Results of the 2021 Louisiana Department of Wildlife and Fisheries
Oyster Shell Disposition Survey

Louisiana House Concurrent Resolution 26 of the 2021 Regular Session of the Louisiana legislature directed the Louisiana Department of Wildlife and Fisheries (LDWF) to conduct a study to determine the final destination of oyster shells removed from Louisiana waters. In the autumn of 2021, the LDWF conducted a survey of Louisiana oyster dealers to assess the sales of oysters in two different forms (whole oysters or shucked oysters) to purchasers in Louisiana or in other states to address this issue. This report summarizes the results of the analysis of that survey.

Previous Studies of Oyster Processing in Louisiana and the Gulf of Mexico

In 2004, the LDWF released its *Final Report for Louisiana's Oyster Shell Recovery Pilot Project*, a multi-faceted report that included a feasibility study of a potential program to collect oyster shells from oyster processors to use as cultch on public oyster reefs. The study included an examination of data from the National Marine Fisheries Service (NMFS) Seafood Processor Survey to estimate the amount of shucked oysters produced in the state and, by inference, the volume of oyster shells leftover after processing. The report identified Terrebonne Parish as a leading parish for oyster processing at that time and revealed that most processors reported selling their leftover oyster shells for restoring oyster reefs or building roadbeds.

The report also compared NMFS commercial seafood landings data to NMFS Seafood Processor data that suggest that Louisiana is a leading state in the Gulf of Mexico (Gulf) in terms of oyster landings but not necessarily in terms of oyster processing. In 2000, for example, when Louisiana produced over 49 percent of Gulf oyster landings, the state accounted for 15 percent of shucked oyster production (by weight) reported in the NMFS Seafood Processor Survey. In contrast, Alabama, which produced about three percent of the Gulf's commercial landings in 2000, accounted for 34 percent of the region's shucked oyster output.[1]

Comparisons of data from these separate surveys are limited by differences in their purposes and methods. The NMFS commercial seafood landings data are derived from legally mandated reports of all seafood landed commercially and, as such, represent a nearly complete accounting of the amount of seafood produced in each state. The NMFS Seafood Processor Survey, on the other hand, is voluntary and consequently incomplete to the extent that processors choose to provide or withhold data to the surveyors. Further, the survey solicits data only for product forms meeting a definition of processed products, not data for whole or unprocessed products that the respondents also handle, produce, and sell. As such, it may not provide a complete assessment of all the economic activity taking place at seafood processing facilities.

A report prepared by the Gulf States Marine Fisheries Commission (GSMFC) and the LDWF, *An Economic Baseline and Characterization of U.S. Gulf of Mexico Seafood Processors* (2014), found that sales of fresh whole oysters represented nearly 57 percent of all oyster sales reported by oyster processors in the Gulf of Mexico for 2012. (These sales may not be reflected in the NMFS Seafood Processor Survey.) It also found that approximately 36 percent of oyster processors' total sales were made within the processor-respondents' base state. The remainder were made to buyers in other states except for a small portion (less than one half of one percent) sold to buyers outside the U.S.

[1] Unpublished data from more recent surveys suggest that these discrepancies persist. Louisiana produced over 70 percent of NMFS estimates of Gulf oyster landings in 2018 but about nine percent of shucked oyster output reported in the NMFS Seafood Processing Survey. Alabama's commercial oyster landings that year totaled less than one percent of NMFS Gulf oyster landings but Alabama respondents to the NMFS Seafood Processing Survey reported processing roughly half of the region's reported shucked oyster output.

2021 LDWF Oyster Shell Assessment: A Survey of Oyster Dealers

Information collected through the LDWF Trip Ticket Program provided valuable, but limited, data to begin this assessment. By law, every time a commercial fisher lands and sells seafood commercially in Louisiana, a record of the transaction, called a "trip ticket", recording the species, quantity, and dockside value of the species harvested (among other variables), must be submitted to the LDWF. These data provide measurements of the quantity and dockside value of oysters at the "point of first sale" or the first link in the supply chain. Further information beyond this point may be obtained through other means. In this case, the LDWF was able to obtain further information through personal interviews of oyster dealers conducted by Office of Fisheries staff.

