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2024 STOCK ASSESSMENT REPORT

of the Public Oyster Seed Grounds and Reservations of Louisiana
Oyster Data Report Series No. 29

LOUISIANA DEPARTMENT OF WILDLIFE & FISHERIES

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Introduction

Louisiana's vast coastal wetlands provide ample habitat where Eastern oysters (*Crassostrea virginica*), also known as the American oyster, thrive under a variety of environmental conditions. Louisiana's American oyster stock is one of the largest oyster stocks in the nation, supporting one of the state's largest and most valuable fisheries and providing important ecological services to the state. The Louisiana Department of Wildlife and Fisheries (LDWF) is charged with managing the state's oyster resource by closely monitoring the size and health of oyster populations on nearly 1.7 million acres of public oyster areas (*Figure 1*) as well as setting oyster seasons, monitoring harvest levels and enhancing habitat (e.g., cultch planting, reef building, etc.).

The oyster industry has historically used Louisiana's public oyster areas as a source of seed oysters (less than 3 inches in length) to transplant to private oyster leases and grow to market-size. In Louisiana, there are approximately 398,726 acres of state oyster leases. The public oyster areas also yield a supply of market-size oysters (greater than or equal to 3 inches in length), which may be taken directly to market during oyster seasons. Louisiana leads the nation in oyster production primarily due to this public/private oyster production system. From 2004 through 2023, Louisiana accounted for 26.8% of the nation's oyster landings value. Louisiana's annual dockside sales have reached as much as $85,000,000 as recently as 2017. The value of Louisiana's 2023 production was $61,631,759 (*Figure 2*). In 2023, Louisiana accounting for 80.0% of the Gulf of America's landings value and 25.6% of landings out of the nation.

Louisiana's public oyster areas are defined as either Public Oyster Seed Grounds or as Public Oyster Seed Reservations. The Louisiana Wildlife and Fisheries Commission (Commission) is entrusted with designating Public Oyster Seed Grounds (POSGs). Currently, the POSGs are comprised of Lake Borgne, Chandeleur/Breton Sound, Barataria Bay, Little Lake, Deep Lake, Lake Chien, Lake Felicity, Lake Tambour, Lake Mechant and Vermilion/Cote Blanche/Atchafalaya Bays. The Louisiana Legislature designates Public Oyster Seed Reservations (POSRs), which include Bay Gardene, Hackberry Bay, Sister (Caillou) Lake and Bay Junop. Other public oyster areas designated by the Louisiana Legislature include Calcasieu and Sabine Lakes.

LDWF manages public oyster areas to balance the fishery's economic opportunity with the resource's biological sustainability. Management depends on obtaining the best fishery dependent and independent data available through monitoring harvest and resource availability throughout the oyster season and performing yearly stock assessments. The annual individual Coastal Study Area (CSA) Oyster Stock

FIGURE 1. Public oyster areas of Louisiana.

Assessment (OSA) reports help fulfill these data needs as they provide estimates of the current stock size of the oyster resource within their respective basin. The information this data provides allows resource managers to implement management changes to utilize the current resource and protect its long-term viability.

Oysters also play an essential 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. Many invertebrates and fish also use oyster reefs as shelter and forage habitat. In addition, oysters provide many ecosystem services, such as the oyster's filter-feeding activities that enhance estuarine water quality. Intertidal oyster reefs can also help stabilize shorelines and reduce habitat erosion.

Louisiana Oyster Landings

Louisiana regularly leads the nation in commercially harvested oyster landings. From 2004 through 2023, Louisiana accounted for 32.7% of the nation's oyster landings by pounds of meat. Out of the Gulf of America states, Louisiana accounted for 77.6% of the oyster meat production in 2023 (*Figure 3*). In 2023, Louisiana accounted for 29.0% of the oyster meat production in the nation (*Figure 3*). Of that production, approximately 7.3% came from the public oyster reefs, while private oyster reef landings were 92.7%. Total landings in 2023 were reported at approximately 6,087,050 pounds of meat, but falls below the state's 20-year LTA of 10,724,000 pounds of meat (*Figure 4*).

Stock Assessment Methods

Management of the public oyster grounds and reservations relies heavily upon data gathered through a comprehensive biological monitoring program. State biologists use two gear types when sampling the public reef areas. One is a 24-inch hand dredge and the other is a square-meter (m^2) frame. Data is analyzed to determine the overall health of the oyster resource throughout the year. Approximately 1,700 dredge samples are collected statewide during each calendar year. Data are used to monitor the overall health of the oyster stock and assess recruitment of new age classes of oysters. Over 1,000 square-meter samples are collected per calendar year, including samples collected as part of the Coastal Protection and Restoration Authority (CPRA) System-Wide Assessment and Monitoring Program (SWAMP). Collected square-meter data are used to measure the annual oyster stock size, which is the basis on which yearly oyster season recommendations are made to the Commission. Additionally, field biologists routinely gather hydrological data on public oyster areas and develop harvest and fishing effort estimates by conducting boarding report surveys of oyster boats during open oyster seasons.

Sampling for annual stock assessments occurs in July. LDWF biologists SCUBA dive on designated square-meter sample stations within each CSA (*Figure 5*). An aluminum square-meter frame (quadrat) is randomly placed at each sample station on the oyster reef. All live and dead oysters, reef-associated organisms and exposed reef material are collected by hand from the upper portion of the substrate within the quadrat. This process is replicated for a total of five samples per station. With this data, a catch per unit effort (CPUE) for each reef is determined from the five replicates. Using the CPUE per square-meter, this data is extrapolated across each reef or reef complex to determine the abundance of oyster resource. Reef acreage has been determined through departmental or contracted side-scan bottom assessments and used for CPUE extrapolation. Water temperature, dissolved oxygen and salinity data are collected at each station, and cultch material types are identified and weighed.

LDWF biologists visited sample stations during the OSA, gathering individual samples. This assessment presents sampling data by

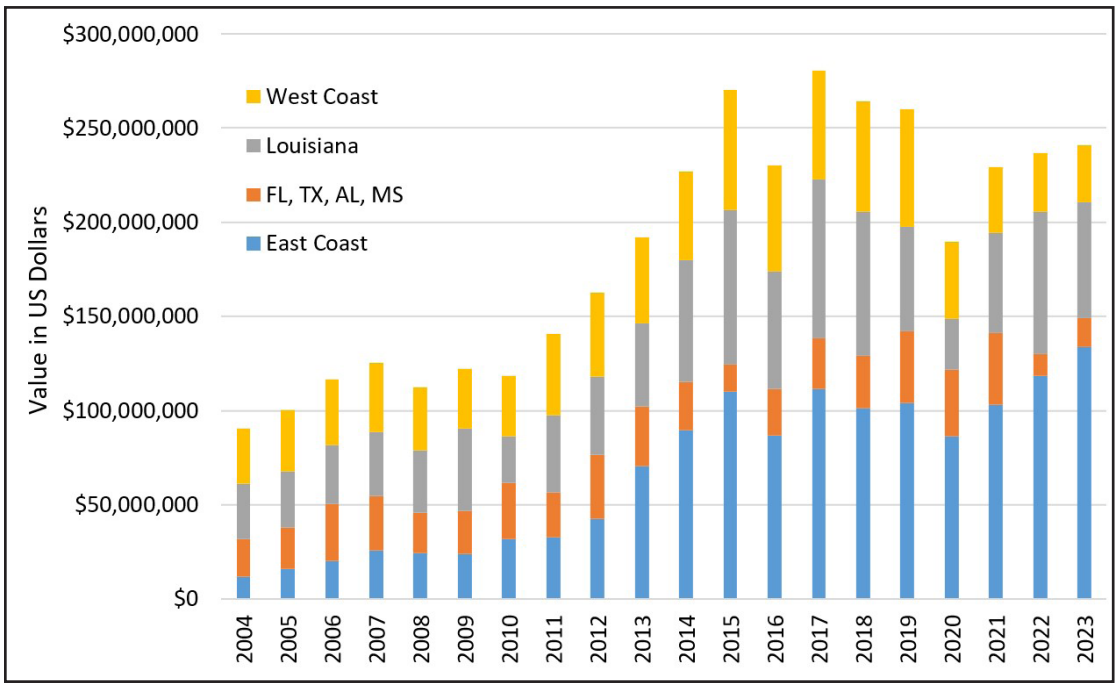

FIGURE 2. Annual commercial oyster landings (all species) in dockside value. Data provided by NOAA Fisheries & GSMFC

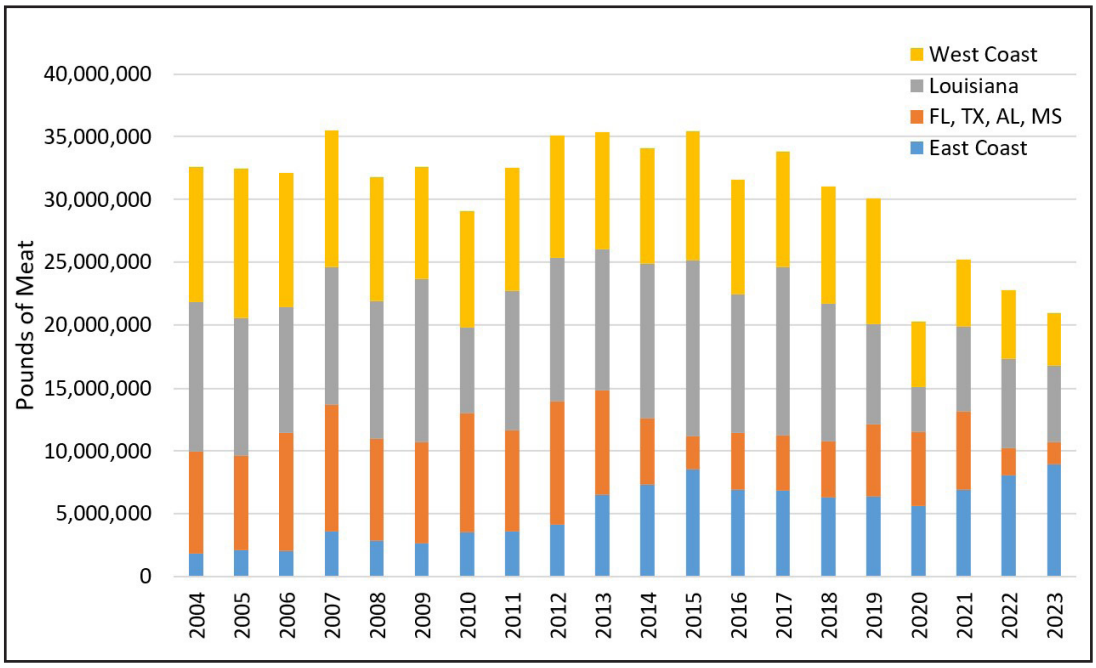

FIGURE 3. Annual commercial oyster landings (all species) in pounds of meat. Data provided by NOAA Fisheries.

CSA. CSA 1 South had the most sample stations (26), while CSA 5 East had the fewest (3). There is a higher sampling density in the Black Bay (CSA 1 South) and Sister Lake (CSA 5 West) areas due to their high oyster production in past years and historical importance to the oyster industry. Twenty-two of the sample stations were located on cultch plants constructed by LDWF since 2004.

The southern oyster drill (*Stramonita canaliculata*) is a marine gastropod known to prey on oysters using a small tooth-like scraping organ called a radula to bore a hole through the oyster shell. Oyster drills occur in coastal waters with a salinity range of 15 ppt or higher. Oyster drill numbers are documented during stock assessment sampling to assess this predator's impacts to each reef complex.

Mud crabs (*Family Xanthidae*), blue crabs (*Callinectes sapidus* and *Callinectes similus*) and stone crabs (*Menippe adina*) are known oyster predators along the Louisiana coast. These crabs will pry or crush oyster shells to access their softer inner tissues. Crab numbers are documented during stock assessment sampling to assess their impacts to each reef complex.

Perkinsus marinus, a protozoan parasite commonly called Dermo, infects live oyster tissue and is known to cause extensive oyster mortalities, especially in high salinities and elevated water temperatures. Oysters are sent off to contracted laboratories to be tested for the prevalence of Dermo to help manage its impacts on reef populations. In recent years, the Dermo sampling schedule

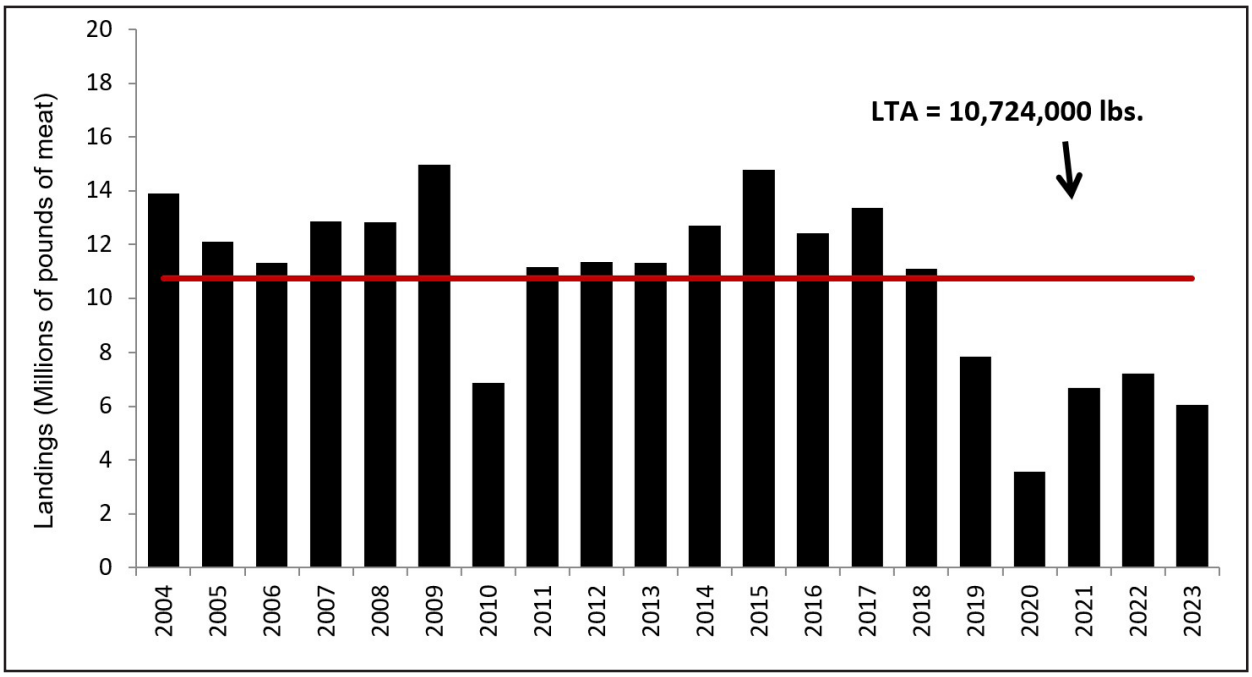

FIGURE 4. Louisiana oyster landings for public oyster areas and private oyster leases, 2004-2023 (LDWF data). LTA is 20 years, from 2004-2023.

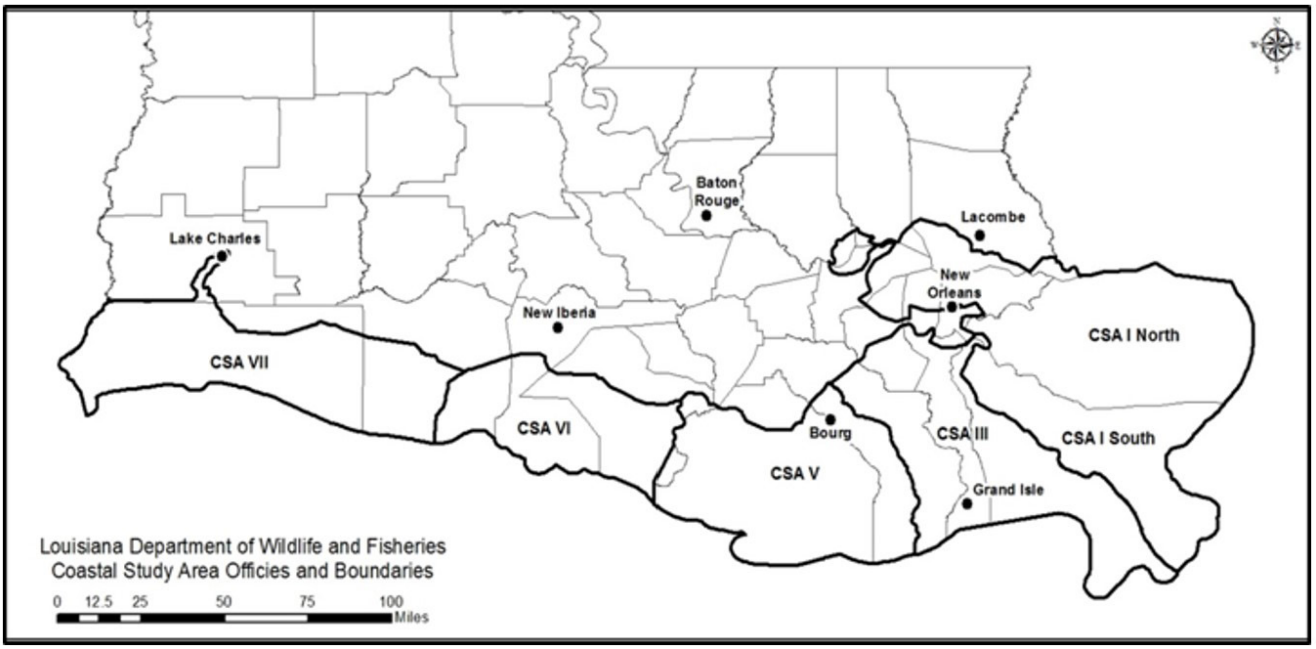

FIGURE 5. Louisiana Wildlife and Fisheries Coastal Study Areas (CSAs).

was pushed from the July square-meter assessment to September and October, due to a higher prevalence of Dermo infections occurring in oysters in the late summer. However, testing can take place after a mortality event, where oysters can be assessed for impacts by Dermo.

The hooked mussel (*Ischadium recurvum*) is a reef-associated benthic bivalve species that competes with oysters for food and settlement surfaces. Large numbers of hooked mussels on a reef can affect oyster growth, lower settlement rates of oyster larvae and reduce meat yield of market-size oysters. Hooked mussel numbers are documented during stock assessment sampling to assess this competitor's impacts to each reef complex.

Sampling conducted as part of the annual OSA plays a valuable role in predicting the success of the upcoming oyster season, which can open as early as September and run as late as the end of April of the following year. However, the season may be closed or delayed if biological concerns or enforcement problems are encountered. LDWF uses OSA information to make recommendations to the Commission regarding setting the oyster season.

In addition, the Sustainable Oyster Shellstock Model is being utilized to provide harvest thresholds for the public oyster areas of Louisiana. This model will help maintain reef material over time and was created in partnership with Dr. Thomas Soniat at the University of New Orleans (UNO). This computerized model guides

fisheries management to conserve the oyster reef base. OSA sampling provides model input data such as estimates of reef mass (grams per meter-square) and size-frequency of oysters. Utilizing additional data on oyster growth, mortality, salinity and estimated commercial harvest rates, the model estimates the amount of oyster harvest allowed on each reef while preserving sufficient reef mass to keep the reef viable. The model outputs harvest rates based on three different conditions- low, medium and high salinity patterns for each basin. The model has been tested statewide and showed promising results. At this time, the Sustainable Oyster Shellstock Model is applied to all reefs in the state. The model harvest thresholds are used by the oyster program manager to facilitate oyster season recommendations and can be used to close over-harvested reefs during the commercial public oyster season.

Annual Stock Size

The 2024 estimated oyster stock in Louisiana's public oyster areas is approximately 1,230,551.3 barrels (bbl) of oysters (*Table 1*), which is a 19.6% increase from the 2023 estimated stock. Similar to recent years, most of the live oyster stock is in Calcasieu Lake (CSA 7), which holds 61.2% of the 2024 estimated harvestable availability (*Table 1*). Statewide, compared to 2023, seed oysters increased by 7.6%, while market-size oysters increased by 31.0%. Most of Louisiana's oyster resource is concentrated on the western side of the state (*Figure 7*). Due to significant increases observed in Lake Borgne/MS Sound, Hackberry Bay, Bay Junop, Lake Mechant, East Side, West Cove of Calcasieu Lake, combined with the decrease in the 20-year LTA, the 2024 public oyster area resource reached 20.9% above the 20-year LTA (1,017,616.0) (*Figure 6*).

Harvest Monitoring Methods

During the oyster season, LDWF monitors commercial harvest through boarding surveys of vessels working Louisiana's public oyster areas. Biologists record vessel location, past and current catch rates, and an estimate of future fishing effort. The boarding data is summarized weekly to maintain a cumulative harvest estimate for specific reef complexes. The data are projected over the number of fishable days (winds less than 25 mph) to determine a total harvest estimate of seed and market-size oysters for the week. Biologists also board vessels collecting seed oysters during the bedding season to determine if the fishermen are harvesting excessive amounts of non-living reef material. LDWF only permits up to 15% removal of non-living reef material. This is an annual Commission action that helps preserve the state's reefs and prevent excessive degradation.

During the 2022-2023 oyster season, a daily reporting stipulation was put in place by the Commission for oyster harvesters to provide their harvest data to LDWF if collecting from the state's public oyster areas. Vessels had to provide the following information: Captain's name, oyster harvester number, boat number, total number of sacks harvested that day, and the public oyster area fished. Each vessel had to call 1-800-442-2511, or send an email to oyster@wlf.la.gov, to submit harvest reports. This daily reporting did not substitute for trip ticket reporting. Harvest reporting compliance was estimated by comparing the reported harvest to estimated harvest from boarding runs. For the first implementation season (2022-2023), Louisiana public oyster area harvest reporting compliance averaged 66.6% across the state, with a low (56%) compliance rate in East Side of Calcasieu Lake and a high (100%) compliance during the Hackberry Bay and Bay Junop bedding seasons.

During the 2023-2024 oyster season, the daily reporting requirement was continued and an electronic reporting option was added. Electronic reporting was done through the e-Reporting application by Shellcatch via smart phone. The eReporting app is supported by both iOS and Android. Fishermen had to download the app from the Apple Store or Google Play Store, then create an account using an email. The registration page required a name, commercial fishing license number, and type of license to register. Once the account was created, the fisherman added their vessels. More information on the eReporting app and how to use it can be found at the following link: *www.wlf.louisiana.gov/page/oyster-e-reporting*.

LDWF also obtains harvest data via its trip ticket program. However, trip ticket data provide limited resolution as they are consolidated by geographic region and are considered preliminary until well after the season. There is a time delay in collecting trip ticket data from dealers, and this harvest data is routinely available two to three months after harvesting takes place. Therefore, this data is better utilized for long-term trends and cannot be utilized for quick management decisions, such as harvest closure, when harvest control thresholds are met.

LDWF collects fishery independent data via monthly oyster dredge sampling eleven months of the year (July excluded due to OSA sampling) to assess the health and condition of the resource. Data from those samples further inform management of the impact harvest activity has on the public grounds.

2023-2024 Oyster Season

The goals for the 2023-2024 oyster season were to allow for sustainable market oyster harvest while minimizing overharvest and/or reef degradation, check the effectiveness of the new e-Reporting application used for the daily reporting requirement, and determine if daily reporting provides accurate harvest estimates. The 2023-2024 Oyster Season opened on October 9, 2023, and closed on April 30, 2024 (*Table 2*).

The estimated commercial harvest totaled 95,738 sacks of oyster resource for all public oyster areas. This was a 218.1% increase from the 2022-2023 oyster season, which only recorded 30,096 sacks harvested. Over the past 10 years, heavy localized harvest, high mortality events, strong tropical events, environmental changes and lack of recruitment have contributed to an ongoing downturn in the oyster resource on the public oyster areas. The 2023 OSA showed a 121.7% increase in oyster resource availability from the previous year, which resulted in opened seasons in CSA 1 North, CSA 1 South, CSA 5, CSA 6 and CSA 7. These areas have seen few openings in past years due to low oyster populations and on-going restoration efforts. The daily reporting requirement was evaluated by the total amount of reported harvest compared to the boarding run harvest reports produced by CSA biologists. For the 2023-2024 oyster season, total vessel harvest reporting compliance was 98.0%. This percentage is the total number of vessels observed during the season compared to total vessels reporting. In addition, the daily vessel reporting compliance was calculated by using the number of unique vessels observed by biologist during a boarding run versus the number of vessels reporting for that area each day. The daily vessel reporting compliance can only be determined on LDWF boarding run days and gives a good estimate of the percentage of vessels that are reporting each day during the season. For the 2023-2024 oyster season, the daily vessel reporting compliance average was 81.0%.

TABLE 1. Estimated oyster stock (in bbl) on Louisiana's public oyster areas by basin. Percentages indicate change from previous year. Green/bold indicates increase, red/* indicates decrease.

CSA	Basin	Seed	Seed % Change	Market-Size	Market-Size % Change	Total Stock	Total % Change
1N	**Pontchartrain (Lake Borgne/MS Sound)**	**259,737.3**	**156.5%**	**135,390.3**	**445.0%**	**395,127.6**	**213.3%**
1S	**Pontchartrain (East of MS River, South of MRGO)**	0.0*	-100%*	4,557.1*	-78.7%*	4,557.1*	-88.6%*
3	**Barataria (Hackberry Bay)**	**14,568.7**	**146.9%**	**12,163.1**	**801.6%**	**26,731.8**	**268.7%**
5E	**Terrebonne (East-Lake Chien/Felicity)**	0	n/a	0	n/a	0	n/a
5W	**Terrebonne (Bay Junop/Lake Mechant)**	**3,742.8**	**98.2%**	**1,382.9**	**3,476.2%**	**5,125.7**	**166.0%**
5W	**Terrebonne (West-Sister Lake)**	17,809.8*	-89.3%*	27,529.7*	-84.3%*	45,339.5*	-86.8%*
7	**Calcasieu (East Side)**	**34,610.5**	**30.6%**	**50,903.1**	**254.7%**	**85,513.6**	**109.3%**
7	**Calcasieu (West Cove)**	**209,818.5**	**15.8%**	**458,337.5**	**58.4%**	**668,156.0**	**42.0%**
n/a	***Statewide Totals***	**540,287.6**	**7.6%**	**690,263.7**	**31.0%**	**1,230,551.3**	**19.6%**

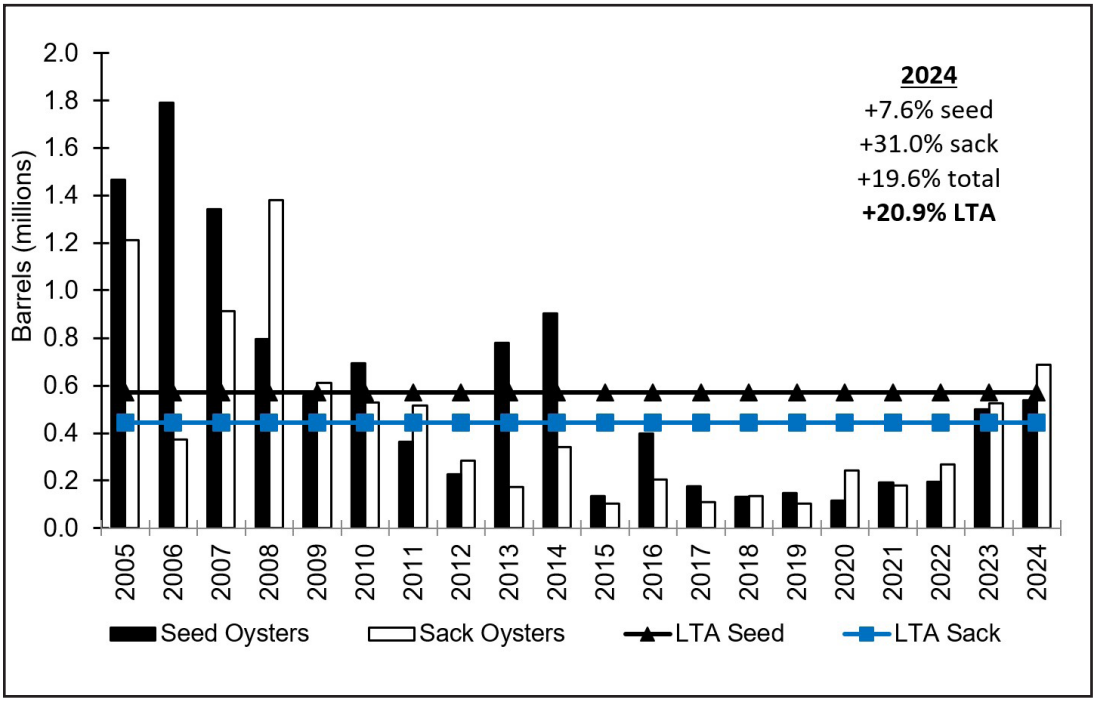

FIGURE 6. Seed and market-size oyster stock availability in Louisiana's public oyster areas. LTA is from 2005 through 2024. Percentages indicate change from 2023. Yearly data excludes Sabine Lake stock assessments.

