

# LIVE OAK POINT LIVING SHORELINES

## 2021 (Fall) Reference Site Monitoring Report



USACE Permit No.: SAJ-2011-00287

FDEP Permit No.: 0387876-001-EI-66

Permittee: Northwest Florida Water Management District  
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Project Location: Live Oak Point Salt Marsh Reference Site  
30.42° North, -86.27° West  
Approximately 2 ½ Miles NW of Santa Rosa Beach  
Walton County, Florida

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## Synopsis

Live Oak Point contains the largest salt marsh system (approximately 1,000 acres) in Choctawhatchee Bay. However, its ecological integrity and long-term survival is threatened by ongoing erosion and shoreline retreat. Analysis of historic aerials indicates that, since 1941, the salt marsh has retreated up to 300 FT along the northern edge. In situ measurements and analysis of recent digital orthophoto quads (DOQs) show that shoreline retreat now averages >4 FT per year.

The objectives of the Live Oak Point Living Shorelines project are 1) halting loss of salt marsh habitat at Live Oak Point, 2) restoring salt marsh habitat in a strip parallel to the current shoreline that will be protected by limerock breakwaters, and 3) enhancing existing salt marsh habitat via improved buffers. To achieve these objectives, a living shoreline is being implemented along the northern edge of the Live Oak Point salt marsh.<sup>1</sup>

Approximately 4,695 FT of limerock breakwaters will be constructed.<sup>2</sup> Breakwater construction began 8/13/2021 (as of 12/1/2021, approximately 450 FT or 9.5% had been completed). Planting of appropriate salt marsh vegetation (e.g., *Spartina patens*, *Juncus roemarianus*, *Spartina alterniflora*) behind completed breakwater segments will begin in Spring 2022. Barring unforeseen events (e.g., a major hurricane), full completion of this project is anticipated by or before 2023.

The Live Oak Point Living Shorelines project is a component of the Northwest Florida Water Management District (NFWFMD) In-Lieu Fee (ILF) mitigation program (USACE Permit SAJ-2011-00287) and will generate up to 2.61 estuarine mitigation credits for use by the Florida Department of Transportation (FDOT).<sup>3</sup>

This 2021 (Fall) Reference Site Monitoring Report has been developed to comply with federal and state monitoring requirements. Parameters for the Fall 2021 reference site monitoring include vegetation cover, fish diversity, water quality, a benthic invertebrate survey, sediment accretion, panoramic and general photos. The reference site has similar geomorphology, tidal range, elevations, and vegetation community structure when compared with the project site (located approximately 3,000 FT northeast of the reference site). Monitoring of the project site is scheduled to begin in late 2022 when construction of the breakwater is completed or substantially completed. All monitoring reports for the Live Oak Point Living Shorelines reference

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<sup>1</sup> The NFWFMD has contracted with the Choctawhatchee Basin Alliance of Northwest Florida State College (CBA) to implement the Live Oak Point Living Shorelines project.

<sup>2</sup> New breakwater construction will tie in with an existing 550 FT of oyster shell breakwater / living shoreline constructed in 2011. When complete, total living shoreline length at Live Oak Point will be approximately 5,245 FT (4,695 FT + 550 FT).

<sup>3</sup> Mitigation credit is associated only with the living shoreline currently under construction; no credit is associated with the 550 FT of living shoreline implemented in 2011.

site and project site will be posted at: <https://www.nfwwater.com/Water-Resources/Regional-Wetland-Mitigation-Program/Regional-Mitigation-Plan/NFWFMD-Mitigation-Sites/Choctawhatchee-Watershed-Mitigation-Sites/Live-Oak-Peninsula-ILF/Living-Shorelines>.

