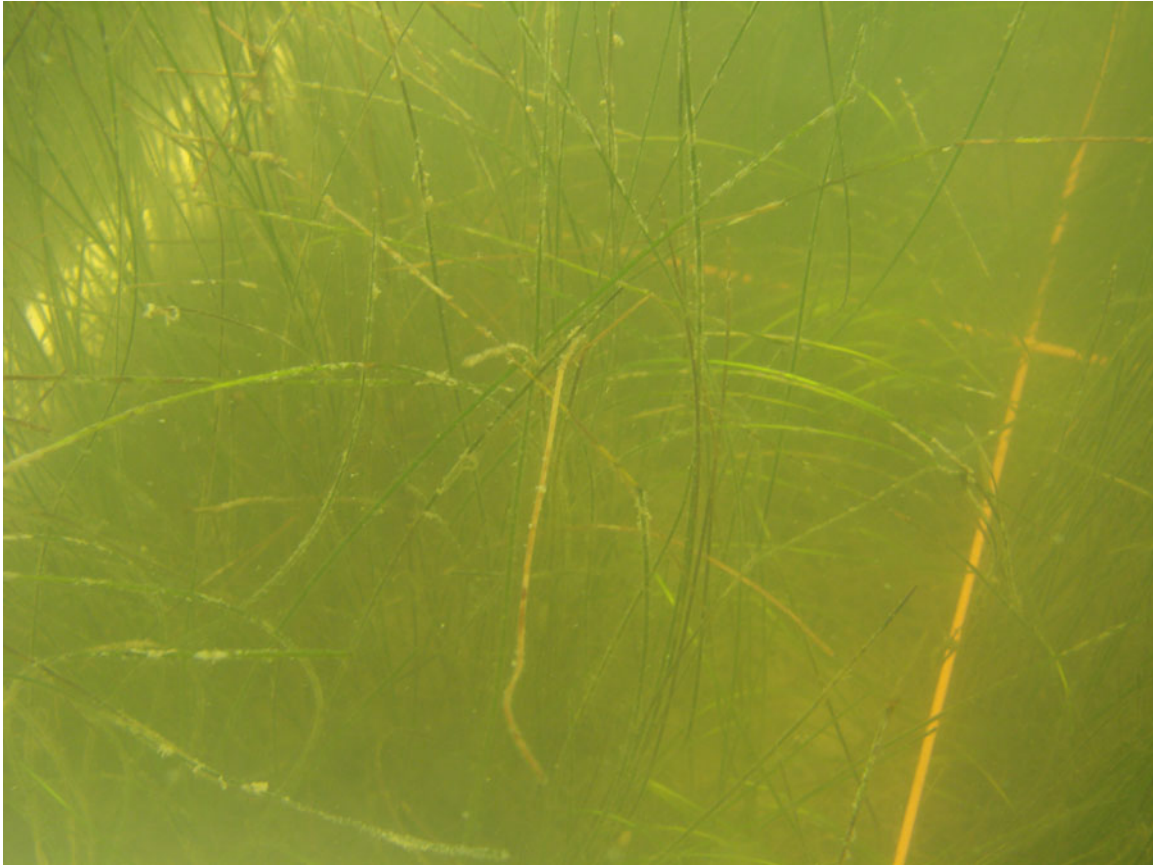


TIER 2 SEAGRASS MONITORING 2015



Prepared for

Mobile Bay National Estuary Program
118 North Royal Street #601
Mobile, Alabama 36602

Alabama DCNR State Lands Division
Coastal Section
31115 – 5 Rivers Boulevard
Spanish Fort, AL 36527