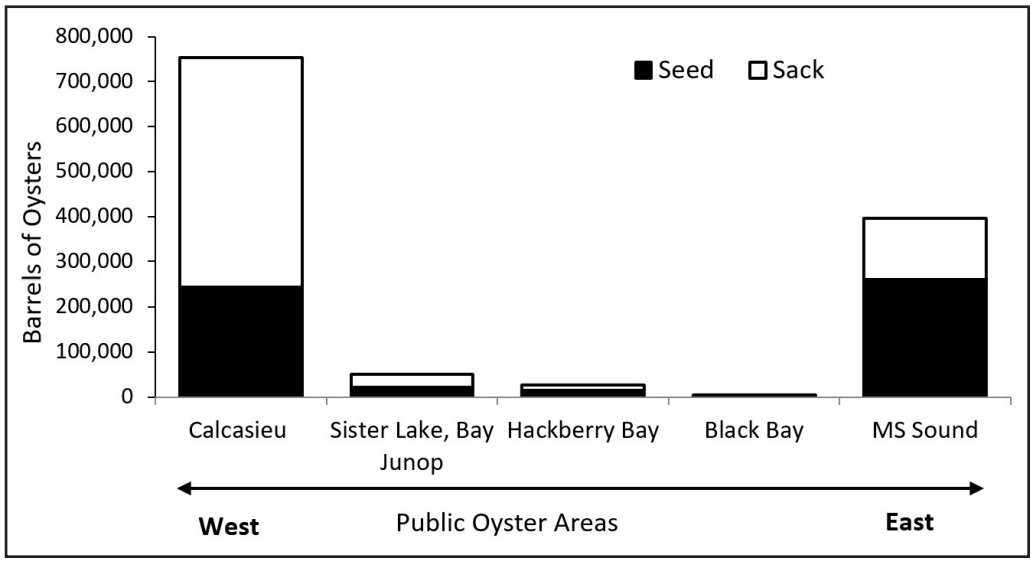

FIGURE 7. 2024 Oyster stock distribution in Louisiana's public oyster areas by basin, organized in a West to East direction.

TABLE 2. Harvest estimates for the 2023-2024 oyster season on Louisiana's public oyster areas. Harvest estimates, based on LDWF-conducted surveys of oyster harvesting vessels during the oyster season. Data derived from fishery dependent surveys of harvesting vessels.

2023-2024 LDWF OYSTER SEASON SUMMARY								
CSA	**Area**	**Season Opening**	**Season Closure**	**Season/Type**	**Days Open**	**Harvest (sacks)**	**2023 OSA Available (sacks)**	**% Harvested**
1	**PSOG East of Mississippi River and North of MRGO**	Nov. 13	April 1	Market Harvest	140	10,385	42,570	24.4%
	POSG East of Mississippi River and South of MRGO	Nov. 13	April 1	Market Harvest	140	3,079	42,872	7.2%
3	**Hackberry Bay**	CLOSED						
	Little Lake, Barataria Bay	CLOSED						
5	**Deep Lake, Lake Chien, Lake Felicity and Lake Tambour**	CLOSED						
	Bay Junop, Lake Mechant	CLOSED						
	Sister Lake	Oct. 9	Oct. 9	Bedding Harvest	1	7,300	333,462	2.2%
		Oct. 10	Oct. 30	Market Harvest	20	69,288	350,968	19.7%
		March 4	March 10	Market Harvest	7			
		March 22	March 28	Market Harvest	7			
6	**Vermilion Bay/East and West Cote Blanche Bay/ Atchafalaya Bay Public Oyster Seed Grounds**	Oct. 9	Oct. 9	Bedding Harvest	1	0	14,398	0.0%
		Nov. 13	April 1	Market Harvest	140	0	9,060	0.0%
7	**Calcasieu Lake**	Jan. 1	April 30	*East Side:* Market Harvest	121	1,738	28,703	6.1%
		Oct. 15	April 30	*West Cove:* Market Harvest	204	3,948	578,683	0.7%

Special Oyster Management Projects

LDWF biologists continue to participate in several important projects to increase oyster production on the state's public oyster areas. Since 1917, LDWF has placed over 1.5 million cubic yards of cultch material on nearly 30,000 acres with positive results. Cultch material provides a substrate for oyster larvae to attach, in a process termed settlement. Areas that are planted with cultch are referred to as "cultch plants." Recent cultch plants include: a 100-acre cultch plant in Calcasieu Lake (2017); a 100-acre addition to the 2012 Lake Fortuna cultch plant (2018); a 200-acre cultch plant in Sister (Caillou) Lake in 2021; four 10-acre broodstock reefs east of the Mississippi River in Petit Pass, Karako Bay, Lake Machias and Mozambique Point, two cultch plants totaling 231 acres in Drum Bay (2022), a 25-acre cultch plant in Calcasieu Lake (2023), and a 288-acre cultch plant in Morgan Harbor (2024). LDWF will monitor the performance of the reefs through regularly scheduled sampling events, and anticipates further enhancement of the reefs with hatchery-raised juvenile oysters as opportunities arise.

Some 2023-2024 projects were funded through *Deepwater Horizon* Natural Resource Damage Assessment (DWH NRDA) settlement dollars to restore for injuries to oysters that occurred as a result of the 2010 *Deepwater Horizon* Oil Spill. The Louisiana Trustee Implementation Group (LA TIG) approved $26 million in oyster projects, including enhancing oyster recovery using broodstock reefs, cultch plants, oyster restoration and hatchery-based oyster restoration.

In August 2023, the National Oceanic and Atmospheric Administration (NOAA) approved $58 million in federal disaster assistance for Louisiana's 2019 Flood Disaster Spend Plan, stemming from the historic impacts of the Mississippi and Atchafalaya flooding in 2019. Over $14 million will be used on oyster related projects and restoration, including cultch plants, spat-on-shell (SOS) reef restoration, expansion of Alternative Oyster Culture (AOC), parish facilitated hydrological projects, and oyster research projects related to the 2020 Oyster Rehabilitation Strategic Plan.

The LA TIG has funded a metapopulation-modeling project starting in 2023. The project is titled "Modeling to Inform Sustainable Oyster Populations in Louisiana Estuaries." The project will enable LDWF to evaluate locations for oyster cultch plants and broodstock reefs. Generally, the model will enable managers to assess the impacts of enhanced or restored reef locations on recruitment to other existing or proposed reefs; larval survival; growth of oysters on existing and proposed reefs; and reef connectivity. This model will enable management of oysters to move from individual reef level to assessment of a network, or meta-population, of reefs under current and future predicted conditions.

The Michael C. Voisin Oyster Hatchery located on Grand Isle, Louisiana, operates through a collaborative effort between LDWF and Louisiana Sea Grant (LSG). LSG assists with facility operations,

provides technical guidance, manages the oyster broodstock, and supports the oyster industry through extension, outreach, and research projects. LDWF focuses on the production of diploid and triploid seed and larvae for state restoration projects, as well as commercial sales to support the oyster industry.

The hatchery produces diploid oyster larvae for SOS and is used for Louisiana oyster restoration projects. To prepare for setting on shell, 3-ft mesh bags are filled with recycled oyster shell, which were previously obtained through the Oyster Shell Recycling Program of the Coalition to Restore Coastal Louisiana (CRCL). In the spring 2023 season, the hatchery produced 122,271,598 larvae for LDWF restoration efforts. An estimated 10 million larvae were deployed as SOS to the Petit Pass Broodstock Reef in April 2023, with an estimated 1,190,952 oyster spat. Marine Fisheries contracted monitoring assessments of the Petit Pass Broodstock Reef deployment to assess survival, and sampling from the eighteen-month monitoring event in November 2024 showed on-going spat recruitment, 50.0% mortality of seed oysters and 0.0% mortality on the surviving market-size oysters. An estimated 110,264,098 larvae were set on macro-cultch and deployed to Independence Island in Barataria Bay during June 2023, with an estimated 4,648,263 seed oysters entering the water. An estimated 2,007,500 larvae were also set on macro-cultch and deployed to Independence Island in Barataria Bay during August 2023, with an estimated 341,889 seed oysters deployed. In the spring 2024 season, the hatchery fertilized 1,261,403,332 eggs, which produced 92,027,666 viable larvae for restoration efforts. An estimated 8,000,000 larvae were set and deployed as SOS to the Lake Borgne Artificial Reef in May 2024, with an estimated 2,032,100 oyster spat. Another 25,040,000 larvae were set and deployed as SOS to the Lake Machias Broodstock Reef in July 2024, with an estimated 697,604 oyster spat. An additional 7.5 million larvae were set and deployed as SOS to the West Karako Artificial Reef in July 2024, with an estimated 539,226 oyster spat. In June 2024, 14,787,666 larvae were set on microcultch and an estimated 3,955,537 seed oysters were deployed to the Lake Fortuna Cultch Plant in St. Bernard Parish to bolster that reef's oyster population. Lastly, on Oct. 9, 2024, an estimated 484,000 seed oysters on microcultch were deployed to the new Hotel Sid Artificial Reef near East Champagne Bay.

Recent Legislation

In 2023, the Louisiana Legislature passed two oyster-related bills. Act 404, lobbied by CRCL, benefits oyster restoration efforts by giving tax credits to restaurants for participating in an oyster shell-recycling program. The Department of Revenue, Tax Policy and Planning Division, adopted LAC 61:I.1933 to administer Act 404 relative to the restaurant oyster shell recycling tax credit. LAC 61:I.1933 describes the eligibility, criteria, and forms necessary to claim the oyster shell recycling tax credit for restaurants. Act 170 changed the language of R.S. 56:433.1 pertaining to oyster seed ground vessel permits. The revision changed the Public Oyster Seed Ground Gear License to a gear permit and made the new gear permit (Public Oyster Seed Ground Gear Permit) an extension of the permitted vessel allowing harvest on the POSGs. This change allowed the permit holder the ability to hire or lease out the vessel to any properly licensed commercial oyster captain. The provisions of Act 170 went into effect in LDWF's licensing system in 2024.

In 2024, the Louisiana Legislature passed one oyster-related bill. Act 71, sponsored by Representative Joseph Orgeron, increases the Grand Isle Alternative Oyster Culture Park from 13 to 27 acres and requires the Grand Isle Port Commission to adhere to the rules and regulations adopted by the Louisiana Wildlife and Fisheries Commission governing AOC activities.

Conclusion and Acknowledgments

The biological stock assessment, historical oyster landings statistics, and a brief synopsis of each CSA's most recent oyster season are all included in the report that follows. Biological data were generated from quantitative square-meter sampling, while landings data were generated from boarding surveys and trip ticket information. This report was prepared by Carl Britt, Willie Cheramie, Konner Lockfield, Jeff Marx, Josh Parks and Troy Sehlinger. Biologists from each CSA spent extensive time gathering samples and producing the report. Additionally, Ty Lindsey, Christian Winslow and Becky Redmond-Chapman assisted with editorial review and preparation of this document. Efforts of the field and office staff are greatly appreciated, as this report could not be produced without their hard work and dedication. Please direct questions and comments to Robert Caballero, Oyster Program Manager, at 504-286-4054 or rcaballero@wlf.la.gov.

COASTAL STUDY AREA 1 NORTH
(East of Mississippi River and North of MRGO)

Introduction
The POSGs in CSA 1 North (North Pontchartrain Basin) consist of approximately 690,000 acres of water bottom located within Lake Borgne, the Louisiana portion of Mississippi Sound, Chandeleur Sound, the Biloxi Marsh and adjacent waters. Louisiana, Mississippi and Texas fishermen harvest oysters from this area, which has historically been an area of high oyster production within the state of Louisiana. Although the state of Louisiana has managed this area as POSGs for many decades, the Commission did not designate the majority of this area by rule until 1988. The Commission designated much of Lake Borgne as a Public Oyster Seed Ground in 1995 and expanded the grounds in 2004. LDWF continues to expand the public oyster reefs in the Pontchartrain Basin through the placement of cultch material (e.g. shell, limestone, crushed concrete) on suitable water bottoms. In early 2020, LDWF collaborated with Non-Governmental Organizations (NGOs) to complete construction of four artificial reefs in CSA 1 North. Limestone, oyster shell and reef balls were deployed at sites near Cabbage Reef, Grand Banks, eastern Lake Borgne and West Karako Bay, with the intention of creating habitat for oyster broodstock. In December 2021, LDWF oversaw the construction of four additional artificial reefs built exclusively for oyster broodstock production. Two of these were located in CSA 1 North at Petit Island and West Karako Bay. In July 2022, LDWF completed the construction of two cultch plants totaling 231 acres in Drum Bay (St. Bernard Parish). In June 2024, LDWF completed the construction of a 288-acre cultch plant in Morgan Harbor (St. Bernard Parish). These projects were funded through DWH NRDA settlement dollars to restore for injuries to oysters that occurred as a result of the DWH spill. Drum Bay and Morgan Harbor were chosen due to their more remote locations from any Mississippi River outflow and their higher resiliency to recent stressors. In an effort to enhance existing reefs and provide oyster broodstock, LDWF routinely distributes hatchery-produced spat. These spat oysters are set on oyster shell, limestone, crushed concrete, or macrocultch material. Since 2018, eight such events have taken place in CSA 1 North. From 2020 to 2024, the artificial reef and the broodstock reef in West Karako Bay received four spat deployments (three SOS and one spat-on-macrocultch). The Petit Island broodstock reef received spat-on-macrocultch in 2022 and SOS in 2023. Also in 2023, spat set on oyster shell and limestone was deployed on suitable water bottom in Drum Bay. The Lake Borgne artificial reef was enhanced with SOS in 2024, as well.

Methods
LDWF biologists collected field samples for this OSA between July 01 and July 17, 2024, from 18 stations within CSA 1 North, according to the methodology described in the Statewide Overview of this report. Sample stations included 17 historical stations and the 2013 NRDA Early Restoration cultch plant at Three Mile Pass. Additionally, per cultch plant sampling protocols, a series of 10 (¼) square-meter samples were taken from each of the 2022 Drum Bay cultch plants (*Figure 1.1*).

To better locate and assess the oyster stock in the public oyster areas, LDWF has conducted a number of side-scan sonar studies of water bottoms in these areas. These studies, coupled with historical reef and cultch plant information, have resulted in more up-to-date and realistic designations of productive water bottoms for use in the annual OSA (*Table 1.1*). The 2024 CSA 1 North OSA is based on a reef assessment of 22,139 acres of water bottom, which includes the 231 acres of the 2022 Drum Bay cultch plants. This acreage, however, does not include the 288 acres of the newly constructed Morgan Harbor cultch plant. This cultch plant was just completed in June 2024, and therefore not sampled for this stock assessment.

Only POSGs, which have an accurate acreage, are included in the OSA. For this reason, some areas, such as POSGs located within Lake Borgne, are not included in the annual OSA.

Results and Discussion

Seed- and Market-Size Stock
The 2024 estimated oyster stock size for CSA 1 North is 259,737.3 bbl of seed oysters and 135,390.3 bbl of market-size oysters, for 395,127.6 bbl of overall stock. This total assessed oyster stock for 2024 is up 213.3% from 2023. This marks two consecutive years with over 200% increase in oyster stock for the North Pontchartrain Basin. It is important to note that both this and last year's oyster stock estimates were largely driven by the oyster densities observed on the two Drum Bay cultch plants completed in July 2022. For this year's assessment, these cultch plants accounted for an estimated 88,777.2 bbl (34.2%) of seed oysters, as well as 109,787.2 bbl (81.1%) of market-size oysters. Compared to 2023, with the inclusion of the Drum Bay cultch plants (2022), there was a 156.5% increase in the seed estimate. The current estimated market-size stock is calculated to be 445.0% above the market-size estimate of 2023. Due to the large increases in predicted oyster stock in this year's assessment, with the inclusion of oyster stock estimated on the Drum Bay cultch plants (2022), seed stock is up 89.1% from the previous 10-year average, while market-size stock exceeded the previous 10-year average by 129.8%. Total assessed oyster stock for 2024 is 101.3% above the previous 10-year LTA (*Figure 1.2*).

As mentioned above, the oyster densities observed on the two Drum Bay cultch plants (2022) drove this year's stock estimate. Seed oyster densities on these two cultch plants were 62.8% square-meter (North) and 72.0 per square-meter (South). Market-size densities were observed to be 14.4 (North) per square-meter and 60.4 (South) per square-meter. When comparing 2024 oyster densities on North Pontchartrain Basin reefs that were assessed in 2023, the Three Mile Pass cultch plant (2013) accounted for 38.4% of the seed oyster stock in CSA 1 North, with a mean density of 74.0 seed oysters per square-meter. A large density of seed oysters was also observed on the Shell Point reef,

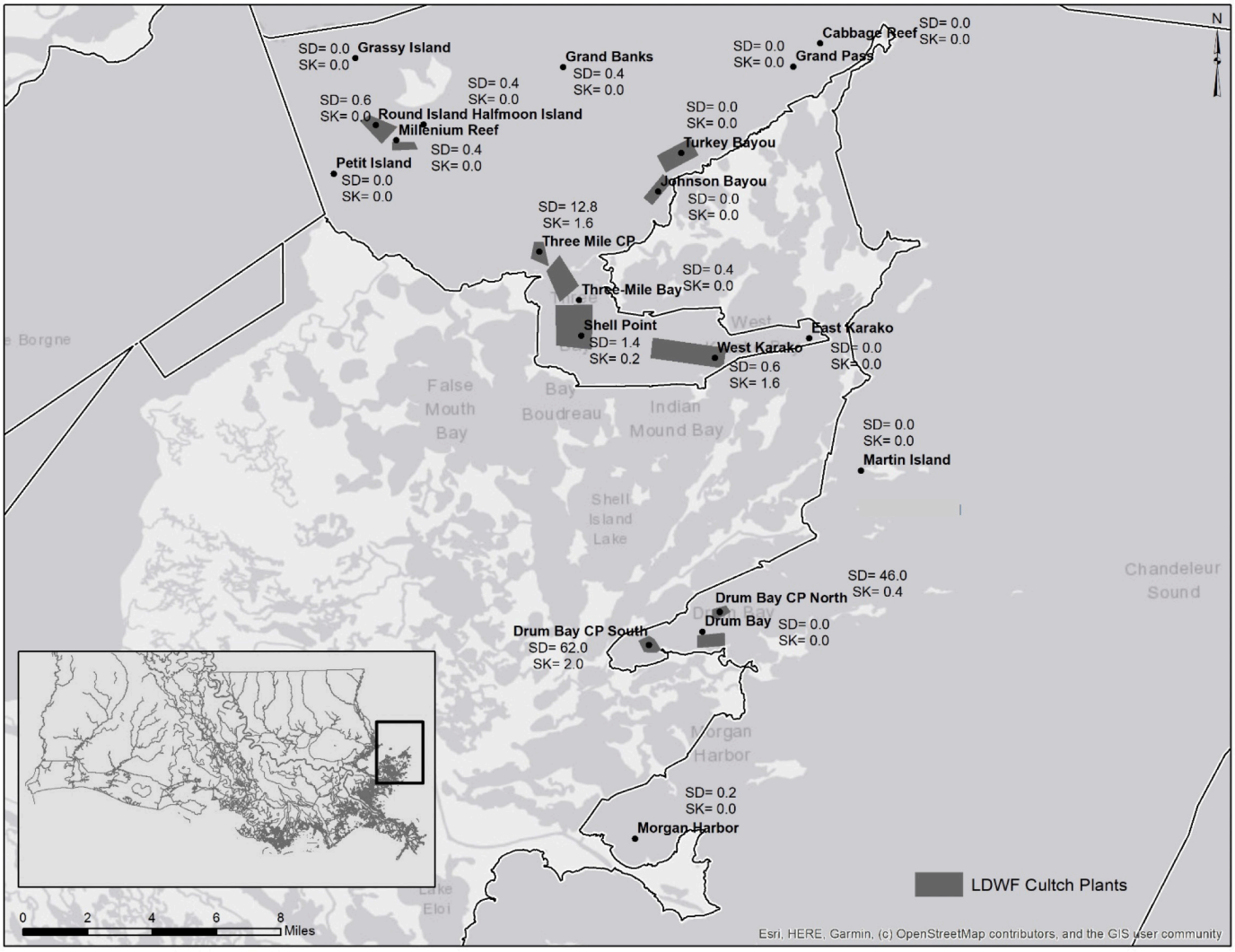

FIGURE 1.1. 2023 OSA average seed and market-size densities from square meter sample stations (CSA-1 North).

with 58.6 seed oysters per square-meter, as well as the Round Island reef with 32.2 seed oysters per square-meter. In all, nine of the 18 stations sampled held seed oysters. The Halfmoon Reef complex held the majority of available market-size oyster resource with 47.1% of the market-size oyster estimate. Greatest densities of market-size oysters were found at Round Island and the Three Mile Pass cultch plant (2013), with 1.2 market-size oysters per square-meter. A large density of market-size oysters was also seen at Shell Point, which held 1.0 market-size oysters per square-meter. These three aging cultch plants accounted for 25.7% of the available market-size resource. In all, seven of the 18 stations sampled held market-size oysters during this assessment.

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 only limited areas of significant resource availability are often identified.

Since 2014, CSA 1 North has experienced periods of heavy localized harvest, high mortality events and strong tropical events such as Hurricane Nate in 2017, Hurricane Zeta in 2020 and Hurricane Ida in 2021. There have also been devastating spring flood events prompting the opening of the Bonnet Carré Spillway five times in the past 10 years (2016, 2018, twice in 2019 and 2020). These continual limits to recruitment and survival have severely reduced oyster resources across the Pontchartrain Basin. As a result, both the estimated seed and market-size oyster stocks have fallen well below the previous 10-year LTA for seven of the last 10 years. The 2024 OSA for the North Pontchartrain Basin is the first since 2017 to exceed these previous 10-year LTA (*Figure 1.2*).

Spat Production

Live spat were observed at just seven of the 18 regular historic stations sampled during this assessment. At these sample stations, mean densities ranged from 0.2 to 18 individuals per square-meter, with the highest average occurring at Shell Point. The Three Mile Pass cultch plant (2013) also had a large number of spat at 14.4 per square-meter. The number of sample stations holding spat oysters decreased greatly from the previous year's assessment, when spat were observed at 13 of the 18 regular historic stations. Despite spat not being found at as many stations, occurrence of spat oysters increased from the previous year's assessment, with a 7.3% increase in the total number of spat collected, and in the number of spat occurring per square-meter sample taken. Additionally, spat oysters were found on both of the newly constructed Drum Bay cultch plants, with 1.2 spat per square-meter on the North plant and 2.8 spat per square-meter on the South plant. While the observed spat oyster numbers are encouraging, there continues to be a persistent trend of modest spat sets on most CSA 1 North reefs during spring spawning

TABLE 1.1. 2024 Oyster availability by sample station or reef complex in CSA 1 North.

