40 hours of community service, preferably in a litter abatement program, if available. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may only be present on a vessel harvesting or processing oysters if that vessel is equipped with and actively using a vessel monitoring system. R.S. 56:424(E)2a

For a second violation of R.S. 56:424, the Louisiana Department of Wildlife and Fisheries (LDWF) will revoke the violator's oyster harvester license and no new license shall be issued for three years from the date of conviction. The violator must serve at least 90 hours of community service, preferably in a litter abatement program. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may not be present on a vessel harvesting or processing oysters. R.S. 56:424(E)2b

For a third or subsequent violation of R.S. 56:424, LDWF will revoke the violator's oyster harvester license and no new license shall be issued for 10 years from the date of conviction. The violator must serve at least 120 hours of community service, preferably in a litter abatement program. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may not be present on a vessel harvesting or processing oysters. R.S. 56:424(E)2c

In addition to other penalties, violators convicted of a first offense for any violation of R.S. 56:424, 431, 433, or 433.1, may be allowed to harvest oysters only from a vessel using a vessel monitoring system for one year after the date of conviction. For violators convicted of a second offense, the court shall only allow the violator to harvest oysters from a vessel that uses a vessel monitoring system for three years following conviction. For violators convicted of a third or subsequent offense, the court shall only allow the violator to harvest oysters from a vessel that uses a vessel monitoring system for 10 years following conviction. LDWF must have access to this system. A violator must notify LDWF about which vessel he will be harvesting oysters. If a violator is required to be on a vessel with a monitoring system and is found harvesting from a vessel not equipped with a monitoring system, LDWF will suspend his license for the remainder of the year and he will not be eligible for a license the following year. R.S. 56:424.1(A-C)

For any unlawful removal of oysters from a lease, violators are subject to the following penalties:

- First offense: LDWF revokes the oyster harvester's license under which the violation occurred and will not issue the violator a new license for one year from the date of the conviction. Violator must serve at least 40 hours of community service, preferably in a litter abatement program. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may only be present on a vessel harvesting or processing oysters if that vessel is equipped with and actively using a vessel monitoring system.
- Second offense: LDWF revokes the oyster harvester's license under which the violation occurred and will not issue the violator a new license for three years from the date of the conviction. Violator must serve at least 90 hours of community service, preferably in a litter abatement program. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may not be present on a vessel harvesting or processing oysters.
- Third or subsequent offense: LDWF revokes the oyster harvester's license under which the violation occurred and will not issue the violator a new license for 10 years from the date of the conviction. Violator must serve at least 120 hours of community service, preferably in a litter abatement program. During the period in which the violator is prohibited from possessing an oyster harvester license, the violator may not be present on a vessel harvesting or processing oysters. R.S. 56:431(D)2

For any violation of R.S. 56:422(C) or (G), the violator must serve at least 40 hours of community service, preferably in a litter abatement program, in addition to other penalties. R.S. 56:433(J)2

In addition to other penalties, violators of an Calcasieu Lake oyster regulations (R.S. 56:434.1.1) are subject to the following penalties:

- First offense: violator must forfeit Calcasieu Lake Oyster Harvester Permit and may not obtain another for the remainder of the period for which it was issued plus one year; during this period, the violator may not participate in any oyster harvesting activity on Calcasieu Lake
- Second offense: violator must forfeit Calcasieu Lake Oyster Harvester Permit and may not obtain another for the remainder of the period for which it was issued plus two years; during this period, the violator may not participate in any oyster harvesting activity on Calcasieu Lake
- Third offense: violator must forfeit Calcasieu Lake Oyster Harvester Permit and is prohibited from obtaining another permit and from participating in any oyster harvesting activity on Calcasieu Lake. R.S. 56:435.1.1(E)1-2

Appendix XIII. Summary of Other States' Commercial Oyster Regulations

Maine, Connecticut, Washington, Oregon, and California are not included in this summary. There is no wild harvest of oysters in these states; oysters are only produced through aquaculture in these states.