Prepared by

Barry A. Vittor & Associates, Inc.
8060 Cottage Hill Road
Mobile, Alabama 36695



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1.0 INTRODUCTION

The Mobile Bay National Estuary Program (MBNEP) and Alabama Department of Conservation and Natural Resources State Lands Division (SLD) funded the study entitled “Mapping of Submerged Aquatic Vegetation in Mobile Bay and Adjacent Waters of Coastal Alabama in 2015”, administered through a Dauphin Island Sea Lab contract (P.O. 37670). In addition to the landscape-scale mapping (Tier 1), habitat condition assessments (Tier 2) were conducted at a subset of field locations following evaluation methods described by Neckles et al. (2012). The Neckles et al. (2012) methodology evaluates seagrass habitat during peak summer biomass, including for water quality parameters, light availability, and quadrat-based assessment of seagrass percent cover and canopy height. The tiered monitoring program is suggested as a method to detect and predict changes in seagrass systems relative to multi-scale conservation objectives.

2.0 METHODS

2.1 Selection of Tier 2 Stations

Shoal grass (*Halodule wrightii*), widgeon grass (*Ruppia maritima*), and mixed beds of both species occur in lower Perdido Bay and the Mississippi Sound areas of coastal Alabama. For the Tier 2 assessments, a total of 12 stations in Perdido Bay and 8 stations in Mississippi Sound were surveyed in late August and early September 2015. Because concurrent aerial imagery was not available at the time of project planning, ArcGIS 10.3 was used to generate 55 random GPS points within polygons mapped as continuous shoalgrass or continuous shoalgrass/widgeon grass in the 2002 and 2008-09 MBNEP/SLD surveys. The stations were then numbered using a random number generator.

In the Perdido Bay area, Stations 1 through 12 were designated as Tier 2 assessment locations, pending field investigation. In Mississippi Sound, all random MS stations were visited starting at the westernmost locations and moving eastward until eight stations were assessed. The pre-plotted station locations were visited using GPS navigation. If seagrass was present, bed patchiness was visually assessed and, if necessary, a quadrat was used to confirm whether vegetation density met the Tier 2 minimum requirements of 50% bottom coverage. Additionally, the location had to have a large enough grassbed area to accommodate sampling four quadrats, one each off of the bow, stern, port, and starboard sides of the survey vessel. If a location did not meet the minimum requirements, the next numbered station was visited and similarly assessed. Appendix A contains maps showing the Tier 2 survey locations in Perdido Bay (Figure 1) and Mississippi Sound (Figure 2). All Perdido Bay stations had shoalgrass, whereas Sound stations had shoalgrass or widgeon grass, or a mix of the two species.

2.2 Assessment Methods

At each station, measurements were made for water quality, depth, light availability, and vegetation metrics. Water quality and depth measurements were collected at the bottom

and surface using a YSI 600XLM-V2 multiparameter sonde unit equipped with a 650-model data logger. Water quality parameters included temperature (C°), salinity (ppt), pH, and dissolved oxygen concentration (mg/L).

Light transparency data were collected at 0.5-m intervals beginning subsurface depth (~3-6 cm), using LI-COR sensors and a LI-1400-model data logger. Light measurements were recorded at each depth using a combination of subsurface and deck sensors. A LI-193 spherical (4 π) sensor was used to collect subsurface light measurements. A LI-190 quantum (deck) sensor was used to record incident light above the water surface simultaneously with subsurface measurements to correct for changes in incident light levels caused by external factors such as cloud cover. The deck sensor readings were used to provide corrected sub-surface readings. The subsurface percent light transparencies were calculated by comparing the at-depth 4- π sensor reading with the deck-corrected sub-surface 4- π reading. Each recorded light measurement was based on a 30-sec. average of sensor readings. All light sampling was performed between the hours of 10:00 AM and 2:00 PM.

Vegetation metrics included species present, estimated % coverage, and mean shoot height (cm). A 0.25-m² PVC quadrat was partitioned into four, 25-cm² grids using nylon rope attached to the frame. At each sampling station the quadrat was haphazardly placed four times by tossing it off the bow, stern, port and starboard sides of the survey vessel, after collection of the water quality and light data. A snorkel diver estimated the % cover within each of the four quadrat sections. Average shoot height was visually estimated in each section using a standard meter stick, ignoring the tallest and shortest shoots within the sampling area. Where sufficient station depth permitted, a digital camera was used to photograph a portion of each quadrat area sampled.

