OYSTER MORTALITY STUDY

Executive Summary (May 2011)

Introduction and Methods

In response to extended periods of depressed salinities in the Breton Sound and Barataria basins during the spring and summer of 2010, a simple, basin-wide biological investigation was initiated to determine the spatial distribution and level of oyster mortalities within each basin. Biological sampling was undertaken during the weeks of August 9 – 20, 2010 at multiple sites on both public grounds and in private lease areas using a 24” hand dredge with the goal of obtaining a sample of no less than 100 animals per sample site. After locating potential oyster resource at each sample site using the poling method, no more than four 3-minute dredge tows were initiated to collect the composite sample. At many sample sites, a sample of 100 animals was not available. The composite sample was then evaluated using standard LDWF oyster data collection methods and the data was recorded. All samples were returned to the water at the location from which they were collected.

Results and Discussion

Selected summary results of biological sampling are contained within Table 1 below. In the Barataria basin, a total of 1,123 animals were collected at 17 locations. Sampling at 21 locations in the Breton Sound basin yielded 827 animals. In general, oysters at up-estuary sites and at sites closer to the lower Mississippi River suffered higher levels of oyster mortality than other sites. Additionally, data suggest that basin-wide mortalities were more significant in the Breton Sound basin than in the Barataria basin. The higher mortality levels in privately leased areas as compared to public grounds in the Breton Sound basin are not surprising considering private leases in this basin are situated closer to freshwater sources. Although discrete salinity measurements provide only a snap-shot of conditions at small temporal scales, average recorded bottom salinity during this sampling event was 3.2 parts per thousand (ppt) in the Breton Sound basin and 9.9 ppt in the Barataria basin.

Table 1. Average oyster mortalities for selected hydrologic basins in coastal Louisiana as determined from August 2010 biological sampling.

Basin Area	**Breton Sound Basin**			**Barataria Basin**		
	Seed	*Sack*	*Combined*	*Seed*	*Sack*	*Combined*
Private Leases	86.7%	74.1%	85.6%	29.7%	36.7%	32.1%
Public Grounds	62.4%	39.3%	56.3%	45.0%	19.4%	34.7%
Total	**80.9%**	**55.7%**	**77.4%**	**31.8%**	**33.8%**	**32.5%**

Comprehensive Report of the

2010 OYSTER MORTALITY STUDY

in Breton Sound and Barataria Basins – May 2011

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ABSTRACT

In response to extended periods of depressed salinities in the Breton Sound and Barataria basins during the spring and summer of 2010, a simple, basin-wide biological investigation was initiated to determine the spatial distribution and level of oyster mortalities within each basin during early August 2010. Multiple locations were sampled via a 24” hand dredge and a determination of oyster mortalities which had occurred over the approximately previous two months was made. In general, oyster resources at up-estuary sites and at sites closer to the lower Mississippi River suffered higher levels of mortality than other sites. Additionally, it appears that basin-wide mortalities were more significant in the Breton Sound basin than in the Barataria basin. This is likely due to the more pronounced and extended period of low salinity throughout the Breton Sound basin. In the Barataria basin, public ground sampling showed higher mortality levels than on private leases and mortality of sack-size oysters (≥ 3”) was greater than seed-sized oysters (< 3”). In the Breton Sound basin, the opposite effects were found as private lease oyster mortality was higher than on public oyster seed grounds and seed oyster mortality exceeded mortality levels found in sack-size oysters.

INTRODUCTION

The American oyster, *Crassostrea virginica*, thrives in Louisiana estuarine waters with a salinity of between five and 15 parts per thousand (ppt) (Chatry et al 1983). During times of low water temperatures, oysters are well adapted to survive short periods of low salinities (Shumway 1996). However, as water temperatures rise, oysters are less able to cope with the physiological stress of both high water temperatures and low salinities, and oyster mortality events often occur (Dugas and Perret 1975; Dugas and Roussel 1983; Dugas 1991). This biological response has been well documented in coastal Louisiana in previous years – most recently in 2009 - when large fresh water inputs (“freshets”) were observed in coastal Louisiana during summertime months. Although a definitive cause has not yet been established, it is likely this phenomenon also occurred this summer in Bay Jaques (lower Plaquemines Parish on the west side of the Mississippi River). Although LDWF marine biologists documented the Bay Jaques oyster mortality event *a posteriori*, environmental conditions documented during field investigations of the area showed the presence of very low salinities (< 1 ppt) and high water temperatures (> 30^{o} C). Due to reports of oyster mortalities in both the Breton Sound and Barataria basins, and the LDWF-investigated Bay Jaques oyster mortality event, a survey of oyster resources within these basins was initiated.

