NOAA Technical Report: Marsh Periwinkle Density and Size

Scott Zengel[1]*, Clay L. Montague[2], Steven C. Pennings[3], Sean P. Powers[4], Marla Steinhoff[5], Gail Fricano[6], Claire Schlemme[6], Mengni Zhang[7], Jacob Oehrig[7], Zach Nixon[8], Shahrokh Rouhani[7], Jacqueline Michel[8]

[1]Research Planning, Inc. (RPI), Tallahassee, Florida 32303, United States

[2]Department of Environmental Engineering Sciences, University of Florida, Gainesville, Florida 32611, United States

[3]Department of Biology and Biochemistry, University of Houston, Houston, Texas 77204, United States

[4]Department of Marine Sciences, University of South Alabama and Dauphin Island Sea Lab, Dauphin Island, Alabama 36528, United States

[5]Assessment and Restoration Division, Office of Response and Restoration, National Oceanographic and Atmospheric Administration (NOAA), Seattle, Washington 98115, United States

[6]Industrial Economics, Inc. (IEc), Cambridge, Massachusetts 02140, United States

[7]NewFields, Atlanta, Georgia 30309, United States

[8]Research Planning, Inc. (RPI), Columbia, South Carolina 29201, United States

*email: szengel@researchplanning.com

Abstract

The *Deepwater Horizon* incident was the largest marine oil spill in U.S. waters, oiling large expanses of coastal wetland shorelines. To examine impacts of the spill on coastal wetland fauna, we compared marsh periwinkle (*Littoraria irrorata*) density and shell length at salt marsh sites with heavier persistent oiling to reference conditions. We also compared periwinkle density and size among oiled sites with and without shoreline cleanup treatments. Marsh periwinkles were affected by oiling and associated habitat alterations. Densities of periwinkles were reduced by 80-90% at the oiled marsh edge and by 50% in the oiled marsh interior compared to reference. Shoreline treatments further reduced adult snail density and reduced snail size at the oiled marsh edge. We conclude that periwinkles were reduced primarily as a result of oiling, but were incrementally reduced further by subsequent shoreline treatments. Based on the size of adult periwinkles observed and literature information on age and growth, population recovery is likely to take a minimum of 3-5 years once oiling and habitat conditions in affected areas are suitable to support normal recruitment, immigration, survival, and growth. If heavily oiled marshes have experienced accelerated erosion as a result of the spill, these habitat losses would represent additional permanent losses of marsh periwinkles.
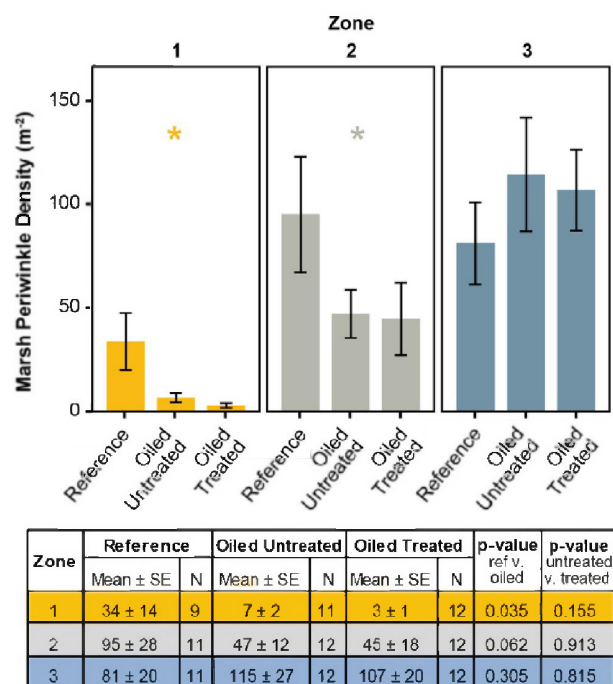
Figure 1. Marsh periwinkle total densities. Data are means ± 1 standard error (SE) with N number of replicates. *Indicates planned comparisons of reference and oiled sites were statistically significant. †Indicates planned comparisons of oiled untreated and treated sites were statistically significant. Statistical significance defined as p ≤ 0.10.

Zone	Reference		Oiled Untreated		Oiled Treated		p-value ref v. oiled	p-value untreated v. treated
	Mean ± SE	N	Mean ± SE	N	Mean ± SE	N		
1	28 ± 14	9	5 ± 2	11	1 ± 0.4	12	0.056	0.027
2	94 ± 28	11	47 ± 11	12	34 ± 12	12	0.045	0.441
3	80 ± 19	11	113 ± 27	12	105 ± 19	12	0.300	0.792