3.0 RESULTS

Appendix B contains the water quality, light, and vegetation data. Depth at Perdido Bay stations ranged from 1.16 m (PB9) to 0.58 m (PB6), with an average of 0.92 m (± 0.15). Depth at Sound stations ranged from 0.71 m (MS2) to 0.20 m (MS 8), with an average depth of 0.46 m (± 0.18). Perdido Bay bottom salinity ranged from 27.7 ppt (PB6) to 24.4 ppt (PB4) (Ave= 26.1 \pm 1.3). Bottom salinity at Sound stations ranged from 28.0 ppt (MS3/MS4) to 23.9 ppt (MS2) (Ave=26.6 \pm 1.3).

Light measurements in Perdido Bay ranged from 80.81% (PB6) to 34.15% (PB2) at bottom, averaging 54.38% (± 11.59). In the Sound, bottom light ranged from 81.34% (MS4) to 29.59% (MS1), and averaged 66.01% (± 19.02). For MS stations with shoalgrass only - three of the eight stations - average light at bottom was 47.8% (± 20.7).

Average seagrass coverage was 75.7% (± 14.9) at PB stations and 72.2% (± 18.0) at MS stations. For the MS stations with shoalgrass only, the average coverage was 52.5% (± 6.2). Canopy height averaged 20.1 cm (± 5.7) at PB stations and 16.9 cm (± 5.7) at MS stations. For MS stations with shoalgrass only, canopy height averaged 10.8 cm (± 3.6).

4.0 CONCLUSIONS

Tier 2 protocols are intended to provide assessment of physical habitat metrics, seagrass areal coverage, species composition, and vegetative condition. A monitoring program that includes Tier 2 ultimately is a method for change detection in habitat quality, and may be used to infer cause-effect relationships to explain those changes. Integrated with Tier 1 (landscape-scale) assessment, Tier 2 assessment has potential as a complementary tool in a comprehensive seagrass monitoring program for coastal Alabama. With sufficient data in terms of the number of stations and years sampled, Tier 2 assessments would be useful for monitoring during years when Tier 1 mapping is not performed.

Compared to lower Perdido Bay, Mississippi Sound has less shoreline development, boat traffic, and associated human disturbances. Moreover, the Sound is exposed to a more energetic hydrodynamic regime, as well as water and sediment inputs from Mobile Bay, and seagrass distribution has historically exhibited greater temporal variability compared to Perdido Bay. Resolving human-caused stress from natural effects, a primary goal of seagrass monitoring and management, is therefore likely to be problematic in the Sound.

5.0 ACKNOWLEDGEMENTS

Funding for this project was provided by the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund, and by the U.S. Fish and Wildlife Service, Department of the Interior through the Coastal Impact Assistance Program (CIAP). The CIAP is funded by qualified outer continental shelf oil and gas revenues.

6.0 REFERENCES CITED

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APPENDIX A – Station Location Maps