The timing of the 2010 freshwater influxes into Breton Sound and Barataria basin created particular challenges for oyster resources within the affected basins as water temperatures quickly rose above 30° C in early June. Due to these stressful environmental conditions and the possibility of such conditions leading to basin-wide oyster mortalities, an oyster mortality study was conducted to document the level and spatial extent of mortalities within the Breton Sound and Barataria basins.

METHODS

Sample Locations and Sample Collection

Biological sampling was undertaken at multiple locations throughout each basin during the weeks of August 9 – 20, 2010. In the Breton Sound basin, 21 locations were visited while 17 were sampled in the Barataria basin (Figures 2 and 3, Table 1). Sample locations were selected for the purpose of providing robust spatial coverage of each basin and to cover both privately-leased areas and public grounds. Privately-leased areas are generally situated "up-estuary" in the Breton Sound basin placing them generally in lower salinity areas. The same is not necessarily true in the Barataria basin as leases are distributed throughout the basin across multiple salinity regimes. Public grounds in the Barataria basin are small in acreage as compared to the private leases and offered minimal opportunities for sampling. Conversely, public ground acreage in the Breton Sound basin is expansive and generally situated in higher salinity areas "down-estuary."

Sites were visited, reconnaissance poling (= probing of the water bottoms with a PVC or cane pole) was conducted until exposed shell resources were located, and then dredge sampling was conducted. Sampling was completed using a standard 24" hand dredge towed behind the vessel for three minutes per tow with the goal of obtaining no less than 100 animals per location. The composite sample of animals consisted of any combination of live and/or dead seed-size and/or market-size animals. Due to time constraints, no more than four dredge tows were attempted per sample location and most locations yielded less than the target of 100 animals. Oysters and shell material from each dredge tow were combined to form one composite sample per location. Each composite sample was evaluated, data was collected, and the sample was returned to the water at the sample location. Coordinate information for each sample station is provided in Table 1.

Data Collection and Analysis

Following collection of the composite sample at each location, the sample was photographed and systematically evaluated. Data on mortality, size distribution and spat set were recorded as per normal LDWF oyster sampling protocols where animals (both live and dead) within the sample are measured to the nearest millimeter and recorded in five-millimeter work groups. Spat oyster mortality data (spat = 1 to 24 mm) was also recorded, although small, dead spat are oftentimes difficult to identify and thus accurate estimates of spat mortality are nearly impossible. However, data collected on spat mortality likely represent the minimum mortality for this oyster size class. Mortality was determined from the composite sample of collected animals by dividing the total number of live and dead oysters by the total number of dead oysters within each general size category (spat, seed, sack). In some cases, data from multiple size classes were combined (i.e. seed and sack-sized oysters). Hydrologic data (i.e. salinity, temperature) at each location was also recorded.

Collected data was compiled in spreadsheet form with each animal from each basin treated as a replicate rather than using sample location as the replicate. This composite method allows for greater resolution of the mortality estimate with less variance than taking the average mortality of all the sample locations. Therefore, a sample location yielding 50% mortality based on only, for example, two collected animals would not be treated as equal to a sample location that yielded 50% mortality based on 100 animals. Because total mortality was calculated using a composite of all animals collected, and not based on the average mortality using replicate stations, statistical comparisons of mortality estimates cannot be made. Caution must be taken in focusing on site-specific mortality estimates as the sample size at each sample site varied greatly.