	Licenses and Fees	Limited Access	Gear	Seasons and Times	Size and Harvest Limits
TX	Commercial oyster fisherman's license	Moratorium on oyster licenses; moratorium on new private oyster leases	No more than 1 dredge (in use/on vessel, unless secured to prevent use); dredge may not exceed 48 in. wide; no more than 2 barrel capacity	Closed May 1-Oct 31 on public grounds; open year-round on private leases; harvest from to sunrise to 3:30 pm	3 in.; 15% tolerance for undersized oysters, dead shell; no more than 50 sacks/vessel/day; no more than 6 sacks unculled oysters (unsacked and separated from rest of harvest)
MS	Saltwater fishing license, commercial tong/dredge license		By hand, tongs, dredges; dredges: 115 lbs. or less, 16 teeth or less, 5 in. or less apart, no more than 2 dredges	Varies by year; only daylight hours (7 am to 4 pm)	3 in. on public reefs; 10% tolerance for total catch; sack limit varies by year
AL	Commercial oyster catcher's license, oyster dredge license	Mandatory harvester education program before purchasing license	By hand, tongs, dredges; dredges: 125 lbs. or less, 16 teeth or less, 3 in. apart or less, at least 15 ft. of rope with a buoy at least 6 in. wide with permit number affixed, permit tag, self-dumping basket	Closed May 1-Sept 30 on public grounds; no weekends; 7 am to 2 pm only	3 in.; 10% tolerance for undersized oysters and cultch in a sack, 5% tolerance for undersized oyster and cultch per load
FL	Saltwater products license	Apalachicola Bay Oyster Harvesting License to harvest from this area	By hand or tongs; all mechanical devices prohibited except by holders of specific leases	Closed Jul 1-Sept 30 except some areas of Apalachicola Bay; no harvest Fri-Sun	3 in.; 15% tolerance for undersized attached oysters; 5% tolerance for undersized oysters; limit of 20 bags/person or vessel/day (whichever is less)
VA	Commercial fishing license, oyster harvester license (by gear), area permits		Varies by area (by hand, tongs, dredges)	Public grounds: varies by area; no weekends; sunrise to 2 pm	3 in.; harvest limits depend on area
MD	Oyster harvester license		Only tonging and diving for first part of season; power dredging thereafter	Open Oct-Mar; no harvest at night; no weekends	3 in.; 5% tolerance for undersized oysters; harvest limits depend on area and gear (between 12 bushels/person/day to 150 bushels/boat/day)
NC	Shellfish license (residents only) or shellfish endorsement on commercial fishing license		Rakes 12 in. wide or 6 lbs. or less; mechanical gear with permit; one dredge/vessel; dredges 100 lbs. or less	Open Oct 15-Mar 31; no harvesting or unloading at night or on Sundays (with exceptions)	At least 2-1/2 in. but set annually; 10% tolerance for undersized oysters; daily harvest limit for public grounds set annually
SC	Commercial saltwater license, commercial shellfish harvester license, permit for specific areas		Mechanical methods allowed with permit	Season set annually, generally Oct 1-May 15; no harvest at night	3 in.; no harvest limit
GA	Commercial fishing license, master collecting or picker's permit		Harvest by hand or hand-held implements, unless other equipment approved in writing	Season set annually, generally Oct- May; no harvest at night	2 in., unless attached to an oyster 2 in. or larger and can't be removed from larger oyster without harm
NY	Shellfish digger permit and vessel endorsement		No mechanical means; dredge with sail allowed on state land and in some towns	Varies by area	3 in. (no size limit for oysters cultured or transplanted under permit); 5% tolerance for undersized oysters; no harvest limits
NJ	Commercial shellfish license, dredge vessel license		Dredge and tong, but varies by area	Varies by area	Varies by area—2-1/2 to 3 inches
DE	Oyster harvesting license	Must meet specific requirements for license	State-owned beds: dredges 52 in. or less along tooth bar, teeth 4 in. or less; no more than two dredges; no attached dredges	Open Apr 1-May 30, Sept 1-Dec 31, except Sun	2-3/4 inches; annual harvest quota set every year
RI	Commercial shellfish license		No mechanical gear; only hand-operated equipment	Public grounds: Sept 15-May 15; no night harvest	3 in.; 3 bushels/day/commercial licenseholder (except some areas)
MA	Commercial shellfish permit, endorsement, shellfish ID card, town permit (requirements vary by municipality)		Varies by municipality	Varies by municipality	3 in.; 5% tolerance for undersized oysters; aquaculture propagation permitholders may harvest oysters 2-1/2 in. or larger for sale out-of-state only