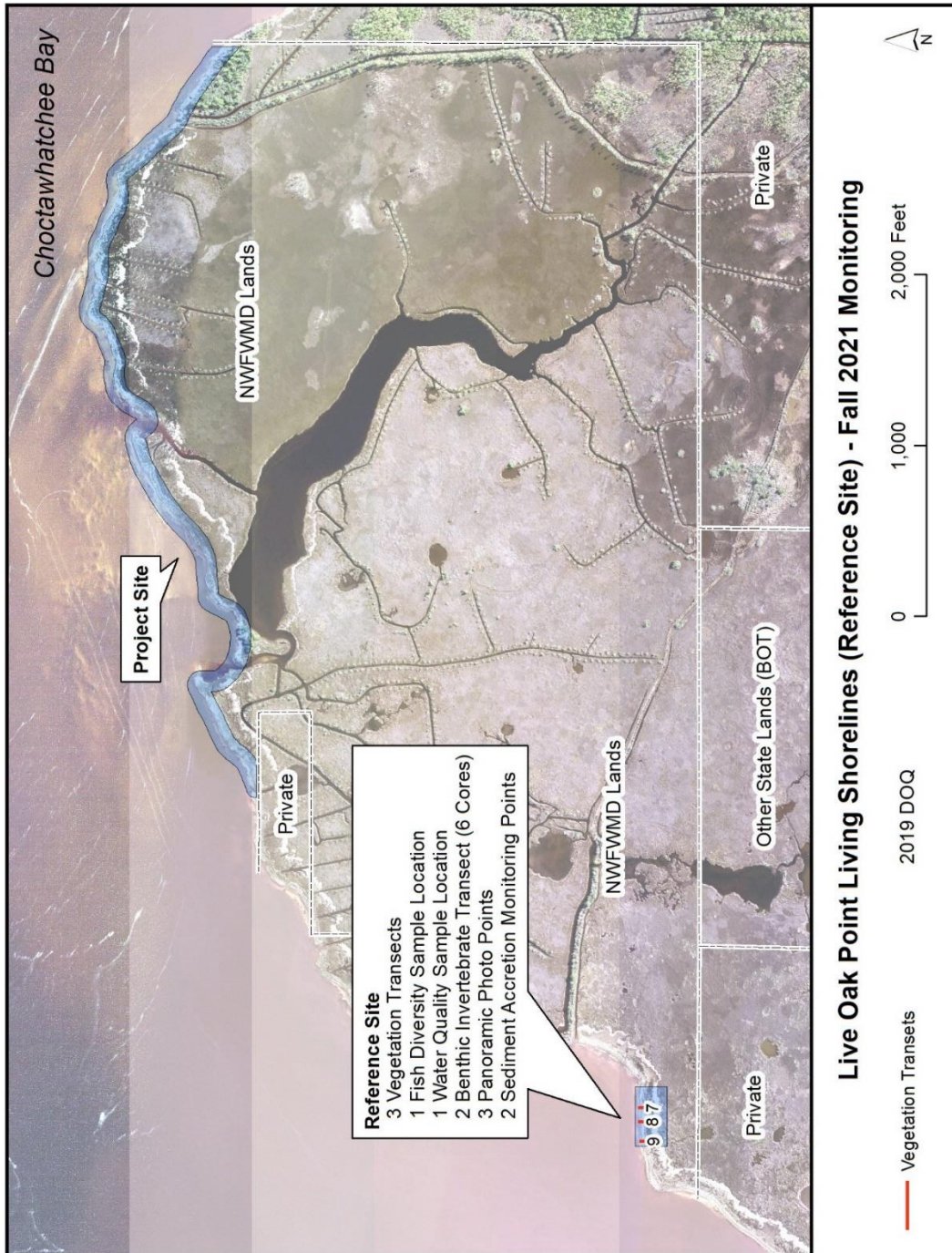


Figure 1. Fall 2021 Reference Site Monitoring Overview

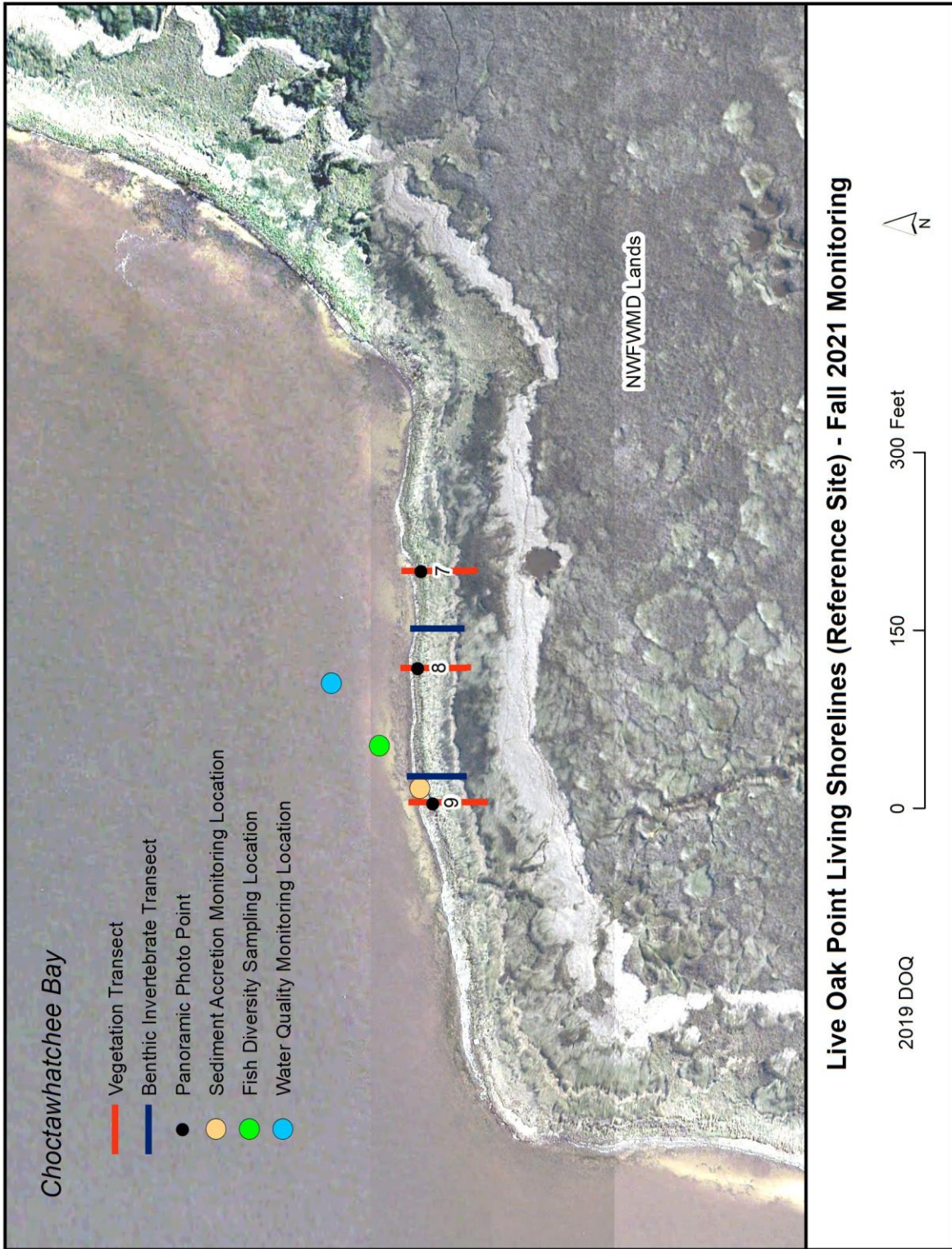


Figure 2. Fall 2021 Reference Site Monitoring Closeup

## Vegetation Monitoring

Vegetation cover was quantitatively measured on 10/21/2021 using a modified Daubenmire method.<sup>4</sup> Three (3) transects of variable length were established in the reference area. Each transect began in the low marsh and extended into the high marsh. Twelve (12) 0.5-meter square (0.25m<sup>2</sup>) quadrats were sampled along each transect. Four (4) quadrats were located in the low marsh, four (4) in the mid marsh, and four (4) in the high marsh. All plant species were identified in each quadrat. Percent cover of vegetation by species and bare ground was visually estimated. No exotic or invasive plants were present in any transect.