RESULTS

Breton Sound Basin

A total of 827 animals were collected in the Breton Sound basin yielding an overall mortality estimate of 77.4%. Sampling at four of the 21 sites yielded 10 animals or less and the average catch per site was 39 animals (combined live and dead) (Table 1). Mortalities at sample sites within the privately leased areas showed increased mortality as compared to sites in public oyster grounds as 85.6% of all oysters collected in the privately leased areas were dead compared to 56.3% on public grounds. Seed oysters also showed differential mortality (80.9%) as compared to market-size (sack) oysters (55.7%) (Figure 1), but were more numerous in samples, accounting for over 86% of the animals collected (excluding spat). Spat mortality estimates were the highest of all size-classes at 93%. In general, sample locations at “up-estuary” locations suffered higher mortalities than those locations in the “down-estuary” area. Discrete salinity measurements recorded during sampling averaged 3.2 (± 4.3) parts per thousand (ppt).

Barataria Bay Basin

Dredge sampling in the Barataria basin yielded 1,123 animals with seed oysters accounting for 65.2% of the samples (excluding spat). Sampling at each site resulted in an average catch of 66 animals per station and only one sample location in this basin yielded 10 animals or less (Table 1). Total basin-wide mortality was estimated at 32.5% with mortalities being fairly evenly distributed across public grounds and private leases, and between oyster size categories. Nearly identical estimates of mortality were generated from public ground sample locations (34.7%) as from private lease areas (32.1%) (Figure 1). Market-size (sack) oysters suffered approximately 33.8% mortality while seed oysters experience 31.8% mortality. Spat oysters showed approximately 49% mortality. “Up-estuary” locations experienced more mortality than “down-estuary” sites, although one “down-estuary” location (Bay Jaques) which is situated very near the mouth of the Mississippi River showed 100% mortality (94 seed and sack animals were collected). Discrete salinity measurements recorded during sampling averaged 9.9 (± 7.9) ppt.

DISCUSSION

Limited oyster sampling within the Breton Sound and Barataria basins during August 2010 showed pronounced oyster mortalities within each area. This mortality event coincided with an extended period of low salinity and high water temperature, and was similar in nature to documented oyster mortality events in past years (Dugas and Perret 1975; Dugas and Roussel 1983; Dugas 1991). Based on discrete salinity measurements recorded during sampling, it is not surprising that the Breton Sound basin suffered more of a mortality signal than did the Barataria basin. Breton Sound basin mortalities appeared to follow a more consistent general southeast to northwest trend of increasing mortalities (Figure 2). In this basin, public grounds are located to the southeast (“down-estuary”) while private leases are generally located to the northwest (“up-estuary) and data indicate that oysters located on private leases suffered significantly more mortality than did animals on public grounds (Figure 1). In general, public ground reefs are located in areas farther away from freshwater sources as compared to private leases in the Breton Sound basin. Due to this spatial component, it is expected that private lease oysters in this basin would respond detrimentally to depressed salinities over extended periods during times of high water temperature.

While significant mortalities were documented in the Barataria basin, they were localized in the extreme northern and southeastern parts of the basin (Figure 3), but did not show any significant trends with respect to oyster size. Additionally, almost no difference in mortality was observed in the Barataria basin among oysters located on private leases versus public grounds (Figure 1). This is an expected outcome considering that public grounds and private leases are both situated throughout the spatial extent of the basin.

It should be noted that additional sampling at each location resulting in the collection of more animals would have bolstered the data set. As time constraints prohibited collection of more than four dredge tows per site, small sample sizes at many stations resulted. These small sample sizes precluded stations from being used as replicates in this study, thereby inhibiting pair-wise statistical comparison of means. Caution should be taken when attempting to compare site-specific mortality as differential sample sizes among sites may influence such comparison. Regardless, clear indications of oyster mortality were documented, especially in privately-leased areas of the Breton Sound basin.