Surveying the oyster dealers that appeared in the LDWF trip ticket data banks as having purchased oysters has, like any surveying effort, advantages and disadvantages and a range of limitations. One of the advantages is the completeness of trip ticket data, which account for all oysters legally landed commercially in the state. Another advantage is the clear identification of all lawful participants, providing a clearly defined pool of potential subjects who may be drawn for the survey sample. Further, LDWF licensing records contain contact information for most of the dealers and thus facilitate the practical administration of survey collection efforts.

Efforts to survey firms that participate in different stages in the oyster market (such as processors, retailers, and restaurateurs) are hampered by the lack of a clearly identified population. The Louisiana Department of Health issues permits for firms that process seafood but does not issue licenses for firms that handle oysters specifically. The NMFS Seafood Processing Survey identifies firms that voluntarily report producing shucked oysters but does not include firms that elect not to participate in the survey. The Interstate Certified Shellfish Shippers List maintains a list of firms that handle fresh and frozen oysters but does not publish contact information or provide other supporting information (such as the amount of oysters that they handle) that may be useful in conducting a survey.

The major disadvantage of surveying oyster dealers in the LDWF trip ticket data banks is its focus largely on the "point of first sale", an early "link" in the marketing chain. The firms reporting trip ticket data report economic activities at the docks where fishers land and sell their catch and, to a certain extent, the purchasing activities of some oyster processors. Surveying dealers may miss what happens to oysters at later stages, such as the processing and distribution stages.

Preliminary research conducted by LDWF suggested that this disadvantage may be relatively minor because it appeared that most of Louisiana's commercial oyster harvests were shipped out of state very soon after being landed. This research supports that view and indicates that the majority of oyster shells removed from Louisiana waters are transported outside the state.

Oyster Dealers in Louisiana

In this report, the term "oyster dealer" applies to any person or entity who reported purchasing oysters directly from commercial fishers in Louisiana during the defined period. This delineation includes many businesses who specialized in the dealer function, amassing quantities of oysters from fishers, and selling them to others for further distribution and processing. It also includes some businesses that performed other functions as well, such as packaging, processing, or retailing.

The number of dealers who handle oysters in Louisiana is relatively moderate. In 2020, for example, 55 resident and non-resident licensed commercial seafood dealers reported handling oysters during the year. (In contrast, more than 300 dealers reported handling shrimp in 2018.)

Further, the quantity of oysters is relatively highly concentrated among an even smaller number of dealers. In 2020, for example, the 25 largest dealers (ranked by the estimated quantity of their purchases) accounted

for almost 90 percent of the statewide total of 3.5 million pounds of oysters (measured in pounds of meat) landed in Louisiana that year.

Survey Questionnaire

Staff in the LDWF Office of Fisheries with a knowledge of the state's oyster industry developed a brief questionnaire to assess the quantity of oysters handled by dealers and the distribution of oysters in different forms sold to buyers inside or outside Louisiana. The questionnaire was designed to be administered over the telephone by LDWF Office of Fisheries staff. As such, it was brief (eight questions long), simple, and focused on generating an estimate of the percentage of the state's oyster harvest that remains in Louisiana and the percentage that is shipped out of the state as whole oysters.

The first two items in the questionnaire asked respondents to provide an estimate of the quantity of oysters that they purchase from other docks, dealers, distributors, or processors in the state. This was designed to provide an estimate of the volume of oysters that each respondent purchased from sources that would not be reflected in its trip ticket records.

The third item in the questionnaire asked respondents to estimate the percentage of the oysters that they buy that are sold in three different forms: whole oysters (or sack oysters), half-shell oysters, or shucked oysters (oyster meat). Respondents who sold whole oysters (or half-shell oysters) were asked what percentages of the total volume of oysters sold in that form were sold to out-of-state buyers and what percent were sold to in-state buyers. Those who sold to in-state buyers were asked what percentage was sold to (a) Louisiana shops or restaurants, (b) Louisiana processors, or (c) Louisiana shippers and distributors.