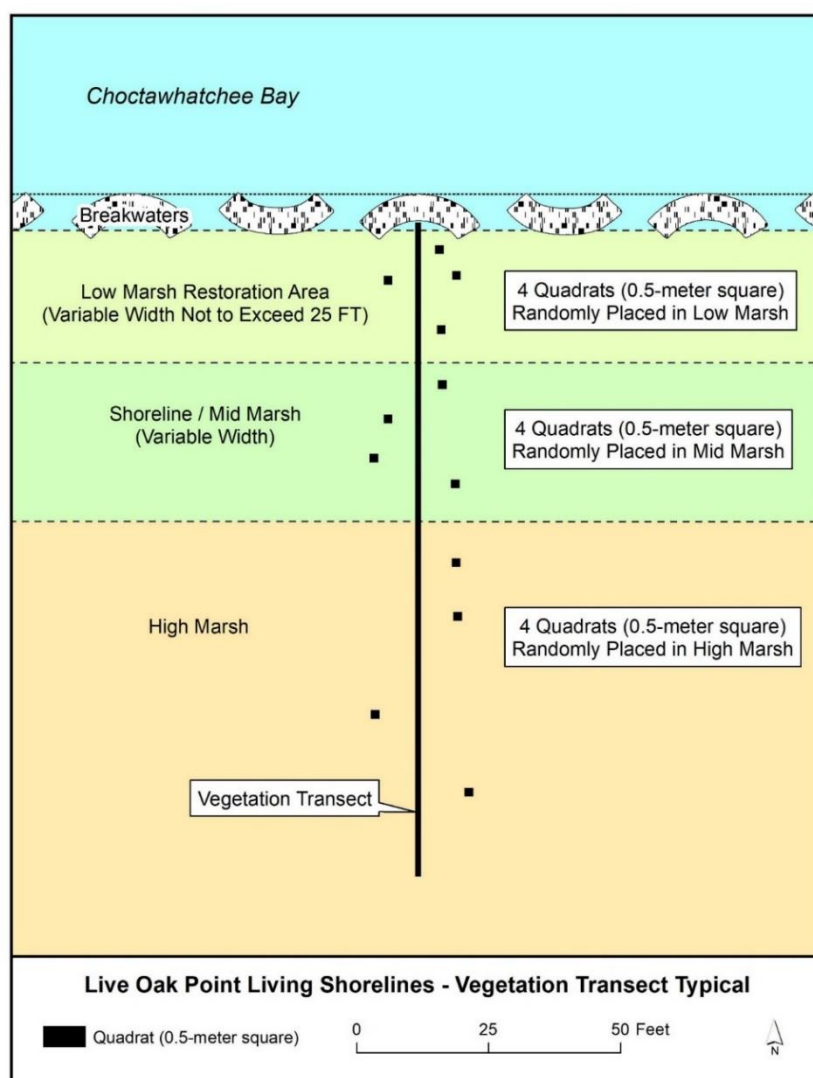


Figure 3. Vegetation Transect Sampling Design

<sup>4</sup> Daubenmire, Rexford. 1959. A Canopy-coverage method of vegetational analysis. Northwest Science 33:43-64.

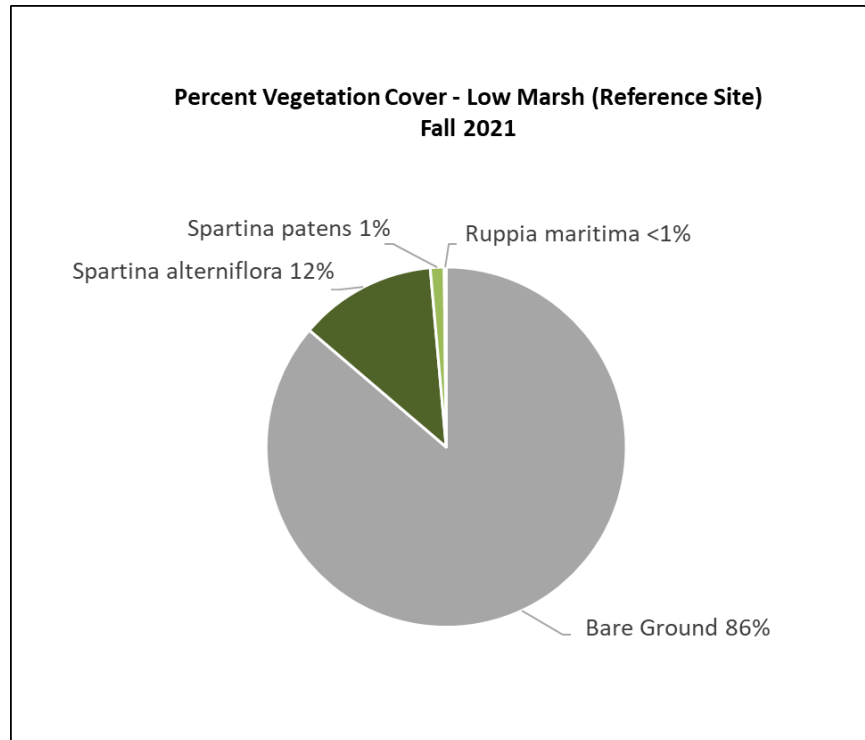


Figure 4. Reference Site Low Marsh Vegetation (Average of Three Transects)