Station	Reef (Acres)	Average Number Seed Oysters/m^2	Average Number Market- Size Oysters/m^2	Seed Oysters (bbl)	Market-Sized Oysters (bbl)
Grassy Island	5,328	1.8	0.8	**34,738.2** (69,476.5 sacks)	**11,978.7** (23,957.4 sacks)
Halfmoon		2.0	0.0		
Petit		0.0	0.0		
Grand Banks		0.0	0.0		
Millennium		2.0	0.2		
Halfmoon Reef Complex	**Cumulative**	1.2	0.2		
Three Mile Bay	3,059	0.4	0.0	**2,292.2** (4,584.4 sacks)	0.0
East Karako		0.0	0.0		
West Karako		0.0	0.0		
3 Mile Bay Complex	**Cumulative**	0.1	0.0		
Grand Pass	5,411	0.0	0.0	0.0	0.0
Cabbage		0.0	0.0		
Turkey		0.0	0.0		
Cabbage Reef Complex	**Cumulative**	0.0	0.0		
Martin Island	3,183	0.0	0.0	0.0	0.0
Johnson Bayou	200	0.0	0.0	0.0	0.0
Drum Bay	1,565	0.0	0.4	0.0	**7,037.1** (14,074.1 sacks)
2022 Drum Bay Cultch Plant North	91	62.8	14.4	**32,120.9** (64,241.8 sacks)	**14,730.6** (29,461.2 sacks)
2022 Drum Bay Cultch Plant South	140	72.0	60.4	**56,656.2** (113,312.4 sacks)	**95,056.6** (190,113.1 sacks)
Drum Bay Reef Complex	**Cumulative**	44.9	25.1	**88,777.1** (177,554.2 sacks)	**109,787.2** (219,574.4 sacks)
Morgan Harbor	2,666	0.0	0.0	0.0	0.0
2024 Morgan Harbor Cultch Plant	288	N/A	N/A	N/A	N/A
Morgan Harbor Reef Complex	**Cumulative**			0.0	0.0
Shell Pt	47	58.6	1.0	**15,546.3** (31,092.6 sacks)	**530.6** (1,061.2 sacks)
Round Island	291	32.2	1.2	**52,666.7** (105,333.36 sacks)	**3,925.5** (7,850.9 sacks)
2013 3 Mile Pass Cultch Plant	158	74.0	1.2	**65,716.7** (131,433.4 sacks)	**2,131.4** (4,262.7 sacks)
Total				***259,737.3 (519,474.6 sacks)***	***135,390.3 (270,780.7 sacks)***

Oyster Type	10-yr LTA (2014-2023)	2024	% Change
Seed	137,387.5	259,737.3	+89.1%
Market- Size	58,909.2	135,390.3	+129.8%
Total	***196,296.7***	***395,127.6***	***+101.3%***

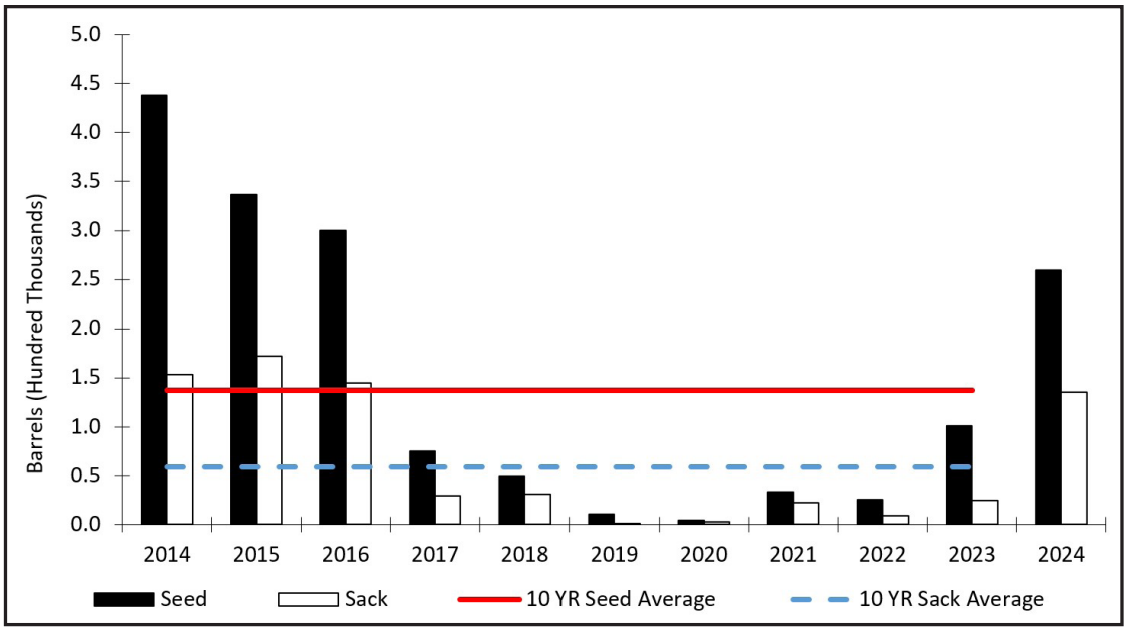

FIGURE 1.2. CSA 1 North historical oyster stock availability.

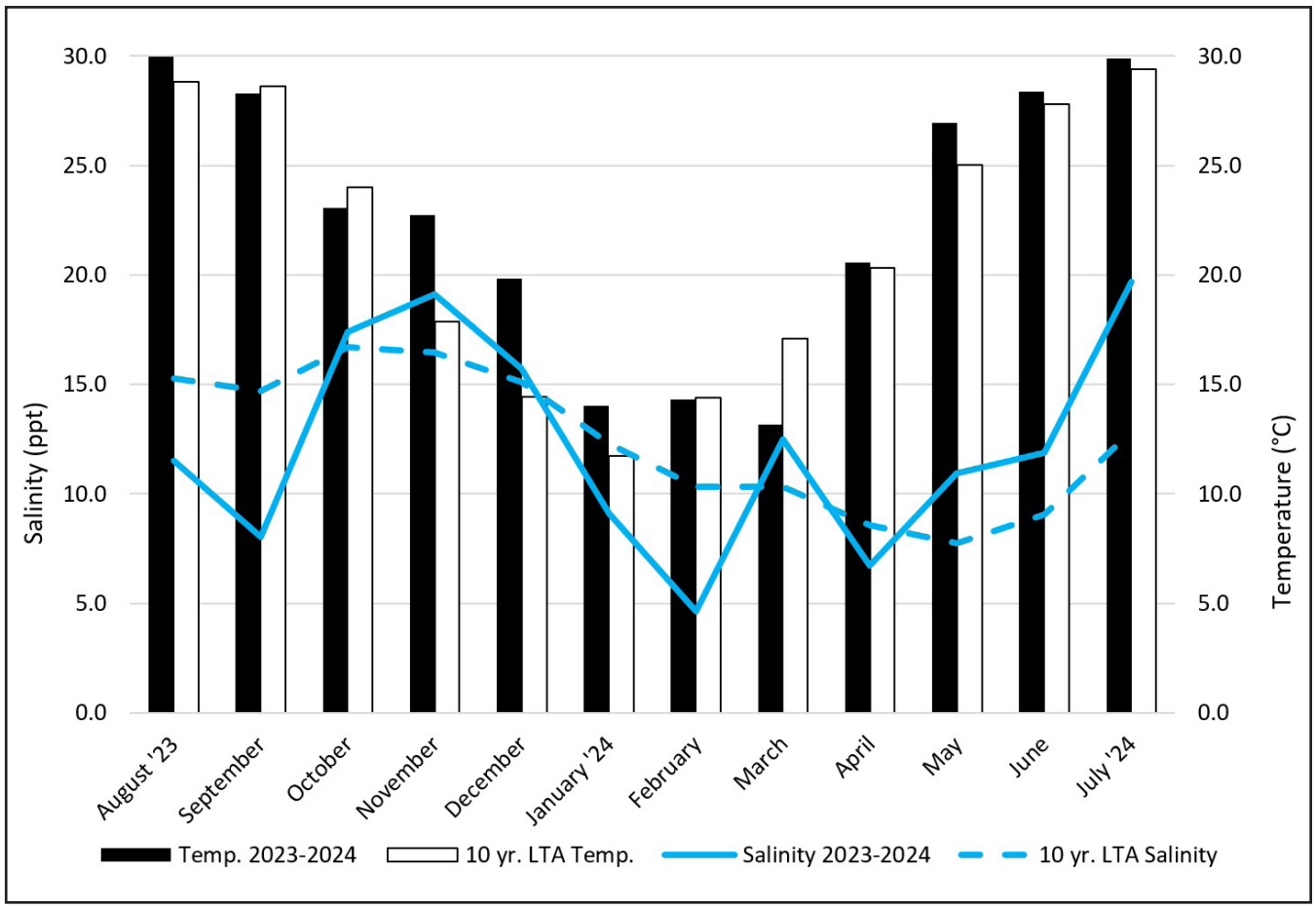

FIGURE 1.3. Mean salinity and temperature for Northern Lake Pontchartrain Basin public oyster areas from August 2023 - July 2024, with the 10-year LTA (2014-2023).

events. These periods of poor recruitment can be attributed to several different factors, such as freshets, hypoxia, overburden, dissolution of cultch, or a combination of these stressors. It is noted that annual square-meter samples may occur between seasonal spawning events in some areas. It is further noted that spat numbers can be somewhat biased by the amount of substrate collected in a given sample.

Hydrological Data

During the period between August 2023 and July 2024, the North Pontchartrain Basin experienced a number of extremes related to hydrological conditions. Starting in spring 2023, the Pontchartrain Basin began experiencing abnormally dry conditions. As the year progressed, the North Pontchartrain Basin experienced moderate drought conditions starting in July 2023 and progressed to exceptional drought conditions through December 2023. Salinities across the basin and most notably in the western Mississippi Sound, were well above the previous 10-year LTA for the months of October through December 2023. This was directly related to the Pearl River being well below flood stage during these times. These drought conditions slowly dissipated through January, February and March 2024. This led to salinities for January and February 2024 being well below the previous 10-year LTA. As drought conditions once again persisted through the early to mid-spring months of 2024, the North Pontchartrain Basin experienced much higher than average salinities from May through July 2024. Along with the higher salinities the North Pontchartrain Basin experienced, the bottom water temperatures were higher than the 10-year LTA for most of the year, most notably during November and December 2023 and January 2024 (*Figure 1.3*). Spring 2024 marked the fourth consecutive year without a Mississippi River flood event necessitating the opening of the Bonnet Carré Spillway. In addition, there were no notable impacts from tropical weather systems or hurricanes between August 2023 and July 2024.

Fouling Organisms

During 2024 OSA sampling, the hooked mussel (*Ischadium recurvum*) was observed at five of the 18 sample stations and the South Drum Bay cultch plant (2022). Densities of hooked mussels ranged from 1.4 to 24.0 per square-meter, with the highest density occurring on Halfmoon Reef. There was a 62.9% decrease of the occurrence of hooked mussel when compared to the previous year. Aside from the Drum Bay cultch plant, observations of hooked mussels during this year's assessment were on reefs located in Mississippi Sound and Three Mile Bay. This corresponds with more favorable growing conditions enhanced by drainage from the Pearl River. The Pearl River was at or above flood stage for much of the spring and early summer months in 2024. The area also held an abundance of mature animals from the previous year. Although there is no documentation of barnacle fouling on oyster shells in the assessment, there had been documentation of light to moderate barnacle fouling of oyster shells in the monthly samples at a number of sample stations prior to the assessment. In addition, there were no observations of bryozoans on the exposed substrate at any of the sample stations. All of these forms of fouling limit the ability of oyster larvae to attach to available cultch.

Oyster Predators and Disease

During this year's sampling event, no oyster drills (*Stramonita canaliculata*) were observed at any of the 18 sample stations. However, oyster drills were found on the North Drum Bay cultch plant (2022), with a density of 0.4 per square-meter. No stone crabs (*Menippe adinia*) or blue crabs (*Callinectes spp*.) were collected in the square-meter samples. Other (Xanthid) mud crabs were noted in numerous samples that contained shell for substrate.

Mortality

Oyster mortality estimates for this year's stock assessment showed a marked decrease below what was observed in the previous assessment. Total oyster mortality fell from 12.4% in 2023 to just 2.7% in 2024. This is mainly due to lower seed mortalities observed on the 18 regular sample stations. There was a decrease in spat mortality from 12.3% in 2023 to 9.0% in 2024. Highest rates of spat mortality were found at both Grassy Island and Cabbage Reef sites (100.0%). A high rate of spat mortality was also observed at Grand Pass (50.0%). Overall, spat mortality was observed at five of 18 sample stations. Seed oyster mortality showed the greatest decrease during this year's assessment, falling from 14.9% in 2023 to just 1.3% in 2024. Seed oyster mortality was observed at three stations; Round Island (2.4%), Shell Point (1.3%) and the Three Mile Pass cultch plant (0.8%). No market-size oyster mortalities were recorded during this sampling event. By comparison, there was no market-size oyster mortality recorded during the previous year's stock assessment. It is important to consider that mortality estimates are often based on an extremely small number of animals. Further, for some annual stock assessments, samples may be taken shortly after large mortality events that have either diminished or severely depleted abundances, such that neither the mortality nor the prior abundance is fully captured in the assessment sampling.

2023-2024 Oyster Season

The 2023/2024 oyster season in the North Pontchartrain Basin opened on Nov. 13, 2023. The Drum Bay cultch plants (2022) remained closed to harvest, as they are were still within the initial two-year monitoring period required for newly constructed cultch plants. Due to continued lack of seed stock observed on reefs in North Pontchartrain Basin, as well as continued recovery from losses during the spring and summer of 2019, the entire area opened as "sacking-only," with a 30 sack per day limit. Harvest was suspended on the Three Mile Pass Cultch Plant (2013) and Shell Point reef on Dec. 3, 2023. This was a result of observed harvest levels on these reefs, where it was estimated that nearly 10 times the 2023 assessed market-size resource on the Shell Point reef was harvested and over 140% of the assessed market-size resource on the Three Mile Pass Cultch Plant (2013) had been harvested. The 2023/2024 oyster season on the remaining public oyster areas in the North Pontchartrain Basin was closed on April 1, 2024.

Harvest totals for the North Pontchartrain Basin during the 2023/2024 oyster season were estimated at 10,385 sacks of market-size oysters. When harvest estimates within stock-assessed areas are compared with the 2023 stock assessment, there was an estimated utilization of 24.4% of the market-size resource. The majority of market-size resource was observed to be harvested from the Three-Mile Bay reef complex, which includes the Three Mile Pass Cultch Plant (2013). This reef complex accounted for 79.2% of the harvested market-size oyster resource. Shell Point reef also yielded notable harvest with 20.4% of market-size harvest.

COASTAL STUDY AREA 1 SOUTH
(East of Mississippi River and South of MRGO)

Introduction
The POSGs and Reservation in CSA 1 South (South Pontchartrain Basin; formerly CSA 2), consist of approximately 300,000 acres of water bottom. The grounds are 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 oyster leases east of the Mississippi River to the Breton National Wildlife Refuge. Historically, this area has provided seed and market-size oysters for oyster fishermen from Louisiana, Mississippi and Texas. Over past decades, LDWF has worked to expand public oyster reefs through the placement of cultch material (e.g. shell, limestone, crushed concrete) on suitable water bottoms. In 2018, LDWF, NOAA and the St. Bernard Parish Government worked together to enhance a 100-acre portion of the (~300 acre) 2012 Lake Fortuna cultch plant by deploying 16,154 cubic yards of oyster shell. In December 2021, LDWF oversaw the construction of four artificial reefs built exclusively for oyster broodstock production. Two of these were located in CSA 1 South at Lake Machias and Mozambique Point. LDWF also enhances public oyster areas by deploying hatchery-produced spat on existing reefs. Since 2018, five such events have taken place in CSA 1 South. In 2018, spat set on fossilized shell was included with the enhancement of the 2012 Lake Fortuna cultch plant. In 2019, spat-on-oyster shell was deployed on suitable bottom in Breton Sound near Lake Fortuna. The Lake Machias broodstock reef received SOS in 2022 and 2024. Also in 2024, spat set on macrocultch was deployed on the 2012 Lake Fortuna cultch plant.

Mississippi River stages heavily influence hydrology in the South Pontchartrain Basin by discharges through gaps in the Mississippi River levee south of Pointe a la Hache and main-stem river distributaries. Most significant impacts to the Basin come through the unrestricted breaches of the Bohemia Spillway and Neptune Pass, Bayou St. Philip and regulated discharge from the Caernarvon and Bayou Lamoque freshwater diversion structures. Additionally, since 2015, CSA 1 South has experienced numerous strong tropical events including Hurricane Nate in 2017, Hurricane Zeta in 2020 and Hurricane Ida in 2021. These hydrological stressors, coupled with the impacts from the 2010 *Deepwater Horizon* oil spill, periods of heavy localized harvest and high mortality events, have severely reduced oyster abundance in the South Pontchartrain Basin.

Methods
LDWF biologists collected field samples for this OSA between July 01 and July 16, 2024, from 26 stations within CSA 1 South, according to the methodology described in the Statewide Overview. Sample stations included 25 historical sample stations and the 2012 Lake Fortuna cultch plant (*Figure 2.1*). With its enhancements, the 2012 Lake Fortuna cultch plant remains significantly different from the surrounding Lake Fortuna Reef Complex; therefore biologists assess this acreage separately (*Table 2.1*).

To better locate and assess the oyster stock in the public oyster areas, LDWF has conducted a number of side-scan sonar studies of water bottoms in CSA 1 South. These studies, coupled with historical 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 OSA. The 2024 OSA has updated reef acreage of 27,762.3 acres of water bottom. Beginning with the 2013 OSA, oyster reefs within CSA 1 South merged into reef complexes based on location, hydrology, oyster productivity and response to environmental stressors. There were 12 reef complexes, each with one to four representative square-meter sample stations (*Table 2.1*). Water bottom assessments have identified an additional 1,524 acres of oyster habitat (reef and scattered shell), but this acreage is not included in the total acres of water bottom or the annual OSA acreage, as no current oyster sample station adequately describes this acreage.

Results and Discussion
Seed- and Market-Size Stock
The 2024 estimated oyster stock for CSA 1 South consists of 4,557.1 bbl of market-size oysters. During this sampling event, no seed oysters were observed at any sampling station (*Figure 2.2*). Although no live seed oysters were observed during this sampling event, this does not necessarily equate to a complete absence of seed oyster resource in the South Pontchartrain Basin. As actual sampling locations are random and include only a small percentage of the total public oyster area, it is plausible that pockets of seed oyster resource or scattered seed oysters are present in portions of the area. Compared to 2023, total estimated oyster stock for 2024 is down 88.6%. The 2024 market-size oyster estimate decreased 78.7% below the previous year's market-size stock estimate. The current market-size stock is down 69.9% from the previous 10-year LTA. Total assessed oyster stock for 2024 is 84.8% below the previous 10-year LTA. The Lake Fortuna reef complex accounted for 100.0% of all oyster stock in CSA 1 South during this year's assessment. South Lake Fortuna held the majority of the market-size oyster estimate, with a mean density of 0.2 market-size oysters per square-meter. The Lake Fortuna cultch plant (2012) held the remainder of the market-size oyster resource. The results of this Stock Assessment indicate an extremely low abundance of oyster resource across the South Pontchartrain Basin. Additionally, seventeen of the 26 stations sampled had no measurable reef material and three others had only a minimal amount. This trend has persisted for a number of years and greatly limits the ability for spat settlement in areas that lack suitable cultch material.

Spat Production
No live spat were observed during the 2024 OSA sampling event. This was an additional decrease from the previous year's stock assessment where spat density across the South Pontchartrain

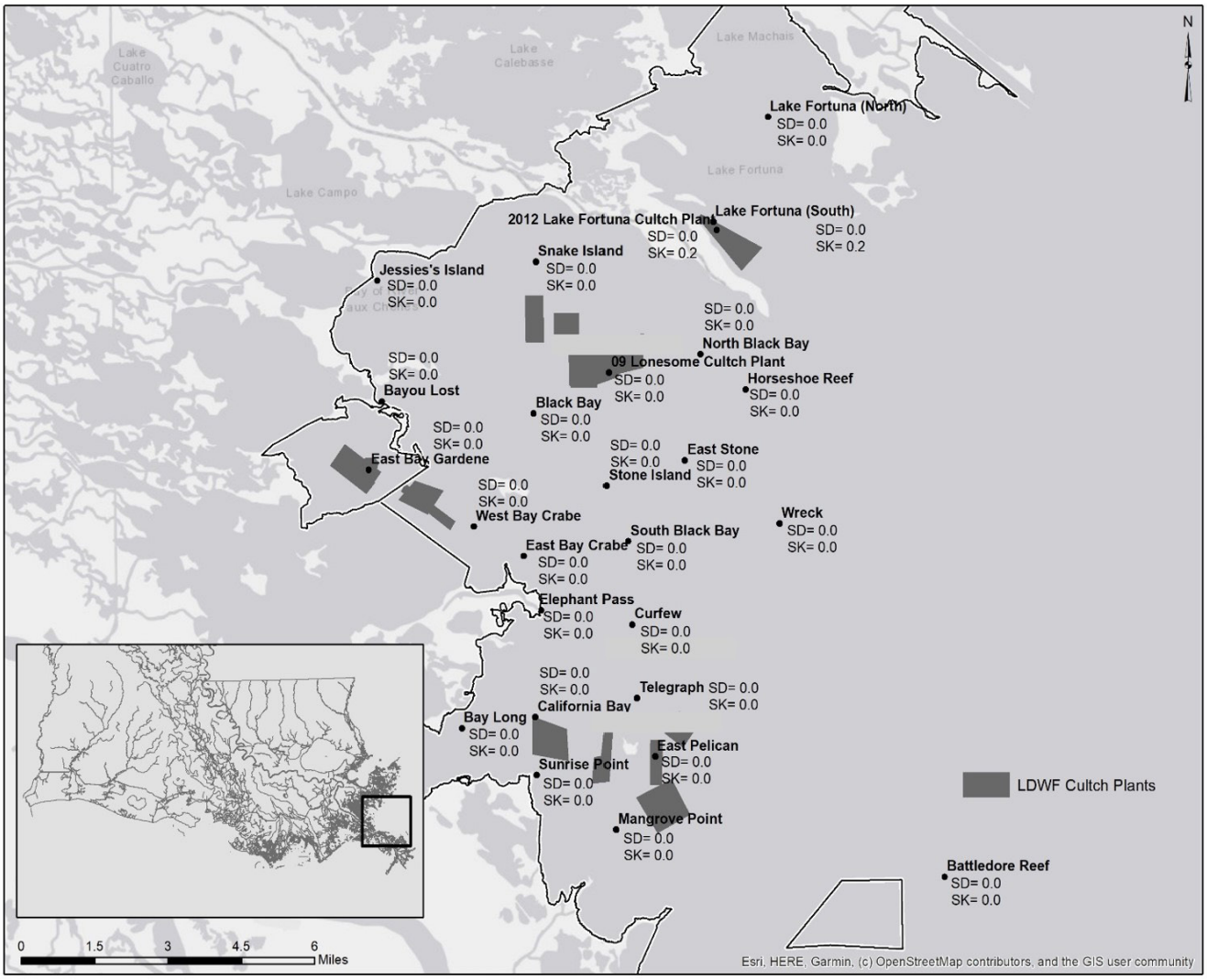

FIGURE 2.1. 2024 OSA average seed and market-size densities from square-meter sample stations (CSA-1 South).

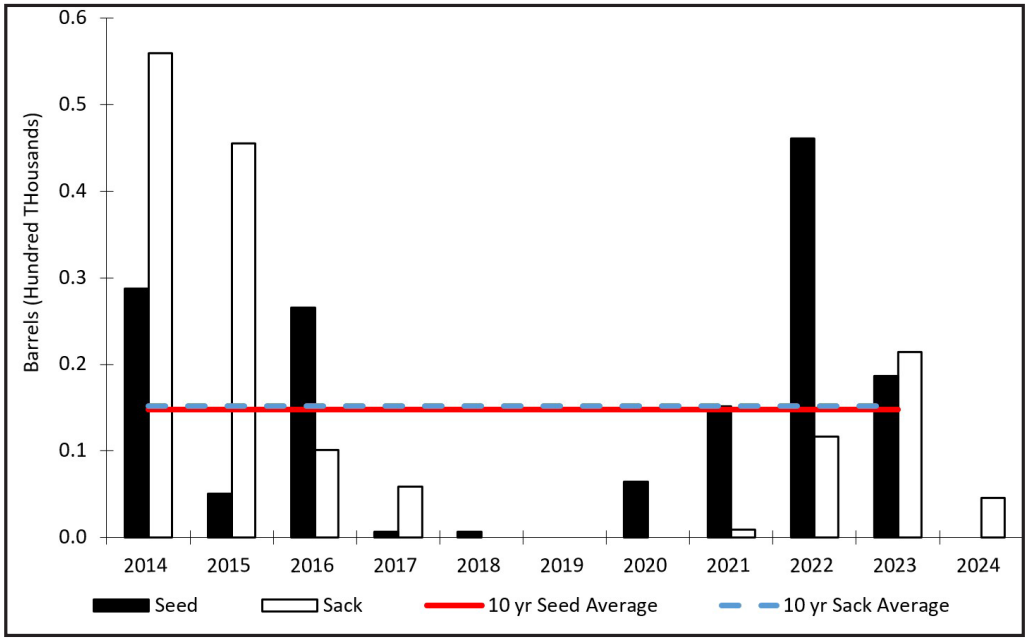

FIGURE 2.2. CSA 1 South historical oyster stock availability.

TABLE 2.1. 2024 Oyster availability by sample station or reef complex in CSA 1 South.

Station	Reef (Acres)	Average Number Seed Oysters/m^2	Average Number Market-Sized Oysters/m^2	Seed Oysters (bbl)	Market-Sized Oysters (bbl)
Jessie's Island	549.9	0	0		
Bayou Lost		0	0	0.0	0.0
Reef Complex	**Cumulative**	0.0	0.0		
East Bay Gardene	1,262.6	0.0	0.0	0.0	0.0
West Bay Crabe	1,732.0	0	0		
East Bay Crabe		0	0	0.0	0.0
Reef Complex	**Cumulative**	0.0	0.0		
Elephant Pass	202.2	0	0	0.0	0.0
Sunrise Point		0	0		
California Bay	3,692.8	0	0	0.0	0.0
Bay Long		0	0		
Reef Complex	**Cumulative**	0.0	0.0		
Mangrove Point	2,889.1	0	0		
East Pelican		0	0	0.0	0.0
Reef Complex	**Cumulative**	0.0	0.0		
Stone Island		0	0		
South Black Bay	3,575.7	0	0		
Curfew Island		0	0	0.0	0.0
Telegraph Island		0	0		
Reef Complex	**Cumulative**	0.0	0.0		
Snake Island		0	0		
Lonesome CP (2009)	2,861.9	0	0	0.0	0.0
Black Bay		0	0		
Reef Complex	**Cumulative**	0.0	0.0		
South Lake Fortuna	3,453.9	0	0.2		
North Lake Fortuna		0	0	0.0	**3,882.6** (7,765.2 sacks)
Reef Complex	**Cumulative**	0	0.1		
North Black Bay	2,485.8	0	0	0.0	0.0
Horseshoe Reef	2,485.8	0	0	0.0	0.0
East Stone Island	2,485.8	0	0	0.0	0.0
Reef Complex	**Cumulative**	0.0	0.0	0.0	0.0
Wreck	4,485.8	0.2	0	0.0	0.0
Battledore Reef	270.6	0	0	0.0	0.0
2012 Lake Fortuna Cultch Plant	300.0	0	0.6	0.0	**674.5** (899.31 sacks)
Total				***0.00***	***4,557.1 (8,664.46 sacks)***

Oyster Type	10-year LTA (2014-2023)	2024	% Change
Seed	14,801.5	0.00	-100%
Market-Size	15,148.1	4,557.1	-69.9%
Total	***29,949.6***	***4,557.1***	***-84.8%***

Basin measured 0.05 spat oysters per square-meter. Biologists observed no recent spat mortality at any of the South Pontchartrain Basin sample stations. Although these sampling 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 recruitment and survival within CSA 1 South. Long periods of poor oyster production needed to replenish available shell stock have largely degraded reef areas to mud and heavily fouled shell hash with mussels and other organisms. This lack of suitable substrate for spat attachment adds another stressor to the oyster population in this area. Seventeen of the 26 stations sampled had no measurable reef material, and several were noted to have material almost completely buried under sediment.

Hydrological Data

During the period between August 2023 and July 2024, aside from the months of January, June and July, salinities in the South Pontchartrain Basin were below the 10-year LTA (*Figure 2.3*). Periods of excessively low salinities during the months of February through May coincided with multiple openings of the Caernarvon Fresh Water Diversion (CFWD) structure. Caernarvon was opened for sixteen days from February 01-16. Flows maxed out at just over 6,000 cubic feet per second (cfs) during this period. The structure was opened again for eleven additional days from March 8-19. Maximum flow rate during this opening reached 4,640 cfs. Water temperatures during the months of February through April were also well below the 10-year LTA. Starting in late spring 2024 and persisting into the summer, the Pontchartrain Basin experienced moderate drought conditions. As drought conditions persisted through the summer months, the water levels and flow rates in the Mississippi River remained well below flood stage. As a result, the South Pontchartrain Basin experienced much higher than average salinities during the months of June and July. Spring 2024 marked the fourth year in a row without a Mississippi River flood event necessitating the opening of the Bonnet Carré Spillway. Regular periods of low spring salinities and periods of hypoxia in the summer and fall decrease spawning success and increase risk of mortality, inhibiting oyster production in this area.