ACKNOWLEGEMENTS

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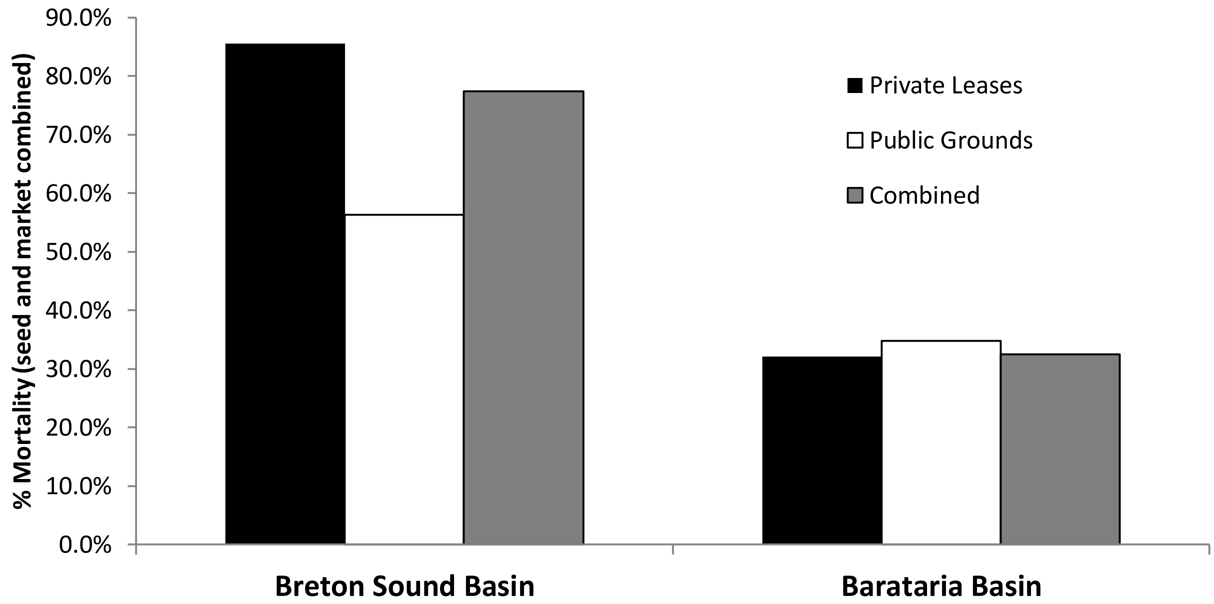

Figure 1. Estimated total mortality in the Breton Sound and Barataria basins based on August 2010 dredge sampling.