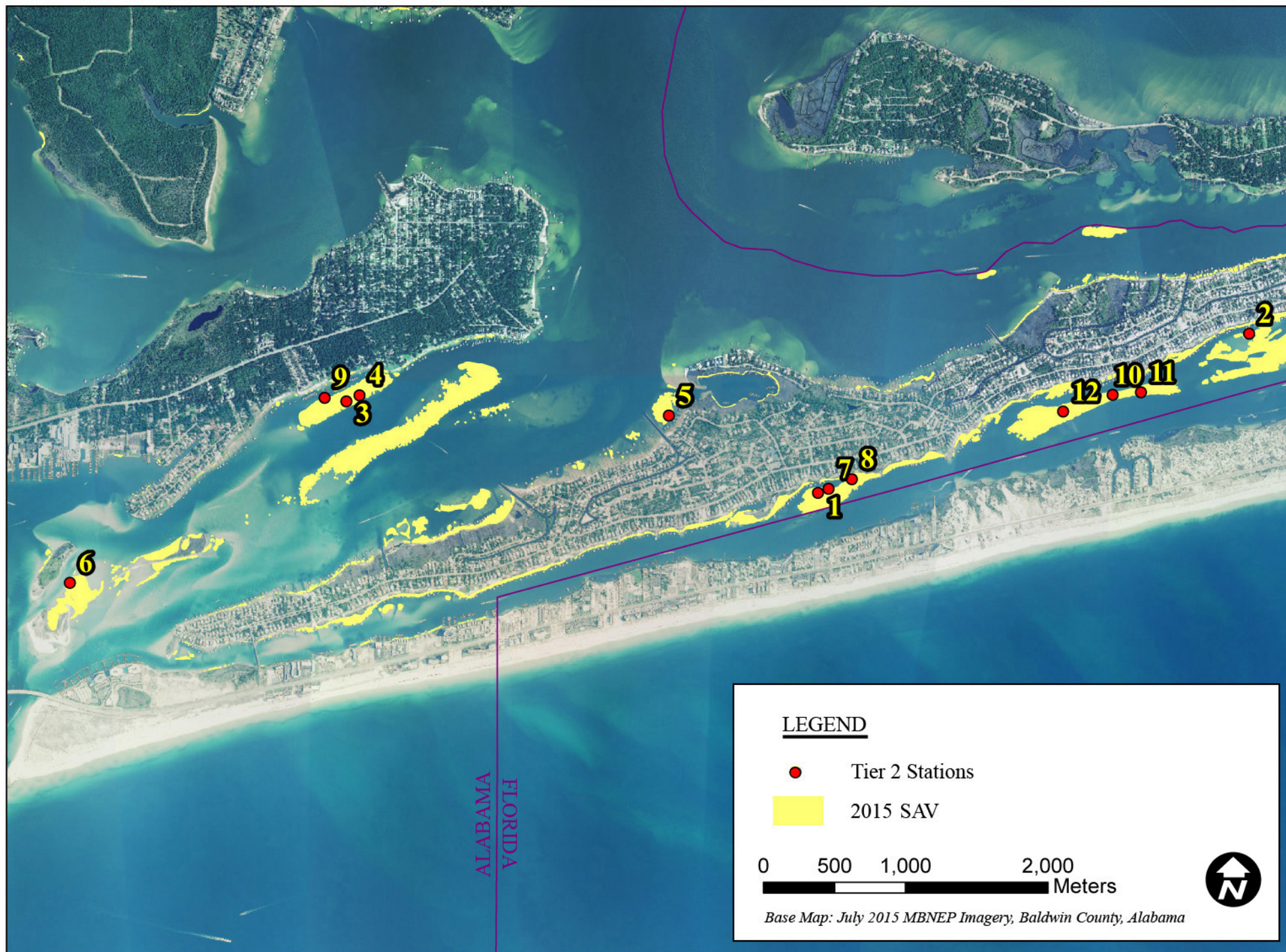


Figure 1. 2015 Tier 2 SAV monitoring stations, Perdido Bay.



Figure 2. 2015 Tier 2 SAV monitoring stations, Mississippi Sound.