Fouling Organisms

During 2024 OSA sampling, the hooked mussel (*Ischadium recurvum*) was observed at five of the 26 sample stations. Hooked mussel densities ranged from 1.0 to 16.8 individuals per square-meter, with the highest density of mussels being observed at the Lake Fortuna cultch plant (2012). There was an 89.4% decrease in the occurrence of hooked mussels when compared to the previous year's observations. The vast majority of hooked mussels occurred at sample stations where the amount of available cultch material was the greatest. The largest decreases in hooked mussel densities among stations where mussels were observed in both 2023 and 2024 stock assessment sampling events were at the Wreck Reef (-98.0%), Stone Island (-89.6%) and South Lake Fortuna (-94.9%). While hooked mussel density decreased at nine sample stations in 2024, there was an increase in hooked mussel density at two sample stations. Most notably, there was a 281.8% increase in hooked mussel fouling at the Lake Fortuna cultch plant (2012). Hooked mussels were observed at a density of 1.0 per square-meter at Bayou Lost, which had no observed hooked mussel fouling in 2023. Although there is no documentation of barnacle fouling on oyster shells in the assessment, there has been

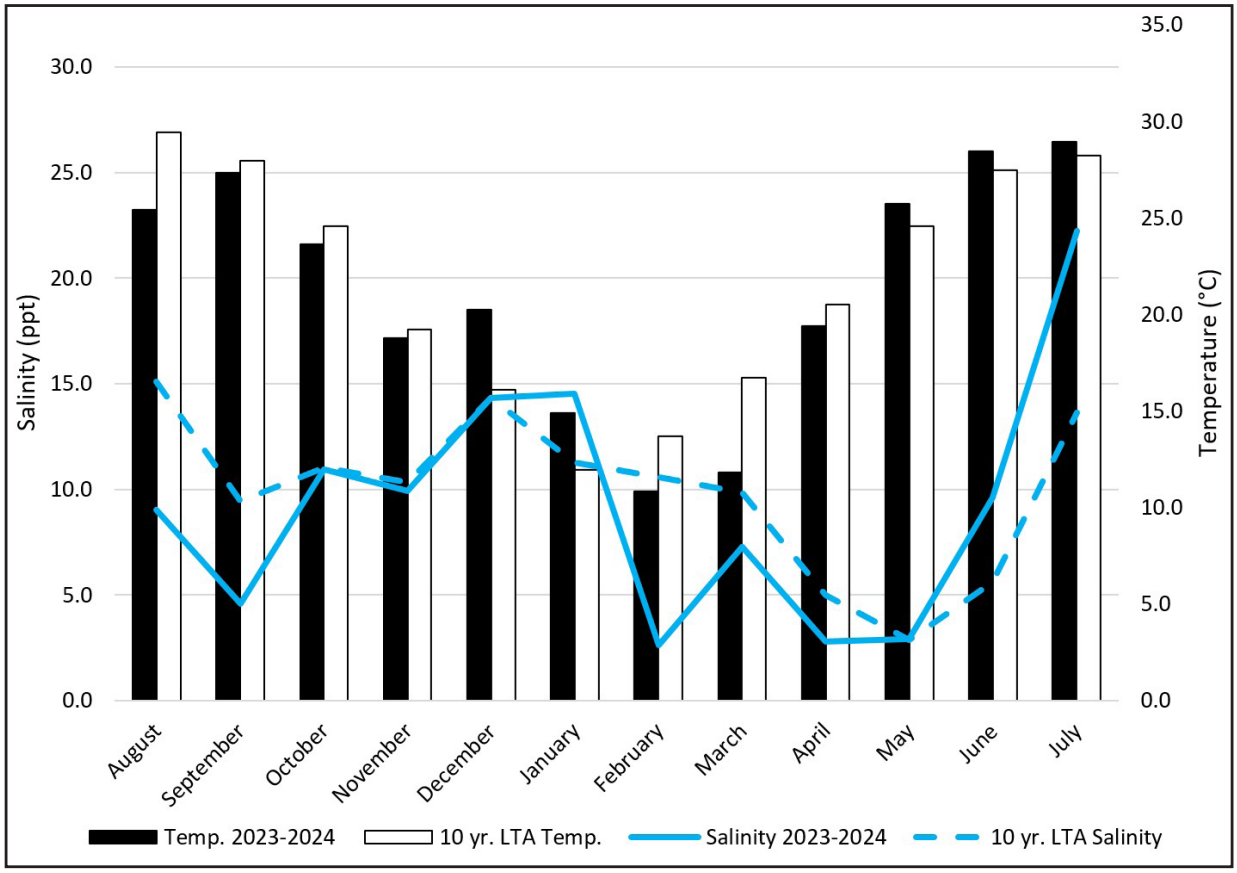

FIGURE 2.3. Mean salinity and temperature for Southern Pontchartrain Basin public oyster areas from August 2023 - July 2024, with the 10-year LTA (2014-2023).

documentation of moderate to heavy barnacle fouling of oyster shells in monthly samples at a number of sample stations prior to the assessment. In addition, there were no observations of bryozoans on exposed substrate at any of the sample stations. All of these forms of fouling limit the ability of oyster larvae to attach to available cultch and continue to be a hindrance to recruitment in the South Pontchartrain Basin.

Oyster Predators and Disease

There were no observances of live oyster drills or stone crabs during the 2024 OSA sampling. Salinities across the area are generally not suitable for such oyster predators. Other (Xanthid) mud crabs were noted in numerous samples that contained shell for substrate.

Mortality

Overall, during the 2024 OSA, observed mortality estimates showed an increase compared to the previous year's stock assessment. Total mortality increased from 4.2% in 2023 to 89.5% in 2024. This was a result of greatly increased mortality of market-size oysters on the Lake Fortuna cultch plant (2012), which was the only station where oyster mortality was observed during the 2024 stock assessment. There was no observed spat or seed oyster mortality during this sampling event; however, it is noted that no live spat or seed oyster resource was observed during this sampling event.

2023-2024 Oyster Season

Harvest totals for 2023-2024 oyster season were estimated at 3,079 sacks of market-size oysters. When harvest estimates within assessed areas are compared with the 2023 stock assessment, there was an estimated utilization of 7.2% of the market-size resource. Observed harvest effort was exclusive to the Lake Fortuna Reef Complex. The vast majority of harvest came from within the Lake Fortuna cultch plant (2012), which accounted for the majority of the total estimated harvest of market oysters in the South Pontchartrain Basin. The season was opened for 140 days in this area, with 96.8% of the total harvest taking place the first month from the opening date.

COASTAL STUDY AREA 3
(Barataria Basin)

Introduction
Coastal Study Area 3 (CSA 3) consists of three public oyster areas distributed generally in a north-south direction within the Barataria Bay estuary: Little Lake POSGs, Hackberry Bay POSR and Barataria Bay POSGs. Hackberry Bay, in Jefferson and 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 stations within Hackberry Bay are the Upper, Middle and Lower Hackberry sampling stations. The Middle Hackberry Bay station is the only sampling station located over existing natural reef, while the Upper and Lower stations are located over former cultch plants placed on top of historical reefs. The Upper Hackberry Bay station was the result of a 1994 cultch plant using federal disaster funds from Hurricane Andrew in 1992. The 1994 Cultch Plant totaled 145 acres and was comprised of six different sections of substrate including crushed concrete, shucked shell, reef shell, clamshell, Kentucky limestone and Bahamian limestone. This station was also the location of cultch plants in 1943 (140 acres), 1945 (70 acres), 1946 (92 acres) and 1981 (67 acres). The Lower Hackberry Bay station is on a reef that was part of a 450-acre 1973 Cultch plant. Since very little natural reef exists on 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 previous cultch plants is not factored into the annual OSA.

Since 2004, LDWF has constructed five cultch plants in Hackberry Bay. LDWF constructed two cultch plants totaling 35 acres in 2004 and one of 50 acres in 2008. Two additional plants, a 2012 Cultch Plant of approximately 200 acres and a 2014 Cultch Plant of 30 acres, combined with the other three, have increased the reef acreage on the Hackberry Bay POSR to its current estimate of 329.7 acres.

The Commission designated the Barataria Bay POSGs as such in response to possible changes in the salinity regime of the estuary stemming from the Davis Pond freshwater diversion project. Davis Pond is a large Mississippi River diversion that aims to reintroduce freshwater and nutrients into the Barataria Bay estuary to help restore the Louisiana coast. As this diversion was anticipated to reduce salinities in the estuary, LDWF estimated that additional public oyster areas farther down-estuary might be productive during years with high freshwater input. The only known existing reef on the Barataria Bay POSGs is a 40-acre cultch plant constructed of 7,536 cubic yards of crushed concrete in the northeast section of the area in May 2004. The reef is vulnerable to predators such as oyster drills and the protozoan parasite Dermo during periods of higher salinities. LDWF does not expect reliable oyster production from this area until salinity regimes in the basin can remain at consistently lower ranges brought about by natural forces or by coastal restoration efforts.

The Little Lake POSGs had previously been used as a temporary natural reef area and once contained 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 governments prior to the opening of the Davis Pond diversion. The Davis Pond diversion has not been consistently used 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. In an effort to have LDWF actively manage the public oyster areas and to allow the harvest of oyster by the public, the Commission designated this area as a public oyster seed ground in 2007. The location of the Little Lake POSGs makes it vulnerable to depressed salinities from rainfall, inflow from the Intracoastal Waterway and discharge from the Davis Pond diversion. Reduced salinities from increased freshwater input can negatively influence oyster survival and availability. However, when salinities are higher, the Little Lake POSGs have provided the oyster industry with additional seed and market-size oysters in Barataria Basin.

Methods
For the 2024 OSA, biologists collected field samples according to the methodology described in the Statewide Overview of this report. Between July 1 and July 22, 2024, nine stations were sampled and 45 replicate samples were collected (*Figure 3.1*). Biologists did not conduct sampling efforts in the Little Lake POSGs due to a lack of information on reef acreage.

Results and Discussion

Seed- and Market-Size Stock
The 2024 stock assessment estimated the amount of oysters available for harvest on the Hackberry Bay POSR and the Barataria Bay Cultch Plant as 26,731.8 barrels (bbl), of which 14,568.7 bbl are seed oysters and 12,163.1 bbl are market-size oysters. Seed oysters were only recorded at the Northern, 2008 Hackberry Cultch Plant and 2012 Hackberry Bay Cultch Plants. The seed availability in July 2024 was 146.9% higher than seed availability from July 2023 (5,901.7 bbl) and 57.8% above the 10-year LTA (2014-2023) (9,230.1 bbl) (*Figure 3.2*). The 2008 Hackberry Cultch Plant had the highest CPUE (17.8); however, the 2012 Hackberry Cultch Plant had the highest available barrels of seed (9,442.7 bbl) (*Table 3.1*).

Market-size oysters were only recorded at the Northern, 2008 and 2012 Hackberry Bay Cultch Plants. The market-size oyster availability in July 2024 was 801.7% higher than market-size availability from July 2023 (1,349.0 bbl) and 303.0% higher the 10-year LTA (2014-2023) (3,018.1 bbl) (*Figure 3.2*). The 2012 Hackberry Cultch Plant had the highest CPUE (4.4) and the highest available barrels of market-size oysters (9,892.4 bbl) (*Table 3.1*).

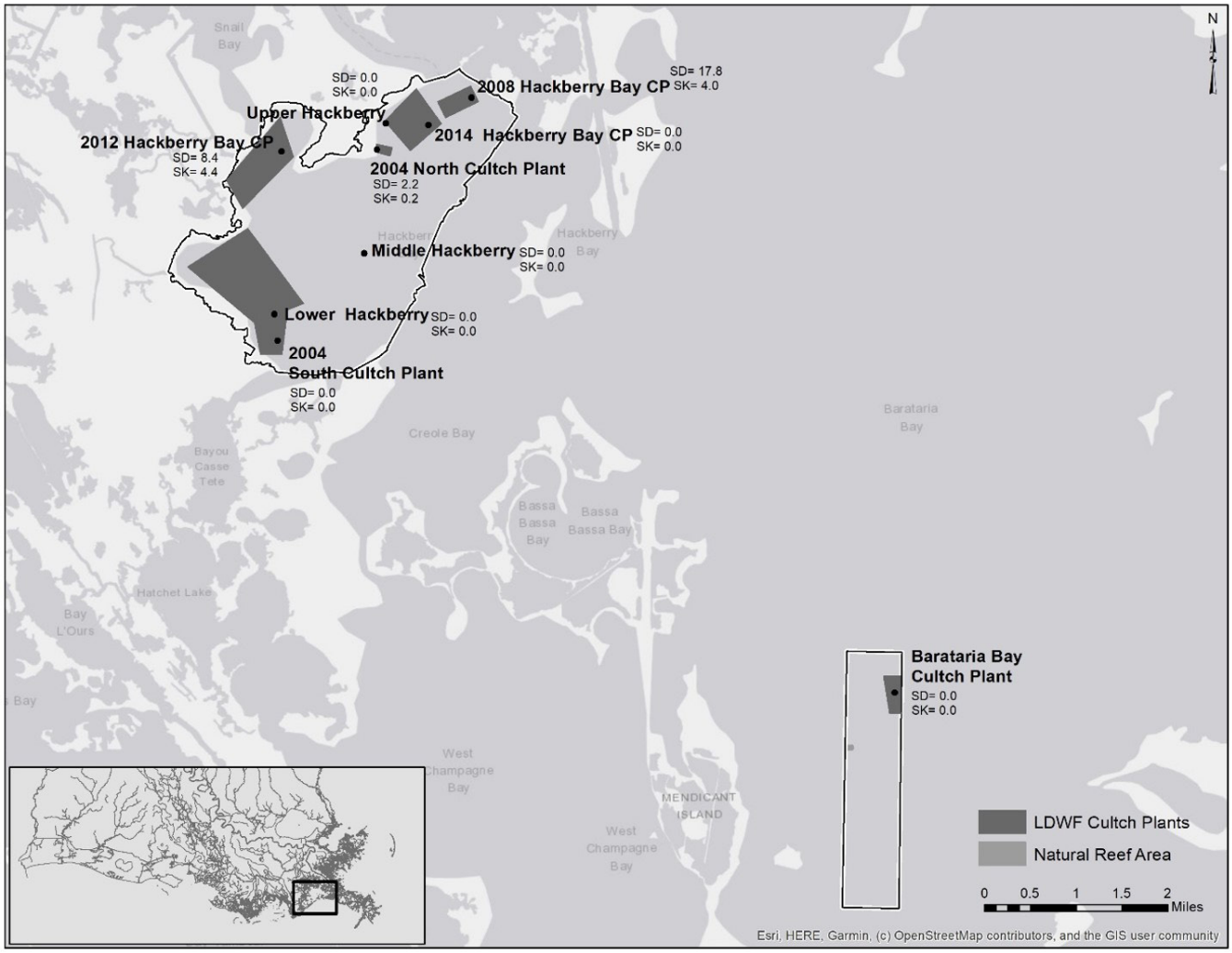

FIGURE 3.1. 2024 OSA average seed and market-size densities from square-meter sample stations (CSA-3).

TABLE 3.1. 2024 oyster availability by sampling station in CSA 3.

Station	Reef (acres)	Average Number Seed Oysters/m²	Average Number Market-size Oysters/m²	Seed Oysters (bbl)	Market-Size Oysters (bbl)
Lower Hackberry	4.9	0.0	0.0	0.0	0.0
Middle Hackberry	4.9	0.0	0.0	0.0	0.0
Upper Hackberry	4.9	0.0	0.0	0.0	0.0
N. Hackberry Bay Cultch Plant	10.0	2.2	0.2	**123.7** (247.3 sacks)	**22.5** (45.0 sacks)
S. Hackberry Bay Cultch Plant	25.0	0.0	0.0	0.0	0.0
2008 Hackberry Bay Cultch Plant	50.0	17.8	4.0	**5,002.4** (10,004.8 sacks)	**2,248.3** (4,496.5 sacks)
2012 Hackberry Bay Cultch Plant	200.0	8.4	4.4	**9,442.7** (18,885.4 sacks)	**9,892.4** (19,784.7 sacks)
2014 Hackberry Cultch Plant	30.0	0.0	0.0	0.0	0.0
Barataria Bay Cultch Plant	40.0	0.0	0.0	0.0	0.0
Total	***369.7***			***14,568.7 (29,137.5 sacks)***	***12,163.1 (24,326.2 sacks)***

The combined stock of 26,731.8 bbl of seed and market-size oysters showed a 268.7% increase from the 2023 estimate (7,250.7 bbl), and a 118.3% increase from the 10-year LTA (12,248.2 bbl). In Hackberry Bay, cultch material was collected at two of the eight sampling stations, while at the other six sampling stations, the only cultch material found was buried under 6 inches or more of mud. Market-size oyster availability has not been documented in Barataria Bay since the creation of the Barataria Bay Cultch Plant station in 2004.

Spat Production

There was a marked increase in spat density per square-meter in 2024 (8.8) compared to 2023 (5.7). During the 2024 OSA, recruitment was not observed at the Barataria Bay Cultch Plant. In Hackberry Bay alone, spat per square-meter was 9.9. In 2024, 396 total live spat were collected. The highest number of spat was found at the 2008 Cultch plant (300). This was 75.8% of the total spat sampled. Spat numbers are considerably higher this year due to decreasing salinity levels (<12ppt) in Hackberry Bay during spawning season (April-June).

Hydrological Data

Oyster habitat suitability for the Barataria-area seed grounds is highly influenced by the Mississippi River discharge and the Davis Pond diversion discharge. The United States Army Corps of Engineers (USACE) Tarbert gauge recorded Mississippi River discharge from July 1, 2023, to June 31, 2024, averaging 409,225 cubic feet per second (cfs), reaching a peak discharge of 807,129 cfs during May 2024. The United States Geologic Survey (USGS) constant recorder located near the Davis Pond diversion structure recorded a monthly average discharge of 1,329.3 cfs of Mississippi River flow being diverted through the structure into Davis Pond (July 2023-June 2024). The highest monthly average discharge over this period was 7,240.6 cfs during February 2024 (*Figure 3.3*).

Oyster habitat suitability is also highly influenced by the salinity and temperature of the surrounding water. Looking at *Figure 3.4*, oyster sites in the Barataria Basin were experiencing drought conditions from August 2023 through January 2024, with salinity well above its 10-year LTA. Salinity levels dropped in February 2024, which coincided with the Davis Pond Diversion opening (*Figures 3.3 and 3.4*). Water quality was also gathered from four United States Geological Survey (USGS) stations at Lake Cataouatche, Little Lake, Hackberry Bay and Grand Terre Island during July 2024. The water temperature in the Barataria area during July 2024 averaged 31.1°C, which was warmer than the July 10-year LTA of 30.5°C (*Figure 3.5*). Salinity averaged 7.0 ppt and the 10-year LTA was 6.7 ppt (*Figure 3.6*). The 2023 Hurricane Season generated 20 named storms, of which zero made landfall in Louisiana.

Fouling Organisms

One hooked mussel was present at one of the nine sampling stations, the 2008 Hackberry Bay Cultch plant. In comparison, during square-meter sampling in 2022, 16 hooked mussels were collected at two different stations.

Oyster Predators and Disease

For the 2024 stock assessment, four oyster drills were collected. In the last 10 years (2014-2023), biologists have collected 46 oyster drills during dredge and square-meter sampling; most of these have come from the 2004 Barataria Bay Cultch Plant. The low number of oyster drills found in LDWF samples can be correlated to the relatively low salinity levels typically found in Hackberry Bay. The LTA (2014-2023) for July salinity in Hackberry Bay is 6.7 ppt.

Mortality

Spat and seed mortality was documented at three sampling stations, North Hackberry, 2008 Hackberry Cultch Plant and 2012 Hackberry Bay Cultch Plants. Mortality rates for spat and seed at these three sites were 1.8% and 1.1%, respectively. No market-size oyster mortality was recorded at any station. The combined overall spat, seed and market-size oyster mortality was 1.4%, which was an increase from the 0.7% in the 2023 assessment.

Monthly dredge samples have provided an additional source of oyster mortality data. Between August 2023 and June 2024, dredge samples revealed an average monthly mortality of 4.4% for spat, seed and market-size oysters combined (*Figure 3.7*). *Figure 3.7* shows high spat mortality rates in September 2023, January 2024 and March 2024. This 4.4% average mortality was an increase from the same timeframe for the prior year- August 2022 to June 2023 (3.7% mortality). No definitive cause was found for these unusual mortality events over a wide portion of the basin. Low Dissolved Oxygen and Red Tide were ruled out, but no other cause was ever determined.

2023-2024 Oyster Season

The Hackberry Bay POSR and the Barataria Bay Cultch Plant were closed to harvest during the 2023-2024 oyster season.

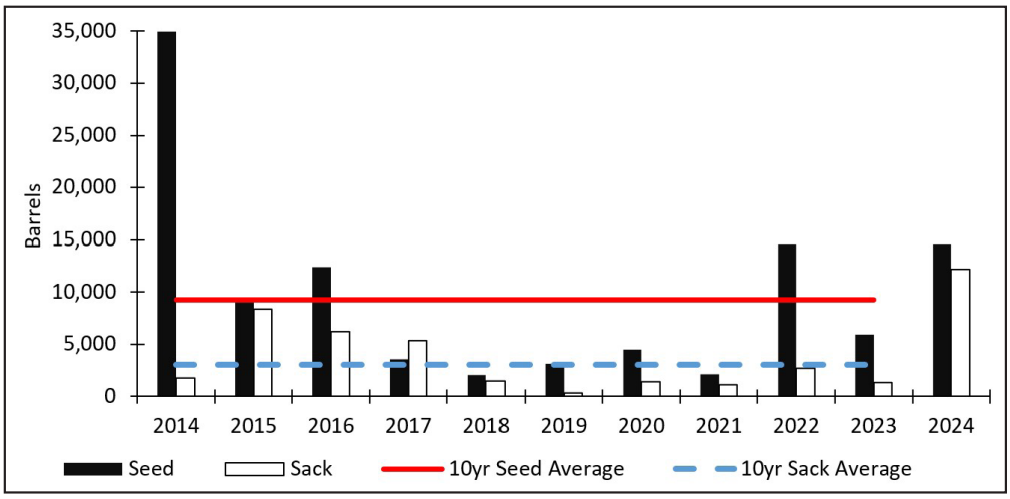

FIGURE 3.2. Hackberry Bay Oyster Seed Grounds historical oyster stock availability.

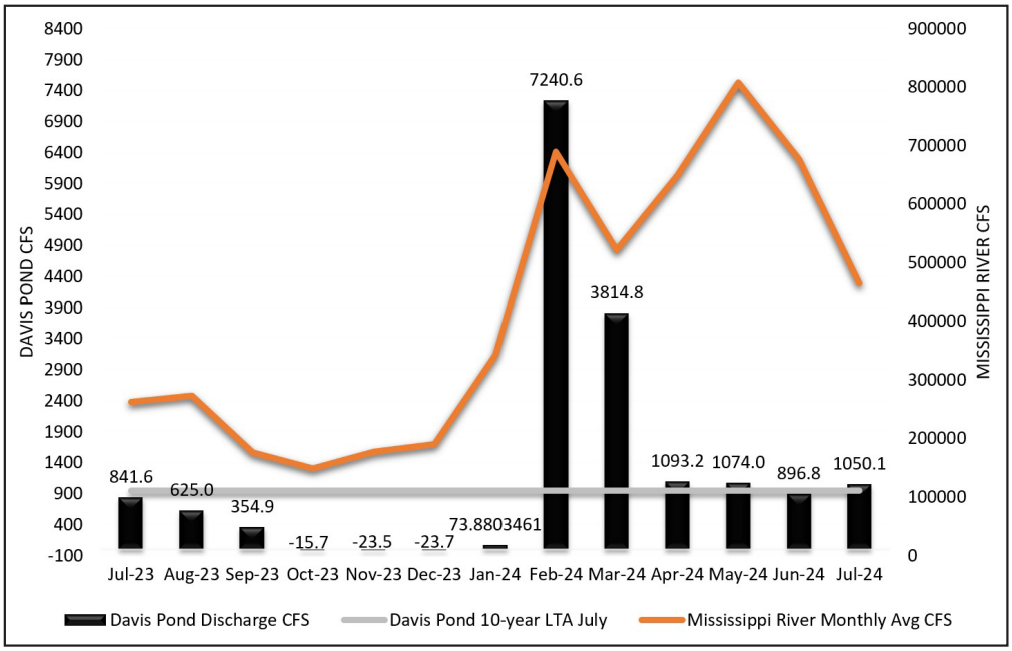

FIGURE 3.3. Davis Pond Diversion discharge (cfs) and Mississippi River flow at Tarbert Landing (cfs).

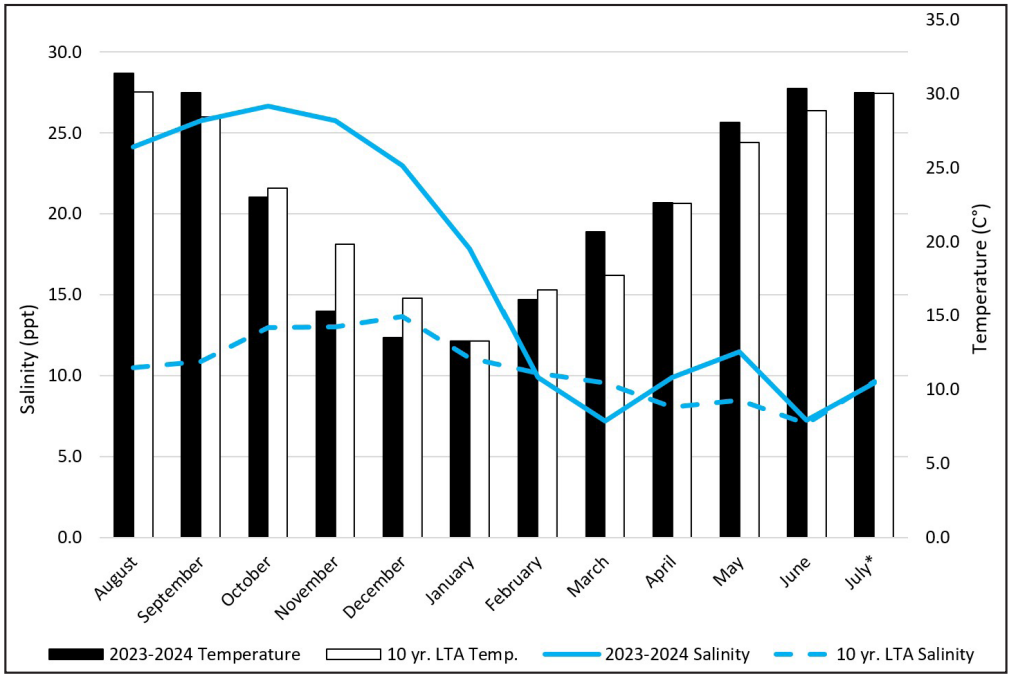

FIGURE 3.4. Mean salinity and temperature for Barataria Basin public oyster areas from August 2023 - July 2024, with the 10-year LTA (2014-2023).