The questionnaire closed with a series of questions related to whether the respondents produced oyster shells as a routine part of their business operations and to what purpose they believed those shells were applied.

Survey Sample

The sample of dealers included in the 2021 LDWF Oyster Shell Disposition Survey was drawn from the trip ticket records of all 84 dealers with trip ticket records of oysters between 2018 and 2020. LDWF staff preferred to base its selection on landings over a three-year period rather than landings in the most recent single year, 2020, because of disruptions associated with the COVID pandemic and hurricane impacts in that year.

Given staffing availability and the amount of effort expected to be expended in the telephone survey process, surveying was limited to a sample rather than the whole population of dealers. The survey sample included 26 subjects: the 25 dealers with the largest trip ticket volumes plus one additional dealer, an industry leader who volunteered to participate. Because the survey subjects were not drawn at random from the total stock of dealers, their responses may not represent those of the "typical" oyster dealer but they should provide a decent depiction of disposition of all oysters landed in the state. The combined trip ticket landings reported by the dealers included in the sample (an estimated 20.4 million pounds of meat) represented nearly 91 percent of the total volume of oysters landed in the 2018-2020 period (an estimated 22.5 million pounds).

Staff from the LDWF Marine Fisheries Section, Oyster Management Program, and Socioeconomic Research and Development Section made at least three attempts to call each of the dealers included in the sample. Contacts were made and surveys completed with 16 subjects. Five dealers did not answer the calls or could not be reached at apparently valid telephone numbers.

Another five dealers (with combined period landings of 2.2 million pounds) could not be contacted because the telephone at the number of record was disconnected or inoperative. These were removed from the

sample to create an adjusted sample size of 21 dealers (with cumulative 2018-2020 landings of 18.2 million pounds). The raw response rate – based on the adjusted sample size – was 76.2 percent.

The cumulative trip ticket volume of oysters handled by the 16 subjects who completed a survey represented (15.4 million pounds) was equivalent to 68.4 percent of the statewide volume of oysters landed in Louisiana during the 2018-2020 period (or 84 percent of the volume handled by the adjusted sample).

Oysters Purchased from Other Dealers

Most respondents reported buying no oysters from sources other than commercial fishers as reported in LDWF trip ticket records. Six reported buying from other Louisiana docks, dealers, distributors, or processors and seven from out-of-state sources. (Four reported buying from both Louisiana and out-of-state suppliers other than commercial fishers.)

Not all respondents who purchased oysters from other in-state docks, dealers, processors, or distributors were willing or able to provide an estimate of the quantity that they purchased. Each of those who obtained oysters from out of state was able to give at least some rough estimate of the quantity, usually expressed in terms of sacks oysters purchased. Their cumulative purchases from out-of-state sources were approximately 62,000 sacks.

Amount of Oysters Respondents Handled

The three-year total of trip ticket oyster purchases for each respondent was divided by three to produce an estimate of the pounds of meat handled in a single "typical" year. These estimates were converted into sack equivalents at a rate of 6.47 pounds of meat per sack.

The combined trip ticket record landings and purchases of oysters from in-state and out-of-state sources other than commercial fishers by all respondents totaled approximately 871 thousand sacks of oysters, approximately 10 percent higher than the trip ticket quantity alone.

Forms of Oysters Sold

Each respondent was asked to indicate the percentage of oysters sold in three forms: whole oysters, half-shell oysters, and shucked oysters. This question can be instrumental in determining the share of dealers who ship oysters out of state whole and the share that produce other oyster products that might result in accumulations of shells.

All but one of the 16 dealer respondents reported selling some amount of whole oysters (Figure 1). Three quarters reported selling 100 percent of their oysters in that form. Four of the respondents reported selling shucked oysters. One reported selling half-shell oysters.

Percentage of Respondents Who Sold Whole Oysters Sold in State or Out of State

Each respondent who reported selling whole oysters was asked what percentage was sold directly out of state and what percentage was sold to some sort of entity inside Louisiana. Those who sold to Louisiana buyers were asked what percentage was sold to restaurants and shops, processors, or distributors.

