**Synopsis of the Sixth Annual Louisiana Oyster Stock Assessment Workshop**

**held**

**5 December 2017**

**at the**

**University of New Orleans**

Compiled by

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**Sixth Annual Louisiana Oyster Stock Assessment Workshop**

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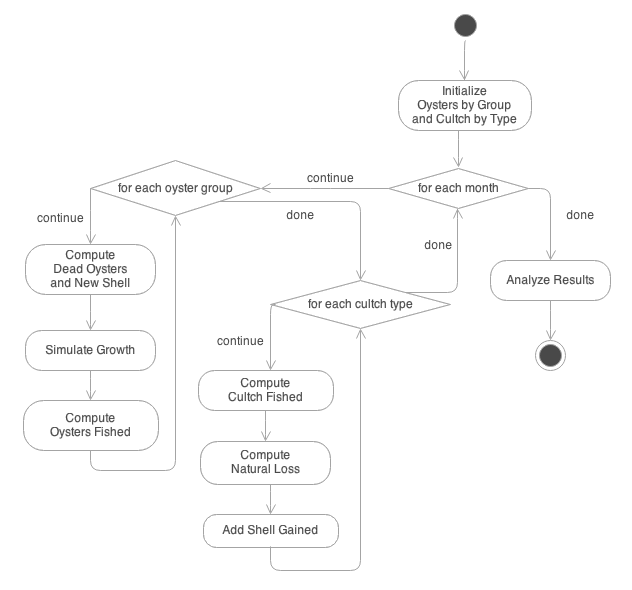
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**Introduction**

The Sixth Annual Stock Assessment Workshop was held on December 5, 2017 at the University of New Orleans. The purpose of the Workshop is to evaluate the status of the oyster stock in public oyster areas of Louisiana, estimate sustainable harvests for the upcoming oyster season in those public areas, and propose and review management and research recommendations.  
**Background and Methods**

A shell budget model is applied to estimate the sustainable catch of oysters on public oyster grounds in Louisiana using no-net-cultch-loss as a sustainability reference point. The model simulates oyster growth and mortality, and natural cultch loss. Shell mass is increased when oysters die in place, and diminished when oysters are removed by fishing (Soniat et al. 2012). Oyster density and oyster size from the 2016 Louisiana Department of Wildlife and Fisheries (LDWF) Stock Assessment covering all public oyster areas in all Coastal Study Areas (CSAs) were input using an automated data entry form (Soniat et al. 2013). The model estimates the number of sacks of seed and sack oysters that could be removed during the 2017/18 season without a loss of cultch. In addition to the standard of no-net-cultch loss, simulations were constrained by the (presumed) monthly effort for sack and seed (Table 1) and the proportion of sack to seed previously harvested in each CSA (Table 2).

Primary model components calculate growth, natural mortality, fishing mortality, cultch density (g/m2), and sacks of seed and sack (market) oysters fished (Figure 1).



**Figure 1.** **Schematic of major oyster model processes.**

Oysters that are not lost to natural mortality or removed by fishing grow into new size classes over time. Natural mortality provides new shell to the reef, whereas fishing removes it. Natural cultch loss occurs from taphonomic processes, mostly dissolution and biodegradation. Change in cultch density is thus a function of initial cultch density, initial population numbers, size-class distribution, shell growth, natural mortality, fishing mortality, and natural cultch loss. Fishing rates and times are adjusted to achieve sustainable harvest; that is, the reference point defining sustainable harvest is a harvest that results in no net loss of cultch. (Model details are provided by Soniat et al. 2012, 2015.) The cultch budget model has practical application such as identifying areas for closure, determining total allowable catch (TAC), managing cultch planting and reef restoration, and achieving product certification for sustainability.

The 2012 Stock Assessment (LDWF 2012) included, for the first time, precise measurements on the quality and quantity of the cultch. Brown (surface) and black (muddy, buried) substrate were collected from 1-m2 grids and weighed. These measurements were repeated for the 2013 (LDWF 2013), 2014 (LDWF 2014), 2015 (LDWF 2015), 2016 (LDWF 2016) and 2017 Stock Assessments. The substrate categories are: muddy oyster shell, brown oyster shell, muddy limestone, brown limestone, muddy clamshell, brown clamshell, muddy concrete, brown concrete, muddy “other” substrate, and brown “other” substrate. All brown cultch types were used as the cultch reference point.

A synopsis of the annual SAW is provided by Soniat (2012, 2013, 2014, 2015, 2016). The synopsis includes a review the status of the stock for the current year, a harvest estimate based on the current stock, a review of recommendations for the previous year and proposed recommendations for the coming year.

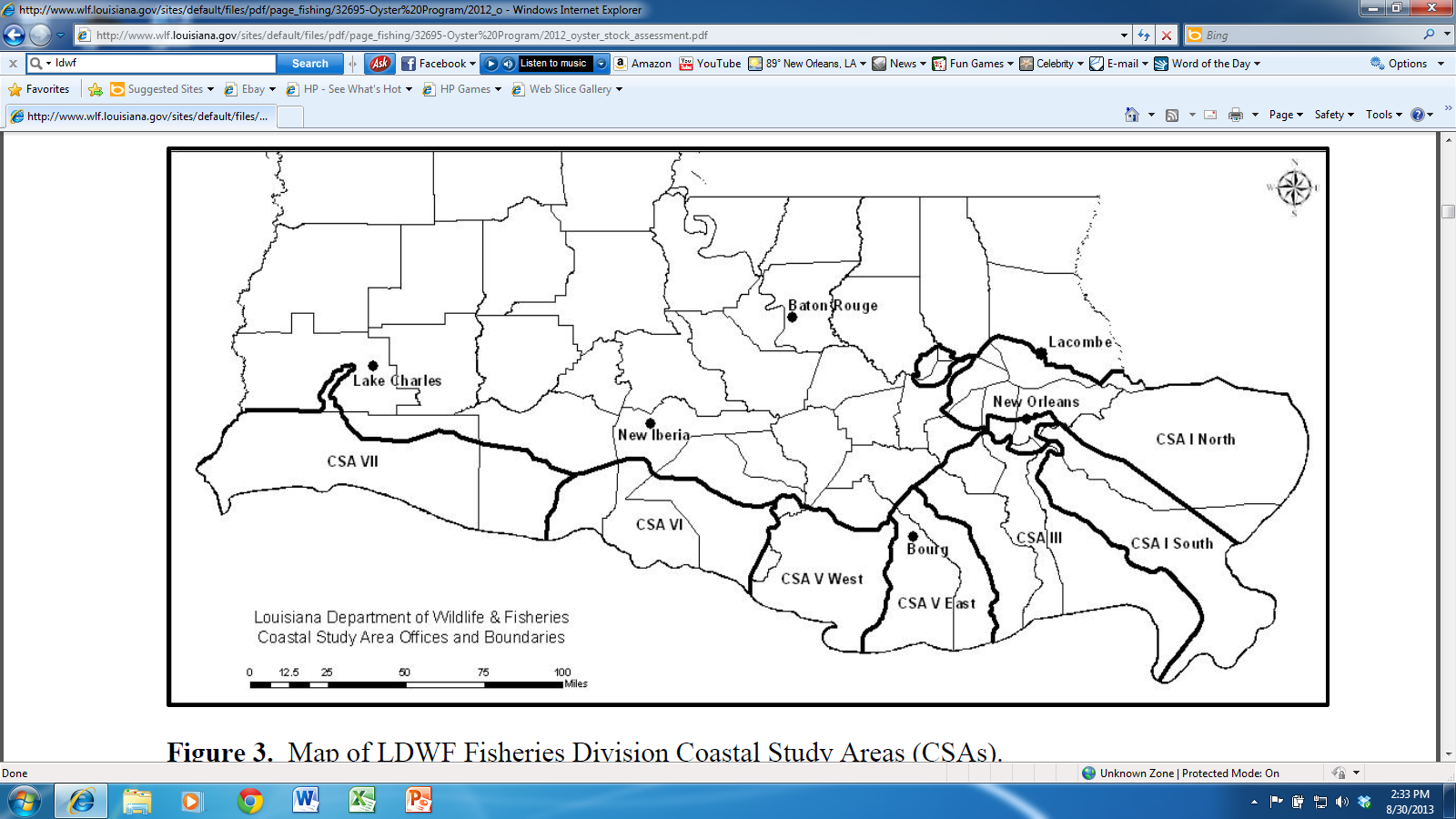
**Status of the Stock**

The 2017 stock assessment sampling by LDWF indicates a statewide 50.8% reduction in combined seed and sack abundance, as compared to 2016 (Sabine Lake excluded.). Abundance of seed and sack oysters are 90.4% below the long-term average (1982-2016). The trend in oyster abundance on the public grounds since 2000/2001 has been steadily downward. The stock has been below the long-term average since 2005, and especially depressed since 2009. The downward trend continues. The 2017 Stock Assessment indicates the lowest abundance of oysters on record (Figure 2).