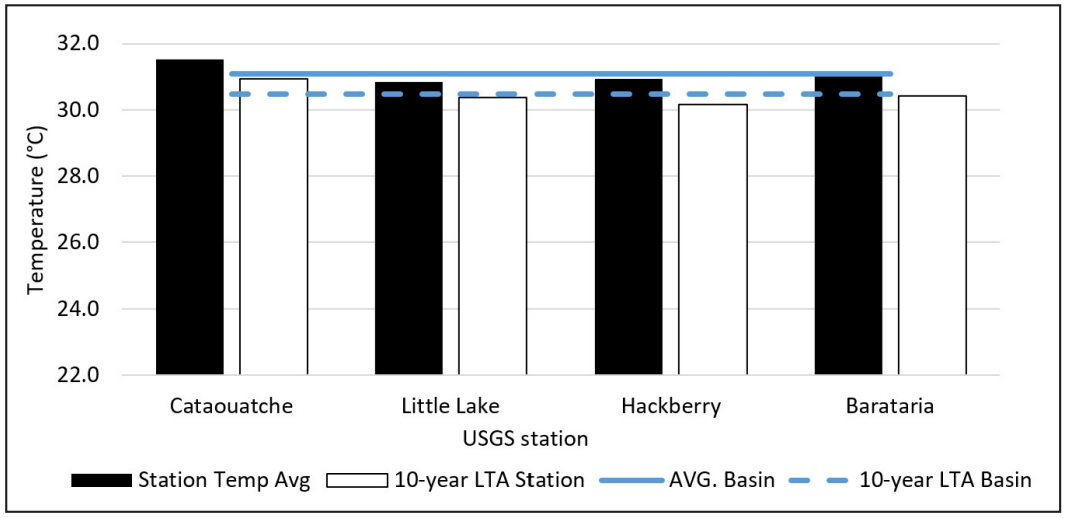

FIGURE 3.5. July 2024 water temperature averages in comparison to 10-year July LTA for the Barataria Basin from four USGS stations at Lake Cataouatche, Little Lake, Hackberry Bay and Grand Terre Island.

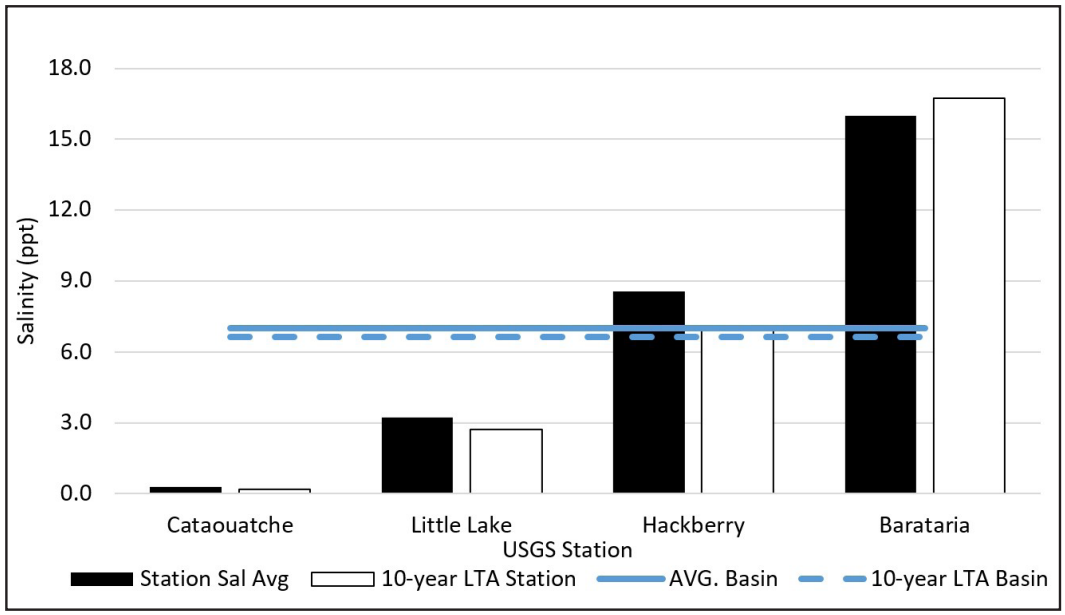

FIGURE 3.6. July 2024 water salinity averages in comparison to the 10-year July LTA for the Barataria Basin from four USGS stations at Lake Cataouatche, Little Lake, Hackberry Bay and Grand Terre Island.

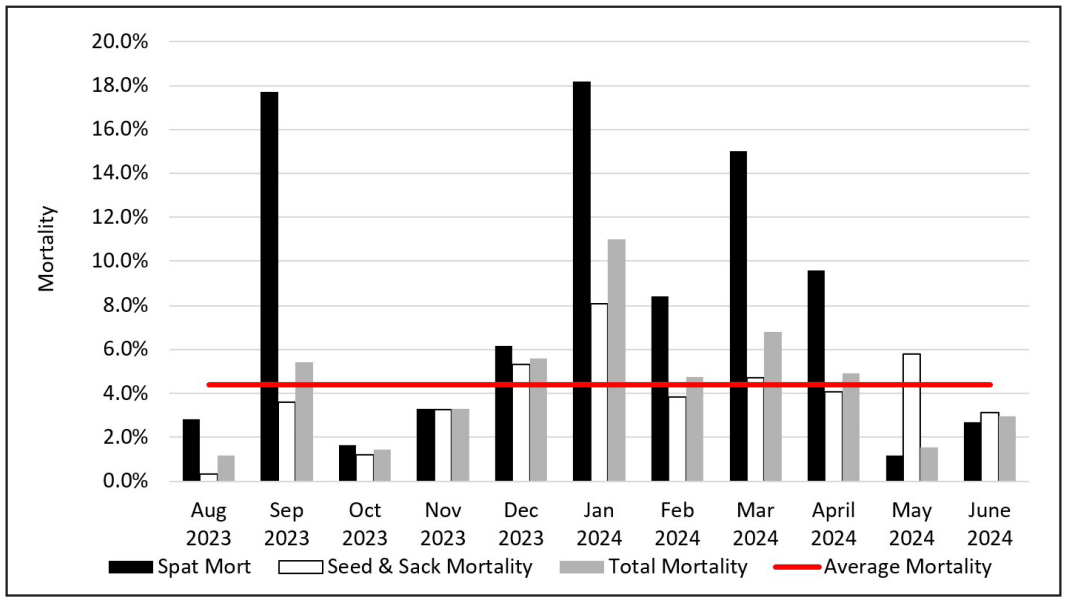

FIGURE 3.7. Oyster mortality from monthly dredge sampling in Barataria Basin - August 2023 to June 2024.

COASTAL STUDY AREA 5
(Terrebonne Basin)

Introduction

CSA 5 is comprised of the Terrebonne Basin from Bayou Lafourche west to the Atchafalaya River, including Terrebonne Bay, Timbalier Bay, Sister Lake, Lake Mechant and Caillou Bay. CSA 5 OSA are divided into eastern and western portions of the Terrebonne Basin. There are currently seven different public oyster areas within CSA 5. This includes the Sister Lake and Bay Junop POSRs and Lake Mechant POSGs, all in the western Terrebonne Basin (*Figure 5.1*), as well as the Deep Lake, Lake Felicity, Lake Chien and Lake Tambour POSGs in the eastern Terrebonne Basin (*Figure 5.2*).

The Commission designated Sister Lake as a POSR in 1940, and it includes 9,150.5 acres of water bottom (*Figure 5.1*). The most recent Sister Lake cultch plant was a 200-acre site in 2021. The 2021 Sister Lake cultch plant was funded through DWH NRDA settlement dollars to restore for injuries to oysters that occurred as a result of the April 2010 *Deepwater Horizon* oil spill in the Gulf of America. The current total reef acreage for Sister Lake is estimated to be 2,575.4 acres.

The Commission established the Bay Junop POSR in 1948, and it consists of approximately 2,646.5 acres of water bottom (*Figure 5.1*). Due to the shallow water depth of the bay and the inability of barges and tugs to enter for cultch plants, LDWF has not been able to construct artificial reefs in this area to augment natural oyster reef production. The current available public reef acreage in Bay Junop is estimated to be 157.8 acres.

The Commission established the Lake Mechant POSGs in 2001 and added acreage of unleased water bottoms between the designated POSGs and private oyster leases in 2007 (*Figure 5.1*). In 2004, LDWF constructed a 30-acre cultch plant. In total, this area consists of 2,583 acres, with the 30-acre cultch plant as the only known reef acreage within the area.

The Commission established the Lake Tambour, Lake Chien, Lake Felicity and Deep Lake POSGs in 2001; this area includes approximately 2,340 acres of water bottom in Lake Chien and Lake Fe-

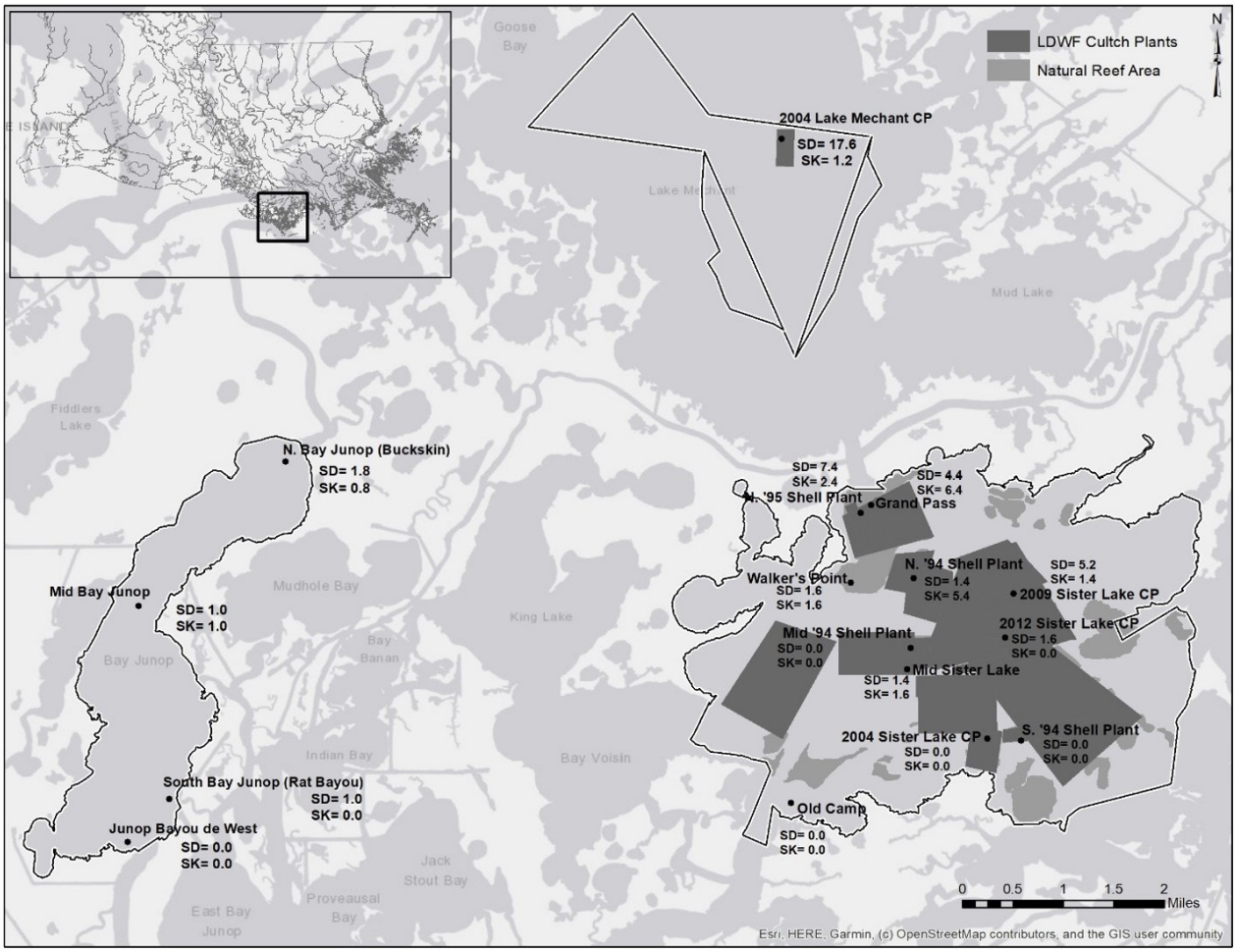

FIGURE 5.1. 2024 OSA average seed and market-size densities from square-meter sample stations (CSA-5 Western Terrebonne Basin).

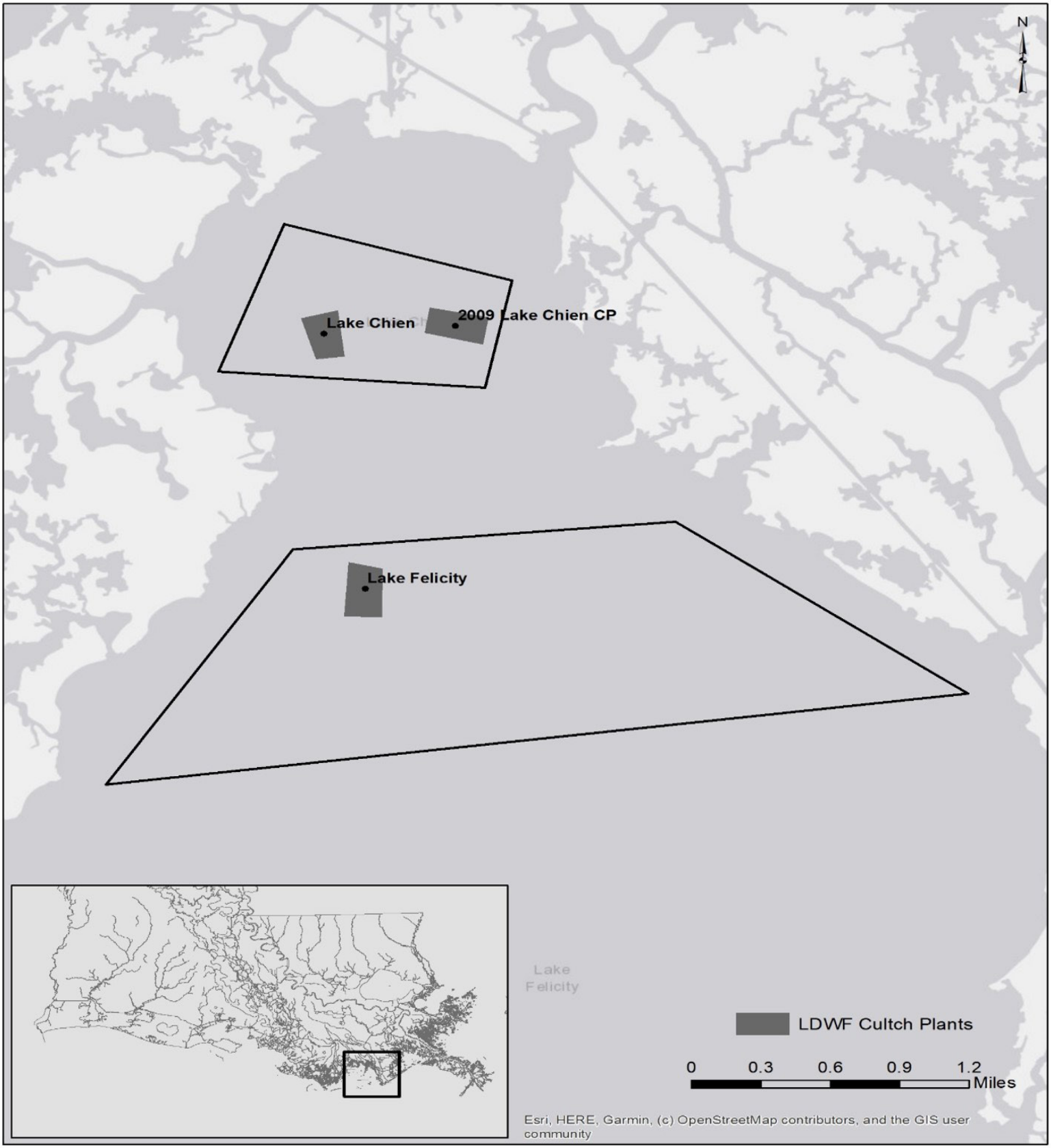

FIGURE 5.2. Square-meter sample stations (CSA-5 Eastern Terrebonne Basin).

licity (*Figure 5.2*). Prior to the more current public seed ground establishment, the areas of and around Lake Felicity had been used as oyster seed reservations in the 1940s and early 1950s, but this has since been discontinued. Salinities in Lake Tambour, Lake Chien, Lake Felicity and Deep Lake are consistently at a higher range than what is considered tolerable for oyster production, but future coastal restoration projects may return the area to a more favorable salinity regime.

Three cultch plants have been built within the Eastern portion of CSA 5: 1) a 16-acre cultch plant in Lake Chien, completed in 2004, 2) a 40-acre cultch plant in Lake Felicity, completed in 2004, and 3) a 22-acre cultch plant due east of the initial Lake Chien cultch plant, completed in May 2009 (*Figure 5.2*). LDWF has not developed any reefs in Lake Tambour or Deep Lake.

Methods

LDWF biologists collected field samples for the 2024 OSA on July 8 and 10, 2024, from 16 sample stations within CSA 5 according to the methodology described in the Statewide Overview of this report. Sample stations included existing oyster reefs in Sister Lake, Bay Junop and Lake Mechant.

Due to lack of live resource in the eastern Terrebonne Basin since 2019, it was decided in September 2022 to reduce square-meter sampling frequency for the three sample stations in Lake Felicity and Lake Chien to every other year, starting in July 2023, to follow the same schedule as Sabine Lake square-meter sampling. No square-meter samples in Lake Felicity and Lake Chien were collected for the 2024 OSA as per established sampling schedule.

Results and Discussion

Seed- and Market-Size Stock

The 2024 OSA estimated the stock in the western Terrebonne Basin of CSA 5 at 21,552.6 bbl of seed oysters and 28,912.6 bbl of market-size oysters (*Tables 5.1 and 5.2*).

In Sister Lake, the most productive oyster area in CSA 5, estimated seed availability for 2024 was 82.0% below the 10-year LTA (2014-2023), and the estimated market-size availability was 26.6% below the 10-year LTA. The 2024 OSA estimated 17,809.8 bbl of seed and 27,529.7 bbl of market-size oysters on the Sister Lake POSR, of which 45.1% (8,041.5 bbl) of available seed and 45.3% (12,482.4 bbl) of available market-size oysters were located in the Grand Pass Reef Complex (*Figure 5.3; Tables 5.1 and 5.3*). Monthly oyster dredge sampling for the timeframe between the 2023 OSA and the 2024 OSA (August 2023-June 2024) indicated the highest spat count in June and the lowest in May in Sister Lake. Overall, seed and market-size oyster mortality was 4.4% and 0.6% for this same period, respectively. The southern shoreline of Sister Lake continues to erode, creating more sedimentation over once productive oyster reefs and causing increased salinities that introduce an increasing number of natural oyster predators. The northern portion of Sister Lake remains productive due to less overburden and more exposed cultch material.

In Bay Junop, estimated seed oyster availability for 2024 was 4.2% below the 10-year LTA (2014-2023) and estimated market-size oyster availability was 0.3% below the 10-year LTA (2014-2023). The 2024 OSA estimated 775.1 bbl of seed and 978.2 bbl of market-size

TABLE 5.1. 2024 Sister Lake oyster availability by sample station.

Station	Reef (Acres)	Average Number Seed Oysters/m^2	Average Number Market-Size Oysters/m^2	Seed Oysters (bbl)	Market- Size Oysters (bbl)
Grand Pass	320	4.4	6.4	**8,041.5** (16,083.0 sacks)	**12,482.4** (24,964.8 sacks)
Walker's Point		1.6	1.6		
N. '95 Shell Plant		7.4	2.4		
Grand Pass Reef Complex	**Cumulative**	4.5	3.5		
Old Camp	140	0.0	0.0	0.0	0.0
Mid-Sister Lake	56	1.4	1.6	**438.9** (877.8 sacks)	**1,003.1** (2,006.2 sacks)
N. '94 Shell Plant	191	1.4	5.4	**1,503.3** (3,006.6 sacks)	**11,596.7** (23,193.4 sacks)
Mid '94 Shell Plant	552	0.0	0.0	**621.0** (1,242.0 Sacks)	0.0
S. 94' Shell Plant	513	0.0	0.0	0.0	0.0
2004 Sister Lake CP	82	0.0	0.0	0.0	0.0
2009 Sister Lake CP	156	5.2	1.4	**4,545.4** (9,090.8 sacks)	**2,447.5** (4,895.0 sacks)
2012 Sister Lake CP	365	1.6	0.0	**3,280.7** (6,561.4 sacks)	0.0
Total	***2,375***			***17,809.8 (35,619.6 sacks)***	***27,529.7 (55,059.4 sacks)***

TABLE 5.2. 2024 Bay Junop/Lake Mechant oyster availability by sample station.

Station	Reef (Acres)	Average Number Seed Oysters/m^2	Average Number Market-size Oysters/m^2	Seed Oysters (bbl)	Market- Size Oysters (bbl)
North Bay Junop (Buckskin)	17	1.8	0.8	**174.0** (348.0 sacks)	**154.7** (309.4 sacks)
South Bay Junop (Rat Bayou)	67	1.0	0.0	**189.3** (378.6 sacks)	0.0
Junop Bayou de West		0.0	0.0		
South Bay Junop Reef Complex	**Cumulative**	0.5	0.0		
Mid Bay Junop	73	1.0	1.0	**411.8** (823.6 sacks)	**823.5** (1,647.0 sacks)
2004 Lake Mechant CP	30	17.6	1.2	**2,967.7** (5,935.4 sacks)	**404.7** (809.4 sacks)
Total	***187***			***3,742.8 (7,485.6 sacks)***	***1,382.9 (2,765.8 sacks)***

TABLE 5.3. 2024 Oyster availability and percent change from 2023 and from the 10-year LTA for Sister Lake, Bay Junop and Lake Mechant.

Region	Area	Seed Oysters (bbl)				Market-size Oysters (bbl)			
		LTA	2023	Change from LTA	Annual Change	LTA	2023	Change from LTA	Annual Change
Western Terrebonne Basin	Sister Lake	99,177.0	17,809.8	-82.0%	-89.3%	37,489.6	27,529.7	-26.6%	-84.3%
	Bay Junop	808.8	775.1	-4.2%	100.0%	980.7	978.2	-0.3%	2,429.7%
	Lake Mechant	1,844.7	2,967.7	60.9%	57.1%	0.0	404.7	100.0%	100.0%

oysters on the Bay Junop POSR. In Lake Mechant, estimated seed and market-size oyster availability for 2024 was 60.9% and 100.0% above the 10-year LTA (2014-2023), respectively. The 2024 OSA estimated 2,967.7 bbl of seed and 404.7 bbl of market-size oysters on the Lake Mechant POSG (*Figures 5.4 and 5.5; Tables 5.2 and 5.3*). Lake Mechant and the northern portion of Bay Junop, near Buckskin Bayou (Sample Station 3038), receive input from the Atchafalaya River via Blue Hammock Bayou on an annual basis. This can have a large influence on salinity levels, which inhibits oyster growth and productivity in this area. Lower Atchafalaya River levels over the past two years have allowed salinities to stabilize, causing oyster growth and productivity to increase resource availability in both Bay Junop and Lake Mechant. This is most notable in Lake Mechant, which had an annual increase of 57.1% and 100.0% resource availability for seed and market-size oysters, respectively. From August 2023 through June 2024, the highest spat concentrations in monthly oyster dredge sampling were observed in November in Bay Junop and in March in Lake Mechant. In Bay Junop, although having much exposed cultch material available, there is also a high presence of hash material which may be limiting oyster production. As in Sister Lake, the southern shoreline of Bay Junop is continuing to degrade, allowing salinities to fluctuate based on prevailing wind direction and river discharge.

Spat Production

In the 2024 OSA, the number of oyster spat ranged from zero to 65.0 per sample replicate. The 2012 Sister Lake cultch plant had the highest sample station average of 32.4 per square-meter. In the western Terrebonne Basin, Sister Lake had the most spat at 351.0 overall. Lake Mechant and Bay Junop had overall totals of 45.0 and 71.0 spat, respectively.

June dredge data for Sister Lake, Lake Mechant and Bay Junop averaged 57.9, 17.5 and 3.8 spat per dredge sample, respectively. Sister Lake and Lake Mechant spat mortality was 5.1% and 5.4%, respectively. There was no spat mortality observed in Bay Junop. No dredge samples were scheduled in Lake Chien and Lake Felicity in June.

Hydrological Data

The monthly average water temperature for Sister Lake ranged from 9.6 to 31.8°C and monthly average salinity ranged from 7.7 to 29.0 ppt, with the 10-year LTA (2014-2023) being 22.3ºC and 12.6 ppt, respectively (*Figure 5.6*). Monthly average water temperature and salinity for Bay Junop ranged from 10.6 to 32.2°C and 8.3 to 27.5 ppt, with the 10-year LTA (2014-2023) being 22.4°C and 12.6 ppt, respectively (*Figure 5.7*). Monthly average water temperature and salinity for Lake Mechant ranged from 9.4 to 32.4°C and 0.8 to 26.7 ppt, with the 10-year LTA (2014-2023) being 22.2°C and 5.9 ppt, respectively (*Figure 5.8*). Biologists collected this data during dredge sample events from August 2023 through June 2024 and during July 2024 square-meter samples. In the western Terrebonne Basin, average temperature and salinity measurements collected concurrently with July 2024 square-meter sampling in Sister Lake, Bay Junop and Lake Mechant averaged 30.0°C and 8.8 ppt, 29.9°C and 11.0 ppt and 30.7°C and 2.5 ppt, respectively.

Due to the change in sampling frequency in the eastern Terrebonne Basin, no hydrology data is presented in this report.

No tropical storm, hurricane, or high river events affected the Terrebonne Basin during the 2023-2024 oyster season.

Fouling Organisms

Hooked mussels were the most abundant incidental species in western Terrebonne Basin samples with an overall average of 2.9 hooked mussels per square-meter. Of this overall average, Lake Mechant had the highest occurrence with 19.6 hooked mussels per square-meter.

June dredge data for Sister Lake, Lake Mechant and Bay Junop averaged 34.9, 1,042.0 and 2.8 hooked mussels per dredge sample, respectively. No dredge samples were scheduled in Lake Chien and Lake Felicity in June.

Oyster Predators and Disease

Biologists collected three types of predator species (mud crab, stone crab and southern oyster drill) during 2024 square-meter sampling. Western Terrebonne Basin samples showed an average of 0.5 mud crab, 0.04 stone crab and 0.1 southern oyster drill per sample.