Approximately 69 percent of the dealer respondents reported selling whole oysters to out of state purchasers (Figure 2). Eighty-one percent sold whole oysters to in-state purchasers, including 18.8 percent who sold to Louisiana restaurateurs and retailers, 37.5 percent who sold to Louisiana processors, and 58.6 percent who sold to Louisiana distributors.

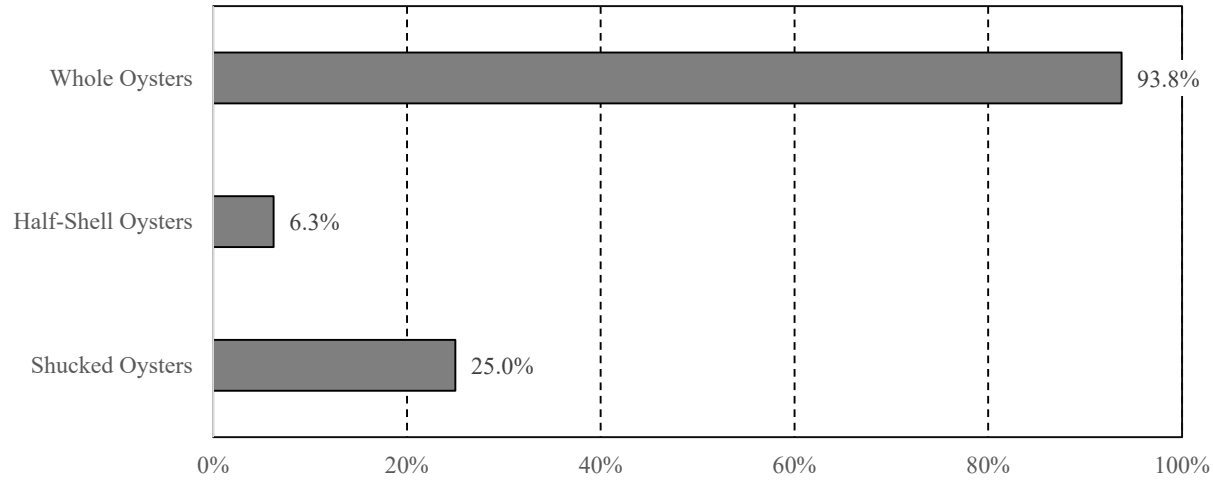

Figure 1. Percentage of Respondents Who Reported Selling Oysters in the Specified Product Forms

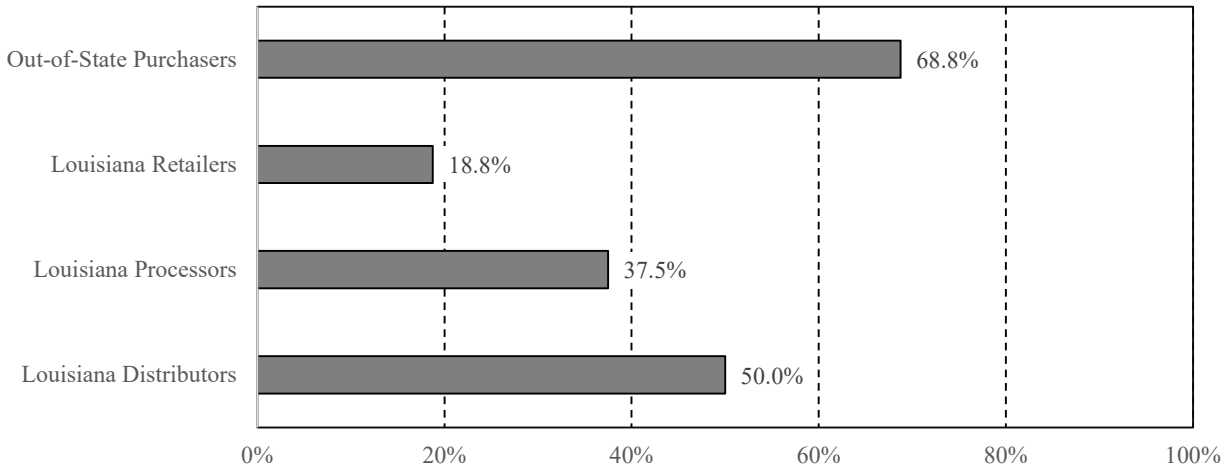

Figure 2. Percentage of Respondents Who Reported Selling Whole Oysters to the Specified Purchasers