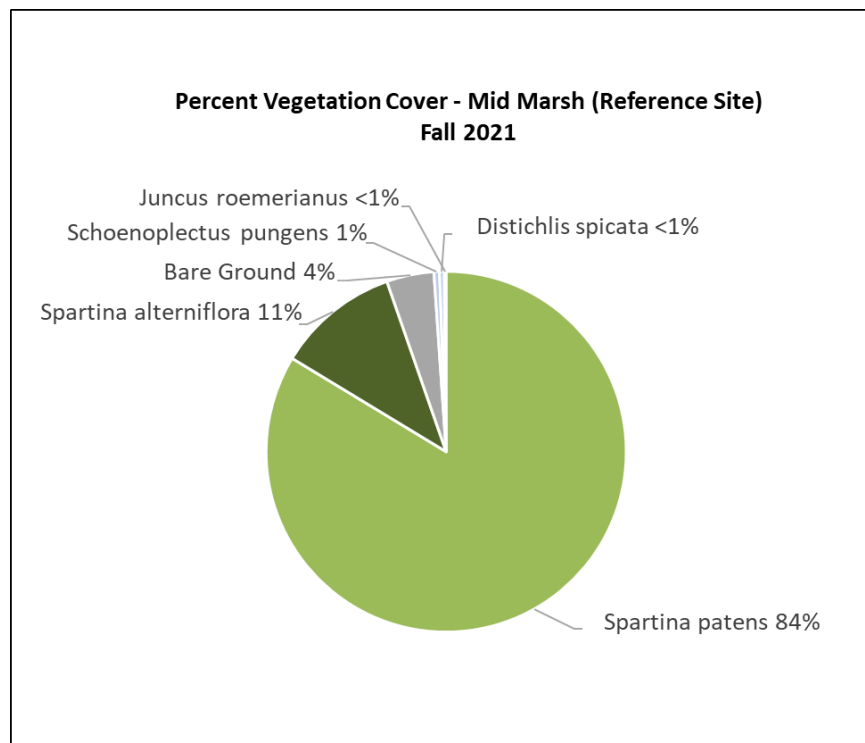


Figure 5. Reference Site Mid Marsh Vegetation (Average of Three Transects)

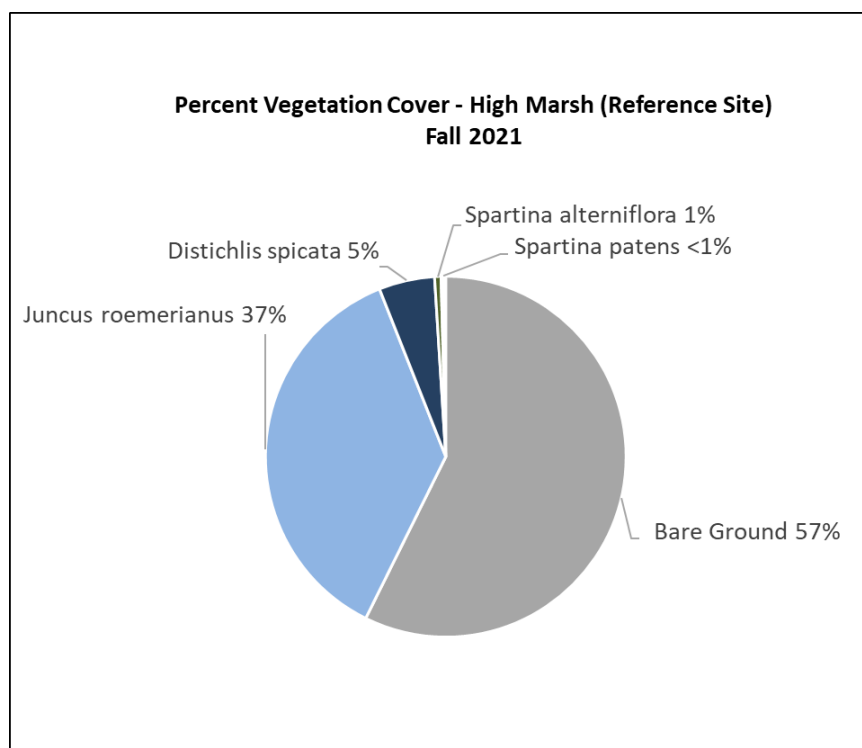


Figure 6. Reference Site High Marsh Vegetation (Average of Three Transects)

Table 1. Reference Site Vegetation by Marsh Zone (Average of Three Transects)

Species	Low Marsh	Mid Marsh	High Marsh
Bare Ground	86%	4%	57%
<i>Distichlis spicata</i>	0%	<1%	5%
<i>Juncus roemerianus</i>	0%	<1%	37%
<i>Ruppia maritima</i>	<1%	0%	0%
<i>Schoenoplectus pungens</i>	0%	<1%	0%
<i>Spartina alterniflora</i>	12%	11%	<1%
<i>Spartina patens</i>	1%	84%	<1%



## Fish Species Diversity Monitoring

Fish diversity was measured at one location at the reference site via pulling of a seine net. The seine net was pulled twice; species and number of fish and shellfish were recorded.

Table 2. Fish and Shellfish at Reference Site

<b>Fish or Shellfish</b>	<b>No. Caught (1st Pull)</b>	<b>No. Caught (2nd Pull)</b>	<b>No. Caught (Total)</b>
Mojarra	1	0	1
Grass Shrimp	0	2	2
Brown Shrimp	0	5	5
<b>Total</b>			<b>8</b>

## Water Quality Monitoring

A Hydrolab Datasonde was used to measure common water quality variables at one location at the reference site. Results are considered consistent with expected values for Choctawhatchee Bay.