**Figure 2. Abundance of seed and market oysters on Louisiana Public Oysters Grounds, 1982-2007. Surveys conducted by the LDWF. Data from Sabine Lake, which is not open to fishing, are excluded. LTA= Long Term Average.**

Coastal Study Areas (CSAs) are large management units (watersheds) designated by LDWF -- from CSA1 in the east to CSA 7 in the west (Figure 3). In CSA 1N, CSA 1S, CSA 3, CSA 5E and CSA 7 a decrease in seed oyster abundance as compared to 2016 was found, whereas seed abundance in CSA 5W showed an increase as compared to the previous year (Table 1). Sack oyster abundance increased as compared to last year in CSA 3 and CSA 7 (Calcasieu and Sabine Lakes). Total abundance (sack and seed combined) showed an increase as compared to 2016 in CSA 3 CSA 5W and Sabine Lake. The LDWF 2017 Oyster Stock Assessment report provides comprehensive information on the status of the stock.



**Figure 3. Boundaries of LDWF Coastal Study Areas (CSAs).**

**Table 1. Seed and Sack oysters (in barrels; 1 barrel = 2 sacks) by CSA and in total. CSA 6 is omitted because of lack of resource. CSA 7 is partitioned as Lakes Calcasieu and Sabine. Seed % and Sack % are the percent of contribution of seed and sack oysters to the total stock. Total is the combined barrels of seed and sack, whereas Total % is the percentage of both sack and seed oysters present in each CSA as compared to the total stock.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CSA** | **Seed** | **Seed %** | **Sack** | **Sack %** | **Total** | **Total %** |
| 1N | 75,235 | 25.2% | 29,300 | 8.8% | 104,536 | 16.6% |
| 1S | 674 | 0.2% | 5,906 | 1.8% | 6,581 | 1.0% |
| 3 | 6,913 | 2.3% | 18,851 | 5.7% | 25,764 | 4.1% |
| 5E | 692 | 0.2% | 0 | 0.0% | 693 | 0.1% |
| 5W | 72,928 | 24.4% | 15,185 | 4.6% | 88,114 | 14.0% |
| Calcasieu | 22,549 | 7.6% | 52,060 | 15.7% | 74,609 | 11.8% |
| Sabine | 119,440 | 40.0% | 211,224 | 63.5% | 330,664 | 52.4% |
| Total | 298,433 | 100.0% | 332,526 | 100.0% | 630,959 | 100.0% |

**Simulation Strategy**

Initial simulations are conducted without fishing. Reefs that gain shell without fishing are deemed “fishable”. Only “fishable” reefs were considered in subsequent simulations. Three simulation scenarios were applied based on possible management recommendations. Scenario 1: sacking only season. Only fishing for sack oysters is allowed in a four-month (Oct. – Jan.) season. Fishing is not simulated in CSAs 1S and CSA 3, since they were anticipated to be closed to fishing (Table 2). Scenario 2: sacking only, delayed season. Only fishing for sack oysters is allowed in a four-month season delayed by one month (Nov. – Feb. fishing season). Fishing is not simulated in CSAs 1S and CSA 3 (Table 3). Scenario 3: Sack and seed fishing, delayed season. Fishing is not simulated in CSAs 1S and CSA 3 (Table 4). The proportion (percent) of seed fishing to sack fishing per season in each CSA for Scenario 3 is given in Table 5.

**Table 2. Scenario 1: sack oyster fishing only, October through January fishing season. Values are percent effort per month per CSA. Sack fishing pressure for a month is shown as the top number, whereas seed fishing pressure is shown below it.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CSA** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| 1N |  | 25 | 25 | 25 | 25 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 1S |  | 0 | 0 | 0 | 0 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 3 |  | 0 | 0 | 0 | 0 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 5E |  | 25 | 25 | 25 | 25 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 5W |  | 25 | 25 | 25 | 25 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 6 |  | 25 | 25 | 25 | 25 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |
| 7 |  | 25 | 25 | 25 | 25 |  |  |  |
|  |  | 0 | 0 | 0 | 0 |  |  |  |

**Table 3. Scenario 2: sack oyster fishing only, season delayed, November through February fishing season. Values are percent effort per month per CSA. Sack fishing pressure for a month is shown as the top number, whereas seed fishing pressure is shown below it.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CSA** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| 1N |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 1S |  |  | 0 | 0 | 0 | 0 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 3 |  |  | 0 | 0 | 0 | 0 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 5E |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 5W |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 6 |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 7 |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |

**Table 4. Scenario 3: sack and seed oyster fishing , November through February fishing season. Values are percent effort per month per CSA. Sack fishing pressure for a month is shown as the top number, whereas seed fishing pressure is shown below it.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CSA** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| 1N |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 100 | 0 | 0 | 0 |  |  |
| 1S |  |  | 0 | 0 | 0 | 0 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 3 |  |  | 0 | 0 | 0 | 0 |  |  |
|  |  |  | 0 | 0 | 0 | 0 |  |  |
| 5E |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 100 | 0 | 0 | 0 |  |  |
| 5W |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 100 | 0 | 0 | 0 |  |  |
| 6 |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 100 | 0 | 0 | 0 |  |  |
| 7 |  |  | 25 | 25 | 25 | 25 |  |  |
|  |  |  | 100 | 0 | 0 | 0 |  |  |

**Table 5. The proportion (percent) of seed fishing to sack fishing per season in each CSA for Scenario 3. In Scenarios 1 and 2, 100% of fishing is for sack oysters.**

|  |  |  |
| --- | --- | --- |
| **CSA** | **Seed** | **Sack** |
| 1N | 10 | 90 |
| 1S | 0 | 0 |
| 3 | 0 | 0 |
| 5E | 10 | 90 |
| 5W | 10 | 90 |
| 6 | 10 | 90 |
| 7 | 10 | 90 |

**Sustainable Harvest Estimates**

Simulations were conducted to estimate sustainable harvests from reefs which showed a positive shell balance in the initial simulations (simulations without fishing). The simulations were conducted within the constrains outlined above for Scenarios 1-3. The constraints include conserving the percent monthly effort for sack and seed (Tables 2-4) and the proportionality between them (Table 5). By thus constraining fishing, some reefs showed a net cultch gain --even under the no-net cultch loss standard. In these cases, the requirements of the fishing constraints were met before the model was solved by the no-net-loss standard.

The “fishable” reefs for which further simulations were conducted are as follows. In CSA 1N, the reefs (stations) which gained cultch in simulations without fishing included only Grand Banks and Shell Point (Table 6). No reefs in CSA 1S were deemed fishable. In CSA 3, the 2004 North and South Hackberry Bay Shell Plants, and the 2008 and 2014 Cultch Plants in Hackberry Bay show a positive cultch balance without fishing. The CSA 5E stations of Lake Chien 2004 Cultch Plant, Lake Chien 2009 Cultch Plant, and Lake Felicity are fishable, as are the CSA 5W stations of 2009 Sister Lake Cultch Plant, Buckskin Bayou Junop, Lake Mechant, Grand Pass, Mid Sister Lake, North 1994 Shell Plant, Old Camp, Sister Lake 2012 Cultch Plant 2, Sister Lake 2004 Cultch Plant and Walker’s Point. In CSA 6, only Nickle Reef is fishable. Sabine Lake stations 1-4 (CSA 7) showed a shell gain without fishing. In west Lake Calcasieu, West Rabbit Island, Northwest Rabbit Island, North Central West Cove and West Cove 9 and West Cove 10 showed a cultch gain without fishing, whereas in east Lake Calcasieu only Chenier’s Reef was fishable. Note that “fishability” is determined by an interaction of cultch density and oyster density (Table 6). Some reefs with low oyster densities are “fishable’ because cultch density is low. With less cultch available to be lost, fewer oysters are needed to achieve a no-net-cultch-loss reference standard. Such reefs, however, provide little sustainable catch.