June dredge data for Sister Lake averaged 5.0 mud crabs, 0.1 oyster drills and 0.4 stone crabs per dredge sample, respectively. June dredge data for Bay Junop averaged 0.5 mud crabs, 0.3 stone crabs and 0.3 oyster drills per dredge sample, respectively. June dredge data for Lake Mechant averaged 9.0 mud crabs per dredge sample. No dredge samples were scheduled in Lake Chien and Lake Felicity in June.

Mortality

Biologists observed no seed or market-size oyster mortality throughout square-meter samples in the western Terrebonne basin. Overall, spat mortality in Sister Lake was 3.3%. No spat mortality was observed in Bay Junop and Lake Mechant.

For June 2024 dredge sampling, no market-size oyster mortality was observed in Sister Lake, Bay Junop and Lake Mechant. Sister Lake seed and spat mortality was 3.3% and 5.1%, respectively; and there was no seed or spat mortality in Bay Junop. Lake Mechant seed and spat mortality was 0.7% and 5.4%, respectively.

In Sister Lake, overall seed and market-size mortality for yearly dredge sampling (August 2023 through June 2024) averaged 4.4% and 0.6%, respectively. Overall, seed and market-size mortality was 14.7% and 4.5%, respectively, in Bay Junop during the sampling year. Overall, seed mortality was 0.8% and no market-size oyster mortality was observed in Lake Mechant during the sampling year.

2023-2024 Oyster Season

The Commission opened Sister Lake on Oct. 9, 2023, for a one-day bedding season. The estimated total of oyster resource harvested was 3,650 bbl. Sister Lake was opened Oct. 10-30, 2023, for sacking of market-size oyster only, with a daily take and possession limit of 30 sacks per vessel per day. Market-size oyster harvest was estimated at 34,921 sacks. Sister Lake opened for a second time March 4-10, 2024, for sacking of market-size oyster only, with a daily take and possession limit of 30 sacks per vessel per day. Market-size oyster harvest was estimated at 16,182 sacks. Sister lake opened for a third time March 22-28, 2024, for sacking of market-size oysters only, with a daily take and possession limit of 30 sacks per vessel per day. Market-size oyster harvest was estimated at 18,185 sacks. Harvest data estimates were collected by biologists while performing daily boarding runs.

The Bay Junop POSR, Lake Mechant, Lake Chien and Lake Felicity POSGs were closed to harvest during the 2023-2024 oyster season.

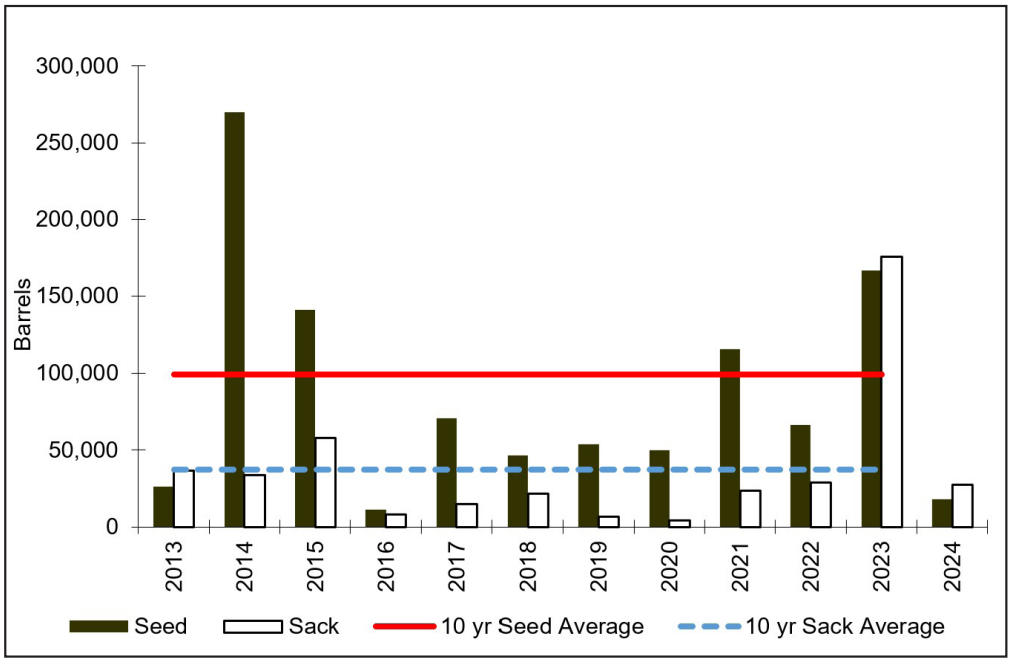

FIGURE 5.3. Sister Lake historical oyster stock availability.

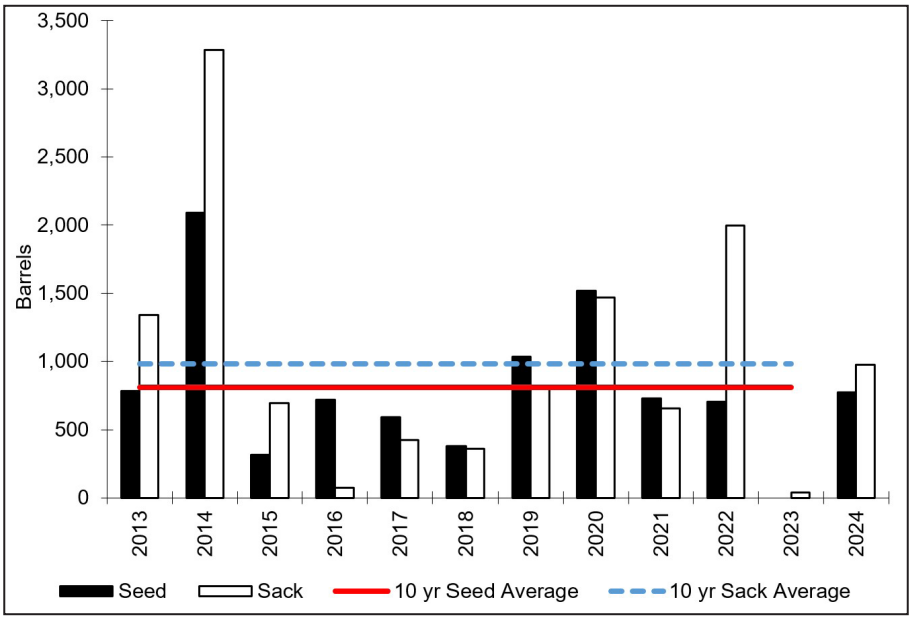

FIGURE 5.4. Bay Junop historical oyster stock availability.

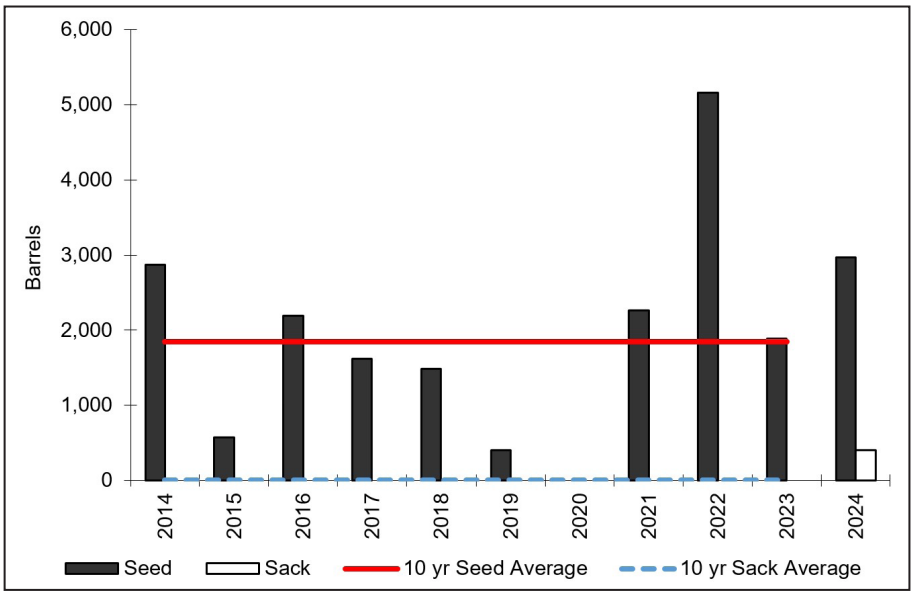

FIGURE 5.5. Lake Mechant historical oyster stock availability.

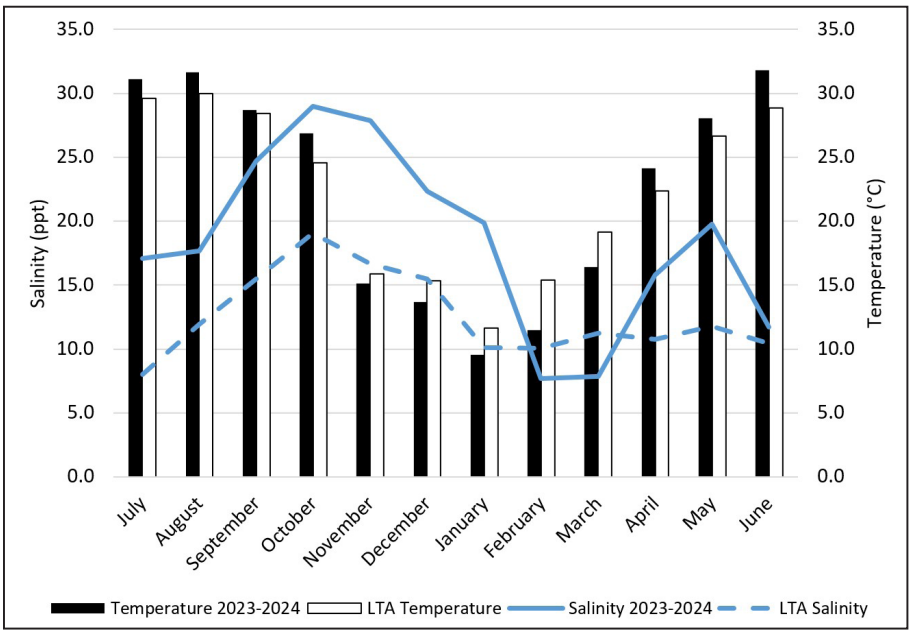

FIGURE 5.6. Mean salinity and temperature for the Sister Lake Public Oyster Seed Reservation from July 2023 - June 2024, with the 10-year LTA (2014-2023).

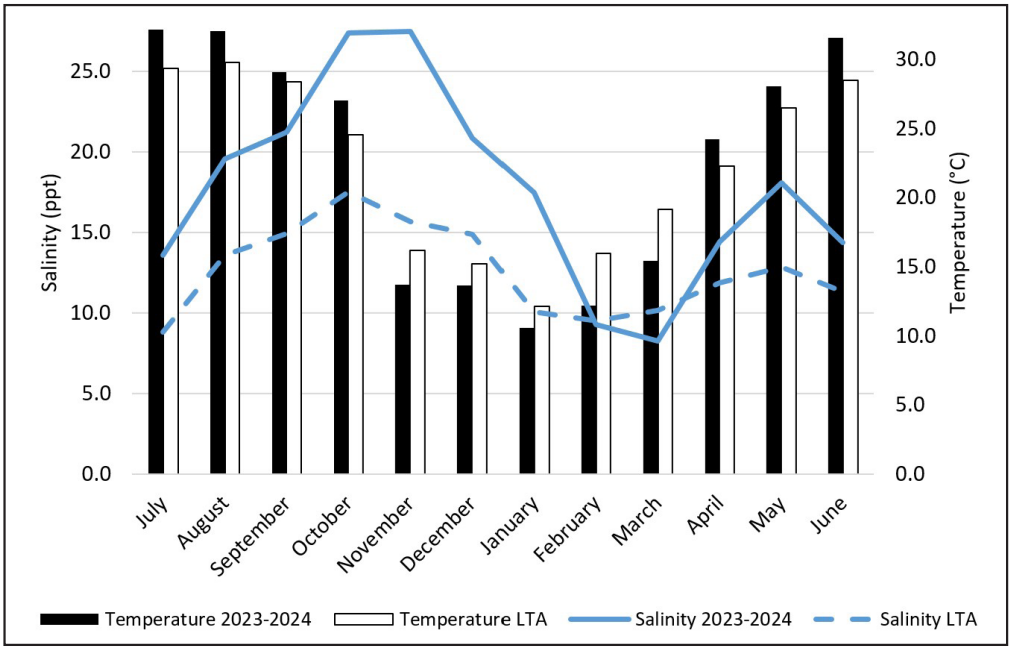

FIGURE 5.7. Mean salinity and temperature for the Bay Junop Public Oyster Seed Reservation from July 2023 - June 2024, with the 10-year LTA (2014-2023).

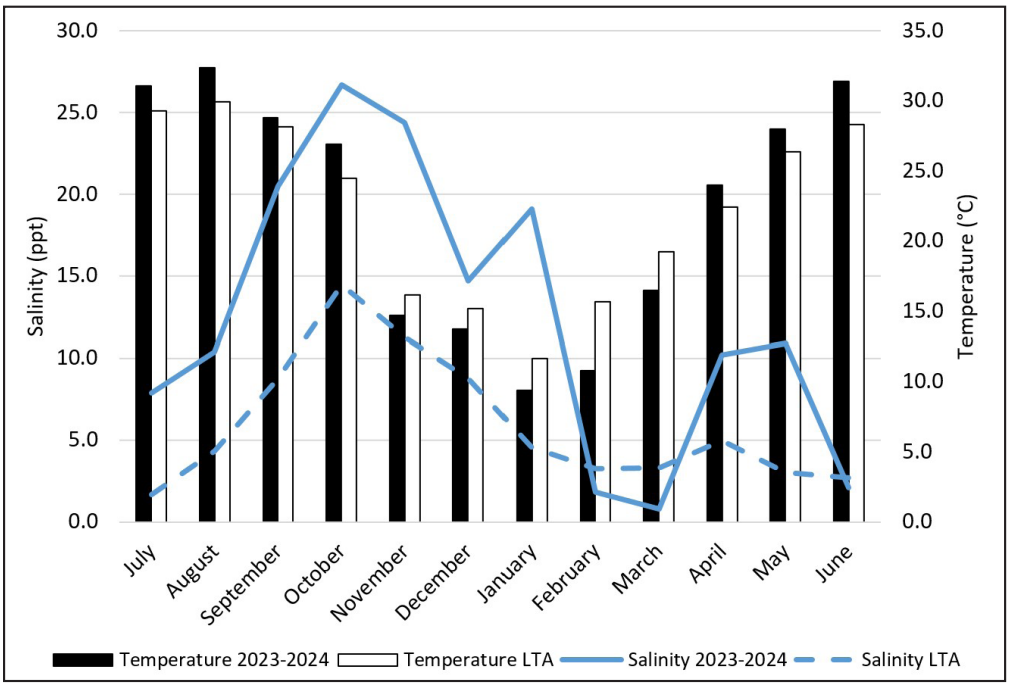

FIGURE 5.8. Mean salinity and temperature for the Lake Mechant Public Oyster Seed Grounds from July 2023 - June 2024, with the 10-year LTA (2014-2023).

COASTAL STUDY AREA 6
(Teche/Vermilion/Atchafalaya Basins)

Introduction
CSA 6 includes oyster reefs found in the Vermilion/East and West Cote Blanche/Atchafalaya POSGs. The Commission established the inside portion of these POSGs in 1990; this area consists 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 Commission established the outside portion of these POSGs in 1988; this area consists of Louisiana State Territorial Waters from the private oyster lease boundary near Mound Point/Marsh Island eastward to Point Au Fer. LDWF manages the oyster resources found on local state water bottoms in a manner similar to current management procedures for POSGs. Management allows limited harvest/relays from the Vermilion Bay area reefs when oyster abundance and distribution permitted.

The Vermilion/East and West Cote Blanche/Atchafalaya Bays complex is a large, primarily open-water brackish system; the POSGs in this area consist of approximately 541,787 acres of water bottom (*Figure 6.1*). Primary influences on the dynamic salinity regime of this bay complex are the Gulf of America, Atchafalaya River, Wax Lake Outlet and the Vermilion River. In general, freshwater discharge from the Atchafalaya River highly influences the POSGs within CSA 6. Independent of local rainfall, biologists have noted a correlation between increasing Atchafalaya River flow and decreasing salinity levels in the bay system. Typically, oyster reproduction occurs in the fall after the river stage abates, with oysters growing to seed size (1 inch to less than 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 result 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 2018 when sizable quantities of seed oysters were available for harvest. LDWF manages these seed grounds similar to other areas allowing limited harvest and relays when oysters are in abundance.

An overall OSA for CSA 6 is not possible at this time, as figures relative to oyster reef sizes are not available. This report compares square-meter density data collected from the 2024 OSA sampling to previous years' square-meter sampling data, with a look at hydrologic conditions, marine fouling and oyster predators on sampled reefs. Observations of monthly dredge data collected during August 2023 through June 2024 are included. In addition, the report also presents information regarding the 2023-2024 oyster season on all CSA 6 public oyster areas.

Methods
LDWF biologists collected field samples for this report on July 10 and 11, 2024, from 11 sample stations (*Figure 6.1*) within CSA 6 according to the methodology described in the Statewide Overview of this report.

Results and Discussion

Seed- and Market-Size Stock
Biologists found live seed oysters at nine of the 11 sample stations (*Figure 6.1*). Densities of live seed ranged from 0.4 per replicate to 25.2 per replicate. Biologists collected market-size oysters at North Reef, Middle Reef, Highspot, Indian Point, Lighthouse Point and Nickle Reef with densities of 0.6, 1.0, 1.8, 3.4, 12.2 and 19.6 oysters per replicate, respectively. There was only a 7.4% increase in the mean density of seed oysters in 2024 square-meter samples compared to 2023, and a 331.2% increase compared to the 10-year LTA (2014-2023). There was a 562.3% increase in the mean density of market-size oysters in 2024 square-meter samples compared to 2023, and a 3,090.9% increase compared to the previous 10-year LTA (2014-2023). Due to the lack of water bottom assessments in CSA 6, a total estimate of oyster resource cannot be determined; instead, CSA 6 data is reported in mean density (*Figure 6.2*).

Catch per unit effort (CPUE) of seed oysters in CSA 6 was highest during May 2024 dredges, with a value of 94.0 per replicate. The lowest CPUE of seed oysters occurred in the January 2024 dredges, with a value of 48.1 per replicate. The CPUE of market-size oysters in CSA 6 dredge samples was highest during May and June 2024, at 33.2 per replicate and lowest in September 2023, at 10.0 per replicate.

Spat Production
There was suitable substrate at all sample stations and biologists found live spat at nine of 11 sample stations. The density of spat at most of the sites ranged from 0.6 per replicate to 5.6 per replicate. Nickle Reef had a spat density of 102.8 per replicate. Low spat productivity during periods of low salinity conditions has been common in this bay system; however, 2023 was conducive for spat production. Spat were recorded in high numbers during routine dredge samples in August, September/November of 2023 and again in June 2024. The CPUE of spat in CSA 6 dredge samples was highest in August 2023, with a value of 71.7 spat per replicate. The CPUE of spat dropped steadily to a low of 9.0 spat per replicate in May 2024 before jumping to 28.4 spat per replicate in June 2024.

Hydrological Data
The Atchafalaya River levels remained well below their 10-year LTA from August through December 2023. River levels were near average during January and February 2024, below average during March/April 2024 and near average during May and June 2024 (*Figure 6.3*). The observed river levels during spring 2024 were

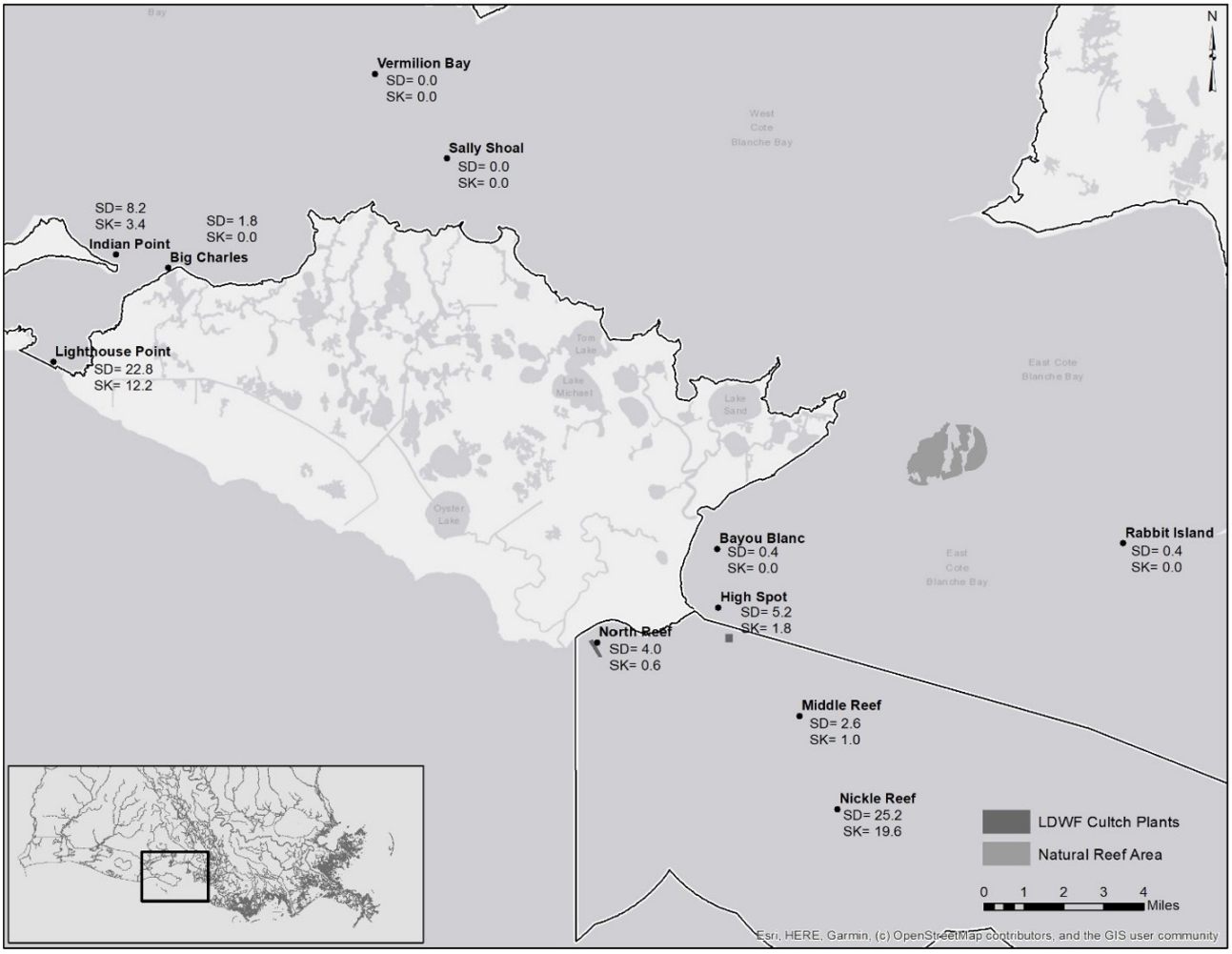

FIGURE 6.1. 2024 OSA average seed and market-size densities from square-meter sample stations (CSA 6).

lower than expected but there was still a decline in average salinities within the area of CSA 6. The average salinities during August 2023-February 2024 were well above their 10-year LTA and signifies drought conditions for this area (*Figure 6.4*). However, the Atchafalaya River levels returned to normal in January and February, which caused the corresponding salinity decrease (*Figures 6.3 and 6.4*). The river levels from January through June 2024 were near or above the 10-foot mark, which caused the Vermilion Bay salinities to drop and remain below average during May and June (*Figures 6.3 and 6.4*). Even though the Atchafalaya River levels were below average during July, a high amount of rainfall was observed.

Bottom dissolved oxygen readings taken during July 2024 were within the normal ranges at 10 of 11 stations and ranged from 6.3 to 7.1 milligrams per liter (mg/L). The exception was Nickle Reef, which had a reading of 4.0 mg/L. Even with above average water temperatures and mostly normal dissolved oxygen levels, no significant mortality was observed. There were no significant hurricane/tropical storm events during the sampling period.

Fouling Organisms

Biologists documented an overall 56.2% decrease in hooked mussel abundance at the sample stations compared to 2023 OSA. Big Charles, Sally Shoal, Lighthouse Point, Bayou Blanc, Middle Reef and Nickle Reef all experienced a decrease in hooked mussel densities, some being substantial. The Bayou Blanc sample station showed the largest decrease in hooked mussel density, dropping from an average of 37.2 per replicate in the 2023 OSA to 1.4 per replicate in the 2024 OSA. Indian Point, Vermilion Bay, Highspot, Rabbit Island and North Reef all experienced slight increases in hooked mussel densities.

Oyster Predators and Disease

Biologists found no southern oyster drills during 2024 square-meter sampling. These marine snails are more often associated with high salinity waters where they are known to prey heavily on oysters and other bivalve species. The occurrence of mud crab on historically sampled reefs increased by 54.3% compared to the 2023 OSA. Vermilion Bay and Sally Shoal had no mud crabs sampled. However, mud crab density reached a high of 7.4 crabs per replicate at Lighthouse Point. This density was slightly less than the mud crab density sampled at the same site in 2023 (8.2 crabs per replicate). Biologists collected one blue crab each at Nickle Reef and Highspot. They collected one stone crab at Indian Point and three at Lighthouse Point during the 2024 square-meter sampling.

Mortality

There were no large-scale mortality events observed during 2023-2024 and conditions in the areas monitored by CSA 6 were favorable for oyster growth during most months. During most of 2023 and 2024, there were significant numbers of seed size oysters observed in monthly dredge samples collected throughout the year at all sites except Sally Shoal. Those seed oysters sampled in October, November and December were sampled as market-size

oysters in April, May and June. There were no notable mortality events observed during the 2023-2024 dredge sampling period even though freshwater conditions persisted through spring and into summer. Nine of 11 stations sampled during the 2024 square-meter sampling event contained live oysters. Big Charles, Indian Point, Highspot, Nickle Reef, Middle Reef, North Reef and Lighthouse Point contained notable numbers of live oysters. The oyster stock found in CSA 6 is highly vulnerable to low salinity/high turbidity conditions, often seen as a result of extended freshwater conditions associated with high Atchafalaya River discharge.

2023-2024 Oyster Season

The Commission opened Vermilion/East and West Cote Blanche Bay/Atchafalaya Bay POSGs for a one-day bedding season on Oct. 9, 2023. No vessels were observed harvesting oysters for bedding. The Commission opened Vermilion/East and West Cote Blanche Bay/Atchafalaya Bay POSGs for sacking of market-size oysters on Nov. 13, 2023, through April 1, 2024. No vessels were observed harvesting market-sized oysters at any point during the season.