Table 3. Water Quality at Reference Site – 10/21/2021

<b>Variable</b>	<b>Reading</b>
Temperature (°F)	76.7
Specific Conductivity (µS/cm)	23.4
pH	6.8
Salinity (PPT)	14.07
Dissolved Oxygen (mg/L)	No Data
Dissolved Oxygen (%)	No Data
Depth (FT)	1.5
Turbidity (NTU)	4.3

## Benthic Invertebrate Monitoring

Six (6) sediment cores were along two (2) transects at the reference site on October 21, 2021. On each transect, one (1) core was collected from the low marsh, one (1) from the mid marsh, and one (1) from the high marsh. Each core sample was washed in the field over a 500  $\mu\text{m}$  mesh sieve using water gathered from the adjacent bay. All material retained on the screen mesh was stored in a labeled Nalgene 0.5 L container and preserved with formalin and later stained with 70% isopropyl alcohol and 30% water with rose Bengal added. The collected samples were analyzed by Barry A. Vittor & Associates, Inc.<sup>5</sup>

Data appear to reflect a normal range of conditions expected for salt marsh habitat. However, benthic invertebrates were highly variable between the two transects. For example, the Transect 7 Low Marsh Zone had a Shannon-Wiener Diversity Index of 2.08 whereas the Transect 9 Low Marsh Zone had a value of 1.29.

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<sup>5</sup> Barry A. Vittor & Associates, Inc., 8060 Cottage Hill Road, Mobile, AL 36695.

Table 4. Benthic Invertebrates at Reference Site (Transect 7) – 10/21/2021

Transect / Marsh Zone	Phylum	Class	Order	Family	Taxa	No.	Feeding Guild	
Transect 7 High Marsh	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	40	Deposit Feeder	
		Polychaeta	Scolecida	Capitellidae	Capitella capitata	1	Deposit Feeder	
			Spionida	Spionidae	Polydora cornuta	1	Deposit Feeder	
	Arthropoda	Malacostraca	Amphipoda	Gammaridae	Gammarus mucronatus	2	Omnivore	
	Mollusca	Gastropoda	Mesogastropoda	Hydrobiidae	Hydrobiidae (LPIL)	1	Herbivore	
Transect 7 Mid Marsh	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	59	Deposit Feeder	
		Polychaeta	Phyllodocida	Nereididae	Nereis succinea	1	Omnivore	
			Scolecida	Capitellidae	Capitella capitata	8	Deposit Feeder	
	Arthropoda	Insecta	Diptera	Ceratopogonidae	Ceratopogonidae (LPIL)	1	Omnivore	
		Malacostraca	Amphipoda	Gammaridae	Gammarus mucronatus	4	Omnivore	
			Tanaidacea	Leptocheliidae	Hargeria rapax	2	Deposit and Filter Feeder	
Transect 7 Low Marsh	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	7	Deposit Feeder	
		Polychaeta	Phyllodocida	Nereididae	Nereis succinea	3	Omnivore	
				Phyllodocidae	Hypereteone heteropoda	1	Deposit Feeder	
				Pilargidae	Parandalia tricuspis	6	Mainly Predator	
			Scolecida	Capitellidae	Mediomastus (LPIL)	2	Deposit Feeder	
	Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Cerapus tubularis	2	Omnivore	
			Tanaidacea	Leptocheliidae	Hargeria rapax	2	Deposit and Filter Feeder	
	Mollusca	Bivalvia	Veneroida	Psammobiidae	Tagelus plebius	1	Filter Feeder	
				Tellinidae	Tellinidae (LPIL)	1	Filter Feeder	
	Nemertea	--	--	--	--	Nemertea (LPIL)	3	Carnivore

Table 5. Benthic Invertebrates at Reference Site (Transect 9) – 10/21/2021

Transect / Marsh Zone	Phylum	Class	Order	Family	Taxa	No.	Feeding Guild
Transect 9 High Marsh	Annelida	Polychaeta	Phyllodocida	Nereididae	Laeonereis culveri	1	Herbivore
	Arthropoda	Malacostraca	Amphipoda	Gammaridae	Gammarus mucronatus	1	Omnivore
Transect 9 Mid Marsh	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	27	Deposit Feeder
		Polychaeta	Phyllodocida	Nereididae	Nereididae (LPIL)	3	Omnivore
	Arthropoda	Arachnida	Acari	--	Acari (LPIL)	1	Most Species are Predators
		Malacostraca	Amphipoda	Gammaridae	Gammarus mucronatus	4	Omnivore
Transect 9 Low Marsh	Annelida	Oligochaeta	Tubificida	Naididae	Naididae (LPIL)	1	Deposit Feeder
		Polychaeta	Phyllodocida	Nereididae	Laeonereis culveri	2	Herbivore
					Nereis succinea	1	Omnivore
				Phyllodocidae	Hypereteone heteropoda	2	Deposit Feeder
	Arthropoda	Malacostraca	Amphipoda	Aoridae	Grandidierella bonnieroides	2	Omnivore
				Gammaridae	Gammarus mucronatus	1	Omnivore
				Ischyroceridae	Cerapus tubularis	3	Omnivore
			Cumacea	Nannastacidae	Cumella (LPIL)	1	Deposit Feeder
			Isopoda	Munnidae	Uromunna reynoldsi	1	Omnivore
				Sphaeromatidae	Cassinidea ovalis	1	Omnivore
		Tanaidacea	Leptocheliidae	Hargeria rapax	44	Deposit and Filter Feeder	
Mollusca	Bivalvia	Veneroidea	Tellinidae	Tellinidae (LPIL)	4	Filter Feeder	