**Table 6. Initial no-fishing simulations. Stations in each Coastal Study Area (CSA) are on natural reefs, shell plants (SP) and cultch plants (CP). Size assigned to stations is given in acres. Fishable reefs are indicated by the integer “1”; unfishable reefs are indicated by the integer “0” in the Fish? column. Oyster numbers (O) include all size classes. Initial densities for number of oysters (O/m2 A), shell (Sh/m2 A) and cultch (Clh/m2 A) in grams per m2 are given. Corresponding post-simulation values are listed as O/m2 B, Sh/m2 B and Clh/m2 B, respectively.**

| **CSA** | **Station** | **Acres** | **Fish?** | **O/m2 A** | **O/m2 B** | **Sh/m2 A** | **Sh/m2 B** | **Clh/m2 A** | **Clh/m2 B** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1N | 3-Mile | 1020 | 0 | 0.8 | 0.4 | 1166 | 1059 | 1336 | 1177 |
| 1N | Cabbage Reef | 1804 | 0 | 0 | 0 | 2432 | 2189 | 2433 | 2190 |
| 1N | Drum Bay | 1596 | 0 | 1.4 | 0.8 | 701 | 672 | 701 | 672 |
| 1N | E. Karako | 1020 | 0 | 0.6 | 0.3 | 587 | 545 | 587 | 545 |
| 1N | Grand Banks | 1066 | 1 | 10.6 | 5.8 | 1020 | 1039 | 1020 | 1039 |
| 1N | Grand Pass | 1804 | 0 | 0.2 | 0.1 | 665 | 600 | 665 | 600 |
| 1N | Grassy | 1066 | 0 | 0.8 | 0.5 | 179 | 188 | 240 | 230 |
| 1N | Halfmoon | 1066 | 0 | 0 | 0 | 137 | 123 | 139 | 125 |
| 1N | Holmes | 1592 | 0 | 0 | 0 | 10 | 9 | 10 | 9 |
| 1N | Johnson Bayou | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1N | Martin | 1592 | 0 | 0 | 0 | 65 | 58 | 130 | 104 |
| 1N | Millenium Reef | 1066 | 0 | 0.8 | 0.5 | 2110 | 1908 | 2313 | 2057 |
| 1N | Morgan Harbor | 2954 | 0 | 0.2 | 0.1 | 214 | 195 | 214 | 195 |
| 1N | Petit | 1066 | 0 | 0 | 0 | 104 | 94 | 151 | 127 |
| 1N | Round Island 2011 Cultch Plant | 291 | 0 | 5 | 3 | 2137 | 2020 | 4949 | 4747 |
| 1N | Shell Point | 47 | 1 | 10 | 5.5 | 323 | 444 | 5690 | 5731 |
| 1N | Turkey Bayou | 1804 | 0 | 0.6 | 0.3 | 455 | 413 | 896 | 722 |
| 1N | W. Karako | 1020 | 0 | 0.4 | 0.2 | 126 | 162 | 269 | 262 |
| 1S | 2009 Lonesome CP | 243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | Battledore Reef | 271 | 0 | 0 | 0 | 325 | 292 | 325 | 292 |
| 1S | Bay Crabe | 511 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | Bay Gardene | 632 | 0 | 0 | 0 | 1011 | 910 | 1258 | 1083 |
| 1S | Bay Long | 923 | 0 | 0 | 0 | 120 | 108 | 122 | 108 |
| 1S | Bayou Lost | 275 | 0 | 0 | 0 | 1864 | 1678 | 1874 | 1685 |
| 1S | Black Bay | 716 | 0 | 0 | 0 | 74 | 67 | 75 | 67 |
| 1S | California Bay | 923 | 0 | 0 | 0 | 0 | 0 | 47 | 9 |
| 1S | Curfew | 715 | 0 | 0 | 0 | 330 | 297 | 342 | 301 |
| 1S | E. Bay Crabe | 511 | 0 | 0 | 0 | 0 | 0 | 15 | 11 |
| 1S | E. Bay Gardene | 632 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | E. Pelican | 1445 | 0 | 0 | 0 | 78 | 70 | 106 | 93 |
| 1S | E. Stone | 829 | 0 | 0 | 0 | 155 | 139 | 156 | 140 |
| 1S | Elephant Pass | 202 | 0 | 0 | 0 | 288 | 259 | 317 | 265 |
| 1S | Horseshoe Reef | 829 | 0 | 0 | 0 | 79 | 71 | 79 | 71 |
| 1S | Jessie | 275 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | Lonesome | 715 | 0 | 0 | 0 | 28 | 25 | 31 | 27 |
| 1S | Mangrove Point | 1445 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | N. Black Bay | 829 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | N. California Bay | 715 | 0 | 0 | 0 | 149 | 134 | 160 | 136 |
| 1S | N. Lake Fortuna | 1727 | 0 | 0.4 | 0.2 | 520 | 479 | 521 | 479 |
| 1S | S. Black Bay | 715 | 0 | 0 | 0 | 444 | 400 | 444 | 400 |
| 1S | S. Lake Fortuna | 1727 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | Snake | 716 | 0 | 0 | 0 | 103 | 93 | 103 | 93 |
| 1S | Stone | 715 | 0 | 0 | 0 | 167 | 150 | 195 | 178 |
| 1S | Sunrise Point | 923 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | Telegraph | 715 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1S | W. Bay Crabe | 511 | 0 | 0 | 0 | 17 | 15 | 17 | 15 |
| 1S | W. Pelican | 923 | 0 | 0 | 0 | 233 | 210 | 242 | 211 |
| 1S | Wreck | 4486 | 0 | 0 | 0 | 462 | 416 | 479 | 428 |
| 3 | 2004 Barataria Bay Cultch Plant | 40 | 0 | 0 | 0 | 8 | 7 | 2106 | 2084 |
| 3 | 2004 N. Hackberry Shell Plant | 10 | 1 | 2.8 | 1.5 | 136 | 175 | 2308 | 2323 |
| 3 | 2004 S. Hackberry Shell Plant | 25 | 1 | 1.4 | 0.7 | 122 | 123 | 130 | 130 |
| 3 | 2008 Cultch Plant | 50 | 1 | 9 | 5 | 392 | 486 | 4144 | 4178 |
| 3 | 2012 Cultch Plant | 200 | 1 | 3.6 | 2.1 | 470 | 589 | 510 | 617 |
| 3 | Hackberry 2014 | 30 | 1 | 7.8 | 4.6 | 258 | 436 | 7800 | 7884 |
| 3 | Lower Hackberry | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | Middle Hackberry | 5 | 0 | 1.4 | 0.7 | 458 | 436 | 776 | 714 |
| 3 | Upper Hackberry | 5 | 0 | 4.6 | 2.3 | 606 | 613 | 1784 | 1592 |
| CSA5E | Lake Chien 2004 | 16 | 1 | 81 | 39.2 | 290 | 589 | 2442 | 2719 |
| CSA5E | Lake Chien 2009 | 22 | 1 | 24.6 | 12.2 | 170 | 260 | 1157 | 1237 |
| CSA5E | Lake Felicity | 40 | 1 | 121.2 | 58.5 | 227 | 689 | 1947 | 2392 |
| 5W | 09 SL Cultch Plant | 156 | 1 | 33 | 19.2 | 578 | 1074 | 3100 | 3566 |
| 5W | Buckskin Bayou Junop | 17 | 1 | 3.2 | 1.9 | 278 | 417 | 282 | 419 |
| 5W | Grand Pass | 107 | 1 | 8.4 | 4.9 | 603 | 796 | 696 | 860 |
| 5W | Junop Bayou DeWest | 34 | 0 | 8 | 4 | 449 | 442 | 450 | 442 |
| 5W | Lake Mechant | 30 | 1 | 24 | 13.5 | 369 | 517 | 3036 | 3152 |
| 5W | Mid 94 Shell Plant | 552 | 1 | 1 | 0.5 | 23 | 49 | 23 | 49 |
| 5W | Mid Bay Junop | 73 | 0 | 1 | 0.6 | 180 | 175 | 180 | 175 |
| 5W | Mid Sister Lake | 56 | 1 | 30 | 14.4 | 122 | 331 | 156 | 361 |
| 5W | N. 94 Shell Plant | 191 | 1 | 1.2 | 0.7 | 63 | 120 | 79 | 131 |
| 5W | N. 95 Shell Plant | 107 | 0 | 3.8 | 2 | 312 | 336 | 436 | 422 |
| 5W | Old Camp | 140 | 1 | 1.6 | 0.9 | 458 | 474 | 458 | 474 |
| 5W | Rat Bayou | 34 | 0 | 13.8 | 6.6 | 950 | 945 | 961 | 953 |
| 5W | S. 94 Shell Plant | 513 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5W | Sister Lake 2012 Cultch Plant 2 | 1 | 1 | 29.2 | 16.6 | 650 | 976 | 2607 | 2910 |
| 5W | SL 2004 Cultch Plant | 82 | 1 | 15.6 | 7.9 | 523 | 552 | 1797 | 1813 |
| 5W | Walkers Point | 107 | 1 | 7.4 | 4 | 477 | 572 | 504 | 590 |
| 6 | Bayou Blanc | 15 | 0 | 0 | 0 | 2250 | 2025 | 2579 | 2252 |
| 6 | Big Charles | 15 | 0 | 0.6 | 0.3 | 2568 | 2314 | 2593 | 2332 |
| 6 | Dry Reef | 10 | 0 | 0 | 0 | 401 | 361 | 506 | 435 |
| 6 | Highspot | 250 | 0 | 0.4 | 0.2 | 2737 | 2473 | 2766 | 2488 |
| 6 | Indian Point | 100 | 0 | 1.4 | 0.8 | 3385 | 3058 | 3388 | 3059 |
| 6 | Lighthouse Point | 30 | 0 | 1 | 0.6 | 3086 | 2805 | 3273 | 2936 |
| 6 | Middle Reef | 20 | 0 | 0 | 0 | 1014 | 913 | 1019 | 915 |
| 6 | N. Reef | 10 | 0 | 0 | 0 | 1677 | 1510 | 2145 | 1835 |
| 6 | Nickle Reef | 100 | 1 | 6 | 3.6 | 1474 | 1483 | 1481 | 1484 |
| 6 | Rabbit | 15 | 0 | 0 | 0 | 1618 | 1456 | 2327 | 1953 |
| 6 | Sally Shoals | 5 | 0 | 0 | 0 | 272 | 244 | 1117 | 836 |
| 7 | 09 Cultch Plant | 14 | 0 | 0 | 0 | 0 | 0 | 184 | 182 |
| 7 | 9 Mile | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Basket Reef | 23 | 0 | 0.8 | 0.5 | 418 | 407 | 542 | 494 |
| 7 | Big Washout | 350 | 0 | 0.2 | 0.1 | 1432 | 1290 | 1432 | 1290 |
| 7 | Chenier Reef | 35 | 1 | 7.8 | 4.7 | 2026 | 2142 | 8840 | 8859 |
| 7 | Lamberts Reef | 206 | 0 | 1.4 | 0.8 | 626 | 633 | 874 | 807 |
| 7 | Little Washout | 350 | 0 | 2.2 | 1.3 | 2215 | 2033 | 2215 | 2033 |
| 7 | Long Point | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Long Point North | 11 | 0 | 0 | 0 | 458 | 412 | 572 | 492 |
| 7 | Mid Lake | 350 | 0 | 3.2 | 1.9 | 2336 | 2224 | 2340 | 2225 |
| 7 | N.E. Rabbit | 297 | 0 | 1.4 | 0.8 | 322 | 380 | 782 | 702 |
| 7 | North Central W.C. | 297 | 1 | 2.8 | 1.7 | 1040 | 1072 | 1068 | 1088 |
| 7 | NW Rabbit Is. | 297 | 1 | 5 | 3 | 1197 | 1392 | 1215 | 1405 |
| 7 | Old Revetment North | 350 | 0 | 0 | 0 | 226 | 203 | 234 | 205 |
| 7 | S.E. Rabbit | 297 | 0 | 1.2 | 0.7 | 2296 | 2118 | 2296 | 2118 |
| 7 | Sabine Lake 1 | 260 | 1 | 62.2 | 37.3 | 2024 | 4843 | 2024 | 4843 |
| 7 | Sabine Lake 2 | 260 | 1 | 19.2 | 11.5 | 3006 | 3469 | 3006 | 3469 |
| 7 | Sabine Lake 3 | 260 | 1 | 53.8 | 32.2 | 2646 | 5201 | 2646 | 5201 |
| 7 | Sabine Lake 4 | 260 | 1 | 18.8 | 11.2 | 3686 | 4110 | 3686 | 4110 |
| 7 | Sabine Lake 5 | 219 | 0 | 2 | 1.2 | 1972 | 1808 | 2232 | 1990 |
| 7 | Sabine Lake 6 | 219 | 0 | 0.8 | 0.5 | 1739 | 1576 | 1739 | 1576 |
| 7 | South Bank W.C. | 298 | 0 | 1.2 | 0.7 | 846 | 838 | 1088 | 989 |
| 7 | W. Cove Trans | 704 | 0 | 0.4 | 0.2 | 1188 | 1071 | 1207 | 1083 |
| 7 | W. Rabbit | 297 | 1 | 2.2 | 1.3 | 1036 | 1090 | 1182 | 1188 |
| 7 | West Cove 10 | 298 | 1 | 1.4 | 0.8 | 593 | 629 | 613 | 643 |
| 7 | West Cove 9 | 297 | 1 | 0.6 | 0.4 | 132 | 194 | 132 | 194 |
| 7 | West Cove Central | 297 | 0 | 0.6 | 0.4 | 340 | 345 | 599 | 522 |

