

Diversity and Abundance of Pensacola Bay

Marine Science 1 Field Project
Marine Science Academy
Washington High School
2010

Introduction

The marine science academy is a school district program designed to introduce students interested in science careers to the world of field and laboratory research. The marine science 1 course is designed to introduce the marine science world, the organisms that live there, and how science goes about studying this environment to the students. This lab project was designed to teach marine science 1 students how to identify marine organisms found in our bay. The students will also try to determine which area of the bay has the greatest abundance and diversity of marine life. The students believe that the locations with more aquatic plants, higher dissolved oxygen, and fewer humans will have a great diversity and abundance of life.

Materials and Methods

Samples were collected at four locations in the bay area. One sample was collected each week and the four locations were rotated so that each location was visited three times during the study. The study began August 31 and ended November 30.

Study Sites

Four locations were selected for sampling that ran a north/south line along the bay.

Bayou Texar - sampling was conducted at Bayview Park (LAT 30.43 N LON 87.19 W)

Pensacola Bay North - sampling was conducted at Project GreenShores Site 1 (LAT 30.42 N LON 87.19 W)

Pensacola Bay South – sampling was conducted at the public boat off of the 3-mile bridge as you enter Gulf Breeze FL. (LAT 30.37 N LON 87.18 W)

Santa Rosa Sound – sampling was conducted at Shoreline Park in Gulf Breeze FL

Sampling

Organisms were collected by dragging a 50x4 ft seine net with 1/8" mesh one time. All organisms were placed in labeled bags on ice and identified in class. Salinity was measured by using a Aquatic Eco-Systems refractometer, temperature and dissolved oxygen using a LaMotte DO 4000 Dissolved Oxygen meter, and turbidity using a LaMotte Smart2 colorimeter. Wind was estimated using the following rubric (0 = no wind, 1 = light breeze, 2 = windy, 3 = very windy). Cloud cover was estimated using the following rubric (0 = no clouds, 1 = cloud cover < 50%, 2 = cloud cover > 50%, 3 = 100% cloud cover). The current speed was measured by placing a plastic ball with holes in it and timing the drift for 10 meters. The number of humans along the beach was counted during the time of sampling (typically 30 minutes).

Sediment Sampling

A shovel full of sediment from the area over which the seine was dragged was collected at each of the four locations. Each sample was dried in a fume hood in the classroom for 24 hours. The dried samples were then screened through a series of standard sieves and weighed on a triple beam balance.

Table 1. Grain Size Distribution for Four Locations (Grams / Seive)

Grain Size	Bayou Texar	Pensacola Bay North	Pensacola Bay South	Santa Rosa Sound
Shell hash	4.0	25.1	21.7	2.0
Shell (2mm)	14.0	37.5	8.4	1.8
Coarse Sand (500µm)	202.0	321.6 (55%)	238.4 (66%)	156
Medium Sand (250 µm)	391.2 (56%)	204.6	79.7	233.0 (57%)
Fine Sand (125 µm)	84.0	0.8	12.0	16.0
Very Fine Sand (63 µm)	2.2	0.0	1.0	1.0
Silt / Clay	1.4	0.0	2.1	0.5

Table 2. Mean Environmental Parameters for the Four Locations (n=3)

	Bayou Texar	Pensacola Bay North	Pensacola Bay South	Santa Rosa Sound
Cloud ^a (mode)	Variable	0	3	2
Wind direction (mode)	E	S	S	V
Wind Speed ^b	2	3	1	V
Water Temperature (°C)	28.7 ± 3.5	27.7 ± 4.7	27.7 ± 2.7	31.2* ± 0.2
Salinity (‰)	14 ± 6.5	23 ± 4.5	24 ± 3.4	27 ± 1.2
DO ₂ (mg/L)	6.48 ± 0.35	7.05 ± 0.55	6.25 ± 0.35	7.02 ± 0.85
Turbidity (FTU)	38 ± 24	64 (n=1)	---	---
Current Speed (m/s)	0.02 ± 0.01	0.05 ± 0.02	0.03 ± 0.01	0.04 ± 0.01
Current Direction (mode)	SW	E	N	E
Total Humans	50	0	13	20
Mean no. of humans / trip	17 ± 6	0	4.3 ± 4.5	10.0
Benthic plants	No	Yes	No	Yes
Tide (mode)	Low	Rising	Low	Rising
Tidal Range (ft)	1.1 ± 0.5	1.9 ± 0.15	1.1 ± 0.85	1.6 ± 0.25

^a (3 = 100% cloud cover), (2 = > 50%), (1 = < 50%), (0 = no clouds)

^b (3 = very windy), (2 = strong breeze), (1 = light breeze), (0 = no wind)

* Only two samples were made at Shoreline Park due to bad weather

Table 3. Diversity and Abundance at Different Locations in Pensacola Bay

	Sample	Diversity	Abundance	Diversity Index
Bayou Texar	1	9	208	0.043
	2	6	137	0.044
	3	7	232	0.030
	OVERALL	15	621	0.024
				Si = 1.989
Pensacola Bay North	1	18	180	0.100
	2	18	845	0.021
	3	21	296	0.071
	OVERALL	33	1321	0.025
				Si = 2.517
Pensacola Bay South	1	20	158	0.126
	2	12	40	0.300
	3	9	306	0.029
	OVERALL	24	662	0.036
				Si = 2.683
Santa Rosa Sound	1	7	1411	0.005
	2	12	5780	0.002
	3	---	---	---
	OVERALL	15	7191	0.002
				Si = 1.347