Table 6. Benthic Invertebrate Data

Transect / Marsh Zone	No. of Individuals	No. of Taxa	Density per SQ Meter	Diversity (H')*	Evenness (J)**
Transect 7 - High Marsh	45	5	5000.0	0.50	0.31
Transect 7 - Mid Marsh	75	6	8333.3	0.80	0.44
Transect 7 - Low Marsh	28	10	3111.1	2.08	0.90
Transect 9 - High Marsh	2	2	222.2	0.69	1.00
Transect 9 - Mid Marsh	35	4	3888.9	0.76	0.55
Transect 9 - Low Marsh	63	12	7000.0	1.29	0.52

\*Shannon-Wiener Diversity Index

$$H' = -\sum [p_i * \ln(p_i)]$$

where  $p_i$  is the proportion of species "i" in the sample and ln is the natural log

\*\*Pielou's Evenness Index

$$J' = H' / \ln(S)$$

where  $H'$  is the Shannon-Wiener Diversity Index and  $\ln(S)$  is the natural log of the total number of species/taxa in the sample

Table 7. Benthic Invertebrate Biomass (Grams)

Transect / Marsh Zone	Annelida	Mollusca	Arthropoda	Miscellaneous	Diptera	Total
Transect 7 - High Marsh	0.0175	0.0038	0.0025	0.0000	0.0000	0.0238
Transect 7 - Mid Marsh	0.0270	0.0000	0.0010	0.0000	0.0002	0.0282
Transect 7 - Low Marsh	0.0144	0.5245	0.0015	0.0025	0.0000	0.5429
Transect 9 - High Marsh	0.0018	0.0000	0.0012	0.0000	0.0000	0.0030
Transect 9 - Mid Marsh	0.0158	0.0000	0.0020	0.0026	0.0000	0.0204
Transect 9 - Low Marsh	0.0717	0.0030	0.0176	0.0000	0.0000	0.0923