Percentage of Oysters Sold in Specified Form to In-State or Out-of-State Buyers

The percentage of whole oysters sold to each destination and purchaser type was multiplied by the estimated weight of oysters sold in the specified product form by each respondent to convert the percentages into quantities. Amounts for each respondent were combined to estimate the percentage of cumulative oyster purchases that were sold in different forms to buyers inside or outside Louisiana.

As previously noted, oysters shucked by the respondents themselves represented about 9.2 percent of the cumulative sales of all survey respondents (Figure 3). Over 75 percent of cumulative sales were whole oysters sold directly to buyers outside Louisiana. About 15 percent were sold to Louisiana businesses, such as distributors (5.4 percent), distributors (9.0 percent), or retailers (1.0 percent).

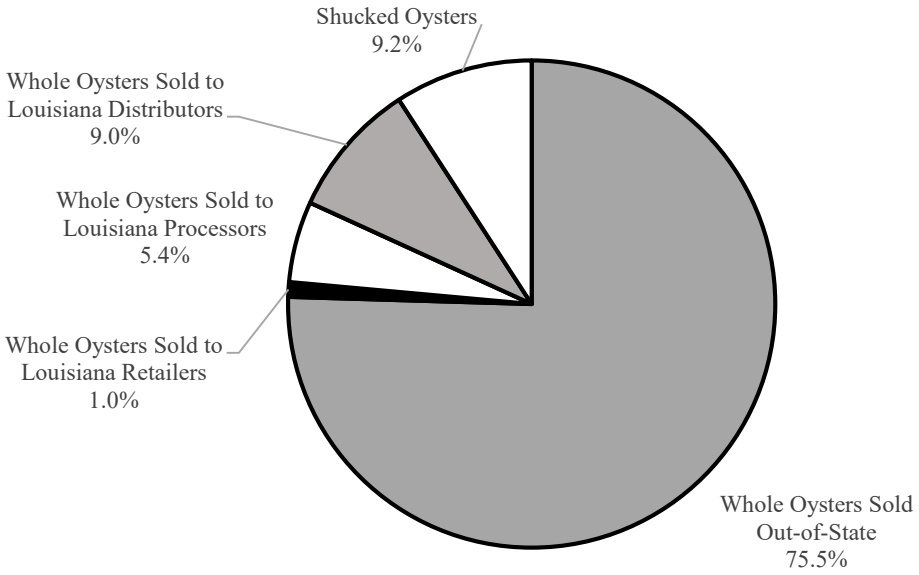

Figure 3. Percentage of Respondents' Oyster Sales Made in Specified Form to Purchasers Inside or Outside Louisiana

Sales by Respondents to Retailers

One percent of the total was sold directly to Louisiana retailers (Figure 3), including restaurants and shops. This number should be interpreted with care. It represents the share of Louisiana's oysters that dealers sell to these businesses, not the percentage bought by these businesses. Most restaurants and shops are likely to purchase oysters from processors or distributors, not from dealers. The percentage of Louisiana commercial oyster landings sold to Louisiana restaurants is likely to exceed one percent but remain a moderate share.

Sales by Respondents to Processors

Roughly five percent of respondents' sales were whole oysters sold to Louisiana processors. Some of these will be transformed into some other form (especially shucked oysters.) Others will not be processed but will be resold as whole oysters to buyers inside and outside Louisiana.

Because seafood processors are not required to report sales and product information, an exact quantification of their output cannot be known. Results from this survey suggest that the amount of oyster processed in the state may possibly amount to 11 to 14 percent of the state's landings.