Index = (diversity / abundance)

Si = Shannon Index value

Phylum	Class	Species	Texar	Greenshores	South	Shoreline	TOTAL		
Chordata	Osteichthyes	Silverside minnow	325	238	81	308	952		
		Mullet	1	1			2		
		Longnose killifish	59	16	14	1	90		
		Leatherjacket	1	3	4		8		
		Sardine	4		2	3	9		
		Spotfin mojarra		78	226	5	309		
		Pinfish		20	1	13	34		
		Needlefish		3			3		
		Catfish				1	1		
		Barracuda			4	1	5		
		Sea robin			1	1	2		
		Sheepshead minnow		1			1		
		unidentified juveniles		16			16		
		Spot croaker			15		15		
		Gray snapper			2		1	3	
		Lizardfish			1			1	
		Pigfish					2	2	
		Pipefish		1	3		2	6	
		Bay anchovy		72				72	
		Gulf killifish			5			5	
		Blackcheek tonguefish			2			2	
		Sailfin molly					3	3	
		Arthropoda	Crustacea	Grass Shrimp	53	9	9		71
				Peneaid shrimp	4		2		6
				Blue crab	8	12	18		38
				Barnacle	15	62	20		97
				Striped hermit crab		8	5	4	17
				Stone crab		6	1		7
				Wharf crab		1			1
				Amphipod					3
		Mollusca	Gastropoda	Olive nerite	6	3			9
				Crown conch		2			2
Oyster drill				2	4	4	10		
Moon snail				1	1		2		
Marsh periwinkle					1		1		
Un-ID snail			7	2		9			
Bivalvia	Oyster			60	1		61		
	Ribbed mussels			3			3		
	Polycheates	2	1		1	4			
Annelida	Polycheata								
Anthophyta		Widgeon grass		697			697		
		Cord grass		29	2		31		
		Shoal grass			79	3273	3352		
		Turtle grass			27	3491	3518		
Rhodophyta		"algae"			80	80			
		n = 44	568	1295	506	7191	9560		
			n = 15	n = 31	n = 24	N = 15			

Results

A total of 11 collections were made between August and December of 2010. Three collections were made at all locations but Santa Rosa Sound (n=2). 44 different species were collected 48% of these were fish. Seagrasses were the bulk of the overall biomass (72% of the individuals collected) but were only collected in the southern portion of Pensacola Bay and in Santa Rosa Sound. The most common fish was the silverside minnow (*Menidia peninsulae*; 62% of all fish). Barnacles (*Balanus sp.*) were the most common crustacean (41% of the all sampled). And the eastern oyster (*Crassostera virginica*) was the most common mollusk (61% of all sampled).

The silverside minnow and the longnose killifish (*Fundulus similis*) were the only two species found at all four sampling locations but several (12 species) were found at three of the four. A few were only found at one sampling location:

Bayou Texar: Sheepshead minnow, Bay anchovy

Pensacola Bay North (Project Greenshores): Needlefish, Spot croaker, Inshore lizardfish, Gulf killifish, Blackcheek tonguefish, Wharf crab, Crown conch, Ribbed mussel

Pensacola Bay South (Gulf Breeze): Catfish, Sailfin molly, Marsh periwinkle

Santa Rosa Sound (Shoreline): Pigfish, Amphipods, Red algae

The greatest diversity was found at Project Greenshores in northern Pensacola Bay and the greatest abundance of life was found at Shoreline Park on Santa Rosa Sound; however the massive amount of seagrass collected here was the reason for this. If you remove seagrass from the abundance data Project Greenshores would have the greatest diversity and abundance of the four locations. The diversity index data suggest more diversity / number of individuals collected at the boat ramp on the south shore of Pensacola Bay (Shannon Index = 2.683) but this is not significantly higher than Project Greenshores (Shannon Index = 2.517).

Discussion

These data suggest the greatest abundance and diversity in our samples was found at Project Greenshores along the northern shore of Pensacola Bay. The marine science 1 students thought the presence of submerged plants, higher dissolved oxygen, and lack of human activity would support a higher diversity and abundance of marine life. Project Greenshores does in fact have submerged plants and the dissolved oxygen levels were the highest of the four locations (though not significantly) but a major difference between this location and the others was the complete lack of human activity (we saw no humans here on the three sample days we went). This suggests that our students may have been correct with their hypotheses.

The highest diversity in this study occurred along both shores of Pensacola Bay. This was quite surprising considering the seagrass beds found in Santa Rosa Sound, but the sand data shows that Pensacola Bay had larger grains of sand and this may be an important factor in the variety of marine life found at a location.

We will continue to sample in the future but feel that this Florida Department of Environmental Protection restoration project is in fact enhancing the biological productivity of our bay system.