**Table 7. Scenario 1 results, sack oyster fishing only. CSA (Coastal Study Area), Station, Acres, Note on simulation solution, initial oyster density (O/m2 A, number per m2), initial shell density (Sh/m2 A, grams per m2), initial total cultch density (Clh/m2 A, grams per m2), sack harvest (TAC in sacks). “Solved” indicates the simulation reached the no-net loss end-point. “Sust.w/ Conds.” indicates a simulation that is sustainable with the fishing conditions applied. That is, the simulation did not reach the no-net-loss standard, but fulfilled the fishing constraints.**

| **CSA** | **Station Name** | **Acres** | **Note** | **O/m2 A** | **Sh/m2** | **C/m2** | **Sack Harvest** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1N | Grand Banks | 1066 | Solved | 10.6 | 1020 | 1020 | 7410 |
| 1N | Shell Point | 47 | Solved | 10 | 323 | 5690 | 688 |
| 3 | Hackberry 2014 | 30 | No Fishing Occurred. | 7.8 | 258 | 7800 | 0 |
| 3 | 2012 Cultch Plant | 200 | No Fishing Occurred. | 3.6 | 470 | 510 | 0 |
| 3 | 2004 N. Hackberry Shell Plant | 10 | No Fishing Occurred. | 2.8 | 136 | 2308 | 0 |
| 3 | 2004 S. Hackberry Shell Plant | 25 | No Fishing Occurred. | 1.4 | 122 | 130 | 0 |
| 3 | 2008 Cultch Plant | 50 | No Fishing Occurred. | 9 | 392 | 4144 | 0 |
| 5E | Lake Chien 2004 | 16 | Sust. w/ Conds. | 81 | 290 | 2442 | 0 |
| 5E | Lake Chien 2009 | 22 | Sust. w/ Conds. | 24.6 | 170 | 1157 | 0 |
| 5E | Lake Felicity | 40 | Sust. w/ Conds. | 121.2 | 227 | 1947 | 0 |
| 5W | Lake Mechant | 30 | Sust. w/ Conds. | 24 | 369 | 3036 | 30 |
| 5W | Buckskin Bayou Junop | 17 | Sust. w/ Conds. | 3.2 | 278 | 282 | 513 |
| 5W | Walkers Point | 107 | Sust. w/ Conds. | 7.4 | 477 | 504 | 1985 |
| 5W | Mid Sister Lake | 56 | Sust. w/ Conds. | 30 | 122 | 156 | 1193 |
| 5W | Grand Pass | 107 | Sust. w/ Conds. | 8.4 | 603 | 696 | 3979 |
| 5W | N. 94 Shell Plant | 191 | Sust. w/ Conds. | 1.2 | 63 | 79 | 2272 |
| 5W | Mid 94 Shell Plant | 552 | Sust. w/ Conds. | 1 | 23 | 23 | 2796 |
| 5W | SL 2004 Cultch Plant | 82 | Sust. w/ Conds. | 15.6 | 523 | 1797 | 0 |
| 5W | Old Camp | 140 | Solved | 1.6 | 458 | 458 | 1025 |
| 5W | 09 SL Cultch Plant | 156 | Sust. w/ Conds. | 33 | 578 | 3100 | 6942 |
| 5W | Sister Lake 2012 Cultch Plant 2 | 1 | Sust. w/ Conds. | 29.2 | 650 | 2607 | 21 |
| 6 | Nickle Reef | 100 | Solved | 6 | 1474 | 1481 | 142 |
| 7 | Sabine Lake 1 | 260 | Sust. w/ Conds. | 62.2 | 2024 | 2024 | 138103 |
| 7 | Sabine Lake 2 | 260 | Sust. w/ Conds. | 19.2 | 3006 | 3006 | 33496 |
| 7 | Sabine Lake 3 | 260 | Sust. w/ Conds. | 53.8 | 2646 | 2646 | 133831 |
| 7 | Sabine Lake 4 | 260 | Sust. w/ Conds. | 18.8 | 3686 | 3686 | 35551 |
| 7 | NW Rabbit Is. | 297 | Sust. w/ Conds. | 5 | 1197 | 1215 | 17578 |
| 7 | North Central W.C. | 297 | Solved | 2.8 | 1040 | 1068 | 2489 |
| 7 | West Cove 9 | 297 | Sust. w/ Conds. | 0.6 | 132 | 132 | 4521 |
| 7 | West Cove 10 | 298 | Solved | 1.4 | 593 | 613 | 3794 |
| 7 | W. Rabbit | 297 | Solved | 2.2 | 1036 | 1182 | 717 |
| 7 | Chenier Reef | 35 | Solved | 7.8 | 2026 | 8840 | 277 |

The TAC for each simulated fishable reef under scenario 1 (sack only) is show in Table 7. No fishing was allowed in CSA 3 and therefore no further simulations were conducted; however, although Sabine Lake was not open to fishing, simulations were conducted to determine the extent of the TAC for comparisons to production in previous years. Most of the available resource is thus in CSA 5W and Lake Calcasieu stations in CSA 7.