APPENDIX B – Water Quality, Light, and Vegetation Data

TIER 2 SEAGRASS MONITORING 2015

Perdido Bay Water Quality

Station	Date/Time	Depth m	Temp C°	SpCond mS/cm	Salinity ppt	pH	ODO%	ODO Conc. mg/L
PB1: Bottom	8/19/15 12:27	0.85	30.2	42.84	27.4	8.2	96.8	6.3
Surface	8/19/15 12:29	0.15	30.3	42.92	27.5	8.2	141.4	9.2
PB2: Bottom	8/20/15 11:00	0.94	29.6	39.26	24.9	8.0	105	7.0
Surface	8/20/15 11:01	0.06	29.8	39.31	24.9	8.0	102	6.8
PB3: Bottom	8/19/15 9:12	1.0	28.9	38.72	24.5	7.9	91.8	6.2
Surface	8/19/15 9:13	0.06	28.9	38.56	24.4	7.9	88.1	5.9
PB4: Bottom	8/19/15 9:26	0.98	29.0	38.58	24.4	8.0	100.4	6.8
Surface	8/19/15 9:27	0.03	28.9	38.15	24.1	8.0	91.5	6.2
PB5: Bottom	8/19/15 10:11	1.1	29.1	39.9	25.4	8.1	107.2	7.2
Surface	8/19/15 10:12	0.18	29.2	38.19	24.2	8.0	100	6.7
PB6: Bottom	8/19/15 8:37	0.58	28.7	43.25	27.7	7.6	74.2	4.9
Surface	8/19/15 8:39	0.09	28.8	41.63	26.6	7.9	94.7	6.3
PB7: Bottom	8/19/15 12:51	0.98	29.9	42.84	27.4	8.1	120.1	7.8
Surface	8/19/15 12:52	0.09	30.5	42.9	27.5	8.1	118.4	7.6
PB8: Bottom	8/19/15 13:19	0.82	30.4	42.88	27.4	8.1	138.8	9.0
Surface	8/19/15 13:20	0.06	30.4	42.89	27.4	8.1	127.6	8.2
PB9: Bottom	8/19/15 9:47	1.16	29.0	38.98	24.7	8.0	91.9	6.2
Surface	8/19/15 9:48	0.06	29.1	38.77	24.6	8.0	91.7	6.2
PB10: Bottom	8/20/15 10:06	0.91	29.6	41.4	26.4	8.0	104.5	6.9
Surface	8/20/15 10:07	0.03	29.5	40.48	25.8	8.1	100.6	6.7
PB11: Bottom	8/20/15 11:13	0.91	30.1	40.7	25.9	8.2	158.8	10.4
Surface	8/20/15 11:16	0.03	30.1	40.04	25.4	8.1	107.2	7.0
PB12: Bottom	8/20/15 11:40	0.82	30.2	41.65	26.6	8.1	106.6	6.9
Surface	8/20/15 11:42	0.03	30.3	40.66	25.9	8.0	113.9	7.4

TIER 2 SEAGRASS MONITORING 2015

Perdido Bay Light Measurements

Station	Depth	Deck Sensor	4π Sensor	Deck correction	4π (Corrected)	% Light at depth
PB1	Subsurface	1677.5	1803	100.00%	1803.00	100.00%
	0.5m	1757	1420.5	104.74%	1888.45	75.22%
	Bottom	1845.5	1095.5	110.01%	1983.57	55.23%
PB2	Subsurface	1183.55	1342	100.00%	1342.00	100.00%
	0.5m	996.2	798.05	84.17%	1129.57	70.65%
	1.0m	829.75	402.75	70.11%	940.83	42.81%
	Bottom	802.35	310.85	67.79%	909.77	34.17%
PB3	Subsurface	1889.5	2019.5	100.00%	2019.50	100.00%
	0.5m	1928.5	1513	102.06%	2061.18	73.40%
	1.0m	1378.15	756.55	72.94%	1472.97	51.36%
PB4	Subsurface	1887	2025	100.00%	2025.00	100.00%
	0.5m	1890	1497.5	100.16%	2028.22	73.83%
	Bottom	1844	1103.5	97.72%	1978.86	55.76%
PB5	Subsurface	1524.5	1755	100.00%	1755.00	100.00%
	0.5m	1611	1311.5	105.67%	1854.58	70.72%
	1.0m	1621	860.1	106.33%	1866.09	46.09%
PB6	Subsurface	1743	1942	100.00%	1942.00	100.00%
	0.5m	1731.5	1559	99.34%	1929.19	80.81%
PB7	Subsurface	1994.5	2135	100.00%	2135.00	100.00%
	0.5m	2046.5	1683	102.61%	2190.66	76.83%
	1.0m	2076	1095	104.09%	2222.24	49.27%
PB8	Subsurface	1635.5	1723	100.00%	1723.00	100.00%
	0.5m	1626	1217	99.42%	1712.99	71.05%
	Bottom	1531.5	1006.35	93.64%	1613.44	62.37%
PB9	Subsurface	1829	1973.5	100.00%	1973.50	100.00%
	0.5m	1753	1464	95.84%	1891.50	77.40%
	1.0m	1805	989.75	98.69%	1947.60	50.82%
PB10	Subsurface	1229.05	1396.5	100.00%	1396.50	100.00%
	0.5m	1670	1429.5	135.88%	1897.53	75.33%
	Bottom	1655	1041	134.66%	1880.48	55.36%
PB11	Subsurface	1396.5	1490	100.00%	1490.00	100.00%
	0.5m	1481	1231.6	106.05%	1580.16	77.94%
	Bottom	1479	727.55	105.91%	1578.02	46.11%
PB12	Subsurface	1999.5	2128	100.00%	2128.00	100.00%
	0.5m	2022.5	1655	101.15%	2152.48	76.89%
	Bottom	2011.5	1396.5	100.60%	2140.77	65.23%