Whole Oysters Shipped to Purchasers in Other States

The survey results indicate that three quarters of Louisiana's oysters are shipped with their shells out of state at an early stage of the marketing chain. (The survey did not assess how or if these oysters were further transformed or processed after they left the state.) This probably represents a minimum estimate of the percentage of Louisiana oysters shipped out of state in whole form.

It is likely that much of the nine percent of the oysters by respondents as whole oysters to Louisiana distributors is eventually resold in that form to buyers outside the state. The exact percentage is unknown, but, since the vast majority of the dealers' sales are made out of state, it is likely that at least half of the distributors' whole oysters are sold to buyers in other states. If this assumption holds, perhaps 80 percent of Louisiana's oysters are shipped out of state in whole form.

Oyster Shells Produced by Dealer Respondents

Four of the dealer respondents in this survey reported producing shucked oysters. Each of these also reported producing oyster shells as a routine part of their business operations and most of this shell is usually returned to the water by the respondents themselves or by oyster harvesters or others who build oyster reefs. Half of those who said they produce oyster shells said that all their oyster shells are already returned to the water. For the remaining half, the share returned to the water ranged from 80 to 95 percent.

Conclusion

Louisiana is a major production state. Its landings have represented a majority of Gulf commercial oysters landings in all but two years (2010 and 2020) of the 20 years between 2001 and 2020, according to NOAA Fisheries Commercial Seafood landings statistics. It is not necessarily, however, a center for oyster processing or consumption.

A consideration of population statistics suggests one reason why this may be so. Oysters are produced for a regional, if not national, market, of which Louisiana's population forms a relatively small part. The U.S. Census Bureau's estimate for the Louisiana population in 2020 was equivalent to approximately 7.4 percent of the population of the states along the Gulf of Mexico (including all Florida) and 1.4 percent of the population of the United States. It stands to reason that, if many of the customers who enjoy Louisiana's seafood reside outside the state, much of the oysters that the state produces will be shipped outside its boundaries, taking their shells with them.

In addition to the potential influence of demographics on the movement of oysters out of the state is the fact that much of the oyster processing capacity in the Gulf of Mexico is situated in other states, notably Alabama, a state with relatively little oyster production. The disposition of leftover shell by out-of-state processors is unknown. While it is probable that at least some of that shell is placed in the waters of the destination states, transportation costs and logistical challenges make it unlikely that large quantities of those shells are returned to Louisiana.

These summary survey results support the observation that most of the oysters harvested in Louisiana are shipped out of state in a form that makes the recovery of their shells for return to the state costly and logistically complicated. An estimated three quarters of the oysters handled by Louisiana's seafood dealers are sold directly out of the state as whole or sack oysters. Further, previous research of Gulf oyster processors suggests that significant amounts of the dealers' sales to Louisiana processors (5.4 percent of respondents' sales) and dealers (9.0 percent of respondents' sales) are shipments of whole oysters to out-of-state buyers.

Louisiana's major oyster processors have a history of producing quantities of oyster shells in concentrated areas that have made them credible sources of oyster shells for possible reuse. The respondents to this survey who processed oysters reported that most of the oyster shells resulting from their operations are already put to some practical application, mostly to serve as cultch on oyster leases. The productive potential of oyster shells and their consequent economic value are widely recognized and relatively little of the shell from these processing facilities appears to be discarded.

The shells from oysters sold by restaurants and retail shops may be more likely to be discarded (or less likely to be reused) than shells from oysters shucked at processing facilities. Many restaurateurs and retailers may be unaware of the potential value of shell and may lack space to store it securely and safely. Their employees may lack the time and expertise to sort shell and put it away properly. The sparse distribution of shops and restaurants, especially outside major cities, that individually produce moderate quantities of leftover shell may complicate the logistics of collecting shells in quantities sufficient for reuse projects.

The sample for the survey in this research project included seafood dealers who are probably more likely to deal with marketing chain middle players, like processors and distributors, than with restaurants and shops themselves. Consequently, the retail-oriented statistic included in this report – the percentage of oysters sold by dealer respondents directly to Louisiana retailers and restaurants - is highly probably an underestimate of the percentage of Louisiana oysters sold in the state's seafood shops and served in its restaurants.