The TAC under scenario 2 (sack only, delayed season) is shown in Table 8. Again, most of the available resource is thus in CSA 5W and Lake Calcasieu stations in CSA 7. The one month season delay resulted in an increased TAC in CSA 1N and 5W, but not in CSA 7.

**Table 8. Scenario 2 results, sack oyster fishing, delayed season. CSA (Coastal Study Area), Station, Acres, Note on simulation solution, initial oyster density (O/m2 A, number per m2), initial shell density (Sh/m2 A, grams per m2), initial total cultch density (Clh/m2 A, grams per m2), sack harvest (TAC in sacks). “Solved” indicates the simulation reached the no-net loss end-point. “Sust.w/ Conds.” indicates a simulation that is sustainable with the fishing conditions applied. That is, the simulation did not reach the no-net-loss standard, but fulfilled the fishing constraints.**

| **CSA** | **Name** | **Acres** | **Note** | **O/m2 A** | **Sh/m2 A** | **Clh/m2 A** | **Sack** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1N | Grand Banks | 1066 | Solved | 10.6 | 1020 | 1020 | 7934 |
| 1N | Shell Point | 47 | Solved | 10 | 323 | 5690 | 780 |
| 3 | Hackberry 2014 | 30 | No Fishing Occurred. | 7.8 | 258 | 7800 | 0 |
| 3 | 2012 Cultch Plant | 200 | No Fishing Occurred. | 3.6 | 470 | 510 | 0 |
| 3 | 2004 N. Hackberry SP | 10 | No Fishing Occurred. | 2.8 | 136 | 2308 | 0 |
| 3 | 2004 S. Hackberry SP | 25 | No Fishing Occurred. | 1.4 | 122 | 130 | 0 |
| 3 | 2008 Cultch Plant | 50 | No Fishing Occurred. | 9 | 392 | 4144 | 0 |
| 5E | Lake Chien 2004 | 16 | Sust. w/ Conds. | 81 | 290 | 2442 | 0 |
| 5E | Lake Chien 2009 | 22 | Sust. w/ Conds. | 24.6 | 170 | 1157 | 0 |
| 5E | Lake Felicity | 40 | Sust. w/ Conds. | 121.2 | 227 | 1947 | 0 |
| 5W | Lake Mechant | 30 | Sust. w/ Conds. | 24 | 369 | 3036 | 30 |
| 5W | Buckskin Bayou Junop | 17 | Sust. w/ Conds. | 3.2 | 278 | 282 | 506 |
| 5W | Walkers Point | 107 | Sust. w/ Conds. | 7.4 | 477 | 504 | 2017 |
| 5W | Mid Sister Lake | 56 | Sust. w/ Conds. | 30 | 122 | 156 | 1198 |
| 5W | Grand Pass | 107 | Sust. w/ Conds. | 8.4 | 603 | 696 | 3998 |
| 5W | N. 94 Shell Plant | 191 | Sust. w/ Conds. | 1.2 | 63 | 79 | 2237 |
| 5W | Mid 94 Shell Plant | 552 | Sust. w/ Conds. | 1 | 23 | 23 | 2760 |
| 5W | SL 2004 Cultch Plant | 82 | Sust. w/ Conds. | 15.6 | 523 | 1797 | 0 |
| 5W | Old Camp | 140 | Solved | 1.6 | 458 | 458 | 1180 |
| 5W | 09 SL Cultch Plant | 156 | Sust. w/ Conds. | 33 | 578 | 3100 | 6960 |
| 5W | Sister Lake 2012 CP 2 | 1 | Sust. w/ Conds. | 29.2 | 650 | 2607 | 22 |
| 6 | Nickle Reef | 100 | Solved | 6 | 1474 | 1481 | 167 |
| 7 | Sabine Lake 1 | 260 | Sust. w/ Conds. | 62.2 | 2024 | 2024 | 137450 |
| 7 | Sabine Lake 2 | 260 | Sust. w/ Conds. | 19.2 | 3006 | 3006 | 33790 |
| 7 | Sabine Lake 3 | 260 | Sust. w/ Conds. | 53.8 | 2646 | 2646 | 132512 |
| 7 | Sabine Lake 4 | 260 | Sust. w/ Conds. | 18.8 | 3686 | 3686 | 35586 |
| 7 | NW Rabbit Is. | 297 | Sust. w/ Conds. | 5 | 1197 | 1215 | 17350 |
| 7 | North Central W.C. | 297 | Solved | 2.8 | 1040 | 1068 | 2959 |
| 7 | West Cove 9 | 297 | Sust. w/ Conds. | 0.6 | 132 | 132 | 4308 |
| 7 | West Cove 10 | 298 | Solved | 1.4 | 593 | 613 | 4437 |
| 7 | W. Rabbit | 297 | Solved | 2.2 | 1036 | 1182 | 854 |
| 7 | Chenier Reef | 35 | Solved | 7.8 | 2026 | 8840 | 324 |

**Table 9. Scenario 3 results, sack and seed oyster fishing, delayed season. CSA (Coastal Study Area), Station, Acres, Note on simulation solution, initial oyster density (O/m2 A, number per m2), initial shell density (Sh/m2 A, grams per m2), initial total cultch density (Clh/m2 A, grams per m2), sack and seed harvest (TAC in sacks). “Solved” indicates the simulation reached the no-net loss end-point. “Sust.w/ Conds.” indicates a simulation that is sustainable with the fishing conditions applied. That is, the simulation did not reach the no-net-loss standard, but fulfilled the fishing constraints. Cultch and shell in g/m2.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CSA** | **Station** | **Acres** | **Fish?** | **Note** | **O/m2 A** | **Sh/m2 A** | **Clh/m2 A** | **Cultch** | **Shell** | **Sack** | **Seed** |
| 1N | Grand Banks | 1066 | 1 | Solved | 10.6 | 1020 | 1020 | 826 | 826 | 2842 | 1023 |
| 1N | Shell Point | 47 | 1 | Solved | 10 | 323 | 5690 | 83 | 6 | 161 | 86 |
| 3 | Hackberry 2014 | 30 | 1 | No Fishing Occurred. | 7.8 | 258 | 7800 | 0 | 0 | 0 | 0 |
| 3 | HB 2012 CP | 200 | 1 | No Fishing Occurred. | 3.6 | 470 | 510 | 0 | 0 | 0 | 0 |
| 3 | 2004 N. HB SP | 10 | 1 | No Fishing Occurred. | 2.8 | 136 | 2308 | 0 | 0 | 0 | 0 |
| 3 | 2004 S. HB SP | 25 | 1 | No Fishing Occurred. | 1.4 | 122 | 130 | 0 | 0 | 0 | 0 |
| 3 | 2008 Cultch Plant | 50 | 1 | No Fishing Occurred. | 9 | 392 | 4144 | 0 | 0 | 0 | 0 |
| 5E | Lake Chien 2004 | 16 | 1 | Solved | 81 | 290 | 2442 | 221 | 35 | 0 | 287 |
| 5E | Lake Chien 2009 | 22 | 1 | Solved | 24.6 | 170 | 1157 | 90 | 16 | 0 | 109 |
| 5E | Lake Felicity | 40 | 1 | Sust. w/ Conds. | 121.2 | 227 | 1947 | 497 | 91 | 0 | 760 |
| 5W | Lake Mechant | 30 | 1 | Solved | 24 | 369 | 3036 | 182 | 27 | 16 | 213 |
| 5W | Buckskin Bayou | 17 | 1 | Sust. w/ Conds. | 3.2 | 278 | 282 | 41 | 41 | 504 | 45 |
| 5W | Walkers Point | 107 | 1 | Solved | 7.4 | 477 | 504 | 272 | 256 | 1990 | 332 |
| 5W | Mid Sister Lake | 56 | 1 | Sust. w/ Conds. | 30 | 122 | 156 | 90 | 78 | 1191 | 177 |
| 5W | Grand Pass | 107 | 1 | Solved | 8.4 | 603 | 696 | 509 | 441 | 3940 | 653 |
| 5W | N. 94 Shell Plant | 191 | 1 | Sust. w/ Conds. | 1.2 | 63 | 79 | 146 | 122 | 2215 | 171 |
| 5W | Mid 94 SP | 552 | 1 | Sust. w/ Conds. | 1 | 23 | 23 | 139 | 139 | 2760 | 154 |
| 5W | SL 2004 CP | 82 | 1 | Solved | 15.6 | 523 | 1797 | 69 | 22 | 0 | 77 |
| 5W | Old Camp | 140 | 1 | Solved | 1.6 | 458 | 458 | 69 | 69 | 641 | 74 |
| 5W | 09 SL CP | 156 | 1 | Solved | 33 | 578 | 3100 | 2938 | 772 | 6829 | 3898 |
| 5W | SL 2012 CP 2 | 1 | 1 | Solved | 29.2 | 650 | 2607 | 13 | 4 | 21 | 17 |
| 6 | Nickle Reef | 100 | 1 | Solved | 6 | 1474 | 1481 | 12 | 12 | 71 | 14 |
| 7 | Sabine Lake 1 | 260 | 1 | Sust. w/ Conds. | 62.2 | 2024 | 2024 | 6237 | 6237 | 136899 | 7775 |
| 7 | Sabine Lake 2 | 260 | 1 | Solved | 19.2 | 3006 | 3006 | 2931 | 2931 | 31893 | 3170 |
| 7 | Sabine Lake 3 | 260 | 1 | Sust. w/ Conds. | 53.8 | 2646 | 2646 | 7102 | 7102 | 131613 | 8503 |
| 7 | Sabine Lake 4 | 260 | 1 | Solved | 18.8 | 3686 | 3686 | 2729 | 2729 | 30492 | 2949 |
| 7 | NW Rabbit Is. | 297 | 1 | Solved | 5 | 1197 | 1215 | 1379 | 1358 | 16204 | 1427 |
| 7 | N. Central W.C. | 297 | 1 | Solved | 2.8 | 1040 | 1068 | 155 | 150 | 1765 | 160 |
| 7 | West Cove 9 | 297 | 1 | Sust. w/ Conds. | 0.6 | 132 | 132 | 341 | 341 | 4308 | 341 |
| 7 | West Cove 10 | 298 | 1 | Solved | 1.4 | 593 | 613 | 224 | 216 | 2824 | 225 |
| 7 | W. Rabbit | 297 | 1 | Solved | 2.2 | 1036 | 1182 | 39 | 34 | 541 | 39 |
| 7 | Chenier Reef | 35 | 1 | Solved | 7.8 | 2026 | 8840 | 26 | 7 | 103 | 26 |