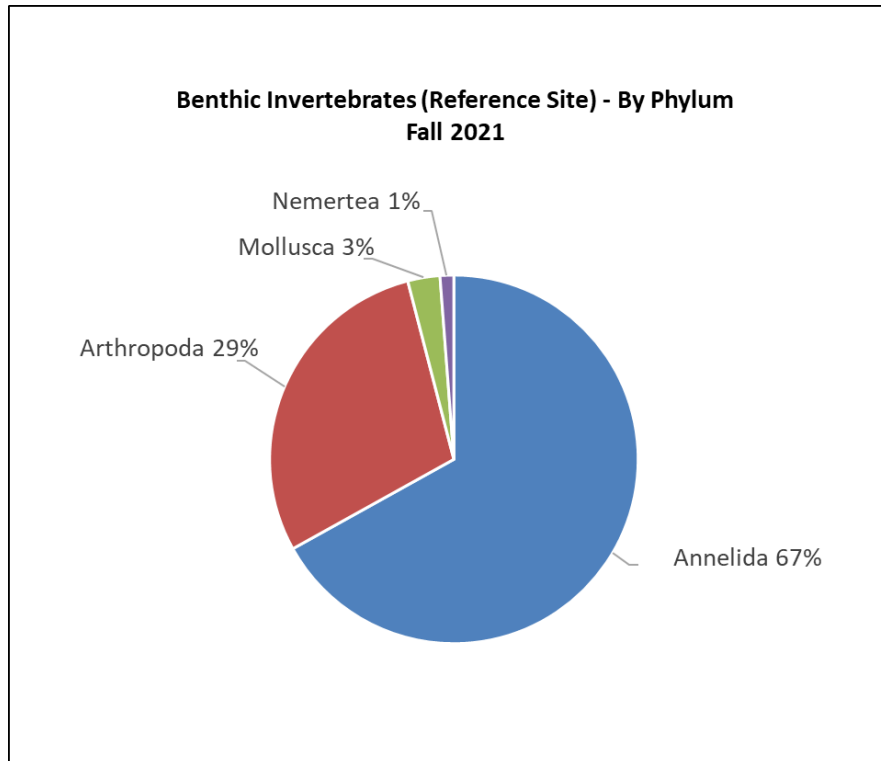


Figure 7. Benthic Invertebrates (Reference Site) by Phylum

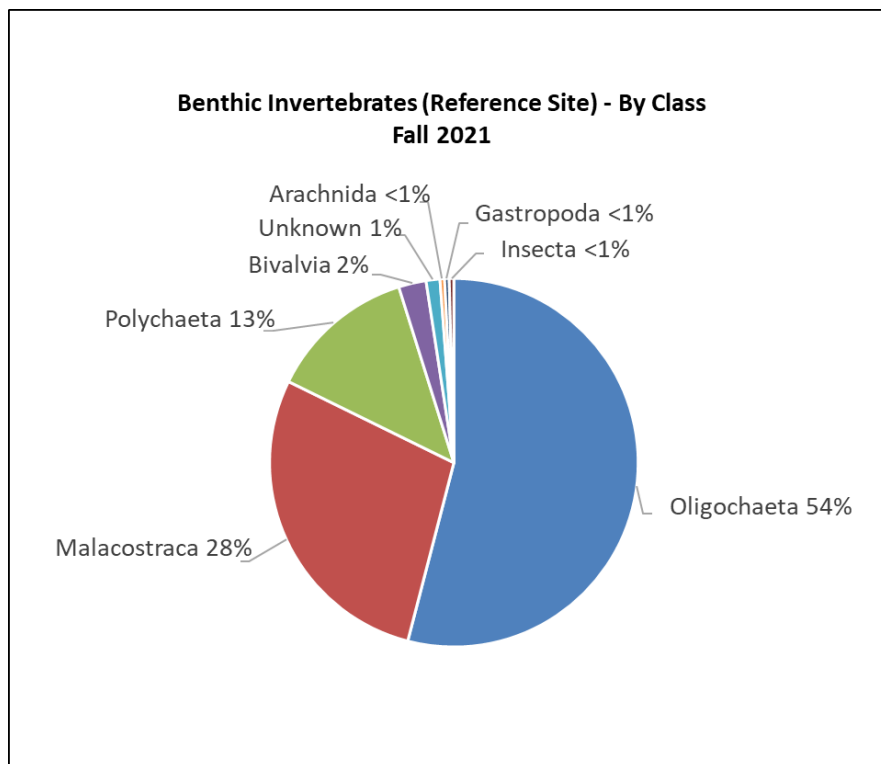


Figure 8. Benthic Invertebrates (Reference Site) by Class

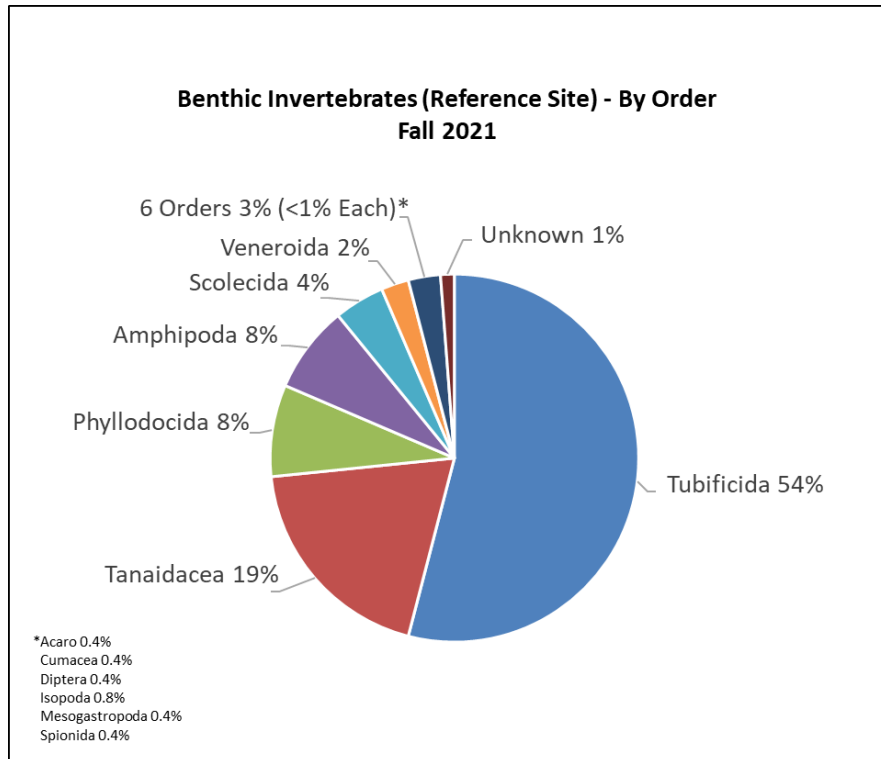


Figure 9. Benthic Invertebrates (Reference Site) by Order

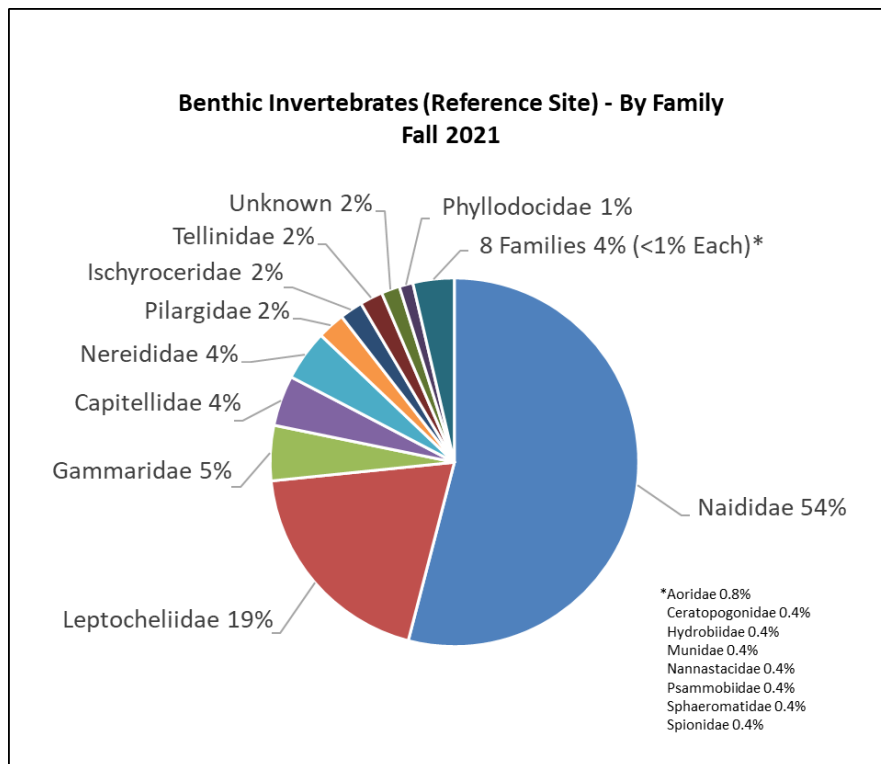


Figure 10. Benthic Invertebrates (Reference Site) by Family

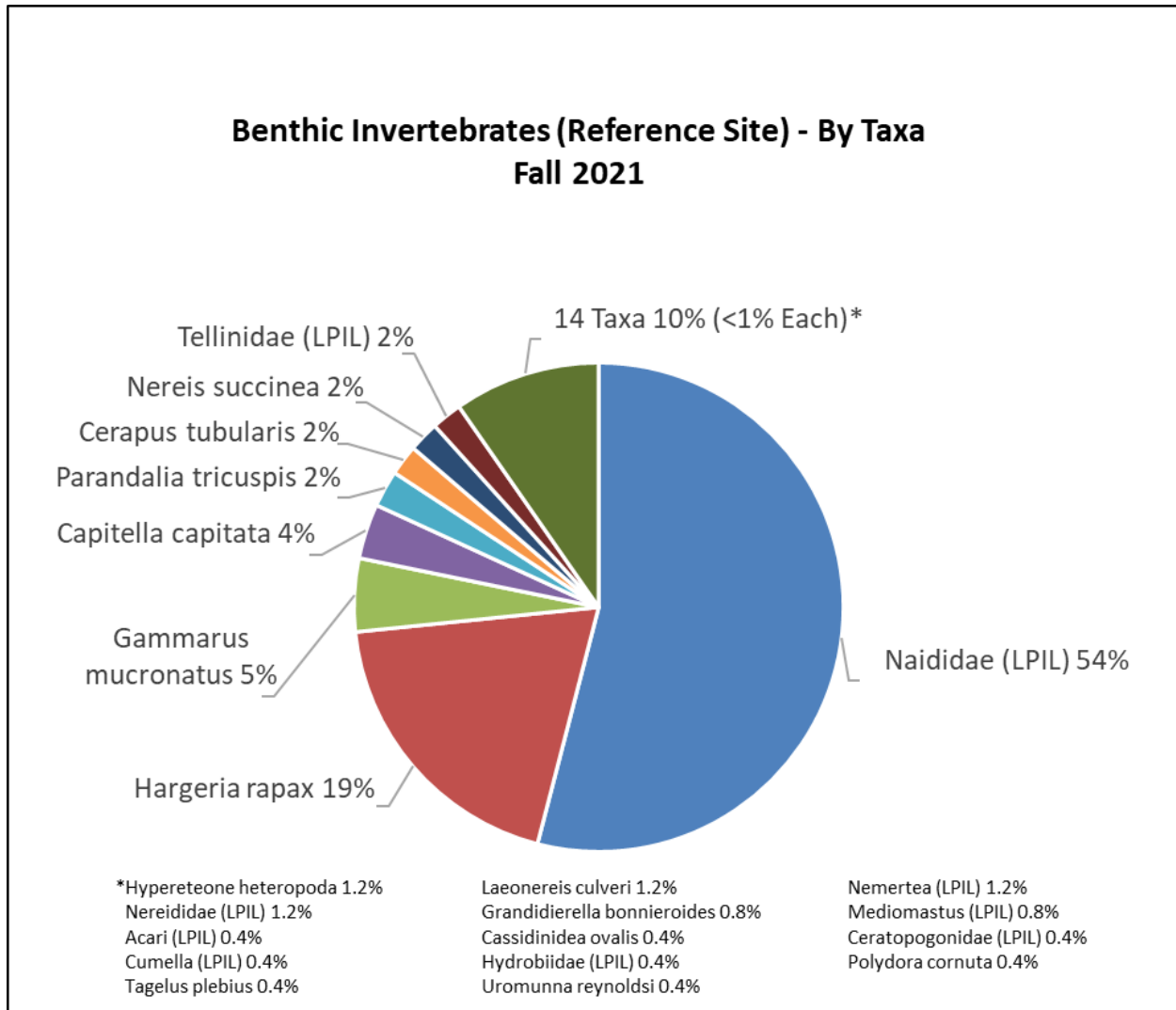


Figure 11. Benthic Invertebrates (Reference Site) by Taxa



## Sediment Accretion Monitoring

Two sediment accretion monitoring points were established in the mid marsh zone at the reference site on 6/14/2021. Each consisted of a 4-inch diameter circular plate set below the surface. Plate A (metal plate) was set 25.4 mm below the surface, whereas Plate B (PVC plate) was set 50.8 mm below the surface. Sediment depth relative to each plate will be measured at least annually or after storm events to monitor surface elevation change. Initial results (10/21/2021) indicate that sediment accretion at the reference site exceeds an estimated annual sea level rise for the Panama City area of 2.29 mm per year (estimated by National Oceanic and Atmospheric Administration).