	Area Restrictions	Operational Regulations	Gear/User Interactions	Restoration and Enhancement	Public vs. Private	Alternative Culture
TX	Harvest areas determined by biological information, water quality	Culling requirements		Cultch planting on public reefs; oyster gardening; lease transplant fishery	Public grounds, private leases	Leases; no off bottom or on bottom operations with cages
MS	Harvest areas determined by biological info, water quality; no use/possession of dredges on tonging reefs (unless temporarily open to dredging)	Check in before harvesting an area; culling requirements; no transferring oysters from one vessel to another until vessel is checked out		Cultch planting; reef cultivation; relaying; Oyster Stewardship Program	Public grounds, private leases	Leases for off and on bottom culture
AL	Harvest areas determined by biological information, water quality	No transporting oysters at night; culling requirements; no oysters from a public reef and a private reef on vessel at same time		Planting of oyster shells from local processors on public reefs	Public grounds, private leases	Leases for off and on bottom culture
FL	Harvest areas determined by abundance, public safety	Check stations; culling requirements		Cultch planting on public reefs; 50% of all commercially shucked shell must be returned to the state	Public grounds, private leases	Leases for on and off bottom culture
VA	No harvest in areas closed by Virginia Marine Resources Commission; no harvest in sanctuaries	Culling requirements		Sanctuaries; cultch planting; rejuvenating beds with dredges; creating reefs; moving seed oysters to grow-out areas; oyster gardening	Public grounds for wild harvest (seed and market), private leases for aquaculture	Oyster aquaculture permit
MD	No harvest in areas closed due to water quality, sanctuaries, harvest reserves (areas rotated for harvest)	Culling requirements		Oyster gardening; reef restoration; hatchery production; sanctuaries; harvest reserves	Public grounds for wild harvest, private leases for growing oysters	Aquaculture leasing and permitting
NC	No harvest in areas closed due to water quality, population management; no mechanical gear in some areas to protect habitat, seed oysters	Culling requirements	No trawl nets, long haul seines, swipe nets in Shellfish or Seed Management areas or Sanctuaries	Transplant/relay permit; shellfish planting	Public grounds, private leases; must meet standards to maintain lease; seed oyster management areas	Aquaculture Operations Permit; water column leasing
SC	No harvest in areas closed by Dept. of Health and Environmental Control	Culling requirements	Some areas for recreational shellfishing only	Oyster shell recycling program	Public grounds for commercial and recreational harvest	Shellfish Culture or Mariculture Permit
GA	No harvest in areas closed due to water quality	Culling requirements	No commercial harvest from public recreational harvest areas	Shell deposit, oyster transplant, cultch deposit requirements; oyster shell recycling program	Commercial leases, public recreational harvest areas	Experimental mariculture
NY	No harvest in areas closed due to water quality	Culling requirements		Transplant/relay permit		On and off bottom with permit
NJ	Harvest areas opened based on water quality, abundance, management goals	Culling requirements	No crab dredging on public grounds, near leased grounds; crabbers must return oyster bycatch to the water; no possession of oyster bycatch	Shell planting and transplant program	Public grounds for seed and wild harvest; private leases for aquaculture	Oyster and clam production account for majority of aquaculture in NJ; license, permit, and leases, on and off bottom culture
DE	Harvest areas determined annually	Culling requirements		Shell planting and transplant program	Public grounds, seed beds, private leases; direct harvest from public grounds for market permitted	Shellfish aquaculture permit, license, and lease
RI	Harvest areas determined by water quality, abundance; areas permanently closed to maintain, restore, enhance wild oysters	Culling requirements		Shellfish transplant program	Wild harvest on public grounds (sporadic due to low abundance, limited season)	Top aquaculture species in RI (98% of all aquaculture); leasing and permitting system
MA	Harvest areas determined by the Div. of Marine Fisheries, Dept. of Public Health, municipalities	Culling requirements		Oyster transplant permit	Varies by municipality	Permitted through shellfish aquaculture permit