Figure 2. Marsh periwinkle adult densities. Adults were defined as snails >13 mm in shell length. Data are means ± 1 standard error (SE) with N number of replicates. *Indicates planned comparisons of reference and oiled sites were statistically significant. †Indicates planned comparisons of oiled untreated and treated sites were statistically significant. Statistical significance defined as $p \leq 0.10$.
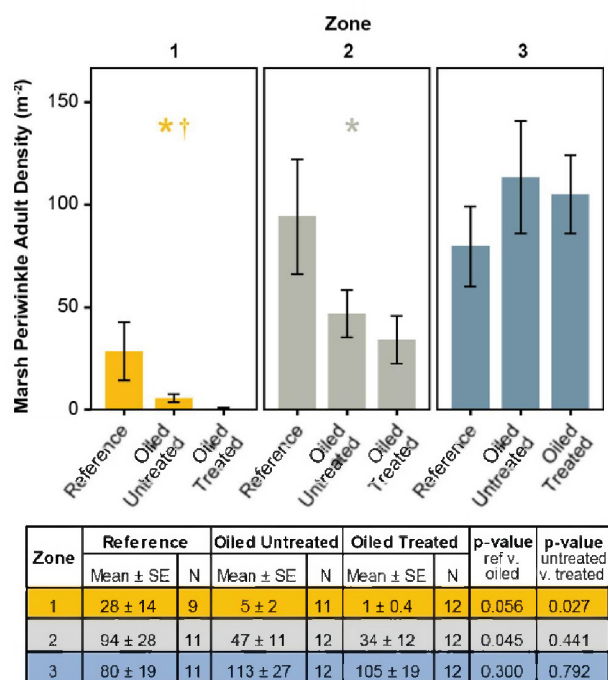
Zone	Reference		Oiled Untreated		Oiled Treated		p-value ref v. oiled	p-value untreated v. treated
	Mean ± SE	N	Mean ± SE	N	Mean ± SE	N		
1	17.3 ± 1.6	9	18.3 ± 0.8	6	11.2 ± 2.4	7	0.119	0.016
2	19.5 ± 1.1	11	20.4 ± 0.3	11	18.8 ± 0.9	9	0.465	0.205
3	20.6 ± 0.6	11	20.7 ± 0.2	12	20.9 ± 0.2	11	0.799	0.508

Figure 3. Marsh periwinkle shell length. Data are means ± 1 standard error (SE) with N number of replicates. *Indicates planned comparisons of reference and oiled sites were statistically significant. †Indicates planned comparisons of oiled untreated and treated sites were statistically significant. Statistical significance defined as p ≤ 0.10.
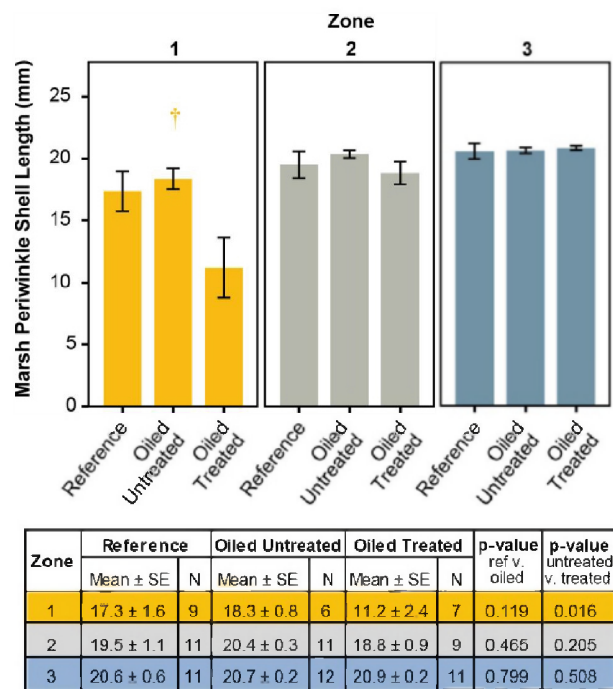
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Table 1. Marsh oiling and vegetation characteristics for the marsh periwinkle study sites. Data are means ± 1 standard error (SE) with N number of replicates. Statistical significance defined as p ≤ 0.10.

Parameter	Zone	Reference		Oiled Untreated		Oiled Treated		p-value reference v. oiled	p-value untreated v. treated
		Mean ± SE	N	Mean ± SE	N	Mean ± SE	N		
Surface oil cover (%)	1	0 ± 0	9	20 ± 10	11	19 ± 7	12	0.002	0.919
Surface oil cover (%)	2	0 ± 0	11	0.1 ± 0.1	12	0.3 ± 0.3	12	0.199	0.451
Surface oil cover (%)	3	0 ± 0	11	0 ± 0	12	4 ± 4	12	0.323	0.323
tPAH in soils (mg/kg)	1	0.5 ± 0.1	8	157 ± 49	7	64 ± 32	8	0.002	0.140
tPAH in soils (mg/kg)	2	0.4 ± 0.1	11	23 ± 5	11	40 ± 19	11	0.005	0.428
tPAH in soils (mg/kg)	3	no data	-	no data	-	no data	-	-	-
Spartina alt. cover (%)	1	54 ± 7	9	29 ± 8	11	25 ± 8	12	0.005	0.690
Spartina alt. cover (%)	2	54 ± 8	11	32 ± 9	12	31 ± 8	12	0.023	0.939
Spartina alt. cover (%)	3	55 ± 7	11	47 ± 8	12	42 ± 7	12	0.272	0.563
Vegetation height (cm)	1	54 ± 4	9	51 ± 11	11	26 ± 7	12	0.022	0.078
Vegetation height (cm)	2	54 ± 6	11	49 ± 7	12	42 ± 6	12	0.140	0.446
Vegetation height (cm)	3	59 ± 5	11	59 ± 4	12	51 ± 6	12	0.603	0.299