Table 8. Sediment Accretion at Reference Site

Sample Repetition	Depth Below Surface (mm): 10/21/2021		Change: 6/14/21 to 10/21/21 (mm)		Annualized Rate of Change (mm)		Averaged Annualized Rate of Sediment Accretion at Reference Site (mm)
	Plate A <sup>1</sup>	Plate B <sup>2</sup>	Plate A	Plate B	Plate A	Plate B	
1	30	64	4.6	13.2	10.2	29.2	25.2
2	24	77	-1.4	26.2	-3.1	58.0	
3	32	70	6.6	19.2	14.6	42.5	
Average	28.7	70.3	3.3	19.5	7.2	43.2	

<sup>1</sup>Plate A is a circular (4" DIA) metal plate placed 25.4 mm below the surface on 6/14/2021.

<sup>2</sup>Plate B is a circular (4" DIA) PVC plate places 50.8 mm below the surface on 6/14/2021.

## Panoramic Photo Monitoring



Figure 12. Photo Point 7 Looking East – 11/8/2021



Figure 13. Photo Point 7 Looking West – 11/8/2021



Figure 14. Photo Point 8 Looking East – 11/8/2021



Figure 15. Photo Point 8 Looking West – 11/8/2021



Figure 16. Photo Point 9 Looking East – 11/8/2021



Figure 17. Photo Point 9 Looking West – 11/8/2021

## Other Photo Documentation



Figure 18. Reference Site Monitoring – 10/21/2021



Figure 19. Reference Site Benthic Invertebrate Sampling – 10/21/2021