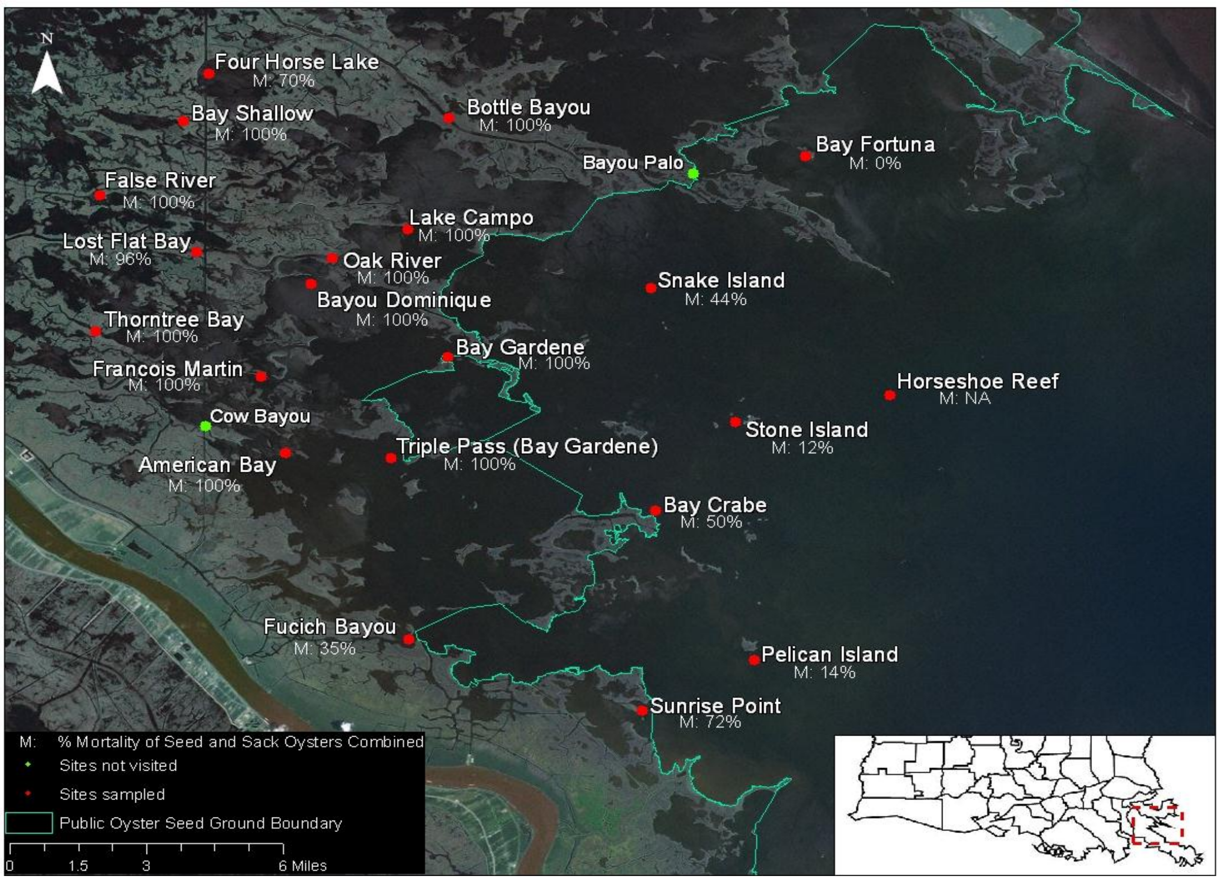

Figure 2. Site-specific oyster mortality estimates for the Breton Sound basin based on August 2010 dredge sampling. Percent mortality represents seed-size and market-size oysters combined.