Perdido Bay Vegetation

Station	Species composition	% Coverage		Canopy Height (cm)
PB1	<i>Halodule wrightii</i>	Q1	75	26
		Q2	60	20
		Q3	85	25
		Q4	90	26
PB2	<i>Halodule wrightii</i>	Q1	60	17
		Q2	80	21
		Q3	50	17
		Q4	60	21
PB3	<i>Halodule wrightii</i>	Q1	70	10
		Q2	65	12
		Q3	75	14
		Q4	90	15
PB4	<i>Halodule wrightii</i>	Q1	60	8
		Q2	50	9
		Q3	80	13
		Q4	50	8
PB5	<i>Halodule wrightii</i>	Q1	75	13
		Q2	80	16
		Q3	85	21
		Q4	80	20
PB6	<i>Halodule wrightii</i>	Q1	98	22
		Q2	98	22
		Q3	98	18
		Q4	98	19
PB7	<i>Halodule wrightii</i>	Q1	75	25
		Q2	95	30
		Q3	70	26
		Q4	80	28
PB8	<i>Halodule wrightii</i>	Q1	75	17
		Q2	90	22
		Q3	90	28
		Q4	90	26
PB9	<i>Halodule wrightii</i>	Q1	90	18
		Q2	80	19
		Q3	95	20
		Q4	98	21
PB10	<i>Halodule wrightii</i>	Q1	70	20
		Q2	70	27
		Q3	75	20

TIER 2 SEAGRASS MONITORING 2015

		Q4	70	22
PB11	<i>Halodule wrightii</i>	Q1	90	27
		Q2	75	31
		Q3	60	26
		Q4	50	21
PB12	<i>Halodule wrightii</i>	Q1	60	16
		Q2	65	24
		Q3	50	16
		Q4	60	21