The actual quantity of oysters sold to consumers in whole form in retail shops and restaurants, though unknown, is likely to be nontrivial. The quantity of oyster shells collected from New Orleans area restaurants between June 2014 and April 2021 by the Coalition to Restore Coastal Louisiana's (CRCL) Oyster Shell Recycling Program (10 million pounds[2]) is one indication that restaurants collectively sell considerable amounts of oysters and produce considerable quantities of leftover shell.

The CRCL Oyster Shell Recycling Program collected 601.2 cubic yards of shell from 16 participating restaurants between April 1, 2017 and March 31, 2018 and 758.6 cubic yards from 19 participating restaurants between April 1, 2018 and March 31, 2019. This translates into approximately 38 to 40 cubic yards of shell per participating restaurant per year, the yield from approximately 544 to 577 sacks of oysters per restaurant per year, adopting the LDWF conversion rate of one cubic yard of shell per 14.46 sacks of oysters.

Attempts to extrapolate the amount of shell available at restaurants across the state from the quantity collected by the CRCL Oyster Shell Recycling Program would probably not produce an accurate assessment of statewide restaurant leftover shell production. The restaurants that volunteered to participate in the program may or may not be representative of most Louisiana restaurants. New Orleans, the area in which the program operated, may or may not be typical of other areas of the state. The population of restaurants that serve shucked oysters throughout the state is not accurately identified. Nevertheless, the fact that the CRCL collection efforts reported gathering the equivalent of about 1.4 million pounds of shell per year from a moderate number of restaurants during the seven-year span suggests that millions of pounds of oyster shells are produced by restaurants across the state.

Because most of the restoration projects that have used recycled oyster shells (such as, reef building, cultch deposits, and shoreline protection) are described in cubic yards of material, it may be useful to express weight measurements in equivalent volumetric measurements. A simple method of doing so employs two conversion factors included in *The Final Report for Louisiana's Oyster Shell Recovery Project* published by the LDWF in 2004 (P. 2-21): the NMFS estimate of 6.47 pounds of meat per 105-pound sack of oysters and the LDWF estimate the yield of one cubic yard of shell per 14.46 sacks of oysters.

The NMFS meat-per-sack ratio implies that, generally speaking, commercial oysters are 6.2 percent meat and 93.8 percent shell. Consequently, a quantity of 1.0 million pounds of oyster shells requires 1.06 million pounds (1.0 million pounds = 93.8% of 1.06 million pounds) of whole oysters, the equivalent of 10,153 sacks (1.06 million pounds/105 pounds per sack). Converting this sack measurement into cubic yards produces an estimate of 702 cubic yards of shell per one million pounds of oyster shell (10,153 sacks/14.46 sacks per cubic yard ≈ 702 cubic yards). Thus, one million pounds of oyster shell would fill area between the goal line and the ten-yard line of a regulation American football field to a height of approximately four feet.

[2] Between 2014 and 2020, according to NMFS statistics, cumulative commercial landings of oysters in Louisiana totaled 71.8 million pounds. Using the NMFS conversion factor of 6.47 pounds of meat per 105-pound oyster sack, this is the equivalent of approximately 1.16 billion pounds of whole oysters, including 1.09 billion pounds of shell. The reported weight of shell collected by the C.R.C.L. from the summer of 2014 through the spring of 2021 is thus equivalent to about 0.9 percent of estimated weight of the shells from the cumulative oyster landings for a similar – but not identical – period: 2014-2020

In the absence of organized collection and recycling, most oyster shells produced at restaurants and other retail shucking facilities outside those that participate in the CRCL Oyster Shell Recycling are probably not returned to the water or repurposed for some other constructive end. The Louisiana commercial oyster sector and others with an interest in conserving coastal resources may be able to reduce the quantity of discarded shell by developing effective and cost-efficient systems for collecting oyster shells from among the numerous businesses and facilities for which they are a recurring by-product.