The TAC under scenario 3 (seed and sack, delayed season) is shown in Table 9. Most of the *available* sack and seed resource is in CSA 5W and Lake Calcasieu stations in CSA 7. Sabine Lake reefs (CSA 7) were simulated for both sack and seed fishing. It has a comparatively large resource, however it is not open to fishing.

**Table 10. Sustainable harvest estimates. Area refers to a CSA or selected stations within a CSA (Sabine Lake). Sack only regular = Scenario 1, Sack only delayed = Scenario 2, Sack and Seed delayed = Scenario 3. Sack and seed reported in sacks**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Area** | **Sack Only Regular** | **Sack Only Delayed** | **Sack + Seed Delayed** | |
|  |  |  | **Sack** | **Seed** |
| 1N | 8098 | 8714 | 3003 | 1109 |
| 1S | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 |
| 5E | 0 | 0 | 0 | 1156 |
| 5W | 20756 | 20908 | 20107 | 5811 |
| 6 | 142 | 167 | 71 | 14 |
| 7 | 370357 | 369570 | 356642 | 24615 |
| Sabine | 340981 | 339338 | 330897 | 22397 |
| 7 - Sabine | 29376 | 30232 | 25745 | 2218 |
| **Total** | 399353 | 399359 | 379823 | 32705 |
| **Total - Sabine** | 58372 | 60021 | 48926 | 10308 |

Table 10 provides a summary of the results from scenarios 1-3 and the estimation of statewide TAC, which is the Total less the estimate from Sabine (Total – Sabine). In CSA 1N delayed fishing results in an increase in TAC by 616 sacks, whereas fishing for seed decreases TAC by 4,592 sacks. Allowing seed fishing in CSA 5E results in 1,156 sacks of seed. A slight (152 sack) increase in sack oysters is achieved by a delayed season in CSA 5E; interestingly, allowing seed fishing there results in an increase in TAC (by 5,070 sacks). Typically, CSA 6 provides little to the statewide TAC; this year is no exception. Delayed fishing adds 25 sacks to the TAC, whereas seed fishing decreases it by 82 sacks. The available resource in CSA 7 is the contribution of the Calcasieu Lake stations (i.e., 7 – Sabine in Table 10). Delayed fishing in Calcasieu Lake increases TAC by 856 sacks, whereas allowing seed fishing decrease TAC by 2,269 sacks. The estimation of statewide TAC (Total – Sabine) is 58,372 sacks for Scenario 1, 60,021 sacks for Scenario 2 and 59,234 sacks for Scenario 3 (sum of sack and seed). Note that delayed fishing results in an increase in TAC and seed fishing diminished TAC; however, the decrease is relatively small (787 sacks), with the benefit of providing 10,308 sacks of seed oysters to the fishery.

**Review of SAW Recommendations for 2016/2017**

**Recommendation 1.** Sustainable harvest estimates of Area Management Units (AMUs) opened for harvest are thresholds that should not be exceeded.

**Status:** Comparisons of the estimate sustainable harvest to the shell budget fraction were made for CSA 1N, CSA3, Lake Mechant (CSA 5W), Bay Junop (CSA 5W), and the East Side (CSA 7) and West Cove (CSA 7) of Calcasieu Lake (Tables 11 -15).

In CSA 1N the shell budget estimate was exceeded by 179% for seed oysters and 262% for sack oysters (Table 11). Seed harvest exceeded the Shell Budget Fraction (SBF) in 7 days, whereas sack SBF was exceeded in a 146 day season.

**Table 11. Harvest of seed (in barrels, bbls) and sack (market) oysters (in sacks) from CSA 1N. Harvest Fraction is harvest as a percent of stock size. Shell Budget Fraction is the estimated sustainable harvest from the shell budget model as a percent of harvest.**

|  |  |  |
| --- | --- | --- |
|  | **Seed** | **Sack** |
| Harvest | 32,265 bbls | 18,072 sacks |
| Harvest Fraction | 7% | 8% |
| Shell Budget Fraction | 179% | 262% |
| Season Length | 7 days | 146 days |

In CSA 3, seed fishing was within the shell budget estimate, albeit with one day fishing season. Sack harvest exceeded the shell budget estimate by 432% in a 7 day season (Table 12).

**Table 12.** **Harvest of seed (in barrels, bbls) and sack (market) oysters (in sacks) from CSA 3. Harvest Fraction is harvest as a percent of stock size. Shell Budget Fraction is the estimated sustainable harvest from the shell budget model as a percent of harvest.**

|  |  |  |
| --- | --- | --- |
|  | **Seed** | **Sack** |
| Harvest | 890 bbls | 1,420 sacks |
| Harvest Fraction | 5% | 23% |
| Shell Budget Fraction | 90% | 432% |
| Season Length | 1 day | 7 days |

In Lake Mechant (Table 13) seed fishing greatly exceeded (1880%) the shell budget estimate in a 33-day season. Sack fishing was not allowed there.

**Table 13. Harvest of seed (in barrels, bbls) and sack (market) oysters (in sacks) from Lake Mechant. Harvest Fraction is harvest as a percent of stock size. Shell Budget Fraction is the estimated sustainable harvest from the shell budget model as a percent of harvest. Harvest of sack oysters was not allowed.**

|  |  |  |
| --- | --- | --- |
|  | **Seed** | **Sack** |
| Harvest | 2,670 bbls | N/A |
| Harvest Fraction | 122% | N/A |
| Shell Budget Fraction | 1880% | N/A |
| Season Length | 33 days | N/A |

Seed harvest in Bay Junop (Table 14) was negligible (15 barrels) and did not exceed the Shell Budget estimate (27%) during a short (3 day) season. Sack harvest greatly exceeded the stock estimate (1,483%) in a 168-day season; this mismatch was due to an abundance of seed oysters present during the stock assessment which grew into market (sack) oysters at the time of harvest. Since the reefs in Bay Junop were “unfishable”, it is not possible to estimate a Shell Budget Fraction.

**Table 14.** **Harvest of seed (in barrels, bbls) and sack (market) oysters (in sacks) from Bay Junop. Harvest Fraction is harvest as a percent of stock size. Shell Budget Fraction is the estimated sustainable harvest from the shell budget model as a percent of harvest.**

|  |  |  |
| --- | --- | --- |
|  | **Seed** | **Sack** |
| Harvest | 15 bbls | 2,240 sacks |
| Harvest Fraction | 2% | 1,483% |
| Shell Budget Fraction | 27% | Not Fishable |
| Season Length | 3 days | 168 days |

No seed fishing occurred in Calcasieu Lake and the thus harvest is reported for sack oysters only (Figure 15). Harvest in West Cove (58-day season) and East Side (88-day season) were within Shell Budget estimates, 61% and 25% respectively.