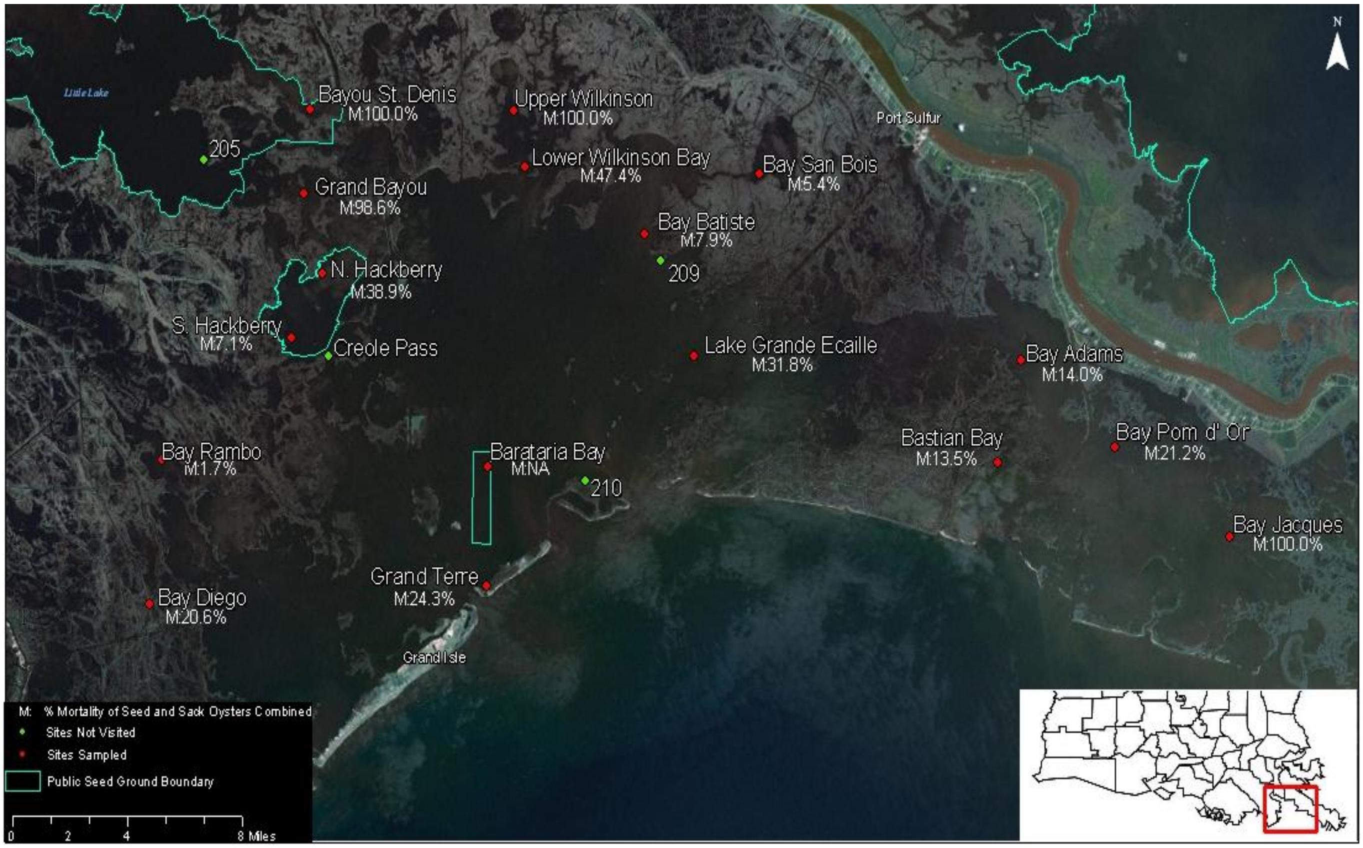

Figure 3. Site-specific oyster mortality estimates in the Barataria basin based on August 2010 dredge sampling. Percent mortality figures represent seed-size and market-size oysters combined.

Table 1. Sample site locations for 2010 oyster mortality study in the Breton Sound (CSA 2) and Barataria (CSA 3) basins. Coordinates listed are in North American Datum (NAD) 1983.

CSA	Station Name	Latitude	Longitude	# of Animals Collected*
2	Bay Shallow	29.6816	89.7149	51
2	Bayou Dominique	29.6260	89.6742	12
2	Four Horse Lake	29.6981	89.7067	143
2	Francois Martin	29.5942	89.6901	55
2	Fucich Bayou	29.5040	89.6429	51
2	Lost Flat Bay	29.6370	89.7106	50
2	Oak River	29.6481	89.6674	10
2	Thorntree Bay	29.6097	89.7427	53
2	American Bay	29.5679	89.6824	50
2	Bay Fortuna	29.6697	89.5168	33
2	Bay Gardene	29.6008	89.6307	53
2	Bottle Bayou	29.6830	89.6304	52
2	False River	29.6564	89.7414	39
2	Horseshoe Reef	29.5878	89.4899	0
2	Lake Campo	29.6448	89.6434	51
2	Pelican Island	29.4969	89.5330	21
2	Snake Island	29.6245	89.5661	9
2	Stone Island	29.5785	89.5390	50
2	Triple Pass (Bay Gardene)	29.5661	89.6486	13
2	Bay Crabe	29.5480	89.5645	2
2	Sunrise Point	29.4794	89.5688	29
3	Bastian Bay	29.3247	89.6465	104
3	Bay Adams	29.3698	89.6320	143
3	Bay Batiste	29.4315	89.8464	63
3	Bay Diego (south of)	29.2737	90.1363	34
3	Bay Jacques	29.2886	89.5145	94
3	Bay Pom de Ore	29.3302	89.5795	104
3	Bay Rambo (north of)	29.3376	90.1275	107
3	Bay San Bois	29.4564	89.7800	92
3	Grand Bayou	29.4536	90.0426	71
3	Lake Grand Ecaille	29.3745	89.8219	22
3	Lower Wilkinson Bay	29.4629	89.9148	97
3	Upper Wilkinson Bay	29.4876	89.9204	15
3	Barataria Bay	29.3302	89.9401	0
3	Bayou St. Denis	29.4913	90.0374	12
3	Grand Terre Intertidal Reef	29.2769	89.9423	37
3	North Hackberry Bay	29.4181	90.0326	90
3	South Hackberry Bay	29.3900	90.0516	28

*Seed and sack-sized oysters combined