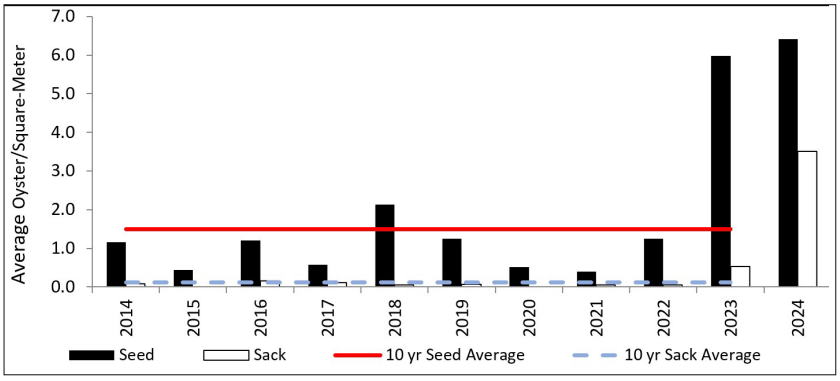

FIGURE 6.2. Teche/Vermilion/Atchafalaya Basins historical oyster stock availability. Availability is in mean density of live seed and market-size oysters.

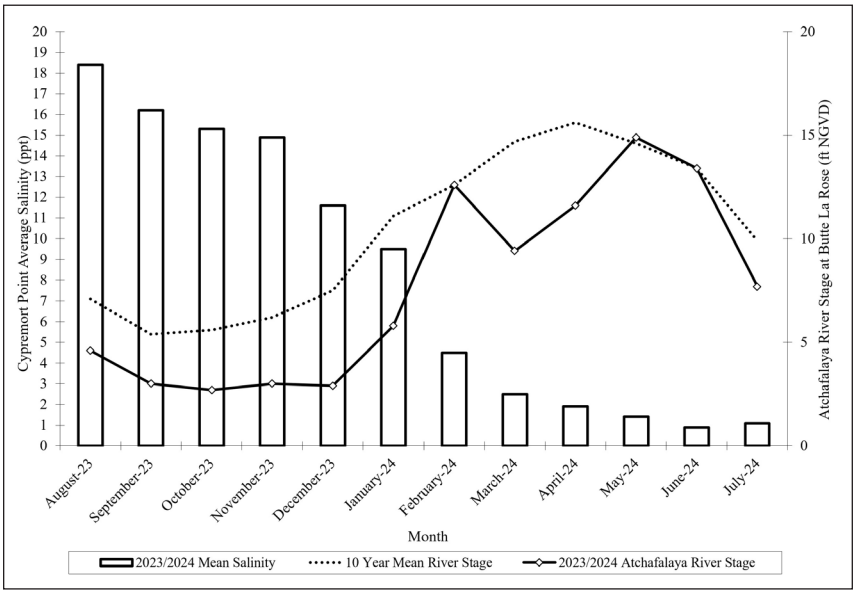

FIGURE 6.3. Atchafalaya River levels at Butte La Rose gauge and average salinity for Cypremort Point, LA, during the period August 1, 2023 through July 31, 2024. The 10-year LTA monthly river stage at Butte La Rose is included.

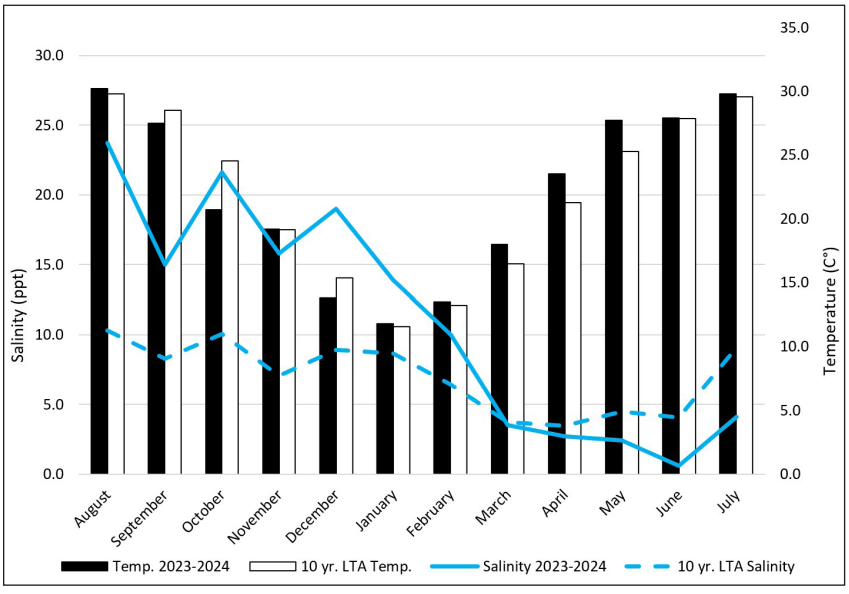

FIGURE 6.4. Mean salinity and temperature for Teche/Vermilion/Atchafalaya Basins public oyster areas from August 2023 - July 2024, with the 10-year LTA (2014-2023).

COASTAL STUDY AREA 7
(Calcasieu and Sabine Lakes)

Introduction

CSA 7 is located in Southwest Louisiana, from the Louisiana/Texas state line to Freshwater Bayou in Vermilion Parish. It is comprised of the 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; the lake consists of approximately 58,260 acres of water bottom with oyster reefs located throughout, but concentrated in the southern end (*Figure 7.1*). There are no oyster harvesting areas in the Mermentau River Basin. Sabine Lake, located at the southern end of the Sabine River Basin in Cameron Parish, consists of approximately 55,057 acres of water bottom. Approximately 34,067 acres are located in the Louisiana portion of the lake; the remainder is in the Texas portion. The majority of oyster reefs on the Louisiana portion of Sabine Lake are located in the very southern portion of the lake.

For assessment purposes, Calcasieu Lake has always been divided into two areas, East Side and West Cove, with the Calcasieu Ship Channel being the dividing line. The Louisiana Department of Health (LDH) classified the areas as conditionally managed giving LDH the authority to close the areas to oyster harvest based on health related concerns due to poor water quality. It has been established that health related closures of oyster harvest in Calcasieu Lake (East Side) occur when the river stage reaches 13.5 feet, and West Cove would close when the river stage reaches 9 feet. Once the river falls below these levels for 48 hours, LDH reopens the areas for harvest. Additionally, the East Side of Calcasieu Lake and West Cove are classified as Growing Area 29 (GA29) and Growing Area 30 (GA30), respectively (*Figure 7.1*). LDH seasonal closure lines also limit the amount of acreage available to harvest oysters. Oysters can only be harvested in the southern portion of the Lake due to the location of the LDH closure line.

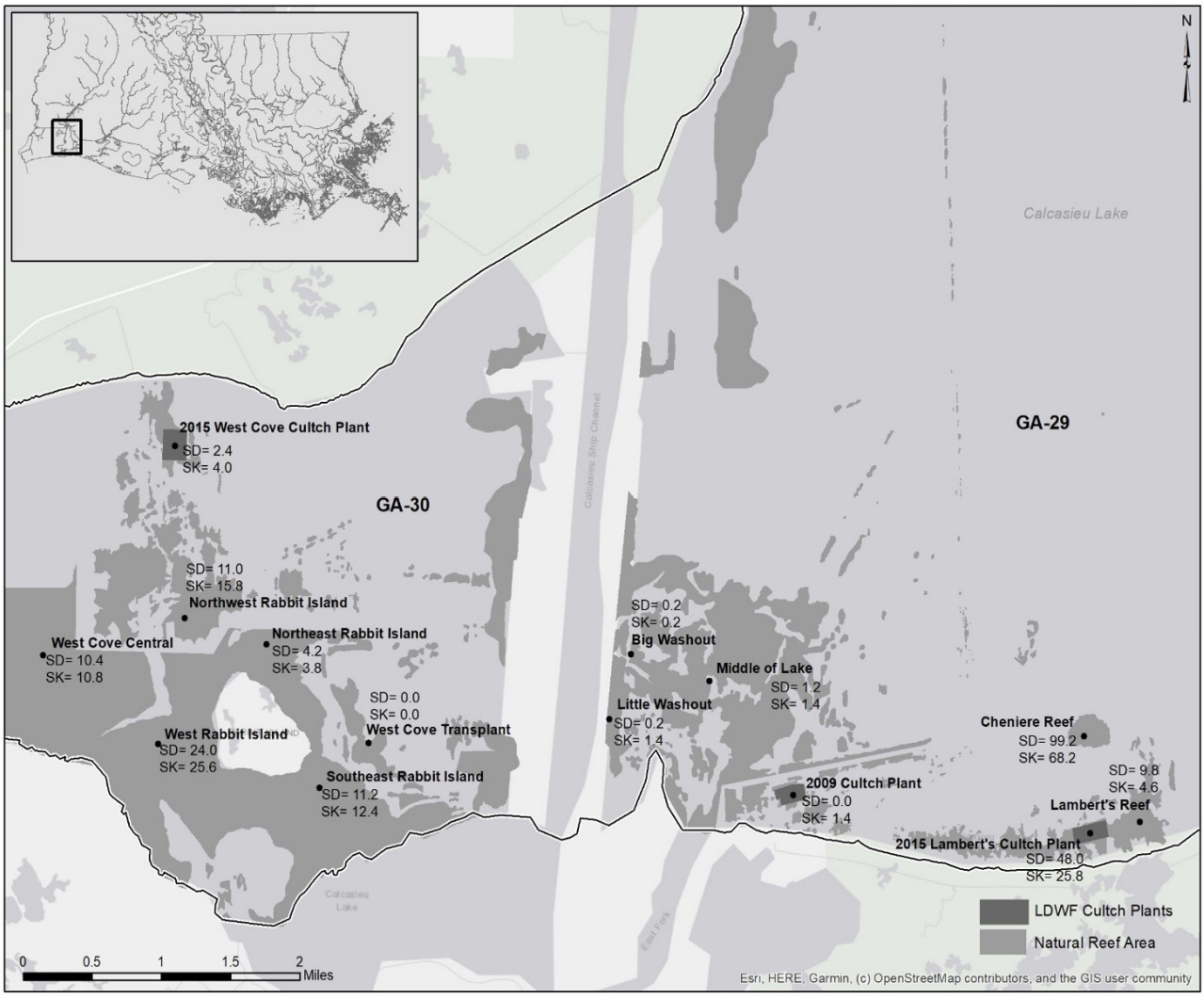

FIGURE 7.1. 2024 OSA average seed and market-size densities from square-meter sample stations (CSA-7 Calcasieu Lake).

LDWF OSAs in Calcasieu and Sabine Lakes use acreage estimates, which have been determined by side-scan sonar water bottom assessments conducted in 2008, 2011 and 2022. LDWF identified all suitable oyster habitat and classified this habitat into one of two bottom types: reef or scattered shell. The results of the side-scan studies estimated that East Side has a total of 2,306.9 acres of suitable oyster habitat, including 1,732.4 acres of reef and 526.5 acres of scattered shell bottom. West Cove has a total of 3,387.8 acres of suitable oyster habitat, including 1,097.2 acres of reef and 2,265.6 acres of scattered shell bottom (*Table 7.1*).

In 2018, additional surveying and sampling on the scattered shell bottom type in the East Side determined that no suitable bottom type material and no live oysters were present. Therefore, 526.5 acres of scattered shell was deleted from oyster habitat calculations. In 2023, 48 acres was removed from East Side reef acreage calculations to account for the Alternative Oyster Culture Park, which was established by the Cameron Parish Port, Harbor and Terminal District in the southern portion of Calcasieu Lake. Beginning in 2023, stock assessment availability calculations (East Side) are based on 1,732.4 acres of reef habitat. The acreage estimates generated from the side-scan sonar studies only include reef acreage of Calcasieu Lake that lie within the LDH allowed harvest areas. LDWF currently conducts population stock assessments in Sabine Lake (GA31) only during odd numbered years; therefore, no sampling was conducting in Sabine Lake in 2024.

Methods

LDWF biologists collected field samples for the 2024 OSA on July 10, 2024, from 14 stations within Calcasieu Lake, according to the methodology described in the Statewide Overview of this report.

Considering there are no private oyster leases and no bedding (seeding) operations in Calcasieu Lake, all harvest is direct market and the unit of measure is in sacks. Historical data in this report (*Table 7.2*) is reported in sacks of market-size oysters. 2024 availability numbers (*Table 7.1*) are presented in barrels and sacks. One barrel of oysters equals two sacks of oysters.

TABLE 7.1. 2024 estimated oyster availability between East Side and West Cove, Calcasieu Lake.

Station	Reef (Acres)	Average Number Seed Oysters/m^2	Average Number Market-Size Oysters/m^2	Seed Oysters (bbl)	Market- Size Oysters (bbl)
2015 Lamberts Cultch Plant	30	48.0	25.8	**12,410.4** (24,820.7 sacks)	**15,850.2** (31,700.4 sacks)
Chenier Reef		99.2	68.2		
Cultch Plant Reef Total		73.6	46.5		
2009 Cultch Plant	1,732.35	0	1.4	**22,200.2** (44,400.3 sacks)	**35,052.9** (70,105.8 sacks)
Big Washout		0.2	0.2		
Little Washout		0.2	1.4		
Middle of Lake		1.2	1.4		
Lamberts Reef		9.8	4.6		
East Side Reef Total		2.3	1.8		
East Side Total				***34,610.5 (69,221.0 sacks)***	***50,903.1 (101,806.2 sacks)***
NW Rabbit Island	1,097.20	11.0	15.8	**45,635.6** (91,271.1 sacks)	**115,939.0** (231,877.9 sacks)
SE Rabbit Island		11.2	12.4		
West Cove Transplant		0	0		
West Cove Reef 1 Total		7.4	9.4		
NE Rabbit Island	2,265.60	4.2	3.8	**163,845.7** (327,691.3 sacks)	**341,274.4** (682,548.8 sacks)
West Cove Central		10.4	10.8		
West Rabbit Island		24.0	25.6		
West Cove Reef 2 Total		12.9	13.4		
West Cove Cultch Plant	25	2.4	4.0	**337.3** (674.5 sacks)	**1,124.2** (2,248.3 sacks)
West Cove Total				***209,818.5 (419,636.9 sacks)***	***458,337.5 (916,675.0 sacks)***
Calcasieu Lake Total				***244,429.0 (488,857.9 sacks)***	***509,240.6 (1,018,481.2) sacks)***

Results and Discussion

Calcasieu Lake

Market-Size Stock

The 2024 stock assessment estimated the current oyster stock in Calcasieu Lake was approximately 509,240.6 barrels of market-size oysters and 244,429.0 barrels of seed oysters (*Table 7.1*). This represents a 67.7% increase in market-size oysters from the 2023 estimate. Seed oysters increased 17.7% from the previous year's assessment. The oyster resource in Calcasieu Lake is well over its 10-year LTA (*Figure 7.2*).

Spat/Seed Production

Seed oysters are typically used to estimate recruitment and predict future market-size oysters. Data collected during the 2024 stock assessment suggest continued improvement in young oyster recruitment in Calcasieu Lake. Seed oysters on the East Side experienced a 30.6% increase and seed oysters in West Cove increased 15.8%, compared to the 2023 assessment (*Table 7.2*). Seed oyster populations on the East Side are currently 123.2% above the 10-year LTA (2014-2023) and seed oysters in West Cove are 210.5% above the 10-year LTA (*Table 7.2*). Spat oysters in the East Side increased by 14,065.6% from 2023 stock assessment. However, it should be noted that spat estimates in 2023 were well below what was found in 2022. It is estimated there are approximately 8,847.2 sacks of spat oysters in West Cove, representing an 86.7% decrease from the previous year. The East Side of Calcasieu Lake has approximately 164,204 sacks of spat oysters. Spat oysters are the most vulnerable oysters to adverse environmental conditions, disease and predation. They are typically the least abundant size-class group of oysters found during stock assessment sampling due the timing of sampling and the fact that late summer/early fall months are the major spawning period for Calcasieu Lake oysters. Warmer water temperatures and low rainfall in the late spring/early summer created optimum hydrologic conditions for an early spawning event. The highest density of spat oysters were found at the Big and Little Washout sample stations on the East Side, reaching 39.4 and 24.6 spat per square-meter, respectively. The highest densities of spat in West Cove were found at sample stations around Rabbit Island. Oyster recruitment in lower Calcasieu Lake has struggled for nearly a decade. Only in the last few years, has there been any notable improvement. It is anticipated that the increases in seed oysters throughout the harvest area will continue to translate to increase in market-size oysters in the coming years. LDWF biologists will continue to sample oyster populations throughout the year to monitor recruitment and survival.

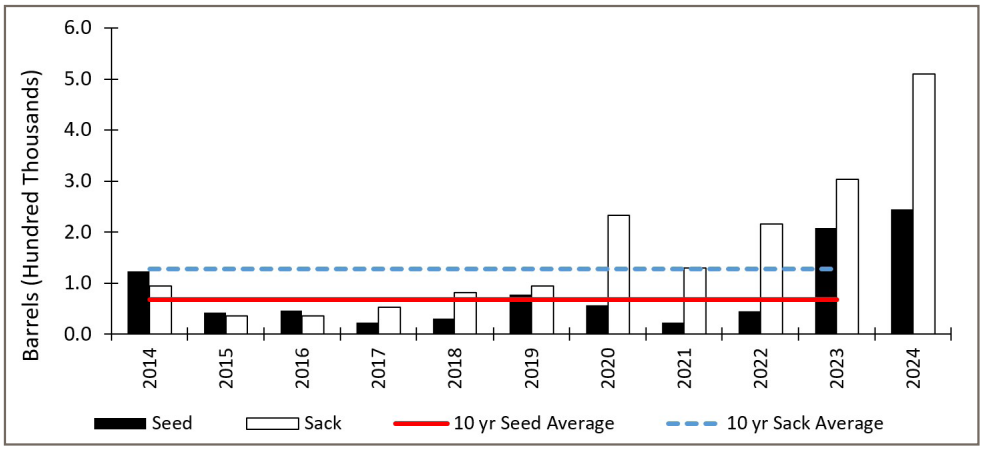

FIGURE 7.2. Calcasieu Lake historical oyster stock availability.

TABLE 7.2. OSAs, in sacks, and percentage change of public oyster areas of East Side and West Cove, Calcasieu Lake.

Year	Market Oysters (≥ 3")		Seed Oysters (< 3")	
	GA29	GA30	GA29	GA30
2014	0	188,616	24,210	213,951
2015	16,862	54,509	47,763	36,075
2016	27,024	45,576	34,398	57,131
2017	11,236	92,884	13,776	31,322
2018	18,390	144,101	17,647	43,270
2019	23,334	166,735	32,227	124,010
2020	46,105	419,460	12,836	100,698
2021	34,370	225,525	5,968	38,867
2022	24,592	407,789	30,067	59,433
2023	28,704	578,684	52,999	362,446
2024	101,806	916,675	69,221	419,637
10-year LTA	***30,220***	***294,596***	***31,010***	***135,167***
% CHANGE FROM AVG.	***+236.9%***	***+211.2%***	***+123.2%***	***+210.5%***
% CHANGE FROM 2022	***+254.7%***	***+58.4%***	***+30.6%***	***+15.8%***

Hydrological Data

Average water temperatures recorded during dredge samples for Calcasieu Lake in May and June were 27.3°C and 31.4°C, respectively. All months during 2024 saw temperatures at or slightly higher than the 10-year LTA (*Figure 7.3*). The average water temperature during the 2024 oyster assessment was 29.5°C, which is near the 10-year LTA temperature of 29.7°C.

Salinities for August 2023- January 2024 were above their 10-year LTA (*Figure 7.3*). Salinities recorded during dredge samples for Calcasieu Lake in May and June 2024 were 5.4 ppt and 4.8 ppt, respectively, well below the 10-year LTAs (*Figure 7.3*). In July 2004, salinity returned to 15.7 ppt, slightly higher than the 10-year LTA (15.4 ppt).

Sabine Lake

Sabine Lake OSA occurs every other year, due to Act 159 during the 2018 Legislative session, which instituted a moratorium on oyster fishing in Sabine Lake. The Last assessment occurred in 2023; for more details on last assessment, see the 2023 STOCK ASSESSMENT REPORT of the Public Oyster Seed Grounds and Reservations of Louisiana Oyster Data Report Series No. 29. *www.wlf.louisiana.gov/resources/category/stock-assessments/oyster*.

2023-2024 Oyster Season

The Commission opened the West Cove Area of Calcasieu Lake to oyster harvest on October 15, 2023, with a daily sack limit of 15. The East Side of Calcasieu Lake was opened to harvest on Jan. 1, 2024, with a daily sack limit of 5. The combined daily sack limit for the entire Calcasieu Lake was 15 sacks total.

The oyster harvest area is classified as a LDH conditionally managed area. The number of closures to oyster harvesting in Calcasieu Lake due to LDH health concerns was near normal for a typical oyster season. West Cove was open to harvest 75.4% of the total oyster season at 150 harvestable days (*Table 7.3*). The East Side was opened 84.0% of the oyster season for 102 days (*Table 7.3*).

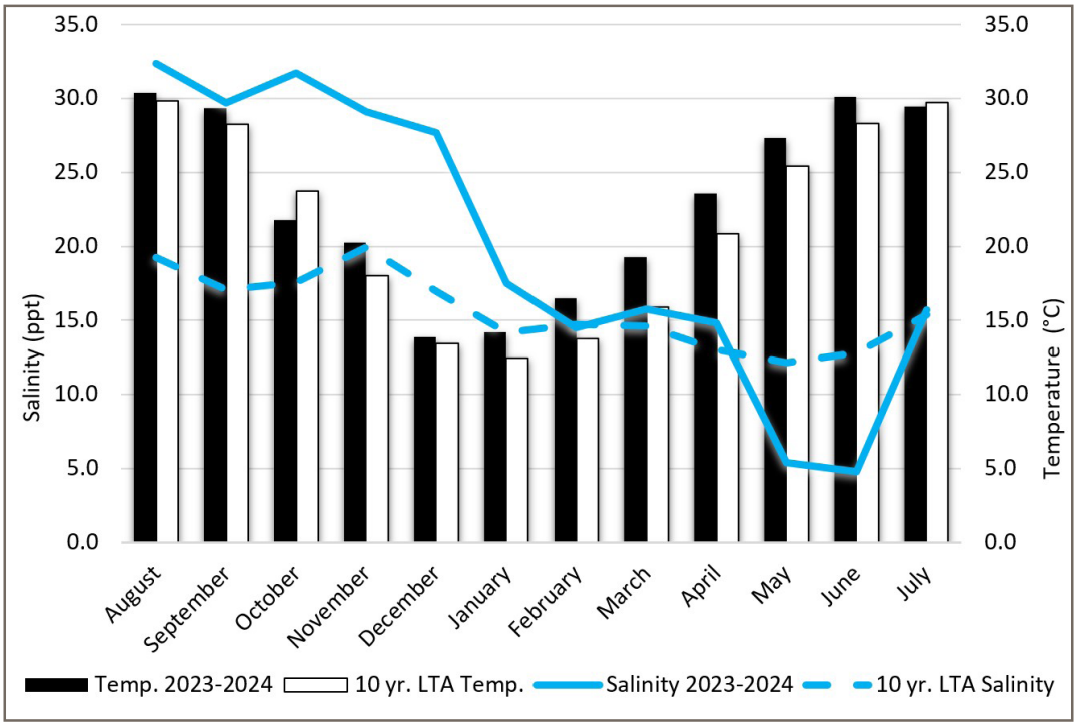

FIGURE 7.3. Mean salinity and temperature for Calcasieu Lake public oyster areas from August 2023 - July 2024, with the 10-year LTA (2014-2023).

TABLE 7.3. Public oyster season and number of days open to harvest by LDH as a percentage for East Side and West Cove in Calcasieu Lake.

Season	Area	Season Dates	Total Days	East Side		West Cove	
				Calcasieu Lake		Calcasieu Lake	
				Days	% Open	Days	% Open
2014-15	**East Side**	Closed	Closed	0	0.0		
	West Cove	Oct. 26 - April 30	187			111	59.4
2015-16	**East Side**	Closed	Closed	0	0.0		
	West Cove	Nov. 1 - April 30	182			108	59.3
2016-17	**East Side**	Nov.1 - Feb. 13	105	86	82.0	n/a	n/a
	West Cove	Nov. 1 - Jan. 24	85			54	64.0
2017-18	**East Side**	Closed	Closed	0	0.0		
	West Cove	Nov. 1 - May 15	196			130	66.3
2018-19	**East Side**	Oct. 15 - April 30	184	145	78.8		
	West Cove	n/a	n/a			88	47.8
2019-20	**East Side**	Nov.1 - Jan 26	87	81	93.1		
	West Cove	Nov. 1 - April 30	182			58	31.9
2020-21[1]	**East Side**	Oct. 30 - April 30	132	107	81.1		
	West Cove	Oct. 30 - April 30	132			49	37.1
2021-22	**East Side**	Nov. 1 - April 30	181	168	92.8		
	West Cove	n/a	n/a			152	84.0
2022-23	**East Side**	Jan.1 - April 30	120	93	77.5		
	West Cove	Oct.15 - April 30	198			115	58.1
2023-24	**East Side**	Jan.1 - April 30	121	102	84.0		
	West Cove	Oct.15 - April 30	199			150	75.4

1. Weekday harvest only permitted during 2020-2021 harvest season

BROODSTOCK REEFS

Introduction

Managing oysters as crucial habitat is vital to maintaining abundant oysters in order to support a sustainable fishery and a wide range of marine species. Active maintenance of spawning populations for the purposes of providing adequate larvae to support oyster populations has historically not been required in Louisiana due to high oyster abundances found throughout the coast. As such, most restoration activities involve the placement of cultch with the assumption oysters would successfully colonize that cultch. However, in certain areas of the state, oyster spawning potential now appears to be limited. Creating and maintaining mature spawning populations protected from harvest may be necessary to ensure adequate numbers of adult oysters are and remain available to increase reproductive potential. Unharvested spawning reefs can provide beneficial ecosystem services, as they can help replenish oysters in surrounding areas open to harvest through larvae dispersal. These spawning reefs can support both restoration efforts and directly contribute to the oyster fishery over time, while also contributing to the productivity of the entire reef system surrounding them.

The creation of the spawning stock sanctuary network was driven by LDWF's Louisiana Oyster Management and Rehabilitation Strategic Plan. The strategic plan, drafted in 2021, was the department's response to declines in oyster populations due to a myriad of stressors including: changes in coastal hydrology, extreme weather events, 2010 *Deepwater Horizon* oil spill and response activities, harvest pressure and 2018/2019 historical Mississippi River flooding event. Depending on area designated for its creation, a spawning stock reef could consist of a small mature oyster reef protected from harvest or contain hard substrate piled vertically to supply relief over hypoxic conditions and unavailable for harvest. Key considerations of a spawning stock reef network include locating individual reefs along different salinity gradients to improve population connectivity and production, but also to help maintain oyster production in some portion of an estuary during periods of stress and help facilitate recovery from mortality events when suitable hydrologic conditions are restored. Reef locations for this technique could be located from the upper-estuary to lower-estuary depending on logistics and needs within basins. Strategic siting of reefs for networking would be based on trends in salinity, observed population response from previous mortality events, proximity to living shoreline projects and/or available larval transport models. Modeling simulation results from Munroe et al. (2014) have shown that siting protected areas for oyster restoration in lower salinity areas may interact with development of disease resistance (e.g. Dermo) in the metapopulation by altering genotype transfer from protected to unprotected "down-estuary" populations. Therefore, there is a potential value of lower-estuary sanctuary habitat and the role it may play when we have significant freshets and upper and mid-estuary populations are affected; these higher-salinity "down-estuary" populations would play a vital role in helping to reestablish "up-estuary" and "mid-estuary" populations. Oysters left undisturbed on spawning reefs can grow to reproductive sizes, producing and contributing larvae to the surrounding ecosystem, thus increasing recruitment potential. Spawning reefs benefit by maintaining oysters within multiple age classes, and when they attain a high density of larger adults, can have a higher recruitment potential.