**Figure 15**. **Harvest of sack (market) oysters (in sacks) from West Cove and East Side of Lake Calcasieu. Harvest Fraction is harvest as a percent of stock size. Shell Budget Fraction is the estimated sustainable harvest from the shell budget model as a percent of harvest.**

|  |  |  |
| --- | --- | --- |
|  | **West Cove** | **East Side** |
| Harvest | 13,717 sacks | 8,063 sacks |
| Harvest Fraction | 30% | 30% |
| Shell Budget Fraction | 61% | 25% |
| Season Length | 58 days | 30% |

**Recommendation 2.** Conduct 2017 sustainable harvest simulations using the standards of no-net loss of cultch and a 10% increase in cultch. Conduct simulations of reefs with a cultch mass of ≥ 1000 g/m2 and ≥ 25 oysters/m2 with a no-net cultch loss standard. Conduct above simulations under the assumptions of a wet year, dry year and normal year.

**Status:** Monthly mean salinities were established to characterize wet, dry and normal years. As a first approximation, a wet year is one with mean monthly salinity of 8, a dry year one with a mean monthly salinity of 20 and a normal year is one with a mean monthly salinity of 14. Simulations were not conducted using this scenario, however.

**Recommendation 3**. Continue to evaluate Annual Stock Assessment methods and explore potential modifications to sampling design to improve estimates.

**Status**: A proposal was submitted to the Gulf of Mexico Research Initiative from the five Gulf States to address this issue. The proposal was not funded and proposals for Saltonstall-Kennedy (NOAA) and the National Science Foundation were developed. LDWF added sample stations in Lake Calcasieu and initiated studies on random grid versus fixed station sampling.

**Recommendation 4.** Apply to each AMU growth and mortality profiles based on temperate and salinity.

**Status:** Equations were finalized for the calculation of oyster growth and mortality as a function of water temperature and salinity. Equations for growth were determined for spat, seed and sack oysters, whereas it was possible to determine mortality for sack oysters only. Results were published in Lowe et al. (2017). The newly-developed equations for growth and mortality were not implemented in the 2017 simulations -- more time is required to test the new equations in the model environment. Furthermore, changes to the Oyster Sentinel model infrastructure (code base) is not complete. Completion of infrastructure changes will facilitate integration of the new equations. Integration of the new equations requires temperature and salinity profiles. The salinity profile would correspond to that of dry, wet, and normal years as described above (wet = 8, normal = 14, dry = 20). Thus, every “fishable reef” could be simulated under the three salinity regimes. An annual temperature profile using monthly means derived from Eugene Island, LA is proposed (Table 16). Because estuarine water temperature varies less than salinity, a single temperature profile is deemed sufficient for all simulations.

**Table 16. Mean monthly water temperatures from Eugene Island, central coastal Louisiana. Data from: https://www.currentresults.com/Oceans/Temperature/louisiana-alabama-average-water-temperature.php#c**

|  |  |
| --- | --- |
| **Month** | **Mean Temperature** |
| January | 11 C |
| February | 12 C |
| March | 16 C |
| April | 20 C |
| May | 24 C |
| June | 28 C |
| July | 29 C |
| August | 29 C |
| September | 28 C |
| October | 23 C |
| November | 17 C |
| December | 13 C |

**Recommendation 5**. Continue to collect and report data on the harvest per vessel per day.

**Status**: Harvest per vessel data for sack and seed were collected during the 2016/2017 season on some of the public oyster grounds (Table 17).

**Table 17. Harvest per vessel per day for seed and sack oysters for the 2016/2017 Season, including the total seed and sack harvest and the number of vessels fishing seed (bedding vessels) and the number of vessels sacking oysters (sacking vessels).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Area:** | **Average SEED per Vessel per Day (barrels)** | **Total SEED Harvest (barrels)** | **Maximum/Avg Num. Bedding Vessels** | **Average SACK Harvest per Vessel per Day** | **Total SACK Harvest (sacks)** | **Maximum/Avg Num. Sacking Vessels** |
| **CSA1N** | 322.6 | 32,265 | 30/20 | 21.6 | 18,072 | 71/12.4 |
| **Hackberry Bay** | 98.9 | 890 | 9 | 23.9 | 1,420 | 18/10 |
| **Junop/ Mechant** | 65 | 2,685 | 4 | 30 | 2,240 | 13 |
| **CSA6** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Calcasieu Lake** | N/A | N/A | N/A | 7 | 21,780 | 46/27 |

**Recommendation 6.** Continue initiative to determine the percent of harvest from private lease production that is dependent on the public grounds.

**Status:** A survey of leaseholders inquiring about dependence on the public grounds would likely be the best method to address this, but no such effort was made in 2016/2017.

**Recommendation 7**. Whenever possible, use oyster shell as opposed to other cultch types for reef restoration and maintenance.

**Status:** Recent cultch plantings and living shoreline projects, including those using shell are shown in Table 18.

**Table 18. Living shoreline and Cultch Plant projects utilizing oyster shell.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Project** | **Location** | **Constructed By** | **Size** | **Material** | **Status** |
| Living Shoreline | Lake Athanasio | CRCL/TNC | 2,700 ft | Cages filled with shells | Complete: November 2016 |
| Living Shoreline | Bay Eloi (CSA1) | CPRA | 2.9 miles | Various (OB,RBa,WAD,JAX,RBI) | Complete: November 2016 |
| Living Shoreline | Calcasieu Lake (CSA7) | TNC | 1 mile | Cages filled with concrete/shell | Complete: August 2017 |
| Cultch Plant | Lake Fortuna | LDWF | 100 acres | Fossil shell/hatchery spat on shell | September 2017 |
| Cultch Plant | Calcasieu Lake | LDWF | 100 acres | Limestone/shell | September 2017 |

**Recommendation 8**. Establish a mature reef in CSA1S by moving large oysters to an existing reef or shell plant.

**Status**: Completed.

**Recommendation 9**. Develop and maintain a program to continuously survey the public grounds to determine reef size and location.

**Status:** Although a state-wide ongoing program has yet to be established, side scan sonar surveys were conducted in Hackberry Bay (CSA 3) and Lake Calcasieu (CSA 7).

**Recommendation 10**. Research and consider sampling methods such as dredging and patent tongs to increase stock assessment survey coverage.

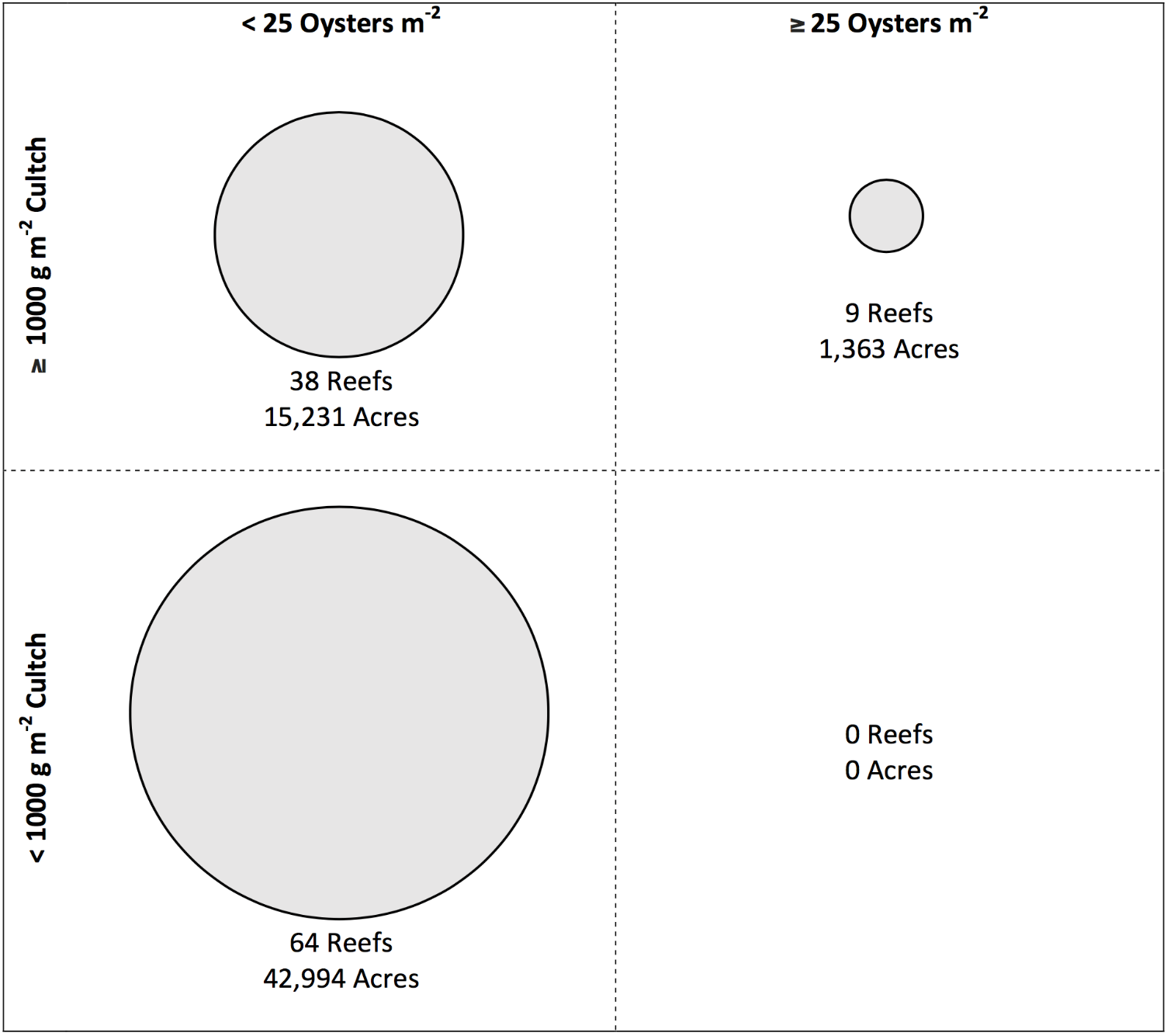
**Status**: A proposal was submitted to GOMRI to obtain resources to address this issue, but was not funded.