TIER 2 SEAGRASS MONITORING 2015**Mississippi Sound Water Quality**

Station	Date/Time	Depth m	Temp C	SpCond mS/cm	Salinity ppt	pH	ODO%	ODO Conc mg/L
MS1: Bottom	8/25/15 10:52	0.68	30.0	41.36	26.4	7.9	83.2	5.4
Surface	8/25/15 10:54	0.04	30.0	41.1	26.2	8.0	91.2	6.0
MS2: Bottom	8/25/15 11:17	0.71	30.0	37.88	23.9	8.0	90.9	6.0
Surface	8/25/15 11:18	0.06	30.1	39.45	25.0	7.9	89.6	5.9
MS3: Bottom	8/25/15 12:21	0.44	30.2	43.71	28.0	8.2	109.7	7.1
Surface	8/25/15 12:22	0.03	30.2	43.79	28.1	8.2	112.4	7.3
MS4: Bottom	8/25/15 12:45	0.42	30.7	43.74	28.0	8.3	140.8	9.0
Surface	8/25/15 12:46	0.04	30.7	43.75	28.0	8.3	141.4	9.1
MS5: Bottom	8/25/15 13:14	0.58	30.8	41.78	26.6	8.2	99.5	6.4
Surface	8/25/15 13:16	0.05	30.8	41.81	26.7	8.2	113.1	7.3
MS6: Bottom	8/25/15 13:39	0.34	31.5	40.95	26.0	8.2	111.3	7.1
Surface	8/25/15 13:40	0.00	31.6	41.09	26.1	8.2	137.3	8.8
MS7: Bottom	9/2/15 12:39	0.30	30.6	42.65	27.3	7.8	114.1	7.4
Surface	9/2/15 12:41	0.02	30.7	42.7	27.3	7.9	117.3	7.6
MS8: Bottom	9/2/15 13:03	0.20	31.4	41.79	26.6	8.2	124	7.9
Surface	9/2/15 13:05	0.05	31.5	41.81	26.6	8.3	139.2	8.9

TIER 2 SEAGRASS MONITORING 2015

Mississippi Sound Light Measurements

Station	Depth	Deck Sensor	4π Sensor	Deck correction	4π (Corrected)	% Light at depth
MS1	Subsurface	1598.5	1873	100.00%	1873.00	100.00%
	0.5m	1604.5	742.15	100.38%	1880.03	39.48%
	Bottom	1606	556.8	100.47%	1881.79	29.59%
MS2	Subsurface	1743	1906.5	100.00%	1906.50	100.00%
	0.5m	1740.5	829.35	99.86%	1903.77	43.56%
MS3	Subsurface	1839.5	2040	100.00%	2040.00	100.00%
	Bottom	1836.5	1523.5	99.84%	2036.67	74.80%
MS4	Subsurface	1859.5	2011.5	100.00%	2011.50	100.00%
	Bottom	1869	1644.5	100.51%	2021.78	81.34%
MS5	Subsurface	1858	1849.5	100.00%	1849.50	100.00%
	Bottom	1859.5	1292.5	100.08%	1850.99	69.83%
MS6	Subsurface	1816.5	2007.5	100.00%	2007.50	100.00%
	Bottom	1815	1411.5	99.92%	2005.84	70.37%
MS7	Subsurface	1849.5	2026	100.00%	2026.00	100.00%
	Bottom	1853	1584.5	100.19%	2029.83	78.06%
MS8	Subsurface	1839.5	1929	100.00%	1929.00	100.00%
	Bottom	1837.5	1552	99.89%	1926.90	80.54%

Mississippi Sound Vegetation

Station	Species composition	% Coverage		Canopy Height (cm)
MS1	<i>Halodule wrightii</i>	Q1	50	17
		Q2	60	14
		Q3	50	10
		Q4	50	12
MS2	<i>Halodule wrightii</i>	Q1	50	8
		Q2	50	10
		Q3	50	7
		Q4	50	6
MS3	<i>Ruppia maritima</i>	Q1	90	22
	<i>Halodule wrightii</i>	Q2	80	23
		Q3	90	22
		Q4	75	24
MS4	<i>Ruppia maritima</i>	Q1	80	17
	<i>Halodule wrightii</i>	Q2	95	16
		Q3	90	18
		Q4	75	23
MS5	<i>Ruppia maritima</i>	Q1	60	16
	<i>Halodule wrightii</i>	Q2	80	24
		Q3	75	24
		Q4	60	18
MS6	<i>Halodule wrightii</i>	Q1	50	14
		Q2	50	8
		Q3	70	8
		Q4	50	15
MS7	<i>Ruppia maritima</i>	Q1	90	20
		Q2	95	23
		Q3	95	21
		Q4	90	24
MS8	<i>Ruppia maritima</i>	Q1	85	19
		Q2	90	21
		Q3	90	18
		Q4	95	20