In August 2020, the Louisiana Trustee Implementation Group (LA TIG) finalized Restoration Plan/Environmental Assessment 5: Living Coastal and Marine Resources (LCMR)- Marine Mammals and Oysters. This plan approved funds for the construction of oyster broodstock reefs that will serve as a spawning stock to improve and maintain oyster production on Louisiana's POSGs and POSRs. In 2021, construction of four reefs east of the Mississippi River was completed. Each reef was constructed using 5,000 cubic yards of limestone cultch placed within a 10-acre site. The overall goal of this project is to increase oyster abundance, restore resilience to oyster populations, and restore a diversity of oyster reef habitats. In June of 2023, Karako Bay and Mozambique Point broodstock reefs were expanded. Karako Bay was expanded 6.2 acres and Mozambique Point was expanded 5.5 acres, to facilitate the Leveraging Opportunities and Strategic Partnerships to Advance Tolerant Oysters for Restoration (LO-SPAT) project's low-salinity tolerant oyster deployment locations. The LO-SPAT project's goals are to contribute to the Louisiana Coastal Master Plan by facilitating the long-term restoration of oyster reefs with a population of oysters capable of surviving the low-salinity conditions along the LA coast.

These oyster broodstock reefs and Louisiana's recreational fishing reefs were promulgated through Revised Statue 56:805 and Louisiana Administrative Code 76:537, which prohibits oyster harvest at these sites. Some of the state's recreational reef sites are in habitable oyster areas with the shifting environmental coastal conditions. *Figure 8.1* shows the current extent of the Oyster Program's oyster broodstock network, which incorporates the newly constructed broodstock reefs (blue boxes) with the state's many inshore artificial recreational reefs (yellow boxes).

Methods

Broodstock reef assessment was contracted out by LA TIG to ENCOS, Inc. (ENCOS). ENCOS collected three replicates via certified diver using a square-meter quadrat at each broodstock area: Petit Pass, Karako Bay, Lake Machias and Mozambique Point. The purpose of these dive samples was to quantify the presence of oyster stock including: documenting oyster recruitment, growth, mortality, size-classes and abundance inside each project area.

The oyster data collected was used to create size frequency histograms for each broodstock reef location. Size frequency histograms for oysters are valuable for monitoring population dynam-

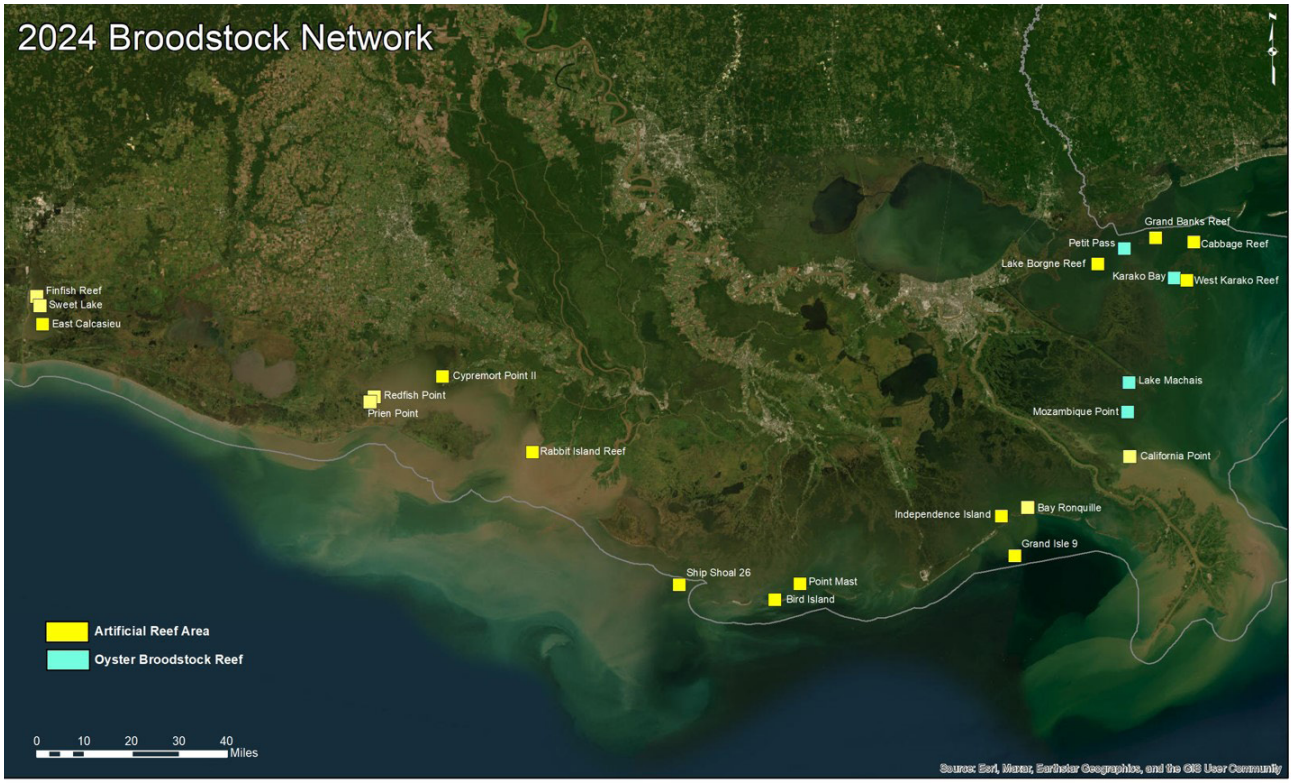

FIGURE 8.1. Current Louisiana broodstock reef network.

ics, assessing growth and health, making management decisions and evaluating the success of restoration efforts. They provide a clear, visual representation of population structure that can inform everything from ecological research to restoration success. Here, we are evaluating the restoration success of the broodstock reefs, if the population is growing and the size distribution is shifting toward larger oysters with increased fecundity, it suggests the broodstock reef is effective.

With continued monitoring efforts, the department will be able to track oyster cohorts and their progression through size-classes. LDWF classifies oysters into three size-classes: 1) Spat, this is the early life stage of the oyster, after the larval stage, when they settle on a substrate and begin to grow. The spat size-class are 0-24 mm or Group 0-4. 2) Seed, this refers to young oysters that are still in the process of growing, but are not yet mature enough to be harvested; the seed size-class are 25-74 mm or Group 5-14. 3) Market-size class, refers to large oysters that are big enough to be sold in the market, but still have room to grow; the market-size class are 75 mm and above or Group 15 and higher. From the single monitoring event here, cohorts can be speculated from Louisiana's yearly spring or fall recruitment events, but continual monitoring can effectively track new cohorts through the size frequency histograms.

Results and Discussion

Mozambique Point

Location

The Mozambique Point broodstock reef is located between Black Bay and Breton Sound water bodies (*Figure 8.2*). This broodstock reef is near the North Black Bay, Horseshoe Reef and East Stone reef complex, which encompasses 2,485.8 acres of historical reefs.

Size Frequency Histogram

The Mozambique Point broodstock reef has a wide range of size-classes (*Figure 8.3*). This gives a good visual representation as to the goal of the broodstock reef project, to maintain several cohorts and breeding potential on the protected reef. As seen in *Figure 8.3*, this reef contains larger size-classes with potential increased fecundity, while still having the next generation in the seed size-class thriving, likely from a late fall recruitment in 2023. Looking at *Figure 2.1* and *Table 2.1*, sampling of the surrounding reefs did not detect any oysters, but this broodstock reef remains a haven possibly due to the larger reef material or the vertical structural relief, providing hard substrate for attachment above potentially hypoxic waters. The goal is for this haven to repopulate the surrounding water bottoms during good environmental conditions.

The Mozambique Point broodstock reef had a density of 11 live oysters per square-meter during this July 2024 sampling assessment. The reef has spat size-class density of 1.3, a seed size-class density of 5.6, and a market-size oyster density of 4.0 per square-meter.

Mortality

Total mortality for this site during the July 2024 sampling event was 10.8%. A breakdown of the mortality by size-class during this sampling event was 0.0% for spat, 10.5% for seed-size oysters and 14.3% for market-size oysters.

Lake Machias

Location

The Lake Machias broodstock reef is located in the Lake Machias water body near the mouth of Mulatto Bayou (*Figure 8.4*). This broodstock reef is situated near the Lake Fortuna reef complex, which encompasses 3,453.9 acres of historical reef and a 300-acre cultch plant.

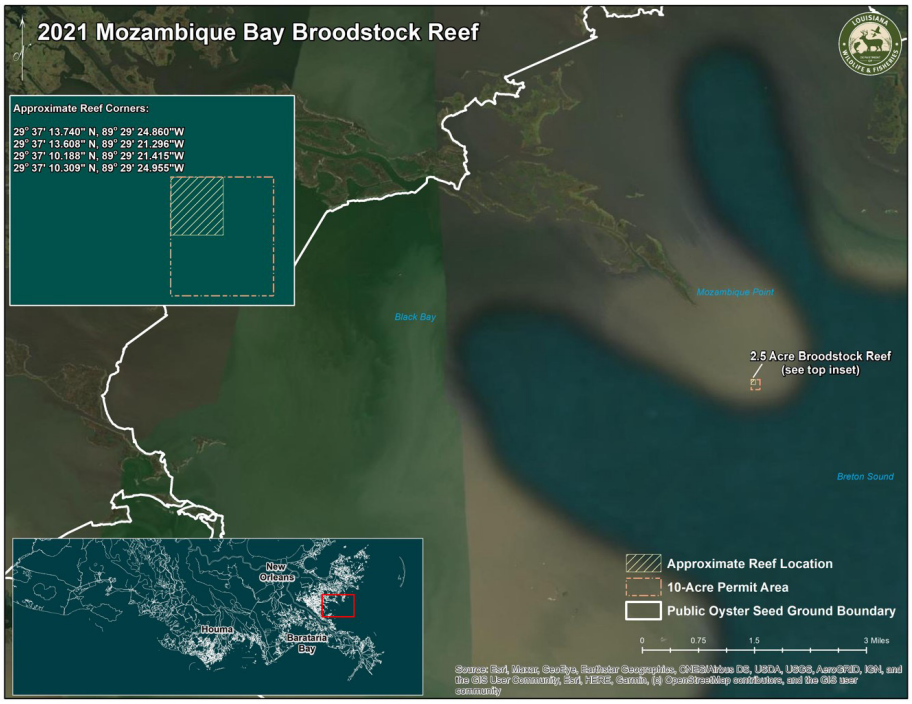

FIGURE 8.2. Mozambique Point broodstock reef.

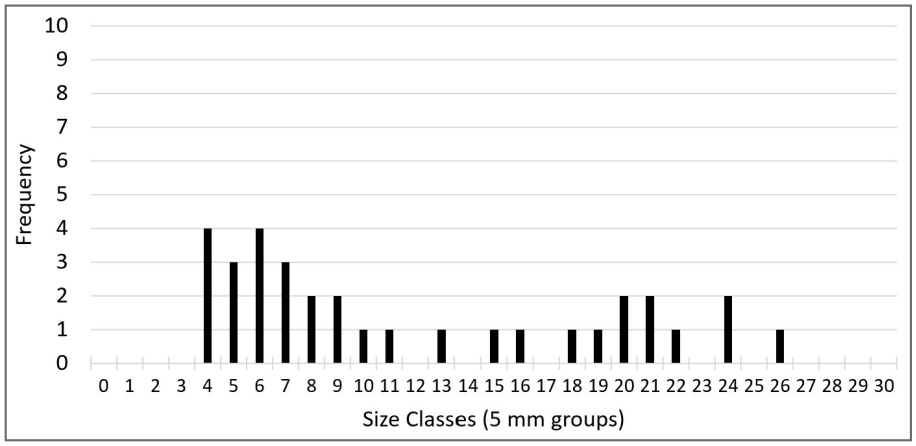

FIGURE 8.3. Mozambique broodstock reef live oyster size frequency histogram for three square-meter replicates.

Size Frequency Histogram

The Lake Machias broodstock reef has a large distribution of size-classes (*Figure 8.5*). This is the goal of the broodstock reef, to maintain several generations and breeding potential on the protected reef. As illustrated in *Figure 8.5*, this reef has a wide range of market-size oysters with potential increased fecundity they provide, while still having the younger seed size-classes and some recent recruitment. This distribution is likely the result of several surviving cohorts at this site. Looking at *Figure 2.1* and *Table 2.1*, the surrounding reefs in the Lake Fortuna area still have oyster resource and this broodstock reef should help contribute to the recruitment on these reefs.

The Lake Machias broodstock reef had a density of 20.6 live oysters per square-meter during this July 2024 sampling assessment. The reef has spat size-class density of 0.6, a seed size-class density of 8.3 and a market-size oyster density of 11.6 per square-meter.

Mortality

Total mortality for this site during the July 2024 sampling event was 7.5%. A breakdown of the mortality by size-class during this sampling event was 33.3% for spat, 10.7% for seed-size oysters and 2.8% for market-size oysters.

Karako Bay

Location

The Karako Bay broodstock reef is located between West Karako Bay and Three Mile Bay water bodies (*Figure 8.6*). This broodstock reef is near the Three Mile Bay reef complex made up of Three Mile Bay and East & West Karako Reefs, which encompasses 3,059 acres of historical reefs and the 47-acre Shell Point cultch plant.

Size Frequency Histogram

The Karako Bay broodstock reef has a concentration of seed size-classes (*Figure 8.7*). This broodstock reef reflects the recruitment seen in this area the last two years due to drought conditions. As seen in *Figure 8.7*, the oyster size is concentrated around Work Group 8, which estimates this recruitment cohort from the fall 2023. The lack of older size-classes at this location hints at unfavorable environmental conditions or heavy predation over the long-term. Looking at *Figure 1.1* and *Table 1.1*, the surrounding reefs in the Three Mile Bay complex have similar size-class make-ups with larger density of seed oysters and low density of market-size oysters on the reefs.

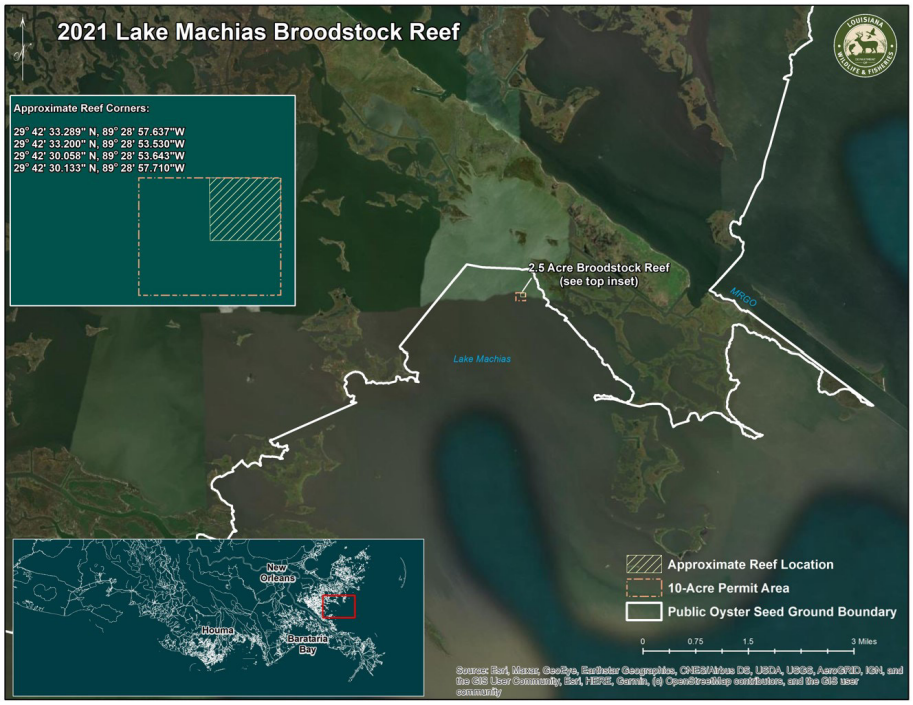

FIGURE 8.4. Lake Machias broodstock reef.

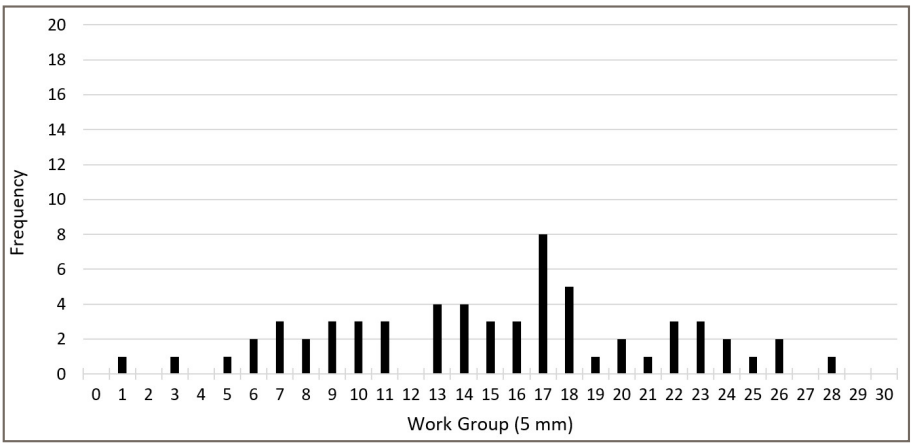

FIGURE 8.5. Lake Machias broodstock reef live oyster size frequency histogram for three square-meter replicates.

The Karako Bay broodstock reef has a density of 106.6 live oysters per square-meter during this July 2024 sampling assessment. The reef has spat size-class density of 10.6, a seed size-class density of 91.0, and a market-size oyster density of 5.0 per square-meter.

Mortality

Total mortality for this site during the July 2024 sampling event was 11.7%. A breakdown of the mortality by size-class during this sampling event was 22.0% for spat, 9.6% for seed-size oysters and 19.2% for market-size oysters.

Petit Pass

Location

The Petit Pass broodstock reef is located between Grand Island and Malheureux Point in the Le Petit Pass area of Northern Lake Borgne (*Figure 8.8*). This broodstock reef is part of the Halfmoon reef complex, which is made up of Grassy, Halfmoon, Petit, Grand Banks and Millenium reefs, which encompasses 5,328 acres of historical reefs.

Size Frequency Histogram

The Petit Pass broodstock reef has a right-skewed histogram with a concentration of smaller size-classes (*Figure 8.9*). This broodstock reef reflects the recruitment seen in this area from the last two years due to drought conditions. As you can see in *Figure 8.9*, the oyster size is concentrated around the larger spat Group 4 to seed Group 8, which blends the cohorts from the late fall 2023 and early spring 2024. The lack of older size-classes at this location hints at unfavorable environmental conditions or heavy predation over the long-term. In this case, Petit Pass can be inundated from Pearl River freshets during times of increased surge events. Looking at *Figure 1.1* and *Table 1.1*, the surrounding reefs in the Halfmoon reef complex have similar size-class makeups with larger density of seed oysters and low density of market-size oysters on the reefs.

The Petit Pass broodstock reef has a density of 112.0 live oysters per square-meter during this July 2024 sampling assessment. The reef has spat size-class density of 45.3, a seed-size density of 63.0, and a market-size density of 3.6 per square-meter.

Mortality

Total mortality for this site during the July 2024 sampling event was 5.3%. A breakdown of the mortality by size-class during this sampling event is 4.2% for spat, 4.5% for seed-size oysters and 26.7% for market-size oysters.

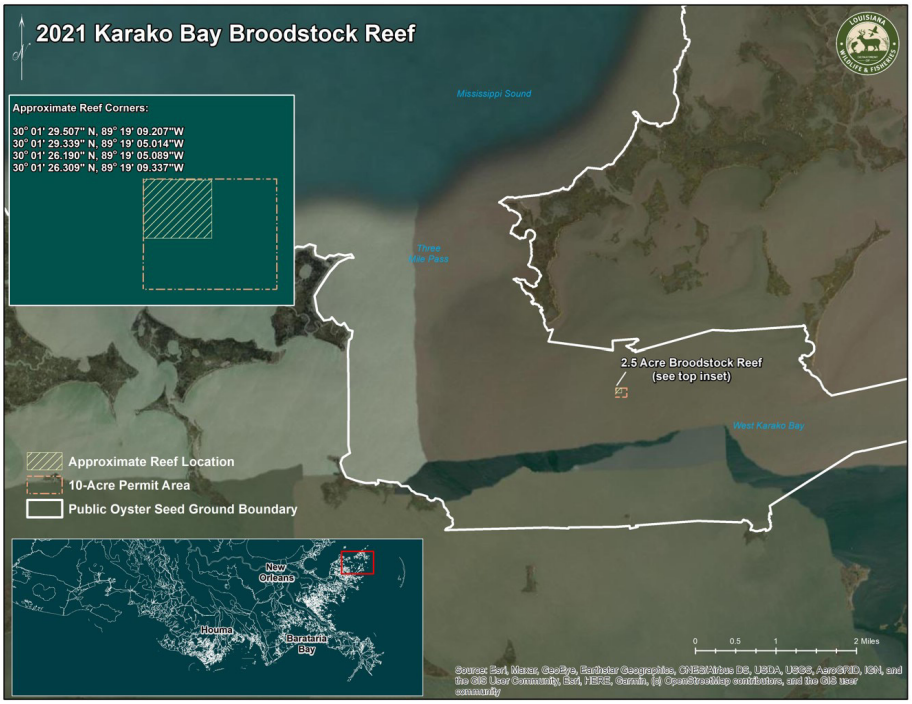

FIGURE 8.6. Karako Bay broodstock reef.

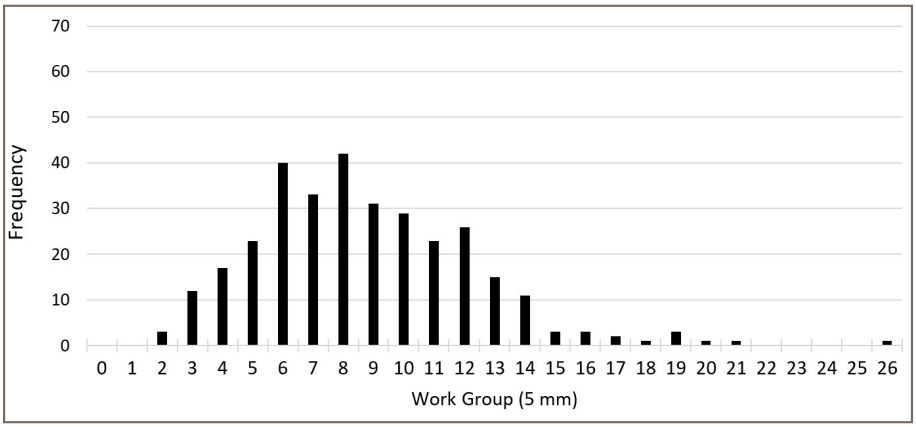

FIGURE 8.7. Karako Bay broodstock reef live oyster size frequency histogram for three square-meter replicates.

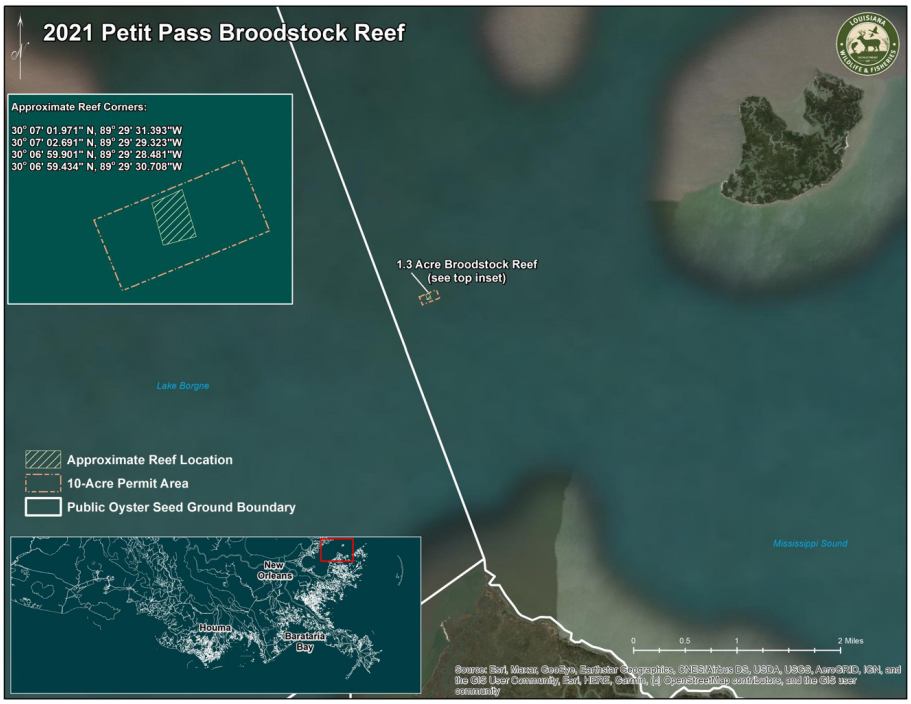

FIGURE 8.8. Petit Pass broodstock reef.

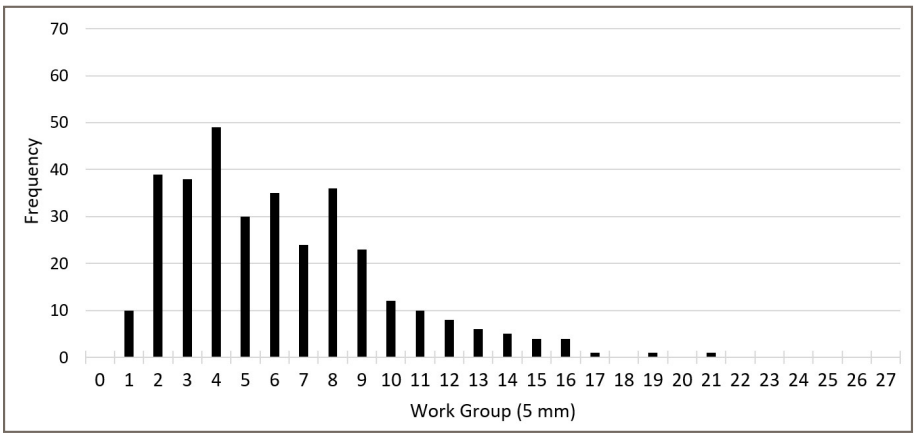

FIGURE 8.9. Petit Pass broodstock reef live oyster size frequency histogram for three square-meter replicates.