**Recommendation 11**. Take advantage of and promote the closure of Sabine Lake to conduct scientific studies on unfished reefs.

**Status**: Sabine Lake remains closed, but has not been the subject of a special investigation.

**Recommendation 12**. Use reference point options for cultch and oyster abundance to develop management approaches under the four possible combinations of cultch density and oyster density.

**Status**: The classification of reefs according to cultch and oyster density (Figure 4) provides a framework for the development of management approaches for the restoration of reefs and populations. The goal of management is to bring all reefs into high cultch/high abundance quadrant. Significantly, there are no examples of reefs with an abundance of oysters (≥ 25 m-2) when cultch is depleted (< 1000 g m-2). Management approaches are as follows. Fishing should not be allowed on low cultch/low abundance reefs. Management strategies there should focus on cultch addition when and where temperature and salinity are favorable for spat set. Spat on shell might be added to boost both cultch and oyster density, but a direct transition to the high cultch/high abundance quadrant is unlikely. The overturning of cultch, intended to expose buried cultch to ambient larvae should be discouraged on cultch poor reefs. The conversion of reef core to surficial cultch, accelerates the cultch loss rate. No fishing should be allowed on cultch and oyster depleted reefs. Overturn of cultch on reefs with a high cultch density, however, may be a viable management strategy. Market oysters could be transplanted to high cultch/low abundance reefs and spat-on-shell would also elevate oyster numbers there. Fishing should not be allowed on these oyster-poor reefs. Fishing should be restricted to the high cultch/high abundance reefs, within the constraint of no-net-loss of cultch.

****

**Figure 4. A classification of Louisiana public oyster reefs according to according to oyster density (g m-2) and cultch density (g m-2) reference points, based on the Louisiana Department of Wildlife and Fisheries 2016 Stock Assessment.**

**Recommendation 13.** Use estimates of the availability of spat-on-shell in simulations to determine its contribution to sustainable harvest.

**Status**: An estimate of the proportion of spat-on-shell to the standing stock was made. The assumption of the estimate is that at maximum hatchery capacity (2 sets per month, a 5-month hatchery season), survival of 3 oysters to market size per 20 spat set per shell and 20 cu. ft. of shell per set, the expected hatchery contribution is 71,667 sacks of sack oysters per year. The hatchery production estimated as a proportion of the stock size. A time series from 1997 to 2016 (Table 19) shows periods of oyster abundance and scarcity. The contribution of spat-on-shell is greatest in times of oyster scarcity (2016, 9.93%) and least in times of oyster abundance (2001, 0.83%). The average contribution of hatchery production over the time series is 3.85%

**Table. 19. Times series of the potential contribution of the hatchery production to the Public fishery. Comparison is made between sacks of market-sized oysters from hatchery production and the number of sacks of market- sized oysters as estimated by the Stock Assessment.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Sacks (hatchery)** | **Sacks (stock asses.)** | **% (hatchery/stock)** |
| 1997 | 71667 | 6828941 | 1.05 |
| 1998 | 71667 | 4539383 | 1.58 |
| 1999 | 71667 | 4399001 | 1.63 |
| 2000 | 71667 | 5113898 | 1.40 |
| 2001 | 71667 | 8609618 | 0.83 |
| 2002 | 71667 | 4447926 | 1.61 |
| 2003 | 71667 | 3258111 | 2.20 |
| 2004 | 71667 | 3045824 | 2.35 |
| 2005 | 71667 | 2421951 | 2.96 |
| 2006 | 71667 | 749044 | 9.57 |
| 2007 | 71667 | 1820940 | 3.94 |
| 2008 | 71667 | 2526948 | 2.84 |
| 2009 | 71667 | 1222214 | 5.86 |
| 2010 | 71667 | 1538400 | 4.66 |
| 2011 | 71667 | 2062734 | 3.47 |
| 2012 | 71667 | 1461665 | 4.90 |
| 2013 | 71667 | 1455442 | 4.92 |
| 2014 | 71667 | 1699456 | 4.22 |
| 2015 | 71667 | 1003018 | 7.15 |
| 2016 | 71667 | 721701 | 9.93 |

**Recommendation 14**. Develop a spat-to-cultch reference point to discourage the fishing of cultch in the absence or paucity of spat.

**Status**: Recommendations were developed. Fishing down of cultch in the absence of abundant spat and seed should be discouraged. The practice results in the fishing of cultch and its removal from Public Grounds, while providing little seed for transplant to private leases. Nonetheless, some reefs are more resilient to cultch loss than others. Examples are cultch plants that have cultch densities far greater than that of unfished natural reefs (e.g., reefs in Sabine Lake). Maximum cultch density of unfished natural reefs is roughly 3000 g/m2. A lower limit for cultch density has been established as 1000 g/m2 (Figure 4). As a precautionary measure, fishing seed should not be allowed to diminish cultch density to < 2000 g/m2. Furthermore, if cultch is “fished down”, the volume of spat, seed, and shell should not exceed the volume of the living spat and seed by more than an order of magnitude; otherwise, the practice results in substantial loss of cultch with minimal gain in seed.

**Recommendation 15**. Suggest improvements for the electronic transfer of data -– in particular, develop a mechanism for the single-entry of Stock Assessment data.

Status: The single-entry of Stock Assessment (SA) data was accomplished. LDWF now enters SA data via their portal only.

**Recommendation 16**. Apply the shell-budget model to private leases, including natural reefs and cultch plants.

**Status**: No applications of the shell budget to private leases have been made.

**Recommendation 17**. Include, in simulations, the effect of seed fishing on sack oysters harvested.

**Status:** The inclusion of the effect of seed fishing on sack oysters was not included in this year’s simulations.

**Recommendation 18.** Express support to LDWF for the re-instatement of the Vessel Management System on Public Oyster Grounds.

**Status**: A letter of support from the SAW for the re-instatement of VMS on Public Grounds was sent to LDWF. A response from LDWF indicated that a lack of funding resulted in termination of the program.

**Recommendation 19.** Continue the Stock Assessment Workshop process. Schedule SAW6 in August 2017.

**Status**: The Sixth Annual SAW scheduled for August 29th, 2017 was cancelled due to Hurricane Harvey. SAW6 was re-scheduled and held on December 5th, 2017.

**Recommendations for 2017/2018**

**Recommendation 1**. Complete upgrades to model/database environment.

**Recommendation 2**. Incorporate new equations for growth and mortality (old equations maintained for spat and seed mortality).

**Recommendation 3**. Incorporate the impact of seed fishing on sack oysters harvested.

**Recommendation 4.** Construct a lookup table for salinity. Use historic data and a quartile approach to characterize low, moderate and high salinity years. Capture monthly variation in salinity.

**Recommendation 5**. Determine sustainable harvest at low (8 annual mean), moderate (14 annual mean) and high (20 annual mean) salinity.

**Recommendation 6.** Use long-term data to determine if the summer high mortality season is becoming extended.

**Recommendation 7.** Develop a multiple year model to evaluate model parameters such as growth, mortality and shell loss.

**Recommendation 8**. Deploy spat collectors where recruitment is expected.

**Recommendation 9**. Use stock assessment data to ground truth side scan sonar in CSA 3.

**Recommendation 10**. Add another Industry representative to the SAW committee.

**Recommendation 11.** Schedule SAW 7 for August 2018.

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